281

C.I. 76 1314 - 76 1315

COPY

Volume 9

1976

Electronic & Electrical Equipment

national safety congress transactions

1975

NATIONAL SAFETY COUNCIL
425 N. MICHIGAN AVE.
CHICAGO, ILL. 60611

PLAINTIFF'S EXHIBIT
NSC-284

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago, Illinois 60611

76 1314

Electronic & Electrical Equipment Sessions

MACHINE GUARDING AND NOISE REDUCTION

By FRED STEARNS
Safety Director, Material & Electrical Products Group,
Texas Instruments, Inc., Attleboro, MA

Machine guarding and noise reduction have always been important factors in our machine design and mechanization activity over the past 60 years of operation in Attleboro. Events within the past 10 years—more specifically, activities since the adoption of the OSHAct in 70-71—have resulted in greater visibility and higher priority being given to the proper guarding for all types of machinery. Emphasis has also been given to better control of noisy operations. Much of our machinery and equipment is custom made, a large percentage in-house, and standard hardware which is purchased usually has to be modified to fit the ultimate demands. This calls for self-developed and applied machine-guarding techniques, including machine design concepts to control noise levels within acceptable limits.

Texas Instruments' Materials and Electrical Products Group, as the name implies, consists of two basic businesses. The materials business is built around a proprietary bonding or laminating of precious and semi-precious metals process, offering original equipment manufacturers combinations of metals in wire, sheet, strip, and a multitude of formed parts. These materials give the designer improved functional and cost savings properties for application in many industries, including automotive, electrical machinery, controls, even the home building trade. The sandwich type coins, quarters, dimes, half dollars, which you have in your pocket may have been laminated by this process.

The electrical products business uses, whenever possible and economically feasible, bimetal, terminals, and other electrical current carrying parts produced by the Materials Division in the design of their line of electro-mechanical controls for motors, appliances, automobiles, as well as precision control applications on aircraft and space craft. Many of the light assembly and calibration operations involved in the electrical products activity are highly mechanized and automated. This custom equipment can involve sophisticated guarding.

Servicing these two divisions are a host of secondary or common fabricating activities, such as chemical plating, cleaning, and refining operations, as well as molding, screw machine, grinding, and material handling mechanisms.

Truly, there is at least one piece of equipment at the Texas Instruments Attleboro facility which each of you can identify with. Guarding problems include pinch and nip points in conventional fabricating machines such as welders and riveters, as well as heavy presses and rolling mills. Noise is generated by many sources, most common being vibrations including high frequency assembly and staking operations. Air feeds can be extremely annoying and ultimately damaging to the human hearing. For purposes of sharing our experiences, we will present and comment on a series of mechanical guarding applications. In selecting a variety of situations, we have included the conventional, the unique, the "impossible," and several problem areas where we feel better solutions must be found. We will include the selection of a sound-absorbing material for application in a press enclosure. This material should be non-porous, so it will not soak up oil. It must not support combustion and the enclosure must be temperature controlled to comply with Factory Mutual Fire Insurance standards.

Approach to the Problem

Any solution to a machine guarding and noise reduction need must satisfy the Texas Instruments Corporation's uni-

form code of safety standards for a safe workplace. It must comply with OSHA standards in detail. If you have experienced an OSHA inspection, you know that the compliance officer is the expert in the interpretation of these standards. Finally, you must come up with a practical approach, one that will not result in a more dangerous situation because of complications and misunderstanding of the guarding by the user.

The user or operator of the machine is most important, and Texas Instruments' approach is one of maximizing the involvement of the operator. The responsible individual starts with a job safety analysis (JSA), discussing with the operator what he is doing and how he is doing it. During the procedure, emphasis must be placed on making the job not only safer but also easier. The best motivation for both the employer and employee is cost savings and more pay. The ideal guarding solution is an easier way at less cost!

The design approach can involve the routine as well as the exotic in applying the fundamentals of nip and pinch point guarding to specific needs. More about this later.

Check out the design with the operator as you progress toward a solution. His ideas can be invaluable. Involve the operator in the installation and tryout of your solution. Let him get experience with the arrangement before wrapping up the design, installation, and signoff by all designated employees.

Finally, check back with the operator. Follow up on his performance and results. He may be most enthusiastic with the installation, which could lead to a 50 per cent increase in production. However, when the window surface starts fogging up and he can't see the work, he has trouble jogging the machine to get parts for inspection, or a mechanism sticks, the operator's enthusiasm wanes, and guards may be overridden in the resultant frustration.

Organization

Because of the importance of team effort in our guarding and noise abatement programs, Texas Instruments' standard procedures call out specific responsibilities involved in achieving safety compliance on all capital equipment, including power presses. We establish safety and OSHA compliance specialists who, working with the Safety Department, have the responsibility for the understanding and interpretation of specific OSHA standards and the application of these standards to all equipment developed in house or purchased outside. Each standard, such as Hazardous Materials, Machinery & Machine Guarding, Electrical, has its expert working with and advising the rest of the team.

The operating managers establish the need, specify the actions based on established guidelines and recommendations of the safety and OSHA compliance specialists, and see that action is satisfactorily completed and approved. This responsibility includes maintenance of the approved installation, and suitable provisions for a review of any changes made in the equipment design and operation which could effect safety and might necessitate redesign of the equipment guarding.

Engineering (which at Texas Instruments can include equipment, facilities, manufacturing, and tool and design, as they may be involved in a specific situation) design, specify, and participate with Purchasing in the make or buy decision. All requests for capital equipment, new or modified, are monitored as to OSHA compliance. Each capital appropriations request must be accompanied by documentation indicating compliance has been considered.

Finally, all equipment, new, modified, or relocated, must be signed off by engineering, safety, and operating management as to compliance before it is released for production. The operating department managers are responsible for proper training in equipment operation and the follow-up to determine that the equipment is operating properly in line with design expectations.

Examples of Machine Guarding and Noise Abatement

Here are some examples. We have selected a variety of situations to explain to you. Some are conventional, some unique and exotic, some represent considerable design effort and expense, including mechanical and electrical, and even consideration of heating and flammability.

As noted above, a variety of skilled specialists as well as management and safety personnel are involved—and always the operator. We are including several areas where we need help—we feel there are much better solutions which many of you may be involved in.

Centrifuge and Spin Dryers. Centrifuges are used in screw machine departments for separating oil from chips prior to salvage, and spin dryers are used in plating for drying purposes. The supplier of such equipment is able to furnish a complete package of brake and interlock. The interlock controls the motion in that the cover cannot be opened until the basket stops rotating. It is not just an electrical power disconnect. The applicable OSHA standard states that the basket cannot revolve unless the guard enclosure is in place. This standard applies to any revolving equipment, for example, tumbling machines. The guard must be in place before the machine will operate.

Box Stapler. After being cited by OSHA for not guarding box staplers, we checked with the manufacturer and found out that they felt the "work" protected the hands and no guard was necessary. They cited a court case involving meat cutting. Our compliance officer would not accept this, claiming the box could be held in a dangerous manner. Our stapling machines must be mechanically guarded. The guard we came up with is spring loaded so that it rests on the surface of the box to be stapled. While analyzing the problem, we noticed that the foot switch mechanically tripped a clutch, with the result that when the starting switch was flipped, the stapler would automatically go through the complete cycle without the foot switch being depressed, a very dangerous situation. We provided a guard over the foot switch, so that it cannot accidentally be tripped, and a light in the electrical circuit to show that the machine is energized.

Gears, Chains and Sprockets, Crank Shafts, Horizontal Shafts. Chain and sprocket guarding can be custom designed and installed on large processing equipment. A sheet metal shop can economically turn out a variety of easily installed enclosures.

Load and Feed. In solving the guarding of a critical crimping and riveting operation, the resultant design more than doubled the production and measureably improved the quality of the work. The operator loads the parts on the fixture and then feeds the fixture into the fastening mechanism, triggering the head and holding the work. As the fixture is pulled out for reloading, the finished assembly is automatically ejected. The hands cannot get into the pinch point, and the operator is shielded from material particles that may be generated during the operation.

Press Guarding Program. There are literally hundreds of presses of all types and sizes on the Texas Instruments Attleboro facility that must be mechanically guarded. More than 200 generate noise over 90 dBA for unacceptable lengths of time. While great progress has been made, we are still developing more sophisticated equipment to meet existing and anticipated standards. The following will describe several generations of design efforts.

The first generation is the conventional wire screen approach, with clear plastic surface door for visibility and with electrical interlocks. There are several high-impact clear plastic materials that have suitable properties for guard design; however, proper cleaning methods must be used. Solvents cannot be used. They will cloud up the surface so that the operator cannot properly observe the work. Detergent type soaps are satisfactory. Depending on the nature of the contaminant, some experimentation may be needed.

In developing the second generation, we went to solid material such as sheet metal and used more clear surfaces so that the parts of the machine as well as the work could easily be observed. Problems encountered included cleaning the clear surfaces and selection of non-absorbant materials due to the presence of oil. Only the moving parts of the mechanism were enclosed. Some enclosures had to be ventilated because of heat generated within.

Outside suppliers of enclosures became involved in the third generation of designs. After trying several we found the lack of flexibility for the great variety of situations we were faced with more than offset any economical advantages. Since we had decided to build complete enclosures for both mechanical guarding and

to reduce accidents. In 1972, the frequency rate of LTA's for the Group was running about 13 accidents/million manhours. Today we are at a rate of 4.7 accidents/million manhours.

In 1972, the frequency rate of all compensable accidents was 46.3 accidents/million manhours. Today we are running at a rate of 23.1 accidents/million manhours.

Severity rate for LTA was 289.3 days lost/million manhours at the end of 1972. Through June 1975, severity is running at the rate of 58.8 days/lost million manhours.

In conclusion, we believe our program of machine guarding and noise reduction is paying off in terms of reduced accidents, better employee morale, and good standing with OSHA. Last, but not least, our operations are more profitable due to less cost of injury and employee absenteeism, and our efforts to make the job easier as well as safer contribute significantly to a lower cost product.

We are happy to share our experiences with you and look forward to receiving inputs from any of you as to how we might do a better job.

OFFICERS OF THE 76 1315

ELECTRONIC & ELECTRICAL EQUIPMENT SECTION

NATIONAL SAFETY COUNCIL 1975-76

General Chairman—HOWARD A. SEEGER, Specialist, Accident Prev. & Safety, Lamp Division, General Electric Co., Cleveland, OH

Vice Chairman—JAMES M. FERRON, Electrical Engineer—KAD, Eastman Kodak Co., Rochester, NY

Secretary—FRANK CAMILLO, Safety Director, Western Electric Co., Reading, PA

Education and Training Chairman—RICHARD S. WHIPPLE, Safety Advisor, IBM Corporation, Hopewell Junction, NY

Research and Engineering Chairman—JAMES O. HERMAN, Mgr., Plant Personnel, General Motors Corp., Warren, OH

Newsletter Chairman—RONALD J. GIES, Manager—Safety, A. B. Dick Company, Niles, IL

Membership Chairman—MEL WHITTINGTON, Mgr., Accident Prevention, Westinghouse Electric Corp., Philadelphia, PA

Program Chairman—ARTHUR F. CICHY, Proj. Manager, Tele-Communications, Fenwal, Inc., Ashland, MA

Nominating Chairman—GEORGE H. POPE, Managing Engineer, Underwriters Laboratories Inc., Northbrook, IL

Section Administrator—CHARLES PRICE, National Safety Council, 425 N. Michigan Avenue, Chicago, IL

Committee Members—WALTER W. BAESE, Manager, Safety, Xerox Corporation, Webster, NY; JACK CONWAY, Group Safety Engineer, GTE Sylvania, Inc., Seneca Falls, NY; G. C. HAYNES, Safety Supervisor, Western Electric Co., Inc., Winston-Salem, NC; JUNE HEYER, Safety Engineer, A. B. Dick Company, Niles, IL; CHARLES E. KOEGLER, Nat'l. Sales Manager, Pyrotronics, Inc., Harrison, NY; L. E. LEFEHR, Executive Vice Pres., Int'l. Association of Electrical Inspectors, Park Ridge, IL; B. R. LUNSFORD, Dir., Job Training and Safety, Electric Power Ass'ns. of Mississippi, Jackson, MS; ROBERT MAHON, Liaison OSHA/NIOSH, U. S. Dept. of Labor, OSHA, Cincinnati, OH; MYRON L. MILLER, Westinghouse Electric (Retired), Trafford, PA; H. A. PERKINS, Western Electric (Retired), Cockeysville, MD; RICHARD PERSOFF, Tech. Consultant, The Hartford Ins. Co., San Francisco, CA; ALAN REED, Corp. Dir. of Ind. Rels., Daniel Woodhead Co., Northbrook, IL; B. B. TURNEY, Corp. Safety Director, Texas Instruments Inc., Dallas, TX; WILLIAM F. VOLZ, Safety Manager, Motorola, Inc., Phoenix, AZ; C. WM. WALTERS, Loss Prevention Mgr., G.T.E. Automatic Electric Company, Northlake, IL; LAWRENCE E. ZEPERNICK, Dir. of Loss Prevention, Norton Simon, Inc., New York, NY; CLARENCE DUNSING, Safety Director, Multigraphics Div. of A-M Corporation, Mt. Prospect, IL

ORDER FORM 1975 CONGRESS TRANSACTIONS

Quantity Ordered	Stock Number	Vol. No.	Title	1-9 Copies	10 or More
	022.16	1-28	**COMPLETE SET OF 28 VOLUMES:**		$18.50
	022.27-1	1	General Sessions	$1.20	$.95
	022.27-2	2	Aerospace; Air Transport	1.20	.95
	022.27-3	3	Automotive, Tooling, Metalworking and Associated Industries; Power Press & Forging	1.20	.95
	022.27-4	4	Cement, Quarry & Mineral Aggregates	.70	.64
	022.27-5	5	Chemical; Fertilizer; Research & Development	1.20	.95
	022.27-6	6	Civic Leadership; Church, Women, Youth, Farm	1.20	.95
	022.27-7	7	Coal Mining	1.20	.95
	022.27-8	8	Construction; Public Employee	1.58	1.39
	022.27-9	9	Electronic & Electrical Equipment	.70	.64
	022.27-10	10	Food & Beverage; Meat & Leather Industries; Trades & Services	1.20	.95
	022.27-11	11	Glass & Ceramics; Rubber & Plastics	1.20	.95
	022.27-12	12	Industrial Subject Sessions; Associations	1.58	1.39
	022.27-13	13	Labor	1.20	.95
	022.27-14	14	Marine	1.20	.95
	022.27-15	15	Metals	.70	.64
	022.27-16	16	Mining	1.20	.95
	022.27-17	17	Motor Transportation	1.20	.95
	022.27-18	18	Occupational Health Nursing; Hospitals	.70	.64
	022.27-19	19	Petroleum	1.20	.95
	022.27-20	20	Public Utilities	1.20	.95
	022.27-21	21	Pulp & Paper; Printing & Publishing	1.20	.95
	022.27-22	22	Railroad	.70	.64
	022.27-23	23	School & College	1.58	1.39
	022.27-24	24	Traffic; Driver Improvement	1.20	.95
	022.27-25	25	Wood Products; Textiles	1.20	.95
	022.27-26	26	Early Morning Sessions	.70	.64
	022.27-27	27	Public Safety	1.20	.95
	022.27-28	28	Home Safety	1.20	.95

Automatic 20% discount to NSC members, or 8% to U.S. federal government agencies, if paid within 30 days. Government please attach purchase order. Payment must accompany orders of $5.00 net or less. Shipped F.O.B. Chicago.

SHIP TO:

organization_____

address_____

city_____ state_____ zip_____

attention_____

NSC member #_____ SIC #_____

BILL TO:

organization_____

address_____

city_____ state_____ zip_____

attention_____

telephone #_____

MAIL TO: NATIONAL SAFETY COUNCIL
425 N. Michigan Ave. / Chicago, Illinois 60611

3M476-61 Printed in U.S.A. 022.27-9

noise reduction, we needed more research in suitable materials and sound deadening or absorbing properties, and in-house efforts proved more effective.

Presently, the fourth generation is a fairly sophisticated combination of mechanical guarding, electrical control, and noise reduction. The press is completely enclosed with sections of a sound absorbing, minimum porosity material consisting of a foam/lead sandwich made up of ½-inch foam, 16 oz. lead, ½-in foam, and Tedlor film one-inch thick. These sections are bolted together for easy disassembly.

All services are built onto one panel for the most flexibility in servicing the mechanical as well as electrical. Flexible couplings are incorporated on control connections so that the complete control box can be easily moved and laid on the floor for servicing.

The window area is minimized to view the work only. Two sheets of clear plastic with a ¾-inch dead air space between are used to complete the sound enclosure.

The enclosure must be vented and is equipped with a temperature control for shutdown in the event of overheating. Factory Mutual asked for sprinklers to be installed until we convinced them of the non-flammability of the materials used and the purpose of the temperature control. All parts are interchangeable wherever possible so that standard modules can be utilized for specific types of presses. The sound enclosure is most effective in reducing noise as heard by the operator servicing the machine over eight hours, from over 100 dBA to 78 dBA (time weighted).

The electrical control panels are so located that the dies can be removed through the door openings without disturbing the electrical wiring. A key selector switch is provided for continuous run, single stroke, and jogging or inching modes. The continuous run calls for two consecutive operations. First, the operator must depress the arming button and then, within a preset time limit (approximately three seconds), push two run buttons simultaneously. One cannot push the arming button and then come back sometime later and start with two run buttons only. The single stroke mode is accomplished by simultaneously pushing two hand buttons. During the single stroke and inching or jogging modes, the doors can be left open. The two hand run buttons are located so that the operator's hands cannot get into the die. The job mode goes as long as the two hands are pushing on the buttons (can do with doors open); however, the machine stops when hands are removed even though the cycle has not been completed. All electrical equipment is in line with NEMA and OSHA standards for the applications.

Complicated Moving Mechanisms. Experience has shown that it is generally most economical and effective to cover the entire mechanism when guarding complex moving parts in automated equipment. Use a clear material with high impact properties for the enclosure so the operator can see any malfunction. Each moveable section must be interlocked to prevent access to pinch or nip points created by the moving parts. The operator is trained and expected to manually shutdown the machine before opening the enclosure for any reason; however, there is always the occasion when it appears easier to correct a malfunction without stopping the work. The purpose of the enclosure is to prevent getting pinched from any cause.

Tool Room Lathes. There is much controversy over just how sophisticated or flexible guarding for this type of operation must be. A hinged chuck guard is relatively flexible, inexpensive, and easy to use. Chip guards can be made most flexible by utilizing magnetic bases. Often chips collect on the magnet, interfering with the work. They are difficult to remove. Look for a permanent mounting means on the machine and achieve the necessary flexibility by bending and hinging. Flexing brackets and a variety of clear shields can be assembled and located based on the needs of the particular job and cut. Considerable training in safety awareness and sensitivity may be desirable to convince an experienced machinist that certain guarding approaches are in his best interest and do not hamper his ability to get the job done in a reasonable time and the best quality.

Wire Cutting Machines. We have a great variety of wire cutters, crimpers, and welders which present a host of fundamental guarding problems. Many have

open arms, linkages and numerous nip points which must be isolated from the operator. Again, the most economical approach is to completely enclose, and this is usually applicable on automatic equipment. Manual fed operations can present complications, and often compromises result. Be sure the operator is totally involved.

Two Hand Button Operation. Riveting and welding operations, properly fixtured, can be energized by two hand buttons hit simultaneously. The location and guarding of the buttons must be such that it is impossible for the operator to get her hands into the nip point before completion of the cycle. Usually this means guards around the button so one has to push directly in with the top of the finger and cannot use the hand, arm, elbow to "beat the machine." Spark guards on welders present a problem. We are not convinced we have the proper solution. Conditions such as location of the work, access to the work, location of the operator, and the characteristics of the sparks or chips themselves all play a part in the best solution for protection of the operator. Proper cleaning of the clear shield material can be critical in this application. We can use help in this area of endeavor.

Shear. Here is an excellent application for clear, high-impact plastic as a mechanical guard. Numerous metal shields have been used; however, holes had to be punched in the guard so the operator could see to properly locate the work. As the jobs changed, so did the holes, and shortly the metal guard became useless. The clear material solves this condition nicely.

Nip Point Guarding. Our rolling mills and associated equipment such as flatteners, slabbers, strippers, slitters, and abraders present numerous nip points. Ingoing nips are present on all the take-up operations. We have only begun to scratch the surface in coming up with practical and economical approaches. The conventional hinged wire guard represents the first generation, and there will be other development programs as experienced in our press guarding endeavors.

An example of a probe into the second generation is the abrader take-up pinch roll where, depending on the thickness of the material and the depth of the roll, you may or may not exceed maximum clearance for "no nip."

An OSHA Inspection

Two compliance officers spending one week in your plant can reveal some interesting situations. This happened to TI in Attleboro just one year ago. Our machine guarding and noise reduction programs were a real plus in establishing our intent to comply in these areas, as well as contributing integrity to our entire safety and health program. We were allowed maximum deductions in the final determination of fines by the area director for the violations which were cited by the officers.

The complete program, particularly the overall plan, schedule, and cost estimates including manpower and skills needed, were used in a presentation to the area director which resulted in vital extensions of abatement dates. We found the OSHA personnel in our area most helpful and reasonable to deal with.

It is interesting to note that all equipment that was not guarded or was improperly guarded was cited, even though we could show actual designs and plans for installation with scheduled dates. Obviously, this information was used in determining abatement dates. We have covered situations, notably the guarding of the stapler machine, where the compliance officer would not accept the theory of the work being the guard (because you must hold the work with both hands away from the nip point doesn't mean it is impossible to get caught). We were told to go back, sharpen our pencil, and find a way to guard this hazard.

The OSHA inspection added considerable more visibility to our safety endeavors throughout the entire organization, employee as well as employer. The entire safety program attained higher priorities in everyone's mind. The necessary funding for our entire machine guarding program to meet the agreed-upon compliance dates has been maintained in the face of severe economic conditions.

Accident Records

The objective of any safety program is

NOTES

plan now to attend the 1976 NATIONAL SAFETY CONGRESS & EXPOSITION

OCT. 18 - OCT. 21, 1976 / CONRAD HILTON HOTEL, CHICAGO

The Congress is always a big week, a worthwhile week, for the 16,000 safety people who attend.

At the '76 Congress you can meet other safety people with the same problems and responsibilities as yourself. You can exchange views and ideas on accident prevention, health, hygiene and fire prevention . . . on safety in industry, traffic, school, at home and on the farm.

You can see the largest of all safety equipment exhibits at the Congress . . . an opportunity for you to make well-informed buying decisions for your company.

This four-day educational program, planned and presented by the National Safety Council, can be your most thought-provoking, most worthwhile safety experience in 1976.

Make plans early to attend the 1976 Congress and bring the other people in your organization who have safety responsibilities.

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue • Chicago, Illinois 60611

National Safety Council

A Membership Organization Dedicated to Protecting Life and Promoting Health

March 21, 2001

Baron & Budd, P.C.
The Centrum
3102 Oak Lawn Avenue, Ste. 1100
Dallas, TX 75219-4281

To Whom It May Concern:

The attached records are kept and maintained in the regular course of business of the National Safety Council, and it is the regular course of business of the National Safety Council to keep and maintain the attached records.

The attached photocopied material is an authentic reproduction of an original file copy of :

NATIONAL SAFETY COUNCIL CONGRESS TRANSACTIONS 1975, VOLUMES 1-5, 7-13, 15, 16, 18-22.
National Safety Council, Chicago, IL.

Respectfully,

Robert J. Marecek

Robert J. Marecek
Manager, Library

Marilyn P. Pettersen

"OFFICIAL SEAL"
MARILYN P. PETTERSEN
Notary Public, State of Illinois
My Commission Expires 10/26/03

1121 Spring Lake Drive • Itasca, IL 60143-3201 • (630) 285-1121 • FAX (630) 285-1315 http://www.nsc.org

AIR BAG SAFETY CAMPAIGN AIR BAG SAFETY: BUCKLE EVERYONE! CHILDREN IN BACK!