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TUESDAY AFTERNOON SESSION

October 17, 1939

The opening session of the Textile Section was called to order by General Chairman E. A. Roberts, District Engineering Manager, American Mutual Liability Insurance Company, Atlanta, Ga., who presided. Chairman Roberts presented in his annual report a brief résumé of Section and Committee activities, and then introduced the first speaker as listed in the scheduled program.

How Far Can We Go Without Management in Developing and Maintaining a Satisfactory Safety Program?

By HUGH L. BRYAN

Personnel Manager, Sonoco Products Co., Hartsville, S. C.

There can be only one answer. The interest taken in the safety program by foremen and other employees is in direct proportion to the interest, enthusiasm and support shown it by management. I say this unreservedly and emphatically.

Who of us has not heard an associate, referring to the boss, say, "You can do almost anything else and get away with it, but you had better not fail to turn in the 'old man's' daily departmental reports," or something similar to that? Many an "old man" has a pet hobby or theory which he is very enthusiastic about and which is strictly observed by his employees, sometimes through fear but usually through respect. Now if this pet hobby or theory happens to be the safety program its success is largely assured.

This is a very ambitious subject, for we may well ask ourselves, how far can we go without the cooperation of our employees? The initial steps, however, must always be taken by management.

Often we find top men, whether presidents, superintendents, or department heads, who have been on their jobs for almost half a century—men of the old school who have done an excellent job of managing, but who have always accepted as a matter of course that a certain number of accidents were bound to happen and that not a great deal could be done about it. Since they really believed this it is only natural that their younger subordinates should share the same opinion.

The entire safety movement throughout our country is still very much in its infancy

and, although in the span of a few years will probably be accepted universally for its true value, the interest shown in it today by some industries is still lukewarm. It would seem to me, then, to be the duty of us believers to make as loud a noise as possible in behalf of the safety work. Just as a product is marketed, the same principles of salesmanship must be employed in selling the safety program to management. As soon as management is sold, the accident-prevention program will pass its probationary stage, for it will have secured executive sanction.

How can we go about this salesmanship? When it is suggested to an employer that he spend more time in developing a safety program in his plant he is naturally going to ask: "How do I know that it will pay?" For after all, an actual investment will have to be made in time and in money, and he will want some assurance that his company and his employees will receive dividends.

The best answer that I know of is from the experience of others and a fair test of such a program in his own plant.

The primary consideration is, of course, from a humane standpoint. It is not necessary to dwell on that, for I am sure that we all agree that any effort to prevent accidents will prevent suffering and this is most worthwhile.

Consider for a moment the far-reaching results of an accident. In addition to the actual suffering from injury there is the injured employee's loss of earnings to consider. The effects of this loss do not cease when he returns to work, for a family man with dependents will usually find that his insurance money, while he is away from work, is insufficient to provide for the regular needs of his family, and he is then perhaps forced to obtain credit which must be taken care of when his full earnings begin again.

From the employer's standpoint a loss is also sustained. If the injured employee is a key man or skilled laborer in a production line, the entire work is retarded or held up until a suitable substitute can be obtained. This, of course, means decreased production and increased overhead.

Certainly these two results of an accident, alone, are important enough to make an employer sit up and take notice if a method can be suggested whereby such an accident could be avoided.

I should like to give you a statement of our plant's experiences in this connection. We are not boastful of our achievements, but our experience may show why our management believes heartily in the safety program.

To get a proper picture of our problem it will be necessary to go back several years for statistics. In 1935, which is the first year that accurate records are available, our recap for the year showed a total of 436 accidents reported, of which 152 resulted in lost time amounting to 2,209 days. After studying these figures our management was jolted into the realization that something must be done to reduce accidents and lost time: for these accidents and resulting losses occurred in a plant employing less than 1,000 people! Imagine, please, if one man lost that much time: he would be out for six years and 19 days!

Before this time we did have a so-called safety program with an ineffective safety committee, but we did not have the attention and interest of the foremen or employees. In the early part of 1936 the management gave a "shot" of enthusiasm to the safety committee which is composed of key men throughout our mill. This committee began meeting once each month to discuss what could best be done to reduce accidents, eliminate hazards, and correct unsafe practices. Sub-committees were appointed to make a study of the proper guarding of machines and the investigation of accidents. These committees functioned with surprising success.

For example, we have an arrangement of automatic circular shears which cut paper patterns on our cone machines. These shears were the source of a number of lost fingers over a period of several years, yet little thought had been given as to just how they could be guarded. The committee, working under orders from the management, suggested a method by which the shear blades were effectively guarded and with little expense. In fact they are now so well guarded that recently I tried to get my finger under one and was unable to do so.

Before guarding the shears, 13 fingers or parts of fingers had been lost; after guarding, only one finger and that on a machine from which a fixer had removed the guard and carelessly failed to replace it.

How did this come about? Simply because

management authorized time and thought and assigned a definite objective.

In 1936 our recap for the year showed that 1,069 accidents were reported of which 159 resulted in lost time. The total number of days lost was 2,327. In comparing these figures with those for 1935 you will immediately think I am doing anything but proving my point, for the figures for 1936 are greater than for 1935. Remember, however, that we are concerned at this point with proving "improvement" only.

One requirement under our new safety organization plan at that time was that every accident, slight or severe, had to be reported. This rule was made mainly to reduce the danger of infection after minor injuries. Consequently, we expected a greater number of *reported* accidents in 1936 than in 1935. But what about the increased number of lost time accidents in 1936 and the greater number of days lost? Let me cite the following:

In January, 1936, we had 23 lost time accidents; in June, 1936, we had 15; in October, 1936, we had 10; but in December, 1936, not a single lost time accident occurred. Throughout the entire year a uniform decrease was noted, so that, although the total number of lost time accidents in 1936 exceeded those of 1935, we felt we were beginning to accomplish what we had set out to do—decrease our accidents uniformly. We felt that it was impossible for so great a decrease to have been by chance alone, so this became the first entry in the credit column of the safety program.

Now let me give you our recaps for 1937 and 1938. In 1937 a total of 981 accidents were reported, of which 65 caused lost time amounting to 1,232 days. This still was a large number, yet it showed a decrease of more than half of the days lost in 1936. In 1938, 497 accidents were reported, of which 28 caused lost time amounting to 536 days. This was 1,673 fewer lost days than in 1935!

To sum up, as a spot comparison, here is our record of lost time accidents for the last four Januaries.

January, 1936....23 L. T. A.
" 1937.... 3 " " "
" 1938.... 2 " " "
" 1939.... 0 " " "

Since January, 1939, we have still been having accidents—too many, in fact—but the number is still below that of the same period in 1938.

Until now, we have spoken of management as though it were one man or one small group, but I must point out to you that management in its final analysis is composed not only of the executive personnel of a company, but also of what we might term the entire "chain of command," from the president of the company to the second hand in its smallest department.

Very often some of the best safety work is carried on by so-called "straw-bosses" because it is these men who have the personal contact and the direct supervision of individual employees. They are in an excellent position *to demand* that employees under them correct unsafe conditions and practice safety in their work *at all times.*

However, I repeat, this desired condition can be attained only if the foremen are convinced by the highest management that safety is a definite part of their supervision duties and they in turn implant in the men under them a strong belief and enthusiasm for safety.

Fitting the Safety Program to the Plant Needs

By A. P. McINTOSH

Resident Engineer, American Mutual Liability Insurance Company, Greenville, S. C.

When a plant safety program is ineffective, or fails, we are prone to look for lukewarm executive attitude or inefficiency in the safety organization membership. Quite often we find what we look for, but the trouble is, we do not look in the right place for the right thing. Nothing is so discouraging to plant executives and supervisory forces as an operating machine with no production, and that is what we have with the safety organization meeting regularly and going through certain motions, without the

plant accident experience showing improvement. Money and time are being spent and nothing is being accomplished.

The greatest cause of failure of many plant safety programs is that but little, if any, thought has been given to the plant safety needs by those who initiated the program. An executive realizes his losses through accidents and tries to do something about it. Usually he looks around and finds a nearby mill following a certain procedure and obtaining excellent results. He immediately obtains a smattering of detail and applies it "as is" to his mill with no results. Or, someone who should know better recommends a "Standard Safety Organization," or simply a safety organization, and leaves it with the plant executive or superintendent to work out his own salvation.

A lot of plants are in about the same predicament that I was when I joined the army during the World War. After being sworn in I was sent to the supply sergeant for my uniform and equipment. The only articles I received that fitted were a messkit and a rifle and I had to clean both of them. The uniform would have been a good fit for a lot of people; but not me. Some of our plant safety programs fit the plant needs just as poorly as that first uniform fitted me.

Every industrial plant has needed and all needs an effective safety program. To be effective, the program must be of such a character that it is an integral part of each supervisor's and employee's duty while on the job. In fitting the plant safety needs we must consider seriously and as fully as possible the following: (1) The Supervisory Set-up; (2) Employee Types; (3) Machine and Work Hazards; (4) Plant Layout.

In the supervisory set-up we must consider the caliber of its membership and just how much, if any, overlap there is in departmental responsibility. In the average textile plant there is very little overlap of this sort; each overseer having his responsibilities all clearly defined. But, there is a wide difference in the manner in which one overseer can handle his labor compared with another overseer in the same plant, but in a different department. Some overseers handle their employees like an army sergeant handles his platoon, while others treat their employees as members of a large family.

We cannot expect to set up arbitrarily a supervisory safety function that will fit both of these cases, but we can give Mr. Superintendent a close study. Usually the army sergeant-type superintendent has surrounded himself with army-corporal type overseers and second hands. A careful analysis of existing conditions will enable us to devise a plan to fit each particular case.

If either type superintendent leaves all employee control to his overseers and second hands, then the safety organization should be built around these overseers and second hands, and they should report safety activities to the superintendent in the same manner as they do their other activities. If the superintendent retains an interlocking employee control for himself, then the superintendent should be incorporated in the safety organization set-up. The better we work out the safety organization details in keeping with plant supervision, the more efficient the organization will be.

There is one item we should not overlook; the plant executive must evidence his interest by meeting occasionally with the plant safety organization in regular meetings or at a special meeting, and by letters of suggestion and/or commendation.

Employee types should be given full study. Frequently, when approached on the idea of a safety program the plant executive will tell you that for certain reasons his labor problem is different from that of any other textile plant. Usually he goes into detail to substantiate this statement.

You should welcome this opportunity, first, because he is telling you how he feels toward his labor and, second, he is giving you an insight as to his caliber as an executive. Usually an executive gets the kind of employees that he wants in his plant, or he consciously or unconsciously moulds them to the pattern he wants.

Employees may be intelligent or ignorant; conservative or radical. Whatever their make-up, they are human and have a definite place in the plant safety program—the same place they have in plant production. Fortunate is the executive who has an intelligent, conservative type labor, for it is then simpler to fit the plant safety program to the employees. He is in a better position to appeal to them directly and frankly than if labor conditions are less favorable.

Ofttimes, for various reasons, he may not be able to include them in the active working set-up of the plant safety program. But he can direct the plant safety activity so that every move it makes will be recognized as being for the personal benefit of all employees. Since the employee loses more than anyone else through accidents, should he not also profit more by prevention? We miss our golden opportunity when we fail to carry this thought to our employees in our safety work.

Whenever possible, the employee personnel should be represented by departmental employees, with rotation of this departmental employee representation at intervals of from sixty days to six months. One mill in South Carolina has been doing this for five years and nearly half their employees so far have served actively in the safety organization. This is an old mill, but accidents occur infrequently. These employees take pride in being members of the safety organization. They retain their memberships as honorary, and are active in this status by making helpful suggestions from time to time.

On the other hand, unfortunately, there are many plants in which it is not desirable to incorporate employee representation. We must so arrange our program to fit their needs also. It may be a situation that requires developing a definite penalty schedule for safety rule violations if faulty production is minimized in this manner. This is definitely not desirable, but at times may be necessary.

In approaching the problem of employee safety education it is always best to give consideration to the following three motivating factors of salesmanship: (a) personal benefit by keeping that which one has; (b) profit or gain for oneself; (c) profit and gain for others in whom there is a personal interest.

I have found the injured employee to be a veritable gold mine of information in accident investigation, by drawing out his suggestions for prevention of a similar accident. This can be done only after assuring the employee that there will be no incrimination or personal criticism. Lions and lambs alike respond to kindness, notwithstanding the fact that we use different methods of applying kindness in each case. We provide a cage for a lion and a pasture for the lamb.

The machine and work hazards in the majority of textile plants have been well protected. There are, however, isolated cases where this is not true and these plants should be given special consideration. There is a surprising number of flimsy and makeshift physical safeguards that exist even in some of the large plants today where this need has not had proper consideration. Fortunately, such plants are not representative of the average cotton mill.

Experience has taught us that a physical safeguard must be substantial but not cumbersome; it must guard the hazard but not handicap the operation, and should be removable but not removed except for repairs.

Some person capable of recognizing physical hazards and designing protective devices should be included in the safety organization membership. The plant engineer is normally expected to handle this work and is capable of doing so, but with his many and varied plant responsibilities, he is unable to devote the time and study required, although he should in all cases be included as an advisory member of the safety organization for the benefit of his experience and advice.

Usually we must consider another person with similar talent. I have found the assistant engineer or machine shop second hand to be a very suitable person to give close study to physical hazards. He is striving to progress and give evidence of his initiative and ingenuity, and takes a creditable pride in his accomplishments more so than the engineer who is firmly established and does the job simply as an added duty.

To guard a machine it requires a properly designed and installed guard plus education of operators as to its purpose and benefits, with sufficient supervision to see that it is properly used. Normal safety organization activities should begin with a study of and protection against physical hazards.

It is all too easy and natural for a plant safety organization to fall into error by devoting its full efforts to physical items selected more or less at random; therefore, serious thought should be given to a progressive physical safeguarding and maintenance program by considering physical hazards in the order of their seriousness and the employee exposure. This is not only financially economical, but provides a continuous educational feature both for labor and supervisory force by keeping before

them concrete illustrations of physical pro- ion.

In studying the plant layout, we should consider the number and size of departments, the number of employees involved and the number of shifts operated at the plant. Each department involves mechanical arrangements and hazards entirely different from others, and frequently there is serious difference in the caliber of the labor involved.

For example, there is a wide variation between equipment and labor used in warehousing and yard operations and the finishing operations, and yet the plant safety program must fit the needs of both. Normally, the safety organization representation should be in a fair ratio to the number of employees, particularly in reference to the number of shifts. Where a mill operates only one shift per day it is a much simpler problem to fit the safety needs than where the plant operates two or three shifts per day.

In practically all lines of industry occasionally we find a plant that started operating a great many years ago as a small unit, and in time has increased to a full-grown operation, with two or more physically separated departments performing identical operations. Strange as it seems, there are a number of such textile plants in category, in the South particularly, ere we find two card rooms, two spinning rooms and frequently two or more weave rooms. Frequently in such cases there is considerable crossing of operations which necessitates excessive handling of materials which in turn involves accident probabilities abnormal to the average textile operations.

For example, the employees of one department passing through another department, or departments, throughout each shift and the handling of material through departments without processing. Surely this is defined as poor planning. Poor planning develops unusual accidents. It is then an obligation of the plant safety organization to better coordinate the operations if possible. There is also present a wonderful opportunity for the safety organization membership to prove its merit, not only as an accident prevention agency, but also as a material aid to plant efficiency.

The item of safety incentive should be given serious consideration in the safety program—not pecuniary reward, but merit recognition that appeals to the better part of humanity as a whole. A deserved pat on the back is more productive than a kick in the pants at any time. It is the obligation of the safety organization to recognize where merit is due, to place it properly and to alter the methods of recognition as plant conditions change. Merit certificates, posters, bulletins and other attention devices, to be effective, should parallel plant safety requirements and should always be in reference to the department rather than to the individual.

Plant safety is a definite part of production. Why not give a serious thought to safety in the plant as we do to process? We plan process, why not plan safety also?

THURSDAY AFTERNOON SESSION

October 19, 1939

A Bag of Safety Tricks

By R. W. LAUGHLIN

Resident Engineer, Liberty Mutual Insurance Co., Portland, Me.

This little gadget is what I call my habit machine.

This thread, you will note is black. That will represent things done wrong.

The flexibility of this device denotes the normal flexibility of a person's will power.

Have you ever considered the wide choice a person may take in accomplishing any particular thing?

Suppose we are thirsty and want a drink of water. There are many ways that this may be accomplished:

(a) Finding a brook, river or stream, kneeling down and lapping up the water.

(b) We can fill our mouths full of water from a hose.

(c) Putting our mouth directly under the faucet.

(d) We can fill a bucket with water and transfer it to our mouths in this manner.

(e) We can use the conventional drinking glass, conveying it to our mouths with either our right or left hand.

(f) We can form a cup with our hands and convey the water to our mouths in this manner.

(g) We can fill our hat full of water and drink out of that, etc.

As a matter of fact, we use the conventional method of the drinking glass because that is the common and conventional thing to do.

The first time we do something wrong we usually have to exert ourselves to do so. That is denoted by the bother of tying this first knot. As we become used to doing this wrong act we find it increasingly easy to do. But if we realize the possible consequences in time, a little exertion of our will power will enable us to break the bad habit that is being formed.

Now let's perform another series of unsafe practices. After a while we find ourselves unable to break the habit formed. Unfortunately, we have no means of amputation of bad habits, so how then can we break this habit that has our will power so completely tied?

The best way to change a bad habit or an unsafe practice is to begin to do the thing the right or the safe way with increasing frequency. We could start in by doing the thing right once out of five times, gradually increasing this to once out of three times, then every other time.

The more often we do the thing the right or the safe way, the sooner we will break the habit and eventually regain our original flexibility. Once this point has been achieved, we can start repeating the act consecutively the right or the safe way until we have formed another habit—but this time it will be the right habit.

This teaches us that the way to break bad habits is to eliminate unsafe acts. It is not so much the big habits that should concern us as the little careless acts.

Now let us consider the best way to attack the problem of the elimination of the little unsafe acts.

First, we must recognize them.

To recognize them we must thoroughly analyze every motion used in connection with a certain operation.

To correct them we can apply what someone has wisely called the four rules of teaching:

1. Tell a man.
2. Show a man.
3. Have the man show you.
4. Check him.

Has it ever occurred to you how you walk? I didn't say "how to walk" but rather how *you* walk.

I feel that there are a few fundamentals governing the correct way to stand, to turn, to walk.

Let us analyze them a bit together.

I claim that the average man should stand squarely on both feet, having his feet approximately ten and one-half inches apart. Why?

Because the hip bones of the average man are ten and one-half inches apart and the feet of the same man are about ten inches long. That will put him on a square base and his legs will be vertical columns.

In turning, I maintain that one foot should never be placed at an angle of more than 80° with the other. Why?

As I stand with my feet about ten and one-half inches apart, I twist my right foot until I feel the twisting action in my knee or hip joint. My feet are now at an approximate angle of 80° with one another.

Now as to walking. Some people walk with a springy stride.

Normally, that is all right, when there is ample friction between the shoe and the floor surface, but the slipperyness of floor surfaces varies greatly. Some floors are oily or wet.

This piece of waxed linoleum represents a slippery floor.

Let me put this weight on this drag and measure the pull of the platform floor on these scales in pounds.

Now let's try the springy stride on the linoleum. Likely to fall on a slippery floor.

That is what I call walking with friction.

Here is another way to walk, walking

in balance. Stepping out while balanced on one foot, and bringing the weight on the other until the center of gravity is directly above the forward foot eliminates the tendency to slip. It is helpful to note here that the average person, when walking on ice or a known slippery surface, tends to loosen up or flex his knee and hip joints a bit.

Before considering turning while walking, let me arrange some properties.

This is the spare floor, the space between the trunk and the step is a machine alley.

Some operatives turn squarely from the spare floor into the alley something like this. Wouldn't a side step, like this, be much better? You might call it "side-stepping" accidents.

Now let us try some steps in the vertical plane.

This step can represent the step on a twister frame or a wool spinning frame, the step or steps to an oil tank or any step in a flight of stairs anywhere.

The same principle of keeping the center of gravity of the body directly above the point of support holds in stepping up or down. But some people approach steps at an angle, like this, or step down like this. Again we should consider friction vs. balance.

Note that one-half of this step is covered with canvas. One mill found that, even under oily conditions, covering steps to oil tanks and on wool spinning frames with canvas reduced their falls tremendously. They also found that the canvas wears well.

Some of you may be thinking that all this business of demonstrating walking may be all right for a conference talk, but would have no practical value in your own mill.

This demonstration on walking was first tried before the employees of a large spinning department, 600 employees. This department averaged one or more falls per month and many of them were lost time cases. It was a "last straw" proposition, as telling them to "be careful" didn't seem to do much good. Since the original demonstration, and a thorough "follow up" by the overseer, second-hands, and section bosses, this department has run nearly 1,000,000 man-hours without a lost time accident.

We meet so many overseers and second-hands who say, "What can you do about dumb-bells who fall down and hurt themselves?" Many times these overseers and second-hands are sincere in their statement because they think that anyone must be a dumb-bell who falls down. As a matter of fact, you don't have to be a dumb-bell to fall down. In our opinion, too many falls are caused because the injured people *don't know how* to balance their bodies properly. If they can be taught to balance their bodies properly the injuries can be avoided and therefore a lot can be done about eliminating falling hazards.

Do you have trouble keeping bobbins off the floor? Does an occasional nail get on the floor and get run over by a truck wheel, cocking it up like this?

How can you get operatives in your mill to adhere to the slogan, "If it doesn't belong on the floor, pick it up?"

One way that has been effective in a number of mills is for the "boss" of whatever capacity whenever he sees such materials on the floor to pick them up himself, hand them to the nearest operator and walk away without saying a word.

I know a boss weaver who occasionally gets down behind a loom and very painstakingly stacks the loom weights, as they should be stacked, in a neat pile close to the frame of the loom; but he doesn't say anything to the weaver and he doesn't have to do this often.

This same boss weaver has provided a socket on the end of the loom frames for the cleaning brushes. He can look down a line of looms and see instantly if a brush is out of position while the loom is running.

Incidentally, he hasn't had a lost time accident in his room for four years. He is the foreseeing type of overseer, not the type that defines "seeing" as "looking" and therefore "overlooks" many things.

Somewhat in contrast! Here is a hook designed to clean a picker cylinder when the machine is stopped. An operative one day, recently, held the hook like this to attempt to adjust the leather apron over the feed rolls—while the machine was running. This is the original hook. I do not care to attempt to describe the condition of the man's hand.

Do your maintenance men wear their goggles whenever they should?

A demonstration of nail driving like this with a hammer made from a goggle eye cup has proved beneficial in some mills. Incidentally, how do they hold the nail when starting it? Like this near the top; or like this near the bottom with a greater chance of hitting the wrong nail?

Now let us consider the handling of material, whatever it may be.

This weight weighs several pounds. Please note the approximate size and shape.

After the handle is removed, how would the average man pick it up? Most of them do it like this. Why?

Because they like to prove, even to themselves, that they are strong enough in their fingers to do so. And most of them are—most of the time!

But what if the weight is oily and their fingers slip? A smashed toe may result, if they are not wearing their safety shoes.

Wouldn't this be a better way to lift this weight? Crouch, bending the legs, keeping the back and arms straight, roll the weight so that the hands are underneath and lift the weight like this. *You* all know the correct way to lift, it has been so greatly publicized, but how about setting it down?

I am convinced that there are as many bad accidents caused by incorrect setting things down as there have been from incorrect lifting.

Suppose I wished to place this weight down beside me on my right. Should I twist my body and lower it like this? Really I'd rather not—I got a bad kink in the back once by swinging a brief case around from the front seat of my car to the floor in back. No. Foot work is important in handling material, just as important as in golf, tennis, boxing or any other athletic activity.

Let us now suppose that this weight is used regularly in your mill — a slasher weight, for example. I'll put on this handle; doesn't that make it much easier to use? Do you have handles on such weights?

Now I want to test the strength of this piece of cord. I can lift the weight with it very easily, can jerk it quite heavily, yet it does not break.

In lifting, the point that is most emphasized is the necessity of bending the legs and keeping the back straight.

This device is a back. It is made from a piece of belting taken from a textile mill, some pieces of pine attached to it, four wood screws, a piece of rope, a hook and some cord.

The leather represents the internal back muscles; the segments of wood, the vertebrae; the two lengths of cord, the external back muscles; and the rope and hook, the arms and hands of a man who is about to lift this weight. Please note that this is the same kind of cord that I just tested by jerking the weight and that there are two strands on the back.

If we lift this weight correctly, keeping the back straight, we have no difficulty—except in balancing it.

But, if we attempt to lift the weight incorrectly, with the back bent—! The back is broken!

You, too, can have your "bag of tricks"—probably most of you already have even a bigger bagful than I have shown here, but do they fully accomplish what they are supposed to? The real big trick is the prevention of accidents.

Safe Practice in the Viscose Rayon Industry

By WILLIAM H. CHESNUT

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Through the combined efforts of the Federal Government and other states, where viscose industries are located, a joint survey was conducted to estimate the toxic gaseous hazards involved in the manufacture of rayon silk. This survey has been described in the literature and the results are now well known to the industry. Within Pennsylvania our own viscose plants, realizing the extent of the toxic hazards, have originated a broad program to correct conditions. The discussion I wish to present today deals with the ventilating and chemical engineering

control of carbon disulfide and hydrogen sulfide, the two toxic gases that previously had been disseminated into the workroom atmosphere of this industry.

The stages of manufacture are mercerizing, xanthating, and spinning. The wood cellulose is first treated with caustic soda, then it becomes sodium cellulose, or the so-called "white crumbs." This process is known as mercerizing.

The next step, or xanthation, has been carried out in the churnroom. The "white crumbs" are fed into a series of churns into which is also charged a quantity of carbon disulfide. After revolving within the churn, and the reaction is completed, the finished product changes color to a golden yellow known as the "orange crumbs." Subsequent operations employing the addition of more soda, change the product into a fluid form which is ejected into the acid-coagulating bath in the spinning room and emerges as solidified fiber.

It is apparent to members of the industry that the most hazardous location has been in the churn room and the chief reason has been the failure to inclose all operations, with the result that carbon disulfide has escaped into the work-room atmosphere in minute quantities sufficient to produce harm over an extended period of exposure.

The second location, where gases emanate into the atmosphere, is the spinning room. Reports have shown that two gases emanate from the reaction of the spinning bath and these are hydrogen sulfide and carbon disulfide. I shall attempt to show, by illustration, actual plant operations which have been designed to produce the product with the greatest factor of safety.

The first illustration shows an airplane view of the American Viscose Corporation's plant at Lewiston. It has 5,000 employees. Please note particularly the two large stacks in the central part of the picture. These are called the fume stacks and have been built with one purpose in mind, to remove the discharged gases of the spinning baths. These stacks are over 150 feet high.

The next illustration shows the storage compartment for carbon disulfide. The safe practice procedure of the company is to have the liquid carbon disulfide delivered in tank cars to this location within the yards of the company, and next to pipe the compound to reservoirs submerged in water.

The next illustration shows an old style churn through the open door of which one can discern the inlet pipe for carbon disulfide. Directly beneath the churn one sees the churn truck into which the "orange crumbs" are dumped at the completion of the churn cycle. These hand-trucks, with their charges, are then hauled to various locations in the churn room and the contents are shoveled through open trap doors in the floor into chutes directing them to the mixing machines on the floor below. After discharging the "orange crumbs," a worker must next scrape the inside of the churn with hand tools until it is free from the film of xanthate which adheres to the inner walls. If this film is not removed the residue will contaminate the new churn-charge in the cycle.

A summarized statement would possibly classify the following four operations as being most hazardous in the churn room: 1. Dumping the churn; 2. Trucking; 3. Shoveling; and 4. Hand-scraping. Because of the hazards involved in the older procedure just described, the Viscose Company has done extensive engineering research which has produced a new type of churn.

The next illustration shows the new invention, combining what was formerly two operations in one. These two distinct operations were the "xanthating" in the churn room and the next step of "mixing" in the viscose room. The entire process is now an inclosed mechanical one which thereby eliminates the former practice of open handling of the material in trucks. This ingenious device also eliminates hand scraping of the churns, hand trucking of the "orange crumbs" and hand shoveling of the same into the hopper openings which lead to the mixer machines. Thus we see that not only labor costs are reduced, but of greater importance, the former dissemination of carbon disulfide vapors into the work room atmosphere has been eliminated.

A brief description of this equipment would classify it as a water jacketed vessel which is re-enforced to withstand moderate vacuum. By the newly invented process, the "white crumbs" are charged at the

top, the equipment is closed, carbon disulfide is added and the first operation of "xanthating" takes place with the help of rotating paddles within the water-jacketed vessel, instead of by the former practice of rotating the churn about a trunnion gear. This operation of "xanthating" is now performed under a vacuum which in itself would prevent the escape of CS_2 during the reaction when the "white crumbs" are thus converted into "orange crumbs." The material remains within the vessel for the next stage of the process known as mixing, of forming viscose solution.

Sodium sulfite and caustic soda solutions now enter the vessel through a metered orifice. At the completion of this reaction, the "orange-colored" viscose solution is pumped from the vessel into aging tanks, preparatory to the next step of spinning.

Formerly hazardous cleaning of the churn is now done by adding a slightly alkaline solution, the agitating paddles washing, or rinsing, all surfaces free from viscose film.

The next illustration shows an inclosed valve-room. When carbon disulfide is pumped to the churn room from the reservoir supply, a measured quantity must be delivered to each churn. The method of handling this is similar to the measuring of gasoline at a service station. However, due to the solvent action of carbon disulfide upon the packing material of the valves, there is occasional leakage of CS_2. This photograph shows the valve room now inclosed and under negative pressure, or vacuum.

The next illustration shows a view of the base of a giant fume stack. The height of a stack is approximately 350 feet, and the ducts leading directly into the base of each stack are 17x20 feet. These ducts come directly from the series of spinning machines and have been designed for the one purpose of removing the fumes given off during the reaction when the viscose fluid is forced into the acid-coagulating bath. Not only natural draft is employed, but extra air velocity is added by giant motor-driven fans located at the base of each fume stack.

The next illustration is a close-up view of the giant motor-driven fan, situated at the base of one of these large fume stacks. The fumes are removed through connections at the rear of the spinning bath. The capacity of each of these large fans is between 300,000 and 500,000 cu. ft. per minute. The diameter of each fan is approximately 18 feet.

The next illustration shows a view of a unit of the spinning bath. Note the glass inclosure which is now placed on each spinning bath to prevent the escape of fumes into the atmosphere of the work room. The inclosure keeps the gases within each unit. When periodical work must be done within the glass inclosure, as each division of the glass section is lifted up, an automatic mechanism causes the ventilation of that section to be tripled, thus removing the gases at their source.

The American Viscose Company, following the Federal and State survey, have retained Prof. Philip Drinker, of the Harvard School of Public Health, as its consultant. Through Prof. Drinker's efforts, special automatic recording equipment has been devised which is of two types, the one being arranged for hydrogen sulfide while the other has been constructed to record amounts of carbon disulfide. In the hydrogen sulfide recorder, there is a moving strip of impregnated lead acetate paper upon which is charged an automatically-moving amount of air containing the impurity of hydrogen sulfide. This H_2S charge of air, upon striking the sensitized paper, produces the well known discoloration due to the characteristic lead sulfide formed. The intensity of the discoloration of the paper may be used as a direct reading of the amount of the hydrogen sulfide present. The quantitative determination of this intensity is made possible by photronic cells. Two cells are used, the first one to record the reading on the plain paper before discoloration and the second one for the final reading after the lead sulfide is formed.

In the carbon disulfide recorder, the air that contains carbon disulfide is led to a furnace and through the heat of the reaction within the furnace this gas is oxidized to sulphur trioxide and as such leaves the furnace. The SO_3 passes through a water-bath where it is converted into SO_3 fog, which in turn is led to a fog chamber. The intensity of the fog is recorded auto-

manually by the conventional process of using a light at one end and a photronic cell at the other.

I understand work is being rushed on these two recording devices so that they may be promptly installed within the churn room and the spinning room, and by the combined action one may learn through a 24 hour cycle, in a chart form, the actual recording of CS_2 and H_2S any hour of the day. This will be an invaluable aid in keeping all processes under control and help immensely in the program of safe practice.

No Secret Formula for Safety

By ALFRED B. HARPER

Safety Director, Edwards Mfg. Co., Augusta, Me.

Do you, when you attend a safety conference, expect to hear the inside combination of wand waving and mumbo-jumbo that makes a safety program click? There is no such secret formula. A good accident prevention program is as hard-headed and hoss-sensed as David Harum ever was.

I wonder, however, if we do not all sometimes interpret safety engineering as something mystic and intangible, bestowed upon the heads of a favored few? I have met engineers who would have us believe this, but not many. Most of them are conscientious, sincere workers for the betterment of and protection of our daily activities.

And when I say workers, I mean just that. Fit companions for the three E's, Education, Engineering and Enforcement, are the three W's, Work, Work and Work. It's hard work too, and worry, with periods of discouragement and despair of ever making progress. Once the seed is sown, however, you are making progress, little as it sometimes shows.

There are, of course, many good systems and methods of lowering the frequency and severity of injuries. These of necessity have to be fitted to the conditions at hand, but the basic nucleus of good accident prevention is the same, be it textiles, steel mills, rubber factories or construction of a railroad.

First, comprehensive analysis of the true causes of injuries occurring. (And I mean true causes and not the superficial reasons so often deduced in haste.) Then honest, sincere cooperative effort of every man, from the big boss to the lowliest cleaner or laborer, to remedy the causes and prevent repetition.

For after all safety engineering is experience plus vision. Your experience and mine, your vision plus mine, plus the knowledge of others able and willing to give.

For specific problems, the source of information is large, the National Safety Council being one of the finest. Others are the engineering departments of the insurance companies, manufacturers of various safety devices and sometimes a good idea comes from where you least expect it. Don't close your minds to any idea because it may originate from a seemingly worthless source. Bigotry has no place in our trade.

Why do some mills really go places in accident prevention and others struggle against an ever mounting accident record? What makes one program active and another, almost identical, passive? I shall give you some specific examples, taken from real life, but told after the manner of a Mother Goose story.

Once upon a time there was a mill with a very poor record. One day while glancing over some costs the big chief noticed the compensation insurance was far, far too high so he resolved to put a stop to so many injuries. At the next safety meeting (three weeks later) he put up his hand and in a solemn voice said, "We must stop these accidents, tell your men not to be so careless." His orders had always been obeyed before, so of course the matter was well taken care of.

Very surprisedly he learned that those careless, inconsiderate workers dared to disobey the royal command and continued their merry bone-breaking, flesh mutilating way. So a clerk, whose idea of safety was using a bent-handled spoon in his coffee cup, was assigned the job of tracing the elusive causes of so many injuries. He, after a week of intense investigation, brought in a

report which summed up the causes as damned carelessness.

Now let's peek into the vitals of that plant, and talk with one of the workers, a section hand. "What do you do at your safety meetings?" we ask. "What meetings?" says he. "Do you have a first aid hospital or are your office girls trained to attend you for minor injuries?" is our next question. "First Aid? Oh! you mean when we get a cut or scratch. We don't bother with small things, mister; we're tough; but if it gets sore after two or three days there's nothing better than a salt pork or tobacco juice poultice to draw out the poison."

After a few more talks with others, including some bosses, we can make our own report of the causes of accidental injuries. Safety meetings are held more or less regularly, but it is apparent that no real interest is shown. Some good suggestions are offered for plant improvement, maybe are acted upon in the future, and perhaps are not if they cost much. It's poor business to spend money on safety recommendations when the insurance company pays the accident costs. There is a definite rivalry of the wrong kind between overseers, each feeling that his suggestions are the only worthwhile ones made; and as all of them are too narrow-minded to admit that they could learn anything more, progression is at a standstill. Although this mill doesn't want accidents to happen they accept them as something inevitable that cannot be helped.

Right within themselves, however, is the basis of good active safety engineering and they let it lie passive. No education against common everyday hazards, no reliable first aid available, very little enforcement of what few rules are in force, no engineering for future preventions. Mostly a lock-the-door-after-the-horse-is-stolen attitude which surely shows little use of the common sense God gave all of us.

Now for the other side of our picture. Once upon a time there was a mill with a fairly good safety program, which still had too many injuries. So they decided to try harder and spare no effort or reasonable expense. First they installed a well equipped first aid hospital with a competent nurse in charge. This centralized the treatment of all injuries, and records were kept so that overseers could at any time review their departments for kinds and number of accidents, repeaters, hazards etc.

A set of twelve general safety rules was designed and posted in every room on large heavy cards forbidding such things as horseplay, running up or down stairs, loose clothing around machinery, blocking or boxes in place of ladders, spitting on floors and so on.

The inseparable companion of the safety rules is an employee safety examination form, filled out by each employee before he starts work. On this form he affirms that he has had the general safety rules explained to him, that he realizes the importance of prompt reporting of every injury no matter how slight, and various other questions pertaining to his safety while at work.

When this man goes to his job his boss explains the particular hazards associated with his job and this new employee, as well as all old hands, is periodically checked by overseers and second-hands to be sure they do not get lax in obeying rules. Before this man has worked long he will get called to a safety committee meeting, either departmental, or general for all workers, where he has the chance to talk and give his ideas or recommendations for necessary repairs, improvements or new guards.

At the general executive meeting, where agent, superintendents, safety director and all overseers are present the accumulation of new suggestions is sifted and talked over. Urgent or serious hazards are attended to immediately and all other accepted suggestions as fast as possible. The most striking part of this meeting is the absolute sincerity and attention of every member, all of whom are sold on accident prevention, and the real spirit of cooperation is evident.

Many ways are used to keep interest alive in this plant: contests between departments with prizes of cigars, chocolates and three day vacations with pay. Some of the workers each year are invited to the State safety conference in company with the overseers.

And so this second mill has reduced its accidents both in frequency and severity, loss of skilled labor is less and employee morale is higher.

Can they rest there? No; in the effort to prevent broken bones, fractured skulls, disabling wounds, there is no rest. New ideas must be had constantly to keep interest

liv There are many pitfalls along the at those earnestly and honestly trying o reduce accidents. Every concern has ome feather-brain, bull-head, smart-alec, or aybe it's one of the apathetic indifferent pe, who is a constant thorn in its side. ne such individual can often hurt the orale of a whole room, and you are much tter off without him.

Another factor to contend with is the an who is hurt outside the plant but cides he is smart enough to make the mill pay for his repairs. Your best efforts are necessary to beat this type of malingerer. Safety should be one of the easiest things in the world to sell, but strangely enough it's one of the hardest. Is it lack of enlightenment, or what is the answer when we have to force workers to practice accident prevention?

We must be doctors and lawyers of a sort, diplomats, jesters and critics, but above all we must be salesmen. Salesmen of the commodity that saves lives.

ADJOURNMENT

General Cha
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Poster Com
cago, Ill.
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*R. C. B.
*F. W. F
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*E. Ross
*Harry
*Roland
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*J. A. P
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