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AUTOMOTIVE and MACHINE SHOP

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AUTOMOTIVE AND MACHINE SHOP SECTION

FERNANDO'S HIDEAWAY

By BRUCE PODZIOUS

Safety Director, Detroit Diesel Engine Div., General Motors Corp., Detroit, Mich.

The Fernando that I am going to discuss is not a character in a song. Fernando is a machine operator at Detroit Diesel. Fernando's Hideaway was the inside of a machine and the object that he concealed was a tobacco can containing six small Allen wrenches. Every morning at starting time for four hundred eighteen (418) consecutive work days, Fernando would carefully remove four screws and take off a cover from the side of his boramatic machine. Next, he would reach inside and retrieve his tobacco can treasure chest which he had hidden at quitting time the previous day.

On the morning of November 18, 1952, Fernando's luck ran out. As usual, he first pressed the starting button for the motor in order to cycle and warm up the hydraulic system for the machine wherein the tobacco can was hidden. Next, he removed the cover. As he reached inside, his left third finger was caught and amputated between a revolving "V" belt and a pulley. Fernando's Hideaway had finally been discovered!

It was almost incredible that a General Motors employee working in a safety-minded plant could perform a flagrantly unsafe act twice a day for four hundred eighteen (418) consecutive days without ever having been detected or corrected by his supervisor, his fellow employees or his safety department. It makes you stop and think, doesn't it?

We in the safety department did plenty of thinking. At first we consoled ourselves by saying, "It is difficult to control the human factor." Next, we reminded ourselves that the business of building Diesel engines is classified as heavy industry and serious accidents are more likely to occur in heavy industry operations.

Then came the thought that in spite of the fact that our safety program provided an hour and a half safety induction talk to each new hire, in spite of the fact that supervisory safety meetings were regularly held, in spite of daily five-minute safety talks to employees, in spite of safety inspections, safety procedures, safe job instructions, safety rules, signs, slogans, bulletins,—in spite of all this and more, it could not be denied that Fernando's unsafe action climaxed an *entire year* of several serious accidents at Detroit Diesel. Somewhere we were missing the boat. Four conclusions were finally reached:

First: All people perform unsafe acts.

Second: If one employee with better than average intelligence and with a previous accident-free record was able to perform a flagrant unsafe act twice a day for nineteen months, it would involve higher mathematics to determine the number of unsafe acts that three thousand employees in the same plant would perform in the same time interval.

Third: In many instances a history of an employee's unsafe practices was discovered *after* actual injury took place. We needed a plan of action to detect and correct unsafe practices *before* an actual injury would result.

Fourth: The safety department needed help—plenty of help.

Early in 1953, the Detroit Diesel "Unsafe Practice Observation Plan" came into existence. Management, traditionally safety minded, accepted the "Unsafe Practice Observation Plan" as a supplement to the safety program based on the General Motors "Six Basic Principles of Safety."

It was decided to try the plan in the manufacturing division first. The energies and talents of thirty men were made available. These men were thirty manufacturing division foremen. Overnight the safety department had been enlarged 750 per cent. These foremen were the first recruits enlisted in an all-out war against the dangers of employee unsafe practices.

A letter from the works manager informed all manufacturing foremen that an

TRADIN' POST

Presiding: LEWIS R. MORRISON, Corporate Mgr.-Safety, ACF Industries, Inc., New York City.

I

BOB REEVES, Mgr., Safety Services Sect., Ind. and Comm. Relations Dept., Allis-Chalmers Manufacturing Co.

Subject: Safety Modifications of Standard Push-Button Controls

Here are two gimmicks on push-button controls that we have made standard at our West Allis Works and which may be of interest.

Overhead Doors — Normal controls are "Raise, Lower, and Stop," momentary contact push buttons permitting the door to be stopped at any height. This is tough on doors, and possibly personnel, from dislodged loads when clearance is misjudged and door is struck by a truck.

We corrected this exposure by eliminating the "Stop" button and requiring the "Raise" control to be automatic. (The latter is standard on many units.) Under this arrangement, a single actuation sends the door to its top height with no way of over-riding or stopping it. The "Lower" button requires continuous pressure so the operator must stay at the control where he can make sure no one is caught under the lowering door. Removal of pressure on the "Lower" button stops the door at any point. Of course, it's possible to bring the door back down to less than maximum open height on cold days, but we have found no tendency to do so.

Electric Elevating Platform—These are normally equipped with both a floor-operated set of controls and a platform set. If the operator leaves the platform while in up position, it is possible for a person on the floor to bring the platform back to the floor, leaving the upper man stranded. Also, the platform could be moved while in use. We require a selector switch on the platform control by which the operator can lock out the set of floor controls so the platform cannot be taken away without his knowledge.

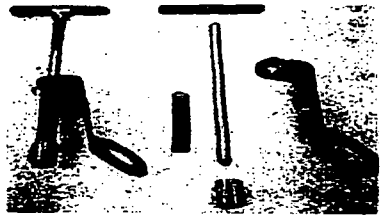
These are both simple wiring operations that are easily accomplished. We find that several hazards have been eliminated by requiring them as standard hookups.

II

CLARENCE E. JOHNS, Safety Supvr., Canton Works, International Harvester Company, Inc.

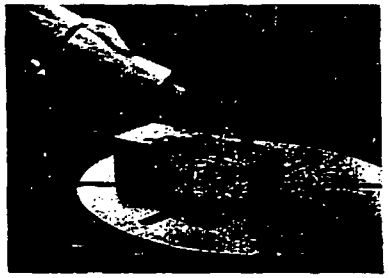
Here are two ideas that we have used with success for the past year.

1. Captive wrench for acetylene cylinders. The assembled unit is attached to the



acetylene cylinder under the regulator mounting nut. The wrench has the distinct advantage in that it is always in place when it is needed.

2. Replacement for oil cans. Oil cans may cause trouble due to puncture wounds.



The can may be damaged easily. We have replaced our oil cans with plastic containers, such as liquid detergent bottles. To make them into an oiling unit, we merely drilled a hole in the cap. The bottles are economical, easy to replace, remove an injury potential. Even more important, our employees like them and they become quite proficient with them.

III

E. SKINNER, Safety Administrator, St. Louis Assembly Plant, Chrysler Corp.

Subject: Trailer Safety Jacks at Shipping and Receiving Docks

This is one solution to a problem that I think we have all had in the past. You've noticed the different methods that are used for securing the trailers when they come in so they won't jump up in front when the fork lift goes in. We've made a set of jacks that we secured to the face of our loading dock or receiving dock. These jacks swing out when the tractor or the trailer comes into place. They can be raised to any elevation. One problem—aluminum trailers. When we first used these, we were bending the structure underneath some of the aluminum trailers. To eliminate this, we put on a wood adapter which covers more of the trailer surface.

IV

H. L. KIRK, Mgr., Personnel and Safety, ACF Industries, Inc., Berwick Plant.

Subject: Air-activated Safety Gate

The walkway leading from one of the doorways of one of our buildings (Freight Erection) is located beneath the truck-carrying crane which travels past this doorway to supply trucks to the track. Due to the usual amount of noise in this building, and the fact that the crane is overhead, workers stepped through the doorway

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directly beneath the passing crane. In order to eliminate this hazard, we installed an overhead air-activated drop gate.

This gate consists chiefly of a round bar from which is suspended straps of asbestos. When the crane nears the doorway, contact is made with a third rail, which energizes the air-activated piston, which in turn causes the drop-gate to lower. The asbestos straps on the gate are approximately 2½ feet long and swing freely on the bar from which they are suspended, so that if a worker should be immediately under the gate as it drops, he would not sustain any injury.

V

E. JAMES, Safety Dir., Sunstrand Corp., Rockford, Ill.

Subject: Relocation of Cooling Fans

Our air circulating fans mounted on pedestals were being placed in hazardous locations such as aisles and other areas having heavy traffic.

Our hydraulic division's plant engineering department picked up this problem, studied it, and solved it this way. They removed the fans from their pedestals. They then placed the fans on permanent mounts which had been attached to selected building columns. The building columns used were those selected on the basis of air movement needed during the hot summer months.

This change not only removed a serious injury potential, it also eliminated a lot of controversy over who was going to use or place the fan.

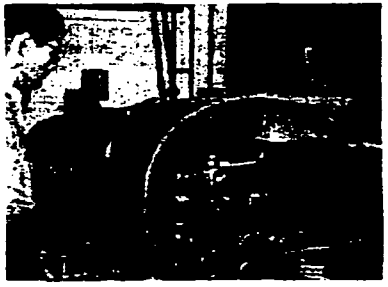
VI

J. K. SKIPTON, Safety Supvr., WKM Div., ACF Industries.

Subject: Shaving Shield on an Engine Lathe

A shaving shield on an engine lathe protects the operator from flying shavings thrown off by the chuck jaws or the revolving work.

The principle used here is a curved horizontal 12-inches-wide shield on roller bearings that can be pushed left or right on a ¾ inch by 2 inch angle iron track the length of the lathe carriage. It can be pushed over the engine housing to the operator's left when he needs to chuck his work or to his right clear of tool post. The operator uses the shield as work dictates and at whatever point needed depending on location of the cutting tool. It has a removable plexiglas window to have work and tool visible. Where a coolant is used, it contains it within the machine. The skirt on back of shield under the ¾ inch angle track protects adjacent operations and helps balance the front overhang.



The roller bearings make it very easy for the operator, with a fingertip touch, to move the shield freely without interference to his production.

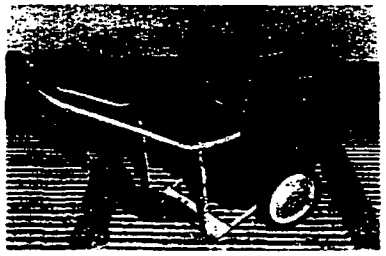
The shield has been successful in preventing burns and other injuries from the flying chips.

VII

ARRON COX, Supvr.-Safety & Fire Prevention, ACF Industries, Inc., Albuquerque Div.

A. Magnesium Extinguishing Powder Cart

This piece of fire protection equipment is basically a garden and lawn cart with an attached lid and leg tray. The lid is attached



to disallow contamination of the extinguishing powder with metal chips and other debris. The leg tray is added to the cart to support a 2X shovel blade while the shovel handle rests on the cart handle.

This magnesium fire extinguisher has proved to be a very useful piece of equipment. It is very portable, holds 50 to 60 pounds of extinguishing powder; the wide opening of the lid makes the powder very accessible, and the 2X shovel provide an ample amount of powder plus being a useful tool to remove burning particles and for clean-up operations.

The cart and shovel are both painted red and marked "FOR MAG FIRES ONLY" in white letters.

B. Crane Hot Line Lights

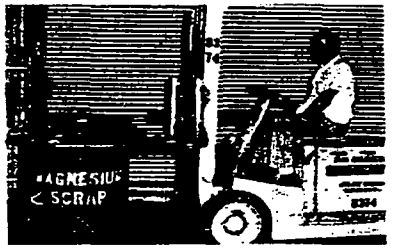
Two red lights extending from a 440 volt to 110 volt transformer which is tied directly in line from the crane power supply act as caution lights to crane operators and maintenance personnel. There are two hot line stations on each crane circuit mounted above the crane rails, and are clearly visible to the crane operators and other personnel.

The hot line lights are not used to indicate the crane power line hot or not hot, but are used mainly as caution indicators and disconnect monitors.

C. Magnesium Scrap Cans

The magnesium scrap can is a safe means of controlling magnesium scrap and in providing a system of control for the fire potential involved in magnesium scrap within a plant area.

The can is made of ⅜-inch steel plate. It is 36 inches deep and 30 inches in



diameter. At 90 degree segments there are braced 2½-inch pipes extending 5 inches from the wall of the can. With this construction, should a fire exist in a magnesium scrap can, a lift truck or crane can easily and rapidly remove the can to a safety area without danger of the burning magnesium being contained in a shop or spreading it about while attempting to remove it from a shop area.

While a magnesium scrap can is in a shop, it is provided with a lid made of rolled one-inch angle iron and 1/16-inch sheet steel with a large handle attached to the lid center. The lid is basically used to disallow scrap contamination with other materials and to hold back the fire potential from cigarettes and lighted matches.

D. Lever Drop Lock

The machine lever drop lock was installed on an engine lathe housing between the high and low range back gear lever positions to prevent accidental range speed change of the back gear. The drop lock is set on an angular plate with an offset pin in the drop lock arm base to always cause it to be extended. In order to change range



speeds, it becomes necessary to raise the drop lock arm before repositioning of the back gear lever can be obtained.

The drop lock not only acts to prevent accidental change of the lever but also is a reminder to the lathe operator that he is changing operating speeds.

In the case of this installation of a drop lock the ratio of speed change was about 8 to 1.

E. Special Welder's Glove

A glove designed to meet a dual purpose. To allow operators of automatic welding equipment touch control and positive feel of the equipment's operating panel and to safeguard against ultra-violet rays causing damage to the operator's hands.

The glove hand is made of thin goat skin to which is attached a heavy five inch leather gauntlet to provide protection between glove and sleeve.

F. Welding Snood

A welding snood, made of black wool, is used to prevent ultra-violet ray burns to the back of the head and neck of welders working inside of cylinders and bowls of bright metals where reflections are prevalent. The welding snood is made to be attachable to the headband of the welding helmet easily. There are only two snap hooks involved in the attachment.

Along with use of the welding snood, the welding helmet is equipped with a fresh air plenum to supply the welder with



a constant supply of filtered fresh air removing possible heat, smoke, and fume problems.

G. Fire System Indicator Board

The purpose of the fire system indicator board is to mark attention to any part of the plant sprinkler and fire main system



that may be reported non-operational. With the marked attention to a non-operational part of the fire system, the plant security force and the plant fire protection section can maintain a closer vigilance over the indicated section, and be prepared to operate under a secondary system in advance should it be necessary.

The indicator board is a photo copy of the drawing of the plant fire protection and sprinkler system. The purpose of the photo copy is to reduce the board to a more suitable size. In this case it was reduced from a drawing 36 inches by 126 inches to 14 inches by 34 inches.

The photo copy was marked with colored indicators to represent the various valves and equipment of the system and each

indicator was numbered or lettered to correspond with its actual valve or equipment. Hydrants are indicated by a fluorescent green triangle; sectional valves on the main are indicated by a fluorescent orange square, and building sprinkler valves are indicated by a yellow circle.

The fully indicated and marked photo copy is mounted over a plyboard back and under a piece of clear plastic glass. Below each marked indicator a 1/16-inch hole is drilled through the mounted board so that a non-operational indicator could be placed if needed. The non-operational indicator, a round fluorescent red plastic tack with a 1/16-inch shaft, is placed in the mounting hole of the corresponding non-operational equipment. The easily noticed red indicator when placed on the board becomes a caution notice that a part of the system is non-operational.

A procedure requiring the reporting of any change in any operation of the fire protection system, either repairing, construction, testing, etc., to the plant security force and plant fire protection section is the first step of functional value for the basic purpose of the indicating board.

VIII

WILLIAM F. PITCHER, Safety Administrator, Kokomo Plant, Chrysler Corp.
Subject: Limit Switch for Electric Carts

We found that the employees using an electric cart had a tendency to ride with their foot out of the left hand side of the cart. This practice resulted in a four-day lost time injury earlier this year. To eliminate this source of injury, we substituted a limit switch for the ignition switch. The limit switch is located on the left floor board. The employee must keep his left foot on the switch to maintain a closed circuit so that the cart will run. This is a simple change and cost us about $12.00.

IX

MILTON RATHERT, Personnel and Safety Dir., Hages Hinge Co., St. Louis, Mo.
Subject: Metal Drum Check and Disposal

Our metal drums through hard use become ragged or torn at the top; and, as a consequence, created quite an injury potential. We frequently had difficulty in removing the ragged drums from our operation due to the fact that as soon as they were empty, they would be re-used. The procedure we set up to eliminate the re-use of bad drums consisted of:

1. Having our safety engineer mark a yellow X on the torn or ragged barrels he found.

2. The foreman sends all barrels marked with an X as soon as it is empty to the scrap bin.

3. An electric magnet is dropped on the drum, thus removing it from further use.

X

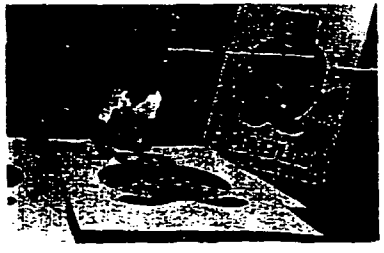
A. CAVANAGH, Safety Dir., The Budd Co., Inc., Detroit.
Subject: "I'm a Bug"

We had a problem. We went through a period which many of you have gone through and many of us are starting to climb back out of—a process of changing people on jobs, of nervous individuals, people who are unsure. In short, I'm saying we went through a period of a potential grave hazard, the changing around of people within a plant.

We had tried quite a number of things, the same things that I know most of you fellows have tried—posters, "Safety Every-

where . . . All the Time," "Knowing is Not Enough," etc. We had posters all over the plant; we had safety committees: everything you can think of, but we still had a problem because these things had been used. They were no longer new.

I had a brain storm, and this is my baby. He did a terrific job for us in four of our Budd plants; and, because he did a terrific job, we want to hand him to you. The program is entirely new, is attention getting, is talk-inspiring, is interest-arousing and includes everyone from the president to the newest sweeper if you want to make it do so.



Our program follows four basic steps. We call this the "I'm a Bug" program. I called together my executive plant safety committee, and I proceeded to make them "I'm-a-Bugs." This little character, "I'm a Bug," is symbolic. Here's the idea. I'm a bug on safety. That's all he is, and it is easy to guess, but you'll be amazed at the number of other answers that it generates as you unfold your purpose.

I called this executive safety committee together, and I proceeded to outline to them the four steps we would follow, and I made them "I'm a Bug" simply by putting on their lapels an "I'm a Bug" pin. They became at that moment a bug on safety. Then, we hit the personal side by saying, "Fellows, as executive safety members, you are now bugs on safety and you are the stepping stone in our program that is going to take four weeks to cover. In that time you must, to make the program successful, follow implicitly the outline. By that, I mean for the next week you cannot tell anyone what that pin means. You have only one answer. The guy comes up to you and says, '"I'm a Bug." What's that about? What's it mean?' You say, 'You'll find out.'"

You know, that came to be a watchword overnight. "You'll find out." Pretty soon everyone was saying, "You'll find out."

During the first week, our executive safety committee, comprised of our top management in the plant, including our plant manager, wore pins that nobody knew anything about. The following week, we conducted our monthly foremen's meeting, and at that meeting we decided to bounce this program to them. We made them "I'm a Bugs" simply by handing them the pin, telling them to put it on, wear it all the time you are in this plant. Further, don't tell anybody what this is about; just say, "You'll find out."

At the end of our second week with all our foremen and all our executive safety committee wearing this pin, there was no one who knew what it was all about except the wearers. We had a lot of curiosity aroused in our plant. At the beginning of this program, the first poster appeared on a Sunday afternoon throughout that plant anywhere there was a spare piece of blank wall, poster board or anything else. That poster appeared on Sunday afternoon with nobody in the plant. People coming in on Monday morning or Monday afternoon or Monday's third shift, everywhere they looked they saw an "I'm a Bug" staring at them. And it was talked about.

The second week, as far as the employees were concerned, foremen were wearing the same pins that were appearing all over the plant on posters. During the third week, our instructions to our foremen were that they would receive as many pins as they had employees working for them. We told them, "We want you to make your people 'I'm-a-Bugs.' This is how you can do it. You can make an "I'm a Bug" out of one of your employees if you see him doing something about which you have cautioned him and he is doing it right and he is doing it safe; or, he comes to you with an idea to prevent an accident in any way or form. We don't even care if it's a good idea or a lousy idea. As long as this man is thinking and has an idea that is acceptable or not, he is thinking safety. He is a bug on safety. Make him an "I'm a Bug." Tell him why, and tell him don't divulge it but

say, 'You'll find out' to any employee that asks him who is not wearing an 'I'm a Bug.'"

Most important we had people talking, and we had them talking about something that, to them, was important. Those in the know thought they were pretty sharp. Those who were not in the know, we double crossed; we really double crossed them.

At the end of that third week, I sent a letter to all employees in our 6,000-man plant and this included our officers. The letter stated: "We suspect that the Budd employee in your family has already let you know about the little fellow, 'I'm a Bug.' He has become well known to all our people as 'I'm a Bug' born at the Budd Company's Detroit plant less than a month ago. He gained immediate acceptance by all who met him. In the campaigns he has been conducting, he gained scores of followers every day.

"The only way in which we can describe him is to say he is an idea which has grown into an attitude and that is what an 'I'm a Bug' is. 'I'm a Bug' simply means I'm a Bug on safety. I am such a bug on safety that I am constantly alert for those things that cause accidents. Since most accidents occur because someone does something wrong, I'm always taking a look at the way I do things. I'm finding ways to do them better and more safely. I believe in bugging other people too if I find them taking chances, but such an idea is not confined to work out at the plant.'

"A fellow's wife bugs him until he cleans up that fire hazard in the basement, gets rid of the tripping hazards on the basement stairs, puts a new bulb in the dark closet, and many more too numerous to mention; but we can retaliate by pointing out that matches should be placed out of reach of children, high heels should not be worn on highly waxed floors, the radio should not be played in the bathtub and you know how it goes; but, when it comes to being a bug on safety, just think how we bug our children, teaching them to cross the street safely, teaching them to ride their bikes safely, and teaching them to live a full life safely.

"The Budd employee in your family is probably wearing a bug pin already. It was given to him by his foreman in recognition of a fact that the employee believes in and practices safety. (Here comes the double cross.) If he hasn't received his pin yet, maybe he hasn't earned it by using safe practices."

I never heard such repercussions as we received from that letter. We had women calling, "What's my husband trying to do, kill himself over there? Does he practice safety, does he want to get hurt, can you control him? Make him do it."

We had men coming into my office, the plant manager's office, and the superintendent's office saying, "Look I want a doggone pin. I don't want to get hurt. What's this thing all about?"

That was the fourth week. These letters went out at the end of the third, so we told our foremen the plan of operation for the fourth week. The last week you have about 40 per cent of your people who are not "I'm-a-Bugs." As yet, they still don't know what it's all about until they read that letter. Now, you take five minutes and talk to every man who doesn't have a pin on. Explain why. You watched him for weeks trying to find one thing right that he was doing safely. One little extra thing or the fact that he didn't come to you with anything concerning a safety idea. Explain to him why "I'm a Bug" is important.

Now you give him a pin. Join the group. Become a bug on safety. We finished up those four weeks and very truthfully not because of my efforts, but because of the efforts of our foremen who ran this and the employees who loved it. We had a far better program, far more results, far greater and far reaching results than we ever would have anticipated.

The Greater Detroit Council is now handling this program. It is available to you. They in turn are going to make a little bit of money on it, not much, and they are going to use it for civic projects. During the week, our foremen received their pins.

One foreman in our tool shop had at home a little six year old daughter, who asked, "Daddy, What's the pin about?" So, he told her, "This is an 'I'm a Bug' pin. The safety man gave it to me over at work today, and I'm supposed to bug people on being safe so they don't get hurt. That

means I've got to watch what they are doing. I've got to get them to work safely," and with that he closed the subject.

He came up to my office on the second day. He said, "Look, I gotta have another pin." I said, "Only one to a person. That's what we agreed. Unless you can give me one whale of a good reason that you have to have another pin, that's the only one you get." He said, "Okay; my little daughter took that pin to school with her and she wore it, and the teacher wanted to know what it was about. So she told him, 'My Daddy got this over at Budd Company and that means he is a bug on safety. He's gotta watch people and he's gotta bug them on safety.' The teacher took the pin and put the class to work, and she proceeded to copy that little guy up on the board as closely as she could and from that day on, she started teaching safety to those children for just a few minutes a day. They became 'I'm a Bugs.' 'Remember, when you go home tonight, I'm a Bug on crossing streets. Remember tonight, when you go home and you play, I'm a Bug when I'm riding my tricycle.'"

There's a big wide open field. It's quick, short, inexpensive probably less than ten cents per employee, and I hope if you use them that you'll find the results even better that what we did.

XI

ROBERT H. CROSS, Supvr.-Safety, Ternstedt Div., General Motors Corp., Flint, Mich.

Subject: Band-cutting Tool

As a result of an employee suggestion, a workable tool was developed for cutting hands on carton materials and coil steel. Present methods of cutting bands is to use some object, usually a hinge, to support hand and to hammer band until it breaks. When cutting shears are furnished to the job, they disappear in a few days. The tool developed as a substitute is much safer, is not attracted to other uses, and remains on the job.

A hardened drill rod is split, welded to a ¾-inch pipe, and threaded for coupling to a handle. The tool is slid over the band, backward and forward motion being used until the band is sheared.

XII

HARRY A. HARRIS, Engineering Safety Coordinator, Farm Equipment and Research Engineering Center, International Harvester Company, Inc.

A. Test Engine Safety Clamp

The metal bands used to fasten our engines to skids were replaced with safety clamps to reduce the hazard of band cutting. The safety clamps fit on and become part of the skid. It is fastened with a spring loading nut, which secures the engine to the skid. The clamp can be moved back and forth along the skid to give maximum use.

B. Spring Loaded Drums—Good For the Last Drop

Drums on storage racks frequently have to be tipped to empty the fluid. We put a spring loaded clamp on the rear of the drum. When the drum is full, the spring is down. As the drum empties, the spring raises the rear of the drum enough to allow the drum to empty as desired.

XIII

K. L. LEWIS, Safety Engineer, Delco-Remy Div., General Motors Corp., Anderson, Ind.

Subject: Center Post for Tumbler

This idea is for the employee who gets his clothing caught on the outside of the tumbler. The idea involves adding a center post in the tumbler with a bolt attached. A nut is attached to the cover. This allows the lid to be fastened at the center, thereby eliminating the projections on the side of the barrel.

XIV

ROBERT BEESON, Supv., Safety and Training, Perfect Circle Corp., Hagerstown Plant.

Subject: Fluorescent Tube Disposal

Our chief electrician saw the need for a way to dispose of used fluorescent tubes. We had been placing them in a drum and hauling them to the dump. As we began using longer tubes, this was a real problem because of breakage and the tubes being difficult to handle. The machine is placed





over a steel drum for the broken glass to drop in.

We require the men to wear eye protection and gloves when operating this machine but have had no trouble with it. It really does the job.

XV

PAUL KRAMOS, Chief Safety Engineer, Butler Mfg. Corp., Kansas City, Mo.

Subject: Safety Trip Bar for Plate Bending Rolls

An emergency safety trip bar was designed and installed on a ¼ inch by 14 foot plate bending roll. This roll was originally equipped with an air cylinder operated end cap and interconnected top roll lifting mechanism. With slight modifications, this safety feature can be adapted to other makes and styles of rolls.

The heart of the mechanism is the limit switch installed above the trip bar at the center of the roll. The "up", or normal, position of the lever on the limit switch has the upper contacts closed and the lower contacts open. In the "up" position, the contacts are in series with the "stop" button on the magnetic switch for the motor. On the "down" position, the contacts are in parallel with the "down" button for the solenoid operated 4-way valve which operates the end cap.

The safety trip bar has spring plungers below and stop bars above to balance the weight of the bar and to prevent vibration

from tripping it. When a foot is placed on the bar, anywhere along its length, the top contact of the limit switch is broken which breaks contact on the motor starter holding coil and stops the motor. As the bar goes on down, the bottom contact of the limit switch is closed and the solenoid on the 4-way air valve is energized, allowing air to flow to one side of the air cylinder. This forces the end cap from the roll, and in turn through a rod linkage also raises the top roll.

The solenoids for the 4-way valve, which operates the end cap cylinder, are normally controlled by two push button stations, one at each end of the roll. After the safety trip has been operated, it is necessary to push the "up" button at one of the two stations to close the end cap or the roll. Then the "start" button can be pressed to close the magnetic starter circuit and start the roll motor.

The approximate cost of this installation is $125 material and $125 labor.

If additional information is desired, contact Clifford Holt, Butler Manufacturing Company, 7400 East 13th Street, Kansas City 26, Missouri.

LOW VOLTAGE SHOCK HAZARDS

By T. W. McCREADIE
Div. Staff, Liberty Mutual Insurance Co., Chicago

If I were to say that high-tension electricity deserves the utmost respect, there would be no disagreement with the statement. Let's review some of the factors involved in the injuries and fatalities from voltage less than 440 volts which is usually called low voltage and see if some of this respect cannot be extended from the high to the lower voltages.

To illustrate my first point concerning the hazards of electric shock from low voltage electricity, I'd like to review two accidents involving electricity which were written in the daily paper a short time ago.

The first case involves a girl who had a habit of listening to the radio rather constantly and had even formed the habit of carrying the radio into the bathroom. The reconstruction of the accident estimated that the radio was on the side of the bath tub and accidentally fell in the tub and the girl grabbed hold of it to lift it out receiving a fatal shock from the standard house current.

Let's move on to another newspaper item. This concerns a Charles Brown, lineman for an eastern utility, who had been working on a de-energized 66,000 volt line, using ground chain and all standard precautions. At end of job he removed the chain just as the line was energized and received severe burns of hand arm and neck through his leather jacket. He was thrown clear, he came to, drove his car 6 miles to a hospital and then spent 6 months in the hospital recovering from his burns.

Why did Charles Brown live through an attack by 66,000 volts while the girl taking a bath and many others you have read about in the newspapers die with ordinary house current of 120 volts?

The difference between the two incidents is contact. By the law of electric circuits called Ohm's Law, current equals voltage over resistance. To rephrase this law as it might apply to a shock condition we can write this law as follows: Current through body varies directly with the voltage applied to body and the resistance of that body. Resistance in turn is dependent upon amount and condition of body contact.

$$\text{Current through body} = \frac{\text{Voltage applied to body}}{\text{Resistance of body and contact}}$$

By means of an illuminated meter and electrodes I will illustrate this principle.

If you will watch the movement of the needle on the meter you will see how much current flows through my body under different contact conditions although the voltage in the circuit is consistent throughout, 90 volts. You notice that when I touch the two contacts together the needle swings to about 100.

Now as I gingerly hold these contacts with the fingers of each hand you will notice that there is a movement on the needle but it is not very high. As I contact more of each hand onto the electrodes you will notice that there is an increased amount of flow and as I grip the electrodes tightly with each hand I get rather closely to the direct contact reading that we had initially.

What have I been doing? The voltage has been constant, there has been no change in the internal resistance in my body and this highly variable shock current has been produced merely by changes in the contact resistance.

We can now see why low voltage shock varies so much from a trifling tingle to a severe jolt and sometimes to a lethal dose of electricity depending upon how poor or how good the contact resistance is that connects us to the circuit.

Take a situation in your own home. Under what conditions are you likely to be making good connection to ground and at the same time a good contact to some defective electrical device? Your basement is a somewhat dangerous place because basements are damp, but of all places your bathroom is the most dangerous.

If you get into a tub of water you have a very large area of wet contact with ground through the water in the tub and piping eventually leading to the earth. If you handle any portable electrical device whatever, whether it be a defective curling iron or a defective portable heater or a defective motor-driven device or a radio that had fallen into the tub you may touch a part that has become charged and your resistance of the body and its contact will be extraordinarily low. You will get a correspondingly severe shock to your body.

Now to illustrate to you how accidental electric shocks may occur through use of common electrical devices we have what I will call a Robot. This Robot is an associate in a uniform, on which are fastened strings of small lamps. These lamps will show how the flow of electricity would pass through his body when handling defective devices. You may be sure however that we carefully insulate both of his hands and both of his feet from the contact in this demonstration.

These wands that I hold are now connected into the circuit supplied by the lighting system of this building. The most common form of contact is hand to hand, across one arm crossing near the heart and down the other arm. Again, the current may enter by the right arm, travel down the whole torso and leave by the right leg, or could cross over and leave by the left leg.

Now the Robot stands on two strips of metal, one foot on each and the wands are touched to the strips. Now this goes up one leg and into the torso and down the other leg and out. This is the type of shock received by a man stepping from the running rail to the third or live rail of a rapid transit system.

Now the Robot has both feet on a metal strip that represents a wet floor or ground outdoors and his right hand grasps a wand the other wand being moved down to the metal strip. Note this carefully as it is the most common way in which people get electric shocks. Standing on the ground they take hold of some electrical device that is defective and receive a charge in this manner. As you see, the current comes in through the hand and the current flows down the torso and slips into two branches, one going down each leg to each foot to ground. You will note that the lamps on the arm burn more brightly than those on the two legs.

The question of how electricity kills is one to be answered more properly by the medical profession, however, there seem to be basically two causes paralysis of the respiratory center and fibrillation of the heart muscles. The paralysis of the respiratory center has probably been well proven by the many instances of successful artificial resuscitation. This is a situation in which manual movement has overcome the paralysis of the respiratory center.

The situation in fibrillation is that when the stimulus given heart muscles by the electric current the heart is caused to flutter and operates so rapidly that it cannot perform its normal function and death follows very shortly. There have been instances of laboratory control, I am told, when the application of an equal and opposite electric

that the tong jaws are replacable in case they are bent or broken.

At regular intervals a quality control man takes a crankshaft from the restrike for a routine check, after which it goes back on the cooling line if the check shows no flaws.

From the cooling line the forging is transferred to the heat treat line, where employees wear steel foot-guards.

Three sets of gas-fired furnaces process the forging through hardening and stress-relieving cycles. Each furnace is controlled by pyrometers and guarded by safety valves, which close on gas, combustion air, electrical failure, etc.

After passing through the hardening furnace, the forging is quenched in water. At this point a crankshaft is removed for a hardness test by a quality control man. Records are kept of the readings.

From the hardening furnace, the forging moves into the stress-relieving furnace, after which a sample is taken for another test.

The forging is taken from the conveyor after stress relieving, and placed on a conveyor, where it is transported to a wheelabrator for removal of scale.

Our sample forging is now centered, and marked for a location point for the engine plant who will machine it. The operator stamps an identification mark on the crank which makes him responsible for the work done on the locating spot.

The crank is now checked again by placing it in a fixture equipped with a dividing head. This check completes the inspection of the crank except for a visual check just before the loaded container is shipped to the machining plant where the engine is made.

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