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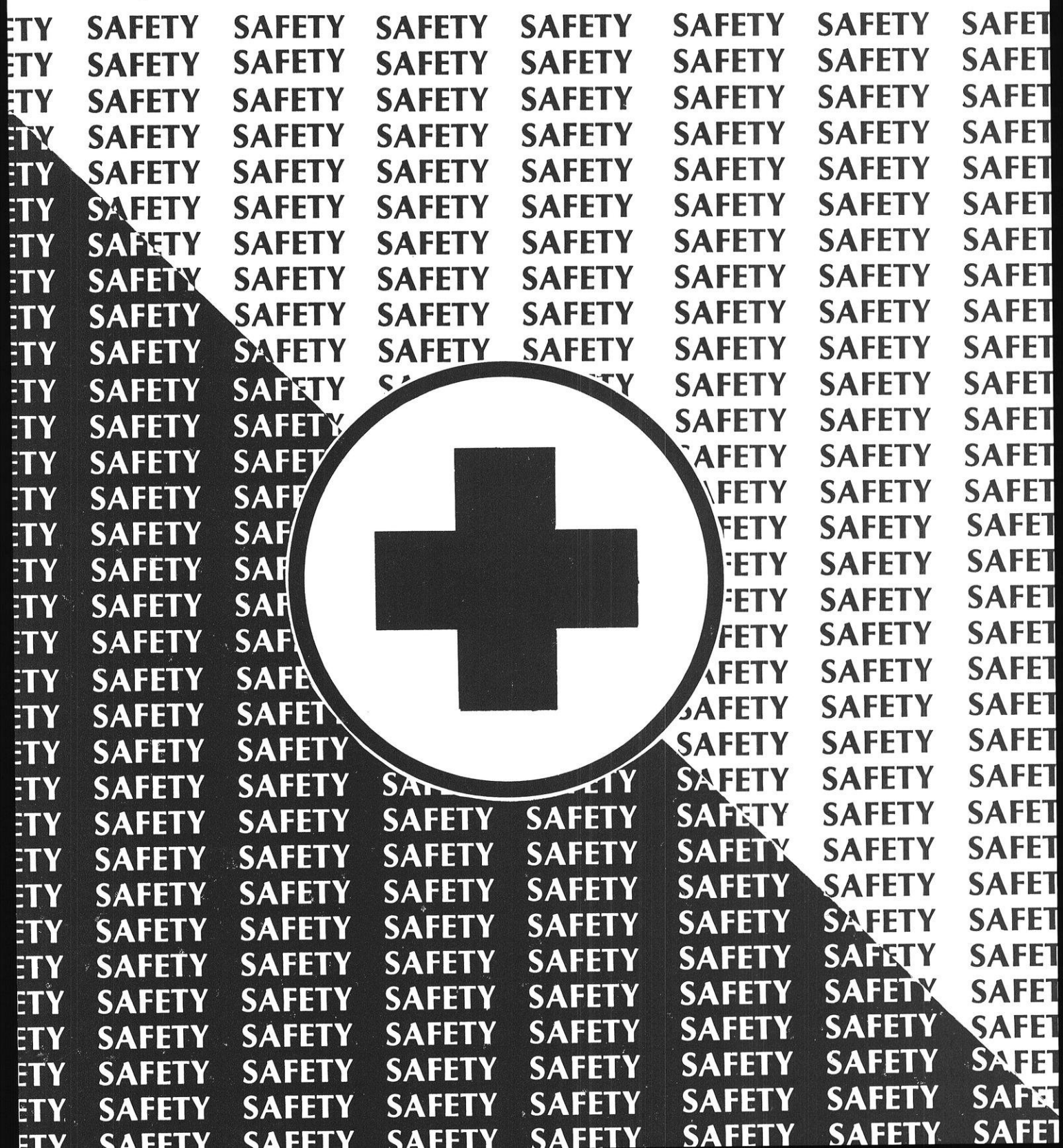
Engineering Safety Responsibility •Building Fire Safety •OSHA



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NICHOLAS MURRAY BUTLER

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Dean's Page

Concerned safety perspective needed for engineering

Dean

W. Robert

Marshall

The public is exposed and bombarded by the media concerning the hazards and risks they must cope with as a result of technological advances. There is some truth in the media's account of the dangers to the public from our technological society. However, the media fails to report the efforts being made by engineering and engineers to ensure that the public is protected from dangerous situations and conditions. Probably the most controversial area where safety is of principal concern is nuclear energy for power generation. The "facts" in this controversy are obscured by the actions of so-called intervenors and "protectors" of the public interest. These individuals and groups have become alarmists who frighten and mislead the public because of their ignorance and lack of education in scientific and engineering matters, and because, basically, they fear technology. This situation clearly presents a very grave challenge to engineering educators and engineering students.

Those of us engaged in engineering as a profession, and those who plan engineering as a profession, must be seriously concerned about the current public attitude toward technology. The sociotechnical problems which concern society—energy resources, safety and freedom from risk, environmental quality, urban development, mass transportation, adequate food supplies, etc.—require the attention of engineering more now than at any time in mankind's history. However, it seems that just the existence of these problems has turned society against engineering.

Engineering education in the remaining decades of the 20th Century must become more concerned with these problems. Fundamental principles to deal with these problems are being introduced into our engineering curricula. The College of Engineering-Madison is developing new courses and providing research opportunities in areas concerned with safety, product reliability, and safety analysis of systems.

Recent studies of nuclear power plant safety (the Rasmussen Report, Wash. 1400) reveal that the public's fears about the safety of nuclear power clearly may be unfounded. On the other hand, reports of the lethal carcinogenic effects of vinyl chloride could jeopardize a chemical industry of over 3 billion dollars a year and endanger the lives of thousands of people. Where does engineering stand in these areas of public safety? It is of the utmost importance that engineering education provide engineering students as well as non-engineering students with a proper perspective on risk, safety, and reliability of engineering products, processes, and systems which impact society and the public.

WE

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Engineering Safety Responsibility

by
Prof. Richard Moll

There once was a time when the safety engineer in a manufacturing plant was the person responsible for distributing safety glasses and safety shoes. His major concern was minimizing employee injuries. With the advent of consumerism and recent changes in products liability law, today's safety engineer is more likely to have considerable responsibility for the safety of the manufactured product. His job could range from coordinating the safety aspects of design, manufacturing and materials engineering to scrutinizing carefully the wording on warning labels, advertisements, and operational and instructional manuals. Let's examine some of the responsibilities and opportunities of a product safety engineer* necessitated by the recent changes in products liability law and the enacting of the Consumer Product Safety Act.

Products Liability Defined

Products liability is the name currently given to the area of case law involving the liability of sellers of chattels to third persons with whom they are not in privity of contract. It is generally a matter of negligence or strict liability.[1] More simply it is the liability of manufacturers for injuries incurred during the use of their products. *Privity of contract is the connection or relationship which exists between two or more contracting parties.*[2] Privity is important because early in the history of products liability law, it was difficult for a plaintiff to sue for injuries resulting from the normal use of a defective product. The courts at that time **(Winterbottom v. Wright,** 1842) established the requirement that there be a direct contract between the user of the product and the manufacturer. Lack of privity generally barred recovery. Today, privity is no longer required in the majority of states in negligence actions. This makes it possible for the injured party to bring suit against the manufacturer, distributors, packer, advertiser, wholesaler, retailer, or anyone connected with the sale of the defective product. Let's examine negligence and strict liability in more detail.

Negligence

Negligence is the omission to do something which a reasonable man, guided by those ordinary considerations which ordinarily regulate human affairs, would do, or the doing of something which a reasonable and prudent man would not do.[3] In other words, the seller of a product can be held liable for injuries resulting from improper design, inspection, testing or labeling. Today the seller (generally meaning anyone connected with the sale of the product) is liable for negligence in the manufacture or sale of a product which may reasonably be expected to be capable of inflicting substantial harm if it is defective. The prevailing interpretation of "defective" is that the product does not meet the reasonable expectations of the ordinary consumer as to its safety.[4]

Two areas which are of particular concern to manufacturers are the failure on their part to either design a safe product or the failure to properly warn of certain hazards resulting from the use of the product. Design negligence cases are generally predicated on one of the three theories:

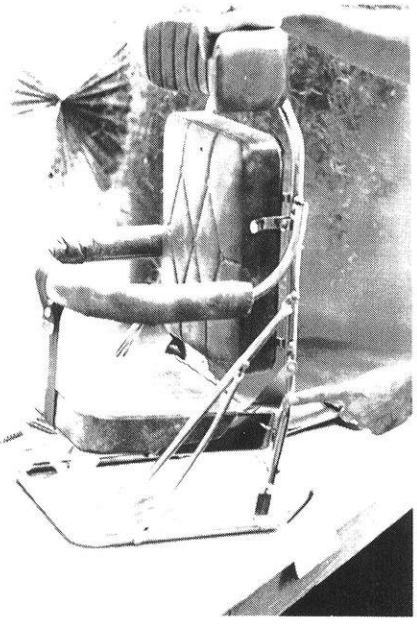
1. That a concealed danger has been created by the manufacturer's design.
2. That the manufacturer has failed to supply needed safety devices in designing the product.
3. That the design called for materials of inadequate strength or failed to comply with accepted standards to make the product fit for the purpose for which it was intended.[5]

To illustrate the state of products liability law involving negligence in design, let's look at the case of **Lindroth v. Walgreen Company,** a 1950 Illinois case involving a vaporizer which had overheated after the water had boiled away. It was alleged that the defendant negligently failed to incorporate in the vaporizer a safety cutoff switch which would have automatically stopped the flow of current, preventing the vaporizer from overheating and causing the fire. The judgement was found against both the manufacturer and the distributor for $65,000, based primarily on the fact that failure to include the automatic cutoff switch constituted negligence in design, making the vaporizer an inherently dangerous product.

There was a time when vaporizer manufacturers could produce and sell vaporizers that would vary in price, depending on the quality and the number of safety features. Today, this would be an unwise manufacturing procedure. Applying the rule of negligence stated previously, one can see why. It is reasonable, the courts say, to expect that a consumer, properly using a vaporizer without a safety cutoff switch over a long period of time, would at some time be faced with a situation in which he or she might fail to refill the vaporizer with water. A conscientious customer who might use the product over a period of ten years or more — and one day either over-sleeps, talks on

the telephone too long, is faced with an emergency situation, or any one of a number of instances in which failure to fill the vaporizer is understandable — can hardly be accused of negligence or misuse of the product. The courts are demanding this reasoning on the part of the manufacturer and holding him responsible for exercising these considerations. And case after case involving similar situations have resulted in a finding for the plaintiff.

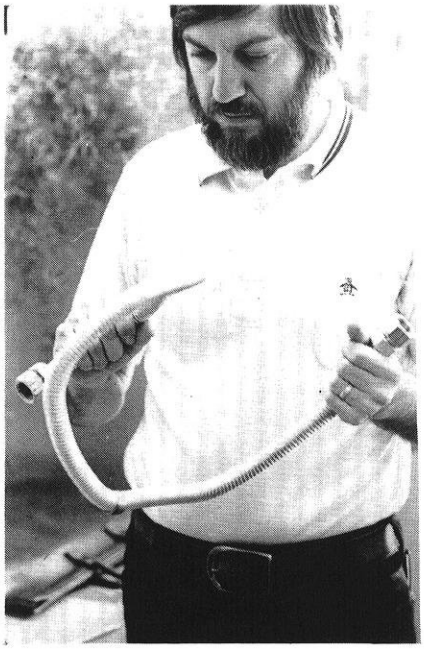
One of the more controversial issues involving negligence in design is in regard to the injuries sustained by occupants of an automobile crash in what is termed second-collision injuries. In this situation, the concern is whether the automobile manufacturer is responsible for making a car "crash worthy," that is, of such design that minimal injuries result in the event of an accident. Automobiles with gasoline tanks placed too close to the occupants, protruding ashtrays and knobs, convertible tops, and non-collapsible steering wheels are examples of controversial designs that can aggravate injuries in foreseeable accidents. The courts are not saying that automobile manufacturers should design armored tanks, just reasonably safe cars. Just what is reasonably safe is difficult to ascertain.



Mr. Dan Kapellan (B.S. in M.E., 1973 and M.S. 1974) and a number of other Mechanical Engineering students tested this car seat and found failure in a 15 mile per hour simulated car crash. *Consumer Reports* indicates that in a head-on crash at 30 miles per hour, a child in a similar car seat would probably be killed.

The other area involving negligence is the failure on the part of the manufacturer to warn of certain dangers in the use of his product. A recent Wisconsin case illustrates what is meant by failure to provide proper warnings. At the same time, it demonstrates why products liability lawsuits are resulting in such high awards. Just what is reasonably safe is difficult to acertain. In October 1973, a Brown County, Wisconsin circuit court jury awarded damages of more than $643,000 in a suit involving Saviour Canadeo, operator of the Canadeo Exterminating Company, and Dow Chemical Company. Canadeo, a former international Golden Gloves champion and brother of Green Bay Packer star Tony Canadeo, was exposed to Methyl Bromide gas while he was fumigating a boxcar in 1969. As a result of the exposure to this gas, Canadeo suffered brain damage and is now confined to a wheelchair. After twelve days of testimony, the jury deliberated six hours before reaching a decision finding for the plaintiff and establishing damages of $643,239. Why such a large amount? A breakdown of the award shows that $200,000 was awarded for past and future pain and suffering, $150,000 for impairment of future earning capacity, $115,000 for future medical expenses, $49,489 for past medical expenses, and $28,750 for past wage losses. The jury also awarded $100,000 to Canadeo's wife for loss of services and companionship.

The finding for the plaintiff resulted from the fact that Dow Chemical did not provide proper warnings explaining that a gas mask might not provide absolute protection when using a certain fumigant. The attorneys for Dow Chemical argued that the reason for this was that the fumigant used by Canadeo was designed for outdoor soil fumigation where no mask is needed, while another product with the same gas was designed for inside fumigation and carried the proper warnings. This case demonstrates why a number of consumer products tnat you are probably familiar with are now being sold with warnings. Hammers, chisels, punches and nails now have the warning "wear safety glasses before using." Automobile batteries now warn against smoking during recharging of the battery because the flammable gases being evolved may cause an explosion. Although the warnings to wear safety glasses when using hammers, chisels, punches and nails may not seem necessary, certainly the warnings regarding the evolution of explosive gases warn of more subtle dangers that many consumers may not have been aware of. Some warnings in the past have been inadequate, as illustrated by the case involving the sign "DANGER FLAMMABLE LIQUID" which appeared on a 250-gallon drum, but only on the lid. Once the lid was removed — yes you guessed it — some unsuspecting person came by with a lighted cigarette and really got lit!



Recently, a company sold a leak detecting solution containing ammonium which when used on this brass flexible gas connector severely corroded the hose. Mr. Dennis Donath, a consumer product safety investigator, said recently that at least two gas explosions were traced to this cause.

Professor Moll points to missing part of the bottom of an aluminum bat that one of his students investigated. Similar defective bats have caused a number of injuries.

Strict Liability

As if situations involving negligence in design and negligence in the failure to properly warn were not bad enough, a majority of courts have now adopted a new doctrine called strict liability in tort, in which the negligence of the manufacturer need not be proven. In the cause of action known as strict liability in tort, the plaintiff must prove the following:

1. That the product contained a defect and was unreasonably dangerous.
2. That the defect was in the control of the manufacturer or that it existed at the time the product left the defendant's hands.
3. That the defect was the cause of the injuries.

Under the doctrine of strict liability — one of the most recent highly controversial developments in the history of products liability — a manufacturer who might have been successfully producing a product by the hundreds of thousands or even millions for years without ever producing a defective product, could be held liable if one and only one such product reaches a consumer and causes serious injury. Under negligence theory, it would be reasonable to say that because of the past high quality control of the company, negligence was not the cause of the defect. Under the theory of strict liability, the fact that a defect was present and caused the plaintiff's injury is often enough to find for the plaintiff. The theory of strict liability in tort described in a book published by the American Law Institute entitled *Restatement of the Law Second Torts*, 2nd, Page 347-348, Section 402A describes Strict Liability in Tort as follows:

402A.**SPECIAL LIABILITY OF SELLER OF PRODUCT FOR PHYSICAL HARM TO USER OR CONSUMER**

(1) ONE WHO SELLS ANY PRODUCT IN A DEFECTIVE CONDITION UNREASONABLY DANGEROUS TO THE USER OR CONSUMER OR TO HIS PROPERTY IS SUBJECT TO LIABILITY FOR PHYSICAL HARM THEREBY CAUSED TO THE ULTIMATE USER OR CONSUMER, OR TO HIS PROPERTY, IF

(2) THE RULE STATED IN SUBSTATION (1) APPLIES ALTHOUGH,

(a) THE SELLER HAS EXERCISED ALL POSSIBLE CARE IN THE PREPARATION AND SALE OF HIS PRODUCT, AND

(b) THE USER OR CONSUMER HAS NOT BOUGHT THE PRODUCT FROM OR ENTERED INTO ANY CONTRACTUAL RELATION WITH THE SELLER.

The fact that proof of negligence is not essential to impose liability is a frightening prospect for most manufacturers, particularly those involved in the production of a large number of products, and particularly if they are consumer products.

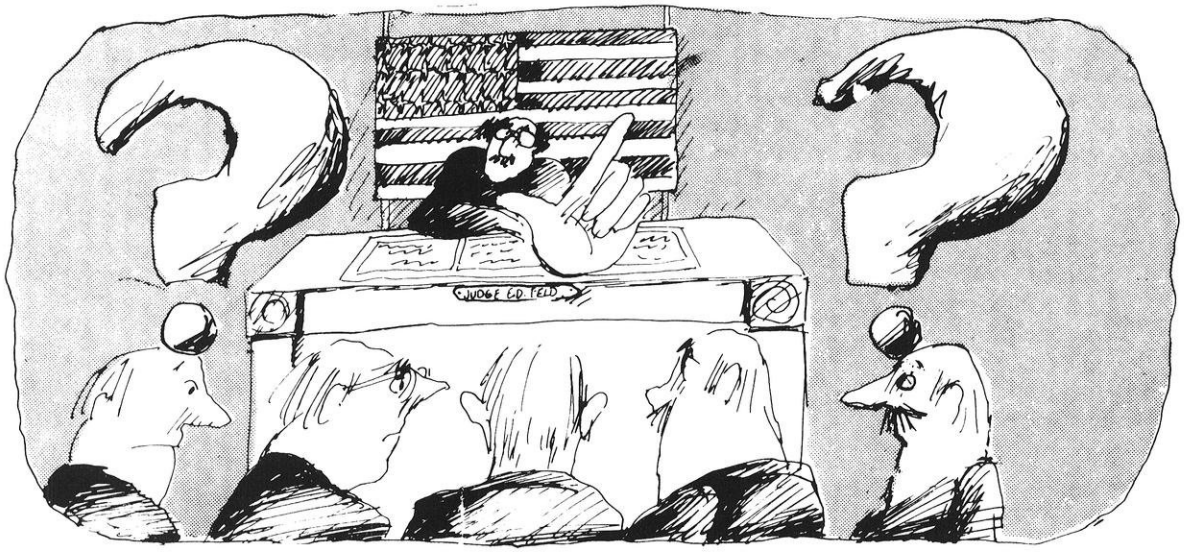
The significance of this doctrine, as far as engineers are concerned, is that although in many cases it is impossible to test every product, the engineer must weigh the chances of a defect causing serious injury against the cost of eliminating or minimizing defects in the product.

Products Liability Prevention

Let's consider some steps the product safety engineeer might use to minimize his company's products liability exposure. One step is known as establishing the risk criteria of the product. Here the product safety engineer would consider the risk or likelihood of his product causing serious injury. Is his company producing tissue paper or snowmobiles, ballpoint pens or snowblowers, furniture or lawn mowers? The higher the probability of a product causing serious injury, the more difficult his job will be to help design it as safely as possible and to provide all the proper warnings for its proper use.

products liability exposure and increasing product safety is to make sure that products conform to federal, state, and trade standards. While conformance to such standards may not preclude recovery by the plaintiff, not adhering to certain standards could be extremely damaging for the manufacturer.

The product safety engineer can insure that product safety is a primary consideration during all stages of product design. He can encourage the design engineer to help solve product safety problems peculiar to his company's product. One question the product safety engi-



neer should always ask of the designer is whether or not the design of the product could be changed in such a manner that the product does not fail catrastrophically when it wears out, thereby inflicting serious injury.

The product safety engineer, with his understanding of products liability, could encourage other engineers to participate in the writing of operational and instructional manuals, advertisements, and other information concerning the product. Inaccurate labels, wording on packages, sales literature, promotional materials, and manuals, as well as improper packaging, have been the cause of many products liability lawsuits. In all his work, the product safety engineer must always remember that manufacturers are not being asked to design and manufacture the best possible product, or even a better product than their competitors — just a reasonably safe one.

Enter the Consumer Product Safety Commission

The reason that I predict that product safety engineering will be of more and more interest to manufacturers is not only to help stem the tide of manufacturers products liability lawsuits but to conform to one of the newest pieces of consumer legislation, the Consumer Product Safety Act, signed into law in October 1972. Establishment of the act was primarily the result of a study by the National Commission on Product Safety, which determined that an estimated 20 million accidents occur each year involving the use of household and recreational products. Approximately 110,000 of these accidents resulted in hospitalization and an estimated 30,000 of them were fatal. Congress established the Consumer Products Safety Commission with the principal mission of protecting consumers against unreasonable risk associated with consumer products. The term *consumer products* covers almost every item found in the home or used in recreational activities except food, motor vehicles, tobacco, drugs, and a few products covered under other acts.

The Consumer Product Safety Commission has the power to ban products; require recalls, repairs, or repurchase; initiate the development of mandatory products standards; and impose civil penalties up to $500,000 and criminal penalties up to $50,000 and/or one year in jail for failure to comply with certain provisions of the act. Product safety engineers or coordinators can help a consumer product manufacturer comply with the act, and help reduce injuries resulting from the use of consumer products.

Summary

Many engineers, particularly those who have little perspective beyond engineering problems, feel that only lawyers really benefit from products liability lawsuits, and that the manufacturer is being burdened by the increased attention to product safety which will drive up the cost of products and simply be passed on to consumers. While this latter statement is an unfortunate fact, it is also a fact that presently manufacturers pay only a small percent of the cost of injuries resulting from the use of their products. According to Dr. Carl Clark,[6] approximately 89% of the public carries health insurance which covers a significant part of injury costs. Medicare and Medicaid, government support of hospitals, and income tax deductions cover another part, yet the injured family also suffers a significant part of injury costs in terms of reduced savings and reduced income. It is, therefore, a fact that if someone is injured we help pay perhaps half of the costs. The conclusion is that we all have an interest in making products as safe as possible. The product safety engineer will make this happen.

WE

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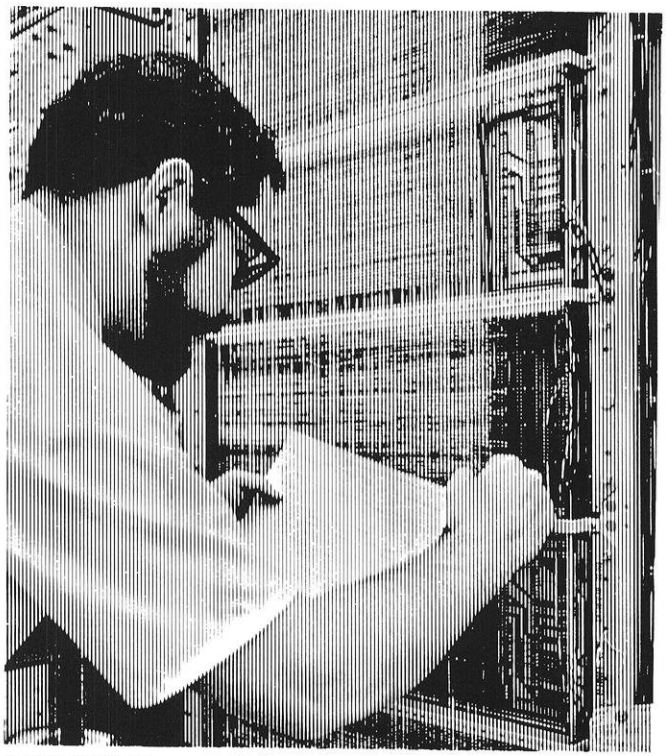

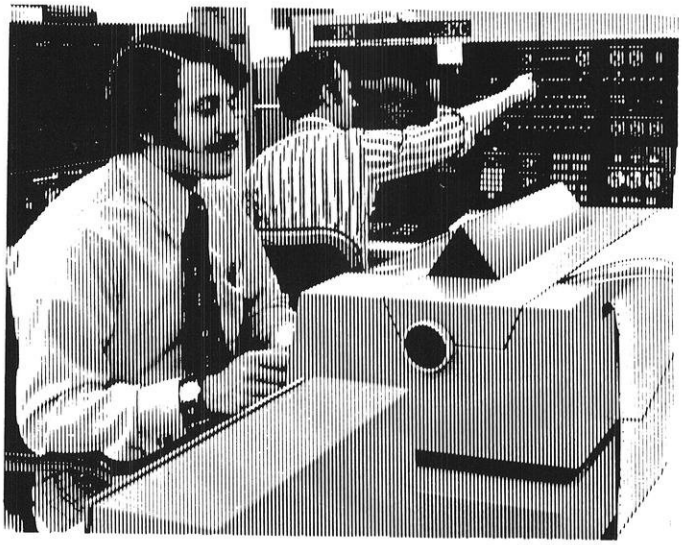

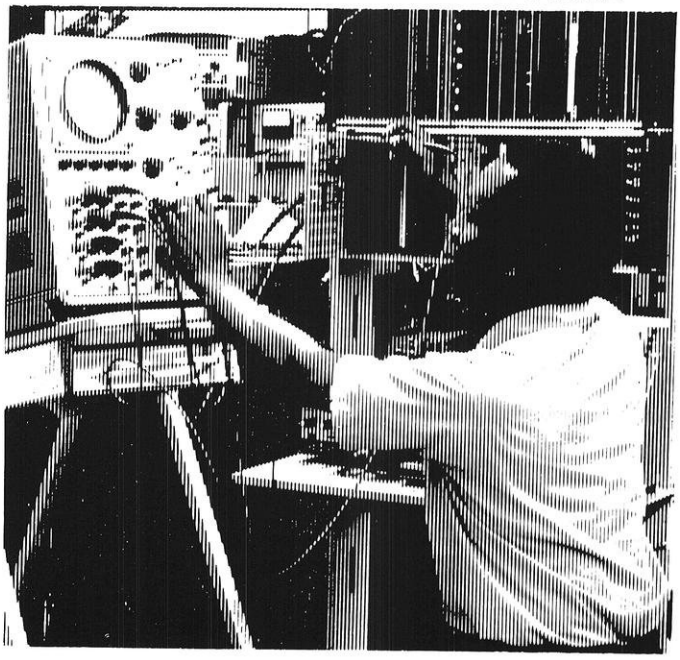

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Indifference causes fires . . .

Planning buildings for fire safety

by Chuck Kuehn of the Engineer Staff

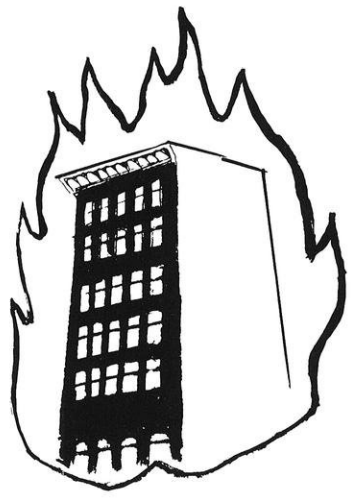
"Indifference . . . where it is least excusable," is the major cause of fires in this country. This opinion, along with some ninety recommendations are the result of the Report of the National Commission on Fire Prevention and Control. Commissioned in 1970 by Pres. Richard Nixon and completed two years later, the report came down hard on those involved in the architectural and engineering fields.

"Designers of buildings generally give minimal attention to fire safety in the buildings they design. They are content, as are their clients, to meet the minimal safety standards of the local building code. Often both assume that the codes provide completely adequate measures rather than minimal ones," the Commission said.

Larry Aaron, of Architects-Engineers Inc., a Madison firm, confessed that the Commission's claim is "usually true". "The problem" said Aaron, "is that you have a couple things to consider here. First of all, there are your clients needs and desires and secondly, there is the cost factor. If for example," said Aaron, "you were going to choose between a masonry and a stud construction and the stud construction was the cheaper route, you would choose that, despite the fact that masonry would provide better fire protection."

FOCUSING ON THE considerations designers must make, the Commission's aim is to unite the fire safety and cost factors involved in building, into what they call a "systems approach". "In a systems approach," the report states, "objectives are set for the building as a whole, and then the most cost effective technology is applied to meet those objectives. Relationships among components becomes important and trade-offs are sought. For example if an alarm and sprinkler system are installed, then fireproofing requirements may be reduced."

Aaron explained how just such a cooperative system could work with regards to the Wisconsin state building code.



"Exit requirements," he explained, "in an industrial building such as a factory demand that every room in the building be within 100 feet of a door. By installing a sprinkler system," said Aaron, "you can extend that beyond one hundred feet and thereby enlarge your building and maintain the same number of exits."

The Wisconsin state code is under the jurisdiction of the Wisconsin Administrative Code and the Rules of the Department of Industry, Labor and Human Relations. As is typical of most building codes, two-thirds to three-fourths of its provisions deal specifically with fire safety.

THE CODE STANDARDS, which require certain types of fire resistent materials to have hour ratings, are based on the type, size, use, and occupancy of the proposed buildings.

Laboratories for testing fire resistent building materials are located throughout the United States. Forest Products Laboratory in Madison is one such facility.

In their report, the national commission vigorously attacked the present system of standards being used, faulting both building designers who substitute materials and the laboratories that design the testing.

"When a designer uses a material in a way of knowing how or whether the fire safety characteristics are different" the report said.

Regarding testing procedures the Commission complained that the standards are "based on empirical knowledge rather than a fundamental understanding of the behavior of fire."

"THIS LACK OF theoretical and experimental underpinnings," the report continues, "contrasts sharply with such fields as mechanical and electrical engineering. In the latter field, for example, the effects of changing the diameter of a wire, or design of a circuit or the amount of current pushed through a system can be expressed as mathematical equations and predicted quite accurately. If such equations could be written to predict the effects of fire and its combustion products, then changes in a material or its use would lead to known changes in fire safety characteristics, without expensive testing. Further research is desperately needed" the report concluded.

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Frank DeCaria holds a BS-ChE
m West Virginia University. He's twenty-four
ars old and has worked at Du Pont's Old Hickory
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bass, bluegill, and carp. In addition, his work
s helped concentrate trace quantities of scarce
aterials to recoverable levels.

At the moment, Frank is a member
a team working to make the waste
eatment plant even more efficient.
1983, he expects that the BOD
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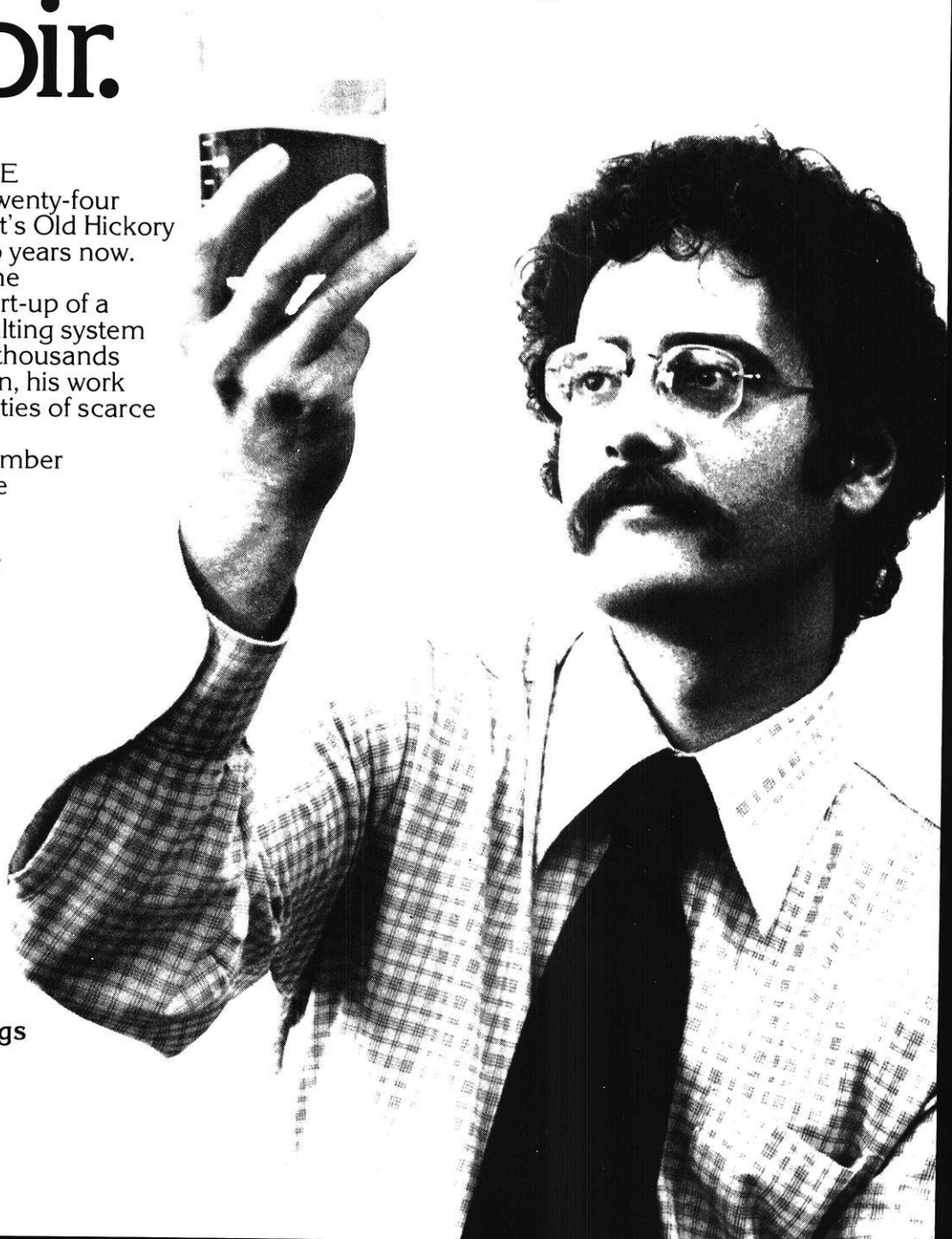

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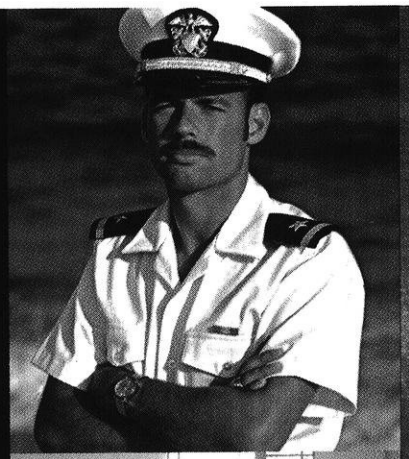

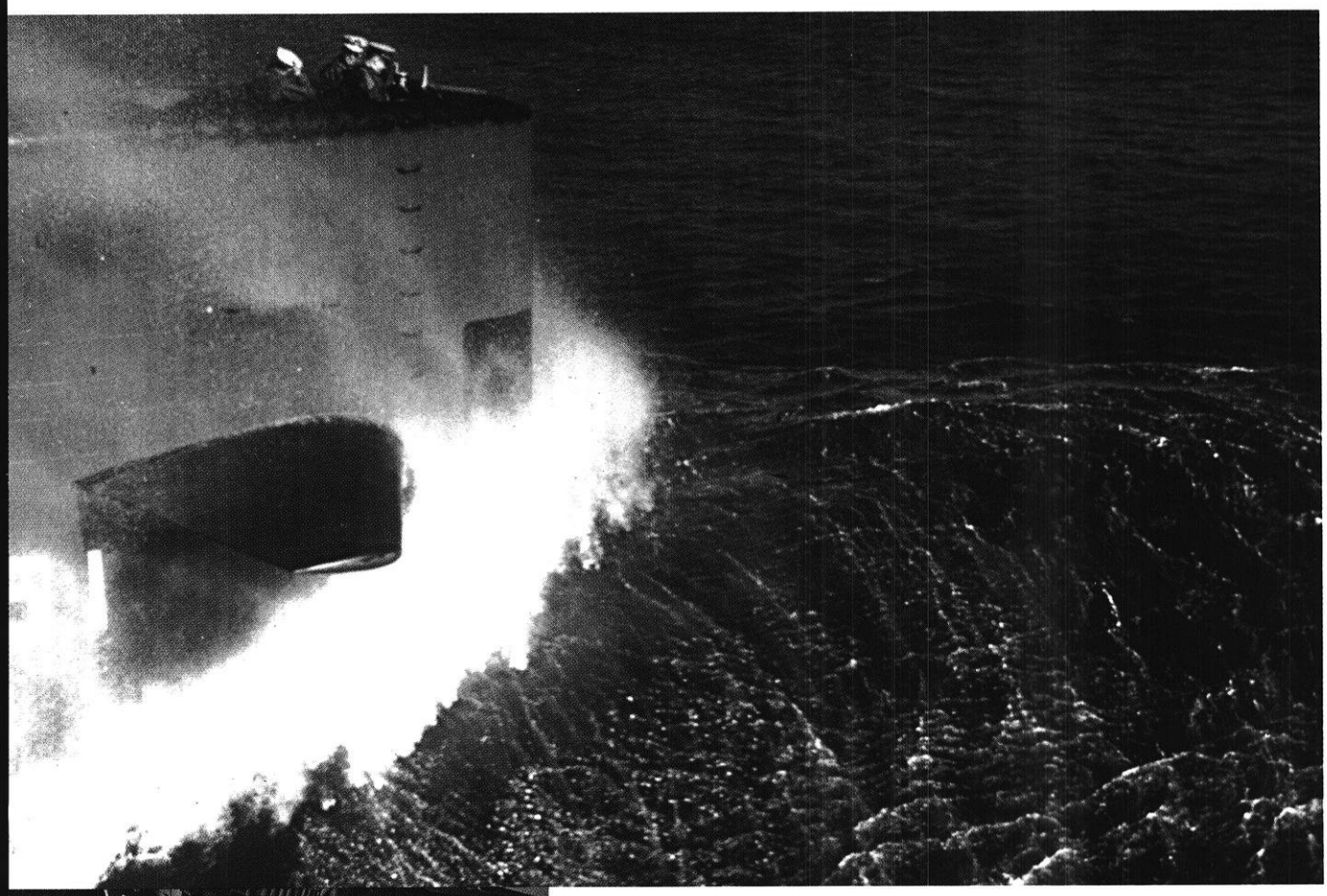

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Exploring fire detection

by Chuck Kuehn of the Engineer Staff

Fire prevention, is a two step process. Not only is it imperative to place importance on what goes into a building initially, it is just as critical to provide for the best possible fire prevention systems upon completion.

Assigned to this task at the University of Wisconsin-Madison is B. A. Uminski, the Fire Prevention and Safety Training Officer in the Department of Safety.

Uminski described how the overall fire safety system on campus operates. "Located in offices of Protection and Security is a lightboard, monitered 24 hours a day. The panel contains lighted blocks representing each building on campus." In the event of a fire, a specific block will light up, relating to the dispatcher not only the building floor, and wing involved, but also whether or not an alarm was pulled or whether a detection device has activated itself. **THE FIRE DETECTION** devices used by the Safety Department are of five basic varieties, each designed and placed in a specific room or building for a specific purpose.

Perhaps the oldest device used is the automatic water sprinkler. In existence since the early 1900's, this system has protected both North and South Halls, two of the oldest buildings on campus.

Each sprinkler is activated when a small piece of lead on its frame melts, at 160 degrees, releasing a circular stream of water at the rate of 20 gallons a minute. Each unit attached to the ceiling will spray about a 10 x 10 ft. area.

Another device used is the ionization detector. Also placed on the ceiling, these units contain a test plate sensitive to carbon."They are quick detectors and will pick up carbon particles before you even see the smoke," Uminski explained.

THEY DO HAVE their weaknesses, however. "The trouble with them is that they must be kept clean, the test plates washed with alcohol every once and a

while," said Uminski. "Besides that, they require a good air-flow system to function properly. We used to have these in the dens at Tripp and Adams halls," grinned Uminski, "but the guys would play cards and smoke and the darn things would go off."

Specially designed fans are also used on campus. Equipped with smoke detectors in the exhaust ducts, they will, on activation, shut down all the air handling systems in the building to choke a fire.

Heat detectors are a fourth device employed. Enclosed within a metal dome placed on the ceiling is a small bellows, inside of which is a vacuum. When the air surrounding the bellows is heated the bellows contracts, forcing two metal clips previously separated to make contact. A short results, activating an alarm.

Electro-magnetic doors have been installed in the new Teachers Education building on campus. This safety feature is designed to keep certain doors open at all times. In case of a fire though, the doors are triggered to close automatically in certain areas, isolating specific corridors.

THE DEPARTMENT OF Safety has also introduced a new type of fire extinquisher which contains a dry chemical-monoamonium phosphate. This single extinquisher will replace the old system of having three separate class A, B, and C extinquishers, each designed for a specific type of fire.

"People will no longer be confused as to whether or not they are using the right kind," said Uminski. "Laboratories still request that we give them carbon dioxide extinquishers," he added, "since with dry chemical there is the danger of harm to research and a massive clean-up required from the residue."

With regards to those involved in the design and construction fields, the Commission suggested that "the absence of training in this country (only the University of Maryland and the Illinois Institute of Technology have 4-year Bachelor of Science degrees in fire protection engineering) helps explain the unenthusiastic attention which architects and engineers, when designing buildings, give to fire safety provisions."

The report therefore recommended three things to institutions of higher learning:

First, schools giving degrees in architecture and engineering should include at least one course in fire safety.

"Second, registrations boards require a specific number of credit hours of fire protection engineering to qualify for state licensing for appropriate disciplines within architecture and engineering.

The third recommendation, aimed directly at touching everyone in the sensitive spot of funding, suggested that "federal funds for engineering and architectural schools might be contingent upon schools having adequate fire protection engineering requirements as part of the degree curriculum."

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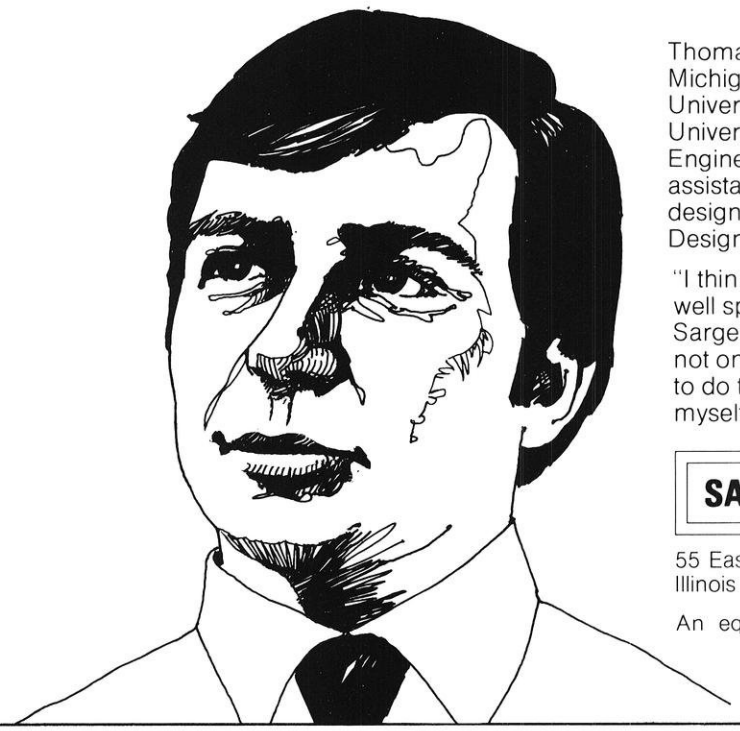

Thomas G. Longlais, B.S., 1969, Michigan Technological University; M.S., 1972, University of Wisconsin, Civil Engineering. Presently, assistant chief structural design engineer, Structural Design and Drafting Division.

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JUMP FOR YOUR LIFE!

By Wayne Hochrein
of the Engineer Staff

Do you have the secret ability to leap tall buildings in a single bound? How about the secret ability to jump down from tall buildings and walk away unharmed? If by chance the building you are in happens to be on fire, escape is desireable no matter how it's done, secret ability or not.

Three mechanical engineering students: (Tom Smart, Fred Stanek and Steve Urbanowski) under the supervision of Dr. Ali Seireg developed a device called a cable descent harness that provides a safe means of escape from burning high rises.

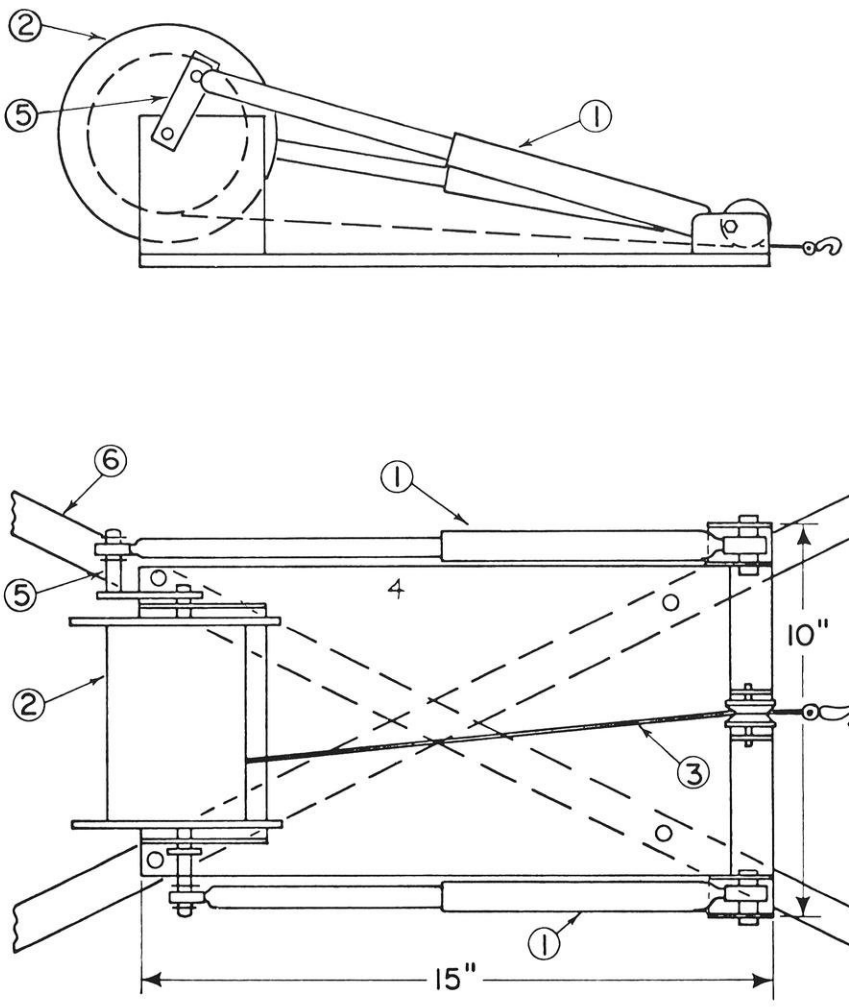
The cable descent harness lowers a person by means of a steel cable to safety below.

THE HARNESS CONSISTS of a parachute harness, spool, automobile-type shock absorbers and 500 feet of steel cable. The unwinding cable causes the spool to turn. Cranks (Number 5 of figure) mounted on the spools shaft are connected to the shock absorbers (Number 1 of figure). The shock absorbers dissipate the energy, acting as a breaking device. The cable can be attached to any opening that offers access to a safe landing.

The model constructed weighed approximately 20 pounds. It could easily be put on without help and the harness adjusts to any size person. The device doesn't require adjustment for people of different weights.

"There is no limit on how you jump or from where you jump." explains Professor Seireg.

The weight of the harness could be reduced by having the components specially designed for weight reduction. It was estimated that the unit could be mass produced for about ten dollars.



General layout of safety harness

THERE IS NO operational cost, no maintenance required and nothing can wear out. The durability over time depends only on the life of the shock absorbers. Theoretically these could last for many years and still work effectively when needed.

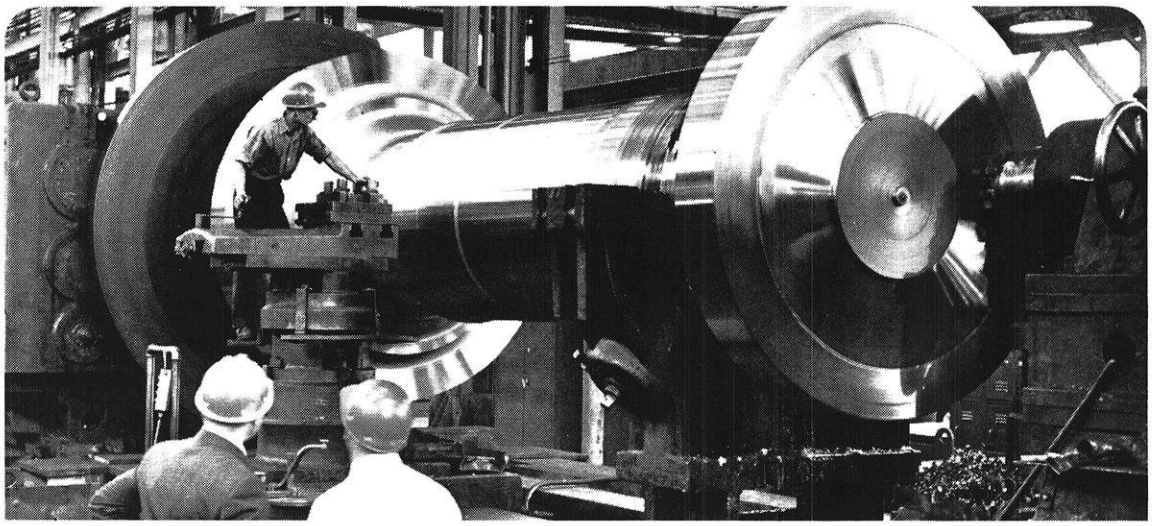
The harness was taken to a national contest dubbed "Students Against Fire", in Marinette, Wis., May 1-4 and received high recognition.

With the number of high rises seen today there is the threat of fire trapping people on upper stories. There is a need to have an inexpensive, safe means of escape such as the cable descent harness.

Everyone may not be a superman but as long as people can escape from a fire unharmed they don't need to be.

WE

manufacturing, sure!



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The nightmare of nuclear safety

by Jeff Kratz of the Engineer Staff

The whole issue of nuclear plant safety is like a nightmare. Like a nightmare, seemingly unreal and impossible happenings are taking place. Like a nightmare, it is partially the result of your own actions.

Nearly everyone will agree that nuclear power plants have the potential to be of tremendous value in the fight to overcome a real energy shortage either today or in the future. Yet at the same time, nearly everyone will agree that the construction and operation of nuclear power plants throughout the country is opposed by a sizable portion of the population.

How is this possible? How can something that has so much potential for good suffer from such a bad public image? This is the nightmare of the proponents of nuclear plants.

OR, TURNING THE question around, how can engineers and power companies claim there is no danger from these plants when the Atomic Energy Commission (AEC) finds fault in one out of three inspections and when the cooling systems keep breaking down with frightening regularity? This is what keeps opponents from sleeping soundly at night.

The issue here centers on the light water-cooled nuclear power reactors that are now in operation in different parts of the country. This is the same type of reactor that is being proposed for the Lake Koshkonog area here in Wisconsin.

These reactors have no chance of ever exploding like atomic bombs, and most people, including many opponents of nuclear plants, know this. The safety question hinges on the cooling systems and their reliability.

Nuclear reactors produce large amounts of radioactive nuclear fission products. Any release of these products into the atmosphere would pose a great threat to public safety.

TO GUARD AGAINST this, the core is kept cool, usually through the use of water in a system that works on roughly the same principle as a car radiator. If there would be a breakdown in the cooling system, the core would overheat, and perhaps reach temperatures that might melt some of the core housing. Opponents say this would greatly increase the danger of radioactive contamination of the surrounding environment. Proponents disagree.

"Its very unlikely that a cooling system would totally break down," said Richard Cashwell, supervisor of the nuclear reactor located on the UW campus. "Even if it did, there are other safety devices that would prevent the discharge of any radioactive material into the air."

Opponents answer by pointing to the occasional cooling system malfunctions that are reported by the existing plants, such as the one recently at the Dairyland Power Co-op reactor in Genoa, Wisconsin.

AT THE NATIONAL LEVEL, retired AEC safety analyst Carl J. Hocevar said in his resignation letter that "in spite of the soothing reassurances that the AEC gives to the uninformed, mislead public, unsolved questions about nuclear power plant safety are so grave that the U.S. should consider a complete halt to nuclear power plant construction while we see if these serious questions can, somehow, be resolved." Moreover, a recent news report indicated the AEC found 3,333 violations in 1,288 of 3,047 inspections last year.

Cashwell provides a counter argument, saying that there has never been a major breakdown at any nuclear power plant that threatened public safety, that nuclear power plants are designed to be able to accept the loss of one or more safety checks and still pose no danger to the public. He also said most violations found by the AEC are on reporting techniques, not on safety.

And when (or if) we wake up from this nightmare, the whole question of waste disposal must be considered. What do you do with radioactive waste that will be dangerous for the next 100,000 years? But this is a dream for another night.

WE

Stan Kaufman Fights Water With Jelly...

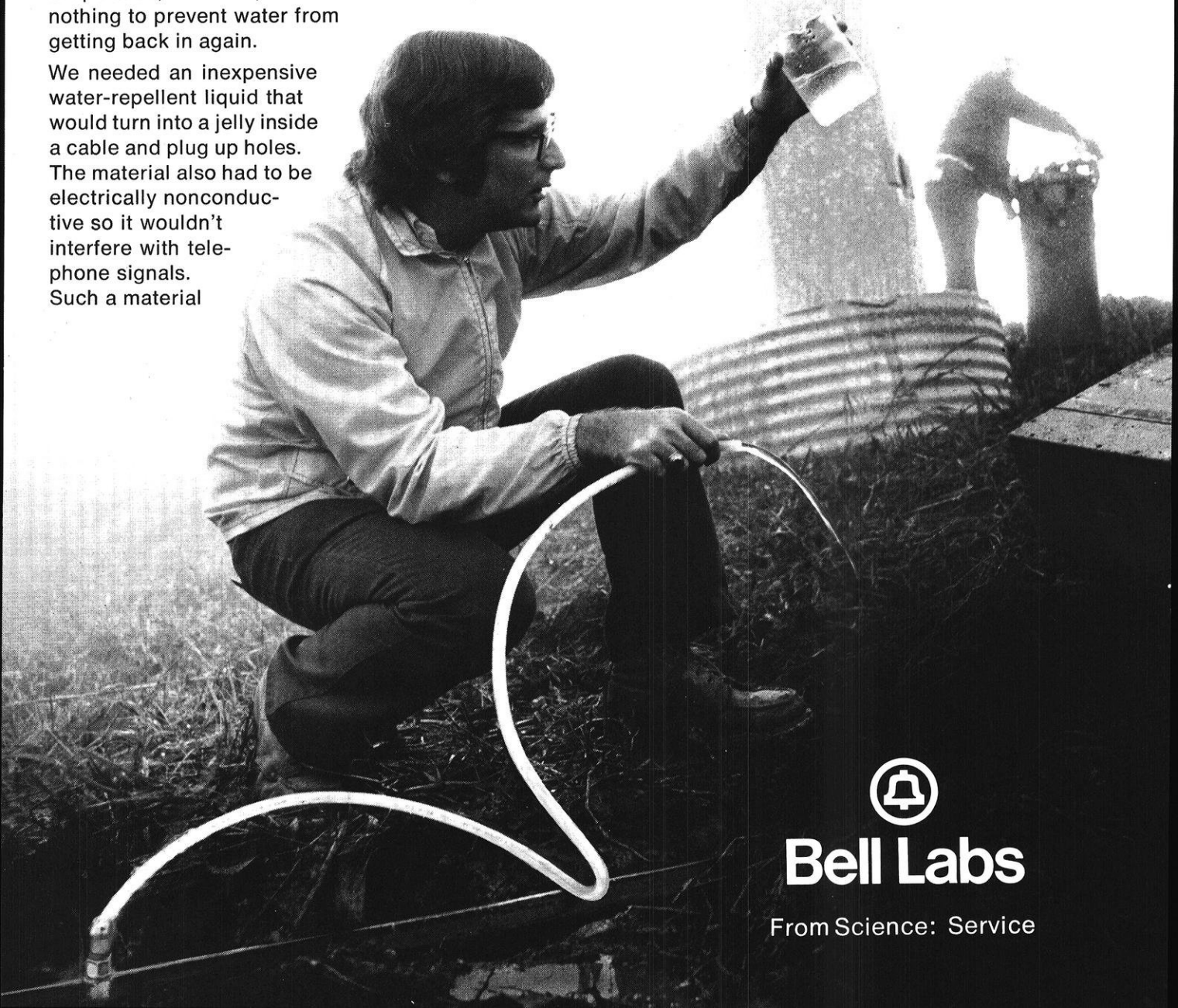
to keep people talking. Bell Labs chemical physicist Stan Kaufman invented a material that turns waterlogged underground phone cable into a water-free "jelly roll" that can carry calls again. Pumped through football-field lengths of cable as a liquid, the material forces water out and then turns to jelly—to keep the water out.

Water sometimes seeps into cable damaged by plows, lightning, gophers, or sharp rocks. Phone calls going through the cable become noisy or don't go through at all. Until now telephone companies had to abandon waterlogged cable, or dig it up and replace it, or use acetone to flush out the water. Once the acetone was evaporated, however, there was nothing to prevent water from getting back in again.

We needed an inexpensive water-repellent liquid that would turn into a jelly inside a cable and plug up holes. The material also had to be electrically nonconductive so it wouldn't interfere with telephone signals. Such a material didn't exist, so we asked Stan Kaufman, a 1970 Ph.D. from Brown University, to tackle the problem.

Drawing on his knowledge of molecular structure and working with telephone company engineers—sometimes in muddy cable trenches—Stan came up with a new compound. A Western Electric engineer modified a pump to force the compound through long lengths of cable. And during field trials, operating telephone engineers suggested installation procedures.

Bell Telephone companies are happy because they don't have to dig up as much waterlogged cable, which often runs under highways and people's lawns, and because restoring an otherwise good cable helps hold down the cost of providing telephone service.



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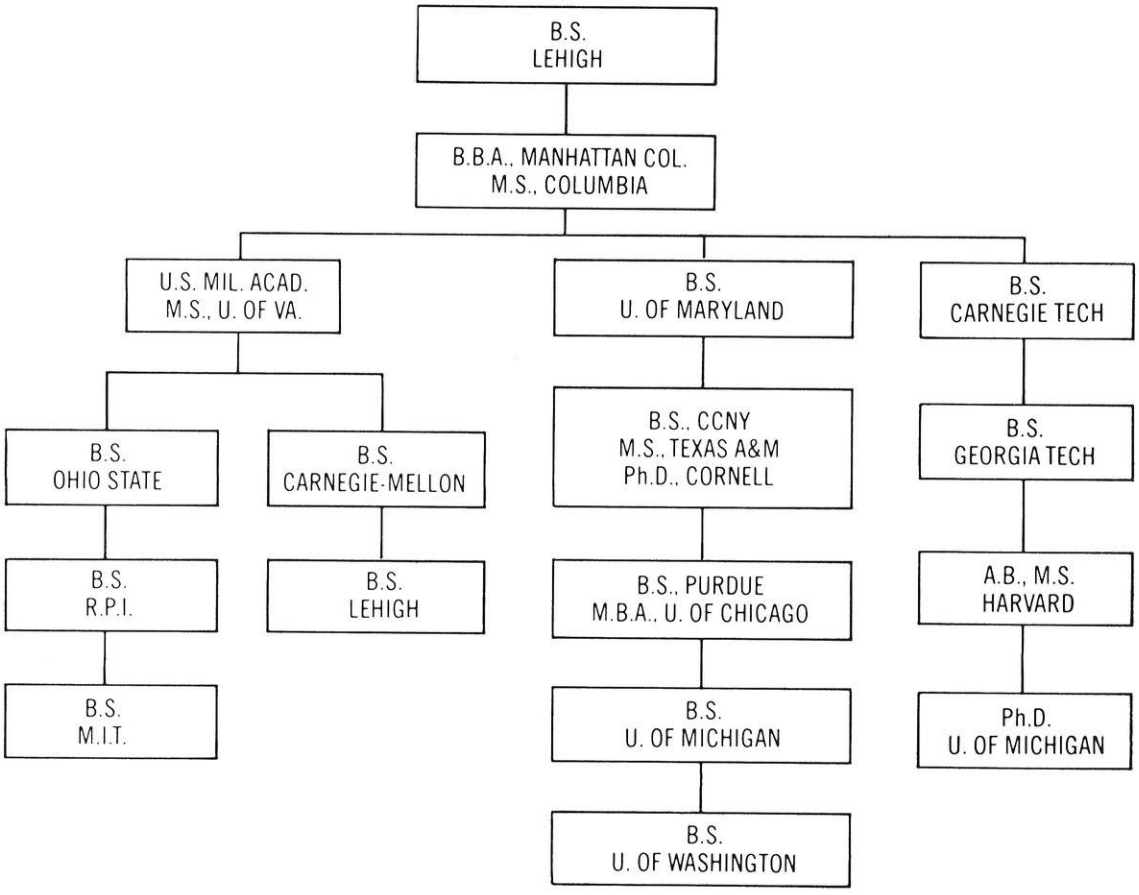

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OSHA:

Everything you wanted to know about the **Occupational Safety and Health Act**

by
Peggy Lawrence
of the Engineer Staff

The most identifying characteristic about OSHA is that no one really knows what it is or does. No, it is not an Oriental greeting, its the Occupational Safety and Health Act put into effect in April, 1971, by the Department of Labor of the Federal government. It is designed to protect the working person against safety and health hazards on the job. Sounds good, doesn't it? Unfortunately it isn't very well liked by either labor or management!

In theory OSHA should be a great idea since before it took control, the amount and standards of occupations safety legislation in different states was so diversified. Some states had little or no protection for laborers. Others, like Wisconsin, had a good program already in use, but OSHA provides one set of standards to be followed by the whole nation. At the same time, it encourages the states to develop their own programs that are "at least as effective" as the federal program.

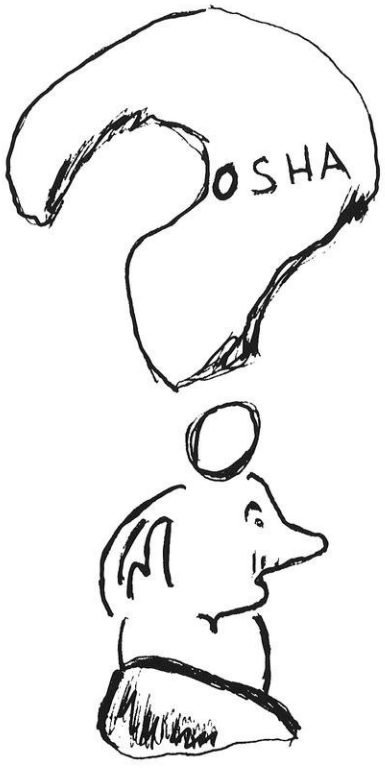
Once a state has a plan that has been approved by OSHA they will also help in the enforcement of safety laws, under close supervision by the federal administration. If, after a minimum three years, the state program meets the federal criteria the federal government will pull out completely and leave the states to keep up the standards and enforce them.

AFTER ALL THIS planning, why doesn't anyone like OSHA? Labor unions and workers claim that the on-the-job accident rate has not dropped since OSHA took effect. The truth is that OSHA just does not have the money or the man power to do a good job of enforcement. So far only about three per cent of the work-places in the nation have been inspected. In 1972 OSHA's budget was $38.5 million and by 1975 it is expected to be $102.5 million. However this still isn't enough.

Because of the limitations encountered through lack of personnel and funds, OSHA has made five industries their prime targets. These are the industries with the highest injury rates; long-shoring, roofing and sheet metal, meat processing, mobile homes, and lumber and wood products. But they still have not been able to even reach all of these industries. Their first priority of course is to check on complaints. What little time is left after this is used for target industries and for random inspections.

Congress has given OSHA the power to do two things that job safety and health programs have not been able to do up to now. OSHA can conduct inspections of working places without advanced warning and they may invoke fines. Many medium sized businesses complain that OSHA will put them out of business (although none have gone bankrupt yet).

Some of the regulations seem too strict and expensive. For instance, decreasing the noise levels in factories from 90 to 85 decibels could cost American businesses an estimated $31 billion. OSHA's regulations have also raised construction costs 10 to 35 per cent.



EMPLOYERS DON'T believe the law itself is bad, but they do feel that many of the regulations are too picky, some even to the point of ridiculousness (i.e. if ice is used to cool drinking water, it must not come in contact with the water). Some regulations also seem contradictory, such as requiring vehicles on construction sites to be equipped with back-up alarms yet making some workers wear ear plugs.

Much of the law seems to have been written to be understood only by a Philadelphia lawyer, and has given employers many headaches trying to interpret it. A regulation that says, "wall openings from which there is a drop of more than four feet, and the bottom of the opening is less than three feet above the working surface must be protected with a guard rail" means only that a window sill less than three feet above the floor must have a guard rail, even after glass (including thermopane glass) has been installed.

To comply with OSHA regulations requires more than just a set of their standards. The standards put out by the Atomic Energy Commission, The American National Standards Institute, The American Conference of Government Industrial Hygienists and other groups are also a necessity.

So far OSHA has been doing well by finding for substandard conditions. If an employer wishes to contest a fine he can take it to a panel of three men appointed by the President. If they agree that there might be cause for an appeal, the case is taken to court. OSHA now has 40 judges hearing cases but they are still swamped. Like our other court systems there is a wait before a case is heard. Many people have appealed but only a few of the fines have been revoked.

IN SPITE OF THESE problems, some states, Wisconsin included, already have permission to carry on their programs. Others want no part of it, they are content to let the federal government run the program. When more states have fully developed their own plans and put them into practice, better enforcement and inspection procedures will probably result since the burden will be more evenly distributed.

The overall picture is good. The laborer now has a definite place to take his complaints and the employer must keep definite records of all major injuries and illnesses. These are two of the things OSHA has changed. Its clear they're heading in the right direction, it just takes time to get there.

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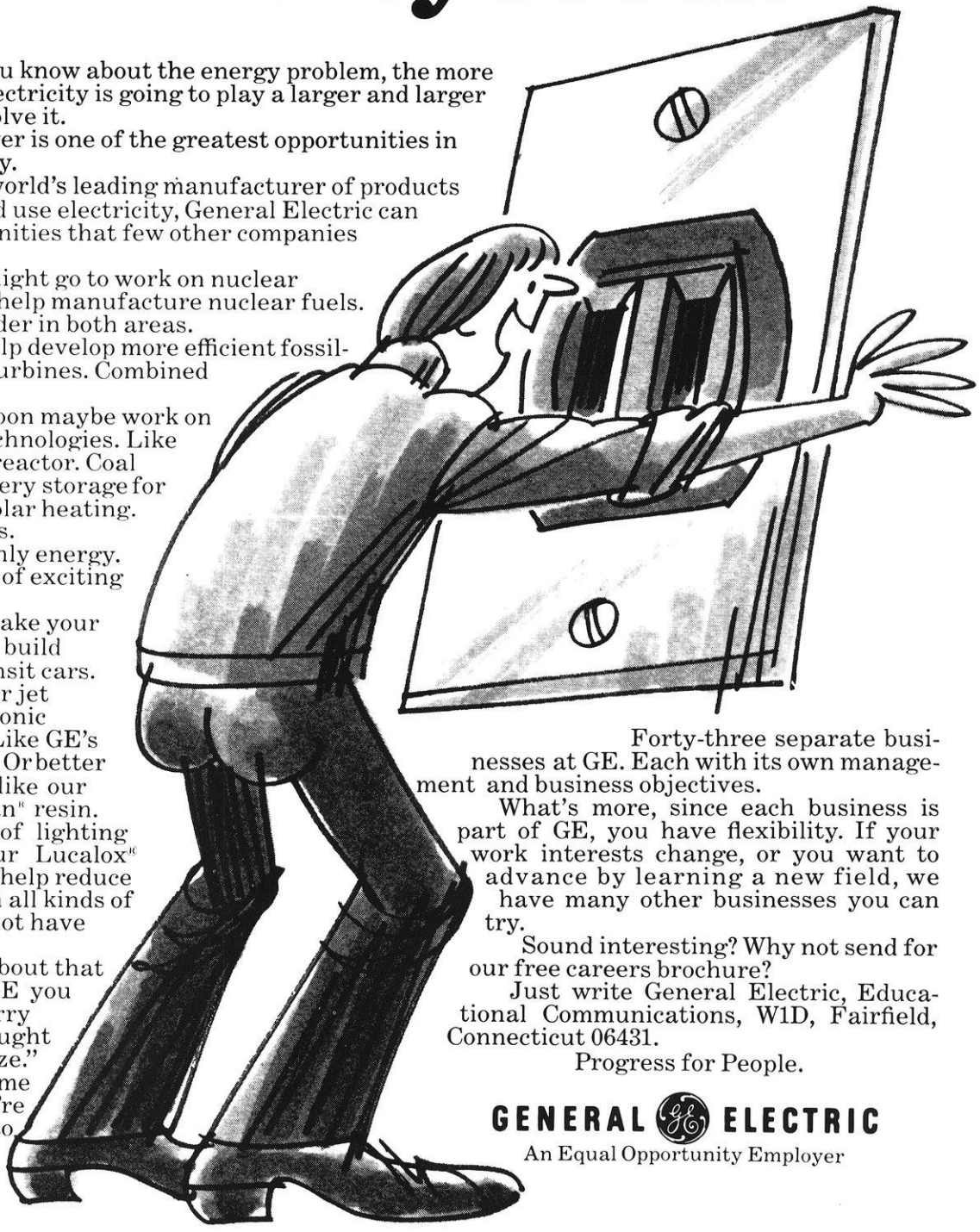

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