You want just the right penetration, not too much, not too little.

Another thing is very important. These guns can shoot pieces of concrete or brick back at you plenty hard. So protect your eyes. Wear your safety goggles. And it's wise to wear a face shield, too, over the goggles, not in place of them. Those chips off the masonry wall aren't likely to be big enough to muss your face up very badly, but they can cut enough to make shaving plenty unpleasant for a while.

Try the gun out very carefully before you load it. Make sure the safety works and that you know exactly how to use it. Practice a while with the empty gun.

One thing more before you start driving studs: Is there anyone behind or near you who could be hit if the stud bounces? If so, tell him to move a safe distance away and see that he stays away, or put up a good husky barrier.

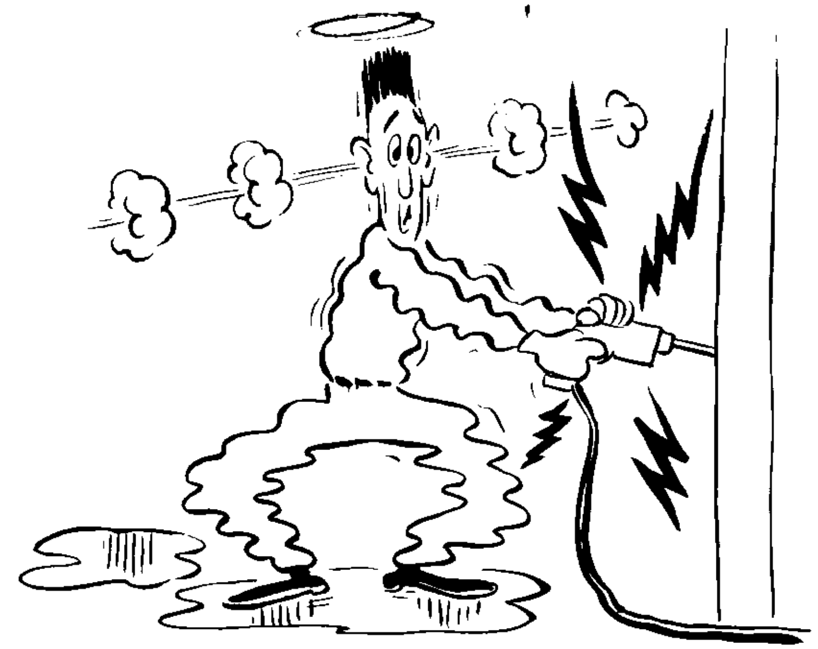
Now you're ready to load up. Make sure the bore is clear. When you slide the cartridge in, make sure that it is home and that the breech is fully closed and locked. That powder is fast and the breech pressure is high. If there's the slightest crack there, the flame will shoot back in your face—another reason for your face shield.

Now you're ready to drive a stud. Be very careful to hold the gun exactly at right angles to the surface you're putting the stud into. If it's off only a little, the stud is apt to fly off at an angle, particularly from concrete or steel.

Don't drive a stud too close to the edge of anything that might crack off. Minimum edge spacing for steel is about 1 inch and for concrete it's 6 inches.

If you get a misfire, hold the gun in place for 15 or 20 seconds—count to 20—before lifting it away from the work surface. That will protect you against a "slow fire" cartridge.

Finally, don't forget for a second that it's a gun—a high-powered one—that you're firing. So handle it carefully. It's a good tool if used right. It saves a lot of hard work. It can be used safely, and it's deadly if it isn't. So watch the way you use it, and don't take *any* chances at all.



LOW VOLTAGE CAN KILL

Whenever a bunch of fellows get to talking about the hazards of low voltage—110 and 220—somebody is sure to say, "I can eat that stuff." If you think that, you were never more mistaken in your life.

The *only* difference between the high voltage stuff—1,100 say, or even 13,200—and the juice in your house wiring is that the higher the voltage, the more likely you are to get killed if you come in contact with it. Even a voltage as low as 50 has been known to kill when conditions were just right, so don't be fooled by low voltage.

The important point is that for all voltages used in homes and to run machinery in plants, it's the *current* that shocks and kills. All the voltage does is to push the current through you, and the current you get will be in proportion to the voltage.

All this is best explained by Ohm's law. It says that an electrical pressure of 1 volt will push a current of 1 ampere through a circuit having a resistance of 1 ohm. If you raise the voltage without changing the resistance, you get more amperage—more current. If you lower the resistance without changing the voltage, you also get more current. Remember that point. It is *very* important.

You can think of the electricity in any wire as always trying to get to the ground or to the other side of the line—the other wire in a two-wire circuit or either of the other wires in a three-wire circuit. The insulation between the two is all that keeps the electricity where it belongs.

Ordinary dirty water is a good conductor; so, of course, are metals. Except for your skin and bones, your body is mostly water; so its resistance is low. Dry, clean skin has high resistance, but moisture and most dirt, and especially sweat, lower its resistance very greatly.

The ordinary, reasonably clean, dry wooden floor usually has high resistance. Clean, dry concrete may have pretty high resistance, too, but you never can count on it because it may be wetter or dirtier than it looks. Also, the reinforcing rods or wire in it is usually well grounded. Metal floors, of course, are good conductors.

Let's figure out just what the picture is when a fellow touches a wire carrying juice at 110 volts—an ordinary lighting circuit. If his hand is dry and clean, if he's standing on a dry wooden floor and not touching any grounded metal, such as a water pipe or a steel building column, the resistance to the ground through him will probably be so high that he may not even feel the juice—not get even a little tingle.

But if he's hot and sweaty and standing on a steel floor or leaning against a steel column or across a water pipe, his resistance is apt to be so low that he'll get enough current through him to knock him out. If so, he'll probably die if he isn't given artificial respiration at once.

Such a shock is likely to stop lung action, but the heart usually beats on. Artificial respiration properly applied will get air into and out of the lungs enough to keep the heart going until the lungs start working again.

Sometimes, however, the jolt also throws the heart out of step so that it just quivers instead of beating in rhythm and it pumps no blood. The medics call this condition ventricular fibrillation. Anyway, if it happens, it's curtains. Do you still think you can eat that stuff?

Instead of enough current to knock you out, you may get enough to set your muscles so you can't let go or get loose. Unless you're rescued, you will slowly lose consciousness and die, very unpleasantly. Still want to eat that stuff?

You're particularly likely to learn better in places like tanks, boilers, and pipe tunnels—in fact, just about anywhere if you are sweaty or wet.

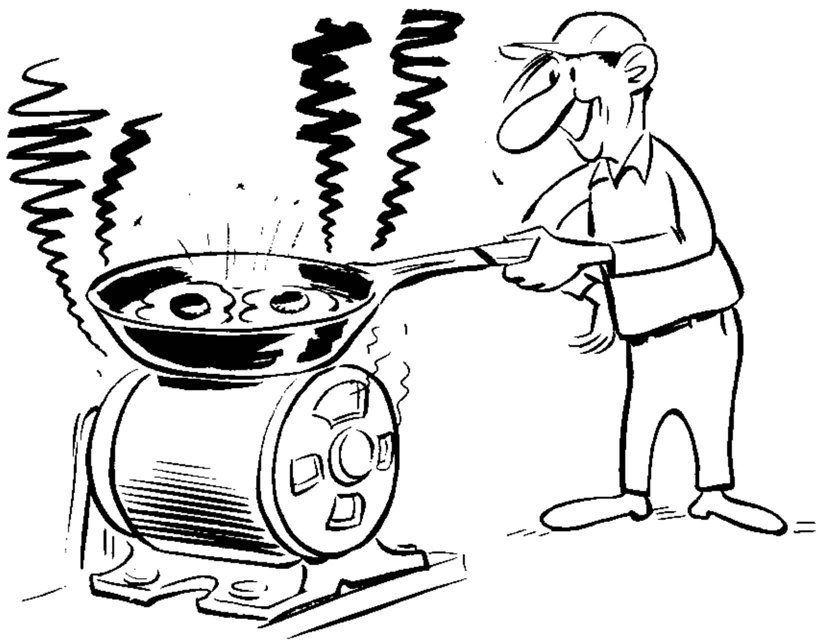
Another important factor is the path the current takes through a person. If it's from one finger to another on the same hand, the worst you're likely to get is burned fingers. But if it's from one hand to the other or from a hand to a foot, the juice probably shoots through your chest and that's bad—very bad.

It's easy to see that the quicker the current is cut off, the better a victim's chance of keeping on living. If you're nearby when someone gets caught, use good judgment in rescuing him. Cut off the juice if you can, but if it's quicker to break him loose instead, be careful you don't get it, too.

If you get much current through you, it will knock you out and probably kill you. A tenth of an ampere or even less is usually enough. You can easily get that much or more from 110 volts.

If you're wet with sweat and in contact with well grounded metal or standing in a wet place with wet feet, the resistance through you to ground may be well under 1,000 ohms. At 1,000 ohms you would get over one-tenth of an ampere.

Do you still think you can eat that stuff? Don't try. There's no future in it.



ELECTRICITY AS A SOURCE OF FIRE

Electricity starts a lot of fires each year—over 10 per cent of all building fires or around 60,000 fires per year, mostly in people's homes. The safety of all kinds of electrical equipment has been steadily improving through the years, but use of electricity has increased so much that the total number of fires keeps on going up, especially in homes.

You fellows know, of course, that electric current heats whatever it flows through. You also know that the higher the resistance of whatever it flows through, the more the heating. You know, too, that a small wire has more resistance than a large one. But do all of you realize that the amount of heat produced by a current flowing through a wire (any conductor) is proportional *not* to the amount of current but to the *square* of the current? If you double the current in a wire, you get four times as much heat. If you put in three times as much current, you get nine times the heat.

Keep that fact in mind. It's called Joule's law, and it's important. It's the why of most electrical fires. People act as though they had never heard of it.

Take the average home. It's wired to carry 15 amperes per circuit. When the wiring is installed, fuses that will carry 15 amperes and no more are put in. That's enough current for lights and a reasonable number of radios, television sets, toasters, and so on. But a guy keeps adding all sorts of gadgets, and pretty soon he has fuse trouble. He buys some spares and shows his wife how to put them in.

That's fine, but some morning the fuse blows when she's making the breakfast toast. What could be more infuriating? If he won't get "stronger" fuses, she will. So in goes a 20 amp. He thinks, "That's only one-third more. Surely that can't hurt anything. Those electrical inspectors are too fussy." Actually, he'll get nearly twice the heat.

That goes on for a while, and then they get another appliance—an electric heater, perhaps. The 20 amp. fuse blows, so in goes a 30, probably a fusestat or fusetron. He thinks, "That's only double the current, and it isn't usually on for long at a time." But 30 amps. will produce four times as much heat per second or per minute as 15. How hot the wires get will depend not only on how fast the heat is generated but also on how fast it can leak away. There are always places along the circuit where the heat leaks away very slowly and the wires get hotter and hotter.

Sooner or later, the insulation breaks down, the current pours through, and the guy gets his fire. He didn't plan for it, but he set up for it just the same. Fires from overloading usually start in hard-to-get-at places and, of course, that means hard-to-put-out places. So he has to learn the hard way that an extra circuit is far cheaper than a fire.

Fires in appliances (and their cords) are usually due to wear or moisture or dirt. Some fellows will tape a worn cord. This doesn't pay because the wear and kinking that have worn the insulation partly through have probably broken some of the copper strands and a short is apt to result. Of course, the fuse will blow, but the arc can easily start a fire. Suppose it happens when your wife is ironing, and the garment she's working on catches fire. I don't need to tell you that the results can be serious.

A fire may easily occur in a vacuum cleaner, too. This equipment takes such a beating that it should be thoroughly cleaned and overhauled at least once a year.

Overloaded extension cords often cause fires. This happens with appliances such as heaters, air driers, and irons that pull too much current for the ordinary extension cords. If the cord that comes with the appliance isn't long enough, any cord that's available is likely to be used. For such situations, longer cords with the same amperage rating as the appliance should be provided.

Misuse and abuse of electrical equipment aren't confined to the home, of course. You'll find that kind of thing in plants, too, and in all sorts of jobs where electric-powered tools and portable power equipment are used. Unless all of us know the hazards and know and follow the safe practices necessary to control them, there'll continue to be both fires and accidents from electricity.

Remember—most electrical fires are caused by overloading and poor maintenance. They *can* be prevented.

SWITCHES—KNOW WHERE THEY ARE—LOCKING OUT

Nowadays, the controls on machines are usually so reliable and so convenient that we're apt to take them for granted. We're apt to lose sight of the fact that it isn't enough to know how to cut the power off *at* the machine. For a number of reasons, we should also know where the switch is that cuts off the power *to* the machine or machinery we operate or work on.

Suppose the switch on a machine—a push button usually—fails to open. This may happen for one of several reasons, depending upon the kind of machine, type of switch, and quality of maintenance. Anyway, switches do fail, and if the switch on your machine fails, you'll want to cut off that power fast.

To keep yourself safe, you must know where that main switch is. Then you can turn off the power before you make an adjustment to the machine, like changing the heads on a four-sided wood planer, or do a clean-up job on it. It's especially important to cut off the juice if you're a member of a team, if, for instance, you work on a paper machine or a long conveyor. If the machine is driven by a clutch, cut off the power to the clutch. If you can't do that because other machines that must keep on running are driven from the same shaft, take the belt off the driving pulley.

The record of men who've been mangled or killed on such jobs when the machine started unexpectedly is a very long one. You may knock the switch closed accidentally or push the starter lever over, or someone else may do so without realizing you're in a position to be hurt. It happens.

Now we come to a point that's been made the hardest possible way—men have died to prove it. Just opening that all-important switch isn't enough; you've got to make sure that it *stays* open. The safest way, and for that reason the best, is to lock it open and keep the key yourself. When you're through, *you* unlock it. I have the only other key to fit your lock. I'm not to use it at all unless you lose your key. Then you must be with me when I do.

Next best to locking switches out is to tag them out. That is, open the switch and tie on it a "Don't Close" tag bearing your name. No one else but you is to take it off. This method isn't as safe as locking out though, for the tag can be removed by mistake.

For example, a helper in a powerhouse was replacing some worn-out buckets on the conveyor that carried the coal up from the pit where the cars dumped it to the coal bin over the boilers. He wasn't quite through when the shift ended and was told to stay overtime long enough to finish. He went to the snack bar across the street for a cup of coffee.

Meantime, the fireman came on to start his shift. He knew of the repair job and looked around for the helper but didn't see him. The helper's tag was still on the switch, but the conveyor looked O.K. to the fireman; so he figured the helper had forgotten to take the tag off. Just to make sure, he phoned the gate.

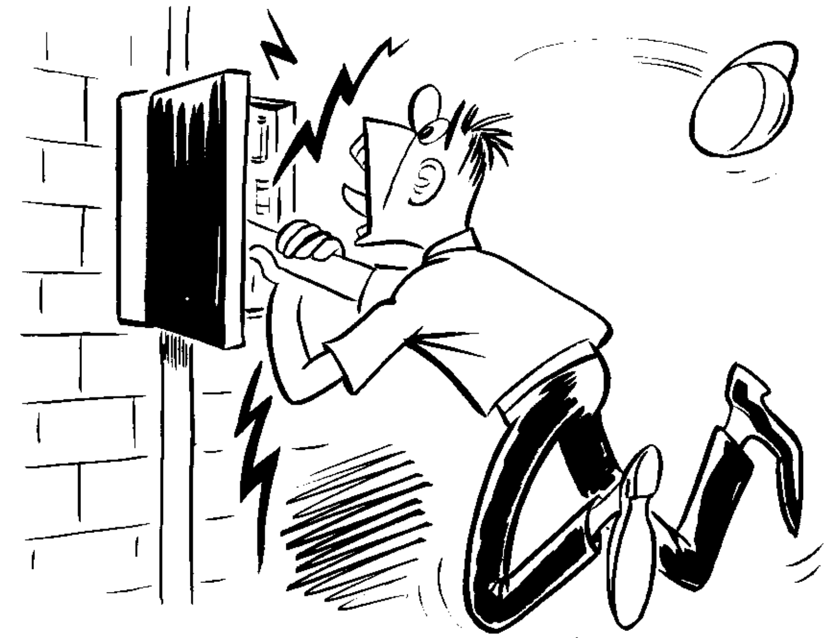
The watchman had seen the helper go out (home, he supposed) and didn't look to see if he had checked out. So the fireman started the conveyor. Meanwhile, the helper had finished his coffee and gone back to work on the conveyor. He lost a leg. It could just as easily have been his life. A lock would have saved him.

Many accidents of this sort have occurred with automatically operated machines, too—not just the big long fellows, but also the little ones like those self-governing air compressors you see in just about every garage. Those V-belts can and do bite fingers off very neatly if they're not treated with due respect. Here's a case in point.

A certain plant used small amounts of compressed air in many places. So instead of a big control compressor with the air piped all over the plant, the small, self-governing kind was installed wherever the air was used. In one room, a compressor and three other machines had separate switches which were mounted in a row on the wall. The plant was running day shift only. The switches were opened at the end of each shift and cut in again next shift as needed.

Two men, Jim and Ed, worked in this room. Jim got in a few minutes early one morning and, remembering that the compressor belt had been squeaking some the day before, decided to look it over. Ed came in, didn't notice Jim working on the compressor, and, wanting some air right away, threw the switch on. The V-belt cut two of Jim's fingers off clean. The pulley rims were almost knife sharp.

In this case, tagging would have saved Jim's fingers. Locks, though, are always safer. They put complete responsibility for your safety exactly where it belongs — in *your* hands. Whenever anyone working on or around machinery puts himself in a position to be hurt if the machine starts up, he owes it to himself to make plenty sure that it won't. It is up to him.



ELECTRICITY FOR ELECTRICIANS

Fellows, today I want to tell you why we should leave electricity to the electricians, let them run circuits, hook up electrical equipment, make repairs, and so on. The reason is very simple. Unless we've had the proper training, we just don't know enough. We're apt to make the kind of mistakes that spell fires or electrocutions or both. And the learning how isn't easy. It takes a lot of time, a lot of hard work, and a lot of going to school.

Electricity has been known for over two centuries. It was just about that long ago that Benjamin Franklin flew a kite in a thunderstorm and proved that lightning is caused by electricity jumping from cloud to cloud or from cloud to earth. Franklin got a shock but not enough to burn him much or knock him out. We know now that he was lucky. He could easily have been killed. Flying a high-going kite (with a cord that will conduct electricity) in a thunderstorm is a very poor way to live to old age. Franklin learned enough not to repeat the experiment.

The discoveries that made wide use of electricity possible occurred about fifty years ago. Since then, the how of using it safely in all sorts of ways and for all sorts of purposes has been learned. It has taken a terrific amount of brainwork and experiment by many thousands of scientists and engineers. And piled on top of all that are fifty years of experience in hundreds of thousands of plants and millions of homes all over the country.

Why do I tell you all this? I'm just piling up the evidence to show that working with electricity is no job for the guy without special training for it.

What is now known about electricity would fill a large library. More is being learned every day. No brain could hold it all. No one could know even the part of it that has to do with the use of electricity in our homes and plants. Even the safety aspect takes a big book.

So to guide those who lay out electrical circuits and make the installations in our homes and plants, two codes have been developed. One deals with fire prevention; the other with accident prevention. Both are sizable books. These codes are revised from time to time to include latest knowledge and experience.

The codes were developed and are kept up-to-date by committees of the best men in the country. So when a person ignores a requirement of either of these codes, he's setting himself up as knowing more about the subject than all these men put together. That sure takes a lot of self-confidence. Rather, it takes a lot of ignorance.

It takes a lot of knowledge and special instruction and training just to apply these codes. That's what an electrician does. He is a professional. So don't go against him, either. He's backed by the codes, and they represent the very best boiled-down knowledge and experience.

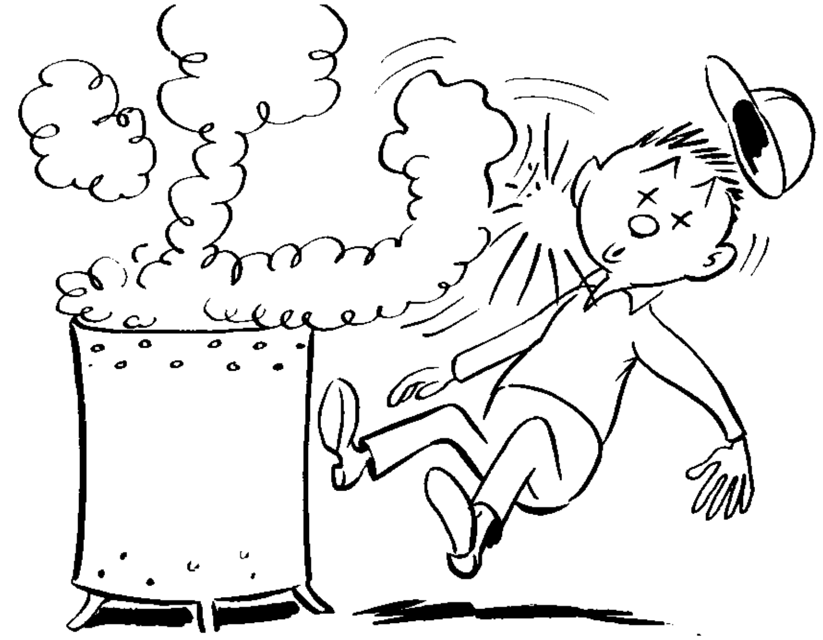
Electric current flowing along a wire or a conductor of any sort is always trying to escape to the ground or to the other side of the line—the other wire in a two-wire circuit or either of the other two wires in a three-wire circuit. This characteristic makes the use of temporary wiring undesirable because it is not protected from mechanical injury.

Through the years, a tremendous amount of research and money has been spent in developing the best insulation for each kind of situation and in developing electrical equipment and appliances that will give good service and stand the gaff. If the insulation gives way, the juice rushes through and you get heat fast—probably an arc and a fire. If it goes through someone, you may have a fatality on your hands.

Many men put themselves into a dangerous situation because they don't realize that even 110 volts may be as deadly as higher, more respected voltages. An alternating current of only 1/10 ampere at commercial frequencies may be fatal if it passes through the heart. Electricity of 110 volts can quite readily pass a current of this size through the body.

In order to make sure that electrical wiring, equipment, and appliances are well made and safe to use, testing laboratories have been set up. They test electrical equipment and appliances and approve all that are found O.K. They authorize the manufacturers of approved equipment to put labels on it showing that it is approved. So when you buy anything electrical, look for that label. It will read "UL approved" or the equivalent. If it isn't approved, think twice before you buy it. It may be O.K., but you can't be sure.

In any event, remember this one big point: leave electrical installations to the electricians.



CARBON MONOXIDE

This won't be news to you, but carbon monoxide (CO) is a real killer. In fact, it kills far more people each year than any other gas does, probably more than all other gases put together. The reason is that it's so common. All you need to do to make it is to burn anything containing carbon—wood, clothing, coal, gasoline—without enough air.

Carbon burns first to earbon monoxide which, if it gets enough oxygen, burns to carbon dioxide. But the carbon monoxide has to be hot to burn so if it gets away from the fire before the oxygen reaches it, it stays carbon monoxide.

That's why it's so dangerous to damper the ordinary room type gas heater. You're likely to get carbon monoxide. If you go to bed with one of these heaters burning without a good vent, you may never wake up. A good many people die that way every year. Electric room heaters are far safer.

You can't smell carbon monoxide. It has no taste, either. It won't even tickle your nose or lungs or make you sneeze. If you breathe much of it, you just get drowsy and pass out. Unless you're rescued, you die.

When you can smell the exhaust from your car or when it's irritating, you're burning some oil or getting some breakdown products of the gasoline. You aren't smelling carbon monoxide.

Carbon monoxide is *not* a poison. It kills by depriving a person of oxygen. The same thing happens in drowning or in choking to death. The human machine runs on oxygen. The function of the red blood corpuscles is to absorb oxygen from the air breathed in by the lungs and carry it all through the body where it is used. But these corpuscles greatly prefer carbon monoxide. They'll absorb it about 300 times faster than they'll absorb oxygen.

That means that if there's only a little carbon monoxide in the air a person breathes—say, $\frac{1}{10}$ of 1 per cent or so—his blood soon becomes so loaded with the carbon monoxide that it can't carry enough oxygen for his needs and he passes out. You can't safely breathe more than one-tenth of that amount — 100 parts per million—all day. Even that little will give some people a headache.

There's one good thing about carbon monoxide. If it doesn't kill a person, he'll practically always recover, usually overnight or so, in fresh air. It doesn't ordinarily cause any continuing injury, either. In a very few reported cases, however, persons overcome by carbon monoxide suffered some permanent brain damage. Brain cells die very quickly if deprived of oxygen.

Every gasoline or diesel engine gives off carbon monoxide—lots of it. You can't fix these engines so they won't. So if you must run them indoors, hook their exhausts up to an exhaust system designed for the purpose or at least run the exhausts outside. Also, have good ventilation to take care of any leakage.

It's important, too, to remember that any fire or fuel-heated furnace or oven may give off carbon monoxide. In fact, almost all furnaces do. That's why all furnaces and ovens indoors should be hooked up to suitable stacks or exhaust systems or have smoke pipes of their own.

Fires that get plenty of oxygen seldom produce much smoke. So be very suspicious of a smoky fire. It's probably giving off plenty of carbon monoxide.

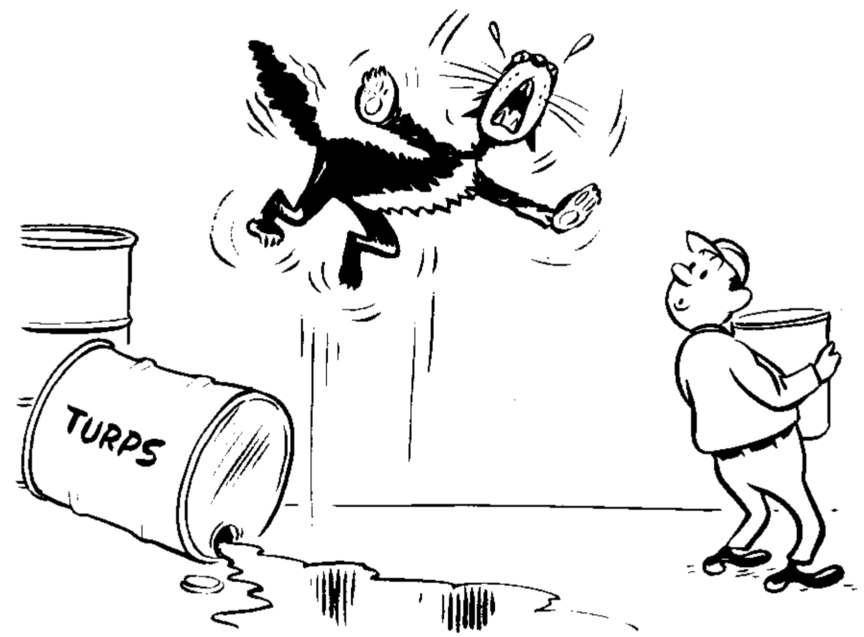
Carbon monoxide indicators that measure the amount of this gas in the air should always be used to show whether or not it's present in tanks or other closed spaces that might contain carbon monoxide.

Masks are available that will protect a person against up to 2 per cent carbon monoxide by means of chemicals that absorb it. For higher concentrations than 2 per cent, the supplied-air type of equipment is necessary. In any case, when dealing with carbon monoxide in any amount, a man must *know* what he's doing if he's to avoid trouble.

The know-how of safety with carbon monoxide is a good thing to take home with you. If you do use either a portable gas or oil heater, better fasten it down and run a smoke pipe outdoors. Fix it so it can't be dampered off, and make sure it always has a good draft.

Another thing, if you have an attached garage, make sure your automobile exhaust can't get into the house.

Finally, if you have any other gasoline engine like the usual power lawn mower, don't ever tune it up indoors. That's strictly outdoor work.



COMMON SOLVENTS

Liquids that can dissolve other substances without changing their nature are called solvents. Water, for instance, will dissolve salt. If you boil the water away, you get the salt back, and it's still salt. Water will dissolve more substances than any other solvent, but it's no good for greases or oils or fats.

Since it's mostly these very substances that make dirt stick to things, we need solvents that are good at dissolving them and washing the dirt away. It has become so common to use solvents for this purpose that the term *solvent* has come to mean a liquid that will clean things dry—that is, without water.

A wide variety of solvents are available, and new ones are constantly being developed. Most of them are mixtures of two or more substances sold under trade names.

> ***Foreman: At this point you might have the men name the ones they know.***

Each such substance—alcohol, carbon tetrachloride, naphtha, and so on—has definite advantages and disadvantages. That is the reason for the mixtures.

One widely advertised "won't burn" cleaning fluid is a good example. It was developed to meet the very serious fire hazard of flammable solvents. It's a mixture of carbon tetrachloride and a flammable solvent. It licks the fire hazard but substitutes a hazard of its own, for its vapors are poisonous—toxic is the word the medics use. It's a very useful solvent and *can* be used safely. In fact, it is used safely in thousands of plants. But those who work with it must know safe practices and follow them *always* if they are to keep healthy.

As a matter of fact, every solvent is hazardous in some way and to some extent. Most solvents will burn and therefore can cause fires and explosions if misused. Many of them are toxic. Some are both. All are useful, and all can be used and worked with safely. It's not hard to do so, but you must know the hazards and the ways to control them.

Whenever you let air get to a solvent, you get at least some vapors. How much will depend upon the nature of the solvent. Carbon tetrachloride and wood alcohol evaporate very rapidly, naphtha more slowly, kerosene still more slowly. Also, the larger the area of contact between the solvent and the air, the more vapor will be produced.

Suppose you leave the cap off a can of solvent. You'll get only a small stream of vapor. If you could lift the whole top off the can, you'd get more. If you poured the solvent into a large, uncovered pan, you'd get still more. Also, you'd get some from the stream as you poured it. Then if you emptied the pan across the floor, you'd get more yet. Finally, if you shot all the solvent out into the air through a paint sprayer, it would all come out as vapor.

The hotter a solvent is, the faster it will evaporate—that is, turn to vapor. It's hard to figure out a condition which requires a solvent to be heated, but it's been done and that way lie trouble and danger.

In some areas, there's enough difference between summer and winter temperatures to be worth taking into account. For example, suppose you're using some wood alcohol in a warehouse on a winter day. The room temperature is 60°. You do the same job during a hot spell in July. The warehouse temperature is 95°. Using the same solvent the same way, you'll get several times as much vapor.

Solvents will make vapor faster in a draft than in dead air. That's why paint dries faster outdoors on a windy day than it does in a closed-up room. But if you depend upon air motion, be sure that you have enough of it and that it will carry the vapors safely outside.

It's very important, when you're using a solvent, to figure out where the vapor will go as it pushes out into the air. This will depend chiefly on the amount of the air motion, but the weight of the vapor can be important, too, if there is very little air motion, as in a basement or closed-off room. The vapors of most solvents are much heavier than air. Gasoline is about 2½ times as heavy, kerosene a little more, turpentine over 4 times as heavy. Carbon tetrachloride is over 5 times as heavy as air.

If you use or handle any solvent, first look the situation over, plan the job through, and use your head. Remember how solvent vapors act, and make sure that they can't get thick enough anywhere to be hazardous. Don't forget that they spread rapidly out through the air and move with air currents just as cigarette smoke does. Bear in mind, too, that the heavier ones, like carbon tetrachloride and turpentine, are apt to collect in low places—they flow downhill as well as spread through the air.

Know your solvent—whether it is flammable or not—whether it is toxic or not—whether it is both.

Foreman: Here is a good place to name the solvents used in the plant and the hazard each offers, particularly such toxic ones as carbon tet and benzene (benzol).

FLAMMABLE MATERIALS

You fellows know, I'm sure, that flammable liquids don't burn; it's their vapors that do. The same thing applies to most solids that will burn—wood, coal, straw, excelsior, and so on.

Take wood, for instance. It's made up chiefly of compounds of carbon and hydrogen and very small amounts of minerals it has gotten from the soil. Green wood contains lots of water; even kiln-dried wood has some.

If you heat wood, several interesting things happen. The water is turned to steam; that's why green wood hisses when thrown on the fire. The compounds of carbon and hydrogen vaporize and burn. That's what flame is, the glowing hot vapors given off by the wood. The carbon that's left over after all the vapors have been burned off makes the coals—that is, charcoal. The ashes are made up of the minerals that were in the wood, potash, mostly.

The hydrogen in the vapors combines with the oxygen in the air to form water. The carbon burns in two steps—first to carbon monoxide, then that burns to carbon dioxide. If the carbon monoxide fails to get plenty of air while it's still very hot, it stays carbon monoxide. The vapors of the compounds of carbon and hydrogen will do the same thing. So when any flammable substance burns without plenty of air, you'll get not only carbon monoxide but a mixture of flammable vapors also.

Let's look for a minute at the consequences of that situation. Suppose we have a smoldering fire, perhaps in the basement or in a tightly closed storage room. It smolders because it doesn't get enough air to burn freely. So the place soon becomes full of a mixture of flammable vapors and carbon monoxide gas. Then someone opens the door. Air enters, and if it reaches the fire there's a big rush of flame or maybe an explosion.

Of course, the first principle of fire prevention is to keep things that will burn away from high heat and high heat away from things that will burn—that is, unless you want them to burn. Any fool knows that, but the number of fires we have in this country every year shows that an awful lot of people don't keep it in mind. Each year there are upwards of 600,000 building fires. Practically all of them are preventable by means that every management and its employees working together can use. But everyone has to know his part and do it unfailingly.

Every flammable substance will catch fire without any flame or spark if it becomes hot enough. This catch-fire-all-by-itself temperature is called ignition temperature or ignition point. It's different for different substances.

For shavings and thin pieces of most dry softwoods, it runs from about 405° F to about 500° F. Hardwoods run a little higher. Paper lights up at about 450° F. Cleaning solvents, such as Stoddard Solvent, naphtha, and kerosene, run from about 450° to 500° F. Most oils run a little higher.

Some materials and some solvents used for special purposes will ignite at still lower temperatures, and require special care in handling and storing. Celluloid is one of the worst. It may decompose and catch fire at about 300° F. When it decomposes, it gives off highly poisonous gases. Carbon disulfide —it smells like rotten eggs—catches fire all by itself at about the temperature at which the radiator of your car boils over, 212° F.

I'm telling you all this to show that flame temperatures, which usually run well over 1000° F (a good match flame may run up to 2000° F), aren't necessary for fires to start. So the slogan "Keep Fires Away" is good, but it doesn't tell the whole story. A lot of fires start because someone let wood, paper, clothing, or a pan of grease get heated to its ignition temperature. So watch out for such situations both in the plant and at home.

It's important not to leave easily ignitible stuff lying around anywhere. Shavings, excelsior, newspapers, and oily rags should be disposed of or kept in metal bins or metal cans with covers, in the plant and in your home, too.

EXPLOSIVE DUSTS

I'm sure all you fellows have read accounts of dust explosions and know that many dusts are explosive if conditions are right. Since any of us might run into such a situation some day, I figured I ought to dig out the dope about explosive dusts. I have, and here is what I've found out.

First of all, the dust of any substance that will keep burning when you light it will explode under the right circumstances. Two things are necessary. It must be fine enough, and it must be mixed with the right amount of air. It won't burn in a pile on the ground or in a layer on top of things. But if you kick a cloud of it up into the air, you're apt to have an explosive condition. Then if you add a flame or a spark, you get a bang.

Just how fine dust needs to be in order to be explosive differs for different substances, but it has to be fine enough to catch fire easily. Wood dust, for example, doesn't need to be as fine as coal dust.

Cotton "flyings" are bad actors. They're the very short pieces of cotton fiber that break off when cotton is being made into cloth. They have a long list of explosions and fires to their credit—a very black record indeed. If they're allowed to collect on equipment and walls, a spark or flame can touch them off. Then you get a flash fire that can run faster than a man can. Through the years a great many people have died in fires and explosions from this cause.

This sort of thing seldom happens now because the equipment and methods used by modern cotton mills take care of the hazard. You may still find it, though, in poorly managed plants reworking old clothing, burlap, and so on. It isn't limited to cotton, but cotton is the worst of the textile materials.

The dust particles have to be close enough together so the flame will spread. They must be far enough apart to get enough air (oxygen) to burn. But whenever any explosive dust is kicked up into the air or dropped through it, the right mixture with air is bound to exist somewhere in the dust cloud for a moment or two at least. So you have the makings for a fire or explosion.

It would be better to say explosion *and* fire because you usually get both. In fact, if there is much dust around, you usually get *two* explosions plus a fire. The first explosion is usually small, but it kicks a lot of dust up into the air and then there's a big one.

The dusts of many metals can be explosive, too. You can't build a fire with pieces of metal as you can with wood or coal, but the dusts of some metals if fine enough — say, to pass through a 500-mesh screen—are explosive in the same way that wood or coal or grain dusts are. Magnesium dust is very bad. It's really hot stuff, as you would expect from the fact that fine magnesium turnings are burned in flashlights. Aluminum and bronze powders are bad, too.

In the open air, dusts, like flammable vapors, will not make an explosion—just a big burst of flame. But closed in, as in a coal mine, or a building, or a tank, they build up pressures that no building and not many tanks can take. Buildings can be constructed, though, with sections of walls or roofs that will open up and let the pressure out before it gets too high. New buildings to house processes likely to have this hazard, such as flour mills, grain elevators, starch works, and metal grinding plants, are usually designed in this way.

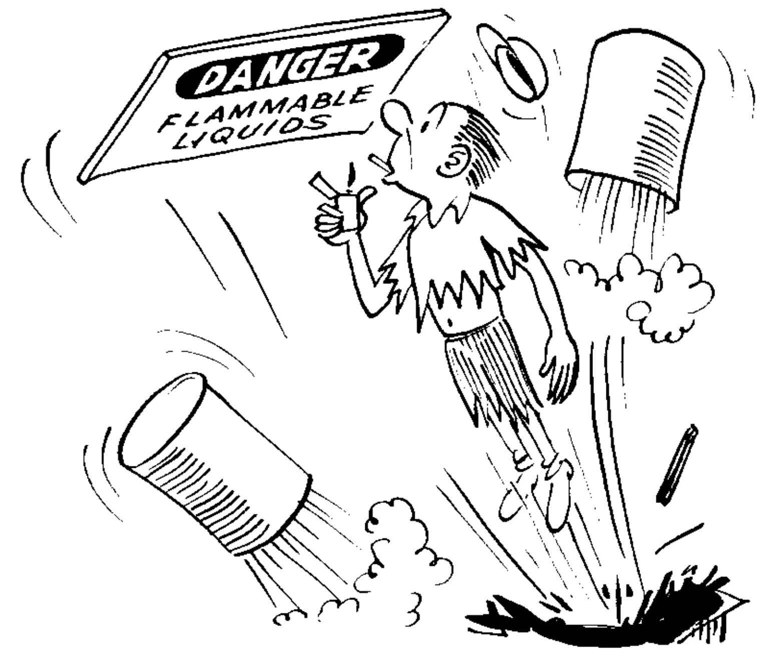
Dust explosions, like fires, are preventable. Only forethought and unfailing use of good common sense are required. Operations and processes in our plant that may produce explosive dust are enclosed where possible so the dust can't get out. Exhausts to catch the dust and carry it safely away are provided where enclosure is not practical. Such dust as does get out we must keep cleaned up—not allow it to collect on things. A soft fiber push broom or vacuum cleaner should be used, never a broom. In some areas, where building design permits, water can be used to wash the dust away.

Just for emphasis, here again are the main points about explosive dusts:

1. The dust of any substance that will keep burning after you light it is explosive if fine enough.
2. It must be mixed with air in the right proportions.
3. It takes only a spark or flame of any kind.
4. Outdoors the dust will give a burst of flame.
5. In a tank or a building it will explode, developing pressures that no building and few tanks can stand.

There are three basic principles for the prevention of dust explosions: Keep the dust out of the air as much as possible; and keep the dust cleaned up; and keep sources of ignition away.

Foreman: You might have the men name as many substances as they can whose dusts may be explosive.



FLAMMABLE LIQUIDS

I suppose all you men know the word *flammable.* It means "will catch fire easily and burn fast." *Inflammable* means the same thing. So when you see either word on a can or tank or drum, you can be sure that if you don't keep fire and sparks away from it you're in trouble. And *never* smoke around flammable substances.

A fact that seems to surprise many people is that the liquids themselves do not burn. It's their vapors that do. All liquids evaporate when open to the air. So whenever you have an open pan of any kind of liquid, you can be sure some of its vapors (or fumes) are in the air just above the surface of the liquid. That vapor-air mixture is what would catch fire if you touched a match to an open can of gasoline.

You fellows know, of course, that burning is simply rapid oxidation—the vapor of the substance that burns up combines with the oxygen of the air. No air, no oxygen, and therefore no burning. Furthermore, if there isn't enough vapor in the vapor-air mixture, it won't burn. The amount is different for different substances. For gasoline it is about 1½ to 2 per cent, depending upon the grade of gasoline. Below that percentage the mixture is too lean to burn. If you have too much vapor, it won't burn either. For gasoline too much is about 6 per cent.

The leanest vapor-air mixture that will burn is called the lower explosive limit of a substance. The richest is called the upper explosive limit. The spread between the two limits is called the "explosive range." Thus for gasoline vapor the explosive range is from about 1½ per cent to 6 per cent. For some flammable liquids it is much wider. For instance, for carbon disulfide it is 1 per cent to 44 per cent.

The explosive range is important because the wider it is and the lower the lower limit is, the quicker the explosive range will be reached.

Another important factor is the rate at which a flammable liquid evaporates—its volatility at room temperature (usually assumed to be 70°). It's easy to see that the more volatile a flammable liquid is, the more vapor it will shoot into the air per minute or per hour. Therefore, the results will be a bigger volume of explosive mixture and a bigger boom if it's touched off.

Vapor-air mixtures in the explosive range will produce only a big puff and sheet of flame if they're out in the open. But in a building or tank the pressure builds up in a small fraction of a second, and the building may well be demolished. The tank may be, too, unless it's a very strong one. So if you must use a flammable liquid, such as alcohol, gasoline, or cleaning naphtha, under conditions that give it much chance to shoot out vapor, take it outside.

For more or less continuous work that can produce flammable vapors, such as paint spraying, exhausts that will pull the vapors away as fast as they are formed are necessary. It's usually advisable also to pull the vapors through a water spray.

Vapor-air mixtures richer than the upper explosive limit won't burn, that is, unless more air gets to them. Except in a tightly closed tank, however, air *will* get to them, and they'll burn when it does if they're touched off.

Vapors diffuse, that is, they mix with the air even if there is no air motion. If you dumped a gallon of gasoline into an air-tight room, by the next day it would be spread all through the room. There would be a little more near the floor than at the ceiling because gasoline vapor is about 2½ times heavier than air.

The vapors of most of the flammable solvents are still heavier. They're likely to settle in pits and basements and other low places. With a heavy vapor there may be an explosive mixture all along the floor but not overhead. Then if it reaches fire or a spark anywhere, the fire will flash across the floor instantly. Whether or not the building will be blown up or will merely burn down will depend upon how much vapor there is. It may merely blow out some windows.

As long as the liquid is in a tank or drum it is very unlikely to have an explosive mixture in it. It will be too rich. If you pour all the liquid out but don't get all the vapor out, you're likely to have an explosive mixture because you've let more air in.

For example, a garage mechanic wanted to do a small welding job on a nearly empty, 55-gallon naphtha drum. He rolled it out doors, carefully poured the remaining naphtha out, and left it outside to air out. Next morning he put the torch to it. The drum was blown inside out, and he got a fast ride to the hospital. During the night enough air had entered the drum to bring the air-vapor mixture in the drum below its upper explosive limit. The safe way is to steam such a drum out thoroughly or to scrub it out with hot water and a good detergent.

Play safe, and you won't have trouble with flammable liquids.

HARMFUL DUSTS

When people say, "It's dusty today" or "That's a dusty plant," they mean dust that they can see. They don't realize that there's a lot of dust in even the clearest air. The particles are too small to see, but they can be shown up by a beam of sunlight through a darkened room. We breathe dust all the time, we have all our lives, and it hasn't hurt us because our lungs can handle such dust without harm. It's only dust that's too thick or poisonous or irritating that does us any damage.

Dusts of poisonous substances are a special subject, requiring special know-how. Today I'm going to talk about the ordinary everyday dusts from rock and clay, just plain dirt, and so on.

The dust that has caused most trouble is silica dust. It is the *only* cause of silicosis. Quartz is silica. So is most sand and sandstone. Granite and many other kinds of rocks contain silica, but many others, for example limestone, contain little or none.

Our lungs are made up of millions of air cells, far too small to be seen without a microscope. Air reaches them through still smaller passages. Dust particles must be less than about 1/2500 inch in diameter to get through them into the air cells. Bigger particles are breathed back out or coughed out. It's this coarse dust that bothers your nose and throat. If it's an irritating dust like lime, the tender linings of the air passages in our lungs become inflamed and sore.

Most of the particles that do get into the air cells are breathed back out, but some stick to the moist cell walls. Such dusts as limestone and clay and ordinary dirt are slowly dissolved and absorbed in the body fluids. But dust particles that won't dissolve and germs carried in on the dust are handled differently.

In among the air cells there's an army of scavenger cells called *phagocytes*, which can go in and out through the cell walls. They kill the germs by dissolving and absorbing them. Also, they carry off the very small number of dust particles that won't dissolve and leave them where they won't hurt anything—in between the air cells mostly.

So a person's lungs gradually become more or less loaded with such dust particles, but it takes many years of life in a lot of dust for the lungs to become overloaded, that is, if the dust is a harmless kind. If it's poisonous or otherwise harmful, the story is different.

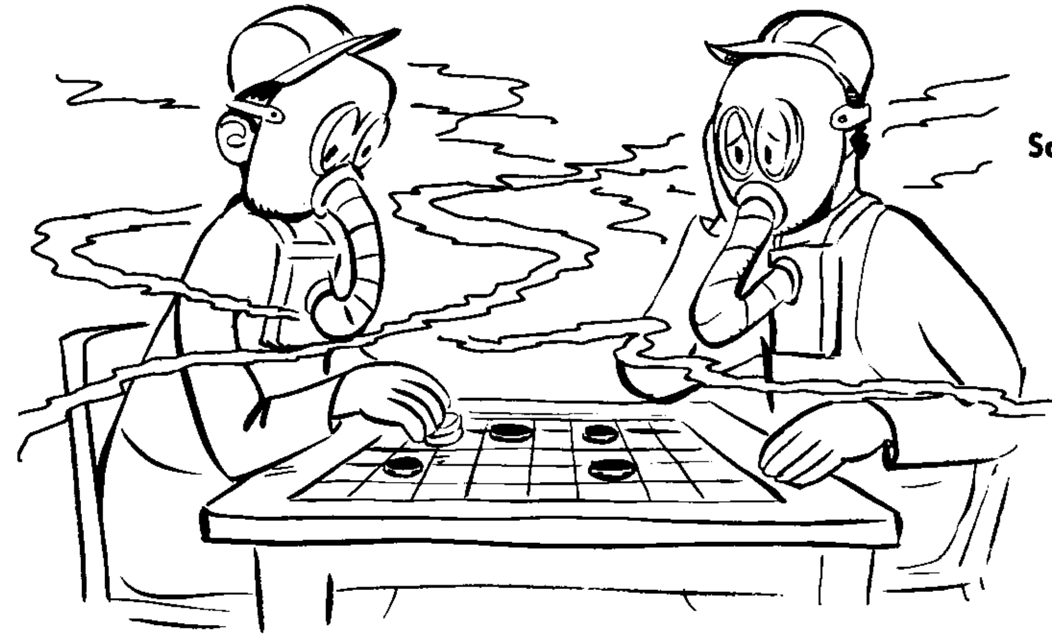
Take silica dust particles. The phagocytes latch onto them all right and carry them off, but they seem to be irritating. At least, the body soon walls each particle off in scar tissue. More dust particles, more scar tissue, and the lungs gradually lose their ability to expand and contract. The victim becomes increasingly short-winded. He has silicosis. It usually takes many years of work in high concentrations of silica dust to do much damage, but with dust enough and time enough, damage will be done. If the victim stays away from the dust, he will get no worse unless he contracts tuberculosis. The silica seems to break down the body's defenses against TB so that most silicotics die of it.

Fortunately, the amount of silica dust a man can work in safely all day long, every day, year after year has been determined pretty reliably. It is three million particles per cubic foot of air. Sounds like a lot, but you seldom find cleaner air. You'll probably have more dust than that in your own living room or out in the country on a clear, windless day. In the dust bowl country billions of particles of dust per cubic foot of air are frequently found.

For the so-called harmless dusts, the safe limit has been set at 50 million particles per cubic foot. This applies to such dusts as clay, shale, coal and limestone that have no silica, and to most organic dusts, such as grain, hay, and flour. Of course, any dust will do some harm if you breathe enough of it. Except for poisonous dusts or silica, you're pretty safe if there isn't enough dust to see easily. If you see dust rising from some operation, a rock crusher, say, or from a screen, you can be sure that the dust count would be high, probably hundreds of millions of particles.

Dust from any poisonous substance can be very bad. If dust merely makes your eyes or your throat smart, it certainly isn't good for you, but it isn't likely to put you in the hospital. If the dust is thick enough to see, as when a load of crushed rock is dumped, it's too much to breathe safely for very long.

Dust can be kept down enough so that it won't hurt anyone, but it is not always cheap or easy to do so. Most of the job has to be done by management, but the workmen must cooperate. If dust escapes from a leak in a piece of equipment, the first person seeing it should report it. When working with dusty materials, try to keep the dust down. If the dust irritates your eyes or nose or throat, report it. You may be especially susceptible. Finally, if you're supposed to wear a respirator, *do so.*



CORROSIVE GASES

Corrosive gases can burn your skin and eyes and lungs. Only a few are widely enough used for many people to be exposed to them. These are ammonia, chlorine, sulfur dioxide, bromine, and fluorine. Bromine is actually a liquid (it boils at 138°F), but it vaporizes so fast that whenever it's in contact with air plenty of gas results.

Three of these gases—chlorine, bromine, and fluorine if thick enough—will attack skin and flesh and burn it, actually eat it away much as strong acids do, but more slowly. They're particularly bad on eyes and lungs. A good lungful of air containing more than about 0.1 per cent of any of them is likely to cause a throat spasm that may be fatal. Serious eye damage may be caused by one-tenth as much, or even less in the case of bromine and fluorine.

These gases are classed not as poisons but as irritants. Concentrations too light to do any real damage will make a person's eyes and nose smart and maybe sting his face a little. These effects are a safety factor because when a man's eyes are smarting and watering and he has a sting in his nose he wants to get out.

The chief danger in working with one of these gases is that of getting a shot of the strong stuff in the face. That's curtains for unprotected eyes and the end if you breathe in much of the gas. Liquid bromine burns deeply. So does liquid chlorine, but not as fast.

Sulfur dioxide is what you get when you burn sulfur. About 20 parts of it per million parts of air will make your eyes smart. Most people can smell 1 part per million. Just the smell doesn't spell danger, but smarting does. And, of course, if the gas is coming from a leak, as it usually is, the leak may get bigger, fast.

Ammonia, as we all know, was widely used as a household cleaner and bleach before the modern detergents were invented. It was so weak a solution of ammonia gas in water that it couldn't do much damage unless someone drank it or got it in his eyes.

The ammonia you see in carboys and in chemical laboratories has from about 15 per cent to about 30 per cent of the gas in it. If you smashed a carboy of it indoors, the gas would chase everyone in the room out, gasping and choking. There would be some sore eyes for a while and perhaps some sore throats, too, but probably no lasting damage.

However, anyone who gets splashed with ammonia had better do a fast undressing and shower bath act. If any of the strong liquid gets into the eyes, it's an emergency. Unless it's washed out right away, serious eye damage is almost certain.

The pure gas is shipped and handled in steel cylinders and tanks under high pressure. It is called anhydrous ammonia (meaning, without water). The chief hazard is that of getting a shot of the gas from a leaky valve or discharge line. If there's high pressure behind it, it can kill or blind if it hits you in the face. It quickly burns bare skin deeply, too.

There's no reason to be afraid of any of these gases, but there's plenty of reason to he careful. Safe practices in handling each of them have been very carefully worked out and tested by experience. If in each case you will follow the manufacturer's instructions exactly, you won't get hurt.

Chlorine is a little more corrosive than ammonia but not much. One-tenth of one per cent will kill rather quickly. About 15 parts per million will make the eyes and throat smart.

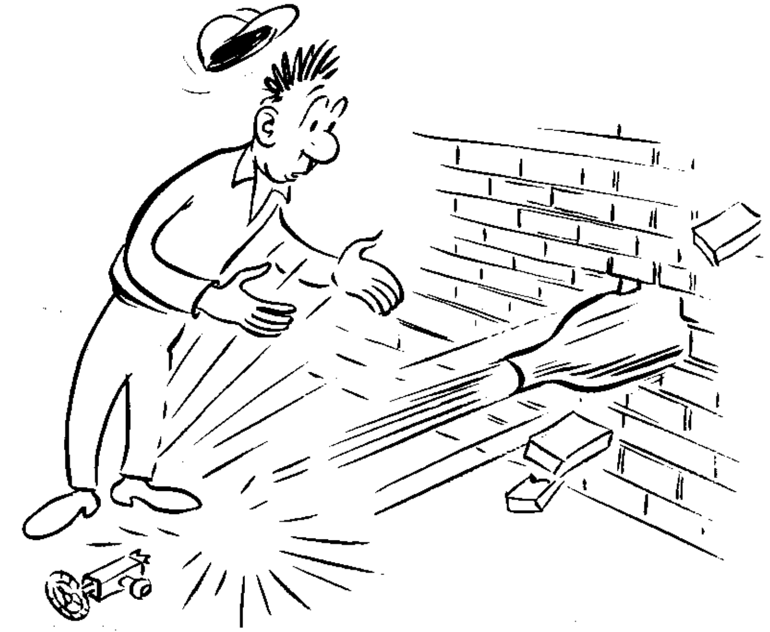
Chlorine is shipped and handled in cylinders and tanks as a liquid. Its boiling point is 30° below zero. As with all liquids, the greater the pressure, the higher the boiling point. So the pressure in a closed cylinder of chlorine (or any other liquid or gas) depends upon the temperature.

At 30° below zero there would be no gauge pressure in the cylinder. At 70° the pressure would be 85 pounds per square inch. At 140° the pressure would be 240 pounds. That spells danger, for that temperature or not far from it can be reached in the summer sun. That's why we're told to keep compressed gas cylinders out of the sun and well away from heat. The fact that they're under pressure is also why they should he handled with care. It just isn't smart to wallop a cylinder already under strain from inside pressure. The weakest point—usually the valve assembly—may not take it.

Bromine is still more corrosive than chlorine and adds the hazard of fire. It won't burn itself, but it can set combustible stuff like sawdust, paper, and straw on fire. A splash of the liquid will burn deeply into flesh.

Fluorine is worse still. It will eat almost anything. It *can* be handled and worked with safely, but very special precautions and protective clothing are necessary.

Corrosive gases *can* be handled safely, but you must know your stuff and use your head.



ACETYLENE AND FUEL GASES

There are so many fires and explosions each year from failure to use and handle acetylene and fuel gases safely that I figured I ought to talk about them. I won't have time today to do more than hit the high spots, but I'll try to cover the more important points.

First of all, it's easy to keep out of trouble with these gases if you'll just use your head. Perhaps the trouble is that people don't take the hazards seriously enough.

All these gases catch fire very easily. Any spark will set them off. That means "no smoking" around them. Keep them away from fire or anything very hot. It doesn't take red heat to set them off. From 600° to 800° will do it.

The lower explosive limits of these gases (the smallest amount which, mixed with air, is explosive) are low, about 2 to 3 per cent mostly—not much higher than the lower explosive limit of gasoline (1.5 to 2 per cent). Also, the explosive ranges of the liquefied petroleum (LP) gases are not much different from the explosive range of gasoline.

Acetylene and hydrogen are something else again. All mixtures with air that have between 4 per cent and 74 per cent hydrogen are explosive. Acetylene is worse still, for its explosive range is 2.6 to 80 per cent. Such wide explosive ranges spell extra hazard because when either of these gases gets to air you're almost certain to have an explosive mixture.

All the LP gases are shipped and handled in cylinders under pressure. In most cases, the pressure is less than 300 pounds because at ordinary temperature it doesn't take much pressure to make them change to liquids. But hydrogen won't do that, so the cylinders are filled to 2,000 pounds pressure. The cylinder pressure for acetylene is 250 pounds. There's a point about this that I want to emphasize.

Acetylene is likely to blow up all by itself if you compress it. Up around 25 pounds it becomes what the chemists call "unstable." It doesn't need a spark or a flame to explode. It may not blow as soon as it is compressed, but it will, given time enough. So 15 pounds per square inch has been set as the highest safe pressure for acetylene as a gas. But under pressure, acetone, a close relative of the acid of vinegar, dissolves acetylene in big amounts. In the acetone, which is a liquid, it doesn't explode under pressure. So an acetylene cylinder is full of a porous substance filled with acetone. It gives up the acetylene as the pressure is bled off.

Somehow or other, even some welders don't know about this. At any rate, once in a while some guy blows himself up trying to compress acetylene. For example, a welder decided to set up his own shop. He figured that he was being charged too much for acetylene. So he got an acetylene generator, a small second-hand air compressor, and a good strong water tank, and hooked them up. The apparatus worked fine for a few days, and then it let go and the whole place came unstuck. They buried what was left of that fellow.

Acetone loses its ability to hold the acetylene if you heat it up much; so the cylinders have fusible plugs that will melt at about the boiling point of water. If an acetylene valve freezes up, thaw it out with lukewarm water, never hot water. Pour the water over the valve, not the cylinder. Never use a flame of any kind. That goes, too, for any compressed gas cylinder, though it's most important for acetylene.

Since the LP gases are liquid under pressure, the cylinders should be used valve end up only. Otherwise you may get shots of the liquid. The same thing applies to acetylene. A shot of acetone won't help the welding job a bit. Hydrogen does not liquefy under pressure.

The LP gases are all much heavier than air. If there's a leak, they'll go down more than up, but they'll spread out through the air (diffuse), too. Acetylene is just a little lighter than air — not enough to count. Hydrogen, though, is about fourteen times lighter than air. That means that if you turn it loose it will go upstairs fast. So look up under the ceiling for hydrogen, down at or under the floor for LP gas.

Handle all compressed gas cylinders carefully. Remember that the metal is fighting pressure all the time unless the cylinder is completely empty. Also, don't forget for a minute that the wallop a cylinder gets if it's dropped onto a concrete floor can break the valve assembly off. If that happens, there's real trouble. If you bang two cylinders together hard, both might let go. Finally, if you're going to do any welding or use any LP gases for any purpose whatever, be sure you know the safe methods and use them. Use your head, and stay safe and healthy and avoid a fire.

OXYGEN

There's more oxygen in the world than any other element, and it's the most important one, too, because it's necessary to life.

Air is 21 per cent oxygen, 78 per cent nitrogen. That seems to be just the right proportion for us. Too much wouldn't be good nor would too little. We could take much more oxygen in the air, but it would drive us too hard. We'd wear out sooner. If the oxygen gets down to about 16 per cent (as it may in a well or tank), a person gets short of breath; at about 10 to 12 per cent, he passes out. Probably you've all read newspaper accounts of someone suffocating in a silo. Usually, the cause is lack of oxygen, which has been used up by the fermenting silage.

Fire, too, depends on oxygen. A flame safety lamp or a candle will go out if the oxygen drops below about 15 or 16 per cent. If there were very much more oxygen in the air than there is, it would increase the fire hazard in two ways. It would make things catch fire easier and make them burn faster.

The temperature at which a combustible substance will catch fire if heated in the open air is called its ignition point or ignition temperature. It's about 400° to 450° for paper and most kinds of wood. For gasoline it's a little higher, and a little higher still for most fats, greases, and oils. Increasing the amount of oxygen in the air will lower the ignition points of combustibles. In fact, in pure oxygen the ignition point of oils and greases is so low that an explosion will occur. So keep all oils and greases away from oxygen, and the other way around, too.

Also, some substances that won't burn in the air as it is *would* become burnable if the percentage of oxygen were doubled or more. Take iron, for example. It won't burn at any temperature in the air. But if you heat the end of a piece of steel (or iron) wire red-hot and stick it into some oxygen, it will burn brilliantly. The cutting torch is based on that fact. In cutting a steel beam, a small spot at the edge of the beam is heated red-hot with the gas-oxygen flame. Then the oxygen does the rest.

The faster a fuel burns, the hotter the fire. In the open air 2,000° F is about as high a temperature as you can get with wood. Use oxygen instead of air, and you get another 1,000° or so. Use acetylene or some other high-powered fuel gas instead of wood, and you double your top temperature or more. That fact makes gas welding possible. It spells hazard though, because we must keep these two gases apart until we want to bring them together at just the right rate. We must keep their burning under complete control all the time. Operating a welding torch properly calls for a lot of know-how and skill. So don't try it unless you know your stuff.

As you know, oxygen comes in cylinders under high pressure (2,400 pounds per square inch), in order to get as much as possible into each cylinder. Fifty years or so ago the pressure wasn't run so high because the cylinders made then couldn't stand it. But the pressure has been increased along with the strength of the cylinders.

Present-day cylinders are safe if handled properly. Yet at 2,400 pounds per square inch, the force trying to blow each cylinder to smithereens runs into more tons than I like to think about. It's just plain good sense to avoid putting more load on steel fighting to hold that kind of pressure.

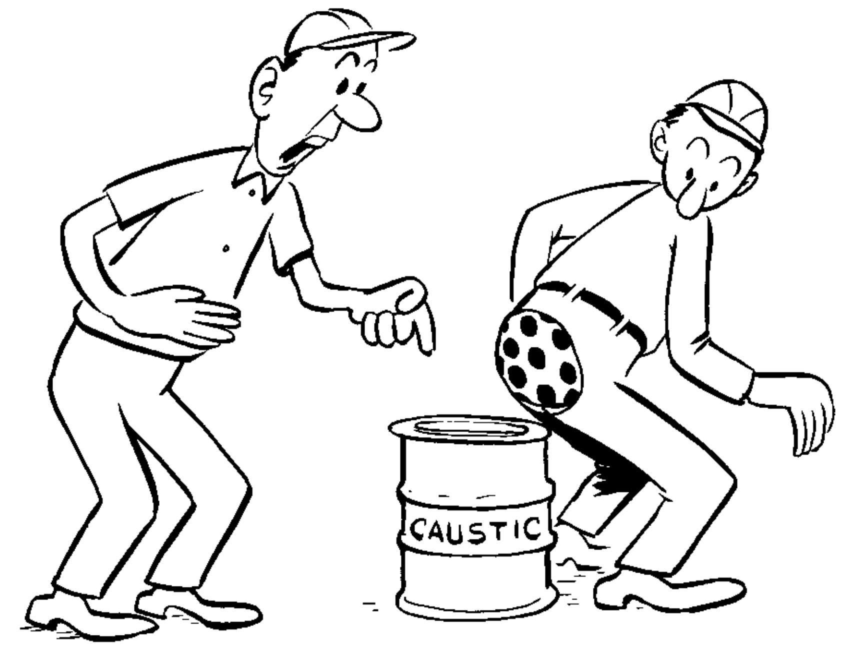
Impact stresses are the worst. If a full oxygen cylinder drops from the tail gate of a truck onto a concrete pavement, the impact stress if it hits just right can run into tons. It may be just too much, and if it is you'll get a real bang. Even letting one tip over from a standing position is dangerous.

Cylinders should *not* be allowed to stand in the sun either. The temperature of the steel can easily reach 130° to 140° in the sun on a hot summer day and that will run the pressure up a lot. Keep fire away, too. It doesn't take much fire to turn the cylinders into bombs—real high-powered ones.

The valve assembly is the weakest point on a cylinder. A stiff wallop can break it off. That's why the cap should always be kept on except when the cylinder is in use. It's also why the cylinder should be kept securely fastened when it's on the welding truck or when it's standing on end.

If the valve assembly breaks off, the oxygen rushing out quickly heats the metal around the opening to its ignition point and the opening gets larger fast. That builds rocket thrust, and the cylinder may take off. Even if it doesn't, that hot blast of oxygen and burning metal shoots out a long way and is a very bad fire-setter, indeed.

One last point—*never* use oxygen as a substitute for compressed air. It will furnish the pressure all right, but it's apt to throw in a first-class explosion to boot.



CAUSTICS

Caustics are chemicals that dissolve or eat animal tissue—skin, flesh, hair, and so on. Strong acids will do that, too, but they like metals better. The caustics that are common, enough used so that you're likely to run into them, are caustic soda and caustic potash. Unslaked lime—quicklime—is caustic, too, but it's not nearly so bad as the other two.

Caustic soda and caustic potash can cause serious injuries. You can work with them safely, though, if you know your stuff and *always* use your know-how.

These caustics come dry (anhydrous), solid, or as flakes or powder in drums of thin sheet steel, or as a solution in water, transported in heavy drums. The form in which they're received determines how they should be handled.

Everyone working with these caustics should always keep in mind that both the solid and the liquid will quickly eat through the skin and into the flesh. They are deadly to eyes. Dust particles of the solid caustic will stick to the skin and eat away at it. It's easy to see that the dust is very bad to breathe. Fortunately, the solid caustic doesn't dust easily; so if the drums are emptied with reasonable care, dusting can usually be avoided.

These caustics are dangerous, but if you give them no chance to eat on you, they can't hurt you. That means wearing good eye and face protection — goggles and preferably a face shield also. It means wearing a cotton coverall snug-fitting at neck and wrists, rubber safety shoes (or boots), with the bottoms of your trouser legs well down over the shoe tops, rubber gloves and apron, and a respirator if there's any danger of dust or of misting in such jobs as steaming out the drums. If there may be leaks from caustic lines overhead, wear a protective hat, too.

These caustics eat leather rapidly. Wool can't take them either. Cotton stands them better. So wear cotton clothing. Then add the rubber apron, get your rubber gloves, and you're set. But wait a minute. Where are your goggles and face shield? Should you wear a respirator? Make sure before you pass one up. You can't take a chance on breathing the stuff.

Foreman: At this point you might put the question, "What is the basic principle of safety in handling caustics?" The answer, of course, is to keep it from getting to you— prevent skin contact. Bring this point out and see that everyone gets it.

Whenever we're going to work with caustics, we'll plan the job carefully step by step, work out the hazards as far as possible, and decide upon the safe procedure. Then each of you will be carefully instructed and trained in this procedure. For example, suppose the operation is to empty out a drum of solid caustic to be used in smaller quantities. It has been poured molten into a drum of thin sheet. The caustic is hard but rather brittle. The filled drum weighs between 700 and 750 pounds. It has been brought in and left lying on its side. The caustic is to be broken up into pieces.

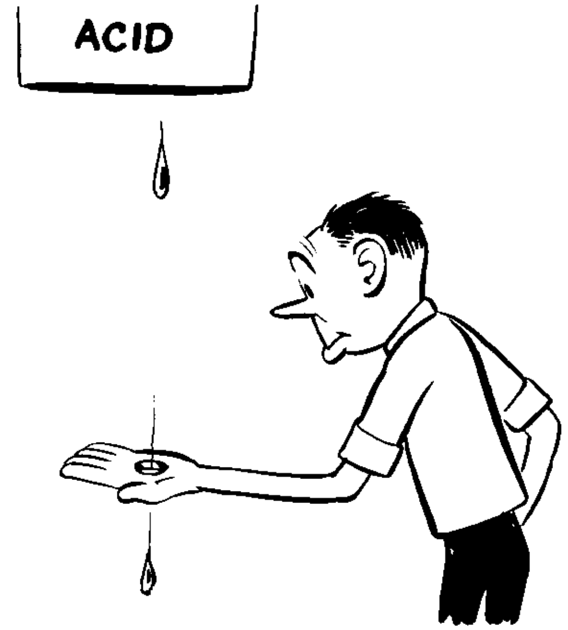
There are two ways of doing the job by hand. The first is to break the caustic by pounding the drum with a heavy sledge or an air hammer, then open the drum with an ax or crowbar. The second is to strip off the sheet steel and then break the caustic up.

Foreman: Select one of these methods and work out the best procedure jointly with the men. Place particular emphasis on the hazard points.

First method: Block the drum on both sides to prevent its rolling from the blows. Two pieces of 1 by 6, a foot or so longer than the drum, will do. Hammer the drum well all over, the heavier the blow the better. Turn the drum as necessary by sliding one blocking strip out, barring the drum to it, and moving the other one up. After the pounding, the steel sheet can be split lengthwise with an ax or a sharp-ended bar and stripped off. Break up large chunks by sledging them under burlap or canvas to keep pieces from flying. Or place them in a barrel or drum on end and break them up with a lawn tamper or similar tool.

Second method: Block the drum as in the first method with the seam up. Take a comfortable stance (with feet well apart) at the end of the drum, jab the sharp end of a steel bar through the seam at its center and, by rocking the bar back and forth, open the seam to its end. Repeat this process from the opposite end of the drum. Jab the end of the bar down between the drum head and the caustic, and pry the head off. Repeat with the other head. Bar the sheet off, and bar the cylinder of caustic into position so that it can be broken up with an ax or a sledge. Use burlap or canvas as in the first method, or curtain off this operation to protect others against flying pieces.

One last important point: If any caustic reaches your skin, wash it off at once with plenty of water.



ACIDS

There was a time when only workers in chemical plants would have anything to do with acids, but that time has passed. We're apt to run into them in almost any plant nowadays. Most of them are more or less hazardous to handle or even to have around. All of them can be handled safely, but you must know how. You must have proper respect for them.

Foreman: Here you can have the men name the acids they know about and tell where they are used. You should prepare yourself by finding out just what acids are used in the plant, what each is used for, and where it is used. Then you can comment on the hazards of each.

The dictionary says that acids have a sour taste and attack metals. The sour part isn't important to us, but the attack part is, because that's what makes them hazardous. The dictionary should have added that they will attack skin and flesh, too, and a lot of other things, as well as metals. Some of them can start fires, and some may give off poisonous or flammable gases. So it's a good idea to know something about those acids you may have to handle.

In this talk I won't try to do more than hit the more important points. Anyone who works with an acid (or acids) very much should have a much more complete know-how than I can give you today. However, if you know in a general way the kind of hazards acids offer and the kind of safe practices you should follow, you will be safer. You will, that is, if you use your heads whenever you have to handle an acid.

Remember always that any acid will attack —that is burn—skin and flesh. It's deadly to eyes. How fast it burns, and how deep, depends upon the kind of acid and how strong— how concentrated—it is. In any case, the first principle of safety in handling any acid is to keep it off you. If it does get on you, wash it off immediately. Right there is where lots of fellows get into trouble. They get a little low strength acid, weak battery acid, for instance, on their hands. It stings a little but not much, and they take their time about washing it off. The skin may get a little red and sore, but nothing more happens. So they figure it isn't such bad stuff after all.

Then they get more careless. Sooner or later they get some in their eyes. Unless they wash it out fast and very, very thoroughly, they're very likely to end up with at least some loss of vision. A good shot of strong acid in the eyes is likely to spell blindness.

Most acids eat metals rapidly and give off hydrogen gas as they eat. Hydrogen is highly flammable. Any spark or flame will set it on fire. Mixed with air, it is highly explosive. Another example is the ordinary auto battery. In it sulfuric acid combines with a compound of lead and gives off hydrogen. So using a match to see if a battery needs water (or even getting a cigarette near the battery) is asking for a shot of flame and battery acid in your face. A lot of fellows have asked for it and gotten it.

Most acids come as liquids. With one exception, hydrofluoric acid, they don't eat glass or rubber. So they're kept in glass carboys or bottles, or in glass- or rubber-lined tanks and drums. Strong sulfuric acid attacks steel so slowly that steel drums are also used for it. Remember, though, that sulfuric acid may generate some hydrogen. So play safe and always treat sulfuric acid drums as though the space above the acid is full of hydrogen.

Handle acid bottles and carboys with great care. Dropping a glass carboy of acid is a very poor way to ensure a long and healthy life.

Another sure-fire way to get into trouble is to heat an acid or let it get hot. Some acids are worse than others, but they'll all give off bad-acting vapors or gases. Sulfuric and hydrochloric acids will shoot out gases that will burn your skin and your eyes and eat at your lungs. Nitric acid will give off very poisonous, yellowish-brown gases. They can damage your lungs so much without your knowing it that, if you're exposed to a heavy concentration without suitable protective equipment, you may die in a day or two.

So here are the ABC's of safety in handling acids. Take no chances with them. Protect your eyes completely. Wear acid-resistant protective clothing, including gloves. Handle acids in a way to avoid any spillage or breakage. Keep them away from heat. Keep them away from substances they can react with.

All this means that if you're going to work with acid—any acid—you must know its hazards and the proper safe practices to use. Acids *can* be handled safely.

PILING MATERIALS

Failure to pile materials properly and to follow safe practices when piling them brings a lot of injuries each year—usually not very many in any one plant, but there are several hundred thousand plants in this country. If each plant has only one such injury every second or third year, it's still a lot of injuries. So if we haven't had one for the last two or three years, we're only average and that just isn't good enough. Get what I mean? If we do a really first-class safety job, we won't have *any* injuries on this type of work.

You know, of course, the difference between accident and injury. You know, too, that in low-hazard work, like most piling jobs, most accidents don't injure anyone. So if we can cut out the accidents, the injuries will take care of themselves. This talk is aimed at just that—eliminating the accidents as well as the injuries.

I'll describe safe procedure and point out the hazards that apply generally. There may be some additional points on each kind of piling job, but if you know the essentials of safe procedure in piling stuff, you'll be able to figure these points out.

When you have a piling job ahead of you, the first thing to do is to give it a good careful once over. What is the weight of each object, its shape, its size? Do the objects vary much in size, shape, or weight? Are they floppy like a bag of beans, or are they firm and stiff like bar steel or ordinary lumber? Does the stuff have to be handled with extra care to avoid damage? For example, is it in paper bags that may break, or are the objects breakahle things in cartons, and so on? Then there's the problem of making sure that once the stuff is piled it will stay put.

The floor strength should be checked, particularly for heavy materials. Even slight settlement or sagging can cause trouble with some kinds of materials, especially bagged stuff. So play safe.

Always figure how high you can pile safely. Sure, feathers might be an exception, but you probably won't have many of them to pile. Sometimes heavy machinery causes enough vibration to make it hard to hold piles of bagged material. This situation calls for both good crosstieing and limiting the height of the pile.

Don't pile so high as to interfere with sprinklers, and don't locate piles where they obstruct access to light switches, fire extinguishers, and so on. Also, leave plenty of aisle space for whatever kinds of traffic there may be.

All bagged material should be crosstied. If the material is firm, like cement, placing the bags in each layer at right angles to those in the layer below is sufficient. Piles of cement should not be over 12 to 15 tiers high because overpressure may burst outside bags in the bottom tier. Piles higher than about 8 tiers should be sloped inward slightly.

Lumber crossties should be used for bagged material that is floppy. The shape and weight of objects of varying sizes, such as foundry flasks, will determine the method of piling and the height and size of the pile.

Of course, in all piling, as in moving materials from place to place, machinery such as fork lift trucks or portable conveyors should be used whenever possible. It is far cheaper, safer, and more efficient than muscle power. But there are many piling jobs that must still be done partly or wholly by hand. Most of the accidents and injuries occur on these jobs. There are strains from incorrect lifting, bruised and smashed and cut fingers and hands, and so on through the list.

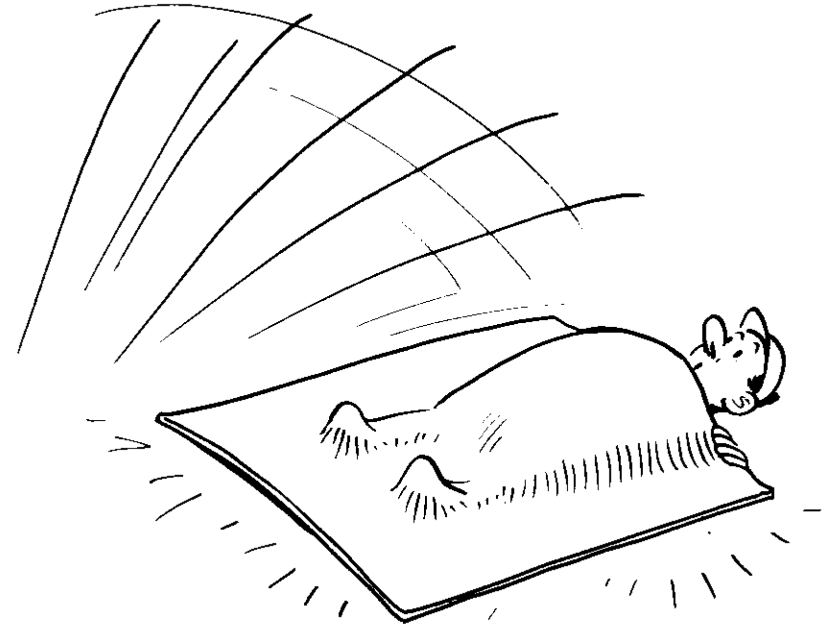
Remember the fundamentals of safe lifting —know how much you can lift safely, look out for sharp edges, be sure of your footing, balance the load, use your leg muscles, and go steady and easy. Be sure you can let go without pinching or tearing your fingers.

If it's a two-man lift, work with your partner in developing the best procedure and make sure each of you knows precisely what he is to do. Don't forget your gloves or other hand protectors, wear safety shoes, and check carefully to find out if you should wear eye protection.

Piling is a two-man job except for light and easily handled things. When the pile gets up to about chest height, a third man is needed on top. That requires good teamwork. It comes with practice, of course, but unless just what each person is to do—the motion sequence—is worked out and agreed upon in advance, it may be some time before the three get together. Meantime, they're wide open for an accident.

High piling calls for hard hats. It doesn't take a very heavy object to dent one's noggin even if it falls only a couple of feet.

In piling things that differ in size, weight, and shape, good judgment has to be used in deciding just the best way to do the job. But if you'll just keep your safety-mindedness close at hand, give the job a good careful once over, plan it through, and then go ahead, you'll do it not only safely, but efficiently as well.



HANDLING SHEET STEEL

I wonder if you fellows know that the work of handling materials produces more injuries each year, the country over, than any other kind of work. Of course, you can't do any work at all without handling things, but that kind of handling isn't what I mean.

I'm talking about the injuries connected with moving, placing, and storing materials and objects. For instance, if your job is to bring some sheet steel from the warehouse to a punch press and to take the punchings and the scrap away and if you get hurt doing it, that's a handling injury. But if the press operator takes a piece of scrap off the press with his bare hand and gets a cut, it's charged to press operation and not to handling.

The job of handling sheet steel is a bad injury-producer. It's mostly up to the workmen themselves to keep from getting hurt because their safety depends on the way they do the work—the way they handle themselves and the steel. The work *can* be done without anybody getting hurt, but it seldom is because to prevent injuries, everybody on the job must follow safe practices all the time, without fail. A sharp corner or a fin on a steel sheet or piece of scrap is like a knife sticking out at you, and you certainly wouldn't grab hold of a knife carelessly. So don't do it when the knife is part of a piece of sheet steel.

Whenever practical, sheet steel should be handled by machinery. A lot of money and brains have been devoted to the development of materials handling equipment, and sheet steel has had its share of attention. Even so, there are still plenty of situations where it must be handled by men, mostly in connection with small or moderate-sized production units, such as a battery of punch presses or forming presses, sheet metal job shops, or shops manufacturing heating and ventilating equipment.

The sheets are received in bundles bound with steel strapping. Unloading and storing the bundles is a job for power trucks suited to the purpose. The truck operator has to know his truck and know how to use it safely for this kind of job. If any helpers are needed, for example, to break the bundles loose in the freight car so the truck can pick them up, they too must know and follow safe practices.

Doing this job safely requires the steps that are basic in getting safety into any operation—looking the job over to find the hazards, planning the operation to avoid them, working out the safe action sequence, and learning and following it. This includes the wearing of necessary personal protective equipment, such as gloves, safety shoes, and goggles.

It's the manual handling operations that are most troublesome. They start with opening up the bundles. The ends of the strapping may spring out when cut. So it's important for the person doing the cutting to stand to one side when he cuts each strap, never in line with it. Since the cut ends may be sharp, they can make nasty gashes in unprotected flesh and can put eyes out. Safety goggles are a must, and face shields are usually advisable.

It is best to keep bundles strapped until they reach their point of use. However, if sheets are transported loose, they should not be piled so high they might slip.

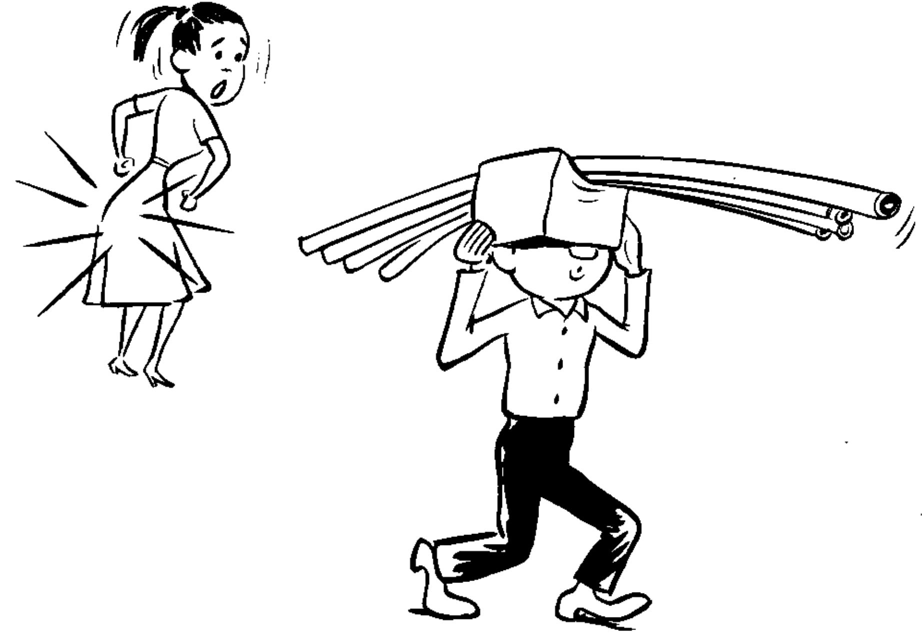
The strapping is stiff and springy enough to be a hazard underfoot also. Each strap should be thrown into a suitable container as it is taken off. Subsequent disposal is easier and less hazardous if the strapping is cut into short lengths.

The corners of the steel sheets can cut and tear; so the method of handling must take account of this hazard. Heavy, wear-resistant gloves are necessary. So are safety shoes because a piece of sheet steel dropped edgewise on the foot can cut through an ordinary shoe or at least leave a bad bruise. Sheet steel on pallets or platforms should be placed so edges do not extend into walkways.

The trimmings and scrap from punch presses and shears are particularly hazardous because of sharp points and edges. Worn dies leave sharp fins on the material. So provision should be made for such scrap to be caught in boxes or containers designed to be picked up at regular intervals.

When you handle sheet steel, you should assume that all its edges may be sharp enough to cut unprotected hands and that the corners may be sharp enough to penetrate clothing. They're bad to run into. So in handling and placing this material, keep that fact in mind and govern yourself accordingly. The same thing applies with even more force to trimmings and scrap.

Sheet steel *can* be handled safely, but it takes a lot of safety-mindedness to do it.



THE ONE-MAN CARRY

Carrying heavy or awkward objects takes more than muscle. It takes know-how, too. Before talking about safe practices for the one-man carry, just to jog our memories I'll mention some of the more important points on safe lifting and manual handling which apply to carrying. One thing certain about accidents is that most of them are due to failure of someone—usually the fellow hurt—to do "as good as he knew how." Repeating some of the safety pointers may help us keep them in mind.

Always look the ground over first. Where are you going to carry to? Is the way clear, the floor nonslippery and unobstructed? Any corners you can't see around? Any narrow places or places without plenty of clearance overhead? Any doors? If so, do you block them open, or tie them back, or have someone open them ahead of you, or do you just "bump" them open?

The point here is that if you look the situation over you can spot the hazards and take suitable precautions against them. And it takes only a minute or so. Sizing up the situation is not only the safe, efficient way, but it usually makes the work easier.

In lifting the object, remember that you must never try to imitate a derrick; that is, your leg muscles are going to do the work, not your back muscles. Place your feet so you'll have good balance. Look out for anything that can cut or tear or jab into your hands or fingers. Take hold of the object in a way that will give you good control and assure keeping a good firm grip, and watch where you're going. Know where you're going to put the load down and how you're going to let go of it without damaging your hands or fingers.

Be careful again about that derrick stuff when you lower the object to the ground because it's just about as easy to get a back strain when you're setting a load down as when you're lifting it.

Next, let's take a look at the proper way to carry an object. Of course, it will depend a great deal upon the object's size, shape, and weight. There is, however, one very important point that's apt to be overlooked. The easiest and safest way to carry certain heavy objects, such as sacks of cement, small compact cartons, and the like, is on your shoulder, provided they can be properly balanced there.

On your head would be better still, but I'm not going to try to get any of you fellows to do it that way. If you'd practice this method a while, though, you'd find out that I'm right. In Far Eastern countries — China, Malaya, India—slender, pint-sized men carry loads on their heads that you'd have trouble getting onto your shoulders. Even some of the women might show most of us up.

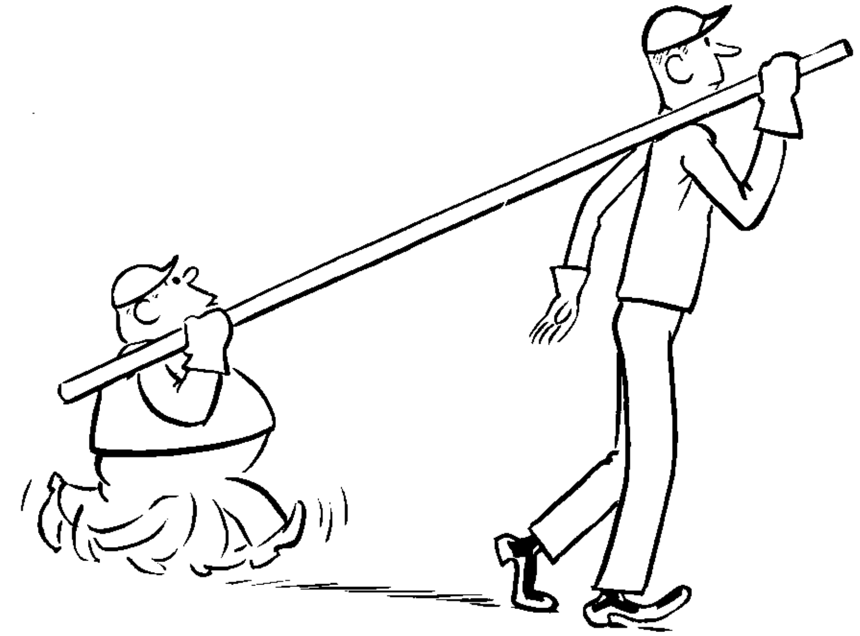
On a very short carry, it may be easier to use the chest carry, particularly for a carton or box. Here, the chief problem is to see where you're going. If the load's too big for that, it's really a two-man job. Of course, a big but light carton can usually be swung up onto a shoulder without much difficulty.

Another hazard shows up in carrying pipe or planks or other long objects. I mean, socking someone in the noggin. A pipe or plank end in the face can do a lot of damage. Also, running it into a column or letting it swing into something can be very upsetting to the fellow carrying it. And if it hits something moving—a belt or pulley—it may be thrown, and that can be really bad.

With all the electric wiring and electrical equipment there is around the plant, a badly handled piece of pipe or steel rod or an aluminum ladder can spell electrocution for the carrier. So scout out the way first, and take note of all places where the clearance is limited, especially around corners, and govern yourself—and the piece of pipe or whatever—accordingly.

Finally, keep the front end of the load high, and watch out for any guy who might unexpectedly barge out in front of you. If there's much danger of that, you'd better do as workers do on the railroads—send a flagman on ahead.

Maybe you think I'm overdoing it in telling you to be so careful, but all the points I've made, and more besides, are justified by the accidents men have had and keep on having in carrying things. So remember to use your head on your carrying jobs.



TWO-MAN CARRY OF PIPE OR PLANK

The two-man carry has the same hazards as the one-man carry, but the fact that the two men must move as one to make it go well complicates things. It sharpens some of the hazards. Close teamwork can overcome this problem, but you don't get teamwork in anything on the spur of the moment. It's necessary to plan the job through and work out the action sequence in detail. Then the motions should be practiced often enough to make sure that both men understand the action sequence and can and will work together safely in this operation.

If one man is only a little slow on the lift or in lowering, an extra load is thrown on him, increasing the chance of his getting a strain or causing him to lose his hold. It's easy to see how bad that can be.

Getting out of step on the carry not only makes it harder for both men, but greatly increases the chance of a stumble and fall.

Finally, when it comes to setting the load down, unless both men know exactly what each is to do and the order of the steps in the operation, one or both may get hurt. They're especially likely to suffer bruised or torn fingers.

Suppose now we run through the operation. We'll start from scratch. The kinds of injuries and accidents that obviously are possible are strains from incorrect lifting, from stumbling, or from lack of teamwork; falls due to faulty floors or objects underfoot; hand injuries from sharp edges or splinters; crushed fingers or toes from incorrect placing and handling of the load; colliding due to bad lighting, lack of teamwork, too much hurry, and interference by others.

First, we inspect the route of the carry, remove or plan to avoid obstructions, make sure of good footing, note all hazard points such as steps, floor drains, ramps, blind corners, and limited clearances. Pay particular attention to the possibility of colliding with others at aisle crossings, in work areas about machines, and in similar places.

Next, we'll decide the best kind of carry to use. About 200 pounds is the practical limit for two ordinary men for a shoulder carry. Generally, if a heavier load must be carried, four men, using special tongs, should be assigned to the job. Under all ordinary conditions, however, moving a load heavier than 200 pounds is a two-man and dolly job.

Two men can use a hand or underarm carry for lighter stuff like 1-inch or 2-inch pipe that can be grasped securely. Because this type of carry looks easy, you may be less inclined to use teamwork, but the accident records show that you should *always*. Hand carries, of course, call for gloves. Shoulder carries call for shoulder pads if much of this kind of work is done.

Men who are to use the shoulder carry should be of about the same height and build, husky, with good coordination. They must work together well, and one will be made the leader.

I'll now run through an action sequence that has been used very successfully on a two-man carry of 8-foot to 12-foot lengths of pipe weighing up to about 16 pounds per foot. Most of it weighed much less.

STEP 1. Each man gets into position on the same side of the length of pipe near his end of it, both facing in the direction the pipe is to be carried. They both crouch and then grasp the pipe with their right hands on one side of it and their left hands on the other so as to carry it in cradled fashion. Applying effort with the leg muscles, they lift together at the word of the leader, and straighten up, raising the pipe to hip level.

STEP 2. When the length of pipe is at hip level, each man holds it with one hand (the hand under the side nearest him) and shifts his other hand so that both are placed under the pipe *on the near side*. Then, at the leader's signal, they lift the pipe to their shoulders.

STEP 3. At the word of the leader, both men step off with the right foot, keeping in step and stopping at a word or signal from the leader.

STEP 4. At the word of the leader, the lifting process is reversed, with each man returning to the position he assumed at the start of the lift. The men then lower the pipe onto blocking placed for the purpose.

Of course, some of these details will vary with conditions, but the basic principles apply to all such jobs. They are:

1. Look things over and correct the hazards as far as you can.
2. Plan the job in all details, working out the action sequence.
3. Make sure that each of you knows exactly what he is to do.
4. Follow the procedure decided upon.

SHIFTING LOADS BY HAND

If I asked each of you fellows in turn whether or not there are any serious hazards in handling such things as cartons, boxes, crates, pipe, and so on by hand—I mean, of course, loads that aren't too heavy for one or two men—I'll bet most of you would think me a little screwy. If so, you'd be wrong because manual handling is one of the worst injury-producers, not only because of the number of injuries but also because of the difficulty of preventing them.

Most machines can be guarded so well that the operator has to do something really foolish to get hurt. But it's the other way around in handling stuff. Unless a fellow learns the safe ways of lifting and carrying and handling and always follows them, he's almost sure to get hurt sooner or later.

Of course, very few men get killed handling stuff. Neither are there many who lose a leg, an arm, or even a finger. Most of the hard-to-cure injuries are strains, chiefly back strains, but there are a good many pulled tendons and muscles, too.

There are lots of broken feet and bruised and smashed toes. Hands take a lot of punishment, too—mashed and bruised and cut fingers, nails torn in two or even pulled clear off, blisters and slivers.

A fellow may get a bruise or a cut just about anywhere from head to toe. Some of the head wallops—if, for instance, a fellow loses his footing and bangs headfirst into something hard—can give a guy a concussion that may put him in the hospital or even the graveyard.

Finally, once in a while someone's eye stops some hard flying object. That's a mighty tough way to learn the value of safety goggles.

Whether or not a man gets hurt handling stuff is squarely up to him. His muscles furnish the power; all the action is under his control. If he gets hurt, he has hurt himself. Oh yes, there are some exceptions as when some fellow bumps into you or trips you up or drops something onto your foot. But, usually, in such cases there's some fault on both sides. If a man wants to keep from getting hurt—or hurting someone else—he must use judgment, use his good sense *all* the time.

First of all, look to your footing. When you're "rassling" with a bag of cement or an awkward carton or length of pipe, a slip or a stumble can be bad, very bad. So see that the floor is clear, not slippery, and free from obstructions. If there's a tripping hazard you can't pick up and put away, handle your feet so you won't trip over it. Wear safety shoes. If you drop something, those steel toe caps will probably spell the difference between smashed toes and uninjured toes.

Of course, the safest and most efficient way to handle objects will depend on their nature and on what is to be done with them. Is it a one-man job or a two-man job? For example, one man can easily and safely lift a 90-pound carton (1′x2′x3′) onto a waist-high conveyor if he places his feet so as to maintain good balance, takes the right hold on the carton, and squats enough with each lift so that he can keep his back straight. He then tilts the carton to get both hands under it, lifts its edge up, and tilts it hack as desired onto the conveyor.

If, however, the lift is only a couple of feet or so higher, it becomes a *two*-man job because lifting above the waist is far harder.

Some of us can't seem to remember that even the most calloused hand is soft compared to most of the things we handle. Too many fellows are apt to take hold of a wooden crate or a plank bare-handed without first looking to see if it has slivers—or a casting or a piece of steel without thought of sharp edges or corners. What's more, if they don't get quite the right hold at the first try, they're likely to slide their hands along the object—giving a wide open invitation to a sliver or a sharp edge or fin. So before grabbing onto anything, take a moment to size things up. Failure to do so lets an awful lot of fellows in for cut and torn hands and plenty of slivers.

Such work calls for hand protection, usually ordinary work gloves but sometimes special protectors, for example, heat-resistant gloves for hot castings or steel-laced gloves that will take extra heavy wear.

Failure to provide for safe "letting go" of heavy things also yields a lot of finger and hand injuries. Sounds foolish, doesn't it? And it is. It takes only a moment to figure out just how you're going to get your fingers out whole from under whatever it is you're going to lift or move.

Finally, on a manual handling job run over the points on safe lifting and make sure you use all of them that apply. Above all, look things over and use your head. That way you won't get hurt or hurt anyone else.

STRAPPED OR WIRED MATERIALS

Metal strapping and wire on bales and cartons is one of our most useful inventions. I don't see how we could get along without it, and we take it pretty much for granted. It's safe to handle, too, if you use it right. But if you don't, it can hurt you plenty.

The edges of the strapping can cut and tear. Slipping your fingers under a strap or a wire is an open invitation to a heavy bale or carton to take a finger or two off, if you lose control of it when handling it. Many fingers have gone that way.

Sometimes, too, a tightly stretched strap or wire will fly back when you cut it. If your face is in the way, you're lucky if all it does is rake it good—it may stab an eye out. And if you throw the stuff on the floor, it's good at curling around a person's ankle and tripping him.

This is another case where the use of good common sense and a little forethought will prevent injury. There's nothing special about putting the wire or strapping on. Just put it in place and work the lever. Of course, there is some knack to getting it tightened just right, but with a little care you can soon get onto that. There is one point, though—always keep in the clear so that if a strap *should* break (it seldom does), the end can't reach you if it flies up. The injuries come mostly in the work of opening up the bales or cartons.

When you tackle such a job, the first thing to do is to size it up. Where is the stuff? What is to be done with it? How heavy are the bales or crates or cartons? How big? What tools are needed? Is it a one-man job or should there be two men or even three? And so on. Look the job over carefully, figure all the moves, and decide on the easiest and safest way to do it.

Suppose you are given the job of opening up a dozen or so bales of paper or rags to be fed into a machine that cuts the material up. The bales are about 2 feet by 3 feet by 5 feet and weigh between 300 and 400 pounds each, depending chiefly upon how wet the stuff is. They have been dumped off a truck onto the landing platform outside by the door.

The cutting machine is about 50 feet away.

The weight and size of the bales make it a two-man and hand truck job. Here's how an experienced two-man team would handle it. The leader handles the truck; his helper uses a hook. If a bale is on edge, the helper turns it flat down with his hook. The leader stands the truck at one end of the bale with its nose at the right distance to take the bale as it is up-ended. He then gives his helper a hand in up-ending the bale. The helper hooks the bale near the floor at the center of the end. As the bale goes up, he pulls the hook, turns it out, and rehooks it to steady the bale. Close teamwork is required; so both men should lift at the word of the leader.

With the bale on end, the leader mans the truck and the helper eases the bale back onto it. It is then a simple matter to run it in and place it in position by the hopper (or belt) to the cutting machine.

You must be careful in using a hook. That point is always ready to jab. Therefore, the hook should never be left around with its point uncovered. When not in use, it should always be put in a safe place—hung up with the point in or jabbed into the bale it is to be used on next.

Some men like to carry a hook in their belts. That method gives the hook a beautiful chance to drive its point deep into a man's insides if he should take a tumble. It's been done many times. If you insist on wearing a hook, keep it in a sheath.

In opening the bales, there are two points to remember. When cutting the strap (or wire), stand to one side so the strap cannot catch you if it lashes out. Next, throw the strapping (or wire) into a large carton or box to keep it off the floor. In some places, the men cut it into short lengths as they open up the bale. That makes it easier to handle.

Use your head, and use care. And don't forget your personal protective equipment—goggles, safety shoes, and usually gloves, too.

FALLS FROM ONE LEVEL TO ANOTHER

Everyone seems to take a tumble once in a while, but few people take falls seriously unless they get hurt. Then they usually realize, if they bother to think about it at all, that they did some fool thing or failed to do something they should have done. This comment applies particularly to falls from overhead but not very high places, like falls from a portable ladder or a platform. Ordinary people don't fall from the very high places much, because they're rightly afraid to crawl around on them. They're wise about such places but not wise enough about the not so high, 8 or 10 feet maybe.

Take stairs, for instance. An awful lot of people fall on stairs. Sometimes we should say "from" stairs because if you make a clean fall running downstairs you're apt to end up on the floor. There's one advantage to that kind of fall—it's easier for the stretcher boys to get at you.

Most stair falls aren't from stair faults; they're from bad stair habits. Of course, stairs should be right. They should be properly railed, well lighted, and the right width for the traffic they carry. It's very important, too, that risers all be the same height. A variation of over $\frac{1}{8}$ inch is likely to cause stumbles and falls. Ditto as to tread width. Watch out for worn, slippery, or broken treads. It doesn't take much to cause you to miss your footing.

Now as to stair habits. If you stand near the foot of a stairway for a while where you can see clearly just how people use stairs, you'll see what I mean. A few will glance over the stairs to see whether there's anything on the steps or any badly worn places. They'll keep a hand on the rail. They'll use reasonable care in placing their feet. I don't mean that they slow way down. That isn't necessary. A person can move right along and still play safe.

You'll find, though, that most people seem to take their stairs too much for granted. They hardly glance at their footing, they usually pass the railing up, they may speed up a little. In fact, they may even run up or down stairs.

Taking stairs two steps at a time may be O.K. in case of fire, but it's strictly unsafe as a habit. Even in an emergency this practice may be a bad gamble because if you have to get somewhere fast a stairway is the worst sort of place to make speed. Landing all in a heap at the bottom is a mighty poor way to get anywhere quickly.

One of the cussedest happenings is to miss a step when you're hurrying upstairs. You don't place your foot far enough onto the step. The flexible toe of your shoe gives a little, and your foot slips off. If you're quick enough at catching yourself, all you get is a jolt. But if you aren't, you're likely to smack your face into the edge of a stair tread. Just that has wrecked many a nose. If you wear glasses, you may get an eyeful of broken glass. It happens. In that case, you need the very best eye surgeon you can find.

In one large plant the washrooms were on balconies reached by stairs. The stairs were excellent and were kept in good condition. Yet there was a number of bad falls on them. A special committee was set up to do something about it. They watched the workers' stair habits and found just the sort of things I've been talking about.

The whole problem was discussed at a joint meeting of all the plant safety committees. With the full approval and backing of the management, the committees set up training in stair habits. They started it in a small way for those who volunteered. The idea caught on and the trainers were run ragged, but it worked. Falls on stairs were practically eliminated the following year. So were other kinds of falls. The walking habits as well as the stair habits were improved in that plant.

Ladder habits are important, too. Falls from portable ladders cause a lot of injuries —back injuries, fractures or sprains, sometimes even death. But they're all preventable so long as your safety-consciousness keeps working. It's so easy.

Make sure the ladder is in good condition. Place it so both rails are supported at the top. Be sure both feet are secure and can't slip. A good placement rule is: locate the base of the ladder one quarter of its length out from the object it is resting against. Be sure both ladder feet are secure and can't slip. Even after taking these precautions, sometimes it's best to have someone hold the ladder.

Be sure there's plenty of head room. Use both hands in climbing, and take it easy. Carry your tools in a belt, or have them passed up to you. Don't throw your weight around up there; keep it over the feet of the ladder.

A lot more could be said about falls from overhead, but we've hit a good many of the high spots today. Keep them in mind, and we'll have fewer falls in this plant.

FALLS—OBJECTS ON THE FLOOR

When I looked up the facts, I was surprised to find that year in and year out falls are the second commonest source of injuries in plants. Handling materials comes first, and falls follow.

Most of the injuries resulting from falls aren't caused by falls from overhead, as you might think. They're from falls at floor level where we walk and work. Of course, if a fellow falls from overhead he's more likely to be hurt and hurt badly. But we get out of most floor falls without damaging anything but our dignity. Yet the total number of injuries from them is so big that it looks almost as though we were falling all over the place most of the time.

That's putting it on a bit thick, but we do have a lot of falls. They're unnecessary, and they're preventable. So why do we have so many? Chiefly, I think, because we don't take them seriously. We don't keep an eye out for setups that might give us a tumble and avoid them. And, especially, we leave things lying around on the floor.

Perhaps this attitude of indifference is natural. After all, we start taking our tumbles when we start walking. We soon learn not to take them seriously. Then as we grow older and play games of all sorts we have a lot of falls. They're a part of growing up. Football, for instance, is mostly falls, good hard ones.

But when we're grown and go to work, we should change our attitude. Falls have no place on the job. Kids can take them pretty well. So can athletes in good condition. But falls are bad on the job—not only because they cause a lot of injuries but also because they interfere with the work.

Every tumble a person takes slows the work up or interferes with it in some way. Now and then one is costly. For instance, a fellow was carrying a tray of television tubes into the testing lab when he stepped on something on the floor and fell. As you can well imagine, the tubes didn't pass that test.

Another fall was much more expensive. A messenger hurrying to take some orders to a foreman tripped and fell full length in front of a fork truck which was taking a load of subassemblies to stock. The truck operator swerved his truck to avoid hitting the messenger and smashed into an expensive machine, partly wrecking it and damaging a lot of the subassemblies.

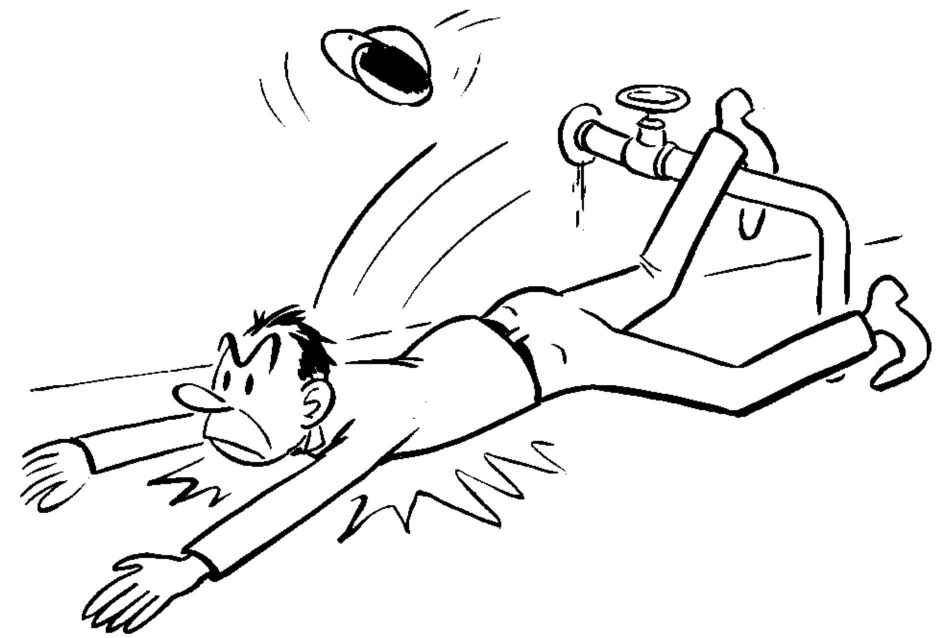
How can we change our attitude about falls? It's really a matter of habit, and the people who have studied habits tell us that about the only way to break one habit is to develop another to take its place and drive the old one out. We don't change our habits just because someone asks us to or tells us we ought to. It isn't that easy. We really have to put our minds to it and work at it.

Every time anyone drops something on the floor he should see it as an accident waiting for a chance to happen, maybe to him. If he did look at it that way, he'd pick up the object right then and there so *that* accident couldn't happen to anybody. And he'd put the thing in some safe place. He'd really practice the idea of "A place for everything and everything in its place."

If every time we saw some object on the floor it looked to us like a mean little toughie crouching there ready to stick a foot out at just the right moment to trip someone, we'd really want to do something about it. We'd haul that little devil off by the scruff of the neck and put him away. And we'd look around to see if there were any more like him.

If we watched those little devils work a while, we'd find that some are meaner than others. The ones, for instance, that look like a short piece of 2 by 4 or a piece of 1 by 1/8 iron miss more often than they succeed. But a short piece of pipe or those shaped like a pipe nipple seldom miss. They give a guy a nice ride and a bad tumble at the end of it.

I could go on seeing these little devils, but I think I've made my point. We just don't take loose objects on the floor seriously enough, but we can if we put our minds to it. Let's change our habit. Instead of "leaving it there," let's "pick it up and put it away." If we'll do that, we'll save ourselves and others a lot of falls. Remember, floors are made to walk on, not to fall on.



TRIPPING HAZARDS

Today, let's take a look at tripping hazards. We all know the importance of keeping loose objects off the floor to keep them from tripping anyone. Today I want to talk about why we trip so easily and what we can do about it.

First of all, our attitude is wrong. We seem to think it's funny when some guy gets his feet tangled up and takes an awkward tumble. If we didn't, we'd never be tempted to stick out a foot and trip some fellow we're skylarking with, on the beach, for instance. That sort of thing is just further evidence that we don't take falls seriously enough.

Did any of you ever stop to think what standing and walking really take? The human body doesn't balance on end naturally, like, say, a 6-foot piece of 12-inch pipe. You have to use a lot of different muscles just to stand up. Then when you want to walk, you have to call on some more and have all of them work together in a very accurately timed series of actions. If each muscle doesn't play its part just right and at just the right time, you're apt to take a tumble.

You take a step by starting to fall forward and then bringing one foot forward in time to catch yourself. If anything gets in the way of that foot, you stumble and maybe you go down. Or if the floor is slippery and won't hold your foot, you do a fast straddle and maybe go down, anyway. So we try to keep our floors safe and easy to walk on, but that's only part of it—the easy part, really.

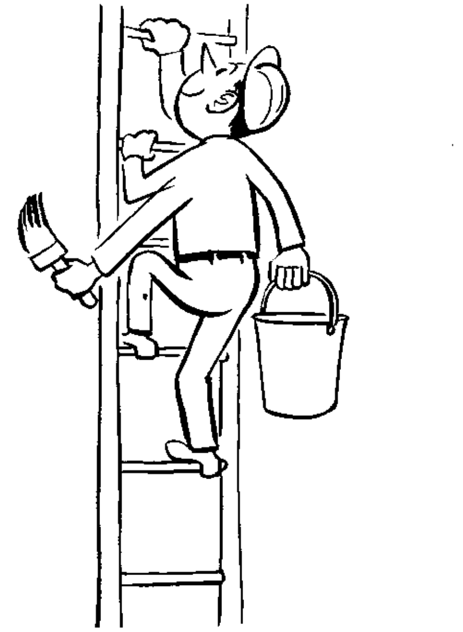
The hard part is learning to pay attention to our walking, and learning to walk carefully and safely. We *can* develop skill in walking and save ourselves a lot of falls. You all know how sure-footed the Indians were. They had to be to move through the woods with any speed. Woodsmen develop the same kind of skill. So do professional hikers. It's a matter of always looking before you put your foot down and of always lifting your foot high enough at each step to clear whatever may be underfoot. It isn't hard. It just requires a little care and watchfulness.

With practice, skill in walking soon becomes second nature. With practice, you can even learn to jerk the upper part of your body back in time to prevent falling even if you catch your foot under a wire or something similar as you take a step.

Of course, you should always keep your safety-mindedness with you and keep it active. If you do, you'll always notice tripping hazards. You'll remove them if you can, and if you can't take care of them yourself you'll report them. Let's list all the tripping hazards we can think of.

***Foreman:** To increase the men's interest, have them suggest the items. There will be all sorts of loose objects to mention. Bear down on things that can hold the foot, such as extension cords, power cables to portable electrical equipment, air hoses, wire, sheet scrap, and so on. Then there are all sorts of fixed obstructions, as well as pits, depressions, unexpected changes in slope, steps just beyond a door, and similar hazards.*

If you develop safe walking habits, they will save you falls not only at work but off the job as well—at home, on the street, when you're out hunting, wherever you do your walking. Perhaps such safe habits will be most valuable to you when age finally creeps up on you. Old folks fall more because their muscular reactions slow up and become less sure. Also, their bones break more easily. But if you have good safe walking habits when you reach that stage, you'll not have falls. It will pay us all to look to our walking.



CLIMBING FIXED LADDERS

We'd all agree that a steeple jack's job is dangerous. Those rungs running up a tall smokestack look pretty treacherous, and they are, for any ordinary guy. He has no business climbing them. But steeple jacks rarely fall. They specialize in climbing safely and in handling themselves safely when they get to the top. They take no chances—take nothing for granted — test and check everything their safety depends on. That's why most of the falls from high ladders are suffered by fellows who don't do much ladder climbing. They don't use enough care.

First of all, no one should climb a high ladder if height bothers him. If it does, he'll be nervous and unsure of himself. A fellow needs steady nerves and a clear head on a high ladder. Lots of fellows won't admit that they're afraid of height, though, because they've been brought up to think that fear is something to be ashamed of. Actually, that's the wrong attitude.

Fear is a perfectly natural reaction to a dangerous situation or one that seems dangerous. It gives a person the extra strength and energy he needs to meet an emergency. If a person isn't capable of fear, he's abnormal—something is wrong with him. The thing to be ashamed of is losing your head—losing self-control—from fear. Brave men get scared just like anyone else, but they keep their heads.

What does all this have to do with climbing ladders? Plenty. If you're afraid of height, have the courage to say so and don't climb high ladders.

If you *do* climb fixed ladders, there are only a few things to be careful about, but you must never neglect any of them. Remember always, a fall from a high ladder can easily be fatal.

Look the ladder over well before you start up. See anything wrong? Bent or missing rungs? Grease or heavy rust on rungs or rails? Any places where there isn't plenty of clearance? How is the toe clearance behind the rungs? It should be enough to keep the toe of your shoe from touching the structure when your heel is snug against the rung.

If a pipeline or anything else cuts the clearance anywhere, don't forget to watch out for it when you get to that place. Lack of clearance has finished off many a man and thrown scares into a lot more because, if you don't allow for it, you're likely to miss a rung. Be especially careful of wooden ladders. Wooden rungs have a way of rotting and coming loose. Take no chances with them.

Electric wires, unless in pipe conduit, are very dangerous to have within reach of a metal ladder because the ladder is usually well grounded. The insulation on the wire may not be very good since it's exposed to all kinds of weather. In fact, the air around the wires may be all that's keeping the juice in them. Getting any part of you against or even close to a wire may give the electric current the chance it's always looking for to escape to ground. If it takes off through you, you'll come to on the ground, if at all.

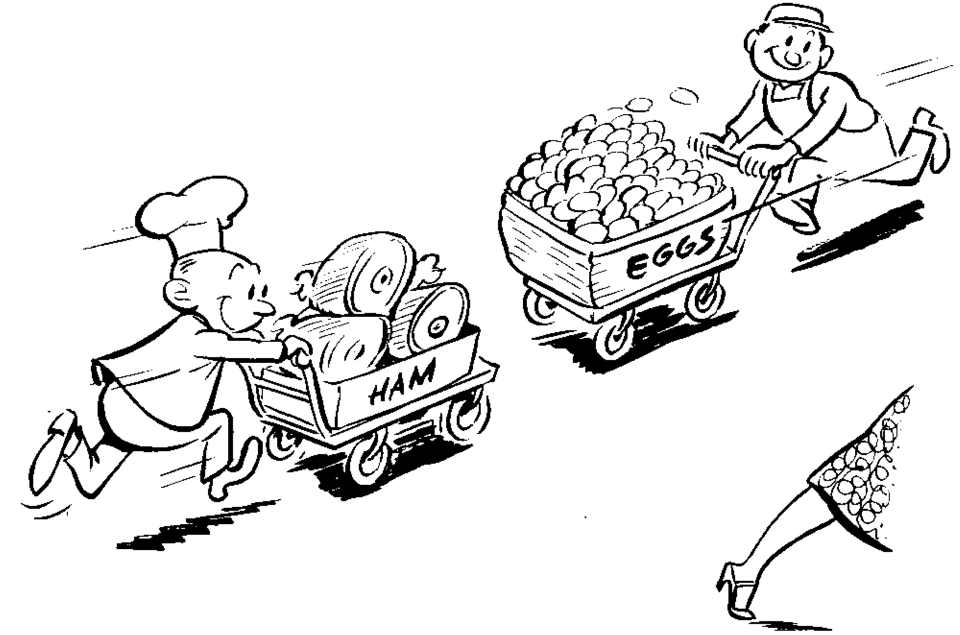
In below freezing weather, check for ice. Sometimes the boys who decide where a ladder is to be put don't reckon with the drip from an overhead platform or an iced-up eaves trough. It's best not even to try to climb an icy ladder. If you must, use a safety belt, be sure to keep it hooked while you work, and knock the ice off as you climb.

After you've checked the ladder, you're ready to start up. Give it a good shake to make sure it's well secured, and look out for any looseness at each point of support as you come to it. In climbing, set your foot on the rung so that your heel is snug against it and close to the rail unless the ladder is too wide for that much spread to be comfortable.

Grasp the rails. If you hold onto the rungs and a loose rung pulls out, you're probably a goner. Even if it turns a little, you may miss your grip. But if you have a good hold on a rail, a rung can let go under your foot and still not throw you. Always be sure you have a good grip with one hand and are solid with one foot before you take a new hold for the next rung. That goes for climbing either up or down.

Finally, when you hit the top, be sure of your footing when you step across from the ladder to the roof. Unless the setup is right, that's the high hazard point. If the ladder rails aren't run up at least 42 inches above the roof or platform edge, turn in a good kick about it. The rails should be spread apart above the roof and curved over with the ends made fast (rungs out, of course) so that the climber steps off the ladder between them.

In climbing down, be sure you have your foot placed securely on the rung below before you change your hand hold. And *never* hurry on a ladder.



BUMPING INTO PEOPLE AND THINGS

People are funny about some things, and in some ways they seem downright stupid. One way to back up that observation is to find out the number of injuries caused by guys bumping into each other and banging into all sorts of things simply because they don't look where they're going. Injuries from this source occur not only in plants—on the job—but at home, on the street, in the woods, in stores, even in cars. That last point is proved by the number of autos each year that drive slam-bang into the sides of standing or moving trains. In Africa a rhino charges a train once in a while, but rhinos have a reputation for stupidity.

If you want to stay on your feet, you have to look to your footing, but that isn't all there is to it. You also need to look where you're going. There's an old story about two cross-eyed men who bumped into each other. One said, "Why don't you look where you're going?" The other said, "Why don't you go where you're looking?" Each of those guys had a good excuse for his share of the bumping, but what excuse has a straight-eyed guy? The answer is "None." If you ride him, he'll always come up with some excuse but seldom one that's really convincing.

For example, you're walking close behind someone. He stops without warning and you bump into him. On the street or in a store this sort of thing is usually squared by mutual apologies. In the plant it may be more serious. One of you may stumble into a machine or may be carrying something heavy enough to smash the foot it drops on, or one or both of you could take a good tumble. All three of these results from bumping accidents, and many other results to boot, have occurred. What was wrong? The guy behind was following too close and wasn't paying enough attention to the fellow ahead.

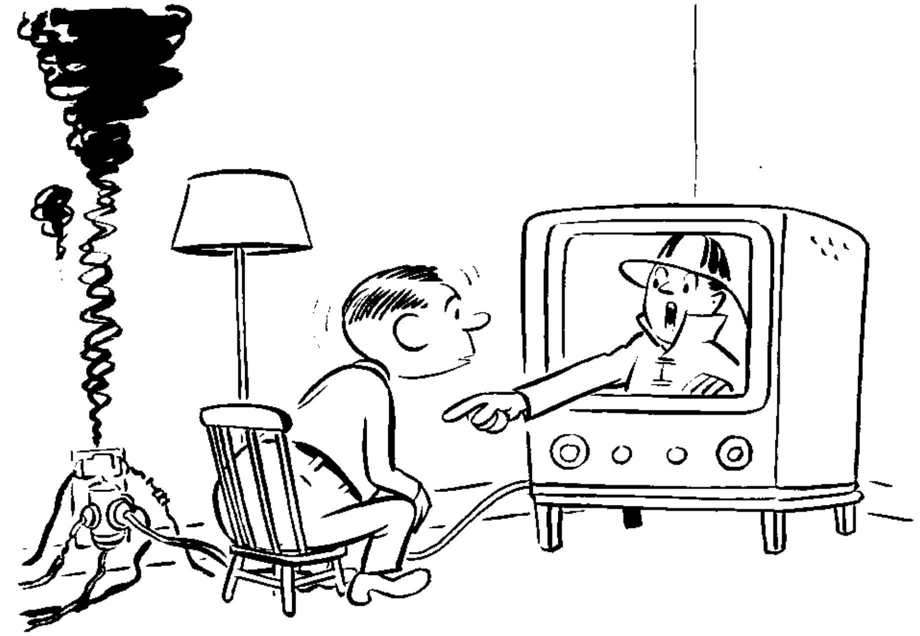
The same thing applies when your car follows the car ahead too close. The fellow ahead stops quick, and you bang into him. He should have signaled, but the law says—and rightly—that the chief fault was yours because you should have kept far enough behind to stop in time. Or perhaps you weren't paying close enough attention. Either way, in such a case you're in the wrong, whether afoot or driving.

Even more stupid is bumping into something that isn't moving. The accident records show that people do it. Why? Because they don't look where they're going. But again why? Usually something attracts your attention. A beautiful blond, maybe. But are you doing her justice if you merely look her over while you're underway? Surely, you can do a better job of it if you stop and give her your full attention.

Unexpected loud noises, particularly loud yells, are bad attention-getters. Of course, if a guy gets caught in a machine, you can't blame him for yelling but in a plant loud yells should be saved for such emergencies.

The most inexcusable bumping occurs when people are running to be first in line at the cafeteria or to get out of the plant at whistle time. Some plants have had so many accidents that way that they have had to get tough and bear down on the runners. There have been sprained ankles and wrists; toes have been tramped on; eyeglasses have been smashed, and so on. Sometimes fists have been used. In one case, a guy jammed his way through and knocked a girl down. Her brother happened to be near enough to see it. What he did to that bumper was plenty. I think we can all agree that the fellow had it coming.

Prevention of bumping accidents boils down to this: it's simply a matter of looking where you're going, walking with some care, and having a proper respect for the rights of others. So watch where you're going. If something distracts your attention, stop. And look again before you start going again. Simple, isn't it?



TAKE SAFETY HOME WITH YOU

Here in the plant we talk a lot about safety and do a lot about it. It's easy for us to keep safety in mind all the time. But I've been wondering how much of our safety thinking we're taking home with us.

I have a reason for asking. I've been looking over a copy of *Accident Facts*, a small book put out each year by the National Safety Council. One fact struck me as particularly important to us: nearly twice as many workers were killed *off* the job last year as on it.

This fact proves one *very* important thing: many of us aren't doing a good safety job in our homes. Too many fellows leave their safety-mindedness hanging at the time clock when they check out.

Of course, no two homes are exactly alike, but most of the things that cause home accidents exist to some degree in every home. So let's try to figure out just how a fellow who takes his safety-mindedness home with him would use it. We'll just pretend we're following one of you home. If you take your safety-mindedness along, you will walk—not run—to your car, and you will drive carefully all the way home.

When you pull into your driveway, you see a toy some kid has left there. You pick it up. It could give you or someone else a nasty tumble. You give the garage the once over. What's that stuff on the floor along the wall? An old seat cushion—a rake—a broom—several pop bottles—some other odds and ends. Better provide a suitable holder for each large tool and some corner shelves or bins for the small stuff, and get rid of the junk.

You close the garage door and lock it because your safety-mindedness reminds you of the time your neighbor left his unlocked and some kids got to playing with a battery he'd just replaced and one of them got a bad battery acid burn.

At the front door your safety-mindedness nudges you again. That old fiber mat is so worn that a high heel, your wife's perhaps, could catch and trip her up. Better buy a new mat, of course.

Better put up some railings, too. There are only three steps, but that concrete gets awfully slippery in winter. Black iron railings don't cost much, and it's a simple job to anchor them.

Your safety-mindedness keeps working on you all through supper and finally teases you into passing up your evening with the TV set and making a safety inspection of the house instead. Unless you've paid more attention to home safety than most men have, you'll find a number of things that could hurt some one or cause fires.

I'll just mention a few of the things that such an inspection should cover because there isn't time to go into much detail. Be sure to have safety-mindedness with you all the way, though.

Check the condition of all extension cords, lamps, and lamp cords. Do the plugs fit and hold, or are the sockets worn out?

Are the electric appliances your wife uses in good shape? Ask her if she ever gets a shock from anything, especially the laundry equipment.

Check the wiring circuits for overloads—over-fusing. Perhaps you need an additional circuit or two. It may seem costly, but it will be a lot cheaper than a fire.

Check basement stairs—back steps, if any—for condition, railing, lighting, slippery treads.

Look into safe practices in your house. Is there a place for everything, and are things kept pretty well where they belong? Is everyone reasonably orderly?

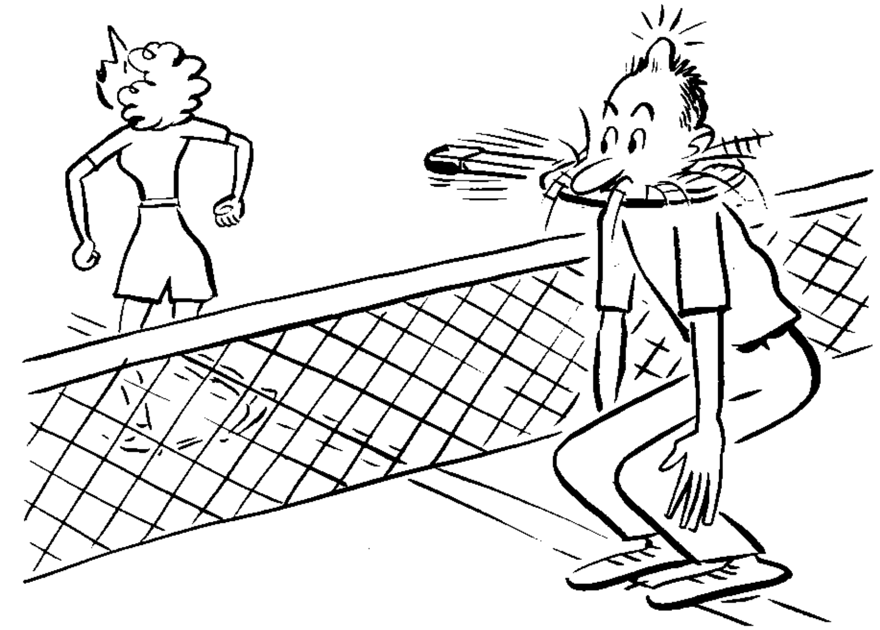
Do you use any insecticides? If so, are they kept locked up? What medicines do you keep on hand? Can the kids get at them?

Do you have a gun? If so, do you ever bring it into the house loaded? Do you keep ammunition in the house?

Does your wife keep any cleaning fluids? Better check them.

Finally, what are your smoking habits at home? Do either you or your wife ever smoke in bed? The records prove this to be the most effective way of all to die by fire.

You fellows can add more items, but this list should be enough to show the importance of taking your safety-mindedness home with you.



RECREATION SAFETY

If we were trying to figure out a way to make some fellow's vacation a washout—a complete flop, what could be better than to get him into an accident—get him a broken leg, maybe? The funny part is that an awful lot of fellows do this for themselves. They don't need any help. They'll insist they didn't plan things that way, but if you get the full story, it's very likely to look as though they had.

It's usually just another case of a guy leaving his safety-mindedness at work instead of taking it with him to use off the job. I'll try to prove my point by quickly running over a few actual cases.

1. Pete checked out early one Friday to get everything ready for a weekend trip to his shack in the woods. On the way home he hit 40 in a 25-mile zone and got a ticket. That delayed him, so it was past midnight when he crawled into bed dead tired.

Things went wrong in the morning, too, and at the shack. When toward supper time his wife discovered that the steak had been left behind, he blew up. He wanted steak; so he jumped in the car, gunned her, and started off.

He'd gone a half block or so before he realized that the jolting was from a flat. More cussing. Probably the tube was ruined. He jacked her up fast and unscrewed the nuts, but the wheel was stuck. He gave it all he had. It came and he went over backward. So did the jack. The axle landed on his leg and broke it. His wife, with little Peter at her heels, ran screaming to a farmhouse a half mile away for help, got there and collapsed. Peter hobbled back to work a month later. What a washout that trip was!

Foreman: This is a good one to have the men analyze. Points to bring out: The small amount of time to be saved by speeding even if he'd gotten away with it. Failure to plan in advance, making a list of things to do and checking it before leaving. Failure to block the car wheels and place the jack securely. Wrong attitude.

2. Sam's hobby was hiking. He went on

one hike in hill country where there were lots of loose boulders around. During the lunch stop, Sam bet a couple of the other fellows that he could beat them to the top of a nearby cliff. Sam quickly took the lead, but a leaf-covered boulder threw him, hard. He got a badly bruised elbow and a sprained ankle. He was laid up completely for two weeks because he couldn't handle a crutch with the bad arm.

Comment—A careful hiker just doesn't run over that kind of ground unless he absolutely has to. Rock climbing is hazardous at best, and such a contest is certainly foolhardy.

3. Tom's best friend bought a new house in the country on the edge of the woods. On a week-end visit Tom found that the kids had been getting into poison ivy somewhere. No wonder. The back end of the lot was full of it. He took pride in the fact that he could handle it with no bad results. The plant nurse had warned him that with sufficient exposure he might lose his immunity, but he didn't believe her.

After dinner, he borrowed some coveralls and a digging fork and got busy. He built a fire, and as he dug the ivy out he threw it on the fire. He went back and forth through the smoke. It made his eyes smart some, but he kept at the job until the poison ivy was all cleaned out. By bedtime Tom's eyes felt sore, and his face felt prickly. By morning it was all puffed out. and his eyes were swelled nearly shut. He spent a very unhappy week.

Comment—Too sure of himself. He wouldn't accept the fact that heat will vaporize the irritant (an oil) out of the plant and make it far more active. Also, once immunity is gone, it's gone for keeps. Incidentally, the next weekend Tom's friend got a dose, too, from the coveralls.

4. Jack was a swimmer, a good one, and a fine diver. His jackknife was really something. He loved to show it off. One Sunday he was cruising around a lake in a small cabin cruiser. The operator ran up to about 50 yards from shore and cut the motor to call to some girls on the beach. Jack grabbed the chance to show off and did a jackknife off the bow.

He didn't know that there was less than four feet of water over a couple feet of mud. Where he had been diving there was plenty of water; so he had been going deep and coming up a good distance away. He went in deep all right, into the mud. If the operator hadn't gone over after him, he would probably have drowned—in mud! *Comment*—Showing off doesn't mix with safety.

I think those four true stories make my point, that in most cases fellows out for some fun and recreation set up their own accidents. They leave safety out of their plans, and that's a sure-fire way to turn a weekend or a vacation into an awful flop.

GREEN CROSS FOR SAFETY

Published by
NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago 11, Illinois

Printed in U.S.A.

Stock No. 152.07 5M15702