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1954 TRANSACTIONS VOLUME 15

Current Safety Topics in the

METALS INDUSTRY

as presented in sessions of the Metals Section at the 42nd National Safety Congress

(Continued on next page)

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Current Safety Topics in the METALS INDUSTRY *(Continued from cover)*

The Big Picture . . .

What's the big picture in the field of safety?

Each edition of the National Safety Congress Transactions is a comprehensive collection of the ideas and experiences of many of the country's top safety men. These ideas and experiences form the big picture.

In the pages of the Transactions may be found new methods, new devices, answers to both old and new problems, and suggested improvements of some of our standard safety procedures. Progressive safety people everywhere have found the contents of the Transactions to be useful in their accident prevention programs.

The Congress Transactions are published in volumes, each covering a phase of the safety picture, along with a General Sessions and Detailed Index to all volumes. The 30 volumes of the 1954 Congress Transactions are listed on the last page of this volume.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE METALS SECTION

This volume is a record of the sessions held at the 1954 National Safety Congress by the Metals Section. The conduct of these Congress sessions each year is *only* one of the *many* cooperative activities which the Metals Section carries on in behalf of its members, and for the benefit of accident prevention work in the metals industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material used in the day-to-day safety programs of metals plants. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

occurred in this district. Gruesome and sobering. They highlight need of greater caution on the highways.

16. *Undefeated Football Season vs A Perfect Safety Record.* Comparisons may be drawn for top supervision, foremen or working man.

The comparison of the undefeated football team to the perfect safety record is particularly useful during the football season and we can discuss briefly the part which applies to supervision. They are the coaches of the safety program. They must surround themselves with capable assistants (foreman) if they are to be successful.

Just as the coach must plan his job so must they plan. As he must select the best players for each position so must they as far as circumstances permit, place their workers in the jobs to which they are best suited. As the coach must explain the rules and the plays so must they teach rules, working procedures, and so on all down the line. There are literally dozens of comparisons and correlations which may be drawn in this connection.

There is one thing which holds as true for them as for the coach. If they do not get into the job whole heartedly, if the do not give it the best they have available from an equipment, training and follow up view points, they can look for the same poor results the coach undoubtedly will get.

In using any of these props, the idea is to sell the individual on incontrovertible facts which the props are meant to indicate. This is just plain common sense. If you draw the proper comparisons and correlations with your thoughts on safety, the worker will buy safety too.

Our actions are governed by our last thought. In addition to our many well known *Safety First* Slogans, I leave this recommendation, *let your last thought be of safety*

Automation—Its Effect on Accident Prevention

By JOHN B. STERLING
Supvr. of Training, Engine and Foundry Div., Ford Motor Co., Berea, Ohio

If safety engineers know the mechanical and operational details of an operation in a given process, their training and experience will enable them to develop the safety engineering features required. Knowledge of the process would lead them to recognition of the advantages as well as of the hazards. Subsequently, their knowledge and experience would develop appropriate protective measures and improvements.

On this assumption, therefore, I have planned to paint a word picture of automation, what it is, how it works, to give a little better understanding of the operational details of automated processes.

Industry is in the midst of a continuing plant expansion and facilities improvement program. The program started during World War II and has continued through the decade of 1940 to 1950. Last year American industry pledged a record of $28.5 billion for new and improved plants and other capital outlay. It is expected that almost that much will be pledged again this year for capital improvement.

This plant expansion took place due to war needs and was influenced by immediate demands for goods both for war and for domestic consumption. Fortunately, during this period a considerable amount of plant expansion for the production of domestic products was possible to take care of our expanding population.

Immediately after World War II the emphasis was often on production without regard for long term modernization of plant and production processes. Since then, however, there has been sufficient time to plan for many facilities which are new from the ground up and which utilize the latest known devices for producing at a lower cost and a higher quality.

Some of these facilities have been publicized in the newspapers, magazines and trade journals of the country and many people have the impression that a large number of automotive factories are now completely automatic.

This is not the case and we feel that the completely automatic factory is still

some distance in the future. However, the expansion program of Ford certainly is proof that we believe the future will see new plants with greater percentage of automatic operations as the manufacturing engineers and the builders of machinery and equipment take advantage of the experience gained in the latest programs.

Other companies and industries, not to overlook magazine publishers, also seem to foresee the development of automation for the future. Interest is very high. It is highly probable that you will be exposed to it if you have not been already.

In Ford, as it probably would be in other companies, the extent of automatic handling (or automation as we prefer to call it) is largely determined on the basis of engineering studies based upon our experience and the experience of the machinery industry in general. These, coupled with an economic analysis, determine how far it is practical to extend automatic handling operations.

In our discussion of automation as it is related to the safety engineer, there are two main subjects which we feel should be defined to some extent in order that a clear understanding of the problems involved may be obtained.

First: Transfer type machinery built with automation in mind. The transfer type machine combines similar operations to be performed on a part into one continuous machine with automatic indexing between work stations.

Second: "Automation," which is a coined word, meaning the automatic handling of parts between progressive production processes. It is a separate and distinct phase of manufacturing engineering which coordinates the efforts of various departments in our plants, and the machinery can become in effect, one large transfer type machine with facilities to handle the parts as well as the scrap generated.

To illustrate the techniques used in the use of the transfer type machinery, we can consider the production of automotive crankshafts. One portion of our machining process involved the drilling of six oil holes, six metering holes, six lightening holes, and an inspection of the operation.

Ten or twelve years ago, twenty-nine separate machines would have been required, while today the same department would require only three transfer type machines of eight stations each. The part would be loaded at one end and unloaded at the other end with all operations in between being completely automatic.

I'd like to try and draw a word picture of what automation is and how it works.

Automation, as we refer to it, applies to the automatic handling of parts between operations. Automation devices are designed to move parts into and out of production machines, turn the part over, rotate it, remove scrap and chips and perform other related functions. These devices are interlocked with the process and are ordinarily completely automatic while in operation. A finished piece of automation equipment is made up largely of standard elements such as conveyors, air, hydraulic and electrical control mechanisms arranged to obtain the proper movement for elimination of unnecessary manual handling operations.

A wide variety of materials can be handled with the elimination of hazardous handling such as in large stamping, heat treat operations, forging operations and others. In many respects automation is the extended usage of conveyors which played an important part in the early development of mass production of automobiles.

By introducing a series of electric nerve-centers to direct the work, engineers have gone beyond the use of control buttons, for the most part, as a method of plant operation. Now switches located in the automation are principally operated by the weight of the work units.

Electric nerve-centers direct the products by mechanical arms and fingers, from one point to another in much the same manner that a policeman or traffic light directs traffic.

A particular nerve center receives hundreds of bits of information continuously from electric switches acting as lookouts. It compiles the data, makes the best possible decision as to course of action, then turns on the power to put the machinery to work.

One lookout may inform the brain that a particular machine is ready to go to work, another that work is available and another that steel arms and fingers are in position to move the work into the machine.

When all conditions are correct, the brain sets the process in motion. Then it concen-

trates on removing the work from the machine, transferring it to another and prepares to repeat the operation.

In a typical sequential operation, in certain processes we require two duplicate lines probably being fed by a single system.

A work unit is located upon the automation. It may have been indexed from a previous machine tool such as Machine Tool "A." The weight or contact of the work unit on the switch located in the automation sets up the electrical impulse to the electrical panel, the nerve center or brain. The information is then resolved into a mechanical action through valves and cylinders to transfer a shuttle bar or actuate an arm to accomplish one operation such as moving our work unit from Automation A1 to the Automation Intersection A2 to Automation A3.

If, as in our example, we have a second machine tool such as "B" which feeds work units into the same automation as Machine Tool "A" such as Automation Intersection B2, we get a better insight to the workings of automated processes. For example, if we have a work unit on Automation A3 and a work unit on Automation B1, both should move into Automation Intersection B2, but obviously not at the same time.

The depressing of the switch in one of these sections by the weight or contact of the work unit would relay the impulse to the panel which would then actuate a shuttle bar transferring the work unit into B2. The weight of the work units depressing switches in *both sections* at the same time indicates there are work units in both critical positions.

Therefore, the panel, receiving warnings from both lookouts would select a preferential index, establishing which transfer device is to operate first. B1 would be given preference, the work unit would slide into Automation Intersection B2, the work unit in Automation A3 would be delayed to subsequently be moved when B2 was emptied.

Thereafter, until different impulses would be received, the two sections, Automation B1 and A3 would feed alternately.

If and when the switch in either section was not depressed, the preference would be given to the other on a steady feed basis. The panel or brain retains information given it, for an indefinite period of time or until such time as an additional impulse is received to rearrange the sequence of operations to accommodate the new physical arrangements indicated by the impulse as now existing.

These panels are electrically interlocked with others in the machine tool performing an operation upon the work piece. Occasionally there is an additional operation to be performed such as turning the piece end for end, rotate it, or upside down. In this case, Shuttle or Automation A1 receives a work unit from Machine Tool "A," and through the panel and solenoid valves and cylinders shuttles the work unit into Automation Intersection A2. This data is conveyed to the electrical panel of the automation section. The panel actuates the valves and cylinders to return the Shuttle A1 to its home position.

It also determines that the Shuttle or Automation A3 is in its home position and clear.

It also determines that the work unit is in proper position at Automation Intersection A2.

After all this information is disseminated in the control panel, the impulse is sent to the solenoid valves and from there to the cylinder that will perform the turning operation. From there the data is again returned to the panel and another cycle begins.

I'd like to outline some of the safety aspects of automation experienced by Ford safety engineers.

In order to fairly evaluate the effect that automation is having on the safety of our employees, I believe it is important that we consider what it accomplishes in the elimination of the well-known accident causes which are found in the non-automated type of operation. With regard to the latter, particular reference is made to single operation machines where there is a need for manual handling of heavy stock in the loading, positioning and unloading of the machine and the transfer of stock from one operation to another.

As safety men, we are all quite aware of the fact that stock handling, especially that which is heavy by nature, is an important contributor to industrial injuries. It is well-known that a very high percentage of serious foot injuries are the result of heavy stock falling from a transfer truck. It is further a fact that the handling of stock is almost the exclusive cause of industrial hernias and injuries to the back.

Now, let us see what automation has done to eliminate or minimize these accident causes. You will recall that, in many instances, after the initial loading of the stock into a series of in-line machines, a multiplicity of operations are performed without the need for any manual stock handling whatsoever. By comparison with former methods of single operation machines, it is obvious that the hazards associated with manual handling of stock into and out of a machine and transferring it to the next operation is almost entirely eliminated. By the same reasoning the hernias and back injuries directly related to heavy lifting are greatly minimized, if not entirely eliminated.

Our experience indicates an 85.5 per cent reduction in the number of hernias in similar operations with the advent of automation. We truly believe that automation has taken the back break, and the "foot break" for that matter, out of engine manufacturing. We are most thankful for this, for not only have we been able to reduce our accident rate and the related costs, but far more importantly every day we are sending our employees, safe and sound, home to their families.

Although I am not a safety engineer, I am quite aware of the fact that every safety man dreams of the perfect mechanical operation where, in the performance of his job, the employee need not at any time expose himself to the working parts of a machine. It is a well-known fact that most of the serious injuries to hands and fingers are the result of the operator exposing himself to the closing or working parts of a machine in the process of loading or unloading it. It is recognized that this problem has been solved to a degree in the single operation method by the application of indexing fixtures, sliding dies and the use of tongs. However, at its best you are faced with the problem of enforcing the use of these provided devices. While automation has not completely solved this important problem, it is a real step in the right direction since it completely eliminates the need for repetitive exposure to the point of operation.

We recognize, however, that because of the relationship of one automated operation to another, it is highly important that a breakdown or machine failure be quickly corrected. This condition could result in the repairman inadvertently exposing himself to working parts of the equipment. However, we have been able to solve this problem with a high degree of success by invoking our safety policy of long standing which provides that before working on a piece of moving machinery the repairman must completely de-energize the equipment by placing his personally issued padlock on the power source. So, with regard to hand and fingers injuries, we see in automation the possibility of almost complete elimination of this problem.

I am sure you are wondering what happens when a piece of stock gets out of position in its travel through a given sequence of operations. To avoid the need for the operator reaching into the equipment to reposition the stock, "push" or positioning sticks are provided at convenient locations for this purpose.

The very nature of automation dictates the generous use of stiles or cross-overs for the convenience and safety of employees in traveling from one location to another. These stiles are strategically located throughout the plant. They are not only important in terms of normal travel but serve an important purpose in the emergency evacuation of the plant.

Our engineers and safety personnel are constantly alert to the improvement of the design of our machines as it relates to the safety of employees. Their thinking has been passed along to our machine tool builders who have incorporated it into the design and construction of machines being built for our plants.

In many instances, the representatives of these companies came to our plants and consulted with our engineers and safety personnel and, in other instances, our representatives visited the machine tool builder's plant and advised him of our needs and requirements with regard to mechanical safety.

The net result of this relationship has been a thorough understanding on the part of our machine tool builders of our program to engineer the mechanical hazards out of the job. While we recognize that there will, undoubtedly, be a continuing need for the guarding of mechanical hazards, we firmly believe that great progress is being

made in simplifying the problem by reason of our close relationship with the people who build our machines. It is a fact that our experience with the complexity of automation has contributed greatly to the decreasing need to add guarding to machines after they are delivered to us. We are rapidly approaching the time when, from a safety standpoint, a machine will be ready to run the moment it is set on the floor. As evidence of this fact, I am advised by our safety personnel that the machines we are receiving for a new plant in Cleveland are *coming in almost completely* guarded. It is important to note that a very minimum amount of additional guarding will have to be applied to them. We believe this is significant since our standard in this regard is very high.

We could go on with the many advantages of automation as it relates to employee safety.

You may gather that the automation of industrial processes represents a completely new approach to the subject of employee safety. I assure you that this is not the case. It is a fact that the same old principles, so well-known, still apply as they did in the single operation processes. Our best friends in this regard still are:

1. Engineer the hazard out of the job.
2. Guard the hazard.
3. Educate the personnel.

We have dwelled pretty much on the first two principles so I would like to explore our approach to principle number three—educate the personnel.

We recognize that in safety, as in all other aspects of our job, there is no substitute for a well trained and informed employee. A typical approach to this principle is exemplified in our Cleveland Plants by the following training program for employees:

Safety is included in the induction of newly hired hourly personnel by the hourly personnel section.

A personal indoctrination is given employees by safety unit representatives.

They are routed through our safety shoe store where safety shoes and spectacles are emphasized.

General safety rules are issued in a package.

Foreman's induction check-off list requires coverage of safety as one item.

A check-off list issued by safety itemizes the coverage by the foreman and when complete the form is submitted to safety for filing.

On the job a follow-up by the foreman and the safety engineer is initiated.

Bulletins of unusual or new accident causes are distributed to all employees, in some cases, to supervisors only in others.

A series of five-minute safety talks are given by supervision periodically to their hourly-rated personnel.

While the representatives of safety have an important part in the training of our employees, the basic responsibility in this regard rests completely and entirely with our foremen. In order to better equip these *members of management* to meet this important responsibility, we conduct regular safety training conferences with them. This is an organized program designed to make every foreman the safety director of his department.

We firmly believe that we see a definite trend toward longer accident-free periods through automation.

Our Cleveland engine plant is now eligible for the National Safety Council Award of merit for having worked more than a million accident-free hours over a 30-day period and our Cleveland foundry is in its fourth *month without a disabling injury.*

Your Accident Record Reflects Your Attitude

By J. M. SYLVESTER
Gen. Mgr., Bethlehem Plant, Bethlehem Steel Co., Bethlehem, Pa.

All of us at Bethlehem are proud of the Bethlehem plant's achievements in safety over the past several years. While our record has been good as measured by today's yardstick, all of us realize that there is room for substantial improvement. Constantly increasing attention will have to be paid to accident prevention just to maintain the gains we have made.

The steel industry over the past decade has decreased its accident frequency rate from 8.06 to 3.90. In 1953 this meant 6,600 less disabling injuries than would have occurred with our experience of merely 10 years ago.

In analyzing our experience at the Bethlehem plant where we have been fortunate to run each of the past five consecutive years with an annual frequency of less than one, I believe that our most potential safety tool is our *Attitude Toward Safety.* Your accident record is a direct reflection of your attitude.

On the desk of every superintendent in our plant, for all to see, are these words—*Safety Comes First in This Plant.* This is not a slogan nor a high sounding cliche. It is the foundation upon which each supervisory man exercises his responsibility. This *principle is his overriding responsibility,* and in our plant a superintendent's performance in safety is an important measure of his overall performance on the job.

Your attitude toward safety will determine largely the emphasis you place upon it, the money you spend on it, and it will spell out the effectiveness of your program. Unless you really mean business, and let *every* man in the plant know that you mean what you say, you will get nowhere in safety.

Why do we consider safety so important at Bethlehem, and not only at the Bethlehem plant, but in all of Bethlehem's operations?

The answer lies behind success in any industrial undertaking. And perhaps because of its simplicity, its fundamental importance is oftentimes not realized.

Safety has to do with men—with the individual—and in the most intimate and personal way. Probably for obvious reasons, many of us are concerned a great deal more about our physical and material well-being than we are about our mental or spiritual welfare. And while many individuals, through a false sense of security or pride, are slow to appreciate constructive suggestions for their own personal safety, a persistent program sets up a subconscious *personal* response.

Individuality — the recognition, response, and purpose of the individual—is the most effective social and industrial force — at least in America. And we have an obligation to keep it that way. Problems of industrial management have become increasingly complex. Finance, raw materials, marketing, scientific and technological advances all have required additional concentration. And while our attention has been directed largely in those channels, forces which would reduce men to the status of mercenaries have had a fertile field.

Factors which recognize the importance and contribution of the individual and have a positive effect on individual action are the factors we must explore today.

Safety and the individual are firmly intertwined. Safety provides the avenue for advances in human relations consistent with those in technological areas, and because it serves so well the enlightened *self-interest* of men and management, we at Bethlehem consider it our first responsibility.

I am certain that nearly everyone will readily admit that he (or she) is a leader. But let's not forget that leadership is not inherited. It must first be earned and it is retained only through a constant demonstration of the understanding of the factors of human motivation. Leadership is not a condition. It is not merely the receiving and passing on of information. Leadership educates, develops attitudes, establishes goals, and provides the means through which achievements can be attained. Industrial leadership is not only a responsibility we have accepted. It is a goal in itself. Un-