must cut themselves free, thus having a tendency to lift
and throw it back at the operator with probably serious r

In a word, if we wish to eliminate the accidents on rip
must have four things:

An efficient spreader.
A substantial and serviceable guard.
A perfect gauge.
A careful workman.
And the greatest of these is the careful workman.

JOINTER AND SHAPER ACCIDENTS AND TH PREVENTION.

H. L. KRUM, SAFETY INSPECTOR, INTERNATIONAL HARVEST PANY, DEERING WORKS, CHICAGO, ILL.

Mr. Chairman and Members of the National Safety
The order of sequence in which the title of my subject has ranged is likewise the order in which my connection with tl national Harvester Company has followed: First as a Clain later with the added duties of safety inspector.

Because of the nature of my earlier service the facts in t then extant or occurring subsequent are vividly in mind. than theorize, it has seemed best to review our accidents v today, that you may weigh the facts presented, note the pro steps taken, as occasion arose, and that you may consider the bility of the protective devices proven thereby.

Let us dispose of the important points common to both the and the shaper:

First is the matter of adequate light, enabling proper adj of equipment, knives, table and guards, also that the grain c may be clearly apparent.

Second—It is imperative that secure foothold be afforded tor at his working position, such as may be secured by old be roofing paper properly fastened to the floor. This precautic would have saved many men from injury.

Third—That no man be assigned duties at either of the chines without adequate instruction, supplemented by strict vision.

The illustrative jointer cases I would have you consider -

I.

In February, 1910, an experienced jointer operator set up to bevel simultaneously three 6′ x 12″ x 1″ boards. We then had a guard over the square head of the jointer, consisting of a slotted steel strip secured by a bolt to a bracket at edge of table. The operator set space between the end of guard and gauge to accomodate the boards, secured the guard and started. In run of order, one of the boards skipped because of a knot and necessitated the rerunning of this piece. Did the operator take a wrench, loosen nut and adjust guard over knife opening to the width of one board? No, it would take too much time, so he ran it through; that is, he started to do so, but his hand slipped from the board into knife head, between the piece resting against gauge and end of guard. The result of this act was the loss of parts of two fingers.

That case, gentlemen, is an argument against the man device; that is, the guard that is not self-adjusting, and, incidentally, the square jointer head.

This experience resulted in our equipping jointers with a device, simulating a fan attached to an arm and held by a tension spring over knife opening against gauge or against material as it was passed over knives between guard and gauge.

II.

In March, 1911, an outside man, too impatient to wait for a shopman to serve him, violated the rules. He had a wedge ⅞ x 4 x 9 inches which he desired to run over jointer. He shoved aside the guard, started the machine, and, judging from the notch at the end of this piece, the knives had just started their cut when he lost control of it; his left hand going into head. It was necessary to amputate half of it.

This case illustrated absolutely the need of round safety jointer heads.

III.

In January of this year a pattern-maker wished to dress a block ⅝ x 6 x 12 inches, starting three inches back from the forward end of piece to make first cut off one-eighth inch. The injured man does not know whether his right hand slipped off the forward or rear end of piece, but at any rate his hand struck the knives. This time only the fleshy part of the index and second fingers were affected, because a round head was in this machine.

It is our belief that this apprentice held back the fan gu his left hand while running this piece over the knives. of but fifteen days resulted.

IV.

In July of this year another apprentice (at this same join a 11 x ½ inch block over the knives three inches back fron ward end, desiring to dress the piece. He says the guard w against an apparent kick back and caused his hand to sli end of piece, striking the round head. The result was a l to the tip of second finger of left hand, but this did not incor him enough to cause his absence from work. Short pieces s dressed by a hand plane and not on a jointer. No known g cover knives quickly enough to prevent the hand of opera striking the knife head if the piece is kicked back while join rial. Men will continue to take chances, but the round head mizes the injury that we should adopt it and cease maiming

A slight pull is experienced in round heads, according tors, not encountered in the square head. Piece workers set knives a fraction over one-eighth of an inch, approachi sixteenths of an inch; however, three-thirty-seconds of a one-eighth of an inch is the margin designated in one shop

SHAPERS.

The protective appliance used by us over our shaper hea which in general features is familiar to you all, being cylin shape with a cone top. A perpendicular rod from its cen tained by a thumb screw in end of curved arm of bracket, to back of table. The guard is raised or lowered as the material on pattern or form may demand.

Solid sheet-metal hoods over shaper heads have been objected to by the men, because they do not permit free wood grain and limit of cut, consequently being a greater ha good because of danger of knives cutting into grain and material. We, therefore, have covered frame with one- mesh wire, permitting clear view of work.

We have been experimenting with three-knife circul heads. It is admitted by our operators that good work is p by safety head if light cuts are made with straight or slight knives. When heavy cuts are attempted, it is claimed that are not thrown clear by knives, but get between riding c

pattern, resulting in irregular work. This is probably because of too shallow a recess in front of knives for a chip breaker. Small heads will not permit of much material being removed safely at this point.

Another complaint is that production is slower on our type of safety head, there being more pull experienced in its use than with the open head. This may be attributed in part to the fact that in a three-blade shaper head of small diameter the set of the knives must be at a lesser degree of angle, considering safe resistance of tool steel, than prevails in a two-blade open head. The set of knives in this case is such that a scraping rather than a clean cut results. Further effort on our part, I believe, will enable us to report satisfactory accomplishment when we meet again.

It was my privilege a few days ago to view a device at our Weber works that comes nearer being a safe shaper guard than anything formerly observed. It was their experience that it was always the top of knives that caught fingers, consequently, the device described suggested itself. The top collar for attachment of this device might be termed of double thickness, the lower half being of same diameter as the riding collar, the upper half shouldering out above same three-fourths of an inch. To reduce the weight of collar it was turned out, starting one-half inch from the outer edge at the top to about the depth of shoulder. At opposite sides of larger diameter of collar threaded holes are provided for three-eighth-inch screws.

The guard itself consisted of a brass cylinder three and three-eighths inches high, walls one-fourth inch, its inside diameter being the same as the greatest diameter of collar mentioned. At its opposite sides are perpendicular bevel-edged three-eighth-inch slots. This brass cylinder was placed over the head and knives to the upper limit of work being shaped, and there held by two flat head three-eighth-inch screws inserted through the slots mentioned and screwed into holes in the larger diameter of the top collar. The slots are of sufficient length to permit raising of cylinder to remove, grind or adjust knives. Brass was used to prevent damage to the knife edge. The three-quarter-inch projection of shoulder allows extension of blades to this depth of cut. No part of knives are exposed except that used in shaping.

One operator, using this safety device for double-pattern work, expressed a preference for the inverted cone-cylinder type of guard whenever he was working upon a single-pattern job. He gave as

his reason that the edge of the hood served as warning of t to head, he then changed the position of his hands on the t opposite side of head.

The weight of material permitting, it is recommended th patterns be used wherever possible, because of the danger pattern work of its tilting into knives and operator being

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BAND RE-SAW, BAND RIP SAW, CIRCULAR TRI CUT-OFF SAW ACCIDENTS AND THEIR PREVENTION.

A. L. HARRIS, KIRBY LUMBER COMPANY, BEAUMONT, '

Mr. Chairman and Members of the National Safety

There are several devices for protection against the many of the exposed saw, though few have proven practical and necessary to continue the use of saws in an unguarded co in most cases combating the dangers necessary thereto wit caution.

An expression we often hear, "That one would fight a saw," carries with it the idea of caution. The caution re begins with the manufacture of the saw and extends to th of the mechanic to recognize a defective saw and to pr use. To begin with, the metal must be perfect. The worki hammers and grinds same must be onto his job in every He must have the ability to put it in such condition, by dis of the metal and maintaining proper tension, as will assure and safe running at the high rate of speed required. Whe done the dangers of the saws within themselves are to a larg eliminated.

This is but the beginning of the journey and there is considered the rig, mandrel, carriage and all those parts of m necessary for operation and control when the saw is put in Well-balanced wheels, perfect mandrels, true carriage track steam feed working in such a manner that the entire mach be governed at all times by the sawyer is very important, here invariably proves disastrous, owing to the high speed ar used.

UNSAFE MACHINERY IS CHEAP MACHINERY.

I take it for granted that all saws and machinery are go course, we have varied preferences, just as we do in buyi

and other goods, but most saws are good. Those of an inferior quality are generally produced on special orders from someone who does not regard Safety First or his fellow man, and who, instead of operating a saw mill should be drafted for front-line trenches in France, where, perhaps, he would learn some of the lessons we are endeavoring to teach.

Errors are sometimes made, and the best manufacturers in the country will sometimes unknowingly ship a defective article. Our only safeguard is to have able and skilled mechanical assistants properly test every saw and piece of machinery connected with its operation. It must be found perfect before it is put into use.

If this is done and the saw is equipped with the proper guards and subject to careful inspection, we have done all in our power to prevent accidents.

Of course, we are daily making strides in safety devices and in addition to what we have more will follow. It is well to remember, however, that a cautious man is our best safeguard—the question is how to get them. Men must think, and I try to keep this fact constantly before my men. Keep the think-box active and free from dangerous accumulations and safety thoughts will replace thoughtlessness and carelessness.

We have in our employ woodworkers, sawyers, filers and mechanics. We pay them not only to keep their hands busy but their brains thinking. It is from these men that safety devices will originate, all you have to do is to get them imbued with the proper idea of safety. We buy the best machinery in the world, or so we believe, and put it in charge of the best mechanics we can secure, and then forget there is an opportunity for improvement in the man or machine. Why not say to John, who runs the saw, the engine or some other part of your plant:

"Look here, is there not some way we can improve this condition. These saws are all exposed and are running just as they were twenty-five years ago. Is there not some way we can improve this condition and make them less dangerous?"

Get him to thinking and see what he will produce—it is in his line and he should find the way.

TIRE OF WORKMAN BEARING NO SAFETY MESSAGE.

This applies to all mechanical parts and the men who directly operate them. I can but direct such methods as will bring out the best thought from each individual in his own particular line and this is the course of my efforts in all my work. The best workman is

he who adopts means to the noblest ends and we tire of bring us no message.

Some tell me they do not engage in safety work becau not know of anything they could do in the way of prote is not now being done. Some of the most successful trar operators, perhaps, know nothing of the mechanical pa engines which move their tonnage, but they have the surround themselves with men who do know and it is to supply such personal ability as will secure efficiency in l and man power and achieve results.

We must recognize a safe man and appreciate what h just as the world is learning to appreciate what safety eng doing for the welfare of the human race. It is up to us attempting to perfect safe methods, to know whether or n getting efficient results; and if not, to create ways for the ing of human factors from whom safe ways and safeg come.

When I learned of the subject assigned to me, and fr I am drifting so far away, I was busily engaged in the co of an army camp at Houston, Texas, a State where lo cattle roam no more. I hoped to get through with the return to the mill and have an opportunity to study out s beneficial, which I could carry to the Congress in person has proved to be impossible, and I am still doing my bit Logan. My duty is to supervise the handling of vast an lumber and building material going into the cantonment tion, and, while I regret my absence from the Nation Council's meeting, I feel I am doing my part to help Kaiser. If the Safety First idea had been given more att the past all of this rush would not now be necessary, but been a trusting people, without suspicion, and will have the best of the situation.

WHAT WE ARE DOING IN TEXAS.

What applies in this war, applies in our civil life, both as and as individuals. We must learn to think. Since I h engaged in the work of erecting an army camp, I have dail bled my assistants for a short conference on ways and means our employes would be compelled to take care of themselv efforts have been quite successful. In handling millions o

slight accidents, notwithstanding all of this material has been handled in a great rush, and lack of time has not permitted us to inaugurate Safety methods. I consider this a very good record and as demonstrating what can be done when we take pains to induce our workmen to think Safety.

President Currie and other members of the Texas delegation will tell you what we are doing down here and I am sure will bring back to us many good returns of your gathering.

I regret that it is not possible for me to be with you and realize my misfortune in not being able to attend the congress. However, I will not be deprived of the value of your meeting and know that I will receive my full share of its Safety accomplishments.

Please accept my sincere wishes for the success of your endeavors, realizing the debt of gratitude due those who are giving their time and effort to universal Safety and for the benefit of our thoughtless and careless brothers.

SLIVER ACCIDENTS, THEIR PREVENTION AND TREATMENT.

DR. FRANCIS J. LENNON, MEDICAL ADVISER, LUMBER MUTUAL CASUALTY INSURANCE COMPANY OF NEW YORK, NEW YORK CITY.

Mr. Chairman and Members of the National Safety Council:
Sliver accidents are the most common form of injury in wood-working plants, but because they are classed as minor injuries and usually do not incapacitate the workman they are not often reported unless the wound is very severe and painful. As a result, there are no reliable statistics available and it is almost impossible to state the average number of these accidents. My own experience during the past year in about fifteen yards and mills leads me to judge that about 15 per cent of all accidents are done to slivers, although not over 1 per cent of them are reported. This is due to the fact that it takes considerable time and effort to fill in the report blanks, a labor that is avoided when possible by the average clerk.

I often notice, when called to a plant, that several men will have a finger or hand bandaged, and on inquiry the usual reply is that a sliver entered the finger or hand. The frequency of these accidents has led me to impress on the first-aid man the necessity of

following these cases closely, for infections are common doubt the total time lost through these injuries amounts t deal in the course of a year.

I wish to speak first of the treatment of these wounds. aid rendered is usually of the crudest kind. It is the univ to bathe the part in tincture of iodine. To most persons ti iodine and peroxide of hydrogen are panaceas for all injur ordinary tincture of iodine is so irritant that more harm t is apt to result from its use. The iodine may suffice if the superficial and only the upper layer of the skin is involve foreign particles penetrate deeply into the tissues mor measures must be employed or infection with pus formatic to result. While serious results are uncommon, still the cannot be neglected, for a rapidly spreading infection may loss of finger, hand or even arm, and, in very rare cases, c resulted. Hence the necessity of instructing first-aid exercise care in the treatment of these injuries.

MEN NEGLECT THEIR INJURIES.

It is my experience that the ordinary individual will no doctor unless he has to. He does not wish to be bothe medicines, and a bandage is in his way. Usually he neglec ment and I find that the majority of accidents must be foll by the physician himself, because the man will not com doctor's office. Now unless the case is important it is no possible or convenient to follow every case, especially i when deep snow impedes travel. The workman feels t way. He is tired at the end of the day and will not take t journey to the doctor's office.

During the past six months I have been following a which is working very well. I have instructed the first-ai how to take care of these minor injuries. The workman objection to being looked after during working hours at t and in a great many cases the clerk can do the dressing very

The area surrounding the wound is washed with hot w then swabbed with grain alcohol. I think that alcohol is disinfectant. Then the wound is probed for foreign bodie clean dressing applied. If the clerk thinks that a physician be called he sends for one. It is important to look at the daily until healed and if there is evidence of pus or the redness spreads or there is considerable pain then the d called.

ANTITOXIN SOMETIMES NECESSARY.

In severe cases it is necessary to open the wound wide and drain freely. However, in the majority of cases the simple procedure described above will suffice and healing will occur at once. I may state that in very severe wounds in which dirty particles have entered a dose of tentanus antitoxin is a wise precautionary measure.

I believe that most accidents are due to carelessness on the part of the worker. In considering the subject of prevention but little can be said. I notice that the old hands, who handle lumber constantly, usualy wear gloves, and they generally escape these injuries. It is among the young men and boys that this class of injuries are most frequent, and they will not, as a rule wear gloves.

ARE WOODWORKING INDUSTRIES KEEPING PACE WITH PROGRESSIVE SAFETY WORK?

J. J. HEELAN, SUPERVISING INSPECTOR, LIABILITY DEPARTMENT, AETNA LIFE INSURANCE COMPANY, CHICAGO, ILL.

Mr. Chairman and Members of the National Safety Council: Every effort in the interest of safety is worthy of praise and too much cannot be said for those members of the woodworking industry who have performed such excellent work along these lines. I do believe, however, that the majority of firms in this industry have spent a vast amount of money for this purpose without obtaining what might be considered satisfactory results.

By reason of the nature of the machinery used in this industry, efforts devoted towards accident prevention are concentrated largely on guards for the various moving parts of machines, including the point of operation or place where the feeding is done. Considering the different types of machines and the variety of work to be performed, there are many difficult problems encountered which situation is familiar to all of us when we realize how little success we have had so far in finding a universal saw guard. I believe this difficulty to be the main reason for failure, in many instances, to carry out progressive safety work.

FREQUENT REPAIRS NECESSARY.

Woodworking machinery must necessarily run at high speed, which calls for frequent repairs and adjustments. This has been

found to be the cause for finding many machines run
the guards being replaced. In an effort to learn why
tions exist, I have been given some varied demonstrati
ing the buck," indicating the need for an efficient safe
the plant.

The opinion generally prevails that because a guar
used for every piece of work it cannot be used at all. T
for guards found hanging on the walls, may have b
for artistic decorations, but I believe better reults coul
in other ways.

A very general explanation for failure to find a g
machine is that the workman will not use it. To my be
no workman has yet refused to accept compensation v
because he worked without the guard when its use
prevented the accident.

Feeding a machine is generally a safe occupation if
knows his business and will keep his mind on his work
accident occurs to a machine operator we often find t
how to do the work of feeding but was not thoroug
with the things he *should not do* in order to avoid bei
such as cleaning up around machine while running; rer
his finger, the small piece from the rear of saw; run
piece over jointer, or some similar operation.

The old-time machine operator receives a serious
sionally through failure to give constant attention to his
points out the necessity for the use of guards where
and particularly a well-organized safety system to carr
tional work.

MODERN MACHINES WELL GUARDED.

Considerable credit is due manufacturers of woodw
chinery for the progress they have made along the line
Modern types of machines are turned out in which n
moving parts, formerly found exposed, are now complete
The cylinder head for the jointer is a wonderful inve
we consider the serious accidents it has prevented. Onc
we run across some one who is still laboring under
that the cylinder head will not do satisfactory work, bu
to say that such occasions are now very rare.

HOME-MADE GUARDS.

The numerous home-made guards and appliances found in the plants of the woodworking industry demonstrate that the means for preventing accidents are no less than with other industries in which certain difficult problems also exist and which have not as yet been entirely solved, but this does not preclude carrying on progressive safety work.

I have noticed, particularly in the woodworking industry, the hesitancy on the part of the employer to exact discipline from his employes in respect to safe methods for doing work, and I do not understand why this should be more noticeable in this industry than in others. If the number of men experienced in this line of work was very limited we might claim this to be the reason, but I do not believe that such is the case. The old-time woodworker is pretty well set in his views and has cultivated a sort of dignity which causes him to act resentful whenever a suggestion is made as to a change in the method of doing his work. I have been in plants where this difficulty has been overcome and a very low accident record has been the result.

While we fully realize the humanitarian duty to prevent the consequences of injury to workmen, there is a great demand for the performance of this duty at the present time. The man in the factory is needed by the government just as much as the one who digs trenches and fights at the front. The difficulty in obtaining help is quite obvious and the elimination of one man from his duty at this particular time as the result of an accident is evidence of a serious error.

CONSTANT BATTLE OF EDUCATION.

In reviewing the difficulties of the woodworking industry with the problem of accident prevention, it appears that discouragement has interfered with progress and in some instances has caused a plant to revert back to the old condition where little effort was made to avoid accidents. The time has now arrived when every firm in this country must take up safety work in earnest and this means the immediate adoption of an efficient and energetic safety system in every plant if it is to continue in operation. Constant attention to education along the lines of safety is the most important part of this system and by reason of the present situation in the industry I believe this feature alone should produce some wonderful results.

WHAT COULD MANUFACTURERS OF WOODV MACHINES DO TO MAKE THEIR MACHI MORE SAFE?

WILLIAM NEWELL, M. E., CHIEF SAFETY ENGINEER, STATE INSURANCE FUND, NEW YORK CITY.

Mr. Chairman and Members of the National Safet
In my opinion the refusal of every manufacturer of wc machinery to sell his product unless equipped with all safety appliances would do more than any other singl make it more safe.

This suggestion may sound impractical and visionar days of keen competition, but that it is not is proven by th at least one large builder of woodworking machinery c adheres to such a policy in the case of all machines desig the last few years and refuses to quote a price except f pletely guarded machine. Their experience had shown purchaser of an unguarded or partially guarded machine blamed the manufacturer when an accident occurred, b latter had not guarded the machine completely.

Practically all manufacturers now strongly recommend sion of guards to their customers when selling them a ma the large majority of manufacturers will also sell the sam without the guards at a lower price if the customer so desi results frequently in the machine being operated without gu the factory or insurance inspector calls, or in the provision shift or sub-standard guards, which really do not cost v less than guards purchased with the machine. If this known to the customer the guards would probably have corporated in the design of the machine and be much n stantial and permanent. It is interesting to note in this c that one manufacturer believes that sooner or later build kinds of woodworking machinery will be required to "bui necessary safety appliances before their machines leave the

ELIMINATE BELTS AND PULLEYS.

The more extended use of individually motor driven is greatly to be desired, as the self-contained units can guarded much more effectually than where line-shaft drive and manufacturers can help to further this plan by recom

such equipment wherever possible. Push buttons for stopping the machine in case of accident can be located on the bed or table thereof, so that they are within easy reach of the operator at all times. The elimination of belts and pulleys is particularly to be desired in woodworking plants, as not infrequently a man carrying pieces of stock is thrown to the floor and injured on account of it being caught in belts and pulleys.

The more general use of ball bearings will also help to cut down accidents, as well as to save power and increase production. Poor machine conditions, such as lack of oil, overflow of oil, loose bearings, play in the bearings and poor adjustment all contribute to cause accidents. The self-aligning ball bearing, which only requires oiling three or four times a year, is the logical preventative for these dangers. The elimination of hot bearings also results in a reduction in the fire hazard, and it is a fact that in Europe insurance companies grant a reduction in rate to plants equipped with ball bearings.

Care should be taken by the manufacturer to make the belt-shifter action used for removing a belt to the loose pulley of a positive character, either by employing one of the many forms of locking gear or a balance weight. Many accidents have arisen through the lack of this precaution, the belt creeping back on to the tight pulley and the machine thus starting unexpectedly.

USE OF BREAKS.

The use of a brake interconnected with the beltshifter, so that the brake will be automatically applied when the belt is shifted to the loose pulley, should be of value in preventing accidents. This scheme has already been applied to a band saw by one manufacturer, and it seems to me that the idea might profitably be extended to other woodworking machines. As is the case with most woodworking machines, the band saw runs so rapidly that it is often difficult to see, especially in a poor light, whether it is running or not. After shifting the belt to the loose pulley the operator will ordinarily walk away without waiting for the machine to stop, and if no brake is provided the saw will continue to run for two or three minutes—in fact, a ball bearing band saw will run for five minutes before coming to rest. Sometimes a workman in the shop will go over to the machine not knowing that another workman has just left it and will cut himself on the saw before he sees that it has not stopped.

In addition to the safety features mentioned above, a sprockets and chains, feed-rolls, etc., should, of course, be with "built-in" guards. This also applies to belts and pulley machine. Circular saws should be equipped with both a knife" or splitter and a guard over the saw. The saw sho be enclosed underneath the bench. This is very importar surprising how many saw benches are sold, even at the pres with the lower portion of the saw either wholly or part posed. Jointers and shapers should be provided with sa cutter heads, and should also have a guard over the k addition. Band saws should have guards for both upper ar wheels. The portion of the saw at the left of the operato be completely guarded, and a guard should be attached saw guide and travel up and down with it, so that the only exposed will be the short section actually doing the work. saws should invariably be provided with a guard over the the saw. There should be a positive stop at the end of th bar to prevent the counter-balance slipping off in case the s holding the weight in position should work loose. A lim should also be provided as an additional safeguard to pre saw swinging forward beyond a certain point.

RESETTING AND SHARPENING SAWS.

Many circular-saw accidents are due to ignorance of methods of resetting and sharpening saws. As a result ma are operated in a dull condition, which, of course, greatly i the chance of the hands slipping off the sides onto the saw, a of a "kick back," due to the increased pressure necessary i to force the saw to cut. The manufacturer would do well nish an illustrated poster with his saws showing the prop to use, file, set and care for saws, or, better still, in additio his representative explain and demonstrate these points to t chaser on the premises wherever possible. This applies es to small shops. In large plants one or more experienced m usually employed solely on such work.

The Will to Win

You know what that means. Every time you tackle a hard job you stop a moment and concentrate all your thinking power on the task ahead of you. You try to draw a picture in your mind of the work you are to do and how you propose to do it.

During the next few months you will be called on to do this many times—sometimes in the shop, sometimes at home. You are helping to make history.

Have confidence in yourself. You *can* do it. You have the *will to win* if you have the courage to try.

REMEMBER You Are an Industrial Soldier

National Safety Cou

Iron and Steel Sectional Meeting

New York City

Sept. 12, 13 and 14, 1917

GEORGE T. FONDA, Chairman
Safety Engineer, Bethlehem Steel Company, South Bethlehem

EARL B. MORGAN, Vice-Chairman
Safety Engineer, The Norton Company, Worcester, Mass.

J. C. SMITH, Secretary
Safety Director, Inland Steel Company, Indiana Harbor, In

WEDNESDAY AFTERNOON SESSIO

THE meeting was called to order by Mr. George T. Fo Chairman, at 2:25 o'clock. One hundred and fifty were in attendance.

ADDRESS BY CHAIRMAN.

Gentlemen of the Iron and Steel Section: This is the session of our second Sectional meeting of the Iron and St tion of the National Safety Council.

Your Executive Committee had numerous meetings at th ning of the year to formulate a plan of action, to better orga Section and to start work in a manner which would prove o benefit throughout the twelve months of the year.

One of the important matters developed by our Section t was the initiating of a monthly News Letter, an idea of Mr. Young's. This we feel has been successful in arousing

Councils and other Sections of the National Safety Council have adopted the idea and developed similar monthly letters.

The object of our News Letter has been to bring certain facts which we felt were of more or less general importance to the attention of the members of this Section. This has been accomplished, at least in part, and the letters are reported to have been very useful to our members. Mr. Young is a member of the Executive Committee of this Section.

As Chairman of the Section, I wish to express my appreciation to the other members of the committee who worked very hard and gave a great deal of time and effort and personal sacrifice to make our work a success. This co-operation meant a great deal, because all of our members, as you know, were taken up with two or three times as much work as they experienced in previous years, making it doubly hard to accomplish the things we had in mind.

SECTIONAL BULLETINS.

One of the things we tried to push forward was sectional bulletins. We were only partly successful. Unfortunately the man we hoped would be able to take this in hand (and I am sure he would have been successful), Mr. Edward H. Peak, entered the service of our country early in the spring and was obliged to resign. As a result, our sectional bulletins were not developed to the extent we would have desired. It is General Manager Cameron's wish that the members of this Section materially assist the Executive Committee this year in preparing more Sectional bulletins. It is decidedly to the advantage of every member to have pertinent subjects covered in the bulletins issued in the accident prevention campaign of our particular industry. The amount of service we secure from these bulletins will be in proportion to the amount of co-operation we have from our members.

Your experience is absolutely essential to the Executive Committee insofar as up-to-date bulletins are concerned and I hope that you will fully co-operate with the new committee and its Chairman in the preparation of material. It is a difficult task for one man to write a series of bulletins such as you desire. I wrote several and it took a lot of time. Every one is very busy, but if each company would send in one, and make it the very best they can produce, we will have enough bulletins to last a couple of years, issuing one each week with the other distributions. It will be a very simple matter

if every one will take upon himself the proper amount (sibility.

SPECIAL REPORTS.

General Manager Cameron would also like to have an (from our members in reference to the special reports of the Safety Council describing specific accidents. It involves a able amount of work to get this data together, but the Council is perfectly willing to continue the service if th so desires.

The remainder of my report will be covered in tho: Chairman of our Program Committee, the Chairman of o ardization Committee and what the Secretary will have to

Before taking up committee reports I would like to hav vote as to whether or not you desire the National Safet to continue the service referred to. Two series have been date, giving descriptions of accidents. Is the service reall and do you wish it continued? All those in favor of ha service continued, please rise. Those opposed, please ris motion was carried by a rising vote.)

CHAIRMAN FONDA: I thank you. The next order on gram is the report of Secretary J. C. Smith, Safety Directo Steel Company, Indiana Harbor, Ind.

REPORT OF THE SECRETARY.

Mr. Chairman and Members of the National Safety I have only served as Secretary of this Section since the res of Mr. Young. Executive Committee meetings were held lows: Hotel Astor, New York, July 17; Hotel La Salle, (Dec. 19, and at Chicago, on March 21. At these meetings t of the Section was thoroughly discussed. We went into th of bulletins and the bulletin service, the appointment of a C of the Safety Committee and authorized the monthly News

Since assuming the duties of Secretary I have prepa letter every month. I might say that it would undoubtedly m letter more valuable if a greater measure of co-operation we by the various members and they would indicate what the should be included. The letter is two or three pages long a quite a task to cover the various subjects and to be certain topics are interesting. The ideas by the members of the

WORK OF COMMITTEES.

I started the year as Chairman of our Accident Prevention Committee, having in charge the sub-chairmen usually found in the departments of an average iron and steel plant. Our Blast Furnace Committee prepared a report and forwarded it to the General Manager of the National Safety Council. A report on metal rolling was also prepared by the Iron Metals Committee. There are so very few of these mills that the Secretary of the National Safety Council did not consider publication of the report necessary. Our Executive Committee was of the same opinion, but we are prepared to furnish copies to anyone interested.

Our Bulletin Committee originated and compiled a number of bulletins during the year, but the service was not quite what it should have been, owing to Chairman Peak's resignation to enter military service. Our distribution of bulletins issued by the various manufacturing industries proved helpful to our members and should be given a permanent place in our service. Members of this Section publishing monthly bulletins are requested to contribute one bulletin each month so that during the year, in the distribution of literature from the National Safety Council each member of the Iron and Steel Section will receive one bulletin from a different company each month. There are about 350 members in the Iron and Steel Section and a contribution of one bulletin from each company will render an effective service to the Section. We also distributed copies of a rule book to all the members of the Section.

This covers the work I have done in my official capacity during the year as Chairman of the Bulletin Committee and as Secretary of the Section.

MR. H. M. BAILEY (Carnegie Steel Company, Duquesne, Pa.): I move that the report of the Secretary be accepted and spread upon the minutes.

MR. J. STANFORD BROWN (Supervisor, Department of Labor, Safety and Welfare, Carpenter Steel Company, Reading, Pa.): I second the motion.

CHAIRMAN FONDA: A motion is offered and seconded that the report of the Secretary be accepted and spread on the minutes. All those in favor will signify assent by saying "Aye." Contrary, "No." The motion is carried.

We will hear the report of the Committee on Standards, Mr. R. J.

Young, Manager, Safety and Relief Department, Illinois S pany, Chicago, Chairman.

REPORT OF COMMITTEE ON STANDARD

Mr. Chairman and Members of the National Safet The Committee on Standards has done very little work wh be confined solely to the Iron and Steel Section. Early i a special committee of this Section prepared a Safe pamphlet on "Standards for Overhead Electric Cranes, work was so well done that the National Safety Council s it and issued it as a Safe Practices pamphlet. The sam true of a number of Safe Practices pamphlets which have b We have in course of preparation a special pamphlet on naces. It will cover gas-handling apparatus, open hearths plants. It will also cover oxy-acetylene welding, which is v tant and becoming more and more so, as from time to ti word of accidents occurring in the use of such apparatus.

USE OF STANDARD FORMS.

Considerable data have been gathered with reference of standard forms. If we can arrive at some uniform getting the number of men employed per day, a general cl as to the duration of disability, also a general classification of accidents, we will have a basis upon which to give you tive data of great value. I think the committee has a for out which can be used by everyone and still keep the individual classifications under the general heads propos form. All of this data, of course, will be turned over t Standards Committee. We only regret that we have not to accomplish more.

MR. C. B. HAYWARD (Winchester Repeating Arms New Haven, Conn.): I move that the report of the Ch the Committee on Standards be adopted as read.

MR. BROWN: I second the motion.

CHAIRMAN FONDA: You have heard the motion. A favor will signify assent by saying "Aye." Contrary, "No. ordered.

We will now have the report of the Program Committ B. Hayward, Winchester Repeating Arms Company, Ne Conn., Chairman.

REPORT OF PROGRAM COMMITTEE.

Mr. Chairman and Members of the National Safety Council: Your committee, appointed to serve you in preparing a program for the Iron and Steel Section at this Congress, desires to express its thanks and appreciation for the valuable assistance of the officers and members of the Executive Committee and the ever-willing, helping hand of General Manager Cameron of the National Safety Council.

Our efforts have been confined to selecting such subjects as will conserve human life and limb in lines advisable and adaptable at the present time. We have discouraged and endeavored to have omitted generalities in addresses. The speakers are all men of nation-wide repute and they honor our Section by their presence.

In response to the Chairman's notices your Executive Committee held meetings, on Jan. 18, March 21 and July 17, to complete the program. The work was successfully finished on the date last mentioned.

It has been the teamwork of all, therefore, rather than the efforts of any particular one or two, that has produced what we feel to be the best program of the Congress. Your co-operation and participation in the discussions is expected and it is your privilege to bring up any point in connection with the addresses.

CHAIRMAN FONDA: You heard the report of the Program Committee. What is your pleasure?

MR. BROWN: I move that it be adopted as read.

MR. O. J. LEWIS (Corrigan, McKinney & Co.): I second the motion.

CHAIRMAN FONDA: Those in favor of the motion will give their assent by saying "Aye." Those opposed, "No." The motion prevails.

WORK OF THE MEMBERSHIP COMMITTEE.

Mr. Hook, Chairman of the Membership Committee, is not present. In reference to the work of the committee, I can say that our Section has increased 15 per cent during the year. Mr. Hook has been in close touch with General Manager Cameron and has obtained a number of new memberships, but a good many organizations are not entirely familiar with the work of the National Safety Council and do not fully realize the benefits to be derived from this

Section. I feel this is true from our experience in th Valley Local Council, where we found that by a little con effort, and by taking a day or so a week for several wee the officers of non-affiliated companies, that it has been a tively easy matter to secure members for this organization. weeks' time we obtained fourteen memberships in our Loca This indicates what can be done in membership work if tim to do it. It is the same old story, most of us have a lot of do and it is very hard to get time for such activities. Our ship Committee made excellent progress this year and I incoming committee will do even better.

APPOINTMENT OF NOMINATING COMMITT

The next order of business is the appointing of a Nc Committee. This brings up a question I wish you would very carefully. Yesterday, at the General Business Sessic National Safety Council, a motion to revise the work of th was unanimously adopted. The Iron and Steel Section was in the Metals and Metallurgy Section, and the general div be known as the Industrial Division. The question invo combination of the Foundry and the Iron and Steel which means that hereafter the Foundry Section and the heretofore known as the Iron and Steel Section will combi election of officers. There will be a Chairman, a Vice-C and a Secretary, and joint committees to cover the previou rate Sections. It will be necessary for the Nominating Co of these two Sections to combine their reports, and I have a Mr. Bennett, Chairman of the Foundry Section, to join w this matter. The Foundry Section's Committee will meet Nominating Committee and present a joint report on Fr last day of our session. This is in accordance with our the change being necessary as a result of the action take whole body.

The Nominating Committee, as appointed, consists of M Young, Chairman, and Messrs. Stingley and Bennett. W committee was appointed, General Manager Cameron sugge Mr. Bennett, Chairman of the Foundry Section, be appo the committee. I think the matter will be adjusted very ni I feel that both Sections will be strengthened by the amalg

Mr. A. H. Young will please note that Mr. Phelps is Chairman of the Nominating Committee for the Foundry Section and he and Mr. Phelps will hold a joint meeting some time today.

A CHANGE OF PROGRAM.

Before proceeding with the addresses, I wish you to turn to your program for Friday afternoon. There is a change to be made. You will note the last session of our Section is a very interesting one and covers a discussion of a number of important subjects. The Sectional meeting on Friday afternoon is the only one scheduled for that time—all others being held in the morning. We have decided to change our meeting from the afternoon to the morning, in order that our members may attend the session of the Health Service Section. You will note the subjects are of considerable interest to every member of the Council, and you are urged to be present.

The program for the meeting was arranged by the Health Service Section, but the details were not quite complete when the program was printed. We will call our Section to order at 9 o'clock Friday morning and devote as much time as possible to the round table discussion and reserve the afternoon for the Health Service program.

At that time Dr. Lauffer will present a paper on "Low-Voltage Hazards"—you will note it is the first address. Mr. Cameron has very kindly had reprints made of Dr. Lauffer's paper and every member will be enabled to read and consider it before it is presented. This will enable us to follow Dr. Lauffer's presentation and to prepare questions. Dr. Lauffer is one of the best posted men in the country on this subject and I know we will all want to take advantage of this opportunity to hear him speak.

We will now return to our program.

We were advised by telegram this morning that Mr. Burnett had been taken ill and will be unable to attend our meeting this afternoon. This is unfortunate, as we had all looked forward to this paper with great interest.

We have with us Dr. Lucian W. Chaney of the United States Department of Labor who, I know, has a very interesting paper and I think we will do well to devote the larger part of this session to a discussion of the subject. It is with great pleasure that I present Dr. Chaney.

Iron and Steel Sectional Meeting

ANALYSES OF ACCIDENT EXPERIENCE

DR. LUCIAN W. CHANEY, UNITED STATES DEPARTMENT
WASHINGTON, D. C.

Mr. Chairman and Members of the National Safet
The paper which I am about to present is an outgrowth o
tions I had with members of the Executive Committee
time ago in which I presented to them a special scheme o
accident occurrence. I intended to try out that scheme a
it at this time, but when the program was communicate
contained quite a different subject and presented an entirel
line of approach. The paper which I shall read I ha
"The Analyses of Accident Experience," because "E
covers a little more than the "Analyses of Accidents."
which I really wish to emphasize, as I go on into the pa
it is of very little use to analyze accidents; we have to
experience rather than with simply the accidents themsel

I want to say just a word on the relation of this sect
bureau which I represent. I regard whatever the Bureau
able to accomplish, and the results, I hope very much,
your hands before a great while, is due to the very cordi
ation of safety men and everybody connected with the
steel industry. If we had not had that co-operation in
which we were trying to do we could not have accompli
thing at all worth while.

REVIEW OF FIVE-YEAR PERIOD.

We have now completed a review of the five-year peri
ing the iron and steel industry from 1910 to 1914, and g
for about 25 per cent of the industry to 1907. I believe
these are in your hands you are going to find them a very i
review of the period and one which will actually shed s
upon the problem of accident prevention. But what I wa
now is that we want you to go right on co-operating. We
on into another period of five years from 1914. We ha
files in Washington a considerable part, nearly 50 per ce
information necessary in these later years, and we are c
you a little later to make up the rest of that information.

I am perfectly well aware that it is a bad sign to come

tion. Why do we have to come to you? Why cannot we get this information from records which you have already made to State bureaus? Simply because of the fact that to date—and I do not know how long in the future—each State bureau is so much a law unto itself that it gathers this material just a little differently from the other fellow, and when we try to put together those slightly different propositions, cast up by the different State bureaus, it is absolutely hopeless; we cannot do anything with it. They are just enough different to dislocate the whole proposition and make it impossible for us. So, what we would like to do is to save you a whole lot of trouble. We have to trouble you, because that is the only way in which we can get the information in the proper form which enables us to treat it in such a way that it can be useful to you. That is why we have come to you directly for the information on which we base this analyses of experience.

PROPER MATERIAL TO ANALYZE.

Now, as to the way in which we have gone about the analyses of experience: The first requisite of a fruitful analysis is proper material to analyze. This requires no proof. But what are the indispensable materials for such an analysis of accident experience? In my judgment two things are absolutely essential: *One,* a record of the amount of employment in connection with which the accidents occur, and, *two,* a record of the accident. Notice I say not the number of employes, but the amount of employment in connection with which the accidents occur, and why I say the amount of employment rather than the number of employes will be visible a little later. I wish briefly to emphasize this element of employment, or as I prefer to call it when discussing hazards, the amount of exposure. It is the same thing, you see, whether you phrase it in one way or the other, but you are looking at a little different side of it. When you speak of employment you are thinking of the amount of work. When you are speaking of the amount of exposure you are thinking of the fact that while they were doing that work they were exposed to the hazards of the industry. And so, in this connection, it seems to me preferable to speak of the amount of the exposure.

For some reason, we have not until very recently appeared to realize to any adequate degree that accidents, apart from their relation to the worker, have no significance whatever. A large part of our accident statistic material is simply treating accidents, and

not treating the relation between this accident and the p
are subject to them. This is more surprising when y
that the Germans, into whose labors in this field we ha
have for more than thirty years used the amount of e
the base of all their discussion.

Just the other day I read a paper in Boston, and t
Transcript was good enough to say that what I said was u
true but they could not understand it. To have mystifi
of course, I regard as an achievement. If there is anyth
paper which is not perfectly clear to you pin me down
me tell you what I mean.

RATES MUST EXPRESS AMOUNT OF EXPOSURE.

I will set down, therefore, as a cardinal doctrine of t
sion that our analysis must, if it is to be worth while, alw
in rates which express the relation of the amount of expo
accidents themselves.

I was very much interested to note that Mr. Dow thi
using rates. For example, he said that accidents to train
seven-odd per thousand employed in a certain year; tha
clined to two and something in another year. Those are
they are the only legitimate means of comparison, in my
between different times and different industries.

Let us suppose that we have a record of the amount of
in the iron and steel industry during the years 1910 to
of the individual accidents occurring during that peri
should we proceed in an effort to arrive at an intelligent u
ing of their significance?

The first step would be to determine some standard
which to express the exposure. Manifestly, the man who
a part of a year at a blast furnace and the man who works
year through, contribute very differently to the exposur
furnace methods. The problem is to devise some comm
in which to combine the varying experiences.

You see, you have two men there but you do not have
work. You have one man working the whole year and
man working some little fraction of a year. How are we
combine those into a single expression so as to make it usef

The solution has been found in the adoption of a stan
of three thousand hours. If in a given case we are

a simple division of this aggregate by 3,000 gives what has been called 300-day workers. The Germans call them full-time workers.

Let me digress a minute to say that it is not possible to present a full statement regarding accident rates. For a complete discussion see the Monthly Review of the Bureau of Labor Statistics, July, 1916, and Bulletins Nos. 216 and 234.

When, as often happens, man-hours are not available, some method of approximating the exposure as clearly as possible must be adopted, and this equivalent of the actual number of hours which were worked must be an equivalent to express in terms, the people working the whole year, 300 days.

If you undertake to use the number employed you can very easily see that you get into great difficulties. Suppose—a very exaggerated case—that you are running a plant with 1,000 people and you turn off the whole bunch every night and employ new hands in the morning, you would then have 26,000 people on the job during that month but you have only done 1,000 men's work, even though you have had that turnover. So we have to get some way to work out a standard expression for the man who works half a month and the man who works a whole month, and these different periods of employment: that is where the term of employment itself again comes into this analysis and calculation.

FIVE FUNDAMENTAL ANALYSES.

Having standardized exposure, we may proceed to analyze the record. There are five fundamental analyses: *One,* by result; *two,* by departments and occupation; *three,* by periods of time; *four,* by nature of injuries; *five,* by cause of injuries. There are others which we could make, but these seem to me to be the five most important and fundamental analyses which we can make of our accident experience.

I shall treat the first four rather summarily in order to save time to apply to the consideration of causes. The application of rates to the study of causes is an entirely new departure, and because of its novelty and because it promises some valuable results it deserves the major share of our attention.

Analysis by results is a familiar proceeding. Its simplest form gives the frequency rates of deaths, permanent injuries and temporary disability, those being the common classes into which we divide results.

For example, in the period 1910 to 1914, these rates were for

the iron and steel industry as follows: Deaths, 1.2 case 300-day workers—this is for the whole five-year period, stand, not for any one of the years; permanent disability, temporary disability, 172.6 cases. That represents the of the iron and steel industry for a five-year period, 191 so far as the frequency of accidents was concerned.

An extension of this analysis has great importance means of it we are able to derive a new and very usefu rates, the "severity" rates. When the permanent disal further analyzed into the specific losses, such as that of eyes, and so on, it becomes possible to assign to them fi in terms of days' loss, such as 2,808 days for the loss of scale of such values has been worked out by the Uni Bureau of Labor Statistics and applied in the reports rec pared. As an example of the results of expressing acci in terms of days' loss, the severity rates for the period nc may be quoted. This, of course, depends upon the rati valuation in terms which the Bureau has completed, and th valuation was not slightly different rates but within the reason.

In this matter of valuation I find there is surprisingly lit ence in the rate which results. These rates are as follows: 10.5 ~~days~~ per 300-day workers; permanent disability, 2.5 d porary disability, 2.1 days.

FREQUENCY RATES AND SEVERITY RATES.

You will notice in the frequency rate which I read ab the word cases, so many cases per thousand. In the ca severity rates they are expressed in terms of days per i and the rates are those which I just stated: Deaths, 10.5 day workers; permanent disability, 2.5; temporary disal days. These are on the basis of the lowest which the bur to deaths. There were equivalents to the loss of 10.5 worker during that period of five years. The permanent rate is 2.5 days and the temporary disability rate 2.1 days.

Trace that for a moment with the others: With the f rate you run up steadily, 1.2, 3.9 and 172.6. That is as you expect. Temporary disabilities are a great deal in excess, many more. When we try to evaluate them on the basi severity, death naturally stands at the head, we reverse it

only 3.9 cases of permanent disability to 172 cases of temporary disability in the matter of severity they are almost together, with the loss from permanent injuries and those from temporary disability very nearly identical, 2.5 days and 2.1 days.

It should be noted that whereas the frequency of deaths, for instance, 1.2 cases compared with that of permanent disability (3.9 cases), gives no hint of the relative importance of the hazards producing these results; the severity rates are in form to be directly compared.

Assuming the reasonableness of the allowances in days which have been adopted, it appears that in the iron and steel industry those accidents which cause death are about five times as important as those which produce permanent disability. I am not concerned in this connection to defend or even present the system of time allowances which the Bureau of Labor Statistics has adopted. I wish simply to point out that the severity rate is a better indication of relations than the frequency rate could possibly be. Since this is the case, I tell you that almost exclusively in the remainder of this paper.

The cases which we now have under consideration are analyzed into groups on the basis of the results. We have determined how many deaths have occurred during the five-year period, 1910 to 1914, how many arms have been lost and how many other cases involving some degree of permanent disability. We have applied to these a definite system of time allowances and have taken into account the working time lost from temporary disabilities. We have then determined the ratio between the amount of exposure expressed in terms of 300-day workers and for lost days. This procedure gives us the "severity rate" for the period.

Right here I am going to make a little statement which I did not care to write into the paper. This idea of severity rates occurred to a number of people at or about the same time. At the time that my colleague and myself in the Bureau of Labor were working upon it and producing the charts which were accepted by the Pan-American Exposition and which were last year shown before this Section, we adopted one scheme. At that time our friend and fellow member Mr. Dudley was working on a scheme of the same sort which he presented summarily and afterwards outlined in some detail to the National Safety Council. A little later Mr. Downey of the Pennsylvania Concentration Commission undertook—at that time Mr. Downey was with Wisconsin—a similar weighting and since the

time our reports were worked out the industrial boards a
sions have had a committee at work upon it but have no
for final adoption by that association a scheme of weight
is somewhat different from any of the others of which I h
This idea has been abroad in the land for some years, b
working out of it on a large scale will occur in the report f
I am taking the information presented in this paper.

A CHOICE OF METHOD.

The next step may be one of two: Either we may a
years to determine the trend of the rates or we may a
departments and ultimately into occupations. We may a
years, so as to show how the rates are progressing, or
analyze into departments and ultimately into occupatio
going to put some of these figures on the board.

As a matter of convenience only we will consider the
When this is done the following severity rates are obtain
individual years of the period. I can tell you what these f
if you cannot see them.

This, you understand, represents the loss per 300-day
these years in practically the entire iron and steel indus
1910, 19.9 days per 300-day workers; 1911, 12.3 days; 1
days; 1913, 16.4, and 1914, 11.8 days.

You will notice that the thing is sliding up as far as th
of accidents are concerned. Curious enough, at the same
frequency of accidents was coming down. A fair comp
between 1910 and 1913. You cannot make a fair comparis
you take years of like industrial intensity. The year 1910 w
intense, and we did not have another one of comparable
until 1913. If I were to go back to 1907, a year on anoth
you would see still higher figures. That is, as we take
points coming along from time to time the high points a
than the preceding high points. We are going to get one
a bit higher than this, 1916 having been the worst year f
standpoint of industrial tension since 1906, the rates hav
accordingly.

I am presenting this simply as an illustration of the m
analysis. Incidentally, you happen to see how the rates ar
I am not concerned with that just now.

I shall not permit myself to offer at this point any obse
regarding the significance of

cess of safety efforts. With that phase of the subject we are not now concerned. As a matter of practical method we would but rarely be obliged to make an actual analysis of a period of years, since the rule is to keep the records in annual groups and treat each year as a unit.

As a matter of practical method I would rarely be obliged to make an actual analysis of such a period of years as this, since we nearly always keep the years in annual groups, keep the record in annual groups, and treating each year as a unit, I have chosen to suppose that I had the whole thing thrown into a mass and that we picked it out.

DEPARTMENTAL AND OCCUPATIONAL ANALYSES.

The departmental and occupational analyses, especially the latter, are of a great deal of importance to the safety man, and the thing which we are most lacking than anything else at the present time is occupational rates. We do not know yet what the different occupations are, except as they have been derived from a study of compensation payments, and the difficulty about that, of course, you understand very well, is that no two States compensate in the same way; no two States pay the same wages, no two States do anything alike. So that out of the results of compensation payments you have great difficulty in extracting the real facts.

I will repeat a little. The departmental and occupational analyses, especially the latter, are of the greatest importance to the safety man. When he reaches the employment groups of his working force he is pretty close to a final determination of the location of his problem. Unfortunately, employment rates are difficult to secure, because exposure is rarely a matter of record with sufficient exactness to render the computations reliable. In a great many cases the hours are taken from the employment, but are not assembled and preserved in a form available for the determination of occupational exposure. Safety men can do a great service to themselves and to the general study of accident questions by insisting that they must have these records in order to have any kind of satisfactory studies of their accident cases.

To illustrate the results of departmental analysis the record over a period of years of the characteristic iron and steel departments, namely, blast furnaces, steel works and rolling mills are presented.

I chose to present in this list only plate mills, because it is the prettiest little declining series that I have; it goes down step by step from year to year. I shall read the figures to you and then put some on the blackboard:

Blast furnaces: 1910, 38.4 days; 1911, 26.5 days days; 1913, 29.1 days; 1914, 20.1 days.

Open hearths: 1910, 25.7 days; 1911, 19.7 days; 191 1913, 20.8 days; 1914, 14.9 days.

Plate mills: 1910, 24.8 days; 1911, 14.2 days; 191 1913, 9.5 days; 1914, 8.7 days.

You notice that nearly all of these have higher rates and steel industry taken as a whole. That is because, the iron and steel industry taken as a whole, there relatively non-hazardous departments. These three com hazardous departments of the industry. You see how the blast furnaces: 38.4, 26.5, 29.5, 29.1, 20.1. I d whether I ever felt quite so pleased doing anything when I worked out these plate notes and saw them steadily year by year.

I wish you to notice that in each of these years affords us a reliable guide to the relative hazard of these and to the degree in which they were changing for bett You can easily go over them and see how they are going and what the relation is between these three departn degree of their hazard.

SEVERITY RATE FOR BLAST FURNACES.

In a group of blast furnaces the severity rate over years was 43.5 days per 300-day worker. These are for furnaces in the country that are represented here, bu special group of blast furnaces which I am now consid rate during this period was still higher than what we se days for the 300-day worker. When this is analyzed by the following rates appear: Casthouse crew, 75.2 da labor, 36.8 days; mechanics, 26.3 days; stocking crew, unclassified labor, select workers, 64.9 days.

You will notice these; they are rather interesting, it You would perhaps like to know why these unclassified higher than do those among the gas workers and oth employed where fatality from asphyxiating gas comes in. there were deaths in the other departments, but these me frequently than the others. Naturally, if there is anyth be done about that most serious place, the casthouse,

furnace is unequally distributed and that for intelligent application of our efforts we need to know what this distribution is.

Thus far all of the procedures suggested except the severity rates are more or less familiar. I wish now to indicate how the principles of accident rate-making may be extended to the study of the nature of injury and cause of accident. Since nature of injury is less important than cause of accident it will not be considered in detail. It is sufficient to say that the method of treatment is precisely the same in both cases.

For illustrative purposes, a group of blast furnaces will be used whose records are available from 1907 to 1914. In the year 1907 the severity rate for the group was 65.1 days per 300-day workers. Notice that in those early days they lost a great deal of time. That is the rate for 1907, 65.1 days.

RETURNS FOR PREVENTIVE EFFORTS.

Upon analysis of this rate it is found that hot substances gave rise to 10.7, falls of worker to 11.9, power vehicles to 11.8 days and asphyxiating gas to 23.1 days. It is at once evident that so far as this experience is concerned the most earnest effort should be directed to any methods which might lessen the hazard of asphyxiating gas. It does not follow that a cause which has a high rate is the one which will yield the largest returns for preventive efforts. Some cause whose rate is much lower may be more readily controlled, but very naturally you will attend to the gas where you get a high rate from a given cause, but you may find something more readily controllable in the less important lower rates.

This point may be illustrated by following hot substances from year to year in contrast with asphyxiating gas. In 1907 hot substances had a rate of 10.7 days. In 1913 the rate was 1.9 days, a decline of 82 per cent. That was a good record. During the same period asphyxiating gas declined from 23.1 days to 5.4 days, 77 per cent. That is, you see, it was considerably more effective, the attention given to hot substances, than that which could be given to asphyxiating gas, 82 to 77 per cent decline in the two cases.

On familiarity with conditions it is possible to say that this greater decline in the rates for hot substances is due to the fact that it was possible to make structural improvements which entirely eliminated some hot-substance hazards. It was not possible to bring about an equal improvement in the matter of gas.

Since the most characteristic blast-furnace hazard is from hot

substances it is desirable to pursue our analysis further. again the year 1907 we find the hot-substances rate to 1 per 300-day worker. The chief elements in this are flashes, 2.1 days; hot stock ejected, 6.5 days; hot wate 1.2 days. When these are followed to 1913 it is found and flashes declined to 2 days; hot stock ejections disa water and steam increased slightly to 1.6 days. He have an illustration of the fact that some causes are n brought under control than others.

About the blast furnace hazard, the hot water and s to be very difficult to get rid of; the rates do not sho getting any better as time has gone on, but here we ha stances in general, with sparks and flashes and hot stock e the furnace going down, one of them going out complet

It would be easily possible to extend these illustrat indefinitely, but this would tend to confuse rather than e have not attempted to present to you the details of the making these analyses. While the methods are simple t tation involves so many details that the attempt to includ would give an impression of complication not warra facts. I have contented myself, therefore, with trying clearly as I could, some things which can be accomplish analyses, hoping that you will be interested enough to matter in the reports of the Bureau of Labor Statistics methods and results have been presented in full. In this I might refer you to the Monthly Review for July, 1916, tins Nos. 216 and 234.

SUMMARY.

Three points stand out in my own mind in connectic matter presented in this paper. Let them serve as sur conclusion. They are, *first,* the fundamental importa determination and use of the amount of exposure; *second* sity of a method of severity rating; *third,* the value of the of the rating method to the study of causes.

CHAIRMAN FONDA: Before having an informal dis Dr. Chaney's paper, I think we will proceed with the formal discussions, you will then have plenty of time Chaney and the other speakers any questions you may ha

Tube Company. I know we will all be glad to hear Mr. Kennedy, as he always has something of importance to tell us.

DISCUSSION BY DUDLEY R. KENNEDY.

DUDLEY R. KENNEDY (Assistant to President, Youngstown Sheet and Tube Company, Youngstown, Ohio): Those of us who have been searching for facts, regardless of whether the facts were pleasing and flattering or not, have constantly been balked by the absolute lack of real statistics; by statistics which were carelessly prepared, to say the least, if not deliberately compiled for the purpose of flattering the individual in charge of the work or the concern which employed him.

In addition to all this a great many concerns, especially the larger of them who are trying to keep real statistics, are as anxious as it is possible to be to agree, through some medium, upon a standard way of keeping statistics, in order that they may make comparison with other factories in the same or similar lines of business, not at all for vainglorious reasons, but because they are giving to accident prevention more and more importance every day, and hence more and more real analytical study. But these concerns, in many states, are compelled to keep their records in accordance with prescribed rules of the state accident board or industrial commission, and if there are any two states whose requirements are the same nobody within my acquaintance has been advised of the fact.

SECURING RELIABLE DATA.

In order to get some concrete and reliable information as to what has happened to our accident frequency in this country, by reason of the tremendous increase in production, incident to the war business and the unprecedent expansion in the last three or four years, I wrote to almost one hundred of the large, representative concerns in the United States, asking them, in a confidential way, for their experience over this period. I promised them that the information thus obtained would be compiled in composite tables in such a manner as to preclude their identity becoming known. Only in this manner was it possible to obtain this information and almost all of the concerns who have given me this information have thanked me for approaching the matter as I have indicated, because they felt that it was unfair to give real information that might be compared and contrasted with statistics that were based upon

entirely different conceptions; perhaps, or deliberately convey certain impressions.

I wish at this time to sincerely thank all of these co the individuals who prepared the information for you and I desire to thank you for honoring me in asking tha a paper on a subject so interesting and vitally important i nomic transformation now in process.

We have reduced the data obtained from interested turers to composite tables and charts, which, after all, i terse and striking mode of expression as well as the n The conclusions reached, and the tendencies as clearly sh or may not be pleasing, but they are as nearly honest a as it was possible to obtain. The searcher for facts often not pleasing.

REPRESENTATIVE INDUSTRIES.

The following concerns were kind enough to furnish mation requested by the writer. I crave your indulgenc merate them for the reason only that their size and impor the well-known interest displayed by these concerns giv erable weight to the conclusions reached:

United States Steel Corporation,
The Bethlehem Steel Company,
The American Rolling Mill Company,
Republic Iron and Steel Company,
Commonwealth Steel Company,
Inland Steel Company,
The Youngstown Sheet and Tube Company,
American Steel Foundries,
Winchester Firearms Company,
Scoville Manufacturing Company,
Goodyear Tire and Rubber Company,
The Republic Rubber Company,
The Norfolk and Western Railroad,
Westinghouse Company,
General Electric Company,
The New Jersey Zinc Company,
Raritan Cooper Works,
Fairbanks-Morse Manufacturing Company,
International Harvester Company,
The Ford Motor Company.

Eastman Kodak Company,
Corn Products Refining Company,
Omaha Gas Company.

Letters were also received from the
National Safety Council,
United States Bureau of Mines,
Department of Labor and Industry of Pennsylvania,
Industrial Commission of Wisconsin,
Industrial Commission of Ohio,
Industrial Commission of New York.

These twenty-three concerns employ, as of July 1, 1917, one-half million employes and you will notice that almost every large group is included; that we have endeavored to obtain the worst possible phase of the situation in using statistics from the industries and concerns which have had the most rapid and phenomenal growth through the demand for munitions proper, or products bringing them more or less within the newly coined (group) "war brides."

There has been much speculation and a few statistics, mostly of individual concerns, tending to show a proportionate increase of accidents due to increased production. It is indeed pleasing to find that this tendency has been greatly over-exaggerated, although the increase is regrettably true, and the charts will present you some interesting contrasts and not a few apparent paradoxes that are usually present when a large number of factors without a common denominator are sought to be compared.

ACCIDENTS ARE DECREASING.

It is impossible and somewhat mystifying to attempt to analyze several of the things which appear. For instance, it is almost the universal experience that accidents started to increase early in 1914, reaching their peak in 1916, and receding rather sharply in the first half of this year in spite of the fact that the employment roll of the industries involved is still mounting in the same, or more pronounced proportion. Hundreds of reasons could be properly advanced for this apparent phenomena and all might be applicable in specific instances, but the most plausible answer, to my mind, is the fact that not until some time in 1916 had this tremendous increase of production been efficiently organized. When additions began to spring up like mushrooms over night; when new men began arriving literally by trainloads, more or less unfamiliar with the new type of employment, lured on by wages, in many cases be-

yond their wildest dreams; when safety departments lutely lost in the maze of new construction and double production, it was not surprising that the accident rate s rapidly and steadily. That the new-man problem had with the situation is very graphically shown by Volur of the Bulletin of the Pennsylvania Department of Labc of the Cambria Steel Company showing that the liabili of the new man of less than thirty days' employment as against a man of thirty or more days' experience. sons have taken the manufacturers severely to task f "speeding up" measures supposed to have been emplc my humble opinion most of the "speeding up" has b voluntary, because the bait of wartime wages hung con front of the workers' eyes as the tempting feed hangs horse in the tread mill.

COMPARISONS DIFFICULT.

It is indeed regrettable that some standard of comp these statistics should have been lacking for the last t because more information could have been made availab ever possible before or may be again in the future. It sary to leave out of different charts many companies wh valuable information, simply because their statistics abso not be contrasted through their lack of a common denor was impossible, of course, to contrast one concern in ter dents against another in terms of days lost from accide where two concerns kept the data in the shape of ac definition of the accident itself was apparently not the sa might keep all accidents, including minor accidents not to some commission, while the other for its own infor corded every accident even though it be a mere scratc

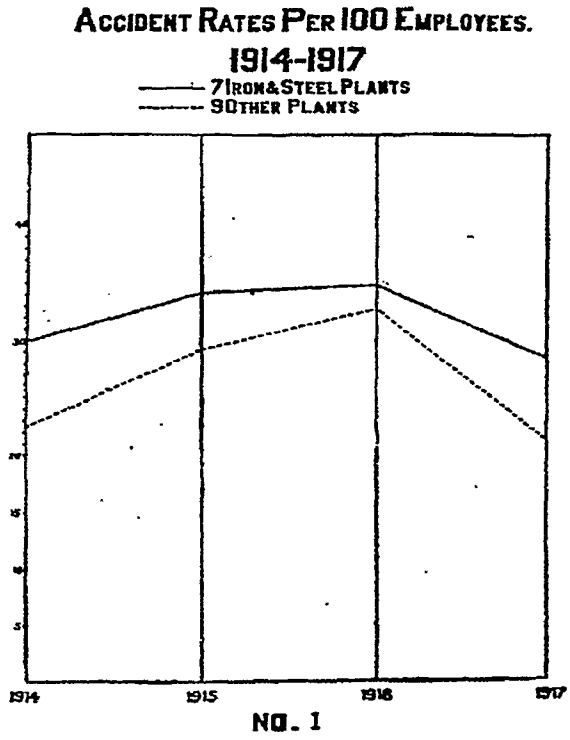
It is really deplorable that such a mass of informat offered for this purpose should be susceptible of such parative composite value.

After trying to adapt every recognized standard of c we find that the only method adaptable, for enough c make a representative showing, was to reduce it to tern dents per 100 employes, using the years 1914, 1915, 1916 Of course we had only one-half of 1917 available, but we the figures for the first half of 1917 by two, after justifyin in a manner which I shall later show you upon a chart

You understand, of course, that I hold no brief for this type of statistics but until the good Lord in his wisdom (and incidentally you gentlemen in yours) permits us to have something more definite and more tangible we must all be satisfied with the best that is available.

CHART NO. I.

This chart shows the accident frequency rates per 100 employes for seven large iron and steel plants and for nine other plants manu-



facturing various products. The rates cover the years 1914, 1915, 1916 and 1917. The top line is the curve for the iron and steel plants, the bottom line is the curve for the other plants.

The iron and steel plants, which furnished the comparable statistics which make up the composite figures for this chart are as follows:

The Commonwealth Steel Company,
American Rolling Mill Company,
American Steel Foundries,
Republic Iron and Steel Company,
Inland Steel Company,

A Subsidiary Plant of the United States Steel C
The Youngstown Sheet and Tube Company.

From the reports of the foregoing companies the figures were compiled:

Total Number Employed	Year	Total Injured
24,802	1914	7,445
26,740	1915	8,157
37,049	1916	12,951
45,945	1917	13,104

The following companies furnished comparable dat presented in the chart:

The Ford Motor Company, automobiles,
Eastman Kodak Company, cameras,
Raritan Cooper Works, cooper products,
Winchester Firearms Company, arms, ammunition,
Goodyear Tire and Rubber Company, rubber product
The Republic Rubber Company, rubber products,
Omaha Gas Company, public utility,
Scoville Manufacturing Company, machine tools, etc
International Harvester Company, farm implements,
Fairbanks-Morse Manufacturing Company, scales.

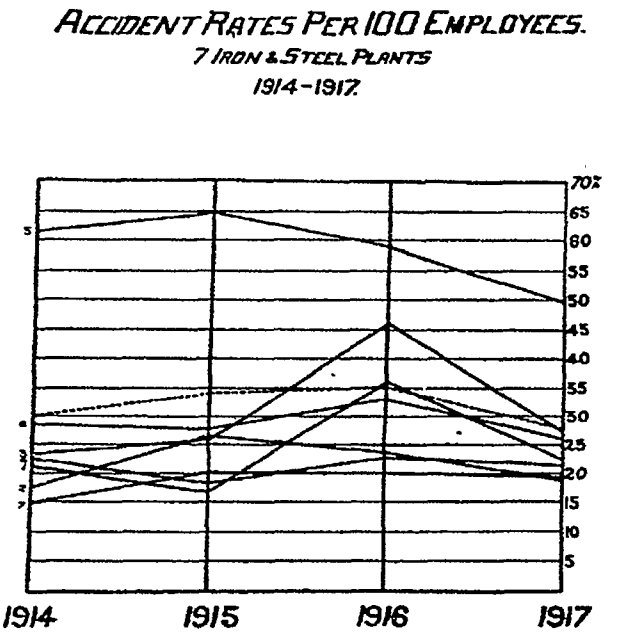
Total Number Employed	Year	Total Injured	I
58,240	1914	13,124	
71,005	1915	20,789	
95,902	1916	31,635	
136,999	1917	29,315	

The chart shows in both groups that there was an i the accident frequency rate in 1915, and that it reache in 1916. In 1917 the rate has gone down, the reports rece that this tendency has been the common experience in ne plant. One or two plants report a drop in 1916. No twenty-three companies show an increase in 1917.

CHART NO. 2.

This apparently complicated chart merely shows the accident rate curve of each of the seven iron and steel pla furnished the data for the composite curve in Chart No rates are given in terms of so many accidents per one hur

ployes. The company furnishing the statistics for the top line in this chart included every accident, while the others showed only off-time accidents.



NO. 2

The dotted curve is the average for all seven companies.

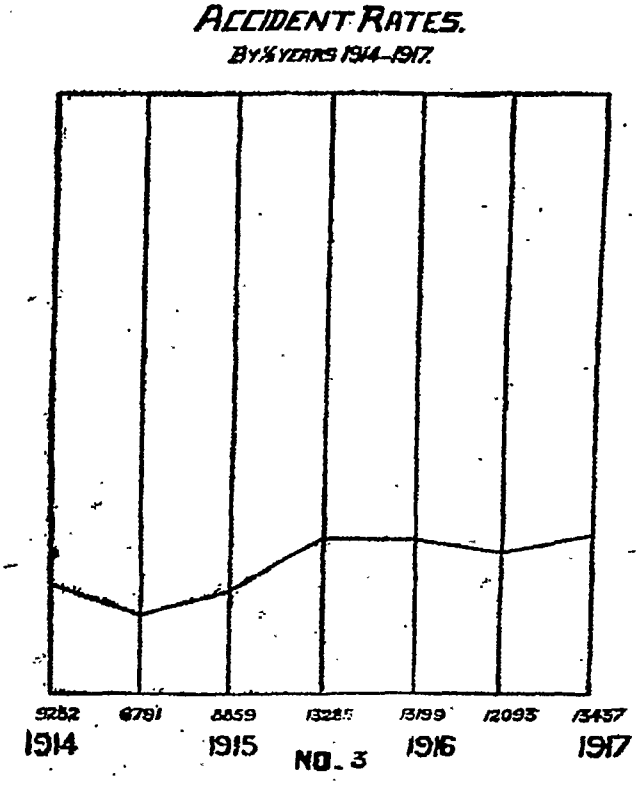
This chart further demonstrates the upward tendency of accident rates in 1915 and 1916 and their downward trend in 1917.

CHART. NO. 3.

In order to arrive at the total accident figures for the year 1917, which was necessary to furnish comparable statistics with the figures for the preceding years, some method had to be devised that could be taken as a fair basis for approximating the figures for the last six months of this year, based upon data of the first half of year. The statistics of the companies who had given them to us in a monthly summary were carefully studied. As a result of this conclusion we became convinced that it would be reasonable to multiply the figures for the first half of year by two to arrive at the year's figures. The records showed that the rate for the first six months of every year was higher than for the last six months. And as to the actual number of accidents, regardless of the number employed,

we find that there were more accidents during the first than during the last six months, save in 1915.

A statement from S. H. Slaymaker, who furnished t statistics for the Fairbanks-Morse Company, also bears this conclusion: "We have found in our past experien late winter and early spring months are always conduc



accident averages, whereas, the months of June, July, Au tember and October invariably show a marked decrease

The following summary shows the figures from wh No. 3 was made up. These are the half yearly accident r the following concerns:

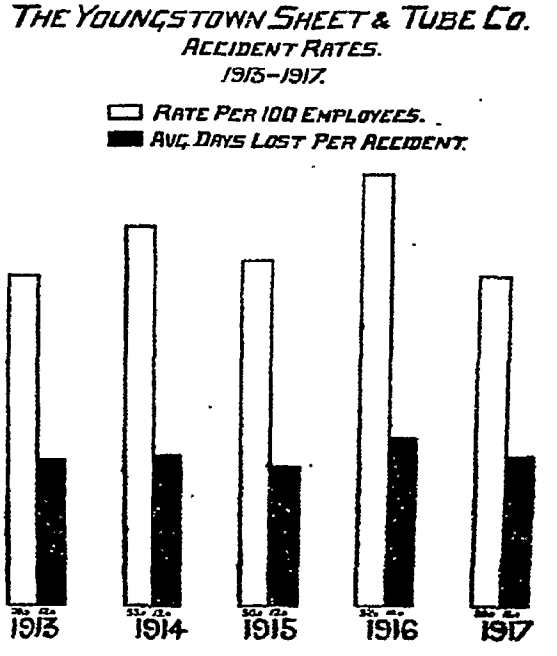
American Rolling Mill Company,
Goodyear Tire and Rubber Company,
The New Jersey Zinc Company,
The International Harvester Company,
The Youngstown Sheet and Tube Company.

Period	1914	1915	1916
January-June	9,282	8,859	13,199
July-December	6,791	13,285	12,093

In view of the common experience of every one that I have approached upon this point, I believe that this method will aid us in arriving at very nearly the correct result. At least we can be reasonably certain that the accident frequency rate for the last six months of 1917 will not be any greater than for the first six months.

CHART NO. 4.

The accident experience of the Youngstown Sheet and Tube Company for the last four years has been similar to that of the other seven iron and steel plants studied. This chart shows the rate



NO. 4

of off-time accidents per 100 employes since 1913 and also the average number of days off for each off-time accident.

These rates and averages are as follows:

	1913	1914	1915	1916	1917
Rate of accidents per 100 employes	28.9	33.1	30.2	37.6	28.8
Average number of days lost	12.8	13.4	12.3	14.9	13.3

The original statistics which furnished the basis for are as follows:

	1913	1914	1915	1
Number employed	7,963	5,648	6,500	8,
Number of off-time accidents	2,302	1,690	1,804	2,
Number of days lost	29,432	22,715	22,300	39,

These statistics also show the importance of the new-lems. The increase in the number employed has been

1914-1915 .....
1915-1916 1,
1916-1917 2,

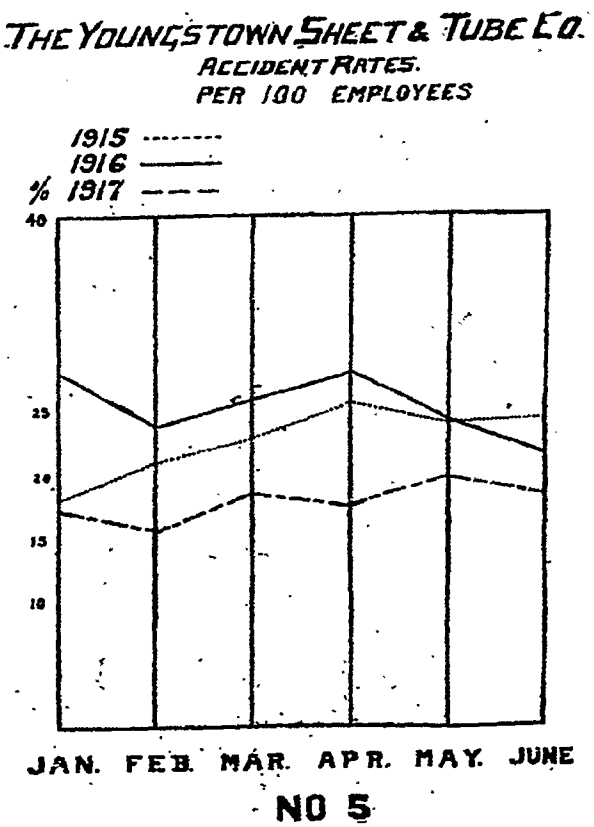


CHART NO. 5.

Rates of accidents per 100 men employed for the first six in 1916 and 1917 give additional emphasis to my point, th dents have decreased in

	January	February	March	April	May	June
1915	17.9	21.0	22.8	25.3	23.7	24.1
1916	28.0	23.6	25.7	27.7	24.0	21.3
1917	17.0	15.5	18.3	17.3	19.5	18.2

These figures, compiled from the accident statistics of the Youngstown Sheet and Tube Company, I believe are a true representation of conditions in the iron and steel industry, and the tendency of the curves also represent quite accurately the experience of the other manufacturing establishments furnishing data for this study.

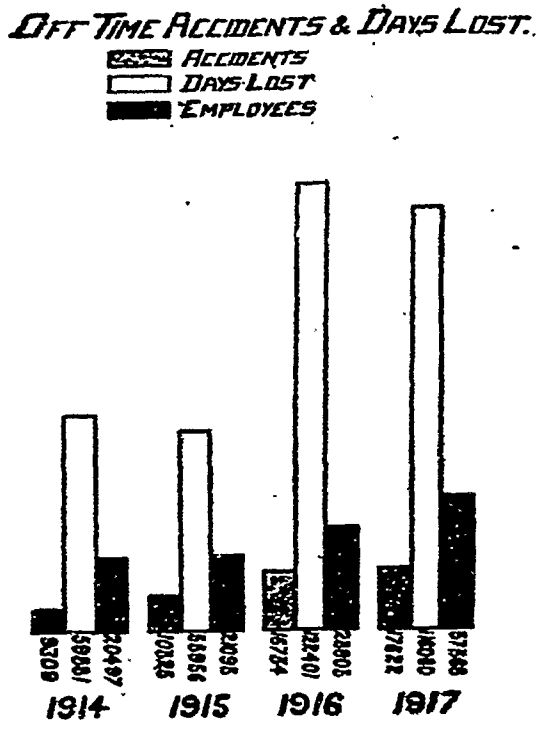


CHART NO. 6.

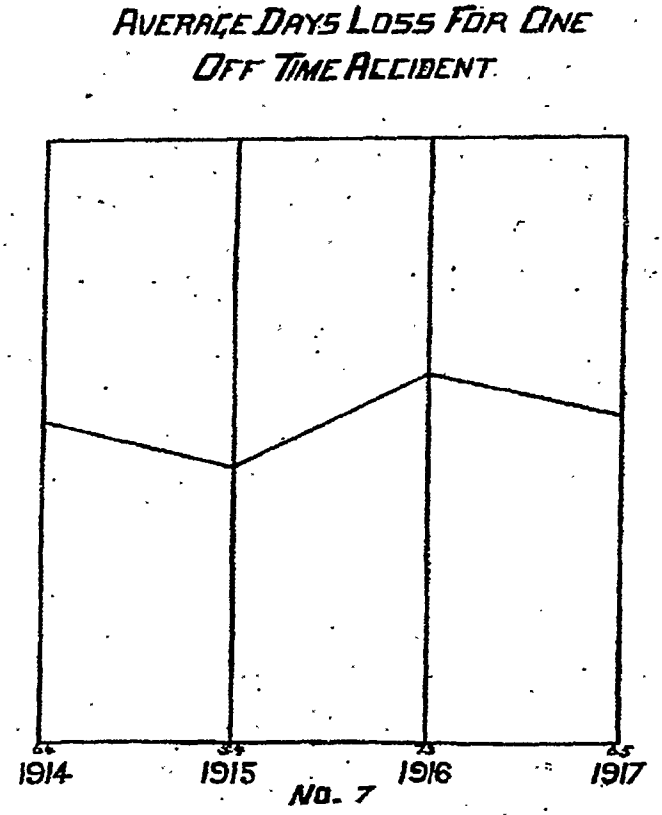
Off-Time Accidents and Days Lost.

This chart shows the actual number of off-time accidents by years, also the number of working days lost account of accidents, and the average yearly number of employes. These figures were furnished by the following seven plants, which furnished us the information in the form needed:

The Commonwealth Steel Company,
American Steel Foundries,
The Youngstown Sheet and Tube Company,
A Subsidiary of the United States Steel Corporati
Fairbanks-Morse Manufacturing Company,
Corn Products Refining Company,
The Republic Rubber Company.
The statistics are as follows:

	1914	1915	1916
Total off-time accidents..	9,309	10,325	16,734
Total days lost.....	59,881	55,956	122,401
Total employed.....	20,497	21,095	28,605

The foregoing figures further support the facts already p showing the tendency in industrial accident rates since 1914



dence thus far has shown that the peak was reached ir
Whether or not accident rates will

pared to show existing facts nothing by way of prophecy has been attempted.

CHART NO. 7.

The purpose of this last chart is to present some facts concerning the severity of work accidents during the period under study. The data for this study has been taken from the accident experience of the following concerns:

A Subsidiary of the United States Steel Corporation,
American Steel Foundries,
Fairbanks-Morse Manufacturing Company,
Corn Products Refining Company,
The Youngstown Sheet and Tube Company,
The Republic Rubber Company,
Commonwealth Steel Company.

The total number of working days lost was divided by the total number of off-time accidents. This gave the average length of time lost for one off-time accident, which furnished a basis for comparison.

These averages were as follows:

	Days
1914—Lost time per accident	6.4
1915—Lost time per accident	5.4
1916—Lost time per accident	7.3
1917—Lost time per accident	6.5

These figures show that the severity of accidents in 1917 has decreased when compared to those of 1916.

CHAIRMAN FONDA: The next discussion on Dr. Chaney's paper is in the hands of Mr. L. W. Hatch, Chief Statistician, New York State Department of Labor. I am sure we will all be glad to hear from Mr. Hatch.

DISCUSSION BY MR. L. W. HATCH.

Mr. Chairman and Members of the National Safety Council: I think it may very fairly be said that both Mr. Kennedy and myself are victims of circumstances, in view of the fact that neither of us, contrary to our expectations, had Dr. Chaney's paper before today. Mr. Kennedy, I believe, had a synopsis of Dr. Chaney's paper, but I have not been so fortunate, and as a result I come before you with only a few ideas that I jotted down as I came to New York this morning.

EXPERIENCE IN NEW YORK.

I might, perhaps, give you one or two suggestions fron York experience in analyzing accidents, that being what is in my mind just now. We must approach the subject of a accidents from three general points of view, according t are trying to learn about them. In the first place, it may are investigating the problem of insurance or questions o resulting from accidents, that insurance now taking th workmen's compensation; or we may be analyzing accid information which will be of practical service from thi view of prevention—preventing damage being done—ra paying for it after it is done. In the third place, we another general point of view, namely, that of measurin from period to period along either of these two lines. at this meeting of the National Safety Council, it is the point of view that we are interested in and just as sc approach accidents from that point of view the questior mount interest is the causes of accidents.

What we have come to believe is of great importance in accident experience and accidents in detail in New Y handling accidents for a good many years with special i the subject of prevention, is the need of elaborating o and classification of details. As chief statistician of the d in New York I am constantly asked by our factory insp by outside parties interested in the safety movement and more details about accidents that occur in given They are wanted not only by general classes but by sub-di classes, and they are wanted by sub-divisions of sub-divisi inspectors are constantly coming to the statistical bureau want to know the number of accidents, and what the accic been on a particular machine in a particular industry, s would suggest as of exceedingly great importance for th tion of accidents is the pressing for more details as to the accidents.

Let me tell you what we are trying to do in New York line. We are sub-dividing our classifications of causes of just as far as we think we can get information which w us to classify all the different accidents within the limits detailed classifications.

CLASSIFYING ELEVATOR ACCIDENTS.

Up to two years ago, for example, all accidents upon elevators in factories were put under the one head of "elevator accidents." I would say that my problem of accident analysis is quite different from Dr. Chaney's. In his study of the iron and steel industry, Dr. Chaney has taken for his field of study one single industry. Under the compensation law in New York we have the problem of analyzing accidents for practically all industries, hence our problem of classification is very wide—much wider and much broader than that in the classification of a single industry.

In the last two years we have undertaken to sub-divide the general classification of elevator accidents, so that we propose to have experience as to elevator accidents sub-divided into twenty different classes. That is, we are going to take all accidents which were connected with cables or due to any condition or connection with cables on elevators—all such problems—and place them in three different classes, according to whether the accident was due primarily to the breaking of the cable, to the unwinding of the cable, or to a workingman being caught by the cable. It may be that later on we will sub-divide cable accidents still further. Then we will separate all accidents due to counter weights on elevators; accidents connected with machinery in two different classes; then accidents connected with the car.

There is another group, that of workmen being struck by the elevator car or falling from the car, and those we will classify in six different classes, according to whether the man was caught between the floor and the car, caught between the shaft side and the car, caught between the gate and the car, whether he was struck by the car while on top of it, or struck by the car in some other manner.

Similarly, we will take other classes of accidents—for example, accidents on scaffolds in the building industry. Heretofore, or up to two years ago, we classified all accidents on scaffolds together. We propose to sub-divide just as elaborately as we can. The only limit of our elaboration will be the information we can get, and we shall have some dozen or fifteen sub-classifications under the general class of scaffolding accidents.

ACCIDENTS ON WORKING MACHINES.

Furthermore, we will revise our classification of working machines—always a very large group of accident causes—and sub-

divide them, particularly the power working machines. are really driving a good way into detail. We will t machines, for example, which we have heretofore, or years ago, classified chiefly by industries and sub-divide as far as we can carry our sub-division. For exampl classified metal-working machines under five or six differ We proposed to devote some hundred numbers in our cl code to metal-working machines. We will make some d ent classifications under lathes, arriving just as far as p distribution of the accidents caused by each particular ty

In addition to sub-dividing our list of working mac going as far as possible with a particular kind of machi use at least three other classifications as to machine acci are trying to use these and are confident we shall even ceed. As I said before, much depends on the informati secure in original reports of accidents.

We will classify our working machine accidents, not particular class of machine and a particular type in that cl the part of the machine on which the accident occurred; fo whether it occurred at the point of operation of the machin it occurred in connection with belts or pulleys which are part of the machine; whether it occurred in connection wheels, and so on. In addition, we will classify by the which the workman was engaged when the accident whether he was adjusting the machine, repairing the mach the machine, and so on.

We will try to go one step further and find just what was that caused the accident in connection with that proce particular machine; whether it was due to flying objects machine; whether it was due to loose clothing or to the being caught in the machine, and so on, as far as we can analysis. We feel sure that all the labor that this is goi will be well worth while, because our safety men are us constantly with questions of just that sort. In additio asked for information of that kind by the committees with our bureau of industrial codes. That bureau, in the New York, has power under our labor laws to establish regulations which shall, when once adopted after publi and so on, have the force of law and must be followed b ployers who are within the jurisdiction of the department.

WORK OF STATISTICAL BUREAU.

When the committee discusses a code the first thing they want to know is where are the danger points and what kind of dangers they are. They come to the statistical bureau and press us for just this kind of detailed information—I am talking of experiences that come up every day. We have a code committee working on elevators and we were asked for detailed figures showing the distribution of elevator accidents by the particular part of the apparatus and by the particular kind of accident at that point. The query was caused by a very practical question which came before that committee. Some members of the committee were inclined to say: "Why do you want an elevator code, or why revise or extend the one you have? Show us that it is necessary." It is along that line that detailed analyses of causes will afford a very practical guidance for safety work. I have repeated several times how far we hope to develop and carry out our cause classification in New York, so that it now numbers from 700 to 800 causes, including all sub-divisions, but how far we will be able to realize that at which we are driving will depend greatly upon the nature of the reports of accidents sent to us. Our stream is not going to be any better than the water at the source and the water at the source is the employer's statement of how the accident occurred.

My suggestion to safety men is that we need the most detailed classification of accidents possible in order to get that which is absolutely necessary. It is absolutely necessary that the original report of the accident shall set forth the cause with as much detail and as explicitly and accurately as possible. I presume you do not realize that quite as much as a state official, but we deal with some one hundred, or hundred and fifty, thousand employers. A safety man in an individual plant has his own individual management to deal with and he probably can bring his officials to see that this recording of accidents is important. The necessity for such data, from the point of view of a State bureau, is very simple—a very elementary A, B, C proposition—and the very foundation of the whole thing. We have to secure original reports that are carefully and accurately drawn up, and what I would urge you safety men to do, in order that the State authorities may give you information which may be of real assistance, is to see to it that original reports of accidents are not carelessly drawn, that there is no guesswork,

that at the time of the accident the details as to how i
and where it happened should be carefully recorded.

CHAIRMAN FONDA: I hope we shall have a free di
the subject that you have heard presented so admirabl
three gentlemen. I trust every one that has a question w
before the meeting.

PUBLICATION OF CAUSES OF ACCIDENTS.

MR. EARL B. MORGAN (Safety Engineer, the Norton
Worcester, Mass.): I would like to ask Mr. Hatch a
Does your department intend to use this detail unless th
type of machine which caused the accident is stated? I
me, Mr. Chairman, there is an excellent field for that kin
Our concern, as a manufacturer of grinding wheel machin
be interested to know exactly whether it is precision grin
grinding wheel for free hand work that causes trouble. (
tion was recently called to a hazard heretofore overlooked.
board extended around the under part of the wheel, bu
intended to serve as a guard. Sometimes, when a wheel b
fragments hit this splash board and break it. The m
brought to the attention of the Safety Committee of th
Committee of the Machine Tool Builders and the fault w
rected in subsequent designs. This action shows a very g
nel for the information suggested by the speaker if it could
over to the proper authorities.

MR. HATCH: We shall make public all information of

MR. MORGAN: Will you not go farther than that?
give it direct to the proper organization, the Machine Tool

MR. HATCH: We will be very glad to do so. All our r
published in special bulletins, and as a rule are forwarded
izations such as you refer to—most of them are on our ma
We propose to make the information available just as fast as

What you have said suggests an exceedingly importar
safety work which has been discussed, but, as far as I know
yet been very largely developed: That is, to guard your m
the source, equipping it with guards when it is being manu
See that it has the proper guards and you will prevent many a
One great difficulty we are up against, when we endeavor t
anything of that kind is that the New York Industrial Co
cannot regulate the manufacture of machines in Connect

come to the point where we can have safety regulations established by the Federal Government I think some tremendously important things can be done by just that method—making it unlawful to use a machine in the United States without certain safeguards.

VARIATION IN STATE LAWS.

MR. MORGAN: At a recent meeting of the Machine Tool Builders' Committee that very point was raised and discussed. One concrete illustration would be a grinding machine, floor-stand type, or a precision machine for grinding. Machine tool builders, as a general rule, do not attempt to put a belt guard on that machine, and our company got into trouble for doing it, because we found that the guard did not conform to the rules of various States—in fact, where you are up against it for one we are up against it for all of them. On our machines we provide a base to which the user of the machine can easily adapt his guard, but we go no farther. We want to put one on, but we are in a position where we are helpless.

MR. HATCH: I did not mean to be understood as criticizing what the gentleman said.

MR. MORGAN: My point was not in rebuttal, it was in explanation. That is the situation of the committee. The machine tool builders want to do it, but they cannot by reason of the laws of the various States.

MR. BROWN: The question of statistics is one which involves interests of great value. The last speaker raised a question which I would like to have brought out. The main point of statistics is: What are you going to do with them after compilation? Statistics are things that are very easy to run into, but if you do not get any useful application out of your study you are wasting time.

I would like to ask Mr. Hatch just how he will apply this enormous collection—if I misunderstood him, please correct me—of 200 or 300 classifications of accidents by specific machines? To make clear the thought that I am driving at: In connection with lathes you might have a chip fly off a tool and hit a man in the eye. I do not see that it makes very much difference what the type of lathe was, it was a question of guarding that chip of the tool. Could you not get classification of causes that would eliminate the different kinds of machines approximately of the same kind, and give the cause to us, no matter what the type of machine?

The same would apply, illustrating the thought from another

angle, to the question of belts. You may have a dozen types of lathes, all belted. If they are belted and a man c sleeve in the belt I do not see that the type of lathe from ei of view makes much difference. I would be glad to have th out, if you please.

MR. HATCH: Let us take the last illustration: That o different lathes you may have accidents occur from the be pose you find that on the dozen kinds of lathes, out of a hun dents that occurred on the dozen, fifty of them occurre particular type of lathe. It would be a good pointer to that had that type of lathe in his factory that he had be with that particular lathe to prevent accidents, working to t if he cannot get at all of them at once. All we are trying out is the point where the accidents turn up most frequently that indicates the point which it is most worth while to gua

I believe that we do want figures showing the total n accidents from belts of every description. That gives us t formation, but when we have, in addition to that, whether t belts on a machine or on transmission apparatus, primary o ary, as statisticians have attempted to classify it—not very fully—working down to the particular part, to each kind of give you the distribution of accidents among those belts, it me you have added somewhat to your information about th dents. Then you can proceed more intelligently.

RATIO OF ACCIDENTS.

MR. BROWN: I accept that with pleasure, but would i worth while to bring out one more thought, that in this whc tion of machinery guarding you are tackling a problem which the smallest end of our accident troubles? If I recall c machine accidents today are somewhere in the neighborhoo or 25 per cent of the total number we have to deal with. I our own plant that our machine accidents were only 3 per c not one of them was serious. From 85 to 90 per cent of a today are connected with handling material which does not machinery at all. I presume that ratio is not very differe tainly not with most of the gentlemen in the Iron and Steel

MR. J. C. SMITH (Safety Director, Inland Steel Compan ana Harbor, Ind.): I have been very much interested in the Dr. Chaney and Mr. Kennedy and I think

some very important phases of the analyses of accidents. Personally I have given a great deal of attention to that subject during the past year. I have gone over Dr. Chaney's reports previous to this meeting, one along the same line was published in the Monthly Bulletin of the Bureau of Statistics and covers his method of analyzing accidents. I think that both he and Mr. Kennedy and every one else who has given though to this subject are of the opinion that some method should be devised whereby we all could rate our accidents on the same basis. We are convinced of that truth, I believe.

Personally, I would not want to see Dr. Chaney's method adopted. He uses a mortality table as his basis. The reason that I would not want to see his basis adopted is simply because it is so much higher than the compensation basis that if the employer should adopt it as a basis, it would give people who have been agitating compensation raises a great opportunity to say that we should adopt a basis which pays 9,000 days for death cases, whereas, under the ordinary compensation plan, compensation is only paid on about 2,000 days, or possibly a little more.

UNIFORM COMPENSATION LAWS.

I think the basis should be on an average of the compensation laws of the various States of the Union. It would be equitable and fair and it would be more reasonable to expect the average manufacturer to adopt such a basis, because we are all coming to the compensation period. If we would adopt a schedule based upon the average compensation law of the various States, it might possibly have an influence in tending to make uniform compensation laws.

There are a number of men in the iron and steel industry who received their training in safety work in Steel Corporation companies. Some of us left the Corporation and entered the employ of independent operators, but have continued the practice of scheduling our accidents upon a basis classification. For instance, "A" includes all accidents from one to seven days, "X" includes all accidents from seven to fourteen days, "B" includes all accidents from fourteen to thirty-five days, "C" over thirty-five days, "D" fatal, "E" returned to work. In that way we are able to get a comparison between results at our plants and results at Corporation plants, and they in turn are able to obtain a comparison between all their subsidiary plants. The method is somewhat crude, there is no question about it, but it has worked out quite satisfactorily.

REPORTS BY DEPARTMENTS.

During the past year I have gone into this subject q sively. We send a report to the superintendent of every c in our company each month, giving a very detailed statem analyses of the causes of accidents in his department. T includes the cause of the accident, the name of the for classification of the accident according to the time lost tabulate the report, showing the number of accidents eacl has, where the accident occurred, as, for instance, at a blas We show how many accidents occurred in the boiler-h many in the engine-house, how many at the casting-house, at the dock, how many at the pig machine. We go through every part of the operation in the various departments an the number of accidents which occurred in that division number of days' time lost. We also show the total numbe time lost for accidents in that department during the month estimated compensation cost and the amount of compensa We give the superintendent every bit of detail possible cause of accidents in his department. We show the par body injured. We give everything that we can think of a thing that anyone else has thought of, so that the super can have exact knowledge of accidents occurring in his de I take the report to the superintendent every month and w it. I point out the different features and there is no opport a superintendent to pigeonhole it.

In that way I think we are getting perfect results analyses of the causes of accidents. I thank you.

CLASSIFYING LATHE ACCIDENTS.

MR. A. S. REGULA (Navy Yard, Brooklyn, N. Y.): like to ask Mr. Hatch a question. Take, for example, types of lathes: In such a machine classification as Mr. H in mind he does not consider the fact that there may be mor lathes in use than turret lathes. In other words, if you report that 200 accidents were due to turret lathes and 100 a were due to engine lathes, that does not necessarily mea turret lathe is more hazardous than an engine lathe, beca may have ten times more turret lathes in actual use than y engine lathes. That indicates to

the same thing that Mr. Kennedy speaks of, using the common denominator.

MR. HATCH: That is precisely the case. To use a colloquial expression, that is just what we are "up against" in the matter of accident statistics. Your figures are significant, in spite of the fact that we have not a base for each machine—that is, a base of exposure. If we knew the number of each kind of machines then we could really get at the hazard of that machine. Take the case of the example cited—an employer has 200 accidents on turret lathes and 100 accidents on engine lathes. You might conclude that it does not make any difference to him, as a matter of fact, whether he has actually found out that the first type is more hazardous than the second, since he has twice as many accidents on the first type as on the second. He also knows, if he discovers that those accidents are running to one particular circumstance on that particular type, that when he has a guard for that one particular thing it is very easy to develop it 200 times, and then he has reached two-thirds of his accidents. When you recognize, as every one must, that you have not measured the actual rate of hazard, if I may use that term, you have not an actual accident rate for that machine at all. I do not know of any way to get an accident rate for particular machines as such. It would be a very elaborate matter to give you exposure for the machine so that you could calculate the accident rate for it.

COMPLEX SCHEDULES.

MR. KENNEDY: It seems to me that we have got to the end of our string on safety work unless we arrive at some basis for statistics. I have been a student of this subject for a good many years, as most of you know, and with all due courtesy and with all deference to Mr. Hatch, I think that the thing we are suffering from is too much of what he contemplates. You are getting your schedules so intricate, so confused, so complex, that no manufacturer can comply with the demands made on him.

It has always been my idea that if we could provide some easy basis of computation that not only would the companies be willing but they would be glad and anxious to co-operate with State boards. If the State boards would go through their organizations with the help of the United States Department of Labor and agree on one standard and then stick to it, we could get somewhere. All of us who are honest and sincere in trying to find the truth about accidents

and accident statistics maintain that ought to be done, and soon.

I would like to bring one point to your mind. This mo heard the splendid address of Mr. Dow. It was a brilliant t all honesty and sincerity he made a statement that was not He thought it was and meant it honestly, I am sure, becaus him very well, but I made misstatements in my talks whe to be absolutely honest. Mr. Dow said they had reduced t dents per ton per mile carried so many per cent in ten ye Norfolk & Western and half a dozen other concerns ar statistics that they have reduced their accidents so much pe mile, but they do not tell you that they are carrying so m tons per mile per train per crew than formerly.

If we are going to be fair and honest, if we are in this make a true statement of our conditions in an endeavor them, that is one thing. If we come here to "kid" ourse make statements which appeal to our pride or to enable u our job or get a better one we had better quit.

EVERY ONE SHOULD ADOPT SAME STANDARDS.

My idea is to let every one have the same standard and j fellow who is not up to the scratch. In making an interior i tion in your plant as to whether it is a machine, turret o lathe, or whether a bolt broke or a lathe gear or a cog or so else, I state with all due deference to Mr. Hatch that the S never do that, because with 100,000 employers the State w get the facts from them to make an analysis. It will not be the employer is not willing to comply with the law or does n well, but in all sincerity, try as he will, the little fellow cann If he knows that he has 500 men employed in the same line ness as John Jones and his rate is 65 where Jones' rate is on will get busy.

Then you can send your investigator and find out what pa machines are responsible and what particular type of mach what part of that particular type of machine is responsible. interested in finding out whether it is a fact, on the same hyp that a certain steel company is reducing its accidents 68 p when as a matter of fact it may be a lot worse off in its reco some concern that only reports 10 per cent.

CHAIRMAN FONDA: I think the point Mr. Kennedy has

I know it would be an almost impossible job to give a State board the information necessary to classify accidents along the lines Mr. Hatch has suggested.

There are a number of companies that keep machine hours on various types of machines, but I think it would not only be difficult for the small organization, it would be a big job for a big organization, because ordinarily they do not need that sort of data. It would mean additional overhead to get it and it is just that sort of thing, I think, that antagonizes employers to some of the State organizations. I am quite sure, on the other hand, if we can get down to substantial basic data, we will be a lot better off than attempting too much of the infinitesimal.

COMMITTEE ON ANALYSIS OF STATISTICS.

MR. HAYWARD: Is it in order to consider the appointment of a Committee on Analysis of Statistics? Two years ago we had a Committee on Danger Emblems and its work is practically accepted all over the country. Is it not possible, through the National Safety Council, to spend one or two years studying this subject under the guidance of a committee? Accident data is vague, we do not know where to go or how to get it.

MR. MORGAN: Dr. Chaney remarked to me this morning that he thought this Section ought to have such a committee. It seems to me Mr. Ha ward's idea is an excellent one. I think the Section should authorize such a committee.

One of my greatest difficulties is to keep my department from working on statistics all the time. If you allow them to do so they will do nothing else but statistical work. I have considered the matter carefully and I can see only one reason for trying to get certain statistics—It is a sales problem. What do you want the data for? You want it to sell your ideas to the management, the foreman and the men. As far as I am concerned it does not make much difference what standards you adopt. I know enough from my own experience in my own plant to be able to sell my ideas along lines Mr. Smith has just laid down. I think his was an excellent suggestion and I am going to try it out.

TWO FUNCTIONS OF STATISTICS.

MR. HAROLD MESTRE (Consulting Engineer, San Francisco, Cal.): It seems to me that accident statistics have two distinct functions. One is that which Mr. Morgan just touched on—the same function that was touched on in Dr. Chaney's paper; a purely com-

parative function, so we will know what we are doing. Morgan says, we can sell the safety idea to the manufactu other is the constructive side which Mr. Hatch touched study of the record is comparatively simple of solution. I r are obviously going to work on standards. It is a question ing out details, but the solution is in sight. On the other, structive, side we are floundering around in a very sad we do not know what to do.

We want something. We want to know in a statistical w is causing our accidents. We are not finding it, obviously, b considering mechanical causes or where the accident h That is simply attempting to work along lines I do not think us anywhere, except in certain classes of accidents, and thos of accidents, unfortunately, are the ones we know most abo are very easily preventing most of such accidents.

We cannot find out very much by tabulating statistics accidents. We know what it would cost to manufacture guards that can be carried on a lathe. The things we rea to know at the present time, I think, are almost impossible reported. We really want to know the psychological acciden want to know why the man did such and such a thing and responsible, whether the responsibility rests with the in with the foreman, or with the man; whether the accident is faulty illumination or matters of that sort. We are not gett data in any accident statistics being reported today that I k and until we devise some method of reporting this in a sim I do not think we are going to get anywhere.

CHAIRMAN FONDA: Returning to the question put by M ward, I would like to say for your information that a commit appointed last year by the Chairman of this Section to make of the classification of accidents, to see if the Iron and Steel could not arrive at some basis of simple standards. We h Chaney with us at one of the meetings in which that matt discussed. Mr. R. J. Young has that matter in hand and he working on a rather big proposition relative to general standa the National Safety Council which has taken a great deal of h He has not been able to make the progress on this particula that he had hoped, but I would recommend to the Executive mittee that they continue Mr. Young in his present capacit would urge that the committee go a little farther, as it is one most important things to be considered. As a Section we

be able to just scratch the surface. Other Sections will probably have to do the same thing and after the data is compiled, even then it would only be a very small start.

STATE BOARDS AND THE FEDERAL BUREAU.

It looks to me as if the ultimate outcome of this question will have to be referred to the State boards—and from what I have learned from Dr. Chaney that is very nearly an impossible proposition—to follow this down in conjunction with the Federal bureau to some definite standard. If State boards and the United States bureau can effect complete co-operation I think we will get results.

Through the efforts that this Section can put forth—and the other Sections of the National Safety Council are willing to help—I hope that next year we will be able to report definite progress on the establishing of proper standards of statistical study.

It is time to close, but I would like to give Dr. Chaney an opportunity to review the discussion on this important subject.

INTERNATIONAL ASSOCIATION OF INDUSTRIAL BOARDS.

DR. CHANEY: In reference to the matter of the classification of different items I wish to call the attention of the Section to the fact that the International Association of Industrial Boards has, in three particulars, adopted classification for their own guidance, and it is worth your while to know what that classification is. It covers industries, the classification of industries for statistical purposes, the classification of the causes of accidents and a classification of the nature and location of the injuries.

In those three particulars this association has devoted very careful attention to that matter, and it seems to me that the action of that association was the thing for all organizations which were dealing with troubles of this kind to follow, especially if the official boards of the States are to be governed by certain classifications.

You will be in a great deal better position if you are governed by the same classification than you would be if you make one of your own. That is the suggestion in that particular and the Federal bureau will be glad to supplement that material to the limit of its capacity. It was published by the Federal bureau and there are still available some copies.

With regard to the terms of classification and the method of treatment: I will turn in the paper that I have read today. I would like to ask you to secure, if you have not done so, one publication

which outlines a method of procedure in the 9,000 differ Mr. Smith referred to, and I would like you to know th worked it out. It is contained in the Monthly Review of of Labor Statistics for July, 1916. Our method of prepa ity rates is explained in that publication. The probability will modify our weighting system to conform to whateve national association may ultimately adopt. They have b a proposition with regard to a system of weighting differe and undoubtedly the Federal bureau will confirm wha association shall finally adopt.

TWO VALUABLE BULLETINS.

I want to ask you, as Bulletins 216 and 234 become these are the two in which I am particularly interested—t names on the mailing list of the United States Bureau Statistics for those two publications. I allow myself you will be interested in them because I prepared ther you do not find anything in them that is worth while aft them. You will find, particularly in the second one—I can ise it right away, but it will come to you ultimately—a ve study of accident causes by means of rates, the number of thousand 300-day workers from each of the different c the number of days of time allowance which goes to each am quite sure when you go over them carefully you will a very worth-while way of getting at the meat of your causes.

I hope you will remember the other things which I have this paper as of importance. In your whole accident study to know the amount of your exposure whenever you ca get it. You need some method of severity rating, one of or one such as I have proposed to you or some other simila What Mr. Smith proposes is his method of severity ra classifies in accordance with seriousness and that is a sever method. Finally, I hope that you will find a way to devel some line or other, the study of causes on the basis of rate I do not believe there is any other way to find out what to know about it.

LABOR TURNOVER AND ACCIDENTS.

MR. KENNEDY: I crave your indulgence for one m think the discussion this year has accentuated labor turn-

safety more than ever. I have not had time to crystallize it in my mind, but we ought to be thinking about it. I am glad to make this suggestion, probably some one can bring it up later in the week—the effect of turnover on safety.

CHAIRMAN FONDA: It will be discussed Friday morning.

MR. KENNEDY: In the preparation of the program next year, or in the bulletins for distribution in the next six months, it might be well to emphasize it. I think it is the biggest factor in the accidents we now have to contend with. We have not given it enough consideration in the past and the terrific situation at hand brings it strongly to our attention. I think we ought to do something specific in the next six months.

MR. ASHE: That will also be discussed in the Foundry Section tomorrow morning.

CHAIRMAN FONDA: I wish you to bear in mind the suggestion of Mr. Kennedy. The program of Friday morning has been changed. It was originally scheduled for Friday afternoon. It is a very important program and I hope that you will all be prepared to take an active part in it.

MR. BROWN: May I ask your indulgence one moment before we close? In connection with the point Mr. Kennedy raised, I would like to ask the gentlemen present whether their records show what ours do, namely, for the past three years, roughly speaking, independent of the enormous increase in the number of workmen employed, the no-time-lost accidents have increased almost in proportion to labor turnover, whereas our time-lost accidents were less. In Pennsylvania fourteen days' time ran roughly on a straight line period. Will your turnover figures and your minor propositions run anywhere parallel?

MR. KENNEDY: That question came up in preparing our charts; that is the experience of very nearly every one. It is almost identical—the proportion of minor accidents is about in proportion to the labor turnover.

CHAIRMAN FONDA: These subjects, I think, can be readily discussed under the proper headings on Friday. Please bear them in mind and bring them up at that time. We will be able to give them proper consideration.

The meeting stands adjourned.

THURSDAY AFTERNOON SESSIC

CHAIRMAN FONDA: The meeting will please con Mr. James, I will ask you to act as doorman, pleas allow about half an hour for stragglers. If we keep the it will prevent confusion.

We will get right into our program. There are a important subjects I know you would like to hear thor cussed. The first is an address on "Safety in Yard Pra Mr. F. G. Bennett.

SAFETY IN YARD PRACTICES.

F. G. BENNETT, DIRECTOR OF SAFETY, THE BUCKEYE S INGS COMPANY, COLUMBUS, OHIO.

Mr. Chairman and Members of the National Safet Attention has been directed to this phase of accident prev doubt by severity rather than frequency of accidents. been a general improvement in all plant yards in the iron industry where accident prevention work has been defini lished. This has been brought about by the recognize employed in accident prevention, engineering and organiza engineering phase of this work will be slowly noticeable lished plants, but must be recognized in new constructio are certain features, along structural lines, in our present can be modified, but an extreme hardship will be placed tain companies where present construction is so establi changes are almost prohibitive. We have studied and acc tain safety devices and practices relating to this subject, will not be discussed at this time.

In every plant a yard seems to be a necessary adj whether large or small, the need of safety attention is These yards are principally used for the storage and handli material, semi-finished product, finished product, machi other articles used in connection with the industry. This tates more or less handling or moving. Various means ployed to do this, but railroads are principally used, and source of transportation plays an important part in acciden severe class.

INTRA-YARD RAILROADS.

In considering intra-yard railroads, we must recognize a different condition than that of main-line railroads, where speed is a factor. This one aspect must have a bearing in formulating clearance rules, either from a statutory viewpoint or otherwise. The state commissions throughout this country, that have jurisdiction over railroads, have thoroughly covered the clearance problem, but this seems to be applicable to fast-moving trains.

In plant yards the movement of trains is practically limited to switching, placing of cars on loading tracks and other slow movements. In the steel plants there are movements that require speed, but this can be regulated and provisions made to insure safety. The subject of clearances would not be such a problem if new construction was to be considered, but in established plants, where buildings have stood for a number of years, it is almost prohibitive to make modifications to which clearance rules can be applied. At a recent public hearing before the committee which is endeavoring to formulate rules to govern intra-yard railroads, under the direction of the Industrial Commission of Ohio, the question was raised as to what a safe clearance should be in plant yards, and a majority favored 6 feet 6 inches from center of track. The State of Ohio Public Utilities Commission has adopted a clearance of 7 feet from center of track, as indicated by their rule nine.

There is no doubt in my mind but this is a proper clearance rule. However, we must consider the old installations where this can hardly be applied. There was considerable evidence submitted before the committee to substantiate the 6-foot-6-inch rule. A railroad official stated that a clearance rule for plant yards should embody a 7-foot clearance for running tracks and a 6-foot-6-inch clearance for loading tracks, where material is piled adjacent thereto. This committee has not completed its work and a final clearance rule has not been adopted.

WARNING SIGNS AND DEVICES.

In plant yards, in connection with railroad tracks, there are always conditions where special safety measures must be employed. I refer to warning signs and other mechanical devices that will warn employes of close clearances. In plants where old installations prevent the application of defined clearance rules, measures of this nature must be employed.

Overhead clearances in plant yards are most commonly applica-

ble to entrances to buildings, and this must be carefully s considered when formulating a clearance rule. The roller is of particular importance in the matter of overhead . If too great a clearance is designated, then the danger o not being raised its entire height of travel is established, fact that it requires more exertion to operate, and in s motive power would have to be used. This would be th matter what clearance rule would be adopted, but the p quirement of Ohio in cases of this kind is a clearance of t feet. We must again take into consideration the slow of cars when being placed in buildings. A clearance of twenty-one feet can be adopted, and, with the use of war or other devices, should be ample in relation to safety.

There are other conditions in connection with the clear lem, such as double tracks, curves, switches, canopies, awr that can be satisfactorily handled after the lateral and rules have been definitely arrived at.

The speed of trains and locomotives in plant yards shou attention, and in most of our plants this is taken care o discipline and rules. Conditions govern this phase of railr portation to a great extent.

GOOD HOUSEKEEPING.

There is always a phase of this subject that cannot l passed over, and that is general cleanliness and tidiness th plant yards. This applies more directly to railroad track unceasing campaign to remedy this evil should be inaugu clean-up gang in the large plants, whose duty is limited e to keeping the plant in a clean and orderly condition, will ficient work to take up its allotted time. Barriers, consti timber of sufficient height to prevent material rolling dow be erected at the base of all piles where same are located to tracks. These barriers, of course, should be placed in co with clearance rules.

In connection with railroad tracks there are quite a few safety devices, such as inclosed frogs, switches, locking de railers and signals, and I do not feel that these need be further at this time.

Pedestrians in and about plant yards require protect there are many devices employed at the present time. signs and baffles at grade crossings

nish protection that is acceptable to safety engineers today. Automatic signals are not to be favorably accepted, as the failure of power to produce the signal might bring about disastrous results.

This also applies to doorways from buildings leading out and on to railroad tracks. Buildings which are located close to railroad tracks should have the windows on the ground floor closed by screen or strips to prevent employes using the same as a means of exit. Designated foot walks about plant yards will help to prevent employes from using other avenues and short cuts. The use of railroad tracks as pedestrial avenues should be prohibited.

TEAMS AND MOTOR TRUCKS.

Vehicular traffic, both horse and motor, demands attention, as the latter is being more commonly used each day. The usual traffic rules should apply to motor trucks in plant yards as are in use on the public highway. It is possible to exercise more direct supervision over drivers who are in plant yards than those on the public thoroughfares, and, as there are not many of this class of employes, good results can be attained. It is exceedingly important that proper roadways and crossovers be provided and maintained in good order.

USE OF SEARCHLIGHTS.

A great many of our plants are engaged, either directly or indirectly, in the production of munitions and supplies for the European war, and this has required extraordinary measures being used about our plants in the matter of protection from plotters and others intent upon interfering with this work. The lighting of plant yards by means of projected rays from searchlights has become popular, but all should give this matter close attention. We know the effect of the glare of these intense rays, and care should be exercised to see that railroads and others are not subjected to the direct effect of these lights. This applies also to street cars and outside railroads that may run close to the boundaries of a plant. If possible, these lights should be placed at a considerable height, and better results can be attained by flooding the area in this manner than by the location of these lights on fences and other fixtures near the ground.

There are other phases of this subject that could be discussed at length, but time will not permit this to be done. There is no doubt as to the importance of safety work in yard practices, and defined and studied methods should be employed. We must all remember that employes of shops and buildings are permitted the

freedom of plant yards at times and they practically c
third party. Our usual safety provisions will afford pr
these persons, but we must reckon with them when c
safety installations and practices.

The safety movement has gone forward with comme
sults, and it is gratifying to know that study is being
bring about better conditions in plant yards.

CHAIRMAN FONDA: We will have a discussion of Mr.
paper by Mr. J. Stanford Brown.

DISCUSSION.

MR. J. STANFORD BROWN (Supervisor Department
Safety and Welfare, the Carpenter Steel Company, Readin
feel very much as did the speaker at the dinner last night—t
has been covered. In our own plant, which is not a larg
are perhaps better situated than some others, in that we ha
on one side and railroad tracks on the other side. Thes
keep the general public away and we do not have son
troubles mentioned in the paper you have just heard. W
trouble from roadways passing across our yards or anythi
kind. Our yard problem, as far as I know, is not differe
respect from that in every one of the large steel plants in
tions of the country. We take the usual precautions in
lighting, roadways and rules. Whoever is compelled to
yard for any purpose must keep clear of loads being carri
cranes and all that sort of procedure.

The question of inspection, of course, comes up in
cranes, both electrical and mechanical points being take
regularly. We have a daily inspection by the craneman a
by a representative of the master mechanic's department.
reports of each craneman go first to our chief electrician f
and criticism. He also issues instructions as to any poin
have to be taken care of in the way of repair. From the c
trician the reports go to the master mechanic for review
mechanical standpoint. After that they come to the safet
where they are looked over by me or by my associate. T
are filed. In case there is anything which particularly
attention from the safety end, other than that which has b
ered by the departments of the chief engineer and the ch

committees, which make their several inspections throughout the plant.

We have a committee of general foremen who make a monthly inspection with a committee appointed by themselves. This committee reports back anything which they find in the slightest degree open to criticism, so that it may be immediately remedied.

We also have an inspection committee from our so-called working or sub-foremen—a workingman's committee—and every two weeks they make an inspection and file a written report.

NO SERIOUS ACCIDENTS.

Through these several methods we have been able so far to keep matters well in hand. I am very happy to report that in the past year we have had only three crane accidents and not one of them serious. Of the three not one occurred in the yards. One of the accidents was not the fault of our employes, as it occurred while one of our men was assisting a contracting firm in taking down an old crane and craneway. We had erected a new steel building and in taking down the old equipment—the conditions were not quite what they should have been—this man put his hand out to save himself from a fall and his fingers were pinched by a crane being operated by the men who were taking it down. While I do not wish to excuse ourselves in the matter, the crane was not immediately under our jurisdiction at the time of the accident.

We have an industrial railway running all through our plant buildings and yards and from the standpoint of safety that little railway gives me more concern than all the cranes in the plant. This is largely due to the class of men that we use as operators, both as trolley boys and motormen, and their infernal propensity to jump on and off cars in motion. You all have that; there is nothing novel about it. We all have rules against it and we all exercise discipline with a pretty free hand in regard to violations.

PRODUCTION AND ACCIDENTS.

CHAIRMAN FONDA: I would like to place before you one thought your committee had in assigning this subject, so vitally important to small plants: That is in regard to plants that do not handle their own switching but have outside people come in. It is a pretty hard question and I think it might be worthy of discussion.

DR. CHANEY: I have one or two figures that I would like to give you from the compilations of our bureau.

CHAIRMAN FONDA: We will be very glad to have th

DR. CHANEY: I called the attention of the Section to the fact that the high points in the iron and steel ind in 1907, 1910 and 1913. Your high points in both acc employment is almost certain to coincide. Those are the i in which industrial tension was at its height and acci likewise at their heights.

The unsatisfactory thing to be noted about yard ex that whereas every other department of the iron and ste had, between 1910 and 1913, taking the high points, a 35 to 85 per cent in the severity of its accidents, the ya ments showed only 3 per cent. I think you will agree tha cent decline is too small to brag about. It might just as e been a 3 per cent raise as a 3 per cent decline.

The fact that there was this small margin of betterm yard department between those two years led me to in carefully whenever I had the opportunity, to what could be Why did the yard department improve, if at all, so very, less than all the other departments of the industry? In gene it may be said that the difficulty lies in the fact that i transportation has not been brought up to the standard s roads in general. That is an enforced standard in the c railroads by the rules and regulation of the Interstate Commission. They must have certain things on their car

So far as large plants are concerned, where they have equipment and do a good deal of inter-plant moving, the is not up to that of the railways. Our railway systems equipped in the matter of couplings, in the matter of g in the matter of all those things which the Interstate Commission requires for general transportation.

CHAIRMAN FONDA:. Our next subject is "Safe Pr Sheet Mills," by Mr. Frank E. Morris.

SAFE PRACTICES IN SHEET MILLS.

FRANK E. MORRIS, SAFETY ENGINEER, AMERICAN ROLLI COMPANY, MIDDLETOWN, OHIO.

Mr. Chairman and Members of the National Safety I have been asked to prepare a paper on "Safe Practices Mills." If you will allow me, I shall assume that not all familiar with the process of making sheets and I will d

briefly, so that we may all appreciate what hazards there are. There is no radical difference between the sheet mill of fifty years ago and the sheet mill of today, and of all the various types of rolling mills it is, mechanically speaking, the simplest.

Whether the design of the ordinary clothes wringer was adopted from the sheet mill or vice versa has never been definitely settled, but the fact remains that there is a striking similarity between the two, the main difference being that in the clothes wringer the power is applied to both rolls by means of gears, while in the sheet mill only the lower roll is driven, leaving the upper roll to be turned by friction. We can carry the simile still further. The housings of our laundry friend are equipped with two screws that operate precisely like the screw-downs on our sheet mill, only in the usual early Monday morning operations these screws are not disturbed, while in making sheets the screws are brought down a trifle every time the iron is passed through, until the sheet is rolled out to the desired thinness. So the operation of passing a bar between the rolls, back over the top and through again, appears to be simplicity itself and the fact is the hazards are very few. I'll venture to say that more people are injured on wheelbarrows every year than are injured on sheet mills direct. So, in this paper on "Safe Practices in Sheet Mills," we are not concerned with the dangers involved in the primary rolling operations so much as with the risks involved in the handling of the raw material and in the transporting of the treacherous sheet during the different processes incident to making the finished product—in other words, from the time the roller is done with it till it is crated in the car ready for shipment.

SAFETY MEASURES ADOPTED.

We have over 1,100 employes in our sheet mill departments, and for the first six months of this current year we had among these 107 accidents that resulted in a loss of one day or more of time. I am not going to burden you with statistics to ameliorate that figure, but I shall rather call your attention as I pass along to a few of the safety measures we have adopted, every one of them a reason why that figure is no larger.

In the very beginning of sheet mill operations the bars from which the sheets are rolled are first immersed in an acid solution in huge tanks to remove surface impurities, and around these tanks we have placed a double rail. Now, the vats themselves are two feet above the floor level. They were used several years without

rail guards and we had had no accident there, but the
now a man would have difficulty in getting into one of
either by accident or design. They were comparatively
now they are absolutely safe, and that, in short, is ou
make working conditions absolutely safe. Over the
which these bars are heated runs a line shaft that dri
stokers, and, of course, it was necessary for a man to
top of each furnace every day to oil this shaft. Al
falling from ladders and of slipping off the top of the f
now been eliminated by the construction of a suspen
that runs the entire length of the shaft.

In the rear of each furnace is the traditional open bos
running drinking water. Lockers for the crew of ea
located near at hand and rest benches are provided at
of rolls. The train of mills, extending the entire le
building, is spanned by frequent bridges that afford sa
ways.

Sweepers, whose sole duty it is to keep the floors
the hot scale swept up. Aside from the danger of burni
scale makes something of a slipping hazard on a plate fl
sweepers—all of our sweepers in fact—are under the sa
ment, for we regard sanitation as a part of Safety in
sense, and, no matter how urgent the demand, the swe
allowed to assist in any other work lest his own work b

CUTTING EDGES.

Now, when the sheet is rolled we must bear in mi
edges are as sharp as the proverbial two-edged sword.
seen the razor advertisements that picture the edge of a
nified 2,000 times? Well, I have authentic information
merely a life-size picture of a section of the edge of a sh
of our accidents in the sheet mill department are cuts, a
sure as you get a shock when you touch a live wire, just
are you to be cut if you come in contact with the edge of

When the roller is done with them, the sheets are
cool, and then they are dragged over to the big shears,
are squared up. These shears, of course, are accident
gears are covered; fly wheel is guarded; counter weigh
fastened, and so on. Up to this time the sheets have be
singly, but now we have them evenly stacked up in piles
we are confronted with a proposition that entails a big a

is the transporting of a pack of sheets safely. In mill practice, to my mind, there is nothing more potent to bring disaster than a pack of sheets let loose from above. They are as sinister as shrapnel. They sort of volplane down, and when they strike they slip like a slick deck of cards, and they are as relentless as a tornado, mowing down any luckless man in their path.

So far as we know, there is no practical invention for carrying packs of sheets that is *absolutely safe*. The device we use—one that I believe is in common use—is a rectangular steel frame suspended from the mill crane, and dangling at each corner by a chain is a large hook having two broad tapering toes; the whole apparatus reminding you at once of a gigantic spider. These hooks are designed with a curve at the top so that when the load is lifted the resultant force is directly over the supporting base. These curves do not straighten out as the old-fashioned right-angled bend used to do, and they are made of such a length that it is absolutely impossible to lift a load that would break the supporting chains were they in first-class condition. But those toes that are inserted under each corner of the pack will wear smooth and the chains will become fatigued, and only constant and competent inspection will assure safety.

HOOKS AND CHAINS CAREFULLY INSPECTED.

Every second day a fresh set of hooks and chains is put on this frame and the old set goes to the sheet-mill smith, whose shop is close at hand. You can well imagine that this is the village blacksmith who stood under the spreading chestnut tree. He puts character into his work. He inspects every link of those chains with a loving care, and when he roughens the toes of those big hooks he puts into his blows something more than mere muscle, for he knows what a great part he plays in taking the poisonous sting out of this giant spider.

Before the sheets are annealed they are given an acid bath, and in the room where this operation takes place we have an immense fume sucker that we designed and fabricated and with which we are having excellent results.

When the sheets come out of the annealing furnace it is necessary to flatten them, and this is accomplished by passing them through a set of leveler rolls.

Right at this stage we met with a large percentage of cuts on the forearm, and we set about to devise a suitable protector. We

tried gauntlets made of leather, but the men complai were too heavy. When I figured that the extra weigl lift them consumed enough energy in a day to shovel ton of coal, I quite agreed that they were too heav various other materials. We made a pair of protector position packing, but they were too stiff, and besic charged us $7.00 for the material. We produced som cuffs that years ago were fashionable with the butch we hit upon the idea of making them out of sheepskin wool on the outside, and, would you believe it, the me wear them. They are light, pliable, and impervious course, we could have insisted on their wearing the h in the very first place, but how much more satisfacto much happier we all are, if a safety device is ado compulsion!

FACE MASKS.

In the galvanizing department we had experience trouble obtaining proper face masks to protect the mer it is to replenish the spelter in the hot metal pots. V correspondence with firms making this sort of device, I we weren't very lucid in making our wants known, for samples of all descriptions, ranging from a mine res down to something similar to what grandfather used tc he went out among the bees to take off the honey. In with an optical house we finally evolved a very satisf weight mask, one that can be worn on top of the head use, and can be conveniently adjusted when needed.

In the handling of sheets on trucks where cranes a able we are experimenting with two electric tractors, meet our requirements we shall have more of them an we hope to do away entirely with hand trucking, whic gerous practice at best.

REPORTING ACCIDENTS.

Now, having stowed our sheets in a car ready for s us consider "Safe Practices in Sheet Mills" from a diff We've been talking about preventing accidents without What do we at the American Rolling Mill Company call a Any injury, no matter how slight. We have a rigidl rule that every injury, no matter how trifling it may

be taken to the hospital for treatment. This reduces the number of infections to a minimum. A record of every accident is made in triplicate, one copy is kept for the hospital file, the injured man's foreman receives one, and one copy goes to the safety department. Every morning the accident reports for the preceding twenty-four hours are carefully scrutinized by the safety department to see if therein we might get an inkling, a hunch, if you please, as to where we might be of safety service.

We have a safety committee in every department that is on the job every day, a general committee that makes a monthly inspection, and we have a safety page in our magazine that is our safety newspaper. We have suggestion boxes throughout the different departments, and if a safety suggestion is adopted the suggestor is suitably rewarded. If we find a suggestion that is of no practical value whatever, and that is often the case, as you know, we go out in the mill and tactfully show the author just why we cannot avail ourselves of his proposition. We assure him that we appreciate his interest, and we bet him dollars to doughnuts that his next safety suggestion is going to be a crackerjack. You can have any number of safety committees, but the committee that brings home the bacon is the practical man on the job. If you discover a scoffer in your ranks, get acquainted with him, cherish his friendship, admire his work, sympathize with him—*a bas* with the white-collar attitude—but at all times be sincere, and, gentlemen, such is the perversity of man that even if he won't be careful for the sake of his wife and kiddies at home, who are out of sight out of mind, even if he doesn't think enough of himself to be careful for his own sake, eventually he will hit the sawdust trail and you will have another safety convert on your staff.

USE OF BULLETIN.

We use bulletins, of course, and we are getting very good results right now by having bulletins made of our lost-time accidents. These show a very good likeness of the subject, and they depict just how he was injured; we give his name, check number, date and description of the accident, with advice on how to avoid its repetition.

This is a very good stunt, for it brings the seriousness of Safety Last most forcibly home. Some of the victims don't enjoy the notoriety, 'tis true, but it's all for a good cause, and they have to take their medicine.

We have only recently begun the physical exa employes, and we all know what a bearing that has or investigating an accident last summer we were led to h man's eyes examined and it was established that the a due to his defective vision, and this incident lent impor plans for a periodic examination of every employe. I re case where better selection would have avoided troubl a brother in our hospital for colored men who had h mashed while hooking up the sheet bars to be charg furnace. We make a business of getting the details of time accident, and when I asked Jackson, "How come dropped on you-all's foot?" he replied: "Well, B-boss, told that m-man to w-w-wait; b-but he jes' nachurally v

FOR THE COLORED BROTHER.

Many of our laborers around the sheet mills are cc in fact, we have, in all departments, about 500 colore about as many foreigners. Now, just a word about th Our men of color are nearly all single and we house t mill property, but we do not restrict their going and con themselves abolished their crap-shooting, and we gave th a recreation hall equipped with pool tables and a piano built an assembly hall for their use and installed therein and regular Sunday services are held, with preaching b pastor. We built a moving picture machine booth ar a motion-picture machine exclusively for the colored l Sunday recently the colored preacher implored his "Remember the Sabbath day and keep it holy," and he ticularly on the evil of Sunday baseball. Well, the good know it, but we are not so puritannical there as folks h York. For example, our only rule is that the regul afternoon ball game shall not be called until after the cl ices are over. We have a Tuskegee graduate who h educational classes, and his assistant pushes along such s ities as the quartette, the choral society, and so on.

You ask, What has all this got to do with "Safe P Sheet Mills?" The direct bearing on safety is this—th welfare activities tend to make the colored man a bet and the more contented he is the less likely he is to go there, and our labor turnover is that much reduced. per cent of all of those 107 sheet mill accidents that I

happened to new men. It is the new man who is most liable to injury, and if a man is hurt through fault of another, you generally find that the other man was a new man, so any effort that lessens the demand for new men is a decidedly safety proposition.

FOR THE FOREIGN BORN.

For our foreigners we have provided a handsome clubhouse with poolrooms, classrooms and so on. We have 124 in our citizenship class. There are sewing classes and cooking classes for the older girls and playgrounds, a kindergarten, playhouse, etc., for the little folks. As a consequence we have a happy, contented foreign colony, and, of course, happiness and contentment at home are big aids to safety in the mill.

Safety devices are pretty well standardized the country over. There may be a difference in method, but granted that the men higher up are fully in sympathy with this movement, you will find that one mill is just about as well guarded with mechanical guards as the next. To go farther than that, we can go into the psychological field and help to start the employe on his day's work in the right frame of mind.

Among our other employes we have all sorts of recreational and social activities too numerous to mention here. We have group insurance that makes no distinctions as to race or color. All of these things help to make us feel that we are really members of our big Armco family.

VISITING NURSES.

This paper would not be complete without a reference to the work of our visiting nurses. They make investigations, do surgical dressings at the homes, give advice to mothers and to expectant mothers, give lessons in sanitation, and so on. I ought to mention that our housing agent devotes all of his time to getting living quarters for our employes and that we have a graduate of an agricultural school who gives scientific instruction to the Armco gardeners of our free garden plots, of which this year we had 673. At our fall garden festival, which comes next month, we expect to see the sheet-mill roller competing with the foreign laborer for the prizes for the best pumpkins, the best potatoes, and so on. All of this mutual interest work, as we call it, incidentally increases the efficiency of the worker, and safety goes hand in hand with efficiency.

The man on the job knows that we believe in our "What is good for the employer is good for the emplc are putting it into practice every day and the result is : of Armco men who stand united. We have an *esprit* our plants and it is a live, tangible thing. We call it A It's the thing that urges us to give bounteously to the it's the thing that demands care in the welding of a l thing that prompts ingenuity in devising a safeguard, thing that is now collecting monthly a sum of over $5,(purposes—Armco spirit.

DISCUSSION.

CHAIRMAN FONDA: We appreciate a talk of this k we put a representative of the American Rolling Mill C our program we are pretty sure to get a splendid paper you all will agree that we were not disappointed.

The discussion of this paper was assigned to Mr. J. Safety Director of the Youngstown Sheet and Tube Unfortunately Mr. Woltz is unable to be with us becai ness, but his assistant, Mr. Evans, will read the pape by Mr. Woltz.

MR. J. M. WOLTZ (Safety Director, The Youngstowi Tube Company, Youngstown, Ohio): The very intere we have just listened to would indicate that the speaker l that there are things that go to make safe mill practices, mechanical safeguards, safety committees, slogans, bullet usual efforts put forth by safety men to call attention to tl loss in industrial accidents.

It has been conclusively proven, time after time, by va panies engaged in different industries, who have expe effort and considerable sums of money to thoroughly machinery with the best and most elaborate systems of safeguards, that accidents still happen in their plants.

In other words, we all know that there is a certain of accidents that are not preventable by mechanical s Just what this is, is disputed, and we need not enter into of the subject. Undoubtedly, if mechanical safeguardin carried to the extent that it is, there would be a great r accidents than there are, so that even though this very part of safety work did not produce

siastic persons had predicted, it should not be lightly treated nor considered of little worth. No matter how well guarded a machine may be, some one can find a way to become injured on it, even though it be necessary to take off a securely fastened guard to do so.

SAFETY COMMITTEES AND THEIR WORK.

Safety Committees have a very important part in any safety work, no matter how large or small that effort may be. It is largely through your committees that you hope to scatter the seeds that will later develop into ideas, actions and results and will sooner or later help, with the other safety activities, in reducing the accident frequency in your plant. Of what material these committees are to be, their length of service, etc., it is thought that local conditions must largely govern, and it is because of this fact that the value of the educational feature of safety work is so problematic. There is this much to be said on the subject: What will produce good results in one plant may have no effect in another. Whether this be due to the personal equation of the safety man at the head of the movement or to some peculiar kink in the make-up of the workers in various plants it is hard to say.

Of course it is not to be expected that we would all agree that any one particular line of activity is best to use in all our plants—our natures and outlook upon life have been too diversified for that. Except in the broadest principles of our work, it is difficult to get many of the craft to work along the same lines.

Slogans are useful in the educational work, for you must have something to talk up to that is capable of attracting the eye and ear of the fellow you want to interest in your work.

Bulletins are a valuable aid in your mechanical attack, because of the many different ways they present to get the various features, new arguments, good and bad examples to each individual, whether he can read or not.

The psychology of accidents is one of the many phases of the work that has not had the careful consideration and study it deserves. Herein lies the gateway to many of the mysteries of accident prevention that are as yet a closed book to those who have entered upon the work with the idea that it was a simple matter, only requiring a brief consideraion of problems that were open to all.

The previous speaker has shown that the mechanics of the sheet mill are simple, and problems of safeguarding, so far as the machinery

itself is concerned, do not require a great concentratic or time.

So far as our experience goes, the greatest danger that our workers, before the safety movement had progress from breaking of coupling boxes, especially those nea gine, where the greatest strain is experienced. This dang est during cold weather, but may happen at any time a largely eliminated by banding each box with soft iro material ½x3 inches. In case of breakage these bands t vent the pieces from flying about the mill.

Another hazard that has resulted in employes being ba about the head is that of kicking screws; the long spanner around and often this results in hitting the man who is turning the screw down. The catcher is also hit by t at times.

These accidents can largely be reduced by using k benzine on the screws before starting up on a cold mill. well to require the operators on a mill to stand back a sa until a trial bar has been passed through the rolls.

STANDARD ACCIDENT VALUES AND RECORDS.

What are the greatest hazards in sheet mill practice? (for the past two and a half years may or may not be t others. In fact we have never seen any published figu line of work. We hope for the purpose of accuracy an us all to present figures that have the same value and are t able; thus the National Council will soon adopt som scheme of accident values and records.

The table herewith takes into consideration, with two only such anatomical parts as show fifty or more reported

	—Number of Accidents—			—Number of D	
Part.	1915.	1916.	6 Mo. of 1917.	1915.	19
Eye	983	524	225	95	1
Fingers	577	429	220	301	5
Forearm	231	150	54	228	1
Hand	116	102	43	78	1
Thumb	115	95	32	114	
Wrist	113	71	35	90	1

Part.	—Number of Accidents— 1915.	1916.	6 Mo. of 1917.	—Number of Days Lost— 1915.	1916.	6 Mo. of 1917.
Foot	59	51	34	99	229	265
Toe	54	44	17	222	255	16
Cramps	305	89	24	65	166	22
Back	18	24	12	319	208	33
Thigh	22	32	25	165	124	35

EYE CASES.

The majority of the eye cases were not serious and did not result in any lost time. As a rule, if an eye case was serious enough to be off at all, several days were lost.

FINGERS AND FOREARM.

The fingers show the highest percentage of injuries and these are divided into cuts, bruises, burns and crushes. The forearm is next on the list, with cuts, burns and bruises as the predominating causes, and the same is true of the other parts so far as injury is concerned.

CRAMPS.

While cramps can hardly be classed as accidents, they are one of the serious hazards of sheet mill operations. We have given most careful consideration to preventive means here, and, while we feel that there has been some progress made, we are not satisfied with the showing, and hope, when measures now in process of being worked out are completed, to be comparatively free from this hazard, at least so far as it is possible through any effort of the company.

The writer believes that if sheet mill employes can be made to see the need of right care of the body, the use of proper food and drink, the cramp problem will be well on its way to solution.

Drinking water of the right temperature has a marked bearing on the frequency of cramp cases, but our observations do not indicate that it has any effect upon their severity. No month of the year appears to be free from cramps, but needless to say the hot months show by far the greater number. It will be noted there is a marked reduction in cramp cases in 1916 over 1915. While this was to be expected, owing to a reduced operating force in the sheet mills in 1916, the percentage of reduction is greatly in excess of what one would expect from this cause.

Various experiments were made in an attempt to c
cramp cases and finally we installed in the standing, on
side of each pair of rolls, a set of grates over an opening
a stream of cool air, under low pressure, to flow conti
ward. This has proven to be a wonderful help in reduc
Another thing that has helped us lower the number of
has been the examination of applicants for employment b
cal department, enabling them to prevent the employm
who are unable to stand the work.

PILING AND HANDLING.

Piling sheet bars and finished sheets too high is a ser
that is very easy of correction.

The handling and transportation of sheets and she
presented some difficult problems, but with the introduc
proved cradles or hooks for crane operations and the
trucks, these hazards have been materially reduced.

"Stickers," as yet an unsolved problem with us, are ha
and account for many cuts and bruises.

WELFARE WORK.

We are installing a drinking water system for the
and a separate unit will be devoted to the sheet mill. We
begun the erection of a change house that will care for
of the sheet mill workers: have shower baths, latrines,
and other conveniences usually found in such places.

We are erecting hundreds of houses for our employ
rent and to sell. We have playgrounds for both youn
We have cultivated hundreds of acres of ground to pr
at a reasonable cost to our employes. Our visiting nurs
complished a great deal of good in the past three years.
cal service, while not free to our employe's families, is
fused when the wife or child calls at the hospital for
attention.

We protect our employes against the crooked lawyer,
and that vilest of humanity, the pseudo-Americanized fore
preys upon the fears and ignorance of his fellow countrym

A PRAYER FOR ARMY AND NAVY.

In closing, I wish to say just a word about those of

person who may hear these words has long since come to a full realization of what war means now and will mean to this country of ours. We are now sending the first who have responded to its call. Many, many more will go the same way ere peace is declared. Let us then send up to Him a prayer for the protection of our men and ask that they may return to us in safety, good health, their faculties unimpaired, bringing anew the message of Christ, "Peace on earth, Good Will to men."

ACCIDENTS ON COLD ROLLS.

MR. G. G. EVANS (Brier Hill Steel Company): Recently, the National Safety Council sent out letters to 100 steel concerns, asking information as to what they were doing to reduce cold drawers. The replies were compiled and a leaflet on the subject was mailed by General Manager Cameron. I presume each of you have received a copy. To my surprise very few said they had any hazards on cold drawers and I think, perhaps, we have heard the explanation, that cold rolls are well guarded and it is simply because these places are well guarded—following, perhaps, the fifteen suggestions my company made in regard to practices on cold rolls—that so few accidents occur from this source. I think it is well to bear in mind that it is only as we safeguard well or ill that we have few or many hazards. If we are to reduce our accidents we must prosecute our safeguarding; otherwise we will fail.

The only safe practice—for the sake of economy as well as safety—is to make a separate unit of the cold rolls. You can see the economical standpoint. The carrying of loads over the heads of workmen is much reduced by the installation of a separate unit. We find that our accidents come largely from opening stickers, cuts between the elbow and the finger tips, and these are quite numerous. I think the suggestion made this afternoon is one which will help to reduce the number of accidents, although we have a rule that men shall not wear anything loose on the hands or clothing that is ragged or liable to be caught in the rolls.

MR. J. C. SMITH: I might say that I was the person instrumental in having the letter requesting information as to the prevention of cold roll accidents sent out by the National Safety Council. Like Mr. Evans, I was greatly surprised at the answers received, in which so many operators claimed they had no cold-roll accidents. I took it up with the superintendent of our department and he said he could hardly believe it was true in so many places. There is practically

no way to guard cold rolls so that accidents may be enti
Our accidents have always occurred when polishing th

We have now provided a device on the hangers for t
is, the small roll that hangs in front of the large roll.
slot there which enables us to swing the hangers for t
two feet out from the roll, so that the men do not h
the rolls. Where the hangers are in close proximity t
the men are caught their fingers are drawn in between

THREE SERIOUS ACCIDENTS.

We also have two platforms in front of the cold ro
man cannot slip. We had one accident of that kind an
all of his hand except a couple of fingers. He clai
slipped and went in, but as a matter of fact the billy
and he was adjusting the billy too close to the rolls.

I want to bring out a couple of other points on sh
dents. We had one very serious accident--I think it
every one who operates a sheet mill to know about it
the jigger falling off the top of the housing. It fell on
causing him to lose it. We were never able to place
bility for the accident, but it was due to the nuts wo
bolts that held the jigger. The bolts were loose or th
not put on properly. This happened right at the start-
day morning.

We had another accident on our old-style shears.
eccentric on the shears with a couple of bolts in front ar
tric moves backward and forward in close proximity
One day the bolt stuck up and the eccentric revolved cl
man got on top of the shears and took hold of the bolt;
centric moved up it caught him and he lost all the fingers
That happened a number of years ago and we have gua
a repetition.

Regarding the spanner bar, referred to a few min
have installed a little chain to prevent its flying around
any one. It is a sort of locking device.

We had an accident in the sheet mill eight or nine y
man was working down in the scale pit, cleaning out the
they were changing the coupling box. The coupling b
off and fell on him. We have a rule that no man is all
scale pit while coupling box standards

have a plank covering the scale pit to prevent any one from going there to do any work at a time when changes are being made.

COOLING SYSTEM INSTALLED.

MR. WILLIAM F. FILMER (Youngstown Sheet and Tube Company): Mr. Evans spoke of a grating on the catcher side of each pair of rolls as a preventive for cramps. I had the laying out of the work of the cooling system in our mill, and, as you know, the ordinary method of cooling is by means of a blast. It was our intention at the time we put in the installation to have such nozzles, but in the development of the plan it was seen that the blast of cool air on the body of the man might possibly be productive of cramps and the suggestion was made to our medical department whether it would not be a better idea, instead of having a blast of air, to have a slowly cooling body of air passing about the man. It was tried in one of our mills for a year and there were no cases of cramps in that mill but in the other mills there were. Since that time the idea has been extended to all the mills. I believe that if we were to use a slowly cooling body of air instead of a nozzle that it would reduce cramps to a minimum.

CHAIRMAN FONDA: What is the nature of your equipment?

MR. FILMER: In our plant the ducts are underground and the pipes enter a chamber under the floor. There is an outlet from the pipe in which the velocity of the air is reduced, then it passes through the floor.

CHAIRMAN FONDA: Several openings along the front of the roll?

MR. FILMER: Yes. The gratings are about four feet long and they run five feet back into the mill. There is no perceptible current of air, so far as the man is concerned, but the air is moving around him all the time. We took the matter up with our medical department and got their opinion on it as a theory. I feel that Dr. Lauffer can verify the pathological phases.

MR. G. G. EVANS: I would like to ask the gentleman which kind of a nozzle he uses? Perhaps there is too great a force to the air if the chamber is a small one.

CHAIRMAN FONDA: What size nozzles were you using; what orifice did you have on your old installation?

MR. FILMER: We did not have an installation.

CHAIRMAN FONDA: You did not use a nozzle?

MR. FILMER: We did not use a nozzle. We were putting in the

equipment and we found the usual nozzle was from inches in diameter.

MR. G. G. EVANS: We are using a six-inch nozzle effect. In another of our mills we are using a fan with g It is placed high enough to throw the air down.

CHAIRMAN FONDA: We will have to take up the n our program, "Open-Hearth Hazards," by Mr. Leslie M.

OPEN-HEARTH HAZARDS.

LESLIE M. RICE, DISTRICT SAFETY INSPECTOR, AMERICAN WIRE COMPANY, WORCESTER, MASS.

Mr. Chairman and Members of the National Safe While improved practice has gradually developed safer efficient equipment for the manipulation of an open-hear the various cycles of its operation, and while we may a all ordinary mechanical means of eliminating hazards installed, there still remain some occasions where a develops the need of another mechanical device due conditions existing in the plant. In addition to which the of accidents still remains well intrenched, namely, the indelibly stamping upon the minds of the operating force sity of observing the first natural law, that of self-preser of inculcating mental habits that will lead them to cc proper way to approach their jobs. The methods employ men in performing work which could be done with abso to themselves and their fellows cause an observer to won possess the instinct of self-preservation.

Experience has taught us that the accident problen approached from two angles: Protection through mechar devices, and educational measures. By mechanical safe we mean guarding exposed gears in moving machinery against contact all live parts of electrical equipment, railings and platforms where necessary and the like. By e measures, we mean methods of studying accidents, way esting the workman in the safety movement and making his share of the responsibility in developing safe working p

While the matter of mechanical guards is now p standardized, it may be interesting to touch briefly upon the hazards of open-hearth practice that can and have bee

MECHANICAL SAFETY DEVICES.

The hazards of railroad crossings are more easily eradicated in new construction where it is possible to arrange the buildings with this matter in mind. However, existing installations can be made much safer in many instances by installing stairways under or over the tracks and changing the location of storage bins. Exposed gears and over-hanging gears on cranes should be protected, and cranes should have runways suitably designed, both on the crane and building, for there are occasions which arise during the course of the usual operations of handling hot metal when some part of the equipment shows symptoms of failure, and quick action is demanded of the operator or mechanician to avoid serious consequences.

The building of the furnace through the cycle of its various operations carries numerous hazards, practically all of which can be eliminated with a little forethought. For instance, the tapping hole of the stationary type of furnace, more particularly in the basic heats, is occasionally opened up by the action of the metal from the inside, due to faulty workmanship or material, before the heat is ready or the operator ready to receive it. Very serious consequences may result if the metal reaches a sewer or damp place on the floor. To avoid such contingencies, the ladle ready to receive the heat should be set in position on suitable stationary horses very shortly after the charge is melted.

The operators of the hot-metal electric cranes should be educated to inspect the crane parts, and especially the efficiency of the brakes previous to the handling of a heat. The brake should be tested by trying it out with the empty ladle hanging on the crane and later examining the brake. Failure of the electrical current during the progress of heat may make it vitally important that the brakes be in good condition.

The controlling valves for gas and steam lines located in front of the furnace are commonly uncovered; numerous instances have occurred where they were broken by being struck during the course of repairs or charging operation by the crane or charger, resulting in severe burns to some of the workmen. They should be covered.

Charger operators should have a protective shield to prevent burning by sparks thrown from the furnace where damp or frozen stock is dumped into molten slag or metal.

Even in the best practices bottom blowouts will occasionally occur, and, if they are not well handled, serious accidents may result.

The men should be drilled to their parts in handling t as they would be schooled for a fire drill.

STOCK-YARD HAZARD.

It is obvious that good housekeeping is one of the be for accidents in the stockyard. Clean trackage leaves trip over in front of a moving train; sufficient clearan tracks and piled material eliminates the possibility o some of the stockers. Stock properly piled materially ai taining an orderly appearance and assists in handling t with less hand labor, which in itself is a source of numer arising out of being forced to work in awkward positions.

PROTECTION FOR SWITCHNG CREW.

Good equipment with such mechanical protection boards, hand rails, pilot cars, automatic couplers, etc., in good condition, still leaves the organization to contend of the accidents incident to railroad transportation servi those arising from men mounting the running board proaching engine from the track and entering buildings switchman piloting the train as an additional warning, b or whistle to make sure that the tracks are cleared.

FUEL HAZARDS.

As might be surmised, a perusal of accident reco numerous cases arising out of steam burns, back fires gas and fuel oil, foreign bodies in the eyes, lumps of c down from the coal pile onto the feet of firemen, falls fro scaffolding, etc. To eliminate them means that each cas thoroughly investigated and ways found to remove the possible; if not, to provide a preventive measure, suc instance, the man who investigates the contents of a fuel oi with the aid of an open torch may need an electric torch, an electric light permanently located.

No attempt will be made to enter into a discussion of methods of eliminating the hazards incident to furnace co and repairs, furnace operation, charging floors, pouring disposal of product and waste material and the like, becaus that it will be more advisable to cover them in a general

EDUCATIONAL FEATURES.

Guards are devised and installed to make a safe place to work. Having installed guards, it becomes necessary to organize a system whereby such guards are going to be maintained and properly used, for we still find men who do not appreciate the value of a guard and will tell you that they have escaped an accident for years and see no reason why one should occur now.

The head of the department must have the safety spirit and must thoroughly believe in it. The men of the open hearth, like those of any other branch of the steel industry, will quickly note any lack of sympathy or inattention on the part of the official in charge, and unless he is careful to show some appreciation of their efforts in the movement the results of the safety work started will be very largely nullified. For instance, it is very hard to convince a workman that if the superintendent does not notice the violation of a safety rule, or neglects to insist on the replacing of a safe guard, he should mention it to the foreman, or himself try to observe safety precautions.

The foremen must also have the safety spirit, for, with the encouragement of the superintendent and the support of the men, they are in a position to accomplish more than any other body of men. As the foremen in the plant organize the force and train themselves to observe and analyze the causes of trouble with the equipment and furnace practice, so is it necessary for them to organize the force and train themselves in the best methods of accident reduction. It is not reasonable to expect that workmen will display any great amount of interest in adopting new working practice or to be thinking about taking chances that rarely result in an accident unless the foreman exhibits as much personal interest, co-operation and attention to details of work and equipment relating to accident prevention as he does to matters of production practices.

The open hearth, as a department, should give the plant permanent safety committee and the workmen's safety committee its cordial co-operation. Without this the value of these suggestions will be more or less nullified and the enthusiasm of the workmen's committee weakened.

Even the usual organization of plant permanent safety committee, workmen's safety committee, safety inspector, etc., will not be sufficient to obtain the greatest permanent results, because the men and foremen who are engrossed in production are likely to overlook the little things necessary to maintain a live organization.

The foremen may start safety meetings by getting a men together at regular, stated intervals, eventually c them, at such times and in such numbers that the usua are not interfered with. Ask and encourage all of them themselves freely, drawing out suggestions pertaining to safety devices, unsafe working practice which may a ignorance, carelessness, lack of instruction, lack of mistaken eagerness, or undue haste in accomplishing wo uncalled for risks. It may be necessary to enliven the discussing some subject with them individually previ meeting, thus giving them an opportunity to make some c of their own.

Minutes of the respective meetings should be kept an of the men attending enrolled, after which they can be and sent around the department for the men to read, place for each man to note and sign after reading. It happens that some of them are unable to read Englis case an interpreter of their own selection does it for th the paper has gone the rounds, it is returned to the superi

The fact that the men themselves have taken part names printed in connection with their discussion cre interest and makes them feel a responsibility, for men interest in a particular subject and pride in their work given responsibility and their advice accepted.

BULLETIN SERVICE.

Bulletin service should be maintained and may consist from outside sources, such as are provided by the Natic Council, etc., selected accidents, and monthly accident r ranged to stimulate friendly rivalry among the different de

ACCIDENT STUDY.

Each case must be studied and the exciting causes t detail, and a lesson drawn from it, since it is quite lik will be peculiar to the plants. For instance, a man on t platform was badly burned on account of the falling o which manipulates the stopper in the ladle. Investigation the cause of its falling and also that a small dog fastened t would absolutely prevent the recurrence of such an accide

Another case of a man caught between the bucket c charging floor while shoveling scrap—which had fallen

was a rule requiring the charger to see that the men were clear of the cars, it developed that the responsibility was not properly divided. To overcome this weakness a whistle was provided for each furnace man, and he was empowered to direct the movements of the cars. One whistle, stop; two whistles, floor clear.

Cleanliness and *orderliness* in the open hearth, like any other branch of the steel industry, is a necessary safety adjunct. When we remember that a large part of the waking moments of the operators is spent on their job it is obvious that pleasant surroundings makes the work more agreeable.

Most plants maintain sweepers to clean up, and while they remove litter they do not necessarily give the mill a tidy appearance, such as might be obtained by putting the rabble hooks, dolomite bars, sand scoops, etc., in an orderly way in a specific place and making it a part of the furnace operations to see that they are always so placed.

It is usually treated at first as a joke, but after seeing the superintendent putting hooks up to a mark the men soon acquire the habit of seeing that their furnace tools are properly taken care of, and it soon becomes a habit, making for precision of movements in the regular operations which are well calculated to avoid many dangerous accident combinations.

OPEN-HEARTH PITS.

An open-hearth pit job is one of removing waste and is constantly fraught with more or less congestion. We are also likely to find the men using not only defective tools but keeping them in untidy places. In one instance it was decided to build steel lockers for their bars and other tools, one in one part for the day turn and one in another part for the night turn, and in a place where they would have a brick floor. Later we found the tools not only a better working condition but the whole place had an air of general tidiness.

The same thing may be said of pouring platform. Proper racks should be maintained for bleeder rods, test scoops and bars and a proper platform with brick paving for men to work on, with suitable means of getting to and from the platform.

RULES.

Any sort of transportation service demands that certain rules be established which can be used as a guide for the operators.

Crane operation is no exception and certain rules are printed and it becomes a part of the foreman's job to see that each operator thoroughly understands them, knows them and practices them.

To do this the foreman should be made to read the hold recitations with the operators on both turns and mak of such to the superintendent. Occasionally the head of t ment should call them into the office and try them out.

In addition to making cranes safer, with the necessary r safeguards and rules established, some means must be foun sure that the operator chosen is a fit person for the job, i without saying that the job of handling quantities of molte not a fit job to take chances with.

A prospective open-hearth crane operator should be for a period of about three months in the electrical de where he will have an opportunity to acquire some kno the electrical apparatus, then three months on the crane wit operator, where, if he appears to measure up to the job, be examined by the master mechanic and chief electrician, require him to answer suitable questions in connection mechanical and electrical apparatus on the crane. A card his standing should be returned to the superintendent by th mechanic and chief electrician. If found incompetent, h be transferred or let go.

POURING PLATFORMS.

Likewise, after it becomes a settled fact that the we goggles and leggings are essential for protection during the c of pouring steel, the pourer should be instructed that it is cause for his removal if he, or men helping him, do not during operations.

MUST CONVINCE MEN.

How much real protection is afforded or real live in induced through the installation of mechanical safety de introduction of educational propaganda are largely proble solve themselves. Accident prevention, to a limited degree assured by mechanical safeguards, but literature or inspectio will not insure accident reduction any more than increased pr would be assured by these methods. Their purpose is to ar interest of the men and provide information for their use. thoroughness of inspection work and conscientiousness re safety work will largely depend on the attitude of their f and to a larger extent than many people realize upon the att the superintendent. The superintendent must realize that t

who talks safety but does not act it, will find that his employes are rather guided by his actions than by his words. They will consciously or unconsciously imitate the attitude of their superiors.

DISCUSSION.

CHAIRMAN FONDA: The discussion of Mr. Rice's paper will be entirely from the floor. "Open-Hearth Hazards" is a subject about which a lot of us ought to have something to say. Tell us your troubles or some of the things you have been able to work out in connection with your problems.

MR. G. G. EVANS: I would like to ask a few questions. I notice the paper says nothing concerning tap hole shields, something we find quite necessary in our plant, although they do not meet the approval of all of the men working back of the furnaces.

Another question is regard to the dinky or lorry that hauls the hot metal ladle from one end of the charging floor to the other. Among the suggestions that came to the central safety committee when the matter was open for discussion were two of this kind: One, a buffer back of the lorry, extending three or four feet, so that when it touched the man he would have time to get out of the way. Another, a platform on which a man could ride. We have not adopted either suggestion; we are using a shield around the lorry, bringing it quite close to the floor. We have had no accidents as yet. If one or the other suggestions is practiced I would like to know what has been the experience with such a plan.

Another device, gotten up by one of our men not long ago, is a tap hole shield. He thinks it is excellent and it has been approved by our superintendent. It is designed to prevent a blow-out of the tap hole, something that occurs once in a while.

One further question: As our charging floor is constructed, I do not understand how we could carry out the plan suggested by Mr. Rice in his paper and put our tools up out of the way. We find it necessary to put them down on the floor in an orderly way, so the charging frame will pass over them and not interfere with operation.

SHIELDS FOR TAP HOLES.

MR. MORGAN: I have experimented in protecting tap holes with shields. I presume you refer to the operation where you inject a nozzle to blow out the bed in the open hearth and sparks will shoot

over the foundry where men are generally working or floor. Is that what you mean?

MR. G. G. EVANS: Did you say shield or seal?

MR. MORGAN: Shield.

MR. G. G. EVANS: Yes, sir; a tap shield.

MR. MORGAN: That is what I mean, too. It is dropp of the tap after the ladle has been taken out by the cran at the time they blow out the bottom.

MR. G. G. EVANS: Yes.

MR. MORGAN: We tried several methods of handli but on account of the heat and the weight we were not al the problem to the satisfaction of the second helpers w handle it. It is still an unsolved problem, so far as I kno

There are two points Mr. Rice did not touch on in his I would like to learn if there are solutions for them. T the matter of repairs to the arches of the open-hearth roof. your arch fails and two or three bricks drop through—a the case—with a big heat right in there. I recall an where I found the superintendent of the open hearth a manager on top of an arch after it had failed. When w them about it the explanation was that they wished to sav and took a chance. We solved the matter by putting in bridge from one arch to another. The walk was of asbe metal. It would not be uncomfortable.

The other point was a matter of railing on tap-hole I I have never seen a successful railing on tap-hole plat open-hearth furnaces. I have seen railings and chains a shift box with counter weights, but I have never seen which would not interfere with the movement of the la A lot of tap-hole platforms are so far below the level of it has to run down and leave quite an open space.

MR. MORRIS: We had over the tap-hole platform a ra counterweight on it; whenever the spout was taken away was in a vertical position, but the rail was constantly bein and it kept a couple of men busy on repair work. I was in hearth department one day and the police officer on guar duty it is to keep every one out of the place when they a lating the heat, called my attention to the fact that one of was bent. I asked him why he did not figure out a solutic trouble. He thought that a table with a hook would be a fi We adopted his suggestion and because it was his idea he s

that every time they start work on that tap hole the table is in place. He is proud of his suggestion and it works out very nicely.

MR. MORGAN: One other point I would like to hear discussed: The method of lighting a new furnace—there have been some bad fire accidents because of improper methods of lighting.

SOUNDING MOLDS.

CHAIRMAN FONDA: Is there any discussion on that subject?

Another question comes to my mind—it is not so much a question of safety as it is a question of organization in the department. We had a very serious accident recently at one of our Bethlehem plants, due to the fact that the man responsible for checking up the molds and pouring the heats did not notice there was a butt in one of the molds. I think you will agree that heats have been poured on top of butts many times without serious results, but enough gas formed this time to cause an explosion at the base of the heat and throw out enough hot metal to literally cover two men on the charging platform. The accident resulted in the death of both men. The man responsible for sounding the molds was negligent and the result cost two lives. I bring this to your attention so that you take it home and look yourself over. Some of us think we are in pretty good shape in our organization, but it is well, sometimes, to check over these matters and be sure we are air tight.

MR. CHARLES R. LOBS (Midvale Steel Company): We had a similar experience. In pouring off the excess metal we usually take an old mold. It happened that one of the molds taken on this occasion had been used for the same purpose before. A crust had formed on the top of the last excess metal pouring and the last pouring was on the crust of a prior one. Naturally the gas that was under the first pouring became heated and caused the old metal to fly out and injured several men, but fortunately no one was seriously hurt.

Insofar as shields are concerned, we use them over the spout of the furnace when tapping, but the shield is suspended on the auxiliary control of the frame that handles the ladle, especially of the basic furnace. Basic furnaces have always given us a lot of trouble in tapping, more than in the sand-box furnace. This shield is of three-quarter-inch metal and is hung by the auxiliary control directly in front of the tap hole—the pouring commencing in the groove in the shield. In that way it effectually stops the material from shooting out.

MR. MORGAN: While tapping?
MR. LOBS: Yes.
MR. MORGAN: I was really referring to after-tappir

USE OF BOX.

CHAIRMAN FONDA: The blow-out of the furnace af Another question comes up in line with that, instead (hearth, the so-called box style. The heats, instead of b directly into the molds from the ladle, are poured into two molds are poured at a time. The box is about 5 : feet wide and 2 feet deep, and lined, of course, with bric The result, you can readily understand, is that you ha pressure of the whole mold in the ladle upon the scr foreign governments insist that steel shall be poured in th

We found several hazards connected with that method steel which we will be able to eliminate very shortly. the boxes it is necessary to hook the box very closely to of the ladle. A chain is used on one side of the box a hook on the other. In order to place the box in positior spout some one has to go under and guide the hook. I done by long rods or by other means, some one actually under. In bringing the ladle down into position the fran has to adjust his load very carefully, otherwise he will and upset his ladle. That has almost happened. As a our experience our engineering department has develo car that runs along the charging platform on a track t extended arm. This box is built into the framework. I plify the pouring of the box because it can be electricall by a man standing on the platform with a shield in fr and he can observe the height of the heat in the molds also regulate the position of the box and move it from molds to another. We feel that we have eliminated two v hazards and simplified the method of doing this work. be of help to some of you who are up against the san proposition.

MR. G. G. EVANS: Do you pick up the box from t floor or from the pouring floor?

CHAIRMAN FONDA: From the ground floor.

MR. G. G. EVANS: We pick up from the pouring floo

ing the crane operator to secure very delicate adjustment on the heavy load before you get the box in position?

MR. G. G. EVANS: There is a hazard there; yes.

CHAIRMAN FONDA: We have a little more time to devote to this subject.

SCREENS, GOGGLES AND ESCAPES.

MR. J. C. SMITH: We had an accident, not very long ago, due to dumping the pan in a furnace they thought was a gas tank. This caused some of the metal to blow out from the furnace. The safety department has issued an order to put a screen in front of the operator on the car to prevent injury from material blowing back from the furnace. That had not been installed in time to prevent this accident, but I think it is a very good point.

In regard to tap-hole shields: The Illinois Steel Company have developed a very good shield to be used for that purpose. We have been using it together with a door arrangement. We also provided a gate on the tracks at the entrance leading to the pouring platform, to prevent cranes being shoved in until the watchman goes ahead to see that no one is in a dangerous position.

We have had two or three very serious accidents due to men on the pouring platform not wearing goggles. I think that is a question that should be discussed, as it is very difficult to get them to wear goggles. One fatal accident occurred at the Gary works when I was there. A man went down to clean out a gas main, but instead of going into the right main he went into the wrong one—there was no number on it. We put a numeral on all the mains after that. This man, when he opened the door, was so seriously burned that he died.

Another hazard I believe to be still unsolved is caused by entering the charging floor from either end. It is a very serious proposition.

In regard to the hazard Mr. Morgan brought up—men standing on the roofs of the furnaces—we have planks on top of the furnaces to be used by all our men for that purpose. We found the same condition Mr. Gorman did—the men stood on top of the furnaces; it was very liable to cave in, the scaffold was not.

MR. MORGAN: Did you fireproof the planks?

MR. SMITH: Yes, they are fireproof. The plan worked out all right.

MR. MORRIS: I would like to bring up a point not yet touched upon: An avenue of escape for men on the pouring platform if

anything happens to the metal while you are pouring molds. An escape should be provided for the man ir cab and the men on the pouring platform. All the o in our establishment have a runway on the outside of t The building, of course, is two stories high, with a do bay, so that if anything happens the men on the pourir and the man on the crane can escape almost instantly to air.

SHIELDS AND CANOPIES.

CHAIRMAN FONDA: In that connection do you use a a shield on the front of the pouring platform? In our case the men did not have time to get to any outside run happened, of course, very suddenly. About the only protection that would have been of any service would some form of shield hanging from above. I know some have used them, but we have not. There have been severa to them and I have been wondering whether any one her them successfully.

MR. MORRIS: We do not have such a shield.

MR. SMITH: I have seen it used in Bessemer oper never in open hearth.

MR. H. M. BAILEY (Carnegie Steel Company, Duque We use a shield; it hangs directly over the men and if spills over in the pouring of the first six bowls—which is t ous part—the men are protected. Every three or four shovel a couple of tons of sand and so on off these covers.

CHAIRMAN FONDA: That is putting a roof over the pl

MR. BAILEY: It is a specially built roof and it protec against splash from the hot metal ladle in case the heat is v

CHAIRMAN FONDA: Built right over the platform?

MR. BAILEY: We call it a canopy over the pouring pla does not extend the whole length, because the men must see operator and the crane operator must see his molds, bu the point of opening we have a canopy sufficient to pro men. We prevent a great many serious accidents in tha We had one man fatally burned before we developed th We do not know of any one else that has the canopy at t time.

CHAIRMAN FONDA: You have not a curtain that hang

MR. BAILEY: No, sir.

MR. SALTER: I think you will find the biggest part of your trouble when you first open up your heat in the open hearth. After you get the first pouring out your danger is over. We had fatal results at one of our plants where we did not have the device installed, although we had asked for it. If we had had it I feel satisfied that while the man might have been burned the accident would not have killed him. The device we have now has proved very satisfactory.

CHAIRMAN FONDA: In the pouring the box steel I referred to, there is a difference because you have the bottom of the box located in such a way as to draw the metal right out, about knee high, on your platform. If you have an explosion of any kind it is not a question of the metal going very high to get much protection from the roof.

MR. SMITH: For a number of years we have used a shield of that kind. It is merely a contrivance consisting of a sheet of metal set on the tapping platform with a brace long enough for the first two molds. It is just about knee high.

MR. BAILEY: We use the type of shield Mr. Smith refers to and we have equipped every man on the pouring platform with asbestos leggings. They are issued to them gratis and the men are required to wear them. There is no joke about it, they really have to wear them or get off the pouring platform, one or the other.

CHAIRMAN FONDA: We could continue this discussion to some length, as it is valuable and interesting, but we will have to postpone further consideration until tomorrow and take up the remaining topics on our program.

We will have the report of our Nominating Committee tomorrow morning. This report will cover a combination of the Foundry and Iron and Steel Sections. We will be one Section after that time. The meeting tomorrow is very important and I hope all the members of the Iron and Steel Section will be in attendance at 9 o'clock.

Our next paper is a very important one. We are very fortunate in having with us today Mr. J. S. Herbert, Superintendent of the Safety Department of the Cambria Steel Company.

SAFETY AND THE FOREMAN.

J. S. HERBERT, SUPERINTENDENT, SAFETY DEPARTMENT, STEEL COMPANY, JOHNSTOWN, PA.

Mr. Chairman and Members of the National Safety I only agreed to accept the assignment of this subject when I would not have to write a paper in advance. The true did not want to write a paper, I think, was because when was afraid I would get so rattled that I could not read it. better be like the old colored minister in Alabama, who was known locally as a public exhorter. Some one presented h new Bible. He said: "Go on 'way with it folk; I don't want I can't read." They said: "Well, how do you manage to w sermons?" He said: "That's easy! that's easy! Ev'ry preach to more than three hundred head of niggers and I ju up in th' pulpit an' I opens my mouth an' let it says wh wants." That is what I am going to try here. I am going my mouth and let it say what it wants to, but I am goi to stick as closely as I can to the text "Safety and the For

This has been a study of mine for the last three or fo but in working out the connection between cause and effect it necessary for me to go back and give you some of the eff so that you will be able to understand why I lay so much the apparent cause later.

Our own statistics cause us to feel that 93 per cent of our have no mechanical connection; no outside, or, we will say, conditions. In other words, there are no bad floors, a ma caught in the machinery, he is not working in bad light—he injured. Seventy-three and nine-tenths per cent of injuries to the man himself from one of several causes.

We have ordinarily termed them "carelessness," but w differentiate between the terms, "carelessness," "indifferen "recklessness?" I think we are all rather too prone to say: he was careless; he was not onto his job!"

Last year in my first offense at speaking in public (thi second) at Harrisburg—I tried to prove to my audience by that I had made, that a man employed in a steel mill less tha days, was twelve times as liable to injury as the man who h employed over thirty days.

This year (I am speaking from the statistics of our own I do not know what you have at your plant) the means

adopted to eliminate that hazard so far has succeeded in bringing accidents down, until today we are running with new men about six times as liable to injury as our older men.

NEW MEN PLACED AT YARD WORK.

I was much interested during the discussion on yard accidents when Dr. Chaney said the reduction was only about 3 per cent. I wonder if anyone stopped to think that new men, eight times out of ten, go to work in the yard, get their yard training, and are transferred into the mill as semi-trained men.

The question is how to train the men. Here are a few of the ways they get hurt, where we claim it is up to the men: 27.7% dropped things on their own hands or feet; 6% injured by fellow workmen, 11.9% fell down and hurt themselves, 5% tumbled over wheelbarrows, 5.4% walked into plainly visible objects (piles of steel or into the side of a car or into a column—something of that sort), 7.5% laid down articles they were handling and forgot to remove their fingers, 1.6% wore their goggles in their coat pockets and 0.2% struck themselves with hand tools.

It appeared very plain to us that we could not put safeguards on a man's fingers, we could not cast a specially shaped pig with lips on it as they do in casting certain other metals, to give men handles to take hold of, and we could not put safeguards on the new man's feet. We tried safety shoes, but they did not work very well. We found that about 80 per cent of all accidents were preventable only through foresight.

Several gentlemen have inquired of me: "Do you mean to say you make your foremen teach the man how to perform his work?" It seemed surprising to them, but we consider that one of the things we are paying the foreman to do. We would consider him a mighty poor foreman if he sat in the shade of a tree and let his gang loaf for six hours; if he has two men in his gang out of service there is twelve hours gone! Yet there is a feeling that we should be afraid to insist that the foreman teach the new men how to perform their labors safely—so that we will not kill two new men and pay $7,000 for it!

FOREMAN MUST BE SAFETY LEADERS.

The attitude we take is that the foreman must teach his men safe practices. We insist that is part of every foreman's work. We go to the army for inspiration; probably our safety work smacks

of army regulations; I went into the service in 1900 an there. I found that the Captain does not take the raw recr drill them. He received his lesson long ago. One man t of others and they were made officers. They trained othe: old-stagers, your non-commissioned officers. You rarely company of new troops, except in an emergency, such as we at present; you get three or four, five or six, perhaps a sc men in a well-drilled company, and the corporal (who c to your gang foreman) is the man who has charge of . He takes them out back of the quarters and teaches them, parts to them merely the knowledge which it is necessary t have.

There is an old saying that, "Simplicity is the keynote c When you ask your foreman to caution the men to gen safe, to be careful, you are not going to get anywhere. "B has caused more accidents than any other slogan, becaus every-day excuse of the foreman that has not taught his practices. "Did you warn that man?" you ask. "Yes." "" did you warn him?" "I warned him." "But, how; wh: say to him?" "Well, I said to him, 'Be careful, watch y

"Be careful!" Be careful of what? When you came your wife said: "Be careful when you are away." Wh mean? Keep away from bad company? How much care exercised since you have been away, due to that warning had said: "Bill, New York is a bad place! It is chuck fu pockets; watch your money while you are there. Watcl because it will be awful if you go broke over there; beside: not have anything left with which to buy a present for me." ter.) You put your hand over your money every once i and you are going to take some of it home. You have ha instructions to watch out for something in particular!

We try not go over our foreman's head and we try t(the warning. We do not stand for "Be careful! Watch Y We try to make a study of each man's work. Going ba army again, some of you have had military training. Th(a man here who has trained for the infantry, that has been t sabre exercise; neither do they teach an aviator to fight wit net. That is not required. They teach him how to fly an They teach infantrymen the bayonet drill and cavalrymen a to use the sabre and how to ride a horse. They never teac make sails in the army; they do that in th

ANALYSIS OF STEEL INDUSTRY.

In making an analysis of the iron and steel business you will find somewhere around 3,000 operations. Bill or Jim or Mike come in, is signed up and sent out to work on the railroad track. Your foreman does not need to understand the 3,000 operations to give that man safety training. He usually has a gang of four or five, or five or six, trained men and he gets a couple of newcomers to fill in. The new man has to repair tracks and he does not have to know anything about running a train. Neither does he have to know or teach the man in front of him about a Kelly converter. He is going to repair a railroad track.

If you will analyze your accidents from observation of actual work going on, how few points there are on that kind of an operation for a man to logically get hurt? You will find, instead of saying to your foreman: "You must instruct these five or six men in 3,000 items," you will find it comes down so you can count them on the thumbs and fingers of your two hands. Carry that right through the mill in connection with every operation you have in the iron and steel business, and you can count the logical ways for any one man to get hurt, and it will not go over ten, except for the unusual accident that pops up every once in a while. The way we get at them is to have an experienced safety inspector make a study of the operation. We have found that nothing will queer a movement so quick as to let some half-baked mutt go out and talk to one of our practical men, who after he leaves says, "Did you hear what that fellow said?"

I remember one time I had a whole machine shop laughing at my expense. I remarked to one of the men working on a lathe that I was going to get a J. & L. turret. Some one asked "What kind, Mr. Herbert?" and thoughtlessly I said, "Jones & Laughlin," instead of Jones & Lamson. I was gone with the machinists right there. They figured I had read something out of a catalogue. Finally, after I got the turret lathe in, they found I knew what I wanted—a lathe instead of a steel company—I regained some of my lost standing with the bunch.

If the safety inspector goes out to peddle his discussion in a high-brow manner, your foreman cannot understand him and you have lost that foreman. He makes up his mind that the inspector is some fellow that comes from the office—a fellow with a white collar that has nothing to do; that is why he holds his job, he comes out and hot-airs a bit.

If your safety inspector first makes a study of conditio to the foreman and shows him his record—by the way, record of every accident and what foreman it occurs average number of men in the foreman's gang, and what work is. These are compared. We can compare Bill Sco Smith, and if Bill's percentage is 40 of his force injured i and the other fellow only has 10 per cent, we want to kno 40? Why the one fellow is so much better than the other? that record and go out and make a study of their opera put it up to the foreman. The foreman usually says: tarnation busy, and they just seem to happen. The day got hurt I had just walked away to get a drink of wat over to get a bolt—I went to get a drift pin. When I car was hurt!" There are so many ways, they pick out new v day. Right there is where you want to do your missior That fellow is wrong. Get after him; show him, not hov is, not how vague, but how *simple* it is, and he will not dar that he is not on the job. He intends to look after these things.

THE WILLING BUT IGNORANT FOREMAN.

As to the different foremen: In the first place you fin low who is willing and able to go along with you. You c him; just give him a tip now and then and he will be the you find the foreman who is willing, but unable, because h been taught himself. You are the captain and there is you but he is going to drill your raw recruits, and your cc going to shape up just as your recruits shape up—with a poral. You are going to have bum soldiers in the squad. your time to take this man, who is willing but unable b does not know how, and teach him how easy it is. Teach h a few minutes, the five or six or ten ways.

Show him how easy it is to transmit that information t or six or ten men in his gang. How to watch all the tim that they live up to the training that he has given them.

Next, you find your mid-stream Johnny. He is going thorn in your side now and forever. He is the fellow w "Well, I do not like to see the accidents, I sure would li them down; I am doing all I can. Yes, sir, I will try ha then does not do a thing. Well, you cannot go at him.

got to sort of suffer in silence until his record gets too bad and then you put the rollers under him.

THE HARD GUY.

Then next you find the hard guy, who says he "don't believe in it; never did. Accidents are going to happen; as long as we have a business we are going to have accidents. There ain't nothing to this; it's all humbug!" We sometimes find that kind of a fellow. I like him better than the mid-stream Johnny, because you know where he is. You can get under his skin if you watch him; if you follow his record. He tells you it would interfere with production and that he cannot get the work out. Find out what departments have broken records in the past month in the way of production; hunt these foremen down and you will find that they are live wires. Get their accident records and production records; pick them out. Say to the hard guy: "How about it, fellow? What are you, a 22-caliber man on a 44-caliber job? Is the job too big for you?" That will start him scratching his head.

We had some roughnecks out in Cambria, all right. They told me that accidents were due to happen. A certain superintendent of a department said "There is nothing in it; they will happen." I said: "Then you believe you will never die until your time comes; is that the idea?" He said: "Yes, sir; I have never been afraid to go any place in this mill in my many years service, because I know when my time comes I am going to get it and not before."

That was four years ago, before we got shields on top of our blast furnaces. Just then No. 4 kicked and I went under a gondola, but he beat me to it. I said to the gentleman: "Really it is a surprise to me, but that illustrates your story. I believe in it now." He said: "What is that?" "I see you were predestined to duck under this gondola," I said. "I came under it to get away from the shower of limestone." Experience later proved to him that he was wrong and he is now one of the biggest boosters we have at the Cambria Steel Company. He is helping the safety movement zealously.

RECORDS IN BUILDING FURNACES.

We built a blast furnace complete in eighty-five days, and when we started they said: "For the love of Mike, keep that safety department man away if you people expect to get this furnace done." That was when they started. It sounded a little suspicious, and we had a safety inspector camp on the job and stay with it, as we thought

they were going to try to get away with something. complete 550-ton furnace with all accessories in eighty-five only twenty-six minor injuries on the job.

That was going some at that time. We have since b seventy-eight days and then we beat that record. No. 11, just a short time ago, took fifty-eight days for full instal had nineteen minor injuries on that. We ran up on th No. 10—just a little bit.

This was done absolutely by chasing foremen. We di a safety order on the construction of any one of those thre We kept after the foremen all the time; we tried to get th to feel that it was not something that we requested them a part of his duty; that he was morally responsible for t the men in his particular gang.

POKING UP THE FOREMAN.

Every once and a while a safety inspector will see a something wrong. He does not caution the man unless it is liable to immediately injure him. He gets hold of the fo tries to find out why the foreman permits anything like tries to make the foreman feel that he is losing his reput that fellow who is pulling off that bonehead act is doing man a dirty trick. The foreman is not going to stand f son of a gun is after him, he must have it in for him, or he go and subject himself to the liability of injury. Now t way we get a fellow who takes the opposite attitude. We got them all yet, but we are trying hard.

If a foreman will not come to time we show him what is and say: "The next accident will be the end of you."

A short time ago a foreman laughed at me when I told h broken a man's leg because he did not watch his work. rigger with four men, and he said he could not watch al these men at once. He had to go away and talk to some on man broke his leg, due 100 per cent to the foreman. I sa foreman: "Pete, the next accident of that kind that hap be the end of you here. You are not trying to play ball you have laughed at this movement from the start." "Huh! I have been a rigger foreman here for eighteen year build all these furnaces. You ain't going to fire me!" night he broke another man's leg, and he changed his mind.

two months off. Being an old employe we could safely let him off for that length of time without fear of his going somewhere else for a job. Then we put him back on, but he had to swear an oath he would look after his men.

WHEN FOREMEN ARE POOR INVESTMENTS.

I have heard the assertion made that in these days of labor shortage—and we are just as short as any of you—that you will not fire a man for unsafe practices. Stop to think of what it means to you in dollars and cents. If you pay a foreman $1,200 a year you expect to make a profit on his labor. You are investing $1,200 of your working capital. We will say, for the sake of argument, that you want to make 25 per cent; that is $1,500, the man has got to return at the end of the year to make him a paying investment. Then through some boneheaded act of his, or lack of attention to his duty, he costs you a lot of compensation—say, to make the figures exact, that he cost you $1,500—(he does not have to do very much damage or have very many accidents to cost you $1,500 in Pennsylvania, when you take compensation and medical attention into consideration). In such a case you have not only failed to get any return from that man's labor; you did not get the $300 you were looking for, you have lost irrevocably the $1,200 working capital you invested in him, therefore you have gone in the hole $1,500 on his labor. If every one of your foremen go just enough on the shady side to make their compensation and medical expenses offset the amount of profit that you expect to get from their labor your company will go broke.

"PRE-ORDAINED ACCIDENTS."

That does not look very big on the profit of one foreman or fifty foremen, but carry it through. Certainly if one foreman has a right to lay down on you, then 100 per cent of them have the right to do that same thing. You have to establish a rule and make them all live up to it on your own work or they will run it to suit themselves, for 100 per cent of your foremen—mark this, because I have figured it time and time again for their own benefit—when they come to tell you how it happened that they had an accident that they should not have had, will say it was just pre-ordained, God was not with them on that particular afternoon. I have gotten these figures out to show them that we expect our foremen and our workmen, all the way through, to be assets and that they are liabilities. It is pretty easy

to show a foreman of that sort that the company is from $5,000 a year better off without him—with him outside th

I had one foreman whose reputation was so rotten tha as an example to the general manager. He looked at i he scratched his head and said: "By gosh, outside of ou is the biggest liability we have." So we eliminated that liability.

FIRING FOREMEN.

Whether you can safely and properly fire a foreman wh meet you half way depends entirely upon the view that you how strongly you put it up to your management. Mind, I co ing only as a last resort. When I get a stick of bad timbe admittedly bad—a man who admits himself before the occ he is bad, I first try to get him to go along with us, showin reputation he is building up.

Whenever a man is promoted around the works, if that i a good accident record back of him (we do not care why he moted) the safety inspectors all over the works talk it arou the foremen that one of the reasons that fellow was put u cause he had such a darn good accident record. You kno not have an accident for so long. That foreman is up on he is a live wire: we make it a point to talk that over in the of three or four pieces of timber that we are trying to work

CAUSES FOR PROMOTION.

As I said, we do not care why the man is promoted; if good record, he makes a fine example, a concrete example the field, and you can feed it to them as hard as you want t will think "That might have been me! I wonder how many I have had." Next he comes into my office and says: "You kno been working hard; I have been awfully busy. I wish you w me know how I am standing on my accidents. I want to get in I believe in this safety movement; I believe that I can do i fellows show me how." They come in to us right along manner.

It has not been a small game because we have 968 foremen of them are old-timers, many of the foremen have long whit ers and were there as foremen before I was born, or before a ber of the safety department was born, and we have had our

gotten very far, but we feel if the time ever comes along when we can get 100 per cent co-operation from them, we will cut out not less than 80 per cent from our personal accident record.

DISCUSSION.

CHAIRMAN FONDA: Gentlemen, I would say that was a pretty good impromptu speech. Mr. J. M. Larkin will discuss this subject.

MR. J. M. LARKIN (Service Department, Fore River Shipbuilding Company, Quincy, Mass.): As Mr. Herbert did not write out his paper I could not, of course, prepare any discussion of it in advance, so I must confine myself to a few notes.

I am very glad to have the opportunity of talking about safety and the attitude of our foremen as a helpful factor in our campaign to prevent accidental injuries. The Fore River Shipbuilding Corporation began a safety campaign about two years ago, and, thanks to the splendid co-operation of our force from president to office boy, we have obtained a large measure of success. Our present organization consists of a general safety committee of the following officials: The vice-president and general manager, the treasurer, the general superintendent, the president of the Fore River Employes' Benefit Association, the company surgeons and the manager of the service department, who is also secretary of the committee.

I will not retrace the steps Mr. Herbert has covered, because I think we have all experienced the same difficulties with certain types of foremen, but I think we should give the foreman his due and appreciate the fact that the foreman as well as his men knew nothing of safety work until a very recent time. In our plant we had the same condition; we had the same type of foreman, the old-line man who did not believe in Safety First; he thought it was altruistic or poppycock and that the Y. M. C. A. ought to be doing the work; that the fellow with the white collar was holdnig his job by "throwing the bull" and all that stuff. I think we have all experienced the same condition, but in the course of a two years' campaign we have been able to work out our campaign, not only as a humane proposition, but in such manners as to show that the foreman's pocketbook would be touched by the accidents he was having.

That was accomplished in this way: All the subsidiary plants of the Bethlehem Steel Company, of which we are one, are placed on a basis of bonuses for productions. The cost of accidents in our plant is divided at the end of each month and the hours lost

time per department is charged against the foreman—charg his overhead expense—and it comes right out of his po were quite a long time in making him understand, but he the point and got busy.

TWENTY GREAT DEPARTMENTS.

The Fore River yard is divided into twenty great de and at the head of each is a foreman. Some of the fore over 2,000 men in their charge and their positions equal factory superintendents at the head of extensive plants. T men act as chairmen of their shop safety committees, of w is one for each department. The other two members ar every three months from the workmen of the department. recently installed a safety inspector, whose duties will be to inspect the entire plant in conjunction with the shop safet tees. We are looking forward to excellent results from hi ment and are confident that he will be able to lower to a our already low "hours lost due to accidents."

I want to say that it is impossible to do anything—whe dent prevention work, social service work, welfare work, ed work, or any other kind of work inside the plant—unless the absolute co-operation of the foremen.

The foreman of a department is like any other person of men—he is the head of the department. If there is anyth done in his department he wants to be consulted first. W great mistake sometimes, those of us who are in this sort in looking for personal credit for some of the achievement trying to attain. I would rather get a better solution th into a department and simply skimping over the ground, te foreman we are going to have a meeting, we are going to tal The bettter plan is to get hold of him and informally su him the things you want him to come back and suggest He will then feel that the idea originated with him and ni out of ten you will get his good will and co-operation. A meeting is over he will say: "That was a bully meeting!" wise he may say: "What was that —— fool talking about works out in directions other than safety work. It is simp of psychology.

Upon the co-operation and sincerity of the foremen a interest and observance of safety regulations depends absolu

committee may draw up rules, the most perfect devices may be installed, the most brilliant lecturers engaged, but if the foreman sets an example of disregard of regulations and of taking personal risks his example will become the rule for the department under his charge.

We attribute the success of our safety campaign to the splendid co-operation of our foremen and to the support given the movement by the officials of our company.

I wonder if you gentlemen ever went out to engage labor for a foreman? Here is an example of what you may be up against: We had one foreman who was continually kicking about the class of labor the employment department gave him, so we sent him out to select some men from probably the worst group we had ever gotten together. He picked twelve out of sixteen men and brought them into the works. Afterward, when we asked him about them, he said they are twelve of the best men he ever had. Why? Because he picked them himself.

That also holds true in safety work. If you have something you want to put across in a department, go to the foreman, sit down for half an hour and talk it over with him; you will generally find him coming your way. Everything in our plant goes to the shop committees through the foreman because he is the permanent chairman of the safety committee.

FOREMEN ARE PRACTICALLY SUPERINTENDENTS.

Perhaps we have a little different situation in our plant from the conditions described by Mr. Herbert, because our foremen are the equivalent of a factory or a big department superintendent, because, as I said before, some of them have from 1,000 to 2,000 men under them. Our foremen, perhaps, are a little higher grade, a more intelligent class of men, than the man who is directly in charge of men and termed a straw or gang boss.

By the way, we have our greatest difficulty with our straw and gang bosses. However, if you give your foreman to understand that he is the lieutenant in the department, to whom you may go and tell your troubles, and he understands that you have not been to the manager first, he will see to it that the fellows down below line up with you. If the workmen fail to co-operate and if it happens too often he puts the rollers under them, as Mr. Herbert expressed it.

Another thing, we have found the foreman who is highest in

safety work is generally highest in production. This is intelligence. In our plant this has worked out to a fine we have the record of one foreman which we tell all the otl about. I may be stealing some of Mr. Herbert's thunde one of the things we have worked out.

It was said in the conference this morning by severa that they always try to give their foremen proper credit mighty good policy, but in one particular shop we had a nev Now the new man who comes into an organization alwa little stronger than the man that has been with you ten or fifteen years, because he feels that you do not knc shortcomings—perhaps he can get by with a few things tl will question.

We tried to line up our new foreman on safety wo1 would not listen, and finally we had to do a lot of missio1 with him. I got around it by having Field Secretary P down from the National Safety Council. I took Mr. P1 to the shop and introduced him to the foreman as one of o1 safety exponents. Price talked his head off, but he did where he was when he got through, because the forem: with everything Price said. Not a man goes into the department who does not talk safety to him. We lost in three months before Price got hold of the new fore he has not had an accident in the last five months. Of told all the other foremen of this splendid record.

Three times a week we have foremen's meetings and s they let us come in and talk safety. The president of the makes safety one of his principal topics in all his talks to or to the foremen, and he always includes courteous trea the workmen and fair treatment with safety conservation. way it goes down the line that it comes from the head of pany and it has his absolute backing.

LECTURES BY EXPERTS.

Periodical lectures are given to our foremen and the committees by practical experts and these have proved benef discussions bring to light existing conditions in our plar would otherwise have been overlooked. Such meetings every other week, the custom being for our members tc suggestions on their practical knowledge of conditions. T referred to the general safety committee which

approval of the committee, action along the lines suggested is taken and in most cases an award is paid to the originator of the idea. In all cases the general safety committee has found it sound policy to inform the originator of the suggestion of their decision in order to prevent a misunderstanding of the purpose of the commitee, lest the men infer that the object was merely to furnish publicity as to the safety of the plant to men contemplating working there or of some similar misconception. Our foremen, although rushed to capacity by national needs, have gladly co-operated with us and have cheerfully instructed our men in the observance of safety rules.

A thought comes to my mind, the humorous side of this serious topic. I am always looking at its saddest phase, seeing a fellow with mangled legs or a crippled body. However, a little humor crops out occasionally. We have accident records coming in all the time and I recall one that my assistant brought to my attention. A fellow, so the accident report read, was found wandering around the plant in a dazed condition. We do not know just what to attribute that to, but that was the substance of one of our reports. Another was that one of our workmen was found in Quincy in the middle of the street, kneeling down saying his prayers. When asked what the trouble was he said: "I don't know, I work at Fore River." That record went to the doctor and the doctor said he would be —— if he knew whether it was a condition or a physical ailment.

I think it is unquestionably true that the foreman reflects the attitude of the company and that the men will follow anything the foreman does, because, after all, anything that any of us do is more or less an imitation. If the workmen feel that the foreman is disregarding safety rules they are certainly going to do the same thing.

RESPONSIBILITY FOR SERIOUS ACCIDENTS.

We have just recently instituted a system of reports in serious accident cases. A report is made out by the safety inspector and referred to the general safety committee. By them the responsibility is pinned on some one man in the plant. It is a very serious thing to have any one's death pinned on you—to have it hanging over your head. In some of the cases referred six months ago we have not been able to settle as to who was the individual responsible. As far as I am concerned I would dislike very much to have pinned on me the responsibility for a man's death. I do not think that it is quite the right thing to do, but at the same time it gets the men

on their toes and they know the minute a serious acci
that they have to take to the woods and prepare a pretty

I want to say a word about the attitude of the men,
of the men on safety and welfare and these various things
to two years ago, when the plant was taken over by the
Steel Corporation, we had none of these things; we j
along with sixty trades in the plant, building ships. A
accidents were occurring and nobody seemed to care any
that the state required a report on it.

FELLOWSHIP WORK AT FORE RIVER.

When the Bethlehem Steel Corporation took over t
seemed to bring with it a different attitude toward the w
have no doubt it was on account of the work of Mr. F
the officers realized the value of the work. We are fo
having a president who, the first day he came to the plan
concerned about looking the plant over—he wanted to
football game and kick the first ball. That has been a to
his reign over Fore River.

One thing after another has been started—bands and
restaurants and restrooms to accommodate the employe
sorts of welfare activities. A big clubhouse, worth abou
has been built, given to the employes, and is run by then
work was instituted; apprentice courses, educational
various other lines of activities have gone on for two year
times we used to stop and wonder if it paid, outside of
business part of it.

About four months ago twenty-nine men, all workmen,
my office one night. They had just quit work, and when t
I turned white. I said "Good night; the plant has blown u
of the fellows asked me if they might use the main din
I told him to go ahead and they asked me to sit in with the
had their chairman all picked out and their various committ
chairman very eloquently told me the purpose of the mee
few words. He said that since the advent of the new
and since the Bethlehem Steel Company had taken over t
the men who had been there for a good many years had
and watched things going on. "We decided it was high tin
to show our appreciation of the effort of the company,"
The best part of the whole thing was that it was spontane

the men. There was not any such thing as going to them and suggesting that it would be a mighty fine thing for them to show their appreciation. In the course of his remarks, the chairman said: "Gentlemen, we have decided the most fitting tribute we can pay to the company and the Bethlehem Steel Corporation is to present our living president with a portrait." They went through the plant, getting 5 cents from this man, 10 cents from that man and a quarter from another, until they collected about $500. They selected an artist and had the portrait painted. They pulled off a big field day and presented the portrait to the president and a reproduction to his wife.

That act is typical of what the men will do when you really do something they appreciate, and the best part of the whole thing was that it was spontaneous. The best indication of their viewpoint was this: They would not give one portrait, they gave two—one to the president's wife; that came right from the heart. That is the way men will line up if you get them coming right.

In May we had 4,000 men in our plant. We are building submarines, destroyers, battle cruisers, etc., and the government suddenly shouldered onto us twenty-six torpedo boat destroyers and an equal number of submarines and battle cruisers. It necessitated the building up of our working force and we now have 8,200 men.

PRESIDENT LEADS SAFETY WORK.

We all know from experience that accidents happen to new men; there is no question about it. We know that over 90 per cent of the accidents happened to men who have been with the concern less than six months. In our case it worked out that about 58 per cent of accidents happened to men who have been with us less than a month.

The bulk of our safety work should rest with the foremen in looking out for the safety of new men. Mr. Morgan suggested a plan this morning that I think is very good. We have a little pamphlet and a letter signed by the president of the company which is sent to all new workmen, and this acquaints them with all the unsafe practices in the plant and asks for his co-operation. Our president is Mr. Joseph W. Howe.

How many men read them I don't know, and it is pretty hard to judge just how much good the letter and pamphlet do. At every meeting of the foremen in the last three months we called their atten-

tion to the fact that they have 4,000 new men in the plant-more green men than skilled men—and that all of thes been recruited from trades foreign to shipbuilding becau was not to be had. There has not been a time in the his industry when it was more necessary to conserve our wor than now, right now. We are at war and the most impo we have to face is the maintenance of our industrial reso only way we can accomplish that is to conserve our indust If we lose a machinist it may hold up the turbine for a for four or five days, and who knows but what those fi days might be the turning point of the war? These are we put up to our foremen and we hope they will have res

You can well realize that a concerted and sustaine necessary to keep our time lost by accidents to a low rec spirit with which our foremen have co-operated is well e in the following record: One department has not had a that necessitated loss of time for the last five months. I last twenty-three months this shop lost, out of 161,365 hours, but 324, or one-fifth of 1 per cent. This is a recor type of industry.

Let me repeat, the foreman holds the key to the succe safety campaign and upon his shoulders rests the main resp We have repeatedly noted that the foreman who leads also leads in department output and has a contented a organized working force rooting for his success.

It may well be said that our foremen are, as the name "foremen," that they observe both the letter and the spir safety regulations and their services in conserving the sp and skilled force under their control cannot be too highly When you consider their position requires great endura highest possible speed and efficiency, and when you recall th out adversely affecting the yard's reputation for rapid and t government work, they have also succeeded in reaching ar ideal condition along lines of accident prevention, you will stand our appreciation of the services rendered by our fore thank you.

CHAIRMAN FONDA: We have a few minutes before clos afternoon's program. I am sure you gentlemen have quest ask Mr. Herbert or Mr. Larkin in connection with this work haps you have had a personal experience which

WHAT TO DO WITH STUBBORN FOREMEN.

MR. J. BURGWIN: I would like to ask Mr. Herbert whether he deals with the boss carmen and the boss roller in the same way he does with the ordinary straw boss.

MR. HERBERT: Yes, we try to put them all on the same basis.

MR. BURGWIN: If you had a boss roller or a boss craneman with eighteen or twenty years' experience, a man who knows the work inside and out, would you fire him for cause you consider sufficient to discharge an ordinary labor foreman?

MR. HERBERT: It is very seldom necessary to fire a man of that sort. We discharge only when there is absolutely nothing else that can be done. I mentioned one man who had worked for us eighteen years. He took such an obstinate stand that we gave him a layoff of sixty days; we knew he had been with us so long that he would not jump the job. A boss roller must be with you a great many years to work up a spirit of that nature. He is a very highly paid man and he is above the average in intelligence, and we very seldom have recourse to harsh measures with men of that caliber. They usually go along with us, but if they do not we give them a rest at home, feeling pretty safe in calling the man back when we want him. Most of our rollers and general foremen own their own homes and it would be pretty hard for them to pull up stakes and move, consequently they are generally our best helpers in safety work.

Many people call the man in charge of a small gang of men a straw boss. We rate them as foremen. We do not have any straw bosses, even if they are paid only 2 cents an hour more than workmen. They would be called straw bosses in other mills, but we call them foremen. Therein lies most of our trouble, not with superintendents or general foremen, as we rarely have trouble with them; if we should, they would be a much harder quality to analyze than the little fellows. It is the man that has four to eight men under his direct supervision for the entire hours of the turn. He is right over them, is watching them all the time, or should be; he is the man whose scalp we are after.

BEST TIME TO HOLD SAFETY MEETINGS.

MR. O. J. LEWIS (Corrigan-McKinney Company): I would like to ask at what hour it has been found most satisfactory to hold meetings of foremen. We have tried the hour immediately following the lunch period, but that interrupts the return gang and the work

itself. It is generally supposed, of course, that we are to h meetings on the company's time. I would like to have the ex of some others on this point.

CHAIRMAN FONDA: A number of companies have been successful meetings in the evening; they have a Dutch lunch kind—sort of a get-together meeting.

MR. LEWIS: On the men's time?

CHAIRMAN FONDA: The men, in some instances, are hourly rate for that time. Others have had the men attend own time.

MR. J. D. JAMES (Safety Engineer, New Jersey Zinc Cor We have committees in every department of the plant, and th regularly every week. They selected the hour between 11 o'clock, always on the company's time. You cannot get th men fully interested if you take this time to attend safety r and the company decided, rather than have any drawback score, to allow the time whenever it would be suitable for partment. As a rule the men selected the hour between 11 o'clock.

CHAIRMAN FONDA: That is, for the committee meeting. Mr. Lewis refers more particularly to a general get-together men.

MR. JAMES: That is exactly what I mean.

CHAIRMAN FONDA: Your safety committees are made foremen from various parts of your plant?

MR. JAMES: We started with the foremen, asking them an example of co-operation as they had already served on c tees. We are dealing now with workmen in every departmen committee meets on the company's time and is composed of fc

CHAIRMAN FONDA: How many men are on the committe

MR. JAMES: About ten.

CHAIRMAN FONDA: Did you refer to a meeting of that to a general meeting?

MR. LEWIS: A meeting such as a safety engineer migh to have with the foreman of the yard department, for insta with the track gang? He may have occasion to call them tc and when such a meeting was held, at what hour would it be

MR. JAMES: That is exactly what I had reference to—m of foremen of different departments; yards, furnaces, coo packing-room, storehouse. All our foremen are supposed to

MR. BURGWIN: We have had our foremen's meetings at quite a number of different hours. We finally settled on 9:30 in the morning. I have kept the records for two or three months and two-thirds of our men are there sharp on time. Of the rest, about 90 per cent are not more than five minutes late.

MEETINGS IN AFTERNOON.

MR. E. R. BLINN (Solvay Process Company, Syracuse, N. Y.): We are in a little different line of business from the other gentlemen assembled here, but we have the same propositions. For foremen's meetings and Safety First meetings we find the best time is about 3 in the afternoon and we require our men to be there on time—those who are asked. If we want the whole section we call all the men together at that time. We find it best. The reasons for that hour are that the workman, the man on the job, knows pretty nearly what he is expected to do from that time on and the sub-foreman or assistant—the straw boss or whatever you call him—can carry on the work from 3 o'clock until quitting time at 4:30. This system allows us an hour and a half for our meeting.

CHAIRMAN FONDA: Does that interfere with the foremen getting in touch with their night shifts? Your work is a by-product, coke?

MR. BLINN: No; the foremen go back to their gangs immediately after the meeting, which is usually over fifteen or twenty minutes ahead of quitting time, and this allows them to arrange for the night's work. That is our custom.

MR. HERBERT: I want to clarify my remarks a little by saying that we do not have foremen's meetings, strictly speaking. We hold our safety meetings every month. These are in the evening and are attended by safety committeemen, but not specifically foremen. We believe it is better to fight the battle on the man's own ground. When you get a bunch of people together each man is rather apt to take the compliments to himself and let the rough stuff go over to the other fellow. One time I played ball in college and we went away from town to play, and I was catching. One of the pitchers turned to me and said: "Jack, the prettiest girl in the front row has got smut on her nose." There were eleven girls in the row and each girl wiped her nose with her handkerchief.

We like to get the man right before us, so if we pay him a few compliments he will know darn well they are his; if we hand him a little bit of the other stuff, he can not say: "Well, he does not

mean me." Before you were married, when you were your wives, you were probably going with five or six ladi same time, but you did not gather them together in a mee tell them about it.

CHAIRMAN FONDA: That is good stuff. Have we a like it to add to our program?

NOT AN ACCIDENT IN FIVE YEARS.

MR. G. G. EVANS: I can contribute an illustration think is pertinent. Two or three months ago, while passing our yard, I came across one of the foremen in charge of m the most hazardous work at our plant. He has been with since w turned the first shovelful of dirt, five years ago. "Arthur, you do not come into the hospital very frequently; I don't see any of your men there. I really do not know you "No," he replied, "since I have been on the job no acci happened to me or to any men in my employ." "That is a record," I said, "and I am glad to make a note of it." A da after our conversation I had his picture taken and pasted of them around the plant, with a proper article underneath. surprise the criticism "that it was all due to luck" did n from the foremen of the plant, but from men higher up. said, "there is a reason for it; all you have to do is to go follow that man and see how he directs his work and you w the secret of his excellent record."

CHAIRMAN FONDA: It is time to close, but I know we w like to go on. I would like to mention again that Dr. Lauffer' while rather long, is very important. It will be the first p morrow morning. Copies have been distributed, but we hav left which can be had from the Secretary. I hope you w this paper over and get an accurate grasp of what Dr. Lauff to bring before us, as it will aid materially in understanc subject. Tomorrow's subjects will be very live ones and we as much time on them as possible.

Is there any further business to come before the Section? we will now adjourn.

A motion was offered, duly seconded and carried that the adjourn to Friday morning at 9 o'clock.

One hundred and forty delegates were in attendance meeting of the Section.

Joint Meeting
Iron and Steel and Foundry Sections

FRIDAY MORNING SESSION

THE meeting was called to order by the Chairman, Mr. George T. Fonda, at 9:25 o'clock, with 200 members in attendance.

CHAIRMAN FONDA: The meeting will please come to order. This is a combined meeting of the Foundry and Iron and Steel Sections. We will hereafter work as one body and be known as the Industrial Division of the National Safety Council. Mr. A. H. Young was elected Chairman by the joint Nominating Committee of the two Sections and as soon as he arrives we will have the report of the committee and elect officers. Until that time we will proceed with our program. Our first paper is one we are very anxious to hear. It gives me great pleasure to introduce Dr. C. A. Lauffer of the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

LOW VOLTAGE HAZARDS.

DR. C. A. LAUFFER, MEDICAL DEPT., WESTINGHOUSE ELECTRIC AND MFG. CO., EAST PITTSBURGH, PA.

Mr. Chairman and Members of the National Safety Council: The dividing line between low voltage and high voltage is placed at 550 to 600 volts; the division is an historical one. The limit of D. C. generation, and, consequently, the maximum current available in industry for some time, was 600 volts. With the advent of alternating currents, however, the transformer was introduced, bringing the voltage available for commercial work at the present time to approximately 150,000 V.

DEFINITION OF LOW VOLTAGE

The National Board of Fire Underwriters (in the 1915 Electric Code) places the dividing line between low and high voltage at 550 V. The Federal Bureau of Mines, in promulgating "Safety

Rules for Electrical Equipment in Coal Mines" (technical 138), classifies voltage as follows:

(a) Any potential less than 301 volts shall be deem potential.

(b) Any potential greater than 301 volts, but less volts, shall be deemed a medium potential.

(c) Any potential in excess of 651 volts shall be deem potential.

The viewpoint as to what constitutes high and low determined by the application of the voltage. In transfor the dividing line is 2,200 V.; 25 V. to 30 V., on the othe considered high voltage among automobile engineers.

With reference to hazard, there is no such thing as lo All circuits are dangerous to a degree; 500 V., D. C., is lo but is very dangerous, both as to electric burns and shock A. C., is not likely to burn, the initial arcing has low inte on a heavily fused circuit, under certain conditions, 11(produce burns, and sometimes causes fatal shock.

Rather than describing a line as low voltage, or high which terms mean very little, it is better to designate a ci its voltage, cycles, direct or alternating, and the capacity c cuit in question. Thus: 110 V., 60 cycles, 10 ampere fuse The terms high and low voltage are confusing, and could, priety, be eliminated.

In this paper, however, the term low voltage will apply of 600 volts and under.

APPLICATION OF LOW VOLTAGE

Electric incandescent lighting is almost universally op 110 V. and 220 V. systems. Industrial motors are run c to 500 V., crans 250 V. Trolley systems* commonly en V. to 550 V. It is thus evident that low-voltage application nates in the industries. In many plants of the iron and dustry, 230 V. is being standardized.

ELECTRIC CODES

The Electric Code of the National Board of Fire Und relating to the construction and installation of electrical to reduce the fire hazard, applies also to reduce the elec and burn hazard.

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* Other trolley systems employ 1,200 V., D. C., and as high as 11,00

The National Electric Safety Code* is a noteworthy contribution to the cause of Safety First in the whole electric field. This electric code is receiving nation-wide recognition; a few state commissions have already adopted it, or part of it; a number are considering its adoption.

At the point of utilization, where the circuit is handled by non-electrical people, the isolation and insulation of the current carrying parts should receive particular attention. Precautions essential for the protection of the consumer of current would be irksome if required in generating stations, and in mills and factories, where skilled and experienced men only have access to the circuits and switchboards. The continuous requirements for alterations and repairs in mills and factories make it very inconvenient to have low-voltage circuits totally enclosed. It is contended that removing the casings from the enclosed conductors retards and prolongs alteration and repair operations without eliminating the electric hazard.

THE HAZARD

A letter in my possession from the Bureau of Workmen's Compensation in Pennsylvania states that "The records of that bureau show that from Jan. 1, 1917, to July 21, 1917, there were forty-four fatal accidents caused by electricity." The total annual number of fatal accidents caused by electricity in this country demonstrates the hazards incident to the careless handling of electric current and emphasizes the necessity of continued Safety First propaganda.

There is hazard in every industry; elevators and cranes, steam piping and boiler applications, coal mining, the chemical and explosive industries, and other pursuits, relative to the number of employes and exposed persons, are more hazardous than the electrical industry and electric applications, in the light of present developments.

ELECTRIC ENERGY COMPELS RESPECT

Electric energy has become the most potent factor in doing the world's work. Like every other form of harnessed energy, however, it must be confined within its proper channels. Fire and water, compressed air and steam, drugs and chemicals, likewise are safe only when confined and intelligently employed.

Electric energy must be shown due respect; it can, sometimes,

* Circular No. 54 of the Bureau of Standards, issued for trial and examination, November 15, 1916.

strike down those who manifest indifference and contem
electric energy is a chosen vehicle for industrial achievem
is safely operated where its laws are known and obeyed.

The ever-increasing applications of electric current f
heat and power, for domestic and factory purposes, prove e
the most flexible and adaptable source of power, and insure
more extensive applications in relieving the burden of l
home and factory, as civilization continues to develop.

Current, however, can, and always should be, as saf
consumer as gas and water now are.

ELECTRIC SHOCK VS. ELECTRIC BURNS

The two types of electrical injuries encountered in the in
are electric shock and electric burns.

In electric shock, the patient becomes a part of the cir
current being transmitted through his body. The internal
the electric current through the patient's body may becom
lished without visible burning or with a mere puncture bur

In electric burns, the patient's body comes in too close pr
to an electric arc. Such electric burns are the result of l
ergy—they are thermoelectric burns. Other burns, as ari
arcing and electric welding, of which "flashed eyes" is a t
due to the actinic rays of the electric arc, the patient be
remote to experience thermic burns. It is thus evident t
circuit need not be completed through the body to produce l

In the case of short circuits, where the patient's body i
posed between the two lines, or between one side and grou
patient's body then completes the circuit. There may be an
fect contact, in which case an arcing distance intervenes;
to hand, both hands may be burned; if hand to foot, then bu
be found on both extremities, those on the feet often follow
nails of the shoes.

When the circuit thus becomes completed through the p
body with an intervening arcing space, both electric shock an
may ensue. The human body, serving in this manner as
circuiting medium, completes the circuit; the amount of
transmitted depends on the electric resistance of the bo
nature of the contact and the potential (voltage) applied
greater the intervening arc, or arcs, with a given volta
less current there is available to penetrate the body. Sin
human body is in series with the arc, produced by poor co

considerable voltage (or pressure) drop may occur in the arc, or arcs—the body, accordingly, being subjected to a relatively moderate shock. It is this fact that makes efforts at resuscitation so successful in the vast majority of cases.

While electric shock and burns are usually associated, they are thus seen to be essentially different. Persons without discoverable electric burns may indeed be fatally injured, and, conversely, persons frightfully burned may suffer less from electric shock, because, as results of the electric arcing, there is a considerable voltage drop in the arc, as just related, and because the coagulation necrosis, and charring of the burned tissues, apparently, block the flow of the current through the patient's body.

Other trauma may be associated with electric shock and burns. A slight shock, producing fright, or muscular recoil, may cause a patient to fall from an elevation, or he may sidestep into revolving machinery, and the injuries from the latter causes may be more grave than those arising from the electric circuit.

DEFINITION OF VOLTAGE AND AMPERAGE

Before discussing the several sources of electric hazard, it may be in order to review the accepted definitions of electric terms, and state Ohm's law and its bearing on electric injuries.

Voltage is defined as the pressure which drives an electric current through the circuit; amperage, as the current flow.

The voltage is pressure piled up ready to act. The pressure of water in the pipe line is the familiar analogy; the water is there, ready to flow with a given pressure whenever released.

Opening the spigot releases the water, at the pressure of the line, just as the closing of a switch, completing an electric circuit, permits the current to flow.

A larger pipe will bring more water to the consumer, but the pressure is constantly that of the water line.

The water pressure corresponds to the voltage of electric current; the flow of water corresponds to the amperage, which is great or small, according to the resistance in its path.

OHM'S LAW.

Pressure = Volts = E
Current = Amperes = I
Resistance = Ohms = R

$$E = I R \qquad I = \frac{E}{R}$$

E (Pressure) (Electromotive force)
(measured in volts)

——————————————————————— = I (Cu

R (Resistance) (measu
(measured in ohms) ar

The voltage, expressing the amount of pressure, determir much current will flow through a given amount of resistance

In flowing through the human body, an electric curren Ohm's law, except in the case of alternating current of hi quencies, to the flow of which the body appears more or less vious.

The skin resistance of the human body is relatively high uring approximately 4,000 ohms. The dry calloused palm workingman afford a much higher electrical resistance. N rate figures can be given, as different individuals vary in t sponse to electric currents, and the readings for the same ind will show variations.*

The accurately measured electrical resistance of hand-t contact, obtained by the bridge method, expressed in equ ohms, dry surfaces, six inches tin-foil contact, gives a minir 40,000 ohms, maximum of 140,000.†

The definite amount of electric current that may pass t the human body without danger to life has not been

* The various external and individual circumstances that influence tent of electrical injury, in the grouping of Dr. S. Jellinek, are: "1. E (*a*) voltage, (*b*) amperes, (*c*) number of cycles, (*d*) points of (*e*) time limit of contact, (*f*) the kind of current (A. C. or D. C.). vidual: (*a*) resistance of skin and body, (*b*) the path of the current the body, or over the surface of the skin, (*c*) the condition of the mi body."

† Quoted in "Electrical Injuries," by C. A. Lauffer, M. D., John Sons, publishers. From "Experiments of H. E. Heath," Consulting E Baker Electric Company, New York City.

	Minimum, ohms	Maximum
Forehead to neck (back)	3,400	4,00
Neck (back to chest)	5,300	7,50
Neck to right hand	14,000	60,00
Neck to left hand	26,800	55,00
Neck to both hands	10,850	35,00
Neck to hip	18,500	80,000
Neck to knee	120,000	170,000
Hand to hand	40,000	140,000

mentally determined. The accidental electric contact injuries do not permit of the measurement of the amperage.

It is conceded, however, that one-tenth ampere of current passing through the body may become dangerous, one-fourth ampere may prove fatal, though seven to ten amperes are registered on the ammeter in criminal electrocutions.

It is thus apparent that the relatively high skin resistance of the human body is the element of safety in handling low-voltage lines. A moist skin, however, reduces the skin resistance.

Certain high-frequency currents are relatively safe because the current is confined to the surface of the skin. Low-frequency commercial currents, however, are prone to take an internal path.

When the skin resistance is broken, the current takes an internal path; a dangerous volume of current may then pass through the body, even at relatively low pressure. A momentary contact may result in no damage, yet the same contact, if prolonged, may result in serious injury.

HIGH AMPERAGE ON LOW VOLTAGE CIRCUITS.

The increased hazard of high amperage circuits of low voltage arises from the high-generated capacity of the circuit. Contact with the high-voltage side of an induction coil involves no serious danger, due to the fact that the capacity of the coil is insufficient to maintain its high voltage when delivering current through the body; the induction coil may develop 5,000 V., but does not sustain it. Contact with a low-voltage conductor, on a generating system developing several thousand kilowatts, however, releases an amount of energy that is relatively unlimited. The resistance of a high-amperage circuit must necessarily be low, and does not to the same extent tend to retard the flow of energy. When more energy is released the potential hazard is augmented.

The danger in a low-voltage circuit of high amperage capacity is evoked by interrupting the circuit, and is manifested by fire and flame. Such arcing may cause flash burns. Interrupting a circuit of great capacity feeds more energy into the arc, and may vaporize metal in its initial arcing; this vaporized metal, by reducing the resistance of the arcing path, may establish a dangerous arc. Low voltage does not sustain an arc as readily, however, as does high voltage.

The hazard from "grounds," on low-voltage circuits of high

amperage, accidentally grounded, however, is but slightl that being a question of voltage rather than of amperage.

SOME INJURIES INEVITABLE

The Safety First campaign has achieved better m handling electric circuits, and has resulted in perfected n devices for reducing the electric hazard. Human nature, "is prone to err, as the sparks to fly upward." Miscellane vertencies will arise, as operatives will forget which line or they may become so familiar with live circuits that f makes them careless; switches will be opened when lines a testers may make wrong connections; and through lack of in various ways, some electric injuries seem inevitable. Tl equation alone resists analysis, in the more complete elimi industrial accidents, and even this, to some extent, can be

SAFE MEN.

Systematic physical examination of prospective emp sults in: (*a*) The *selection* of keen, qualified men, mentally physically fit, for those posts in industry requiring such tions; (*b*) the *elimination* from industry of those unfit for in that industry; (*c*) the *adaptation* of the physically de posts in industry where their existing defects do not disqua from employment; (*d*) the *restoration* of others to ind correcting existing defects—such as lenses to correct vision; dental work; surgical operations, for hernia, v hemorrhoids, etc.

The industrial physician will recommend that men wi cular lesions and organic heart disease be not placed wh handle live circuits, but be located in some less hazardous ment where their existing defects militate less against the medical inspection of employes is thus a safety factor, app by employe and the management alike as a justifiable n reducing the accident hazard. Only qualified men shoul electric circuits or work in proximity thereto.

PRUDENCE

"Handle every line as if it carried 10,000 V.," is the displayed by qualified electrical experts. Regard the line unless it is positively known to be otherwise. You can not t the line may become charged. Energizing a circuit on wh

are making repairs and adjusting apparatus is a prolific source of hazard; hence, the need of locking switches, grounding lines, and appointing leaders in operations on live circuits and those potentially alive. Such Safety First instruction to men working on low voltages will measurably minimize the hazards associated with low-voltage systems.

Ignorance accounts for few electric injuries, carelessness for few; thoughtlessness is probably responsible for a larger portion of them.

Familiarity dulls caution; in handling current, a man must be thoughtful, his mind must be on the job, he must be looking for each and every possibility all the time. In defining a qualified person, particular emphasis is given to the concentration of personal attention on the work in hand. The amount of distraction permitted by other activities tends to disqualify an otherwise qualified person.

JUMPING.

The jumping distance of 500 volts is one-fiftieth of an inch, which justifies the conclusion that the jumping distance of low-voltage is negligible as an electric hazard.

Contrasting with high voltage, 20,000 V. will jump an inch between needle points, 60,000 V. will jump five inches between needle points—there is a relative safety in low voltage, as regards jumping from conductors. High-voltage lines are placed high out of reach, danger signs are employed for high voltage, and in consequence of this known jumping distance, no dependence is placed on insulation; all lines are made "dead" when repair operations* are in progress. Such precautions rob high voltage of its dangers.

RELIANCE ON INSULATION.

In consequence of the low-voltage jump being one-fiftieth of an inch or less, excessive reliance may be placed on the insulation of conductors. Excessive confidence in insulation, trusting in insulation for immunity against electric shock and burns, increases the low-voltage hazard. Live low-voltage conductors are handled indiscriminately in homes and factories, with the result that defects in insulation constitute a perpetual hazard to the electric consumer.

Insulation gets old and decays. Old rubber becomes brittle and

* Repair operations on live circuits up to 40,000 V. are conducted, elaborate insulation being provided for the protection of repairmen. It is desperate practice, however, too hazardous to commend.

breaks, exposing the conductors. Conductors exposed to w friction lose their insulation, and, at the thin points in the tion, the persons handling the conductors, especially if g when the contact is made, may experience a shock or burn hazardous in our homes to drag extension lamp cords ar the floor and over gas pipes and radiators. Lamp sockets defective as well as other parts of the conductors.

Attention to the renewing of service wires and leads is to safety from leaks through defective insulation. In go practice, lines and leads are inspected and measured peri and renewals made where defects exist, or carrying cap requires, thus insuring against possibilities of grounding and in insulation.

The domestic consumer is being protected by improve ment application and by the educational campaign, urging call an electrician when things go wrong, rather than tin much himself.

DUST AND DIRT.

While the jumping distance of low-voltage constitutes no ordinarily, a damp or dusty path may contribute to the ru the air resistance, permitting arcing to occur at a greater Particularly when the dirt consists of iron filings or other waste, and there is simultaneously defective insulation, increased arcing occur. After the arcing is once establishe draw off an increasing amount of current; hence, combina conditions can arise in which the low-voltage hazard is incr

FLASHING COMMUTATORS.

Cleanliness is necessary as a safety factor in handling as well as other electric apparatus and equipment. Dirt a accumulating on the commutator may cause it to arc over; phraseology, "the commutator flashes over." The flash brushes to bars, or across the whole surface of the commutat

Such arcing causes flash burns of the skin, if anybody ch be near at the time; the actinic rays of such an electric ar welding,* may even cause "flashed eyes" among persons be range of the heat of the arc.

Other reasons may account for commutators flashing ov

* The use of tin or aluminum hoods, containing glass, protect the eyes of welders: shirt sleeves and gloves protect their hands and arms

as excessive speed or load, the type of motor, and short circuits on the line, yet dirt is the commonest cause of this form of electric hazard.

If the motors are attended by practical men, and the brushes and commutators kept clean, such arcing is avoided. Conducting particles worn off the bars and brushes may short circuit the bars, unless they are kept clean.

BUCKING ROTARIES.

High voltage lines transmit the power to the stations where the transformers step it down to rotary converters. A. C. is thus converted into D. C. of voltages required for special applications of power, heat and light.

Rotaries are known to "buck over," causing a grave hazard to life and property. The bucking rotary flashes and burns terrifically at the commutator. This phenomenon, best understood by the electrical engineers, usually occurs on very heavy overloads. However, the present greatly improved designs of rotaries eliminate this hazard.

BREAKING CIRCUITS.

Cutting a live wire, or opening a switch on a loaded circuit, will draw out an electric arc, its intensity dependent on the voltage, the characteristics of the circuit, and the generated capacity.

The cautious lineman, who assumes that every lead carries 10,000 V., will not cut a live wire, but will employ switches, properly safeguarded, and will do his work whenever possible on dead lines.

The flash resulting from opening a circuit may cause electric burns and is often an unnecessary hazard. When switches are recklessly opened by unqualified men there is property hazard involved as well as personal hazard. The arcing, as from opening a circuit at a switchboard, may communicate to adjacent circuits, and destroy equipment.

Central switchboards should be fenced off, placed in separate rooms, in galleries, or on platforms more than eight feet above the floor, so as to be entirely out of the way of unauthorized persons coming in contact with them. Some switchboards need added protection front and rear; others are safe in front but require additional protection in the rear, if so exposed that an employe might come in contact or might heedlessly lean a crowbar against the bus bars.

Starting switches for industrial motors, both for group drive,

and for individual drive, require complete protection. A this type of hazard has developed many styles of covered and control apparatus which prevent the operator coming ir with live parts. Knife switches with handle outside, so cor that everything inside the box is dead as soon as the box is is one solution of the problem of safe circuit breaking on low systems. The key is in the possession of the authorized pers has ready facilities for access; the unauthorized person is t away. Replacing fuses, or other repairs within the switchb sent no electric hazard, as opening the box automatically br circuit.

A slowly opened switch, on a low-voltage line of high a flow, will draw a heavy arc. Quick operating breakers of pr sign are employed, therefore, to avoid flash injuries. Arcs broken under oil in certain types of switches.

The flash hazard, incident to opening switches on heavil circuits, is also successfully solved by employing remote switches for high voltage are operated electromagneticall any desired distance, by utilizing an auxiliary switch operate V. and above.

Low voltage circuit breaking is dangerous, but it carrie surmountable electric hazard, when the best modern equip used and qualified men, properly schooled in safety methods, ployed.

SURGES.

In low-voltage circuits surges constitute a minor hazard. breakers will trip, relieving the load, preventing flashing at t mutator. Transformers may transmit surges and osci amounting to thirty per cent to forty per cent, yet, as compar high voltages, the surges of low voltage constitute a negligil tric hazard.

SHORT CIRCUITS.

Short circuits arise (*a*) when circuits of different volta different polarity are thrown together, (*b*) through the bre of insulation on lines, motors, generators, etc., (*c*) when a conductor of relatively low resistance is placed across termi conducting elements, differing in potential.

The personal element enters largely into this phase of hazard: bare lines are allowed to touch; a screw driver sl

goes across a bus bar; pliers, or other tools, inadvertently cross the two lines.

The intensity of "short circuits" will depend on the size of the units that are connected to that line, and the setting of the protective devices, as fuses, relays, circuit breakers. "Shorts" have a tendency to blow fuses.

A backed-up induced current may also increase the intensity of a short circuit. Thus, a large generator will be feeding a motor, or series of motors; its lines will become crossed—a cross inside of the load may feed the power of the generator into the "short circuit," and also back up the load (induced current) from the motor.

GROUNDS.

In trolley line installation, the steel rails carry one side of the circuit.* Coming in contact with the steel rails is not dangerous—we cross them with impunity every hour of the day. The trolley wire is just as harmless to touch, providing your insulation is perfect. One must be positively insulated from ground, however, when touching the trolley wire. Yet the steel rails, on which we tread, are as much a part of the electric circuit as the trolley wire. The shock-and-burn hazard ensue when both the rails and the trolley wire are touched at the same time, as the patient's body then makes a "short circuit" between the two lines.

Electric generator and motor frames are grounded, but both the outgoing and the incoming lines are insulated from ground, unless, as stated, the circuit is employed for railway purposes.

Should any portion of such circuit become grounded, however, then contact with the opposite line, and at the same time with ground, would involve precisely the same electric hazard as touching ground and the trolley wire on trolley systems employing ground.

In low-voltage systems, nevertheless, either side of the line may be repaired, if the line being repaired is purposely grounded, providing contact with both sides at the same time is avoided, and providing, moreover, that there are absolutely no abnormal line conditions.

In handling any circuit, therefore, the only safe procedure is to assume that it is grounded; but as a precaution, obtain the volt meter readings from line to ground to make sure that this assumption is correct. If one side of the circuit is already grounded, intentionally

*In trolley systems employing a third rail the same hazard exists with relation to the third rail that applies to the trolley wire of overhead systems.

or unintentionally, grounding the other side produces a sh
If the body makes a better ground than the ground alreac
there is hazard involved. If one side of the circuit i
grounded, it is safe to work on that side—bearing in min
other side is "hot." Place additional ground on the line. I
ing a line, employ a big cable, not a thin wire; it is good p
the workman to protect himself with a thick cable, or a
grounding his line, as the protection might be lost through a
burning off.

Standing on dry wood, or some other insulating mat
precautionary measure, in dealing with live low-voltage ci
repairs in every case must be completed on one side of th
time, as handling both sides of the line simultaneously ca
circuits.

Insulating the body is not a safe practice in handling
voltage circuits, as the insulated body has a potential of its
this difference of potential is an electric hazard. The mai
on a low-voltage line, or up to 2,200 volts, is absolutely s
line is grounded and he is on ground. Place the man on insu
terial, however, and there then exists a difference of pot
tween the man and the line grounded.

TRANSFORMER BREAKDOWNS.

High voltage is generally employed for transmission an
tage for distribution, in order to ensure greater efficiency in
mission of power. Transformers step down high voltage t
tage for motors and for lighting purposes. Now, assur
out and the high voltage, or any fraction of it, may feed
something goes wrong in a transformer; the insulation r
service line.

This hazard from transformers is reduced by careful t
ducted by manufacturers, before transformers are markete
a lightning storm, however, a transformer's insulation may b
out, permitting the high-tension primary to impose its volta
low-tension secondary.

The precaution mentioned earlier in the paper will bear r
It is best to work on dead lines, but if compelled to wor
ones one should assume that every live line may carry high

A line assumed to be low voltage may actually be highe
through the accidental crossing of lines—as when falling

electric storms cause high-voltage lines to come in contact with those of low voltage. A telephone wire and trolley line, crossing, is a familiar instance of such possibilities.

If wiremen can not see both ends of the line, it is best to assume that it is "hot."

ELECTRIC TESTING.

While less general interest may be attached to the assembling and testing of electrical apparatus than in the safety and efficiency of the completed apparatus, yet it is the unusual that is attended with greatest hazard, hence brief reference to rules of test seem in order, as the greater hazard includes the lesser ones.

Security against accidents in this phase of the work is difficult, owing to the temporary character of the work. Special points emphasizing Safety First are as follows:

(1) Employ only carefully selected and physically tested men.

(2) Instructions in rules of test must precede practical work. A book of rules * and methods illustrating safety signs, signal systems, etc., is imperative.

(3) Testers must not be driven for production—increasing speed multiplies accidents.

(4) Whenever possible, use one hand only when working about an electric circuit, even though it is supposed to be dead.

(5) All switches should be marked, indicating the voltage, etc.

(6) Test equipment and floor must be kept as open as possible; spaces employed for tests must be free from miscellaneous unused wires and cables.

(7) Proper signs must be placed to give warning that apparatus is being tested.

(8) All connections, even though made for temporary purposes, should be neat, orderly, and properly insulated.

(9) The location of switches should be known, likewise the proper procedure to be followed in case of accidents.

(10) Two or more men should work together, one being appointed as leader of test, who has authority to direct the others, and who bears the responsibility in case of accident to any of the men under him.

Unless a definite job is assigned each man, they work at cross pur-

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*The "Rules of Test" used by the Westinghouse Electric and Manufacturing Company, may be obtained by addressing E. M. Olin, Superintendent of Test.

poses; production is retarded, accident hazard is increa man alone must be made responsible for turning the curre off, and all the testers, whether four or ten, must obey the test.

REPAIRING LIVE WIRES AND SWITCHBOARDS.

(1) Avoid personal contact with both sides of the cir same time. By handling just one lead at a time, what is on that side may be finished before the other side is touche

(2) Avoid "shorts"—do not allow wires or tools to t tact with both sides of a circuit at once.

(3) Operators on low voltage may be insulated from standing on dry wood or other non-conductors to insure s should that side of the circuit be intentionally grounded, should be also grounded.

(4) The leader should be made responsible for the switches and grounding.

(5) Only qualified men should make alterations and switchboards or handle switches.

BREAKING THE CONTACT.

Accidental electric contacts should be immediately br the flexor muscles are more powerful than the extensor m individual who grasps an electric conductor of low vol.ag be able to release his grip.

It reduces the electric hazard, therefore, to have mer pairs, or in gangs, so that no workman, encountering electri be isolated from his comrades.

Safety First instructions, varying with the sphere o must include methods of instanly breaking the electric co by opening switches, (*b*) cutting the line, (*c*) grasping his dry clothing and pulling him bodily away, (*d*) removin ductor from him by means of dry wood, dry clothing, c As the hazard from electric shock and burns is proportion duration of the contact, methods must be devised in an of such emergencies to expeditiously meet them.

Caution is essential for the rescuing party—cutting a c for instance, might prove hazardous. All methods de breaking the contact, therefore, must be relative to cond countered, and must embody absolute safety for the rescue

RESUSCITATION FROM ELECTRIC SHOCK.

As soon as the patient is freed from the electric contact, artificial respiration by the prone-pressure method should be instantly begun. It immeasurably diminishes the life hazard in electric shock to have every employe engaged about electric lines and electric equipment instructed in anticipation of such emergencies.

The prone-pressure method of artificial respiration requires no apparatus. It is easy to learn. It can be taught to twenty men—including practical demonstration by every member of the class—within one hour. It is a one-man method, hence in relays of two men or more, all of them instructed in prone-pressure, there is ensured a minimal electric hazard.

Familiarity with the prone-pressure method of artificial respiration should be a compulsory requirement for all men who wish to qualify or desire to be considered qualified for service on electric circuits.

MODE OF PRONE-PRESSURE.

The three essential features of the prone-pressure method of artificial respiration are:

(1) *Prone position of the patient.*

Patient is laid flat on his stomach, face turned to one side, so that the mouth and nose do not touch the ground. Patient's arms are extended above his head.

(2) *Posture of the operator.*

Operator kneels, straddling one or both of the patient's thighs, or kneels by either side of patient's thighs, facing patient's head. The operator's hands are placed on the outer ends of the patient's lowest ribs, his fingers curving around the body. Care is observed to keep the pressure away from the spine and the pelvis, confining the pressure to the outer ends of the lowest ribs.

(3) *Mode of operation.*

Operator's fingers are parallel, his thumbs rotated outwards, which assists in keeping his arms straight, from shoulder to wrist.

His body weight is brought from his shoulders, by swaying his body forward to apply the pressure, backwards to release it.

The weight is gradually increased, there is no sudden thrust. Pressure is applied three seconds, then released. The weight is suddenly removed, after the vertical pressure from the shoulder of the operator has compressed the parts.

The pressure occupies three seconds, the release of pr seconds; five seconds for each act of artificial respiration.

The preferred rate of operation for adults is twelve minute.

MECHANISM OF PRONE PRESSURE METHOD.

When pressure is thus exerted on the lowest ribs, under the diaphragm (the liver, stomach, spleen, kidneys, up the diaphragm; when the hands are removed, or the p mitted, the displaced organs drop back to their normal r

When the diaphragm is thus forced to rise, the lungs a When it descends, a partial vaccuum exists, and the lung by atmospheric pressure. The lungs are thus passive, like breathing.

SUPPLEMENTAL ASSISTANCE.

While the artificial respiration is being carried on a se should clear the mouth of all foreign material and then tinuously a cloth saturated with aromatic spirits of amı the nose. The collar and neck band may be loosened.

While this is being attended to a third party summons

No liquids dare be given by the mouth while the pa conscious.

On the arrival of the doctor, he can stimulate the h patient with such drugs as atropine and strychnine, and the infliction of such pain as is deemed requisite, such as patient's hair, pounding his feet with a board, slapping a his arms and legs, stretching the sphincter ani muscle, tongue.

Sprinkling cold water on the face in summer, and blankets and hot water bottles in winter, are desirable su measures.

TREATMENT OF ELECTRIC BURNS.

The limited time allotted me and the scope of my subj no prolonged consideration of electric injuries, aside fr shock.

ELECTRIC CONTACT BURNS.

These burns, though deep, are frequently painless, o destruction of the sensory nerves and the anaesthetic cha of electric current. The slough is slow in separating i

extensive contact burns; the lines of demarcation that arise will indicate the extent of tissue loss that will ensue.

"FLASHED EYES."

The congestion, lachrymation, and photophobia of "flashed eyes" are best treated by cold compresses for an hour in the works dispensary before sending the patient home with instructions to stay in a darkened room, using ice cold compresses, but not ice, alternate hours, and wear smoke-lensed spectacles until the sensitiveness to light subsides.

If the flash has been near, the thermic element may enter; the cornea may be coagulated, temporarily impairing the vision, until the separation of the opaque layer of the cornea. In milder cases, with superficial coagulation of the cornea, the irrigation of the conjunctival sac with sterile boric solution, or eye water,* and the brushing of the dust and tissue debris from the conjunctival sac with cotton mops will remove the opaque layer of the cornea at once. While cold compresses and exclusion of light suffice for the mild cases of flashed eyes the more severe cases require atropine to allay ciliary irritation, and those still more severe, involving burns of the cornea, demand expert attention, preferably in a hospital. Cases involving corneal burns, especially, must be kept clean and covered to insure satisfactory recoveries.

After the rather extensive observation and treatment of this species of eye injuries, I can recall no case where bona fide permanent impairment of vision, either as to corneal scars, or optic neuritis, arose from "flashed eyes."

"FLASHED SKIN."

Thermoelectric burns arise, if the patient is near, actinic ray burns may develop if the exposure is more remote. They are, prevailingly, burns of the first and second degree. Our treatment is not to open blisters at once, but wash cautiously, carefully removing

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* A serviceable formula for eye-water is as follows:

Recipe—

Sodii biboric	0.30
Acidi boric	0.15
Alumini sulphatis	0.06
Zinci sulphatis	0.06
Aquae camphorae	30.00

M. Sig.—Use freely as an eye-wash.

grease and grime with cotton mops, employing gasoline ar soap.*

The careless washing of such burns by unskilled pe serve to introduce infection; yet in our opinion the flasl sterilize the wound; the contiguous parts must first b then finally the wound, using many changes of cotton using mops on the burn that have touched other surfaces.

Employing unguentine on these burns, as soon as washed, controls the pain. Dressings do not adhere when are employed, hence the cautious use of certain ointments redressings as well as promotes recoveries.

"Flash" burns heal up promptly without leaving sc extensive loss of the outer skin is alarming, but not dang great blebs, the water contained acting as cushions, prom ery, and should not be opened before they become uncomf the patient.

INHALATION OF FUMES.

The odor of burned insulation, the copper oxides carr electric arc, the malodorous nitrogen of charred tissues, r to the lungs dangerous fumes. The inhalation of flame a heated air is injurious.

The life hazard, however, is from shock, rather than l fumes in the several types of electric injuries.

CO-OPERATION REQUIRED.

The function of the safety engineer is to minimize th hazard in its mechanical aspects, and co-operate with the engineers in eliminating, as rapidly as possible, all dis avenues of electric hazard.

It is the function of the physician to promote rapid r after the injuries have occurred, as well as to assist in the of qualified men.

The prerogative of all parties concerned is to educate precept and example in such habits of right living as will

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* A good formula for ethereal soap, that dissolves and removes th grime and at the same time renders the area antiseptic, consists of:

Sulphuric ether	(oz.) 4
Turpentine	(oz.) 1
Alcohol	(pts.) 3
Surgical soft soap	(lbs.) 4
Water, enough to make	(gal.) 1

long hours of sleep, proper diet, amicable domestic and social relations, to the end that men in hazardous vocations will be keen and wide awake, never absent minded, when handling electric current.

DISCUSSION.

MR. HAROLD KIRSCHBERG, CONSULTING ILLUMINATING ENGINEER, PITTSBURGH, PA.

Mr. Chairman and Members of the National Safety Council: I am indeed sorry that I shall find it impossible to be present at the reading of Dr. Lauffer's paper on "Low Voltage Hazards," and that I will not be able to add, in person, what little I may have to say in further consideration of this subject.

I have read Dr. Lauffer's paper with a great deal of interest, and am strongly impelled to compliment the doctor on the completeness with which he has presented his subject and the Council on being favored with so valuable a contribution. The combination of the two terms "Low Voltage" and "Hazard" is one which is often considered, although erroneously so, either as an impossibility or of such small moment as not to deserve very much consideration. In fact, among a large proportion of those working with electricity a rather general impression exists that there is no hazard to low voltage. This impression prevails strongly in regard to lighting and power circuits of 110 and 220 volts. Above 220 volts, and up to the limit of 650 volts, which is still considered low voltage, it is a fairly well-known fact, which has been established by personal experience of those who are prone to be careless, that personal contact is very likely to result in considerable of a jar. Very few who have ever had the experience of getting across 600 volts care to repeat the experience, even in the face of high skin resistance and short duration of contact.

In my own field of work, illuminating engineering, the majority of cases I encounter do not present voltage values exceeding 220. The exceptions, such as series lighting systems, present what would be considered high-voltage conditions, and they are, therefore, foreign to the subject of this paper. The larger proportion, however, mentioned hereinbefore, include many cases in which the hazard, due to low voltage, might easily result most seriously. I refer particularly to the lighting and power circuits in industrial plants.

INDUSTRIAL LIGHTING.

Industrial lighting has been a gradual development a lines of illuminating engineering. The tendency has bee general illumination of large areas in preference to the ol of localized lighting. To this extent the improvement in tion has also resulted in clearing up considerable of the lo hazard which existed, inasmuch as general illumination pr high mounting of large units in preference to the old m drop cords in which the majority of the cords were not pu and fastened to a machine, either directly or by agency o even wire. Aside from the danger resulting from the close p of the lamp and its accessory to the operator or to moving the machine, and not considering the possible danger result poor distribution of light, high local intensity and low ger mination, made seemingly lower by comparison, this con cludes the low-voltage hazard to an extreme degree. wear on the drop cords will, in a reasonable length of time the insulation. The resulting short circuits and arcing h the cause of many fires and great losses, notwithstanding that this cause of fires has been rather overworked in t cases where other causes were not apparent.

It may truthfully be said that the danger from sh these 110-volt circuits is in itself not sufficiently severe t damage, especially in consideration of the high surface r offered by those most likely to come in contact with these The main danger from such shocks in industrial plants what may result from the natural muscular contraction w lows the shock. Sitting on a pin is not in itself a very d proceeding, but the results caused by the sudden jump i produced might last for a considerable time, either as a as a result from striking some other object in getting o way of the pin. Practical jokers with great dependence u and lighted cigars have caused considerably more damage i many cases than they have ever expected. The same is results of low voltage shocks.

LEAKAGE CURRENTS.

Dr. Lauffer has covered the physiological side of thi so thoroughly, however, that anything I might say would l

the consideration of leakage currents from low-voltage lines. The amount of damage to property and the possible loss of life which has been caused by electrolytical decomposition as a result of leakage from low-voltage currents can probably not be estimated. With the increasing use of steel in building construction, the increasing tendency toward underground transmission of electricity and the ever-present menace of grounds, engineers have learned to be on the constant lookout for leakage losses. It is entirely possible for such a leakage to eventually undermine a structure. The same precautions which will assist in preventing personal injury from low-voltage circuits will do much toward reducing the last mentioned hazard.

Considered from every angle it is safe to conclude that an electric circuit demands a certain amount of respect as such, whether it be high or low in voltage. The term "safety" is, in a whole dictionary of comparative terms, one of the least comparative in its meaning. It represents an absolute condition and admits of no series of degrees, inasmuch as it is closely allied to two of our most absolute terms, life and death. Conditions are either absolutely safe or not safe at all, and any safety movement in the field of electricity should include the use of all means to protect life, limb and property from all hazards, no matter how small. The old story of the horseshoe nail is classic; the physician says "All medicine is poison to the system." We might take as our parallel statement "All electric circuits are dangerous" and make no further distinction as to voltage.

INFORMAL DISCUSSION.

CHAIRMAN FONDA: We will proceed with an informal discussion of Dr. Lauffer's paper, devoting twenty minutes to the discussion and limiting each speaker to three minutes. Kindly give your name and the company you represent when asking for the floor.

MR. STRICKLAND (New York and Queens Electric Light and Power Company): The paper is very comprehensive and covers the ground most thoroughly. However, considering that 10,000 volts should always be considered the voltage of the wire, nothing has been said about the use of rubber gloves. I suppose it is understood that that should be done, as it is a very important feature in working on electric wire and in the handling of overhead wires. The gloves should be tested under pressure voltage every two weeks. We do that in our company.

There is a very important addition to the usual methods em-

ployed in resuscitation work. I have been using the pr
for electrical resuscitation for the past seven years.
years ago we had a man hit with 6,600 volts. He fell to
but immediately became conscious and lived for three
eventually died from his burns. That caused me to stu
cumstances of the case, not immediately but after a lapse

AWAKENING THE NERVE CENTERS.

I had seen policemen strike the feet of a drunk ir
bringing him to consciousness at once. I gained a new
from that, so I instructed our men to lift the feet of
man—one at each foot—until the weight of the body re
back of the neck and then let the patient drop.

One of our foremen, while out of the city, found a
had been struck with 2,200 volts. His fellow-workm
even know the prone method. The foreman put it int
and saved the man's life. After that our instructions
have more weight with the men.

The first case in which I attempted to place my theor
tion was successful. The first aid men went further than
them—they dropped the injured man to the ground from
three feet, then raised his feet and struck them with su
were handy or with a club. The man was resuscitated
use of a pulmotor or lungmotor or other artificial respira

In another case a man regained consciousness shortly
the prone method. Just six weeks ago a man who made
circuit with 2,200 volts was resuscitated almost imm
think this method of resuscitation ought to be generally
have had two articles describing it in the *Electrical Wor*
C. B. Scott of the Bureau of Safety, Chicago, told me
he knew of eight cases of resuscitation through this metho

DO NOT SCARE YOUR MEN.

MR. S. W. ASHE (Educational and Welfare Departme
Electric Company, Pittsfield, Mass.): We have had a gr
experience with electrical cases and the prone method at th
works. Our work covers a considerable period of yea
to emphasize what Dr. Lauffer and Mr. Strickland hav
also to point out one or two additional things.

Speaking of low-voltage hazards, there is hardly a r

room in the steel foundry business who does not use motors, either 220 volts or 550 volts, in the carrying on of his work.

There is a great tendency for the average layman, especially in alternating-current operation, to get a wrong conception of the magnitude of the danger with low voltages. For instance, take an alternating-current voltage of 550; it is not 550 volts of alternating current which strikes the man, it is the maximum. The 550 volts must be multiplied by the square root of two, or 1.41, which brings it up to about 770 volts. So, instead of having 550 volts to work with, you really have the maximum power of the peak of your alternating current wave. Suppose you have a two-phase 550-volt motor circuit, and suppose the man gets across the two outside phases; in the first place you do not add this to 550 volts to find what you get across the outside, but you have to use the factor I mentioned. In both cases we have 550 volts, which means that the man gets across the outside of the two-phase circuit, he is insulated from the ground, he gets 770-odd volts; then you multiply 770 by the square root of two, which brings it up to more than 1,000 volts. Therefore, when you get 550 volts, two-phase on your motors, bear in mind that if the man was insulated after he got across the two outside phases it is as bad as getting 1,000 volts.

That same line of reasoning applies to 220 volts when you are working with alternating current and with two-phase voltage. So it is well to caution your men, because we have had several instances lately where fellows wanted a raise because they had gotten this in their bonnet. They said they were not working on low-voltage circuits, that they were high-tension men, and, therefore, their dangers were greater. You have to use a good deal of judgment in passing out such information, after you work out in your own mind for fear it will react.

I wish to suggest another thought of importance in all work connected with metals: You should realize that it is very difficult to keep circuits from grounding. You will find in most establishments that circuits are more or less grounded and that means a man, instead of having to go across both wires, simply has to get hold of one. In other words, he is on part of the circuit all of the time.

EDUCATING A FOREMAN.

I went through a place one day and found a couple of wires hanging down—they had taken off the buttons for putting on the lights—about a foot from an iron girder. I took hold of both the

wires with my fingers—you will say that was something man should not do—and I found current there. I said to man: "You ought to have these wires removed." "Oh," "there is no danger!" He knocked the wires together and t no spark. I knew immediately what was the trouble, so first one wire and then the other to find which was the l I peeled it back three or four inches and poured gasoli I gave it back to the man and said: "Strike that on the pc did so and it burned off about an inch of the wire, due to that circuit was grounded. He very promptly had the v moved. That is the second thought: Look out for ground

Another thing is emphasizing what has been said about th pressure method: A good many men are anxious to sta work; we have trained a good many thousand people in th pressure method of resuscitation. It is the best in the arouse enthusiasm and get a crowd started, because if you men together and give them a talk and a demonstration t take up the work. If any of you have not witnessed a de tion I believe Dr. Lauffer, who is the pioneer in introducing th pressure method and giving extreme publicity to it in this will perhaps give you a demonstration.

We found a demonstration to be a splendid way to s thusiasm in first aid work. In planning your campaign do a crowd of men here and another there, but train men in each ment all over your plant—the way you would lay out a fi system—because you never know where a man is going to be Our experience has been that the place you think men will be most is the place where they are shocked the least.

Out of ten cases of electrical shock in four years we res seven. It is very hard to lose a man after you have work him and brought him to. We had quite a lot of experien want to emphasize three things: First, the prone-pressure m a good way to start your safety men; second, train every you can interest in the work; third, look out for your grou minimize damages.

PRONE-PRESSURE DEMONSTRATION.

MR. SHALVEY: Dr. Lauffer is to give a talk on the pressure method of artificial respiration to the Health Serv tion this afternoon and included in that talk will be a demon

ence, so come around and see and hear a demonstration of this very interesting topic.

MR. BROWN: I would like to ask one or two questions in connection with points brought out both by Dr. Lauffer and Mr. Strickland—the question of what might be called repetition of shocks in a motor way: What is the theory? Is it that a man has been shocked? Just what is the explanation; how does it work; why does it work?

CHAIRMAN FONDA: Dr. Lauffer, do you care to answer?

DR. LAUFFER: It frequently happens that when a new-born baby arrives it is blue and will not breathe—it is customary for the doctor to hold it up by the feet and spank it. That is not an infliction of cruelty, it is merely that a certain amount of pain inflicted on one part of the nervous system seems to wake up another. The pain inflicted in this case is on the cerebro-spinal nervous system, which stimulates the sympathetic nervous system. It is on this account that we take a board and hit the man on the soles of his shoes. If the man is given a reasonable amount of pain it seems to bring him around quicker.

I approve very much of the method mentioned this morning, of actually letting the man drop. Something can be accomplished by giving him a hard thrust; it can also be accomplished, as mentioned in the paper I read, by pulling the man's hair—if he has plenty of hair—or by pulling his tongue. The infliction of pain stimulates a return of breathing, the same as sprinkling ice water may, through some concealed method, acting through the nerve centers, facilitate a return of breathing.

MR. BROWN: I was familiar with the fact, but I wanted to get the explanation.

CHAIRMAN FONDA: Does that answer your question, Mr. Brown.

MR. BROWN: Yes, thank you.

CHAIRMAN FONDA: If there are no other questions we will proceed to the next item of business on the program, the report of the joint Nominating Committee of the Foundry and Iron and Steel Sections. Mr. A. H. Young, Chairman of the Iron and Steel Section committee, was elected Chairman of the combined committee. Mr. Young, will you please make your report?

REPORT OF THE NOMINATING COMMITTEE.

Mr. Chairman and Members of the National Safety Council: The Nominating Committees appointed by the Foundry Section and

the Iron and Steel Section met yesterday and effected a jo
ization to serve as the Nominating Committee for the M
Metallurgy Section of the Industrial Division and I have
to present a report of what they did and why they did it.

We unanimously agreed that the essentials which shou
our selection of individuals were, first, in the matter of a (
a neutral, who would not predominantly represent eithe
Having selected such an individual we thought it wise, v
any way recommending an observance of the rule of succe
nevertheless, if that rule were observed by the joint Secti
would not be a predominating influence from any one Se
the method adopted was to choose as Vice-Chairman an i
from the other side of the house than that represented by t
man. A Secretary was chosen from the same side as the C

If succession is observed in the selection of officers at s
annual meetings we will alternate from the old Iron and Ste
to the Foundry Section and back again each year, and
Chairman of this Section and the Secretary of the Section-
any discourtesy to the Vice-Chairman—who are the more i
officers, it is necessary that they keep closely in touch v
other, will be from the same Section.

Another essential, we felt, was that each of the individu
we chose to place in nomination and to recommend to yo
be consulted as to their willingness to assume all of the
the offices, including that covered by succession or prom
subsequent years. That naturally brings with it membershi
Executive Committee of the National Safety Council and w
be represented, we felt, by men whose companies had indica
willingness to send them to attend such meetings wherever th
be held, so that the Division might be adequately represente
Executive Committee of the National Safety Council.

All of these essentials were unanimously agreed upon
joint Nominating Committee unanimously proposes as C
the gentleman who happens to be Vice-Chairman of the I
Steel Section, who resigned last year as Secretary of the
Section, a man whom we all love, and who also is very happil
—Mr. Earl B. Morgan.

Mr. Morgan comes technically from the Iron and Steel
and therefore the Vice-Chairman, we thought, should come
Foundry Section, and the committee very properly chose M
of the American Steel Foundries as Vice-Chairman

Again swinging back to the Iron and Steel Section the committee unanimously chose Mr. Dudley R. Kennedy as Secretary.

We sincerely hope that in this representation of the two sections there will be no inference that sectional lines should be maintained. The Executive Committee has given us a definite organization as the Metal and Metallurgy Section, and we desire to give the plan a fair trial. Probably before any question of succession arises we will be just one Section and all together in a happy family. I thank you.

ELECTION OF OFFICERS.

CHAIRMAN FONDA: Gentlemen, you have heard the report of the joint Nominating Committee. What is your pleasure?

MR. ASHE: I move that the Secretary cast one ballot for the election of the persons nominated.

MR. HAYWARD: I second the motion.

CHAIRMAN FONDA: You have heard the motion of Mr. Ashe, that the election of officers be made unanimous and that the Secretary cast a ballot accordingly. Are you ready for the question? All in favor of the motion kindly give their consent by the usual sign. Contrary, "No." (The motion was carried by a unanimous vote of the Section and the Secretary was instructed to cast one ballot for the nominees. This he stated he had done and the Chairman thereupon declared the nominees duly elected as the officers for the ensuing year.)

It gives me great pleasure to turn the meeting over to Mr. Earl B. Morgan, who will act as your Chairman for the year 1917-18.

MR. EARL B. MORGAN IN THE CHAIR.

Mr. Dudley R. Kennedy, Assistant to the President, Youngstown Sheet & Tube Company, Youngstown, Ohio, assumed the position of Secretary for the remainder of the meeting.

CHAIRMAN MORGAN: I deeply appreciate this honor. A great many things can be accomplished by the joint Section, but the success of our work is entirely dependent upon the hearty co-operation of our members. I do not think all of our members quite realize how much time the Executive Committee spends in their efforts to accomplish things for the Sections. I know the committeemen who will be appointed this year will get into the game and play ball with us.

We will now proceed with our program. Your committee de-

signed it primarily as a round table discussion and merely t
of the subject will be presented by the gentlemen assigne
the papers. We are not going to have lengthy addresses–
real stuff from the floor. We will hear from Mr. L. L.
"New Kinks in Eye Protection." The discussion will be v

NEW KINKS IN EYE PROTECTION.

L. L. PARK, SAFETY AND APPRENTICE SUPERVISOR, A
LOCOMOTIVE COMPANY, SCHENECTADY, N. Y.

Mr. Chairman and Members of the National Safety
The problem of eye protection is, as we all are aware,
the co-operation of the owner of the eye. With the presen
one of wisdom in the choosing of the protector and the se
development of eye protectors available for every class of
number of eye accidents which could not be prevented b
of suitable protectors is very small.

Facing, then, the problem of making the use of eye p
effective, we may consider it from four standpoints: t
adapting of the protector to the requirements of each i
case; second, the causes of neglect to use the protectors p
third, educational methods for extending the use of safety
and, fourth, prompt attention to eye injuries.

Eye protectors, as commonly used, are chiefly of tw
Those placed on or about machines to prevent chips or d
thrown from the cutting tool and those worn by the worker

Of the former, the use of screens about machines or
benches has been quite general. There is a field for the dev
of small, portable screens which can quickly be attached to
pieces where chipping is required at places where such wo
regularly done. A heavy screen cannot readily be carried
the chipper, and it is often difficult to make a small scre
properly in irregular places. A magnetic screen which can b
anchored to any iron or steel part has been tried but withc
success. There is a chance for development along this line.

A second form of protector is that attached to a machi
to prevent chips and cuttings from flying from the tool, bei
sometimes of leather, rubber, metal or of heavy glass in
frame. Some of these might be described as "putting the

the worker but those passing by or working near the machine. We have found men more willing that the machine should wear the goggles than that they should wear them themselves, and in some cases the protection is very effective. We believe that there is opportunity for further development along this line, supplementing whatever may be done toward the direct protection of the eye itself. Occasional accidents to men wearing goggles might have been prevented by adequate protection at the machine, by intercepting the flying pieces at the beginning of their flight.

BE CAREFUL IN SELECTING GOGGLES.

The use of goggles has been so widely accepted as the most effective means of protecting eyes from injury, both from flying particles and from strong light, that only special comment is necessary here. Proper care has not always been exercised in choosing the style of goggle for a particular job. Goggles which should be dustproof have not always been so selected, and where a wide range of vision is required, narrow range glasses have at times been used. Not all types of goggles are safe for use by chippers, the glass in some of the types having a tendency to fly when broken.

The best form of goggles for use by chippers is that in which the glass is held securely in a metal frame under tension, so that when fractured the pieces of glass are gripped together by the frame. Rubber frames will sometimes be broken by heavy chips and destroy the protection entirely. Colored glasses for welding operators have not always been adapted to the temperature involved and accidents to eyes have resulted from the wrong color of glass being employed. Too much care cannot be exercised in adapting goggles to each line of work.

VALID OBJECTIONS TO GOGGLES.

In enforcing the wearing of goggles in a shop where flying material demands their use, many real objections, as well as fictitious ones, are raised against the practice. The valid objections may be summarized as due to the following causes:

1. *Frames poorly fitted to face, causing discomfort to face and ears.* Goggles should be of a design permitting complete adjustment to the face and the safety inspector should see that goggles are fitted properly to each man. Cases might be cited where men have brought cheap eyeglasses at the 10-cent stores to wear instead of goggles, because of their being more comfortable. The possibility

of making goggle frames of aluminium to reduce the weight i: believe, worthy of consideration.

2. *Glasses steaming.* Under ordinary conditions the us glycerine pencils or other compositions of a similar character prevent this, but in summer the glasses will cloud from perspir which runs down from the forehead. A sweat band on the head or attached to the top of the goggles to divert the moi around the eyes should help to relieve the difficulty to some exte

3. *Special lenses needed.* Men who wear eyeglasses to cc their vision need specially ground lenses in their goggles, so the latter serve both for correction and protection. The use of special goggles can best be insured by the employer paying th pense involved.

4. *Inconvenience in carrying goggles when not in use.* classes of work where goggles are not required to be worn cor ously, the need of a light, convenient case is often felt. If ca in the pocket without case they are liable to be bent out of s and the standard cases are rather clumsy in the pocket. The of keeping goggles in the workmen's lockers is liable to le: their disuse. The oft-repeated question to the neglectful man, "W are your goggles?" usually brings the reply "In my locker." means for assisting the habit of always having goggles on will, we believe, help increase their use. Much of the objecti men to wearing goggles is due to the fact that the lenses are soiled and obscure the vision. Any encouragement to clean in this regard will assist in keeping the glasses in use. It is bad practice to encourage the men to occasionally return their go for general cleaning, exchanging the soiled ones for others v have been cleaned and disinfected.

EDUCATIONAL METHODS TO INCREASE USE OF GOGGLES.

Various educational methods for increasing the use of gc on dangerous work have been tried, among them the following

1. *The campaign method.* This consists of "whooping t up" for a definite period, offering rewards for best showing endeavoring to popularize the use of the eye protector. Like other waves, the campaign crest is apt to be followed by a rea of lowered interest, and although many reforms come through cessive risings and fallings, the presence of waves does not al indicate that the tide is rising.

2. *The universal method.* Some shops have tried to mak

goggle habit stronger by requiring every one in the department to wear these appendages. Usually it is difficult to enforce such a rule and unless enforced it is little better than the rule of wearing goggles on dangerous work only, since the practice is apt to become a partial one finally. If enforced, the rule is, of course, nearly ideal. The example of the foreman and other officials will count much in the working out of this scheme, for it is very difficult to secure the willing support of the rank and file if those higher up do not set proper example.

3. *The compulsory method.* As indicated above, the enforcement of any goggles rule, be it a universal or partial one, depends upon the discipline of the shop. Where the management has the courage of its convictions and enforces its rules by dismissal or other penalty for violation, the results are certain. In these days when it is difficult to hold men, owing to the scarcity of help, there is apt to be a letting down of discipline of this sort except in extreme cases.

4. *The welfare club method.* Where a shop has a social or welfare club of some sort, such an organization can be made to count for safety if the club has for its chief object the establishing of certain standards and the developing of a shop pride. Such organizations may extend the interest in safety matters among employes, if their coherency is such as to make them factors in the life of the shop people.

5. *The shop committee method.* Voluntary co-operation on the part of the workmen is undoubtedly the most effective means of eye protection and a well-worked plan of education through shop committees and proper literature will bring good results. The new man must be carefully instructed and watched and the "old timer" must be brought around, but these results come only through persistent effort and good team work and leadership.

PROMPT REPORTING OF INJURIES.

Many serious cases of eye injury could have been prevented if the initial injury had been properly reported and treated. These slight injuries are sometimes unavoidable, and, if treated at once, would probably occasion no loss of time. It is because of the fact that so many serious eye injuries had their start in trivial accidents that we feel it proper to include prompt treatment among the methods of eye protection. Unfortunately, it is often as hard to get men to report their injuries as it is to use other means of accident prevention, and education is necessary to overcome this false pride.

Eternal vigilance is the real price of eye protection and a inspector who is ever on the track of a neglectful man, not "talking goggles" but getting at the causes behind the negl diplomatically and wisely seeking to remove the cause, wil to be the best means of keeping down the eye accident reco

DISCUSSION.

CHAIRMAN MORGAN: Mr. J. B. Ayres, Superintend Safety, Sanitation and Welfare, National Tube Company, M port, Pa., was selected by the Program Committee to condu round table. Mr. Ayres has been a most enthusiastic worker Iron and Steel Section since its inception. He advises us that has prevented him from attending the Congress—this is th time he has been absent.

The paper is now open for discussion.

MR. BROWN: It will interest every one here to learn tha four months ago the Hon. John Price Jackson, head of the I ment of Labor and Industry of the State of Pennsylvania, app a committee to formulate a goggle code for our state. Th mittee met in Philadelphia with an attendance of twenty-t thirty men, representing all the large steel and foundry in and some of the large and important manufacturing ind where the goggle problem was of importance. Representative all of the large and some of the small manufacturers of gog the country were also in attendance.

At that meeting several committees were appointed to co the problem from its various angles, including standards for facture and standards for use. Some of the committees have preliminary reports and these will go before a re-convention understand, of the general committee within a very short Proofs of the original draft are available even to outsiders, I b and those interested can secure copies by sending to the Depa of Labor and Industry at Harrisburg. As soon as the com makes a final adoption for the State of Pennsylvania the goggl will be put in force by law.

LAW REQUIRING USE OF GOGGLES.

In Pennsylvania we have a law which puts a fine, not only employes but on the employer, and requires the use of safety de

to actual imprisonment. I am sorry to say there is a feeling that the law in its present shape is not, perhaps, the wisest law under present conditions, owing to the unfortunate labor turnover problems now confronting us. So far, I am informed, the law has not been enforced.

At the meeting in Philadelphia one gentleman, representing a company with a great many hundred chippers, stated that if he enforced the law he would probably have to shut down his entire plant. Be that as it may, it is a problem one has to take into consideration at the present time.

MR. J. T. MACBAIN (Union Carbide Company): At the Safety Exhibit I saw goggles made with two layers of glass cemented with celluloid. Is such a thing necessary? The idea was that chips would not shatter both parts of the lens. I would like to know if the double lens is considered necessary and if there is any danger to the face from the combination of glass and celluloid?

CHAIRMAN MORGAN: That the glass would not shatter if it was broken?

MR. MACBAIN: Yes.

CHAIRMAN MORGAN: Can any one answer the question for Mr. MacBain?

MR. HAYWARD: We experimented with goggles having a celluloid interlining between two discs. Some goggle manufacturers put it on the inside of the lens. As far as I can find it is detrimental to the eyes. We do not use such goggles.

MR. BROWN: If I remember correctly that point was brought up by the manufacturers and the decision was that with the improved varieties of glass now available for goggle purpose it is absolutely unnecessary to use anything except the composition glass.

MR. HAYWARD: The underwriters would not accept the goggles referred to.

CHAIRMAN MORGAN: Mr. MacBain, does that answer your question?

MR. MACBAIN: Yes, sir.

MR. J. D. JAMES (Safety Engineer, New Jersey Zinc Company): We are using goggles quite extensively in our plant and we have had quite a number of them broken. Many a man undoubtedly would have lost an eye had he not worn goggles. We never had a splinter of glass from the inside of the goggles hurt or injure one of our men. We have decided to leave well enough alone.

CHAIRMAN MORGAN: You have never had a piece of sl glass cut a man's eye?

MR. JAMES: No, we never had a piece of splintered g the eye.

CHAIRMAN MORGAN: Has any one here ever had tha rience.

GLASS FROM BROKEN GOGGLES ENTERS EYE.

MR. JOHN LUCAS (Duquesne Steel Company): We had s experience. We use a standard make of goggle in our works

CHAIRMAN MORGAN: Give us the name of the goggle Lucas. I think it should come out right here. I would like t what make of glass caused the accident.

MR. LUCAS: We use Wilson goggles, made at Readin We had one break.

CHAIRMAN MORGAN: What broke it?

MR. LUCAS: A chip broke the glass and a piece entered the eye and destroyed his sight.

CHAIRMAN MORGAN: A piece of the chip or the glass?

MR. LUCAS: A piece of chip went entirely through the gl

CHAIRMAN MORGAN: It went right through?

MR. LUCAS: Yes.

CHAIRMAN MORGAN: How large a chip was it and what v velocity? Was it something that you could hardly expect stopped?

MR. LUCAS: It was a chip from a pneumatic hammer; a small piece, not much larger than the end of a lead pencil.

MR. E. H. INGRAM (William Cramp & Son): Out of injuries we have had but one in which glass was found in the I was at Harrisburg about a year ago, when we had an eye me of our service division and I remember a physician speaking i it. He said that out of 10,000 cases he had only seen two v glass entered the eye. Immediately after that, at our dispensa our first aid station—a man came in with his goggles shattered photograph was taken and is on record at the Safety Exhibi could not say what goggle it was, but the accident was cause a chip made by a pneumatic chipper which went through the of the goggle and a piece of glass was carried to the eye. The was not seriously injured, but there was a laceration of the co

In conclusion, I might say that we have found the first station the best place to distribute

to get a man to put on a pair of goggles is after he has undergone the pain of a steel fragment about twenty minutes and his eye is good and sore. If you ask him if he wants a pair of goggles he will say "Yes." All during his treatment you can educate him in goggle wisdom.

CHAIRMAN MORGAN: I think that is a most important point, the contention that glass may enter and cut the eye. All of us, when we try to spread the gospel of goggles, are unquestionably met by this comment from the men: "The glass will hurt your eye worse than the chip." I am glad this discussion came up.

REDUCING EYE HAZARDS.

MR. J. C. SMITH: We made a study of the goggle question and have had excellent results. Our records for 1915 indicate that 13 per cent of our total number of accidents were due to injuries to the eye. Our records for the first half of 1917 indicate that only 3½ per cent of the total number of accidents were injuries to the eye. I attribute our success to the use of goggles, also to permanent stationary spark shields on emery wheels. I believe that the permanent spark shields take care of the situation, whereas it is difficult sometimes to watch all the men and get them to wear goggles.

I believe that goggles should be restricted to those approved by the Underwriters' Laboratories. If we do that—and it is a duty we owe our men—then we are not taking chances on getting a goggle which will allow chips to fly into the eye. We use the same goggles—that is, the same lens—for all purposes. I do not believe in putting a light lens in the plant at all, because you never know how the goggle is going to be used. I believe in giving all the men the same kind of lenses—lenses supposed to stand up, that have been proven. We use "dust-safe" and a standard lens. We make each man sign a receipt for the goggles when he receives them and he pledges himself to wear them. In that way we have a complete record.

Under the Indiana law—under which most of our large operations are conducted—if a man fails to use the safety appliances furnished, he is not entitled to compensation. The receipt is *prima facie* evidence that he has received the goggles, so it is valuable from that standpoint.

THREE EYE INJURIES DUE TO BROKEN LENS.

MR. J. H. K. BURGWIN (Crucible Steel Company of America): We had three accidents from broken glass and in only one of them

the glass entered the man's eye. That was caused by a chip, to the one just described, which injured the man's sight, thou permanently. Two of these accidents happened at the same within six weeks of one another. I immediately went to the and asked them to account for it. Their reply was that the gles were passed by the Underwriters Laboratories and they not see any reason for these accidents. I then went to the writers Laboratories and gave them the dates of the acc They replied that the makers of the goggles, shortly before th of the first accident, had withdrawn their connection wi laboratories and that the underwriters at that time were not r sible for the glasses. It could not be determined at just e what time these goggles had been purchased, whether bef after the withdrawal of the manufacturers, so we were com to drop the matter.

MR. BROWN: I hold no brief for Wilson or the Wilson gc but we have used hundreds of these goggles and so far as I am we have never had a case where the broken glass injured th

A MEMBER: I would like to ask Mr. Smith whether i decision of the Industrial Commission or whether it is now th of the state that compensation shall not be paid in case an em is not wearing the goggles.

CHAIRMAN MORGAN: Will you kindly answer the questio

MR. SMITH: It was a decision of the commission and i since been incorporated in the law.

CHAIRMAN MORGAN: The Iron and Steel Section issued a letin quoting the decision. You can secure a copy by dropp line to the National Safety Council headquarters if you woul to post it. The bulletin gave the decision in very good form.

THE LAW IN WISCONSIN.

MR. J. BROWN: I think the Wisconsin law deducts 15 per ce compensation if a man has been given glasses and does not them.

MR. LUCAS: Just to set myself right in regard to the W goggle: Over at the exhibition they have a new lens whic remarkably strong. I do not wish to be understood as condem the Wilson goggle. It is a good goggle and the lens they now is remarkably strong and stands a wonderful test.

CHAIRMAN MORGAN: I would like to have Mr. Smith of the Commonwealth Steel Company tell why the president of his company has to wear goggles when he goes into his own shop.

MR. CARL SMITH: We have had quite a lot of experience with goggles, due to the wonderful work of your Chairman when he was our safety engineer—the work was well under way and well taken care of when he left us. All that was necessary was for us to use vigilance and for our safety inspectors to follow up the work. Of course, we have a lot of trouble with new men.

The hardest thing the safety inspector has to contend with is enforcing the wearing of goggles. To enforce that rule he must be a man with no fear in his heart. If he is meek about it he cannot succeed. We had occasion to "call" our president, Mr. Francis H. Howard, and the vice president one day because they came through the shop without wearing goggles. Mr. Howard was taken by the arm, turned around and told to go right outside and get a pair of goggles before he could go in the shop. He did so.

I have a museum in my office, where we have stacks of goggles, broken frames, broken lenses and every sort of damaged goggles you want to look at. We have come to the conclusion that eye injuries bother us only in extreme cases. We measure our lenses and I have yet to find a goggle lens that did not come up to specifications. In a lens that is seven-tenths millimeter and three and three-tenths maximum you have a good lens that will stand up under almost any kind of job.

I want to tell you just a little more about the enforcement of wearing goggles. Recently we had a foreman at our plant who was sent there because he had been a friend of one of our officials in schoolboy days. He was a hard man to line up. Our safety inspector would find his men without goggles. He insisted on their use and the men put them on, but he found the foreman did not enforce the rule requiring the wearing of goggles. It was necessary for the safety inspector to go to the front so he told our manager that the foreman must enforce the wearing of goggles in his department or get out; if he did not do it he could have the safety inspector's job. This brought results. The foreman was called to the general manager's office and told in a very nice way the importance of wearing goggles, that it was up to him to see the light and if he could not see it as an executive he was not necessary in the maintenance of the organization.

"WEAR GOGGLES OR QUIT."

The other day I had a little tilt with the labor departm new man, just put to work, was a very good mechanic, but exception to wearing goggles. He said they hurt his eye purchased special lenses, but he said they did not suit hin labor department asked: "What are you going to do?" "I up to me to tell you what you are going to do," I said; "what think you can do?" "I guess we cannot keep him." "I gu cannot, that is all there is to it," was my answer.

Safety inspectors and safety engineers must insist up wearing of goggles, regardless of who the party is, whether h president, general manager or general superintendent. Un corporation gets the safety idea strong in their hearts, y going to have eye losses, and just as soon as they do get it y not have arguments, because your goggle protection is per O. K.'d by the underwriters' association.

MR. L. L. PARK (Safety and Apprentice Supervisor, Am Locomotive Company, Schenectady, N. Y.): The only c have had that amounted to anything was one where the fra goggle was loose—the screw which joins the two portions frame had dropped out—and the man put in a piece of wir safety man feels that the essential thing is a frame that properly.

CHAIRMAN MORGAN: I have seen a case like that, wh man had wrapped thread around the frame at the temple.

We will lay aside the next subject because of the abs Mr. Ayres. In its place we will have a very important "Labor Turnover as Related to Safety," by Mr. Dudley R. K

LABOR TURNOVER AS RELATED TO SAFET

DUDLEY R. KENNEDY, ASSISTANT TO THE PRESIDENT, YOUN SHEET AND TUBE COMPANY.

Mr. Chairman and Members of the National Safety C I believe it is unnecessary to accentuate the importance of of new men; you know the danger just as well as I do. Labo over is a new phrase to the layman and it is only within the l years that we have come to study labor and turnover and to stand it. We have very few statistics that bear out the

Company—these are the only ones I have seen published. He has proved to his own satisfaction that the liability to injury to the new man of less than thirty days' employment is six to one over the man of more than thirty days' employment. When you think that labor turnover in the best shops in this country—in the best regulated plants, the most kindly disposed toward their men—is running up to 300 to 400 per cent a year, you can imagine the hazard you are subjected to in the new man problem.

Some real figures might interest you. When I was with the B. F. Goodrich Company at Akron we kept accurate statistics of turnover for the year 1916. We interviewed every single man who left; it was some contract, but a man could not get his money until he came to our office and was interviewed as to where he came from, where he was going to and why he was going. We were trying to get to the bottom of why we had a turnover of 150 to 200 per cent. We found some astonishing facts and I will give them to you to think over.

Every reason under the sun was given for a man's leaving. Incompatibility with the shop, of course, was the main reason, but our turnover for the year was 187 per cent—not to be ashamed of in the light of other people's experiences, because all of you have that much if you look it squarely in the face and a lot of you have more. Of that 187 per cent month after month, and without any deviation to speak of, we found that 87 per cent of the men who left had been with us less than six months. That was startling; 87 per cent of the turnover had been with us less than six months. Of all our turnover we found only 11 per cent was composed of men who rented their homes and only 4 per cent were home owners.

You can bank on those statistics, they are real. You have all thought of that, I know; you have heard a great deal about building homes for workmen, getting them to settle down and make a home stake, but I was very much surprised to find the figure as low as that. Four per cent out of 187 per cent, you see, is nearly a negligible quantity. These matters are of general interest, because it is a natural graduation from Safety work into industrial relation work and there are a great many men in this room who started when safety was the first slogan around the mill or the shop; now they have graduated into the employment end and many have charge of the employment and medical departments. Even paymasters and time departments are under ex-safety men, or, as they are now called in many plants, heads of departments of industrial relations,

or personnel, or whatever it may be. I feel sure the safety the pioneer of the labor relations and industrial relation wor

TREMENDOUSLY INTERESTED IN LABOR TURNOVER.

The labor turnover problem is a very serious propositi we are all tremendously interested in it. I think the subjec to be thrown open for a discussion to find out how some of trying to keep your help. I was very much amused a day ago listening to a discussion about laying off help. I do no how they can do that now, when every one is 30 to 40 per cer and scouring the country, trying to steal, borrow or cajo into working for him.

I think that we have all failed to properly understand mate the number of accidents we are having to green hanc unfamiliar with the work. The study of turnover in rela accidents shows the new, green man is a very, very prolific so accidents, not only to himself but to his fellow employes. accident rate easily runs six times what it should be when co with the man who has been there for thirty days or longer.

CHAIRMAN MORGAN: We have twelve minutes for dis so I will limit each speaker to two minutes.

MR. FONDA: In the matter of labor turnover I think thre are rather fundamental: The *first* is the question of what w pen to a man when he is hurt? That has been taken car a majority of states by compensation laws. *Second,* the m himself, "What is going to happen to me and my family if I sick while in the employ of this company?" In our case, ou and beneficial association has answered the question and w from hundreds of cases that have come to us directly fr beneficiary that it has well paid the Bethlehem Steel Com go into this matter in detail, and that, I think, has a direct upon labor turnover. It will stablize your force if a man is that, in case of sickness, he is going to be taken care of. T man asks himself: "What is going to happen to me when I old, if I give my best years in faithful service to this compa am no longer able to carry on my regular occupation?"

PENSIONS FOR EMPLOYES.

Those three things, I think, are fundamental in the workingman's mind and would have a very considerable in

In that regard I would like to mention the Sears-Roebuck system. I do not know whether there is any one here from the Sears-Roebuck Company, but to me theirs is the finest system—they call it a profit-sharing pension plan—that I have ever heard of and it is sure to have a direct effect upon the minds of the men employed there.

The plan, in substance, is that an employe must be in the service of the company three years before he is eligible to membership in the association. After that time the employe can contribute 5 per cent of his earnings into a fund, but in no case more than 5 per cent. I cannot give you an outline of the plan in two minutes. If there is a Sears-Roebuck man here I hope he will utilize his two minutes to explain it.

CHAIRMAN MORGAN: Excuse the steam roller tactics, but we must limit our debate. Has any one else any remarks on this important subject?

MR. G. G. EVANS: A large percentage of our turnover comes from floaters, men who want to come in gangs of fifty, seventy-five or a hundred and insist on having their own foreman. They come in one group and they want to go in the same way. You cannot say to one gang: "We want five men to go down into the furnace." They will not go unless they can all go in a bunch. I have made this suggestion to my own company: "That only unanimous action on the part of all employers in the Shanango Valley in refusing to hire gangs in this way will put an end to this kind of labor turnover. We think that is the only course to pursue.

What to do with a man when he becomes old in the employ of the company is nicely solved by the large-hearted men in charge of our work, men like our general manager and president, who is 98 percent heart. The financial help given to men thrown back on account of sickness or accident, aside from the compensation awarded by the state, helps largely toward keeping our men. Men like to work for our company, especially if they own their own home.

THE COLORED WORKMAN.

MR. BAILEY: I would like to ask Mr. Fonda what he is going to do when 50 per cent of the men employed today do not have enough intelligence to ask themselves, "What are we going to do when we get old?" His proposition is all very well for 50 per cent of the men but not for the remainder. Many men have been with us for some time, and we do not have any turnover on this account. But when you get a gang of, say, 450 to 500 negroes you have some

difficulty in impressing the thought upon them of what th going to do in their old days. They say: "We are going down South; it is too cold up North."

CHAIRMAN MORGAN: Mr. Fonda, can you answer that qu

MR. FONDA: If you will give me two minutes I can expl Sears-Roebuck plan. I am not willing to admit that a mai not care how ignorant he is, will not go to it if he fully unde the principle.

In the first place, the Sears-Roebuck employes contribut cent of their wages after they have been there three years- case can they exceed $150 a year. The company contribute cent of its net earnings and they keep it in a separate fund. a man has served the company ten years the earnings whic been set aside at 5 per cent are combined at so much per d proportion to the man's deposit, and the whole deposit—in t of the Sears-Roebuck Company—amounted to something for every $1 for the first year they tried the plan. Up to te the deposits are compounded annually at 5 per cent—a very saving.

As it has worked out in their case, few people that are to go into that fund have not done so, because it means that continue with the company at the end of ten years they get th pany's contribution as well as their own savings. If they before ten years they only get their own contribution. Unc plan it has been figured out that if a man worked for the thirty years and the savings accumulated at the same rate last year (1916) the man putting in the maximum amount o a year will have $42,000 to his credit.

MR. BAILEY: That is very good, but how can you line it u Mr. Kennedy's figures of 85 per cent of men under six n employment? This scheme does not begin to work until a m been in the employ three years. We have trouble keeping r three days. They cannot even get acquainted with their own man before they leave. Sometimes they stay as long as three How can you impress on them in three days or three weeks th fits of staying with your particular company?

MR. FONDA: If you can impress one out of ten in tha weeks he will eventually get some one else and thus you wil progress; you will not stand still, that is sure. You have to start and I think the thing is workable.

MR. BAILEY: The thing is workable, but the query is:

you are going to start it? Every one knows that the United States Steel Corporation's pension system works out very well with something between 50 and 60 per cent of the force.

CHAIRMAN MORGAN: Have you anything to say about these figures, Mr. Kennedy?

CLUBS AND FELLOWSHIP.

MR. KENNEDY: No; Mr. Bailey is a little pessimistic, but I think he is about right.

MR. CARL SMITH: The idea of the colored man, and in fact with all newcomers, it seems to me, is to keep them long enough in your plants to get acquainted with them and for them to get acquainted with you. After that is done you can impress upon them the results of things you are trying to do for their benefit. The colored labor in our plant is equally as good as any class of labor we have and they are equally as steady as any we have.

We have handled the colored situation something like this: A colored man is pleased if you show him you are doing something for his benefit, although it takes a lot of money and a lot of patience. He is very appreciative. We maintain a club for them in St. Louis. It consists of a reading room, a pool room, a dining room and kitchen, and eight dormitory rooms. It is absolutely for the employes of our company and they must present their pass when they enter the clubhouse.

When new men come to work a committee of our colored men meet them, tell them who they are and immediately give them an application to this club—they line them up and the new men see we are trying to do something for them. It is quite different from any institution where he has ever worked. He becomes enthused with the idea and he usually stays long enough to become acquainted. If he stays that long we have him as a permanent employe. We have colored men in our employ as cranemen, chippers and workers of that class who have been with us for years. They would not go to work for any other concern, for we pay as much money as any neighboring company—we usually pay just a little more. We keep the men and we keep them because of our fellowship activities.

CHAIRMAN MORGAN: We are getting a little away from labor turnover. Get down to the ground. What are you doing to keep your men?

A MEMBER: We are holding our colored labor and our method is interesting. As long as the negro is broke he will stay with

you. He will shoot craps, get drunk or do something else, of the things we are doing is to give him just enough money him going. Just as soon as the negro gets his pay, as soon a $2 to spend, he will not work.

CHAIRMAN MORGAN: We will have to continue our p The next subject is "First Aid," by Mr. J. R. Mulligan.

FIRST AID—ACCIDENT PREVENTION.

J. R. MULLIGAN, ASSISTANT SAFETY ENGINEER, BETHLEHEM COMPANY, SOUTH BETHLEHEM, PA.

Mr. Chairman and Members of the National Safety C First aid, as it is known at Bethlehem, is in two phases: 1. T in that phase of first aid that rescues men from danger, gives a respiration, treats shock, applies tourniquets, binds up wounds broken bones and then to the doctor. 2. Training in accident tion, that most important phase of first aid work, which prev jury to fellow employes, by knowing the hazards of the operations and guarding against them. Both phases of th are naturally complementary, each to the other. The training go hand in hand and especially so in view of the end to tained—a fully qualified safety committeeman.

FIRST AID—ACCIDENT PREVENTION TEAMS.

The men are instructed in units designated as teams, more teams representing each shop or department. A team posed of six regulars and two substitutes. One of the reg designated as captain and another as the patient; all take t course, the substitutes filling in on team work in the absence regulars. Each team may have but one man who has previousl the course, but he cannot act as captain in the annual first ai This committeeman acts as team coach at the rehearsal peri puts the men over the work given them by the regular instructo departmental teams are composed of the more intelligent mer shop, selected from the various work operations. About 25 p of these men are foremen.

THE COURSE—TRAINING IN FIRST AID WORK.

The course is, and necessarily should be, as simple as p With repeated drill on essentials the thing to do and how t becomes more or less automatic when an accident occurs.

is laid upon the exercising of good judgment in cases of emergency —think, do the right thing first is the motto.

This course covers a period of four months, two hours per week on company time, of which one hour per week is spent with the regular instructor and one hour per week in rehearsal under the supervision of a committeeman who has previously taken the course. At the completion of the course the graduating exercises take place in the form of the annual first aid meet. The first aid instruction is based on literature on this subject circulated by the Federal Bureau of Mines and other first aid authorities.

Before taking up bandage and splint work, a very thorough but simplified course is given in anatomy, muscles, circulation, the vital organs and the nervous system—a review and practical application of the essentials of a course in physiology as given in the average grammar school.

The instruction is made as practical as possible through the medium of pictures, charts and the human subject. Practical instruction is accentuated throughout the course, in view of the practical application of the knowledge acquired. A very sharp line is drawn between real first aid and the doctor's work. Simple names and terms are used. Medical terms are left for the doctor's use.

The triangular bandage is used almost exclusively. Some training is given in roller bandage work to be used only in cases of sprains at joints and finger and toe injuries. In splint work the men are taught to pad the splints with cotton or other soft material and wrap in triangular bandages before applying to limbs—this detail to insure free circulation in the limb and also prevent consequent pain due to splint pressure.

TRAINING IN ACCIDENT PREVENTION.

You cannot qualify a man for safety committee work over night. Safety committemen are not born that way. A man may be naturally careful and prevent accident to himself, but he must be trained in accident prevention if we expect him to look out for the other fellow. Neither can we expect long service in the shop to qualify a man for accident prevention work; very often he has grown so familiar with danger that he does not see it for himself, much less point it out to his fellow worker. Men must be trained to see the causes and near causes of accidents in order to prevent them. Such training must come through a detailed study of the unsafe practices and hazards of the particular department.

Safe practices covering the various operations are dwel
Departmental accident statistics and accident investigation
are used. Photographs and prints showing accident caus
in the work. Current literature is quoted on the subject unc
cussion and interchange of ideas encouraged. Much stress is
upon the attitude and proper spirit of the committeeman in ap
ing a fellow-worker on accident prevention work; realizing t
cident prevention through education is a persuasive pro
rather than commanding. A part of each first aid instruction
is devoted to this work.

At the conclusion of the course the annual first aid meet
in which all departmental teams participate. Prizes are awa
the three teams having the highest average, viz: First prize,
ican Red Cross Bronze Medals, the silver and bronze depar
trophy (to be held by the winning department for one year)
trip for the entire team to a World Series base ball game.
prize, twenty-five dollars in gold to each member of the enti
and American Red Cross certificates. Third prize, fifteen do
gold to each member of the entire team and American Re
certificates.

THE SAFETY COMMITTEE ORGANIZATION.

The Safety committee organization comprises four divis
classes, three of these divisions being composed of qualified
committeemen.

1. The permanent safety committeemen, one in each
ment. He has charge of all first aid—safety committee wor
department, and is responsible for first aid equipment, safety
boards and the distribtuion of safety literature throughout his
ment. He makes written reports of accident investigations
shop. He is under the supervision of the divsion safety in
and is compensated at the rate of $5.00 per month for the
attention he gives this work in addition to his regular shop d

2. The departmental teams taking the course in first a
cident prevention, and who qualify for this work by comple
course with the annual first aid meet.

3. The active safety committeemen.—This group assum
duties upon completion of the course and serve for one year,
the next first aid meet. In company with the permanent safe
mitteeman they make an inspection of the shop once a month

4. The general safety committeemen (once a commit

always a committeeman) those who have served for one year as active committeemen. This group are the auxiliaries of the Active Committee, but do not make the monthly inspection of the department.

SAFETY COMMITTEE ACTIVITIES.

The safety committee organization is the natural agency for all human relation work in the plant, and the effectiveness of this organization can be very largely measured by the degree to which it participates in plant human relation activities. The recent Liberty Loan campaign in the Bethlehem plants and in the subsidiary plants of the Bethlehem Steel Corporation was conducted by the safety and welfare department of each unit, clearing through the safety and welfare department at Bethlehem. Twelve hundred of the 1,500 bondsellers at Bethlehem were members of the safety organization. The effectiveness of the organization work is shown by the results obtained—97.8 per cent of the Bethlehem plant force of 29,000 men were written for a total of $2,066,000, and for the entire corporation, 93.4 per cent of the total force of 68,000 men were written for a total of $5,777,000. During the past year 500 homes in the Bethlehems have been sold to plant employes through the medium of the Housing Committee.

Committe work in fitting the man to the job, night school education, athletics, recreation centers, the injured, the sick and unfortunate—all plant activities of the human element are within the realm of the safety organization. If the problem of the employer and employe is to be solved finally, the solution should naturally come through the medium of such a democratic organization—trained to be considerate and helpful each to the other.

Some organized accident prevention work was done beginning with the year 1914. Intensive training for this work was begun in September, 1915, and up to the present time 1,200 men or about 5 per cent of the working force at Bethlehem—one man in every twenty—have qualified as safety committeemen.

During this year (1917) intensive training work was begun at five other plants of the company and the men qualified through first aid meets held at these plants. Twenty per cent of the teams taking part in these meets—those having the highest averages—took part in the finals of the third annual first aid meet held at Bethlehem, Aug. 25, 1917. Seventy Bethlehem plant teams—over 500 men—took part in this meet and are now serving as the active safety committee group.

A study of the accident statistics at Bethlehem, covering three years of the unorganized accident prevention period, 1 13, as compared with results of organized work covering the 1914-15-16, shows an accident reduction as follows: lost eye per cent; amputations, 41.5 per cent; fatals, 10 per cent. reduction for all causes, 28.38 per cent. This reduction, des fact that accident causes were many times increased due productional activities.

THE FUTURE OF THE WORK IN FIRST AID.

True first aid relieves the injured person from immediate ing and prevents further injury. First aid has failed to m served progress due to a lack of a proper conception of th Much of the work done has invaded the sphere of the docto has resulted in criticism and prejudice against the movemer practice of medicine or surgery does not enter into true f It is a layman's work, pure and simple.

Owing to the misconception of true first aid, much of the tion and equipment has been complicated and overloaded- ing in inefficient first aid, and, in some cases, aggravated True first aid requires neither complicated systems, technica nor overloaded equipment. Given proper drill and instruct first aid man's equipment should be as simple as possible. At hem, the first aid kit equipment is limited to splints, triangul ages, a few roller bandages, gauze dressings, cotton, aromati of ammonia and a pair of scissors. Picric acid gauze an should be added to this equipment in mining or other industr not having close dispensary or hospital service. Much of th iveness of the work will depend upon the instructor. H know his work and its limitations thoroughly, be a good tea have such a personality as can get and hold the attentio classes.

Should training in first aid be limited to industry? V make instruction in this work general—isn't it worth while shouldn't the mother be trained in this work as well as the Why should she remain helpless when her child is injured and want of knowing what to do, be compelled to wait and wit suffering of her offspring until the doctor comes?

Why not teach the essentials of first aid in connection study of physiology in the public schools and make this o dead subject alive and practical. Put preliminary training

work where it rightfully belongs; industry can then elaborate on this preliminary training to suit its need.

THE FUTURE OF THE WORK IN ACCIDENT PREVENTION.

What is the future of the work? Are we satisfied with the progress made through present educational methods in accident prevention? Are results obtained commensurate with the time and attention we are giving the matter? Should industry feel itself responsible for the training of *all* its men in safety, and if that were possible, what degree of success can we expect in accident prevention through teaching and preaching safety to the *adult* mind? Are we striking at the root of the evil—are we on the right track?

We are accused of being the most careless nation on the face of the earth. Statistics show that the present accident rate in the United States per year is over 50,000 killed and over 1,000,000 injured. By the present general method of assigning the causes of accidents, we charge off about 75 per cent of this number of accidents as due to carelessness—and then teach and preach "be careful" with the expectation that this class of accidents will be reduced in proportion to the amount of preaching we do.

A closer analysis of accident causes will show that the term "carelessness" is a general term, a cloak which covers a number of accident causes clearly distinct from it—negligence, distraction, preoccupied condition of mind, lack of foresight, forethought, etc. These *habits* must be treated as such in the educational scheme of accident prevention.

Can you teach an old dog new tricks? Can you train a careless man to be *always* careful? Can you give him caution and forethought after habits of negligence, carelessness and inattentiveness to the thing in hand have been formed through years of countless repetition? Is it an easy matter to change our known habits, even when we know them to be injurious to us? Much more difficult is the task of overcoming habits not obvious to the injured until the accident happens. Is there a more logical and effective way of doing this work, and how can results be accomplished? What is the best method of reaching the individual, and when?

THE PUBLIC SCHOOL FUNCTION IN ACCIDENT PREVENTION.

Does the public school system have any obligation in the matter of accident prevention through education? Anything educationally worth while to the general populace is within the province of pub-

lic school work. "Carelessness is the crime of the century, eradication through preventative education is the serious pr the hour. The public school system has its responsibilit vital matter of conserving human life and limb as the *natur tional medium,* but its responsibility in accident prevention g further than that.

Education is training for life work through knowledge a pline. Discipline is mainly a matter of training in good habi tion—all of which should be safe habits. The school sy very largely fulfilled its mission if it sends forth boys and g are accurate, attentive, careful, thoughtful, trained to obser check up and prove out their findings. All this as opposed t of carelessness, negligence, misjudgment, distraction, rec and "don't care."

Begin with the child in the formative period—the hab ing period when the mind is most receptive to safe habit t This training can be made practical in the school grades the organization of juvenile safety societies, school patr directly connecting the work with lessons in home safety safety and public safety. In the higher school grades teach dustry of the community and, in this connection, the hazards industries.

The writer has in mind two 18-year-old high school gr killed in industry during the past summer. One was killed second workday, the other in his third week on the job. Bo killed through hazards indirectly connected with their wo after disregarding verbal instruction and written warning sig ing on these particular hazards. Both had spent twelve scho in preparation for their life work. What part of this time v voted to safe habit formation? *Why should we train for life a having in view life preservation?*

CHAIRMAN MORGAN: Shortness of time, I think justifie ting discussion on this paper.

We will now take up the subject of "Lunch Rooms and Houses," by Mr. John P. Eib.

LUNCH ROOMS AND CHANGE HOUSES.

J. P. EIB, SUPERVISOR OF SAFETY AND LABOR, ILLINOIS STEEL COMPANY, JOLIET WORKS, JOLIET, ILL.

Mr. Chairman and Members of the National Safety Council: In preparing my remarks on the subjects of "Lunch Rooms and Change Houses" I have chosen to consider lunch rooms first. While these are most certain kindred subjects my reason for considering the question of lunch rooms first is that our experience dates back farther on this subject.

It is my pleasure to be connected with the Illinois Steel Company at Joliet, Ill., which company is a subsidiary of the United States Steel Corporation, and I am interested in the Department of Safety and Labor. When I say "our" experience I refer to the experience at that plant.

I believe that the committee which extended me the very courteous invitation to speak here today intended that I should interpret my subject as I best saw fit, therefore, I believe that the best message which I can give to those who are deepest interested is a frank statement of our experience.

LUNCH ROOMS.

The need of a lunch room at our plant had been apparent for some time, but the first definite action was taken back in 1911 when a committee was appointed to work out the details of installing a small lunch counter. This action was the result of a careful survey of the conditions which existed at that time. In the first place our plant is located some distance from the center of town. There was but one small lunch room in the vicinity and the quality of the food served was very poor. The only competition was from the saloons. These saloons all set out a kind of a lunch which was bad but the accompanying drinks were worse.

At that time there were no restrictions on the men leaving the plant during the noon hour and consequently the number going out was very large. We tried to keep count on several occasions but the crowd moved so fast that it was impossible to get an accurate count. The men rushed from the plant to the saloons, hurriedly swallowed the bad lunches and the worse drinks and then rushed back to their work. Some men did this from choice, just to get the drinks, and others, particularly new employes who had not as yet

found a boarding place, did it from necessity. Regardless of it was done from necessity or choice, the result of the bad and drinks was reflected in the production and in the records. Investigation of a large number of accident cases beyond any question of doubt that the cause was directly t to these lunches and drinks.

When the information obtained was presented to the offi the company they agreed that the noon hour drinking wou to stop and that the only way of stopping it, in fairness to t was by providing a place in the plant where the men coulc a lunch.

FIRST LUNCH COUNTER AS AN EXPERIMENT.

On Jan. 1, 1912, a little lunch counter was installed to the men wanted accommodations of this kind. It was run profit so that a good lunch might be obtained at practical cos a number of years past it had been the practice to furnish ho free to the men when heavy construction or repair work progress, especially in bad weather or under exceptionally conditions. Their appreciation and the good results obtaine very evident, so with all these things in mind it was felt t success of the lunch room was assured.

This lunch room was installed in a building 20x36 feet, fc used for a fire hosecart. It was centrally located and had a c to serve about 500 men per day. Within a few weeks after s there were being served from 1,000 to 1,500 men per da demand for more. The facilities were soon found to be inac and on July 1 it was necessary to discontinue serving hot l and limit the service to stews, coffee, sandwiches, cold drin the like. This limitation of service, of course, was not de but the men were all good-natured about it. With this situatic fronting them the committee in charge found themselves peculiar dilemna of operating a business that was too succes so much so that it was embarrassing.

EXPERIMENT PROVED LARGER BUILDING WAS REQUIRED.

The marked success of the experiment and the disappoi of the men when the service was curtailed demonstrated long the year was out that they wanted a lunch room. Accordingly building was erected. This building is 30 feet wide and 10

coting eight inches high with remainder of wall and ceiling finished in white enamel. It is equipped with storeroom, refrigeration and cooking facilities and other modern equipment necessary for its operation.

CAFETERIA PLAN.

Our lunch room is conducted on the cafeteria plan. A careful study of this question was made and it was found that this plan could be best adapted to operation with the minimum amount of help, offer the quickest service, and at the same time give the largest choice of menus. We have a capacity of 132 and counts recently taken indicate that approximately 60 per cent of our working force patronize the restaurant. The busiest time is between 11 and 12:30 o'clock and the average daily attendance between these hours is between 400 and 500. Approximately 2,000 men patronize the restaurant every twenty-four hours, so that now our men walk in an orderly fashion into a building where they get a good, substantial meal, properly balanced, and at reasonable rates, instead of rushing for poor lunches and worse drinks as was the case a few years ago.

We believe that the chief reasons for the success of the lunch room are that we aim to see that properly balanced rations are served promptly and cleanly. This appeals to the men and the low price schedule insures their attendance with resulting benefits.

NOT RUN FOR PROFIT.

The lunch room is not run for profit but we do aim to make it self-sustaining. The sale of cigars, tobacco, candy, ice cream, soft drinks and other so-called luxuries at retail prices means a profit and the profit thus made helps to offset the loss on the basic articles.

All of this is accomplished without any compulsory rules of attendance; in fact, we also aim to provide places for the men who carry their lunches. In some of these places stoves or gas plates are furnished.

RELATION TO ACCIDENT PREVENTION.

At Joliet we are thoroughly convinced that the lunch room has been of material benefit in our accident-prevention campaign and the relation which this and other similar welfare measures has to accident prevention, to increased efficiency, and to minimizing time lost through sickness is so well thought of by the Illinois Steel Company and the United States Steel Corporation that, in addition to

the one at Joliet works, we have three plant lunch room
tion at our South Chicago works and one is under con
our Gary works.

WASHROOMS AND CHANGE HOUSES.

BATHING CONSERVES HEALTH.

Many good reasons exist for the installation of wash
one of the chief reasons is that bathing conserves health,
is the greatest of all assets. Everywhere today the cry
servation and efficiency, and efficiency depends on he
wealth of a nation depends on its production and producti
on efficiency, and efficiency depends on health.

Many diseases are caused by taking germs into the sto
the food and if a man is provided with a place where he
his hands before eating and a clean place is provided ir
main defense against contagion, hence bathing is not only
eat a great deal of sickness can be prevented. Cleanlir
for removing dirt and refreshing the body but is an imp
in keeping us well.

PROMOTES SELF-RESPECT AND LOYALTY.

Most workmen like to go to and from their work dry
and such self-respect is commendable and should be enco
providing suitable means whereby it might be satisfied.
of washrooms should be encouraged, as a great many hom
have running water which makes bathing a task which is sh

That it pays in every sense of the word to safeguard
man from loss of limb or accidents goes without saying
the same effort should be made to safeguard a workman
of health. The greatest asset which any company has i
of loyal workmen and it also goes without saying that t
physical and moral condition of the men the better work the
and the employer relies upon the effective service of the em

MAKES FACTORY WORK ATTRACTIVE.

From the employer's standpoint the chief reason why t
install washrooms is that it attracts men to his plant. Mos
work is dirty and if men are to be attracted to it a was
desirable; especially is this true of iron and steel indu
account of the heat and di

The average young man starting out in life, fresh from school, is full of action and a desire to step in and do things—to make himself a part of things, to create, and yet he turns from factory work to office work because he is not attracted by the prospect of dirty clothes the rest of his life, even though he knows the opportunities for advancement and increased earning power are greatest in the plant. Very often a father who has put in a good many years of his life in a factory where no consideration is given to his welfare helps the boy to arrive at his decision.

On the other hand, if a father has worked a number of years in a plant where thoughtful consideration is given to his welfare, he is proud of his connection with that company and is willing and ready at all times to uphold its good name. His spirit of loyalty reflects itself in his work and his home life and he is proud to have his children enter the service of such an employer. Thus the employer gains, in addition to the loyal service of the father, the service of the young man who is anxious to enter the employ of such a concern, with the advance knowledge that his welfare is to be considered and he is eager to learn and advance. Therefore, an employer in addition to fulfilling a duty which he owes to his men is placing his money in equipment that is in reality an investment.

STANDARD REQUIREMENTS.

After the decision has been made to install washrooms the next step is to decide on the location and kind of building and equipment. The following brief suggestions are quoted from the standard requirements issued by the sanitation committee of the United States Steel Corporation and I believe them to be worthy of expression at this time.

LOCATION AND CONSTRUCTION OF BUILDINGS.

Wherever possible buildings should be located in places most convenient to the men to be served to avoid exposure to accidents en route such as crossing railroad tracks, roll trains and other dangerous places. Experience has also shown the desirability of installing washroom in the same building as locker-room to obviate the inconvenience of traveling any distance for change of clothing. Special effort should be made to construct buildings to open to outside light and air.

Experience has proven that it is desirable to install buildings of

fire-resisting construction and that they be located abo instead of in basements.

Where wash and locker rooms are located in the sam with toilet the rooms should be separated by a partition care should be taken to see that rooms are of sufficient siz men to use equipment conveniently without interference other.

INTERIOR FINISH OF BUILDING.

Floors should be of concrete or non-absorbent mat laying the floors care should be taken to see that a slope t drain is provided. If drains are located under fixtures it the water to run toward and not away from fixtures a cleaner appearance is presented.

Sufficient window space should be provided to afford light and ventilation. Too much importance cannot be a the liberal admission of sunlight. Rooms should also be a lighted artificially, with the light distributed so that fixtur thoroughly lighted.

Ample heating facilities should be provided.

Permanent hose connections should be provided for t flushing and cleaning rooms.

FIXTURES, LOCKERS AND SHOWERS.

Facilities for washing hands and face should be such must necessarily wash from a flowing stream to prevent mission of disease through the common use of a washi made to contain water. The number of faucets for wash and face should not be less than one to every six emplo on the maximum number employed on a single turn. Bot cold water should be provided for each fixture.

A steel locker with proper ventilation should be pro each employe. Lockers should be at least four inches off and should be not less than 12x15 inches in size.

Each shower should be separated by a partition to men to use them and to prevent the user splashing his The number of showers should be not less than one to ever five employes, based upon the maximum number emplo single turn. The proportion may be varied according to acter of the work and the number of men quitting at one t

CARE.

In order to keep the washrooms clean and inviting and to prevent the abuse of equipment a special man should be delegated to attend to same.

QUESTION OF MEN USING FACILITIES.

The question of the men using the facilities is a large one and in a good many instances requires a study of individual conditions.

Our experience has been that the better class of workmen use the facilities from the start and the others gradually fall in line. A campaign of education has proved to be of great assistance.

From my observations I believe that failure of men to use the washing facilities is largely due to crude and antiquated and uninviting facilities and that if a clean room, with warm water and adequate facilities, is provided the men will be glad to use it.

MR. DUDLEY R. KENNEDY, CHAIRMAN.

CHAIRMAN KENNEDY: It is 12:05 o'clock and one of the most interesting papers on our program is to come from our modest Chairman. I think we ought to wait for it. We will close in plenty of time for luncheon. Is there any discussion on the topic "Lunch Rooms and Change Houses"?

MR. ROY S. BONSIB (United States Metals Refining Co.): What is the experience of other members in getting foreigners, Hungarians and Polacks, to use washing facilities? They will wash their faces and hands, but they will not wash their bodies, and, of course, it is very necessary to have clean bodies. Sometimes we have almost lost heart. I would like to know what methods have been adopted in getting them to use shower baths?

MR. BAILEY: We had the same difficulty; in fact, we still have it. When we started we found that when bathtubs were put in their houses they were used as coal containers. I believe every one has had that experience. The only way you can get results is for your company to employ a visiting nurse and get at it through her. She will teach the women and children and they will bring the men around.

CHAIRMAN KENNEDY: Mr. Bailey, I regret to say that you are a little off the subject. Change houses in the plant proper was what Mr. Bonsib referred to.

MR. BAILEY: I so understand.

CHAIRMAN KENNEDY: Have you had experience with

MR. BAILEY: Mr. Bonsib wanted to know how to g use bathing facilities. You will have to do that through t nurse, teaching the women; they will bring it back to the

MR. JAMES: We have had quite a good deal of e along that line. We have a number of change rooms and b in each department of our plant. We have a lunchroom a ing room and we also use a basket to take care of the clot change room. Before a man goes on duty he goes into t room and puts on his working clothes. He puts by his stre and swings them up so they get plenty of air and ventilat have pretty much done away with lockers. We have fo baskets, hanging up against the roof, each man having lock, are far better than lockers. During the night the clothes are well ventilated and thoroughly dried and the put on dry clothing when he comes in the next day.

We have a dining-room, but before the men go in to t meals every man can have a good wash as we have an supply of wash bowls, etc. We have no trouble in gettin use the washroom and also the dining room. We consider success and the company is contemplating putting in a m the same style for the other departments.

MR. DUNSMORE: I would like to ask if you furnish t towels?

SOAP AND TOWELS FURNISHED.

MR. JAMES: Yes, the company is furnishing soap an also a man to take care of the building and keep every good, clean order.

CHAIRMAN KENNEDY: It is very important to keep the in good order.

MR. EVANS: What kind of soap—liquid or bar or what used and what kind of towels?

MR. JAMES: Ordinary, common soap and good towels; extra fine, you understand, but of good quality.

MR. BONSIB: We have had a great deal of trouble w carrying the soap home. I would like to know how that is because the company usually furnished soap both for the ho the employes. They take a bath and then take the soap home can that be avoided?

CHAIRMAN KENNEDY: We have a very good change house in the puddling department. A great many foundries all over the country are taking up puddling, as you know. We had some trouble at first, but we have a very wise foreman. He organized the boys in this particular washhouse into a club. They buy their own soap, they furnish their own towels and they have a lot of fun. In addition they have papers and magazines, buy flowers for sick members and so on. They are working up a little welfare club in this particular change house and the idea is so good we are trying to adapt it to our other houses as we are building quite a number of them. We are now working on one to accommodate 200 men. It will be of the type referred to by Mr. James. I am glad that this question has been discussed because I believe the elevated basket or hooks are preferable to the lockers.

MR. JAMES: One point I failed to mention, Mr. Chairman: Our company has also built a large washroom located outside of the plant, for the benefit of the workmen's wives and children.

CHAIRMAN KENNEDY: Gentlemen, you will pardon me for shutting off the discussion at this point. Because of the lateness of the hour we will have to proceed with our program. I do not need to introduce our genial Chairman—he will read a paper on "The Problems of Returning Injured Men."

PROBLEMS OF RETURNING INJURED MEN.

EARL B. MORGAN, SAFETY ENGINEER, THE NORTON COMPANY, WORCESTER, MASS.

Mr. Chairman and Members of the National Safety Council: What are we doing with our injured men? Are we simply furnishing them medical attention, paying compensation, and then sitting back with a sigh of relief and saying: "Well, that's done! Our obligations to society have been fully discharged."

Are we allowing our workmen, who have been so unfortunately injured in the course of their regular employment, to drift into the human scrap heap as a burden on society? Or are we utilizing the human resources, which so unfortunately have been impaired in our industries, by replacing them on jobs for which they are physically suitable, and thereby making these men contented and happy workers, doing their bit in the work of life?

When we employ a physically acceptable man in our industry,

we take him from society at large as an asset. Have we to be accessory to destroying this asset? Have we an pass him along to the next industry as damaged goods?

No one would be rash enough in these days to dispu that a safety engineer can save money, not only for his but also for the employes, by preventing industrial accid there is still another field in which he can operate to effe appreciable saving for both employer and employe. Getti jured man back to wage-earning capacity as soon as possi half a man power, saved twice from the human scrap he as much a conservation measure and just as valuable a industry as is the saving of one man's life; absolutely no algebraically speaking.

My subject really should be: "What to do after the i

If you will bear with me, I will outline a system whic developed at our plants to overcome certain difficulties t industries in handling the employe after an injury.

WHEN AN EMPLOYE IS INJURED.

It is then the duty of the plant physician at the time o treatment of the injury to decide:

1. Can the man return immediately to his old job chance of further injury?

2. Must he be temporarily prohibited from working, o words, placed on a period of enforced absence?

3. Or can he return to work immediately by being tr to a different character of work, which he can do witho of further injury?

Of course, in most cases the answer is obvious, but th great number which require rare judgment, based upon a familiarity with the job analysis, either by the physician o visors. His logical advisors should be the safety engineer employment manager.

Right here let me remark, is a very strong argument the plant physician over the outside physician. The physician, as a general rule, has little or no knowledg industrial conditions in which his patient is employed judgment as to whether the man should return to work only a guess at the best. He can very easily bring an inju only upon the employe, but the employer, by keeping the m

returning to work when he is really physically fit to do so. This incurs a loss of full-wage earning time to the man and increases the employer's compensation burden. Furthermore, this compels the employer to place a new man on the job and incurs an item of turnover expense, which, based upon the estimates of our best authorities, ranges from $25 to $50. Then, too, he may judge that the man is able to return to work when such is not really the case. Then the man aggravates his injury, suffers a setback, and loses more full-time wage earning power than is really necessary. Also, the employer, or his insurance carrier, suffers an increased compensation burden.

In minor foot and hand injuries, any of the above circumstances are likely to arise. Such cases require a finesse of judgment upon the part of the attending physician, and this judgment is good or bad, depending entirely on the familiarity with the job analyses of the plant. Here is an example. We had an employe lose all the fingers and the thumb of his right hand in an accident on a rubber mixing roll. Within six weeks after the injury, while the hand was still bandaged up and under the care of our plant physician, this man was re-employed at his full-wage earning power on a job in which it was his duty simply to count the quantity of material fed to a machine. It was only necessary for him to make a single stroke or pencil mark in keeping tabs on this count. This man is still doing this work today, about nine months after the injury, and is a satisfied and contented workman. Obviously a big saving was accomplished both for him and the company. If he had been under the treatment of an outside physician we can hardly imagine such a short lost-time period.

SUCCESSFUL CONVALESCENCE.

If the injured employe can return to his old job immediately after the accident and the first treatment at the hospital, even then the case cannot be dropped. He must be closely watched afterward to see that he convalesces successfully. How many times have we heard of cases where a man was allowed to return to his old work after an injury and then because he had not received the necessary medical attention an infection developed, resulting in a loss of a great many working days. In such cases, the injured man should report regularly to the hospital until he is fully recovered and finally discharged by the plant physician. If he does not do so, it should be some one's particular job to see that he does. Many a dollar of

additional compensation and turnover expense can be by a close follow-up of all such cases.

FINDING LIGHT WORK FOR INJURED EMPLOYE.

If the man can return to lighter work immediately accident, then it is a function of the employment mana some work for which the injured is physically suitable a cess will be dependent upon his knowledge of the job anal plant. The case must still be followed up closely for a sl even after the man is replaced, because there comes a tim man is fully recovered and can be utilized to better advan company and be kept better satisfied himself by being heavier work. By close co-operation with the plant phy safety engineering department can accomplish this at jus time.

"PERIOD OF ENFORCED ABSENCE."

If the man must be temporarily prohibited from work then it is necessary to place him on what we call a "per forced absence." To accomplish this, a notice is forwar injured's foreman, timekeeper and the employment off automatically removes him from the pay roll and prevents returning to work without the plant physician's release. the employment office prepares them to immediately neg the foreman to substitute for the injured man. This acc quite a saving in time for the foreman, who may not kr the injury right away and lose considerable productive ti machine which the injured was operating.

Before we adopted this measure we had cases where n on by greed for money and very often burdened by the d of a large family, had more faith in their own judgment doctor's and returned to work in spite of orders to the As a result their recovery was often very seriously retarde they had to quit suddenly and the foreman was left for ma without a man to fill their job.

Another advantage of putting a man on a period of absence is that it places his name on the follow-up list. low-up man is then responsible for keeping in close touch injured and seeing that he does not get away from prope attention.

A man injured by accident in our plant

now unless he is either completely recovered and discharged by the plant physician; released subject to further treatment and considered sufficiently recovered to pursue his regular employment; or placed on a temporary job requiring less physical effort. The foreman, timekeeper and employment office are notified when the man is released and he is then returned through regular employment channels just the same as a new applicant for a position. This has its advantages. The foreman is relieved of the responsibility of replacing the man. It often happens that the old job is taken by the time the injured is ready to return to work and here is where the employment manager can use his knowledge of the labor demands of the plant to good advantage in finding another suitable job.

This "period of enforced absence" also enables the safety engineering department to effect settlements promptly, because it gives them absolute knowledge of and control over the length of the period of disability. It also gives them an opportunity to do some good missionary work in converting the man to a good safety man through personal contact. It has been our experience that when a man recovers from an accident he has come to realize that he, as well as the company, has lost in dollars and cents, and he is, therefore, in a very receptive mood to receive the safety propaganda.

WHEN TO REPLACE AN INJURED MAN.

Just when to terminate the period of disability depends:

1. Upon the plant physician's judgment.

Right here is where the plant physician, co-operating with the safety engineer, has all the advantages favoring him over the outside physician.

2. Upon the injured man showing the proper spirit and willingness to do his part. Sometimes he can be brought to the proper attitude by being impressed by the dollars and cents which he is losing while not working. Other times it may be necessary to appeal to his family or a friend to swing him around. Then there are extreme cases where the drastic measure of stopping compensation is necessary to prevent malingering.

3. Upon whether it will be a better business proposition to continue compensation a while longer rather than to place the man back to work, knowing that he will not fully earn the wages which will be paid him for a time at least. This phase of the problem requires careful consideration and study. Some men will take advantage of being placed temporarily on an easy job and will not only

fail to earn their salary, but they will create a bad effect
of the workmen with whom they come in contact. T
intangible loss on the whole gang in which the man
otherwise would not have been incurred if compensat
continued. Some men, when replaced on an easy job, t
entitled to special privileges and will try the foreman'
loafing. Replacing a man under such conditions is an i
a foreman.

4. Upon the ability to detect malingering. Many
clever at this that it takes a very keen and experien
to detect it. Each individual case is a problem of its
takes a keen student of human nature to successfully

A HAPPY AND CONTENTED WORKER.

I would say that to me there is a certain sense of pe
faction in knowing that you have made a man a co
happy worker. Here is an example: One of our old
employes had a hernia. After the operation he came
quite discouraged. He was an elderly man and felt th
be of no more use to industry and that he would not be
port his family. We placed him temporarily on an elev
a few weeks, until he had fully recovered his former s
vitality and then got him back on his old job. Making this
tented and loyal worker was indeed worth while.

In conclusion, this subject seems to me to be simply
co-operation on the part of the physician, safety engin
employment manager.

1. The physician to be the judge of the physical cc
2. The safety engineer to decide whether it will be a
ness proposition.
3. The employment manager to place the man.

DISCUSSION.

CHAIRMAN KENNEDY: Is there any discussion on
interesting phase of the work?

MR. HAYWARD: It would seem to me that one of th
portant points brought out by Mr. Morgan is that of the
men. In every system of efficiency and industry toda
of the follow-up man and in no other instance can a foll
be more valuable, in my estimation, than in safety worl

test when I get home. If a man in our rolling mill had dust in his eye we tried to find out why he should be off four days from so simple an injury. We found the man was not off due to the dust—he was simply taking a vacation. A follow-up system will materially reduce your record of actual time loss and you will return many men within the time limit.

DR. SHOUDY: There is one point I do not quite agree with, and that is when you jump from the department of the safety engineer to the employment bureau. Every one in this Congress has taken a rap at the employment agent. If you are going to rap him all the time, he will get back at you. I found that the work goes better if you go from the doctor to the safety engineer and then to the foreman. The foreman does not like to have you come to him and say, "Here, Bill, use this man on your job!" simply because the safety engineer and the employment agent say to do it. If you go to the foreman and say, "Bill, this man ought to be back on the job; he can do something for you!" the foreman will say, "No, he cannot." Go to him on another tack: "This fellow has a wife and family to support; we want to help him and we want you to help us to help him. Give him some place where he can work." You not only help the man and get the spirit of co-operation between yourself and the man, but you get the spirit of co-operation into the whole works, and the idea that the foreman is doing something, not that the doctor is doing something, not that the safety engineer is doing something, not that the employment bureau is doing something, but the fellow who has been injured is being helped, not by those three fellows but by the foreman in the shop. Do not go over his head.

RETURNING INJURED MEN.

MR. MORGAN: Dr. Shoudy has made a very good point. I assumed, in treating the subject, that we all understood the point and that it would be properly covered in the debate. Far be it from me to think that an employment department will thrust anything upon a foreman. The foreman should first confer with the employment department. We handle the question in that way, the employment man dealing with the foreman.

MR. SMITH: I would like to say a few words in relation to the foreman. Following a conference with Dr. Farnum in St. Louis many months ago I immediately got in touch with our general manager and he saw the light very clearly. Our problem was to return

injured men and we owed it to them and to their famili them to their work as quickly as possible. The first t: was to assure the man when he was returned to wrk position that he would receive the same compensation porary job as he received on his old one.

About the co-operation of the foreman: We had t the foreman direct and a foreman or superintendent i 500 men is responsible for their safety. His official rec is held accountable and every injury in his departmer against his efficiency record—we can find at any time injuries any superintendent has had in his department. if he is responsible for the safety of a man, and that ma in his department, he is responsible. He must also see th is put back to work as quickly as possible and given a can fill. That is where your transfers come in. If he with two good arms doing some lighter work and he c man somewhere else, and if he has a man with a crushe something of that kind, who can do the work the mar good arms is performing he immediately arranges a transf the foreman understands that he is responsible for that job and that it is up to him to do it, he readily co-ope the department.

If a man has a crushed finger and it is necessary t finger off, if the operation will put the man back to work tion we can provide for him in ten or twelve days we p operation. The foreman is responsible in placing a ma work as quickly as possible consistent with his injuries.

CLASSIFYING THE JOBS.

DR. FARNUM: This matter of getting men back to thing very, very dear to my heart—this matter of givi square deal. The only way I know you can possibly do your labor man, your employment man, have the jobs in absolutely classified so he can give the men jobs they can example: A man came in the other morning with a li off and wanted to go to work. Well, he lost two days, we work and drew his usual compensation.

One of the worst cases of fractured arms I have eve four days. How can you put a man back to work witl broken arm in four days? We did not put him to work heavy timber, which he formerly did.

All of our foremen work with us. The foreman says to the employment man or the safety engineer: "I have a bunch of work for some of your one-armed fellows." That is recorded; it is the simplest matter in the world. It is a matter of applying the proper system. Our men lose very little time. Another thing, no matter what work they are put at they are paid what they received before they were injured and as soon as they are able they are put back to their own work.

The average man is just as human as we are, maybe a little more so. If you get under the hides of your men you will find they are the cleanest bunch of fellows you ever met. They may be a little dirty on the outside—a little scrubbing may do them good, but you will find a man there just the same.

Mr. Morgan has referred to malingering and so on, but after six years of this work I cannot recall a single case of that kind and I do not remember of a single case where I did not get absolute co-operation from the man.

I had a fellow with a broken arm—this is our line of argument—and I said: "Jim, you have a broken arm?" He said: "Yes." "You can go back to work whenever you get ready," I said. "Why, I cannot do that sort of work." "You can do something else." "Not with this arm." "What difference does that make? You are being paid because you were injured in this plant. You will receive the same money you got before, to do what work you can properly accomplish. The broken arm belongs to me; I will give it back to you some of these days, but just now it belongs to me; the rest of you we will put to work." It is the simplest matter in the world and it works out absolutely.

MR. EVANS: Mr. Morgan's paper is an outline of the plan used at the works where he is engaged. It was adopted by the management and the foreman is employed to carry out the plans of the company and see that all cause of soreness is removed when the workman understands that he is paid for carrying out this plan.

MR. EARL B. MORGAN, CHAIRMAN.

CHAIRMAN MORGAN: Unless it is your pleasure to continue this very interesting round table I desire to make two announcements.

I wish to call particular attention to the one activity which this Section developed during the year and of which the Executive Committee is very proud—the News Letter. In fact, the News Letter

is full of good material. Whether we can keep it alive a it depends on each and every one of our members sendin tary Kennedy the little points of interest that may arise. a good article in a periodical or develop a new idea, ir an envelope and mail it to your Secretary.

I think I voice the sentiments of the Section in saying thanks is due our good Chairman of the Program Comr C. B. Hayward of the Winchester Repeating Arms Co should like to see such a resolution spread upon the record.

MR. JAMES: I desire to offer a motion to that effect.

MR. LEWIS: I second the motion.

CHAIRMAN MORGAN: You have heard the motion. any remarks? If not, all in favor of the motion will sigr by saying "Aye." Contrary, "No." The motion is carried.

Mr. Hayward, we certainly appreciate your work. I tl one in attendance enjoyed your well-arranged and profitable

It is no small job to gather around a table and try to where to get subjects and speakers for a Congress of this l are in this work to give and receive and you cannot rec than you give. You have to get in and play ball. This is be a live Section. The appointment of the Executive C will be communicated to the Section in due time.

What is the pleasure of the meeting; shall we continue table further or adjourn?

SUBJECTS FOR NEXT CONGRESS.

MR. HAYWARD: May I make a recommendation? A r has been brought forward by Chairman Morgan and m mendation is that it be placed on our program and cons the next Congress. It is one of our most vital problems an a new question next year.

CHAIRMAN MORGAN: You have heard the motion; your pleasure?

MR. BURGWIN: I second the motion.

MR. HAYWARD: I move the adoption of the recommen

MR. KENNEDY: Mr. Morgan and I have discussed the of widening the scope of safety work a little for this p Section, because many of us are interested in other thi problem in our country today is the number of convention invited to attend. Many of us would like to attend them have not the time to do so. You have the Corporation Schoo

zation, the House Association, the Employment Managers' Association and one thing and another, and the men in charge of safety activities cannot go to all of them and absorb all the debate, so I would like to have an expression of opinion as to the wisdom of injecting some new ideas into our sessions.

CHAIRMAN MORGAN: That is a very important point, but a little out of order at this time. We have a motion on the subject of "Replacing Injured Men,"—that the subject be included in our program for next year. The motion has been seconded. Is there any discussion on the question? Those in favor of the motion will signify assent by saying "Aye." Those opposed, "No." The motion prevails.

Your committee will see the motion is taken care of. I wish we could have an expression of opinion on Mr. Kennedy's point. I think we will have to broaden the discussions before this Section if we are going to cover the field of our activity.

BROADENING WORK OF SECTION.

MR. HAYWARD: Our national officers seem to want us to specialize in iron and steel industries. I took up the fight, the consideration of other questions, and Mr. Morgan helped me. It seems wise to have other topics considered, because we do not hear them discussed in the general session. We do get them here; we just have had them.

MR. EVANS: As a suggestion, may we not next year have something on the subject of coke works, by-products, benzol plants, and so forth?

CHAIRMAN MORGAN: We will keep that in mind.

MR. EVANS: I would like to correspond with Mr. Kennedy about it; it may save time.

CHAIRMAN MORGAN: What is your pleasure; do you wish to continue the round table or shall we adjourn? I would like to have your views, Mr. Fonda.

MR. FONDA: I feel somewhat as Mr. Hayward— a good many topics on iron and steel are pretty well threadbare. We discovered that in the discussion of the program. There are one or two subjects, however, I think, would bear repetition, such as open hearth hazards, as that is a matter none of us have satisfactorily solved. A lot of new things are coming up and I think our Program Committee had that in mind when they placed the subject on our program. We had a very fair discussion, generally speaking, but I think we

would do well to get off the regular line of old subjects.
that we ought to bear in mind the question of employment.
of good information will be available next year. Mr. Kenn
a lot of other members will have live things to bring up.
the subject ought to be included in our discussion for next y

SESSION FOR YOUNG SAFETY ENGINEERS

MR. CHANDLER: I picked up one thought in this Cong
believe it applies to this Section as well as to some others.
there are some men who have not attended our previous Con
One of them told me it made him rather dizzy to listen to s
our discussions, because he is a beginner. He has not starte
of these things and to listen to some of the discussions her
all of this work is so far advanced that it looks and feels a
high as a mountain to beginners.

My suggestion is that we devote a part of one session ne
to the beginners' problems—"Lunchrooms" or "First Aid" w
splendid examples. The Bethlehem Steel Company has
that to such a state of perfection that the new man may th
never could tackle that job," and yet our work is largely
beginner in the small plant but it does not at all mean that he
be expected to start out on that magnificent scale.

MR. BURGWIN: Another subject has been brought up
three times and I think it would bear repetition, that is "Th
dent as Compared with Return Service." I have gone ov
records of the Crucible Steel Company for a period of six o
months and I find they are a little different from anything
tioned on the floor—the number of accidents to new men a
pared with old men.

CHAIRMAN MORGAN: Please make a note of suggestio
forward them to the Secretary of the Section. Mr. Young
you anything further on this subject?

MR. YOUNG: Next year we might give benzol plants a p
our program. The iron and steel industry is becoming mo
more interested in the subject.

ADDRESSES IN ADVANCE OF CONGRESS.

MR. EVANS: General Manager Cameron suggested that
be prepared and sent in before the Congress opens. That
save a good deal of time

CHAIRMAN MORGAN: We will make you Chairman of the Program Committee and place your statue in the Hall of Fame if you succeed in getting the papers. Believe me, you will have a job.

MR. EVANS: It worked well this year with the Electrical Engineers.

MR. H. V. ESTEP *(Iron Trade Review and Foundry)*: I happen to be Chairman of the Program Committee of the American Foundrymen's Association, which will meet in Boston week after next, and I want to say it is possible to get papers in advance. We have today 610 pages of papers printed and ready for distribution. We accomplished that by constant hammering; I think we started the latter part of July. We made it pretty hot for the fellows until they sent in their copy.

CHAIRMAN MORGAN: Your committee has made every effort to get papers early, but we were not very successful.

MR. BAILEY: I think the more round table discussion we have the more help we will get. That may not be true of some of you men, but I think the great majority of us get more information out of small sectional conferences than we do from large ones.

CHAIRMAN MORGAN: As there appears to be no further discussion I will declare the meeting adjourned.

National Safety Cou

Industrial Division—Mines and Qua

New York City

Sept. 12 and 13, 1917

B. F. TILLSON, Chairman
New Jersey Zinc Company, Franklin Furnace, N. J.

H. G. DAVIS, First Vice-Chairman
Coal Mining Department, D., L. & W. R. R., Kingston, P

W. A. LUCE, Second Vice-Chairman
Assistant General Manager, The Ellsworth Collieries, Ellswo

WM. CONIBEAR, Third Vice-Chairman
Safety Inspector, Cleveland-Cliffs Iron Works, Ishpeming,

J. W. PAUL, Secretary
Mining Engineer, United States Bureau of Mines, Pittsburg

SYNOPSIS OF MEETINGS

WEDNESDAY, SEPT. 12.

MEETING called to order at 2:45 p. m., Sept. 12, by B. F. Tillson. Thirty-three persons were present.

The Chairman delivered his annual address.

Verbal report made by Secretary Paul.

Verbal report made by R. Dawson Hall, Chairman of Committee.

Verbal report by George S. Rice, Chairman of Standa

Committee on Publications—J. P. Reese not being present, no report was furnished.

Mine Fire Protection Committee—Verbal report by John Lloyd.

No report furnished on Accident Statistics, Ropes, Standardization of Rules on First Aid Methods, and Standardization of Mine Rescue Methods.

The Chairman appointed the following as a Nominating Committee, to report at the close of the sessions: R. Dawson Hall, D. K. Glover and H. I. Young.

The printed program was taken up.

Mr. John Lloyd read a paper on "Mine Fire Prevention and Fighting." Discussion by Messrs. C. E. Pettibone, George S. Rice, J. W. Paul, R. Dawson Hall, D. K. Glover, Wallace McKeehan, H. G. Davis and B. F. Tillson.

Paper read by H. I. Young, "Underground Mine Sanitation," following which Mr. D. K. Glover presented a paper on the same subject prepared by Dr. Lanza, which, however, was not read.

Mr. E. E. Bach presented a paper on "Visual Mine Safety Instructions," following which presentation the meeting repaired to the main ballroom to witness several reels of moving pictures as an exhibit to Mr. Bach's paper.

Mr. Young's paper was discussed by Messrs. H. G. Davis, D. K. Glover, Wallace McKeehan, George S. Rice and Dr. Mengle.

Mr. H. M. Sigafoos presented a paper on "Hoisting Ropes." Following the presentation Mr. Tillson gave a discussion on "Testing Hoisting Ropes." Discussion by Messrs. J. W. Paul and H. C. Behr.

It was voted to extend further time to Mr. Behr in the discussion of this subject on the following day.

The session adjourned at 5:50 p. m.

THURSDAY MORNING, SEPT. 13.

Meeting called to order at 9:57 a. m.

Mr. A. H. Fay presented a paper entitled: "What Each Operator Can Do to Aid Accident Statistics." Discussion by Messrs. John Lloyd, E. E. Bach, R. Dawson Hall, B. F. Tillson, H. G. Davis and T. T. Read.

Mr. T. T. Read read paper by Mr. A. J. Moorshead, entitled "The Equipment and Organization of Mine Rescue Stations."

This paper was followed by Mr. George E. McElroy, who described the rescue and training station in service by the New

Jersey Zinc Company, Franklin, N. J. This paper was by Messrs. C. G. Brehm, J. T. Ryan, D. J. Parker, Georg H. D. Mason, Jr., James L. Price and J. W. Paul.

D. J. Parker read a paper entitled "The Mine Rescue (Government." This was followed by comments by Tillson.

Mr. J. W. Paul presented a paper entitled "Status o Rescue Apparatus and Physiological Effects on Users." I by Messrs. Rice, Price and Brehm.

Mr. Behr continued the discussion on "Hoisting Rope discussion was also entered into by Mr. H. G. Davis and t engineers of the Hazard Manufacturing Company of Barre, Pa.

The meeting took a recess at 1:07 p. m.

THURSDAY AFTERNOON, SEPT. 13.

The meeting reconvened at 2:15 p. m.

Mr. G. H. Deike presented a paper entitled "Advantag Use of Permissible Electric Lamps in Non-Gaseous Mine cussion on same by Messrs. Rice, Ryan, Read, H. D. Ma Brehm, Hall and Paul.

Mr. Graham Bright of the Westinghouse Electric and M turing Company, Pittsburgh, Pa., informally discussed t subject on the program, entitled "Safety Precautions in the tion of Electrical Apparatus in Mines." Discussion by C Tillson and Mr. G. S. Rice.

Mr. Carl Scholz's paper on "Standardization of Mine Car Mines," etc., in the absence of Mr. Scholz, was read by M Read. Discussion of Mr. Scholz's paper by Messrs. R. Hall, George S. Rice, H. G. Davis, Graham Bright, H. C. B J. W. Paul.

Paper announced to be read by Professor R. M. Raymc not presented, owing to the absence of Professor Raymor wired the Chairman of having missed his railroad conr The paper, however, was not presented for the proceedings

Mr. George S. Rice read a paper entitled "Necessity for M ically Produced Ventilation for Metal Mines." Discuss Messrs. H. I. Young, W. A. McKeehan, R. Dawson Hall, H. (and Chairman Tillson.

The next order of business was calling for the report Nominating Committee and election of officers. The ...

Nominating Committee was made by Mr. R. Dawson Hall, stating that the committee had recommended the following for officers of the Mining Section for the ensuing year:

Chairman—B. F. Tillson.

First Vice-President—H. G. Davis.

Second Vice-President—H. I. Young.

Third Vice-President—E. E. Bach.

Secretary—T. T. Read.

Chairman Tillson vacated the chair and asked Mr. J. W. Paul to act as Chairman pro tem, whereupon, by motion duly made and seconded, the report of the Nominating Committee was adopted.

Meeting adjourned at 5:58 p. m.

J. W. PAUL, Secretary.

DELEGATES IN ATTENDANCE SEPT. 12-13.

B. H. Adams, Locust Mt. Coal Company, Shenandoah, Pa.

C. B. Allen, National Workmen's Compensation Bureau, New York City.

L. W. Bevan, Hazard Manufacturing Company, Wilkes-Barre, Pa.

Rudolph J. Bravand, Hazard Manufacturing Company, New York City.

H. C. Behr, Consulting Mechanical Engineer, New York City.

Thomas H. Bolitho, Zinc Mines, New Jersey.

Graham Bright, Westinghouse Electric and Manufacturing Company, New York City.

C. G. Brehm, Oliver & Snyder Steel Company, Oliver, Pa.

E. E. Bach, Ellsworth Collieries Company, Ellsworth, Pa.

A. E. Blackwood, Sullivan Machinery Company, New York City.

B. C. Christy, International Harvester Company, Chicago, Ill.

H. G. Davis, D., L. & W. R. R., Kingston, Pa.

N. L. Diem, Clearfield Bituminous Coal Corporation, Barnesboro, Pa.

George H. Deike, Mine Safety Appliances Company, Pittsburgh, Pa.

F. G. Dawson, Winding Gulf Colliery Company, Charleston, W. Va.

Edmund Ewing, Alabama Coal Operators' Association, Birmingham, Ala.

V. C. Edminster, C. M. Dodson Coal Company, Beaver Pa. (Hazleton, Pa.).

A. H. Fay, Bureau of Mines, Washington, D. C.

D. K. Glover, Lehigh Coal and Navigation Company, L Pa.

J. F. Henry, Dodson Coal Company, Shenandoah, Pa.

W. S. Hart, Hazard Manufacturing Company, Pittsbu

R. Dawson Hall, *Coal Age,* New York City.

E. R. Hunter, M. D., American Red Cross.

J. E. Jones, Inspector, Illinois.

William Kerensky, Dodson Coal Company, Morea, Pa.

R. J. Lauder, Consolidation Coal Company, Jenkins, Ky.

John Lloyd, Lehigh Valley Coal Company, Wilkes-Barre,

Dr. W. A. Lynott, Webb City, Mo.

T. D. Lewis, Lehigh Coal and Navigation Company, La Pa.

H. D. Mason, Jr., Mine Safety Appliances Company, Pitt Pa.

H. H. Moore, Bureau of Standards, Washington, D. C.

D. H. Moore, Fayette Supplies Company, Uniontown, Pa

R. S. McGee, Aetna Life Insurance Company, Hartford

Dr. Mengel, Lehigh Valley Coal Company, Wilkes-Barre,

Wallace McKeehan, Phelps Dodge Corporation, Bisbee, A

G. E. McElroy, New Jersey Zinc Company, Franklin, N. J

J. S. McKaig, New Jersey Zinc Company, Franklin, N. J.

George C. Nelms, Mine Safety Appliances Company, Pitt Pa.

George B. North, Hazard Manufacturing Company, New City.

J. W. Paul, Bureau of Mines, Pittsburgh, Pa.

D. J. Parker, Bureau of Mines, Pittsburgh, Pa.

E. H. Price, P. & R. Coal and Iron Company, Pottstown, J

James L. Price, United States Government.

C. E. Pettibone, Pickands, Mather & Co., Cleveland, Ohio

Duke Peckett, Empire Steel and Iron Company, Catasauq

J. H. Payne, Westinghouse E. & M. Company, New Yor

G. W. Phillips, Champion Fibre Company.

Charles S. Pobat.

George Rowe, New Jersey Zinc Company, Franklin, N. J.

George S. Rice, Bureau of Mines, Washington, D. C.

J. T. Ryan, Mine Safety Appliances Company, Pittsburg

J. B. Riefkin, New York Edison Company, New York City.
Thomas T. Read, New Jersey Zinc Company, New York City.
Charles E. Rowe, Security Cement and Lime Company, Security, Md.
E. M. Shipp, New York City.
H. W. Stotz, Edison Storage Battery Company, Orange, N. J.
A. M. Staehle, *The Blast Furnace and Steel Plant,* Pittsburgh, Pa.
M. H. Sigafoos, Hazard Manufacturing Company, Wilkes-Barre, Pa.
F. K. Smith, Toledo Railway and Light Company, Toledo, Ohio.
B. F. Tillson, New Jersey Zinc Company, Franklin, N. J.
Clare J. Trager, Pittsburgh Coal Company, Pittsburgh, Pa.
John Wright, Aetna Life Insurance Company, Hartford, Conn.
C. A. Wood, Mine Safety Appliances Company, Pittsburgh, Pa.
H. I. Young, American Zinc, Lead and S. Company, Carterville, Mo.

WEDNESDAY AFTERNOON SESSION

THE Section was called to order at 2:45 o'clock by Mr. B. F. Tillson, Chairman.

REPORT OF CHAIRMAN.

Gentlemen of the Mining Section of the National Safety Council: After the lapse of a year we are meeting to give and receive stimulus in our endeavors to reduce hazards in the mining industry. The enlightenment resulting from a free discussion of the various safety measures and from personal contact between those who are giving these matters their best thought, as well as those who have not as yet become enthusiasts in the protection of their fellow-workers, has become all the more important because of the intensified demands made upon the mines as a result of the exigencies of war.

The demands for alert and able men to serve at the front have impaired the efficiency of the working organizations at the mines and it is evident that unusual measures must be employed to protect the remaining industrial labor from a loss of time or efficiency because of accidents, and to conserve every hourly unit of labor so as to obtain the maximum results from each man. This requires that every man shall be kept fit for his work and that the conditions

under which he labors shall be so free from hazards tha concentrate his attention and energies upon productive effo

MEETING LABOR SHORTAGE.

In the main, this problem may be met in two ways. Fir precaution should be taken to insure that the general and methods of mining are as free from risks as can pract devised. The mining equipment should be of such a qu in such condition as to minimize the chances and serious r accidents. Secondly, an intensive study must be made of mon sources of injuries and an educational campaign carri gain the co-operation of the men engaged in the work in a safest to themselves and their fellow laborers. They shou imbued with this knowledge that their unthinking actions cord with safe practices.

A rather ambitious program was planned for our activit ing the past year, but the many unusual wartime demanc upon the members of your Executive and other committe it impossible for them to meet more than twice and made unwise to push for greater activity in carrying out special re or for the establishment of standards to be recommended Safe Practices pamphlets.

PERSONNEL OF COMMITTEES AND SUB-COMMI FOR YEAR 1917-1918.

MEMBERSHIP AND PUBLICITY COMMITTEE.

Chairman—R. Dawson Hall, Associate Editor, *Coal Age* avenue and Thirty-sixth street, New York City. Members— Wolflin, Chief Mine Inspector, Industrial Accident Commis California, 407 Underwood Building, San Francisco, Cal.; Wilson, The Associated Companies, 524 Federal street, N. S burgh, Pa.; W. A. Luce, General Manager, Ellsworth Co 2216 Farmers Bank Building, Pittsburgh, Pa.; M. J. Bracke eral Superintendent, Tunnell Coaling Company, Gallitzin, P C. W. Goodale, Aanaconda Copper Company, Butte, Mont.

MINE RESCUE, FIRST AID AND CONTESTS COMMITTEE.

Chairman—William G. Whildin, Mining Superintendent, Coal and Navigation Company, Lansford, Pa. Members—L ant-Colonel Clarence H. Connor, American Red Cross, W

D. C.; Dr. A. F. Knoefel, 315 Terre Haute Trust Building, Terre Haute, Ind.; Dr. W. A. Lynott, Southwestern Missouri Mine Safety and Sanitation Association, Webb City, Mo.; E. E. Bach, Ellsworth Collieries, Ellsworth, Pa.; J. W. Paul, Mining Engineer, United States Bureau of Mines, Pittsburgh, Pa., and M. D. Cooper, Bessemer Coke Company, Oliver Building, Pittsburgh, Pa.

STANDARDIZATION COMMITTEE.

Chairman—George S. Rice, Chief Mining Engineer, United States Bureau of Mines, Washington, D. C. Members—Prof. J. S. Roberts, Professor of Safety Engineering, Colorado School of Mines, Golden, Colo.; John Lloyd, Efficiency Engineer, Lehigh Valley Coal Company, Wilkes-Barre, Pa.; Prof. F. W. Sperr, Michigan School of Mines, Houghton, Mich.; William Conibear, Safety Inspector, Cleveland Cliffs Iron Company, Ishpeming, Mich.; O. P. Hood, Chief Mechanical Engineer, United Staes Bureau of Mines, Pittsburgh, Pa.; Prof. Robert M. Raymond, Columbia School of Mines, New York City; Albert H. Fay, United States Bureau of Mines, Washington, D. C.; Dr. A. J. Lanza, United States Public Health Service, Butte, Mont., and Benjamin F. Tillson, New Jersey Zinc Company, Franklin, N. J.

PROGRAM AND PUBLICATION COMMITTEE.

Chairman—John P. Reese, Manager, Superior Coal Company, Gillespie, Ill. Members—H. G. Davis, Efficiency Engineer, D., L. & W. R. R., Coal Mining Department, Scranton, Pa.; Lauson Stone, Superintendent of Pittsburgh Station, United States Bureau of Mines, Pittsburgh, Pa.; A. J. Moorshead, President, Madison Coal Corporation, Chicago, Ill.; Edw. Steidle, United States Bureau of Mines, Pittsburgh, Pa.; Roy A. Cook, Safety Inspector, Hecla Mining Company, Burke, Idaho; R. S. Foster, St. Joseph Lead Company, Bonne Terre, Mo.;Wallace E. McKeehan, Safety Inspector, Copper Queen Consolidated Mining Company, Bisbee, Ariz., and Robert Harlan, Member of National Executive Board, United Mine Workers of America, Indianapolis, Ind.

ACCIDENT STATISTICS.

Chairman—Albert H. Fay, Mine Statistician, United States Bureau of Mines, Washington, D. C. Members—Royal Meeker, Commissioner of Labor Statistics, United States Bureau of Labor, Washington, D. C.; Dr. F. L. Hoffman, Statistician, Prudential Life

Insurance Company, Newark, N. J.; H. M. Wilson, The Asso
Companies, 524 Federal Street, N. S., Pittsburgh, Pa.; Benjan
Tillson, Head of Mining Department, New Jersey Zinc Com
Franklin, N. J., and William Conibear, Safety Inspector, Clev
Cliffs Iron Company, Ishpeming, Mich.

ROPES AND SAFETY DEVICES IN HOISTING AND HAULAGE.

Chairman—O. P. Hood, Chief Mechanical Engineer, U
States Bureau of Mines, Pittsburgh, Pa. Members—Profess
W. Sperr, Michigan School of Mines, Houghton, Mich.; W
Kelly, Manager, Penn Iron Mining Company, Vulcan, Mich.;
Behr, Consulting Engineer, Woolworth Building, New York
Mr. Sunderland, Chief Engineer, J. A. Roebling Sons Com
Trenton, N. J.; R. M. Catlin, Superintendent, New Jersey
Company, Franklin, N. J.; M. W. Reed, American Steel and
Company, Worcester, Mass.; C. W. Burrows, United States B
of Standards, Washington, D. C., and M. H. Sigafoos, Ge
Manager, Hazard Manufacturing Company, Wilkes-Barre, Pa

MINE HYGIENE AND SANITATION.

Chairman—Dr. A. J. Lanza, United States Public Health Se
Butte, Mont. Members—W. O. Borcherdt, Superintendent, B
Mineral Company, Austinville, Va.; Dr. W. S. Rountree, Chief
geon, Tennesee Coal, Iron and Railway Company, Wylam, Ala.
S. F. Mengel, Surgeon, Lehigh Valley Coal Company, Wilkes-B
Pa.; D. K. Glover, Safety Engineer, Lehigh Coal and Navig
Company, Lansford, Pa.; Charles A. Mitke, Copper Queen Co
dated Mining Company, Bisbee, Ariz.; Dr. Andrew W. Dowd,
Fuel Company, Sunnyside, Utah; N. B. Braly, General Man
North Butte Mining Company, Butte, Mont., and H. I. Yo
Manager, American Zinc, Lead and Smelting Company, Carter
Mo.

MINE FIRE PREVENTION AND FIGHTING.

Chairman—John Lloyd, Efficiency Engineer, Lehigh Valley
Company, Wilkes-Barre, Pa. Members—Edwin Higgins, Calif
Metal Producers' Association, San Francisco, Cal.; Oscar Cartl
Chicago Fire Brick Company, Ottawa, Ill.; T. Oaas, Safety E
neer, Anaconda Copper Company, Butte, Mont.; W. G. Whi
Mining Superintendent, Lehigh Coal and Navigation Comp
Lansford, Pa.; R. S. Foster, Safety Engineer, Doe Run Lead C

pany, Flat River, Mo.; Harry F. Randolph, Randolph-Means Company, Oliver Building, Pittsburgh, Pa., and J. W. Groves, Tennessee Coal, Iron & Railway Company, Birmingham, Ala.

STANDARDIZATION OF FIRST AID METHODS AND RULES FOR CONDUCTING AND JUDGING FIRST AID CONTESTS.

Chairman—Lieutenant-Colonel Clarence H. Connor, Director, Bureau of Medical Service, American Red Cross, Washington, D. C. Members—Dr. W. A. Lynott, Southwestern Missouri Mine Safety and Sanitation Association, Webb City, Mo.; Dr. A. F. Knoefel, Terre Haute Trust Building, Terre Haute, Ind.; J. W. Paul, Mining Engineer, Frick Building, Pittsburgh, Pa.; C. E. Pettibone, Chief Safety Inspector, Pickands, Mather and Company, Cleveland, Ohio, and E. E. Bach, Ellsworth Collieries, Ellsworth, Pa.

STANDARDIZATION OF MINE RESCUE TRAINING.

Chairman—D. J. Parker, Safety Engineer, United States Bureau of Mines, Pittsburgh, Pa. Members—George H. Deike, Mine Safety Appliance Company, 541 Fourth Avenue, Pittsburgh, Pa.; C. E. Pettibone, Chief Safety Inspector, Pickands, Mather & Co., Cleveland, Ohio; George E. McElroy, New Jersey Zinc Company, Franklin, N. J.; Dr. F. U. Ferguson, Tunnel Coaling Company, Gallitzin, Pa., and J. W. Paul, Mining Engineer, Frick Building, Pittsburgh, Pa.

ESTABLISHED A GOOD RECORD.

Nevertheless, as the reports of your standing committees will show, the activities of the Section have been considerable and we all owe much to the members of these commitetes who have unselfishly found time to accomplish so much under discouraging circumstances.

Forty-three new coal mining members and forty new metal mining members have been acquired since last year's Congress, so we now have a membership of 216 mining companies, of which 138 are coal mining members and 78 metal mining.

Our representation is principally from the large and important mining companies of this country and our bulletins, therefore, reach a large number of workmen.

We have printed fifty-eight mining bulletins, of which nine were distributed last year and thirty-one this year, and we have eighteen more printed bulletins ready for distribution. The technical program arranged for these meetings is practical and should appeal to a

diversity of interests; we have been fortunate in obtaining ad from men of experience and ability. It is to be hoped that profit by their presence to discuss freely the phases of thes tions which each of us has had occasion to consider.

FIRST-AID CONTESTS.

Until a short time prior to this Congress we planned for a Interstate First-Aid Contest, similar to that we held in Detr year, but a canvass of the opinions of different mining in resulted in a decision that it was advisable to omit this eve year, as it was difficult for the different mines to spare tea men from their operations during the present war conditions.

However, the Mining Section of the National Safety Coun fostered local first-aid contests and during the past year has thirty medals, which were competed for in five different fi contests, namely: In McAlester, Okla., on May 19; Joplin (City District), Mo., on July 4; Huntington, Ark., on May Cresson, Cambria County, Pa., on July 22, and Boswell, Sor County, Pa., on Sept. 2, 1917.

The detailed accounts of these meets will be published i transactions and will record the problems, teams contestin winners and their scores, so I will not take the time now to fi consider them.

In closing, I wish to express my appreciation of the pleasa operation given your Chairman by the other members of the E tive Committee of the Mining Section and to indicate the ple it has been to serve as your Chairman throughout the year, furthermore, to represent the activities of the Mining Sectio the Executive Committee of the National Safety Council.

May we now ask for a report from the Secretary of the M Section, Mr. J. W. Paul?

REPORT OF THE SECRETARY.

SECRETARY J. W. PAUL (Mining Engineer, United S Bureau of Mines, Pittsburgh, Pa.). *Mr. Chairman and Gentle* The Secretary has no written report, and, owing to the compre siveness of the Chairman's report of the details of the operatio the Section during the year, I have merely to report that the v of the Secretary has been [illegible]

matters in co-operation with the great activity of our Chairman during the year.

CHAIRMAN TILLSON: Mr. Hall, we will have a report from the Membership and Publicity Committee.

REPORT OF MEMBERSHIP AND PUBLICITY COMMITTEE.

MR. R. DAWSON HALL (Associate Editor, *Coal Age*, New York City). *Mr. Chairman and Gentlemen:* I have no written report, and I feel that after what the Chairman has said relative to our progress during the year it is hardly necessary for me to add anything. I really believe some of us did not quite grasp the whole significance of some of the things that he said, but we have gained forty-three coal mining members during the year and forty metal mining members. We now have 138 coal mining members and 78 metal mining members, making 216 members in all.

The work has been largely done by General Manager Cameron and the efficient force at his Chicago headquarters. Mr. Paul very kindly gave a list of coal mining men to the Council, and literature was distributed by the Council to these prospective members. I prepared a list of metal mining companies, so a fairly complete circularization of the whole field has been made. Of course, it takes more than circularization, it takes a great deal of hard work.

MORE PUBLICITY NEEDED.

The Council needs a greater degree of publicity. So far there has been, in the coal industry, a degree of publicity, but not all we might desire. The paper with which I am connected has donated quite a bit of space to that purpose, and I think it has been helpful, both to the Council and to the publication. Some of the other papers have not given us publicity to the degree I would desire, but I think that can be arranged in the course of the year. We need more publicity because circularization does not have the effect as publicity in the press. I hope, then, that during this coming year something will be done to enlarge our membership, and while I feel that I have done very little myself—so little, in fact, that I really do not deserve an appointment—I sincerely trust that if I am reappointed I will find time to serve you better in the coming year than I have in the past.

STANDARDIZATION COMMITTEE.

MR. G. F. RICE (United States Bureau of Mines, Wa D. C.). *Mr. Chairman and Gentlemen:* I have no writt of the committee's proceedings. The Standardization Com your Chairman will recall, was formed rather late. The c is composed of a series of sub-committees, and, after havi received acceptances from the various groups, only one problems were presented to the full committee. One of the resulted from an inquiry by a mining company as to wha be a proper clearance between cars. That problem, toget other features of the same sort, was submitted to a sub-cc to see if there could be found a way in which rules could be about. Inquiries were also made in reference to ropes.

LACK OF STANDARDS.

It is not altogether clear to the Chairman of your Standar Committee just what will be the final direction of the effort Standardization Committee. It seems to me, however, that an opportunity of doing something which may bear fruit. that in other departments of the National Safety Council st ization has borne fruits. There have been valuable publ on certain phases of railroad work and in quarrying, and I reason why this is not as good a time as any to attempt more work. Those who first enter into the mining field are fre surprised at the tremendous variety of standards—maybe the of the tracks or the size and kinds of cars and that sort of t and the tremendous variety that we have is conspicuous.

On the other hand, there are many mines which do not hav lar conditions and we notice, as a whole, the mining population from one district to another. In the interest of safety it doe very desirable that we should have such things as standard ances, and, to a certain extent, a standard of couplings or m of connecting cars.

Of course, with the problems we have, there would have some variety; there would have to be certain classifications an tinctions between coal mines and metal mines, but whenever plant is about to be designed, a new mine, the designing engi it seems to me, totally disregard almost everything that has done before. It

I hope that if these committees are continued, if I serve or if someone else serves, that practical questions will be brought up which, through discussion, will bring about the desired results.

SUGGESTIONS FOR SAFE PRACTICES LEAFLETS.

CHAIRMAN TILLSON: I might interpolate here a thought in answer to the question raised by Mr. Rice, as to the opportunities which the Standardization Committee could serve. The Safe Practices pamphlets issued by the National Safety Council have proven to be one of the most valuable items which it offers to its members. These pamphlets are the result of the co-operation of a number of safety engineers in considering the safe way of performing certain operations or constructing certain units of equipment. It seems to me that our Standardization Committee can fulfill a very great service through questionnaires and meetings of its committee, by gathering ideas as to methods which are safe in any particular branch or equipment of mining work, and from the information they could develop Safe Practices pamphlets.

The National Safety Council has considered it unwise to make any set of standards or rules, saying that you shall use such methods. They consider it more advisable to describe the safest way or safest method suggested by a consensus of opinion as a correct method or correct equipment, and permit members to profit by their advice. I think that our energies can be very usefully spent along those lines.

The Chairman of the Program and Publication Committee is absent, so we will pass the report. All members of this Section are requested to forward to the Secretary any literature which we can use in forming bulletins. I hope that you will all consider it part of your privilege and duty to help this committee in its work.

The Accident Statistics Sub-Committee, represented by Mr. Fay, is not present.

Mr. Hood of the Ropes and Safety Devices Committee is not present.

The Mine Hygiene and Sanitation Committee, of which Dr. Lanza is Chairman, has a representative here in the person of Mr. Young. He has a paper on the subject that will cover any report there is to make.

THE MINE FIRE PREVENTION AND FIGHTING SUB-COMMITTEE.

MR. JOHN LLOYD (Efficiency Engineer, Lehigh Valley Company, Wilkes-Barre, Pa.). *Mr. Chairman and Gentlen* The committee has prepared no report. The members of the c mittee have been unable to get together.

CHAIRMAN TILLSON: I will ask the Standardization of F Aid Methods and Rules for Conducting and Judging First Contests Sub-Committee to report later.

Standardization of Mine Rescue Training Sub-Committee- Mr. D. P. Parker, Chairman, is out of the room, we will ask f report later.

APPOINTMENT OF NOMINATING COMMITTEE.

Next in order is the appointment of a Nominating Commi Its duty is to present to our final meeting nominations for offi of the Mining Section for the coming year. It is the pleasur your Chairman to ask Mr. R. Dawson Hall, Mr. D. K. Glover Mr. H. I. Young to serve on this committee. You will pl arrange to meet and present your suggestions at the meetin Thursday afternoon.

It is understood that the functions of your Nominating C mittee are merely to put forward names for consideration, so we will not lapse into an undecided state of getting officers. N nations from the floor are equally as acceptable as the repor the committee.

Is there any new business to be brought before the Mining tion? If not, we will proceed to the technical part of our prog and I will ask Mr. John Lloyd, Efficiency Engineer of the Le Valley Coal Company, to address us on the subject of "Mine Prevention and Fighting."

MINE FIRES AND THEIR PREVENTION.

JOHN LLOYD, EFFICIENCY ENGINEER, LEHIGH VALLEY COAL COMPANY, WILKES-BARRE, PA.

Mr. Chairman and Gentlemen of the National Safety Cou Mine fires and their prevention are matters of great importance cause a great deal of anxiety to both owners and managers. M fires, fortunately, are not of very frequent occurrence, but when

do occur the damage to property amounts, in many instances, to thousands of dollars. Often there is considerable loss of life.

There is also always an element of danger to lives when fighting mine fires; especially is this true where the fire happens in that part of the mine that has not sufficient air current to carry the fumes away from those fighting the fire. Considering the amount of combustible materials in a mine—consisting principally of mine timbers of all grades that are necessary to carry on operations—it is a marvel that fires are not of more frequent occurrence. Mine timbers decay rapidly and provide an easy means of carrying or retaining sparks that might accidentally drop from the miners' lamps. Ventilating doors are also a menace if naked lights are carelessly handled too close to the crevices or where slight leakages occur. A wooden air bridge, no doubt, is the highest risk in this respect to any other method of construction.

REMOVE ALL DECAYED TIMBERS.

In order to avoid fires as much as possible, all decayed timber should be removed to the surface; air bridges, stoppings, ventilating doors and all permanent structures of any nature should be constructed of non-combustible materials. Where timber stoppings and brattice are used, either of a temporary nature or otherwise, frequent inspections of such structures should be made and repairs promptly executed, so that it will not be possible for a fire to gain sufficient headway to cause serious damage before it is discovered and extinguished.

When electric power is used in the mine, care should be taken to avoid any short-circuiting of the wires, by providing substantial supports and careful insulations. Mule barns and other structures should be properly lighted by electricity.

Men who work in or who have occasion to pass through heavily timbered sections of a mine should be cautioned to be careful, especially when they carry open lights. It might result in a considerable advantage to all mining companies if they were to institute a campaign of education along the lines of the Safety First movement in the nature of fire prevention.

PREVENTION OF MINE FIRES.

The attention of every individual who works in the mines should be directed towards the prevention of mine fires. Those who are employed on timber renewals should exercise extraordinary precau-

tions and make a thorough examination after each day's work completed, as many fires have started where men have been engaged on timber repairs. Such fires are the result of carelessness and inexcusable indifference to safety of life and property. We can be too active in bringing about results that will ultimately eliminate entirely all fires of such nature. These, in a general way, are the precautions that should be taken. Details should be thoroughly studied in every mine by the foreman and his assistants.

In order to successfully fight a fire, the first requisite, of course, is an abundant supply of water. Where water is scarce a good supply of (liquid) fire extinguishers should be kept convenient to hand. These can be procured in various sizes, the handiest for immediate use being those which are of from one to three gallons capacity. There should also be a number of large (liquid) fire extinguishers provided. These are mounted on wheels and have a capacity of from forty to eighty gallons. Two forty-gallon units are preferable to one of eighty-gallon capacity.

FIRE-LINE SYSTEMS.

Mines that are dry should have a good, substantial fire-line system extending to all parts that are heavily timbered. Connections should be provided at convenient points, with a substantial amount of hose on hand, properly racked and ready for instant use. When it is not advisable or necessary, on account of the damp condition of a mine, to pipe the same for fire protection, a sufficient amount of pipe should be available to reach any part of the mine from the main water source. There should also be sufficient number of fittings and valves, so that the erection of a pipe line can be quickly accomplished. Some of the large mining companies have provided a sufficient supply of such materials and keep them in a freight car conveniently arranged, so that all fittings can be readily located, the car being placed at a central point, when it can be quickly moved to any of their mines.

Isolated collieries that have no permanent fire lines and equipment to fight a fire should keep a reasonable amount of the following material on hand:

Two and one-half-inch standard wrought iron pipe, or some other suitable size.

Pipe wrenches.

Pipe fittings, consisting of elbows, tees, nipples, coupling flanges and gate valves.

Fire hose to suit the size of pipe used.

Tools such as are ordinarily used at a mine, consisting of picks, shovels, drills, sledge hammers, axes, saws, etc.

Brattice cloth, brattice boards and nails.

INSPECTING FOR FIRE.

A great many of the fires are not discovered until the morning examination is made by the fire boss or assistant foreman, when, no doubt, the fire had started during the working day or shortly before the men were about to leave the mine. It would seem advisable that all mine sections where men work or must pass through to reach the surface, should be thoroughly inspected very shortly after the day's work is completed. Such inspections should be made by men who are thoroughly reliable and feel the responsibility of their positions. This practice is followed, to a certain extent, by some of the large companies.

DISCUSSION.

CHAIRMAN TILLSON: We are favored by having such a splendid opening to the discussion on this subject as Mr. Lloyd's presentation. There are others who have spent considerable thought on this question and I trust you will give us your views. I ask for volunteers.

MR. C. E. PETTIBONE (Chief Safety Inspector, Pickands, Mather & Co., Cleveland, Ohio): I would like to ask what kind of hose the members have found most satisfactory for underground use, particularly where it is stored in a damp place.

MR. LLOYD: From our experience I have found that rubber-covered and rubber-lined hose is the most preferable inside the mines. It does not mildew and lasts for a great many years.

MR. G. F. RICE: What is found the best standard size of hose for mines?

MR. LLOYD: The anthracite mine companies use two and one-half inches or two and five-eighths inches with two and one-half-inch gaspipe fittings. These are used almost universally.

MR. RICE: Do they have any standard pressure?

MR. LLOYD: No; that would depend a good deal on the source of supply. Most of the drainage pumps are equipped with connections for fire fighting and the pressure, of course, would be equal to the head or the depth of the shaft.

MR. RICE: They do not use differential valves?

MR. LLOYD: Not to my knowledge.

SECRETARY PAUL: May I ask Mr. Lloyd as to the standardiz tion and the sizes of nozzles for hose used for fire fighting?

MR. LLOYD: The standard underwriters' nozzle is used, fro seven-eighths to an inch hole.

MR. RICE: Can two men handle the hose?

MR. LLOYD: That depends on the pressure. Sometimes w have pressure due to a 600-foot head. I have tested hose under tho conditions and it took four men to hold it.

CHAIRMAN TILLSON: Under such conditions, would you fee perhaps, that a differential valve might be of value?

MR. LLOYD: I believe it would. It is a good suggestion to brin out, considering the conditions. We can reduce the pressure, if is necessary, by choking off, you understand, using an ordinary gat valve.

FIRE IN COAL AND GOB.

MR. R. DAWSON HALL: I think it might be interesting to th members if Mr. Lloyd would say something about the drive types— the kind which they use to put out fires in places they can't reac in any other way, due to falling materials. The Lehigh Valle people, as I understand, use a drive pipe for conducting water t places they can't reach by ordinary hose.

CHAIRMAN TILLSON: That is a gob fire you are referring to

MR. HALL: Yes, it is a fire in the coal and in the gob.

MR. LLOYD: We have in our fire car, the only place we kee them, these long nozzles—made from pipe anywhere from an inc up to two and one-half inches—and these nozzles are about ten fee long. They can be coupled to standard hose. They are pointed; th blacksmiths point them somewhat like a shell, and they are per forated for a distance of four or five feet with holes ranging abou one-fourth of an inch in diameter. We also keep, centrally located, available at all times, about 10,000 feet of two and one-half-inch pipe that can't be used for any other purpose.

CHAIRMAN TILLSON: Mr. Glover, I happen to remember, two years ago in Philadelphia, that Mr. Whildin of your company made some very interesting remarks about organization for fire fighting. Will you give us a little more information?

MR. D. K. GLOVER (Safety Engineer, Lehigh Coal & Navigation Company, Lansford, Pa.): The system ~~now in vogue at all our collieries~~ is as follows: We have compressed air lines, standardized to two and one-half [illegible]

have a pipe with another valve, which is connected with the water supply, so that, on an instant's notice, a compressed air valve can be shut and the water valve opened. We would have water on our pipe line inside of fifteen or twenty minutes. In addition to that, each one of our assistant foremen has a map showing the little details which never appear on the standard twenty-foot map. He is acquainted with every valve in his section. In case of an emergency, if the assistant foreman should be one of the men overcome, we would not be at a loss to know the condition of his place in his absence, nor would we be forced to rely on the foreman who looks after the entire mine. The assistant foreman makes the sketch. We scale them by the engineering department, put a small scale on a handy blue-print, and the fire lines are marked out in red lines, with the locations of the valves and directions for shutting the valves in any particular part of the section or the entire mine in general. These maps are gone over at the meetings of the foreman and the assistant foreman, and often come up in our safety meetings.

We find that the little kink of having the connection on the surface amounts to quite a saving of time in case of an emergency. There is no question of running about and looking for pipe; we maintain a large supply at the storehouse—two and one-half-inch pipe—and never let the supply get very low.

FIRE PATROLS.

Another feature Mr. Lloyd spoke about in his paper was the examination. I do not know whether Mr. Lloyd's company, the Lehigh Valley Company, have gone into the appointing of fire patrolmen or not, but we have. Our mines work from 7 in the morning until 4 o'clock and our fire patrolmen go on duty at 4:30 o'clock. Each fire patrolman looks after two fire boss sections. He travels around with an Edison electric cap lamp and a safety lamp. He is not allowed to carry a naked light, so there is no chance of him leaving any sparks after he has passed over the territory.

When he comes out he records in a book the condition of the places he has examined as to safety and fire and electric current.

We had one fire in our No. 9 colliery that resulted in considerable loss of production. It was caused by a stick of lumber falling on a trolley wire. We have section switches at the entrance of each gangway and in addition we have other section switches on the main haulage road. The last switch is outside; this controls the entire power for inside.

Any time there is a period of two or three days in whic is no operation, the foreman can pull out the switch on the and lock it and be absolutely sure there is no power going i cause fires by falling timbers.

We had an experience on October 25, last year, in No. 1, trolley wire came out of the hanger during the late afternoon, the patrolman had come on duty, and came in contact with timber. The steel timber carried the current to the coal and to it.

In half an hour or so the patrolman came on duty and dis the fire, reported it, and in another hour or so the fire was out brought to light the value of having the fire patrolman m rounds after everyone else has gone home.

To prevent fires in the future occurring in that mann designed a standard guard board that we use wherever the wire passes through a section timber. It is constructed by a sill, going up from one set of steel timbers to another, and sill there is an eight-inch plank, nailed to the sill. A little fill care of the web of the steel timber. The hangers are then f onto the sill rather than fastened to the steel timber, so tha you have a pipe hanger that has to extend possibly from eigh to a foot or a foot and a half below the trolley wire, the troll comes out against the sill, instead of the pipe itself, whicl to come in contact with the steel timber.

We have not succeeded in getting all our places fixed up th but we have not had any fires of that nature since, although occasions where the trolley came out of the hanger and fell the support.

MR. WALLACE MCKEEHAN (Phelps-Dodge Corporation, Ariz.): Can you cut off your current, if necessary, after yo is out?

MR. GLOVER: In some cases, yes. That is, taking care night shift, which come out from work about 11 o'clock; othe about 3 and work until 11. The patrolman is on duty aft men, and he may have the power on at that particular place is only on in the one gangway. He has to make his route ar his ground after those men have gone home. The circuits ranged so that he can shut off any one place without di another place.

We also have an automatic system. We are installing a

shut off as soon as it is short-circuited—one section is shut off so as not to interfere with the operation of the rest of the mine.

SPRINKLER SYSTEMS.

CHAIRMAN TILLSON: May I ask a question in regard to this subject: Whether the use of a sprinkling system in timber shafts, either in metal mines or coal mines, for fire protection, has been in vogue among any of the companies represented here?

MR. PETTIBONE: We use in practically all of our mines, in a vertical shaft, the sprinkler which consists purely of a sprinkler at the top of the shaft. We found, after a fire in one of our shafts, it was a good idea to keep the control valve about 100 feet from the shaft.

We had an occasion where fire from a locomotive set fire to a timber trestle and it communicated to the shaft house and then to the shaft. The fire was so hot it was impossible to get close enough to open the sprinkler valve. Since that time we have had all our sprinkler valves removed to a distance of 150 feet. We have had occasion to work such valves several times, and they have worked successfully.

It is a little harder on an inclined shaft. In that case we usually take the water line, coming up from the shaft, and put a series of sprinklers through the entire length, operating with one long cable. This is also operated from the top.

CHAIRMAN TILLSON: Have you used an automatic sprinkler system such as we use for mill and building protection, say the Grinnell valve of fusible alloys?

MR. PETTIBONE: No, we have not.

CHAIRMAN TILLSON: Has any one knowledge of such an installation?

MR. MCKEEHAN: We have four timber shafts and they are all equipped with sprinkling system. Most of our shafts, of course, contain three to five compartments and we use a portable every twenty-five feet in each compartment the full length of the shaft. Our shafts are from 450 to 1,600 feet deep.

We found that turning water into a shaft at any one particular point has no great value—it has to be distributed over the length of the shaft. We had one sad experience with a mine shaft. Any one with experience with a mine shaft on fire knows that no matter where it starts it soon reverses the air current and if the water is thrown into the top it is not very effective below. Consequently, we

tap our lines—we have special lines just for the water, tappe twenty-five feet, and on each center. That makes three different nozzles at these points. This water is turned in top, but, in addition, we have air-controlled doors off of each We go a sufficient distance away from the shaft to get in ground. We put in concrete bulkheads and steel doors, ar are air controlled. Before the water is turned into the sha doors are closed.

We have a very positive rule that nobody can turn wa a shaft that is on fire except on orders from the superin That is due to the fact that sometimes the air current is rever we might catch men in the mine. We are very particular abc Nobody but the mine superintendent can close the doors or the water. Our mines of the Copper Queen units are all ve with pressure systems, and I think we have a very thoroughl of ventilation. I know that our mines are clear of workmer there is any interference with the ventilating system. Our me be one or two or three miles away from the shaft, and w have other openings where they can get out, they might get

I was interested in Mr. Glover's statement about his fir men. We have what we call "fire bugs;" but we send them in Under our state law our men can stay underground only eigl but we start these men at 9 o'clock in the morning, which gi sufficient time to cover the mine after all shafts are closec must make reports. I feel that in our work inspection is the of the game—it is just like the prevention of accidents, if th tor is working for us. We have enough men to cover t within two hours. That is a big preventive measure. system we have is the giving of a fire signal. We have private phone system, and, of course, we work two shifts. fire-bug should discover a fire after the night shift has gon even after the day shift, all he has to do is to call the centra and report a fire in a certain division. All our mines are k divisions Nos. 1, 2 and so on. He reports a fire in this and the operator notifies the other men, starting with the tendent, then the plant inspector, and so forth. The opera about fourteen men.

These men must all go to their stations. The superinten to his office, the supply man goes to the supply-house, and th mechanic goes to his office, so that the superintendent ca

We have had a number of mine fires, and some very disastrous ones. Consequently, we keep our organization in good working shape all the time. The time to fight a mine fire is right at the start. The first hour is worth a whole lot more than the succeeding days, so we get after it at once.

TURNING WATER INTO SHAFT.

MR. RICE: I might supplement the previous speaker's remarks about certain dangers of turning water into a shaft for extinguishing fires without knowing just what conditions are, by reminding you that in at least one or two fires—one notably, in Nevada—where men were in the mine, not a large number but quite a group, were probably smothered through turning on the water. The shaft had been up-casting and the water was sufficient in that case to reverse the air and affect the men below. Another case of that sort occurred in a Lake Superior mine, so I think great caution should be exercised before that is done.

In speaking of devices used in fire-fighting, I wonder whether any one in this country has used a device I saw abroad some years ago. It struck me as very good—a valve made for quick attachment to a column pipe, or if there did not happen to be an attachment for fastening to a hose, they could clamp this on a pipe and put a valve on by drilling through the pipe. They had a very quick attachment for drilling and they made a connection in this way for the hose. It was a part of the equipment of a co-operative mine fire-fighting station and it struck me as a very good device.

CHAIRMAN TILLSON: I might possibly answer your question, or possibly you know there is a standard tool which is often used on water service mains in the cities for tapping mains. I do not know whether they get to two inches in diameter or not, that is pretty large, but for tapping pressure mains there is a regular pipe cutting attachment. I presume it is the same thing you describe, Mr. Rice. It answers the same purpose. It is just a question of buying such equipment from hardware dealers, because it is well-known standard equipment.

The question I raised originally was in regard to automatic sprinklers. I take it from all the remarks that nobody is using an automatic sprinkler and that one possible objection to the same would be the reversal of air currents when it would not be wise to do so. Does any one know of any other objections to the use of automatic sprinklers, such as are used in buildings?

MR. LLOYD: One objection would be freezing up. It be possible to maintain such a system during the winter.

MR. RICE: The fire people have met that objection they keep them air-filled, so that they are not affected by

CHAIRMAN TILLSON: We do the same thing in unhea ings.

MR. LLOYD: That is true, but I have had experienc connections in shafts. They do not remain tight, due to pa

MR. GLOVER: I will bear Mr. Lloyd out in that. In shafts it has been our experience to have the air line freeze the water line. In our particular location it is not necessa any sprinkler system. We need a drying system to dry out

REMOVAL OF DECAYED TIMBERS.

SECRETARY PAUL: I would like to ask Mr. Lloyd a q regard to this paper. He made mention of the possibility sity of removing decayed timbers from the mine. I re oftentimes timber is so located in the mine that it is n recover it. It necessarily remains there, and, in the cours becomes decayed or oxidized. I would like to ask Mr. Llo is any danger in the anthracite field of it causing fires thro taneous combustion or through liability of contact of o with the decayed timber.

MR. LLOYD: I do not think there is any likelihood of sp combustion. What I referred to—possibly I did not make was that decayed timber should be removed from trave All live roads should be clear of decayed timbers. I did that to apply to all places.

MR. DAVIS: I think the custom is to remove any that can be taken from the mine, not on account of da spontaneous combustion so much as the danger of carryi from point to point. We have known a fire, at one of ou in the Wyoming Valley, to jump 1,500 feet on a gangwa the high temperature from the fire reaching old, decayed t does not seem possible, but it is a fact.

Going back to this other question of providing fire line posing air lines for that purpose, we did that for many ye mines and it worked out all right, except once, and we r water that once the worst we ever needed it, only to fi lines were all frozen solid. We came to the conclusion tha

and equipment, such as described by Mr. Lloyd—regular fire-fighting equipment.

At our Kingston station we have a rescue car and rescue apparatus, electric lamps and everything that goes with rescue apparatus. We maintain a separate car, loaded with such fire-fighting material as Mr. Lloyd described. Just the minute a fire is recorded in the mine, that entire equipment, together with the hospital car—in all, three cars—is sent into that mine. It is possible that before they arrive the fire is out—so much the better. I think if you desire successfully to protect your mines from fire you must have separate lines.

One of the most important questions is how to provide suitable water for your lines. We did not, for years. We depended upon our mine pumps for fire-fighting purposes. We do yet, but our lines for fire-fighting purposes are connected with the mains on the surface, and the minute we have a fire at any point in the mine the pumps are started and the valves opened, and we get the pressure on the entire line.

The object of keeping the mine water away from the fire line is to preserve it. Our mine water is very bad and oftentimes when we wanted water we found the pipe was not good and we had to change the pipe or a few lengths of hose and so on.

USE OF TREATED TIMBER.

I do not know whether it has occurred to anybody else or not, but it occurs to me, in connection with fire prevention, that treated timber should be used in preference to untreated timber. I expect somebody will object to that, and for that reason I would like to hear the matter discussed. There is an objection to it, I know, but I would like to argue whether or not it is safer to have the treated timber in mines or untreated timber which becomes decayed and is liable to receive a spark from a mining lamp and hide itself for some time and all at once break out in a furious fire in the timber section of a gangway. It seems to me we can get away from that danger by using treated timber. I do not say what it should be treated with—maybe some one here representing the people who manufacture creosote or something else could tell us.

MR. RICE: Before Mr. Davis finishes the other subject I would like to ask, if I may, a question of how he handles the question of preventing freezing in his water lines by having a separate line. Is

it by circulation, or always going down the down-cast, or do heat the water?

MR. DAVIS: We heat it with a small steam connect have to do that with our shafts, which run from 1,220 to 1

CHAIRMAN TILLSON: Where do you put the steam?

MR. DAVIS: On the surface. We have a steam pipe down every shaft, and we put in a one-quarter-inch connect surface. Sometimes we do not connect it at all, we bind cover it up—bind the steam and water pipe together. Th the purpose very well. We did try hanging these pipes ir shafts, but we found that very inconvenient at times.

I do not know whether Mr. Lloyd knows anything a question or not, as a fire preventive, whether or not ot gangway roads should be built of treated in preference to timber, thus doing away with the chance of decay. I do : how long it would take treated timber to decay; I never sa that did decay.

MR. LLOYD: In answer to Mr. Davis' question, we ha that has had treated timber in the gangways for somet twenty-two years. To my knowledge, there has never be in those gangways, but we have had fires where untreate was used. That would seem to support Mr. Davis' idea.

CHAIRMAN TILLSON: Treated with what—creosote, neum or chloride of zinc?

MR. LLOYD: Creosote. I would like to ask a very i question on this matter: Whether or not any of us have i ill effects from the use of chemical fire extinguishers in extinguish a fire in the mines—sickness or ill effects chemicals?

MR. DAVIS: I will answer that in the affirmative and why.

CHAIRMAN TILLSON: Dr. Lanza is the Chairman of mittee on Underground Mine Sanitation. He has prepare which Mr. Glover will be kind enough to read after we ha address from Mr. H. I. Young, Manager of the Ameri Lead and Smelting Company, Carterville, Mo.

*UNDERGROUND MINE SANITATION.

H. I. YOUNG, MANAGER AMERICAN ZINC, LEAD AND SMELTING COMPANY, CARTERVILLE, MO.

DR. A. J. LANZA, UNITED STATES PUBLIC HEALTH SERVICE, BUTTE, MONT.

Mr. Chairman and Members of the National Safety Council: The importance of proper mine sanitation is at present greater than it has been at any time heretofore. All mining industries are now crowding production, and in order to maintain maximum output employes must be in good physical condition in order to be efficient in their work. Best efficiency can only be realized when proper sanitation prevails in the underground workings of the mines.

When underground sanitation is mentioned it generally conveys to the hearer the process of cleaning up trash, food refuse and maintaining proper toilet facilities. Making underground working places healthful, the removal or mitigation of conditions that threaten the life and welfare of the miner, imply a great deal more than the cleaning up of what are properly classed as nuisances but which do not in themselves menace life. Underground sanitation has for its sphere the elimination of certain conditions and processes that are intimately connected with mining; conditions directly detrimental to human life and which, unfortunately, are largely considered as inseparable from mining. It is probable that in spite of the utmost care and effort there will always be an accident hazard in the mining industry; there is no good reason why there should be a distinct health hazard, and the prevalence of miners' consumption is an evidence of the general cheapness at which we hold human life.

Health conditions that menace human life underground are largely within the domain of the metal mine rather than the coal mine. Foremost in the ranks of offenders against mine sanitation is hard rock dust. We believe it may be safely asserted that for every man killed or disabled by injury in hard rock mines, twenty-five have been victims of hard rock dust. The history of hard rock mining districts throughout the world is predominantly overshadowed by the spectre of miners' consumption, and unfortunately the

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*The material for this paper was obtained through investigations conducted on behalf of the U. S. Bureau of Mines and the Public Health Service in mines in the Joplin district of Missouri and in the vicinity of Butte, Mont.

relationship between cause and effect is not as evident in dis
in injury.

MINERS' CONSUMPTION.

Miners' consumption, be it understood, is a disease of the
mechanically produced by the inhalation of particles of silicio
which research has shown to be so small that they average bu
to five microns in diameter. The structural changes produced
lungs by action of silicious dust cause shortness of breath or
tion, with a gradual disabling of the miner. The injury to th
tissues predisposes to tuberculosis, so that the victim of roc
finally succumbs to the latter disease, usually leaving an
erished and often an infected family. Miners' consumpti
been recognized for centuries, but it remained for the machi
to elevate it to the position of one of the foremost occup
diseases. This does not mean that only the machine ma
miners' consumption; the shoveler, the timber repairer, the
or others who move the broken ground, may also be exposed
inhalation of silicious dust.

Cases of miners' consumption have been seen in mill me
had never worked underground. Generally speaking, the
silica in the dust, the more harmful it is; the flinty dust
sheet-ground mines of southwestern Missouri, for instance,
silica content well over 95 per cent, being among the most ha
Once dust is in the mine air the protection of miners by resp
or other devices is fallacious; no respirator can be comf
worn by working men and eliminate dust less than five mic
diameter. The remedy lies in preventing and laying dust
proper use of water in drilling and sprinkling.

In this country indiscriminate dry drilling is but little re
by law; many states have laws on the statue books, but they
actually regulate dry drilling. England, South Africa, A
and British Columbia have enacted laws which enforce seve
alties for dry drilling in hard rock mines; possibly in some
the law is not strictly enforced, but at least an effort is
Blasting, chambering holes, shoveling, repair work, loading
of chutes may all cause much dust under certain condition
the overcoming of this by proper sprinkling is law in other
tries. A recent investigation of the prevalence of miners' co
tion among the sheet-ground miners in the Joplin district i
indicated that about 35 per cent of them were affected, w

about the same conclusion arrived at after many thousand examinations of miners on the Rand. In other large hard rock camps in this country it would appear that the percentage is also large. But suppose we put it as low as 5 per cent; an industry showing 5 per cent of the workers afflicted with an occupational disease reveals conditions that should not be allowed to prevail indefinitely. But it would appear that the situation is not materially improving, especially where mines are getting larger and deeper.

ELIMINATING INJURIOUS DUST.

The elimination of injurious dust, then, is of prime importance in mine sanitation. It can be secured, first, by doing away with dry drilling. Two methods may be resorted to—the use of drills which feed water through a core in the steel, or the application of water to the holes while drilling by water lines, sprays affixed to the drills or squirt guns. The first is the best method, as it insures constant application of water and puts less reliance upon the coöperation of the miner, consequently it is less likely to fail.

Until 1914 only reciprocating or piston drills were used in the Southwest Missouri district. A number of sprinkling devices had been tried in an effort to lay the dust, but without success. Since that date hammer drills, which feed water through a core in the steel, have been installed in the majority of the hard-rock or sheet-ground mines. These machines wash the cuttings from the hole and produce very little dust. Where piston or stopping machines are used, and two men are employed in the working face, independent water lines can be installed and water sprayed through a nozzle on the collar of the drill hole, which will help lay the dust, but this method is not as effective as the water drills. The installation of the water drill has not only improved the sanitary conditions for the machine men and other underground employees, but it has also enabled them to increase their efficiency, as the drilling speed of the drills where water is applied is much greater than dry drilling.

Spray attachments fixed to the drill are efficacious when working, but are apt to be messy and much of a nuisance, and it is the history of most places where tried that the men soon stop using them. Squirt guns loaded from buckets of water that have to be carried to the working place are apt to be a failure, especially if the men have to carry water up to a stope or raise. However, local conditions will usually determine which system is indicated. While water hammer drills and water drills of the jackhammer type have

proved successful, there does not seem to be a wholly sa water stoper for drilling overhead holes, though the evc such a drill is largely a question of demand. The reason w stopers have not been as successful as other water drills is due mostly to the attitude of the men; miners usually objec to using water overhead where it may fall back on them laws, proper discipline and a little educational work wo come this objection in time. It should be recognized tha sufficient to have a law compelling an operator to furnish ing drills or appliances; the law should go further and m use obligatory on the miner and provide penalties for do so.

The system of chambering or squibbing holes, popping loading ore out of chutes, or shoveling broken ore, also dust, and to eliminate this some mines have employed m duty it is to sprinkle the broken dirt in the mine daily a see that all holes drilled during the day are washed out. that no squibbing may be done during working hours, laws passed in Missouri making it a misdemeanor for a miner t dry hole during work hours. Shooting of large boulders a much dust and this should be prohibited during the shift, this can be done when the shift goes off duty. Also the b the ground should be done when the shift goes off, and in there is more than one shift working the last shift c blast all dirt.

VENTILATION.

The matter of proper mine ventilation is of much in In the coal mining districts this is regulated by state la ever, this is not the case in the majority of the metal m tricts, and various systems of mechanical ventilators are practically all states more than one shaft or opening is when several openings are available, the installation of a tion or blower fan can be made, which will give proper v In mines where there are not sufficient openings, ten-inch have been put down and small ventilating fans installe give good results.

We include under this heading high temperatures with humidity, and gases and powder smoke, as the lack of prop tion usually carries one or more of the others in its train.

mines, are within the domain of the engineer rather than the sanitarian, but the latter may point out the ill effects that result where ventilation is insufficient.

Where men work in the presence of a high temperature and a high relative humidity, there is an impairment of physical ability and vitality, in proportion to the severity of the conditions; experience has shown that such impairment begins when the temperature is above 75 degrees Fahrenheit and the atmosphere is saturated or nearly saturated. Where heat and dust are combined, and this combination is not infrequent, especially arduous conditions result. Whether working in moist heat, in itself, produces any permanent ill effect on the physical organism is a matter of dispute; but certainly the depressed vitality, if only temporary, affords a better chance for other diseases to take hold; where the winter is severe, the sudden transposition from hot working places into the cold is a contributing cause to pneumonia and acute chest infections, which in turn help on the advance of tuberculosis. Men with dust-injured lungs are particularly liable to pneumonia and chest colds. Among the lesser evils of poor ventilation are the effects of powder smoke, though it would seem that the headache and temporary disability caused by powder fumes are the only damage they do. The presence of deleterious gases in sufficient amount to threaten life usually implies an emergency outside of the scope of the sanitarian. So remarkable are the benefits, so far as efficiency is concerned, where previously inadequate ventilation is remedied that it needs no other argument in its favor.

An example of this came under observation recently. The cost of driving a long drift, about 2,000 feet below the surface, was $15 per foot, paying on a day-labor basis; the place was hot and moist; a small blower fan was installed at the shaft, with a canvas pipe leading nearly to the working face. Without any other changes the cost was reduced to $8 per foot. In shaft sinking this mine had made 50 feet in one month and 60 feet in another. A small blower with canvas pipe was installed and the next month a progress of 120 feet was made. No better evidence could be given of the deleterious effect of poor ventilation on working ability.

LATRINES.

Inadequate systems for the disposal of human waste underground lead to promiscuous ground pollution. This is often an offense against decency, and, where conditions are favorable, may

lead to the spread of hookworm disease and possibly ty
In some of the Southern and Southwestern mines th
menaces. A proper toilet system should be provided ir
adequate to the size of the mine, and use of same sh
be compulsory.

A very simple type of latrine has been used in the A
in the Joplin district during the past six months, and
very satisfactory. It is constructed of cast iron, bri
crete. (Sketch filed with the Council.) This is co
that all openings can be closed with the exception of
is connected to a drill hole. A small firebox is built at
the latrine, which is fired with pieces of powder box
shine cases. The natural draft will rush the flame
latrine proper and consume any refuse which may h
lated and the fire leaves no ash. Within five or six ho
are fully cooled and the latrine is ready for use by the t
comes on the following day. This latrine accommoda
and can be built at a very low cost, approximately $1
other types of latrines which are manufactured can
in the mine, but where drill holes are available I beli
can be installed at the lowest cost, and in addition it re
tically no attention.

The first requisite for the success of any system, no
simple or how elaborate, is that it receive sufficient atter
the place set aside for the purpose clean and odorless.
done the system will fail, and careless disposal of hum
ways contains grave possibilities of disease.

DRINKING WATER.

The proper handling of drinking water also is of
in underground sanitation. Too often we see a c
or water bottle from which a large number of men d
common drinking cup and sometimes from the spigot
or the mouth of the bottle. This practice is inexcusabl
and dangerous. Separate drinking lines should be ir
sanitary drinking fountains in centrally located pla
should be placed both above and below the surface. In
laws have been passed making it necessary for minin
to provide separate drinking lines and there should
passed prohibiting the men from using the common d

the men cannot drink directly from the keg, but be compelled to use their own buckets or cups.

Metallic poisoning, notably lead, is of importance in some places, while various lesser ills are peculiar to certain localities. These can usually be overcome by strict attention to personal hygiene, and the miners should receive instruction in this regard where necessary. However, give the miner good air and protect him from injurious dust and contamination by human waste and you have made his working place sanitary in the real sense of the word.

The coal miner, in this country, is apparently free from disease that may be attributed to his occupation—except, possibly, in some districts hookworm. Coal dust apparently does not do serious injury to the lungs, and it is claimed by some that it confers an actual immunity to tuberculosis. Natural circumstances have compelled the coal mine to be sanitary as far as ventilation and heat are concerned, while the metal mine has been lagging behind. Not that a great deal has not been accomplished in recent years in improving working conditions, but exposure to dust and to humid heat is still entirely too extensive.

GENERAL.

In localities where the mining is being conducted or controlled by a few companies, proper sanitary measures can be adopted and educational campaigns carried on with much greater success than in localities where a large number of small companies are operating. Where there are a number of operating companies it has been found to be a very satisfactory method to organize safety and sanitation associations, where various safety and sanitary subjects are discussed. This also enables the operators to have uniform rules and regulations at the mines, which is of great benefit to the miners, as they are usually changing from place to place at frequent intervals. In localities where this method has been adopted the greatest drawback has been the educating of the miners, which is necessary in order to carry out any sanitary measures that may be adopted, as sanitation is first of all educational.

EDUCATIONAL WORK AMONG MINERS.

The education of the miners on proper sanitation is, no doubt, the best way to bring about the desired results. This work is usually carried on by giving lectures to the miners during the noon hours, lectures to the miners' wives in special meetings,

and to the children in the public schools, and by visits c and visiting nurses, employed by operators, to the ho miners. This program has worked out very satisfactor localities. In the Joplin district very successful work o was carried on by the United States Bureau in co-operation with the United States Public He ice during the years 1914, 1915 and 1916, and lowed up by Dr. W. A. Lynott, who visited the dis in the service of the Bureau of Mines. The operators trict later employed him to help educate the miners on sanitation subjects and to help keep the towns and villa district in a proper sanitary condition.

The work of visiting nurses has been of great in the education of the miners and their families and i where "miners' consumption" is prevalent visiting nurses excellent work in educating the families as to the pro give the patient.

The bulletins published by the National Safety Coun tary measures are also received very favorably by the are very helpful in the educational campaign.

The following sanitary rules were adopted by the Missouri Mine Safety and Sanitation Association, an o working in the Joplin district, for the purpose of be working condition of the miner:

1. Each man employed in the mine must make it help keep the change house clean.
2. Do not spit on the floor; do your chewing outsi
3. Empty your carbide lamp in a box provided for th outside the change house. Put your cast-off clothing, sh the trash burner.
4. Do not use your partner's drinking cup and do n your "buddie's" plug.
5. If possible, wash up and make an entire change c and shoes before going home, but be sure under all circ to put on dry clothing before leaving the property.
6. To avoid dust, always wet holes before blowing
7. Where possible, sprinkle broken dirt.

This association was organized in 1914. A very campaign was conducted, endeavoring to better the un working conditions. Water lines for drinking and laying installed; new, improved change houses built, and

passed compelling the miner to use these. At the time of starting the association miners' consumption was very prevalent. Today, working conditions are much better, health and efficiency of miners improved, and I believe in two or three years, if we enforce our sanitation rules and continue to educate the miner as to how to care for himself, miners' consumption will be a thing of the past in the Southwest Missouri district.

CHAIRMAN TILLSON: Mr. Glover will present Dr. Lanza's paper and discussion of the same subject which Mr. Young has so well brought to our attention.

MR. GLOVER: I noticed that many of the points Mr. Young touched on are also covered in Dr. Lanza's paper.

MR. YOUNG: Dr. Lanza was in the district two years ago and we worked together a good deal. I presume our information is very much the same.

CHAIRMAN TILLSON: That being the case, I think, in fairness to the authors we will publish in the minutes a joint paper by Mr. Young and Dr. Lanza.

DISCUSSION.

MR. DAVIS: I would like to ask Mr. Young a question on the efficiency point that he gave us. I think he said that, before the installation of a fan on the sinking shaft, the progress amounted to fifty or sixty feet per month and after the fan had been installed it jumped to 120 feet per month. What was the size of the shaft, Mr. Young?

MR. YOUNG: The shaft was put down in Butte, Mont., and I cannot give you the size of it. It was called to my attention and I was told the progress they had made after they installed proper sanitary measures. I would like to say that our experience in this regard is that our efficiency has increased 50 per cent since we installed water drills and have water in all of our working places.

MR. DAVIS: What I had in mind, of course, was the jumping of fifty to sixty feet up to 120 feet; I would like to ask another question. Mr. Young said they installed a force fan on this shaft. Has any one tried to use an exhaust fan in a sinking shaft, and if so, with what success?

MR. GLOVER: In sinking our shafts we have used exhaust fans. We carry an eighteen-inch spiral riveted pipe for the exhaust.

MR. DAVIS: Have you any gas?

MR. GLOVER: No, we never experienced any trouble. accident we had in shaft sinking was men falling off the p or things like that. There was really no trouble whatever ventilation. We have gone down eleven to twelve hun without any trouble.

MR. MCKEEHAN: We generally use an exhaust fan if much smoke in the shaft. We use exhaust fans in tur crosscuts. They are often advisable and exhaust the smoke

MR. DAVIS: Have you explosive gases?

MR. MCKEEHAN: No, we have gas from mine fires explosives.

MR. DAVIS: Some time ago I happened to be in a pla they were using an exhaust fan in sinking a shaft. Th two or three old miners, one a particularly good, practical I asked him: "What do you think of that?" He said: " fools are not dead yet." I asked him why he said that and on to explain why it was you could not ventilate th with that fan. As a matter of fact they were stuck at tha they could not do it. After reversing that condition and twenty-four-inch spiral galvanized pipe blower fan it was tory. Of course, it gave a good current in the shaft itself.

CHAIRMAN TILLSON: What were the symptoms of his Mr. Davis; do you recollect?

MR. DAVIS: The short-circuiting of the currents at th the pipe. They did not strike the point where the gases wer from. The laws of diffusion were not doing the work with that pipe thirty or seventy-five feet from the bottor shaft. There was a good current down there, but not fifty twenty-five feet away, which was about as close as you c and some places you could not get any circulation.

CHAIRMAN TILLSON: If they had put in a temporary s pipe would the difficulties have been solved?

MR. DAVIS: They could not get in closer than twenty-f

CHAIRMAN TILLSON: They would have to put it right the work.

MR. DAVIS: And remove it every time they worked, ye

THE CLEVELAND TUNNEL.

MR. RICE: I can mention one case where suction work well, the case of the Cleveland tunnel. Under the lake t marsh gas. It was generally met in the face of the tunnel

had a bad explosion there which caused a collapse of parts of the casing of the lining. The casing was made up of concrete blocks, and apparently the explosion pushed the blocks out. The amount of gas given off was very considerable and seven or eight days after the explosion it was still coming out of a three-inch pipe. It was a tough problem because they had already had casing lining and they had made no other provision.

They increased the capacity of the compressors behind an air lock and then arranged a funnel which could be pushed forward as the gas collected at the heading. The gas was drawn into this pipe and sent out to the surface. The tunnel was completed safely on that basis.

I think that I visited the particular mine where they were using the canvas pipe referred to by the previous speaker. Mr. Bailey invented a coupling arrangement that they hang to the pipe. It may be a similar invention, but I really think it is quite worthy of your attention. I visited a tunnel where they were driving a connection to another mine—my recollection is that it was about 2,500 feet long—and it was ventilated by a canvas pipe. My recollection is that it was about sixteen or eighteen inches in diameter, and they used a fan to create rather a high head. The special virtue of this particular arrangement was the hanging part of the device; they had a coupling or a connection on each section of the canvas pipe, say, ten feet apart, and the pipe was hung on a wire strung across the timbers at various places. They could put up or take down the pipe very quickly. When they were shooting at the base of the heading they would take down the pipe and bring it back, and almost as quickly put it up again. The pressure, of course, would keep the canvas pipe filled.

The other device was the coupling connections. The sections of pipe were about twenty feet long and there were two connections. You pushed one ring inside of another, then drew it back till it caught, and it was a very tight fit. They tried to use ordinary galvanized pipe, but the leakage had been very great. The air in the long tunnel was very good, and the temperature was actually lower than it was further back in the open workings from which the tunnel started.

The advantage of the coupling was in the shaft sinking. It could bear the weight and take the full stress of the canvas, and besides they could hang it up. I think the system was used at a 3,000 foot level, and they were ventilating down into the shaft about

600 feet further, and then out from the foot of that. I much impressed with the device as it seemed to me that it h application to tunnel work. It has no reference, of cour plosive gases, gaseous conditions such as we have in coal

MR. PETTIBONE: Has any one a quick method for holes in canvas pipes used for ventilating? Very freque one sticks a pick through the pipe, and we do not know of way to repair it except by inserting wads of paper, and not work very well. Is there anything in the nature o that could be put on?

PREVALENCE OF TUBERCULOSIS.

DR. S. P. MENGEL (Surgeon, Lehigh Valley Coal Wilkes-Barre, Pa.): It is very readily seen that the i this particular Section, perhaps, is not strongest on the side. I do not want to let this opportunity go by witho something on the elimination of dust in these mines.

My personal experience in the mines is very meage know that in our anthracite mines tuberculosis is rath disease. We know also that in your metal mines tuberc very common disease. Consequently every precaution taken to allay the dust, even in our anthracite mines, be know we get it later on in the life of the miner, and ever tion should be taken. I am surprised at statements ma essayists, that in some of the states, where in drilling an mining work is carried on, it should be so essential that l be enacted. We have very strict legislation in our anthrac we know that the dust that is inhaled is of vegetable orig not very injurious to the lungs. However, in later life, mulation of dust in the lung tissue and in the air cells be great that the blood supply is lessened and eventually it bre and we have what is known as miners' asthma.

Cannot the foremen and those responsible for placing t add materially to their lives and incidentally do a favor to and his family by placing infected men at the proper time i healthful open-air position? If such men were taken o mines—we know from experience that they work until last—if those men were taken out at the proper time a in a good open-air position their lives would be prolong dentally you would not have a case of tuberculosis and tuberculosis counted against the industry. By carefull

those men, a great deal could be done in that way ,and the question of tuberculosis would practically be nil, especially in the anthracite region.

When the St. Gothard tunnel was dug there was a very high mortality from tuberculosis. In the Simplon tunnel—which is one of the longest in the world—they used hydraulic drills and smothered their dust with water. In consequence there was practically no tuberculosis in the building of that tunnel. That was along in the neighborhood of 1900. As early as 1905, Dr. Wainwright of Scranton made a careful study of tuberculosis, and made a series of experiments with rats—used, of course, his control animals—and then he used rats which he kept in a box inhaling the anthracite dust or coal dust until he produced anthracosis. He then injected into those rats, the control animals and others, tubercular bacilli. In a number of instances he found among the rats that had inhaled dust that anthracosis had developed, or tuberculosis in the peritoneum and different parts of the body, but not in the lung, while invariably the control animal died of tuberculosis of the lung.

This is interesting simply from a medical standpoint, but it is up to all of us to try to lessen tuberculosis affections.

CHAIRMAN TILLSON: I would suggest that we adjourn to the main banquet hall and view the picture to be shown by Mr. Bach, after which we will continue our program.

(The meeting then adjourned to the main banquet hall, where a motion picture exhibition was given entitled "Visual Mine Safety Instruction," by E. E. Bach, Mine Safety Director, Ellsworth Collieries Company, Ellsworth, Pa., showing dangerous and safe practices, during which Mr. Bach gave an explanatory address.)

VISUAL MINE SAFETY INSTRUCTION.

E. E. BACH, MINE SAFETY DIRECTOR, ELLSWORTH COLLIERIES COMPANY, ELLSWORTH, PA.

Mr. Chairman and Members of the National Safety Council: Since the passage of the Pennsylvania Workmen's Compensation Law, something more than a year ago, mine safety has been given such an impetus generally as to make working conditions safer, the workmen more alert and the operators more receptive along safety lines.

Some of the larger companies had already organized in a tentative way but when the necessary requirements of the state and

insurance companies became known it was very evident t surface had been merely scratched. Many of the companies v done intensive work along safety lines now began to co their own through the reduction of premiums for insura felt justified in carrying out further measures of safety. work usually can be done through the following channels:

1. Safety organization.
2. Safety instruction.
3. Safety mechanical devices.
4. Safety signs and bulletins.
5. Safety demonstrations.
6. Safety awards.

Specifically speaking, the Ellsworth Collieries Company the field of safety as follows:

Organization—1, the Central Safety Committee; 2, Centr Safety Committee; 3, Mine Safety Committee; 4, Workmen ings.

Safety Instruction—1, In the use of self-contained oxy paratus; 2, First aid to the injured.

Safety Demonstrations—Large safety demonstrations stag a community basis.

Safety Signs and Bulletins—Safety signs and bullet changed at regular intervals, both inside and outside the m

Safety Awards—1, Service buttons at the close of a co general instruction; 2, American Red Cross buttons for hol American Red Cross certificates; 3, American Red Cross cates where examinations have been successfully passed; 4, can Red Cross medallions at the completion of a second co first aid; 5, United States Bureau of Mines certificates at t of a general course of instruction and examination in both and mine rescue work; 6, Cash bonus for the reduction of ac 7, Cash bonus for safety suggestions which have proven pr 8, Silver loving cup to the mine scoring the highest number o in competition at the annual safety demonstration. To three times before it becomes the property of the mine; 9, of the team scoring the highest percent placed permanentl the bulletin board of awards.

Safety Devices—Safety devices consist of any improven the general practices of mining coal or the manufacture c which protect the workmen from danger or minimize the to accident.

DRIVING SAFETY LESSONS HOME.

While the entire safety propaganda is one of coöperation between the operator and the workman, yet the problem which is most difficult for a safety director is that of driving the lessons home to the workmen. This is especially true where the usual large precent of non-English-speaking employes enter into the proposition.

Some years since, editors of the American Red Cross First Aid Manual attempted to obviate much of the difficulty by publishing the manual in some of the most common foreign languages. It was discovered, however, that, although the foreign workman read his book and the instructor read his book, yet they had no method in common of communication whereby one could make the other understand, hence much of the instruction fell far short of the mark both in the preventing of accidents and in the caring for the injured. Then it was that other means were sought for impressing the lessons of safety, which finally led to the discovery of the old psychological truth, that more lasting impressions can be made upon the mind through the eye than through the ear; in other words, the most successful safety work is that which can be visualized.

Close analysis of our accident record for the past year showed that about 26 per cent were due to falls of coal and slate, 23 per cent to haulage, 5 per cent to mining machines and the remaining 47 per cent were distributed over such a wide area of accidents that it was not deemed advisable to classify them.

VISUALIZING SAFETY LESSONS.

The recurrence of accidents along the principal lines suggested led to the idea of visualizing both safe and unsafe practices in mining through means of still pictures and moving pictures. These were taken in coöperation with the United States Bureau of Mines. The number of still pictures that were taken and their classification is as follows.

Haulage	30	Machine mining in operation	10
Miscellaneous safety features	25	Testing for fire and methane	7
Electricity	18	Ventilation	6
Shot firing	18	Handling explosives	4
Timbering	17	Handling tools	4
Testing roof	17	Switching	3
Loading coal	11		

In motion pictures the safe and unsafe practices were as follows:

1. Lowering of men.
2. Sounding roof.
3. Trimming rib.
4. Spragging face of coal.
5. Loading coal.
6. Machine work.
7. Haulage.
8. Electricity.
9. Lighting.
10. Ventilation.

It was soon found that it was easy to hold the interest workmen in the safety work where time was divided between ing, demonstrating and the showing of either still or motion p Language in this form of instruction was no barrier since the men immediately recognized and understood the pictures as they were shown. These pictures were staged in our own and with our own workmen, which adds the personal to interest.

I take great pleasure in showing the two reels of "Sa Unsafe Practices in Mining" at this time. (The picture shown.)

CHAIRMAN TILLSON: Mr. Bach has covered this subje carefully and given us a fine presentation. The next paper "Hoisting Ropes," presented by M. H. Sigafoos, General M Hazard Manufacturing Company, Wilkes-Barre, Pa.

EARLY FOREIGN HISTORY OF HOISTING ROP

M. H. SIGAFOOS, GENERAL MANAGER, HAZARD MANUFAC COMPANY, WILKES-BARRE, PA.

Mr. Chairman and Members of the National Safety C The application of wires to the form of ropes for engin purposes was first utilized in 1813 for the supporting ropes Geneva suspension bridge. They were, however, not const in what today would be strictly classed as wire rope, but were f of a series of wires laid parallel to each other and bound to by a serving of smaller wires, which were in turn, covered with yarn. There seems to be no authoritative data available as number and size of the individual wires employed in making supporting ropes for the Geneva suspension bridge, but it is for granted that the material from which the wires were pro

for some time later, was almost exclusively used in the production of wire ropes.

We find at a later date, 1835, that some ropes of this type were produced for the Freiburg suspension bridge, which has a span of over 800 feet in the clear, and the supporting ropes for this bridge were composed of about twenty bundles of iron wires, each wire being 0.125 inches in diameter laid parallel, the combined total of wires making a rope, in the aggregate, about five and one half inches in diameter. There is no doubt but what this type of rope, when properly constructed, would present a breaking efficiency very nearly equal to the tensile strength of its individual component wires and perhaps is the only construction of wire rope where each wire bears as nearly as possible its due and proportionate share of the load stress.

Ropes of this class, while not extensively manufactured, have been applied in this country on the Niagara suspension bridge, the Ohio river bridge and for the large main supporting cables on the New York and Brooklyn suspension bridge; also more recently on the New East river or Williamsburg bridge. This type of wire rope is known as the "Selvagee" construction. Unfortunately, they cannot be utilized for hoisting purposes.

WIRE ROPES IN GERMANY.

In 1834, a mining engineer named Albert, of Clausthal, Germany, interested in the mining industries in Saxony, and who later became director of the Hanoverian mines, finally succeeded in fabricating, under considerable difficulty, a "stranded" wire rope, composed of iron wires and put in operation for hoisting ore in the shafts of the Hartz mines, where its superiority was immediately recognized over its hempen predecessor, and Albert's efforts were crowned with success. In 1837 Mr. Albert, before an engineering society in Berlin, read a paper on "The Construction and Manufacture of Stranded Wire Ropes," which treated on the production of wire ropes along the same lines of construction as was previously applied to the manufacture of hemp and fibre ropes, then employed exclusively in the mining industry.

The size of the wires entering into the manufacture of the first stranded wire rope produced by Albert are said to have been 0.144 inches in diameter, with a tensile strength of about a thousand pounds each, or approximately 27.5 tons per square inch of actual cross-section, but as to the exact number of wires in the strands and the number of strands employed there seems to be no absolutely reliable

information. However, it is known that ropes manufactur 1835 and 1838 were made up of four wires to the strand, being about three thirty-seconds of an inch in diamete ropes composed of four, six or eight strands. It is qu that there was some variation in the sizes of the wires, as t of strands increased. It must thus be conceded that as results of Mr. Albert's experiements, the commercial world a mechanical appliance to which can be traced the establi many of the foremost industrial activities of modern tim

ROPES OF BRONZE WIRE FOUND IN POMPEII.

It was immediately after the first successful experimen out by Albert, that a partnership was formed by Felten & C of Cologne, to manufacture wire ropes upon a commer These two men were quick to realize the possibilities of adaptable to numerous enterprises and for some time mar wire ropes for mining purposes in Germany and Franc Musio Borbonico at Naples is to be found on exhibition a sh of bronze wire rope about 1 inch in diameter which was from the ruins of Pompeii, but beyond the fact that it wa wires twisted into strands and the strands in turn laid out there is no other information except that it proves that rc of bronze wires were in exisence before the destruction o in the year 79 A. D. Beyond this period there is no tra stranded ropes, but it is an established fact that the ancie centuries before the process of drawing wire through die vented, made wire from precious metals by hammering.

WIRE ROPES IN ENGLAND.

The application of wires to ropes was known to exist in as early as 1813, but their practical introduction in Engla ently did not transpire until some years later. Before a m the British Association, held in Newcastle in 1838, Mr F. R. S., read a paper on "Wire Ropes," by Count Brenne the same year Mr. R. S. Newell of Dundee, Scotland, act information and advice from a friend who was studying th conditions in Saxony, designed some rather crude machi the purpose of manufacturing wire ropes with four strai strand containing four wires. Mr. Newell carried on som ments with his early inventions, on which he gradually i

land for improvements in the manufacture of wire ropes and machinery for carrying same into effect. With these improvements, apparently arrived the introduction of cores or "hearts," as they were then referred to, as Mr. Newell's patent related to the construction of rope with wires laid around a core or heart to form the strand, the several strands laid around a central core or heart to form the finished rope. After these letters patent were obtained by Mr. Newell a company was formed forthwith, and under his personal supervision wire ropes were manufactured in England on a commercial scale.

WIRE ROPE IN AMERICA.

In the United States wire rope was first manufactured in the early forties and has been improved upon year by year until the present time, when it represents the very highest development of this means of hoisting and haulage. In the last fifty years there has been a gradual change from the use of one kind of rope material to another, and this was brought about by the demand for an increased production by speed and efficiency. In the preceding paragraph we have shown that iron was practically the only material used for wire rope, and this continued to be the case until the introduction of crucible steel, which opens the second period in wire rope manufacture. The third period came with the introduction of higher carbon steel, known by the trade as plough and special high-strength steel. In none of these periods has the material in the production of wire rope of the preceding periods been forgotten for we find certain operations that still demand iron cables and there are other operations in which it is entirely out of the question to substitute plough steel or the special high-strength steel for cast steel.

STANDARD MATERIAL.

The material entering into the manufacture of wire ropes is perhaps of greatest importance in the wire rope industry, for upon its quality depends largely the final result of the finished product. Through its careful selection, constant experimentation and analysis, with minute researches into the physical and chemical properties of the raw materials, the standard manufacturer is guided toward the production of a dependable wire rope, with durability and ductility as two of its fundamental qualities.

Until recent years in the manufacture of wire rope it was generally conceded that the foreign steels were by far the best, due prin-

cipally to the fact that Swedish ores, up to the present da the finest ores the world affords, are employed as their l tion. Such foreign steel material as is imported by t manufacturer for wire rope purposes, is made up to mee fications, insuring as nearly as possible a uniform qu and is carefully tested and analyzed to insure their cor ages of manganese, silicon and carbon content for the v of the steels, as well as the great necessity of their bei low in sulphur and phosphorus. Both of the latter known to be detrimental to the final production of wi in the manufacture of wire ropes of best quality.

Acid open-hearth steels are generally admitted to quality than basic open-hearth and it has been sugge is due to the higher oxygen content in the basic steel.

Much has been claimed for the qualities of chem steels, such as vanadium, chromium, etc., and in many in manufacture of steel products have proven the claims m but so far as their adoption to wire rope is concerned in the experimental stages and no data is available at t without doubt may eventually be used in connection v ores and produce a finished article for the wire rope i has for other purposes.

WIRES DRAWN FOR HIGH TONNAGE.

Wire made from steels intended for the manufac rope for ordinary purposes are divided into three cl viously stated, namely: Iron, with a breaking strain mately 80,000 pounds per square inch; cast steel, ofte called crucible cast, which has a breaking strain of 170,0 pounds per square inch, and plough steel, with a br of 200,000 to 250,000 pounds per square inch. Wire is to a considerably higher tonnage but this is rarely other purpose than for standing rigging on racing y maximum strength with the lightest possible weight such wires are sometimes drawn to 260,000 pounds pe Very small sizes of wire rope or strands for aeropl drawn to even a higher tonnage.

There has been much discussion on the point: Wh rope reached the end of its usefulness and when sh moved? Up to the present time it seems the ques unanswered, at least, satisfactorily.

BINDING STRESS AND LOAD STRESS.

In an exhaustive investigation conducted by the Bureau of Standards on this subject, a report of their findings was published in Bulletin No. 75 and included some tables and other data, stating in substance: That a rope should be removed after a certain number of broken wires appear in each of the strands. These tables have undoubtedly been compiled from stated loads, speeds, head sheaves and drum diameters; from shafts of various depths, and, taking into consideration the torsional and load stresses, no doubt form a useful guide, provided they can be applied where conditions are the same, or as nearly alike, as those from which these tables and figures were compiled. However, as there is no standard of sheave and drum diameters, except those as recommended by rope manufacturers, or any set rule for maximum loads, it is evident that with each variation in the diameter of sheaves or load, so will the bending stress and the load stress vary. Both of these stresses are of very great importance and both have a direct bearing on the factor of safety.

The various conditions of operation that exist in the different mines make it almost impossible to find any two mining conditions that are alike. There can always be found some vast difference in the diameter of sheaves, loads and speeds, therefore it is obvious that no set rule can be laid down by which all mining operations can be governed.

In the catalogues of the wire rope manufacturers are to be found the "Proper Working Loads" of wire ropes for the given sizes and grades. This "proper working load," in almost all cases, is approximately 20 per cent, or about one-fifth of the approximate breaking strength of the rope, and would appear to be a factor of safety of five. This, however, is not the case, as will be shown, and it is very important in calculating the proper rope for a certain load, with a required factor of safety, that this "proper working load" should not be confused with the actual factor of safety. While the proper working loads do not show approximately one-fifth of the breaking strength of the ropes, it does not by any means indicate, that in operation, the rope selected on account of its showing a proper working load in the list corresponding very nearly to the load which it is desired to lift, would have a factor of safety of five, due to the fact, in addition to the working load, there are other stresses to which we must give ample consideration, the most

important of which is the stress due to bending over th and drums.

FACTORS OF SAFETY.

If the rope to be used is operated over standard size and drums, as recommended by the rope manufacturer, th average of this bending stress equals about 10 per ce approximate breaking strength of the rope. For instance, steel wire rope of one inch diameter, composed of six st nineteen wires to the strand, the approximate breaking st which is thirty tons, showing a proper working load of or six tons, to be used on a minimum size sheave or dru feet, as recommended by the manufacturer, the bending str be 2.70 tons, or 9⅓ per cent, nearly, of the approximate strength of the rope. It is thus evident, that by adding th cent to the load stress, which is 20 per cent, we have uti of the ultimate, and instead of an apparent factor of safe we actually have only 3.41—or less than 3½. This fac further reduced by the stress due to starting the load, ar some cases, the stress due to the weight of the rope an same. The latter, of course, varying with the size and the rope, and in calculating the proper sizes of rope re such operations as mine hoists and incline planes, where often long and heavy, their weight must be considered to the load and carriage, or cars, as the case may be, in arrive at any true factor of safety. For short lengths c small diameter, such as used on derricks, etc., this latter is not necessary.

SIZE OF SHEAVES IMPORTANT.

It is often impracticable to utilize the sizes of sheaves as recommended by the manufacturer under the heading mum Sizes of Sheaves or Drums," and different diam sometimes be used. In such cases the bending stresses inversely as those diameters are greater or less. For assuming in the above example, the conditions were two-foot diameter sheaves were used, the bending stress would be 5.58 tons, or about 18⅔ per cent of the breal of the rope; this, in addition to the working load, wou per cent of the ultimate strength of the rope, thus re factor of safety to 2.6. Under these conditions the tot stress would be greater than one-third of the ultimat

strength of the rope when new and is not considered good engineering practice. Obviously under such conditions a wire rope could not possibly give the same service as when operated over the standard or larger sized sheaves or drums. On the other hand, if we should employ sheaves of twice the diameter of those recommended by the manufacturers, or ninety-six inches, the bending stress would be only 1.4 tons (approximately) or about 4¼ per cent of the ultimate strength of the rope. It is evident that by reducing the bending stress to a minimum, more economical service could be obtained, and in many cases a smaller diameter of rope could be applied to do the required work; thereby increasing the efficiency of the rope, and a considerable saving in first cost.

OVERWIND AND UNDERWIND ROPES.

In speaking of bending stresses it might be well to describe briefly the effect of these stresses on the initial structure of the metal in the wire rope. It has been shown repeatedly that reverse bends play a very important part in the early let down of a wire rope. The underwind rope, in which there are reverse bends, will invariably give a shorter service than the overwind rope. The difference in service of the two ropes on a hoist varies a great deal, but from our experience we find that the overwind rope will give 10 per cent to 25 per cent more service. The reason for this is quite obvious, but we will endeavor to explain as clearly as possible the causes leading up to the shorter service of the underwind rope.

The underwind rope as it comes off the head sheave has taken somewhat of a set, the permanence of which depends altogether on the relation of the rope diameter to the sheave diameter. The smaller the sheave the greater the set. The rope now travels to the take-up drum, which is set some distance away, and will wind on the drum in the opposite direction to the way it came off the head sheave, thus a reverse bend is thrown into the rope, and, consequently, into the wires themselves. The rope cannot recover itself in most cases, for the set it received by the head-sheave is not entirely overcome before it strikes the take-up drum and consequently the effect of the latter bend is more severe.

Wires removed from ropes that have been retired from service, operating under conditions of reverse bending, show under the microscope that minute cracks have been set up in the steel, sometimes running in planes between the grains, while in other cases the grains themselves have cracked. Examination made of the steel

at different points shows that the nearer the break the m
oped the cracks and fissures are. Of course these mint
will eventually develop into larger cracks which will in d
be the cause of the wire parting, and later, if the rope is no
in time, the breaking of the entire rope.

EFFECT OF REPEATED SHOCKS.

Another cause for failure of wire ropes can be att
repeated shocks being thrown into the rope. A rope may
combined stresses which are beyond the breaking strain of
or may fail due to a succession of applied loads in exc
elastic limit of the rope, and may fail due to repeated sh
is, loads applied that may reach the elastic limit at in
minutes or hours. The effect of these strains or overstrai
may be called, is shown best by a microscopic examinati
metal leading to crystallization with a consequent embritt
the steel.

The overlapping of the rope on the hoisting drum,
occasional slipping down of the top layer into the groove
the layer underneath, will do two things: First, will ca
which increase the load on the rope by an amount depen
the slack between the drum and head sheave. In most ca
very small, but in time the wires will show the effect of the
not only by the increased load, but also by the vibration i
which usually settles at one point, causing trouble later on.
the inner series of wires will crush somewhat from the
between the top and bottom layer and will assume a pe
shape.

In this disturbed condition it is impossible for these in
to perform their proper functions, and the outer wire
forced to take more than their share of the stresses. Not
but they will gradually assume the shape of their cushion,
series, causing trouble in the form of abrasion on themse
course, we know that overlapping cannot be eliminated in
on account of the amount of rope that must be taken
drum, but the point we wish to emphasize is the fact tha
inspection must be made of the rope in order to minimize

SOCKETS AND CLIPS.

The effect of overloading has already been referred

are constructed to take care of certain loads and when these loads are exceeded the steel in the rope must suffer. The rope, as made, has a certain lay and the method of attachment to the load has a great deal to do with the running out of the lay and stretch of the rope. This should not be confused with the material itself. There are several methods of fastening ropes to the load, either by means of sockets or clips. Both of these means of fastening can be made in such a manner as to break the rope before the connection gives out. In the matter of using sockets it was formerly thought necessary to turn in or bend back the strands or wires into the basket of the socket. This method is now being replaced by a process of opening the wires in the strand of the rope which is to be socketed, thoroughly cleaning them with muriatic acid cut down with zinc, and spelter poured in on the straight wires.

Tests of this method of socketing have proven that a more uniform strain on each individual wire can be depended upon. However, it necessitates great care and carries with it at all times the fact that there is no possible means of inspection. Whereas the connection made with clips, if properly applied, is as strong and careful inspection can always be made of such a fastening. This latter connection should be made with the "U"-bolt section of the clip over the short end of the rope. This insures more safety, due to there being no indentation on the main section of the rope by the "U"-bolt. From a safety point of view it is preferable to socketing.

PROTECTION FOR ROPES.

We believe that all users of wire rope appreciate the value of protecting the rope from mine and other injurious water which corrode and take into solution the steel of the rope, but it might be well to state that the most dangerous element is often lost sight of. In mine water the sulphur has been taken into solution, resulting in the formation of sulphuric acid and when this acid attacks the steel there is liberated an element known as hydrogen which causes a great deal of trouble. Hydrogen is regarded as a metal inasmuch as it replaces metal in an acid reaction and hence it often combins with the steel of the wire in the rope. The acid eating into the steel dissolves the iron leaving free hydrogen which remains occluded. Heat of the correct temperature and applied a sufficient length of time will drive off the hydrogen, but in the case of a wire rope this is impractical, hence brittle steel often results. In order to keep corrosion at a minimum it is absolutely necessary to cover the rope,

or at least fill the interstices of the rope with some sort of A mineral compound of the right consistency has been proper material to use in this connection.

NECESSITY FOR INSPECTOR.

In dealing with the problems in which wire ropes p portant part it is most essential that a man be emplo familiar with the construction of wire ropes and its This knowledge has resulted in the employment by m companies of an inspector. The duties of this inspect numerous to mention, but the mere fact that there is such emphasizes the point that wire rope is a part of the equi requires expert knowledge, careful handling and rigid in

In conclusion, we wish to state that the points cove paper are the results of our practical experience coverin of nearly three-fourths of a century, in which we have test and actual service the merits of the suggestions and have been adopted as standards by our engineers. If, next session of this Council, there should arise any specia peculiar to your own operations, our engineers stand respond to your call for advice and service.

If there are any questions in connection with this in order that your questions may be answered clearly a can go as far afield as possible, I have brought with me neers, so we are at your service.

CHAIRMAN TILLSON: We appreciate the great intere paper which Mr. Sigafoos has presented to us. I hope t take advantage of the presence of his engineers in raising tions that we have had in our experience with wire rope open now for discussion and question.

The idea which I would place before you, possibly of value in the record of our transactions, is the old q when a wire rope has served its time, what units shall its measured in. I make the suggestion that possibly units are as fair as any other, and fairer than a great many, consider that the conditions have been standardized and pare those units of work against standard conditions.

In that respect, to start a little discussion, I will be gl sent a few notes of some tests that the New Jersey Zinc made on wire ropes some four years ago, in order to dete

HOISTING ROPES.

B. F. TILLSON, NEW JERSEY ZINC COMPANY.

In discussion of Mr. Sigafoos' excellent paper on hoisting rope, it may be of interest to include some figures resulting from actual practice. These tests were made upon one and one-eighth-inch plough steel hoisting rope with six strands of nineteen wires in each strand, arranged according to "Seale's patent" in which the large wires are upon the outside. The test pieces were each three feet long and six of them were from a regular right-handed lay rope and cut from the end of rope which had previously been fastened to the hoisting drum and, therefore, subjected to but little strain during service. Six other pieces were from a right-handed Lang-lay rope and cut from the end of the rope which had been attached to the loads and been subject to working strains, but no external abrasion. Some of these samples were broken in a testing machine, without mutilation, and some of the wires and strands were locally mutilated, to stimulate severe conditions which may exist during the operation of hoisting rope. In the process of severing some of the strands it was not possible to avoid further mutilation and it therefore seems fair to assume that the few wires which snapped during the test had been unintentionally mutilated.

I am glad to place these figures before you, because of the laws enacted by some of the states—some of them to the effect that when three wires are broken within any one foot of a running length it was worthless. We took some ropes out of service because of a condition in which twelve wires were broken within a distance of eight feet, and we thought it was time to find out how much those ropes had suffered because of that condition. I think you will find that most people in the mining industry are scared, as we were scared, when we saw a few broken strands of wire in a rope.

I have a note here which possibly some one would like to copy or criticise. If it is worth while I should be glad to offer it for the transactions. It is the formula expressing the bending stress in a wire rope in terms of the ratio of the diameters of the wires and diameters of the outside of the rope when passing over a sheave wheel or drum. I think it would be of value as a matter of record if some of you have not made use of such a formula and do not know just where to lay your hands on it. May I ask some one to express an opinion?

SECRETARY PAUL: I move that we accept our Chairma on the strength of wire ropes and to include this formula ing stress of ropes. (The motion was seconded, and, bei a vote, was carried.)

TESTS ON SAMPLES OF PLOUGH STEEL ONE AND ONE-EIGHTH INCH HOISTIN SIX STRANDS EACH, OF NINETEEN WIRES, SEALE PATENT LAY.

(Test Pieces Three Feet Long in the Clear, Made at Plant of J A. Roebling's Sons on A

	Right-hand Regular Lay Rope Drum End, American Steel & Wire Co.	Right-hand Lang. Rope, Load
In service on ore skips from.....	April 27, 1910, to Feb. 8, 1912, or 21 1-8 months.....	Feb. 8, 1912, to , and still in ser months.
Total sheet tons hoisted.....	315,759 tons per rope.....	266,460 tons per ro
Foot tons of work done on ore...	292,110,560 tons per rope.....	259,333,284 tons per
Gross work done in foot tons with load at 6.10 tons, skip at 2.75 tons and including work done on ropes lowering the empty skips.....	Average length of 1,273 feet of rope at 1.27 tons 676,500,000 tons per rope.....	Average length of rope at 1.34 ton tons per rope.
Measured diameter of rope tested.	1 7/64 inch.....	1 5/64 inch.
1. Full sample, no wires cut.....	Three strands broke at tension of 109,300 lbs.....	Six strands broke 121,000 lbs.
2. Full sample, no wires cut....	Six strands broke at tension of 111,200 lbs. Average 110,250 lbs.....	Three and one-half at tension of 110,7 age 115,850 lbs. broke where rop about thimble in
3. One strand severed.....	Two strands broke at tension of 91,300 lbs., so showed 82.8 per cent of initial strength.....	One strand and ter at tension of 89 showed 77.2 per c strength.
4. Two strands severed.....	Two strands broke at tension of 71,700 lbs., so showed 65 per cent of initial strength.....	One strand and five tension of 77,200 l 66.7 per cent of in
5. Twelve wires severed in one strand within a distance of one foot and some additional wires nicked in the process.....	Seventeen wires failed first and then three strands broke at tension of 103,000, so showed 93.3 per cent of initial strength.....	Seven wires failed fi six strands broke 104,500 lbs., so sho cent of initial stre
6. Twenty wires severed within one foot, ten in line on successive strands on one side of rope and ten in line on opposite side with some additional wires nicked.	Nineteen wires failed first and then two and one-half strands broke at tension of 70,200 lbs., so showed 63.7 per cent of initial strength.....	Five wires failed fi six strands broke 93,900 lbs., so sho cent of initial stre

CHAIRMAN TILLSON: Another matter which has be tioned in Mr. Sigafoos' paper and which should be greatly sized is the bending stress produced upon a wire rope and lihood of this factor being overlooked in calculating the factor of safety. The following formulæ may be worthy o for the assistance of those desiring to ascertain the stress in wire ropes and will correct the catalog factors of safety in ance with the actual service for which the ropes are used.

BENDING STRESSES IN WIRE ROPE.

Let:

A– = metallic area of rope section in sq. in.
T_c = load tension in pounds per sq. in.
T_b = bending tension in pounds per sq. in.
T– = total tension — $T_c + T_b$.
S– = ultimate strength of wire in pounds per sq. in.
d– = diameter of wires comprising rope.
D– = outside diameter of bend of rope on sheave or drum in inches.
E– = modulus of elasticity of steel varying from 28,000,000 to 29,500,000 pounds per sq. in. Use 12,000,000 for 6 strand rope.
L– = load on rope, in pounds.
F– = factor of safety-breaking strength divided by load.

Now:

$$T_c = L \div A$$

$$T_b = E \times d \div D = 12{,}000{,}000 \times \frac{d}{D}$$

Then:

$$\frac{D}{d} = \frac{F}{0.44F - 1} \times \frac{E}{S} \quad \text{(for steel rope)}$$

$$\frac{D}{d} = \frac{F}{0.50F - 1} \times \frac{E}{S} \quad \text{(for iron rope)}$$

And:

$$F = \frac{DS}{0.44DS - Ed} \quad \text{(for steel rope)}$$

$$F = \frac{DS}{0.55DS - Ed} \quad \text{(for iron rope)}$$

S ranges in value as follows:

Iron, from 75,000 to 100,000 lbs. sq. in.
Cast Steel, from 160,000 to 220,000 lbs. sq. in.
Plow Steel, from 225,000 to 265,000 lbs. sq. in.
Improved Plow Steel, from 266,000 to 320,000 lbs. sq. in.

d has the following ratios to rope diameters:

6x19 scale rope d– = 1/12– = 0.0833 of rope diameter.

6x19 rope d—=1/15—=0.0667 of rope diameter.
8x19 rope d—=1/18—=0.055A of rope diameter.
6x37 rope d—=1/21—=0.0476 of rope diameter.
6x7 rope d—=1/9— =0.1111 of rope diameter.
6x42 tiller rope d—=1/27—=0.0370 of rope diameter.

SECRETARY PAUL: I would like to ask the Chairman a in regard to the tests he related. I may appear rather abs I want to ask if those breaks occurred within a distance of along which several of the wires had been cut or if the br curred in other parts of the rope.

CHAIRMAN TILLSON: The breaks occurred in the se which the rope had been mutilated when they occurred.

MR. BEHR: The subject is a very important one and sl thoroughly discussed at the next meeting of the Section.

CHAIRMAN TILLSON: Mr. H. C. Behr, for years co mechanical engineer of the Consolidated Goldfields in South is attending the Section this afternoon. His paper on "] from Great Depths," before the Institution of Mining and lurgy at London, is considered one of the classics. I feel sur can induce him to address the Section, we will all profit imm

*HOISTING ROPES.

H. C. BEHR, CONSULTING MECHANICAL ENGINEER, NEW YOR

Mr. Chairman and Members of the National Safety (I wrote out a few notes on the subject of safety hoistin and believe they will interest the safety engineer as well mining man. I want to know that the rope I am using is as it can possibly be. In this connection the question of the s the rope is very important. Mr. Sigafoos, in his paper on Ropes" yesterday, brought out a calculation of stresses.

He did not give us the formula but it is the ordinary of the bending stress of a bar bent around a cylinder, w proportionate to the diameter of the wire and inversely tionate to the diameter of the drum; this ratio is multiplied ordinary coefficient of elasticity.

Of course, that is a very safe formula and gives a stress v outside of what probably is the load on the rope used. Pr

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*To preserve the continuity of the discussion the remarks d on "Hoisting Ropes" on Thursday morning are inserted at this Chairman.

Hrabach, in his "Elements of the Machine," brought out that point. He states that while the rope is still straight it is subject only to the tensile strain of the load, as soon as it is bent the outer fibers are under additional tensional stress while the inner fibers are under compression. That seems unreasonable. There must be an adjustment for some distance while that stress is changing from the one to the other. It has been remarked here that this question was answered, although it does not seem in a very satisfactory manner, by assuming a lower margin of elasticity based upon elongation; tests of actual ropes, as compared to that record, establishes thereby a modulus of elasticity which is considerably lower than the twenty-eight million assumed. According to Hrabach, for a new rope, it would be about three-eighths of that. Another treatise on the subject, by Grover, Director of the Bohemian Mining Bureau, contends that this factor increases with the age of the rope; the stress of a new rope is greater than an old rope and it merely increases inversely to the elasticity on that rope. He says it will be about double that amount, or three-quarters towards the end of the life of the rope. Whether this is so or not, we have no means of knowing. Of course, I have always figured my ropes on the safe side, just by the ordinary formula.

STRAINS AND STRESSES.

Another point in connection with that question of the stress of the rope where it is wound on a drum, is that the first layer of rope compresses it slightly and reduces it in diameter. The next will compress it more, and gradually the preceding layers are relieved of the tension stress that was on the rope originally. The bending stress would still remain, so that the rope that is actually wound on the drum has less stress on it than it had when it was just winding up on it, so that the strain would come on it only for a minute.

In addition to this there is the friction of the rope on the drum; this also affects the question. The whole question of determining the stresses of the rope becomes very complicated and we know very little about it. I do not know whether experiments in that line can be made. At any rate, it is worthy the attention of engineers, generally, to look into this question further and by way of experiment to test this matter out.

As a point of practical experience in this connection we are surprised and wonder why a certain rope has given way, but sometimes we are equally surprised that the rope did not give way sooner

under the stresses supposed to be brought on it by the dia the sheave or drum on which it is wound. Take, for exa ropes that have been in use, the so-called patent strand typ wire, which must be subject to considerably greater stre to bending, than the ordinary type of wire. I think these ro lasted quite well. I have never used any of them. The ropes also have a considerably larger dimension and the st the outer fibers must be considerably greater than in the construction of 19 by 6 type of ropes.

What we need on that point, I think, is more results of tions with that kind of ropes. Of course, the question is and it is difficult to compare results. There are so many which enter into the life of the rope in mines owing to its tion. To get all the facts about ropes is very difficult important.

Mr. Sigafoos mentioned the factor of safety of five ropes, based merely on the standard load which the rope is to carry. That is probably suitable for most cases. We h ropes, and they lasted in some cases twenty-two months for rock, but the law of the Transvaal demands that such ro not be used for hoisting purposes—the factor of safety sha less than six in handling men. The rope must initially have greater safety factor, due to the deterioration of the rope, course, most ropes ae used frequently for two purposes—t apparatus that is used for handling men is also used for timbers. We never know what the load is and it may be e

THE TRANSVAAL LAW.

The Transvaal law states that the load of persons, ass person to weight 150 pounds (which is generally assume official weight) should never exceed 85 per cent of the m load the cable will be subject to in operation for other p That was found to be a very great hardship. It limited the l of men to a depth of 4,200 feet. One of our shafts was depth, so we could not handle men or any other loads or hoist—on the same apparatus that we used for the han material. If any of the Council members wish to see a copy laws, I will be very glad to show them to you.

We had one very serious accident in one of our mine ropes are used in the Transvaal, and it was a case of neglec

In this case the wear on the rope was at a certain point—about one-third of its length—the shaft was about 2,100 feet deep—and the rope broke at about one-third, or about 600 or 700 feet from the cable. Forty workers and one watchman at the bottom were killed. It made quite a stir at that time, and was really the start of government legislation by the new authorities—the British had just taken hold at that time—on safety devices and ropes.

I was a member of the committee and noted that this rope had been worn through by the action of the sheaves. The sheaves were very large in diameter and the bending stresses were slight. The construction of the sheaves wore the rope, and it was considerable. An inspection should have shown the trouble, but the inspection was not carried out. The accident soon came before the courts, but the government was lenient and did not press the matter.

These sheaves were made with a very heavy rim—the arms should be heavy in order to obtain a smaller inertia of the sheave and less tendency to spin in stopping, particularly by means of a brake. In some cases a smaller sheave has less inertia and may produce less deteriorating effect on a rope than a larger sheave with a heavier rim.

This accident led to a very close investigation of the old laws. The British government did not want to bring about hostility in the industry, so they consulted a large number of engineers before advocating the various laws that were finally enacted. One of these regulations, a very good one, I think, was the specification that at every mine there should be kept a special rope book, and every accident, everything, in fact, from the start of the rope and the first manufacturer's certificate, everything had to be entered in that book and the book was to be open for the inspection of the government inspectors at all times.

These regulations prescribed the periods of capping the ropes, and how much should be capped. A daily inspection was required, a very cursory one, of course, but it might show additional broken wires and then keep the mine rope inspector in touch with the condition of the rope from day to day. There is a more rigorous weekly inspection and a thorough monthly inspection, if I remember rightly.

One other cause of deterioration of ropes has been found, where ropes mount with a second layer—I think Mr. Sigafoos brought that out—and we tried to eliminate that. It was given in the suggestions published in the report of the commission in South Africa

on ropes and safety catches for mounting ropes. I mus
the thing did not turn out satisfactorily; it did not—tha
not seem to—reduce the shock on the rope in the mount
first layer to the second layer by the groove being brough
if that should ever come before you it is still a problem.

ROPE ACCIDENTS OCCUR NEAR CAGE.

One other point was brought out by the government
of machinery, a British naval officer named Vaughan.
very able man and had received a very good technical trai
arrived at the conclusion that long ropes have a lower
safety than short ropes; that is, for the upper end of the r
it winds on the drum. It is not necessary to go as far as
ropes, but this theoretical investigation of his is very mu
with the findings of similar commissions appointed in
notably in the Dortmann district. These reports show tha
the accidents to ropes occurred near the cage and about
up the length of the rope. This was for ordinary depths.

We had a very deep winding problem, and in order
safety factor sufficient for our own views and those of th
ment for the handling of men, we had to go to tape
Tapered ropes have been in use, I think, for fourteen ye
mines of Bohemia. A great number of such ropes have
structed recently for the collieries in Belgium. We foun
culty with these ropes; they were just as ordinary rope
course, when you come to great depths, it means that you
mize in the construction of your hoist. First, it requires
less storage on the drum with a smaller rope. The wei
and the cost is cheaper, because you have considerably
for the same strength than a rope of uniform cylindric
throughout its length.

Selecting ropes for great depths, of course, is always
problem, and my way of treating the matter has alway
discuss the matter with the rope manufacturers befor
out the specifications. A rope like that, cylindrical or
cannot be handed down from the shelf or kept in storage.
to be thoroughly considered in regard to the material it is t
of and the size of the wires. I have frequently sent out
nary specification with a view of asking comments of

smaller ropes you can generally secure ample margins, and the selection, even by the resident engineer at the mine, is no great difficulty.

Co-operation between the makers and users of ropes is most important in this respect, because they can supplement each other's experience, and it will certainly lead to a better understanding of the question and of elements of safety, which, of course, is a thing we want to arrive at in this connection.

I have been studying wire ropes for a very long time, but the more I see of them the less I know about them. I would like to get the views of others on a great many points and I hope the discussion will lead to a better understanding of the problem.

GALVANIZED ROPES.

I have never used galvanized ropes, but in upcasting shafts, where there is acid or acid water dropping from the timber, they have been used by some companies. I do not know to what extent galvanizing affects the strength of the rope. Sherrardizing by zinc dust has been employed on ropes, but whether it has led to any better results than the ordinary galvanizing I do not know.

I would also like to know whether lock-coil ropes have been used for hoisting in this country, and what is the greatest ultimate strength of the material that has been used in flat ropes in the strands? For stitching you have to use a very mild material. I have known some flat ropes in which the strands lasted a very long time, but stitching had to be done almost continuously. One rope was taken off and restitched and another was put on, and it kept a crew of rope men constantly at work.

At the old shaft on the Comstock—that was about the year 1880, before it closed down—they had ropes about three-quarters of an inch thick at a depth of about 3,000 feet, and they had two ropes being spliced for each one operating. The mine was very acid, but the wear of the stitching, of course, was at the outer edges.

Then the question of Lang's lay and ordinary lay—there are a great many different opinions on that. The ordinary lay is claimed by many to be too lively and liable to kink. Some of our ropes were of peculiar construction, they were made of eighteen strands of seven wires each about a hemp core, and the strands were laid up 12 about 6 about the core. They were very good ropes, but they had a tendency to kink and had to be handled very cautiously where they came on the drum.

STRENGTH OF STEEL USED IN ROPES.

As to the ultimate strength of steel used in ropes, we erally, for long ropes, not hesitated to specify 120 long is, most British manufacturers list their ropes in long to pose because the long ton approximates the metric ton. used 120 long tons—that is, about 170,000 pounds to t inch ultimate strength—but we have had ropes submitted 140 long tons. I have never used any of them; some of t been used, and I would like to know what the opinion of turers here is in regard to that, and whether any impro the ultimate strength of material in ropes, which, of cours desirable, has been made.

In making specifications for a rope it is obviously t thing to state as many as possible of the conditions un the rope is to operate in the mine. The sizes, the drums, th the number of bends, the lateral deviation, the conditio roding, what influences the rope may be subject to; whe vertical or inclined rope. The hoisting speed must have erable influence on strains that are thrown on the rope, less chance for relief during the winding on. The method ing to the cages and into the skips forms a subject almost and the subject of safety devices another.

I had to prepare my notes rather hurriedly, but I shou see a discussion started at various centers on the question The subject interests the safety engineer as much as it mining engineer, and, therefore, deserves a great amount o Perhaps, at some future time, I may be able to add somethin I have just said.

CHAIRMAN TILLSON: Mr. Bevan, can you answer an Behr's questions?

TENSILE STRENGTH OF WIRE ROPE.

MR. BEVAN (Hazard Manufacturing Company, New In regard to the tensile strength of wire rope, Mr. Behr question about the highest point you can reach in the w named about 120 long tons as the maximum in hoisting wo ropes that are generally used for hoisting purposes in th States, I think, are drawn to about eight-five or ninety square inch; that is, long tons. The practice has been of

but the manufacturers prefer to keep away from the high strength of plow steel as much as possible, due to the fact that it will crystallize sooner in winding around a drum, because of the higher carbon contents of the steel. Reverse bending injures high carbon steel much more rapidly than it does low carbon steel.

Another question Mr. Behr raised was about the modulus of elasticity, using the figure of twenty-eight million. That, of course, refers to a square bar. In a wire rope we have a very much different thing to consider. You have wires which work on each other in the rope when it goes around the drum or over the sheave, and these wires will take up some of the bending; that is, they will reduce this modulus, I believe. In figuring out bending stresses in ropes we use a modulus ranging from about twelve million to ten or fourteen million. We find in using twenty-nine million we get a bending stress very close to the ultimate breaking strain of the rope, which, of course, is not correct.

Figuring out the cross section of the wires entering into the rope, and comparing it to the area of the cross section of the rope itself—in the six by nineteen wire rope it is about 50 per cent. Therefore, that will reduce the twenty-nine million to some extent. I think we figured out, taking a five-eighths rope, for example, and figuring out the bending stress, we found in some cases—using the twenty-nine million five hundred thousand pounds—we found it pretty near equaled the ultimate breaking strain of the rope, which, of course, is quite a ways off.

LAY OF ROPE.

Mr. Behr also raised a question in regard to Lang-lay rope, as compared with regular lay rope. I believe Mr. Hart can take that up.

MR. HART (Hazard Manufacturing Company, New York): Personally, I have had some experience in watching the service received from what we call regular lay rope and Lang-lay rope in the last twelve or fifteen years. I have in mind two or three operations where they use one and one-eighth and one and one-quarter ropes. The average service of regular lay rope had been about two years. They afterward went to the Lang-lay rope and the average service, working under practically the same conditions, has been over thirty months.

I remember, in one instance, the first Lang-lay rope that was put on had only been on about six weeks, and the superintendent of

the mine called me up and seemed very much alarmed a: his rope was acting. I went up and talked the matter him and told him that I thought the rope was all right and get good service out of it. The result was that he got so four months' wear out of it, as against an average of tw on the regular lay.

The wires in a Lang-lay rope are not laid up as tigh are in the regular lay rope, because of the construction of and the wearing surface of the wires in the Lang-lay is mu than it is in the regular lay rope. They will stand shor without the wires breaking than will a regular lay rope.

The rope is a little more flexible and for some purpos gives a great deal better service than the regular lay rope.

Mr. Behr thought it was a good idea to have users of consult with the manufacturers as regards their needs. I t is a very good point. While some person may use a cer struction of rope at a particular place, if you put it on anoth tion it will not give satisfaction at all, because the condit be altogether different.

The Lang-lay rope, of course, is to be used with b fastened firmly; in other words, one end to the drum and with a closed socket. Some one asked my opinion as to w not a swivel socket was the proper thing to use on a Lang- I answered no. Another manufacturer's representativ mended a swivel socket. The superintendent of the mine the man who recommended the swivel socket knew more did about it, and he used it. He put the socket on one called us up the next and told us the rope stretched a hund I did not think it stretched that much. I thought the lay and I recalled the fact to him that I had not recommended t socket.

In the early history of Lang-lay rope, particularly in th States, I believe, the ropes were quite twisty; in fact, I kn were, but of late they have it down to a point where they just about as dead as the regular lay rope. After they in service they do not have any trouble.

I saw the working of the Lang-lay on clam-shell work the work of six by nineteen rope on clam-shell work w ninety days, as against twenty-five days of the regular lay, same quality of steel in it; so it certainly spoke very well

"BIRD-CAGING."

CHAIRMAN TILLSON: Mr. Hart, may I ask if your experience has not indicated that the six by nineteen Lang-lay rope tends to produce a condition known as "bird-caging"; that the stress of the outer wires tends to a loose condition as compared to the inner wires, and the diameter of the rope is thereby increased? Is it not evident that the outer wires are not taking the strain to the same amount as the inner wires? The rope tends to swell up—the outer wires loosen up. My personal experience has been that, although abroad they seem to be onto the trick of making Lang-lay ropes in which they haven't that trouble, those made in this country give such trouble; and, as is acknowledged by one of the deans in the rope profession—a manufacturer who has been in charge of one of the rope shops and in charge of making ropes—that there is a trick in making six by nineteen Lang-lay ropes that at least all of the American manufacturers have not learned.

For that reason I have come to the conclusion that a Lang-lay rope is fine and the best lay of rope, but that the best type of Lang-lay rope to use is a six by seven—six strands of seven wires in a strand. We are using six by seven with very good success in our present ropes, of which a record will be given before the American Institute of Mining Engineers, showing the relative amount of work done by regular ropes and Lang-lay ropes of six by seven construction. The six by seven are still in service, and have done far more work than any other rope which has been in that service. Possibly the best indication is not the length of time a rope has been installed, but the amount of foot tons which it has performed, because it may be lying idle a proportionately greater length of time in the case of one rope than in that of another.

MR. HART: Was that six by nineteen with the wires of one size or seal patent?

CHAIRMAN TILLSON: Seal patent.

MR. HART: It is a fact that the six by seven is a more compact rope than six by nineteen. The greater number of wires you have in your rope, the greater chance you have for the softening up or opening up of the strands, and more so in the Lang-lay rope, because of the fact that the strands are twisted in the same direction as the rope is twisted.

The wires are not as tight in a six by seventeen or six by nineteen as they are in a six by seven. Six by seven Lang-lay rope is

possibly the most preferable rope to use, providing your and the other operations which it has to go through are to a six by seven rope.

You get an inch or one and one-eighth inch or one quarter inch rope of six by seven plow steel and you have stiff rope, while with the six by seventeen construction—I ha seen a six by nineteen in the larger sizes, only the six b or six by seventeen construction in sizes larger than one have never noticed that "bird-cage" effect, I think, alth wires are not as tight, as I said a while ago, as in a regular but I have never seen them open up.

When I was speaking of the difference in service bet Lang-lay and regular lay, I should have said that I had in number of tons hoisted. The two different mines that I ha ence to work every day and their tonnage was practically day after day, so that the amount of tons hoisted in one about equal to the next. I think, that if conditions wa six by seven rope, that is the rope to use; in other cases, prefer six by nineteen.

There is one advantage in the six by nineteen con When your outer wires are broken—or a number of the ou are broken—you still have a good factor of safety left in th your strands, or in the inner wires of the rope, whicl majority of cases in six by nineteen rope is about 40 per ce breaking strain of the rope.

WHEN TO REMOVE A ROPE.

The question was raised, I think, by Mr. Behr, as to th time to remove a rope. There is a large company in the wes of Pennsylvania who use ropes one and three-quarter inches inches in diameter for the purpose of hoisting human l they do not remove their rope until it shows fifty broken any one foot of the rope.

There are a great many people who are not well a with the construction of ropes and the breaking strain and so on, that would look at a rope with fifty broken wir one foot and think it was a pretty bad rope with which to b human lives; but the Pennsylvania people have never had dent, and the ropes tested after being taken off with tha of broken wires, proved they still had a large factor of safet

CHAIRMAN TILLSON: About how much, Mr. Hart?

MR. HART: I think it was 60 per cent of the original breaking strain of the rope. I won't say positively, but as I recall it, it was about 60 per cent. That was brought about by the fact that the inspector condemned the rope and the manufacturer claimed that the rope was still safe. It was thoroughly tested and the fact was brought out that it still contained about 60 per cent of the breaking strain of the rope.

MR. DAVIS: In the anthracite region we believe that a good rope is the best safety device we can have. During the last ten years we have lost seventeen lives by ropes breaking. It is still a question as to when the rope has rendered the service and when it should be taken off. I agree with Mr. Hart that if we had a rope with a good deal less wires than fifty in we would not be taking any chances at all. But there is something I should like to know: When should a rope be taken off, upon what service should it be based upon, tonnage hoisted, or what? With the company I am with we take the rope off when the stretch is out, and if the stretch is not out in two years it comes off anyhow. We re-cone and re-cut all our ropes every six months; it does not make any difference if there are broken wires, it is re-cut and re-coned every six months. I think that is a very good rule, an excellent rule to follow. I would not want to see any man hoisted in our shafts with even two wires broken in a rope. If we had any broken wires—if we could discover those wires, or if they were reported—we would get that rope off pretty quick. I think that is a good recommendation.

I want to answer one question that Mr. Behr asked in connection with interlocking ropes. We tried some of those for shaft sinking, with very good results, otherwise, as far as I know, they are not used in this country.

MR. BEHR: They are all right for a small load, such as for a bucket. They give very good service. We have one now that was used in sinking a shaft 10,000 feet in depth, and this rope, at the present time, has been in use between six and seven years, and it is in good condition. It is re-coned, though, every six months.

REVERSING ROPES.

CHAIRMAN TILLSON: Do you reverse your ends of a rope—take the end off the drum and attach the other end to the drum?

MR. BEHR: No, we have never reversed a rope during my years with this company. That is liable to give you a false idea of safety, because most of the breakages have been in the lower end,

and that end has been subjected to greater strain than
end. One gentleman, writing on that subject, said the r
be tapered the other way, in view of results. Of c
moderate depths that was all right; you have so mu
for a small depth—you have a great margin of safety.
the depth becomes great that it is dangerous and you h
careful in regard to the size of the rope as well as
remember seeing two of these interlocking ropes used; o
ropes ran perfectly, but the other rope bird-caged, opene
that scared them and they never used any more of them.
know whether it was the under rope or the over rope th
this defect.

MR. BEVAN: In connection with Mr. Behr's refere
factor of safety of five used in Mr. Sigafoos' paper yes
want to state that the factor of safety of five is only u
example. It is not intended as any standard. Also Mr. Be
tion as to galvanized hoisting ropes. Galvanized hoisting r
been used very little here, due to the fact that galvanizing
very readily on operating over shieves and drums, and th
izing then, of course, is of little or no value. They are u
the river front in New York City, hoisting on lighters, a l
successfully, but the majority of such ropes are imported.
manufacturers are making very few galvanized ropes fo
purposes.

CHAIRMAN TILLSON: Does the galvanizing weaken
and to what degree?

MR. BEVAN: Galvanizing does have some effect on
breaking strain of the wire itself. It varies from 7½ to 10
according to the size of the wire.

Lock coils are very rarely used for hoisting purpose
Davis said; but they are used a great deal for tramways a
ways, because of very great wearing surface and consid
sistance to friction for the carriages to run over. Outsid
for hoisting they are not used very much.

Mr. Behr also mentions the fact of a lively rope having a
to kink, compared to rope that is a little bit stiffer. From
rience, I have found that the most flexible rope has the least
to kink. I believe that almost every one who is familiar
use of wire rope will bear me out on that particular point
a flexible rope has more life in it and it is harder to put
such a rope it will spring out and get away from the ki

question of flat ropes also came up during Mr. Behr's questions. Mr. Hart has sold a great many miles of rope, and I think he can explain the situation more thoroughly than I can.

MATERIAL USED IN FLAT ROPES.

MR. HART: I believe Mr. Behr asked a question as to what the greatest tensile strength was in flat ropes.

CHAIRMAN TILLSON: Of material used in flat ropes.

MR. HART: About 120 long tons; that is the highest tensile strength that I know of that has been used; at least it is the highest we have ever used in a flat rope. As Mr. Behr said, of course, it is necessary in the lacing or threading to use a soft wire. That is done for a two-fold purpose. It makes a little neater job where you turn back and lace through the different ropes; and then again, it prevents inside abrasion of the wires in the rope itself.

The soft, annealed wire used as a lacing gets all the abrasion and the ropes themselves get very little. I have never had the pleasure of watching any of the operations of a flat rope, they were always sent to places where I did not have the opportunity and the privilege of watching their operations. I cannot answer as to their actual service. The call for flat rope, recently, has been very small.

I would like to answer Mr. Davis' question: When is the proper time to take off a rope? That depends on conditions—the condition of the operation and the condition of the rope. Different men have different ideas and different views as to the proper time to take off a rope. About twelve years ago, up at the anthracite mines, a rope broke and dropped nine or ten men to the foot of shaft, killing them. That rope had been in operation about nine years, I think. They had a record of nine years, and they did not know how much longer it was on. I had a sample of that rope taken about eight feet back from the fracture. I tested every wire in it, and the ultimate breaking strength of the wires in that rope—about three feet from the fracture—was thirty-five tons.

That rope had already undergone strain enough to break it, and the second test, after it had already broken, three feet away from the fracture, took thirty-five tons to break it a second time. There were ten men in that cage, say 1,500 to 1,800 pounds plus the weight of the cage. The engineer claimed that the rope broke while the cage was being lowered, and he knew nothing of it until the end of the rope came in the engine-room. I can't conceive of a man running a direct-connected engine and the rope breaking, possibly

400 feet away, with at least a strain of thirty-five tons and could not have felt the jar.

MR. DAVIS: The engineer was stopping at a level w rope broke; he knew something happened, but did not kn what. I happened to be there shortly after the accident. were about at the landing when the rope broke. I under was a single-hoisting man cage, out of balance, and, of cou engineer went by jerks. One of the last jerks was by th when the wire rope broke.

RESULT OF UNDUE STRAIN.

MR. HART: The rope had been in use nine years, possi been in use ten or twelve years, maybe more. That rope, nc was able to take care of the load it was supposed to care for. was some undue strain put on the rope, whatever it was. not brought out at the inquest and I never heard the res so far as I was able to find out, they could not discover wha it. If that rope could stand thirty-five tons after it had been broken, there must have been more than that put on it broke.

MR. DAVIS: It was a pretty well-rusted rope.

MR. HART: Yes, naturally it was rusted; but, neverth stood that strain to break it three feet away from the fracture

CHAIRMAN TILLSON: What would be the original ra that rope, how many tons?

MR. HART: Approximately 47 tons, if it was a one ar quarter-inch rope, which I think it was.

MR. RICE: If that rope showed a considerable amount rosion, is it safe to say that there was not very much greater sion at the point where it broke?

MR. HART: It is not likely the corrosion would take p the middle of the rope. If it was a cone where the dampne liable to collect, naturally, you would say it would be at tha but I can't see why the corrosion should take place at a certa in the rope away from any obstruction on it.

CHAIRMAN TILLSON: Was the rope ever dressed or lubr

MR. HART: That I do not know; I presume, though, it ha It had not been recently. I do not know whether they ever cated the rope or not.

CHAIRMAN TILLSON: It seems to me Mr. Rice's expl

MR. HART: That might be, but I cannot understand why it should corrode at any one spot.

MR. RICE: Where was it that the rope broke?

MR. HART: The rope broke, if I remember correctly, about 150 feet above the cage, and the shaft was some distance from the engine-room.

MR. RICE: There can be some relation to the position of that break and the position it occupied on the shieve.

MR. DAVIS: In going over the matter I think the conclusion was reached that the bottom of the rope was always under tension and it was left standing with the brake on the drum. When it broke it was right under the drum, and, figuring the distance from the top to the shieve and the shieve to the drum it was noticed that the rope broke where bent about the shieve when the load was held idle in the shaft at its usual position.

MR. RICE: Was the rope on an underbend or overbend?

MR. DAVIS: Underbend.

RE-CONING OF ROPES.

MR. HART: The point made by Mr. Davis helps to eliminate it—that his company re-cones the rope every six months. I think it should be done every three months, for every time you re-cone the rope you change the set that comes in a place where you stop. By re-coning every six months or three months, better still, you change the strain, for, particularly on a shaft, you stop practically at the same spot every time, and you get that jerk on your rope, which is a hard strain on it, at the same spot. By re-coning and cutting off three or four feet, you change that spot in your rope.

MR. RICE: I would like to ask Mr. Davis why the company does not reverse the rope, because that has been rather a practice of companies in which I have been connected in the past. When they had occasion to take the ropes off, they very frequently changed them end for end, on the theory that it would prevent a special strain on any one point.

MR. DAVIS: I think that is taken care of by the re-cutting and re-coning. We did it every three months for quite a while, but came to the conclusion it was not necessary every three months. We did it every six months, and oftener if necessary, if there were any broken wires between the cones.

The meeting then adjourned to meet at 9:30 o'clock Thursday, Sept. 13.

THURSDAY MORNING SESSION

THE Section was called to order at 9:30 o'clock by Ch
B. F. Tillson.

CHAIRMAN TILLSON: Our first paper is by Mr. A. H. F
the United States Bureau of Mines, "What Each Operator C
to Aid Accident Statistics."

WHAT EACH OPERATOR CAN DO TO AID ACCI
STATISTICS.

A. H. FAY, MINE STATISTICIAN, UNITED STATES BUREAU OF M
WASHINGTON, D. C.

Mr. Chairman and Members of the National Safety C
The magnitude of the mining industry may be grasped wh
realizes that more than 6,000,000 men are engaged in the
in the world. Of this number 3,800,000 are employed in th
mines and 2,200,000 in the metal mines. In addition, millions
are engaged in allied industries dependent directly upon the
for coal and metal.

Mining is one of the hazardous industries employing over
000 men in the United States of which three out of every
men employed are killed each year by reason of some ac
While complete data relating to non fatal injuries are not ava
yet reports to the Bureau of Mines, for all metal mines
United States, show that about 200 men per 1,000 per ye
injured sufficiently to cause a loss of time. A reduction of
cent in the number of mine accidents would mean a saving of
lives in the United States every year, in addition to reduci
loss of time and suffering resulting from more than 200,00
fatal injuries.

OBJECT OF STATISTICS.

Before offering any suggestions as to what the operator c
for accident statistics, it is well to point out some of the r
"why are accident statistics?" The reason for statistics is
show a record of experience, discomfort, pains and sufferi
the employe to hand down to future generations; to furnish
ticians with a set of figures which may be juggled to suit any
liar whim, nor to provide data for the construction of fancy c

To obtain information by which to diagnose industrial accidents to determine the cause and provide a remedy. Statistical records are absolutely essential as a matter of evidence to prove the guilt of certain mechanical devices, which assault with intent to maim or kill, and to determine with a reasonable degree of accuracy the personal element entering into the cause of accidents. As in every court of justice, it is necessary to have all the evidence available to find out who is the guilty one in order that proper sentences may be determined.

There are a few operators who have not awakened to the need of statistics, and, therefore, feel, when asked for certain information concerning accidents to their employes, that it is a sort of inquisition being forced upon them to disclose their private business. Far be it from this. It is for their benefit as well as for the welfare of their employes. Whatever helps human beings in the matter of health and comfort will pay good dividends to the man who provides these essentials. Sick and crippled employes in the hospital or at home are a burden to themselves and their families, the community and the state, without any benefit whatever to their employers. Even though a crippled man may be employed as a pensioner he cannot render full service to his employer.

Statistics should embody all of the information available, concerning each accident, if the best results are to be obtained. It is not enough to know that a man fell down a shaft and was killed. Why did he fall down? Who was to blame? Was the shaft properly guarded? Could the accident have been avoided? It is the answer to these questions that should be recorded in accident statistics.

WHAT CAN THE OPERATOR DO?

So long as accidents occur it is necessary for the operator to keep correct and detailed records. He should study intelligently every accident from all angles. If the accident was preventable, he should install a device that would prevent its recurrence. At the close of the year he should take an inventory of his accident records with the object of finding out what and who was to blame for each group. Having found out the principal causes, he should see that proper remedies are then applied. For example: Should it be known that a certain type of machine has cut off a dozen fingers during the year the remedy is not to supply additional fingers but to devise a guard for the machine or install another type for this particular work. If human beings were perfect and it were possi-

ble to devise perfect machinery there would be no need f dent statistics. While some one has a lapse of memory fo: stant, a machine that is under human control moves thre too far and crushes a man to death. Another did not lool he was stepping, and, as a result, fell down a shaft. True the shaft should have been guarded to prevent the thoughtle going into it. Lead pencils have rubbers because peopl mistakes.

Industries have many accidents because of mistakes; ma dents occur because of carelessness and many because of ir mechanical devices. Mistakes are made by manager as we the employe; both are often careless and both are res for mechanical equipment, the employer in providing it employe in keeping it in proper condition when installed and over to him to operate.

In all industries there are a certain number of accidents inherent, for which it is impossible to place the blame on a These equal about 50 per cent in the mining industry. The sibility for the remainder may be placed about equally on th tor and the employe, as shown by the records of the inspe the Union of South Africa.

UNIFORM RECORDS.

In order that accident records of one company or state comparable with another, they should be collected and tabu a uniform basis, being careful to separate each branch of th try from all others. The number of men employed should b fied as underground and surface employes, with a corres grouping of fatal and non-fatal injuries by principal cause formity may be brought about by the standardization of st relating to statsticis. The Bureau of Mines is doing all in it towards this end, having had a committee draft standard r regulations as relating to metal mines, while one relating mines is under consideration. It is hoped that state legi will adopt as nearly as conditions will permit the rules and tions proposed by the bureau. The operators can help in th

EXACT RECORDS.

Exact records of labor are necessary. These should number of men on the payroll and days and wages lost by of accidents as well as days off duty by other causes. A cl

tion of employes by occupation is desirable by reason of the varying occupational hazards. Inasmuch as all industrial plants do not have the same number of working hours per day or per year, it would assist very materially in the matter of comparing accident records and rates if the operators would keep record of the time actually worked by all employes. In other words, the plant which operates on the basis of ten hours per day should have a greater accident hazard than a similar one operating on an eight-hour basis, and a comparison of the two without an adjustment is not fair to either the one or the other. The company's payroll in every case, except in contract labor, shows the number of hours for which wages are paid during the day, week, month, or year. Taking the number of hours as a basis upon which to calculate the accident frequency it is an easy matter to arrive at the number of 3,000-hour or 2,000-hour workers as the case may be.

Comparing accidents on the basis of the number of men on the payroll is not strictly correct, although it may answer for all comparative purposes. In most cases the number on the payroll is considerably higher than the number actually at work, thus having a tendency to show in reality a lower accident record than would otherwise appear.

INSURANCE RATES.

If the operators are desirous of obtaining lower insurance rates than they are now paying, it can be obtained by keeping correct records of labor and all accidents and having available sufficient proof to show that the accidents at certain plants are not as high as they are at other plants of a similar nature. The absence of records has a tendency to hold the rates higher than perhaps they should be.

EDUCATION.

The campaign of education for employes in the various industries has also been extended to the mining industry to the extent that many of the larger operators are making special efforts to educate their workmen in various ways. So far as accidents are concerned probably the principal thing that can be done by the operator along educational lines, is to see that the employes are thoroughly instructed as to the dangers which they encounter when they enter the mine and to furnish them, through their superinendents and shift bosses, instructions as to how to avoid accidents and

take care of themselves. Much of this educational work r done through safety committees, which should consist, in p members from the various occupations in and about the giving the miner an opportunity to make suggestions which l siders will prevent accidents in his particular department. of the companies have these committees actively at work ar are meeting with gratifying results.

PUBLICITY.

Another feature which might assist in accident reduction matter of publicity. Whenever a mine operator finds that discovered some means of preventing accidents in certain br of his work it would be serving his fellow operators a good he would in some way let his ideas be known to them. A change of ideas with reference to safety work among the op of a district or community should result in much good being plished toward the reduction of accidents.

SUMMARY.

As a summary of what the operators may do to assist i dent statistics I submit the following:

1. Keep exact records of all accidents as to time, place and result of accident along the line of the report required insurance companies before they pay a claim.

2. Keep detailed records of men employed, days worl well as shifts and wages lost by reason of accident. It wil materially in obtaining the proper insurance rate.

3. Urge the standardization of mining laws, rules and tions so that all companies will be required to render to th mine inspector the same type of a report.

4. Co-operation with state and Federal agencies. This r be a difficult task when all the facts appear in the operator's r

5. Spread the Safety First propaganda as much as pos any manner whatever whereby an interest may be created the employes, and in this connection make public your meth accident prevention.

6. Prevent accidents as much as possible to the point o: nation and then there will be no need of accident statistics

(During the reading of Mr. Fay's paper, Mr. H. G. Davi as temporary Chairman.)

DISCUSSION.

TEMPORARY CHAIRMAN DAVIS: Mr. Fay's paper has opened ground for some good discussion. You may ask Mr. Fay any questions you desire, and I assure you he will be prepared to answer them.

MR. E. E. BACH: Since the operation of the State Compensation Law in Pennsylvania, the data of which Mr. Fay speaks must be available, and we will have less trouble than in the past in securing necessary information.

MR. R. DAWSON HALL: I do not think our records contain enough detail. Most of the records say "The car left the track," they do not say why the car left the track. The wheelbase of the car is not given and the gauge is omitted. Very often we omit matters which are really quite important. I do not know whether such things could be tabulated or not, but we might be able to draw important conclusions from such details, even if they were not exactly statistical conclusions. We could draw inferences based on a rapid perusal of those records. Unfortunately, we think that when we have divided accidents into classifications suggested by the Bureau of Mines we have gone far enough. It seems to me we should go very much further. Very often the apportioning of blame is a very hard thing to do. The working man may be to blame for seven-eighths, but if the operator is to blame for one-eighth, he really cannot escape his responsibility. In most cases, it seems to be a little detail which, if corrected, would have prevented the accident, yet at the same time it may not be described as the cause of the accident—it is only an incident in the accident, yet without it no accident would have occurred.

It takes 100 per cent of causes to complete an accident and very often we get 75 per cent or 90 per cent, but we do not get the other 25 or 10 per cent, with the result that the accident does not happen. The accident is there potentially, if it is not there actually. When the accident does occur it is because the 25 or 10 per cent of contribution on the part of the operator has materialized.

It is necessary that our accidents should be described in great fullness of detail, in order that we may recognize and know on whom to put the whole blame—how to distribute the blame among the various persons who were responsible. I do not think it is safe to say that such and such an accident was due to the carelessness of an employer; in many cases it was partly due to him and partly

due to the carelessness of an employe. It is necessary tha should have our accidents well described, so that we can appo the blame; in some cases if the operator had pursued a diff course the accident never would have occurred.

CLASSIFICATION OF ACCIDENTS.

MR. FAY: I would like to see accident records kept i manner described by Mr. Hall, but the Bureau of Mines h authority to enforce any such rules and regulations. We have the best we can.

For four or five years we classified explosive accidents und item "Accidents due to explosives." There was no segreg whatever under that one heading; there might be a hundred. D the last two years we have subdivided the classification into t or fourteen different sub-causes or conditions. Under expl we have "Transportation of Explosives," "Charging and Loadi Holes," "Thawing of Explosives" or "Unguarded Shots," various other items; "Returning Too Soon," "Short Fuses," all of those accidents. And yet each one of these could be cla further. Why was it due to transportation, etc.? There i another topic beyond the word "transportation," and there i beyond that which the operator may be able to work out and for himself, without reporting to a state organization or t Bureau of Mines.

If he will investigate his own accidents and get the details h find out why his cars left the track. He may find that a whee broken, the rails separated, the wheelbase was too short, the was too short—any one of a dozen things might have occ Those are the items the operator can look for and solve to hi satisfaction, whether the public has a record or not.

SECRETARY PAUL: In the classification of accidents as to c my recollection is that mine cars are charged up with about 2 cent of the total underground accidents.

MR. FAY: About 15 per cent, I think, in coal mining.

SECRETARY PAUL: In some states it runs as high as 25 per

MR. FAY: For the United States, I think, it is about 14 per cent.

SECRETARY PAUL: I am under the impression that acc are oftentimes attributed to mine cars which are merely in to the use of the car. Accidents due to mine cars might be subdi

tributed to mine cars were occasioned by defective or improperly constructed track or lack of clearance for the cars. I would like to ask Mr. Fay, in looking over descriptions of accidents, if he gets them in sufficient fullness to determine the line of demarcation between a real mine car accident and other factors which contributed to it, such as defective or improperly constructed track or lack of clearance?

TWENTY-TWO CAUSES LISTED

MR. FAY: We do not, I am sorry to say. We send out a form once a month to the coal mine operators. We have listed twenty-two different causes—some of them, like "Explosives," with ten or fifteen sub-headings; under "Haulage" we have five or six sub-headings—and we expect the operator to check opposite each of these items the mortality due to that cause, but we do not get a report of each individual accident. I think we accomplish better results by asking fewer questions than if we try to get too much detail at this stage. We are adding some details, increasing little by little, but as far as a detailed report of each individual fatality is concerned we do not get it, and there is no law whereby we can get it, nor do the state mine inspectors have to get it. It is only a matter of co-operation and a friendly spirit that exists between the bureau and the state inspectors.

(Mr. B. F. Tillson here resumed the chair.)

CHAIRMAN TILLSON: I hope that the members of this Section can be of assistance to the Bureau of Mines and Mr. Fay, as statistician, in getting information which is so essential to accident prevention. The question continually arises as to the difficulty in getting details. A great many people feel that the term "detail" implies a hardship in the keeping of records. It has always seemed to me, from my experience in trying to classify accident records, that the detail is a great aid rather than a hardship. With the classifications in vogue some four or five years ago I know it was impossible for the same man to go over the same hundred records twice and classify them anywhere near the same way; the divisions were so broad that it was a very easy matter to throw the accident into one classification from one viewpoint and into another classification from another viewpoint. It seems to me that the detail is of assistance rather than a hindrance in the work of classifying and recording accidents.

It would be interesting to know the experience of the others in that respect; especially where the Bureau of Mines furnished us

with forms on which we can make our entries as a daily of the accidents in their proper classified group, it seems t hardship is worked upon any one. I know that the plant i I am interested has been doing that for two years. They it a matter of great value and of no hardship. The mine fo office alone is classifying all of the accidents as they occur, them on these daily journal sheets.

What is the opinion of the members of the Mining Sec garding the value of the four mimeographed bulletins w last year, giving a description of the causes of a number of a taken, I think, mostly from a transcript of accidents in Penns

We issued four bulletins describing accidents that cause ties, and there were only three responses in acknowledgmen bulletins. The three members who replied thought they immense interest and value. The bulletins entail considerab but if they are of any value we can extend the service du coming year. If they are not of value we can better dev energies to some other line of thought.

BULLETINS DO NOT GIVE SUFFICIENT DETAIL.

MR. HALL: I think the bulletins you refer to are not des enough. They are very short and cursory descriptions of accidents. It seems to me that one accident well described i a dozen merely briefed. The information we are getting f Bureau of Mines as to the proportion of accidents along any lar line is sufficient, unless we can get more definite, more e and enlightening descriptions of the accidents.

The statistics which the Bureau of Mines are getting about as perfect as any one could hope for. I did not desire, moment, as I think Mr. Fay thought I did, to criticize the s of the Bureau of Mines. They have always been a pleas a wonder to me, but there are other things, which, possibly, these days may be done, which are even more complete t Bureau of Mines have so far been able to do. I wish to spea highest praise of what has been done, but when it comes to th ographed bulletins that have been sent out by the Council, the most part these bulletins have a relation to the record accidents of a certain plant, why, they seem to be very short very enlightening. It is to be hoped that when we publish a

light on certain definite classes of accidents which have hitherto eluded us.

MR. H. G. DAVIS: I want to thank Mr. Hall for his expression regarding the bulletins. It has been my pleasure to try and prepare something to go with those bulletins and it has been a question to inject something readable without making them too long, showing it with a photograph and not saying too much.

MR. HALL: I am not referring to those illustrated with photographs. I am referring to the mimeographed lists: "Men killed, run over by car; men killed by falls of roofs." We know men are killed by falling of roofs and we know men are run over by cars. My reference was not to the bulletins issued by the Mining Section.

MR. DAVIS: Let us return to the question under discussion. Prior to the passing of the Compensation Law in the State of Pennsylvania, the operator—when I refer to the operator I mean the man in charge of the mine, the mine foreman, or the mine superintendent—felt as though he did not want to tell all the truth on the first trip, because there was a day coming when he would have to tell that truth over again. So he reserved some of it; that is, he did not tell it all. It came when there was an inquest called on the fatal accident and he was called to the stand and swore to tell the truth, and nothing but the truth. He was pretty clever, because even then he did not tell all the truth, because again there was another day of reckoning coming, when he was called into court and his home and everything else was in danger of being confiscated.

The state mine inspector came and made an investigation, and of course, he generally agreed with the mine foreman. The mine foreman was a pretty good fellow, he had lots of votes and election day was coming, and the mine inspector had to be re-elected or lose his job. There was a political aspect to the thing.

That is all done away with now, and the compensation law applies in almost every case in the anthracite and bituminous fields. There is no reason now why the truth should not be told, there is no after effect. The state pays the mine inspector to put a soul into his reports and place the blame where it belongs, and I say this with all due respect to the mine inspector. I did the same thing myself, I blamed the fellow that was dead, because he could not help himself, but others, sometimes, were to blame, too. Isn't that true? How about Illinois, Mr. Jones? Do the mine inspectors out there investigate and place the blame where it rightfully belongs?

MR. JONES: Yes, we try to.

CARELESSNESS OF WORKMEN.

MR. T. T. REED: In regard to the question of detail. only necessary for the classification of accidents, but it is al tial for a really proper conduct of accident prevention. very familiar with underground accidents, but as far as plant accidents are concerned, probably 75 per cent of accidents that could be roughly classed as due to the carele the workmen.

When you come to look into the matter a little closer it a point of fine judgment in every case, whether it was car of the workman or not. There are many cases in which arises as to whether a man with reasonable care could prevented the accident. Such a thing as a man unloading a a box falls down on his foot would indicate that in handli a certain number would roll on your feet, no matter how ca may be. Then, again, an accident attributed to careless investigation might prove to be due to the fact that the had not given proper instructions to enable the workman to guard himself against accident. As we know, many accident to men who have only been working a short time and are i enced in their work. Therefore, we really require the fulle possible in regard to any given accident if we are to rightly d the cause of it and determine the blame.

I have found that you can kill two birds with one stone b a discussion of the cause of accidents in a safety committee In the first place, the judgment of a number of men is bet the judgment of a single man; in the second place, you g men speaking in a precise way instead of a fuzzy way. By down to an argument as to just what was the cause of the you get your men thinking in a precise way; as a result yc more careful set of men.

MR. FAY: I did not take Mr. Hall's remarks as he se think I did. I am often accused of being outspoken and Mr criticism closely followed my views in the matter. We hav detail we want. I appreciate Mr. Hall's remarks and we deavoring to do the very best we can.

A good many accidents are credited to new men. Well, I figures to prove that they do not. It seems, from my exp around the mines, that some of these accidents happen to th men rather than to the new men. A man who goes into th

for the first time is a little bit timid, he is careful and will watch every timber, every stone and look where he steps. He will watch all the time, look for the cars, for the hoists, for the trolley wires; he will watch everything. He will do that for six months or more, until he gets so-called inured to the dangers that are underground. He thinks, after a while, he is immune to them. Pretty soon he will be tamping with his drill steel or pulling down rocks or working under rocks that are loose, to which he pays no attention whatever.

If we could only get the data, which these detailed reports would eventually show, I would not be surprised to find a number of accidents occurring to men who have been in the business ten or fifteen years instead of to men who have been there thirty days.

ACCIDENTS TO NEW MEN.

MR. REED: I think the figures do show that as a rule it is the men who have been working less than thirty days who are most likely to get hurt. Of course, that explains itself, because you have not the condition of darkness in an industrial plant which yau have in the mines; in the second place, a man goes around in more places, so that it is almost impossible to coach him sufficiently in an industrial plant, whereas underground everything has to be guarded against.

CHAIRMAN TILLSON: I will answer Mr. Hall's criticism, which I think we all appreciate, of the lack of detail in the mimeographed accident reports. This is due to the fact that we can give only such details as are turned in when reporting accidents. The lists were compiled from reports turned into the Pennsylvania Department of Labor and Industry at Harrisburg. We used all the detail we could get; we did not make up any fairy tales to make a well-sounding report, but we did use all the information we could get.

If the members of this Section would only send us descriptions of fatalities which are from more or less basic causes of accidents, we would be able to have our committee assemble and publish them and they would be of advantage to all of us.

The time is growing short and we are to be favored by a paper from Mr. A. J. Moorshead, President and General Manager of the Madison Coal Corporation, Chicago. Unfortunately, he is not able to be present and I have asked Mr. T. T. Reed to read his paper. Mr. George E. McElroy of the New Jersey Zinc Company has a short discussion of the paper and some lantern slide illustrations. The blue prints illustrating Mr. Moorshead's paper are here and those who desire them can secure copies from Mr. Davis.

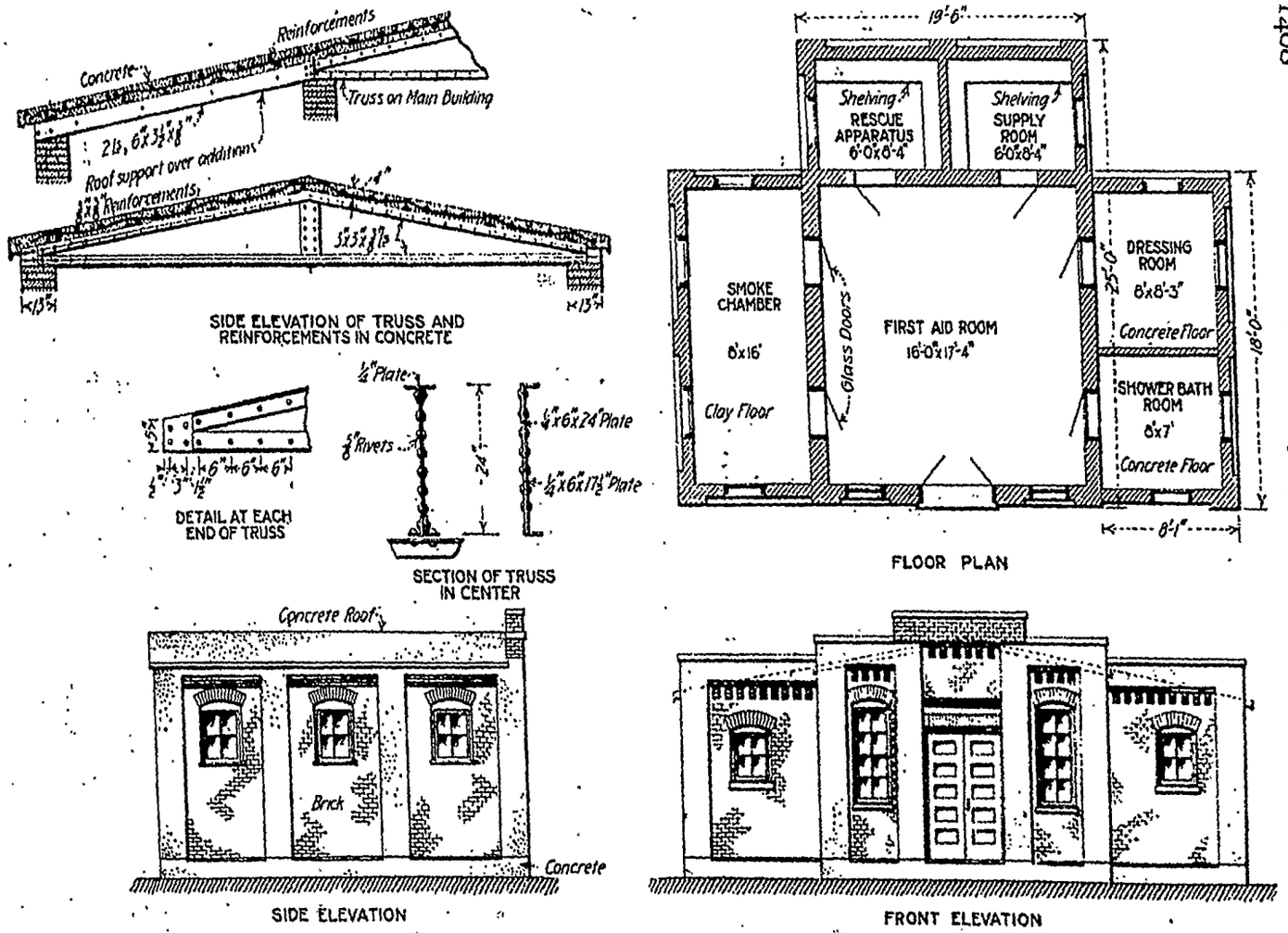
THE EQUIPMENT AND ORGANIZATION OF MI RESCUE STATIONS.

A. J. MOORSHEAD, PRESIDENT AND GENERAL MANAGER, M COAL CORPORATION, CHICAGO, ILL.

Mr. Chairman and Members of the National Safety C
There is not a single branch connected with mining, and p larly the mining of coal, that to my mind is so importan thorough organization and equipment for mine rescue wor there is nothing that I know of that will bring greater ecc benefits to mining companies than well-equipped rescue statio well-equipped rescue organizations of men, because it mean the companies who contrive to secure thoroughly well-org mine rescue bodies will seek to do everything in a safe manne in doing so will lower the accidents to a minimum, lessen suff and in a large measure stop the great expense attached to acc to employes and damage to property.

There cannot even be a mine fire underground without m less property being destroyed, and the mines that are fitted breathing apparatus and well-drilled crews will put out a fire quickly, where it will be impossible for men to work without apparatus; consequently, fires may be controlled before much age is done, and this I can testify to, not only in putting out at our own property, but often those of our neighbors.

Of course our neighbors suffer more than we, because they not be reached as quickly as necessary to obtain the best re We all know a fire that may be quickly put out if caught withi first ten or fifteen minutes of its starting, means destruction o property entirely if not controlled in less than twenty or t minutes. Experiences extending over many years has taugh that there is no single thing that will bring greater relief to mi companies, and more particularly to the supervising officers of mines, than a well-equipped rescue station at each plant, toge with thoroughly trained rescue crews. At all of the plants of Madison Coal Corporation are rescue stations of the same de built for the purpose and planned to comfortably accommodate crews, and care, in the best manner possible, for the injured. (B prints of our design of rescue buildings and of our rescue cars be had on application to the Chairman, Mr. B. F. Tillson.)



Courtesy of Coal Age.

ELEVATIONS AND FLOOR PLANS OF A MINE-RESCUE STATION.

PREVENTION OF ACCIDENTS.

The prevention of accidents is one of the most important c duties of not only myself but all of our supervising officers a plants, and this, together with the reasonably efficient fire-fig organization and rescue crews, have been the means of givi an excellent record, both in the matter of injuries and loss of as well as expenditures connected therewith. I hope I ma pardoned for saying that, although we have tried a very large ber of personal injury suits in the last fifteen years, we have no one, and our low cost of carrying our own insurance during period, which amounts to less than 1 per cent of pay roll, tes clearly that we have not made settlements for the sake of ke out of court.

I wish to divert from the subject for a moment to say that gr efficiency in injury-preventing and lifesaving can be more gene depended upon, in my opinion, when companies carry their ow surance, because they realize that they must pay the bill thems for their own thoughtfulness and carelessness in their mining o tions. All employers, who desire from human motives only to d they can to lessen injuries and loss of life, will be spurred to gr activity when they know that every serious injury or numbe small injuries, as well as loss of life, will make a perpetual expensive record in the books of the company. It is altogethe true that too many people will not think of the welfare of ot and sometimes not of themselves until they pay the bills. Th the reason I am an advocate of companies carrying their own in ance, because I believe it spells for safety in all that the word me

EQUIPMENT.

For practical and active rescue work, including fighting i fires, the following equipment should be provided:

Six sets of two-hour type breathing apparatus complete, one to be kept for reserve purposes or repairs to the other five sets.

Six extra oxygen cylinders for above.

Two single six-cubic-foot capacity oxygen cylinders. These to be carried as emergency cylinders by the rescue team; tha if the oxygen cylinder of any of the men should give out thro leakage the emergency cylinder could be applied, and in this n ner the wearer could get back to the fresh air.

especially when exploring districts where men are thought to be alive. If the roadway between the pit bottom and the men who survive the explosion is found to contain an atmosphere dangerous to life, the above apparatus is put on the men and the breathing bag is kept full by one member of the squad. In this manner the victim can be brought safely through the foul atmosphere. If the victim is unable to walk he is carried on the stretcher with the oxygen cylinder by his side.

The oxygen cylinder of the Salvator apparatus can also be used as an emergency cylinder in any case where a rescue man's oxygen is not sufficient to carry him back to the fresh air base.

One oxygen pump for the recharging of the small cylinders from the large storage cylinders.

Six oxygen storage cylinders of at least 100 cubic feet capacity.

One complete set of wrenches, also extra sets of piston leathers, gaskets, glycerine for the lubrication of pump, and distilled water for the charging of the pump cylinder.

Four hundred cubic feet of oxygen should be kept on hand at the least.

One hundred and sixty pounds of 99 per cent pure caustic soda to be used for actual rescue work of fire fighting.

Two hundred pounds of crude caustic soda for training purposes.

One oxygen reviving apparatus, with three extra oxygen cylinders for same. For this purpose the automatic pressure and suction part of the pulmotor is not recommended, but the inhalation device of the pulmotor, in conjunction with the performing of artificial respiration, is sufficient.

Three pair flexible rubber gloves for handling caustic soda.

Six reliable electric hand lamps of the accumulator type, capable of giving at least four hours light per charge.

Six extra accumulators for same.

Six Everready flashlight lamps of from four to six-volt batteries, with at least two extra batteries for each and one lamp bulb for each.

Six pairs of rubber smoke goggles.

Six oil-burning safety lamps complete. At least one gallon of oil should be kept on hand for same, also a supply of lampwicks.

Six extra lamp glasses for the safety lamps and a good supply of asbestos gaskets should also be kept on hand.

Two small birds should be kept by some member of the rescue team for the testing of the atmosphere in affected areas.

Four glass-stoppered bottles of about three-ounce capacity shoul be provided for securing of samples of mine atmosphere for analysi

One meter for testing the volume of oxygen passing through th reducing valves on the breathing apparatus.

One box of crayon chalk.

Ten pounds of lump sulphur for making fumes in the smok chamber.

Six fifty-foot lengths of cotton rope, about five-sixteenths-inch i diameter, with snaps at each end, so that all may be fastened togethe if necessary. These are to be used when rescue men are workin in smoke. As the men travel along the rope is paid out and serv as a guide line when the men return, cutting out the chance of ge ting lost in the smoke and exhausing their oxygen supply before th return to fresh air.

CARE OF ABOVE EQUIPMENT.

All rubber parts should be kept in a cool, well-ventilated roon lighted by a north window only; this does away with any possib chance of the hot sun playing on the rubber parts and drying sam up; in the winter it is preferred that no steam heat be kept in th apparatus room; cold will do them no harm.

By attention to the heat of the room in which the apparatus kept the rubber breathing bags have been kept serviceable for fi or six years, although the average life of rubber breathing bags (I believe) said by the Bureau of Mines to be less than twel months.

All rubber parts not in actual use should be washed in soap ar water of about 150 degrees Fahrenheit at least once every montl this will prevent hardening and cracking.

After use the caustic soda should be emptied out of the bag once and the bag washed out and hung up to drain, but in the eve of the men having to travel a long distance from the place where th actual work was done and the caustic soda should dry and cake the bag, no attempt should be made to break the soda while in th bag, because if this is done a torn bag will surely result. The ba should be filled with water of about 150 degrees Fahrenheit ar allowed to stand until all the caustic has dissolved and then wash in the usual way.

Mouth pieces should be washed with soap and hot water ar then disinfected with diluted carbolic acid or some other disi fectant; the inhaling and exhaling valves should be cleaned wi

water and allowed to drain to prevent the sticking of the valves through the collection of saliva.

The bags should be fully charged with caustic soda and oxygen at all times; for experiment at the Madison Coal Corporation Mine, No. 8, station, one machine has been kept fully charged with soda and oxygen for six months. At the end of this period two hours' work was performed with the same apparatus in sulphur fumes in the smoke chamber of the rescue station.

When the apparatus is kept fully charged, more time is left for the thorough testing of same and parts are not liable to be mislaid.

All safety lamps should be carefully assembled, making sure that all gauzes are in and that the asbestos gaskets are in good condition.

All electric lamps should be kept fully charged.

The extra batteries for the flashlights should be renewed immediately the maker's guarantee date is reached, and which is usually about six months.

All the above equipment should be in charge of one competent and responsible person, who should have authority over same at all times.

FIRST AID SUPPLIED.

At least two large first-aid boxes.

Three stretchers.

Three blankets.

Three air pillows.

Two dozen jars of moist picric acid gauze for the treatment of burns.

Three full sets of splints for the treatment of fractures.

One gallon of tincture of arnica, for the treatment of bruises, and a good supply of bandages.

One set of charts for instruction purposes.

ORGANIZATION.

For a mine employing from 300 to 400 men, at least three full teams of five men to each team should be organized and composed of all the underground officials and men of sober habits who are studying mining and who are liable to stay with the company.

A fourth team should be made up of top men and mine examiners, which would include the carpenter, electrician, blacksmith and two mine examiners. Three or four good laborers should also

be trained as reserve men to fill vacancies in any of the teams any cause.

The training of these men should extend over about t weeks, one lesson being given each week, consisting of work the breathing apparatus on in the smoke chamber filled with su or formaldehyde fumes, and the recharging, cleaning, assem and principles of the use and testing of artificial breathin paratus.

The first three lessons in the smoke room should not be of than one hour's duration, but after that the practice time i smoke room should be increased by half hours until a two period is reached.

For a full drill course the men must test all joints, u gauges, amount of soda in bag, all valves, including inhalin exhaling valves, relief valves, reducing valves, emergency v and main valve; the last three valves are best tested by imm in water or may be tested by putting a lighted paper to the if any leakage the light will burn much brighter.

After putting on the apparatus the men should be given a out in the sulphur fumes, as follows:

Pull fifty-pound weight 120 times.

Travel over overcast fourteen times.

Go through tunnel 17x19 inches six times.

Saw four props.

Carry 200 bricks from one end of the smoke room to the end and build a stopping with same.

Set four props, and take out again.

Put up brattice cloth once.

Apply emergency cylinder once.

The men should be taught to disconnect the flexible tube delivers the oxygen to the breathing bag, by clamping betwe finger and thumb the neck end of the bag where the oxygen in, to prevent any leakage in or out of the bag, and replace w tube fitted to the emergency cylinder and use the oxygen out latter cylinder to get out to fresh air with, the assumption that the oxygen has leaked out and there is not sufficient regular cylinders. In the latter case, being unable to use the lating valve, therefore, he must work intermittently; that is, h fill his bag by opening the main valve and then close it agai more oxygen is needed.

IMPORTANT MATTERS THAT SHOULD BE STUDIED.

Rescue members should be taught the composition of mine gases and their effect upon human life, the symptoms of the different gas poisonings, how they should be treated, the proper way to collect samples of gases for analysis, how to test for different gases with the safety lamps, birds, etc. They should also know how to treat rescue men who may become distressed from any cause, such as the accidental cutting off of their oxygen supply.

The study of maps, methods of exploring mines after explosions, tracing the origin of the explosion, keeping notes on the condition of the roadways, stoppings, doors, the direction in which the timbers are blown out, the signs of force on pit cars, signs of heat on timbers, burnt paper, the position of the dead, whether death occurred from burns, violence or the inhalation of the poisonous gases, the tallying of bodies and marking the positions in which they were found.

How those found after the explosion should be brought through gaseous zones by the use of the Salvator half-hour apparatus.

The disinfecting of the dead bodies and the places where found.

The use of the hygrometer in determining the amount of moisture in the air.

The charging and using of fire extinguishers.

First-aid treatment of burns, wounds, fractures, etc.

How to perform artificial respiration.

A good system of teaching the theoretical work would be for the instructor to typewrite his lecture for each lesson and append questions, giving each member a copy and requiring them to answer the questions orally at the succeeding lesson.

The oral system of training is not sufficient; the men too often remember very little of the lecture because they do not thoroughly understand what was said at the time; but if it is given in writing they can study it when away from the Rescue Station.

UNDERGROUND EQUIPMENT.

Rescue cars should be provided and kept in a suitable place at the bottom of the shaft, and should be equipped with fire extinguishers, first-aid box complete, all sizes of splints, sledge hammer, saw, wire clippers, brattice cloth, nails, stretcher, rubber gloves, and seats for six men.

The car is designed for the transportation of tools and injured men, the stretcher being arranged to attach to the four corners of

the car by hooks and springs, making it very comfortable f person on the stretcher. It is also used for conveying resc to the base of operations.

It is, of course, understood that the car is only used af main roadway has been inspected by the rescue men and foun of afterdamp and has been cleared of falls that might have oc

When an explosion has occurred each member of the party will immediately proceed to the mine rescue station, they must be given written instructions by the mine superint of the work to be done and the route to be taken. A copy o instructions must be kept by some responsible person so that event of the exploring party not returning within a reasonabl a reference to the book in which the intentions of the exp party have been recorded would enable the searching party to without delay.

Each machine should be tested to see that it contains the ma amount of oxygen (120 atmospheres) in the cylinders and charge of caustic soda (four pounds); all joints, valves, etc., be tested, as already explained; the pressure of each app should be recorded by the captain, and a further reading gauge made every fifteen minutes and recorded in his note boc this manner any leakage of oxygen will be quickly detected.

Before leaving the rescue station every member should and work in the smoke room (which is filled with sulphur f for five minutes.

All safety lamps should be tested before entering the ca the names of the rescue persons taken and recorded by the in charge of the shaft gates.

EXPLORING TEAMS.

The exploring team should be equipped with one Salvat paratus, one spare emergency cylinder, two safety lamps, a least four electric lamps, chalk, a fifty-foot length of rope a flask of brandy or some other stimulant, and one bird in a

They should examine the stables immediately for signs c and rescue all who may be alive at the shaft bottom, test the a phere with the bird and safety lamp, and return to the surfa report.

They will then descend again, and, assuming the air to to breathe, travel along the main roadway, carrying the birc on the level with the face to test for carbon monoxide, and the

lamp low down to test for heavy gases, such as carbon dioxide. As soon as any sign of these gases are found they will immediately put on their mouthpieces, read their gauges, travel a distance ahead, after which they will come back and make their report.

A fresh air base will then be made with a telephone fitted so that persons on the surface may know how the work is proceeding.

First-aid squads will then collect at this base with stretchers and another squad of men will be put to work repairing brattices and doors, while another squad carry material and supplies.

When a very considerable distance is to be traveled by the rescue party and work done such as putting up a brattice, etc., at least twenty atmospheres of oxygen should be kept in reserve; that is, supposing the distance traveled should require the using up of thirty atmospheres of oxygen, we know that it will require the same amount to come back, assuming the ground to be level. The crew should only be allowed to work until the lowest gauge shows fifty atmospheres of oxygen; this will be a signal for the retreat of the party, who will then have plenty of oxygen to take them back to fresh air for the cleaning and recharging of their apparatus.

This makes a rather lengthy statement on such a subject, but in reviewing it I do not feel that full justice has been done to it by any means. If anything that has been stated by me on this subject, aided by the blueprints previously referred to, may stir mining companies to great activity in this direction, then I shall feel well paid for the work and the example my company has set in the conduct of its mining operations on safety lines.

CHAIRMAN TILLSON: We are all indebted to Mr. Reed for his presentation of the address and to Mr. A. J. Moorshead for this agreeably fine paper on the subject. Our great regret is that he cannot be present to discuss it with us. As a preliminary I will ask Mr. McElroy to present the short discussion he has prepared.

DISCUSSION.

G. E. MCELROY (New Jersey Zinc Company, Franklin, N. J.): At Franklin mine we have ten crews of fully trained oxygen-apparatus men, and, in addition, six fully trained men not assigned to crews on account of their present occupation. Each crew consists of six men—an American or English shift boss as captain, and five foreigners, the pick of that shift boss's gang. Thus each crew is particularly acquainted with a certain mine territory, which fact

it is expected can be used to advantage in case of actual resc tions.

These sixty-six men are what is left of a group of se trained during the summer of 1916, and a group of seven tr last spring. It is our intention to keep our ten crews t strength, training enough new men each half-year to accon purpose.

The newly trained men are given one period a month c mentary training for three months and then one period e months, except during the summer months, when training on account of the heat.

The following schedule of training has been adhered as practical in the training of new men. During supp training other features were and will be introduced fror time in order not to make the work monotonous:

SCHEDULE OF TRAINING.

First Day—Physical examination. Instruction in the tion, assembling, charging and testing of apparatus.

Wear apparatus one hour without oxygen in fresh air room.

Work Schedule—Walk, climb and crawl around smc Average rate of walking, three miles per hour. Carry fi sand (fifty pounds each) to top platform and return sam taken from.

Instruction in dissembling and cleaning apparatus anc bottles.

Second Day—Supplementary instructions in assembli ing, testing and wearing apparatus.

Wear apparatus one hour with oxygen in fresh air room.

Work Schedule—Same as first day.

Supplementary instructions in dissembling and cleaning and charging bottles.

Third Day—Assemble, charge and test apparatus.

Wear apparatus two hours in smoke in smoke room.

Work Schedule—Walk and climb around smoke roo erate pace for ten minutes. Take down and set up fc sets. Connect line of pipe as instructed by captain. Fin by alternately carrying bag of sand up inclined manway ladder and walking around smoke room.

Dissemble and clean apparatus and charge bottles.

Fourth Day—Assemble, charge and test apparatus.

Wear apparatus two hours in smoke in smoke room.

Work Schedule—Walk and climb around smoke room at moderate pace for ten minutes. Build wall on south side of smoke room across track; make of sand bags backed by stone. Tram stone in car from chute. Dissemble line of pipe. Finish period by walking around smoke room, sawing timber, etc.

Dissemble and clean apparatus and charge bottles.

Fifth Day—Assemble, charge and test apparatus.

Wear apparatus two hours in smoke in smoke room.

Work Schedule—Tear wall down and replace materials. Take down and set up two timber sets. Tear up track.

Dissemble and clean apparatus and charge bottles.

TRAINING QUARTERS AT FRANKLIN.

We are especially proud of our training quarters at Franklin, sketches of which we have in lantern slide form. Although the building is called the first-aid building, it is in reality our safety building—the headquarters of all forms of safety instruction.

The training or smoke room in the back, 22 by 43 feet in plan, is as nearly airtight as possible, and so equipped as to permit practically all operations that might be necessitated during actual rescue work. The room may be filled with smoke in a few minutes by means of a smudge pot.

The main features of the training room are: An inclined raise or manway, a vertical cribbed raise with a standard chute at the bottom, a mine ladder set at the slope of the majority of our mine ladderways, a low-timbered drift, standard mine timber sets (of which four are loose for erection and dismantlement), standard mine tracks along all four sides with turnplates at the corners, and a standard mine car. The inclined raise and the vertical raise extend to a platform nineteen feet above the floor level. Passage from the ladder to the top of the inclined raise and from the low drift to the bottom of the raise is effected through trapdoors.

A 4 by 7 foot observation chamber, projecting twenty-four feet into the room at a height of ten feet from the floor, permits the trainer to keep watch on the crew at all times. This chamber is reached by means of a ladder from the adjoining apparatus room. An easily opened side door permits a quick exit to fresh air in case

of trouble and assists in quickly clearing the room of smok fumes.

The apparatus room, 13 by 22 feet, is so equipped as to fac the handling and storage of the apparatus and miscellaneous r equipment. This room also answers the same purpose for branches of safety training. One end is fitted to a depth o feet and the full width with a set of closets and drawers. Two dry tubs, a white enamel sink and an antiseptic solution con are inserted in a lead-covered drain board that extends the full of the opposite end of the room and part way along an adj side. Hot and cold water plumbing extends to both sinks an and the room is steam heated. A six-tank rack connected to pressure oxygen pump, a workbench and a table complete the tial features of the room.

Over the apparatus room is a 6x8x12-foot storeroom, re by means of a ladder extending through an opening in the ceili

Our oxygen apparatus equipment consists of seven Fluess- machines of the two-hour mouth-breathing type and all nec accessories, including a Fluess high-pressure oxygen pump. reducing valves of the apparatus are set to give a flow of a imately two liters per minute.

The rubber bags of the apparatus, containing used caustic are washed out in the laundry tubs, while the goggles, mouth and tubes are washed in the sink, in order to avoid getting soda on the parts that come in contact with the skin. G mouthpieces and tubes are sterilized after each use by placing after washing, in a 5 per cent carbolic acid solution for five minutes.

SHIFT BOSS CAPTAIN OF CREW.

MR. C. G. BREHM (Oliver & Snyder Steel Company, Pa.): I would like to have Mr. McElroy explain just a littl fully his organization. I understood him to say that he had ticular shift boss for each section. Are those men not familia the remainder of the mine, as well as that particular section- men, I understood him to say, have completed the training. do you fill the vacancies in those sectional crews?

MR. MCELROY: That is one point I meant to mention, bu not. Each crew is very familiar with a certain mine territor is, the territory within which the limits of their work are co In every case the shift boss of that territory is their captain.

Of course, there are a good many men in that territory that are very well acquainted with other parts of the mine. Then we have a few in reserve that are acquainted with all of the mine, but each crew practically takes care of one section of the mine. In case of trouble in that section we hope to have them work in it on account of their being most familiar with it, and we expect them to be assisted by squads of workers taken from other parts of the mine, according to the class of work they might have to perform.

Those crews do not keep up to full strength, men are quitting all the time, but five or six men of a crew are picked men—men that have been with the company quite a long time, men that we think, when we pick them, will remain with us, and a majority of them do. There is hardly ever more than one man gone from a crew at one time, because every half year we train up enough new men to fill our crew to full strength.

MR. BREHM: Picked from that particular territory?

MR. MCELROY: We only pick them from that territory to fill in the crew from that territory. We very seldom have to train up more than one more man in any particular crew in any half year.

MR. RYAN: In Western Pennsylvania we have an unusual method of training men. Some of the members of the Section may be interested to learn about it. The rescue crews have their training-room underground, and in each case it is about a half-mile from the mouth of the slope to the shaft. They take a breast or any area of breast on the intake side; they build a brick wall, leaving a small opening so that they can ventilate it from the intake. They have an air door, a trap door at the other end of the breast, and they walk the men in there and test out the apparatus for tightness and so forth. Then they walk the men into the training-room, filled with formaldehyde fumes, as a rule, and make the men do actual work, such as mining coal. In that way they get actual training. This method has been in use about two years. We have about seventy trained men. After we train them they are examined by the Bureau of Mines and receive the Bureau certificates.

INSTRUCTION GIVEN RESCUE TEAMS.

MR. PARKER: I think it is generally conceded by operators owning rescue apparatus, and also by the Bureau of Mines, that these rescue squads should be composed of at least five men. In Mr. Moorshead's case he has only one extra apparatus. In Mr. McElroy's case he has two. One man is a negligible quantity as a

reserve squad. Three men are better, but five men would b ideal combination, and that is what the Bureau of Mines recomm

Mr. Moorshead speaks of instruction given the rescue the exact route over which they propose to travel, in order if they do not show up within a specified time, others may b abled to rescue them, but it is a very embarrassing propositio to have any apparatus for your base when the rescue squad doe show up when the time has elapsed. The Bureau of Mines ha a very sad experience in that particular case by not having at five men with apparatus all charged and ready for the emer signal, which should be received through the medium of the lif from the rescue squad making the investigation.

I believe this matter is well worth considering. I believe Moorshead speaks of his mine having 300 or 400 men. He well afford to have at least ten apparatuses. On the other han has been very thorough in his paper in giving the various deta the equipment that is necessary to prosecute rescue work. I admit that you can do wonderful work with this apparatus. illustration, one of the Bureau of Mines' crews will get a cal three or four will probably be able to dig up one or two men have had training. We have five or six men; we can't affo wait and train men or wait until men are sent to get five more We simply take a chance and go ahead with five or six and d best we can. At the same time, I would like to bring out the that we make great use of the life line. It is always a mea communication back to your fresh-air base and you can let reserve squad know the condition you are in at any time.

CHAIRMAN TILLSON: Mr. Parker, may I ask what indic there is that fire has not destroyed the life line? Is there any of determining that, so that the rescue squad may know their l intact back to the base without giving a false signal?

MR. PARKER: The average squad would not go beyond the because when they come to the fire that is the first thing they to dispose of. They put all their energy on the fire and extin it, because no squad will drag a life line beyond an average fire. They would take care of it the first thing, and then pr to the other work. I believe that would hold true.

CHAIRMAN TILLSON: Also a fall of ground on the line?

MR. PARKER: That, of course, would obstruct communica that is simply a chance you have to take. You are taking a p hazardous chance whenever you get away from your fres

base. You have to take your chance of a fall of ground stopping the life-line signals.

CHAIRMAN TILLSON: I did not know but what your answer would be that the life line would be a telephone cable.

MR. PARKER: No; we have used an especially prepared telephone under certain conditions, but we have never tried it on a rescue trip or an ordinary trip in to make an exploration. Of course, your telephone cable would be subject to the same conditions from the fall of ground as the life line.

CHAIRMAN TILLSON: With the telephone cable you could tell if your message was not going through; you could tell from your magneto if it was short-circuited. I was wondering if that was not the answer to the difficulties with the life line. Why not go a step farther and make the life line a telephone cable? It would be just a question of the original equipment costing more.

MR. PARKER: We have that, but have used it only on level ground, as well as going down a shaft, where you have to establish a communication.

USE OF TELEPHONES.

MR. RICE: I can see where it would be very advantageous. At the time when I was beginning this work with the bureau, I had an occasion to go down a shaft in Illinois which had been on fire, and it was uncertain what the conditions were below. As it was an active fire we went through and made an air lock at the top of the shaft, so as not to admit air to the fire, because there was explosive gas in that case and danger possibly of it catching fire. We were still using the helmets—we then had the helmet telephone—and as we went down it was fastened, attached to the rope overhead, straight out, so as to insure not being tangled up. In that way we were able to keep in communication with the top and get past the obstructions and down to the bottom, where we had to stop. The water was close to the roof and we could not get off the tub. It was an immense advantage to be able to communicate with the telephone.

As many of you know, there has been a device, a telephone, for attaching to the throat for transmitting, but there was a difficulty, I think there was a very great cost in the construction. I hope some genius will be able to bring out a telephone system which will be effective and within ordinary reach in point of price, because I believe that is the final answer for a life line. Of course, you

can't use an ordinary telephone, because the minute you tak thing out of your mouth you at once endanger the man who att to use it.

MR. H. D. MASON, JR. (Mine Safety Appliance Company, burgh, Pa.): Speaking of a fall of top or ground, as you the Bureau of Mines' life line is only 1,000 feet in length, s if there were a fall of any extent it would be noticed by the r crew. In any event the crew—the exploring crew—would more than 1,000 feet ahead of the reserve crew. Another if a fall of top came down on the gangway or entry prev traversed by the advance crew, of course, it would stop th line running off the reel; it would be noticed at once by the r crew. They would know something was wrong and probabl the fall also.

SECRETARY PAUL: Answering further your question in reg the use of the line in preference—not in preference, but as a the use of a telephone line. As Mr. Rice has explained an Parker also, we have used telephone lines, especially design this use, but they are rather expensive, and there have onl one or two of them manufactured. However, in shaft wo have used successfully a telephone equipped to an ordinary l

In one instance a crew was descending the shaft and th on the cage wore a telephone helmet and the man in the e house, right adjoining the engineer, was at the other end telephone. They were able to report from time to time, a were being lowered, just the condition in the shaft, and th ported at one time that they were stuck in the shaft on acco the guides having been disarranged, and it was with some di that we were able to dislodge them. Otherwise we wou have known what the trouble was and would not have known proceed, but by means of the telephone they were able to r the shaft and replace all of the displaced timbers. We fc especially advantageous in shaft work.

In advancing in a mine we found the life line thoroug liable, for the reason that when it has been paid out the full it is usually withdrawn a few feet. The man possibly is l on to the line, and the man at the advance knows when th has been extended its full length, so that any pull exerted o end is communicated to the other unless something has d on it, and when anything has dropped on it they know tha

are out of communication and the crew acts accordingly and does not rely on further communication to the outside.

Referring to Mr. Moorshead's excellent paper, I think this is one of the first papers delivered before any particular technical mining society in this country which has related in detail the exact conditions under which a modern mine rescue station has been equipped and is in operation. Heretofore, most of the papers presented before technical societies have been in the nature of advice as to what should be done. I may say that also applies to the station at the New Jersey Zinc Company. We may misapprehend certain features of Mr. Moorshead's paper, mentioned by Mr. Parker in the matter of the equipment of each particular crew. My understanding is that the Madison Coal Corporation has several of these units of rescue stations. They are located centrally at their different mines, so that when a disaster occurs at any one mine the apparatus and equipment from the adjoining stations are brought into requisition at this particular mine.

I think that is the situation, although Mr. Moorshead has failed to give details in his paper. That is the impression I received from conversations with Mr. Moorshead when he was planning the installation and equipment of these stations.

I think his equipment, as recommended here and which he has adopted at his different stations, consists of a set of five apparatus for one individual crew, with one extra apparatus for that particular crew. In the event of one apparatus being put out of business in the actual work of recovery, after the explosion or fire, he would have several crews on the ground, and each crew would be qualified with six apparatus. In that respect, and throughout his entire paper, he shows that he has very fully studied the situation and has followed very largely the recommendation heretofore made by the Bureau of Mines. I think it is a most excellent paper.

MR. E. H. PRICE (Pennsylvania and Reading Coal and Iron Company, Pottstown, Pa.): I would like to ask Mr. Paul about the helmet he described.

HELMETS OF FOREIGN MANUFACTURE.

SECRETARY PAUL: We have had in use two types of telephone helmets of foreign manufacture. The helmet is made in like manner as the helmets worn by other members of the crew, in that the front part of it is made of metal, attached to which is a pneumatic cushion

and fasteners for holding it on the head. Attached to the fra the helmet is an ordinary receiving device, such as telephone ators wear in telephone exchanges. This fits right over th and straps in that position, and on one side of the helmet, nea front part, is fastened into the metal part of the helmet the t mitter, to which the wires are attached. The cable, consisti two wires, is wound upon a reel, having certain electrical conne so that an ordinary transmitter and receiver can be used a fresh-air base.

MR. PRICE: In other words, then, the helmet is all righ that what I understand you to say?

SECRETARY PAUL: It answers the purpose very well. principal objection to the use of the helmet is the objection t raised to the use of most any kind of helmet, in that there much large, dead space in it there is liability of leakage.

MR. PRICE: Do you think it is safe to use a telephone he

SECRETARY PAUL: No, I would not say that the tele helmet is safe.

MR. PRICE: Why did you use it?

SECRETARY PAUL: The telephone helmet was used for by the Bureau, before we discovered it was unsafe to use. we made that discovery it has been discarded.

MR. PRICE: You have not used any telephone helmet sinc

SECRETARY PAUL: No; that was the reason for the specia phone device which Mr. Rice mentioned in which the trans attaches to the throat.

MR. PRICE: Could you talk and have the breathing app tight?

SECRETARY PAUL: Yes.

MR. RYAN: I saw a demonstration in Alabama recentl new telephone equipment, devised by Mr. Groves of the Ten Coal and Iron Company. They have some unusual conditions there—long slopes—so they have to use the Preston view app This device was made entirely by their own company, in the shops, and was comparatively inexpensive. I do not know e about the details to give a description, but if any one is int and will write to Mr. Groves he will get enough informa enable him to construct a telephone attachment to be use mouth breathing apparatus that would be very inexpensive— more so than any other equipment now on the market.

RESUSCITATION.

MR. PRICE: I would like to ask what is used for resuscitation; what sort of machinery and what the bureau is using.

SECRETARY PAUL: From my recollection of the reading of the paper by Mr. Reed, they did not use anything for resuscitation other than an oxygen inhalator—did not use any mechanical respirator in connection, I take it, with manual, artificial respiration.

MR. PRICE: I would like to know what the Bureau of Mines is using for resuscitation.

SECRETARY PAUL: The bureau is now using an oxygen inhalator, the product of the engineers of the bureau, in connection with manual, artificial respiration.

MR. PRICE: It has discarded the pulmotor?

SECRETARY PAUL: They are not using the pulmotor or any mechanical resuscitator.

CHAIRMAN TILLSON: May we ask Mr. Parker to give us his address on "The Mine Rescue Car of the Government." Mr. D. J. Parker of the United States Bureau of Mines, Pittsburgh, Pa.

THE MINE RESCUE CAR OF THE GOVERNMENT.

D. J. PARKER, UNITED STATES BUREAU OF MINES, PITTSBURGH, PA.

Mr. Chairman and Members of the National Safety Council: In the production of raw material from the mines in the United States over 1,000,000 men are employed, and an additional million in quarries and in various metallurgical operations necessary to convert ore into a commercial product, yet we find that up to 1908 the Federal government had paid but little, if any, attention to the lives and welfare of the huge army of toilers in this great but hazardous industry.

Many mine accidents of a serious nature had occurred prior to this time, and the death rate in mines averaged 3.5 per thousand men employed, a figure considerably higher than the rate in England, Belgium, Germany and France, but it was not until December, 1907, when four most disastrous explosions occurred—claiming, together, 689 lives—that the public anxiety was aroused to this appalling and unnecessary sacrifice of human life.

An investigation as to the causes of such dread explosions was then authorized through an appropriation by Congress in May,

1908. Among other work, investigations were authorize the best types of mine rescue apparatus, and the methods safety and mine rescue work in general. These investigatic intrusted to the technologic branch of the United States G Survey, and were placed under the direction of the late Dr A. Holmes, a man of high ideals, unswerving purpose and b energy, who later became the bureau's first director. To t the mine owner, and more particularly the man undergrou faces day by day the hazards of the occupation, and the safety owe a debt they can never repay, and as a monume memory the Bureau of Mines will ever stand.

Through the work done in 1908 and 1909 by the tec branch and the resultant awakening as to the enormous was and resources, the Bureau of Mines was established by act gress in May, 1910. Primarily, the purpose of the Bureau c as outlined in the organic act, is twofold:

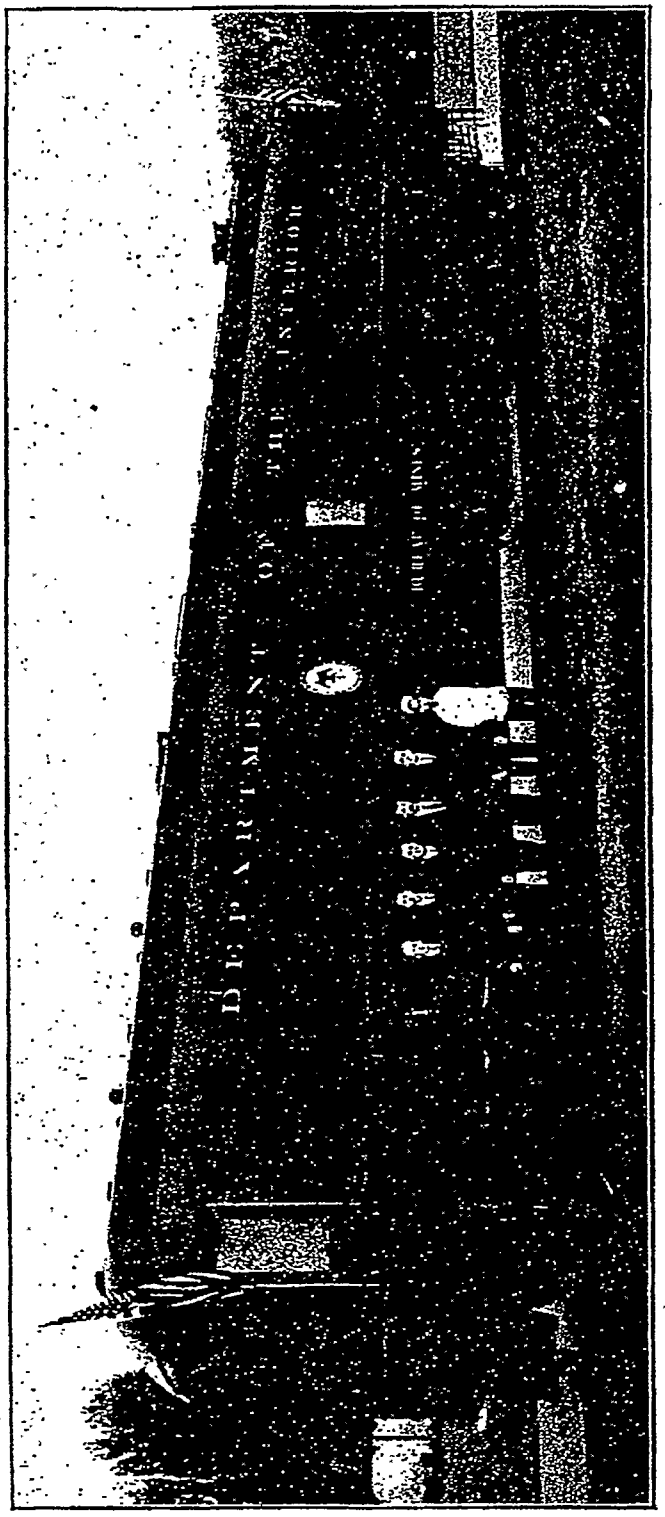
1. Promoting conditions leading to the improvemen safety and health of the miner.

2. The efficient and economic development of our metallurgical and other mineral industries.

CONSERVATION OF HUMAN LIFE.

The first purpose, involving as it does the question of servation of human life, received, most properly, the first a est attention. Although the disastrous explosions of 1907 forcibly, though sadly, before the public and Congress the Federal investigative and educational aid to lessen these the fact remains that the deaths from explosion causes in average years not more than 15 per cent of the total fa coal mines. A study of the causes of the remaining fatal also the non-fatal accidents showed that a very large perc all accidents resulted either directly or indirectly from the ness and ignorance of the employer or employe, and as pa general scheme to remedy these conditions the late Directo conceived the idea of assigning to each of the more imp the mining sections of the country several representative bureau, who would travel from mine to mine and spread trines of safety. To facilitate the housing of these men considerable equipment he proposed the establishment of cue or safety stations of both the stationary and movable

Seven Wagner sleeping cars of a somewhat antiquated



Courtesy of Coal Age.

secured and altered to meet the requirements of the wo: another car of similar type was added. These were assi headquarters at the following cities, which are geogr: railroad centers of important mining sections:

Car No. 1 at Wilkes-Barre, Pa.; car No. 2 at Trinid car No. 3 at Evansville, Ind.; car No. 4 at Rock Sprin car No. 5 at Billings, Mont.; car No. 6 at Pittsburgh, Pa.; at Huntington, W. Va., and car No. 8 at Ironwood, Mic

The crew of each car consisted of a mining engineer, w it was to investigate mine disasters; to investigate safety at mines, and advise the mine officials as to the possibilit proving these conditions; to deliver illustrated lectures to and impress upon them the need of greater care in their only to safeguard their own lives, but also the lives of foreman miner, who demonstrated and taught miners t the oxygen rescue apparatus; a first-aid miner, who taug in first aid to the injured, and last, but by no means lea Either the first aid or foreman miner is usually a practi man, while the other is a young mining engineer.

EQUIPMENT OF RESCUE CARS.

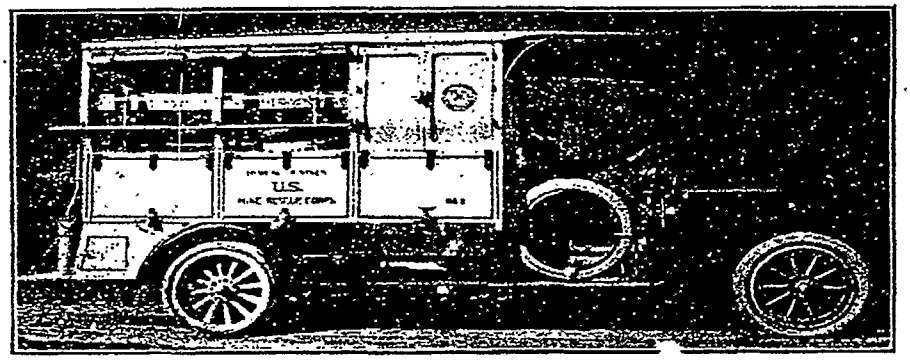
These cars were remodelled so that one end was fitte demonstration room and here the equipment was carrie ing of twelve sets of rescue apparatus, safety lamps, firs plies, fire extinguishers, electric lamps, gas analysis appar optican and the various miscellaneous supplies and re needed for training and disaster work. The remainder served as the living quarters for the crew and was arrang vide a kitchen, stateroom and office for the man in ch toilet and washroom for the crew. Two opposite sectic as a dining-room and provided sleeping quarters for th and foreman miners.

Illumination was provided by oil lamps, but the cars w for electric lighting, and this method was used wherever available. A Baker heater kept the quarters reasonably winter. It was not quite "just like home," but if the pi Baker heater didn't freeze and break, and the cook was plenty of miners came to take the training, the crews v contented.

The engineer would arrange an itinerary in his district a trip of possibly two or three month's duration, and the

then travel from mine to mine, according to this pre-arranged itinerary, stopping for a week here and there. It might be mentioned here, in passing, that the greatest praise is due the railroads of this country for their hearty co-operation in this work, both in the early days and continuing up to the present time. One hundred and ten of the more important railroad lines of the country grant the rescue cars and their attendants free passage over their lines. The appropriations for the work have been limited, and the expenses have been heavy, and were it not for this assistance by the railroads it would have been necessary to seriously curtail the training.

As a means of arousing interest and enthusiasm on the training trip, material advising of the coming of the car and inviting the



Courtesy of Coal Age.

BUREAU OF MINES RESCUE TRUCK NO. 2.

miners to visit it and co-operate in the work was sent to each town possibly a week in advance of the arrival of the car. During the stay at each town a crew of miners would be trained in both first aid to the injured and in the use of the mine rescue apparatus, while the engineer would give illustrated talks on mine safety methods as advocated by the bureau.

Training is given without cost to the miner or operator, and at a time convenient to both; in fact, under special conditions in some camps classes have been held in morning, afternoon and evening. Generally speaking, the best results have been obtained where mine rescue training has been given in the daytime, as a miner, after a hard day's work in the mines, is too tired mentally and physically to absorb the lectures which are given, or to properly perform the necessary practice work.

A WORKING SCHEDULE.

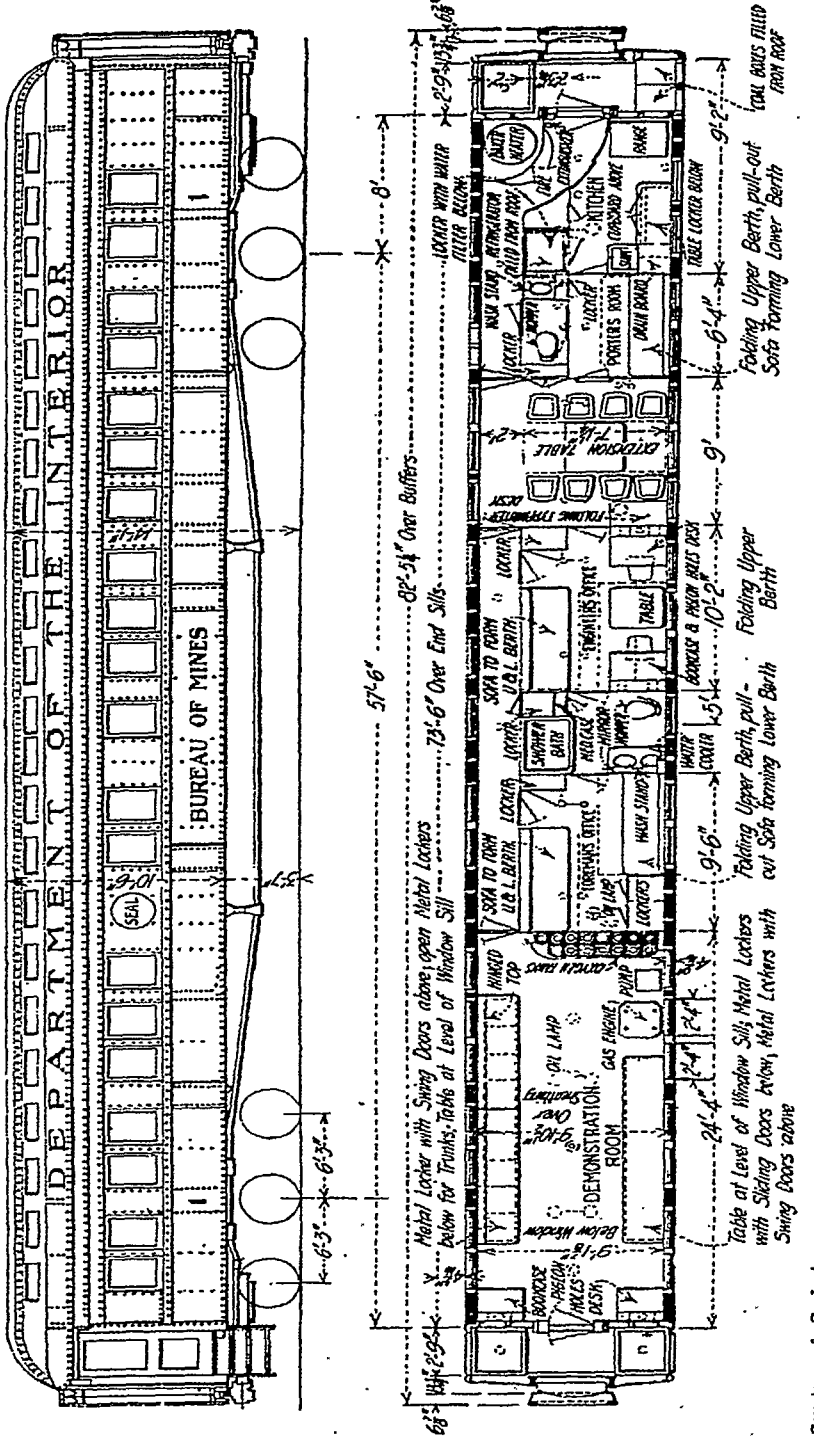
It might be of interest to speak briefly of the manner in the men on the cars pass an average day.

The crew arise at 7 a. m., and take their morning ex which consists of ten minutes of setting up exercises, follow a two-mile walk. From 8 to 8:30 o'clock they eat breakfas by this time a class of miners has usually arrived to recei mine rescue training. By 12:30 p. m. the rescue training is pleted for the day, and from 12:30 to 1:30 o'clock dinner is s In the afternoon, from 1:30 to 4:30 o'clock, a class of min trained in first aid, while for the remainder of the afternoc crew is busy putting the equipment in shape for the next training, or for an emergency call. Supper is served from 5 6:30 o'clock, and in the evening the men work on their re replenish the commissary and water supplies, show visitors th the car, give additional first-aid training, or talk with the n and operators concerning first aid, rescue, safety and general ing subjects until possibly 10:30, when they turn into bed with ing to do until the morrow.

The rescue training occupies five days of about four hour day, and during this time the man is under oxygen from ni ten hours. Most of the training work is done in the mines, a atmospheres of smoke or fumes, and under conditions as simulating those at an explosion as possible. Both the for and first-aid miner are required to wear the rescue apparatu a two-hour period each week in order to keep in constant trai

The first-aid training and practice covers a period of five with a three-hour period each day. The work is very prac having been standardized for the Bureau of Mines by a comn of five prominent mining surgeons as a result of their yea experience in the treatment of mining accidents. The cars tinued with this personnel for about one year when, owing to of funds, and to the urgent need for engineers on other work engineers were withdrawn, and up until November, 1914, only t ing work was attempted by the cars, and this was carried on two-man crew; in fact, at times, owing to lack of funds, it necessary to operate with only one man.

When the work was first started the bureau had practically only installation of mine rescue apparatus in this country, and aid was but little known anywhere except in the anthracite field



PLAN GIVING INTERIOR DETAILS OF THE BUREAU OF MINES RESCUE CAR.

Courtesy of Coal Age.

Pennsylvania. The field campaign, however, had been ver
ful, and mine inspectors, mine owners, miners and doctc
seen the value of the work and were taking a lively interes
First-aid and rescue contests were held throughout the c
and Safety First became a slogan in every mining district.

HEALTH AND SANITATION IN MINING TOWNS.

The cars had been so successful, when used as bases for
ing the safety movement, that it was felt that they could se
additional great service if the crews were increased so tha
could be secured relating to the economy and efficiency of
methods, and the health and sanitation in mining towns.
November, 1914, after mature consideration, a mining engi
surgeon and a clerk were added to the crew of one of th
This fully manned car was operated in one of the large co
ducing states for approximately two years, and very satisf
results were obtained, so much so, that three of our cars ar
larly manned at present, and the others will be as soon as
are available.

By 1915 all of the cars were in a bad state of repair, anc
of them were condemned. All cars were of wood and in
to comply with Interstate Commerce Commission requirem
was necessary that steel underframes be applied to the rem
five. To replace the condemned cars Congress provided mon
the purchase of three modern all-steel cars, which were del
early in this year. These cars were the first to be designe
built in accordance with the bureau's own plans and specific
Living quarters on these cars are much more comfortable th
the old ones, and each car is provided with an electric lightir
tem. Three additional cars will be completed this fiscal yea
probably three the following year, making a total of fourtee
All of the new cars will carry a full crew of six men.

It is intended that the new cars shall remain in training s
for possibly ten months of the year, only departing from its
itinerary in case of a call to a mine explosion or other di
Ordinarily the operators and mine officials and the state insp
force are provided with the cars' itineraries so that in case of t
they will not be delayed in securing the services of the car a
crew.

In some districts where the mining is concentrated, or whe
railroad facilities are poor, it has been found advisable to p



INTERIOR OF BUREAU OF MINES RESCUE CAR.

Courtesy of Coal Age.

motor trucks to carry the equipment for training and dis
These are located at Pittsburgh, Pa.; Birmingham, Ala.
tle, Wash. The cars are headquartered at present at th
points: Car No. 1 at Reno, Nev.; car No. 2 at Raton,
No. 3 at Evansville, Ind.; car No. 4 at Pittsburg, Kan.
at Butte, Mont.; car No. 6 at Pittsburgh, Pa.; car No.
wood, Mich., and car No. 8 at Huntington, W. Va.

I might speak briefly of the organization of the wo
the cars and stations come under the supervision of the 1
engineer, who is headquartered at Pittsburgh, Pa. Tl
and rescue men report through the car engineers to him
engineers report to him on all matters pertaining to fi
rescue work, and are subject to his orders in time of di

RESULTS OBTAINED.

In closing, I might mention a few of the results obta
proximately 35,000 miners have received the complete
first-aid to the injured and 15,000 have received the com
ing in the use of the mine rescue apparatus. In addi
other thousands have received partial training. An aver
000 persons per year attend the various lectures given
structors.

Bureau men have given service with rescue apparatu
investigations at over 450 disasters, and the value of the
on these occasions, as exemplified by their work, has b
by the fact that in the state of Pennsylvania alone over
tors have purchased rescue equipment. Miners have be
in first-aid in every section, and the value of the wor
these men is evidenced in that hundreds of mining comp
employ instructors whose main duties are to teach the
first-aid work. Many bureau-trained men and bureau emp
been called to this line of endeavor. Our records show
lives have been saved by miners trained in first-aid, while
ity of injuries of others has been reduced so that they
enabled to resume work much sooner than they could
This is a conservation which it is difficult to estimate in c
cents.

Of late the bureau's motion pictures have been widely
have been of great value in showing the miner, especial
learned and foreign miner, the various common dange

tices and the dangers that accompany them, together with the safe and proper methods.

Concluding, I will say that although our work has accomplished much, we all have much to learn, and we want both miners and operators to feel free to give us the benefit of their practical knowledge. We look forward to valuable suggestions from each and also co-operation but, after all, we can never expect that discoveries will be made which will render needless constant care and vigilance on the part of all concerned.

DISCUSSION.

CHAIRMAN TILLSON: It is a pleasure to be able to make public acknowledgment, in the name of the New Jersey Zinc Company, for the great assistance which the Bureau of Mines' rescue car gave us in inaugurating our training of rescue crews and first-aid work in our mines. We were several years in appreciating the fact that we had at our service this fine organization for starting rescue work in its very best aspect. When we did realize that we could take advantage of the service of the government, as indicated through the Bureau of Mines, we have never ceased to appreciate the benefits which have been derived. I trust those of you who do not realize the tools which are at your hand through the aid of the Bureau of Mines, will take every advantage to profit as we did.

Mr. Parker has outlined the fine work which they have done, and it is a question of our taking advantage of their facilities. If there is no discussion I will ask Mr. J. W. Paul to give us his address on "The Status of Oxygen Rescue Apparatus and Physiological Effects on Users." Mr. J. W. Paul of the United States Bureau of Mines.

STATUS OF OXYGEN RESCUE APPARATUS AND PHYSIOLOGICAL EFFECTS ON MEN.

JAMES W. PAUL, MINING ENGINEER, UNITED STATES BUREAU OF MINES, PITTSBURGH, PA.*

Mr. Chairman and Members of the National Safety Council: When oxygen rescue apparatus was first introduced in the United States and made use of in the mines following explosions and fires, there was a wide misconception on the part of many miners and

* Published by permission of the Director, United States Bureau of Mines.

mining men as to the extent to which they might be u limitations of the physical endurance of those who vol wear the apparatus.

Many conceived the idea that with an oxygen appar immediately acquired superhuman strength and enduran idea may still prevail among many who have not acq knowledge of the apparatus. It is not putting it too stror that a number of good men have gone to their death in satisfy a false belief on the part of spectators that the ap no limitations and that the wearer knew no limit of physic Many men trained in the use of the apparatus have against their better judgment in order that relatives of miners might be satisfied that sufficient effort had bee rescue the living, when to do so involved greater liability to save life.

Prior to the introduction of oxygen rescue apparatus r miners went to their death in an effort to penetrate the gases of an exploded mine, in an effort to rescue his comrade. However, since the introduction of rescue apj the educational work inaugurated for greater safety in the methods of recovery having been placed on a more m the loss of rescuers has been largely reduced. It is now that men rush in without apparatus, only to add to the dead. This is one of the most consoling features as a re adoption of the rescue apparatus and saner methods of

The subject of this paper is the same as the title of paper issued by the Bureau of Mines under the joint au Dr. Yandall Henderson and your speaker, and all pha physiological effect of the use of the apparatus are discus as to deal with the mechanical construction of the different in general use. This publication has been out only a f and it is my belief that a careful study of its contents b participate in mine rescue and recovery work will result of life through the improper use of the apparatus, and effective rescue work will be accomplished.

HELMET TYPE NOT SATISFACTORY.

The helmet type of apparatus has received condemna scientific investigators who have gone into the subject, ar reau of Mines has publicly denounced its use for mine or fi purposes; still there are some who persist in its use and th

challenging death. Some helmets may be made to fit tightly temporarily, but the models now in use have large dead spaces, and under enforced breathing admit external air.

It is safe to say that a number of deaths in this and foreign countries have resulted through the wearer breathing his own carbon dioxide, or through leakage of external air into the circulating system of the apparatus. To overcome rebreathing of air highly charged with carbon dioxide an efficient absorber is one of the essentials; the apparatus, if of a constant feed model, should supply an excess of oxygen above the requirements of the wearer; if an intermittent feed, there should be either a constant leakage externally or an auxiliary supply held within a flexible medium under small pressure, which will make the breathing circuit under positive pressure.

The difficulty experienced by designers and manufacturers heretofore has been that the physiological requirements have not been given full consideration. The apparatus has been constructed in a manner which enables the wearer to perform limited physical work. However, it is a source of gratification to report that some manufacturers are now enlarging the absorbers and providing a by-pass valve and readjusting the zone of reduced or negative pressure.

ADAPT APPARATUS TO WEARER.

The Gibbs apparatus, described in Bureau of Mines technical paper No. 82, is constructed with the sole idea of adapting the apparatus to the limitations of the wearer, whereas some types now in use require the man to adapt his activities to the limitations of the apparatus.

The use of gas in warfare has brought together the minds of many scientists in a study of the physiological effect of various gases and it is to be hoped that out of these many minds there may evolve some solution for an absorber of practical adaptation for carbon monoxide gas. Such an accomplishment would greatly simplify mine rescue work and I look forward to its realization during our generation.

DISCUSSION.

CHAIRMAN TILLSON: A discussion of this intensely interesting subject is now in order and I trust that it will not be slighted. Are there any questions to be asked Mr. Paul in regard to the subject on which he has had so much experience and done so much work? Mr. Paul, have you any questions on which you would like to get the opinion of those present?

SECRETARY PAUL: I would like to know if there is any tion to any of the statements I may have presented.

MR. RICE: I would suggest that we may learn a great de the development of gas masks used in military operations. I hopeful that we may evolve a mask which will be useful, disaster work but as a protection from silicious dust, so se some mines and in some industrial establishments. We mi them around furnaces, as on the tops of blast furnaces th been considerable difficulty along that line. The idea is tha apparatus is much too cumbersome to use day in and day out expensive for every one to wear, but if we can get a satis light mask it would be a very great gain, I believe.

I think those who have inventive genius should keep study problem. It has been shown that the ordinary helmets ha been satisfactory at all, because it is the fine, silicious dust been very well shown by the South African investigations those conducted by Dr. Lanza, the assistant to Mr. Harring is the very fine dust which gets into the lung cells and whi mately brings about a great deal of trouble. The coarser p are caught in the passages, and while they are annoying ar tating, it is not that dust which usually brings about miner sumption.

MR. PRICE: The company that I represent has forty-five h and we get good results, although the bureau has condemned

CHAIRMAN TILLSON: Have you used them in rescue ope in mine fires, Mr. Price?

MR. PRICE: Yes, sir, we used them for three months nig day; that was two years ago.

CHAIRMAN TILLSON: That is very interesting.

MANNER OF USING TRANSMITTER.

MR. PRICE: I would like to hear the opinion of others. are many people who claim that you cannot talk with the n breathing type helmet—that you run the chance of droppi rubber plug. How can you talk through the telephone wi mouth breathing apparatus?

CHAIRMAN TILLSON: You enunciate just as usual, onl vibration of the throat muscles transmit the sound. You ca with your lips closed and your month half open.

MR. PRICE: Suppose you open your mouth just enough f

CHAIRMAN TILLSON: Probably I had better let some one else answer, but if you hold something between your teeth and grip it you can still talk.

MR. BREHM: The common telephone transmitter does not depend on the sound in any respect. It depends upon the vibration. Therefore, you get exactly the same effect from the vocal chords as you do by talking into the transmitter. The gentleman can test that out to his own satisfaction very nicely with any common telephone, by holding the transmitter against your chest. Some day when you are talking put the transmitter against your chest and talk in a natural voice. You will find they hear you just as well; the transmitter takes the vibration just as well as if you were talking directly into it.

(The discussion on wire hoist ropes which took place at this session will be found in the proceedings of the previous day. This change is made to preserve contiguity.—Chairman.)

The meeting adjourned to meet at 2 o'clock.

THURSDAY AFTERNOON SESSION

THE meeting was called to order at 2 o'clock by Chairman B. F. Tillson.

CHAIRMAN TILLSON: The first address on the programme is "Advantages in Use of Permissible Electric Lamps in Non-Gaseous Mines," by Mr. George H. Deike.

ADVANTAGES IN USE OF PERMISSIBLE ELECTRIC LAMPS IN NON-GASEOUS MINES.

GEORGE H. DEIKE, MINE SAFETY APPLIANCES COMPANY, PITTSBURGH, PA.

Mr. Chairman and Members of the National Safety Council: The selection of this subject brings before us the time-honored and battle-scarred phrasing which has caused some very strenuous arguments, and in an expression of opinion as to what constitutes a gaseous or non-gaseous mine all coal mining men here present have undoubtedly participated.

From the standpoint of a safety engineer, gained after several years of service in mining practice, I am led to an expression of opinion which precludes the designating of any underground operation as non-gaseous. To do so would be to forecast the future as to

whether certain underground operations would encounter gas conditions. All classifications, past and present, along these are based upon the past record of the individual operation or particular district under discussion.

We have been very forcibly reminded of our inability to such classification by several accidents during the past twelve mo where gas explosions occurred in mining operations supposedly removed from the possibility of encountering gas accumulat Among others of like character we might mention the gas explo in the Cleveland water tunnel under Lake Erie, the gas explosio a copper mine in Michigan, and the more recent gas explosion shaft near Ithaca, N. Y., which was being sunk to a bed of rock If operations of this character are to come under gaseous operat previous classifications must of necessity be revised.

GAS EXPLOSION IN CLEVELAND WATER TUNNEL.

The accident in the Cleveland water tunnel occurred wh blower of gas was encountered at the face of the lake tunnel 120 feet under the surface of the lake and sixty feet under the of same, about five miles out from shore, twenty-three men l their lives as a result. After this explosion a safety engineer three certified fire bosses were placed in charge of the work, missible electric cap lamps were installed, and the remaining feet to connect the two tunnels was completed without fu difficulty.

GAS EXPLOSION IN COPPER MINE.

The Michigan explosion referred to above occurred early year in an old copper mine which was being pumped out an opened. The workmen were using carbide lamps when explo gas (methane) was encountered, resulting in a severe explosion the loss of two lives. The work of reopening this mine was sequently completed by the use of electric cap lamps in conjun with Koehler safety lamps for gas testing purposes. This s as a very forceful example of the unexpected occurrence of plosive gas in a metal mine.

GAS EXPLOSION IN ROCK SALT MINE.

The explosion in the shaft near Ithaca, N. Y., resulted from accumulations encountered at a depth of about 830 feet. The of rock salt, to which they are sinking, lies at a depth of about feet. This shaft was within 200 feet of Lake Cayuga and ve

intervening rock was so impervious that there was absolutely no seepage and it was necessary, in order to operate the rock drills, to pipe water down to the foot of the shaft from the surface. After the explosion fire bosses were employed, a complete equipment of permissible electric cap lamps was installed so that the work of sinking could be carried on in safety.

In all three of these cases there was no expectancy of encountering gas, and at the time the accidents occurred no one in charge was familiar with gaseous conditions to handle the situation. These operations were to be considered as typically non-gaseous. The general classification of gaseous mines failed to include operations of that character, and yet such outbursts have happened previously.

In this connection, I take the liberty to quote from a communication from Mr. Frank Haas, Consulting Engineer, Consolidation Coal Company, Fairmont, W. Va.: "The finding of gas in salt developments is not, however, an unusual occurrence, as they have invariably had considerable trouble from this source in the salt mines of Germany. We also find similar conditions in the clay mines of Ohio, also limestone quarries and in such shallow operations as cisterns in Northern Ohio."

CHARACTERISTICS OF A NON-GASEOUS MINE.

Having been brought to a more careful study of such conditions, it becomes necessary to revise somewhat the characteristics of a non-gaseous mine. Upon what shall we base the distinction? Answered as is usual by other inquiries. What are the possibilities of encountering gas in any defined operation? And how does this gas occur? In all of the accidents enumerated the gas, as found, was pure methane and by chemical analysis it was proven that no other hydrocarbons were present. To designate a non-gaseous mining operation we must take into consideration, first of all, the probable occurrence of methane in the strata to be worked. The gas will be found in pervious strata where there has been the decomposition of carbonaceous material in the vicinity and it requires only overlying impervious strata to make such a pervious stratum a reservoir for the gas accumulations, and this condition may exist in strata far removed from any coal measures.

In coal mining operations coal seams usually act as reservoirs for gas. When the coal seam is under water level we have the impervious agency necessary to retain the gas in the crevices of the coal. An impervious rock stratum may also act as the container

even with the coal seam above water level. Similar gaseous con tions may be found in metal mining or any underground operati if a carbonaceous stratum or material is present in that vicinity there is the proper arrangement as to porous and non-porous o lying strata. The fact that gas is encountered more often in mines does not indicate that the gas always comes from the itself. From the porous character of the coal it can very rea become a reservoir for the accumulation of the gases which origi in the carbonaceous shales which are usually found in close pr imity to the coal seams.

The question of a safe and efficient means of illumination mining operations has been taken care of by the development permissible electric cap lamps under the direction and approval the United States Bureau of Mines. A schedule of very rigid t was outlined and various types of lamps were submitted by the la manufacturers for approval and six electric lamps have thus been approved by the bureau.

THE EDISON LAMP.

The company with which I am connected is the general tributor for the Edison electric safety cap lamp, which was fected by Mr. Edison, and, being submitted for approval, was first to be passed for safety, efficiency and general practicabilit mine service. During the two and one-half years since this appr was granted over 90,000 Edison electric cap lamps have been pla in operation, and because of the very general satisfactory ser they are giving Mr. Edison is to be congratulated upon the devel ment of so efficient a safety device. Mechanically and electric this lamp stands up to all the rigors of mine usage, and we that it has solved the mine illuminating problem to the satisfactio all concerned. These permissible electric lamps have been pla most generally in coal mines, replacing about equally flame sa lamps and open lights.

MAIN REASON FOR SUCCESS OF ELECTRIC CAP LAMPS.

The great success which has attended the installation of elec cap lamps has been largely due to the development of a small stor battery of such construction as to withstand the rigors of m service; to be more or less "fool-proof," and to require a minim of care and attention so as to be well cared for by the average e

rigidity of construction as to give years of service without any mechanical or chemical deterioration.

ADVANTAGES OF THE ELECTRIC CAP LAMP.

The main advantages of the electric cap lamp as regards safety and sanitation may be enumerated as follows:

1. It minimizes the hazard of gas explosions.
2. It reduces the hazard of gas burns.
3. Reduction of mine fire hazard.
4. Reduction of accidents from falls or roof, rock, ore, etc. (Illumination being more uniform.)
5. Reduction of haulage accidents. (Illumination being more dependable.)
6. Reduction in accidents from handling explosives.
7. Reduction of fire risk on breakers, tipples and head frames.
8. Increased opportunity for escape following explosions or heavy falls.
9. Elimination of burns from open lamps.
10. Elimination of miners' nystagmus or eye strain.
11. Reduction in miners' asthma and tuberculosis.

This list of advantages applies to all underground operations excepting the first and second items, which apply especially to mining operations in which explosive gas occurs.

We must also recognize our inability to determine in advance the possible occurrence of explosive gas in any underground operation.

GAS EXPLOSIONS IN MINES.

The open light presents the greatest hazard as regards gas explosions. Statistics show that about 85 per cent of gas explosions in mines are initiated by the open light. The use of the approved electric mine lamp is a safeguard against this class of accidents.

REDUCTION OF GAS BURNS.

The thousands of miners burned by gas every year in the mines of this country is another object lesson against the use of open lights. All such accidents are eliminated by the use of approved electric lamps.

ADVANTAGES IN NON-GASEOUS OPERATIONS.

The balance of the list will be treated as advantages in non-gaseous operations, it being understood that they are of similar ad-

vantage to every class of mining operation. Permitting any cla fication as to gaseous or non-gaseous mines which individual opi may dictate, we feel that the use of permissible electric lamps i be preferred as a general proposition in any mine in the inte of greater safety. Now add to this greater efficiency, practicab and economy, and the adoption of this method of mine lighting i underground operations should receive most thorough considera from all thoughtful mining men. As a basis of such study we to enumerate the many advantages to be obtained, basing sam reports we have received from over two hundred different c panies in the United States and Canada where approved ele lamps have been installed by us.

REDUCTION OF MINE FIRE HAZARD.

Every open light inside any mine is a menace as to mine f This is to be considered in metal mines as well as coal mines, and introduction of permissible electric lamps will certainly reduce hazard. "Although many fires occur in mines at which no fatal result, yet the hazard is there, but it is only brought before public by some large disaster in which many men are trappe the mine as a result of a fire." *

We have but to recall the great loss of life and destructio property at the Cherry mine fire at Cherry, Ill., in November, 1 where the origin of that disaster was an open-flame torch comin contact with inflammable material. That mine was no diffe from many others where open lights were used. A blast of air f an opening door and the the flame impinges against the adja timbers or other material of like character and a roaring furnace by the strong air currents fills the traveling ways and mean escape with smoke and fumes before sufficient warning can be g to the men inside. Or a candle stuck in a timber and left ungua may cause a fire which may spread disaster before it can be trolled.

Unfortunately permissible electric lamps had not been perfe at the time of the Cherry accident, and it is to be presumed occurrences of this kind were instrumental in bringing forth time and effort spent in developing such a safety device. these permis ible electric lamps been available at that time suc accident could have been avoided.

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* Coal mine fatalities in the United States (1915) Bureau of M

FIRES IN METAL MINES.

In reviewing the mine accidents of the past year we find several instances where mine fires were caused by open lights. Two of these fires were in metal mines near Butte, Mont. The more recent of these accidents, in which 168 men were killed, is attributed to an open lamp in contact with an electric cable, a portion of the armor having been torn off by an accident and exposing inflammable insulating material to the flame from the open lights of the workmen. Other instances of like character might be cited, but these give sufficient evidence of the necessity of using closed lights as a safety precaution. The accident record can be very materially reduced by substituting permissible electric lamps for all open lights, *which are the principal cause of mine fires.*

For the purpose of determining just what number of accidents could be decreased or eliminated by the use of permissible electric cap lamps, there is given herewith tables for metal mines, 1915, and coal mine accidents in the year 1916. These are taken from the Bureau of Mines' published reports for these years, and all classes of accidents not directly affected by the use of permissible electric lamps are excluded.

TABLE I. FATALITIES AND INJURIES BY CAUSES IN METAL DURING YEAR 1915.

(The statistics for 1916 not yet published.)

NUMBER KILLED—UNDERGROUND.

Kind of Mine.	Fall of rock or ore from roof or wall.	Rock or ore while loading at working face.	Timber or hand tools.	Explosives.	Haulage accidents.	Falling down chute, winze, raise or stope.	Mine fires.	Collisions [illegible]
	1	2	3	4	5	6	11	
Copper	69	2	4	16	5	13	....	
Gold, silver and miscel. metal.	49	4	2	37	7	23	....	
Iron	42	3	1	6	4	8	....	
Lead and zinc (Mississippi val.)	27	1	....	11	1	1	....	
Non-metallic mineral	4	....	....	2	1	....	....	
Totals	191	10	7	72	18	45	....	

NUMBER SERIOUSLY INJURED.

Copper	834	425	260	49	484	111	8
Gold, silver and miscel. metal.	384	133	151	36	163	87	9
Iron	387	220	278	35	392	62	1
Lead and zinc (Mississippi val.)	62	60	4	18	58	8	3
Non-metallic mineral	4	7	2	5	11	1	....
Totals	1671	845	695	143	1108	269	21

NUMBER SLIGHTLY INJURED.

Copper	2495	1477	1029	75	1009	263	4
Gold, silver and miscel. metal.	1128	815	695	47	598	222	5
Iron	1043	700	703	41	743	61	....
Lead and zinc (Mississippi val.)	261	580	79	26	250	29	12
Non-metallic mineral	25	59	9	10	24	3	....
Totals	4952	3631	2515	199	2624	578	21

TABLE 2. NUMBER OF MEN KILLED IN AND ABOUT THE COAL MINES IN THE UNITED STATES DURING THE CALENDAR YEAR 1916, WITH THE FATALITIES CLASSIFIED ACCORDING TO CAUSE.

KILLED UNDERGROUND.

State.	Falls of roof (coal, rock, etc.).	Falls of face or pillar coal.	Mine cars and locomotives.	Gas explosions and burning gas.	Coal-dust explosions.	Explosives.	Suffocation from mine gases.	Mining machines.	Mine fires (burned, suffocated, etc.).
Alabama	28	....	15	23	32	3	....	....	....
Arkansas	4	....	....	1	2	....	....	....	....
Colorado	17	8	7	....	....	1	....	....	....
Illinois	48	2	54	7	....	6	....	....	1
Indiana	16	1	12	4	2	5	....	....	....
Iowa	22	1	3	....	....	1	....	....	....
Kansas	18	1	....	21	....	8	....	....	2
Kentucky	35	1	14	....	....	4	....	1	....
Maryland	10	2	....	....	16	2	....	....	....
Michigan	1	....	....	....	....	1	....	....	....
Missouri	6	....	....	....	....	....	....	....	....
Montana	8	2	6	....	....	....	....	....	....
New Mexico	12	2	3	....	....	2	....	....	....
North Dakota	1	....	....	....	....	....	....	....	....
Ohio	69	....	23	1	....	5	....	1	....
Oklahoma	13	....	3	2	3	1	....	1	....
Oregon	....	....	....	3	....	....	....	....	....
Pennsylvania (anthracite)	180	35	64	43	....	86	10	....	....
Pennsylvania (bituminous)	195	28	89	36	....	10	1	6	....
Tennessee	9	....	2	....	....	....	....	....	....
Utah	13	....	5	....	....	1	....	....	....
Virginia	36	1	9	....	....	1	....	1	....
Washington	5	2	2	2	....	4	....	....	....
West Virginia	201	15	74	27	1	3	1	8	....
Wyoming	14	2	5	....	....	2	....	2	....
Totals, 1916	961	103	390	170	56	146	12	20	3
Totals, 1915	919	160	347	153	151	155	16	12	1

The statistics given here for metal mines are of particular interest in connection with this paper, as the introduction of permissible electric lamps in coal mining operations of all classes and in all localities is receiving most favorable attention. The principal cause of the accidents as enumerated in the above tables is improper, varying and insufficient illumination. The remedy is apparent.

REDUCTION OF ACCIDENTS FROM ROOF ORE, COAL, ROCK, ETC.

Fatalities in metal mines under this heading in 1915 totaled 191, number seriously injured from same causes 1,671, and number

slightly injured 4,952; a total of 6,814 accidents from these c alone. We have found that the constant and ample illumi from electric cap lamp has materially reduced the number of dents from the above named causes. The reason for this is fo the fact that the miner has his light in such a position that the working face is equally and fully illuminated; the angle of illu tion is 160 degrees, so that roof, ribs, bottom and face are all erly lighted.

A report from one of the large coal mining companies using lamps furnishes data that indicates a reduction of 41 per cent i dents from the above causes during the first year electric cap were in service. We can undoubtedly bring about a similar tion in this classification by the application of the same me metal mines and how much that would mean as an economic pr tion aside from the personal and moral effect.

Under the headings "Falls of Rock or Ore While Load Face," "Timber or Hand Tools Falling Down Chutes, etc.," ping on Nail," we have totals of sixty-three fatalities, 1,863 se injured; 7,356 slightly injured, a grand total of accidents from sources of 9,282. It is found that these accident causes also very generally under improper illumination and the apparent of a reduction is the same.

REDUCTION OF ACCIDENTS ON HAULAGE ROADS.

Haulage accidents accounted for eighteen fatalities, 1,108 s ly injured, 2,624 slightly injured in metal mines during 1 grand total of 3,750. As to the causes of this class of accide records indicate that in many instances they have been due workman losing his light from various causes, resulting in his run down by trips or caught between cars or crushed betwee and ribs of roof.

High velocity air currents, windy shots, bumps and concu have no effect whatever on the illumination afforded by th missible electric cap lamps, hence the miner, driver, motorm trip rider are never left in the dark, as so often happens i should be wearing an exposed flame lamp or flame safety la

The use of open lights by breaker-boys, head frame and hands creates a dangerous fire hazard which is eliminated

INCREASED OPPORTUNITY FOR FOLLOWING EXPLOSIONS OR HEAVY FALLS.

Following many of the great mine explosions in this country, many lives were lost owing to the fact that all lights were extinguished or blown away by the force of the explosion, so that the surviving miners had no light by which to direct their escape from the deadly afterdamp. With permissible electric lamps the entombed men have an even chance of escape as long as they have their lights. The fact was practically demonstrated in an Alabama mine in 1914, when men wearing electric cap lamps were able to escape following an explosion, while some other men wearing open lights in the same section of the mine were lost, owing to their lights being extinguished.

PREVENTION OF BURNS FROM OPEN LAMPS.

Statistics fail to give the exact number of accidents, mostly of minor character, that happen to individual miners from oil or carbide open flame lamps. These are much greater than is generally known, and the protection given by permissible electric lamps in cases of this kind would effect a considerable saving in every way.

REDUCTION OF ACCIDENTS IN HANDLING EXPLOSIVES.

The records during 1915 in metal mines show a total of 414 accidents from explosives underground, classified as 72 fatalities, 143 serious accidents, and 199 minor accidents. The open-flame lamp is an especially dangerous agent in the handling of explosives, and many disastrous explosions have resulted from this combination. In the classification just numerated the safety features of the permissible electric lamp have been recorded under each heading, indicating how various accidents can be eliminated or reduced in number in any class of underground operations by the elimination of open lights entirely and substituting therefor permissible electric lamps.

As a safety measure such a substitution would mean a greater reduction in the accident records in mines than any one other preventive measure now before us for consideration. The manner of exercising such a measure and its anticipated favorable results have been outlined in a general way. In addition to increased safety, however, we have the other attractive features of greater efficiency, greater practicability and greater economy of operation. Of necessity conclusions are drawn from the experience which we have had

during the past two years and a half with Edison permissible lamps as the standard.

INCREASED EFFICIENCY AND PRACTICABILITY WITH PERMISSIBI ELECTRIC LAMPS.

The open-flame lamp, either oil burning or carbide type, requ frequent attention and adjustment throughout each shift in orde keep anything like a regular length of flame or keep the lamp fo supplied with oil or carbide and water. From tests made in p tical experience it is found that from thirty to fifty-five minute required by each employe in each eight-hour shift to keep his c flame lamp adjusted, and even with this attention the variatio candle power was so great as to greatly reduce the efficiency of workmen.

Where permissible electric lamps have been in continuous c service for a period of thirty months we find a greatly incre tonnage per miner, which is rightfully attributed to the be illumination. Such an increased tonnage from this cause has l estimated at 35 per cent. In these days, when the shortage of l is affecting the mine output so materially, any change of equipr which will permit the day men to give thirty to fifty-five min more per shift to their work, and also increase the loaders' ou 35 per cent, should be adopted as quickly as possible.

To measure the time saved with electric lamps we have bu follow through the operation of a working shift. The wearer at the lamp house and is handed his complete lamp, locked, charged and burning. He places the battery on his belt and lamp on his cap and enters the mine to his place of working. light is sufficient for all working purposes, properly and equ distributed, and does not change in intensity, so that his work ceeds without any interruption from that score, and he comp his shift without the necessity of giving any thought or atter to his lamp. After the day's work is completed he returns his o to the lamp house to be re-charged over night. He had handlec lamp only twice during the day, to put it on and to take it off at lamp shanty. From the standpoint of efficiency such a proce cannot be surpassed.

GREATER ECONOMY OF OPERATION WITH PERMISSIBLE ELECTR LAMPS.

The oil lamp or the carbide lamp show a maintenance cos

per shift will be approximately 7 to 8 cents. These figures may be exceeded on account of local conditions in some parts of the country. From detailed reports which we have available over a two-year period, we find that the average cost of maintenance of electric cap lamps will not exceed 3½ to 5 cents per lamp per shift. These figures include the original cost of the installation, all repairs, interest on investment, etc., and represents the maximum outlay. There would be a saving then of from 1 to 3 cents per lamp per shift to the party who pays the bill, and the accumulated savings month by month very quickly mount up to a very convincing sum.

Safety devices of all kinds are given preferential rate discounts in the workmen's compensation insurance premiums where the standards of the Associated Companies is in effect. The value of permissible electric cap lamps is such as to warrant their universal adoption, if not from the humanitarian standpoint, then for the actual money to be saved by reduced insurance premiums. This saving represents about 18 per cent interest on the original investment of a complete electric lamp installation. The value (or reduction in premium) per $100.00 payroll for permissible electric cap lamps in the various states is as follows:

Class of Mine.	Pa., Anth.	Pa., Bit.	Ill.	Ind.	Colo.	Kan.	Ia.
Non-gaseous	$.11	$.11	$.13	$.11	$.13	$.10	$.13
Gaseous	.175	.14	.17	.15	.22	.12	.15

This reduction applies only to coal mining operations in the different states indicated. The same standards, however, would be applied to metal mine insurance on the basis of a non-gaseous coal operation where the value is accounted for by better and increased illumination and elimination or reduction of many classes of accidents which are caused by the less efficient lighting from open lights. If the insurance companies will automatically reduce your premium 11 to 13 cents per hundred dollars of your pay roll in non-gaseous mines, need we present any further proof for the advantages of permissible electric cap lamps?

Aside from the many advantages already enumerated there have been brought to our attention several other matters of especial interest also. These pertain to the elimination of nystagmus and eye strain and the elimination of miners' asthma by using permissible electric lamps.

Very convincing evidence has been brought to our attention along these lines, but further verification is to be anticipated as the period of installation increases. The theories which have been par-

tially substantiated are presented for your attention, as yo doubtless have the opportunity of observing similar results time to time.

ELIMINATION OF NYSTAGMUS AND EYE STRAIN.

The constant, soft and diffused illumination afforded by th missible electric cap lamp is a remedy for miners' nystagmus, c by working with the insufficient light of a flame safety lamp a remedy for the eye strain caused by working with the ever ing illumination of the oil or carbide open light. There can argument as to the strain on the eyes because of the necessar justment of the vision to meet the varying amount of light with lights. As we remove entirely any possibility of varying illu tion with electric lamps, we bring about a much more satisfa condition for the underground workmen.

ELIMINATION OF MINERS' ASTHMA.

Reports are already at hand that miners' asthma has been tically eliminated where electric lamps only were used. These use absolutely no oxygen from the mine air, they do not fou air in the mine in any manner whatsoever, while with the flame light the oxygen is depleted and every lamp is fouling th with smoke, soot or fumes and rendering it less pure for the m use. We have then the additional advantages of a cleaner and sanitary and healthful mine. The tuberculosis prevalent a metal miners in some districts, which may be largely attribut poor ventilation, can be largely reduced through the use o electric mine lamp.

CONCLUSIONS.

In setting forth the many advantages of the permissible el lamps we feel that there is sufficient evidence to warrant the clusion that they are equally as efficient for non-gaseous min for gaseous operations, no matter what method of classificati employed.

Greater safety, efficiency, practicability and more econo operation is obtained, also more healthful and sanitary working ditions by the use of permissible electric lamps, and during the five years we shall see the general adoption of this type of illu tion in all classes of mines, and the mine safety engineer is th to bring about such improved conditions.

Sixty per cent of the mine accidents can be classed as preventable. This is the basis on which coal mine insurance is rated, and their standards are so designed as to bring into play every safety measure that can in any possible manner help to eliminate this 60 per cent, or the avoidable accidents. Now, 15 per cent of these preventable accidents are directly due to the use of open lights, while from the tables given above we find that there is a possibility of open lights causing as high as 75 per cent of the preventable accidents in metal mines.

Are we not engaged in a most worthy undertaking if, by our efforts to secure the universal adoption of permissible electric lamps in all underground operations, we can bring about a reduction in mine accidents of at the very least 9 per cent of the total, with a possibility of decreasing the total number of accidents in the mines of this country 40 per cent? Certainly this most excellent safety measure carries with it an economic proposition, the far-reaching value of which is difficult to estimate.

DISCUSSION.

CHAIRMAN TILLSON: Mr. Deike has given us such a comprehensive paper that I imagine it has started us all thinking and wondering why metal miners and coal miners still retain carbide lamps.

He gives costs which are quite surprising to me, as I had assumed that one of the reasons why carbide lamps are preferred is because they were much cheaper to operate. So far as my limited experience has gone, the cost of carbide lamps has been borne by the individuals or miners—they have bought their own lamps and the company has merely supplied the calcium carbide for illuminating purposes. In the case of storage-battery lamps, I do not know whether a similar practice has worked out satisfactorily in the various mines—whether or not the operators expect the men to buy their own lamps.

Another phase that would greatly interest me would be a graphic charting—the customary method in dealing with any subjects of illumination—of the foot-candles or other measurements of luminosity such as mean horizontal candle power of the beam of light thrown from the storage-battery lamp, as compared with the average flame of a certain standard length from the acetylene mine lamp.

Mr. Deike, can you give us any information in regard to the luminosity, comparing one lamp with the other, and the field of illumination?

FIELD OF ILLUMINATION.

MR. DEIKE: The field of illumination of the carbide making tests with the reflector in place and a normal len flame, the lamp head on—shows considerable variation. It i different when the lamp is placed at right angles to the fie you place the lamp with the flame straight on and the refle back of it, you get an increased illumination, but it is not and requires frequent attention to keep a normal length of that is, the flame is changing all the time. The attention ne figures about thirty-five minutes out of eight hours, in or keep a normal length of flame and to get anywhere near the a illuminating power from carbide lamps.

When placed at right angles and the candle power taken is a considerable reduction, bringing it down to about hal the light head on and the reflector in place. Such tests have a made and the reports printed. The tests were made, I thi the candle power of carbide lamps and open-flame lamps w varying length of flame, and a comparative chart could be because the electric lamp has also been tested in the same r and the candle power determined.

In all the various methods that are in practice at the p time such charts are available. I am sorry I have not the pr copies of the reports or obtained information that could b sented in chart form, to show just what is the variation of the power of the carbide, the electric and the oil lamp due to va in flame, as compared with the regular illumination of the e lamp, which is one of its greatest advantages.

CHAIRMAN TILLSON: May we hope to have such cha pended to your excellent paper for publication in the report? the Bureau of Mines assist Mr. Deike in any way, Mr. Rice?

MR. RICE: I think we can. I am not sure that I know tests made in comparing carbide and torch lamps. Most co sons have been built on the basis of the safety lamp. The re ment has been virtually that, to receive consideration, they exceed in candle power the standard safety lamp. I think th can unqualifiedly say that the Bureau of Mines thinks the e lamp, and particularly the cap lamp, is a tremendous step in ac for safety in coal mining.

The Bureau of Mines staff has not as yet tackled the prop of direct replacement in metal mines. There is no question bu

in certain particular places, it would be of the greatest advantage, but we want to take the thing we feel sure of first and let it work itself out. That is to say, it is obvious from what Mr. Deike has said there has been a tremendous gain in coal mines. I think the record that he speaks of—a single company having introduced 90,000 lights in so short a time—speaks for itself. The Indiana mines, which, although considered non-gaseous, are manifestly gaseous because explosions occur, are taking tremendous risks in not introducing the electric cap lamps.

The United Mine Workers' officials, I think, are in favor of electric or permissible lamps, but, unfortunately, there has been a tendency on the part of local unions to use them as a means of getting an advance in price when they have been introduced. This tendency has very seriously handicapped the movement. A number of mines are really in a dangerous condition because they are old and in many instances more and more gas is encountered. Entries and passageways cannot readily be enlarged, it is alleged, to get satisfactory ventilation. Ventilation is sufficient for breathing purposes but not for removal of the gas or to keep it below a point where it is safe to use open lights.

There are one or two things in Mr. Deike's paper that ought not to go unchallenged, I think. He made many good points, but did not cover everything. I am personally interested in investigations in connection with the prevention or lessening of silicosis, or miners' tuberculosis, as it is usually called.

I can see no relation between the slight lessening of the oxygen consumed by open lights and the inhalation of silicious dust, made by drilling, blasting and loading. Excellent results have been produced in the Joplin district, as was shown so ably in a paper yesterday. Much has been accomplished by going after the dust question in a systematic manner. This is especially true in South Africa. Inquiries are being carried on by the bureau under Dr. Lanza and Mining Engineer Harrington in the Butte district, and the work has received the hearty support of the mine operators there.

MINERS' ASTHMA.

The question of asthma is tremendously interesting. I had supposed that asthma, which is found chiefly in the anthracite district—one of the gentlemen termed it anthracosis—was a clogging of the cells by anthracite dust. I think it has not yet been shown that anthracosis or asthma is the same as miners' tuberculosis or silicosis.

As a matter of fact, findings produced by Dr. Hawley, the nent physiologist of Great Britain, and figures supported b South African investigations (which were very thorough) to indicate that bituminous dust tends to be rather antiseptic that coal miners are freer at corresponding ages than are av male laborers working on the outside. Nothing has been p as yet that bituminous dust is a cause of miners' consumption.

I would add another little suggestion, simply a digressio cause it is not in the paper, as I notice that Mr. Deike makes a ment, or at least implies, that gas found in coal mines doe necessarily originate in the coal. I have always been interest the subject of the formation of gas and it is hard for me to see that statement is necessary. We have gas, sometimes, in ca aceous shale, but in many parts of the country it is not at all re You may have a roof of non-carbonaceous shale, or again, found through the Rocky Mountain region, the roof is of stone, and the amount of carbonaceous matter is insignificant. one hand you may find coal that is quite gaseous, provided past the lignitic stage, but, so far as I know, in the Rocky M tain region, gas has never been detected or observed, by analys the air, in the lignite or sub-bituminous mine. It seems to me it rather points to the fact that in the change of coal from pe lignite some gas is formed; and again from lignite to coal that have gas in very large amounts being given off, and it mus somewhere. If the strata above is impervious, or it is below w level, why you have it accumulate right in the pores of the coal adjacent to the roof.

The most gaseous mines we have in the United States—gas strata, perhaps, I might say, rather than mines—are in the ant cite district, and the higher the grade of coal the more gaseous find the mine.

My remarks are merely digressions. Mr. Deike has brougl mind many points which need careful consideration and his p is most suggestive. I would like to see some of the metal mi people take the other side and say whether or not they are o looking something valuable in the electric permissible lamp. gaining ground rapidly in coal mining operations and in mine tunnels where gas is encountered.

CHAIRMAN TILLSON: Is the candle power of the electric l equal to that of the ordinary carbide cap lamp. Mr. Deike?

ELECTRIC AND CARBIDE CAP LAMPS.

MR. DEIKE: The average candle power of the normal flame is practically the same as the electric lamp.

CHAIRMAN TILLSON: What candle power is that?

MR. DEIKE: That depends on how it is measured; the electric cap lamp varies from 1.21 up to about 1.8; for the carbide lamp, the maximum probably is 2—from there down to less than one candle power.

CHAIRMAN TILLSON: The question of illumination by the carbide lamp is the question of its being developed so as to produce an even feed and an elimination of water troubles.

MR. DEIKE: You can have a greater candle power with a carbide lamp with a four-inch flame.

CHAIRMAN TILLSON: That it is better with a four-inch flame than with a short, intense flame is, I think, the experience of metal miners. What is the expression of opinion of some of the other members?

MR. RYAN: The candle power that Mr. Deike has just given is the average candle power, distributed from 130 to 160 degrees, depending upon the type of lamp and the angle. Generally the beam candle power, the candle power directly in front of the bulb, which you might say is the effective candle power, is used. If a man has a lamp on his head, when he turns his head he turns the beam candle power. The average of that is 2.7. That is what I term the effective candle power.

CHAIRMAN TILLSON: That is the maximum candle power?

MR. RYAN: Yes, the maximum.

MR. RICE: I remember that Mr. Clark was very instrumental in the development of these lamps, helping not only one company but all the companies that sent in their lamps. The best lamps at that time, including the Edison, made a very narrow zone of illumination. If a man stood at the base it was manifest that a light of that kind was really a danger, because a man should see more space. This led finally to the selection of such an angle as a man could take in with his eyes while looking at a certain spot, and thus be able to pick up a tool that had been dropped or see a broken piece of rock liable to fall on him. That was what led to the development of the more even illumination throughout the whole area of the circle.

MR. REED: I would like to ask Mr. Deike whether the figure

he gave of thirty-five minutes spent on adjusting the carbic during an eight-hour shift is actual time, studied from under operations, or a laboratory figure? It is a matter of quite importance if figured in days—a matter of twenty to twe minutes a day on the maintenance of a carbide lamp.

MR. DEIKE: Our figures come principally from laborato in keeping the carbide flame adjusted as near as possible to a one-quarter-inch flame. A manager of one of the large cor in West Virginia made the statement that in actual practice mine it took the men about fifty-five minutes in eight hours their lamps adjusted to the proper length of flame for satis illumination.

MR. MASON, JR.: The test made in West Virginia co period of three months. The mine manager engaged twelve men to watch the various operations of the miners through working day. The average for each operation, such as cars, waiting on cars, attending their lamps, and so forth, about on that basis.

CHEMICAL BURNS.

MR. BRENNAN: Mr. Deike made a statement that the cap lamp eliminated all danger of minor burns through How about dangers from chemical burns, speaking particul the acid batteries? I remember in making some tests with d classes of electric lamps in my own work that not all of the absolutely acid proof and that some of them burned. Ha any data on chemical burns from storage battery lamps?

MR. DEIKE: I shall have to make a division, as far as lamps are concerned. There are two types of electric lamps, one the lead acid type and the other the alkaline type Edison is of the alkaline type, and, in order to meet the r ments of the Bureau of Mines, it must have a non-spillable l The burns that Mr. Brennan spoke of come from leaking from the breaking of the container. Burns of that charac not possible with the alkaline type of battery. It is a non-s battery and practically indestructible.

The construction of the Edison lamp is of nickel steel th out. There is absolutely no chance of breakage, no jars broken. You can smash them but there is no breakage—t no leakage of the caustic potash. There are no burns fro score, as there would be in the lead-acid lamp.

MR. DAWSON HALL: I was very much interested to hear that the electric lamp was going to do away with nystagmus. I do not believe that there is any nystagmus in American mines; that has been my belief for a great many years. I would like to know whether anybody else has seen much of it.

SECRETARY PAUL: Mr. Deike probably had in view exporting lamps to countries where they have that trouble.

CHAIRMAN TILLSON: Is there any further discussion on this paper, gentlemen? It is a very interesting subject.

SECRETARY PAUL: The Bureau of Mines, with the assistance of Mr. Stock and Mr. Ryan, made a great many tests of the candle powers of safety lamps and miners' oil torches and the carbide lamps. The bureau has the records. Since then Mr. Clark, in developing and testing out lamps, has done some work with electric lamps and the bureau has that data. I do not know whether or not it is available for publication at this time in connection with Mr. Deike's manuscript. That is a question for consideration by the directors of the bureau. I feel, as Mr. Rice does, that if it is possible to furnish any data the bureau will be very glad to do so.

ILLUMINATING CHARTS.

MR. RICE: The only question at all is whether the tests were official or were merely casual.

SECRETARY PAUL: They were hardly casual, they were more elaborate than that; they were extensive tests.

CHAIRMAN TILLSON: I think a few charts showing the indication of the illumination from the two sources of light would be interesting and valuable to a great many of us. I hope the Bureau of Mines will be able to release several representative charts indicating the illumination secured from lamps of the two types.

Our next paper is in regard to "Safety Precautions in the Installation of Electrical Apparatus in Mines." We will be favored by an address on this subject from Mr. Graham Bright, one of the engineers from the Westinghouse Electrical and Manufacturing Company of Pittsburgh, Pa., and a member of the Committee on the Use of Electricity in Mines of the American Institute of Electrical Engineers.

SAFETY PRECAUTIONS IN THE INSTALLATION OF ELECTRICAL APPARATUS IN MINES.

MR. GRAHAM BRIGHT, WESTINGHOUSE ELECTRICAL AND MANUFACTURING COMPANY, PITTSBURGH, PA.

Mr. Chairman and Members of the National Safety Council: It was only yesterday that I was requested to prepare a paper on this subject, and, of course, it was practically an impossibility to prepare a paper on such an important subject on such short notice. However, I have been more or less connected with this work for some years and am fairly familiar with the work recorded by Mr. Clark in that very excellent paper, No. 138, issued by the Bureau of Mines. The title of the subject assigned me suggests safety rules for installing and using electrical equipment in bituminous coal mines and my notes cover the subject fairly well.

The Committee on the Use of Electricity in Mines, American Institute of Electrical Engineers, of which I am a member, has discussed this paper quite a little, and we have it now before the Power Club, an organization consisting of representatives from the various motor manufacturers. The club is making suggestions for putting these rules in such shape that they can be accepted by the American Institute and possibly the various state legislatures.

LACK OF UNIFORM RULES.

Each state has its own set of rules and they are not very uniform; that is, there are states like Pennsylvania, West Virginia and Ohio, where mining operations are carried close to the line. One set of mines has to operate according to the rules of the state they are in, and a short distance away another mine will operate under a different set of rules, which may allow a great deal of advantage over the first mine. The idea of having uniform rules adopted by the various State Legislatures is to have a set of rules by which all mines can operate on an equitable basis.

Another thing—we would like to have these rules extended so as to include the anthracite mines; it may be possible, later on, to extend them still further to include the metal mines.

By inviting the various people interested in the use of these rules to take part in the discussion and suggestions for changes, we hope to get a set of rules which will be universally accepted by the people interested. There has been a great deal of work done on



the rules so far, and we hope to get them in such shape before long that they will be acceptable to the various interested parties.

When electricity was first applied to coal mining there was no apparatus particularly adapted for such use. About the nearest thing was railway equipment, due to the fact that railway and mine requirements were somewhat similar. As a result railway appliances were applied to the first mine equipment but did not just fill the bill. A good many things were wanting particularly because mining equipment does not receive the same attention that railway equipment does. Secondly, mining equipment needs to be more rugged and more foolproof, and it has to operate in such damp atmosphere that windings should have better protection from dampness. To meet these requirements various manufacturers have gradually developed equipment particularly adapted for mining use. At present there is a great deal of apparatus which is designed especially for mine service and it is doing very good work. At the same time it is not just what it ought to be in regard to certain features.

EXPLOSION PROOFING.

Explosion proofing is exciting quite a good deal of attention just at present, but it looks as though a mistake was being made by manufacturers in going too far in attempting to make a piece of apparatus explosion proof, if there are agencies right in the vicinity which will produce just as much trouble as the motor control would, in the way of sparks sufficient to set gas on fire.

For instance, take a mining machine. There are a number of machines now running with so-called explosion-proof motors, but if the trailing cable back of it parts, it will produce a heavy arc.

A cutting machine may strike a sulphur ball and a shower of sparks ensue which may be sufficient to set gas on fire. Things of that kind may occur, so that it seems hardly just the thing to spend a great deal of time making an explosion-proof apparatus when there are agencies right in the vicinity that may produce as much trouble as the apparatus itself.

Manufacturing companies have done quite a little in producing the explosion-proof motors, but do not feel that they are going to entirely solve the problem. That is, if a miner has an explosion-proof motor, he thinks he is safe, but that is not the case. The equipment furnished by the manufacturer is all right, according to the standards of the American Institute of Electrical Engineers.

This is a very good practice, in that it gives motors a definite rating upon which the application of the work can have a definite basis. Without these rules as a background, a motor might be given any rating at the whim of the manufacturer.

In the early days, for instance, they gave the motors a thirty-degree Centrigrade temperature rise basis of a forty-degree basis or a sixty-degree basis or a constant service basis; all depending on what the customer wanted.

As a rule the operator of a small mine is not very well acquainted with electrical apparatus. If he is going to buy a motor one salesman is liable to sell him a hundred horse-power motor and another fellow will say: "Here is a motor of 150 horse-power." One is based on constant service and the other on an hour basis; they may be both the same motor, but he will buy the larger motor, thinking he is getting more for his money.

If the basing of the equipment on standardization rules of the American Institute is adhered to, then we will have equipment going in on a fair basis and the chance of misapplications is very much reduced.

KEEP NAME PLATES ON EQUIPMENT.

Manufacturers, as a rule, put a name on their equipment, and it should remain on the equipment and not be taken off, and, as is sometimes the case, be lost. Then the rating of the machine is no longer known and it is very likely to be shifted to some other part of the mine and cause trouble. With the rating on the machine, the average electrician can see that it is put into its proper place. The mine electrician is the man that is responsible for maintaining the standards of the electrical manufacturer. If the equipment is put in and maintained the way it is intended to be, a great deal of trouble will disappear, but, as is very often the case, the equipment is allowed to run down and insufficient care is taken of it. The best way to combat that is to see that the proper kind of machine is employed, for the mine electrician too often does not give it proper consideration.

There is another point in this connection: Too often equipment is a little late in arriving and is installed in a hurry. Temporary wiring is run, and it is put in so as to get it in operation in the quickest time possible. It is then allowed to run in that manner for a long period of time and possibly trouble occurs. That is most liable to occur in smaller mines. Large mines realize the disadvan-

tage of putting in temporary equipment and temporary wiring, and you will find, among the larger mines, that equipment is put in properly to begin with and is maintained in that way.

Where wiring is run promiscuously (any way to get it running), there is a great chance of having troubles occur, due to short circuits and grounds. Another thing, where connections like that are allowed to exist the operation of the whole mine will be inefficient.

I have gone into power plants where the engineer to oil his engine has actually had to go around with a torch in the daytime. A condition like that is inexcusable. As a rule where you find a mine like that you can go through the entire mine and find everything along the same line. It may, apparently, cost a little money to fix up the power plant and light it properly and keep it clean, but it pays a hundred fold in the moral effect it has on the operators themselves. If any individual part is kept like that, everything about the mine will probably be kept in the same condition.

The question of mine voltage is a very interesting one. In the operation of mines both direct current and alternating currents are used. In the early mines direct current was used exclusively; it is only recently that the alternating current has come to be used in connection with mine operation. Direct current is provided in two voltage classes, the 300 and the 600. It is rather a little close, probably 250 to 500, but the limit is supposed to be 300 to 600.

COMPARING VOLTAGES.

There is a great difference in opinion in the use of these voltages. A man that has distribution lines to run is going to stick to 500 if he possibly can, because there is a great deal of difference in the amount of copper required for the 250 as compared with the 500 volts, but there is no doubt about the safety of 250 volts being much greater than with 500 or 600 volts. In fact, there is so much difference that a great many states have legislated against the use of 500 volts for operating mine locomotives and mining machines.

Two hundred and fifty volts is very much less apt to produce a fatal accident in case of contact, but, of course, requires a great deal more copper to take care of the distribution and in mines that have entries running far back it means sub-stations located rather frequently.

I might just state—I meant to tell you at the start—that this is a rather informal talk; if any person has any particular question to

ask he can do so at any time, because you might forget at the finish just what you wanted to ask. I will not guarantee to answer the question, but there may be some one here who can do so. Do not hesitate to stop me at any time to ask any question that may be of interest to yourself or others.

The question of 500 volts against 250 volts resulted in a rather amusing incident near Johnstown, Pa. The man who had charge of the mining operations about five or six years ago—he is at present Captain of an engineers' corps in France—advocated 500 volts. He was very strong in his argument for 500 volts, he could not see the reason at all for considering 250 volts. He was out in the mine with a number of others and away back in the mine the ground was pretty wet. He is bald-headed, by the way, and he was stepping under the trolley from one side of the track to the other when the top of his bald head touched the trolley wire—500 volts. This particular man is very prolific in the use of what you might call "French." He cut loose and they say he did not repeat himself for fifteen minutes.

A little while later, after they had all come out of the mine, a deputation of miners visited him. The miners, as a rule, are a pretty tough bunch, you know; that is, you can't say anything that would shock their sensibilities. These fellows hunted up the superintendent and wanted to know where that fellow was that knew how to talk; they wanted to hear him again. Needless to say, since that time, this gentleman is not so strongly in favor of 500 volts; he thinks 250 volts is all right and plenty high enough for mine service.

MR. RICE: May I interrupt you? Have you worked out such factors as the distance that you think it is advisable to carry 250 volts before you put in a sub-station?

MR. BRIGHT: That depends largely on the size of the mine and the haulage system; whether the grades, for instance, are in favor of the load, or against it. You might say that it is an individual problem and depends on local conditions.

I should say that in an ordinary mine, up to 2,000 or 3,000 feet, 250 volts can be handled very nicely, in fact, up to 4,000 feet without sub-stations; with 500 volts you can easily double that distance.

TOO MUCH COPPER REQUIRED.

I know of some mines where they go as high as 8,000 feet with 250 volts, but the grades are mostly in favor of the load. In other

cases, where they have grades against the load, about 3,000 or 4,000 feet is as far as it is economical to go without adding too much copper. If you go beyond that you start a copper mine instead of a coal mine, unless you want to put a sub-station back in the mine.

MR. RICE: I was asked a question the other day and I was not prepared to answer. In a pitched bed, where the levels are put off on just a slight grade in favor of the loads, and the coal goes on indefinitely at that same pitch, how far would it be expedient to carry that voltage?

MR. BRIGHT: If they are short trips, small locomotives, they may go as high as 10,000 feet with 250 volts. If the trips are rather long and the grades are heavy and the locomotives large, you would probably not want to go over 4,000 feet. You would have to know the size of the trip and the weight of the locomotive, so that you can tell what currents will be handled. It is largely a question of drop. If you have 250 volts at the sub-station it should work so that you would never get less than 150 volts at the locomotive.

I have tested a number of places where they have got down to 150 volts, but the motion is so slow that it is not good practice—not economical to operate. Operators wonder why they are burning out equipment. The locomotives are big enough to do the work, but when you find that they are working around voltages of fifty or sixty, which means that instead of getting up a certain grade in a minute it takes five or six minutes with the same current, it is very apparent why they are burning out their equipment. If they would put in sub-stations, bring up the voltage to 200 as a minimum, they would have no trouble with burning out equipment. Slow voltage is more responsible than overload for burning out electrical equipment in mines.

It seems that 250 volts is becoming more prevalent and most new mines are going in under it. There are, however, a number of mines operating at 500 volts and it would be a very expensive proposition to change over to 250 volts. These mines, of course, will be allowed to operate at 500 volts for some time to come.

BUYING POWER.

Pennsylvania is one of the states that permit 500 volts. I believe West Virginia and Ohio do not permit 500 volts on any new installations. The alternating current is becoming more prevalent in mines, due largely to the use of central-station power. Up to

three or four years ago practically all mines made their own power in small power plants—direct current. About that time central stations woke up to the fact that there was a lot of business in coal mines they could have by going after it. It was a little hard, at first, to convince the mine operator that he could buy power cheaper than he could make it. It did not go at all, at first, but when an analysis was made and he was shown that he could buy his power as cheap, if not cheaper than he could make it, it did not take him long to change over.

The coal operator, as a rule, is in the coal mining business; he does not know anything about power plants, with the result that he does not generate power in the most economical way and his power plant generally gives him more or less trouble. It did not take long to convince mine operators that they could buy power cheaper than they could generate it, especially when it came to building additions to their power plants and adding sub-stations when they were working too far in to transmit power from a single point.

That brought up the question of the alternating current, because practically all power purchased is of that nature, and it is necessary to use a sub-station or a rotary converter or motor generator set to convert this power into direct current for locomotives.

It is a natural question for one to ask: "Why not use alternating current on the locomotives?" As yet we have not been able to design a motor equipment which will be satisfactory for locomotive operation for mine service. They are not practical for small railways, either, for that matter. So that a straight series wound direct-current motor is best adapted for operating mine locomotives; and until a motor is developed which will be as satisfactory as a direct-current motor it will probably remain direct current for some time to come. There are other equipments about a mine which do not have that limitation: Pumps, fans and motors operating tipples and breaker equipment; so that where power is purchased, if we can use the alternating current, it saves us from going through the motor generator set or rotary converter and saves the conversion losses and saves the first cost of the extra capacity required in the converter equipment. For outside work, for the fan, for instance, and tipple equipment, there is no question but that the alternating current is safe to use, because it is just as satisfactory in its operation, in fact, more so, than the direct current.

Where we can use a squirrel cage motor, for instance, it is the

the objection of having a commutator as the direct-current machine has and from a safety standpoint it is a large step in advance, there being no live parts about the motor which any person can come in contact with. From a safety standpoint the use of alternating current had made considerable advances, especially in the equipment outside of the mine itself.

SEPARATE FEEDERS.

When we come to the equipment down in the mine, it means we have to run a separate set of feeders. For pump work, where we have very large pumps, it pays to do this. If we have small pumps, like gathering pumps, it is such a simple matter to tap right on the trolley wire and run to these pumps that it is a question whether it pays to put the alternating current in for the small pumps.

The question of voltage on alternating current is one that is rather important. If we have a single large unit in the mine, then the high voltage, 2,200 volts, is frequently used.

At first thought you would think that was very dangerous, but in my opinion the 2,200 volts is far safer than the average 440 or 220 used about a mine, due to the fact that this current is brought down through a bore hole and taken from the bottom of the bore hole to the equipment through a conduit and there is no chance of anybody getting in touch with it, and it will go to the motor without having any exposed wire whatever. In that way there is no danger of a person coming in contact with the wire itself.

For the lower voltages, 440 or 220, as a rule they use an open-type switch; although I believe our company has recently developed a starter which allows the wires to be taken to the starter in the conduit and leads from the starter in the conduit to the motor, so that even in a low voltage we have developed a starter in which there are no bare parts whatever. When it gets to the motor there are no bare parts on the motor winding which a person can come in contact with. We cannot have that with a direct-current motor, because we always have the commutator and brushes, which must necessarily be left exposed. The best we can do is to enclose this, but they have to be opened for inspection from time to time, so that we cannot use 220 D. C. very well in a mine, because it is too heavy copper, although some mines do use it.

Four hundred and forty volts D. C. can be used, but if we have very far to go it has to have separate heavy feeders. As a rule

they do not use the rail at all when alternating current is used, although a rail is a very good conductor for direct current, but is not so good for alternating current, due to the magnetic effect of the current and the fact that the current travels on the surface of the rail instead of uniformly through the rail as with direct current. So a rail cannot give you much assistance as a conductor for alternating current.

GROUNDING ALL CONDUCTORS.

We have to ground all three conductors to our motor when we use the alternating current. The coal cutters, although generally direct current, are to some extent being changed over to alternating current. It makes a simpler motor, one that has no live parts on it for the operators to come in contact with. It means, of course, running three conductors to the motor instead of two, as in the case of the direct current motor.

The one disadvantage of the alternating current for this purpose is that we must put larger conductors in than we would for a direct current motor, due to the fact that we cannot stand for as much drop in voltage. A direct current motor of 250 volts will operate at 150 volts, although it will operate slower. If you take an alternating current motor, designed for 250 volts, at 150 volts, it is doubtful whether it will run at all. The pulling power, the torque, does not hold up. The torque on a direct current is just the same for a given current at 150 volts as it is at 250 volts, except it runs slower. With alternating current torque drops as the square of the voltage. You see, at 150 volts, it is about one-third what it would be at 250 volts. For that reason we must put larger conductors in to keep the voltage up better. You cannot stand for as big a drop in voltage for alternating current as you can for direct, and that is one reason why the alternating current motor is not used more down in the mine than the direct motor.

MR. RICE: Is that the reason, also, that it is not so much of a success in haulage? They have been tried out, I believe.

MR. BRIGHT: We have them running for industrial railroads where the distance is rather short. There are two things which militate against them: One is that it will not stand the drop, even if the drop is the same in the trolley and rails, that the direct current will. On account of the rail, with the same current, we get a great deal heavier drop. If we did put the alternating current in, we would have to put so much heavier copper in, and copper reinforce

the rail, and we must have two trolley wires. One is bad enough to take care of in a mine; if we have two there is that much more trouble. There are a great many reasons why the alternating current is not well adapted to haulage operation in a mine.

You might say that the single-phase motor would be a solution of the problem. We have, as you know, such motors on the New York, New Haven & Hartford—their locomotives are single-phase motors. We find that we can build motors to large capacities like that, single-phase, which are fairly satisfactory, but when we attempt the little fellows, around forty or fifty horsepower, we do not seem to be able to get them to work; especially where a man may put the current on and let the motor stand with the current on for a minute or so getting ready to start. Direct current will stand that, but alternating current will not, especially in small size. It may come some day, but we have not been able to develop the motor so far.

PROTECTING TROLLEY WIRES.

Protection of the trolley wire is a rather important point in regard to safety mines. The amount of protection depends largely on whether the haulageways, where these trolleys are located, are used as manways. A great many mines have separate manways, so it is not necessary for the men to travel in the main haulageways. In that case, it is not necessary to protect the wires except at crossings, and at crossings they generally put up an inverted wooden trough, so that a person marching along with a tool over his shoulder will not be able to come in contact with the wire. That is about all the protection that is generally done for trolley wires.

You see about mines—some of the better class of mines—a good many warning signs. These signs, of course, are very good and very often will prevent men from coming in contact with wires. But I think the selection of the place for those warning signs should be rather carefully considered. About three years ago in a mine near Hoover's Valley, I pretty nearly had my head knocked off by one of those warning signs. I was on top of the locomotive, just getting ready to go into the mine, and was about 200 feet before coming to the mouth. I was sitting on top of the locomotive and had plenty of time, but when I was 150 feet away someone yelled and I jumped down just in time to miss a Safety First sign stretched across above the locomotive.

The bonding question, although it does not greatly affect the

safety features, is one that should be carefully looked into. There have been cases where air pipes and water pipes have not been bonded to the track and there has been quite a difference in potential between the rails and the pipes. That may be enough to cause a spark, sometimes enough to set off gas, and I think in all cases the rails should be carefully bonded. It not only prevents this voltage from existing, but prevents electrolysis, which is liable to eat holes in the pipes and cause leaks which are very difficult to find and repair.

Feed lines are often put in mines to do a certain amount of work. New equipment is added to from time to time and everybody forgets about the feed lines, with the result that they become overloaded. That is a question which the mine electrician should watch carefully —not to keep adding to the equipment back in the mine and forgetting to take care of the feeders. You can very easily get a feeder hot enough to set fire to surrounding equipment, not so much from the temperature itself but where you have a solder joint, if it is not a particularly good joint, it may become hot enough to spark and cause an arc, so that the question of capacity of wires should be checked up occasionally by some person in authority.

VALUE OF PROPERLY BUILT POWER HOUSES.

I mentioned, a few minutes before, the condition of the power house itself. In visiting the various mines you will find conditions anywhere from that which I mentioned, the operator having to go around with an oil lamp in the daytime, to some of the very fine power houses which have brick or stone buildings with well-lighted interiors, just as well built as railway power houses and lighting company power houses. Although this might cost a little more in the beginning, you will find that it pays in the long run, because it introduces a certain amount of pride among the men in keeping their equipment in good shape.

The condition of the power house is felt back in the mine. The operators inside may come out and see the condition of the power house and it makes them feel like keeping their inside equipment up to the same standard. This also applies to sub-stations. It costs very little money to put these in right and it costs very much less to keep them that way. If they are put in that way they practically take care of themselves, with the assistance of the operators. In the case of the sub-station the operator has very little to do

AUXILIARY EQUIPMENT.

A fanhouse is a place where a great deal can be done for the safety of the men inside. You will find fanhouses anywhere from a wooden shack which looks oil-soaked, due to the oil of the exhaust of the steam engine, to fine concrete buildings in which a fire could not occur if it tried. I think considerable could be done in building fanhouses out of non-combustible material and installing equipment which will take care of itself over long periods of time with very little or no attention. Electrical equipment, as developed today, will operate over long periods with little or no attention, and there is no excuse for a fan giving much trouble if the proper equipment is put in.

MR. DAVIS: Do you recommend the installation of an electrically-driven fan for a gaseous mine?

MR. BRIGHT: It is often done, and I do not see why it is not perfectly safe to put an electrically-driven fan in a gaseous mine. If there is any way of introducing power from two sources it is doubly safe.

The records of shutdowns from central-station power, in some cases, are very high; that is, the records of no shutdowns. In a community where a central station was supplying power, and they had a very poor record in regard to shutdowns, I would be just a little dubious about putting the fan of a gaseous mine on that circuit. In case everything else is electrified it is not really necessary to have steam up just for the fan. There may be some auxiliary means, like a gas engine, which would be started up quickly to operate a fan in case of the power going off. There are a great many gaseous mines in and about Pittsburgh that are running with electric fans at present and the operators seem to be very well satisfied with them.

MR. DAVIS: Without any emergency?

MR. BRIGHT: Without any emergency connections whatever.

MR. DAVIS: What I had in mind was a mine generating large quantities of gas and the steam plant in connection with that mine: The question of installing a fan driven by electricity as compared with steam. I might say that I am not asking this question to embarrass you in any way, but I am seeking information, because at some of our mines, within the last three or four years, we have changed from steam to electric current. I refer to a continuously driven fan. Whenever there are signs of an electric storm the fan

engineer starts his fan engine from the steam engine—the emergency fan is started with a steam engine and is run slowly until after the storm is past. In case the power is off just for a moment the steam fan is placed in operation at full speed. I think that much better results are being obtained by the continuously driven fan. The speed is steadier, the operation of steam plant does not affect it and the variation of the steam pressure does not affect the fan.

MR. BRIGHT: The question of variation in steam pressure, I think, is a very important one and in a great number of mines where I have visited they have continuous operation of fans. There are a great many cases where the pressure drops at night, but in all cases it is due to the laxity of the fireman going to sleep or forgetting about his fire. The pressure goes down and it takes a little time for him to get it up again. Of course, with the electrically-driven fan that is out of the question as long as the power is on.

As to whether an emergency fan should be available, I think it would depend largely on the size of the mine and its gaseous condition. It certainly would make an operator feel much safer to have an auxiliary equipment ready to start if the power should happen to go off due to storms, especially when you are buying power which comes over a long distance and lightning may cause a temporary interruption of your power circuit. It would certainly be a great relief to the operator if he had a steam fan that he could start up. That is, where we have a steam plant in operation nearby, but where he is buying power, say from a power plant that may be fifty miles away, it would mean keeping up a separate steam plant for this particular operation.

Where a mine has a steam plant in operation right at the mine I do not see any particular reason for putting in an electric fan. If he has a steam fan and he has the steam there I should just as soon stick to the steam. But where you are some distance from the source of the power, it looks to me as though the electric fan is the proper solution, and it is one being followed by a great many mines. The importance of having reserve fans depends on the size of the mine and the condition of the mine.

INSTALLING PUMPS.

Pumping is something that has to be resorted to in almost all mines and the pumping equipment, in some cases, is not installed in

a very damp place, very close to the floor. There are cases in which the water, with a temporary cessation of power, may cause the pump to be entirely submerged. With a direct current motor that is pretty nearly bound to put the motor out of business. You can, however, build an alternating current motor which will stand submerging for short periods without any serious damage, especially if it is a low-voltage motor. In fact, there are some manufacturers who advertise a motor which will operate under water. As a rule they do not advocate running in that way, but they say if it should happen once in a while it will not cause serious damage.

If you have conditions where that may occur, the alternating current motor certainly has an advantage over the direct current motor. Care should be taken in installing the motors, so that they are put up high enough, if possible, to remain dry; I do not mean in a dry atmosphere, but not submerged in water. Mine water, aside from being wet, has, as a rule, certain impurities in it, sometimes a great deal, and forms an acid which is not particularly healthy for insulation. Although it may apparently do no harm, it certainly does not do any good. It is only a matter of time when the insulation will break down and the motor will have to be repaired.

The haulage system in mines requires in most cases an electric locomotive. In the last two or three years the storage battery locomotive has come to the front rather strongly and has proved itself very successful in many applications. These applications, however, are mostly for gathering service, where the hauls are not particularly long and the grades not heavy. Where the grades are bad it means that very few cars can be handled at one time. But for mine haulage the trolley-type locomotive is still the locomotive to be used. Of course, precautions must be taken to safeguard the operators who must take care of the locomotive and the trips.

REELS AND CABLES.

Equipment as turned out by the manufacturers is made as foolproof as possible and all live parts kept away from the operators. Trolley wires are protected at crossings and where reels are used protection is obtained by having a two-way switch which will keep the current away from the trolley when the reel is in action. When the reel locomotive comes to the end of the trolley, they hook the cable onto the trolley wire. When they go out to a room in which there is no trolley the cable unwinds on the reel and winds up again

as you come out. The trolley, which is hooked down from the locomotive, may be alive, and is rather a dangerous condition; if the proper two-way switch is installed this trolley will be always dead when the reel is alive and the reel will always be dead when the trolley is alive.

Live parts must be protected as much as possible. In fact, they must be entirely protected, because there are a great many operators who know nothing about it and are liable to come in contact with the locomotive. In view of the fact that the locomotive goes back in the mine where the miners are working, it is necessary to keep all live parts well protected.

The storage battery locomotive is quite a step in advance from the safety standpoint, due to the fact that there is nothing about the locomotive that a person can come in contact with unless he actually and deliberately goes about it, that is, from a contact standpoint. There is no doubt that the storage battery locomotive is very much safer than any trolley locomotive. From the explosive standpoint it also has a big advantage, in that there is no sparking at the trolley wire. You will always notice a great deal of sparking at the wheel when it goes over the rough places on the trolley wire, and since gas usually collects at the roof there may be trouble from the spark of the wheel. We do not have that on the storage battery locomotive, because there is no trolley. There may be a little sparking from the motor itself and there may be sparking on the controller.

The question arises as to whether making the motor and the controller explosion-proof will permit the use of this storage battery in gaseous places. I believe the Bureau of Mines are investigating the question as to whether sparks from brake shoes may set gas afire. Stopping a locomotive quickly, sometimes you will get a few sparks from the brake shoes, and the question has come up as to whether the heat is sufficiently high to set gas afire by sparks. I believe Mr. Clark of the Bureau of Mines has an investigation in view to determine just what happens when these sparks occur.

In machine mining it is necessary to have trailing cables and about the best they can do is to keep these cables in good condition. When they show signs of wear they should be repaired. There is always the liability of these cables being run over and cut in two, which may produce heavy sparking. When they are dragged along the floor of the mine the insulation wears off and live points are made which operators may come in contact with. It is rather an important point for the electrician to keep these cables in first-class

condition. The same applies, of course, to the reel cables of a gathering locomotive.

Have any of you ever noticed the drums of the reel locomotive? If so you noticed holes were frequently burned in the drums. We are at present building drums with wood lagging on them to prevent this. If the cables were kept in proper condition this would not occur. It is due to the fact that the insulation gets worn off the cables and when they wind up and come in contact with the metal drum something happens. It generally burns a hole in the drum before it is knocked off.

CONCENTRIC AND ARMORED CABLES.

MR. RICE: In the case of trailing cables why not a concentric cable in which the outer is the ground?

MR. BRIGHT: Twin conductor cables have been used, but we developed a reel a few years ago which uses a concentric cable. In that case we have the outer layer the ground. In case the insulation wears off, no trouble occurs. It is a little more expensive and difficult to repair, but I think it is a step in the right direction.

MR. RICE: Is that an armored cable?

MR. BRIGHT: No, it is not an armored cable.

MR. RICE: Isn't that practicable?

MR. BRIGHT: No, because you can't wind it on a drum eighteen inches in diameter.

MR. RICE: Why not a trailing cable?

MR. BRIGHT: Even the trailing cables must be wound on a small drum. We have a very heavy braiding on the outside.

MR. RICE: They have been under suspicion, a number of times, of causing explosions.

MR. BRIGHT: The reel we developed was with that in view, using the concentric cable. I think it worked out very well.

MR. RICE: There is no essential difficulty in the concentric cable?

MR. BRIGHT: No; manufacturers of cable are perfectly willing and able to supply the concentric cable, and I do not believe it is any more expensive than the twin conductor; in fact, I think it has a good many advantages in that it reels much better. A flat twin conductor is very hard to reel up uniformly, while the concentric is a round cable and you can reel it up much better and smoother. It is a little more difficult to repair a break; that is the only disadvantage I can see.

ELECTRIC HOISTS.

Hoisting equipments, up until a few years ago, have largely been steam or air, but during the last few years a great change has taken place in that a great many new hoisting equipments are electric. A great many old steam hoists and air hoists are being changed over to electric. In doing this proper precaution should be taken, of course, to install equipment in the safest possible manner, not only from an electrical standpoint, but from a mechanical standpoint. There are a great many old steam hoists which should not be used as electric hoists, as the idea appeals to the operator to take his engine out and put a motor on, thinking he can save a lot of money. He can in first costs, but he will find the operating cost so high it would have been much better to throw out the whole hoist and put a brand new one in.

The steam hoist is designed to take the maximum torques that can be reached by steam at a certain pressure in a steam cylinder. The torque of a motor can be controlled as the operator manipulates the control handle, but a motor connected to a steam hoist can produce strains on the hoist very much larger than could be produced by the steam engine. The result is that the hoist, in a short time, is liable to rack itself to pieces and cause considerable trouble and damage.

Unless it is properly rigged I do not advocate the use of a motor on a steam hoist. I would rather see the whole thing thrown out and a hoist designed for electric drive put in.

There is one advantage in a hoist, as most of the equipment is concentrated in a small space and it can be properly installed and properly looked after, while a lot of other equipment, like locomotives and pumps, have to be scattered about in a great many places and do not get the attention that a single piece of apparatus like a hoist gets.

COAL BREAKER DRIVES.

The equipment on tipples and breakers, of course, is outside and can be installed properly without a great deal of trouble. There has been a tendency to require totally enclosed motors for tipple and breaker work, due to the large amount of coal dust that occurs. The operator does not always realize what enclosing a motor means. The capacity of a motor depends on its ability to get rid of the heat losses, which, of course, raise the temperature to a certain pre-deter-

rid of these heat losses. A fifty-horsepower motor of an open type, if enclosed, probably would not give more than fifteen or twenty horsepower, simply because we cannot get rid of the heat losses. That means that a very much larger motor must be put in, which the operator does not feel like paying for, owing to the expense for putting enclosed covers on.

I believe a better scheme than enclosing the motor is to put in either a self-ventilating motor, which means putting enclosing covers on and then piping from outside the tipple or breaker by means of a blower, and blowing into the motor and having openings for the air to get out. In that way you keep the motor fairly clean and keep the size within reasonable limits.

Another scheme is to build a house around the motor and then blow the air into the house and let it escape through small holes. In that way you can use standard motors. Enclosing a motor, as a rule, means a special type, and not only increases the cost but increases the size, but due to development of designing these special covers we can get a safe equipment by building a little house around the motors or putting the covers on them and piping air from outside.

WIRING FOR MOTORS.

The kind of wiring for motors depends somewhat on the voltage. Where you use 2,200 volts on the tipples and breakers the wiring should be run in a conduit right up to the motors and from the control to the motors, and there is absolutely no question of the operator coming in contact with live parts. Where we have lower voltages, of course, insulated wire should be used. Starting equipment should not be the usual open switches, it should be by means of enclosed switches.

In alternating current we have entirely enclosed equipment now, so there is no chance of a person getting in contact with it. Direct current is necessarily more or less open, but can be enclosed in covers with a handle sticking through a box, so that unless a person actually tries to get at the live parts he cannot come in contact with them.

These safety appliances are applied in factories and places of that sort and there is no reason why they should not be made standard for mining equipment. There is really no excuse for the open switch about any of the mine equipment with the present state of the art.

PROTECTING CIRCUIT BREAKERS.

CHAIRMAN TILLSON: I would like to ask whether you know of any type of oil-immersed direct current circuit breaker for mine haulage purposes, thus protecting the circuit breaker from corrosion and also from a situation which once came under my observation and nearly caused a serious mine fire in a shaft. The fire was detected in time to put it out. It was an open-type of direct current circuit breaker which, upon the circuit being opened, threw a hot flash of copper. It so happened that the hot copper fell upon some blankets that had been brought down for first-aid rescue purposes and were located about twenty feet away on a timbered shaft station. When I came along and smelled smoke I found a fire starting in a shaft station and traced it back to that cause. Since then I have been searching the markets for an oil-immersed otherwise totally enclosed direct current breaker for electric mine haulage purposes.

MR. BRIGHT: I do not believe there is a direct current oil-immersed circuit breaker on the market to meet those conditions. The oil circuit breaker is strictly an alternating current piece of apparatus, due to the fact that the current goes through zero so many times per second, depending on the frequency, when the arc is extinguished as it goes through zero in the oil. When we have a direct current we do not have that condition. It is very hard to extinguish the arc under oil, especially if it is a very heavy short-circuit condition.

I do not believe there is a direct current oil circuit breaker which would meet your conditions. What we try to do is to produce a circuit breaker in which we guide the arc and produce a shield of non-combustible material—generally asbestos—for the arc to impinge on; that is the best we can do. In locomotives, for instance, where we have all air brake switches for direct current, we have arc chutes—or a definite path for the arc and an asbestos barrier for it to strike against. Where we have a heavy alternating current we use oil switches. The only thing to do is to provide an air-tight breaker and guide the arc—have it kept within, confined within certain distances where there are no combustible materials.

MR. RICE: How about breakers supposedly used in connection with the explosive-proof motor equipment? Are they not feasible?

MR. BRIGHT: That is a very small switch. You mean in connection with this little motor we have been testing with the Bureau of Mines, in which the switch was inside the motor?

MR. RICE: I am speaking generally of the type of motor required in Great Britain and some other foreign countries—enclosed switches.

INCLOSING SWITCHES.

MR. BRIGHT: It is possible to place the whole switch in an inclosure. It would have a grating, too, which would not allow the flame to go out, but the trouble with a switch of that kind, if you have a great many breaks one after the other, would be that the air would become so saturated with the copper vapor that it would be liable to hold the arc a long time. We have experimented with a breaker of that type, I think, but have not produced one yet that we are willing to put on the market.

For direct current the best way is to let the arc go out in the open air and fix a place where it can go and not do any damage. For instance, on the Pennsylvanian electric locomotives we have a big fuse box, all lined with asbestos, on the side of the locomotive. The arc is shot down to the track, but there is nothing there that can suffer any particular damage. It might set a tie on fire, if the locomotive was standing still, but the arc is not allowed to go up into the cab where it might find combustible material.

CHAIRMAN TILLSON: The open type of direct current circuit breaker is seriously affected by the corrosive action of the mine vapors, whether acid or alkaline. Our experience has been that any type of asbestos lined boxes would not exclude the humidity of the air, which would carry sufficient saturation of water to badly corrode the breakers. They get in bad condition.

MR. BRIGHT: Especially so if they are not operated every day. If operated today they are in good condition, but later on they may be found in a corroded condition.

CHAIRMAN TILLSON: If a breaker could be devised to be immersed in some material—carbon tetrachloride would be good—to aid in extinguishing the flame, it might have a field in the safety practice of electrical installations.

MR. BRIGHT: I think something like that is probably coming. I think they are experimenting along lines that may produce something of that nature.

RECOMMENDATION FOR BOTTOM PUMPS.

CHAIRMAN TILLSON: Another suggestion is that recommendations for a bottom pump station in a mine should include the use of

completely enclosed, air-tight, water-jacketed and water-cooled motors, so as to make the pumps, centrifugal or otherwise, readily able to unwater the mine, should the water level rise above the elevation of the pump station.

MR. BRIGHT: I think there is no question but that such a pump should be installed. They are, as I stated a while ago, making motors now which will operate even if water surrounds them, but, as you suggest, it would be better to have the motors arranged so that the water could not get in. Although manufacturers will say the motors will operate under water, the water certainly damages the motors —there is no question about that. It is only a matter of time when the insulation will break down. We have methods of impregnating coils which will stand a great deal of moisture, especially an alternating current motor which does not have any live parts exposed.

I think a motor of this kind would stand immersion for some time, but I believe it would be better to go one step further and have casing the water could not get through. I believe a motor can be developed that will pump itself out when the pump is operated, and if any water leaks in the casing it will be pumped out.

CHAIRMAN TILLSON: We have been operating an installation of that sort for seven years, only slightly different from what you suggest. I do not know whether it is the first installation of the sort or not. We are able to use motors which are entirely enclosed by a water-jacketed area by connecting our compressed air main through the water-jacketing to the inside of the motor housing, and thereby avoid the danger of a leaky gasket in a supposedly watertight housing. The motor must be of ample current capacity, to permit a large increase in temperature during operation, but it is also provided with a water-jacketed cover at all available points, throughout which there is a constant circulation of water from the pump in order to keep the motor cool in operation.

It might be interesting to know that the installation has been tested out by complete flooding without the least difficulty in operation. We would be interested in knowing the possibilities of people in general obtaining that type of motor. It so happens that I am interested in another installation of that sort and some eleven refusals have come from different electrical manufacturers in providing the water-jacketed motor. I do not know if I will be able to find anyone who will build it.

cient demand the manufacturers will produce it, but if there is only an occasional demand they are very reluctant to attempt the development.

UNDERCUTTING IN GASEOUS MINES.

MR. RICE: I want to add something to this splendid talk of Mr. Bright on explosion-proof motors. He drew some question about undercutting work in gaseous mines. I hardly think it was a fair statement, comparing risks of ignition through the breakage further back of a trailing cable or through the striking of a sulphur ball. I think it is still open to question whether sulphur ball sparks are sufficiently hot to ignite gas. I have repeatedly seen attempts to ignite gas by putting a ball inside the gas chamber and making a flash of sparks, but it had no effects in igniting the gas. As you know, the temperature is considerable for igniting methane gas. Maybe some of you witnessed Mr. Clark's experiments, when he was endeavoring to show that certain voltages and volumes were required of electric sparks and arcs in order to cause ignition. The shower of sparks was certainly surprising, it brightened the whole room, yet did not cause ignition of the gas. I think, therefore, that while it may be possible that the temperature may, in some extreme case, be caused by such sparks it will be found to be so extremely rare and will be nothing as comparable to the danger of mining machine cutting in the Pittsburgh bed with which we are so familiar, where you strike a clay pocket that carries gas and it comes out. I have frequently seen gas struck in that way and before the men could turn off the machine, if there was a chance for sparking, there would be liability to cause ignition.

We have the danger of a break further back, but that is one which requires a gaseous mixture that must be just right to ignite, and there is usually an opportunity of seeing that condition. I feel that the explosion-proof motor fills a need which nothing else has yet attempted to supply. You will have to accept the condition until electrical manufacturers remedy it and provide large enough motors.

We have made repeated examinations of explosions, where the motor and the cutting machine have been under suspicion. We know that it is easy, through carelessness, to destroy all the explosion-proof conditions, by leaving out something or by the mine machinists boring holes through the casings. But that goes back to what you said about having a good electrician on the job.

MR. BRIGHT: In mentioning sparks from sulphur balls, that was only an opinion and was not based on facts at all. The same applies to sparks from brake shoes. I think the Bureau of Mines is in much better position than any of the manufacturers to tell whether such sparks will produce explosions. I am glad to hear that sparks from sulphur balls are not likely to cause explosions of gas.

Manufacturers are, I think, perfectly willing to try to build an explosion-proof motor, but the question of putting that motor in a mine and calling it explosion-proof, is rather a serious matter, because in case there should be an explosion in a mine the manufacturer might be held liable and it might be up to him to prove that it was not his motor which caused the trouble. That would be a difficult thing to do. There is always a chance, as you see, of tampering with it and making ineffective the explosion-proof equipment which had been put on the motor. The only thing we can do is simply to go as far as we can and that will mean many less chances of an explosion, although it may not be possible to do away with all chances of explosion by applying these motors. We can reduce the risk of an explosion and if that is accomplished, why the explosion-proof motor would be worth while.

ELECTRICAL RULES.

MR. RICE: May I ask a question? How soon is the electrical committee of your national society likely to make a report on the regulation? I happen to be serving as a member of the New York committee on mine regulations and the question of electrical rules has come up. We have been acting on Mr. Clark's rules and no doubt he would be glad to accept any recommendations and changes that might be made.

MR. BRIGHT: There will be a meeting of the Power Club Committee about a week from now and they expect to make a final recommendation.

MR. RICE: Will that be on coal mining?

MR. BRIGHT: Yes, that will be on these particular rules of Mr. Clark's.

MR. RICE: As far as New York is concerned, they are more concerned in metal mining.

MR. BRIGHT: The suggestion has been made that the rules be a little broader than they are now. It will probably be some time before they are put in final shape because it is a big job and so important that it should not be gone over lightly.

MR. DAVIS: I am surprised to learn that it is not well known that gas can be ignited by sparks from an undercutting machine. It is a frequent occurrence for us in the anthracite region to have gas ignited from picks in the undercutting and even from what is called an explosion-proof motor.

MR. RICE: That is of very great interest. What happens in that case? Are the men burned?

MR. DAVIS: No; the gas ignites with a little puff; that is all there is to it.

MR. RICE: Is that from sandstone getting in?

PROPER VENTILATION.

MR. DAVIS: No, it is the sulphur ball in the bottom of the seam. It seems to me that the only essential thing is to see that the places where these electric motors are installed are properly ventilated. Rather than build a flameproof motor, keep your places clear and do not let accumulations of gas or explosive mixture get on the trolley lines. It is a criminal offense, it seems to me, to permit it to occur.

MR. RICE: Yet they do occur in the anthracite district.

MR. DAVIS: Where?

MR. RICE: Local explosions.

MR. DAVIS: Not from trolley lines, do they?

MR. RICE: No, perhaps not.

MR. DAVIS: I know of one only.

MR. BRIGHT: I intended to mention a while ago that it was my opinion that more could be done in producing better ventilation than can be produced by bringing out explosion-proof motors. If the mines were properly ventilated the chance of explosions occurring from electrical equipment would be very much reduced. We may have these little local explosions I just mentioned, due to small pockets, but to have a real explosion means there must be quite an accumulation of gas. With proper ventilation I do not see how that could occur. It looks to me as though the real way to get at this problem is to improve ventilation. Bringing out an explosion-proof motor might do considerable good, but I think more can be done on the ventilating question than on motors and the commutators.

CONDITIONS WHICH ARE HARD TO MEET.

MR. RICE: I feel that we have some good cases where it is very difficult to get what you would call good ventilation at the

moment of striking gas. I recall one, and Mr. Paul will remember the case, of an explosion in a mine where the mine management and every one else agreed that in a certain heading where there was brattice right up close to the face, within, I think, probably six or seven feet of the face, they struck a clay slip and a large volume of gas was given off and as soon as the safety light was brought inside that brattice the gas would snap in the lamp. There was a good current there, and further back, right around the corner where it had not diffused, you could hardly get a cap light, twenty-five feet back, just showing dimly on the lamp. Those conditions are pretty hard to meet. It is hard to see a way to get them any better except to keep the brattice up close and then strike into the blowers of gas. Those things occur and will occur.

MR. DAVIS: Those things are sudden outbursts and are not an everyday condition. You are talking of building a motor to meet every day conditions and not sudden outbursts.

MR. RICE: That was not a great outburst of gas and it was not an uncommon occurrence. You know the clay slips come rather regularly in the Pittsburgh field and very often they carry gas. One mine over there is rated as a gaseous mine, you will find a dozen or so places giving off gas, and yet back as far as the floors of the main run are concerned it is less than a quarter per cent. It is right at the face where you strike these clay slips.

MR. DAVIS: That is true of most of our mines in the Wyoming Valley, the anthracite mines, but at the same time if there is a good swift current of air on the face you will not have a mine fire from a spark from an electrice locomotive. I have had several of them on the rail—the locomotive 500 or 600 feet away has ignited gas at the face. The coal came down on the rail and it ignited that coal. There was no explosion.

MR. RICE: You have a more fortunate condition than they have in the soft coal district, because anthracite is not essentially an explosive dust. It is hard to prevent coal dust in the bituminous district and my proposition is in the bituminous mines where a very small ignition may be very disastrous in results.

THANKS TO MR. BRIGHT.

CHAIRMAN TILLSON: I feel that we are all very deeply indebted to Mr. Bright for the most complete paper which he has given us. We are greatly indebted also to the Westinghouse Electric

Manufacturing Company for furnishing his services to us at short notice. The discussion of this subject is very interesting and important to us. If there is no further comment we will close the discussion by thanking Mr. Bright for his valuable services.

We will now have a paper on "Standardization of Mine Cars in Coal Mines, with Special Reference to Couplings, Bumpers and Brakes, Wheel Bases, Gauges, Clearance at Ends and Sides and Projections to Catch Clothes." This paper was prepared by Mr. Carl Scholz, Consulting Mining Engineer of the Chicago, Burlington & Quincy Railroad. Mr. Scholz is unable to be present and Mr. Reed has kindly consented to read the paper.

STANDARDIZATION OF MINE CARS IN COAL MINES.

CARL SCHOLZ, CONSULTING MINING ENGINEER, CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY, CHICAGO.

Mr. Chairman and Members of the National Safety Council: In the development of its industries the United States has taken the lead over other nations by making great strides in decreasing production cost and increasing the volume of production. This has been demonstrated most clearly in the solution of our transportation problems, perhaps on account of the greater distances and larger volume involved as compared with the European countries, where to this date the railroad cars have a carrying capacity of from twenty-five to thirty tons, which is not much in excess of the cars in use fifty years ago. During the same period our railway cars have grown from fifteen tons to a carrying capacity of seventy tons, and the limit has as yet not been reached.

The growth in coal mines has been almost at the same ratio. A decade ago 1,000 tons was considered the maximum which could be obtained from a single opening. Today we deal with mines running from 5,000 tons to 7,500 tons output per day, and, with the innovations which are being worked out daily, it is not unlikely that within another ten-year period the mines which are now considered very large will be considered relatively small. This great increase in tonnage has come about by the adoption of mechanical appliancs and the elimination of man and animal power. Finally, transportation is perhaps the most important factor in the output of a mine, because the production of coal merely depends upon a sufficient number of available working faces for a given tonnage, but the transportation of coal from working face to the railway car is the

controlling feature, and this phase of the work is therefore deserving of the closest study.

NEW STANDARDS.

Within the experience of the present generation of mining men there has come a change from the wooden rail, or, as expressed in mine parlance, from the 2x4 to fifty and sixty-pound sections of steel rails; powerful locomotives have taken the place of car pushers and mules; the growth of a mine car from one-half ton tub to five and six ton car; the use of roller or ball bearing wheels against the old-fashioned wheel which had to be oiled every trip, else the squeaking of the dry axle could be heard above the rumbling of the car trip through the mine.

The title of this paper is misleading, because it would not be possible to adopt a standard which would fit all conditions, such as railroads have been compelled to adopt on account of the interchangeability of their equipment. Nevertheless, there is a certain need for each condition which is of the utmost importance to the situation existing at a specific mine, and since operating conditions vary so much the standard for each mine must vary according to roof and floor conditions, thickness of vein, grades, distance of hauling, and method of hoisting, and when we speak of a standard we should bear these features in mind.

The design of a suitable car is one of the most important features for the consideration of a mining engineer charged with the development and equipment of a mine. The first consideration should be the design of a car which will reduce accidents, and it is gratifying that much has been accomplished in this direction. Nevertheless, there is much room for further improvement.

CLASSIFICATION OF ACCIDENTS.

A scrutiny of the 1916 Coal Report of Illinois discloses the following information:

Total number of mine employes. 75,919, with injuries as follows:

	Fatal Accidents.	*Non-fatal Accidents.*
23,017 machine loaders	3	182
24,974 miners	82	515
	85	697
3,581 drivers	19	176

This indicates the employment of about thirteen miners and loaders for each driver, but the nineteen fatalities among the drivers, compared with eighty-five to miners and loaders, or a fatality ratio of one to five against the occupation ratio of one to thirteen.

The greatest single cause for accidents is the falling of rock and coal, but since all the men are subject to this condition and no one excepting drivers or locomotive operators are subject to injury by pit cars, it is very obvious that as far as the number of men engaged are concerned there is a much larger percentage of injury due to the transportation of the coal than to the mining of the coal and operations at the working face.

With the increasing use of mechanical means for hauling, in certain directions the dangers increase and in others it diminishes. The abolishment of the mine mule, with the proverbial kicking tendencies, reduces the number of black eyes, broken jaws and ribs. On the other hand, the handling of longer trains and coupling of trips, where gathering locomotives are used, increases damages in this direction and calls for special attention to couplers and bumpers.

The increased size of cars, because of the largest possible carrying capacity, is the first aim of each operator. The track gauge is usually fixed by roof conditions, and this usually decides the width of a car and to some extent the length. A short wheel base has the advantage of taking shorter curves and is easier replaced in case of derailment, but perhaps a wheel base too short is responsible for many derailments which would be obviated if the wheel base had been of the proper length. The establishment of the correct wheel centers therefore is of the utmost importance, and from the safety standpoint it may be better to err on the side of making the wheel bases too long rather than too short.

The design of a car bumper has a far-reaching effect on the life of the car and the safety of the men handling it—a feature which is quite important now on account of the great increase in the weight of trains and the severe service which cars are subjected to by mechanical haulage. The mining laws of several of our states prescribe the length of the bumper beyond the end of the car, and seven inches should be the minimum of such requirement. A bumper extending the full width of the car is considered the better practice, because this type prevents interlocking when couplings are made on curves.

By far the greater number of accidents are due to the design of couplings, and wherever possible couplings should be adopted which

do not hang between the bumpers and which can be coupled when the cars are standing still, because every coupling which requires the movement of a car increases the risk to the employes.

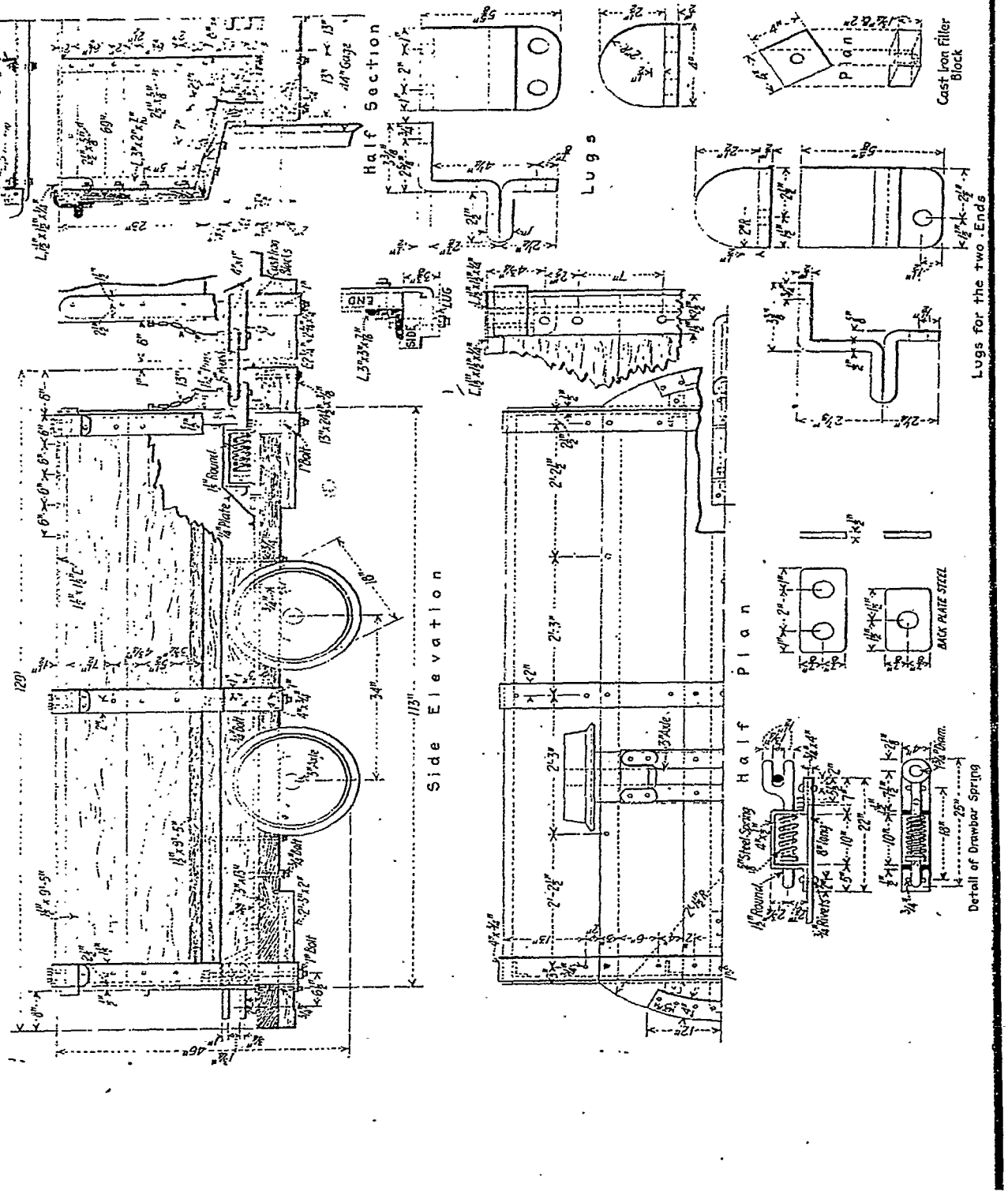
The use of automatic couplers on mine cars cannot be said to have met with much success. This failure may be largely due to the instability of tracks rather than to the design of the couplers. The field therefore is still open for improvements in coupling devices which are safer than those now available. Limitations in weight and cost are necessarily influencing factors.

The use of brakes on mine cars is by no means universal. Perhaps the principal reason for the absence of brakes is the failure of many designs which have been used. With the adoption of mechanical haulage the use of brakes is less advantageous than it was with single-car mule haulage, and the sprag or stop block seems to be a most effective method of handling cars on grades or bringing them to a stop at the shaft bottom.

A sketch of a car filed with the National Safety Council, blue prints of which may be had on request, represents equipment adopted by a very large mine in Illinois, which has a capacity of 10,000 pounds, with a topping of fifteen inches above the car body. The height of the car is kept to the minimum, because four feet seems to be about the practical limit over which the coal can be handled by hand shoveling. To fill this car level full requires an expenditure of 24,000 feet-pounds of energy. If the sides of the car were six inches higher this would be increased to 27,000 feet-pounds (a feature readily observed by the miners), and a mine where cars are loaded easily is more attractive to the men.

In order to have a height of 3 feet 10 inches it becomes necessary to widen the gauge to forty-four inches in a district where forty-two inches was usually considered the standard, but since this company has no other mines the question of interchangeability of equipment did not need consideration. The car has no end gate, because the coal will be dumped in a rotary tipple.

There are many advantages to this scheme of handling coal, especially the elimination of the end gate, which results in much spilling of coal along the roadways; also the elimination of stirrups and irons in fastenings on the front gate, which are expensive and form projections along the roadway. The bumper and couplings are designed so as to prevent the necessity of the coupler to subject himself to the danger of being crushed, and the coupling link will slide between the jaws of the drawhead. In order to increase the


Half Section
Lugs
Plan
Cast Iron Filler Block
Lugs for the two Ends
Side Elevation
Half Plan
BACK PLATE STEEL
Detail of Drawbar Spring

tractive power of the locomotive and to offset the advantages gai by a loose-link coupling, one drawhead is equipped with a spri The wheel base of the car is nearly one-third the length of the and the stability which these cars will have in traveling will prev many derailments.

It will be noted that all of the car irons are rounded at ends, to prevent the catching of the clothes of bypassers. This particularly carried out in the three dump supports with wh these cars are equipped to be held in position while in the rot dump. On account of the flat vein in which the equipment is us no brakes are required.

CLEARANCE.

Even with the most perfect design of mine cars accidents oc which are charged to mine cars, but for which they are not resp sible, and this refers to the clearance between the cars and ribs or timbers. Wherever possible and where employes m move between the cars, a minimum clearance of twenty-four inc should be provided. It seems far preferable to have ample cle ance on one side of the track and none on the other, rather t to have too little on both sides. This will avoid confusion.

The great rapidity with which cars must be handled calls the selection of cool-headed men for this class of work. Undou edly a great number of accidents to drivers and motormen are to the daredevil spirit which is often inspired by a desire of men who rival to outdo each other, thus not only bringing inj upon themselves, but interfering with the steady operation o mine, with resulting loss due to damage and destruction of equ ment.

DISCUSSION.

CHAIRMAN TILLSON: This paper is now open to discussion. would be glad to have the comments and experience of those prese

MR. HALL: In many places where, if the driver does not r on the chain, the wheelbase is so short that the car will go off track, he practically has to help load down on the car or else it v tilt up and leave the track; in many cases, it seems to me, our sh wheelbases have a great deal to do with the cars going off the tra It also causes that same result, or that same result is helped a gr deal, provided the track may not be just exactly of standard ga at any one point, as it enables the car to swing around just so m

more. I think that is a very important matter and it is one that has not, as a rule, been given enough consideration. The fact that you can put a car on the track very easily also argues that you can unship it very easily; what is very easy to remedy is also very easy, usually, to effect.

GATES AND COUPLINGS.

MR. RICE: I think Mr. Scholz has given us a very good paper. I am glad to see he advocates the use of a car having no gates, for bituminous mining at least. The reason is obvious to those who are familiar with the dust-making propensities of cars with gates which swing open and in which, very nearly always, there are large cracks. I can cite experiences which one of the subsidiary companies of the Phelps Dodge Copper Company had, where, following a disastrous explosion, they decided to put in tight-end cars and have gradually been putting them into their mines. I happened to be there when the first installment in one of their mines had been put in some six months. The superintendent told me that that mine made less dust in the six months on those roadways than was made in a single day in their other mines with the regular gates. That is one of the best means of taking care of the coal dust problem in bituminous mines where there is danger of dust explosions.

I would like to hear some discussion of the question of coupling, the method of coupling the cars, for the reason that you, or Mr. Cameron—perhaps it was you—put the question to me as Chairman of the Standardization Committee, as to what might be done toward standardizing mine cars. This paper is one of the results of that question, but Mr. Scholz does not come out very distinctly, I think, in just what method he would use.

Personally I have been rather in favor of the link and pin for safety purposes. I think this discussion can apply either to coal or metal mines and there may be others interested who might be willing to express opinions and give the commitee guidance when it tries to accomplish something on this subject.

MR. DAVIS: In the anthracite region we have a variety of mine cars and the question of bumpers and couplings is one of the main things in connection with the safety movement in transportation. I know we have nine-inch and six-inch bumpers; that is, we have some cars with six inches and some with nine inches. We also have the question of couplings; when the draw bar comes in between there is only room enough for a man to get his hand in to reach that coupling.

During the month of July I was out in West Virginia and saw a entirely different type of mine car. I went over to Jenkins, ar saw an entirely different car there and from there I went to Garric The best car I saw was at Garrick. At Garrick they have a bump semi-circular in the center and the one-link coupling has a draw b and a pin—just one fourteen-inch link. It is always in position ar when the cars come together it can't fail to get in the proper pla and the pin goes right in.

With our three-ton cars we have to have a stronger arrangeme than that, but the principal, in my opinion, is advisable. From safety standpoint, I think, if we are going to equip new mine ca or equip a new mine I would recommend your going to Garrick see that car. They may have a similar car in other places, but th particular car appeals to me as being the best car I have seen.

In our cars we have a solid bumper, just enough for t coupling. We have a twenty-four-inch coupling and when t fifty-ton locomotives start off with thirty cars, God help the locom tive and cars and everything else. If we had a one-link coupling would be all right, but we have the link pretty near twenty-fo inches to get around. When we are on a straight road the locom tives pull our cars to pieces. They were designed for a mule, n for locomotives. I rather think the Garrick car was designed f locomotives as they have nothing but locomotives. It is an ideal c and that semi-circular arrangement gives you plenty of space to g in when the car is standing. The stretch is small and in a cur you can almost go around a circle without any interference fro bumpers.

MR. RICE: The locomotive starts out with a full load?

MR. DAVIS: Yes.

AUTOMATIC COUPLERS.

CHAIRMAN TILLSON: I take it from Mr. Scholz' paper that does not recommend automatic couplers. That is a practice whi I have seen in the iron districts of Michigan, Minnesota and W consin, and they think very highly of them. His objection, I take is that it is unwise to couple cars under any condition with the c in motion. You have to move cars to couple them and that seems require either a chain and hook or link and pin. The thought com to me: Isn't there another way of avoiding the danger of a m being crushed in coupling outside of leaving sufficient clearance f

his body without danger of being crushed by a movement of the car; that is, to make the clearance between the ends of the cars so slight that he knows if he does get between moving cars he is sure to get injured, that he has no chance at all. Could we not require him to use some form of tongs or other mechanical device to reach in and handle the link and pin? If he is sure he will get caught if he attempts to put his arm between he will then, of necessity, use a mechanical device and his whole body will be outside of the clearance of the cars.

MR. RICE: If you have loose couplings and the cars are a little distance apart I think it is almost inevitable he will try to go between the cars.

CHAIRMAN TILLSON: I think you can make them close enough to discourage such attempts.

MR. RICE: They will not always be in that position; if so, you could not go around a curve. Will there not be a temptation for the men to pass from one side to the other when they are apart, because there are always times when men have to pass to their work and they will attempt to pass through rather than go around?

CHAIRMAN TILLSON: Mr. Davis remarked in regard to the strain on the couplings with the long links. It seems to me that might be all obviated if we combined the draw bars with the same set of springs to act both in compression and in tension. We would thus relieve the strain on the rolling stock to a very great degree.

LONG WHEEL BASES.

MR. BRIGHT: I am glad to note that Mr. Scholz advocates a little greater wheel base on cars than is generally found. The locomotive manufacturer is continually asked to produce a locomotive that will go around a corner instead of a curve. Where they have cars with very short wheelbases miners will put in curves with a very short radius, because the little cars will go around them, but it is rather difficult to produce a locomotive that will negotiate the same curves. The longer wheel bases advocated by Mr. Scholz, no doubt, will produce a greater radius of curves in mines—a very much easier proposition for the manufacturer of rolling stock to meet.

MR. BEHR: I would like to mention an experience we had with an electric locomotive, built over twenty years ago in California. The truck was only twenty-inch gauge and we wanted to get a pretty good curve. There was no way we could use the ordinary type of locomo-

tive with a twenty-inch gauge obtainable at that time, so we had design our own locomotive. We got the motors from the Gene Electric Company and put in an idle gear between the gears on t axle. We placed the motors in the middle of the locomotive, raisi them up and thereby bringing the center of mass right into the cen of construction.

As a result we got the mass away from the edge of the track, ar in running over the sharp curves we had to make, that locomoti never left the track. I think it is very important to keep the ma near the center, and a long wheelbase will help out in that matt Where you have to have a short wheel base, on account of sh curves, I think it is advisable to consider a construction of that kir We had a demonstration of the oppositive effect with a locomoti having a large mass at the end. It was a compressed air motor a the short wheelbase was a detriment because it spread the rails wh going around a curve.

LINK AND PIN.

SECRETARY PAUL: The type of car described by Mr. Davis having been seen in Kentucky, with the bumper in the center—semi-circular or curved bumper—with a one-link coupling, is us very largely in the Pocahontas field. They use a large size of ca with a rather large wheel.

The locomotive, however, uses a coupler of several links, ve strongly made; they utilize that large link coupling in starting a tr to get the momentum of the motor in starting, instead of using a st single-link coupler between the motor and the first car.

MR. BEHR: I understand that the link referred to is of the ty which used to be common on all railways. Switchmen have to u both hands in order to couple up the train. They are used in c lieries here as well as in Europe. Where you have the pin attach to a three-link chain with an open end, the pin passes through t bottom of the jaw and stops against the upper part, so you can put in with one hand. I should think that would be a connection th would be safer than where the pin was detached from the chain.

MR. DAVIS: That is what you call a shackle, Mr. Behr. I not know whether it is twelve or fourteen inches long.

MR. RICE: It holds its place and passes into a bell-shaped r ceiver, so that it catches; it goes right in place and if the train on a curve you have to line it up; then it goes right in.

MR. BEHR: You do not have to lift it?

MR. DAVIS: To uncouple, but not to couple. It goes in place in coupling. There is a little recess in the sill, I presume where the pin drops in, so as not to let it tilt either way when the draw bar pull comes on. It is the best coupling I have seen, and I have seen a great many; it is the best protected car, I think the best car to keep the track, of any I have seen. I do not know who manufactures it.

MR. RICE: I would think it would be a good thing to get a picture of it.

MR. DAVIS: I think that would be very easy.

CHAIRMAN TILLSON: Will you do that, Mr. Davis?

MR. DAVIS: Yes, sir.

HAND HOLD ON HITCHING HOOK.

MR. HALL: The Lehigh Valley has a very good arrangement for hitching mules to cars. It often happens that a mule does not behave very well and a man is liable to get his fingers caught when making an attachment between the mule and the car. The arrangement consists of a hand hold on the hitching hook. In that way, when holding the hook, there is no chance of the man getting caught between the hook and the coupling; he is perfectly safe. The new safety hook of the Lehigh Valley Company appears to be a very good thing. In their employes' magazine, recently published, they speak very highly of it.

They have another stunt which is very good. Their cars are very much like most anthracite cars in that they have very little bumper clearance. In order that a man may be safe in putting his hand in between the cars he slips a block in between the bumpers when the cars are coming together. He can stoop down and make the attachment while the block hangs there. In that way he escapes possible injury.

SECRETARY PAUL: Is that block strapped to his leg or is it suspended?

MR. HALL: I think he carries the block by a strap; then he has a hook which will pass over one end of the bumper. When the cars come together they do not come so close that they will pinch his head or any part of his body.

CHAIRMAN TILLSON: Mr. Rice, may we hope for your address on "The Necessity of Mechanically Produced Ventilation for Metal Mines"?

MECHANICAL VENTILATION OF METAL MINES.

GEO. S. RICE, UNITED STATES BUREAU OF MINES, WASHINGTON, D

Mr. Chairman and Members of the National Safety Coun

Mechanically produced ventilation of mines and the coursing of throughout their workings has been regarded, until the last f years, as necessary only in coal mines. The more or less haphaz ventilation of metal mines is in striking contrast to the high or of engineering shown in other departments of metal mining ope tions. Ventilation of coal mines, on account of inflammable ga given off by the strata, or the loss of oxygen of the air throu absorption by the coal, made the positive "coursing" or circuiting the air current a vital necessity. This was recognized a century a after serious explosions of firedamp had occurred, although c mining operations were on a very small scale at that time. Notw standing the slow development of positive ventilation in metal-m ing operations, mechanically produced ventilation of metal mi received an early start. Agricola, in his book describing the min practice of the sixteenth century in the Hartz mountains, repeate refers to ventilation. The following are some quotations, ta from Hoover's translation of Agricola's book:

"I will now speak of ventilating machines. If a shaft is v deep and no tunnel reaches to it, or no drift from another sh connects with it, or when a tunnel is of great length and no sh reaches to it, then the air does not replenish itself. In such a c it weighs heavily on the miners, causing them to breathe with d culty, and sometimes they are even suffocated, and burning lar are also extinguished. There is, therefore, a necessity for machi . . . which enable the miners to breathe easily and carry on th work.

"These devices are of three genera: The first receives and verts into the shaft the blowing of the wind. . . . The second ge of blowing machine is made with fans, and is likewise varied and many forms, for the fans are either fitted to a windlass barrel o an axle. . . . Blowing machines of the third genus, which are less varied and of no fewer forms than those of the second ger are made with bellows, for by its blasts the shafts and tunnels not only furnished with air through conduits or pipes, but they also be cleared by suction of their heavy and pestilential vapou

CRUDE BUT NOT INEFFICIENT

Agricola's drawings show many varieties of ventilating devices; some dependent, as indicated in the above quotations, on the effect of the wind, and others are the predecessors of the centrifugal fans. Several of the drawings show large feathers set radially in the axle; others show wood blades or paddles arranged as in the later Guibal fan. Apparently, however, the proper arrangement for admitting the air to the fan at the axis had not yet been discovered. In the drawings, the air appears to enter a slot on the circumference of the casing and is discharged through a wooden conduit at another place on the circumference. Presumably, however, the action of the fan was improved through leakage through joints and cracks in the wood sides, so that accidentally it may not have been so inefficient in design. The drawings seem to indicate that the use of brattices in shafts and ventilating doors was understood, although there is no indication that a circuit of the air was maintained away from the shaft or beyond where a shaft intersected drift workings, except by wooden pipes.

Little advance seems to have been made in metal-mining ventilation for the 300 years following until compressed air drills came into use, then the exhaust from these was and ordinarily still is regarded as furnishing sufficient air in the working place. When the drill is not running, if the atmosphere is oppressive in the heading or stope, or is bad following blasting, the compressed air is allowed to blow direct from an air pipe outlet. Undoubtedly in small metal mines, or those in which there is no considerable amount of noxious gas given off or where workings are a short distance from the drift mouth or shaft, this may be sufficient. In most metal mines, owing to the ore formation generally having length along the strike, and depth vertically or to the dip, but often not great width, differences in temperature between the lower workings and the outside atmosphere readily generate air currents when secondary connections have been made to the surface.

INFLAMMABLE GASES RARELY ENCOUNTERED.

Inflammable gases are rarely encountered in metal mines and generally there is little absorption of oxygen by the ore or inclosing walls, although in mines in which there is much timbering it has been found that there is considerable absorption of oxygen by the timbers due to bacteriological action. Nevertheless thousands of samples of air that have been gathered by the Bureau of Mines in metal

mines indicate that except after blasting it is rare when the a a considerable amount of impurity. Occasionally, as in the C Creek district, Colorado, metal mines encounter large amou pure nitrogen gas residual in the strata. Such mines can or worked by the employment of a plenum (pressure) system of tilation. In general, however, the chief air impurities in metal ing arise from blasting.

In the case of long drainage tunnels the rule is to ventilate fans and air pipes and it is obvious that it is an economic adva to quickly ventilate the heading after blasting so that the miner get back to their work as soon as possible.

In great ore bodies, such as found at Butte; in the Lake Su iron and copper mines, in the copper mines in the Southwest especially in the deep and extensive gold mines of South A there has been a gradual introduction of mechanical venti methods apart from any dependence on compressed air at the

Attempting to ventilate by means of compressed air when is a considerable volume of noxious or poisonous gases prese from blasting, is extremely inefficient both in sweeping awa smoke and gases which it tends merely to stir up, and from a chanical efficiency standpoint in using air which is usually pressed inefficiently to a high pressure, and liberating it witho ing mechanical work, at atmospheric pressure. The reme to arrange as far as possible a circuiting of the air, supplement "booster" fans of fireproof construction. In driving explor tunnels, drifts and winzes, twelve to sixteen-inch diameter pipe used effectively—compressed air jets discharging axially in the induce a considerable flow of air, but are not as efficient or eff as small high-speed fans.

EXITS FROM MINES.

It is hardly necessary in this day to argue the necessity of h two means of exit from a mine, as this is the requirement in state metal mining laws. Probably over 95 per cent of the mines of the country which have reached a permanent basis o production have two exits, and the remainder are probably pu in such second exits as rapidly as it can be done. Where ther two such exits one naturally becomes the upcast and the othe downcast. Unfortunately, however, these conditions some change with the season, and during the change or approachi the natural ventilation underground is insufficient. Hence in

mines there is necessity for the use of fans. In very deep mines, as in the copper mines of the Lake Superior district, normally the upcast and downcast conditions do not reverse and the natural main upcasting current is very strong. It then becomes a problem in such a special case whether or not in the interest of safety to prevent reversal of current in the case of a mine fire in the downcast, if it is not best to install a large fan, which may never be needed except for this fire protection.

However, in the great majority of metal mines a strong non-reversing current, due to the difference in temperature in the upcasting and downcasting shafts, does not obtain; this being the case, it is highly important both for fire protection and for a positive circuit of air through the mine that fans should be used.

The great variety of conditions found in metal mining in the United States, varying from typical fissure veins to the great lenticular and irregular iron ore bodies of the Lake Superior district, makes it impossible to lay down as exact a procedure as is usually regarded as a necessity in planning coal mining developments. Nevertheless, it will be generally conceded that a great deal more might be done in the future than has been done in the past if preliminary planning of a ventilating system is borne in mind, particularly in developing low-grade deposits, the volume of which has been more or less determined in advance by prospecting.

VENTILATION OF HAPHAZARD CHARACTER

While metal mining laws and modern practice require two exits and recognize the necessity of air downcasting in one shaft or winze, and returning through another shaft or winze, adit or tunnel, the necessity for provisions for circulating the air through the body of the mine has not been well recognized, with the result that in some of the great mines of the United States the ventilation is of the most haphazard or badly arranged character. Often the writer has had occasion to observe that the main fan placed underground is ineffective because part of its air discharge has been circuited around and around. Therefore, although the percentage of impurity in the air might be low this arrangement did not take care of one of the most important advantages of metal mine ventilation in deep mines, *i. e.*: To keep the air current temperature below that of the mine walls. It is not always a question of depth or natural heat of the strata, but where large masses of timber are used—especially in the caving system employing a timber mat—the temperature is frequently far

greater immediately under the mat than it is in the deeper deve ment levels.

It is believed that if the same degree of care were taken in la out in advance the ventilating system that is given to laying out levels, drifts, crosscuts and raises, for extracting the ore bod great deal of the difficulty of a physiological nature now experie by the miners in certain districts would be prevented. These t bles are not simply those of temporary discomfort of the work but their health is likely to be affected and make them liable to tract diseases, lessening their working efficiency and thus in co quence decreasing the earnings of the mine. Ventilation, theref becomes a matter of economic importance. It is difficult to sp of specific mines or districts without causing unfortunate comp sons, but that the problem is an acute one in many districts wil readily admitted by most mining authorities.

HOT MINES

Another phase of the physiological problem concerning wor in hot mines is that it is not alone the high temperature of the air whether or not that air is in motion. In the experiments of Dr. H dane of Oxford the celebrated physiologist brought out strikin that in still, hot air the body is enveloped with a film of air at or blood heat and the skin is not cooled by evaporation of the sw But if the air is in motion, unless it is saturated, which it seldom evaporation occurs and thus the skin is cooled. The writer rec a case where in a certain stope there was no movement of air miners complained of the heat and from time to time they went a nearby cross cut where there was a strong current of air and w comfortable, although in the latter place the temperature was a ally several degrees hotter than in the former.

GENERAL PRINCIPLES

The tremendous variety of mining conditions found in the Un States prevent formulating any exact specifications for a ventilat scheme which would fit all conditions but in order to bring out cussion which it is hoped will follow these suggestions the follow general principles are mentioned which may be of guidance in pl ning the ventilating system of new mines or in adapting the arran ment of old mines as far as is possible to do so:

1. That each mine should have a permanent upcast and a p manent downcast shaft.

2. The downcast shaft should be as far as practicable the shaft in which the men are hoisted and lowered—it may or may not be the main ore hoisting shaft—the object being that in case of fire in the mine the main hoisting arrangements for men will be available; and, if practicable, this shaft and its landing shall be concreted or otherwise fireproofed, and back of each landing there shall be a fire door to protect from the workings beyond. In hot mines, particularly in cold climates, the men leaving the mine at the end of a shift should have arranged for them a warm dry place in which to stay while waiting for a cage.

3. The main downcast shaft should extend to the lowest working so that the fresh air may go to the bottom of the mine and then ascend on either side through the workings to the upcast shaft. Sufficient splits of air to be taken off on the different levels to provide for proper ventilation of these levels; the returns to be taken around the downcast shaft by crosscuts or concreted air bridges.

4. The main ventilating fan should be placed on the surface; the fan to be of metal, with fireproof housing, and to be reversible. Generally the most convenient arrangement would be to place it at or near the collar of that shaft which is not the main hoisting shaft (of course, a tunnel or slope mouth would be equally as good) so as to avoid an air lock; therefore the fan would normally be an exhaust fan, but as stated previously it should be reversible to provide for an emergency such as fire in the air intake.

5. The fan should be of sufficiently large size so as to take care of the largest volume of air which is likely to be necessary for at least five or six years to come, and it should be able to deliver or draw air at a pressure in excess of that which could be produced by maximum natural causes; that is, the maximum "motive head" of the air column, due to the maximum difference which may obtain, between the temperature of the mine air and of the outside air, in the coldest or the warmest day of the year. For undeveloped mines such figures have to be more or less conjectural, and so it is often necessary to make assumptions from past experience.

In general, the main fans now employed at metal mines are entirely inadequate, and fans such as are employed in large coal mines should be installed in large metal mines, the workings of which are expected to be of large extent and employ many men underground. By this is meant fans which will discharge from 100,000 to 300,000 cubic feet of air per minute against pressures measured by two to six inches of water gage.

On account of the fire risk it is not good practice to place the main fan underground, and moreover there is usually liability of the air short-circuiting—that is, going round and round and not being discharged to the surface. Of course, there are special conditions where the ground is badly cracked and creviced near the outcrop, and the leakage of air would be too great to place it at the surface, but the conditions are exceptional where the openings cannot be sealed by surface covering or clay filling.

"BOOSTER" FANS

6. "Booster" fans are necessary in exploratory drifts, and in making winzes or raises and in high stopes. These fans should be metal and the housings and surroundings fireproofed so if a short circuit in the electric motor occurs a bad fire will not be started. New devices in the way of canvas pipes and hanging arrangements for same have been developed recently and make admirable auxiliaries for reaching the face of headings and winzes, but wherever possible it should be planned, just as in coal mining, that a continuous circuit of air be obtained after it has been established that bodies of ore exist that sooner or later will have to be blocked out, in order to give adequate ventilation in the interior of the mine and such arrangements should especially be provided for sake of fire protection.

A number of the greatest fire disasters in metal mines would have resulted in a much lower loss of life had there been continuous circuits of air, which would have enabled the miners to follow up to intaking air. The great merit in fireproofed downcast shafts and the landings adjacent to same is to enable the escape of the men who could keep in fresh air by travelling out in the intaking current. On the other hand, if an unfireproofed downcast shaft takes fire, as at the Cherry coal mine or the North Butte copper mine, it nearly always spells disaster and the only possible remedy then is prompt reversal of the fan, which, if accomplished in time, might save the men. If this cannot be done or if all the escape passages are already filled with smoke the only thing left for the men is to "brattice" or "bulkhead" themselves off in some heading free from smoke, marking with chalk where they have gone for the subsequent direction of the rescue parties.

COST OF INSTALLATION

While the cost of providing adequate ventilation is considerable,

a vital necessity for deep mining. Any one who has visited deep or hot mines, such as on the Comstock lode or at Butte, must realize that it is a vital necessity to provide the best ventilation possible in order that deep mining may be carried on at all. Under conditions such as those where nitrogen gas is encountered or where spontaneous fires occur in rich sulphide ores as in some Montana and Arizona mines or those mines where sand or slime filling cannot be done, it is necessary to erect fire walls and put in a plenum (pressure) system of ventilation so that the gases may be forced back into the crevices in the strata or behind the fire walls.

SUMMARY.

The need and importance of mechanical ventilation in metal mines may be summarized as follows:

1. To provide good quality of air for the underground workers in all parts of the mine, including the face. The exception would have to be made for conditions at the face immediately after blasting, and then only for a short time, during which the miner must be kept out from the face for the sake of his health and for best interest of the mine operator.

2. To keep down the temperature of the mine air at the working place.

3. To provide a positive movement of the air in hot working places in order to keep down the bodily temperature of the worker and thus increase his efficiency.

4. To provide a positive circuit of air, so that in the event of fire the underground workers may escape by traveling against the fresh intaking air. This is, of course, provided the fire has not occurred in the intake. If it has, the only possible way of saving all the men is by immediate reversal of the fan, except as they may bulkhead themselves in and await rescue later.

DISCUSSION.

MR. YOUNG: Where Mr. Rice recommends a downcast shaft for handling men, in our district, with which you are no doubt familiar, the men are handled in tubs instead of cages. During the winter it is necessary to handle them in shafts with an upcast, because shafts are sometimes wet and where they downcast the ice and high speed in the shaft makes it very dangerous, if not impossible.

MR. MCKEEHAN: The matter of ventilation is something that

has been taken seriously only in the past few years. In the Wes up to a few years ago, it was hard to make the average metal mir manager understand the benefits to be derived from mechanic ventilation. Of course, coal miners always understood it. When first proposed it to our people, some years ago, they held up the hands in horror. We had always had natural ventilation. Up about eight years ago, in 20 to 25 per cent of our places, all th men could wear was a G-string and a pair of shoes, it was th hot. By introducing a fan we made a wonderful difference.

Starting with one of our divisions, No. 5 in the copper field un we put in ventilation system and soon got the others. Practical all our mining camps have now introduced mechanical ventilatio In the warm district we now have only one division that is natural ventilated, and this one is well situated. It is an old mine and being worked gradually.

We have no trouble. We have to use the pressure system of ve tilation on account of old mine fires. As a rule our fans are locat on the lower levels, or near the lower levels, and we keep up o pressure on account of gas working out from old fires which we ha to fight continuously.

Our ventilation system is worked out for each one of our di sions by a ventilation engineer. Before we install a system we kno just how much air we can release, and how much we have to put i

In the Queen unit we have eleven working shafts, ranging all t way from 1,000 to 1,800 feet concreted up to 400 feet. They a so equipped that it keeps our ventilation engineer on the job pra tically all the time—watching his fire doors, gas areas and so fort The worst trouble that we find is ventilating individual worki places—the long drifts, raises and the top-slice stopes. The top-sli stope is the hardest to ventilate, as it is difficult to keep all corne clear, especially when the men are coming down. We may pull o stopes—stopes that were worked years ago—and these coming do bring more or less gas. Gas comes from decaying timbers as well from fires that start from sulphur gobs, and it is hard to keep t mine clear. I think that is the chief trouble our mine foremen ha —keeping individual workings clear. Mechanical ventilation u doubtedly has been a great help in all of our mines.

FALLACY OF METHOD.

CHAIRMAN TILLSON: In mentioning the top-slice stoping sy tems it may be of interest to call attention to a fallacy which

personally noticed in some of the cave stopes in the Michigan iron mining district. There was one mine in particular in which the ventilation was extremely poor in the top slices. It was so poor that a candle in motion would not burn. Acetylene mine lamps, by the way, burned all right and gave proper illumination. The amount of oxygen required for the acetylene mine lamp is considerably less than it is to keep a candle flame burning when in motion. They did not have a fan system of ventilation and attempted to get enough fresh air ventilation with small nozzles tapped into the compressed air mains. The fallacy in their method, outside of extreme extravagance of attempting to use compressed air for ventilating air, was due to the fact that by making these numerous openings in their sublevels they overtaxed the capacity of their compressing plant; the result was that the compressors were run at overspeed and were overheated. The air in the mine was so miserable it made me wonder what class of air they were delivering through their compressed air mains. A visit to the power-house showed that the compressors were taxed to overcapacity and the steam-driven compressors were run at a very high speed.

A question to the engineer as to whether he had any difficulty in lubrication, due to the overheating of the compressors, evolved the answer: "Yes, they used up a considerable amount of oil." As a result of this system they were vaporizing oil in their compressors, delivering it into the compressed air mains, and, instead of getting any advantage from the compressed air, they were shooting noxious gases into the mine, which made it even worse than usual.

It was the most striking example of the need of fan ventilation of any place that has come under my attention. I call attention to this fact because it is a common habit to rely upon the exhaust from air drills and the little bleeders which we think, individually, do not amount to much, in the total amount to a great loss of power. We think they will furnish sufficient ventilation in a dead end heading or a long raise, when as a matter of fact, they do not.

USE OF DOWNCAST SHAFT.

MR. HALL: There are a great many people in the metal mining business, from what I have heard, who take exception to the statement that men should be brought up through the downcast. The metal mines are very warm and the downcast is often very cold and the shock to the men is considerable. Some concerns have considered with a great deal of care, I believe, the possibility of using the

downcast as a means of lifting the men, because of its advantage in case of fire.

MR. RICE: I really did not think of it as being advisable in a very cold climate to have the man shaft as the sole downcast. I thought of it, rather, as being a shaft in which the air would be more or less neutral. I can see, in certain cases, it would not be advisable.

The greatest difficulty I found was in attempting to prepare suggestions for the tremendous varieties of mines, but we do know there have been very serious fire accidents due to hoisting the men in the upcast shaft and the inability of adequate escape by other means.

PROFESSOR RAYMOND: I think the experience of the mines in the Butte district is quite valuable to us, because Montana is about as cold as any part of the country and they have about as much heat in their mines as in any mines that we have throughout the country. Their general experience has been, after some of the serious fires they have had, that it was better to use the downcast shaft, or to make their hoisting shaft for the men in the downcast shaft, largely on account of greater safety for the men—it was really the best shaft to give good ventilation through the mine.

There is the danger of men coming out from warm places in the mine and developing pulmonary troubles; but that is largely due to the fact that they are breathing impure air, unles ventilation be good, rather than to coming out in a cold temperature. If the air throughout the mine was thoroughly good the danger of anything of that sort would be very much less.

The Butte mines find it does not interfere with their operations to thaw out the ice around the upper parts of their shafts with steam pipes. Ice is kept away with little expense and the shaft is kept in good condition for the operation of hoisting and is not at all dangerous to the men.

The main point, however, is the fact that the mines need good ventilation in order to secure efficiency from the men and to prevent pulmonary troubles on account of bad air.

I think we are very near the time when we must give more thought to the actual quantity of air necessary for men in metal mines This has been done in coal mines. As a matter of fact, it pays dollars and dollars to give good ventilation to the men and to provide good fans and to see that the men are provided with good air.

This has been worked out pretty thoroughly in South Africa where it was found after making tests to clear the atmosphere o

dust rather than anything else, that the actual quantity of air that a man required when he was working hard and generating and steaming out carbonic acid was at least thirty cubic feet per man per minute; they fixed it definitely and decided that it should be seventy feet. I think if we agree that fifty feet, or at least thirty feet should be used, fifty feet better, and seventy feet is not too much, and as a matter of cost it makes very little difference—that we would arrive at a point that would give the miners very much better working conditions and actually get the work done more cheaply than is now the case in a lot of the mines where they are struggling with hot air.

After the mine gets to a depth of 2,000 feet and over the hot air becomes so serious as to interfere with the men in actual everyday operations. In mines which are not particularly affected by hot air or hot gases—in some places like Cripple Creek and in some places in Mexico—hot water has been encountered.

Some of the mines in Wisconsin have tremendously high temperature and the men were not able to work, but simply by moving the air a little bit, although it did not reduce the temperature very much, it took the humidity out of the atmosphere in which the men were working and enabled them to work very much better.

The question of humidity, perhaps, is beside the question of gas or carbonic acid, such as they have had in Cripple Creek and Mexico in some of the mines. The question of humidity is most serious when you bundle 100 men in a long stope and they are working hard and breathing out steam and puffing it out to such an extent that unless the foul air is carried away in very large quantities and fresh air is furnished them, their efficiency for that day and every day is very much impaired. I think the actual cost is so little, inasmuch as it is less than a cent per ton in a large operation, and the better work, which is trebled or quadrupled in a great many places, shows the advantage of good ventilation, that really it makes the work in the mine very much cheaper and more efficient.

PLACING OF FANS.

MR. BEHR: Most of our shafts are pretty deep and it was found that the cross sections available in those shafts was not sufficient. We had to use pretty high pressure ventilating fans to get the air down, but the situation which we had to consider was to place the fan in the shaft. If the shaft was insufficiently deep we subdivided the work and placed one fan at the top and another at the bottom, thereby cutting the resistance of the mine to the currents

so as to get more currents of air through the mine. You get a certain amount of pressure with one fan, and this way you get double the amount.

In regard to the Comstock: I think the excessive temperature was due to chemical action. I remember the water came up in the bailing tanks of one shaft at 150 degrees Fahr. I remember the case of one man working a pump; the packing blew out and he could not get away; he was boiled. The company made every effort to reduce the temperature and get the water out. Ventilation in those days was all natural. We had one fan but no scientific data was available. That was a very long time ago, in the '70s.

MR. RICE: Yesterday I called your attention to the figures given in the paper on the increased efficiency of certain workers in the Butte district. I know they can be multiplied many times. Before they put ventilation into a tunnel or heading there was very small accomplishment of work; after fresh air was put in their efficiency increased greatly. Before having proper ventilation the men had no energy and could not work much; with the fresh air they were able to go ahead and do a reasonable day's work. I think ventilation can be placed on a dollars and cents basis in many parts of the country.

CHAIRMAN TILLSON: Is there no further discussion? We will have a report from the Nominating Committee. Nominations from the floor, also, are in order at the same time. Mr. Hall, have you a report from the committee?

REPORT OF NOMINATING COMMITTEE.

MR. R. DAWSON HALL: The nominations, which we propose, possibly need a little preliminary statement.

We feel that it would not be well to make any change in the chairmanship this year. Mr. B. F. Tillson has already made arrangements for the various committees and they have hardly accomplished the work which they have so well started. Therefore, we offer Mr. Tillson's name as Chairman for the coming year.

As far as possible we desire to carry out the policy of the section and to alternate metal miners with coal miners, and to arrange equal consideration for anthracite and soft coal interests. We have another point in view, as far as possible we should choose either Eastern men or Western men. I think it is a mistake to attempt to combine

letterhead, but when you try to get those men together to hold a meeting, why, it cannot be done. The result is you have one or two Eastern or Western men and you do not get a representative meeting—you merely have a representative piece of writing paper. You do not have a representative committee, because they never meet. Therefore it seemed to me that it would be better to alternate and to let the Section be run on an Eastern basis one year and on a Western basis the next year. I know that is a very revolutionary suggestion and is not adopted by any of the big institutes of the country, and I would not be at all surprised if some one took a different view and the action of your Nominating Committee was not approved, but it seems to me that therein lies a possibility of making committees really active and forceful.

The report, definitely, is as follows:

THE NOMINEES.

Mr. B. F. Tillson, head of Mining Department, New Jersey Zinc Company, Franklin Furnace, Chairman.

Mr. H. G. Davis, Efficiency Engineer, D., L. & W. Railroad, Coal Department, Scranton, Pa., First Vice Chairman.

Mr. H. I. Young, General Manager, American Zinc, Lead and Smelting Company, Carterville, Mo., Second Vice Chairman.

Mr. E. E. Bach, Sociological Superintendent, Ellsworth Collieries Company, Ellsworth, Pa., Third Vice Chairman.

Mr. T. T. Reed, New Jersey Zinc Company, New York City, Secretary.

CHAIRMAN TILLSON: Mr. Paul, may I ask you to take charge of the meeting? (Mr. Paul took the chair.)

TEMPORARY CHAIRMAN PAUL: Gentlemen, you have heard the report of the Nominating Committee. What is your pleasure?

MR. RICE: I move that it be adopted as read.

PROFESSOR RAYMOND: I second the motion.

On being put to a vote the report was adopted unanimously.

TEMPORARY CHAIRMAN PAUL: Mr. Chairman, will you take charge. (Mr. B. F. Tillson in the chair.)

ADDRESS BY CHAIRMAN.

CHAIRMAN TILLSON: Gentlemen, I feel deeply grateful for your vote of confidence. I appreciate the opportunity of attempting to carry out the program which has only partly been completed this year in view of the fact that present war conditions made it ex-

tremely difficult to gather together as a working unit the variou representative bodies of men planned for our committees. I trus that the coming year will bring forth far more satisfactory result because we all realize the Chairman is merely the representativ of the committees of the organization and must rely on the suppo of his committees to secure results.

I am gratified to have such able assistants as you have chose for your Executive Committee and I trust that the geographic distribution, as suggested by the Nominating Committee, will wor to advantage this coming year.

It is very late, and if you desire, after we have adjourned, may be possible to show three lantern slides, which will depict th first aid building which you were unable to see during the discussic at an early time in the meeting.

ADDRESS BY FIRST VICE PRESIDENT.

MR. DAVIS: Mr. Chairman and gentlemen, I want to thar you, not so much for the honor of being elected First Vice Chairma as for your re-election of Chairman Tillson. The work of th Chairman of this organization is worthy of a lot of praise and am very glad he has been re-elected, as I know he is a willing worke I trust Mr. Hall's suggestion will be considered and that next ye we will get a Chairman and a Secretary from the West. I shou like to see the West; I never will if you do not meet out there. thank you.

VOTE OF THANKS TO SPEAKERS.

Before taking my seat, if it is in order, and I think it is, I wa to offer as a motion that a standing vote of thanks be tendered who contributed to make this meeting a success.

MR. RICE: I wish to second the motion. (The vote was unar mous.)

CHAIRMAN TILLSON: The thanks of the Section are official extended to all the speakers for their carefully prepared and int esting papers.

The Section stands adjourned.

SMOKER

Preparatory to the technical sessions of the Mining Section a get-together dinner and smoker was held at the Cafe Boulevard, Broadway and Forty-first street, on the evening of Sept. 11. Members of the American Institute of Mining Engineers were invited to attend the smoker, which was complimentary, the expense being generously borne by a number of mining companies having their head offices in and around New York City. The principal entertainment was a burlesque of a meeting of mine workers (?), written and staged by Mr. C. H. Deike; this was supplemented by professional entertainers. The good fellowship of these evening meetings is much appreciated and leads to a better acquaintance among our members.

First Aid Contests

Five first-aid contests were held under the auspices of the Mining Section of the National Safety Council in 1917: An Arkansas state meet at Huntington on May 12; an Oklahoma state meet at McAlester on May 19; a Joplin-Webb City district meet at Webb City Mo., on July 4; a Cambria County (Pennsylvania) meet at Cresson Aug. 20, and a Somerset County meet at Jenners, Pa., on Sept. 1

ARKANSAS STATE MEET.

The Arkansas Annual Statewide First-Aid Contest was held a Huntington, May 12, 1917. There were two Huntington teams composed of boys and two Huntington teams composed of men an one team composed of miners from Hartford, Ark. The No. Huntington boys' team made a score of 567 points out of a possib 600. Team No. 2, composed of men, made a score of 562; team N 3, Huntington boys, made a score of 513; team No. 4, composed men from Huntington mines, scored 585, and team No. 5, compos of Hartford miners, made a score of 597 out of a possible 600 a won the State Cup. The judges were physicians from Greenwo and Ft. Smith. The Huntington First-Aid Society had charge the arrangements and conducted the meet, which was a decid success. This organization is composed of working miners w are real first-aid boosters, and they deserve a great deal of cre for the work accomplished. The Huntington Cornet Band furnish music. Messrs. Ryan, Rutledge and W. W. Fleming of the Bure of Mines assisted the local committee in conducting the contest.

OKLAHOMA STATE CONTEST.

The Fourth Annual Statewide First-Aid Contest and Mine R cue Demonstration was held at the Fair Grounds of McAlester afternoon of May 19, 1917, under the auspices of the Oklaho Coal Operators' Association, The United Mine Workers of Amer and the United States Bureau of Mines. Mayor P. D. Watson

McAlester, City Commissioner F. D. Pittman and a committee of Red Cross officials headed a procession of automobiles from the Busby Hotel to the Fair Grounds immediately before the contest. All of the teams were in the parade and some carried banners.

Dr. J. J. Rutledge, District Mining Engineer of the Bureau of Mines, acted as announcer. Dr. E. H. Troy acted as chief judge, ably assisted by sixteen local physicians, two judges being assigned to each team. Martin Clark and Charles Smith were timekeepers; G. Brockerman and R. L. Bradley were recorders. W. W. Fleming, foreman miner, McAlester Station, and J. B. Hynal, first-aid miner, assisted in arranging the teams and conducting the mine rescue demonstration and gas testing contest.

The contest and field meet was a great success, the large grandstand comfortably seated the crowd of spectators who watched with great interest the treatment of the imaginary injuries by the boys from the mines. The leading teams competed so closely that only a fraction of a per cent separated them when the final averages were computed.

The winners are given in order as follows, with their general averages for six team events, together with the prizes they carried off:

First—Gowan, 100 per cent; W. B. Mitchell, captain, Frank Main, Luther Fitzgerald, Louis Vitalie, Louis Caudron, and Ted Fitzgerald, patient. Prizes: Silver cup, six National Safety Council medals, six watch fobs, marked "First Prize," and six individual first-aid packets.

Second—Alderson, No. 1, 99 per cent; Thomas Malloy, captain, S. B. Reddell, H. B. Gladden, Lloyd Kirkpatrick, Walter Greer, Dudley Terry, patient. Prizes: Six watch fobs, marked "Second Prize," six Justrite carbide lamps, six subscriptions to the *United Mine Workers' Journal*, six individual first-aid packets, two Hailwood safety lamps.

Third—Haileyville, No. 1, 97.3 per cent; E. A. Elliot, captain, John Nichols, George Maltzen, Elmer Batston, Wesley Jones, Charles Batston, patient. Prizes: Six watch fobs, marked "Third Prize," six Johnson & Johnson first-aid books, Johnson & Johnson first-aid chart, Baldwin carbide lamps, and six individual first-aid packets.

Fourth—Brewer, 97.1 per cent; R. W. Wright, captain, A. M. Mosco, Ed. Victor, James Collier, I. M. Kuykendall, John Moore, patient. Prizes: Six individual first-aid packets and six watch fobs.

Fifth—Lehigh, 95.6 per cent; William Strange, captain, Ale Ogilvie, Frank Brinkworth, William Shoemake, Thomas Gold, Pet McManus, patient. Prize: Six watch fobs.

Sixth—Alderson, No. 2, 04.6 per cent; L. P. Core, captain, Osc Cook, Oscar Stipes, Walter Tate, Tony Trione, John Musial, patie Prize: Six watch fobs.

Seventh—Hartshorne, 94.1 per cent; R. P. Smith, captain, Arth Watley, William Conner, John Bain, John Powell, S. M. Knigl patient. Prize: Six watch fobs.

Eighth—Haileyville, No. 2, 91.8 per cent; William Katigan, ca tain, Thomas Cope, Thomas Lewis, W. R. Martindale, Peter Jeffri F. K. Patterson, patient. Prize: Six watch fob..

Immediately after the first-aid contest there was a mine resc demonstration. A miniature mine passageway had been erected the field; this was filled with smoke and gases and six min equipped with breathing apparatus, safety lamps and flash ligh and using a life line, went into the mine and rescued a miner w was supposed to have been overcome with smoke and gas a brought him to the surface, where artificial respiration was adm istered and the supposed victim revived.

Following the mine rescue demonstration there was a tug-of-v between teams from Bewer, Alderson and Lehigh. In the fi contest Brewer was eliminated. The finals were between Alder and Lehigh. This was a battle royal and aroused a great deal enthusiasm and excitement. The teams held each other to a sta still for about five minutes, when Lehigh by Herculean efforts s ceeded in pulling Alderson over the line. The prizes were as lows: First prize, $15, Lehigh; second prize, $12, Alderson; th prize, $6, Brewer.

On the field, Mayor Watson of McAlester authorized the nouncement that he would be glad to have the members of the te take dinner at the Busby Hotel in the evening as his guests. This vitation was accepted and all of the teams enjoyed the hospitalit the Mayor. Immediately after the dinner all the contestants gathe in the Busby parlor and listened to an address by Mayor Wat He spoke of the interest he had in the work which had been d onstrated. After the address by the Mayor, Dr. J. J. Rutle with a few well-chosen remarks urging the boys on to greater eff distributed the prizes to the captains of the various teams. best of spirit prevailed and the losers took a sportsmanlike vie the situation and expressed a determination to do better than

in the next contest. The miners voted a vote of thanks to Mayor Watson and to those who arranged the contest and also passed a resolution to hold the next contest in McAlester.

From 8 to 9 p. m. there was a contest in judging the amount of gas as shown in a safety lamp. The lamp-testing gallery (a machine giving the flame shown by a safety lamp in different percentages of gas), which has been recently installed in the mine rescue station, was used for the demonstration. The contest was open to only active working fire bosses. The following men were the winners in this contest: I. N. Kuykendall, Brewer, Okla., first, and John Moore of the same place took second prize. There was a total of 10 per cent of the gas turned into the gallery at different times and Mr. Kuykendall's totals were 11. Mr. Moore's totals were 11¼. Four tests were run with the gallery. The first prize was $5 in gold and the second $3.

Mr. Arthur Oliver of Alderson, 67 years old, won the prize offered for the oldest active miner present at the meet. Mr. Oliver is one of the pioneer miners of this state.

JOPLIN-WEBB CITY CONTEST.

The first annual first-aid contest of the Joplin-Webb City district was held in Lakeside Park, Webb City, Mo., on the morning of July 4, under the auspices of the Mining Section of the National Safety Council, United States Bureau of Mines, American Red Cross, and the mine operators and business men of the Webb City-Cartersville district.

The program consisted of six problems for one-man demonstrations, four problems for two-men events, and five problems for full team events.

The teams contesting were as follows: Three teams from the American Davey mines, three teams from the Boy Scouts and one team each from the following mines: Athletic Mining Company, Onamena Mining Company, San Gabriel Mine, A. M. Company, Coahuila Mining Company, Hartford Mining Company, Vogey Mining Company, Cyzi Mining Company, Queen Esther Mining Company, Carmean & Squires Mining Company, Mont B. Mining Company, Wingfield Mining Company, Hurry Up Mining Company, D. C. & E. Mining Company, Tom C. Mining Company, and Allas Powder Company.

The winners were as follows:

First Prize—Trophy, six American Red Cross bronze meda and $100 in cash: Queen Esther Mining Company team; Roy Jone captain, J. E. Hume, M. E. Lawrence, Bethel Sweeten, Fred Sweete and Frank York.

Second Prize—Six National Safety Council medals, America Red Cross certificates and $60 in cash: Winfield Mining Compar team; F. Gary, captain, K. Cochran, C. Potter, Zim Clark, Frar Pullman and Pink Case.

Third Prize—American Red Cross certificates, $30 in cash ar merchandise: Mont B. Mining Company team; C. Rhea, captai J. B. Stringer, C. Best, Ed Smith, O. B. Payne and Ray Hartman.

The merchants of the district were liberal in their donatio of merchandise, so that a prize was available for every team cor peting in the meet.

The judges were Drs. E. H. Welcome, Craig, Stormont, Berr Rogers, Cummings, Lanyon, Locke, Hewitt, James, Leaming, H.] Mason, Kaemmerling, Grantham, Balsley, Gentry, Buich, Bake McAllaster, Wise, Keatcham, Webster and Arnold.

SOMERSET COUNTY (PA.) MEET.

The Fifth Annual Miners' First-Aid Meet for Somerset Count Pa., was held at Jenners on Sept. 1. The program for the conte consisted of five problems for one-man events, five problems f two-man events, and twelve problems for full team events.

Ten teams from the Consolidation Coal Company mines were e tered in the contest, two teams from the Brothers Valley Coal Cor pany and one team each from the following companies: Qumaho ing Creek Coal Company, Maple Ridge Coal Company, S. M. Ham ton & Co., Victor Coal Mining Company, Grazier Coal Mini Company and the Merchants' Coal Corporation.

The usual Red Cross and National Safety Council medals a certificates were awarded to the winning teams, while additior prizes were provided through the courtesy of P. A. Schell & C Du Pont Powder Company, Somers, Fitler & Todd, John Simmo Company, Mine Safety Appliance Company, Frick & Lindsay, Joh son & Johnson and the Colonial Supply Company. An enamell gold-plated first-aid watch fob was presented to each member the contesting teams.

PLAN OF ORGANIZATION AND OPERATION OF THE MINING SECTION OF THE NATIONAL SAFETY COUNCIL ORGANIZATION OF SECTION.

1. ELECTIVE OFFICERS.

Chairman, B. F. Tillson, New Jersey Zinc Company, Franklin, N. J.

First Vice Chairman, H. G. Davis, Delaware, Lackawanna and Western Railroad, Coal Mining Department, Scranton, Pa.

Second Vice Chairman, H. I. Young, American Zinc, Lead and Smelting Company, Cartersville, Mo.

Third Vice Chairman, E. E. Bach, Ellsworth Collieries Company, Ellsworth, Pa.

Secretary, T. T. Read, New Jersey Zinc Company, 55 Wall street, New York City.

The Vice Chairmen are chosen to represent the anthracite and bituminous coal, and metal mines respectively, in accordance with Section 5 of the by-laws. The elective officers shall be ex-officio members of all committees.

2. APPOINTIVE OFFICERS.

Chairman, Membership and Publicity Committee, R. Dawson Hall, *Coal Age,* Thirty-sixth street and Eleventh avenue, New York City.

Chairman, Standardization Committee, George S. Rice, Bureau of Mines, Washington, D. C.

Chairman, Mine Rescue, First Aid and Contests Committee, W. G. Whildin, Lehigh Coal and Navigation Company, Lansford, Pa.

Chairman, Program and Publication Committee, J. P. Reese, Superior Coal Company, Gillespie, Ill.

(The Executive Committee of the Mining Section may appoint such additional committees or sub-committees as may seem advisable to further the objects of the Section. See Sec. 8 of by-laws.)

3. The General Manager and Secretary of the Council is ex-

officio a member of all sectional committees. (See Section 7 of by-laws.)

4. The General Manager and Secretary of the Council should be advised promptly of the appointment of all committees, or changes in personnel of committees.

5. The Executive Committee of the Mining Section should be advised by the Chairmen of committees in regard to the personnel of their committees, or changes in the same, and may be looked to for advice in this respect.

6. DUTIES OF COMMITTEES.

(a) Membership and Publicity Committee.

(1) To lay plans for comprehensive membership campaign during the year.

(2) To co-operate with headquarters of the Council in circularizing prospective members.

(3) To co-operate in following up prospective members.

(4) To prepare data for continuous publicity propaganda in trade papers of the mining industry.

(b) Standardization Committee.

(1) Should decide upon certain subjects upon which research should be made by sub-committees.

(2) Should make a report and, if possible, recommendation based upon the findings of its sub-committees at the annual meeting of the Mining Section, for action upon by the Section membership in regard to methods, practices, or appliances which would benefit the Safety or welfare of men or property involved in mining.

(3) The following sub-committees are recommended for the year 1917-18.

Accident Statistics.

1. To standardize methods of reporting mine accidents statistics.

2. To collect data on mining hazards and such statistics as refer to mining.

3. To advise Standardization Committee of the chief mining hazards to which the attention of the Publication Committee should be drawn in reference to the preparation of a Safe Practices folio.

4. To receive data of hazards from the National Safety Council

5. To prepare annual report of the various hazards involved in different mining methods and practices.

6. To recommend standard forms for recording and reporting mining accidents and proposed means for gaining universal co-operation in the adoption of such forms.

B. Ropes and Safety Devices in Hoisting and Haulage.

1. To study the reported deliberations of other bodies who have considered these subjects and summarize the preponderance of evidence.

2. To collect evidence from the rope manufacturers, mine operators, insurance companies, bureaus of standards, and transactions of engineering societies as to the amount of work which may be performed by hoisting ropes under various conditions of operation with certain reductions in the values of the factor of Safety.

3. To recommend for Safe Practices folio certain standard installations and methods of attachment of different wire ropes and other devices pertaining to Safety in hoisting and haulage by wire ropes.

4. To prepare an annual report upon all the above and recommend action upon such standards as can be conclusively formulated.

C. Mine Hygiene and Sanitation.

1. To investigate methods of drilling rock in respect to their influence on the health of the workmen and recommend standard practices for the preparation of a Safe Practices folio.

2. To recommend standard practices and devices to be used in the ventilation of coal and metal mines, demonstrate the respective needs for the same, and prepare such data for the Safe Practices folio.

3. To investigate the different systems of underground mine sanitation and recommend the practices which are found satisfactory, preparing detailed descriptions of appliances for the Safe Practices folio.

4. To consider the problem of furnishing pure drinking water to men working in mines and report findings upon the same.

5. To study the different types of "change" or "dry" houses suited to the use of miners and report on their cost, adaptability and their respective merits; and contribute such information in suitable form for the Safe Practices folio.

D. Mine Fire Prevention and Fighting.

1. To collect data relative to various mine fires in both coal an metal mining, their probable causes, growth and extent; also th conveniences at hand for fire fighting, the methods employed, an the lessons to be learned from these particular fires.

2. To prepare for publication in the Safe Practices folio pamphlet describing and illustrating the best methods for preven ing the growth of mine fires and overcome them if they becon of great extent.

(c) Mine Rescue, First Aid and Contests Committee.

1. Make arrangements for an annual meet of Inter-State Firs Aid Contests of mining teams during the Annual Congress of th National Safety Council.

2. Stimulate inter-company or state first aid contests of minir teams for representation of state teams in the annual contest.

3. To be advised by the General Manager of the Nation Safety Council and members of Mining Section of all first-aid co tests or meets, and compile data in regard to the same for present tion in annual report and for answering inquiry of other minir members of section.

4. To accumulate information about and report on particul installations or methods of merit in the organization and practi of first aid and mine rescue work in the field of mining.

5. To form sub-committees as follows:

a. Standardization of First-Aid Methods and Rules for Co ducting and Judging First Aid Contests.

b. Standardization of Mine Rescue Training.

(d) Program and Publication Committee.

1. Preparation of tentative program for annual meeting of Mi ing Section at the National Safety Council Congress.

2. Arrangement for the publication of such papers before t meeting and the delivery of digests of them.

3. Arrangements for one or more prepared discussions of ea paper.

4. Collection of photographs and plates for reproduction proper and improper mining practices, devices and installations.

5. Preparation of bulletins to be distributed to the Mining S tion members by the National Safety Council weekly throughc the year.

6. Preparation of Safe Practices folio with the collaboration of the Standardization Committee and its sub-committees.

ADMINISTRATION OF MINING SECTION.

1. Five meetings of the elective officers and chairmen of the committees should be held during the year:

(a) One on Nov. 19, 1917, to plan the work of the committees and consider methods for stimulating the increase of membership.

(b) One on Jan. 15, 1918, to thoroughly organize details of the work planned for or revise the plans.

(c) One on March 19, 1918, to make tentative plans for the annual Congress program.

(d) One on July 16, 1918, to check up work in process.

(e) The last on Sept. 17, 1918, to make final arrangements for the annual meeting of the Mining Section and for the rounding up of work in hand by various committees responsible for the same.

2. The Chairman of each committee should have special meetings of his committeemen at least four times a year:

(a) One in January to prepare plans for work.

(b) Another in March to thoroughly organize details of the work planned or revise the plans.

(c) One in July to check up the work in process.

(d) The last in September to check up the results and prepare the reports for the annual Congress.

It is suggested that they meet at the same time and place as the Executive Committee.

3. The Chairman of Mining Section should write Chairmen of committees regularly every two weeks and follow up specifically the work planned and in hand.

4. Chairmen of committees should write sub-committee Chairmen and committeemen at least every two weeks in following up the work in hand and should furnish copies of correspondence to the officers of the Mining Section.

5. Notices of all meetings of committees should be sent to the General Manager and Secretary of the National Safety Council, as well as copies of minutes of all meetings.

6. The General Manager and Secretary will send to the Chairman and Secretary of Mining Section and Chairman of Membership Committee copies of acknowledgments of new memberships; and will send to the Chairman of Mine Rescue, First Aid and Contests Committee information and particulars as come to his atten-

tion of proposed or completed first aid and mine rescue contests i which members will or have participated; and he will, furthermor print and distribute letter paper and envelopes to each member c the Executive Committee of the Mining Section for his use in cor ducting the work of the Section.

7. The National Safety Council will pay "out of pocket" ex penses for postage stamps, printing, stationery and similar item but NOT traveling expenses or other similar incidentals.

ACTIVITIES OF MINING SECTION.

1. *Bulletin Service:* Preparations should be made to send tw special Mining bulletins to each member, through the headquarter every week, or 104 bulletins per year. (Headquarters will send t the Chairmen of Program and Publications Committee, the Stan ardization Committee, and the sub-committee on Accident Statistic copies of all bulletins produced to date, and other printed materi related to Mining Section work.)

These bulletins should be illustrated in every case; should rela strictly to the *technical or specific safety* problems of mining, ar not apply generally to other Sections; general safety material shou be sent to headquarters for general Safety bulletin service.

Two thousand of each of these bulletins will be printed. Surpl copies will be used for soliciting new memberships. Considerati should be given, however, to increasing the use of these bulleti by members so that the Council may be recouped in part for t large expense involved for making cuts and printing. This expen can be lessened if members will try to obtain for the Council cu of the illustrations they recommend for bulletins.

2. The Chairman of the Program and Publication Committ should request each member of the Section to send samples to hi of every item published or printed by the member, so that t experience of all the members of the Section may be contribut for bulletin purposes, etc. (The distribution of addressed envelop to the Chairman of the Program and Publication Committee shou be considered in order to make sure of securing this material.)

3. *Safe Practices Leaflets:* The Section should aim to produ six or more of these leaflets per year for a folio to cover in det the safe practices of the various departments of the industry. (S Safe Practices relating to Ladders.) Three metal mining and thr coal mining leaflets.

4. *Annual Congress:* A program for three and one-half day sessions should be carefully prepared and relate to *technical* subjects only. Discussions of the subjects presented should especially be stimulated, and to further this end the papers to be presented should be printed in advance, abstracts should be given at the meetings and some leading discussions of each paper should be planned for in advance of the meeting. Future Congresses of the Council will provide for a general session for discussion of topics relating to all Sections, namely: "Employment as Related to Safety," "Physical Examination of Employes," etc.

5. *Inter-State First-Aid Contest:* Complete arrangements should be made by the Mine Rescue, First Aid and Contests Committee to assure suitable field or auditorium for the convenience of contestants and spectators; the contest should be effectively advertised and a number of attractive prizes and cups and medals should be obtained; ample provision should be made for competent, experienced judges and reliance should not be placed upon the possibility of drawing upon local talent; and the judges should be convened before the contest to select the problems and determine a uniform procedure in judging the importance of different omissions or commissions in treatment.

6. *Publicity:* An important field of activity yet untouched is represented by the technical trade journals covering the Sections' activities, and these should be primed with especially prepared Safety articles heretofore unpublished. This is an important field for reaching all the industries in the Section. The Chairman of the Membership and Publicity Committee should take immediate steps to get in touch with these trade journals and find out how far they will co-operate.

7. *Membership:* The Mining Section Executive Committee should do its very utmost to extend its influence by increasing the membership; the Council's headquarters will co-operate with the Membership Committee; but the members of the Section itself can have greater influence by reaching their own friends and securing their affiliation.

8. *Miscellaneous:* Plans may be made for—

(a) Special Safety meetings at the annual meetings of the engineering societies representative of the mining industry.

(b) And for the stimulation of discussions of Safety problems at such meetings.

(c) For a well prepared Safety exhibit of photographs, models, reports, statistics, bulletins and pay-envelope notices to be shipped from one member of the Mining Section to another during the year.

(d) And for a suitable collection of photographs, models, etc., to be used as a Mining Section exhibit at the National Safety Council's Annual Congress.

GENERAL.

The Chairman of the Section should be the leader; he should impress his Executive and other committees with the responsibility they have undertaken for reducing accidents in this specific industry; to impress upon them that to save one life will be worth all of their activities; that the Council is a non-profit co-operative organization and its influence and worth and growth depends upon the performance of the duties undertaken by each committeeman.

This Section is especially urged to prepare a classification of "Causes of Accidents" germane to the various methods of mining for the guidance of each member in getting better accident statistics, for comparative purposes, and for predetermining the wisdom of employing certain systems of mining as judged from the viewpoint of their hazard.

BY-LAWS.

NAME.

Section 1. This organization shall be known as the MINING SECTION OF THE NATIONAL SAFETY COUNCIL.

OBJECT.

Section 2. The object of this Section shall be to promote the science and practice of safety in metal and coal mining, quarry and open pit operations; to recommend the adoption of approved methods and appliances for safety, first-aid, and rescue work; to promote the adoption of proper safeguards against injury or loss of life or property; to promote the standardization of recording and rating of hazards and accidents, and to obtain and circulate information on these subjects.

MEMBERSHIP.

Section 3. Membership shall include all members of the National Safety Council who shall be interested in the activities and purpos

of this Section and who shall signify to the General Manager of the National Safety Council, or to the Secretary of this Section, their desire to affiliate.

OFFICERS.

Section 4. The officers of this Section shall be a Chairman, three Vice Chairmen, and a Secretary, who shall have the usual duties of such officers and whose terms shall extend to the annual meeting of this Section following that of their respective election, or until their successors are elected.

ELECTION OF OFFICERS.

Section 5. Nominations of officers shall be made by a Nominating Committee of three appointed by the Chairman of the Section, which committee shall report at the annual meeting its recommendations, which report shall be followed at said meeting by the election of officers for the ensuing year. At this meeting other nominations may be made by any members. Nominees should be selected, as far as practicable, to represent various branches of the mining industry with appropriate geographic distribution.

MEETINGS.

Section 6. There shall be an annual meeting of the members of the Section held during the period of the Congress of the National Safety Council, notice of the time and place of which meeting shall be posted at the information desk of said Congress. Other meetings of members may be held on due call and notice by the Sectional Executive Committee.

COMMITTEES.

Section 7. The affairs of the Section shall be conducted by a Sectional Executive Committee which shall be composed of the Sectional Chairman, three Vice-Chairmen, and a Secretary, and the General Manager of the National Safety Council, who shall be ex-officio a member thereof, and the Chairman of the following four standing committees, which committees shall be appointed by the Sectional Chairman.

1. Membership and Publicity Committee.
2. Standardization Committee.

3. First-Aid and Rescue Training and Contests Committee.
4. Program and Publication Committee.

IN GENERAL.

Section 8. The Sectional Executive Committee shall appoint such other officers of committees and amend these by-laws or adopt other laws and do such other acts and engage in such activities as may be needed to wisely further the objects of the Section.

SUPERVISION BY NATIONAL SAFETY COUNCIL.

Section 9. This Section shall be under the direction of the Executive Committee of the National Safety Council. All by-laws and amendments thereto, activities, expenditures, literature, bulletins and published data of this Section shall be subject to the prior approval of the Executive Committee of the National Safety Council and all publications of the Section shall be under the name of the Section as a Section of the National Safety Council.

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