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Popular Mechanics

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food dryer for \$75**

PICKUP TRUCKS

**Guide to all makes
PLUS: Options
and customizing**

**NOW: TV AS
THIN AS A
WRISTWATCH**

**The 10 best
shop tricks
of a master
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**HOW WE
FIGHT NEW
KILLER
EPIDEMICS**

**13 fix-ups to
foil burglars
PLUS: Plans for
home safe**

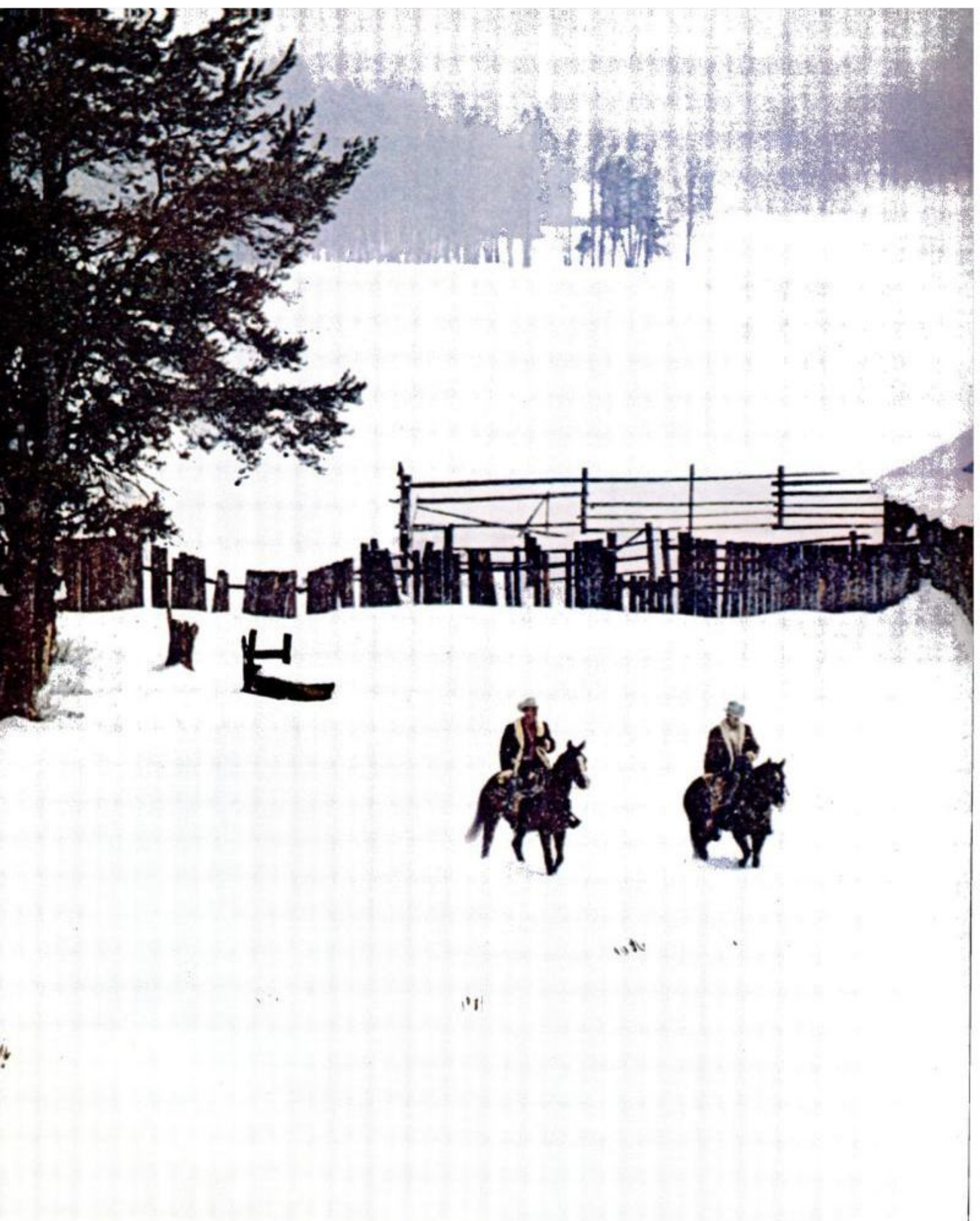
**STAY ALIVE DRIVING
IN SNOW WHITEOUTS**

**PLANS: Build a
store-everything
colonial toy chest**

RAIL DISASTER!

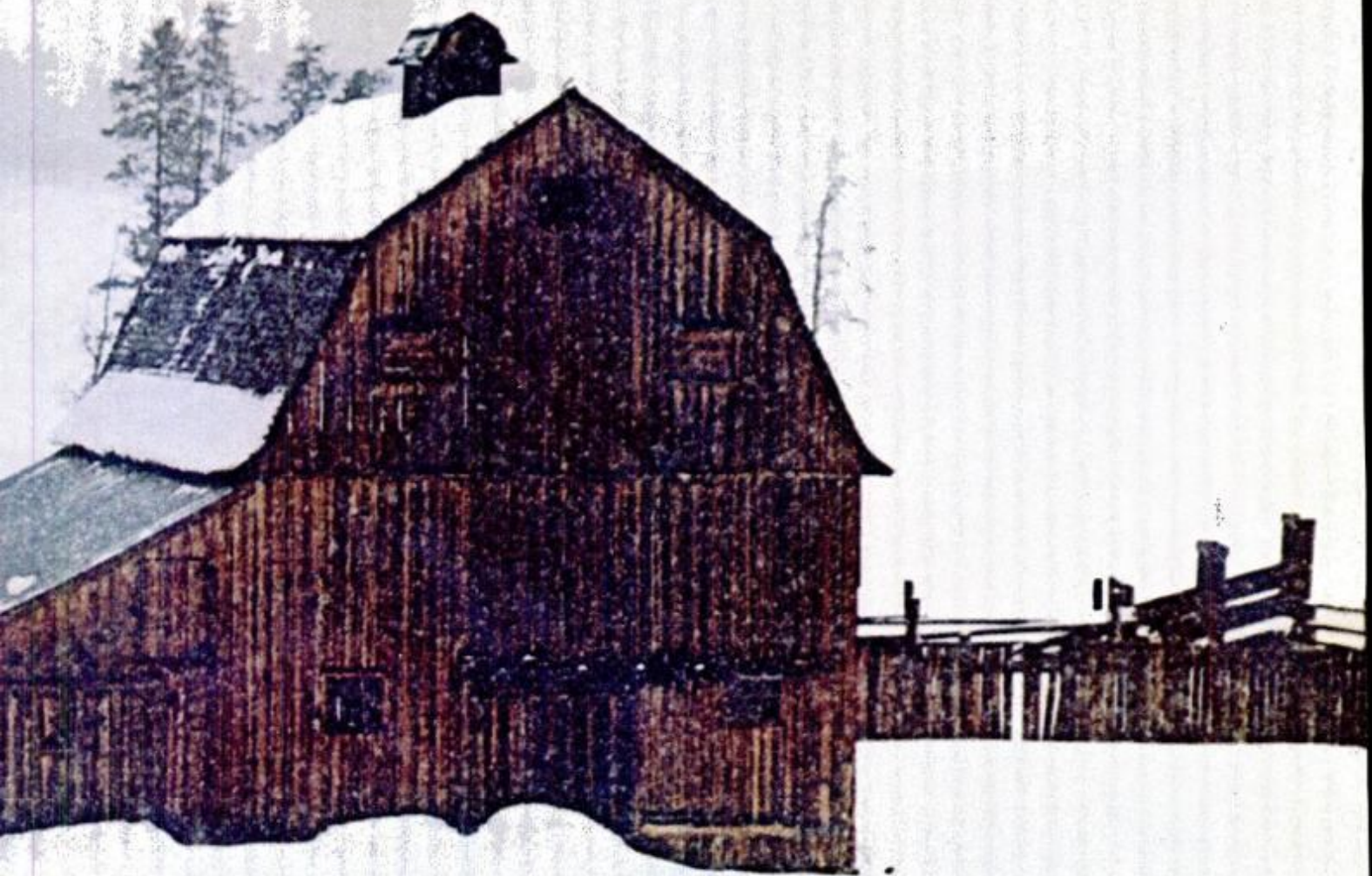
Defusing those speeding bombs





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On the cover

PM's cover illustration reflects the potential destructive force of an imminent train derailment. Mort Schultz's story (page 57) discusses the increasing dangers of hazardous materials involved in derailments, tells what governments, railroads and municipalities must do to make the rails safer.

—Painting by Ed Valigursky

Popular[®] Mechanics

JANUARY 1979

CONTENTS

VOLUME 151 NUMBER 1

INTERNATIONAL EDITIONS: AUSTRALIA, CARIBBEAN, MEXICO, SOUTHERN HEMISPHERE

Special features:

Special section: Pickup trucks

PM's guide to all current makes and models, plus how to customize with new options.

61

A master craftsman's 10 top shop tricks

Secrets gained from years of woodworking experience help you save money on materials, do fine carpentry with less effort.

96

Ultrathin LCD TV set

With liquid crystal technology, wall-sized TV is easy.

76

Surviving a whiteout

Superhighway "snow chutes" are waiting to trap unwary drivers.

68

Home security special: Foiling the burglar

33 fixes to protect your belongings from theft—plans for an attractive safe cabinet.

84

New killer epidemics

Disease detectives discover how buildings can harbor infection.

72

Automobiles and bikes

- 20 Car Clinic
- 24 The PM Garage
- 43 Imports and Motorsports
- 50 Detroit Listening Post
- 61 The pickup: The hottest thing on wheels
- 68 Whiteout: Winter's worst superhighway nightmare
- 80 Now our navigation system can keep track of your car
- 106 Saturday Mechanic: Care, testing and recharging of maintenance-free batteries

Home and yard

- 16 Appliance Clinic
- 87 17 low-cost ways to burglarproof your house
- 90 16 products that make it tougher for burglars
- 92 Give your prefab fireplace a custom look
- 126 Homeowner's Clinic

Science and engineering

- 10 Science Worldwide
- 57 How experts are defusing rolling bombs that ride our rails
- 72 The Center for Disease Control: Where science squares off against killer diseases

Every month

- 7 Letters
- 53 PM Briefs
- 67, 83, 110 It's New Now

Shop and crafts

- 14, 134, 150 Hints from readers
- 40 PM Workbench
- 84 Protect your valuables in PM's colonial cabinet
- 94 Build this rugged colonial toy chest
- 96 10 great shop tricks from a master craftsman
- 99 Make your own rough-sawn barn siding
- 100 Build PM's solar food dryer
- 102 Repair your electric drill
- 104 Workshop Minicourse: Portable drill accessories

Boating and outdoors

- 13 All Outdoors
- 78 Boats for '79: Better performance, bigger power

Photography

- 46 Photo Hints
- 30 11 new snapshot cameras

Electronics, radio and TV

- 44 7 exciting new electronic products
- 76 Liquid crystals: Key to TV that's thin as a wristwatch

Worth writing for

Looking for more ideas and information? See page 180

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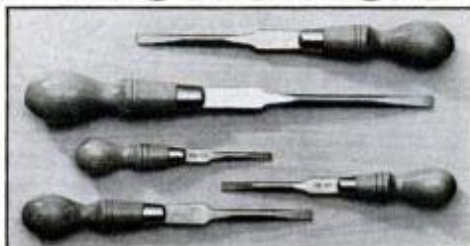
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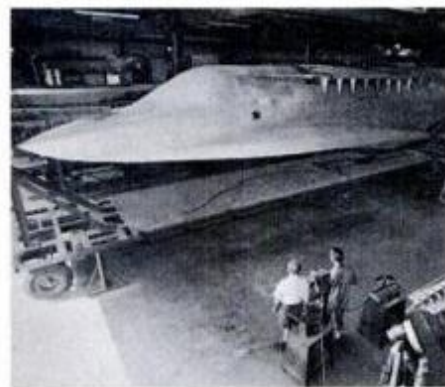
LETTERS TO THE EDITOR

Thought we'd forgotten, eh?

What's the status of the Skyshark amphibious jet (*Coming: The Incredible Skyshark—First Amphibious Jet*, page 77, April '71)? I've heard nothing about it since your cover story.

JOHN LOWE
SYCAMORE, ILL.

According to Dr. G. Leonard Gioia, one of Skyshark's designers, the plane is "alive and well," but modified considerably since it first appeared on our cover. It still sports a variable wing, but placed up high. A tunnel hull (like that of a



Wind-tunnel model (top) shows Skyshark's latest modifications. The fuselage plug (bottom) has now been completed.

hydroplane) has also been added. Dr. Gioia and others are building the plane with their own funds; it may be completed in 1982 or 1983.

Plastics and fire

The article *The Home Inferno—Now It's Deadlier Than Ever* (page 96, Sept. '78) contained a number of misleading implications that will probably create an erroneous impression about plastics in general and polyvinyl chloride in particular.

There is no doubt that plastics will burn. Neither is there any doubt that plastics are part of the hazard which every home presents when ignition occurs. Plastics are not, however, when properly used, the hair-trigger bomb portrayed by the article.

You seem to imply that wood, because it smells good when it burns, is a friendly hazard. When burned, wood will produce at least 175 different combustion gases. There are no nonhazardous vapors of combustion, regardless of material.

Contrary to the article, no chlorine, phosgene, nitrogen dioxide, sulfur dioxide or ammonia are produced from the combustion of typical polyvinyl chloride compounds.

JAMES D. TANZILLI
B.F. GOODRICH CHEMICAL DIV.
CLEVELAND, OHIO

Author Ed Fales replies: True, the problem is not only plastics. As we said, modern fluids, some panelings and finishes and even house design are all contributing factors. But let's face it: Plastics are of top concern to many experts. It's a serious problem which should have been brought to the attention of the public long ago, but was not.

As for Mr. Tanzilli's other points, "friendly hazard" is his terminology, not mine. Obviously wood can be dangerous; the public has yet to be educated about more modern materials like plastics. The story paragraph about chlorine, phosgene, nitrogen dioxide, sulfur dioxide and ammonia was somewhat misleading. I did not mean to imply that those gases were products of PVC combustion.

What's the R value?

I have a question concerning your *Home Energy Guide* (page 125, Sept. '78). Could you please give me the reference used in reaching the minimum R value of the urea formaldehyde insulating material?

BYRON E. THOMSON
MINNEAPOLIS, MINN.

Claims differ. One manufacturer, Rapperswill Corp., claims an R value per inch of 5.0 to 5.5. But Abt Associates, a leading independent engineering consulting firm, said

recently in a report prepared for HUD that urea formaldehyde has an R value of 4.2 per inch. The Abt report is titled "Cost-effective Methods to Reduce the Heating and Cooling Energy Requirements of Existing Single-Family Residences."

An uplifting solution

With reference to *Make This Drill-Press Table Lifter to Save Your Back* (page 55, Oct. '78): I, too have often been annoyed with the cumbersome task of changing the height of a drill-press table. My solution differs from PM's and may be of interest to your readers.

I use a 25-pound lead weight to offset the weight of a 30-pound table. I mounted a pulley on the motor bracket and ran a cord from the back end of the table through the pulley to the weight.

With this rig, the table will not drop when the table clamp is loosened. I can raise or lower the table the entire length of the column with one hand in a matter of seconds.

P.J. MODJESKI, M.D.
RICHMOND, VA.

Pressure vs. weight

It should perhaps have been pointed out to your readers in the article *Make This Compact Scale to Check Your Hitch Height* (page 32, October '78) that the diameter of the cylinder (1.128 inches) was chosen so that the resulting cross-sectional area would be just one square inch. Therefore, the pressure gauge scale, while calibrated in pounds per square inch, would read the weight applied to the piston directly in pounds.

ROLAND G. MARCOTTE
SOUTH PORTLAND, ME.

In the groove

I disagree with one of the dimensions of the hitch weight scale. There are two .125-inch grooves in the piston detail, yet the minimum width of the groove-forming tool is shown to be .180 inch. It should have read .099 inch.

TRANCY BELCHER
PRINCETON, W. VA.

Mr. Marcotte is right, Mr. Belcher, half right. The dimensions for the groove-forming tool are correct, but the groove should also read .180 in.



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Country fresh menthol.
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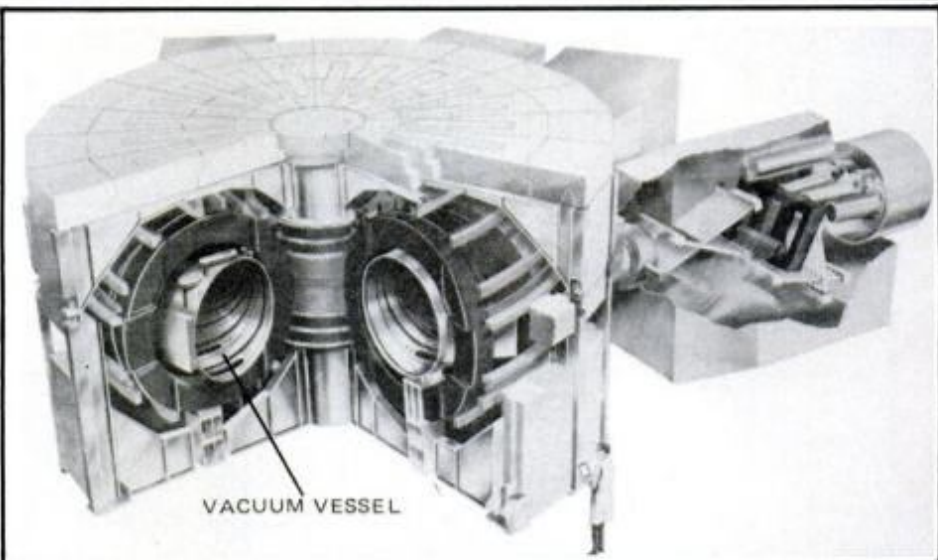
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SCIENCE WORLDWIDE



VACUUM VESSEL

During fusion, ionized gas releases energy from doughnut-shaped vacuum vessel.

'Happy' plasma in fusion test

Researchers at Princeton's Plasma Physics Laboratory recently took a major step toward harnessing atomic fusion as a source of energy when they raised the temperature of a gas to four times the temperature at the core of the sun.

The temperature—over 60-million degrees Celsius—was more than double that in any similar experiment. But the real significance of the work was that the ionized gas, called plasma, did not deteriorate, clot or fall apart in the heat.

"The plasma behaved," said a spokesman for the lab. "It appeared to be happy." The stability of the plasma encouraged confidence that fusion has strong potential as an energy source.

Fusion is the source of the sun's energy. During fusion, lightweight hydrogen isotopes combine, resulting in a smaller total mass and a release of energy. The process is promising because the "fuel"—hydrogen—is plentiful as a component of water. Scientists estimate that the Pasadena Rose Bowl filled with ordinary tap water would contain hydrogen isotopes equal in energy potential to 160 million tons of coal. That's enough to heat and cool all U.S. houses for a year.

In the Princeton research, scientists confined the plasma within a doughnut-shaped vessel called a tokamak. Magnetic fields kept the gas suspended in a ring inside the tokamak, out of touch with the stainless steel walls, where the gas would cool. Then the researchers shot pulses of high-energy hy-

drogen particles through the magnetic fields to heat the plasma to the point where fusion could occur. This took about a tenth of a second.

Several hurdles remain before fusion becomes practical as an energy source. One problem: existing systems don't produce as much power as it takes to heat the plasma. But Princeton researchers expect that a new and larger tokamak now under construction will pass the break-even mark after it goes into experimental operation late next year.

Heart pump from tire material

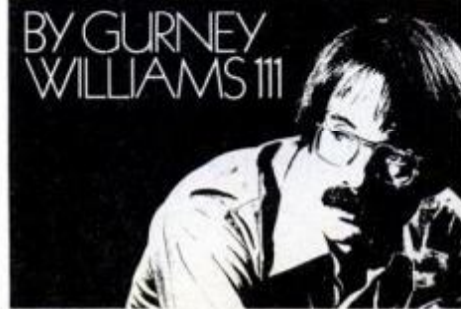
A heart booster pump under study at Cleveland Clinic uses a synthetic rubber once planned for use in Goodyear auto tires.

The heart-assisting device could be ready in about three years for preliminary tests on humans with irreparable heart damage. Then, according to Dr. Yukihiro Nose at the clinic, the pump could enable some severely ill heart patients to lead fairly normal lives.

The pump is built around a diaphragm made of Hexsyn, a synthetic rubber invented for auto tire sidewalls. The device, with a self-

(Please turn to page 157)

BY GURNEY
WILLIAMS III



A CAR CAN BARELY DEFEND ITSELF AGAINST WINTER. SCOUT® FIGHTS BACK.

Scout Traveler—four-wheel drive handles slick city streets easily. Scout II can tote a whole family—complete with gear—all the way out to ski country.



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Easy going when snow is hubcap deep. Scout's four-wheel drive provides something cars cannot; pull from front wheels and push from rear. In snow, traction from four wheels is more efficient than two; when not necessary,

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A few other thoughtful touches. Scout's undercarriage is built higher

than a car's, so driving down an unplowed street is no big problem.

As for getting away during the winter months, Scout can tote a gaggle of gear, and tow 5,000 pounds behind it, all the way through February. And that's any Scout: Scout® II, Traveler®, SS II, Terra®.

If you really want to give Scout a tough test, visit your International Harvester Scout dealer and take a test drive after the first snowfall.

SCOUT.®

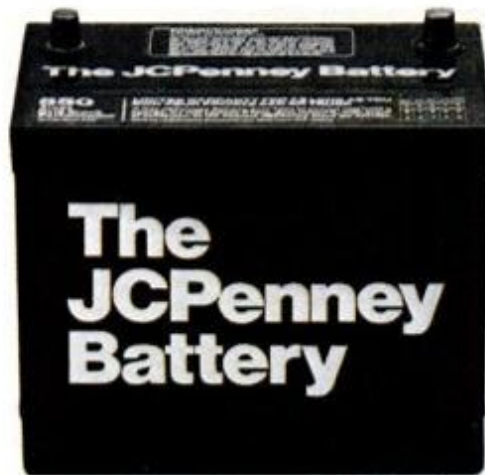
Anything less is just a car.



INTERNATIONAL HARVESTER



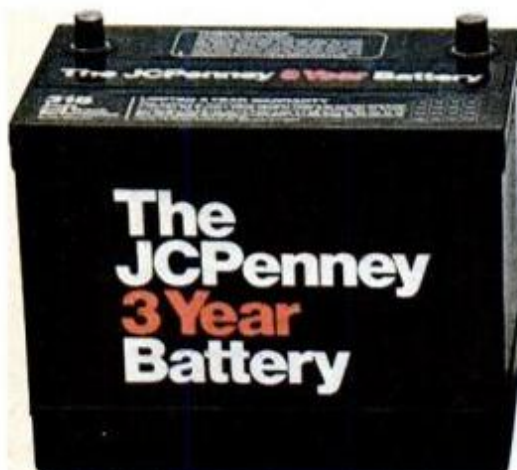
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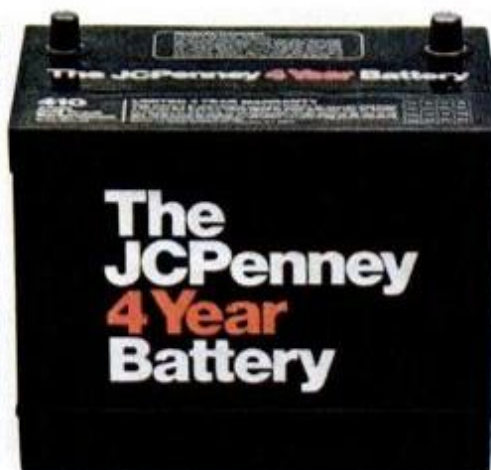
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First there was only one. The JCPenney Battery. The first maintenance-free battery. No water to add or check. Not even filler caps. Just power. Now there are three more. Three equally maintenance-free batteries. The JCPenney

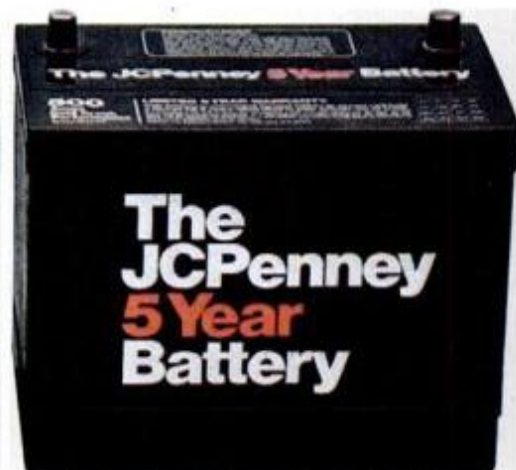
3, 4, and 5 year batteries. Still no water to add or caps to fool with. But now you can choose the power you need and the price you want to pay. The JCPenney 3, 4 and 5 Year Batteries. Take your choice.



315 Amps (Group Size 24)
Cold Cranking Power



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Cold Cranking Power

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Just return it with proof of purchase to the nearest JCPenney auto center for service. Prices slightly higher in Alaska, Hawaii, and Puerto Rico.

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- If it fails during the first 2 years—we will replace it free.
- If it fails during the 3rd year, we will allow \$20.00 towards the purchase of a new battery.
- If it fails during the 4th year, we will allow \$10.00 towards the purchase of a new battery.

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THIS BATTERY IS WARRANTED AGAINST FAILURE TO ACCEPT AND HOLD A CHARGE FOR 5 YEARS WHEN USED IN YOUR PRIVATE CAR OR TRUCK.

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- If it fails during the 4th year, we will allow \$20.00 towards the purchase of a new battery.
- If it fails during the 5th year, we will allow \$10.00 towards the purchase of a new battery.

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The JCPenney Batteries

The *Full* Line of Maintenance-Free Batteries.

ALL OUTDOORS

New Year's resolutions

January is a good time to consider books to read, equipment to test, hunting, fishing, skiing, diving, hiking, boating and camping spots to see or see again. Here are a few selections.

Robot retrievers

The space age really caught up with sportsmen when Ben Wilson in Wichita Falls, Tex., started thinking up ways to improve his hunting a couple of years ago. First he decided he could liven up his goose decoys by adding flocks of geese taking off and landing. His solution: kites he designed and patented made of DuPont's Tyvek. This plastic is so light the Canadian, snow goose or duck hen kites will "fly" and stay aloft in a breeze of only five mph. All can be staked out unattended, and sell for \$26 apiece. They are hand-made, and you don't have to run with the string to make them take off. Ben says they can be adjusted for life-like maneuvers.

His next development was radio-controlled decoys. Now you can sit in your blind and send a goose, mallard drake or hen decoy swimming out 100 yards in any direction while you steer it and make it go forward or in reverse with a hand-held transmitter. Better still, they can even be rigged and sent out as retrievers to bring back downed waterfowl. One of these decoys costs about \$150 and includes the radio-controlled decoy with retriever attachment, rechargeable C-cell batteries, charger and transmitter control unit. They are available from Sports Innovations, Box 385, Wichita Falls, Tex. 76307, and from mail order suppliers like Cabela's, Sidney, Neb. 69162. Ben Wilson tells us he has more innovations in the works.

Better shells

Now that waterfowlers on major flyways must use steel shot to prevent the lead poisoning of ducks and geese that eat spent pellets, ammo manufacturers have been upgrading the shot shells available. Remington now has a new 12-gauge 3-inch magnum shell loaded with 1¼ oz. of shot that is said to operate the repeating actions of autoloading magnum shotguns even in very cold weather. Larger shot sizes of 1, 2 and 4 are used to

equal the 2, 4 and 6 of lead, and a special powder delivers 1375 fps muzzle velocity from the new 2¾ and 3-inch Remington steel shells.

Lead problems of another kind—the toxic fumes that can pollute the air of an indoor firing range—have been tackled by Smith & Wesson. Their new S&W Nyclad nylon jacketed .38 and .357-cal. handgun bullets are claimed to reduce airborne lead oxide contamination by up to 89 percent, while preventing bore fouling almost that well. Police and other practice ranges should all benefit.

Keeping warm afloat

Outdoors it can get cold any time of year; a fall overboard this season could be lethal, and the new exposure and survival suits are particularly welcome when hypothermia is a threat on the water or



Winter outdoorsmen who may end up overboard now wear flotation survival gear like Mustang's Ensolite-lined suit.

even when you are ashore.

Several excellent suits and jacket-pants combinations are available. Imperial, in Bremerton, Wash.; Bayley, of Fortuna, Calif.; and Stearns, in St. Cloud, Minn., are among sources. And recently we looked over a new model from Mustang Sportswear, Vancouver, B.C. They make the U-Vic Thermo-float jacket, based on hypothermia research by the University of

Victoria, and their jacket and new suit are also available from Whitefish Marine in Seattle. At \$250, their flotation survival suit should appeal to commercial fishermen and sailors. But for anyone around water in winter, the price seems small when you compare it with the forbidding alternative.

Off-season info

On a cold winter's night, the best way to brush up on fishing techniques for warmer days is certainly with Jerry Gibbs's new book, *Bass Myths Exploded*, published by David McKay. Covering the newest ways to catch largemouths, Jerry spent hundreds of hours underwater studying the specie and has surfaced with the definitive book on the subject.

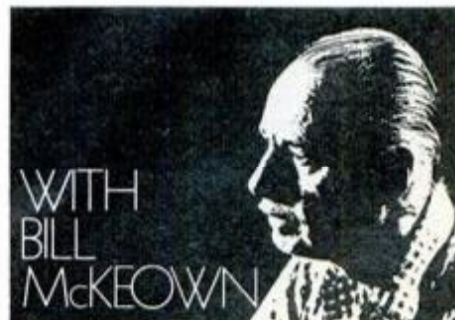
For old gun collectors, old master Merrill Lindsay puts it all together in *The Lure of Antique Arms*, from Stoeger Sportsman's Library.

Indoor tennis players can improve skills immediately with the explicit hints in *Lifetime Treasury of Tested Tennis Tips* from Parker Publishing of West Nyack, N.Y. Vicarious excitement is the bonus as you go *Thunderboating with Bill Muncey*, the world's winningest unlimited driver. It's from Tony Hogg Publications, Newport Beach, Calif.

Where the action is

This time of year if I had a choice of ways to get away from winter I'd want to fly south to summer on the upper Amazon at Manaus, Brazil, and fish for South American exotics with travel author Buck Rogers. For great fishing nearer home, I'd contact Stan Slaten at Mexicana Tours in Houston, Tex., for reservations on Lake Guerrero, Mexico, where the most bass are, or call Bill Martin of Bass Champions, Fort McCoy, Fla., to line up the biggest bass in famous Rodman Pool.

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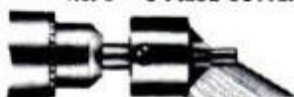


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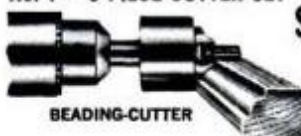


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HINTS FROM READERS

Simple battery tester



Use a spare bulb and pliers to check the power left in small batteries used for toys and flashlights. This is particularly helpful if only one battery is dead or low. Place negative end of battery on one handle of pliers. Hold bulb on positive pole of battery and touch other handle to side of bulb as shown. If bulb lights, there is life left in the battery.—*Emery J. Loiseau*

Packing material takes shocks



Pieces of foam-type plastic egg cartons are lightweight and make ideal packing material to cushion fragile items.—*John Hosack*

Shoe-polish scratch cure



Camouflage scratches in varnish and lacquer with wax-type shoe polish in a color to match the wood. Rub dressing into scratch and buff with a cloth or soft-bristled brush.—*Walter E. Burton*

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APPLIANCE CLINIC

QUESTIONS ANSWERED

Exhausting possibilities

The original builder of our home made a small steel box in the wall to vent exhaust from our electric clothes dryer. This box collects water and lint and needs regular cleaning. I disconnected it and attached a nylon stocking to the exhaust as an experiment. Instead of cleaning the box, I just replace the stocking.

Now the dryer is working more efficiently, but moisture from the hot exhaust fogs up my windows. Mildew is appearing. The nearest window is 25 feet away. Any suggestions?—J.W. Picone, San Diego, Calif.

If possible, move the dryer near the window and vent the unit to the outside. You don't have to get real close. The venting system can run a maximum of 16 feet and have a maximum of two elbows if 4-inch-diameter aluminum duct is used. With flexible tubing, the length should not exceed 8 feet. If the dryer can't be moved near the window, move it toward a wall, then install a venting system through the wall to the outside.

Failing these choices, why not rely on the original steel box? It should work okay provided you clean it out following each drying cycle. You're wise not venting the dryer into the attic or into a chimney or crawl space. As you know, lint is flammable when it dries. Why take chances?

You can always continue with the stocking method; just eliminate the mildew by installing a dehumidifier. Console yourself with this fact: If you had purchased a gas dryer, you would have been required to vent it to the outside for safety's sake, no matter what the cost might be.

Bearing down

Our 15-year-old Speed Queen washing machine makes a loud, rubbing sound during the wash cycle. I can reproduce the noise by manually moving the tub sideways. The machine is level and mounting springs are in place. So what's wrong?—R.A. DeLong, Alexandria, Va.

Your unit's agitator shaft is out-fitted with two bearings, either of which may be worn. One bearing is directly under the collar; the second is located below the drive mechanism.

First check the one below the collar on the top end of the agitator shaft. You can replace it without too much trouble.

The bearing below the drive mechanism on the lower end of the shaft is much tougher to replace. If this one is causing the rub, try lubricating it with a water-resistant grease, such as water-pump grease.

If this should not work, you can continue using the machine until the bearing freezes (binds up). Then have it replaced by a serviceman. It's not an easy do-it-yourself job.

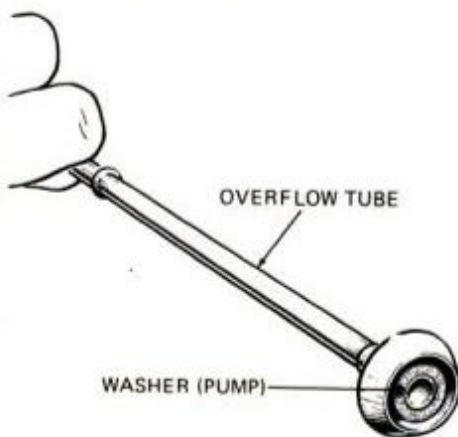
The rest of the story

I had the temperature sensing unit of one heating coil on my General Electric range (model J304T1WH) replaced about a year ago. The coil has worked well since then—too well. Even when I keep the knob adjusted as low as "warm," the coil operates at a roaring boil. The service-

(Please turn to page 158)

SERVICE TIP

If your electric coffee pot is producing hot water but no coffee, check the overflow tube. The tube's base must fit securely into the well in the pot. If the tube is in the right position and the pot still produces hot water only, replace the overflow tube. The washer in the



Coffee pot overflow tube and washer.

base of the tube (see drawing above) is probably worn out. When functioning properly, the washer acts as a pump to get hot water to the basket holding the coffee.

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Stall stymies Stan

Why haven't three new exhaust gas recirculation (EGR) valves and two major tune-ups, at \$72 each, corrected a stalling problem with my 1976 Maverick 250-cu.-in. engine? When the EGR hose is disconnected and plugged, no problem. The Ford mechanic suggests I leave it this way, but won't this violate antipollution laws? What do I do?—Stan Griffin, South Euclid, Ohio

Reconnect the EGR system and install a distributor vacuum control check valve (part No. D3VY-12A197-A) between the thermal vacuum switch (TVS) on the air cleaner and EGR valve. The check valve keeps the EGR valve closed when it should be closed. An EGR valve that opens when it shouldn't causes vacuum loss, resulting in stalling, rough idling and surging.

The distributor vacuum control check valve is inserted in the vacuum tube between the TVS and EGR valve by using two three-way tees (part No. 373846-S). It should be placed about four inches from the TVS. The fix covers all 1976 Ford and Mercury models with 200 and 250-cu.-in. and 2.8-liter engines.

Man in the middle

My 1978 Oldsmobile Cutlass Supreme came equipped with Firestone 721 P195/75R14 tires. It also came with a noticeable vibration between 50 and 55 mph, which no one has been able to do anything about. Wheels have been balanced five times—twice by the Olds dealer and three times by Firestone. Each company blames the other for the problem, and I'm stuck in the middle with a \$7000 seat-of-the-pants massager I don't need. Can you make suggestions?—Timothy B. Shugart, Cedar Rapids, Iowa

Vibration is caused by tire or wheel run-out, or by a mechanical defect in the car. If a tire, or tires, are at fault, Firestone is responsible. Any other problem belongs to

Olds. Responsibility should be established.

Testing equipment generally used by car and tire dealers is not sensitive enough to detect every tire defect that can cause vibration. Balancing, therefore, is not conclusive. So how do you establish, without doubt, whether tires and/or wheels are to blame, or whether there is a mechanical problem, such as axle-shaft run-out? Find a dealer possessing a sophisticated, expensive Tire Problem Detector. The only dealers I've found having TPDs are Cadillac dealers.

Make the suggestion to your Olds and Firestone dealers. If they wash their hands of the affair, call customer relations at company headquarters. You will get action.

Chico and the shakes

A vibration in our otherwise great little 1977 Pacer was giving me fits. You know why? Because the 258-cu.-in. six-cylinder engine has one belt to pull the airconditioner compressor, that's why. This belt must be as tight as possible. A loose belt creates compressor vibration. Hope your readers who drive six-cylinder

AMCs remember this.—Chico Saravio, Erath, Ala. Me, too. Thanks.

Warranty complaint

My daughter and her serviceman husband bought a new Toyota. They were transferred from the state in which the car was purchased, then my son-in-law was sent overseas. The Toyota dealer in the town where my daughter now lives won't honor the warranty. He wants to charge \$90 for the second major tune-up called for under the warranty. I think something ought to be done. Whom do I call?—Mrs. E.S. Bird, Live Oak, Fla.

It seems there's a breakdown in the communication between your daughter and the dealer. The "second major tune-up" is probably the recommended 12,000-mile service. The customer is supposed to pay for parts and labor. The warranty covers only parts and labor required to repair a defect.

If you are not satisfied with this explanation, speak to someone at the company level. In Florida, you can call Toyota, toll-free, by dialing 1-800-342-8488.

'Normal' it's not

I own a 1977 Ford Granada that has a 302-cu.-in. V8 engine. A constant clicking noise is heard only when the transmission is in gear. I've driven other Granadas of the same year and with the same engine, and the irritating clicking is not heard. Ford agency people, who admit the clicking is present, have taken the position that the car is normal to their standards. Your suggestions would be welcomed.—Lester H. Jordan, Denver

I don't blame you. Too bad that

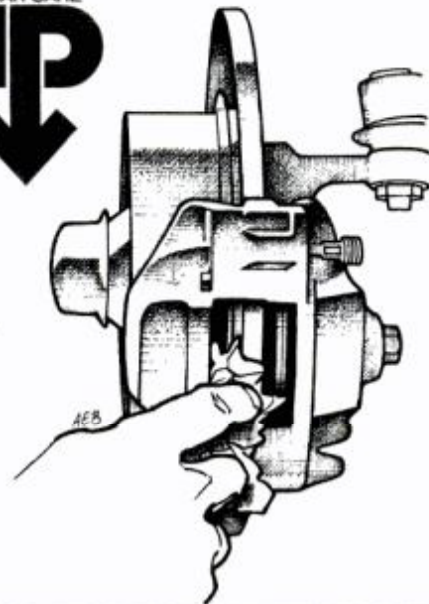
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PM CAR CARE

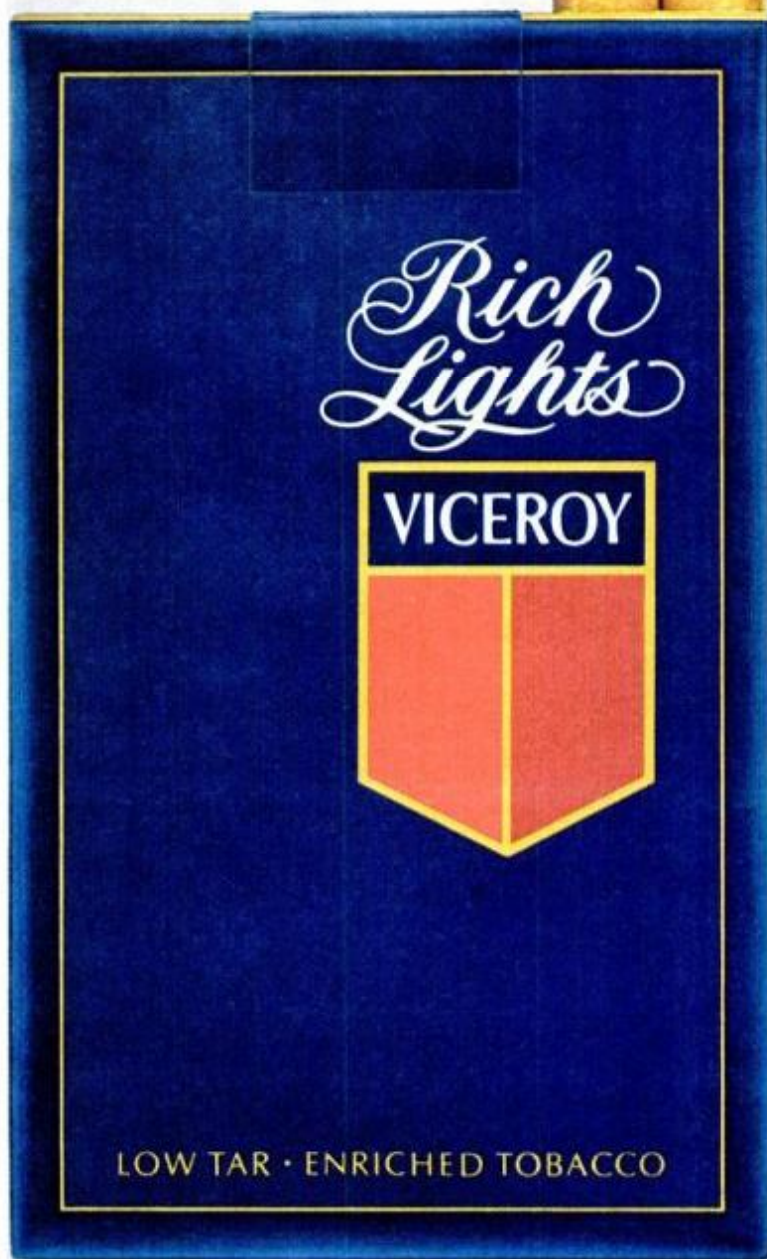


Give brake pads a clean 'pad'

The next time that you replace your car's disc-brake pads, keep in mind that cleanliness can help avert scored rotors. Damaged rotors must be replaced, which is an expensive proposition. Therefore, after removing the old pads, clean the caliper and rotor before inserting new pads. Use denatured alcohol as a cleaner. Nothing else! Cleaners that contain any petroleum can cause a brake system to lock when the brakes are applied. Make sure that the caliper and the rotor are completely dry before you insert the new pads.



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CAR CLINIC

(Continued from page 20)

Ford may lose a customer because a dealer is too quick to pass off a condition as "normal." A vehicle, in gear or out, should not make clicking noises.

The fact that the noise occurs in gear points to a driveline malfunction. Look for a worn or damaged universal joint, crack in the transmission converter or loose converter-to-flywheel bolts. Another possibility is a wheel bearing, if the clicking occurs on-the-move.

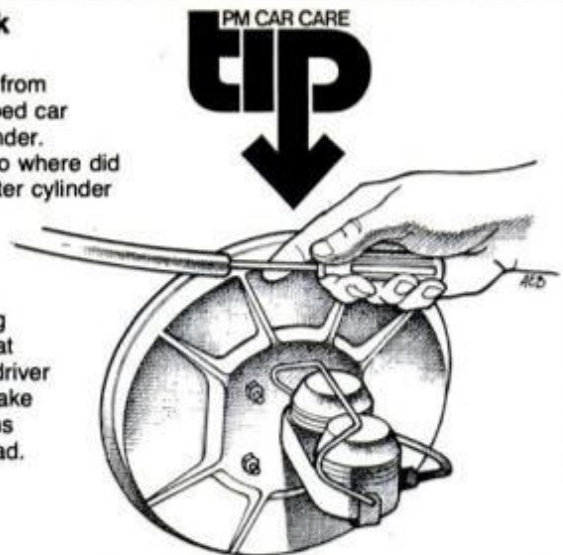
Slapdash theory

For the past three months, the alternator indicator light of my 1974 Oldsmobile Cutlass has been on when the engine is running. The alternator and battery check out fine. The alternator belt is tight. But the light is bright and blinks when I use the turn signals.

One mechanic says he received a bulletin about the alternator light losing its electrical ground because dashboards are plastic. He says replacing the dashboard will correct the problem. It's expensive. What should I do?—David J. Sidebottom (no address given)

Finding an 'unfindable' leak

Car Clinic received a letter recently from a reader whose power-brake-equipped car lost brake fluid from the master cylinder. He swore he could spot no leaks. So where did the fluid go? If seals inside the master cylinder fail, vacuum pulls the fluid from the cylinder into and then through the brake power booster to the intake manifold. If you ever encounter such a baffling fluid loss, pull off the vacuum hose at the brake booster and twirl a screwdriver inside the hose. The presence of brake fluid on the screwdriver shank means that the master cylinder seals are bad. The cylinder should be replaced.



Replace the 25-cent, 10-amp. fuse in the fuse panel. If there is a bulletin about plastic dashboards causing lights to shine, it's news to me—and to Olds.

All about 74-C-1

I just bought the cleanest 1971 Cadillac you've ever laid eyes on. But one thing bothers me. Under the hood, on the front rail, is a label that says: "Cadillac 74-C-1 Campaign Completed—Do Not Remove." The

used-car dealer doesn't know what this refers to. Do you?—Paul Robinson, Syracuse, N.Y.

Sure. It refers to Caddy's product safety campaign for '71 and '72 models, except Eldorados. They were recalled to have a lubrication fitting installed in the idler-arm assembly or to have the idler arm replaced if judged to be defective. Lack of lubricant in the original idler arm, plus exposure of the part to road splash, causes the idler

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joint to corrode and bind. This affects control.

Any '71 or '72 Cadillac still out there which doesn't have this label affixed to it should be driven to a dealer, and the owner should ask him to apply Production Campaign 74-C-1. It's a "must" for safety. But you have the label, so you're okay.

Wagon master

Can you help me solve a problem with my 1977 Jeep Wagoneer? It has a 360-cu.-in. engine and a four-barrel carburetor. It also has a very strong and unpleasant gasoline odor. The dealer says the problem is common to Wagoneer and Cherokee, and there is nothing he can do about it. Is he right?—Dwight B. Aden Jr., Spokane, Wash.

Partly. The problem is common to Wagoneer and Cherokee, all right, but it can be fixed by using service bulletin 7-01 (2/6/78). This bulletin also applies to '75 and '76 models. The bulletin says the dealer should replace the multisectional fuel filler pipe with a new one-piece pipe (part No. 8129294).

If your Jeep is still under warranty, the conversion will cost you nothing. If it's out of warranty, but

SAFETY AND SERVICE TIPS

■ So you want to be maintenance-minded and replace the fuel filter in your Mazda RX-7 every 12,000 miles or 12 months. Good luck. Unless you happen to know that the filter is under the rear of the car, near the gas tank, how will you ever find it?

■ According to the National Highway Traffic Safety Administration, at last count five children have been killed and 13 seriously injured by being ejected through the rear of hatchback cars that were running with the

hatch lids open. In addition, occupants of the cars were exposed to carbon monoxide poisoning. No further comment is necessary.

■ A 1978 Ford 6.6-liter (400-cu.-in.) engine that is experiencing rough idling and surging during a steady road speed or light acceleration has to have its carburetor main jets replaced. Also, the float level setting has to be readjusted and an EGR system restrictor installed. The whole procedure is outlined in Ford Service Bulletin 158.

you're on record as having had the problem during the warranty period, check with AMC's local zone office to determine cost responsibility. Owners who have to pay for the modification are facing a \$50 repair.

Move over Ali

If you can tell me why my 1977 Plymouth Fury has made a clunking sound similar to a loose shock since day one, you'll convince me you're the greatest. The whole suspension system, including shocks, has been checked and rechecked. No one has helped, and I'll give up only if you tell me to. What do you say?—Gene Mitchell, South Bend, Ind.

Don't give up. Several '77 Furies, Cordobas, Monacos and Chargers were manufactured with mislocated front shock clearance holes causing interference between the shock upper-bushing retainer and cross member in the area below the upper control-arm support bracket. The solution involves removing the shock and grinding the retaining area until stress on the shock is relieved.

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

A sponge for sanding

If you have need of occasional wet sanding—as I do in restoring older cars—there's a new item to ease the chore. It's a rubber sponge that is covered on all but its ends with an abrasive material. Called Quiksand, it comes in various grits. You can easily rinse out any paint buildup in the sponge and use it



Sanding sponge is good for wet sanding.

over and over again. It's made in Britain and retails for \$1.40 at most of the larger U.S. and Canadian paint and hardware stores. Or you can order it from Ken Collins, Inc., Box 747, San Francisco, Calif. 94101.—M.L.

Self-tightening filter wrench

A wrench that can remove spin-on oil filters can be worth more than its weight in gold. It happened recently that I found myself wrestling with a filter that refused to unscrew. So I was thankful that the J-Mark filter wrench is double-hinged so that it tightened its grip as I applied pressure. Never, by the way, tighten a spin-on filter with a wrench—only by hand. The J-Mark wrench costs about \$3.25 at auto parts counters. Its manufacturer is J-Mark Quality Products, Inc., 800 Kasota Ave., Minneapolis, Minn. 55414.—M.L.



Wrench removes stuck-on oil filters.

Easy oil change

Recycling dirty oil is catching on, but until it becomes more convenient with recycling centers set up nationwide, you'll continue to face the problem of what to do with your crankcase droppings. An interesting solution has been introduced by NAPA Filters. Open their "empty" box (actually it's filled with a fibrous material), slide it under your pan, pull the plug and drain away! Twist-tape the plastic bag liner and discard in your trashcan. Drain-Away, as the product is called, is a breeze to use. It has been distributed to the 5700 stores in the NAPA network of dealers and is usually given free to customers who purchase NAPA oil and filters. It's a clever idea that could



Oil drain box soaks up full five quarts.

help eliminate those most dastardly of acts, pouring used crankcase oil into storm drains or burying it. NAPA Filters, Gard Corp., Box 1892, Gastonia, N.C. 28052.—B.H.

No-spill fill



Gun-type oil dispenser does a neat job.

Load a can, pull the trigger and one quart of clean oil flows like honey over your rocker arms. You can almost shoot from the hip with this gun-type oil dispenser. The Model 85 Marksman shown is \$3.34 retail; a second type at \$4.10 has a flex tube for transmission fills. J-Mark, Inc., 800 Kasota Ave., Minneapolis, Minn. 55414.—B.H.

Oil by the gallon

Do-it-yourself oil changing is subject enough for a complete story. In fact, it was: See *World's Biggest Oil Leak*, page 30, Sept. '76. Each of us has his own preferred method of changing oil, some as crude as using old paint cans to catch the stuff. Another way is to buy oil in gallon containers, then use the emptied container to discard the dirty oil or to carry it to a waste collection center. For those who like the gallon-jug idea, Valvoline has introduced (east of the Rockies) its All-Climate HD in gallons. Instructions on the container help novice oil changers and a self-locking cap prevents spills. List is \$4.95 but you can find it cheaper. Valvoline Oil Co., Ashland, Ky. 41101.—B.H.



Oil in gallons is new for Valvoline

Bench for pickups

If you really want to take advantage of your pickup's versatility, you have to be familiar with the many truck options that are popping up. This Sportsman's Bench is one way to get more fun and practical usage from your pickup. It folds down for sitting and sleeping and folds up to serve as a pair of handsome, hardwood-and-steel side racks. It will fit most Detroit pickups and a pair of the benches costs \$170 for the six-foot size and \$200 for the eight-footers. Stephan Wood Products, Inc., 605 Huron, Box 669, Grayling, Mich. 49738.—B.H.



Benches fold up and become side racks.

FORD PINTO. NEW DESIGN FOR '79.



Compare Pinto: It may be the best small car buy in America today.

A NEW DESIGN PINTO.

Pinto for '79 has a new design. New bump front, new in back, new inside. With more standard features than last year — it's a complete small car.

PINTO VALUE PRICED.

Compare Pinto's low sticker price to other comparably equipped cars. You may be in for a surprise.

PINTO RUNABOUT IS:

\$1,168 LESS

than Toyota Corolla Liftback

\$997 LESS

than Datsun 210 Hatchback

\$642 LESS

than Honda Civic CVCC 3-Door

\$531 LESS

than Omni/Horizon Hatchback

\$366 LESS

than Monza 2+2 Hatchback

Comparison of sticker prices of comparably equipped models excluding destination charges which may affect comparison in some areas.

PINTO STICKER PRICE \$3,787.

The Pinto Runabout, shown below, is sticker-priced at \$3,787 (including optional white sidewalls), excluding title, taxes and destination charges.



NEW PINTO RUNABOUT

MORE STANDARD FEATURES THAN LAST YEAR.

Steel-Belted Radials • AM Radio (may be deleted for credit) • Tinted Glass • Protective Bodyside Molding • Full Wheel Covers • Rear Window Defroster • Front Bucket Seats • Deluxe Bumper Group • 2.3 Litre Overhead Cam Engine • 4-Speed Manual Transmission • Rack and Pinion Steering • Front Stabilizer Bar.

32 MPG HWY., 22 MPG CITY

EPA estimates with 2.3 litre engine and 4-speed manual transmission. Your actual mileage may vary, depending on how and where you drive, your car's condition and optional equipment.

REDESIGNED FUEL SYSTEM.

Of course, all '79 model Pintos, like the '77s and '78s before it, have redesigned fuel system features, including a longer filler pipe, plus a gas tank shield.

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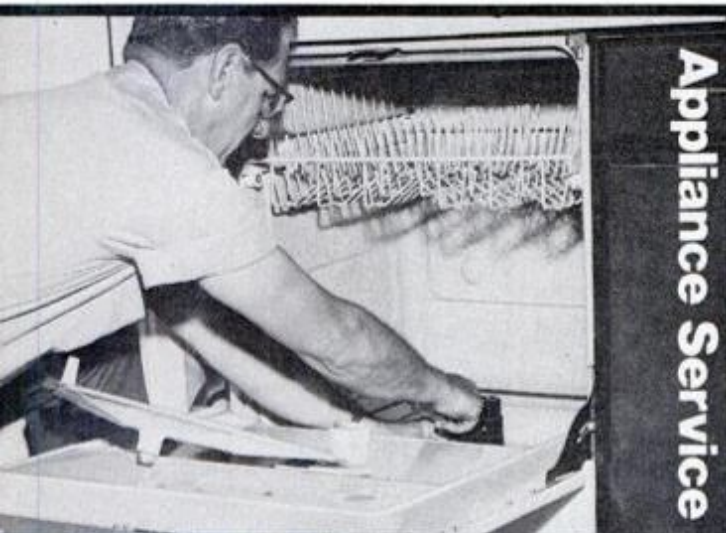
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varactor diode tuning and digital read-out. Computer courses now include the NTS/HEATH computer with 4K memory, Interface, and Video Terminal.

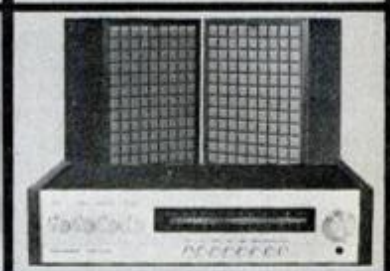
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Electronics



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11 new snapshot cameras

Automatic exposure, built-in flash and automatic focus highlight this crop of pocketables and instants.

by Tom Sahagian

Much attention has been paid of late to single-lens-reflex cameras. But new cameras of all kinds have been introduced lately, particularly snapshot cameras. PM picked 11, most of which feature automatic exposure control and built-in flash, and put them to practical tests. We looked at three basic types: 35-mm, instant and 110 format.

35-mm—best of the bunch

The three 35-mm cameras were the most impressive tested. Each had unique features, and took good pictures.

■ **Konica C35AF (\$273):** The AF stands for Autofocus, a system we've already told you about (see *First Automatic-Focus Camera*, page 66, Dec. '77). It's not a perfect system, for in some situations it can be fooled into focusing on the wrong part of a picture, and it can't be overridden for manual control. But for most snapshots it worked well and was well received by PM staffers who tested it. The AF comes with a 38-mm f/2.8 lens.

■ **Vivitar 35EM (\$170):** This small (4.2 x 2.7 x 1.4 in.), compact item has a 35-mm f/2.8 lens that retracts into

its body. The fold-flat feature makes it eminently pocketable and protects the lens without the worry of losing or forgetting to remove a lens cap. It has no built-in flash, but does have a hot shoe. One gripe: Focusing is largely guesswork. The lens is marked, but you must measure or estimate the subject distance, and you can't focus while looking through the viewfinder. Also, the aperture ring on the lens was easy to confuse with the focusing ring.

■ **Canon A35F (\$189):** Sure, there are plenty of 35-mm cameras with autoexposure, rangefinder focusing and pop-up flash. But when Canon's flash is popped back down, it disappears into the body for protection. Additional features include a self-timer (so you can appear in your own pictures) and a special film-loading arrangement, so that the film winds directly to the first frame. A built-in safeguard prevents the shutter from working if the subject is beyond flash range. Problems? The ASA dial on the 40-mm f/2.8 lens was difficult to adjust.

Instant cameras

None of the instant cameras is

completely new. You'll have to decide if the convenience of instant snapshots is worth having a relatively bulky camera in addition to somewhat unfaithful color reproduction.

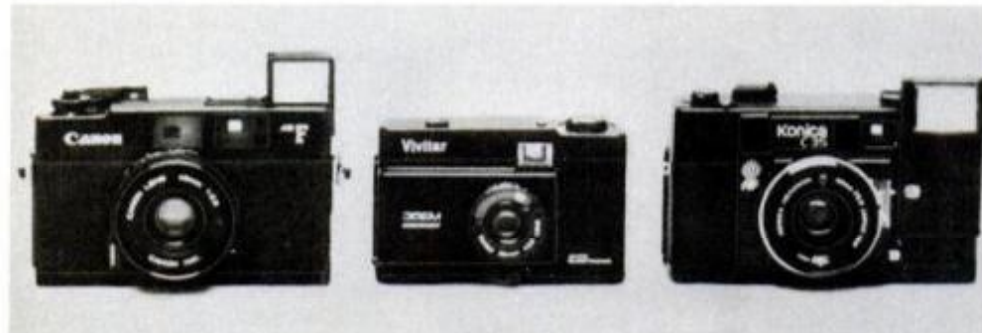
■ **Polaroid SX-70 Sonar One Step (\$250):** Identical to the SX-70, except for its autofocus feature (see *Polaroid's Sonar-Focus Camera*, page 85, July '78), the camera is a technological marvel. But, it is a bit awkward to hold, and the viewfinder makes framing the shot difficult. It's also easy to have your hands in the way of the picture as it emerges.

A focus preview allows you to check the focus in advance to make sure the autofocus unit isn't fooled. Although we used FlashBars, there will be separate flash units for both Sonar models by the time you read this.

■ **Polaroid Pronto Sonar One Step (\$100):** It uses the same autofocus unit as the SX-70, but we had some problems with incorrect focus on this camera, possibly because it has no focus preview. Both Sonars have manual focus, by the way. The Pronto's exposure meter seemed less accurate than that of the SX-70, although the camera itself was easier to use.

■ **Kodak Colorburst 300 (\$75):** The motorized 300 is similar to the others in the Colorburst series, with the addition of built-in flash. It's a little easier to use than the Polaroid cameras, and the flash is convenient. But the "zooming circle" focusing device drew criticism from all who tried it. The idea is to adjust a circle of variable size in the viewfinder until the subject's face is just within the circle. It's imprecise and

(Please turn to page 32)



Three 35-mm cameras (left to right): The Canon A35F has a protected pop-up flash and self-timer. The Vivitar 35EM folds flat for true pocketability, while automatic focusing is one of the top features of the Konica C35AF. All three did well in a test.

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A trio of instant cameras: The Kodak Colorburst 300 is flanked by two Polaroids. Motorized Colorburst features built-in flash. SX-70 Sonar One Step (left) and Pronto Sonar One Step have automatic focusing. SX-70 also has a focusing preview.

11 NEW SNAPSHOT CAMERAS

(Continued from page 30)

doesn't work with a young person, pet or inanimate object.

110 cameras

We tested four new ones (five, counting U-Build, page 36) against an established model, the Minox 110S (about \$210 with add-on flash), for comparison. All accepted the new 400 ASA color film cartridges, and had built-in flash.

■ **Vivitar 742XL (\$190):** A camera with a solid feel, it has rangefinder focusing and a fast f/1.9 lens. A sliding cover/shutter interlock protects the lens and prevents accidental tripping of the shutter. The shutter release is fairly smooth, but the viewfinder's bluish tint reduces brightness. The autoexposure system ranges from 1/800 to 5 seconds and f/1.9 to f/16.

■ **Kodak Ektramax (\$90):** Like the 742, it has an f/1.9 lens and focusing capability. There's a distance readout on the camera top, but five symbols in the viewfinder there correspond to different distances. I

found myself constantly looking up to check the distance scale. The camera has four settings: bright light, dark shade, low light and flash. A sliding cover/shutter interlock protects the lens and viewfinder.

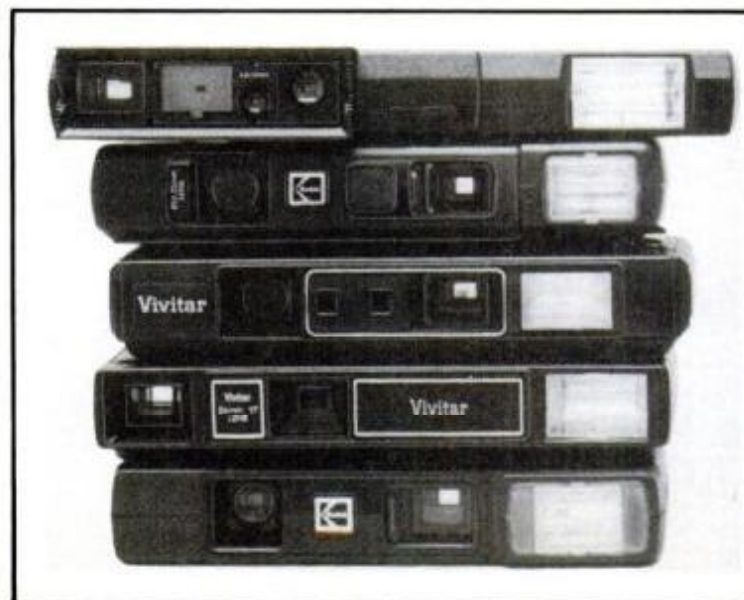
■ **Vivitar 700 (\$55):** It has a better-feeling shutter than its more expensive cousin and both Kodaks, and a slightly faster fixed-focus f/1.7 lens. It lacked a lens cover. When using flash with 400 ASA film, a button must be slid over and held in place during the shot.

■ **Kodak Ektralite 10 (\$40):** A sliding cover/shutter interlock protects the lens and viewfinder, but the shutter felt sticky and the camera did not seem as well made as some. The fixed-focus lens is f/8.

Photo results

We shot a 20-frame 110 cartridge of 400 ASA color film with each camera in a variety of indoor and outdoor situations. All the photos came out pretty well; surprisingly, there was little to choose among them. Flash results, generally good, were best with the Minox. **PM**

(For a build-it-yourself camera, see page 36)



Tower of pocket power, from top: Minox 110S with F110 flash (used for comparison); Kodak Ektramax; Vivitar 742XL; Vivitar 700; Kodak Ektralite 10. All four tested models include built-in flash and accept 400 ASA color film cartridges. Ektramax has a mechanical exposure system, while the 742XL's is electronic; both feature rangefinder focusing. Ektralite 10 and 700 are fixed focus.

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The U-Build 110 pocket camera is a kit designed for children, although it should not be considered a toy.

Assembly details are clearly outlined in seven steps, with accompanying illustrations. However, in Step 2, the builder is told to "squeeze a small amount of cement along edges of the shield," a metal plate which tops the shutter housing, "and glue into place." This builder searched the kit in vain for glue, then used Duco cement and a thin stick.

The complete assembly took about two hours. While the kit is designed for children, there are a few tricky moments when anything less than good manual dexterity and a lot of patience could result in a broken spring on the film advance wheel, lost screws, or a scratched or dusty viewfinder lens.

The camera has a fixed shutter speed of 1/60 second and a 29-mm f/11 fixed focus lens. Ordinary color film outdoors on a clear day or 400 ASA film indoors should produce decent snapshots.

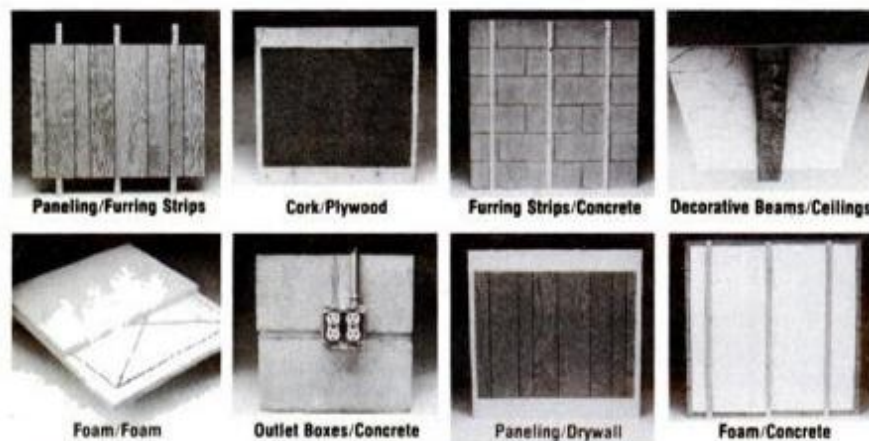
One word of caution: In case the camera must be disassembled, it is not advisable to use glue on the housing screws to compensate for an unsteady hand, as suggested in the "Helpful Hints" in the instructions.



U-Build lens is fixed focus, 29-mm f/11.

Again, a patient adult can compensate for any child's lack of dexterity.

A test roll of film produced some unsharp photos and some unexposed frames, but for \$14.50 it's unreasonable to expect super results. The kit is available from Ehrenreich Photo-Optical Industries, Special Markets Div., 7550 North Oak Park Ave., Niles, Ill. 60648.—*Patricia A. Murphy*



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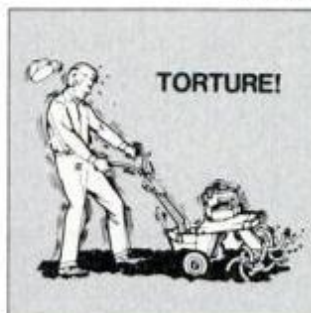
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- Automotive-type engineering — precision gears, tapered roller bearings, no chains to stretch, wear or work loose!
- Sold direct to keep prices down — would have to be at least \$125 higher if sold ordinary ways!
- Comes with our famous no-time limit promise to you!
- Will GREATLY increase your gardening joy!



Why, for heaven's sake,



suffer any longer with the FRONT-END type of tiller shown at left—the type with the revolving blades in FRONT and NO POWER to the wheels — the type that shakes the living daylight out of you — the type that leaves Wheelmarks and Footprints in the nice smooth soil you have just tilled or cultivated?

SO, PLEASE don't buy any other Tiller — don't put up any longer with the Tiller you now have! Mail the coupon NOW for complete details, prices, OFF-SEASON SAVINGS for this wonderfully different and better idea in Tillers — The TROY-BILT® Roto Tiller-Power Composter!

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Useful information

Do you know how to properly care for and maintain your home's domestic water-heating system? For 50 cents postpaid, the Hydronics Institute, Box 262, Berkeley Heights, N.J. 07922, offers an informative eight-page pamphlet, *Instructions for Care of Residential Hydronic Systems*. Topics covered include a basic description of steam and hot-water systems, what to check before calling a serviceman, gas and oil firing instructions, conservation tips and how to close down your system.

Latex contact adhesive

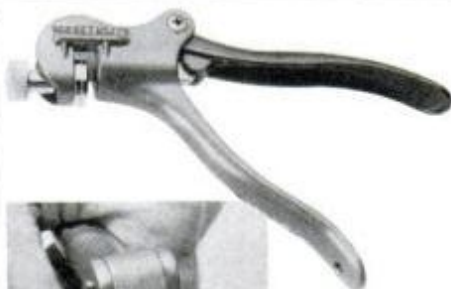


Latex base makes clean-up easy.

Lokweld 700 is a superstrong latex contact adhesive that's nonflammable, nontoxic and freeze-thaw stable. It bonds laminated plastic, plywood, wallboard, wood veneer, rubber, paper, leather and particle board in 25 to 45 minutes, depending on the temperature and humidity. You can clean it off with water. One gallon sells for about \$14 at home centers and hardware stores. From Ralph Wilson Plastics Co., 600 General Bruce Drive, Temple, Tex. 76501.—D.O.

Saw setting tool

With the appearance of the Hard SS-7, you can now purchase one tool to set most of the handsaws in your shop. Instead of a flat anvil, this unit features a rotary anvil with a graduated bevel, so that you can set any blade up to a 16-gauge thickness with 4 to 12 teeth per



Center tooth over the anvil and squeeze handle. Plunger drives forward, setting tooth precisely.

inch. Sold at hardware and home centers, or for \$8.34 postpaid from Great Neck Saw Manufacturing Inc., 165 East Second St., Mineola, N.Y. 11501.

Versatile nylon nuts

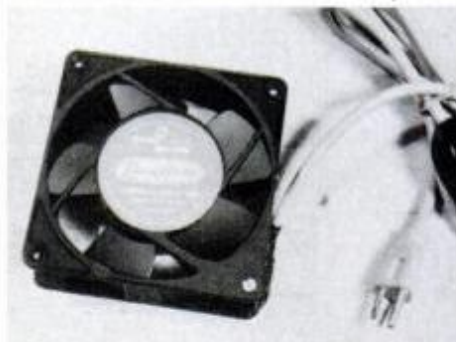
Homecraft's nylon, self-locking "Super Nuts" will fit any type of screw—wood, machine, sheet metal or metric. Rustproof and electrically insulating, they come in four sizes— $\frac{1}{4}$ in., No. 10, No. 8 and No. 6—or in an assortment pack. Since nylon has an elastic memory, nuts will maintain their grip indefinitely and can be reused many times without loss of torque. List price is 69 cents per pack at hard-



Color-coding indicates four sizes.

ware stores and home centers. From Homecraft Div., Gries Reproducer Co., 400 Beechwood Ave., New Rochelle, N.Y. 10802.—D.O.

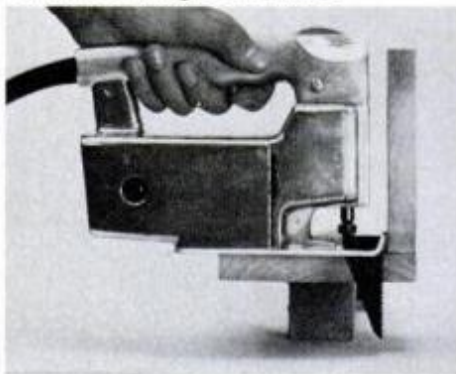
Useful box fan



Finger guard, cord set are accessories.

The quiet, single-speed Dayton Box Fan is ideal around home or shop when you want moving air, but no stiff breeze. It can also cool electronic instruments; \$21 to \$24 at housewares stores. W.E. Granger Inc., 5959 West Howard St., Chicago, Ill. 60648.—H.W.

Flush cutting saw blade



Blade cuts ahead of the saw shoe.

You can cut directly up to a wall or other obstruction with this FL7 Flush blade. Installed in a sabre saw, it actually cuts ahead of the saw. It's handy for electrical wiring work, as it cuts holes in floors and ceilings flush with a wall. It also helps to make countertop cutouts where you must cut directly up to the back splash. One blade sells for \$1.05. G.W. Griffin Co., Franklin, N.H. 03235.—H.W./P.A.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

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"tar", 1.0 mg. nicotine, av. per cigarette, FTC Report MAY '78.



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Ford pickups are built tough. With tough Twin-I-Beam front suspension, an all-welded cab, extensive rust protection, and a double-wall box on every Styleside. And they're tested tough at Ford's Arizona Proving Ground over miles of truck-jarring bumps, chuckholes, salt sprays.

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*Based on R.L. Polk & Co. registrations.

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IMPORTS & MOTORSPORTS

Rabbit convertible



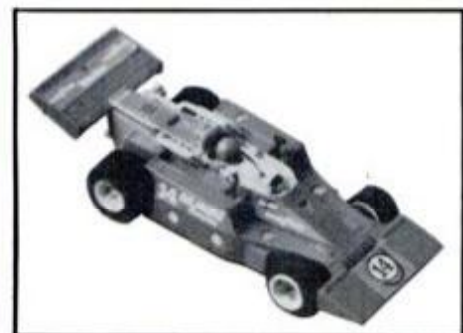
Rabbit Targa will replace the Beetle convertible before too long.

A golden anniversary for the Beetle convertible was just not meant to be. Before 1982 rolls around (which would mark 50 years since the Porsche Type 32, forerunner of the Beetle, made its appearance), the familiar shape will surely surrender to an improved successor—a convertible version of the Rabbit.

The Karmann coachbuilders in Osnabrück, Germany, are well along with a folding top for the Rabbit (it's Karmann craftsmen who've been lovingly shaping Beetle convertibles and, more recently, the Scirocco sport coupe). The Rabbit convertible, or Targa, as it may be called, is designed with a roll bar for top support and safety in the event of a rollover. You can bet the soft top will be as good or better than the one on the Beetle—perfectly stitched, insulated and easy to put up and down by hand. The time has come for the Targa: The Beetle convertible is a most charming little machine, but a dog to drive compared to the Rabbit.

Readin', ritin' and racin'

You've probably heard of another respected automaker that makes small cars—very small cars: Aurora is a name we old modelmakers know well, but their road racers go back "only" 18 years. Aurora's latest line includes AFX Super G-Plus HO-scale racers, Super Mag-



A.J.'s car is an Aurora Super G-Plus.

na-Traction cars, the Magna-Sonics and more.

The Super Gs, like A. J. Foyt's Indy car shown here, are especially fascinating to the enthusiast who appreciates technical excellence. The little screamers have in-line, high-revving engines, brass armature bearings and unique magnets.

Aurora has become a generous patron of full-scale Grand Prix



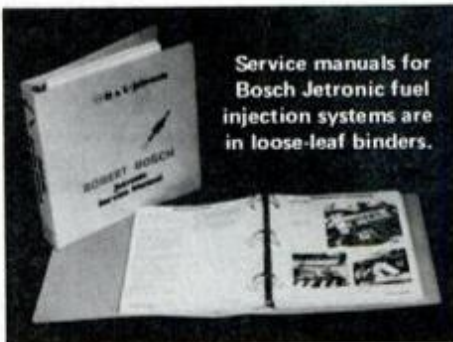
Racing lingo is in a new book for kids.

racing with its sponsorship programs that began last year. This year its prize fund will top \$250,000 on the 12-race, international GP circuit. Watch for Aurora April 6-8 at the Long Beach GP, where they'll be holding competitions on scale model tracks.

PM's exciting full-color feature about the Long Beach Grand Prix becoming the U.S.'s second GP (we're the only country with more than one GP race on the calendar) appeared in March '76 (page 80). Ross R. Olney, who did that story for us, has just published another book that'll really "cut in the boost" on your kids' vocabularies. *The Illustrated Auto Racing Dictionary for Young People* is \$5.89 from Harvey House Publishers, 20 Waterside Plaza, New York, N.Y. 10010.

Servicing Jetronic systems

If you own an Audi, BMW, Mercedes, Opel, Porsche, Renault, Saab, VW or Volvo with a gasoline fuel-injection system, you are probably well aware that the name on it is *Bosch*. The Robert Bosch D-Jetronic system was introduced in 1967 and the L and K-Jetronic systems followed in 1973.



Service manuals for Bosch Jetronic fuel injection systems are in loose-leaf binders.

If you read PM's how-it-works story about fuel injection (page 97, Nov. '75), you know the theory behind the various approaches to f.i., as well as some service and troubleshooting tips.

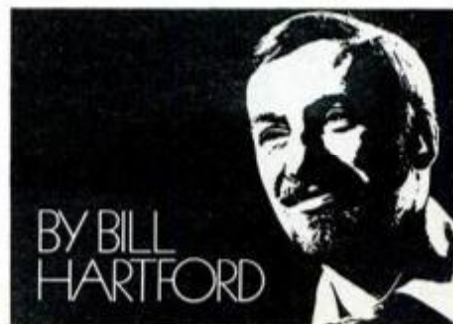
If you want to know even more about your Bosch system, however, the \$45, two-volume factory service manual is a must. To obtain a pamphlet with ordering information, write Robert Bosch Corp., Dept. S/AMA, 2800 South 25th Ave., Broadview, Ill. 60153, and ask for literature No. 222104.

Comin' down the pike

Later this year you should be spotting some new cars in your neighborhood. Here's what's cooking:

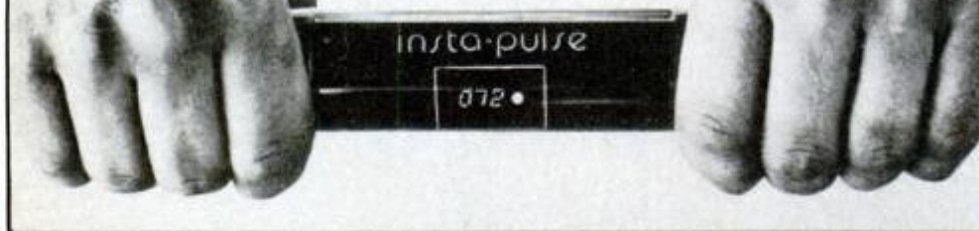
- A new Audi Fox that'll look a lot more like the 5000.
- A diesel-engined Volvo.
- A V8-powered Triumph TR7, which will then be called—you guessed it—the TR8. A ragtop version of the TR7 is also in the works.
- A turbocharged version of the Porsche 924.

We'll have more about these cars as the year speeds on. **PM**



7 exciting new electronic products

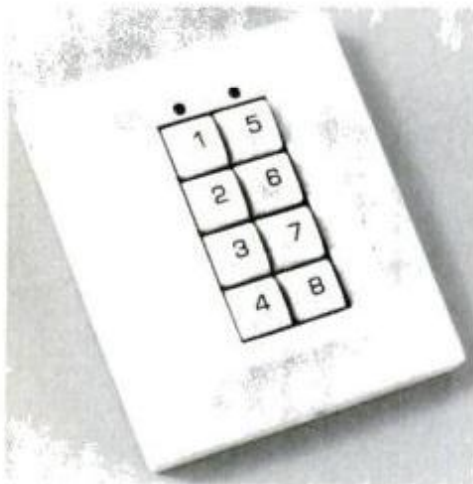
by Neil Shapiro



■ Ever wonder what your pulse might be? Just get a grip on the Insta-Pulse from Biosig Inc., Box 651, NDG, Montreal, Que. You can pick it up for \$150.



■ Sinar's new digital shutter, for manufacturer's large-format cameras, provides exact quartz crystal exposure timing under microprocessor control. The LED read-out allows second-by-second timing for longer exposures; also displays aperture settings. This unit is available for \$2136. Write to Unitron Instruments Inc., 101 Crossways Park West, Woodbury, N.Y. 11797.



■ Open sesame—or whatever your door is named—with this pushbutton key from SenDEC, 54 West Ave., Fairport, N.Y. 14450. Priced at \$119, the key may be programmed with any four-digit number sequence. If a wrong sequence is entered, a separate two-digit code must be keyed in before the next try. Tampering with the unit's case also triggers the alarm.



■ This walkie-talkie-styled Travel Phone works over the mobile telephone network. You may dial a number, or push a button to enter

one of three previously stored in memory. Each time that you make a call, a central computer keeps track of your hand-held phone bill. Incoming calls are noted with a beep. Retail at \$3895. It's made by Travel Electronics International, 17291 Skylark Blvd., Irvine, Calif. 92714.

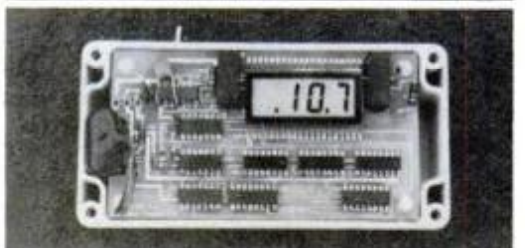


■ Pioneer's CT-F900 cassette deck (\$500) offers a microprocessor-controlled digital tape counter, along with memory repeat functions. Set the memory to replay any selection on a tape and then to repeat it automatically. From U.S. Pioneer Electronics Corp., 85 Oxford Dr., Moonachie, N.J. 07074.



■ Canon's Communicator allows the handicapped to communicate. Only 11 ounces, it prints messages on paper tape at a speed of 10 characters per second. It retails for \$550 and is available from Telesensory Systems, 3408 Hillview Ave., Palo Alto, Calif. 94304.

■ A swinger—in the game of golf—can now time his approach with the GT100 Swingtimer. This device provides a digital readout on the speed of the club as it strikes the ball. One function of speed is distance, so using the Swingtimer during practice sessions might improve your game. Retail at about \$72. Write to G.T. Golf Products, Box 370847, Miami, Fla. 33137.



THE REMARKABLE THING ABOUT THIS BIG SCREEN TELEVISION IS ITS GE VIR COLOR SYSTEM.

In 1977, General Electric won an Emmy for being the first to use the broadcaster's VIR color signal in home television. This year, we bring you a revolutionary new big picture television with the incredible VIR color system built into it. We call it Widescreen 1000.

Like every GE VIR set, computer-like circuitry uses the broadcaster's VIR signal on many programs to automatically adjust flesh tones, background colors, blue skies and green grass. Giving you vivid lifelike colors. And all of this



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happens an incredible sixty times a second.

The Widescreen 1000 is a super-size TV with a picture three times as big as a 25" diagonal console. With all the advanced engineering found in GE sets. Including electronic tuning and the "chairside convenience" of random access remote control.

Call toll-free 800-447-4700 (in Ill. 800-322-4400) to find out where you can see the Widescreen 1000 and other GE VIR color TV sets.



GE "Command Performance" VHS video cassette recorder optional.



This is GE Performance Television.

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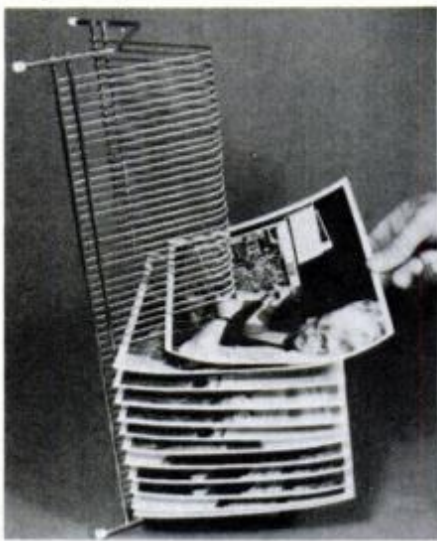
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PHOTO HINTS

Dry RC prints on record rack



Resin-coated (RC) enlarging papers require little washing time; in fact, the less time they are wet, the better. Finding a place to dry them is sometimes difficult, but this rack should solve the problem. Stand a record storage rack on end as shown and place prints between the metal separators. If you find the prints tend to touch one another, use every other slot.—Ken Patterson

Reduce portrait glare



Portraits of people wearing glasses, when taken with a flash, can be spoiled by reflections in the lenses or frames. To avoid this, attach a small flashlight to the flash unit with an elastic. The lighted bulb can be seen as a spot of light on the glasses. Adjust the flash or the person's head until the light spot can't be seen through the viewfinder; you'll find your portrait will be glare-free.—Russell A. Dixon

Five major power tools packaged into one unique, big-capacity unit. Now you don't have to spend a fortune to enjoy a complete woodworking shop

Whether you're an experienced craftsman, a dedicated hobbyist, or a week-end "do-it-yourselfer", at one time or another, you've probably dreamed of owning a complete woodworking shop. And as anyone who has ever tried any woodworking project more complicated than nailing together a birdhouse knows, a table saw and maybe a couple of hand-held power tools just can't hack it!

At a minimum, you should have—in addition to that table saw—a top-quality vertical drill press, a lathe, a boring machine, and a disc sander. So equipped, the world of the true woodworking expert, and all its rewards, becomes your oyster!

But there are two problems. One is space. A woodworking shop with five separate major power tools takes up more space than a lot of people can manage to find in their basement or garage.

The second and larger problem is sheer cost. Those five precision power tools, purchased separately, have got to run you at least a couple of thousand dollars.

The Perfect Answer

Insurmountable problems? Not at all! In fact, some 300,000 woodworkers have already discovered the perfect answer—a single, precision tool that combines all five of the major power tools in one unit that actually takes up less space than a bicycle. . . and that can be yours for about ONE-THIRD of the price of the five separate units!

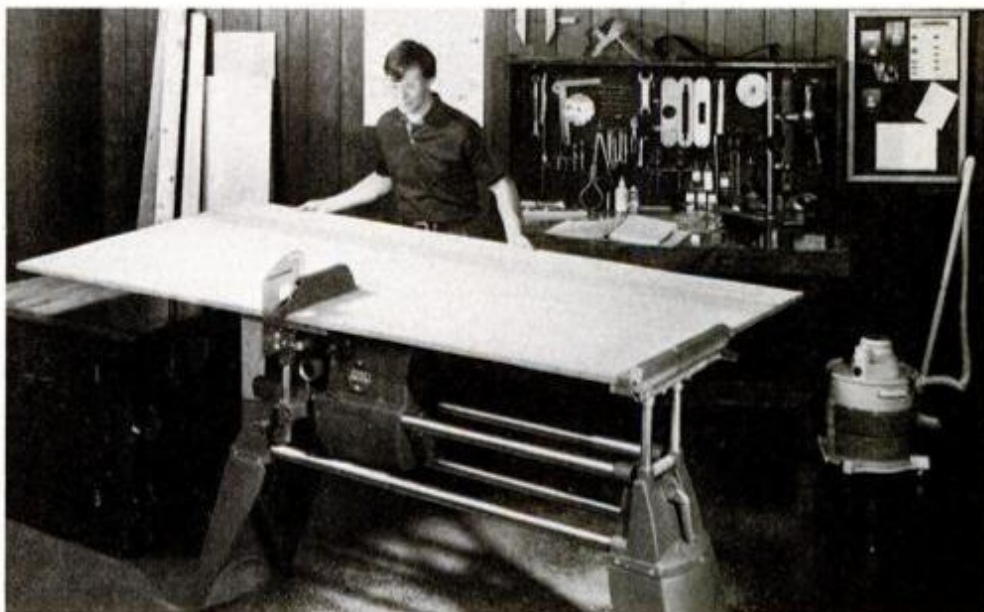
This is the world-famous Shopsmith Mark V. Invented back in 1953, the time-tested Mark V is the only true multi-purpose professional tool. It's enjoying a remarkable boom in popularity as more and more people discover its amazing versatility, and utter simplicity of operation.

Outperforms Individual Tools

Even if you have plenty of space and an unlimited budget, the Shopsmith Mark V can outperform a shop-full of individual tools. It's unique design not only gives you greater accuracy and more convenience—it allows you to do things you just can't do with other power tools.

This truly ingenious woodworking system combines a 10" table saw, a 12" disc sander, a horizontal boring machine, a 16½" vertical drill press, and a 34" lathe—all powered by a rugged 13.5 amp, 110-volt motor that develops 2 h.p. That's more than enough power for the toughest jobs. And an exclusive speed dial even lets you change operating speeds without turning off the motor.

After only a half-hour of practice, even a novice can change over from one tool to



any of the other four tools in less than 60 seconds.

With the 5-in-1 Mark V, you can perform literally dozens of sophisticated woodworking operations—including sawing, rabbeting, beveling, mitering, grooving, concentric drilling, spindle turning, doweling, edge sanding, and metal drilling. With optional accessories, you can perform more specialized operations such as mortising, dadoing, shaping, routing, molding and many others.

And the Shopsmith Mark V is so simple to operate that even beginners can easily build their own furniture and cabinets, make gifts, and do money-saving home repairs and complex remodeling projects. The skill. . . and above all, the accuracy. . . are built into the machine.

Send Today for Free Facts

And now you can use the coupon below to receive, by return mail, an informative free booklet, "What to Look for When You Buy Power Tools", plus all the facts about the Shopsmith Mark V and its "big-job" capabilities—and how you can actually test-use it in your own home without risk, for a full month.

There's no cost or obligation for this free information. It can help even inexperienced amateurs become skilled woodworking experts whose projects show a professional touch. For the real craft "buff", it's the low cost answer to a lot of frustrating problems.

The Mark V as a 10" table saw offers a ¾" depth-of-cut with a 48" ripping capacity. The exclusive Speed Dial permits power sawing of hardwoods.

The Mark V as a 12" disc sander gives you operations not possible on other sanders. . . like finishing edges to precise dimensions.

The Mark V as a lathe offers exceptional capacity with a 16½" swing for face-plate turning. Speed Dial allows a speed range of 700 to 5200 rpm.

The Mark V as a horizontal boring machine permits perfect doweling. The exclusive feed stop assures all holes will be exactly the same depth.

The Mark V as a 16½" vertical drill press can be set up to drill perfect screw pockets. The Mark V has an accurate depth control dial, ready-made jigs, and the right speed for every operation.



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DETROIT LISTENING POST

Ape over turbos

"I think the kids'll go ape" over Ford's '79 turbocharged Mustang and Capri, says Ford Motor Co. executive vice president William O. Bourke in an interview with the Detroit trade publication *Ward's Engine Update*.

Maybe so, but there will be only 60,000 available in the '79 model year due to a limited supply of the turbo unit supplied by Garrett AiResearch Corp. "We could sell 200,000 of them," Bourke predicts enthusiastically, adding that he expects turbo availability to increase significantly after this year.

Ford intends to turbocharge other four and six-cylinder in-line engines in the future, but balks at developing turbo V6s and V8s because of added cost involved with the supercharging of two cylinder banks.

GM's Pontiac Div., on the other hand, is delaying plans to turbocharge its own 2.5-liter Four. "Why go to a turbo Four when you can go with a V6 or small V8 and get the same performance?" asks Pontiac chief engineer Steve Malone.

Offhand, I can think of two good reasons: For one, a turbo Four offers an advantage in fuel economy over a V6 or V8 whenever the pedal's not to the metal. For another, there's a tremendous image boost for any manufacturer of turbocharged cars these days. Porsche, Saab, Buick and now Ford are cashing in on their turbo images, but Pontiac (whose past successful years were built largely around its image as a creator of exciting, technically innovative, performance-oriented automobiles) apparently isn't interested for now.

Here's hoping the cost-cutters at Pontiac don't put the kibosh on their limited-edition turbo V8 Firebird TransAm, currently planned for next fall.

Ford sticking with in-line Six

Another interesting difference in philosophy between Ford and GM is that Ford apparently intends to stick with in-line six-cylinder engines for most of its products far into the future. There is a 3.8-liter V6 in the works for a new line of front-drive cars due in '82, but the in-line design is expected to remain

prevalent even beyond then—indicating that Ford's standard and mid-size cars will be conventional front engine, rear drive.

GM, however, plans to convert nearly all of its lines to front-wheel drive between now and 1985, and will go almost entirely to Fours and V6s because their compactness makes them ideal for transverse front-drive cars.

European V6 for Chrysler/AMC?

Chrysler and AMC also will stand by the in-line configuration for future domestic Sixes, although both could wind up purchasing V6s overseas. Interestingly, one of the world's best V6 engines (the PRV V6) was developed jointly by Peugeot and Renault of France, along with Sweden's Volvo.

American Motors is about to link up with Renault in a joint manufacturing and marketing effort, and Chrysler recently sold its European holdings to Peugeot for a percentage of that French company plus a bundle of cash. So, it's logical to assume that both AMC and Chrysler products in the future might be powered by versions of the European-built PRV V6.

Chrysler currently has no engine suitable for transverse use in its '81 front-drive compact Volare/Aspen replacements. AMC, too, sooner or later, will have to jump on the front-drive bandwagon; and both companies' in-line Sixes are just too long for the space-saving transverse front-drive layout. Chrysler, however, could opt for long-nosed, front-drive compacts with its slant Six mounted north-south like in VW's Dasher and Audi's Fox.

DOE may mandate gasohol

The U.S. Department of Energy (DOE) is thinking hard about a plan to require the phasing of some alcohol into gasoline, possibly beginning just two years from now.

Studies have shown that blends of up to 10 percent ethyl alcohol (also known as ethanol or grain alcohol) and 90 percent gasoline can be used in most current engines with little effect on economy or emissions. But the DOE plan being considered calls for very gradual introduction of alcohol—1 percent by 1981, 3 percent by 1985.

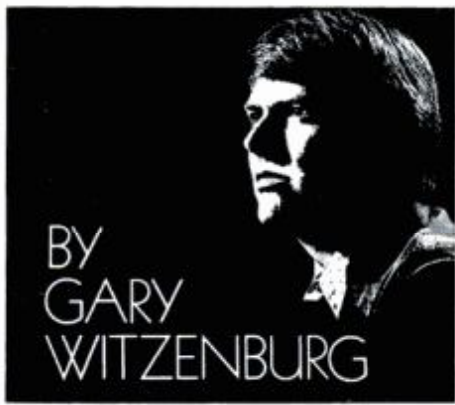
The idea, of course, is to save gasoline, which, unlike alcohol, is a nonrenewable resource.

DOE is also stepping up research on lowering the cost of ethanol production, such as distilling it in large quantities from waste plant residue. While gasohol research and experimentation are carried on almost worldwide, it is still expected to be some time before the gas-saving blends can be made cost-competitive with straight gasoline in this country.

Turbo-injected Chevette

It's not for production just yet, of course, and if it were, few could afford it—but Chevrolet Engineering has built another exciting little toy. It's a sexy-looking, slightly modified Chevette with the 1.6-liter four-cylinder engine both turbocharged and fuel-injected. With turbo courtesy of Garrett AiResearch (the same company that supplies production units to Buick, Ford and almost everyone else) and electronic injection via a modified Cadillac system, this Chevette mini-motor puts out some 100 hp—nearly 40 percent more than the stock Four's 63 hp. A preview of things to come?

Also from "nonracing" Chevy comes a new 305-cu.-in.-displacement aluminum engine block with steel cylinder sleeves, to "provide off-highway enthusiasts a wide variety of applications—sprint cars, drag racers, USAC Championship and CanAm cars, as well as numerous off-road applications and in competitive boating throughout the United States." The new lightweight block will be added to Chevy's already lengthy catalog of off-highway parts and components. **FM**



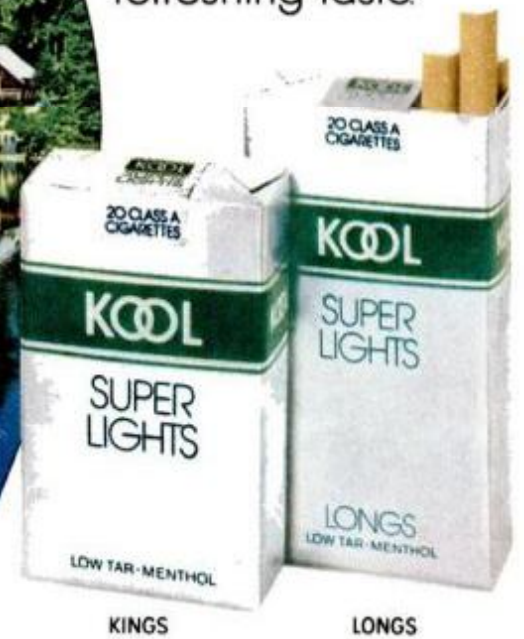
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Chevy Van Sport with windows in sliding door



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tough bodies that have plenty of room for hauling motorcycles, bicycles or bulky cargo—and available passenger seating for up to five. Chevy Van Sport Stripping is available on all G10 and G20 Series vans. Why not test drive a tough Chevy Van at your Chevrolet dealer? Get the whole Chevy Van story. Stripes are in this year.

THE BRUTE FORCE



BUILT TO STAY TOUGH.

Paper chase

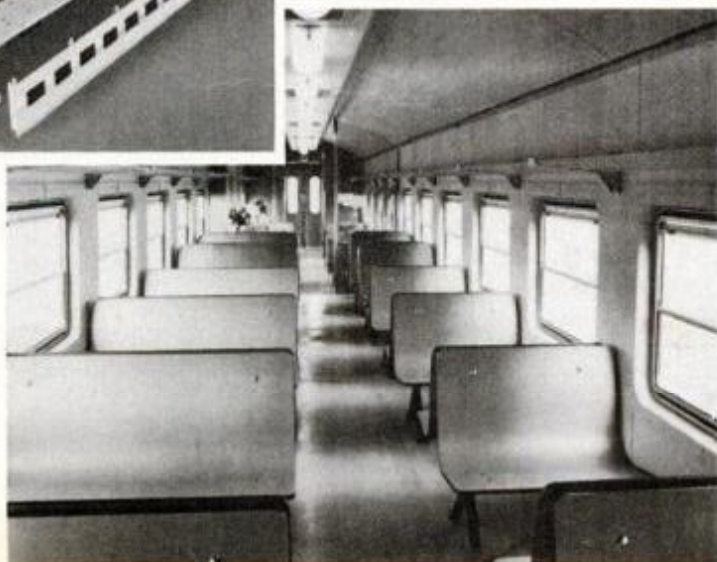
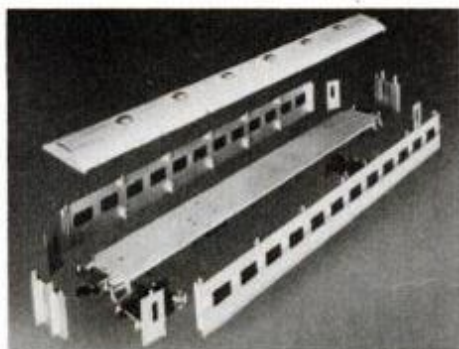
If waste paper products for recycling start bringing much higher prices on the open market, a lot of us are going to be pushing the Boy Scouts out of the way. At the moment, used corrugated boxes, in growing demand by the country's 225 recycling mills, are a premium item among the waste collector's wares. One California man began collecting corrugated boxes full time, made \$27,000 the first year and had to trade his pickup in on a bigger truck. Another factory worker in Los Angeles does his corrugated scrounging in the early morning before his 8 a.m. shift, earns \$50 to \$60 per day for about two hours' effort. If you want to get in on it, write the American Paper Institute, Paper Stock Conservation Committee, 260 Madison Ave., New York 10016 and ask for free information on how to recycle waste paper.



WORLD'S LARGEST KIT?

Okay, model builders. Bored with the world in miniature? Take a whack at this full-size prefab railcar from Budd Co. She's specially designed for easy assembly by workers in developing countries, so you should be able to whip 'er into shape over a long weekend. Nice stainless steel finish,

plus trucks that adjust to different gauge tracks, so they'll fit whatever runs through your backyard. Sort of plain Jane interior, but you do get two restrooms, molded fiberglass seats and fluorescent lighting. Comes nicely crated. This beauty can be yours for only \$150,000.



'Tain't comical

All of a sudden "lead pizenin'," that old Dodge City euphemism for the condition of the loser in a misunderstanding negotiated with sidearms, is in the air. No doubt Wyatt Earp is resting more comfortably now, knowing that nylon-jacketed bullets (see page 13) are being used for indoor shooting ranges just to keep airborne lead concentrations within safe levels. The toxic effects of lead, however you ingest it, are well known. One of the lesser known ways to give yourself a fast shot of unsafe lead is to use the Sunday (color) funny papers to start a fire in your indoor fireplace.

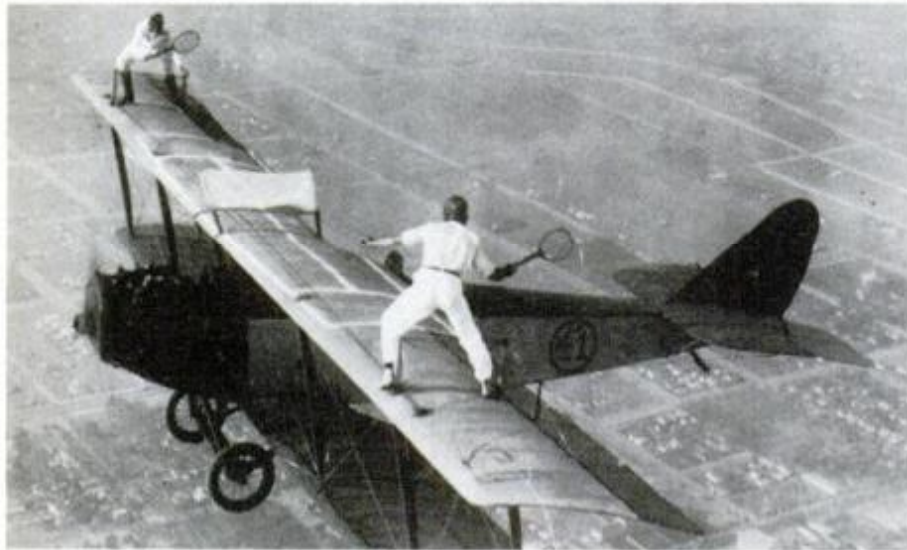
The relatively high amounts of lead use in colored inks on newsprint are passed off as toxic fumes when the paper is ignited. Using Sunday comics to start a barbecue fire is even worse; although it's outdoors where the fumes can disperse, traces of lead can be deposited on the foods cooked over the fire. Black inks — regular newspapers — do not contain lead.

IPM BRIEFS

THEY ALSO SERVED

It has been brought to our attention that PM's comprehensive article on aircraft wings (Dec. '78 page 63) ignored one fascinating—if not exactly crucial to the advancement of powered flight—aspect of airfoil history: We failed to mention wing-walkers, the most spaced-out citizens of the dare-devil

world of barnstorming. The remedy for that oversight is herewith—two guys, apparently unsupported by wires or harnesses, lampooning Wimbledon on the upper wing of a Jenny. We always did feel the game had a little more decorum when only white outfits were permitted.



PM's Whatsit

This photograph documents the first legitimate contact with intelligent life from another planetary system . . . and if you believe that, you probably spent a lot of money on movies last year. Actually, what looks like the Martian ambassador missing the White House lawn by a few miles is a 14-inch-wide, 4.5 ounce "dropsonde" unit used to measure barometric pressure. Contained in the Styrofoam body is a nickel-sized pressure-sensing cell developed by Bunker Ramo Corp. Packaged with solid state radio circuitry and battery into a device called the Airsonde by its manufacturer, Atmospheric Instrumentation Research, Inc., the instrument is dropped from a weather research aircraft at altitude and simply flutters down like a maple tree seed.

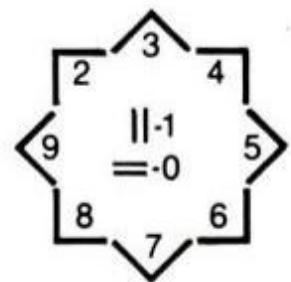
PM Follow-up: Galapagos . . . and feral animals

In PM's article on the endangered endemic wildlife of the Galapagos Islands (Oct. '78, page 96), both the Hawaiian petrel and the flightless cormorant were singled out as highly doubtful survivors of the 20th century, for various reasons. Scientists at the Charles Darwin biological research station have since advised PM that research not available when we went to press reveals that the Hawaiian Petrel may be doing somewhat better than at the time of the study we cited, and that the flightless cormorant's plight may also be less than dire. Happy news, in both cases.

Readers have inquired as to the tax-deductible status of donations sent to U.N.-backed agency in Belgium which administers the Darwin station's activities. We are advised that tax-deductible donations can be made via the Smithsonian Institution and World Wildlife Fund, both in Washington, D.C. In either case, a note should accompany the contribution designating it for conservation research in the Galapagos.

An article accompanying the Galapagos story outlined the problem of feral (once domesticated, returned to the wild) animals in the U.S., prompting inquiries in particular about the government's Adopt-a-Horse program for the wild mustangs and burros roaming free in several Western states. Inquiries should be addressed to: Bureau of Land Management, Resource Systems Div., Denver Service Center, Building 50, Denver, Colo. 80225.

As a sidelight, PM found the identification system now being used for adopted horses and burros to be of interest. The animals are not branded with a hot iron, but are "freeze-marked" with a new instrument. This is described as a relatively painless procedure leaving no open wound and a more distinct mark than hot branding. The animals are marked with International Alpha Angle code numbers indicating year of birth and registration number. Key to interpreting the Alpha Angle code appears at the right.



INDICATES REGISTERING ORGANIZATION

YEAR OF BIRTH (TOP TO BOTTOM)

REGISTRATION NUMBER



INSTRUCTION: READ EACH ANGLE TO DETERMINE FREEZE MARK NUMBER. WRITE ALL EIGHT ACROSS AS 57031987.

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HOW EXPERTS ARE DEFUSING ROLLING BOMBS THAT RIDE OUR RAILS



The recent rash of tragic freight-train wrecks involving highly dangerous chemical cargoes is causing new national concern. Here's why they're so deadly and what experts are doing about them.

Using special foam-spraying gear, a gas-masked railroad salvage worker rushes in to blanket wrecked tank car leaking deadly chlorine fumes. Despite such efforts, eight persons perished in this tragic accident at Youngstown, Fla., last February.

by Mort Schultz

I picked my way carefully through the mass of twisted, shattered wreckage, all that remained of a string of derailed freight cars strewn along the trackside. As a reporter for PM, I was accompanying a team of crack salvage experts whose mission is to rush special emergency equipment to railroad accident scenes like this one, especially wrecks involving tank cars carrying hazardous cargoes.

It's not just a matter of clearing away debris and restoring torn-up rails. This is routine. Far more insidious is the possibility that hidden within the rubble is a ticking bomb ready to go off, a disaster about to happen. It could be a leaking explosive gas powerful enough to blow up whole city blocks or chemical fumes

so deadly they could spread for miles and blind, burn or kill anyone they touched. The job of these salvage crews is to detect and defuse such bombs before they maim and kill. What they do, and how fast they do it, can make the difference between a minor mishap and a major catastrophe with many fatalities.

Derailments increasing

A rash of recent freight derailments has plagued the nation's railway system. In 1977 there were 7868 accidents, a 40-percent increase over those of the previous year. (Complete statistics for 1978 were not available as this was written, but are expected to show a toll as great or even greater.)

What's particularly frightening is

that, of the 7868 train wrecks in 1977, approximately 500 involved hazardous materials, or "Hazmat" as they are referred to in railroad jargon. Hazmat has killed and injured scores of persons, forced thousands to flee their homes and caused millions of dollars in property damage.

Hazmat is any substance deemed by the Secretary of Transportation to pose serious risks to health, safety and property when transported in commerce. Such materials range from highly explosive gases to poisonous chemical fumes that are fatal if inhaled. (See accompanying chart for a listing of hazardous materials, their characteristics and safety tips on what to do if threatened by one.)



Giant fireball fills the sky as ruptured gas-filled tank cars burst into flame in 1970 derailment at Crescent City, Ill. Blast injured 66 people and demolished many buildings.

More than 250,000 shipments of hazardous materials are made *each day* through the nation's transportation network. While these include shipments by truck and air as well as those by rail, the National Transportation Safety Board believes that the greatest potential for a Hazmat disaster lies with the railroads. The reasoning is grimly simple: A single railroad tank car can carry 33,000 gallons of a hazardous substance; a tank truck can haul only 8000 to 10,000 gallons. Of the 4 billion tons of hazardous materials shipped annually, more than 40 percent is transported by rail in a fleet of 135,000 tank cars.

Future shipments to double

While many would like to see the shipment of hazardous materials stopped altogether, this is not feasible since such substances are essen-

tial to our living and manufacturing needs, personal comfort and national defense. Not only can't they be stopped, but they will actually increase dramatically. The Department of Transportation estimates that over the next 12 years traffic in hazardous materials will *double*. It also predicts that, unless improvements are made in the nation's declining railway system, more and more catastrophic accidents can be expected.

This prediction has already come to pass. Rail accidents are becoming more serious each year. In all Hazmat-related derailments of 1977, only a relatively few persons—four—lost their lives. But in just two accidents last year, 22 perished, indicating the growing severity of such tragic events.

The first of these accidents took place in Waverly, Tenn., on Feb. 22

when tank cars of a Louisville & Nashville freight jumped the track. Two days after the derailment, a car filled with liquid petroleum gas (LPG) exploded as salvage crews worked nearby. Fourteen were killed.

The second accident occurred Feb. 26 at Youngstown, Fla. Forty-seven cars of a 146-car Atlanta & St. Andrews Bay Railway freight hopped the track. A car carrying pressurized liquid chlorine began leaking a yellowish-green gas over the countryside. Eight died.

Hidden dangers

Bad timing seems to have been the catalyst for tragedy at Waverly. At first, salvage operations proceeded according to the "book" as an orderly evacuation of residents from nearby homes took place, freight cars remaining on the track were pulled by locomotive from the area, and derailed cars were uprighted and rerailed.

But two days after the derailment, something went wrong. A still-derailed LPG tank car suddenly exploded with terrifying force, sending chunks of shrapnel hundreds of feet from the roadbed, destroying an area two city blocks in size and taking a heavy toll in life.

What happened?

"I imagine there was damage to the tanker that hadn't been detected, and that a buildup of internal pressure reached the explosion state," Art Proefrock told me.

Proefrock is manager of the Hazmat Team of Hulcher Emergency Service Inc., Virden, Ill., which specializes in railroad salvage operations. The company is called in by railroads that lack equipment and experience to clear derailments themselves. In the Waverly accident, a Hulcher crew arrived at the scene after the explosion to neutralize a second LPG tanker.

Hulcher is kept busy. The clean-up operation I watched was just one of 16 derailments being cleared by a Hulcher division that particular day. The company has 19 divisions located strategically around the country along the heaviest-traveled freight routes.

Tragic aftermath

As I poked around the splintered boxcars, I remembered a report I had read about a young volunteer fireman who raced to the scene of a freight wreck at Point Pleasant, W. Va., last January. Among eight derailed cars was a ruptured tanker spewing out more than 20,000 gallons of epichlorohydrin—a chemical so deadly it can cause lasting

Material, защищенный авторским правом

COMMON HAZARDOUS MATERIALS

SUBSTANCE	CHARACTERISTICS	POTENTIAL HAZARDS	IMMEDIATE ACTION TO TAKE
Acrylonitrile	Flammable, explosive, corrosive.	Contact burns skin and eyes.	If possible, don self-contained breathing apparatus (such as scuba gear). Extinguish open flames. Don't run or start an internal combustion engine within 20 yards of a spill. Keep upwind—evacuate area.
Anhydrous ammonia	Nonflammable, explosive, corrosive.	Vapors extremely irritating. Contact burns skin and eyes. Harmful if inhaled.	If possible, don self-contained breathing apparatus. Keep upwind—evacuate area.
Chlorine	Nonflammable, explosive, poisonous.	Contact burns skin and eyes. Fatal if inhaled.	Same as for anhydrous ammonia.
Epichlorohydrin	Flammable, explosive, poisonous.	Vapors extremely irritating. Contact causes severe burns. May be fatal if inhaled. Lung injury will occur.	Same as for acrylonitrile.
Ethyl chloride	Flammable, explosive, corrosive.	Runoff may create fire or explosion danger in sewer system. Contact burns skin and eyes. Harmful if inhaled.	If possible, don self-contained breathing apparatus. Extinguish open flames. Don't run or start an internal combustion engine within 20 yards of a spill. Evacuate area by at least 2000 feet.
Ethylene	Flammable, explosive, corrosive.	Same as ethyl chloride.	Same as ethyl chloride, except no need to don breathing apparatus. However, don't run or start an internal combustion engine within 50 yards of the vapor cloud.
Hydrogen chloride	Nonflammable, explosive, corrosive.	Same as anhydrous ammonia.	Same as anhydrous ammonia.
Hydrogen cyanide	Flammable, explosive, poisonous.	Gas explosion danger and poison hazard indoors, outdoors, and in sewers. Skin contact deadly. Inhaling vapors fatal.	Same as acrylonitrile.
Liquid petroleum gas	Flammable, explosive.	Gas explosion hazard indoors, outdoors and in sewers. Contact burns skin and eyes. Vapor indoors can cause dizziness and suffocation.	Extinguish open flames. Don't run or start an internal combustion engine within 35 yards of the vapor cloud. Keep upwind—evacuate by at least 2000 feet.
Vinyl chloride	Flammable, explosive.	Gas explosion hazard indoors, outdoors and in sewers. Contact burns skin and eyes. Vapors can cause dizziness and suffocation. Fire releases poison gases.	If possible, don self-contained breathing apparatus. Extinguish open flames. Don't run or start an internal combustion engine within 20 yards of the vapor cloud. Keep upwind—evacuate area by at least 2000 feet.

damage, even cancer, in the lungs, kidneys, liver and other body organs.

Spotting three children approaching the lethal spill, the fireman, 28-year-old Junior Gillespie, ran right through it to warn them away in what would later prove to be a life-saving act of heroism. For Gillespie it was a costly sacrifice. Within hours he collapsed and was hospital-

FIRST-AID PROCEDURE:





Some major 1978 train mishaps

■ On Jan. 18, a derailed Western Railway of Alabama tank car spilled its cargo of poisonous methyl-ethyl-ketone near Montgomery, Ala., an accident that endangered the city's water supply.

■ Five days later, on the 23rd, an accident at Point Pleasant, W. Va., forced 400 families to flee their homes. A derailed Chessie Railway System tank car spilled 20,700 gallons of toxic epichlorohydrin 100 feet from the Ohio River. Two days after the accident, workers began to scoop up and cart off topsoil, now useless, from an acre of ground.

■ On Jan. 30, practically the entire town of Mayhew Flats, Ky., fled when poisonous acrylonitrile spilled from another ruptured Chessie Railway System tank car. Fortunately, there were no injuries.

■ An accident on Apr. 13 at West Memphis, Ark., had all the earmarks of a major catastrophe. Three cars of a derailed Rock Island Railroad freight began leaking 40,000 gallons of crude oil and 30,000 gallons of propane. As 400 residents fled, workers began dumping piles of dirt around the cars to prevent substances from entering a nearby ditch. The ditch drained into the city's sewer system. If propane had been carried into the sewers and had mixed with methane gas present in the sewers, the almost certain resulting explosion would have ended the existence of West Memphis, Ark.

■ Green River, Wyo., found itself the victim on Apr. 15. A broken wheel on a freight car caused 21 cars in a Union Pacific train to derail. Three of the cars, each containing 18,000 gallons of methyl alcohol, caught fire. There were no injuries, luckily, but the line had to shut down for a week.

■ On May 19, a 12-block area of Evansville, Ind., had to be evacuated when two tankers of a Louisville and Nashville freight train derailed. The tankers were filled with liquid petroleum.

■ On June 29, a highly flammable liquid called styrene-monomel-inhibited underwent a chemical reaction and began spewing forth from a tank car parked in a railroad yard at Destrehan, La. The liquid has a tendency to explode in hot weather, and it's usually hot in Destrehan in June. Fortunately, it wasn't too bad on this particular day because the leaking tank car was flanked by two other tankers, each loaded with deadly chlorine of the kind that killed eight persons at Youngstown, Fla. As a precaution, the entire community of 3000 was evacuated. The tank car didn't explode, but could have caused a major disaster if it had.

Tossed like matchsticks in a jumbled mass are remains of 47 derailed cars shown in aerial photo (left). Wreck occurred at Youngstown, Fla., last year, claimed eight lives.

ized with severe chest and stomach pains. No amount of medical care has been able to restore his health. Today, a year later, he still suffers from chronic weakness, breathing difficulty, headaches and nausea, is unable to work and, worse yet, faces the terrifying specter of cancer.

Fortunately, no such threat lay in the wreckage that Art Proefrock and I were investigating. The worst we encountered were tons of splattered soybeans sprayed from smashed-up boxcars. Still, the soybeans could have been something else. Pointing to a gash about two feet square in the side of an overturned car, Proefrock explained what can happen in a derailment

involving hazardous substances.

"Suppose," he said "this car was leaking LPG instead of soybeans. Chances are it would have caught fire at the time of the derailment. We would have to wait for the fire to burn itself out and pour water on other overturned LPG tankers, if others were involved, to keep them cool. We wouldn't want them reaching the explosion temperature or pressure stage."

Watching out for decoys

If the soybean car had been filled with LPG, Proefrock would have ordered everyone out of the area as the fire dwindled and was about to die. At a distance of at least 2000 feet

from the site, we would have waited and waited and waited some more.

"We have to be careful that we aren't being decoyed," Proefrock explains. "One of the most dangerous points in a derailment involving an explosive like LPG is when the fire goes out."

Why? Because the fire could have been blown out by wind or extinguished by water. LPG might still be leaking, in which case it would be suicide to re-enter the area. Any source of ignition—starting an engine, lighting a cigaret—can cause liquid petroleum gas to explode.

How long after the fire goes out do you wait before going near a dam-

(Please turn to page 154)

THE HOTTEST THING ON WHEELS!

That's right. The pickup has become the family's second car, the kids' hot rod and the outdoorsman's camping and off-road rig.

by Wally Wyss



Heading for the hills is a Fleetside Chevy Cheyenne gussied up by Hickey Enterprises.

If the *Grapes of Wrath* pickup truck were dug out of its Hollywood studio graveyard and put on the block today, it would be scooped up in a flash. It would soon be out cruisin' in fresh coats of metallic-grape-flake lacquer and rechromed bumpers shimmering in the California sun.

Pickups used to be the wheels of "hayseeds" who couldn't afford a car, but now they're the steeds of urban and suburban cowboys who measure their manhood in gross vehicle weight.

But not all pickup trucks are being ordered by the footloose and fancy-free—many are the choice of

family men to be used in both work and recreation.

The motor home's growth was seriously curtailed by the energy crisis of 1973. The pickup-plus-trailer offers much better mileage, and you can leave the trailer to "reserve" your camping spot while tooling around in the truck.

The pickup's popularity is also related to emissions controls. Up to this year, if your truck weighed more than 6000 pounds, only the bare minimum of emissions control was necessary. But now the feds have, for 1979, moved the minimum weight up to 8500 pounds, which means that, unfortunately for pickup fans, all

trucks (including all half-ton and most ¾-ton models) *under* this weight will be desmogged.

Another reason for the popularity of pickups is the availability of four-wheel drive (4wd), which is great for, say, building a cabin in the wilderness, camping in remote, seldom-used areas, hauling shot

THE COMPLETE PICKUP: HOW TO CHOOSE

The stock pickup you take home from the dealer is only the beginning of the fun—and the expense—of getting a vehicle to meet your tastes and requirements. It takes accessories and/or options to make your vehicle fully competent. Some can be had as options, but others must be purchased and added later. Here's an idea of some of the items needed to turn your stock pickup into a complete pickup.

Four-wheel drive, or 4wd for short, is almost a necessity for rough off-roading. The average cost is about \$700 more than the same vehicle without it and the best way to buy it is built into the truck at the factory. Add-on cost goes out of sight.

First cost is not the only price for 4wd. Full-time 4wd chops about 2 mpg off an already low figure, but saves getting out to switch WARN or other front hubs to 4wd when the going gets rough.

Safety equipment comes next, right after deciding on off-road capability with 4wd. And, at the top of the list is a roll bar or bed bar as it's called in a pickup. Why a bed bar? Because even the most careful off-roader can have the ground collapse from under him putting him on his head.

With a good bar, chances are he'll be okay. Otherwise?

Tires and wheels come right after the bed bar as both safety and capability options. Get them from a shop experienced in off-road requirements. Prepare to be on the hook for about \$1000 or more if you're changing everything. Flotation tires won't roll on water, but they'll take you over soft sand more easily. But selection requires care and real knowledge of where you'll be driving. Stagger-block or knobby off-road tires make a terrible whine at speed on the highway. They also have a lot of drag which cuts into fuel mileage and wears them out quicker. Special tires often fit only on special wheels. Aluminum wheels are usually better off-road than steel, with forged aluminum usually better than cast. Prices go up accordingly.

Once you pick wheels and tires, consider fender flares to stay legal in states that require them. Rubber ones give when dinged and fiberglass saves weight. ABS plastic is also available.

Suspension modifications come next to use the capabilities that 4wd and the tires and wheels give you. Consider:

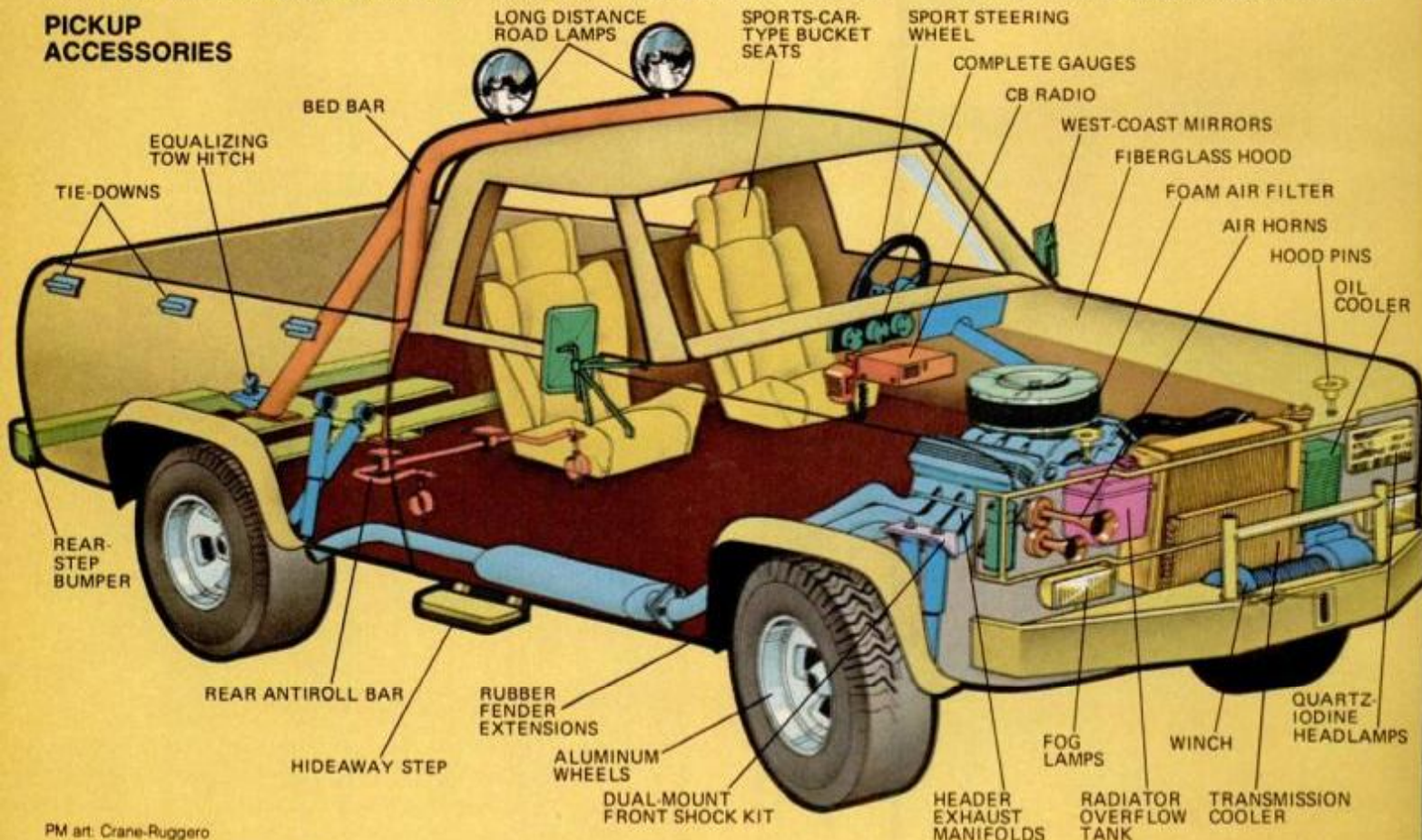
Antiroll bars or antisway bars as they're sometimes called. These 1½-inch steel bars connect the wheel on the right with the one on the left to help stabilize your truck if one goes up and the other goes down. If you carry a camper or other high load, you need them. Cost: about \$100 and up if mounted both front and rear.

Special springs can be ordered with the truck at little extra cost. Replacing those in an existing truck is expensive. Air helper springs inside standard coil springs or mounted on top of steel leaf springs can help out at a little less cost than respringing.

Auxiliary shock absorbers are the next step after beefing up the originals. They require special mounting brackets for your vehicle (bracket kits come separately), and cost varies with the job to be done. As many as three shocks on each corner are common on racing off-roaders with costs running \$300 or more.

An axle truss beefs up the long end of a drive axle, either front or rear. With the differential offset to one side, you may need these to keep the long side of the housing from flexing enough to leak oil

PICKUP ACCESSORIES



game out of the boonies and getting to and from your work through piles of deep snow.

Timeless trucks

Then, there's timelessness. Somehow the pickup's obvious utility removes it from the curse of planned obsolescence

that cars are subject to. No matter how old a pickup is, it can still haul logs or furniture.

But cars, on the other hand, rapidly fall in value unless they are special-interest models.

Today, there are almost enough options for pickups to simulate the interior

of a plush luxury car. Where Detroit leaves off, the aftermarket takes over and such niceties as wraparound bucket seats and velour upholstery today are common.

If you haven't driven a pickup, go down to your pickup dealer and ask to take one out on the road. You will have to swing

ACCESSORIES



Chevy 4wd shown here displays a number of useful options, including a solidly braced bed bar with driving lights mounted on the top, a headlight-embracing brush guard, a front winch and a towing ball.

or actually break some critical parts.

Hydraulic steering dampers are simply smallish shock absorbers that take some of the shock out of off-road driving by keeping the wheel from jerking in your hands. GM 4wds have them stock, but they're available for all others.

Shimmy dampers are springs that load the steering ball joints to prevent sloppy steering. Shades of the Model T Ford, but they work and are not expensive.

Skid plates protect the underside from rocks and make it smoother so it can slide or be slid off boulders or other hangups that might catch an unequipped truck. Besides, dumping the radiator, oil, tranny, or even rear axle out in the wilds could ruin your whole trip.

Also in the interests of keeping going, you can get a number of engine accessories. These include special air cleaners, oil coolers for both engine and transmission, and coolant overflow systems, if they don't come standard on your vehicle. Exhaust headers improve both performance and mileage.

Grinding along in compound low through the desert can heat up even the best decked-out truck. An oil cooler helps to keep you from cooking the engine. A tranny cooler is equally useful out there and also required for towing a trailer. A coolant recovery system costs only a few bucks and, while it won't keep the engine from overheating (it may help some), it'll keep coolant from being lost if it does.

A winch is recommended even if you don't drive off-road. It can be the only way to pull out of mud if you can't get a stronger vehicle to tow you out. A reversible winch lets you back off a bit if you get hung up pulling another vehicle up a hill

or out of a hole. And a remote control lets you stand safely out of the way while working the winch.

One winchmaker, Hickey Enterprises, offers a horizontal-winding winch with a remote-control device. With its 9000-pound pull, it can hoist a well-equipped Blazer and haul almost anything out that you're likely to need to get out.

Brush guards go on the nose along with the winch. In fact, if you have a winch, you may require a special guard. Aside from keeping your radiator from being holed, these guards keep lights from getting knocked out of alignment and grille bars from getting bashed.

Special bumpers are another trend with savvy off-roaders. Tubular bumpers are popular, but even better are the step bumpers. These are made from patterned steel plate and often incorporate toolboxes, trailer hitch mountings and other conveniences.

Side steps, like shortened versions of the old-fashioned running board, make climbing aboard easier. Some models fold out of the way when not required.

Less of a frill and sometimes downright necessities are **cargo tie-downs**. These specially shaped hooks can be bolted or welded in place like cleats on a sailboat. Placed around the bed, they make it easy to secure anything you may want to take with you.

Hood pins like those seen on hot rods are not just a custom touch on an off-road pickup. With all the twisting and shock, they really keep that hood from flying up in your face.

Towing hitches come in the same category as tie-downs. Standard ball hitches are the most common, but equalizing

hitches are better for heavy boats or travel trailers. The equalizing hitch moves some of the tongue load back into the chassis so it isn't all cantilevered off the very back of the truck. Fifth-wheel hitches take up the most bed space and may make it relatively unusable for general hauling, but they do tow big loads with maximum stability.

An auxiliary towing ball on the front bumper makes it easier to maneuver a boat down a ramp and keeps your rear wheels up where traction is best.

Interior goodies include special driver seats, sponge-covered sports steering wheels, extra gauges, CB radios, West Coast mirrors, and all the other expensive add-ons that make your truck different from and better than any other. The seats and wheel give you more security and better control. The gauges tell you what's happening mechanically and the CB lets you yell for help if needed.

Auxiliary lights can be a whole field in themselves. Consider adding fog lights with wide-beam patterns to the front bumper and driving lights up on the roll bar where they'll be relatively safe and can give you the most light. When installing extra lights, or quartz-halogen lamps in place of standard headlights, make sure every circuit is both fused and switched with a relay. This way, you may blow a fuse, but you won't burn up your wiring or your whole truck.

Air horns like those used on big trucks help tell people on the other side of the mountain that you'll be coming around it, but they may not be street-legal.

This list just scratches the surface on accessories. You can spend more on them than on the pickup itself.—W.W.

yourself up into the cab, not down, as in a car. You'll find you have a commanding view of the road.

After the first mile, you'll probably notice that the ride isn't as bad as you expected, and that the rig handles pretty well with power steering. You turn on the radio and airconditioning and pretty soon the thing is as livable as a car. Maybe you arrange to borrow one for a week and, by the fifth or sixth day, you wonder why people spend all that money on cars

when they are so, well, *useless* compared to pickups.

Shapes and sizes

Time was, all pickups came in one style—a two-door, short-wheelbase model with a bare bench seat and four wheels. Now, you have more choice. If you want just a standard pickup, you can order it. But first you must decide whether you want flat sides on the outside, in which case the wheel wells will be forced

to intrude on the pickup-bed floor space, or whether you want a bulge-sided cargo box, in which case the box area has flat sides while the wheels and tires are in separate fenders. Each truckmaker has different names for these body styles, Chevy calling them "Fleetside" and "Stepside" and Ford using "Styleside" and "Flareside." But it all depends on where you want the bulge, inside or out?

Once you have the pickup-bed style figured out, you have to decide how many

THE MACHO LOOK: WHAT THE CUSTOM CRAZIES ARE DOING



Don Kuster's 100-mph Ford F350 Camper pickup sports Cat diesel turbobed to 325 hp, four-speed Allison AT540 auto trans and 3.73 rear with Detroit Locker differential gears out back.

Builders of off-road trucks borrow much from California hot rodders, including the old axiom, "There's no substitute for cubic inches."

Don Kuster of Long Beach followed it when he yanked a 636-cu.-in. Caterpillar diesel out of a 16-wheel tractor and stuffed it into his 1976 Ford F-350 Camper Special. The big Model 1160 Cat put out only 225 stock ponies, so he had his three full-time mechanics (Larry King, Gary Clayton and Bobby Spears) add an AiResearch turbo to boost that to 325 hp. Even more impressive, it produces 700 foot-pounds of torque which, without 70,000 pounds to lug, makes this pickup a real wall-climber.

Squeezing the 1200-pound diesel into the Ford was no simple drop-in job. A new front subframe had to be fabricated

to hold the beast, then accessory brackets made up out of aluminum. If this sounds hard, figure how to get an Allison AT540 four-speed automatic under the smaller pickup cab. It took a special shifter made from scratch to do it plus more fabricated brackets.

Ford F350 pickups have Twin I-Beam front suspension—good for ride but not quite up to handling the diesel's extra weight. Larry King had it beefed up before chroming the beams and adding

trailing arms to locate them better for off-road driving.

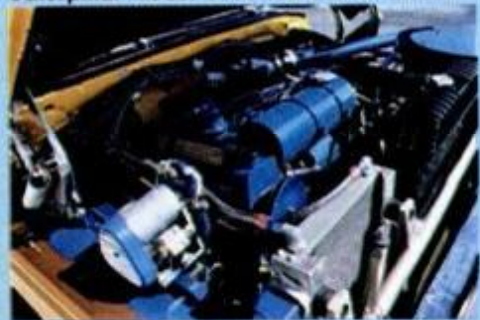
The truck now rides on Firestone air suspension in place of steel leaf springs. Designed for the GM Motorhome, these springs can be pumped up to handle different loads with a control on the dash. And, to keep it all tied down, there are now three Rough Country shocks on each front corner. For insurance against bottoming out after a big jump, an aluminum skid plate guards the vitals.

Batteries have to go somewhere and, with the engine and turbo filling the nose, they had to go somewhere else. Larry built stainless-steel cases under the truck for twin 12-volt batteries.



Never too old for a facelift, Big Window '56 Ford pickup gets new engine, a 2½-inch drop and custom Tru-Spoke wire wheels. Builder, Randy Sullivan, has already invested \$7500 in the redo.

Big air cleaner and turbocharger hide Caterpillar Model 1160 636-cu.-in. diesel.



wheels you want. Yes, wheels. Many truckmakers offer six, with dual rear wheels. A model so equipped receives a higher gross vehicle weight rating (GVWR) and is usually orderable only on 1-ton models.

Next, you have to consider the cab. Several larger trucks come in four-door models with either a load area in back of the front seat or a second bench seat. The dual-seat model is usually called a "crew cab."

Don Kuster likes things real pretty in all his cars and trucks. So all aluminum parts were anodized, steel parts plated, and the interior decked out with Taylor bucket seats adjustable in four directions like those in a Granada. Extra gauges keep track of oil pressure, oil temperature, manifold pressure and there's a pyrometer to monitor exhaust temperature so Don won't cook the turbo or the diesel.

Sparing no expense, Don had the Summers Brothers (of Bonneville land speed record fame) built up a 3.75 rear axle with a Detroit Locker differential. Four-wheel disc brakes with metallic pads and hydro-boost (a diesel has no vacuum, remember) from a late-model T-Bird handle stopping. All brake lines are braided stainless and/or Teflon.

Tires, after much testing, are now Parnelli 1000 Firestones up front in 10.50-15 and Mickey Thompson Baja King 14-15LTS in the rear on custom Centerline wheels.

Why only two-wheel drive? Larry explains, "If she can't climb it with all that torque, it ain't worth climbing."

Another big-buck approach to the custom pickup is the black Big Window '56 Ford on the previous page. It started life with a workaday Six, but that's replaced with a 390-cu.-in. V8 mated to a C-6 three-speed transmission. Power steering makes it easy to turn the wider tires and a tilt-telescope steering wheel fits the cab to the driver. Out back, the pickup bed is floored in solid 1¼-inch white oak. Cal Customs did the blue velour interior.

The low custom look came from dropping the truck 2½ inches from stock. Replacing the front axle with a dropped hot-rod type and smaller 14x8-inch front and 10x15-inch rear B.F. Goodrich 50-series radials did the job.

Paint makes a custom truck just as it does a car. Jet black Emron does the job here. That says nothing about the prep work required because black shows every minor imperfection far more than other colors. As the pictures show, these were ironed out of the 21-year-old truck before spraying and polishing.

While work and thought are required, another major ingredient is money. The total investment in this antique is now \$7500 and still climbing. But it would probably all come back if the truck were sold. An old truck never fades away—it just becomes more appreciated . . . and appreciates more with time.—W.W.

The next step is "trim level." This really means "How fancy" and depends on your intended use. Obviously, a work truck will be plain, a fun truck more fancy.

One of the most crucial stages in ordering a pickup is selecting the options, for it is here that one of Murphy's Laws operates: "If you don't order it now, it'll cost more to get it later."

Again, you must consider how you will use your truck. If you plan to install a camper body, it is almost necessary to order an option called the "glideout spare-tire carrier," in which the spare tire swings out on an arm from its storage area. Without this, you must crawl under the camper to get at the tire.

If you carry the type of cargo with which you often have to stand on the rear bumper to load and unload, you can order a skid-resistant step-bumper surface. This bumper also is useful when you are towing since it is stronger than the chrome "style only" bumper.



Chevrolet's 1979 light-duty pickups have revised grille, radial tires as standard equipment and 250 Six as the base engine.

If you won't always travel with a full load and want a means of securing loose cargo, most truckmakers sell pickup-box side rails that provide the necessary tie-down points.

And then there's comfort. Most pickups used for camping are subjected to long drives. Power steering and power brakes are considered minimum, with a tilt steering wheel, an airconditioning system and complete instrumentation strongly recommended.

If you order your pickup instead of buying it right off the lot, thoroughly investigate the options you might need.

There's no charge for installation at the factory, but there will be if the same items are installed at the dealership. Among the options to ask about are stabilizer (anti-roll) bars, auxiliary fuel tanks, heavy-duty springs and special packages for trailering or carrying camper bodies.

What about weight?

If you're a potential truck purchaser, ask yourself two basic questions:

- How much weight am I going to carry in my worst case?
- In what type of use will this weight be carried?

Weight-carrying capacity of a truck is referred to as its gross vehicle weight rating or GVWR. If you've ever seen big semi-tractor-trailers pulled over by the side of the road being weighed, the



Dodge's D-150 Club Cab gives you extra room behind the front seats. Wheelbase of biggest model is a whopping 149 inches.

authorities are checking for overloaded vehicles.

In many states, the same weight limitations apply to pickups. Although each axle of a pickup truck has its own weight rating—for example, 3750 pounds for the back axle of a Chevrolet C-10 and 3400 pounds for the front—does that mean the truck can carry 7150 pounds of cargo? No; you have to subtract the weight of the truck, which might be 5000 pounds.

When a manufacturer builds a truck, he affixes a plate to it specifying the GVWR. This gives the buyer some indication of what allowable payload the vehicle will carry. To determine payload, all you do is subtract the curb weight of the vehicle from the GVWR.

For example, if you have a pickup truck with a gross vehicle weight rating of 8100 pounds, and the vehicle weighs 4100 pounds, then you have a 4000-pound-payload. But the thing to keep in mind is that the 4000-pound payload includes people, gasoline, personal effects, plus the camper unit if you carry one. And, if you are pulling a trailer, there is the tongue weight of the trailer.



Ford's F-350 4x4 is new to the lineup for '79. Engines in F-350 pickups range from 300-cu.-in. Six to 460-cu.in. V8.

The rule of thumb in advising buyers who haven't yet selected a camper to go with their truck is to get the biggest GVWR you can, for the simple reason that it will give you a better margin of safety.

Even after you subtract the weight of the truck, say 5000 pounds, from the two axles' capacity, of say, 7100 pounds, you still don't have 2100 pounds of payload. That's because the makers want a safety margin, so they specify GVWR a little under rated capacity of the axles.

Then, too, you have to subtract from your payload (also called MLR for maximum load rating) all the accessories you ordered for your truck. Once you subtract the 100-pound rollbar, the 200-pound auxiliary fuel tank, the 50-pound extra

battery, the 100-pound brush guard, the 100-pound winch, and on and on, you will find your actual payload to be much smaller than you imagined.

The "weekend warrior" who only puts the camper on the pickup during the weekend has the problem of two widely different loads being carried on the same pickup. Even if the truck is only carrying the camper 20 percent of the time, you have to build the truck for the 20 percent when it's carrying the heaviest load.

The dual-purpose buyer, then, is faced with the reality that he will have to buy



GMC half-tonners for '79 continue the diesel engine option, get more corrosion-resistant steel in doors, hood, fenders.

"more truck than he needs" for occasions when the truck is heavily loaded.

Type of use

Carrying 1000 pounds over a rocky, bumpy road might be equivalent to carrying 2000 pounds on a smooth freeway in terms of what it does to the suspension. Thus the way you use your truck should also determine its GVWR.

Although there are many off-road accessories that will considerably strengthen a stock pickup-truck chassis, there is one basic problem with buying a half-ton truck and trying to beef it up to ¾-ton specs. You're still in violation of the law if you exceed the GVWR *originally* posted on the truck by the manufacturer. Also, the axles won't take the beefing up.

There is a folly in "beefing a truck" as well, for upgrading the springs, tires or shock absorbers will not change the axle capacity the truck was "born" with. Most

half-ton pickups, for instance, have rear axles rated at between 2900 and 3800 pounds. This contrasts sharply with ¾-ton trucks, which have axles in the 5300-pound-capacity range. So it's the axle itself that makes the biggest difference between the two sizes. The capacity of the springs might only be 300 pounds apart between the half-ton and ¾-ton, but the axles will vary much more.

Axle types

There are two types of axles used on trucks, *semifloating* and *full-floating*. The semifloating is the same as that on most passenger cars where the axle itself is a load-carrying part of the suspension. If you break an axle, you may lose a wheel. With the full-floating axle, such as found in most ¾-ton trucks, the axle does nothing more than transmit torque to the wheel. You can take the wheel off, actually remove the axle and reinstall the wheel. The full-floating is much safer, though more expensive.

Specifying a full-floating rear axle is one easy way of building a strong foundation for whatever future loads you expect. Unfortunately, full-floating axles aren't usually available in the half-ton-truck range. You have to go to the ¾-ton pickup.

Four-wheel drive

Two types of customers buy a 4wd truck. The first is the guy who absolutely needs it—construction workers, hunters, fishermen, sportsmen. A second type, according to Gary Twombly of Fairway Ford in Placentia, Calif., "is the type who *thinks* he needs four-wheel drive, but really doesn't."

"We try to work with that second type to find out what his needs *really* are," says Twombly, "and if we think a two-wheel drive with a limited-slip rear axle will do it, we recommend it over four-wheel-drive." (PM will have more on 4wd next month in a special section).

Chevrolet and GMC

For 1979, Chevrolet (and nearly identical GMC models) offers three basic weight classes of two-wheel-drive pickups and one class of four-wheel-drive pickups.



Jeep J-10 four-wheel-drive pickup sports the Honcho dress-up package. Other trim levels include Golden Eagle and 10-4.

C-10: Two-wheel drives start with the C-10 model—a basic half-ton. It can be ordered with a GVWR of 4900 to 5600 pounds.

Powerplants begin with an economical 250-cu.-in. in-line Six, then jump to a 305-cu.-in. V8 with two-barrel carburetor or a 350-cu.-in. V8 with four-barrel. Sorry, no engines bigger than 350 cubes anymore in this series.

Transmissions have a three-speed as standard and four-speed or automatic optional. Rear-axle ratios run from a 2.56 to a 3.73, depending on your GVWR.

The C-20 series is what Chevrolet calls its ¾-ton trucks. They have a GVWR range of 6400 to 8200 pounds.

The powerplants, like with the C-10, again start out with the 250-cu.-in. Six with the two-barrel, bypassing the 305-incher offered in the lighter C-10. The next step up is the big 454-



Dodge D-50 Sport is a Mitsubishi-made mini pickup with a 1400-pound payload.

cu.-in. V8. With this powerplant, you can only order a four-speed or automatic—no three-speed as with the smaller engines.

In the stretched-chassis C-20 models, such as the Bonus and Crew Cab, even the six-cylinder is left out of the engine lineup because Chevy feels it isn't strong enough to pull any

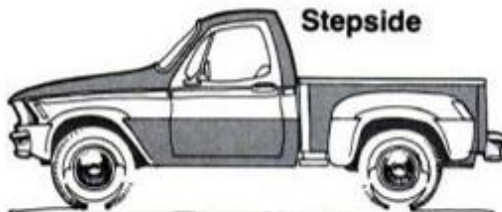
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SPOTTERS' GUIDE TO PICKUP TRUCK TYPES

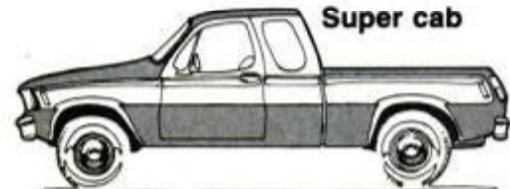
Slabside



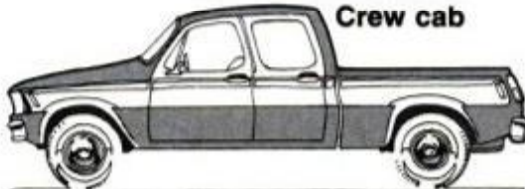
Stepside



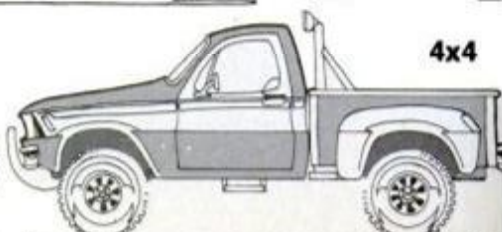
Super cab



Crew cab



4x4



IT'S NEW NOW



Makes automation a household word

The Chronol is a microcomputer timing control that can be programmed to turn lights and appliances on and off, according to almost any schedule. The 8¼-inch-wide unit will plug into any wall outlet and is said to be as easy to operate as a pushbutton phone. A four-outlet unit is available for about \$100; a memory protector (in the event of power failure) is approximately \$10. Lindburg Enterprises, 4888 Ronson Court, San Diego, Calif. 92111.

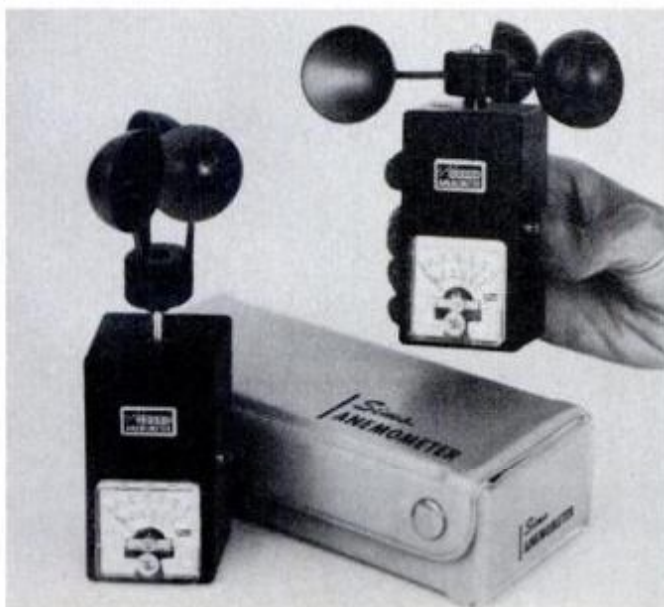


Point 'n count

A photo-tachometer with digital readout measures a range of 120 to 19,999 rpm with an accuracy of ± 1 rpm, claims the manufacturer. The two-pound unit features LCD display, integrated circuitry and a crystal-controlled time base. You simply point it at a rotating object and the readout is immediate—no contact need be made. Two AA batteries and a 9-volt transistor battery are required for operation. Stock No. 42719 is available for approximately \$400 from Edmund Scientific Co., 7782 Edscorp Bldg., Barrington, N.J. 08007.

Sound off

This ultrasonic cleaner differs, the maker claims—in the special cleaning solutions it provides. The Clean N' Brite K-42 now offers an exclusive solvent (shown in prototype container, right) for cleaning grease and dirt off tools and metal parts like screws or bicycle chains. The ultrasonic unit including beaker, measuring scoop and three cleaning powders is approximately \$50. Ultrasonics International, 5951 Northwest 151 St., Miami Lake, Fla. 33014.



Blowin' in the wind

This Sims anemometer makes use of cups that will fold when they are not in use and it works without using batteries. Units measure from 0 to 70 mph or 0 to 60 knots. A conversion table on the back compares knots, mph, kilometers per hour and Beaufort scale. Model BTC, with case, is available for \$86.50 from Simerl Instruments, 238 West St., Annapolis, Md. 21401.



On the level

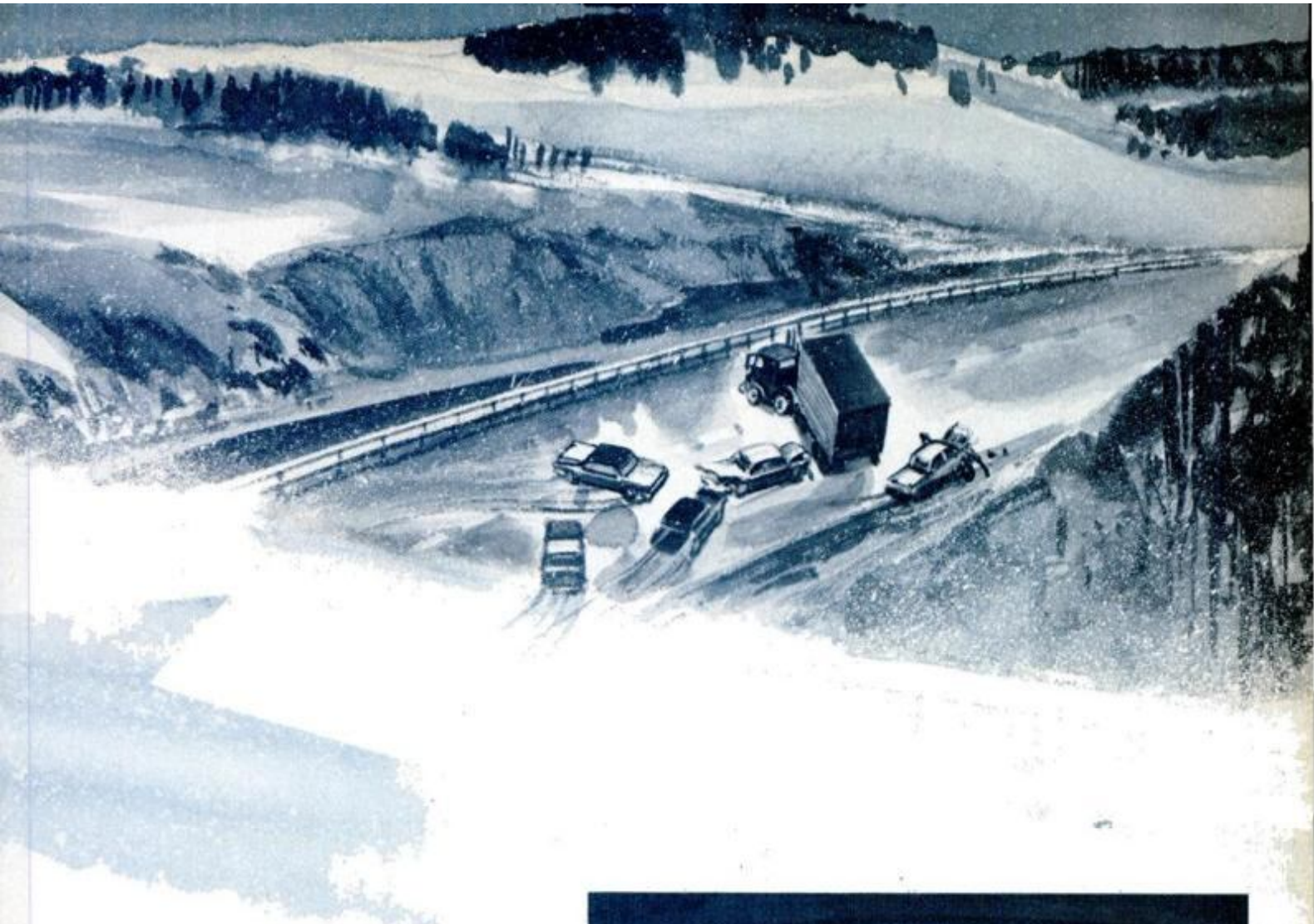
The proper leveling of a hi-fi turntable can be a critical factor in the way your audio system performs. The T-Level makes the leveling job easier and a good deal more precise than if it were done by eye. Model 41-133 is \$4.25. Available from Robins Industries Corp., 75 Austin Blvd., Commack, N.Y. 11725.

WHITEOUT: WINTER'S WORST SUPERHIGHWAY NIGHTMARE

Gouged from natural terrain, an Interstate highway
can become a 'wind tunnel' with a knockout punch.

by Edward Fales Jr.





"...Flakes flowing solid, right to left across his windshield. He couldn't see a thing."



Never had there been such a winter. Near Chicago, traffic came to a full stop—and stayed stopped for a day. Nearing Boston, trucker Jeff Steele of New Lisbon, Wis., hit a "whiteout"—a wall of rolling snow—and nursed his truck to a stop. Steele sat in his cab for four days, unable, some of the time, even to see.

Southbound on I-81 near Binghamton, N.Y., another trucker was less lucky. Bill Reed of Williamstown, N.Y., suddenly hit a wall of blowing snow and recognized a dreaded whiteout. Just ahead, newspapers reported later, the driver of a yellow Chevrolet, going at high speed, had also hit the blowing wall of wind and snow, panicked, hit his brakes. . . .

The Chev spun into whiteness—

gone as though over a cliff. In his truck, Bill Reed now hit his own brakes to avoid running over the car.

Anything that disturbs the flow of traffic in a snowstorm raises hell with trucks. Bill Reed's was no exception. But this wasn't even a storm. A storm had come and gone and now the sun was shining; the road was bare.

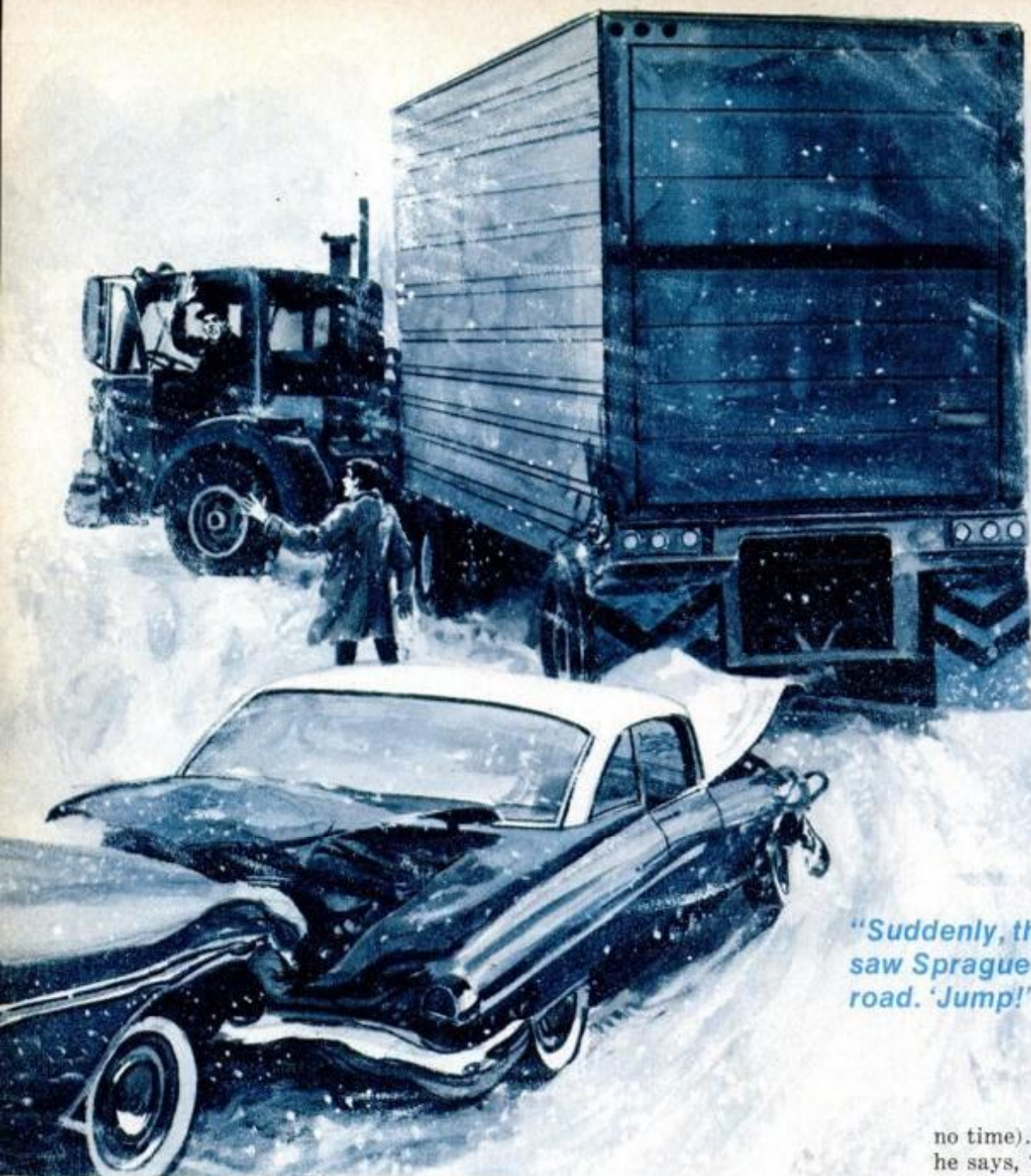
But suddenly his truck was in the "river"—flakes flowing solid, right to left across his windshield. He couldn't see a thing. And, incredibly, he was on ice. Braking to save the other driver—if, indeed, the Chevy had been wrecked—Reed somehow kept his 18-wheeler on the road, right-side-up. With the skill of years, he got it stopped, tractor nosing the left edge, trailer angled behind. To Reed it was a nightmare.

He'd come down a sunny hill. Against the snowy valley, around a curve, the blowing snow was invisible—camouflaged. From sun to blizzard in seconds.

Whiteouts in the hills

The strange thing was: It was such a narrow river. The snow was blowing down a wind chute—a slot in the hills. And the river was a mere half-mile wide. North-South I-81 is a new Interstate. When it was built, open meadows to the west began sucking whiteouts down from the hills. Newspapers say there had been other wrecks.

When Reed's truck stopped, it had gone partway through the whiteout toward the other side where the sun was shining. But following cars now



"Suddenly, the truck driver saw Sprague standing in the road. 'Jump!' he shouted."

raced toward the whiteout. No driver could guess that a truck was in it.

To make matters worse, there was a hill. Coming over the hill, Ron Sprague, a manufacturer's rep from Binghamton, N.Y., felt his car suddenly wrapped in snow. "It hit like an explosion," he says. Then the snow blast stopped for a moment, the sun came out, he says, and he saw the truck. Two other cars had just hit. Dust was settling.

Knowing he couldn't stop, Sprague aimed, he says, for one of the truck's tires.

It was a good target. The left rear tandem tire cushioned the blow. He sat in his own wreck, stunned but alive. Not so fortunate was driver Robert Ogle of Cortland, N.Y. When his car crashed, he was killed. Then two more cars plowed into Sprague's. Shaken, he cut the ignition and crawled out.

A voice called down. Up there in the cab he could see trucker Reed sending

a highway SOS. Reed was shouting into his CB. "He was breaking 19 and (emergency channel) 9, calling for people to slow down, and trying to get help," Sprague says.

Suddenly the truck driver saw Sprague standing in the road. "Jump!" he shouted.

"I looked just in time to see two more cars coming at me sideways," Sprague says. In a flash, he went up and over his own hood. The truck driver had saved his life.

He'd driven through whiteouts before, always wondering what to do. And what would happen if he hit something? "You're afraid to go but you're afraid to stop," he says.

So now he knew.

"You'd never believe what it's like," he told me. The whiteout wall behind him kept opening up and spewing out more cars.

And the sounds were *not* what he had expected. There was so *little* sound. No horns (because there was

no time). No scream of tires because, he says, "it was like an icy tunnel in there. The road was slick."

For five minutes there was just the steady, ghastly crunch-crunch-crunch of cars piling on each other, and even this sound surprised him. It wasn't a booming, loud sound. It was like a beer can when you crumple it—like 20 beer cans being crumpled one at a time.

For a while, mercifully, the crunching stopped. But now the screams began coming from people trapped in and under wrecks. Then came the suffocating smell of gasoline. And oil was underfoot. And all the time, up above, the stern voice of trucker Reed kept calling his SOS.

Two girls, dazed, stood in the road bleeding from their chins. "Watch out!" someone shouted. They, and others, jumped down a cliff. The crunching had begun again. This time nothing could be seen. Cars were colliding back in the whiteout. People tumbled downhill, across snow, desperately hoping to reach the north-bound lane for safety. But there was no safety. Cars in *that* lane began

Материал, защищенный авторским правом

stopping. Now there was crashing down there. Someone kept shouting: "Don't smoke. For God's sake, don't smoke." The gas smell was everywhere.

And when at last the crashing had ceased and deputies arrived they added up 45 smashed cars, one man dead, those bleeding girls and 41 other men, women and children hurt.

Yet some called this a fairly *mild* accident, as whiteout crashes go. "Thank God, it was Saturday—not many trucks," says Sprague. "On a weekday it would have been a massacre."

Like being in an explosion

So this, then, is what life is like in a whiteout. And some extend for 100 miles. I've floundered through them from Idaho Springs, Colo., to Bowling Green, Va., and in Buffalo—the nation's worst whiteout city, where winds hit 60 mph. As Ron Sprague says: It's like being inside an explosion.

And I can tell you: You get scared.

New Hampshire's Highway Maintenance Engineer, Bob Hogan, says: "You just don't know what to do. Keep going? You hit someone. Slow down? You get hit. What do you do?"

Hogan hit the nail on the head. The scary answer is that no one yet knows.

And the shocking fact is that no one has tried to find out. Time and again last winter safety people and patrols called on anyone with a 4wd (four-

wheel-drive) vehicle—or snowmobile—to be ready to turn out for rescue work. But that's not preventing whiteout pileups.

Only a few are trying to help you when the inevitable snowblast strikes. "Well, we sand the roads as well as we can and keep them plowed," said one state transportation department official, apologetically. "And our budget is getting very tight."

Windssocks and strobe lights

In other words, until more safety people get moving, you're on your own this winter, come wind, come snow. And working against you are some of our "best" auto designers. They've given us defroster systems so feeble they never really heat the windshield in front of the driver. It simply ices over. And some headlights are so recessed they instantly fill up with snow—taillights, too.

The worst recurrent whiteout spots are known to patrols, and you should get your engineers to do something about them. New Hampshire is screening some "chutes" with wind-break pines. It also posts warning signs. At some dangerous spots New Hampshire and a few states even hoist airport-type windssocks.

And New Hampshire now is switching to quick-change signs. If wind comes, patrols report by radio. Up in the mountain routes, signs will flash: WIND (They *could* flash: WHITEOUT).

New York, where whiteouts are a

major problem, is moving to investigate the "chute" near Binghamton. Besides warning signs, engineers may be asked even to reshape the side of a mountain to change local wind-flow characteristics.

But more is needed—especially near cities. Pilots know that strobe lights (sequence flashes) can help guide them to runways in foul weather. Powerful strobe flashes, properly aimed to avoid glare, could also be used to delineate the road's edge for drivers over short, critical distances (as on bridges or high hills).

One primary trouble is that many of our Interstates have been built with no thought to wind. By blasting away natural barriers, contractors actually have created whiteouts.

Tips that may save your life

For years it has been my job to report on winter driving coast to coast. Here are tips learned from my own test trips—and from some very able car and truck drivers.

■ **Prepare well in advance.** Otherwise, a whiteout will catch you sooner or later.

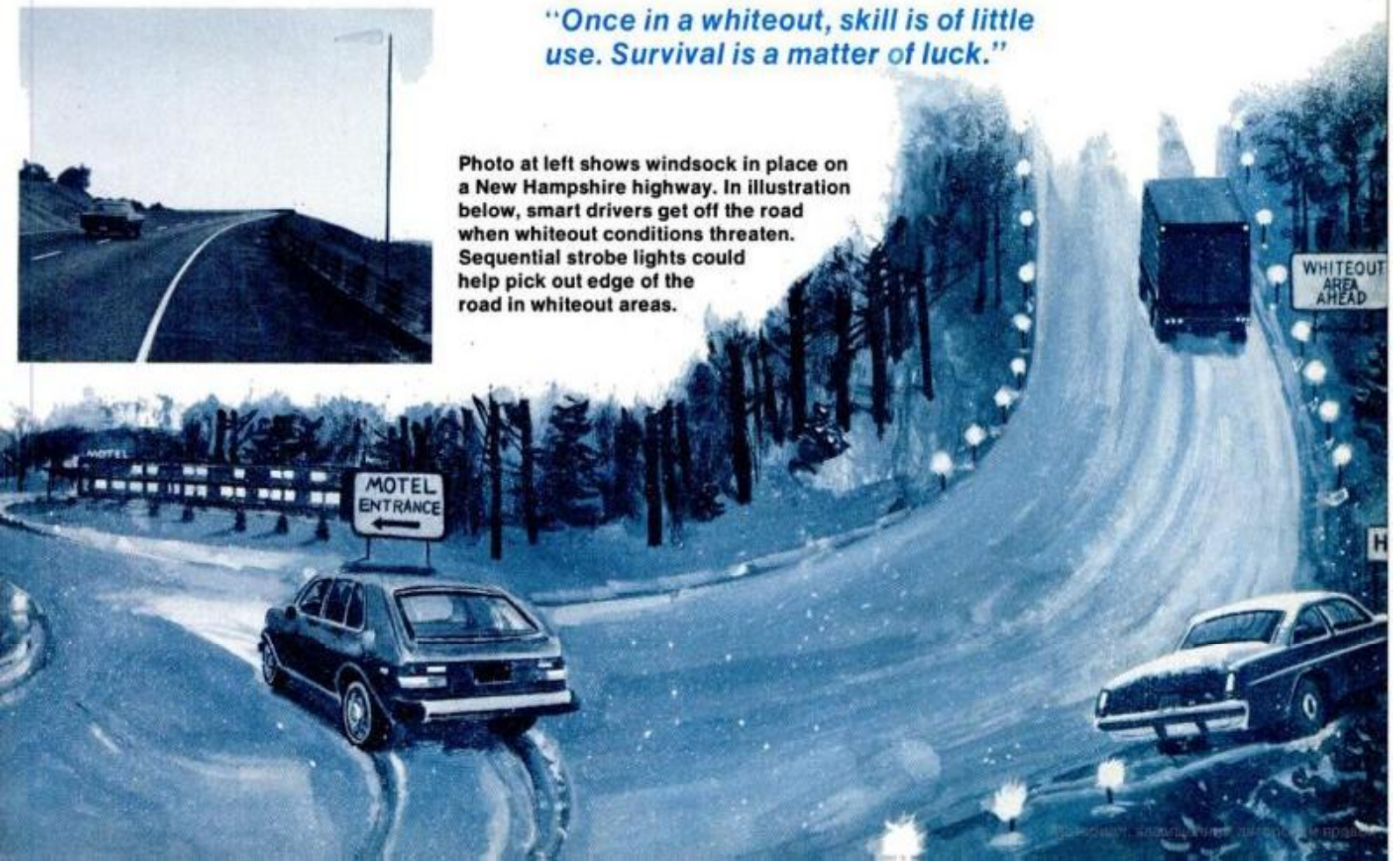
■ **Know the storm conditions into which you're venturing.** If Weather Service issues a heavy snow warning, expect up to 150 miles of intermittent whiteout blindness. This applies from Canada to Arizona and the Gulf Coast.

■ **Know about fair-weather whiteouts.** These strike night or day, when-

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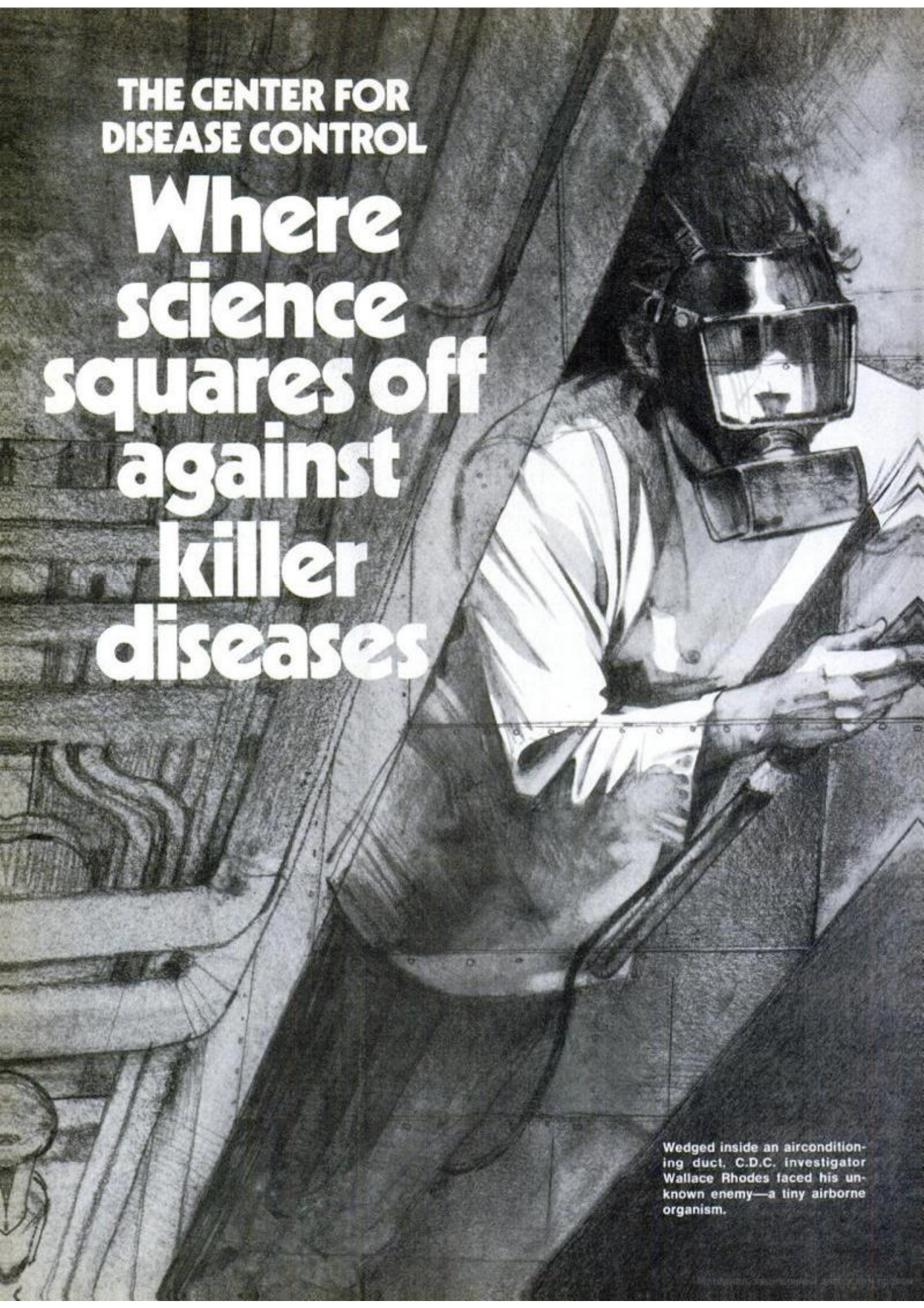
"Once in a whiteout, skill is of little use. Survival is a matter of luck."

Photo at left shows windssock in place on a New Hampshire highway. In illustration below, smart drivers get off the road when whiteout conditions threaten. Sequential strobe lights could help pick out edge of the road in whiteout areas.

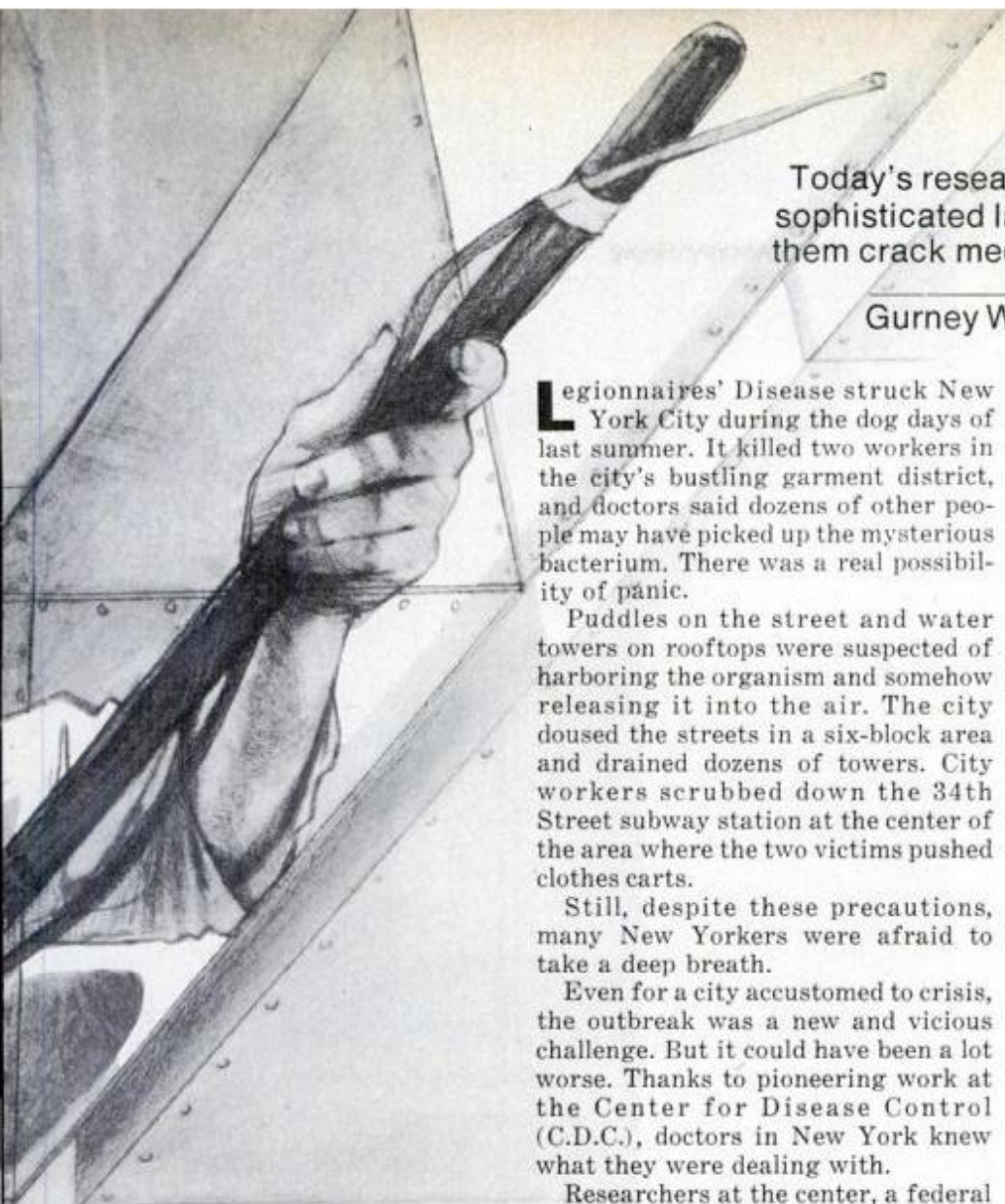


**THE CENTER FOR
DISEASE CONTROL**

**Where
science
squares off
against
killer
diseases**



Wedge*d* inside an airconditioning duct, C.D.C. investigator Wallace Rhodes faced his unknown enemy—a tiny airborne organism.



Today's researchers call on sophisticated lab gear to help them crack medical mysteries.

Gurney Williams III

Legionnaires' Disease struck New York City during the dog days of last summer. It killed two workers in the city's bustling garment district, and doctors said dozens of other people may have picked up the mysterious bacterium. There was a real possibility of panic.

Puddles on the street and water towers on rooftops were suspected of harboring the organism and somehow releasing it into the air. The city doused the streets in a six-block area and drained dozens of towers. City workers scrubbed down the 34th Street subway station at the center of the area where the two victims pushed clothes carts.

Still, despite these precautions, many New Yorkers were afraid to take a deep breath.

Even for a city accustomed to crisis, the outbreak was a new and vicious challenge. But it could have been a lot worse. Thanks to pioneering work at the Center for Disease Control (C.D.C.), doctors in New York knew what they were dealing with.

Researchers at the center, a federal facility which has been fighting dangerous diseases since 1946, had previ-

ously identified the organism as clearly as a face on a "Wanted" poster. The center was able to suggest a treatment—erythromycin, a common antibiotic. As the weather turned crisp last fall, there were no further fatalities, no new cases, and no panic. The city breathed easier.

The puzzle of Legionnaires' Disease is far from solved. But many of the pieces are in place today thanks to inventive and courageous work by medical researchers at the C.D.C.—and thanks to sophisticated lab gear that has helped them along. The story of C.D.C. research on Legionnaires' Disease is typical of case histories involving investigators at the sprawling laboratory in a suburb of Atlanta. From here, they're sent on high-level missions to track and destroy exotic illnesses. The job is a kind of medical guerrilla warfare: frequently investigators don't know what they're fighting, or where it's hiding.

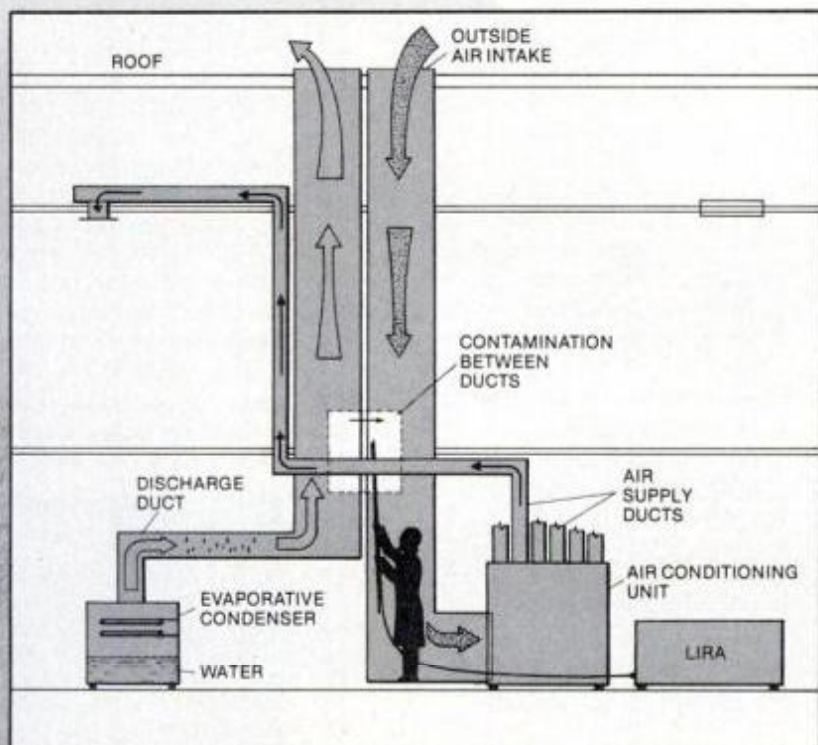
The C.D.C. was drawn into the Legionnaires' Disease case, for instance, years before the bacterium had been identified. The story really began in the 1960s.

It was a rare medical mystery. At a county health department building in Pontiac, Mich., dozens of doctors and others began to get seriously ill. They developed fevers, suffered crippling headaches, muscle pain and disorientation. Eventually, 144 persons caught the strange disease. Local doctors were at a loss to explain what was happening. Somehow, the health department building itself appeared to have the power to make people sick.

Within a short time after the mysterious outbreak in July 1968, Michigan health officials called for help from the C.D.C., which sent a team of investigators to Pontiac.

Two members of the team promptly contracted high fevers, headaches and muscle spasms themselves, apparently just by breathing the air in the building.

The investigators' preliminary conclusion in 1968 seemed to come right off the pages of *The Andromeda Strain*, the science fiction novel in which the villain is a deadly microorganism from space. It appeared to the ailing C.D.C. researchers in Pontiac that a virus, bacterium, fungus or something, was living in the aircondi-



Rhodes raised a makeshift probe along the surface of the air intake duct. His discovery of a leak between ducts showed that the mysterious organism was growing in water in the air conditioner's evaporative condenser.

Re winter ailments: Does C.D.C. make house calls?

It's unlikely, in the course of a normal winter's bout with sniffles, sneezes or flu bugs, that you or your family will make contact with officials from the Center for Disease Control.

For one thing, there are only about 100 epidemiologists—specially trained disease detectives who work in the field—on staff at the C.D.C. And they have to cover the whole country, so generally they only have time for the most serious infectious diseases. For another, the federal agency goes out of its way to avoid stepping on the toes of state health officials. Normally, requests for help from the C.D.C. come from these local doctors who need extra expertise in fighting illness. The center does jump into some situations on its own—if infections spread across state lines, for instance, or if ships or planes arriving from abroad are suspected of carrying dangerous organisms.

C.D.C. researchers entered one case in 1974, for instance, when an American tourist returned from Haiti suffering from anthrax. That's a potentially fatal disease caught from infected animals. The C.D.C. traced the disease to the tops of native drums, made from bacteria-laden goatskin, which the tourist had planned to give to friends. The disease-fighting team was able to recover all the suspect drums, preventing the spread of the anthrax.

Doctors at the center do, however, suggest what to do if normal

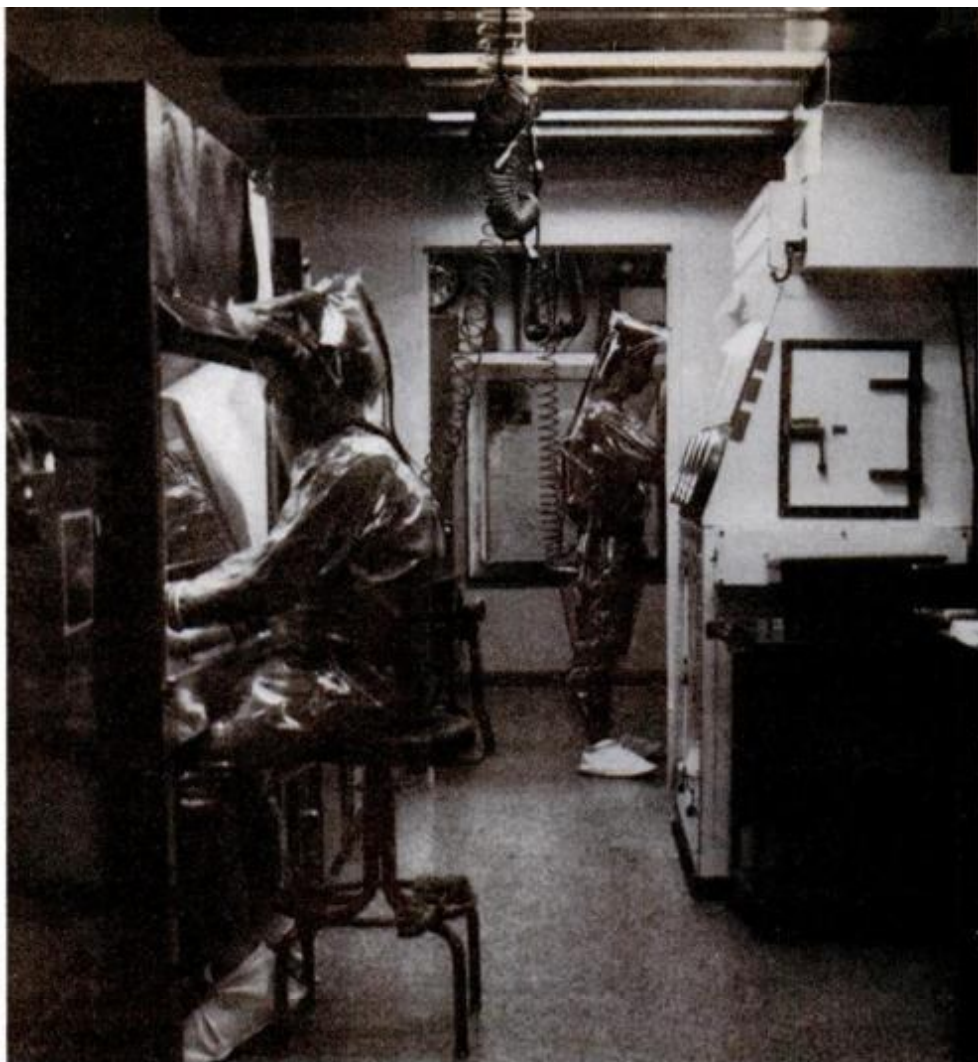


Electron microscope view of flu virus.

treatment or the passage of time fails to cure your winter misery.

"Anytime you're under the care of a physician, and things are not going well and you continue to run a high fever," one said, "you should ask your doctor to call in a local infectious disease specialist to look the case over. Patients always have the option to ask for a second opinion."

Then, if your disease stumps the specialist, he or she can make contact with C.D.C. epidemiologists, who are on call 24 hours a day—and often make house calls.



C.D.C. researchers breathe air through spiral tubes in new top-security lab.

tioning system. Whenever the cooling system went on, investigators guessed, the tiny organism traveled on cool breezes through metal ducts, then scattered out through vents and into the air.

To check out this theory, C.D.C. investigator Wallace Rhodes—who had been called away from a Florida vacation after the other investigators had gotten sick—opened the wall of the main vertical air-intake duct in the basement of the building. The shaft, running from basement to rooftop, where dim light now poured down on the gray walls, was big enough to climb into. Courageously, Rhodes wedged himself inside to search for clues on how the air leading to the basement airconditioner could have been contaminated.

Rhodes looked and sounded like a character from *Star Wars*. His breath hissed and clicked through the filter of a gas mask. Slowly, he thrust a plastic probe, like a sword, high above his head. The probe sucked in whiffs of air from the duct and carried the samples down, out of the duct, and into the basement where the air could be instantly analyzed by a seven-foot-long machine called a LIRA.

Outside the shaft, a technician named Karl Branch—who also wore a gas mask—hovered over the LIRA's

graph readout, watching for twitches in the inky line that would indicate a leak into the air duct.

The LIRA principle was simple. Periodically, Branch shot traces of non-toxic freon gas into a second large duct adjoining the duct where Rhodes now stood. If the second duct was leaking into Rhodes's duct, Rhodes's probe would sniff out the freon and the graph pen would jump, indicating a leak between the two ducts.

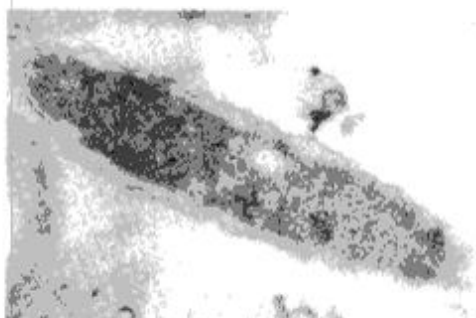
"My gosh!" Branch said suddenly, his voice muffled by the mask. "Look at this." Rhodes scrambled out of the duct and both men bent over the orange-tinted graph paper. The line on the paper had suddenly shot up into a

Blood serum, straw-colored liquid, is collected from patients and stored in freezers to help fight new outbreaks of disease.



distinct point. Rhodes climbed back into the duct and probed again, and again the line on the LIRA readout spiked sharply.

It was a key piece of evidence. The duct adjoining the main air duct, both men knew, was often filled with droplets of water used to cool the air-conditioner's condenser in the basement. When the cooling system was off, this water settled into a pool beneath the condenser coils. It now appeared almost certain that the culprit in the case was growing in the small dark pool in the basement. From there, it traveled toward the roof, swept up by warm air. Along the way, the LIRA test showed, the water droplets leaked



Legionnaires' Disease bacterium.

into the air duct at the point where Rhodes's probe picked up the freon tracer.

Further tests back at C.D.C. labs added more evidence. Guinea pigs exposed to water from the basement pool caught the same fever.

But after running the guinea pig tests, the investigators ran into a stone wall. They were still unable to positively identify the mystery bug that could infect both man and animal.

"We knew it must have been something in the water under the condenser," said Dr. Peter Skaliy, chief of the microbiological control section and the man who ran the guinea pig tests. "We were at a loss as to what it was. We continued work for a couple of years, but after three years, the case was all but dropped. We were criticized for putting it on a back burner. But how long can you justify testing when you're coming up with negative results week in and week out, year in and year out?"

The case was put on ice, literally. C.D.C. technicians froze some samples of blood serum—the straw-colored liquid part of the blood—from Pontiac victims. They stored them in test tubes



Technician injects a sample into a gas chromatograph. Within an hour, it will draw a profile of a disease agent.

in the center's serum bank, a windowless room full of Sears Coldspot freezers containing more than 100,000 specimens of blood serum from victims of thousands of diseases. They marked the Pontiac sera "Etiology unknown." In Pontiac, the airconditioning system was rebuilt. No one else caught the disease. No one died from it. And no one knew where it had

(Please turn to page 136)

Is your air conditioner safe?

The mysterious outbreak of fever in Pontiac, Mich., in 1968 is not the only case in which the problem has been traced to a microorganism living in a large airconditioning system.

Last August, C.D.C. officials announced that they had isolated Legionnaires' Disease bacterium in water from an airconditioning cooling tower atop a hotel in Bloomington, Ind. Twenty-three of 25 confirmed victims of Legionnaires' Disease had stayed in the hotel within two weeks before the onset of illness. Four of the patients died. Researchers also found organisms closely resembling Legionnaires' Disease bacteria in water from an auxiliary airconditioning tower at Baptist Memorial Hospital in Memphis. At least 13 persons are known to have caught the disease, all of them workers or patients in the hospital. One died.

Large airconditioners were suspected in other outbreaks last summer in New York City and Dallas. Researchers probed cooling units in Dallas hotels housing some 36,000 persons attending the National Veterans of Foreign Wars convention. Six of the conventioners caught the disease.

None died. There were two deaths reported in New York. Samples of water taken from the two cities were

still under study at the C.D.C. last fall.

Doctors interviewed at the center expressed concern over the role large airconditioning systems might play in spreading dangerous disease. And some said it was possible that less virulent organisms—cold virus, for instance—could be spread from one or two victims through entire buildings in the ducts of airconditioners.

What can be done to keep common bacteria or virus out of large cooling systems? Doctors I spoke with said clean filters and proper design—with exhaust ducts placed far from intake ducts, for instance—might help. But they said the question needs more study.

"The whole issue of airborne infections is one we're having growing awareness of... further investigation may well be fruitful," said Dr. David Fraser of the C.D.C., an expert on Legionnaires' Disease. "Our approach right now is to understand more how the airconditioning systems are involved (in the spread of Legionnaires' Disease) before we suggest a set of regulations."

I asked Dr. Fraser if he could at least come up with recommendations to make large airconditioning systems safer against Legionnaires' Disease while the research continued. For instance, should filters be

changed or cleaned regularly to block the bacterium?

"No," he said, "cleaning filters wouldn't necessarily stop Legionnaires' Disease. I think we have to learn how Legionnaires' Disease Bacterium is spread, and then we can make some recommendations. But if we start making recommendations before we understand the biology of the disease—the epidemiology of the disease—our recommendations will only be as good as our guesses."

The experts don't know enough yet—that's the bad news. The good news is that home airconditioners are not implicated in the spread of Legionnaires' Disease. Other officials at the C.D.C. said that exhaustive studies revealed no higher incidence of the illness among people with home airconditioners than among people without home-cooling units.

Of course, even if Legionnaires' organism is found in airconditioners, it may not begin there. At the same time C.D.C. researchers isolated the bug in the Bloomington hotel cooling tower, they also isolated it in a creek about 50 meters from the hotel. "Whether the organism might have been transferred from the creek to the cooling tower water or vice versa, I can't say at this time," Dr. Fraser said.

LIQUID CRYSTALS: KEY TO TV THAT'S THIN AS A WRISTWATCH

by Jorma Hyypia

Imagine a television with a screen so flat that you can hang it on your wall just as you would an oil painting. How about a set with a flip-up lid, and the lid itself is the TV screen? You could take one of these sets to the beach or the golf course and—even in the brightest sunlight—the pictures would be easily viewed. Of course, they would run off long-lived batteries.

You can't yet buy these sets, but the prototypes exist. Two major Japanese companies, Matsushita and Hitachi, have unveiled the first versions of these new TVs. It may be a few more years before you can get your hands on one, but the technology exists today—the technology of Liquid Crystal Display (LCD).

Right now, the screens are on the small side (though larger than some of today's mini sets) and are expensive to produce. Still, it isn't any longer science fiction to speak of wall-size TV, or even the wall itself as a screen. Some day you'll walk into your living room, flip a switch and the opposite wall will just fade away to be replaced by a front row seat at your favorite movie. The limitations of this new LCD application are set only by the human imagination.

Matsushita's TV weighs in at less than a pound and a half, with a 2.4-inch diagonally measured screen. The screen, a flip-up type, is only three-eighths of an inch thick and draws only 4.6 volts. That's amazing when you think that a conventional TV screen guzzles literally



thousands of ever more costly volts.

Hitachi's LCD TV has less definition than is claimed for Matsushita's, as it uses fewer LCD elements per square inch and a different technique. However, both sets are pioneering examples of what future TV technology will be.

That future lies in the way liquid crystals twist and turn in order to alternately block or pass light waves and thus form images. Liquid crystals have been around a long time in digital displays. You likely own an LCD watch or have at least seen one. They are distinguished from their LED (Light Emitting Diode) cousins in that their displays are black and white, rather than bright red, and are not washed out by bright sunlight.

Techniques began in watches

LED techniques first became available in watches. The newest LCD TV sets use an analog display—as opposed to a digital one.

Texas Instruments has come out with a line of watches that use display screens similar to LCD television. Rather than the complexity of displaying a quickly moving and very dense TV image, these watches simulate the hands of a normal watch, along with some other functions, by activating 120 LCD elements (as opposed to more than 56,000 in the Matsushita TV and about 9000 in the Hitachi set.)

Primitive? Yes. But only if you think in terms of tomorrow. For today, these watches are the first step into the future.

Crystals operate logically

Liquid crystals are not the easiest things in the world to understand, but they do operate in a logical manner. They are chemically produced organic compounds which have unique properties that make the crystals actually seem to behave like both ordinary liquids and crystal solids at the same time.

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Think of a liquid crystal molecule as being shaped like a microscopic rod. These rods have what is called a "dipole" characteristic. Just like many electronic elements, they have two poles: positive and negative.

Opposite poles attract (just as in two magnets), so a liquid crystal rod in an electrical field will align itself with that field's polarity. Picture how iron filings are caught in a magnetic field and positioned along the lines of magnetic force. The same thing happens to the tiny LCD rods whenever an electric charge is applied. By applying the right electric charge, you can align or "twist" them any way you might want—and that is the basic secret behind LCD technology.

Liquid crystals do *not* generate

light, as do light emitting diodes or the common light bulb. But, by twisting and turning them in their electric field we can use them to *transmit* or *reflect* light from outside sources. Depending on the application, the principle is as simple as that of the venetian blind.

"Dynamic scattering mode"

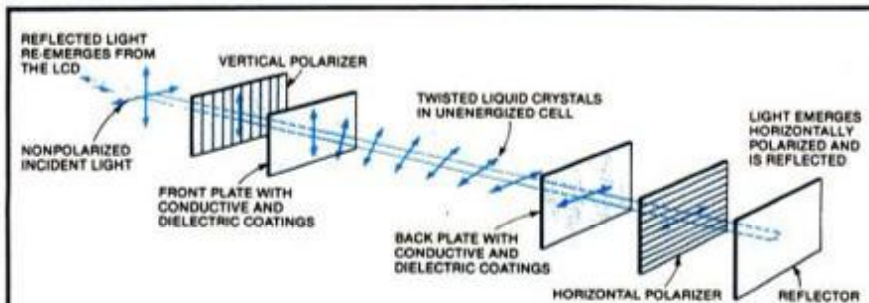
The Matsushita TV system uses a "Dynamic Scattering Mode." Most LCD watches and calculators use a "Field Effect System." The words don't matter, what's going on inside does.

The accompanying diagram shows a three-dimensional image of the Matsushita TV display. Complex as the diagram appears, we show an area of only 35 LCD picture elements (electrodes), or less than one

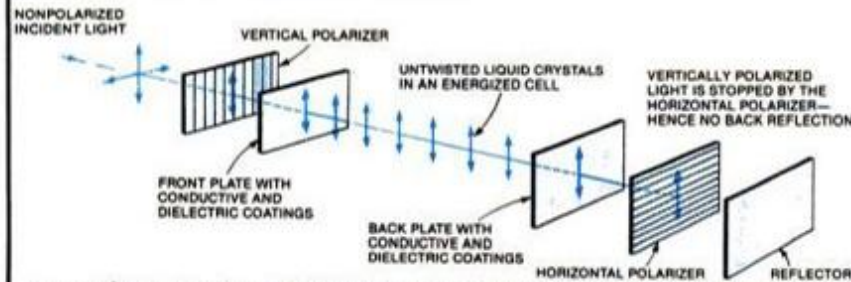
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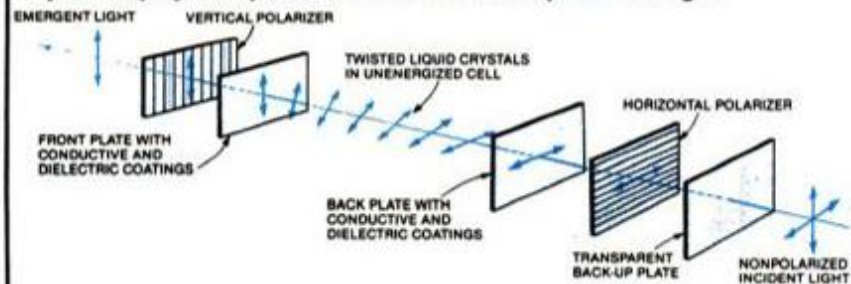
Matsushita of Japan recently showed this new, flat-screen TV. The picture is formed by an array of liquid crystal black and white "dots," much as photos in a magazine are produced by dots of black and white.



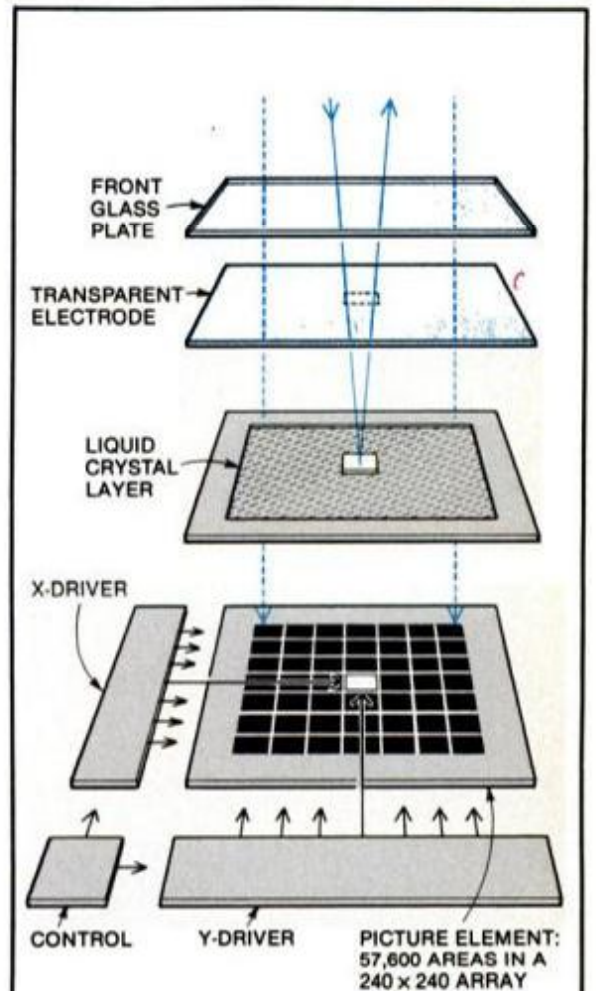
Unenergized Reflective Field Effect Cell returns incident light to produce a white image. Incident light is vertically polarized, then twisted 90° to pass through the horizontal polarizer. After being reflected, it retraces its reflected path to re-emerge from the cell. This may be considered as the "off" state of the cell and occurs when no electric current is applied to the liquid crystal matrix. Try to track the polarization twists.



Energized Reflective Field Effect cell absorbs incident light to produce a black image. Incident light is vertically polarized and continues through the cell unaffected when an applied electric current untwists the liquid crystal orientations. The vertically polarized light cannot pass through the horizontal polarizer. The light cannot, therefore, be reflected back out of the liquid crystal display. The polarization twists have captured the light.



Unenergized Transmissive Field Effect LCD is rear illuminated. If no electric current is applied to the LCD matrix, the horizontally polarized light is twisted 90° to pass through the vertical polarizer in order to produce a white image. Current untwists the liquid crystals, light remains horizontally polarized and cannot pass back through vertical polarizer. This creates dark images on a light background. The text explains white-on-black.



A Dynamic Scattering Mode (DSM) type liquid crystal display consists of a liquid crystal layer sandwiched between a transparent electrode and, in the case of the Matsushita TV, a picture element consisting of an array of 57,600 areas activated by signals from X and Y Drivers coordinated by a Control Signal Generator. Electric current flows from a central square area to the transparent electrode, activating a similar segment of liquid crystal layer. Light from above is reflected back only by the activated area and passes through the unenergized areas to black picture element and is absorbed so viewer sees white square on black background. System needs no polarizers.

BOATS FOR '79-

Better performance, bigger power

Hulls to handle the hottest engines are on the way for action this spring.

by Bill McKeown BOATING EDITOR



With a tunnel hull under streamlined decking, the Sleek Craft 20 can mount 235 horses of Johnson outboard motor power.

Now next season's hulls are catching up with last year's powerful engines. And our preview of newest models shows the resulting extra size and strength allow room for more accommodations as well.

Boats are being designed and balanced to carry their push power all the way aft. Instead of an inboard engine filling up the cockpit mid-

ships, outboards and sterndrives are doing the same job out of the way back at the transom. Even inboards with V-drives are being positioned at the stern, and the depth of the popular deep-V hull allows powerplants to be mounted lower, out of the way.

The larger cockpits, surrounded by higher topsides, can place the underfoot decking above water level,

where overboard drains make the cockpits self-bailing. Another bonus: The space below those elevated cockpits no longer needs to be an engine compartment, so several space-conscious builders now are stowing mini-staterooms there. Cruisers can not only carry a crowd, but will be able to sleep the group this year, though the overnighting quarters may at times seem more cramped



The runabout is still a favorite. Checkmate's new four-seater, shown with 75-hp Evinrude, will tow skiers with ease.



Extra accommodations are a Bayliner advantage; their 31-foot Conquest Sun Bridge takes three double berths, one single.



First Starcraft with extra-wide 9¼-foot beam, the 25-foot Star-Cruiser Flybridge has cabin, flying-bridge steering.

Chrysler "package" boat (left), 15-foot Striper bowrider, has factory rigged 45-hp outboard and steering already installed.



An offshore fisherman with cruising capabilities, the Pursuit 2500 from Tiara, has done 45 mph with a MerCruiser 260 engine.

Fishing machine with casting platform aft, the Cajun Special from Sabre Marine is 20 feet from bow to transom deck.



than cozy for night-long sleeping.

Among smaller craft, the bass boats maintain their popularity, with trends toward stripped-down aluminum skiffs at bargain prices, and metal flaked, chromed and accessorized models for big budget bassbusters. Some design improvements aim at activities other than angling, however. Windscreens, sunlounge seats, ski-tow rings and

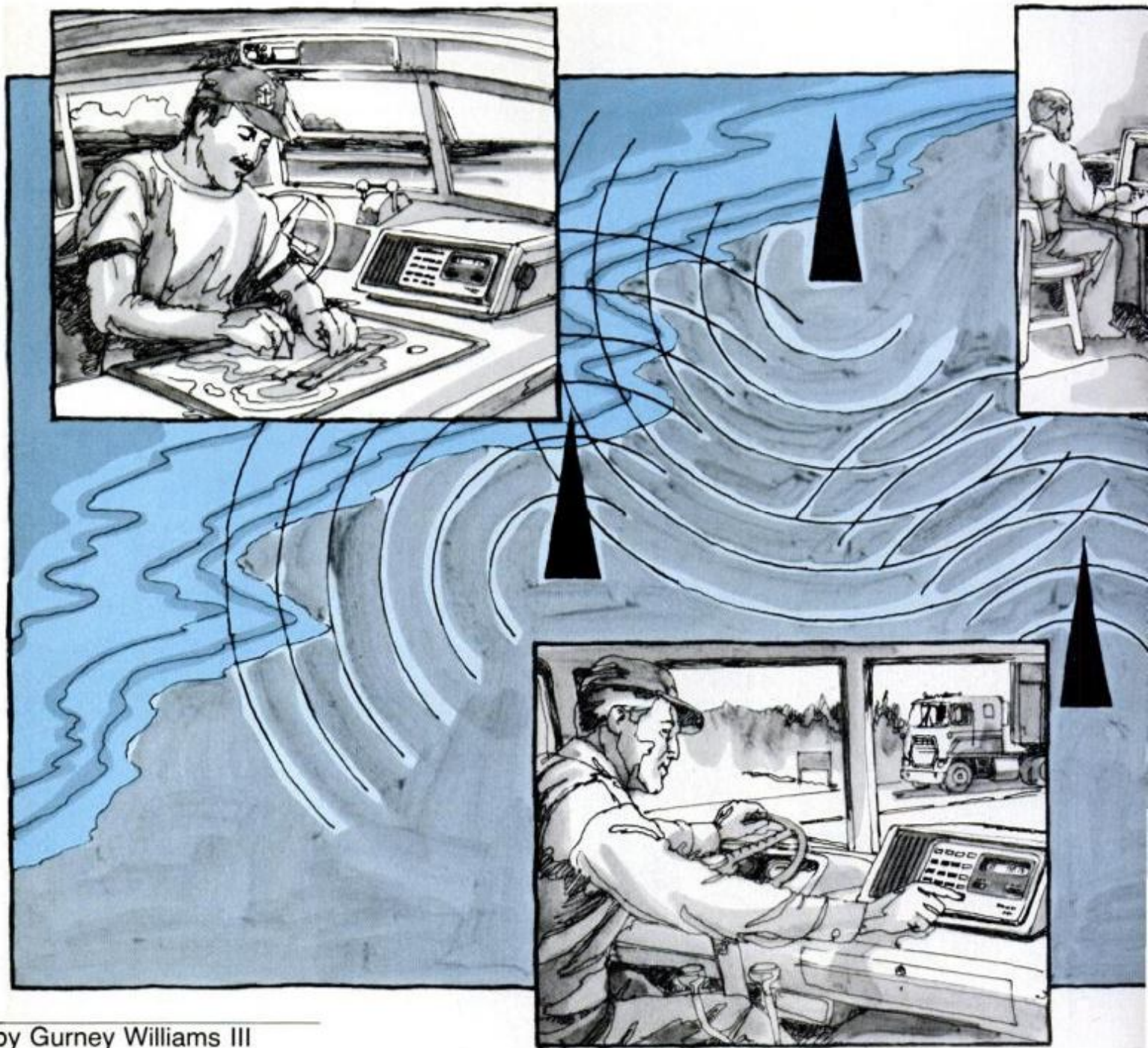
canvas tops are being offered to make a fishing boat a multipurpose family boat, as well. Larger cruisers are also being designed for dual-purpose action. Few "convertible" cars are still being made, but a number of new cabin cruisers are being called "convertibles." Afloat, the name means that the craft can be switched easily from family over-nighting to offshore sports fishing.

The houseboat is expected to stage a modest boom this year. Once overproduced and overstressed in open water where it didn't belong, the floating home lost popularity. Now it seems to be coming back, thanks again to big outboards and compact I/Os for convenient power. Look for a larger variety of floatables from which to choose this summer.

PM

Now our ocean navigation system

Wide-coverage Loran C signals cover most land areas in the United States and can be used to guide, or keep track of, trucks and cars.



by Gurney Williams III

Loran C, an astoundingly accurate navigation system that has guided boatmen for years, is coming ashore.

CB-sized Loran units, capable of leading pleasure boats back to within 50 feet of a previously discovered fishing ground, are beginning to show up in *land* vehicles. Engineers in many companies and government agencies are looking into dozens of possible land-based applications, from following weather balloons to helping with the Federal census, or tracking ambulances and police

cars. Time may not be far away, according to Coast Guard Capt. William Mohin (who works full time on land applications of Loran), when the system will be as popular in private cars as CB is today.

Like an evolving prehistoric fish struggling up onto land, Loran systems face some difficult adjustments as they are given new roles on shore. Receivers have to contend with power lines, bridges, mountains and skyscrapers that cause mishaps in the pulsing radio ground waves which are the heart of the

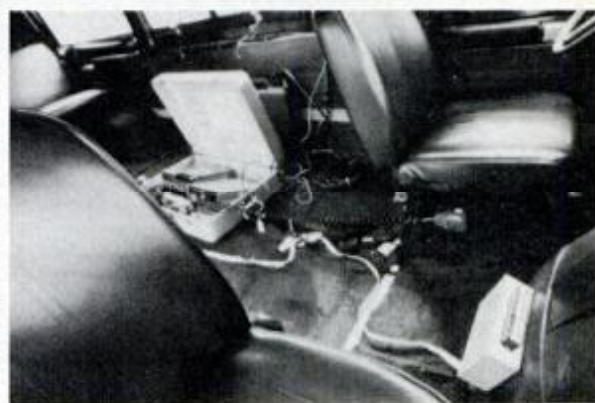
system. Prices are still too steep—a new unit from Texas Instruments carries a suggested list of \$2095. (Spokesmen for Chrysler, Ford and GM all mentioned the high cost of equipment in reporting that they had no immediate plans to market Loran C units as an option in their cars.)

Currently there's a big hole in Loran C coverage. Even with recent improvements in Loran chains, several midcontinent states, from North Dakota through western Texas, are not covered. They're too far

can keep track of your car



Interior of Loran-C-equipped van (above) and the base station which tracked it all over Washington, DC. In this experiment, the van's Loran coordinates were continually recorded on tape. Using these coordinates, the base could chart a map of van's route. Map was accurate enough to show such things as illegal turns the driver made. This technique may see much future use, as companies keep track of their truck fleets, and police HQs pinpoint patrol car locations.



Boaters already know about Loran C as a convenient aid to navigation. Now that more Loran transmitters are coming into operation, their signals will cover much of the U.S. land area, as well as the ocean. Signals are received from three stations, two "slaves" and a "master." By comparing difference in time for each signal to arrive, an accurate location may be plotted. Right now, these time-difference lines must be plotted on a chart. In the future, computers could change the data into an easily usable and understandable form.

from transmitters, which have maximum ranges of 600 to 1000 miles. Whether those states ever will be covered depends on cost-benefit studies currently underway and future Congressional appropriations.

Even with that gap, an estimated 50 percent of the land area of the United States is now serviced by Loran C. And by February of 1980—when a new transmitting station is scheduled to open in International Falls, Minn., for the Great Lakes region—Loran signals will radiate

through about two-thirds the land area. By that time, Capt. Mohin estimates, about 95 percent of the United States population would be able to tune in Loran C near where they live.

As demand for the Loran C sets increases, he says their price should drop. Mohin estimates that the price of a receiver could drop to around \$500 over the next several years.

Meanwhile, researchers have been testing Loran C applications on land. The consensus of those we talked to: Despite the malfunctions,

Loran C frequently can place you within 300 feet of where you want to be. Under ideal conditions, Loran in your car could tell whether you were parked by the front or rear doors of your house.

The idea of Loran on land isn't new. John M. Beukers, president of a laboratory in Pennsylvania specializing in Loran equipment, says he's been building Loran units to track weather balloons over land since 1964. The balloons carry a Loran C receiver and a radio transmitter to send coordinates to ground tracking



Texas Instrument's TI9000A is a programmable Loran C receiver which can track up to four secondary stations. It will display any one coordinate or up to four in sequential order via computer memory.

stations. All a weatherman has to do after sending a balloon aloft is tune into the transmitter's frequency and plot the path from coordinates on a standard Loran chart. The system beats radar, says Beukers, because it doesn't require a tracking dish, and the accuracy—readings are within 300 to 400 feet of actual position—is better than radar.

Within the past year or so, the principle behind Beuker's balloons has been adapted for several experimental programs designed to track or locate motor vehicles. In Washington, D.C., for instance, the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA) have been following a white van equipped with Loran as it wanders all over the capital.

A receiver in the van converts the Loran coordinates to audio tones and feeds them to a tape recorder. Later, back in an office building, the tape is fed to a plotting machine and the coordinates are converted into a graphic display on a small green-tinted screen. The path of the van shows up as a line of numbers marking the course.

To make a complete picture of where the van went on its recorded run, researchers call up a pre-recorded map from a computer. Roads appear as white lines. Occasionally, the dot wanders slightly off the lines as if the van were careening through capital buildings. But the researchers find it easy to ignore such aberrations, usually caused by powerlines or other local, electrical "noise."

System is revealing

The system can be used to determine vehicle speed, total distance traveled, location at any time the tape was on—a complete inventory of where the van went and how it got there, ready for instant replay. In one previous test, Capt. Mohin said, it even revealed that a driver of the van the day before had made an

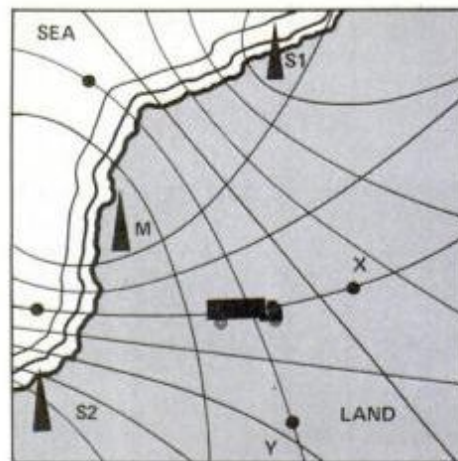
Loran C: Finding you wherever you may be

The Department of Defense developed Loran—the name is an acronym for Long Range Navigation—in the 1940s to help determine the positions of ships at sea.

The initial World War II system, called Loran A, was useless over land. Signals faded within a few miles of transmitting stations. Loran C, an improved and more accurate version dating from the late 1950s, operates at a lower frequency—100 kHz—and has a range today of hundreds of miles over land. Coverage has expanded with new chains in the Northeast and Southeast—with a Great Lakes chain scheduled for next year.

Loran A and C work under the same general principle. Loran receivers compare standard signals from different radio transmitters, two at a time. Suppose your Loran rig is a few hundred miles from a master station, M, in the drawing, and a secondary slave station, S2. Loran pulses travelling at known speed leave the master and slave stations and arrive at the receiver at different times. This time difference, measured by your set—in millionths of a second or microseconds—will be constant anywhere along a hyperbolic line, marked X.

Loran charts display a whole series of curved lines, each corresponding to a time-difference reading. The first reading alone isn't much help—it merely locates you somewhere on a long curve arcing between and beyond the stations. You need more information to pinpoint your location on the curve. Boatmen use depth sounding, sometimes, to locate themselves on a Loran A line. Loran C offers more precision—any area covered offers



at least two slave stations. Time difference readings between a master and a second slave station, S1, locate you on one of another set of hyperbolic lines. Determine your position by following the second line on a chart (line Y) until it meets with the line from your first reading.

The time-difference readings for Loran C are expressed by six digits, down to a 10th of a microsecond, like 14876.4. Numbers like these, of course, won't be of much help to the average motorist who wants to know his position without having to stop and pore over a set of Loran charts.

But today, there are microprocessors which will be able to convert Loran coordinates into other data, more easily used—such as Latitude and Longitude readings.



Teledyne's Loran C receiver can automatically track and display two signals.

illegal left turn.

Another project during the past year, in Tennessee, has collected data on the use of Loran in 13 highway patrol cars. The \$3000 Teledyne TDL-701 unit fits unobtrusively under the dashboard of a police car and pulls in Loran signals from a yard-long antenna. The primary use for the sets is accident site location to improve road safety.

Accurately recording the site of an auto accident can help prevent future mishaps by pinpointing engineering problems in roads, such as bad curves or misleading signs. But frequently today, according to Prof. Paul R. Tutt at the Transportation Center of the University of Tennessee, police at the scene of an acci-

dent record "guesstimates," or jot down ambiguous notations such as "near the big oak tree." "Often there's more than one big oak tree," Prof. Tutt pointed out. Snowplows knock down road markers. Highway names change with the political breezes.

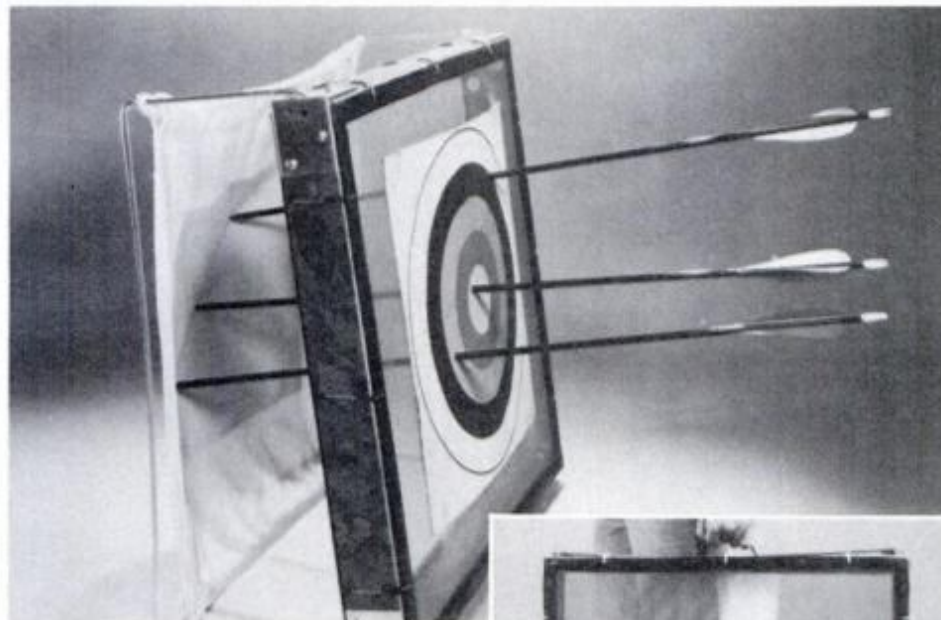
Aid to census takers

Another use for Loran C might be to aid census takers. Suppose you're a U.S. census taker operating in rural farmland. You've got several problems, a census bureau source explained. "A rural post office box and a house may be two different things," he said. "Rural delivery route numbers don't necessarily go in sequence." Sometimes census takers can't even find signs to identify road intersections, much less homesteads.

Enter Loran. Census vehicles equipped with receivers would let census takers record the location of the front porch of a house after they have finally found the farm. Future census takers would then find it much easier to drive back to the same front porch. Using

(Please turn to page 144)

IT'S NEW NOW



On target

Arrows shot even from a compound bow are repeatedly stopped by the nylon mesh of the Promat Archery Target, says the manufacturer. All three models are of light weight and fold compactly for handling and storage. The frame parts, nylon mesh and woven backstop are replaceable. Promat I with 24-inch-square target costs about \$40, and weighs 11 pounds; the 36-inch model is about \$60 and 19 pounds. Impact Industries, 904 Sumner St., Wausau, Wis. 54401.



Hot stuff

Shake this pocket-sized bag a few seconds for instant heat that will last for at least four hours, according to the manufacturer. Two dry chemicals mix to produce temperatures up to 120° F. It's designed for camping, outdoor sports or emergencies. Hot-Z is priced at \$3 from Kolin Industries, Box 357NR, Bronxville, N.Y. 10708.



Winter skateboarding

Strap the two skis of the Snow Skate to the wheels of your skateboard and leave the streets far behind. The skis permit the same slalom, downhill and freestyle maneuvers on snow that you get from wheels while riding on asphalt or concrete, according to the manufacturer. Polystyrene skis and Neoprene straps that won't rust are secured to any skateboard with four noncorrosive pins.

The cost is about \$30 a pair from Pan Western Enterprises, 17985 Skypark Circle, Suite B, Irvine, Calif. 92714.

Trolling plate

The Trolling Plate eliminates the need for an extra trolling motor. It is able to be installed in 20 seconds and slows your boat to 1 to 3 mph. The engine then runs about 200 rpm above idle. For Mercury and late model Johnson and Evinrude outboards, it sells for \$25 to \$50, depending on engine size. Kader's Machine Shop, 464 East 33 St., Erie, Pa. 16504.

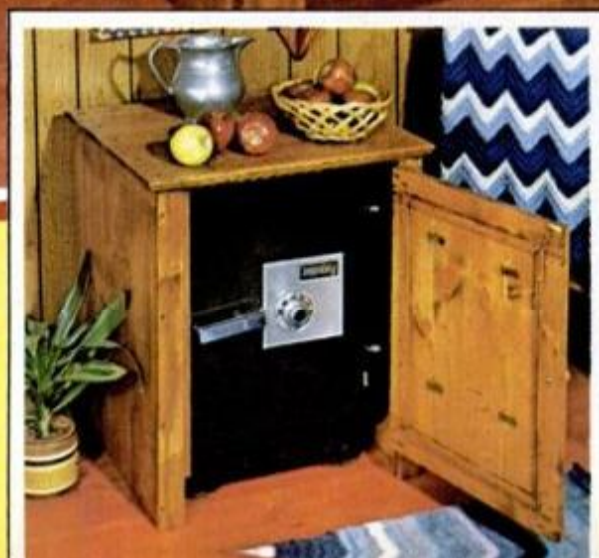


Instant Kodak back

This motorized instant film back is Kodak's first instant photography product for professional use. It adapts Graflok back-equipped 4x5 cameras and other photographic recording equipment to use Kodak PR10 instant print film. Applications of the unit are primarily commercial or industrial. The film back lists for \$100; optional a.c. power supply is available for \$50. Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650.



Would you believe that the handsome Colonial cupboard above houses a safe? When door is swung open (right), Sentry's Standard is revealed inside. The safe's door swings within the space created when cabinet door is open fully.



Protect your valuables in PM's colonial cabinet

We picked a safe that gives security from fire as well as theft. By building our cabinet, you can keep it in the room of your choice.

by Harry Wicks HOME AND SHOP EDITOR

This time of year, both home fires and burglaries make a sharp swing upward.

Look carefully around your home, and you will quickly realize that you have many items worth protecting. Electronic equipment, cameras, TV sets and other large items need protection from burglars. But, be aware that you have other possessions that need protection from an even more insidious enemy—fire. By filing valuable papers, deeds, insurance policies and the like in a safe with a fire rating label, you will be assured of having those documents on hand should fire strike your home.

To make a safe acceptable in any room, we created this colonial cabinet with its handsome raised panel door. The most basic construction techniques are used throughout.

Our cabinet is sized to suit Sentry Standard safe model S-3, manufactured by John D. Brush & Co. Inc., 900 Linden Ave., Rochester, N.Y. 14625. Available at department stores, home centers and the like, the safe sells for about \$184. Since the materials for the cabinet should run you less than \$30 (if you use No. 1 common pine as we did), your total investment for great peace of mind will be about \$215.

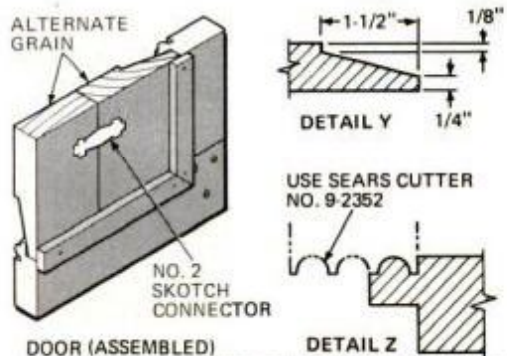
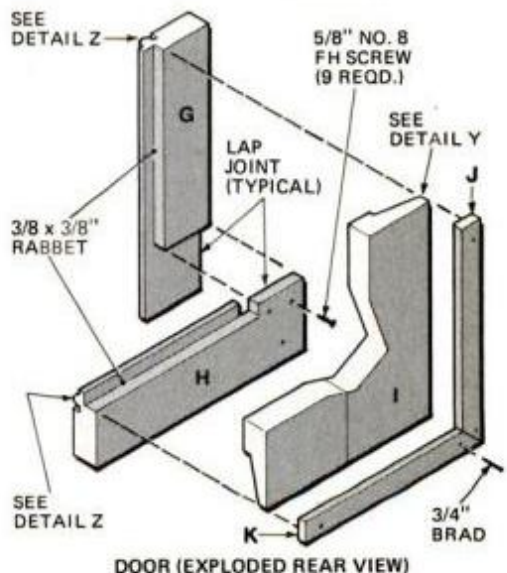
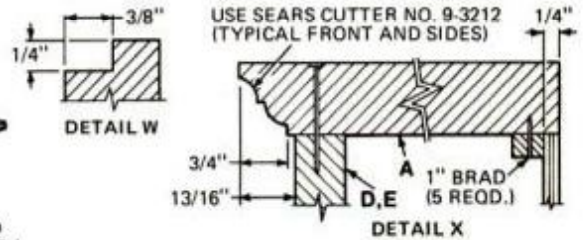
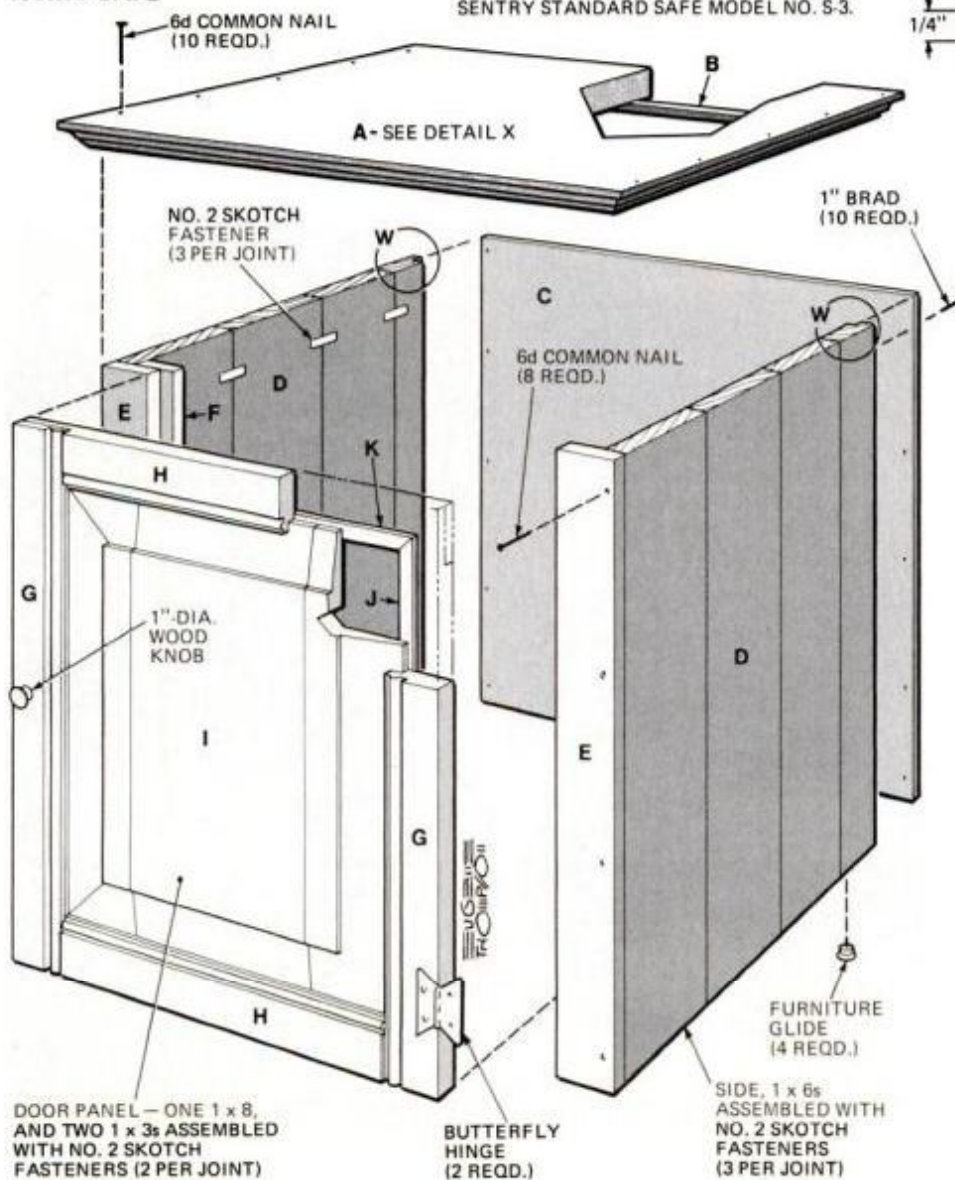
Start by cutting the boards to length for sides, top and door panel. Mark the pieces with the letter code (i.e., A, D, I) to avoid mixing the parts. Edges to be butt-joined must be perfectly square, so run the

MATERIALS LIST—COLONIAL CABINET

Key	Pcs	Size and Description
A	1	1 1/4 x 20-9/16 x 21 1/8" pine (top)
B	1	1/4 x 1/2 x 18 1/4" pine (cleat)
C	1	1/4 x 19 1/2 x 24" plywood (back)
D	2	1/4 x 19 x 24" (side)
E	2	1/4 x 1-15/16 x 24" (stille)
F	1	1/2 x 1 7/8 x 20 3/4" (stop)
G	2	1/4 x 2 x 21" (door stile)
H	2	1/4 x 2 1/4 x 16 1/4" (door rail)
I	1	1/4 x 13 x 17 1/2" (door panel)
J	2	1/4 x 1/2 x 18" (door batten)
K	2	1/4 x 1/2 x 13 1/2" (door batten)

HOME SAFE

NOTE: CABINET IS SIZED TO SUIT SENTRY STANDARD SAFE MODEL NO. S-3.



boards through a combination blade on your table saw if they're not. Lay out boards for each section to get the most pleasing grain appearance. Then, flop the boards so they are inside surface up. Apply a light coat of carpenter's aliphatic resin (yellow) glue to mating board edges. Let glue air dry for a few moments, then press board edges together. Permanently fasten boards, using No. 2 Scotch Connectors as shown. Clamp the boards tightly together before driving the connectors home. When all boards are joined, there may be a tendency for the section to curl. If so, flop the workpiece, wipe excess glue from joints with a water-dampened cloth and set heavy weights on boards overnight.

The decorative edge on the top's front and side edges is made with a molding cutterhead on the table saw. Push the top through to cut the end grain edges first and finish with the pass for the front edge. The back edge is not shaped. Sand the top smooth, dust and set aside. Next, finish the sides. Check length and width measurements and make sure both sides are identical. Using the

(Please turn to page 144)

BURGLARY PREVENTION THAT DOESN'T COST A CENT



There is a house break-in about every 12 seconds in the United States. By observing a few rules, however, you can lower the odds of your house being the next victim:

- Before leaving your home, make sure all doors are completely secured.
- Check seldom-used entrances, such as basement and porch doors regularly.
- Check locks on other possible access ways, such as basement vents, skylights and accessible windows.
- Close your garage door when you leave your home.
- Keep plantings near windows trimmed so they won't screen intruders.
- Leave a couple of lights on when you go out in the evening—but not in an obvious spot like the front window.
- Don't put identifying name tags or addresses on your key sets. They may be picked up by a burglar.
- When leaving a key for a friend or family member, don't hide it in an obvious spot, like under the doormat or in the mailbox. You should leave it with a trusted neighbor, if possible.
- Leave only your car ignition key at parking lots and auto repair shops. Lock your glove compartment.
- Store tools and ladders under lock and

key to prevent burglars from using them.

- Have a locksmith change keys on all locks when you move into a new home.

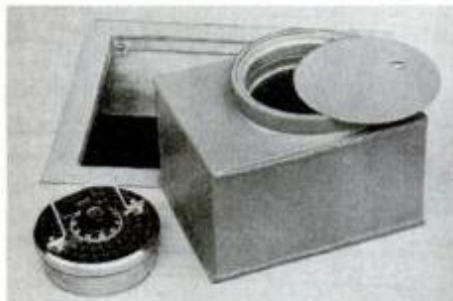
Going on vacation?

- Only tell those people who *have* to know about it.
- Do carloading out of sight of passers-by—in the garage or behind the house.
- Stop all deliveries and have a friend pick up your mail.
- Ask a neighbor to keep an eye on things.
- Tell the police; ask them to check your property occasionally.
- Don't leave your house looking empty or deserted. Draw open all the curtains and blinds slightly.
- Don't hide valuables in your bedroom, where many burglars look first.

Be a good neighbor

Respond to alarms and suspicious events. If a stranger knocks at your door and asks for someone you've never heard of when you're at home, report the occurrence to police right away. Note his description and, if he has a car, his license plate number. It may just be enough information to solve or prevent a burglary.

FLOOR SAFE WITH CONCRETE JACKET CAN'T BE CARRIED AWAY



To install rectangular floor safe (above) cut a hole between floor joists 2 to 3 in. larger than the safe on all sides.



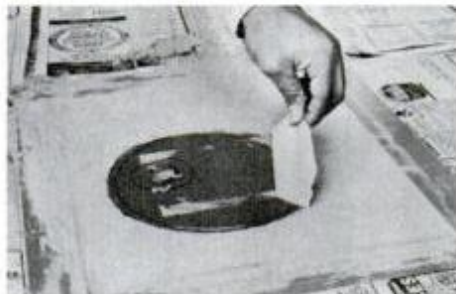
Fasten the basket made from metal lath to joists with 1 3/4-in. roofing nails. Provide nailers at the ends for added support.



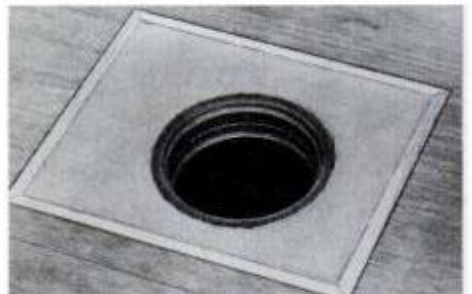
Tape lid upside-down to neck of safe. Trim off the excess tape hanging beyond circumference of neck with a utility knife.



Use a straight piece of 1x3 to screed topping cement level prior to smoothing it with a trowel. Newspaper protects floor.



Before topping cement dries, soak up any excess moisture, then pull away masking tape to form a neat edge around neck.



Do not place door in neck of the safe until the concrete is dry. The locking mechanism must be kept absolutely dry.

Before laying out the hole for a floor safe, check to be certain that no cables or pipes under the floor will interfere with your installation.

Make the cuts with a heavy-duty sabre saw, using a tacked-down straightedge as a guide. Next, nail a metal-lath basket to joists

and line its inside with 15-lb. felt. Add 1x3 frame inside opening, if desired.

Proceed to partially fill the basket with concrete and install the safe with the lid taped on. Level the top of the neck to the existing floor, then fill in around the safe with concrete to 1/2 in. below the neck top and allow it to set.

Finish with topping cement, smooth and level.

The rectangular safe used in our installation was a 67-lb. beauty that retails for \$224. The clear door opening is 6 1/2 in. For your nearest distributor, write to Major Safe Co. Inc., 3600 East Olympic Blvd., Los Angeles, Calif. 90023.—J.P.

17 low-cost ways to burglarproof your house

It's not hard to make would-be intruders think twice about breaking into your home.

by Rosario Capotosto

It makes no sense to spend a couple hundred dollars to install the latest in key cylinder technology in your door locks when all a burglar has to do is kick in an air conditioner and climb in through your side window. Little things, like the security tricks that follow, can often make the difference between a successful break-in and a foiled attempt. Although they won't make your house absolutely burglarproof, they will beef up your protection. The tighter your security, the more likely an intruder is to be deterred. As unneighborly as it sounds, most of us would much prefer to have a thief turn away from our own home to look for easier pickings down the street.

Little things you can do

The simple steps shown in this article can be taken right now to elim-

inate, or at least strengthen, weak links in the perimeter defense of your home. Many will cost you almost nothing and most of the required materials for these projects can be found in the typical home workshop.

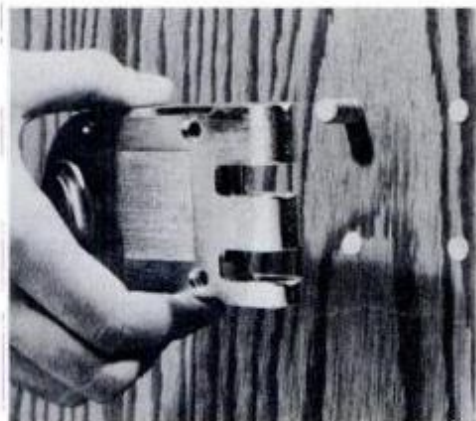
The projects fall into three basic categories: simple locking devices, lock reinforcement and improvement, and acrylic plastic shields. We've also included a rudimentary alarm that may make a thief think twice before ripping you off. Many of the principles involved can be modified to meet the requirements of your situation. The hints may also give rise to solutions that you can develop on your own.

One caution to keep in mind: Never install a device that will in any way hamper your exit during a fire or other emergency. **PM**

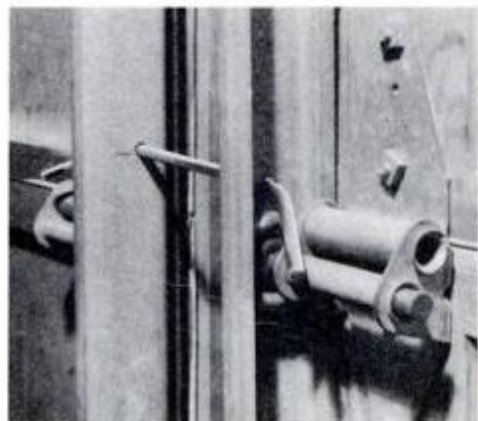


The standard lock strike is usually light-gauge metal "secured" to a softwood jamb with a pair of $\frac{1}{2}$ to $\frac{3}{4}$ -in.-long screws. Installation of a maximum-security strike like this one prevents easy entry. It's oversized in length and thickness and is anchored with four hefty screws which engage the 2x4 stud behind the jamb.

To install, temporarily remove the doorstop molding to permit routing or chiseling the necessary recess. The doorstop will conceal the long portion of the strike when it's reinstalled. A large hole at the center of the oversize strike allows you to drive a nail through the stop into the jamb to prevent an intruder from using a plastic card to retract a spring-latch type of lock, a favorite technique with burglars.



No matter how good the lock, it's only as strong as the grip of the screws holding it in place. Most doors and jambs are constructed of softwood, which has poor screw-holding ability. To provide a better anchor for screws, counterbore the screw holes and insert hardwood dowels. Use $\frac{3}{8}$ -in.-dia. spiral-grooved dowels and resorcinol glue. Note that the door shown in the photo has a plywood veneer, but the interior consists of soft ponderosa pine. This is typical of many doors—and one reason a large number of homeowners have decided to replace wooden doors and jambs with steel units.

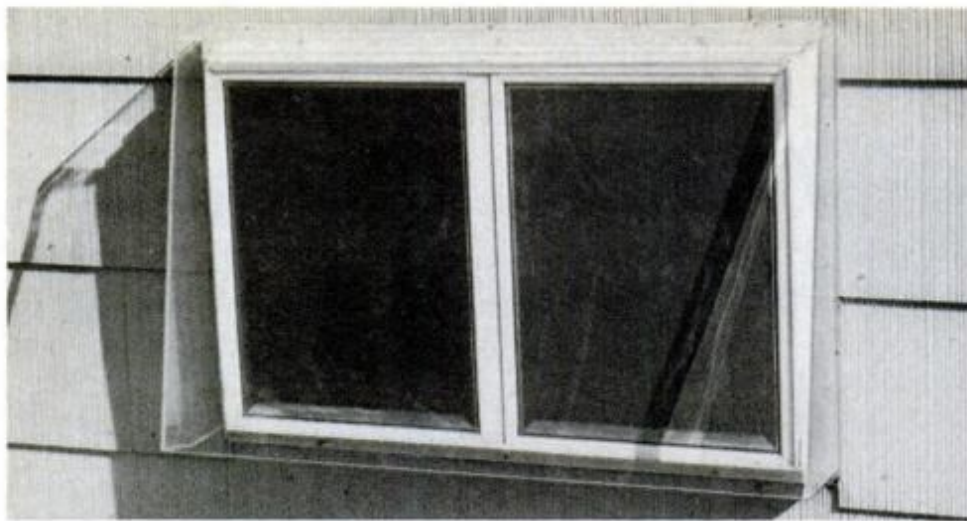


Garage door locks are easy to pick because builders usually use the cheapest-quality locks money can buy. It does a thief no good to pick your garage door lock, however, if you prevent him from raising your overhead door with this foolproof method: Drill a hole in the track slightly above one of the rollers and insert a $\frac{1}{4}$ -in.-dia. steel rod to act as a stop. For a double door, drill the hole in both tracks and use a longer rod. A slight downward bend at each end will keep the rod in place.

Caution: Do not use this method with automatic-lifting doors; it can damage the lifting mechanism.



One of the easiest entries for a burglar is to push back a spring-latch lock when the doorjamb is the nonrabbeted type. To do it he slips a thin piece of plastic such as a credit card beneath stop and past door edge (arrow). To prevent such entries, drive four or five 6d finishing nails through the stop in front of the strike plate hole. Now a card can't be slid under stop. Use pilot holes to avoid splitting the stop and set nailheads below surface and fill with plastic wood filler to conceal nails. If greater strength is desired, substitute $1\frac{1}{4}$ in. No. 8 fh screws for the nails and insert them in counterbored holes.



Basement windows are frequently left open during the day for ventilation. Burglars know this and often gain entrance here. Install a Plexiglas shield/vent over the window to increase your security. Form the shield from a single 1/4-in. sheet. Make the necessary bends with a strip heater. A

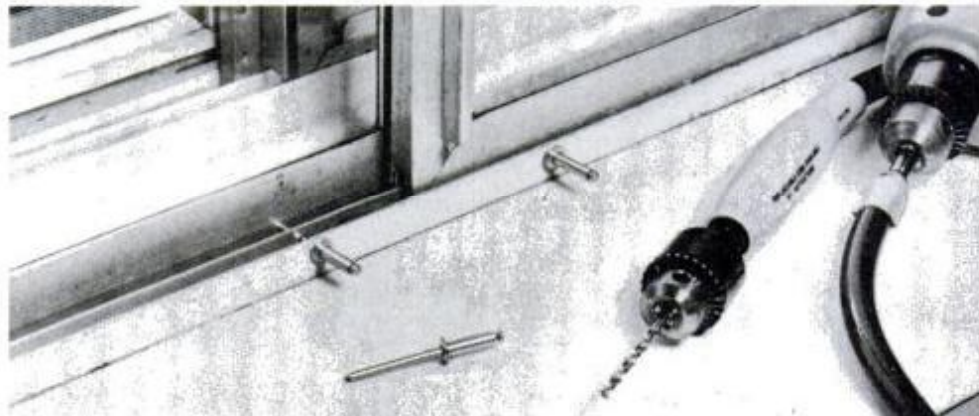
homemade strip heater can be made with a Rohm and Haas heating element available at some hardware and most plastic supply outlets. Plans for the heater are provided with the heating element. To install, bore pilot holes for one-way screws in the window frame.



Burglars may try using a keyhole saw to cut out a lock which they cannot pick. 1/4-in. steel rods inserted through the edge of a door, above and below the lock, will discourage such attempts. Do not use glue to set the rods—leaving them free to rotate will make sawing even tougher.



Door chains are of limited value when installed with the small screws often supplied with these devices. Note how much larger a screw can be used without rebor-ing the original holes in the hardware. Caution: Chains are secondary locking devices meant only to let you interview a stranger without unlocking door completely.



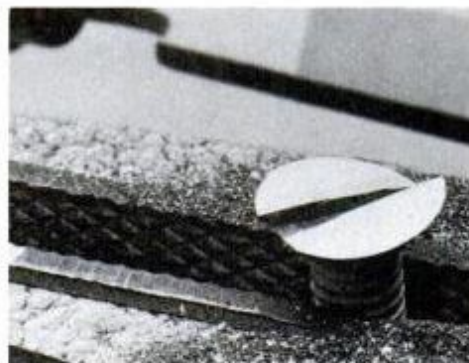
Sliding aluminum windows can be opened if a burglar pries apart the typically flimsy framing which usually houses equally-flimsy locks. Drill a hole through the track and window frame to allow insertion of a steel pop rivet. The pop rivet pin locks the sliding panels in a closed-position. Use two rivets at the bottom of each panel. An additional

hole in the track will let you leave the window locked but slightly open for ventilation. If window ledge is deep, use a drill bit extension or a flexible shaft to permit drilling close to the edge. Heads of rivets are easy to grip and can be quickly removed from the inside in case of fire or other emergency that requires quick exit.



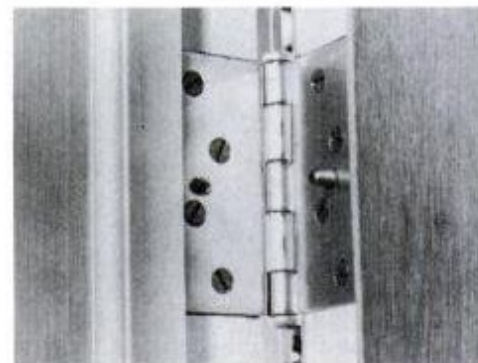
A pair of sturdy screw eyes installed on both sides of a door frame will allow the insertion of a 1/2-in. steel rod or pipe across the door. This is a simple, positive method of keeping out a lock-picking burglar.

Important: be certain that the bar is easy to remove and allows quick exit in emergency situations. Use at least 3-in.-long screw eyes anchored securely to 2x4 door frame members. You should find studs to fasten into between 2 and 5 in. from the edge of the door.

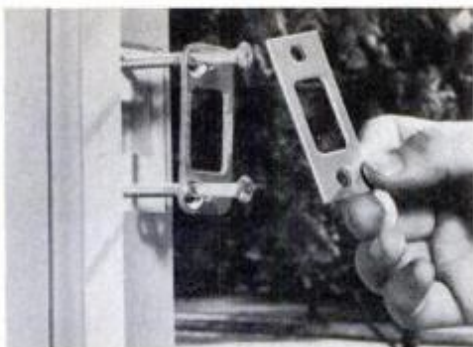


Nonretractable, one-way screws are often hard to find or not available in the size you require. You can easily make your own screws by filing or grinding two slants as shown above. Rubber or wood pads in the vise will protect screw threads.

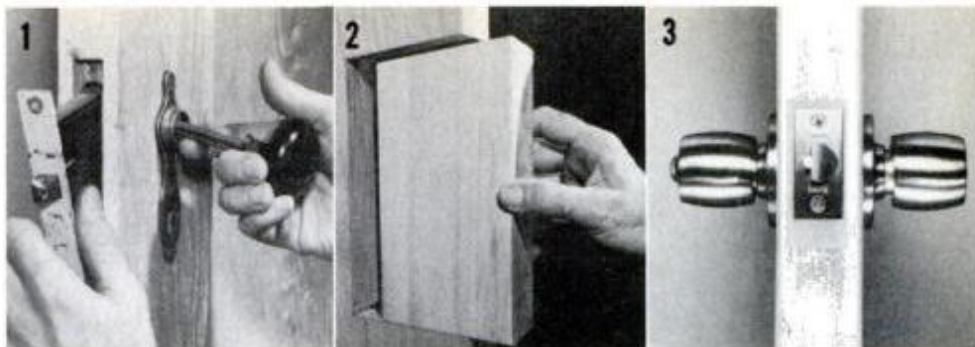
Use this type of screw to attach any hardware or ornamentation exposed on the outside of the house, but keep in mind that removal of the hardware will be practically impossible without drilling out the screw or grinding off the screw head.



Entrance doors that open to the outside and have removable hinge pins are a welcome sight to burglars. To prevent one from removing the pins and lifting out the door, drill a hole in one hinge leaf and insert a 1/4-in.-dia. steel pin. Allow it to protrude about 1/2 in. Then drill a mating hole through the opposite leaf to receive the protruding pin. The hole should be slightly elongated to provide clearance for the pin as it swings. Add pins to all three of the hinges that hold a typical exterior door.



This supplementary, heavy-duty strike is sized to fit under the standard strike for a key-in-knob lock. The off-center holes permit the use of heavy, 3-in.-long screws which penetrate well into the stud behind the jamb. A second pair of holes (partly obscured) allows the original strike to be reinstalled with the original screws. Deepen the mortise with a chisel to accommodate the extra thickness.

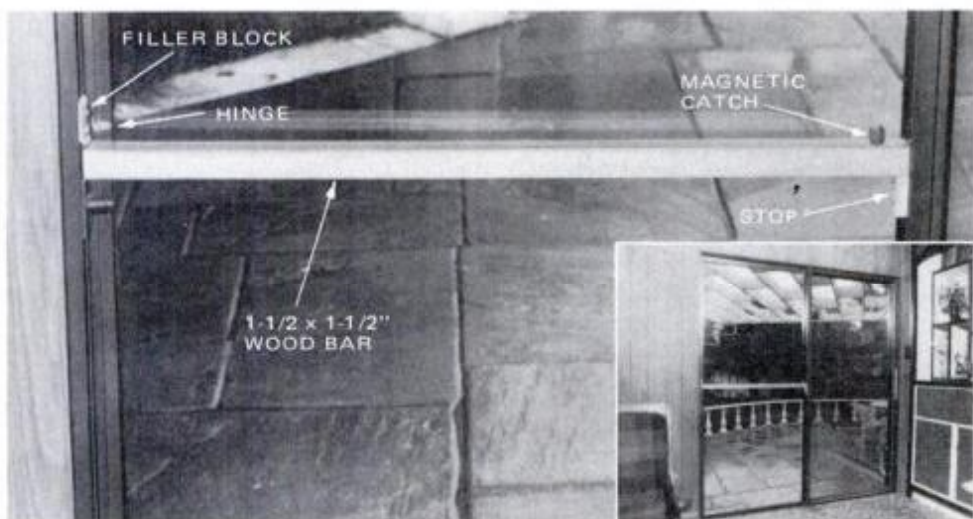


Old fashioned, easy-to-pick lever-tumbler locks (photo 1) can be replaced with modern cylinder type or latch-and-deadbolt locks by cutting out the mortised section and replacing it with a block of solid wood called a Dutchman (photo 2). Taper the cut-out and mating block slightly as shown.

Glue the block in place with resorcinol glue, applying pressure with a bar clamp between the strike and hinge edges. The

keystone shape transmits clamp pressure to all three sides—which would be impossible with a square insert. No nails or screws are necessary, but if you use them, be sure to set or counterbore so heads are below the wood surface.

The surface of the door can be left as it is or faced with panels (photo 3), depending upon the original thickness of the door into which the new lock is fitted.



Sliding patio doors are usually equipped with flimsy locks which can easily be sprung with a hefty screwdriver. A stout length of wood wedged between the frame and the movable section will prevent the door from being opened even if the lock is jimmied.

Cut a piece of 1½-in.-square stock to fit

the space between the door edge and frame. Attach it to the jamb with a hinge. Then install a wood block stop on the door to hold the bar horizontal. Use a magnetic catch to keep the bar up and out of the way when not in use. Filler blocks fit into the jamb recess allow flush mounting of the hinge and catch.

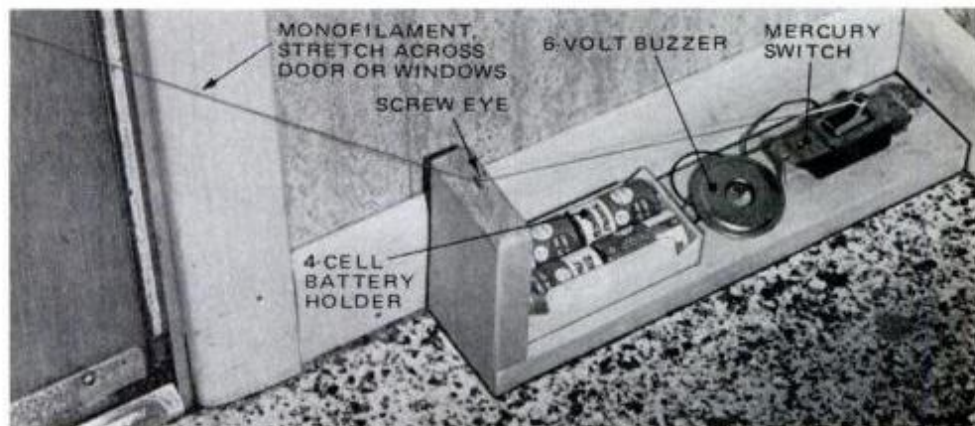


Police statistics indicate that many burglars push in first-floor window airconditioners to gain entry to houses. A ½ x ¾-in. steel bar (you can also use ½ x 1-in. aluminum stock), secured across the top and bottom of the air conditioner with lag screws, will prevent such break-ins. Windows are rough-framed with double or triple studs, so you can use two 5/16 x 3-in. lagscrews at each end of the brace for a solid grip.

If the design of the air conditioner permits, it's also a good idea to drive screws into the housing to prevent removal to the outside as well. Most modern airconditioners, however, are housed in flimsy plastic that doesn't allow solid anchoring. You may have to settle for the method illustrated above.



Add a piece of sheet plastic on the inside of a glass paneled door (or front door's sidelights) to keep burglars from getting in by smashing a panel. Acrylic plastic is unobtrusive yet cannot be broken quietly, even with a hammer. Cut and drill the plastic to suit your opening, using ordinary woodworking tools. Be sure to use an ample number of roundhead screws with washers to secure the plastic.



You can make a rudimentary buzzer alarm to scare off a burglar for about \$6. The parts required are stock items which can be purchased at hardware stores and radio supply shops.

The principle is simple: a length of monofilament fishing line is stretched across an opening so that, if deflected more than an inch, it will trip a mercury switch. The switch completes the buzzer and battery

circuit, thereby turning on the buzzer alarm.

To attach the line to the switch, drill a small hole in the switch lever. Some mercury switch levers move more readily than others, so check this out. Use one that trips with very slight pressure. The 6-v., buzzer, No. 273-049, is available at Radio Shack, as is the battery holder, which is listed as No. 270-390.

16 products that make it tougher for burglars



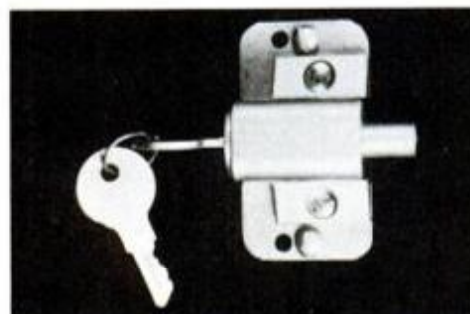
Security-3 system (\$195 to \$370) uses steel door, steel-reinforced frame, latch, three deadbolts and self-locking hinges. Inside knob disengages all locks. Pease Co., 7100 Dixie Hwy., Fairfield, Ohio 45023.



Easy-to-install, one-way, all-brass viewer has a fish-eye lens, lets you see who's at the door. Fits doors up to 2½ in. thick. Costs \$3.90 from Hager Hinge Co., 139 Victor St., St. Louis, Mo. 63104.



Chain-Guard deters intruders with knob-ring design and casehardened chain secured to jamb with a 3-in. lagscrew. Price is \$3 ppd. Better Way Products, 21330 Center Ridge Rd., Rocky River, Ohio 44116.



Patio door bolt, mounted on edge of inside sliding panel, deadlocks to outside panel. Provides locked ventilating position, if desired. At retail stores for \$6.70. Stanley Hardware, New Britain, Conn. 06050.

It's a good bet that a professional burglar can get into the average home in less than 10 seconds. There are, however, many products to help you slow him down long enough to discourage him or maybe even scare him away.

Start at doors, where burglars usually try first. Most wooden doors can be pried open in a few seconds with a claw hammer. If you have an extra two or three hundred dollars, spring for a steel-encased door with a steel or steel-reinforced wood frame. Since steel doors insulate better, you'll recoup some of the expense in saved heat.

Second in importance to the door's composition is its lock. If yours is a simple key-in-knob, spring latch type, it is only slightly better than no lock. Basic security requires that cylindrical or tubular locks at least have a deadlocking latch bolt—a small auxiliary plunger that locks

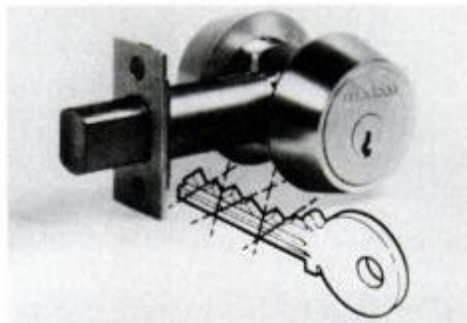
the latch in place. Even better would be the addition of a deadbolt lock. Choose one that features a hefty-sized bolt (one that has plenty of extension on both sides of the lock faceplate). Many bolts have concealed, hardened steel rollers to make sawing nearly impossible. Also look for beveled, wrench-resistant cylinder guards.

Caution: Although double-cylinder deadbolts (locks which need keys on both sides of the door) are helpful on doors with vulnerable glass panels, this type of lock should be used cautiously. In a panic situation, such as a fire, the few seconds lost fidgeting with a key might be fatal.

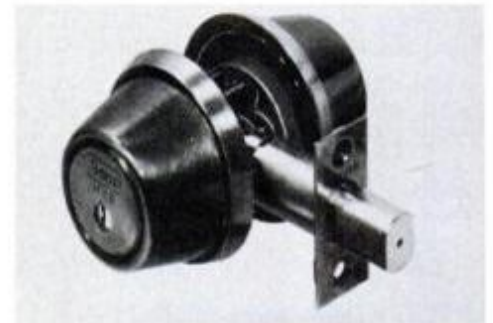
Use your common sense when purchasing other security aids like chain locks and door viewers (peepholes). A chain's primary purpose is to stop the unexpected rush of an in-

(Please turn to page 152)

Door security hardware



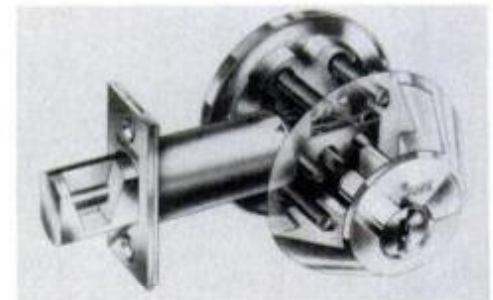
New high-security deadbolt lock by one of the leaders in pick and drill-resistant cylinders has 2-in.-long, hardened steel antisaw bolt with 1-in. bolt throw. Sells for \$48 to \$63. From Medeco Security Locks Inc., Box 1075, Salem, Va. 24153.



Cylinder of Sears's MKS match key system lets you reprogram your lock or locks to any of 1000 combinations. It can be used with this heavy-duty deadbolt lock or other type locks. Replacement cylinder costs \$6.99; with deadbolt, \$15 to \$17.

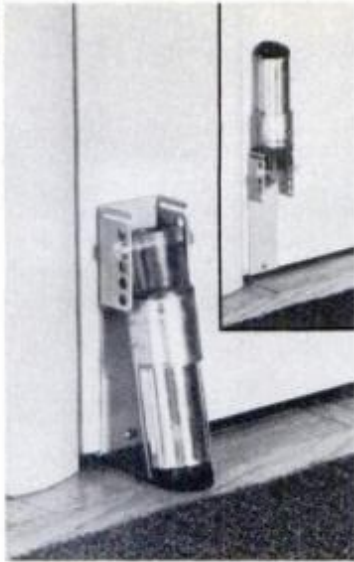


Kaba 8 high-security cylinders deter lock pickers. Key with precisely-milled dimples operates lock cylinder either way it's inserted. Mortise or rim cylinders with two keys, about \$23. By Baldwin Hardware, 841 Wyoming Blvd., Reading, Pa. 19603.



B500 Superbolt has 1-in. throw and bronze alloy security cover that's wrench-resistant and anchored with hardened steel bolts. From locksmiths at \$34 for single cylinder. Schlage Lock Co., 2401 Bayshore Blvd., San Francisco, Calif. 94134.

Point-of-entry alarms



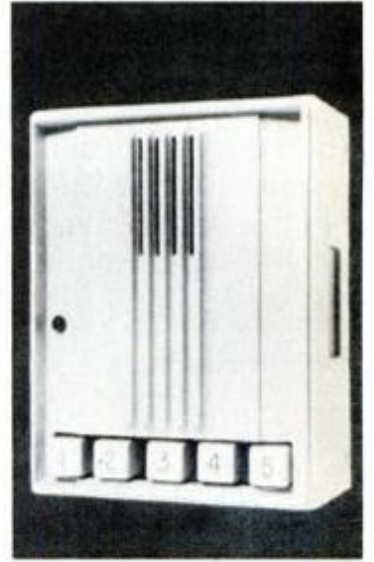
Combination alarm/door stop powered by aerosol container emits a 90-decibel blast when would-be intruders attempt to force door. Priced at under \$10. Sunbeam Appliance Service Co., 5300 West Roosevelt Rd., Chicago, Ill. 60650.



Pre-intrusion alarm is designed to scare off an intruder before he makes a serious attempt at entry. The battery-powered alarm sounds for as long as the knob is touched. Retail for \$24.95. Unisen Inc., 17951 Sky Park Circle, Irvine, Calif. 92714.



A battery-operated Entry/Alert sets up a detection field in and around a metal doorknob. Unit is ideal for travelers, as well as homeowners and apartment dwellers. Retail price is \$19.95, from Entry/Alert, 6241 Yarrow Dr., Carlsbad, Calif. 92008.



An easy-to-install, battery-operated Burgalert is armed by entering five-digit code and disarmed by re-entering code. May be used at door or window. Omtronics Manufacturing Inc., 910 Skokie Blvd., Northbrook, Ill. 60062. About \$40.

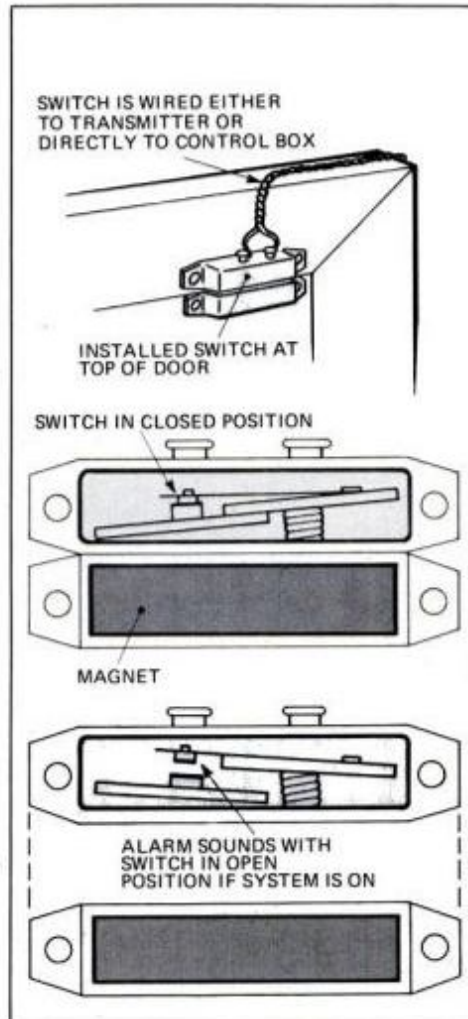
Home alarm systems



Easy-to-install wireless system (\$199) provides you with two magnetic switches, two transmitters, a smoke alarm and a receiver/alarm control box. Extra components available. Chamberlain Manufacturing Corp., 845 Larch Ave., Elmhurst, Ill. 60126.



Lifesaver IV includes door and window alarm/transmitter, ionization smoke detector and a.c.-powered receiver. Alarms transmit to receiver up to 200 ft. away. About \$200. Golin Communications, 500 North Michigan Ave., Chicago, Ill. 60611.



When magnetic detection device is tripped, protective circuit is broken, causing a nearby transmitter to signal a remote receiver (in wireless systems) or else causing a relay in control box to latch shut and sound alarm (in hard-wired systems).



Guard Site uses radar to protect area in home through which intruder must pass to get to your valuables. To install, simply plug it in and connect bell. About \$200, from Casady Engineering Assoc., 560 Alaska Ave., Torrance, Calif. 90503.



Easy-to-install Watchman system features a two-stage alarm. Audible beep sounds first. Then, unless it's deactivated due to false alarm, a loud 6-in. bell rings. Bell housing is tamperproof. About \$200. Orient-Martin Inc., Concord, Calif. 94520.

Give your prefab fireplace

Using conventional materials you can enclose a fireplace with this handsome cabinetry in just one weekend.

by Harry Wicks and Joseph R. Provey

Today's fireplace doesn't have to sit with its back against the wall. Prefabricated units can be used in new and creative ways—the prefab fireplace displayed in PM's Year-Round Vacation Home (page 106, Sept. '78) proves the point. The design problem in this house was to make the most of the available living space. Architect Ira Grandberg chose to maintain an open, spacious feeling in both the living room and snack area/dining room by separating the areas with a low-profile, free-standing fireplace.

The fireplace and its surround visually distinguish one space from the other and effectively provide a degree of mutual privacy. At the same time they won't dead-end your vision or cramp your access to the other areas. For example, you can gaze across fireplace and snack counter and through the kitchen window beyond.

Choosing the right prefab

The easiest type of prefabricated fireplace to customize is a built-in model. This type is engineered for zero clearance—so that combustible materials can touch its sides, back and bottom without fear of fire. For our installation we chose a Preway unit called the Energy Miser that uses outside air for combustion and reheats and recirculates room air for added energy savings. The outside-air intake ducts, along with the bifold doors, cut down on the amount

of warmed air in the room being lost up the flue.

Depending on the size that's best for you, the cost of a prefab fireplace will range from about \$530 to \$620 from Preway, Inc., Wisconsin Rapids, Wis. 54494. These prices include air intake ducts. The chimney package and accessories (grates, blowers) are extra. The chimney kit costs about \$208.

Tips on installation

The first step in any fireplace installation is deciding where you want it. Don't put it where it will be in your way or disrupt convenient traffic patterns. Also, choose a spot that will give the most heat benefit. Ideally, as in our installation, a fireplace should be located smack in the middle of the most-used space on the first floor, or in the basement of your house. Since warm air rises, putting it near a stairwell provides you with

PM photo by Richard Garland



Handsome enclosed prefab fireplace serves as room divider. This design is by Ira Grandberg, AIA, and Robert Brooks.

a custom look

ready-made ducting to warm the upper floors. Another consideration is proximity to combustibles. Even with zero-clearance units, remember that the fireplace should be located so its opening is at least 30 in. from combustible furniture or walls. Finally, choose a spot where the chimney can be installed without cutting into your rafters or ceiling joists.

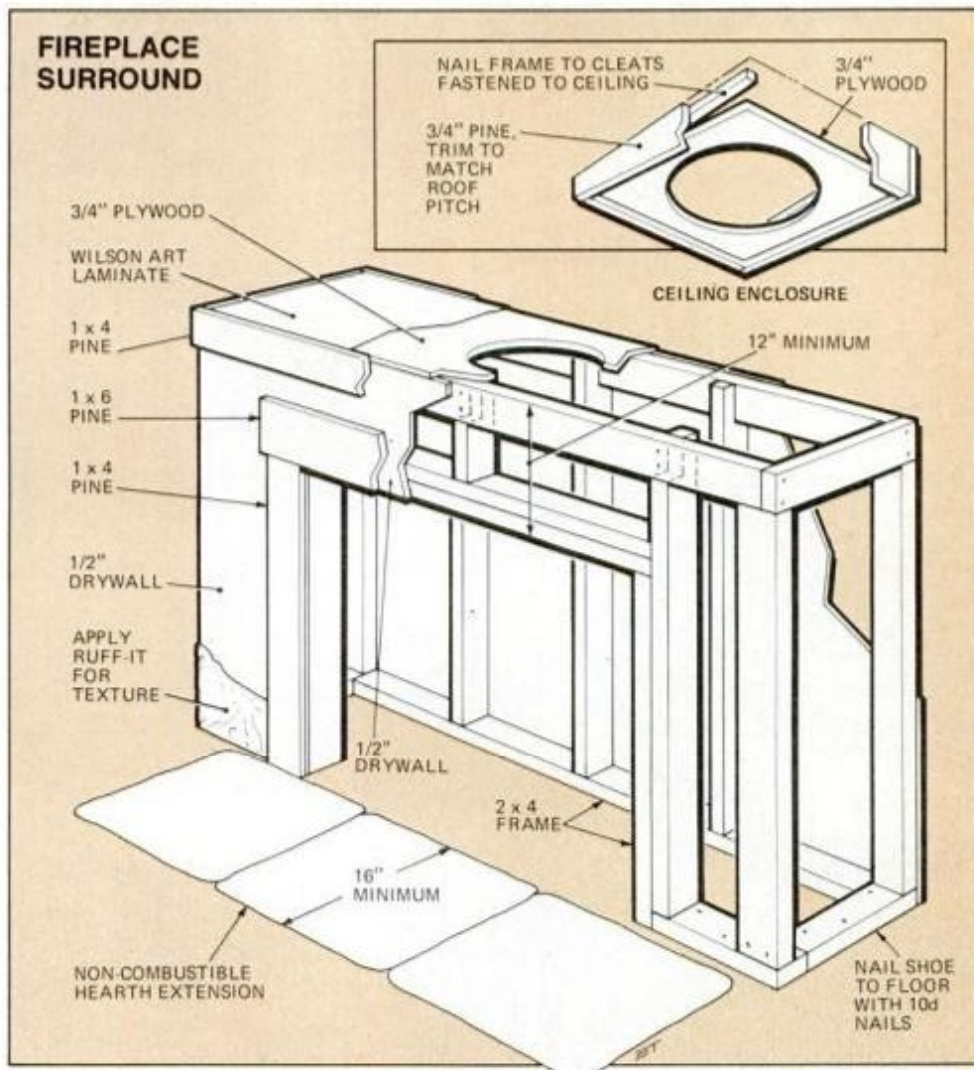
A do-it-yourself job

Installation of most prefab fireplaces is within bounds for any competent do-it-yourselfer. After you chose a location, position the fireplace and then use a plumb bob to mark the center point for the chimney opening on the ceiling. Push a wire marker through a hole drilled at the center point and check the space above the cutout to avoid cutting wires or plumbing above the ceiling. Then cut a hole in the ceiling to suit the chimney with a keyhole or sabre saw.

Fit the first section of triple-walled pipe onto the top of the fireplace. Then add sections as you continue toward the ceiling, rotating each section until seams are aligned. To support chimney at the ceiling penetration, use ceiling support box for free-standing fireplaces. Next, cut a hole in the roof and proceed to install the rest of the chimney, its flashing, storm collar and rain cap. The finished chimney must be at least 3 ft. above the high point of the roof cutout and at least 2 ft. above the highest point of the roof that's within 10 ft. of the chimney.

The air intake ducts to a unit like the Energy Miser must terminate outside the house. *Do not* draw air from the attic, other rooms or from the garage. Once the outlet positions have been located, cut the required holes for the combustion air ducts and connect the ducting to elbows fit into the stove.

Don't forget a hearth extension. It's an important safety feature that guards against errant sparks and embers from falling logs that might otherwise land on your rug and start a fire. The hearth extension should extend at least 16 in. in front of and at least 8 in. beyond both sides of the fireplace opening. It must be composed of a noncombustible material such as brick, tile, slate or concrete. It's a good idea to sketch floor plan and elevation



drawings of your proposed fireplace and chimney and bring them to your local building inspector when applying for your building permit. Also bring along all pertinent information about your stove.

Building the fireplace surround

The surround is basically a straightforward job of framing with 2x4s and skinning the framework with plasterboard. Start by laying out the walls for the surround in the spot you have chosen for the fireplace.

Next, you position your unit. Then precut all studs and plates to length as determined by your stove's base and height dimensions. Our unit required a 12-in. clearance from the top of the fireplace to the underside of the mantle. Be sure to follow your fireplace manufacturer's installation manual carefully for safety and efficiency.

Nail down the end soleplate first and then preassemble the front and back walls—and erect each as a sin-

gle unit. Nailing on the ends of the mantle framing and toenailing in the unnotched corner studs could come later.

Next, install the drywall and set the ringed nailheads slightly below the surface (i.e., dimple, but don't break the plasterboard paper). Tape and compound all joints and nail depressions.

You will require only one coat of compound if you plan to finish the surface with Ruff-It as we did. Once the plasterboarding is completed, nail on the plywood top—with the chimney hole cut out beforehand. Bond the high-pressure laminate to the plywood and trim around the mantle and the fireplace opening with 1x4 pine. Paneling, brick, stone or ceramic tile can also be used to finish off the surround with the look you desire.

Details for an optional ceiling enclosure are provided in the plans. You may want to use the trim faceplate provided with most chimney kits instead.

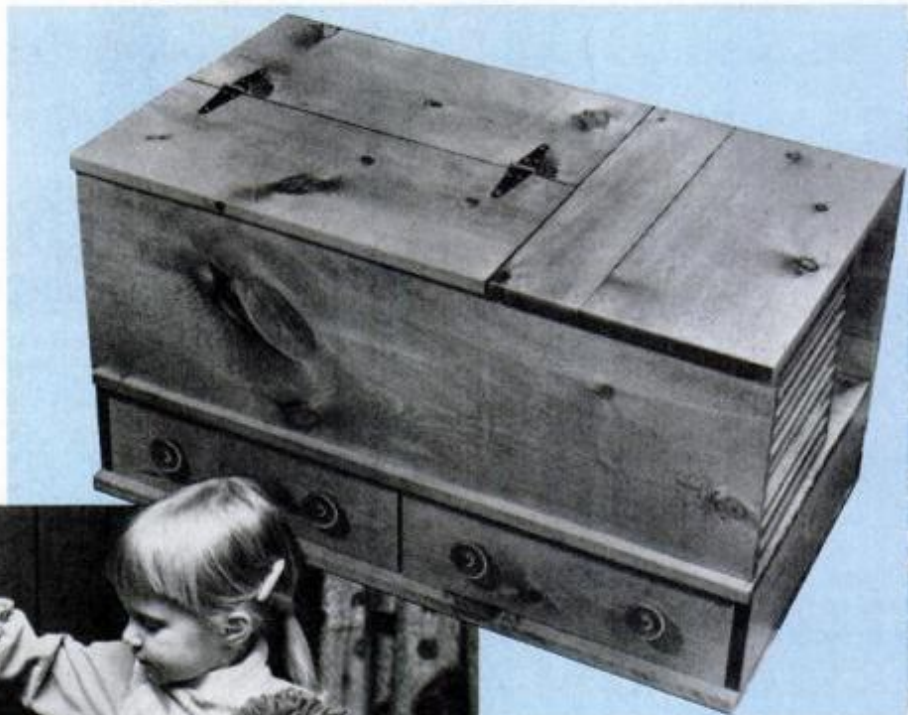
PM

Build this rugged colonial toy chest

Roomy, neat and attractive, this functional chest will provide years of service.

by Willard and Elma Waltner

You'll appreciate how many toys stay off the floor and out of your way when your kids use PM's colonial toy chest. Children love its slid-



Simple lines and stained pine boards give PM's toy chest an Early American look. When kids are grown, it can be used for blankets, other seasonal storage.



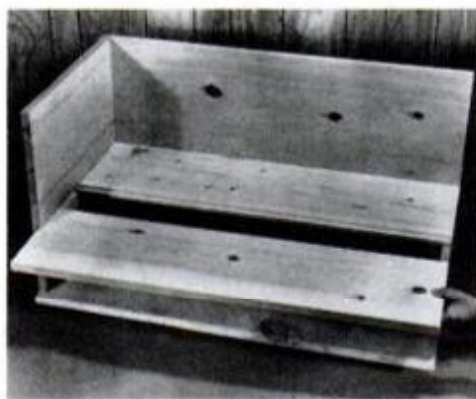
zles and game boards as well as space for oversized children's books. PM's colonial chest was designed by Anthony Epp.

Except for the drawer bottoms and the sliding shelves, which are made of $\frac{1}{4}$ -in.-thick plywood, the chest is built entirely from $\frac{3}{4}$ -in.-thick pine stock. To create the wide boards, edge-join 1x6 boards using lap joints. Use white carpenter's glue and clamp overnight.

Next, cut lumber to dimensions given in the materials list and drawing. Cut the groove in end piece (B) as shown. Nail and glue B to chest back (C). Turn the assembly upside down and nail and glue the chest bottom (A) to B and C. The front

ing shelves and spacious storage for all their toys and games. And with its compact size and fashionable design, the chest can be put to other uses when the youngsters are grown and gone.

The upper toy compartment is shallow enough so that a child doesn't have to dig deep to get the toy he wants. The half-lid top folds back on itself, decreasing the chance of its falling back down and slamming fingers. Two bottom drawers provide additional storage space, and an open compartment at one end has 10 sliding shelves for puz-



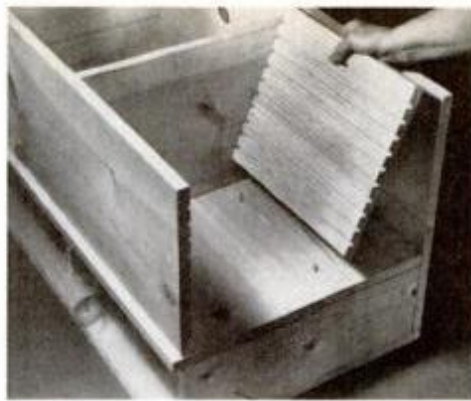
Shelf (F) between chest and drawer areas is let into groove ploughed in panel (B).



Use a dado head on a table saw to groove chest front piece (D) and divider (I).



Divider (H) is butt-joined to front and back of chest, held with nails and glue.



Install compartment divider (I) as shown here, using dowels, nails and glue.

edge of A should protrude $\frac{3}{4}$ in. beyond the front edge of B. Nail and glue the drawer compartment end (E) to A and C.

The toy chest bottom (F), which also functions as the top of the drawer compartment, slides into the groove in B as shown. Nail and glue F to B, C and E. The front edge of F should also protrude $\frac{3}{4}$ in. Next, abut the drawer compartment divider (G) as shown between A and F. Nail and glue G to A, C and F.

Cut 10 13-in.-long grooves along the inner side of front piece (D) and on one side of open compartment divider (I) as shown. These grooves will accommodate sliding shelves for game boards, puzzles and larger

nursery books. Some shelves can be removed to accommodate larger puzzles or game boxes. To cut the blind grooves to proper length on a table saw, mark an arrow on the wood 13 in. from the end. Place a piece of masking tape on the rip fence opposite the center of the saw blade or dado head. Then, with each pass, feed in the wood until the arrow just lines up with the tape.

Cut rabbet in D where it attaches to B as shown. Turn chest assembly upside down and fit D into position. Drive nails through F and D. Turn chest right side up and glue and nail B to D. Insert toy compartment end (H) and glue and nail to D and C. Glue and nail I in place. Nail on the

MATERIALS LIST—TOY CHEST

Key	Pcs.	Size and description (use)
A	1	$\frac{3}{4}$ x 19 $\frac{1}{2}$ x 36" pine (chest bottom)*
B	1	$\frac{3}{4}$ x 18 x 18" pine (end)*
C	1	$\frac{3}{4}$ x 18 x 36" pine (back)*
D	1	$\frac{3}{4}$ x 11 $\frac{1}{4}$ x 36" pine (front)
E	1	$\frac{3}{4}$ x 6 x 18" pine (end)
F	1	$\frac{3}{4}$ x 18 $\frac{3}{4}$ x 36" pine (toy compartment bottom)*
G	1	$\frac{3}{4}$ x 6 x 17 $\frac{1}{4}$ " pine (drawer compartment divider)
H	1	$\frac{3}{4}$ x 11 $\frac{1}{4}$ x 18" pine (toy compartment end)
I	1	$\frac{3}{4}$ x 11 $\frac{1}{4}$ x 13" pine (open compartment divider)
J	1	$\frac{3}{4}$ x 13 $\frac{1}{4}$ x 19 $\frac{1}{2}$ " pine (open compartment top)*
K	2	$\frac{3}{4}$ x 9 $\frac{1}{4}$ x 22 $\frac{1}{2}$ " pine (toy compartment lids)
L	10	$\frac{1}{4}$ x 10 $\frac{3}{4}$ x 13" plywood (shelves)
M	2	$\frac{3}{4}$ x 5 $\frac{1}{2}$ x 17 $\frac{1}{4}$ " pine (drawer fronts)
N	4	$\frac{3}{4}$ x 5 $\frac{1}{2}$ x 17 $\frac{1}{4}$ " pine (drawer sides)
O	2	$\frac{3}{4}$ x 4 $\frac{3}{4}$ x 15" pine (drawer backs)
P	2	$\frac{1}{4}$ x 15 $\frac{1}{4}$ x 17 $\frac{1}{4}$ " plywood (drawer bottoms)
Q	2	2"-diameter $\frac{3}{4}$ " pine (drawer knobs)

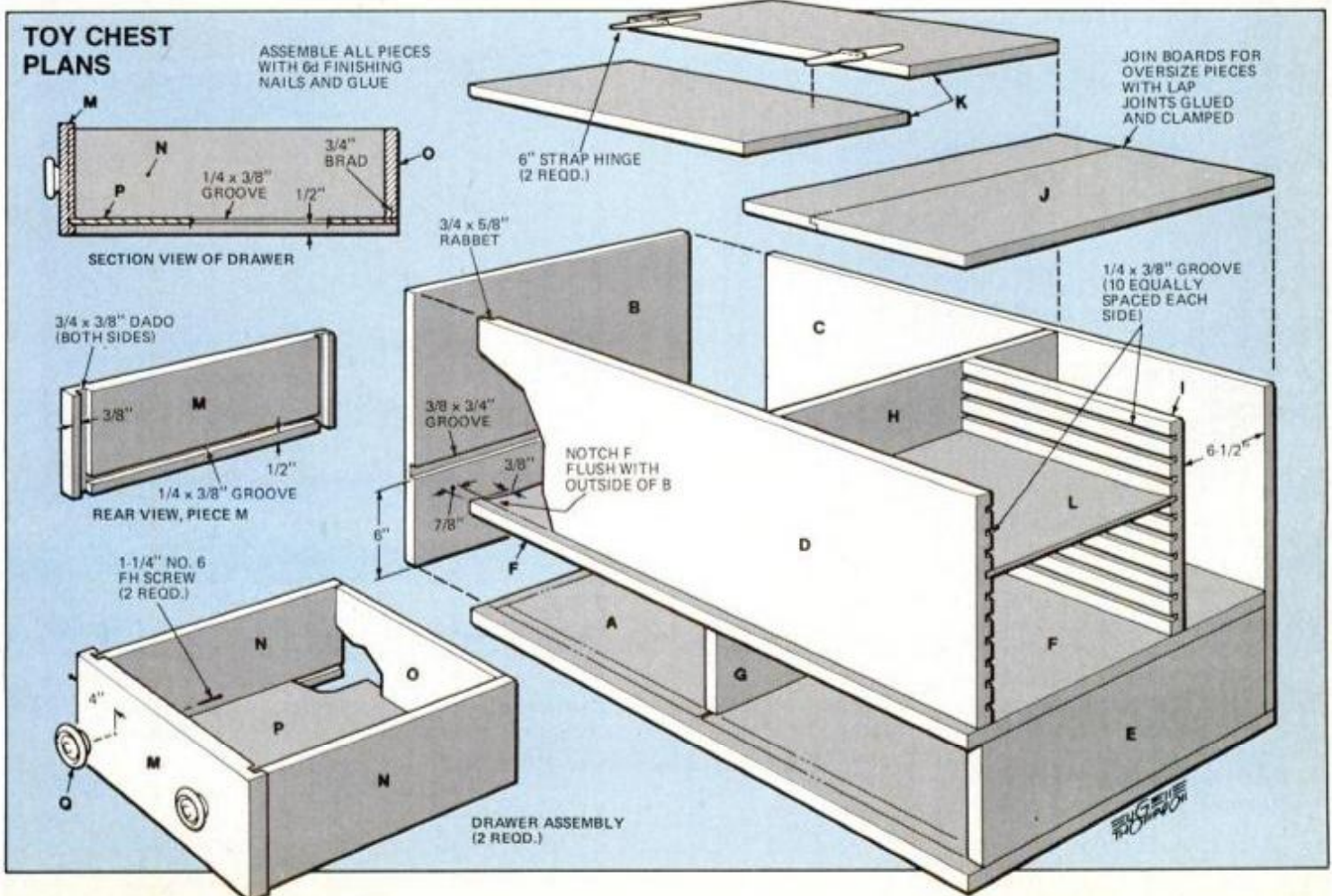
Misc.: 2, 6" strap hinges; 4, 1 $\frac{1}{4}$ " fh screws; 6d finishing nails and white carpenter's glue as needed.

*Edge-join 1x6 boards; rip to indicated width.

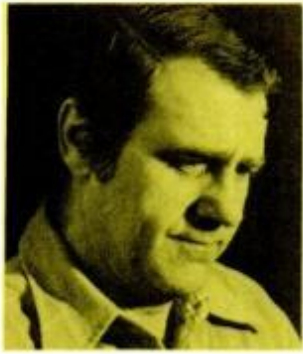
open compartment top (J). Nail on the back lid of the toy compartment (K) and hinge the front lid to the back lid.

Cut dadoes and grooves in the fronts and sides of the drawer pieces as shown. Assemble with nails and glue. Turn drawer knobs on a lathe, using contrasting wood for a decorative effect if desired. Countersink screws to attach knobs as shown. PM's colonial toy chest will last for years and become a favorite family heirloom.

PM



10 great shop tricks from a master craftsman



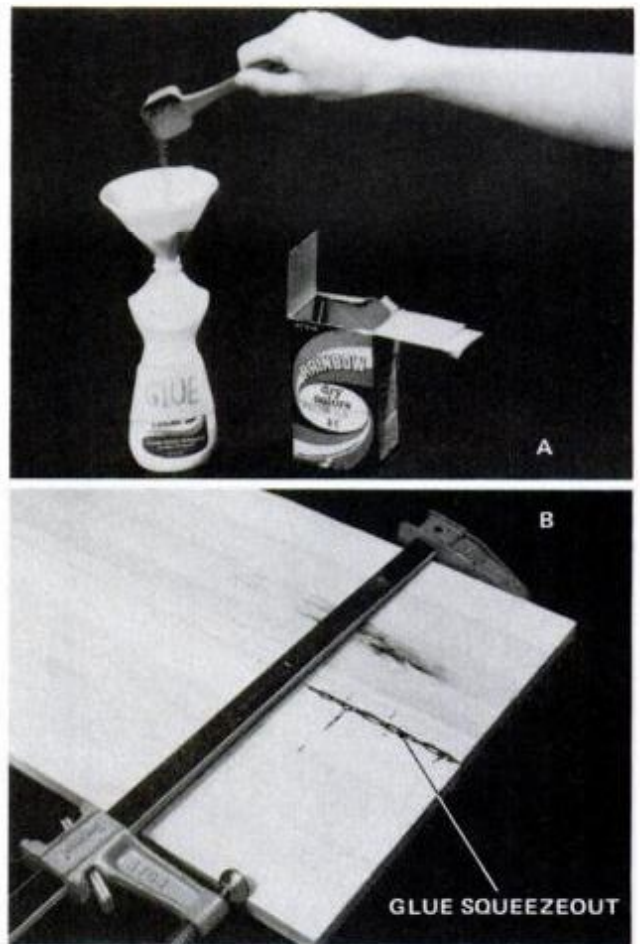
This is the third in a series of articles by noted craftsmen who are willing to share their shop secrets with PM readers. This month's resident expert is shop pro Harry Wicks, PM's Home and Shop Editor. A former carpenter, who conducted his own home improvement and custom furniture business, Wicks is the author of two books and is currently at work on an encyclopedia of craftsmanship to be published later.

Pay less for shop glue



Pros have long known that buying large quantities of glue is a sure way to save shop dollars. If you do a lot of shopwork, you should consider buying the stuff by the gallon. For easy use I pour the glue into thoroughly washed detergent bottles that my wife saves for me. Typical savings (using Sept. '78 prices): the white glue shown cost \$8.95 a gallon, or 7 cents per ounce (a gallon is 128 oz.). By contrast, a four-ounce bottle of the same glue was marked at 89 cents, or 22¼ cents per ounce. That's a saving of 15¼ cents per ounce. For maximum shelf life, keep glue capped tightly and don't expose it to freezing temperatures.

Spotting glue squeezeout



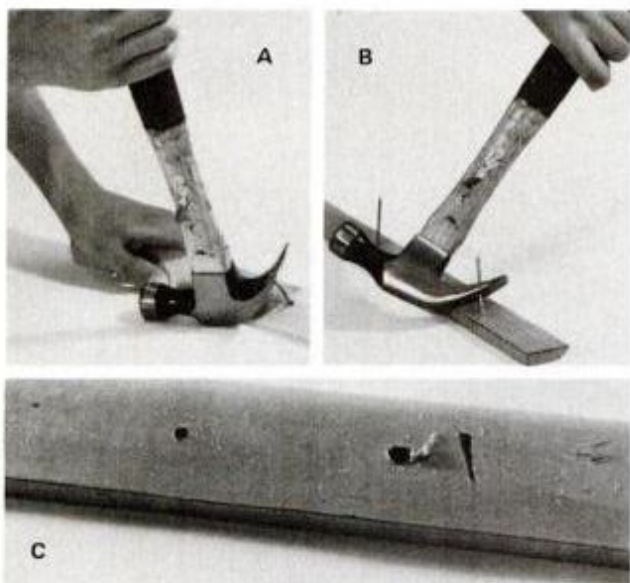
All woodworkers learn early in their furniture-building careers that glue permitted to dry on a board seals the surface and spoils the stain job (i.e., leaves white spots). And, since white glue is just about invisible against white pine, it isn't too difficult to miss a spot that should be wiped. To make it easy to find excess glue, try tinting the glue with a small amount of blue or red chalkline powder. It won't affect the glue's holding ability, but will make it easy to spot when it oozes out of a joint. Remove any unwanted glue from wood surfaces by wiping it off completely with a clean, water-dampened rag.

Mixing your own stain



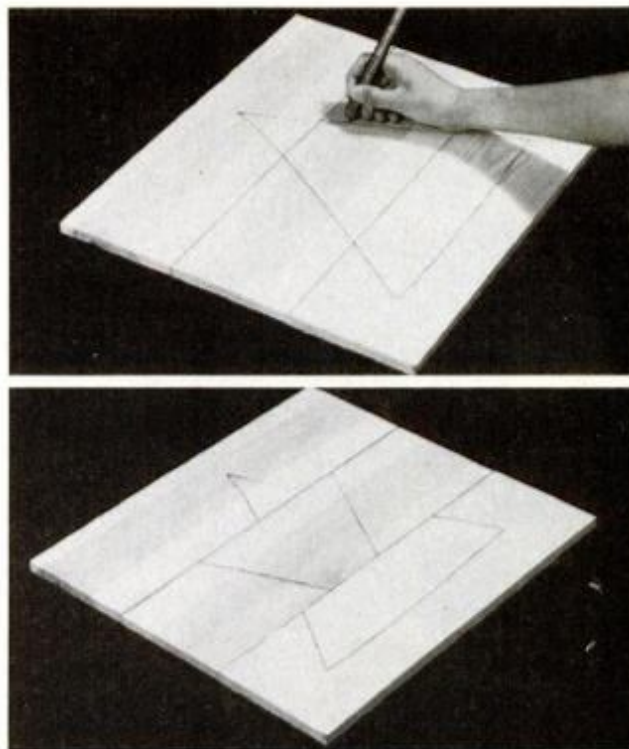
It is often desirable—and frequently a must—to mix your own stain color, rather than use one right from a can. In fact, if you stock your paint shelf with three stains—mahogany, walnut and maple—plus some umber and sienna pigments, you can mix just about any color you want. To avoid waste, use a small coffee measure to determine correct proportions of the various stains to use. When you are satisfied with the tint—on a scrap of the project wood—mix the stain in the volume needed, using proportions you determined with the measuring cup.

Reusing expensive moldings



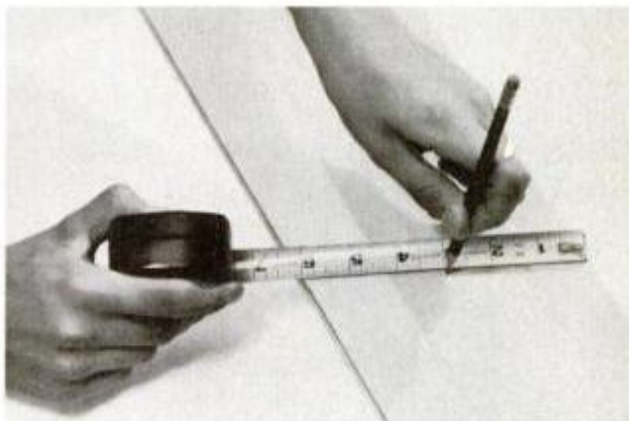
When a piece of molding is removed from a wall or the like, nails should be pulled immediately to prevent any chance of a job accident. If the lumber is to go on the trash pile, the finishing nails can be pulled from the front (top left). But, when the molding is expensive and must be reused, pull the nails from the back side (top right) to avoid damage to the surface (photo above). For extra leverage when pulling nails, use a block of wood beneath the hammerhead.

Better match marks



Assembling and disassembling projects on the workbench for test fit is a necessary part of cabinetmaking. To save frustration and to avoid the possibility of aligning parts with the wrong match marks, I use the triangle method shown above, instead of lines across the joints. Used on the backs of completed drawers, this method tells quickly and accurately to which opening a particular drawer is fitted.

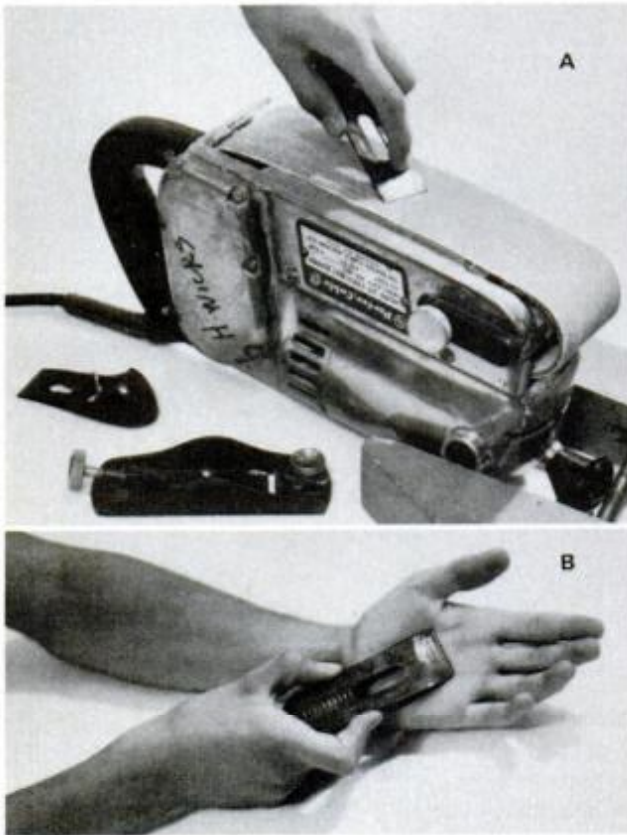
Find board center quickly



Here's an old carpenter's stunt for finding the center of an odd-width board in a hurry—without having to calculate fractions and the like. Line up the top corner of your rule with one edge of the board and swing the outboard end up until an even number is on the second edge. Then divide the whole number by two; here, six divided by two locates the board center at the 3-in. mark.

10 shop tricks

2 emergency sharpening stunts



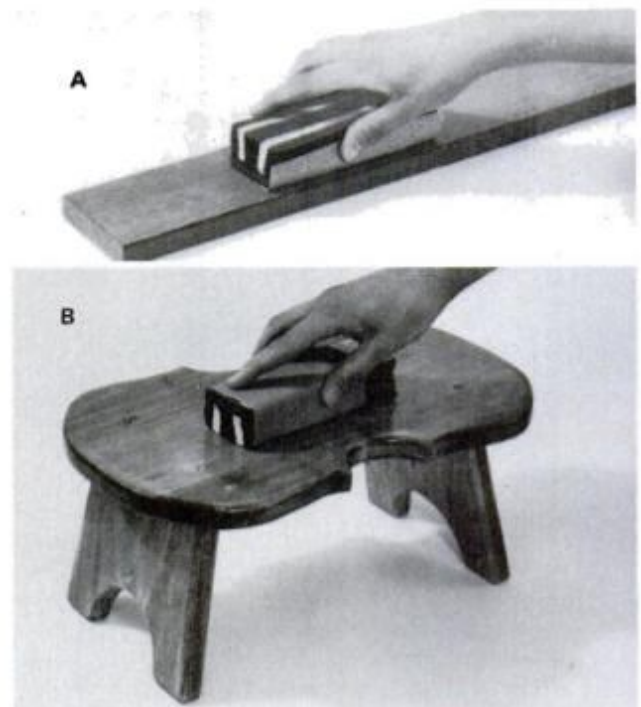
When you're away from your shop, with its handy grinder, here's a good way to give plane irons and chisels a cutting edge touchup. Install a 120-grit or finer belt on your belt sander and clamp the tool securely. Then hold bevel against the moving belt to restore a slightly nicked edge. For a quick and temporary honing, try stroking the iron in the palm of your hand. Draw the iron so the cutting edge trails and you won't cut yourself.

Make the end grain take stain like the rest of the board



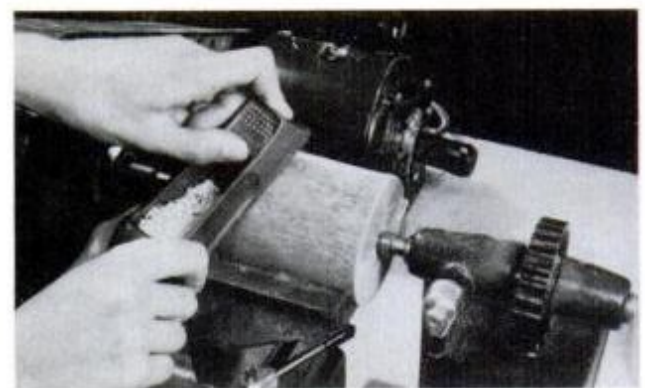
Unless the end grain is given some special attention before you stain, it is certain to soak up too much stain and turn almost black. To assure the exposed end grain taking stain evenly, first apply boiled linseed oil—as it comes from the can—using an artist's brush as shown. This slows stain absorption and permits wiping for good blend.

Hand sanding aid



One of the handiest sanding tools that you can add to your finishing tool collection is an ordinary chalkboard eraser—it gives two sanding backup blocks in one. Its rigid back is perfect for sanding new wood when some pressure is desirable (top photo). But when you're working with finer grits, such as when sanding between finishing coats, flop the eraser and use the soft surface for paper backup (above). You will find this gives good control and feel, and that you won't tend to round the corners of the workpiece.

Aid for woodturners



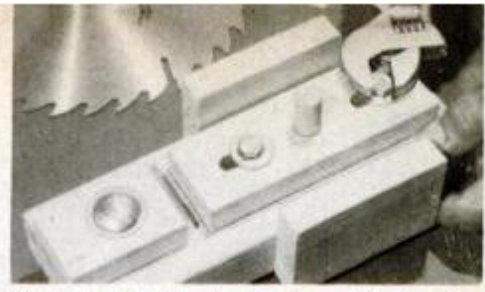
Like many woodturners, I use the deep gouge to rough-round stock and then touch it up slightly with a coarse file before proceeding with the turning. Recently, I discovered that Stanley's Surform tool makes the smoothing task a quick and easy chore. Make certain that the plane is held securely and that the toolrest has been adjusted, so that the plane does its cutting on the upper surface. Set lathe at a low speed.



Make your own rough-sawn 'barn siding'

Use PM's special technique to cut professional-looking, rough-sawn boards in your own shop. They're ideal for interior, exterior trim. Texture A (above) was made with a regular rip blade. Strips B, C, D and

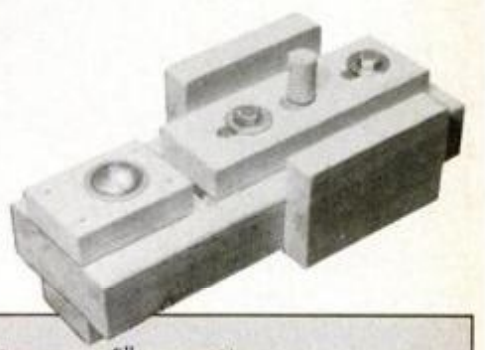
E—with varying degrees of texture—were cut with blades shaped on our easy-to-make jig. Use jig to set your blade tips for rough cut, and vary the feed rate to obtain the textured look you want.



Slotted arbor block adjusts so blade edge can be precisely located on anvil.



Fix jig in vise, hold blade and strike teeth with ball-peen hammer as shown.



This jig lets you set your own table-saw blades to rip textured wood. A 10-in.-diameter blade that fits a 5/8-in. arbor fits on the jig and rotates so any tooth can be positioned on the anvil, with 1/16 in. projecting past the anvil.

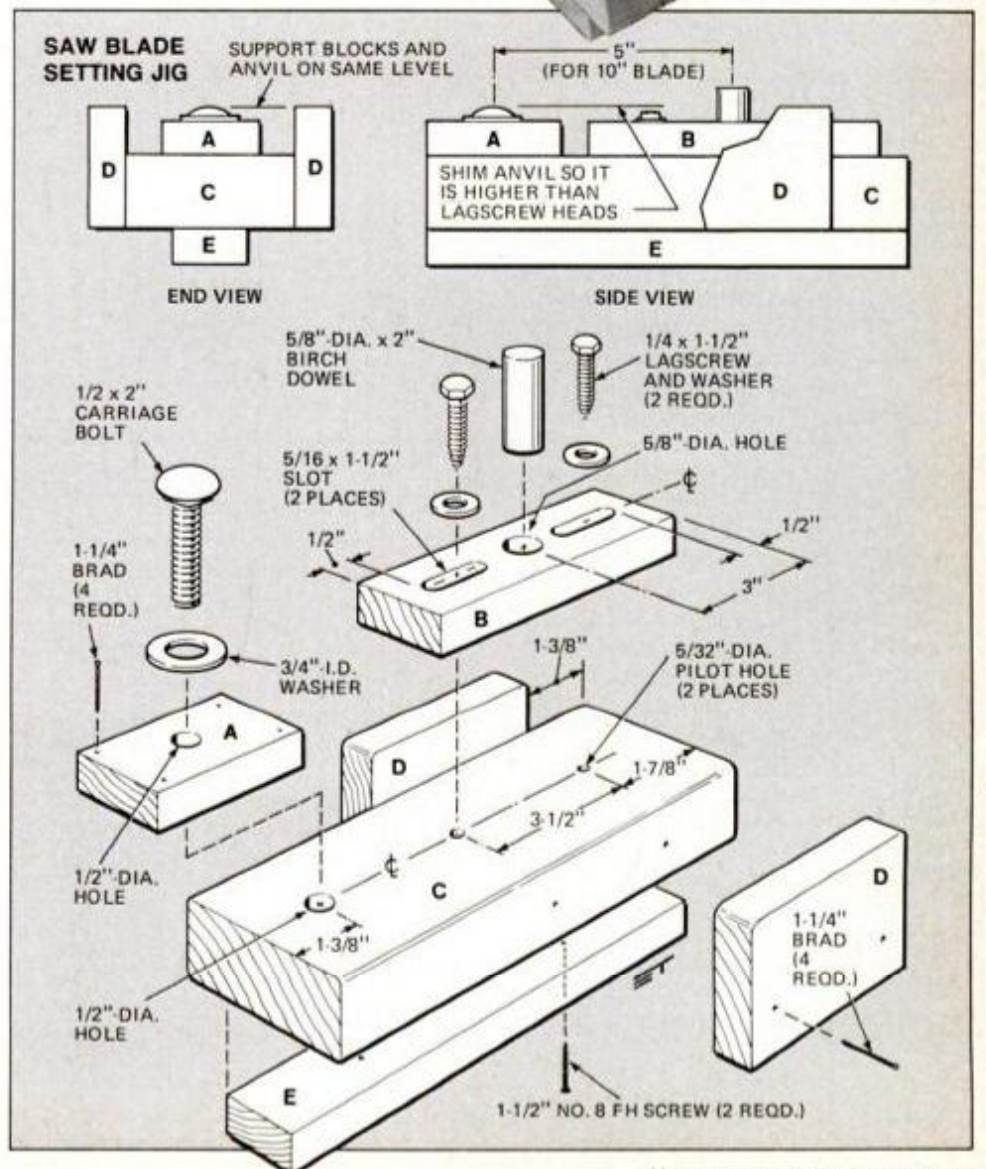
Use a ball-peen hammer for extra set. Every second tooth set to left and every second tooth set to right is set an extra amount. Leave the other teeth as is to create a skip-tooth blade. (One of our 26-tooth blades was set by tool sharpening expert Al Price. Seven teeth were set an extra 1/64 in. to the left, seven to the right, and 12 were unaltered. Mark teeth before setting, and use trial cuts to determine how much set gives the look you like.

You can rip wood to size or resurface pre-cut stock. Rate of feed also affects texture—the faster you feed wood into the blade, the rougher the texture. On hefty stock, rip at a moderate, safe speed first; then move fence 1/32 in. closer to blade so only tips of extra-set teeth contact surface. Then push board through again, with a faster feed.—*John Gaynor and Rosario Capotosto.*

MATERIALS LIST—Saw-blade Setting Jig

Key	Pcs.	Size and description
A	1	3/4 x 2 x 2 3/4" hardwood
B	1	3/4 x 2 x 6" hardwood
C	1	1 1/2 x 3 1/2 x 10" hardwood
D	2	3/4 x 2 1/2 x 4" hardwood
E	1	3/4 x 1 1/2 x 10" hardwood

Misc.: bolt, screws, washers and dowel as shown in art.





Build PM's solar food dryer

With this unit and sunshine you can preserve dried fruits and vegetables for future use.

By Jon A. Hoffman

PM photos by Rosario Capotosto

Dried apricots, apples and pineapple are favorite snacks with a lot of people, but they're also expensive. Build this solar food dryer for about \$75 and you'll be able to dry your own delicacies—including vegetables such as chard, kale, tomatoes, beans, bell peppers and onions. The dried produce can be stored in airtight containers and used later in soups and stews—or in the case of the fruits, as dessert toppings or a nutritious candy substitute for you and your family.

The dryer has a collector area of 16 sq. ft. and the capacity to dry 5 to 10 pounds of food in one sunny day. The unit shown in the photos obtained a temperature of 140° F. on a sunny fall day when the temperature outside was 78° F. The temperature reached 160° F. when a deflector was installed to recirculate some of the heated air.

Heat generated by the collector can also be ducted to a storage medium such as a rock or concrete block, to be ducted at night into a room in your home, a greenhouse or brooding house.

Jon A. Hoffman is an associate professor in the Aeronautical Engineering Dept. of California Polytechnic State University.

MATERIALS LIST—PM'S SOLAR DRYER

Key	Pcs.	Size and description	Key	Pcs.	Size and description
A	1	3/4 x 4 1/2 x 22 1/2" pine	U	1	1 1/2 x 1 1/2 x 3" glued-up pine or plywood
B	2	1/2 x 1 1/2 x 24" lattice or rip from 1" stock	V	1	3/4 x 2 x 5" pine
C	2	1/4 x 3/4 x 95 1/4" pine	W	1	3/4 x 2 1/2 x 22 1/2" pine
D	1	1/4 x 3/4 x 21" pine	X	2	3/4 x 3/4 x 22 1/2" pine
E	1	3/4 x 1 1/2 x 21" pine	Y	2	1/2 x 3 x 10" plywood
F	2	3/4 x 4 1/2 x 96" pine	Z	2	1/2 x 3 x 11" plywood
G	2	3/4 x 1 1/2 x 96" lattice (or rip)	AA	1	3/4 x 2 x 18" pine
H	1	3/4 x 2 1/4 x 22 1/2" pine	BB	2	3/4 x 3/4 x 96" pine
I	1	1/2 x 3/4 x 24" pine	CC	1	1 x 22 1/2 x 94 1/2" Styrofoam
J	1	1/2 x 2 1/4 x 28 1/2" plywood	DD	1	3/4 x 11 x 11" plywood
K	9	1/2 x 2 1/4 x 18 1/2" plywood			
L	8	1/4 x 3/4 x 28 1/2" pine			
M	1	3/4 x 24 x 96" plywood			
N	2	3/4 x 2 1/4 x 95 1/4" pine			
O	1	3/4 x 3 x 5" plywood			
P	1	1/2 x 2 1/4 x 28 1/2" plywood			
Q	2	3/4 x 2 1/4 x 96" plywood			
R	2	3/4 x 2 1/4 x 3" pine			
S	1	3/4 x 24 x 96" plywood			
T	1	3/4 x 2 x 21" pine			

Misc: 19" vinyl foam tape weatherstripping; 2 x 17"; 6-mil polyethylene sheet or equivalent; 2 pr. 2x3" butt hinges; 3 latches (or use hooks and screw eyes); 6 x 24" piece of aluminum flashing; 4"-wide roll coarse steel wool, nontoxic black spray paint; Dayton IC 939 fan; door pull; meat thermometer (optional). Screws and nails as required.

Note: The bulk steel wool can be obtained from janitor supply outlets or some restaurants. The Dayton fan can be obtained for \$20 postpaid from Capro Craft, Box 18, Greenlawn, N.Y. 11740.

How the solar dryer works

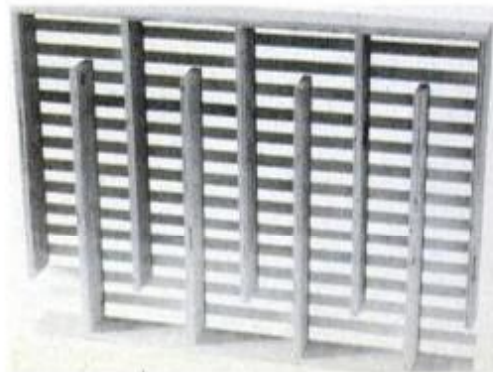
The dryer consists of a solar collector, an insulated food storage compartment, airflow passages to connect the two and an electric fan to circulate the heated air. The collector's absorber plate is made of a layer of steel wool, sprayed with nontoxic, flat black paint. The steel wool traps radiant energy from the sun as it is transmitted through the clear plastic cover plate. Our prototype has a cover plate consisting of two layers of polyethylene, although other, more durable plastic glazings could be used. The dead air space between the double plastic cover helps to reduce heat loss from the steel wool to the atmosphere.

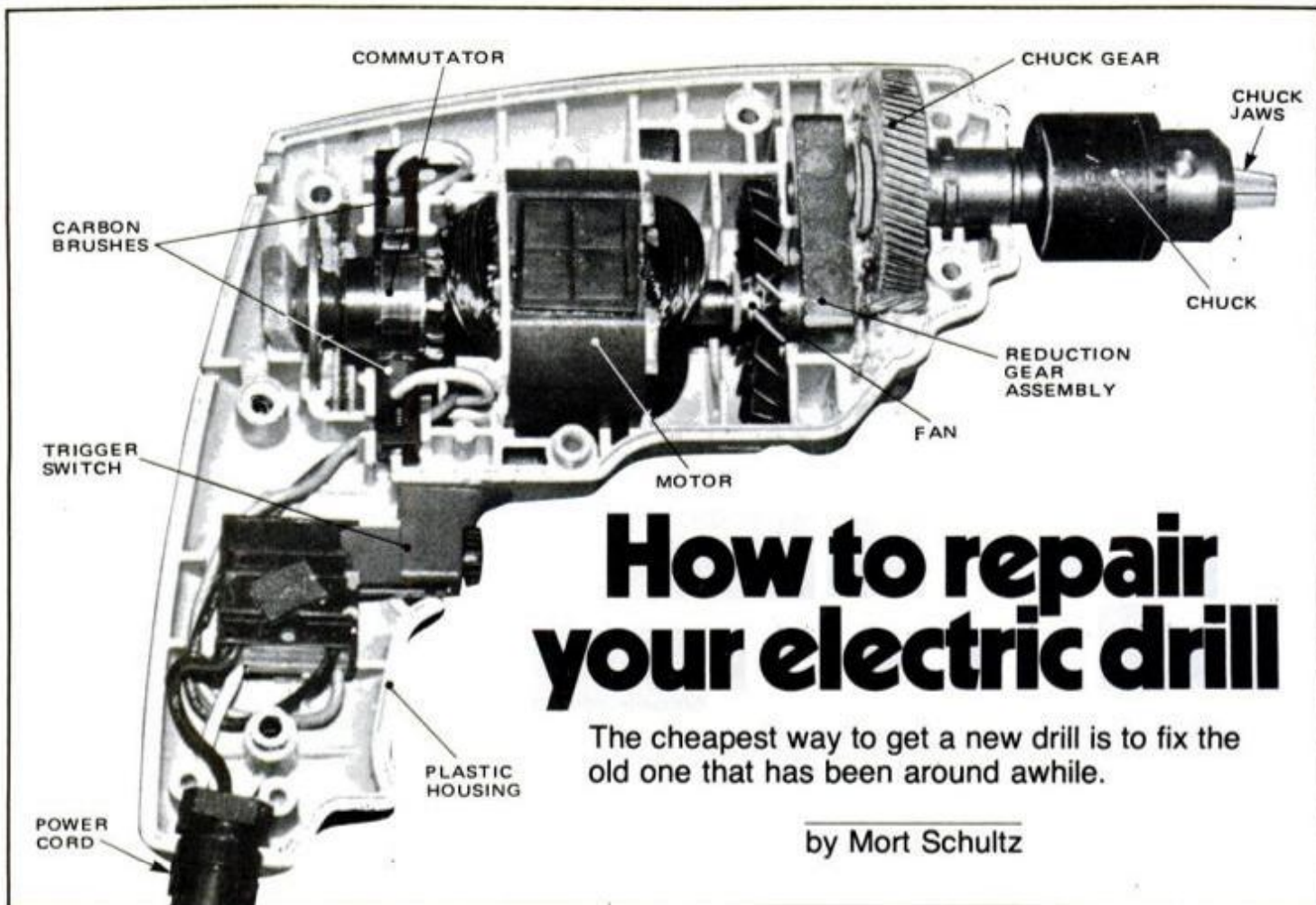
A fan draws air through the steel wool and moves the heated air through a food rack. Use of the fan significantly increases the drying

efficiency, as compared to solar drying systems which rely solely on convection. The cost of running the dryer is about 2 cents per hour.

The food rack is designed to maintain
(Please turn to page 128)

This rack aids airflow around food. Inset above shows rack loaded with apple.





How to repair your electric drill

The cheapest way to get a new drill is to fix the old one that has been around awhile.

by Mort Schultz

There's a wrong way and right way to treat an electric drill with a malfunction. The wrong way is to assume that new drills aren't expensive (high quality ones are) and throw away the old one. The right way is to fix the drill yourself. In most instances, you can.

Drills— $\frac{1}{4}$, $\frac{3}{8}$ or $\frac{1}{2}$ -inch—are simple machines. From the standpoint of repair, there are two basic kinds: clamshell and metal case. Most drills sold today are clamshell and double-insulated. To get inside such a drill, unplug from power and remove the housing screws and one half of the case. The entire mechanism will be exposed.

The other type drill has a metal case composed essentially of a front gear housing, bearing plate and rear housing. To get inside, remove the front gear housing, main drive gear and bearing, and bearing plate.

When an electric drill malfunctions, it usually reacts in one of four ways: (1) it goes on and off when the switch is held in the *On* position; (2) it won't run at all; (3) there is a noticeable power loss; (4) it makes noise.

The same malfunction may cause one problem in one drill and a different problem in another. However, the troubleshooting procedure, which follows, will allow you to pinpoint the cause and make repairs:

1. With the power cord plugged in, hold the switch in the *On* position and flex the power cord back and forth where it enters the housing. If the drill cuts on and off as the cord is bent, the cord is damaged.

To repair this defect in a clamshell-type drill, unplug the cord and separate the housing. Disconnect the cord from the switch, cut off two or three inches of the cord at the switch end, strip back insulation to expose wires and reattach the cord.

To repair this failure in a metal-case drill, remove the screws holding the two halves of the handle together, open the handle, disconnect the cord from the switch, then proceed as described above.

The only difficulty you may encounter is disconnecting and reconnecting the power cord and switch. The cord is attached to the switch by screws or by a spring. If by screws, loosen the screws to remove and reattach the cord.

If leads are attached to the switch by a spring, use a small finishing nail or an awl-type tool with a thin end to separate the wire from the switch. Insert the tool into the hole in the switch, push the spring aside and *gently* withdraw the wire from the switch. Don't pull on the wires. Reverse the procedure to reattach the lead.

Important: Wires must be reattached to their correct positions in the switch, so note these positions (make a sketch, if necessary) before making this repair. Most switches are marked in some way to facilitate identification.

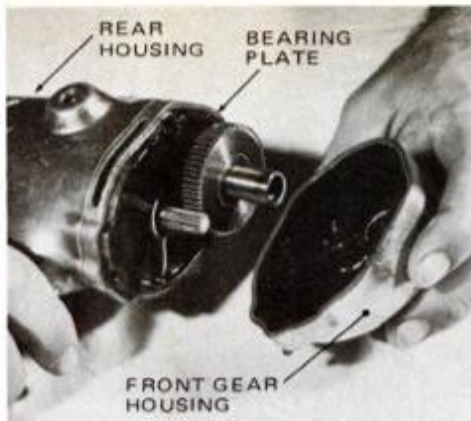
2. The power cord can also be damaged at the plug end because of carelessness. To check the cord at this point, tie the switch in the *On* position, lay the drill on the floor, plug in the power cord, and flex the cord back and forth at the plug end. If operation is erratic, disconnect the cord, cut off several inches at the plug end, strip back wires, and install a new plug.

According to Gary Cohen, service center manager for Skil Corp. in Hillside, N.J., about 75 percent of all erratic operation is caused by a power-cord break. Almost 25 percent is caused by a bad switch, which can also prevent the drill from running at all.

3. Test a switch by detaching the two field wires from the switch. They are the wires that *aren't* the power cord wires.

Connect a test power cord to the two field wires. A test cord is good to have on hand and should have two alligator clips soldered to its wires for connection to field wires.

Caution: Before plugging in the test power cord, you must reassem-



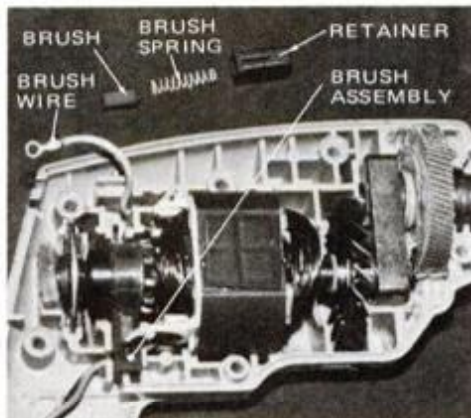
Metal-encased drills are composed of the three main housings shown here.



Switches with spring-connected wires are disconnected with thin-pointed tool. Wires may be attached to some switches with screws; loosen the screws to disconnect.



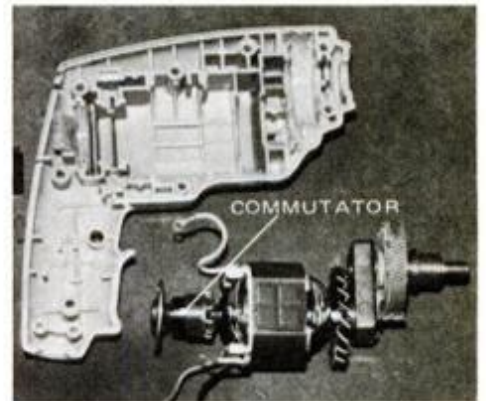
Note wiring pattern before removing faulty switch. Rewire replacement accordingly.



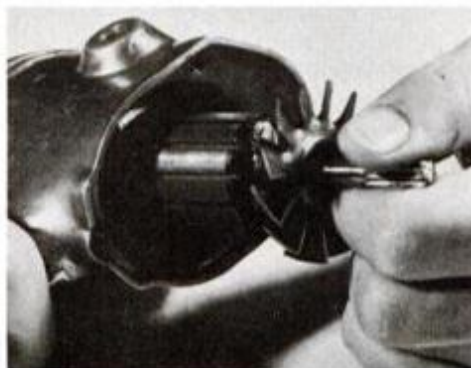
The brush assembly is often the key when your drill is running, but is losing power.



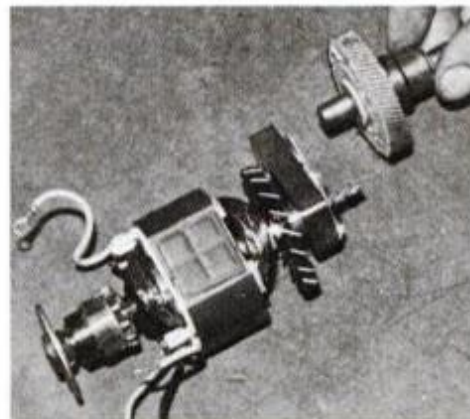
To remove a brush from metal-case drill, unscrew slotted retainer on housing. Release it slowly to avoid losing the spring.



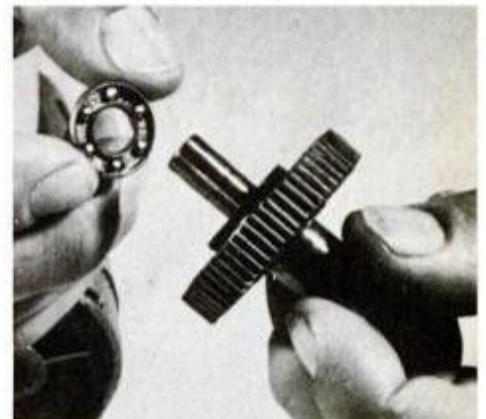
To remove commutator from clamshell-type housing for cleaning, lift it from casing along with gear, fan and motor assembly.



To get at commutator in metal drill, remove front housing and brushes. Then remove main drive gear, bearing and bearing plate. Finally, pull out the armature.



Disassemble components by gently pulling them apart; slide together to reassemble.



When you replace the main gear, also be sure to replace the main gear bearing.

ble the drill to avoid possible serious electric shock. Screw the two clamshells together or reassemble the handle.

Plug in the test power cord. If the tool now performs satisfactorily, the switch is bad and should be replaced with a new one.

A brush spring or brush that fails to make contact with the commutator is another reason for erratic on-off operation.

4. With a clamshell-type drill, open the housing, depress the brush springs to disconnect the wires, remove the brush retainers (one on each side of the commutator) and

(Please turn to page 140)

TROUBLESHOOTING CHART

PROBLEM	CAUSES	PROCEDURE
Drill cuts on and off (runs intermittently)	Damaged power cord Switch failure Poor brush/commutator contact Burned armature segment	Repair or replace cord Replace switch Replace all brushes, springs; dress commutator Replace motor or drill
Drill won't run at all	No power at wall outlet Switch failure Burned-out motor	Check and/or repair outlet Replace switch Replace motor or drill
Drill exhibits loss of power	Worn brushes	Replace brushes, springs; dress commutator
Drill is unusually noisy	Gear needs lubrication Gear is stripped	Lubricate using grease made for drills Replace gear and bearing

WORKSHOP MINICOURSE

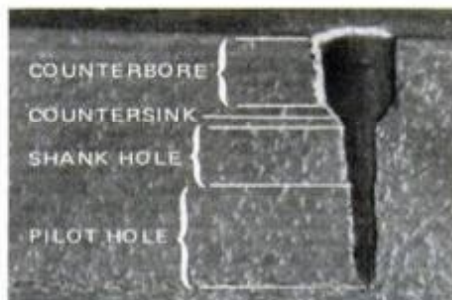
PORTABLE DRILL ACCESSORIES



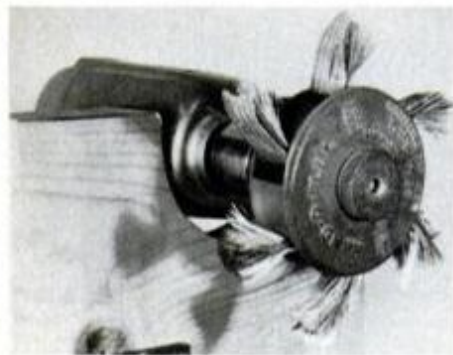
Handy set of spade bits in a pouch lets you bore $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1-in. holes.



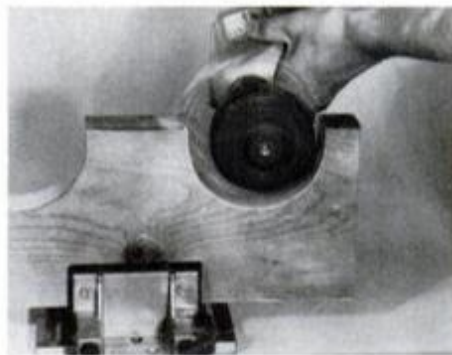
Bit shown in drill bores pilot and shank holes and countersink in one operation.



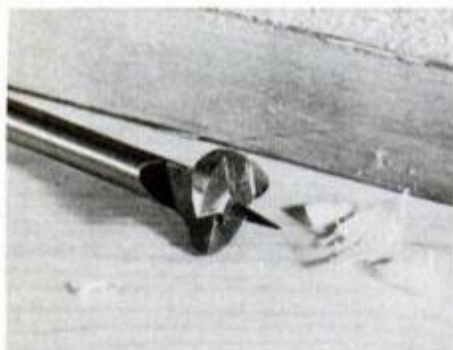
Hole was bored using the bit shown at left; note counterbore for dowel.



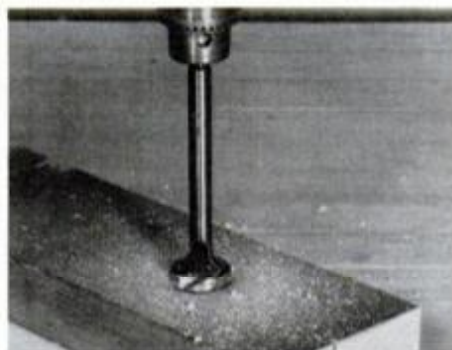
Sand-O-Flex strip sander is a fast way to smooth scrolls and irregular edges.



Drum sanders come in various diameters and grits for sanding rough-cut circles.



Power Bore bit from Stanley produces a perfect circle for craftsmanlike hole.



Bit cuts cleanly and makes a hole that will fit a dowel or dowel plug perfectly.

Though I admittedly shun so-called multipurpose tools, there are cases when a good power tool can be made even better by coupling it with the *proper* accessory. A good example is the portable electric drill: No tool around has more accessories designed for it. Many are excellent—and some are pure junk. For openers, we will stick to a couple that I think most homeowners should know about.

Be aware that all drill accessories are intended for use at specified speeds. So when you buy one that you have never used before, take the time to read the maker's instructions. A serious injury, as well as damage to a project, can be caused by an improperly used accessory.

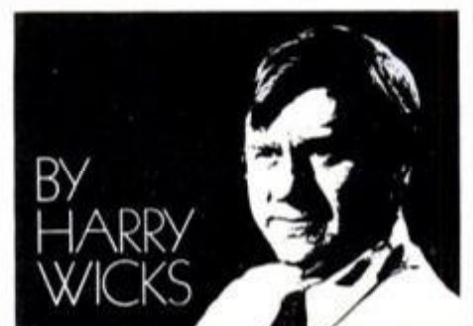
After twist drill bits (for use in either wood or metal), the boring tools to buy are a set of spade bits. With these, you can bore accurate, large-diameter holes in wood with very little effort. A spade bit is ideal in construction work, such as boring through studs for electrical or plumbing lines. In fact, a spade bit will suffer minimal damage should you hit an occasional nail.

Other accessories to look into: **Screw Sink.** This is Stanley Tools' name for the bit that lets you bore pilot, shank hole and countersink, all at one time. Variations are also available from Sears and other tool suppliers.

Power Bore bits: Here is another winner from Stanley. These are my personal favorites for boring accurate circles.

My preferred sanding accessories include the drums, available in several diameters. For fine finishing of contours, nothing matches Sand-O-Flex. I keep two handy in my workshop—one fitted with rough grit, the other with fine. Both types are available at hardware stores.

PM



BY
HARRY
WICKS

GENERAL STORE

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report MAY '78

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Ordinary cigarettes just don't have what Camel Filters has.

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GAS TRAPPING AND VAPOR
CONDENSING TOP DESIGNTWICE THE
ELECTROLYTE
RESERVOIR

New top design and extra electrolyte reservoir space over the plates characterize construction of the typical maintenance-free battery.

WHAT YOU SHOULD KNOW ABOUT THE CARE, TESTING AND RECHARGING OF MAINTENANCE-FREE BATTERIES

by Mort Schultz

Your battery buying habits are about to change, if they haven't already. So says Anthony Sabatino, president and general manager of the automotive battery division of Gould Inc. Gould makes the maintenance-free battery for J.C. Penney, among others.

According to Sabatino, 87 percent of the batteries put into new cars and sold by aftermarket distributors between 1977 and 1980 will be maintenance-free or low-maintenance units. (Aftermarket distributors are those from whom you buy new batteries and other auto parts.) In terms of numbers, 87 percent represents 65.2 million batteries.

The remaining 13 percent, a mere 9.8 million car owners, will stick by the conventional battery.

The trend toward conversion is proceeding rapidly. General Motors began putting maintenance-free batteries in all its 1979 cars. Ford Motor Co. is installing maintenance-free batteries on a limited basis and low-maintenance batteries in the rest of its vehicles, and has announced a complete shift to maintenance-free by 1980.

American Motors and Chrysler have equipped 1979 models with low-maintenance batteries. However, it is anticipated that both companies, as well as Volkswagen, will soon

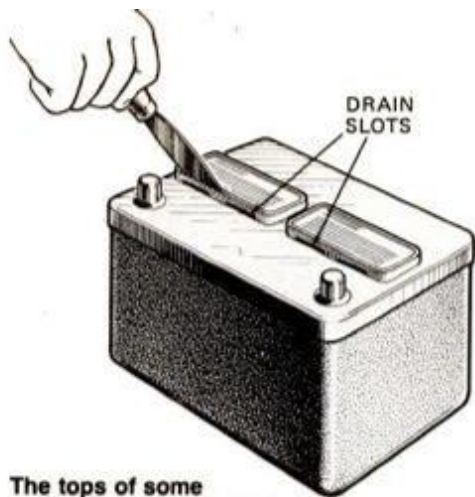
be switching to maintenance-free.

In addition to J.C. Penney, other major retail chains selling maintenance-free and low-maintenance batteries include K-Mart, Montgomery Ward, Sears and Western Auto. Oil companies are following suit. For example, an Atlas battery called "Worry-Free" is being sold by American Oil Co., Chevron and Exxon.

What is 'maintenance-free'?

Some batteries called maintenance-free by store personnel or in-store advertising are really low-maintenance types. Major battery manufacturers spell out, by labeling

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The tops of some maintenance-free batteries allow access to the cells. Cover plates on this AMC battery can be lifted off.

on the battery or in literature accompanying it, if the unit is truly maintenance-free.

Maintenance-free batteries are more expensive than low-maintenance batteries. Both cost more than conventional batteries, but cost is not the only difference. Whether a battery is low-maintenance, maintenance-free or conventional depends on its grid construction.

Battery grids are lattice networks that hold pastes of active materials, which form the positive and negative plates. Grids also conduct electric current from the plates to the poles.

In a conventional battery, grids are an alloy containing 5 to 6 percent antimony and the rest lead. In a low-maintenance battery, grids are an alloy of 2 to 3½ percent antimony. In a maintenance-free battery, antimony has been eliminated and replaced by a calcium-lead alloy.

The degree of maintenance a battery requires depends on the amount of its antimony content. By "maintenance" we mean how often it is necessary to check cells for water loss and clean battery ter-

minals, cable connectors and battery case.

Antimony causes a battery to accept current after the battery is fully charged. This overcharging leads to a loss of water (electrolyte) because excessive current reacts on water, turning it into hydrogen and oxygen.

Electrolyte loss presents you with three maintenance tasks. First, you have to replenish the water.

Second, gases given off through battery vents settle on connectors and terminals, causing corrosion that can impede the flow of current to the starter motor. If corrosion is not cleaned off, the engine could fail to start.

Third, gases escaping from vents can settle on the battery case and create a self-discharging path, draining battery strength. This will require you to have the battery charged frequently if you don't wash it to eliminate the electrolytic salts. Electrolyte is an electrical conductor. Calcium-lead batteries—that is, maintenance-free—do away with these tasks.

"Calcium-lead batteries just about turn themselves off when they become fully charged," states John J. Zalecki, national service manager of the Prestolite battery division. "They accept little more current." Therefore, in a calcium-lead battery, the gases emitted when overcharging takes place are reduced 90 to 97 percent. (The exact percentage depends on the manufacturer you talk to.) Water loss is kept to a minimum during a battery's lifetime.

"In a vehicle with the voltage regulator set to limit voltage to 14.2 volts, it's possible for a battery with 5 percent antimony to accept up to 6 amps. in overcharge current," Zalecki says. "A calcium-lead battery will accept an overcharge current of less than 0.1 amps."

Two venting systems

Make no mistake about one thing. Every battery gives off gases. Calcium-lead and low-antimony batteries are no exceptions. Although many maintenance-free batteries look sealed (the familiar vent caps are not present), venting must be built into the battery in some way. A battery that isn't vented has no way to purge itself of gases that accumulate inside and can cause the battery to burst.

Two methods of venting a maintenance-free battery are used—through tiny holes in the sides or ends of the battery, or through a microporous disc. Either method permits flame-retardant venting; that is, it prevents flames created externally from traveling into the cell and igniting explosive gases.

Installing a new battery

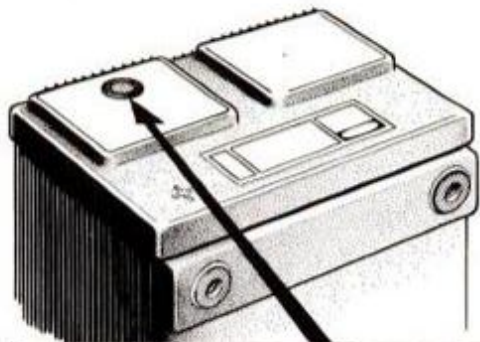
Installing a battery correctly is necessary to prevent damage, so let's run down the procedure.

When you buy a new battery, you never know how long it's been in storage. Maintenance-free batteries have excellent shelf-life characteristics because of their low rate of self-discharge. They can remain in storage for at least 12 months without need for charging. However, you have no guarantee that a battery wasn't neglected. It may have been in stock long enough to lose charge. A booster charge of 20 amps. for two hours assures you that the battery will enter service fully charged. Charging is also advisable if the battery is being installed in cold weather or has been stored in a cold place.

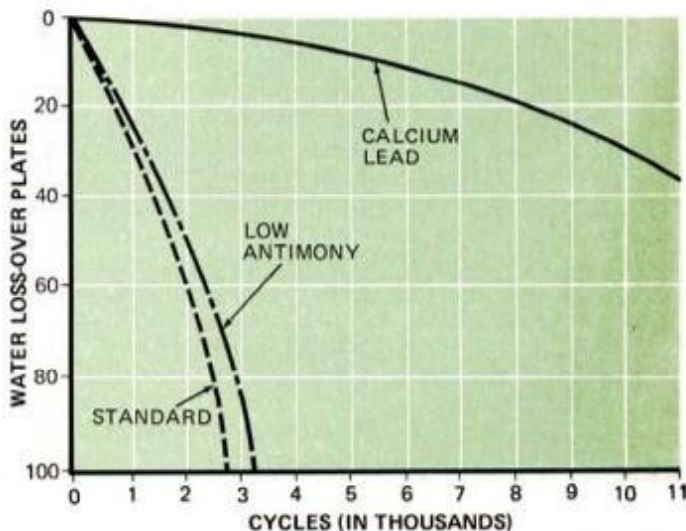
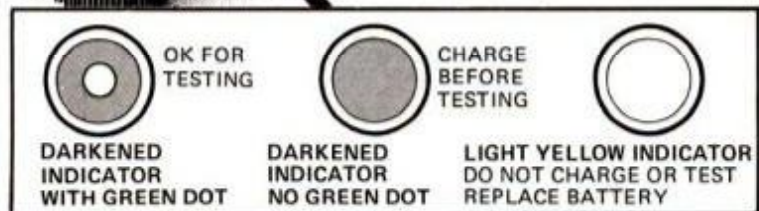
Important: Do not charge a Delco Freedom battery if the visual indicator reveals a green dot.

Removing an old battery

As the battery is charging, remove the old battery from the car, notic-



"Eye" in some maintenance-free batteries indicates correct test procedure to follow when you have a no-start condition. Graph at right shows slight water loss of maintenance-free batteries using calcium-lead.



ing the position of positive and negative terminals. To avoid accidental damage that the cross-switching of terminals and cable connectors may cause, mark pieces of masking tape (-) and (+) and place each on its respective cable: (-) on the ground cable (the one with one end connected to the engine block); (+) on the positive cable (the one that goes to the starter switch or starter relay).

Caution: Whenever you disconnect a battery, remove the ground (-) cable first. This minimizes the possibility of sparks shooting off that could ignite the hydrogen given off by a battery.

Inspect cables. If they are cracked, frayed or worn through, replace them. If cables are not worn, clean the connectors with a battery-cleaning tool or a wire brush. This may be the last time you will have to use a battery-cleaning tool. The small amount of gas given off by a maintenance-free battery is directed away from terminals and connectors, virtually eliminating corrosion.

Next, clean the battery hold-down and tray with a wire brush. Wash them with a weak solution of baking soda and water. Rinse and dry. Leave nothing on the battery tray. A stone, nut, bolt or tool will damage the new battery.

Place the new battery on the tray. See that its terminals line up with the correct battery connectors. **Connect positive cable first.**

Very important: Do not overtighten cable connectors. Doing so may distort the battery and cause early failure. Use a torque wrench. If the battery has side terminals, tighten bolts to between 60 and 90 in.-lb. or 6 ft.-lb. If the battery has posts extending from the top of the case, tighten the cable connectors to 15 ft.-lb.

Servicing a battery

A low-maintenance battery requires the same maintenance you've been giving conventional batteries, although not as often. This entails checking the electrolyte level every 12 months or 10,000-15,000 miles, keeping the battery and connectors clean, and testing the state of charge when a starting problem appears to be caused by battery failure.

Maintenance-free batteries require service when a starting problem occurs. (Don't confuse service and maintenance. Service is necessary to determine if a starting failure is caused by the battery.) This is why Delco-Remy equips its Freedom battery with an "eye." Some

think that the "eye" reveals whether the battery is good or bad, but this is *not* the case. The "eye," or visual indicator, indicates the level and specific gravity of the electrolyte in *one* cell.

You don't have access to the cells of the Freedom battery to check electrolyte level or test electrolyte specific gravity. This battery is sealed. "In normal vehicle operation, there is no need to view the 'eye' until a starting complaint is involved," states F.L. Bronnenberg of the Delco-Remy engineering staff. "Then the 'eye' reveals what procedure to follow."

If the "eye" has a green dot, it is safe to load-test the battery to determine if it is causing the starting problem. The amount of load placed on the battery depends on the model. The minimum voltage depends on temperature. The load-testing procedure for the Freedom battery is outlined in GM service manuals, and in Delco-Remy service bulletin 1B-116.

If minimum voltage is not attained during the load test (9.6 volts at 70° F. or above), replace the battery. The fact that the "eye" shows a green dot makes no difference. Remember: The "eye" doesn't tell if the battery is good or bad. If the "eye" is dark (no green dot), the battery should be charged before it is load-tested. Rate of charge varies with battery model and is outlined in service literature.

Caution: Charging should be halted when the green dot appears in the "eye" or when the maximum charge is reached, according to service instructions. If the "eye" is pale or light, do not charge or test the battery. The electrolyte has been depleted. Since water cannot be added, this is one situation that calls for replacing the battery.

Cells are accessible

If your maintenance-free battery does not have an "eye," you have access to cells, although it may not seem that way. The battery may look sealed, but it isn't.

Some companies make no attempt to hide cell openings. For example, the Red Camel maintenance-free battery, manufactured by ESB, has conventional battery caps. The caps can be removed, allowing water to be added if a voltage regulator goes bad and excess current is permitted to reach the battery. Excessive current increases gassing and will cause premature battery failure if water is not replenished.

The Roughneck and Liberator batteries, manufactured by Prestolite, are two types of maintenance-

free batteries that have cells hidden, but accessible. With the Liberator, the center cover is removed by pulling straight up on the ends. After checking electrolyte level, the cover is placed in position and pressed down firmly until it seats.

With a Roughneck battery, a knife is used to cut through the top plaque center section. Removing the plaque reveals individual screw-type vent plugs.

Hold onto your battery hydrometer if you switch to a maintenance-free battery that allows access to the cells. You can check the battery's state of charge in the usual manner.

If you are hesitant about cutting through the battery to get at cells, there is another way to determine state of charge besides using a hydrometer. Ford suggests the following steps:

- Perform a battery capacity test.
- Wait one minute.
- Measure *no-load* battery voltage. If it is 12.4 volts or better, the battery is adequately charged. If no-load voltage is less than 12.4 volts, a booster charge should be applied.

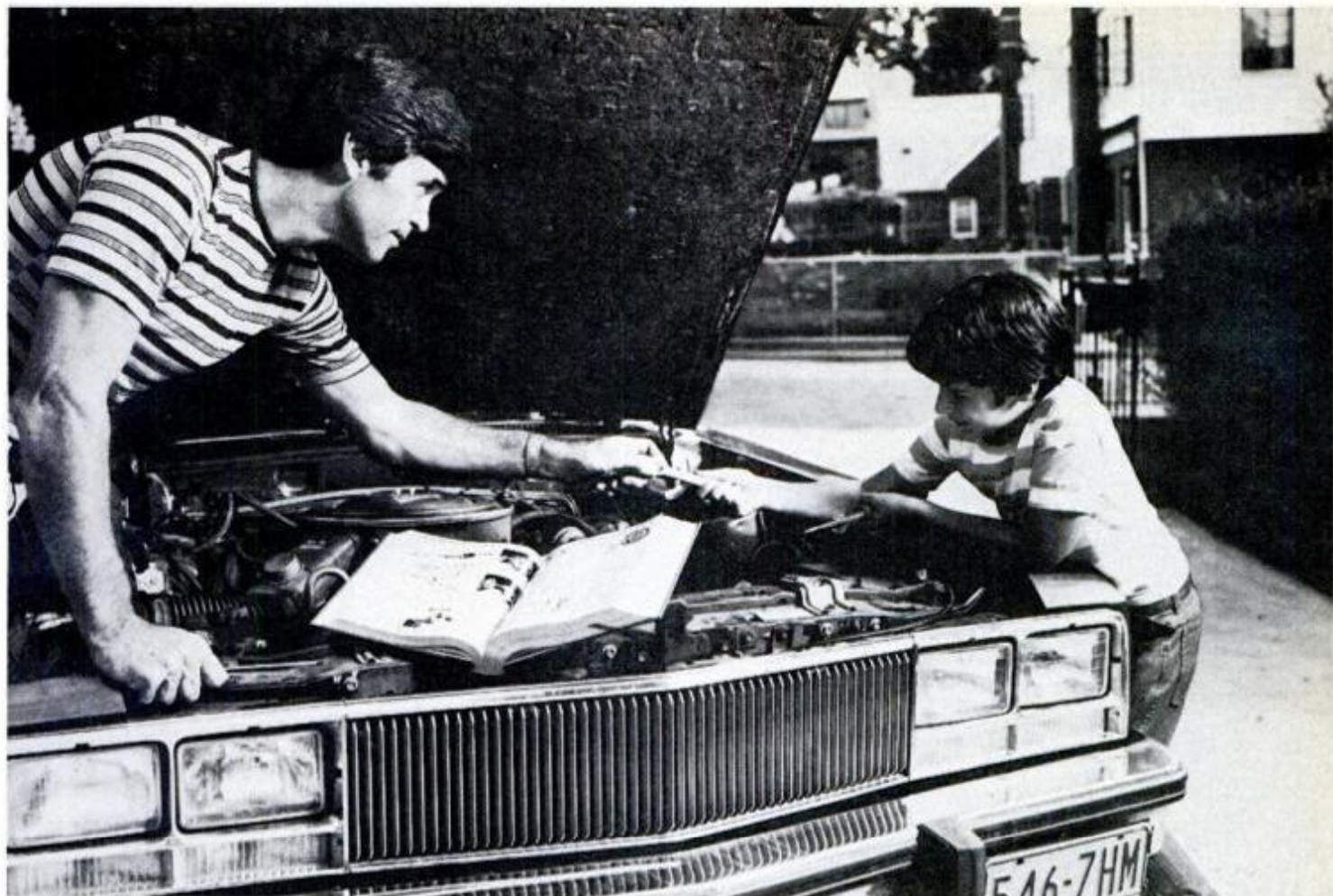
"This procedure, we believe, will work for all maintenance-free batteries, competitive makes as well as our own," Ford says.

Avoid tipping

- Avoid tipping a battery, even a maintenance-free battery. It's possible that electrolyte could leak out of the vents.
- "The number one problem associated with discharged batteries is a loose generator drive belt," says J.R. Pace of ESB Inc.
- The charge voltage of maintenance-free batteries is more critical than with conventional batteries. A voltage regulator out of specification will result in a discharged battery if the setting is low, or premature water consumption if the setting is too high.

Storage tips

- If you are going to store a maintenance-free battery, keep it upright in a cool, dry place. Avoid a place where the temperature will be above 80° F. High temperature increases the rate of self-discharge. To prevent freezing, do not store the battery where the temperature goes below 32° F.
- You can jump-start a maintenance-free battery in the usual manner. However, cover the battery's top and/or ends with a clean cloth to block vent holes. This will prevent gas that may escape from possibly being ignited by a spark. **PM**



HOW TO GET PROFESSIONAL CAR REPAIRS FOR JUST THE COST OF PARTS.

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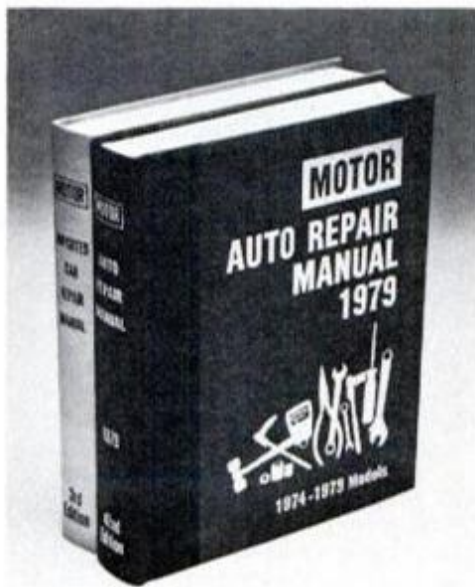
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Pick up a copy today. And for years you can get professional car repairs without paying stiff prices for a professional mechanic's labor.

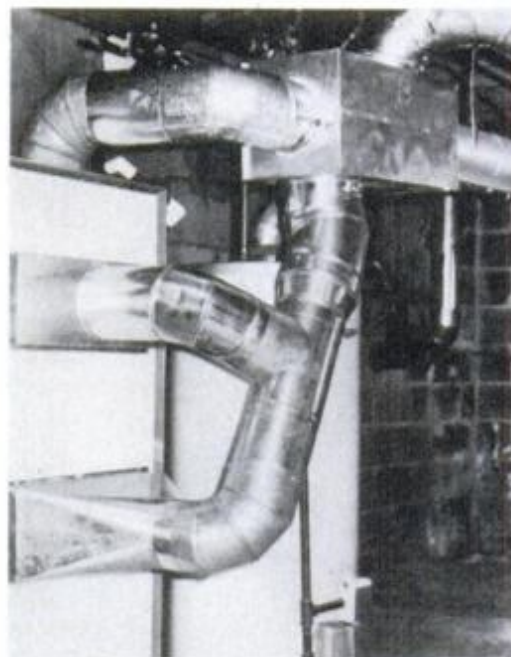
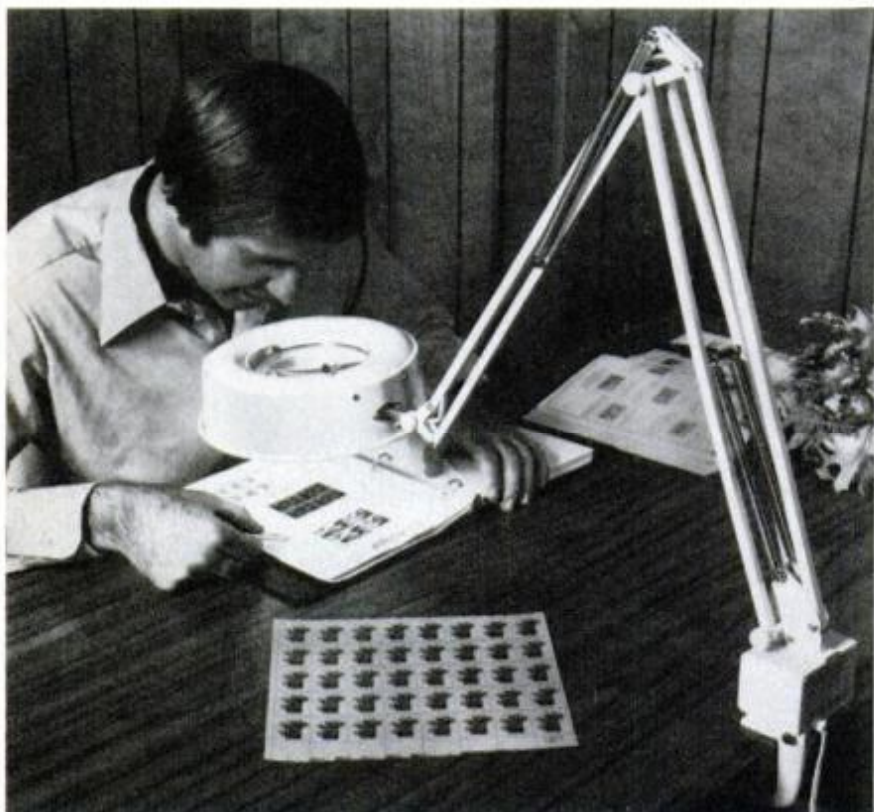
MOTOR AUTO REPAIR MANUAL THE BOOK THE PRO USES

New domestic 1979 edition on sale early November. Available wherever books are sold.

NEW NOW for home and shop

Magnifying lamp

This pivoting lamp features a magnifying lens that is surrounded by a circular fluorescent lamp. It is designed for use in hobby work, modelmaking, repairs and other closeup work. The lamp's pivoting arms can extend as many as 45 inches and rotate the full 360°. The lamp bulb is 22 watts, and the 10-in.-dia. reflector has a lamp switch that's built in. Different clamps are available to make mounting easier, whether in horizontal, vertical or slanted position. In addition, a screw-down mounting is possible. Dremelite 1320 retails for about \$80. Dremel, 4915 21st St. Racine, Wis. 53406.



Recycle lost heat

Many modern homes are so airtight they can't "breathe" to provide sufficient combustion air for the furnace. The He-Conomiser Bi-Loop system provides an outside vent to let air in and then preheats it by running it past the furnace's exhaust flue. Thus, the device's combined effect is said to yield fuel savings of 15 to 20 percent. The unit has no moving or electrical parts and stack gas temperatures remain high enough to maintain a good exhaust draft, the manufacturer reports. The heat exchanger box is \$140 for smallest size; connecting ductwork is extra. Min-Ell Co., Box 821, Cherry Hill, N.J. 08003.



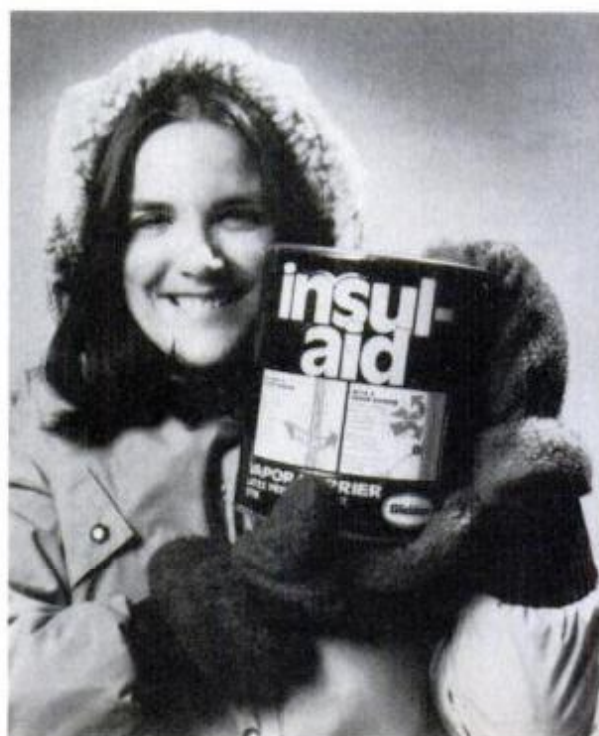
For chisels

These heavy-duty wood chisels are made from Sheffield steel. Imported from England, a set of four— $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1-in.—is available for \$15.70 with vinyl case. The handles are made of high-impact plastic and are said to be shockproof and splinterproof. Chisels of $1\frac{1}{4}$ and $1\frac{1}{2}$ inches are priced at \$5 and \$6.50 respectively. General Hardware Mfg. Co., 80 White St., New York, N.Y. 10013.

Paint-on vapor barrier

Uninsulated homes and those that are equipped with insulation without a vapor barrier can benefit from the use of Glidden's Insul-Aid primer-sealer latex paint. When this is applied at a rate of 400 sq. ft. per gallon, it is said to provide an effective vapor barrier so that moisture—and the heat carried with it—is retained in the house and the insulation is kept dry. This primer-sealer dries quickly; a top coat can be applied over it approximately four hours later. The cost is about \$13 per gallon.

Also, you can pick up Glidden's free booklet on vapor barriers wherever Insul-Aid is sold; at hardware stores, home centers and Glidden paint stores. Glidden Coatings & Resins, 900 Union Commerce Bldg., Cleveland, Ohio 44115.



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THE HOTTEST THING ON WHEELS!

(Continued from page 66)

extra weight you might load. The Bonus and Crew Cab models start out with a higher GVWR—7500 pounds—than the Regular Cab models, so by ordering a longer model you get a stronger truck.

The C-30 series is Chevrolet's largest—the 1-tonners. Regular cab models start at 8600 pounds GVWR, run to 10,000 pounds. After that, you are out of the light-truck category.

This series has a six-cylinder engine as standard, but at 292 cu. in., it's a lot bigger than the Six in the C-10 and C-20 series. Two V8s—350 and 454—are optional in the C-30 series.

The C-30 rear-axle ratios run from 3.21 to a stump-pulling 4.56. The transmission choices are only a four-speed or automatic—no three-speed.

The C-30 comes in a Bonus or Crew Cab as well, with the minimum GVWR at 9000 pounds and a little more choice in axle ratios.

The K-Series

Each of the Chevrolet C-10, C-20 and C-30 pickup series has four-wheel-drive versions marketed under the designations K-10, K-20 and K-30.

The main difference in powerplant offerings is that the Six is not offered in the K-20 but is available in the C-20. A second difference is that, in the K-30, the largest V8 displaces 400 cu.-in., while in the C30 it's a 454. The same limitation is placed on the K-30 in the Bonus and Crew Cab forms, where a 400-cu.-in. V8 is tops.

The diesel

The C-10 is available with a 350-cu.-in. diesel engine which comes with automatic transmission only. The GVWRs run from 5300 to 6200 pounds and there are only three axle ratios to choose from—2.76, 3.07 and 3.40. The diesel pickup comes standard with an engine oil cooler, and engine block heater, a 63-amp. alternator, dual batteries, dual exhausts, power brakes and steering and, of course, special diesel nameplates.

Dodge

Dodge is offering five basic sizes of pickups for 1979—a half-ton, heavy-duty half-ton, $\frac{3}{4}$ -ton, 1-ton and 1½-ton models—plus a diesel Six option.

Unfortunately, Dodge has lost the use of the hot-performing 400 and 440 engines in many of the lighter trucks, and this will crimp its image of building fast trucks for 1979. Fortunately, the 360 V8 has survived and will be available.

Dodge has a unique lock-up feature on all its truck automatics with GVWRs of 6000 pounds or less. This feature locks up the torque converter, eliminating the slippage that usually results in poorer gas mileage with automatic transmissions.

D-100: Dodge's basic half-ton comes in either a 115- or 131-inch wheelbase. The GVWR is 5000 pounds with minimum payload of 1390 pounds and maximum of 1860 pounds.

The code name for the flat-sided bed is "Sweptline" while outside-fendered models are called the "Utiline."

Engine choices are: a 225-cu.-in. in-line Six, a 243-cu.-in. in-line diesel Six or a 318-cu.-in. V8. The diesel is not available in California on the D-100.

Dodge offers a wide variety of transmissions—a three-speed manual, three different four-speeds, the last with overdrive, and an automatic.

D-150: The Dodge D-150 pickups come in two of the same wheelbases and body styles as the D-100 but take a big jump upward in their GVWR—from 5000 pounds in the D-100 to 6100 minimum in the D-150. The payload is 2405 pounds, just over a ton. Salesman call it Dodge's "heavy-duty half-ton."

The D-150 also comes in two longer wheelbases—133 and 149 inches—in the Club Cab model. As with the other pickup makers, this is a roomier cab with storage space behind the bench seat.

The engine lineup starts with the 225-cu.-in. in-line Six and jumps to the 243-cu.-in. diesel Six. The V8s include the 318- and 360-cu.-in. powerplants. Included among the 360-powered pickups is the famous "Little Red Truck," still available with dual exhausts in spite of catalytic converters by having a converter on each exhaust. The 400 and 440-cu.-in. V8s are no longer available in the D-150.

Transmission choices include the base three-speed manual, a heavy-duty version of the three-speed manual, a three-speed automatic, a four-speed with overdrive, and a wide-ratio or close-ratio four-speed. A close-ratio has the advantage of not losing too many revs between gears.

Dodge four-wheel-drives

The D-150 four-wheel-drive offers the most choice among Dodge's 4x4s. It can be ordered in wheelbases of 115, 131, 133 and 149 inches but only in one GVWR—6050 pounds. The 225-cu.-in. Six cannot be ordered in California but the 243-cu.-in. Six is available in all 50 states. In V8s, the 318 is not available in California, nor is the 360 with the Club Cab (149-inch wheelbase).

Trans choices include the heavy-duty three-speed manual, a three-speed automatic and close or wide-ratio four-speeds. Axle ratios are usually 3.55 in back and 3.54 in front. Antispin is available in back.

D-200: Referred to by salesman as Dodge's $\frac{3}{4}$ -ton pickup, the D-200 is the next size up in Dodge models. It comes in three wheelbase choices—131, 149 and 165 inches. The GVWRs range from 6200 to 8100 pounds.

Although the 225-cu.-in. Six is standard, it is not available if you pick a gross vehicle weight rating of over 7000 pounds. The diesel Six is not available in California or in states with allowable noise levels it would surpass.

Two V8s are offered—318 and 360-cu. in. The 318 is not available in California on the 165-inch wheelbase D-200. The 400 and 440-cu.-in. V8s have been dropped.

Transmission choices include a three-speed manual, heavy-duty three-speed manual, three-speed automatic and either close or wide-ratio four-speeds.

Only one rear-axle ratio in the D-200 is standard with any engine—the 4.10. The standard front-axle ratio is 4.09:1. With the 360-cu.-in. V8, you can order an antispin rear axle for more dig.

The D-200 4x4 equivalent is the W-200. You can order it in a 131- or 149-inch wheelbase with GVWRs of 6500, 7000 or 8400 pounds. Engine choices start with the 243-cu.-in. Six (not available in the long-wheelbase, 149-

inch, Club or Crew Cab models). The 318-cu.-in. V8 is not available in the 131-inch wheelbase models, and the 149-inch-wheelbase Crew Cab powered by it is not available in California. The largest engine, 360-cu.-in., also is verboten in the Golden State in this 4x4.

Dodge's D-300 used to be its heaviest light-duty truck. Wheelbase choices are 131, 149, 159 and 165 inches. The GVWRs start at 8600 pounds and go up to the maximum light-truck rating of 10,000 pounds if you order the dual-rear-wheel option.

Only V8s are available on the D-300 and the smallest—the 318—can be bought only in Canada. The U.S. market has to take the 360-cu.-in. V8 and like it—the 400 and 440 V8s were dropped. There are three transmission choices being offered: a three-speed automatic and either a wide or close-ratio four-speed manual.

Although most D-300s will come with a 4.10 rear-axle ratio, two models have a 4.56 rear end as standard, or you can order that option on many of the others. Also available on the D-300 is a plain 4.88 final drive as an option or the same ratio with an antispin device for better traction.

The 4x4 version of the D-300 is the W-300. It comes in one wheelbase—135 inches—and in one GVWR—10,000 pounds. The engine is a 360-cu.-in. V8 with either close or wide-ratio four-speed or automatic. Final-drive ratio, both front and rear, is 4.88.

D-400: Dodge's largest light-duty truck even exceeds the usual definition of "light duty" by having a GVWR of 10,500 pounds. Last year, it was only available as a 4x4. Now it comes in two-wheel-drive, too.

There are two wheelbases, 139 and 159 inches. The engine is a 360-cu.-in. V8. Transmissions are the wide-ratio four-speed manual or the three-speed automatic. The standard final drive is either 4.10 or 4.56, but a 4.88 is optional, also a 4.88 with antispin.

The four-wheel-drive version called the W-400 Power Wagon has a higher GVWR—11,000 pounds—and one gear choice—a 4.88 to 1. The close-ratio four-speed transmission is offered.

Trim levels. Dodge has three levels of pickup interiors. The Custom, its basic one-step-above-the-plain-truck package, includes vinyl upholstery, a 10-inch inside day/night rear-view mirror and a few outside bright trim pieces. The Adventurer has a deep foam vinyl seat or optional cloth-and-vinyl. This package includes carpeting, wood-grained door trim and various bright moldings on the truck exterior.

The Adventurer SE is what Dodge sells to make a pickup seem like a car inside. Cloth-and-vinyl seats are standard with all-vinyl optional. There's simulated rosewood on the inside, nameplates galore, an oil-pressure gauge, dual electric horns and various chrome moldings outside.

You can order bucket seats for the Club Cab or the conventional cab, or rear jump seats (which face the center of the cab) for the Club Cab in order to give it "temporary" five-seat capacity.

Dodge stylists are hipper than most automakers to the "custom truck" trends and offer three wheels usually found only at hot-rod supply stores. Among the options are white-

(Please turn to page 115)

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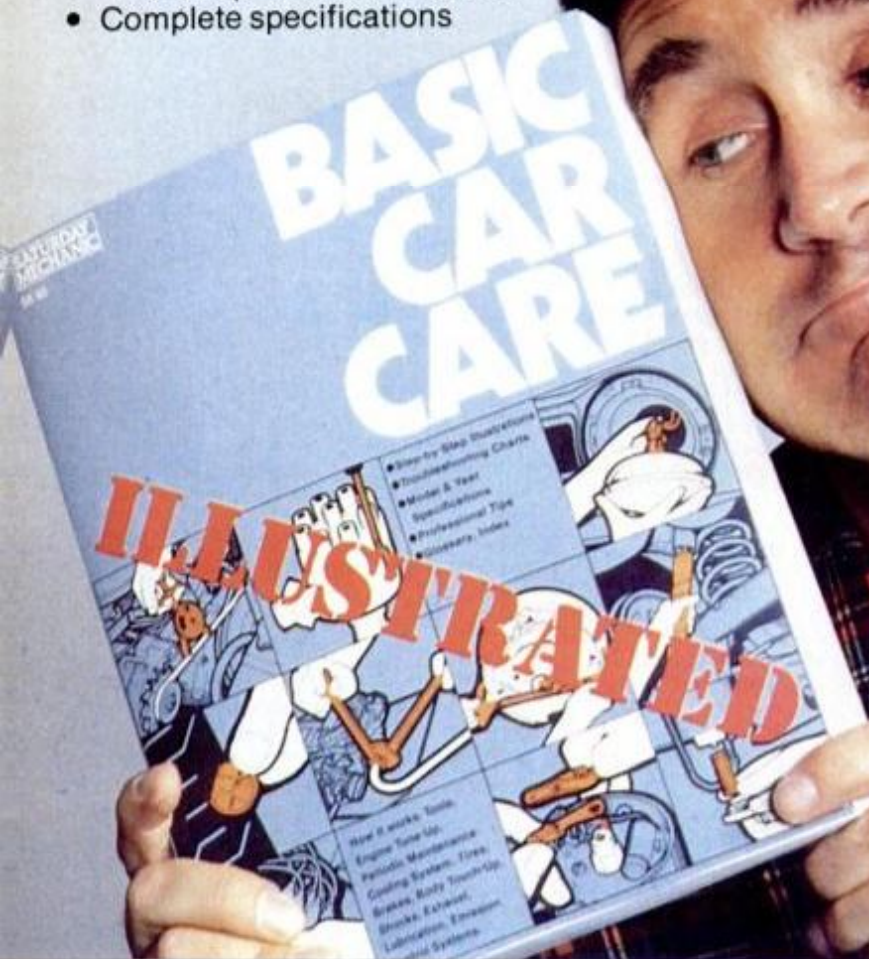
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THE HOTTEST THING ON WHEELS!

(Continued from page 113)

painted spoke wheels, five-slot, deep-dish chrome rims and chrome stock wheels.

Ford

Ford has four sizes of light trucks from the half-ton to the 1-ton.

F-100: This half-ton model comes standard with a GVWR of 4800 pounds; a 5300-pound rating is optional. Ford lists maximum load rating (MLR) as 1230 pounds for the standard F-100 and 1685 pounds if you order the optional GVWR.

There's a long-wheelbase F-100 called the SuperCab Styleside, with which you get a higher GVWR—5200 pounds standard and 5600 to 5800 pounds optional, depending on whether you get a 138-inch or 155-inch wheelbase.

The standard engine is a 300-cu.-in. in-line Six that burns unleaded fuel only, except in California where the 351-cu.-in. V8 is required. The 400-cu.-in. V8 is no longer available in a F-100 model.

Ford's F-150, its "heavy-duty" half-ton truck, starts with a 133-inch wheelbase on the Regular Cab model compared to 117 inches on the F-100.

The basic F-150 two-wheel-drive model comes standard with a 6050-pound GVWR. For about \$30 more, you can get 100 pounds more capacity. There is also a stretched cab called the SuperCab. It's built on a 139-inch wheelbase and has a GVWR of 6050 pounds in standard form, which is no more than the short-wheelbase pickup.

The next step up in options with the F-150 is the four-wheel drive—about \$1700 more, depending on model. This is available on the F-150 Regular Cab and the SuperCab.

Powerplants start with a 300-cu.-in. in-line Six in the Regular Cab and the 351-cu.-in. V8 in the SuperCab 4x4 (Regular Cab 4x4 in California). The 400-cu.-in. V8 and 460-cu.-in. V8 are also offered.

The F-250 is the next size (¾-ton). These have the same 133-inch wheelbase as the F-150s, but start with a slightly higher GVWR of 6200 pounds. The F-250's MLR also goes a lot farther than the F-150 with three different optional GVWRs—the maximum totaling 3715 pounds (compared to 2230 pounds for the F-150).

The F-250 also comes in a Crew Cab with a 150.3-inch wheelbase, or in a SuperCab with either a 138.8- or 155-inch wheelbase. A 4wd option is available on the Regular Cab, SuperCab and Crew Cab.

The standard F-250 engine is again the 300-cu.-in. Six in the Regular Cab or 351-cu.-in. V8 in SuperCab or Crew Cab 4x4s.

Engine options include the 400-cu.-in. V8, with two-barrel carburetor or 460-cu.-in. V8 with a four-barrel.

The 1-ton F-350, Ford's largest light-duty truck, comes in a Chassis Cab form—that is, a cab with a bare-rails chassis on which you put your choice of load bed. You can have a 136.8- or 160.8-inch wheelbase and up to 2½ tons in payload capacity.

For more carrying capacity, there's a "doolie" option of two rear wheels on each side. Top-rated version has a 10,000-pound GVWR and 5765-pound payload carrying capacity.

You can't order the Flareside style in the F-350 and even the Styleside is an option. The latter, on a 140-inch-wheelbase, is almost 1½

feet shorter than the F-350 SuperCab Styleside, which has a GVWR of 9200 pounds—and MLR of 4570 pounds. For more seating capacity, almost another foot is added to create the 166.5-inch-wheelbase Crew Cab Styleside. With that, the standard GVWR is 8800 pounds; an optional one is 9100 pounds.

For the first time, the F-350 can be ordered in a 4wd version. The 4x4 option applies to the Regular Styleside, SuperCab Styleside, Chassis Cab and, oddly, the Flareside, offered on the F-350 only if you order the 4x4 option.

The F-350 is also powered in the standard version by either a 300-cu.-in. six-cylinder in the Chassis Cab or Crew Cab versions or a 351-cu.-in. V8 in the Styleside or SuperCab and all 4x4 models. Optional engines include a 400-cu.-in. V8 with a two-barrel carburetor or a 460-cu.-in. V8 with a four-barrel.

Trim Levels. Ford divides its F-series trim into three levels. The base package called the Ranger includes various bright exterior moldings, vinyl or cloth-and-vinyl upholstery, rubber floor mats and sound insulation.

Next step up, the Ranger XLT package gives you a more carlike interior such as a soft Picton cloth-and-vinyl seat, cut-pile carpeting, wood-tone appliques and added insulation.

The final step up, the Lariat, decorates the exterior with two-tone paint, aluminum appliques, and adds the soft cloth seat matched by padded headlining, deluxe door trim and other features.

An exterior trim package, the "Free Wheeling" option, is available for the short-wheelbase Flareside. It adds pin stripes, black-painted grille and black bumpers. For style it has a tape stripe on the body side and other stripes on hood, doors and roof.

International

The Terra, a pickup truck named after "Earth," is a compact, almost stubby rig that borrows a lot from its tough cousin, the Scout II. It has a 6200-pound GVWR.

A six-cylinder diesel is offered on the 4x4—a practice International began in 1976. The 1-ton capacity of the Terra and its 6-foot pickup bed make for a lot of load-carrying capacity in such a compact rig.

Engine choices include an economical 196-cu.-in. Four, either a 304 or 345-cu.-in. V8 and the 198-cu.-in. six-cylinder diesel. You can order an automatic, but not with the Four or diesel Six.

International equips all 4wd Terra pickups with manual hubs. When you want to switch into or out of 4wd, you have to stop the vehicle, get out and manually turn the center of the hubs. But, at extra cost, there's a device that will lock or disengage front hubs. Neat on a rainy day.

The standard axle ratio varies according to the engine and trans. With the four-cylinder, it's a 4.09 or 3.54; with the V8s, it's a 3.54 or 3.07; and with the diesel, a 4.09 or 3.73. Other ratios are optional.

International Harvester is offering the new Goodyear Tiempo All-Season radial tires which have a mud-snow design tread yet "retain quiet highway operation," says International. This is important when most off-road tires wail and whine.

A valuable option is an auxiliary oil cooler for the automatic transmission. This is of vital use

(Please turn to page 116)

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(Continued from page 115)

if you tow a heavy trailer or insist on climbing large hills with your automatic International where the vehicle will be under load.

Other International options include dual shock absorbers for the front and rear (with freon cells in them to offer special resistance to heat), a brush guard, tubular bumpers, aluminum or steel wheels, and a "total performance" suspension kit including the double shocks and heavy-duty springs.

The cargo capacity of the Terra is one ton. This is a remarkably compact and cleanly styled 1-ton pickup. Because International Harvester isn't in the "planned obsolescence" school of auto styling, you can plan on this remarkably compact and cleanly styled 1-ton pickup staying the same for some time and thus depreciating less than some pickups built by the Big Three.

Because it is so closely related to the rugged Scout, almost every heavy-duty option offered for the Scout is available for, or will adapt to, the Terra. That's what makes the Terra sort of a "hard-core" pickup truck—buyers who concentrate on it are those who know all about the truck market and want something that's no-nonsense and as tough as they come.

Jeep

Jeep Corp. has a built-in advantage when it comes to building an image of toughness. That's because, when it comes to off-road, Jeep *invented* the genre. Jeep offers two trucks for 1979, the J-10 and J-20. Standard equipment includes power disc brakes, dual horns, amp. and oil gauges. Three special packages are offered to dress up the Jeep pickups.

The Jeep J-10 series has a Model 25 and Model 45. The 25 comes in a 118-inch-wheel-base chassis and the 45 has a 130-inch wheelbase. The standard engine is the two-barrel, 258-cu.-in. Six. A 360-cu.-in. V8 with a two-barrel carburetor is optional.

The J-10 models have a GVWR of 6200 pounds. Manual front disc brakes are standard; power disc brakes, an option.

The standard J-10 comes only as a 4wd model using Dana 20 transfer cases front and rear. This means you can switch back to two-wheel drive for highway cruising to get better gas mileage. With the part-time 4wd system, you can order a three-speed manual transmission or a four-speed. Since the axle is "dual range," you can also run the vehicle in a high or low range of gears to suit the terrain.

If you don't want to bother switching from two-wheel drive back to 4wd, four-wheel drive, Jeep also offers its Quadra-Trac system—full-time 4wd. But be warned—it means worse overall gas mileage because you can't switch back to two-wheel drive when on the freeway. Quadra-Trac comes only with the three-speed GM-made automatic transmission.

The J-20 GVWR ratings are 6800, 7600 and 8400 pounds. The latter two might be uncomfortable for street driving unless you balance out the rig with a camper or heavy load. Standard engine is the two-barrel, 360-cu.-in. V8. Either the Dana two-speed axle or the full-time 4wd Quadra-Trac system can be ordered. The Dana, comes with a three or four-speed manual transmission; Quadra-Trac, has the automatic.

Jeep is also trying to make its pickups more comfortable, while retaining their hefty

(Please turn to page 118)

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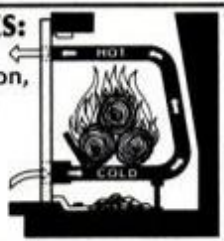
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THE HOTTEST THING ON WHEELS!

(Continued from page 116)

macho image. Among new options are more insulation inside the cab, intermittent windshield wipers and a passenger-assist handle.

Trim Levels. Three packages are designed to add "image" to the Jeep pickups. The Honcho package uses multicolor stripes, denim fabric on seats and even denim on the doors. It adds painted spoked steel wheels, white lettered tires, pin striping, carpeting, an "engine-turned" instrument panel, "soft-feel" steering wheel and underhood insulation.

The Golden Eagle package contains many things in the Honcho package, but adds a roll bar for the pickup box, a steel grille guard and off-road driving lamps mounted on the roll bar.

The 10-4 package (ring any bells, good buddies?) includes striping, decals, Tracker 10-15L tires, spoked steel wheels, box-mounted roll bar and rear step bumper.

The mini-pickups

Chevrolet's LUV truck is a tough little minitruck built by Isuzu, a firm that GM owns part of and which is famous in Asia for its tough pickup trucks.

LUV has a GVWR of 3550 pounds, about 1350 pounds under its lowest GVWR-pickup truck. But an optional 4150-pound GVWR with the LUV boosts the payload from the usual 1125 pounds to 1635.

You can only order one engine with the LUV truck—a 110.8-cu.-in. in-line Four rated at 80 hp with 4800 rpm. You can choose one of two transmissions—a four-speed manual or an automatic.

The LUV comes in wheelbases of 102.4 and 117.9 inches. The long-wheelbase version adds about 17 inches more length in cargo space—important if you carry lumber or pipes.

Three different upholstery arrangements are available—vinyl, knit vinyl or cloth—all in either a bench or bucket seat form. The plain bench seat model is the Custom Deluxe. All the other choices are available in the Mikado model.

Among options are a sliding rear window, rear step bumper, airconditioning and "Mighty Mike" striping.

The LUV truck is among the first minis to offer an automatic—and with its half-ton capacity and over-20-mpg gas mileage it's a practical "first pickup."

LUV 4x4. When Vic Hickey and others began to build 4x4 versions of minipickups, several automakers wondered whether they had missed out on a market. Taking no chances, Chevrolet is marketing a 4x4 version of the LUV, coded Series 9.

The 4x4 is powered by a 110.8-cu.-in., 80-hp, overhead-cam Four, with 95 foot-pounds of torque at 3000 rpm. Brakes are disc/drum as in the standard LUV.

The front axle has a ratio of 4.10 to 1, as does the rear. The front axle uses torsion bars for springing. A stabilizer or antiroll bar is standard up front.

The transmission is a four-speed with a transfer case as standard, meaning that you can drive along in "2H" (rear-wheel drive and High speed), "4H" (4wd and High speed) or "4L" (4wd and low speed). The transfer case is combined with the transmission in a single unit.

The pickup bed is 6 feet, 1 inch long with no optional longer beds. One advantage of the

LUV 4x4 is its ground clearance—7.5 inches from the rear differential to the ground.

Datsun

Datsun's minipickup for 1979 comes in three body styles—regular cab, long-bed pickup and King Cab, each with a GVWR of 4085 pounds. Each has a gross axle weight rating of 1745 pounds in front and 2350 pounds in the rear. The payload on all three is 1100 pounds net—enough to qualify them as half-ton pickups.

The engine in the pickup is the same 1952-cc in-line Four that's used in the 510 and 200SX passenger cars. It has an 8.5 to 1 compression ratio and is rated at 92 hp at 5600 rpm in 49 states.

The difference in bed size between the regular version and the long bed is 15.4 inches. The King Cab has the regular version's bed length but a roomier cab to stow locked cargo behind the seat.

A wide-ratio five-speed transmission is optional, as are airconditioning, automatic, a 3000-pound-pull winch, cloth seating, a chrome-step bumper and a Deluxe King Cab package which includes cut-pile carpeting, white sidewall radials, reclining bucket seats, a console with armrests—enough options to make you forget you are in a truck.

Dodge D-50 and Plymouth Arrow

New to the Plymouth and Dodge lineup is a minipickup made by Mitsubishi. The Plymouth Arrow and Dodge D-50 are half-tonners in the same payload range as the Ford Courier and Chevy LUV. They'll carry 1400 pounds.

The D-50 and Arrow have a 109.4-inch wheelbase and a 6½-foot-long cargo bed. For power there's a 2-liter engine rated at 93 hp and a 2.6-liter Four at 105 hp. The exhaust emissions control is built into the basic design with the MCA Jet System devised by Mitsubishi. Standard models come with a four-speed manual trans, while the Sport models have a five-speed manual. A Torqueflite automatic is optional on either model.

Standard and Sport models differ in basic trim; the Standard has a rubber floor mat while the Sport has a carpeted floor and other Standard options as standard. Among options are airconditioning, sun roof, in-box roll bar, grille guard, step bumper and cover for the cargo box.

Ford Courier and Mazda

Ford's popular Courier pickup is a half-tonner with a lot of choices, a GVWR of 4100 pounds and a payload of 1400 pounds. If you want a 7-foot-long pickup bed, you can order the long-wheelbase (112.8-inch) model, which also comes with a larger fuel tank (17.5 gallons). As you might have guessed, the same models are offered by Mazda (since it makes the Courier for Ford).

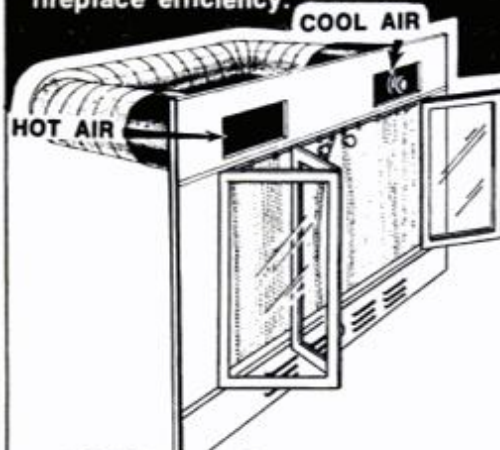
Engine displacement of the Four in the Mazda B2000 pickups is up to 2 liters for '79. The Courier has two engine choices—the base 2-liter Four or Ford's 2.3-liter Four. With the larger engine, there are two manual shifts—standard four-speed or optional five-speed, including overdrive. There's also an optional three-speed automatic. The Courier has disc brakes up front and drums in back. Variable-ratio manual steering is standard.

Minitrucks sometimes get criticized for their hard ride, so Ford is offering a Soft Ride

(Please turn to page 120)

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THE HOTTEST THING ON WHEELS!

(Continued from page 118)

package with five-leaf rear springs. This package, though, drops your maximum payload down to 900 pounds.

Ford is sprucing up the Courier. A Sports Group option package adds high black plaid buckets, more instrumentation, a sporty steering wheel and other niceties. Among other options are airconditioning, rear-step window defroster, heavy-duty battery and a high-output heater.

Toyota

Toyota's pickup truck has been restyled for 1979 with a "crisper," more carlike look, along the lines of Dodge's D-50. Most significant is

the change to a torsion-bar front suspension from coil springs.

Another technical step forward is a standard proportioning valve linkup between front and rear brakes to prevent rear-end lockup when the truck is unloaded and you hit the brakes.

The most deluxe model, SR-5, offers bucket seats, simulated wood grain, a five-speed or optional automatic and a long or short bed. The longer (7-foot) bed might have more packing room, but the GVWR is the same—4100 pounds. Maximum payload is 1100 pounds, not counting passengers and optional equipment.

After SR-5 comes the Deluxe model with

five-speed as standard, a 2.2-liter engine (as in all Toyota trucks) and white sidewall tires. The standard pickup, comes with four-speed and blackwall tires.

Among the options are cargo tie-down hooks to line the bed rail with, chrome step-up bumper, 40-channel CB, bucket seats and AM/FM to make mini-truckin' more palatable.

Special-purpose vehicles

If it's got a bed, it's a pickup, right? Well, the Subaru BRAT used to be a "special purpose truck" but the EPA has placed it in a new special-purpose vehicles class. That doesn't mean that it doesn't have its bed-in-the-back anymore. If you want to see the bed with its pair of jump seats, take a look at page 118, March '78.

Another pickup that may be added to this list of minis, maybe this year, is the Rabbit. A pickup truck version of the VW was spotted at VW's new Pennsylvania plant, but there are no official production plans yet.

Chevy El Camino

Chevrolet's El Camino would be pretty fancy just for a car, but it has the advantage of being half-pickup, too.

Four engines are available in 49 states—3.3- and 3.8-liter V6s, plus 4.4- and 5-liter V8s. In California, only the 3.8-liter V6 and 5.0-liter V8 are offered. The 49-Staters can order a four-speed with either V8, but Californians can only order automatics.

The El Camino comes standard with a bench seat, but bucket seats or 50/50 split-bench seats (with a fold-down center divider) are optional. Bench or bucket seats come in cloth or vinyl. Although there isn't that much roof to an El Camino, you can get it vinyl-covered.

There are four trim packages: the Classic, Super Sport, Conquista and the Royal Knight, which is combined with the Super Sport.

Ford Ranchero

The Ranchero, Ford's "luxury pickup," is half-car, half pickup. Although it can't carry any more weight than a car, it does have a 6½-foot long load bed. If you leave the tailgate down, you can fit in a 4x8-foot sheet of plywood or plasterboard.

There are two V8 engines choices in 49 states—the 5-liter and 5.8-liter—both with two-barrel carburetors. In California, only the larger one is available. Transmission is a three-speed Cruise-O-Matic with a 2.75 final-drive ratio available on the 49-state car with the larger engine. California cars have the 2.47 final drive.

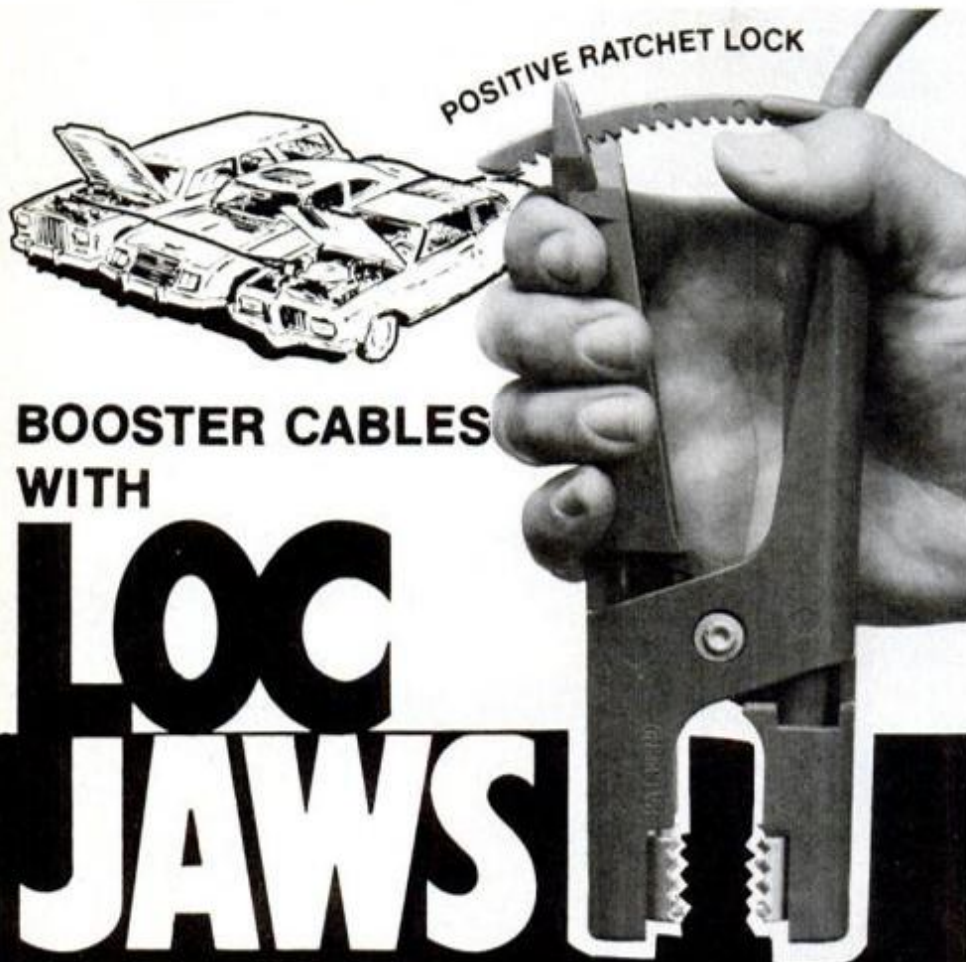
The Ranchero comes in three stages of trim—the 500, or baseline model; the GT, which has a seat with a fold-down center armrest and full instrumentation, plus stripes galore; or the Squire. Woodgrain appliques decorate the outside of the Squire, recalling the days when "woodie" wagons had real, varnished wood on the sides.

Interesting Ranchero options are a 77-amp. battery in the trailer towing package and a Traction-Lok (nonslip) differential.

One disadvantage to a Ranchero-type car is that its finish and springing are to passenger car specifications. You can't put it through what you put a half-ton pickup through and expect it to stay cosmetically perfect. The Rancheros are made for gentlemen ranchers, with the emphasis on "gentlemen."

FM

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WHITEOUT: WINTER'S NIGHTMARE

(Continued from page 71)

ever a big clear-off wind comes roaring down—usually within 24 hours after any big snowstorm on its way eastward. It's this wind that picks up fresh snow and moves it.

■ **When you hear a heavy snow warning either (a) get going at once, or (b) if you can't outrun it, by all means hole up until it's over.** Your driving may be superb. But it takes only one unlucky driver to block an Interstate for days.

■ **If you think you can safely maneuver around the storm, and decide to risk it, stay off the Interstates!** *Interstate officials themselves advise this.* Choose a slower road. Then if someone blocks traffic, you can turn back to another route—or at least shelter in a home, motel or gas station.

■ **Urge your local radio and TV stations to add "Urgent Whiteout Warnings" to their forecasts.** They know (you don't) when wind is going to strike. If you're at work when you hear such a warning, stay there overnight if necessary. In Buffalo, some workers who tried to drive a few blocks home had to crawl back to their factories on hands and knees.

■ **Use snow tires, natch.** But also—as engineers do—*put chains on your summer wheels* and carry them along. If a snow-wind comes up, change them. Chains are priceless.

■ **Erect your car's headrests.** "I always do when conditions get tough," says New Hampshire's Bob Hogan. "I want protection if hit from behind."

■ **Driving into a whiteout.** The best rule here is: if you possibly can, avoid it. It really could be worth your life. You won't believe it until it happens, but you lose *all* contact. The wind blinds you. It makes you dizzy. You may want to keep turning with those whirling flakes.

1. In a real whiteout, skill is of little use. Survival becomes simply a matter of luck. So pick a safe spot and wait. Or, if you can turn, retreat to safer areas.

2. But if you must go, as on Interstates where you can't turn back, take bearings on the last visible objects. Try to follow wheel tracks if you can see them. If not, search for roadside posts. Often you can't see them, either. But at night glittering post reflectors may show.

3. To pick out reflectors, flash your high beams *frequently*. Sure, this creates glare. But it also picks out glitter that low beams can't see. And high beams will also reveal the reflectors on stalled trucks or cars.

4. Even in daytime, run with lights on. People stranded ahead can

see you before you see them. Also your taillights come on, adding a little further protection. *High-beam headlights will pick out reflectors in daytime, too.* Also use hazard lights for extra protection.

5. Sound your horn frequently.

6. It can now be suicide to continue at road speed, and suicide, also, to go *too* slow. Bob Hogan advises: "Slow down enough to cut the *speed differential* between you and other vehicles—in case of collision."

7. If you can find turnouts, stop—never on or near the road! And clean your headlights. You'll probably find them frozen over. Also clean taillights and side reflectors.

8. Expect slippery ice, even if the road a half mile back was bare.

9. Be sure your windshield and wiper blades have no ice buildup and are warm. Peephole driving is sure disaster. Yet many defrosters simply won't work in a bad storm. You need full windshield vision to go into a whiteout and survive. (Furthermore, today's base-mounted blades can't drain! Some experts want to see blades that pivot from the top of the windshield.)

In *How to Go in Snow* (page 82, Dec. '77) I told of one way to remove ice when you can't stop: Reach around the corner post and let the wiper blade run over your fingertips. Then let it snap against the glass. But in a bad storm recently, I found a better way. Modern defrosters don't work because they simply don't throw heat to the driver's edge of the glass. What little heat they do give is blown away by the wind. So find a safe place, be sure the blower is on full, then wait. In minutes, with no forward speed, windshield ice will melt. If you can't stop, cutting speed for a while helps.

10. Use your CB not only to warn others, but to ask what lies ahead. Clear road may be only minutes away. In a Virginia whiteout, with nearly two feet of wind-carved snow on my roof rack, I suddenly ran from driving snow to bare, dry pavement and perfect visibility. Stars twinkled. Ahead lay the lights of Washington. A carhop asked: "Where did all that stuff come from?" Two miles from a blinding Southern storm it hadn't even snowed at all!

If you have to stop

Road blocked? Spinout ahead? You're in great danger of being run over. This is no false alarm. Get out! Get everyone away from the road.

Leave headlights on at night, with flashers working. Use taillights and flashers by day. Don't raise your hood at night. It blocks the protective glow of your headlights.

You should always have flares—the sputtering, chemical type—within reach. If you feel it's safe for a moment, grab a handful. Light one behind your car, staying ready to run for the ditch. Watch and listen. If it's still safe, you might risk running back along the shoulder with a lighted flare, holding it low (so it won't burn your hands or eyes). Even a third, fourth or fifth flare is useful—trucks skid long distances.

Stay ready to jump. Having done your best to save others, get off the shoulder and save your own life.

Three rules to remember

No two crises are the same. No rules always apply. But three that saved me trouble many times are:

1. Turn and go back. I've said it before. It's still my *No. 1* rule. Never *knowingly* head into whiteout trouble. If you can turn, go back. Often you're in the clear in minutes.

2. Add weight. I use from 25 to 50 pounds of any sensible weight material like sand (nothing solid) over the rear axle of any rear-drive car. Front-drive cars don't need it.

In rear-wheelers, weight usually saves the day. When I last mentioned this, Dale Tripp, a veteran north country driver, including Alaska, wrote: "I go along with everything you said, but one: You used 25 pounds; I put 300 in my car, 600 in my pickup. And I promise you, even in 13 inches of wet, heavy snow I will go-go-go, even uphill."

I believe it. But over 300 pounds in a car would scare me. Doug Cook of Sheboygan, Wis., wrote that farmers there use a 100-pound bag of feed. Doug uses cracked corn, which he says also can be used as wheel grit. Even kitty-litter helps.

What spins many cars in whiteouts is simply lack of traction. Weight adds traction.

3. Total quiet. I try to maintain total silence. No talk, radio or blower. I even keep windows rolled up.

When my car starts to jostle uneasily, I want to hear every little telltale sound, every message it sends. Examples: Hissing wheel-houses ("There's some good sand in this snow"). Sudden loss of wheel rumble ("You've lost contact with the road. You're snowborne"). I want total concentration so I can analyze every slight tilt, tracking change, loss of grip, the beginning of rear-end fade.

And that concentration is what will get you through blowing snow.

With these three rules alone, you stand less chance of being caught among the millions who will get stuck—or worse—in storms this winter. **FM**

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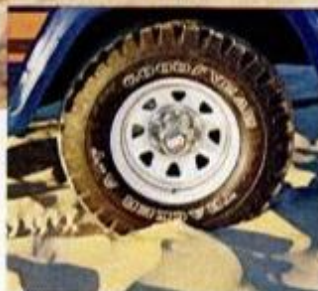
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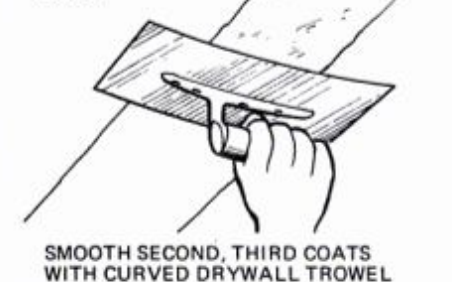
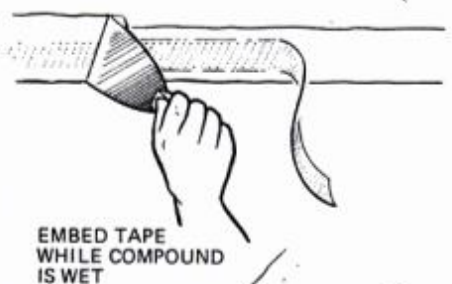
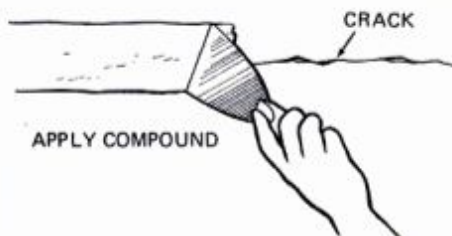
HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Kitchen ceiling crack

How do I repair an 8-foot-long crack in my drywall kitchen ceiling? We were thinking of using texture paint to hide the crack, but were worried about flaking because I'll be washing the ceiling often. Should we just cover it with tile?—Mrs. J. Stewart Wright, Wolf Point, Mont.

The crack may have been formed by shrinkage in your ceiling joists which has since subsided. First, re-tape the joint. Liberally apply joint compound to cover at least 1½ inches on each side of the crack. While the compound is still wet,



Mend the crack before painting ceiling.

embed the tape over the crack. Press the tape firmly into the compound with a taping knife and lightly draw off excess compound. When dry, sand lightly and apply a second coat. Draw off excess more firmly. Sand when dry and repeat. For the second and third coats, use a curved drywall trowel—it has a concave surface—which provides a slightly thicker buildup at the center and feathered edges. When dry, apply a coat of shellac to seal and you're ready to paint. Texture or sand-finish paints won't cover a crack that's not properly corrected. Many people find it easier to paint than wash a ceiling.

Tree root problem

A green ash tree stands 15 feet behind my house. It's about 40 feet tall and 2 feet in diameter. Do its roots pose a threat to my 8-inch poured concrete foundation?—William V. Fogler, St. Louis.

According to the Department of Agriculture, green ash grows well on home lawns and may reach up to 50 feet in height and 1½ feet in diameter. Your tree has apparently reached maturity. If your foundation shows no signs of cracking now, I'd say you have no problem.

A tree with horizontal root growth like the silver maple, however, is a serious threat to foundations and sewer lines. As with any large tree close to a house, have yours pruned of any dead wood which might fall on your home.

Lying low

The rear of our property is lower than the property of our four adjacent neighbors. The previous owner of our house raised the land with fill, but in a short time the neighbors did the same. The ground is entirely clay. We don't want to fill again and dump water on our new neighbors, but we'd like to add soil for gardening. Can we build a drywell in clay, or is there a way to pump water to the city's storm drain, which is 10 inches higher than our property level?—Mrs. Thomas Stevens, West Hartford, Conn.

A drywell is similar to a cesspool; blocks are laid with the cores horizontal so water can seep into the soil. In your case, a grate would have to be placed on top and adjacent ground sloped toward the grate. Percolation is extremely slow in clay. So the area around your drywell would have to be back-filled with stone. Depending on your soil, "fingers" of drain tiles in loose stone similar to those of a septic tank may have to be installed. There are submersible

pumps which could be installed in a drywell to activate when water reaches a predetermined level. However, these will freeze up if they're not deep enough, and they must be kept free of all debris.

I strongly suggest you meet with your neighbors and city engineers to come up with a satisfactory solution. The city must have approved the original building plans and should participate. You and your neighbors may want to hire a civil engineer to assess the situation. His fee should not exceed \$200.

Walls crumbling down

The concrete basement walls of our 80-year-old house are deteriorating. They seem to be made of mostly gravel. Layers and chunks keep falling off, accumulating dust and rocks in our basement. What do we do?—Mrs. F. Karls, Downers Grove, Ill.

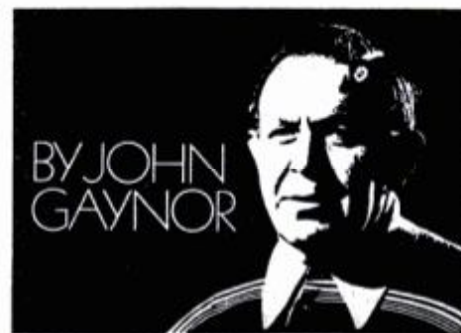
You must first determine whether your walls are structurally sound or in danger of totally failing. If you're not absolutely certain yourself, consult a reliable contractor or engineer. If the walls are sound, the following repairs should work:

First, scrape and wire-brush all loose concrete off the walls. Next, nail wire lath (specifically for stucco) at 16 inches on center, vertically and horizontally, to the wall with masonry nails. Make sure the nails are long enough to fasten securely.

Mix stucco by volume as follows: one part portland cement, ¼ part hydrated lime, and between two and three parts clean, fine mortar sand. Add water to form a fairly stiff mortar mix. Dampen the wall by "throwing" water on it with a whitewash brush. Then embed stucco firmly into the mesh with a trowel. The finished coat should be about ¾ inch thick.

PM

Do you have a home maintenance or repair problem? Send it to Homeowner's Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.



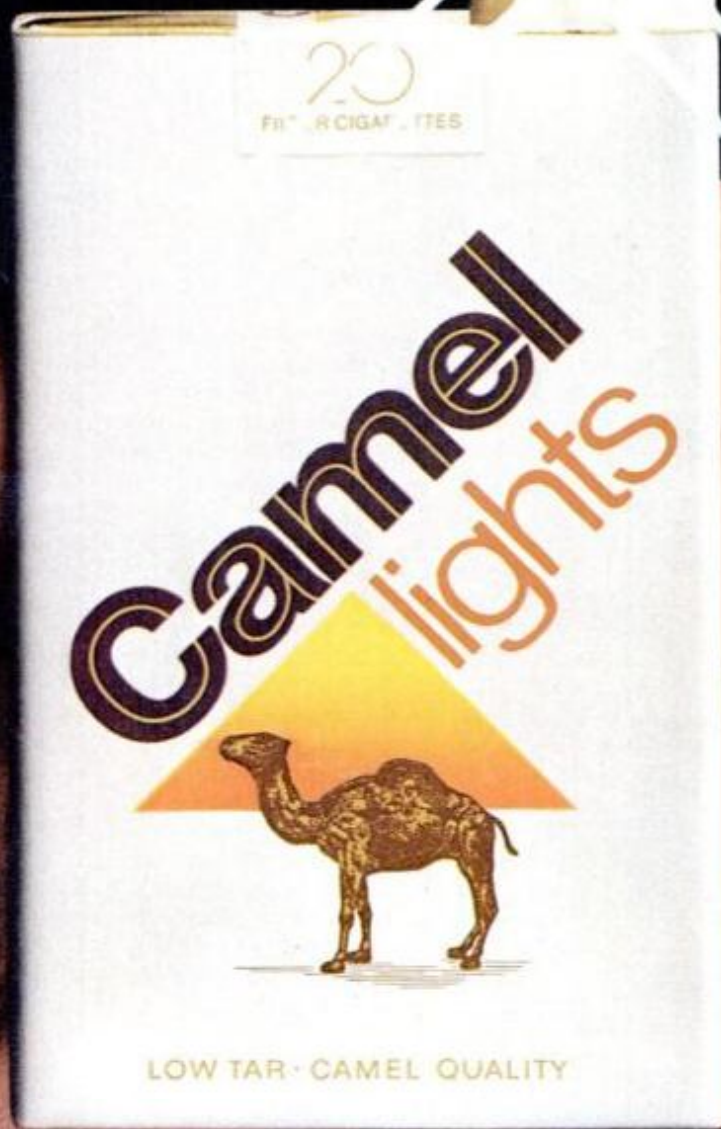
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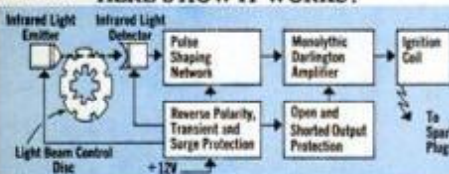
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BUILD PM'S SOLAR FOOD DRYER

(Continued from page 101)

tain high-velocity airflow over the food. This results in rapid food drying. Larger foods such as vegetable leaves, which cannot be accommodated by the rack, can be placed on several layers of cheesecloth located in the food compartment.

The temperature of the air passing through the unit can be controlled in several ways. The easiest way is to adjust the angle of the collector tilt with respect to the sun. Note that the blower end should always be raised so the heated air will rise up to it. On days with diffuse radiation, a deflector made of aluminum flashing may be installed over the intake/exhaust end of the dryer to increase the temperature and improve dryer performance. Some venting around the sides of the deflector should always be maintained, so that moisture can escape. High temperature can also be maintained by adding more insulation to the sides, as well as to the unit bottom. Our plans call for rigid Styrofoam to be used on the underside of the food compartment.

How to build the collector

First, cut the plywood bottom panel and bore a 2½-in.-dia. hole as indicated in the plans, near one end. Use a hole-cutting saw chucked in your drill or a sabre saw. Then nail the side and end cleats (E and N) ¾ in. in from the edges. Inside the open-ended box you have formed, lay steel wool in double 8-ft. lengths to make a 1½-in.-deep layer. Staple the ends to the plywood.

To increase the absorptivity of the steel wool, thoroughly spray it with flat black paint.

Staple a sheet of 6-mil clear polyethylene plastic to the top edges of cleats E and N. Be sure to allow about 2 in. of the plastic to project beyond the open end. Trim the plastic flush to the sides and then cap it with ¼ × ¾-in. strips (C and D).

When you're finished with the first layer of plastic, attach the collector sides and ends, A, F and H. Pull the loose end of the plastic to the outside face of H and staple it in place. This will seal up the dead air space.

Now attach the second sheet of plastic to the top. Staple it along the box perimeter and then conceal the staples with nailed-on lattice.

Building the food compartment

Begin construction of the lower half of the drying unit by cutting a 10 × 10-in. opening in the plywood bottom of the food compartment.

Nail on the side walls and the fan recess box with 4d box nails. Then make a border with ¾ × ¾ pine, ripped from 1-in. stock, to protect the edges of the Styrofoam insulation. Attach the Styrofoam sheet to the plywood with construction adhesive.

Next, construct the food rack as shown in the plans. Fasten it in place with two screws.

Assembling the dryer

Before attaching the collector to the food compartment, be sure to add vinyl foam tape weatherstripping to the top edges of W, Q, and R. Then place the collector on top of the food compartment and use clamps to slightly compress the weatherstripping. With the sections clamped and aligned, attach the hinges and latches.

The motor is attached to the blower housing with two small screws. Remove the original screws and bore new 1¼-in.-dia. holes completely through the housing. This will enable you to use 3-in. No. 10 screws to attach the blower over the 2½-in.-dia. opening in the plywood. Pass the power cord through a hole in the fan-recess box and tie a knot to prevent pull-out. Then join the power supply cord to leads from the blower with solderless connectors. Add the bracket shown in the plans to neatly store the power cord when the unit is not in use.

A meat thermometer can be used to check the air temperature in your dryer. To install it, bore a hole of the same diameter as the thermometer stem on the side of the food compartment.

Caution: Now that you are ready to start drying, run the collector for one day prior to adding food to draw off fumes from the paint used on the steel wool that might taint your food.

For more information

If you're interested in learning more about preserving food by drying it, read the pertinent chapter in *Putting Food By*, published by the Stephen Greene Press, Brattleboro, Vt. 05301. USDA Home and Garden Bulletin 217 entitled *Drying Foods at Home* can be obtained for 45 cents from the U.S. Superintendent of Documents, Consumer Information Center, Pueblo, Colo., 81009. If you're a resident of California, *Drying Foods at Home* is available free from County Cooperative or Agricultural Extension offices. Ask for leaflet No. 2785.

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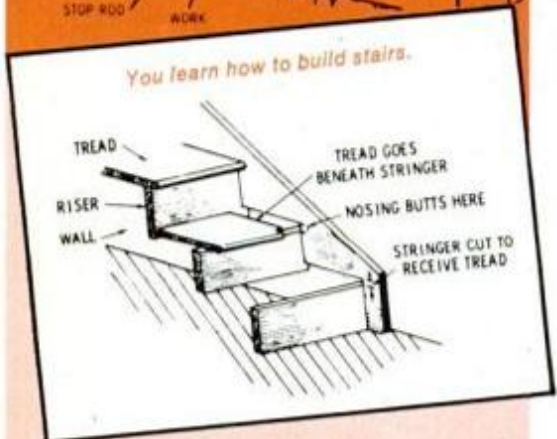
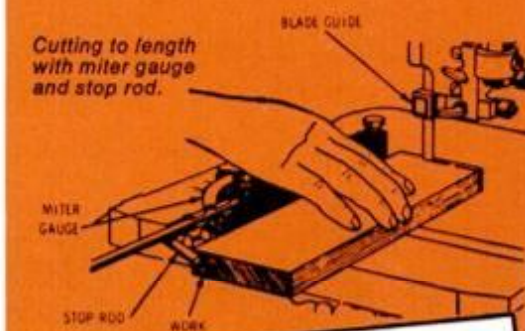
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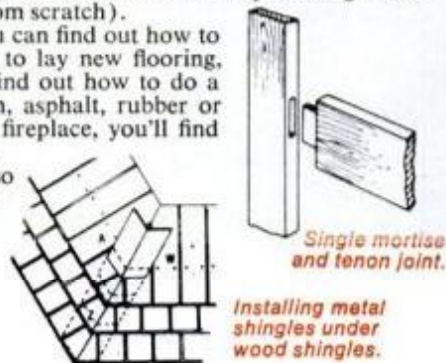
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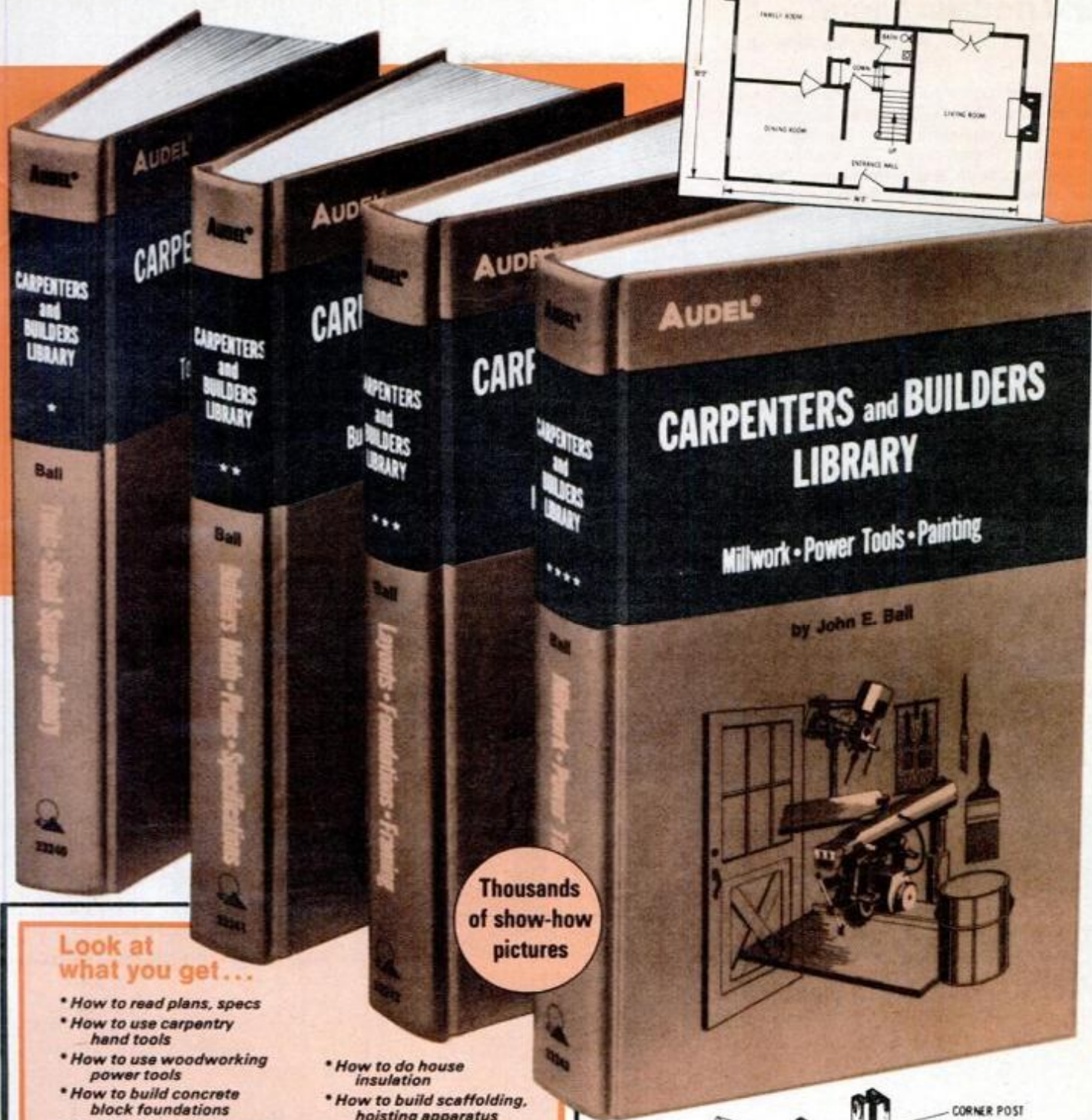
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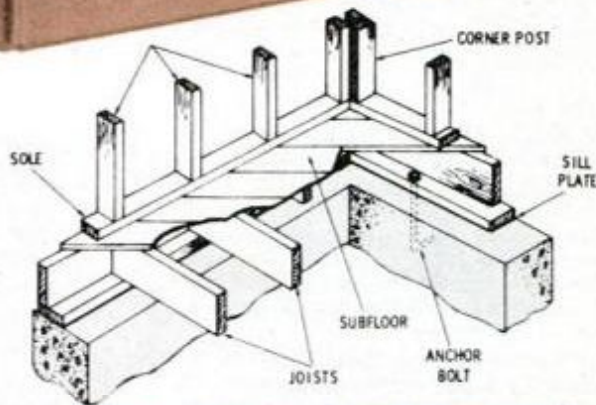


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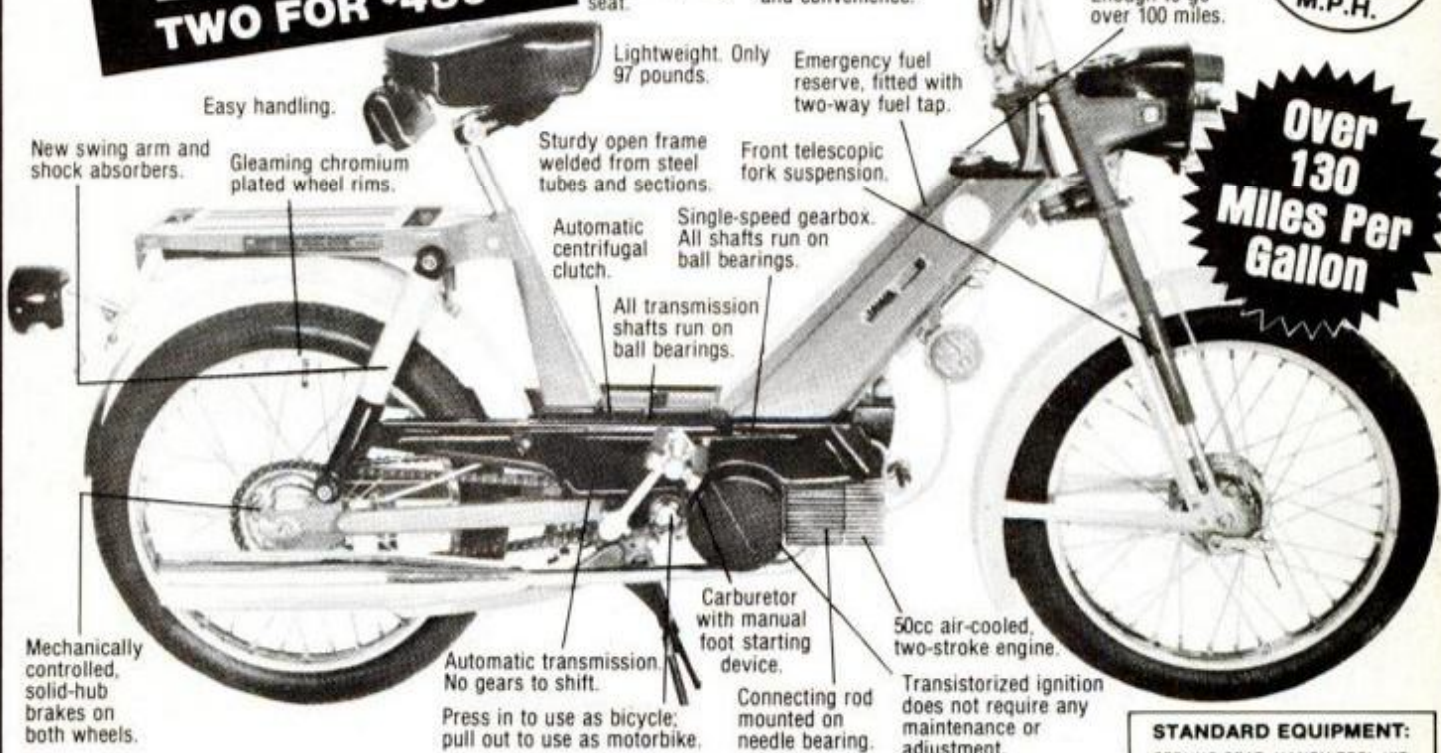
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CENTER FOR DISEASE CONTROL
(Continued from page 75)

come from, or why it had stopped. That might have been the end of the Pontiac story if it weren't for advances in medical technology over the past few years. Improved equipment and new techniques have brought C.D.C. researchers a giant step closer to being able to identify and fight tiny enemy organisms, many of them unknown until the past decade or so.

Legionnaires' Disease was among the most frightening of these unknown enemies. The illness got its name in 1976 after it attacked 221 persons who attended an American Legion convention in Philadelphia. Thirty-four died. The Bellevue Stratford Hotel, where most of the conventioners stayed, closed down as visitors shied away. C.D.C. researchers were launched on another investigation.

After six months of exhaustive lab work, doctors identified the cigar-shaped organism responsible in Philadelphia.

Thawing out the connection

Then one day, on a hunch, C.D.C. investigators went back to the serum bank, thawed the Pontiac serum, and compared it—using sophisticated tests—with the blood serum of known Legionnaires' victims.

The tests paid off. They showed with a high degree of certainty that the patients in Pontiac had been suffering from Legionnaires' Disease, some eight years before the illness got its name.

The story of the Pontiac mystery is typical of hundreds of medical detective stories told in the labyrinthine hallways of the country's foremost lab for the study of dangerous diseases.

The setting itself is fabulous. The center comprises 14 buildings with dozens of laboratories to study hundreds of human afflictions. Their names are often exotic and deceptively innocent: *Marburg, Lassa, Kyasanur Forest, Machupo, Junin*... The words roll off the tongue like the names of imported shampoo—but each of these is a potential killer with no known cure, and each could produce a devastating epidemic.

Isolating the killers

These particular agents are so dangerous, in fact, that the center has set aside an entire building to house and study them. The Maximum Containment Lab in Building 9, which opened—or rather closed

itself off to the world—last April, has as many security locks as a spaceship to protect researchers and outsiders alike. In two of the three working areas in the building, in a kind of inner sanctum, researchers wear clear plastic suits filled with filtered air delivered through a spiral tube from a ceiling connection. The suits permit scientists to move more or less freely and talk with other workers.

The thick plastic of the one-piece suits provides one level of protection. For further safety, a suit in use is blown up like a balloon; if it develops a leak, a continuous supply of fresh air into the suit will literally blow dangerous organisms away. But the lab doesn't tolerate even small leaks. One day recently, when some of the suits began developing tiny leaks from the wear and tear of shoes worn inside the plastic, the suits were redesigned and rebuilt virtually overnight. Now shoes are worn outside the suit, if at all.

Workers in these suits look something like astronauts. And they are supported by several backup systems. They enter the lab through interlocked doors—the second can't be opened until the first is closed. They take a series of water and chemical showers when leaving the work areas. Everything—even research notes—is left behind: The note paper might be contaminated, so the labs are equipped with a telephone facsimile transmission system to send written words a few feet away into a safe zone.

Other rooms in the C.D.C. complex are more conventional, but nothing here is done on a small scale. The center's machine shop, for instance, contains more than \$100,000 worth of bandsaws, drill presses, lathes, sanders, power shears and other equipment for working in metal, plastic and fabric.

Everyone who works in C.D.C.'s laboratories and shops has a story to tell about tracking unknown diseases, and finding them in odd places.

In 1946, for instance, a Connecticut man died of anthrax, a disease caught from infected animals. Anthrax begins as a localized black-crusted lump, or lesion in the lungs. Investigators were stumped at first as to how the man had been exposed. Eventually, by careful interviewing, they discovered the source. The victim worked for a piano manufacturer and had been making keys out of contaminated ivory.

Classic stories like this about disease detectives cast them in a

(Please turn to page 138)

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CENTER FOR DISEASE CONTROL

(Continued from page 136)

Sherlock Holmes role, often solving the case single-handedly.

Stories about today's investigators are slightly different. Now, a vital piece of equipment for a disease detective is a telephone credit card so the worker in the field can call the home office for consultation or data. And increasingly today, stories focus on the critical role of sophisticated technology based in C.D.C. labs.

Fingerprinting with gas

One highly sophisticated device at the C.D.C., for instance, can provide what amounts to fingerprints of dangerous diseases so they can be quickly recognized whenever and wherever they strike. The device is called a gas chromatograph. In one recent application, Dr. Wayne Moss at the center injected six samples of fluid made from lung tissue or other specimens taken from five different human patients and one guinea pig. Each of the victims had been diagnosed as suffering from Legionnaires' Disease. Four of the human cultures came from people who died in the Philadelphia epidemic, and the fifth came from a patient in a smaller outbreak in Flint, Mich., in late 1976. The pig had picked up its infection by spending some time in the Pontiac health building in 1968.

Moss was faced with a puzzle. Doctors noticed that the symptoms were slightly different among these victims. The pig didn't die from its disease, for instance—no one in Pontiac did. In Philadelphia, 34 died. Moss and other researchers wondered whether the infectious agents in each case were the same or, if not, how they differed. He hoped the gas chromatograph could help find out.

He injected the samples into the device—the size of a console hi-fi set—where they passed in vapor form through a spiral tube. The tube was packed with a coated material that broke up the vapor into separate chemical parts, delaying some components more than others, something like a succession of filters. The vapor then began to come out the other side, different components at different times. A pen registered surges of components as sharp points on a graph.

Six twisted pitchforks

After several hours of testing, Moss and his staff lined the graphs up like a rogues gallery. "Damn, I can't believe this," Dr. Moss said ecstatically. The results were clear-

er than he had hoped. He found that all of the six specimens had roughly the same profile. The graph of each looked like a misshapen pitchfork, with the third line from the left split down its shaft and extending menacingly above the others. But there were also slight differences in the pictures of what Dr. Moss was now sure was one family of Legionnaire's Disease.

Dr. Moss' conclusion: there are at least six different members of the Legionnaires' Disease bacterial family, some more dangerous than others.

Now that the initial work is done, Dr. Moss's machine provides researchers with a quick and accurate test for Legionnaires' Disease in future patients. All it requires is a fast injection into the machine, and about half an hour's monitoring of a graph, watching for the misshapen pitchfork pattern.

Increasingly, machines like the gas chromatograph help in the fight against disease, but of course machines can't do everything. For instance, they can't interview patients—and patient interviews and questionnaires continue to be critically important in tracking the cause of sickness.

In one 1975 case, C.D.C. investigators were called in to help Colorado health officials who were concerned about an outbreak of salmonella. Victims of salmonella food poisoning suffer fever, chills, cramps, diarrhea and vomiting. Some 23,000 cases were reported to the C.D.C. in 1976, the most recent year for which figures are available.

More women stricken

A statistical review of the Colorado cases turned up a significant clue: 69 percent of the victims were women. Overall, center researchers knew, cases of salmonella are evenly divided between the sexes. Why were the women more susceptible in Colorado?

The answer came from an interview. It fell like a firecracker into the middle of a humdrum, routine conversation between a patient and a health investigator. The woman told the doctor that two days before she got sick, she had eaten a small amount of raw hamburger while she was cooking dinner. Eventually, the source of the outbreak was traced to beef from a Dallas processing plant.

That explained the high percentage of women: many of the victims had sampled raw hamburger while preparing a meal. The innocuous comment of a kitchen nibbler had cracked the case wide open. **PM**

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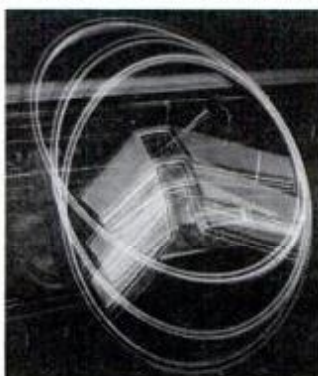
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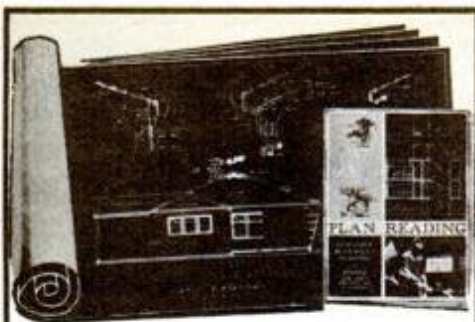
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REPAIR YOUR ELECTRIC DRILL

(Continued from page 103)

take apart the brush assembly which consists of the brush, spring and retainer.

Caution: The power cord must be disconnected during Step 4.

To remove the brush and brush spring from a drill with metal housing, look for two slotted retainers on the housing. Unscrew them to release brushes and springs.

Separate the brush and spring, and depress and release the brush spring between your fingers. It should move freely.

Check the edges of the brush. If the brush has been making poor contact, one edge will be burned away more than the other.

If one brush or brush spring is damaged, replace all brushes and springs. Clean off the commutator with a clean rag and polish it lightly with very fine sandpaper. Do not use emery cloth on the commutator, and do not apply oil or grease.

Clean the slots in the commutator by passing a dull knife carefully through them. One pass per slot should be enough.

Check worn brushes

Worn brushes will cause a drill to lose power. You can check on this without taking the brushes out of the drill by operating the drill and looking inside the tool through the cooling vents on both sides of the housing. You should see a fine line or arcing. If you see splashing on one or both ends, it means the brushes and springs should be replaced.

To prevent severe motor damage, worn brushes should be replaced at once.

5. If your drill hangs up—that is, it revolves to a point and stops—chances are that an armature segment is burned severely. You can check on this by turning the chuck by hand. If the drill releases, rotates and hangs up again, the motor is burned.

It may not pay for you to have a motor repaired or replaced if your drill isn't a high-priced tool. However, if it is an expensive item, get an estimate from a manufacturer's repair facility before making the decision.

6. The last problem in drill malfunction is gear noise. This can be caused by lack of lubrication or by a damaged gear.

With a clamshell-type drill, remove and lubricate the gear with grease specified by the manufacturer for your drill. If the noise persists, replace the gear and bearing.

With a metal-case drill, remove the front cover and apply grease. Hopefully, the noise will disappear. If not, check gear teeth to see if one is stripped. If one is, replace the gear and bearing.

Preventing damage.

The best way to prevent electric drill damage is to observe sensible operating and maintenance procedures. The following are several points to keep in mind:

1. When inserting bits into the jaws of a geared chuck, tighten all jaws by inserting the key into each hole in the chuck. Partial tightening causes jaws to wear, because bits will slip.

2. Push bits all the way back into chuck to prevent slipping.

3. Never crowbar a bit. This will cause bearing wear. "Crowbar" means to wobble the bit back and forth as you drill to enlarge the hole. If you use the proper size bit to begin with, you will never have to crowbar.

4. Before boring into metal, coat bit with stick wax, to help keep the drill from overworking. After boring, let the drill run free for a few seconds to cool it off.

5. Never store a drill with chuck jaws protruding. An accidental whack could damage them.

6. Never drill so deep that jaws come into contact with the work. Use a long enough bit to prevent this.

7. Everyone knows that keeping cooling vents clean of sawdust prevents overheating. Also, be aware that metal dust and filings can get inside vents, settle on the commutator and cause a short. Use the blower mode or exhaust of a vacuum cleaner to blow this stuff out of the vents.

8. Observe proper drilling techniques, especially when drilling metal, to help prevent stalling and subsequent motor damage. Use only high-speed drill bits on ferrous metals, along with a few drops of lubricant as required.

9. Never pull or hang a tool by its power cord. If you have to use an extension cord, choose one that is heavier than the one you think you need. An extension cord that is too light restricts the amount of amperage the tool receives. Ampere reduction puts a needless strain on the motor and causes excessive heat, or burnout.

10. Use drill accessories (polishing pads, saw) for light-duty work only. Putting a heavy load on your drill will hasten its end. If a job other than drilling is extensive, use the right tool for the job—not your drill.

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KEEP TRACK OF YOUR CAR

(Continued from page 82)

Loran coordinates, the census bureau could also produce reasonably accurate answers to such questions as "How many people live within half a mile of the Canadian border?"

The Loran idea was attractive enough to the bureau to test some receivers a few years ago. The tests showed that Loran would enable census officials to return to the same spot, but the cost of equipment at the time ran into millions of dollars, and so the idea was dropped.

Loran in ambulances

Another dream—police and emergency vehicle tracking—will be tested in New York State over the next few years with state and federal funds. James Murdoch, in the state's Motor Vehicles Department, said that 12 police cars, 12 ambulances and one helicopter will be equipped with Loran sets during the test in one county. Part of the experiment will match work in Tennessee, by exploring Loran use for accident site location. Another test will determine whether Loran can help

emergency vehicles respond more quickly.

Murdoch suggested a compelling reason for the test. "In one region (the Syracuse area) of New York State several years ago, there were 3000 dry runs by ambulances," he said. "The driver got lost, radioed for directions, still couldn't find what he was looking for, and went home."

With Loran in an ambulance, a driver would have an efficient system for telling a dispatcher by radio where he was. The dispatcher could respond with destination coordinates and full directions. Under a slightly more complicated system, ambulances or police cars would continuously and automatically radio their coordinates into headquarters where a dispatcher would monitor a display board showing the location of every emergency vehicle.

The U.S. Forest Service in Montana is exploring whether Loran can help planes spraying insecticides on trees. In mountainous countryside, an official in Missoula, Mont., said, pilots have a difficult time laying down regular patterns of bug killer without overlapping swaths or missing entire strips of trees. To avoid skips and save trees, the service is

about to begin an experiment using a Loran-equipped plane. An on-board computer will determine whether the pilot is flying correctly on a preset path.

For homeowners, too

Loran might also help homeowners—particularly in rural areas—to get a quicker response to fire, police or ambulance calls. This winter, the Kentucky Department of Transportation, with help from engineers at the University of Louisville, is passing out hundreds of stickers to farmers in Pulaski county, near the Tennessee border. The stickers, attached to telephones, display Loran coordinates in bold numbers so farmers can call in their location if they need help.

"Emergency vehicles have had a lot of trouble in rural areas," said Vern E. Baxter, associate professor of electrical engineering at Tennessee, "because there aren't many signs. A farmer might say 'Turn left at the creek,' and that's all an ambulance driver has to go on." Baxter said the Loran coordinates were accurate to around 150 feet. So Loran should make it much easier to get help where it's needed on land, just as it has for years at sea. **PM**

PM'S COLONIAL CABINET

(Continued from page 86)

table saw, cut the edge rabbets along the back edge of each side to receive the back panel. Cut the front stiles to size and attach to the sides using glue and 6d common nails. Use a stout nailset to set nailheads below the surface. Do not fill the nailheads; leave them rough set for an attractive primitive colonial look. Then install part F.

Fashioning the door

Trim the door insert panel to 13 x 17½ in. and set up your table saw to make the diagonal raised panel cut. Draw the shape (shown in Detail Y) on a piece of scrap lumber and use the scrap to set up your saw fence, blade height and blade angle. Make a test cut on the scrap and, when you're satisfied, set scrap aside. On the door panel make the two end-grain cuts and then the two cuts running with the grain. Next, return blade to 0° setting, and use that test piece of scrap to adjust blade height and fence to make the shoulder cutoff. Run scrap through the saw to be sure settings are correct. When they are, make the cuts on the panel itself. Once again, first do the

end-grain passes, then cut with the grain.

Rip the door stiles and rails to width, then, using either router and rabbet cutter, or table saw and two passes, cut the edge rabbet in each member to receive the panel. Next, mount the molding cutterhead (Sears No. 9.2352) on your table saw and shape the inside edges. Finally, after double-checking the panel measurements, cut the lap joints at both ends of stiles and rails. Join the frame members, using glue and ⅝-in. No. 5 fh screws. Install the panel before driving screws home to assure the door remaining square. Hold panel in rabbet with a couple of brads, then lightly apply glue over the joint and conceal it with the ¼-in. batten (J & K) pieces.

Temporarily assemble the cabinet, using scrap strips tacked across the bottom to maintain correct distance between the sides. Tack the top in place and install hinges on the door. Mount the door to the stile and install the knob. (Note: The door on the prototype was created to be a press fit; there is no need for a friction or magnetic catch.) With cabinet assembled, carefully place it over your safe. It should fit with the safe door closed. Double check the

cabinet for square and measure for the plywood back. Also measure for the cleat, part B.

Cut the back and disassemble the cabinet. Reassemble the cabinet without the door, using nails and glue. Tack a temporary strip between sides at the cabinet front (nailed to bottoms of sides) to keep the cabinet square while glue sets.

Dust off all wood parts and wipe with a tack rag. On the prototype, we used Beverlee's walnut stain, thinned a bit with turpentine, and tinted slightly with yellow ochre from an art supply dealer. Apply stain, allow it to set at least five minutes, then wipe with a clean, lintfree cloth. Let the cabinet stand for 24 hours.

The next step is to apply a wash coat of 3-lb.-cut white shellac thinned 50 percent with denatured alcohol. Allow shellac to dry at least four hours, then sand it lightly with 180-grit paper. Dust and wipe with a tack rag. Apply one coat of satin-finish varnish. Let it dry at least 48 hours, then rub lightly with 220-grit paper and remove all dust with a tack rag. Add a final coat of satin-finish varnish. When it's dry, mount hinges on the door and door on the cabinet. Install the doorknob. **PM**

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**William Wescott
Willoughby, Ohio 44094**



Husband and wife have a going spare time shop

"I'm a construction foreman, and my wife is a nurse's aide. Our Foley shop fits in nicely with our regular jobs, and we earn extra money. Our sons help out too, so ours is a real family business."

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**Victor Kosloski
Sturgis, Michigan 49091**



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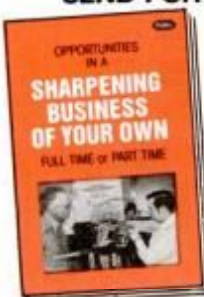
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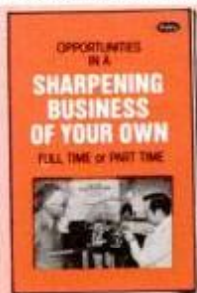
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LIQUID CRYSTAL DISPLAYS

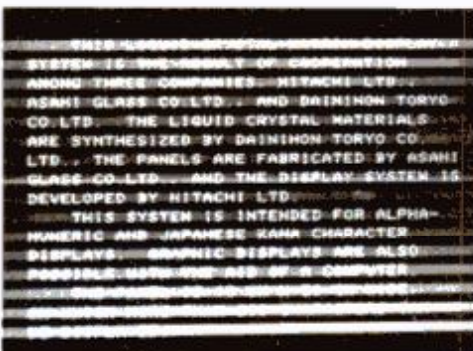
(Continued from page 77)

two-thousandths of a square inch. The total screen has 57,600 elements in a 240-by-240 format.

The picture elements, the bottom-most layer in our LCD "sandwich," can each create an electronic field. Each individual field can be separately controlled by means of a miniaturized set of integrated circuits.

Picture each element plotted on a flat graph-like chart. Each element's center could be represented by an X and Y coordinate. By means of the X and Y drivers shown, every individual picture element can be turned on and off.

Note, in the diagram, that only the central portion of the picture ele-



One of the many uses these new, flat LCD screens may be put to is for computer output. Shown here is an LCD computer display from Hitachi, capable of selectively displaying about 600 Roman letters, numerals and Japanese kana characters. Further development is underway in an attempt to speed up the computer display.

ment array is activated—we have turned "on" a number of elements which together form a rectangle. All other elements are "off."

The electric fields generated pass upward through the liquid crystal jelly in the middle of the sandwich. The rod-like liquid crystals have been lying around, like matches in a box, in a neat, parallel arrangement. These undisturbed crystals are like open venetian blinds, and readily transmit light from outside. That light hits the specially blackened picture element and is absorbed—so you see a completely dark screen when everything is in an "off" state.

But we have turned on a rectangle's worth of picture elements. The electric current from those elements passes upward through the liquid crystal layer and creates a turbulence.

The orderly arrangement of the crystals has been disturbed, and the disturbed crystals reflect light. That reflected light bounces up through

the top, transparent electrode and out the protective glass front plate. So you see a white rectangle in the middle of the screen.

A white rectangle is pretty boring. How do we get from a white rectangle to, say, *Charlie's Angels*?

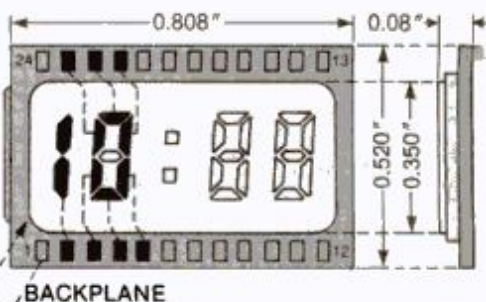
Get a strong magnifying glass and check out the black and white photographs that appear in this (or any other) magazine. All you will see is a conglomeration of black dots. The more black dots in an area, the darker that area appears to the unaided eye. Printers are thus able to reproduce every shade of gray from white to black.

Here's where having 57,600 TV picture elements to play around with really comes in handy. Think of each element as a tiny dot which looks either white or black, depending on whether it's "on" or "off."

These LCD spots are much smaller than even the halftone dots in a magazine photograph. So, you now have the capability of reproducing a highly viewable television picture that can catch every glimmer of a pretty smile. In black-and-white, that is; color LCD TV is still far in the future.

Three types of screens

That's how the Matsushita version of LCD TV gets the picture across, but Hitachi uses a different



This men's 3 1/2-digit LCD watch display, designed by Fairchild Camera and Instrument Co., is only .08 in. thick, with a liquid crystal area thickness of only .0005 in. The pins along the top and bottom provide electrical contacts to activate the segments which produce digits. (We have darkened the ones that activate the segments for the number 10.) Pin 1 is a special-purpose pin which is for a common ground. These transmissive displays may either reflect or transmit light from behind the backplate.

method. Though the resolution of the Hitachi screen is only about one-sixth that of the Matsushita unit, it still bears examination. There is no reason that a transmissive screen such as Hitachi's cannot be further developed.

To understand transmissive screens we are also going to look at (Please turn to page 148)

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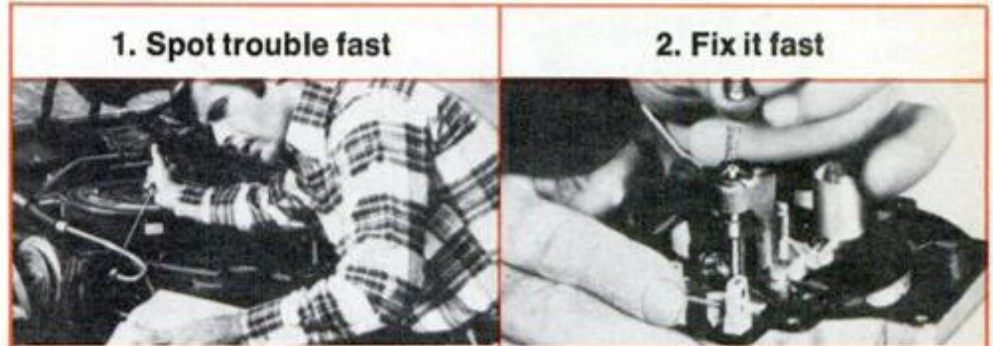
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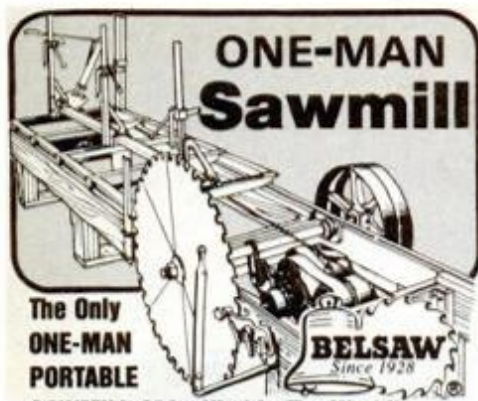
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LIQUID CRYSTAL DISPLAYS

(Continued from page 146)

reflective and transmissive types—all three types, by the way, are now used in various watches and calculators.

The reflective type requires front illumination, the transmissive type calls for light coming from behind and the transmissive form can utilize either kind of light.

Now a light wave is somewhat like a stick that you can wave up, down and sideways as you approach a picket fence. But, when the stick passes through the fence's slats you will only be able to wave it up and down (if the slats are vertical) or from side to side (if the slats are horizontal). This process—called polarization—can be achieved with a filter—or the venetian blind effect of charged liquid crystals.

All three of these methods use both means of polarization. But they do it to achieve the same ends—a readable display, be it numbers on a watch or a Hitachi-style TV picture.

All of these LCD designs are contained in very thin cells. There are two plates of glass, each with two thin coatings on the side that touch the liquid crystals sandwiched between. Each plate has a transparent coating which conducts electricity. The front plate has a

cal polarizer (the picket fence) and the back plate is rotated 90° so that it is like a horizontal polarizer (the venetian blind).

Take a look at the diagram of an unenergized reflective field-effect cell. Note that the light is vertically polarized by the first filter. Then, "twisted" liquid crystals deeper in the cell gradually rotate the light to a horizontal polarization.



Hitachi's prototype LCD TV uses a different system from Matsushita's. Hitachi is using a transmissive display that has about 9000 picture elements. The resolution is, therefore, on the coarse side, but the transmissive form of LCD TV cannot be ruled out as the final flat-screen victor.

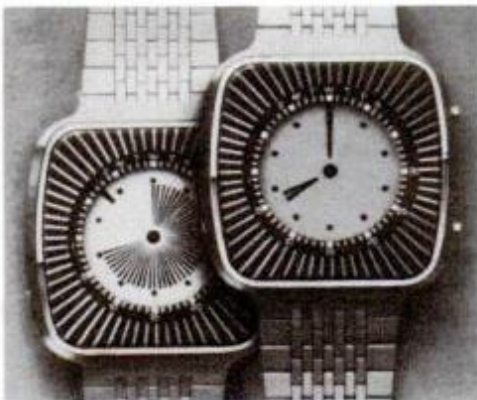
The light hits the reflective plate, bounces back along the same path and comes back out the LCD front. The field appears white.

Turning on the power untwists the liquid crystals into a fully vertical position. The light cannot get through the horizontal polarizer and is never reflected. That area appears black.

Now look at the transmissive cell. Light comes from behind the LCD (no longer from the room). If no power is applied to the crystals, the light goes through the horizontal filter, is rotated by the twisted liquid crystals to vertical, and escapes through the front, where we see it. Turn on the power and those little rods untwist, the light remains in the wrong polarization to escape and we see a black area. This gives the familiar black-on-white of most LCD watches. It also lets Hitachi use "dots" of black just as Matsushita did in another way.

Liquid crystals are one of the most surprising developments in recent technology. In a way, these "solid-state" flat TVs really have literally millions and millions of moving, twisting, turning parts—only they are too small to be seen.

LCD is still an infant of technology, and the biggest steps remain to be taken. We have the TVs already on the way. Who can guess what the future will bring?



These are the new analog watches from Texas Instruments. They use much the same form of technology to display moving hands as LCD TV does to display a high-resolution, moving picture.

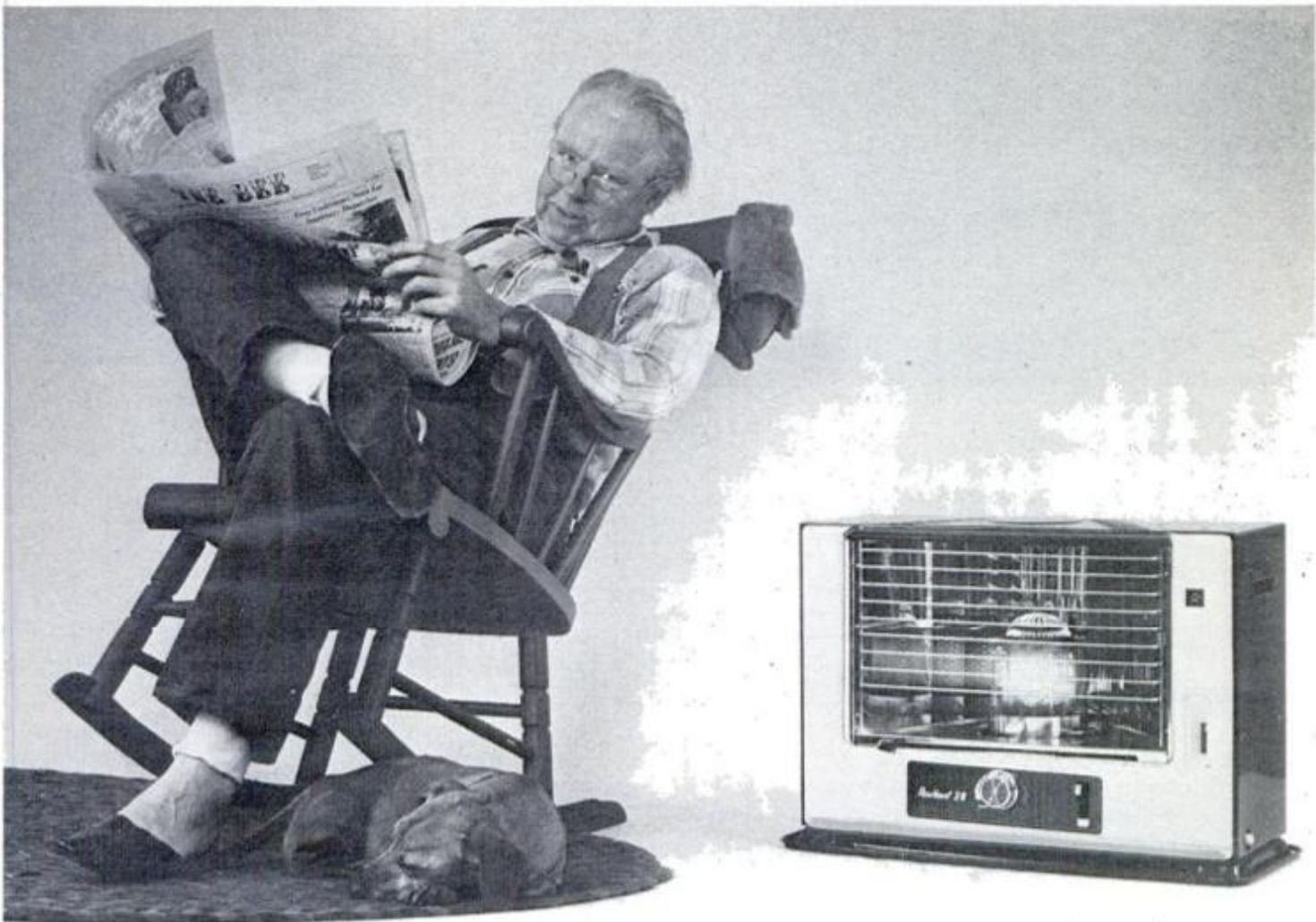
coating in the shape of the display—numbers or whatever. This is usually segmented so that the display may be changed. The back plate has a continuous conductive coating so that it is a full electrode.

On top of these conductive coatings, right next to the LCD layers, are second coatings of what is called a "dielectric." This dielectric causes the LCD rods to lie in definite alignments.

Usually, the first filter is a verti-

PM

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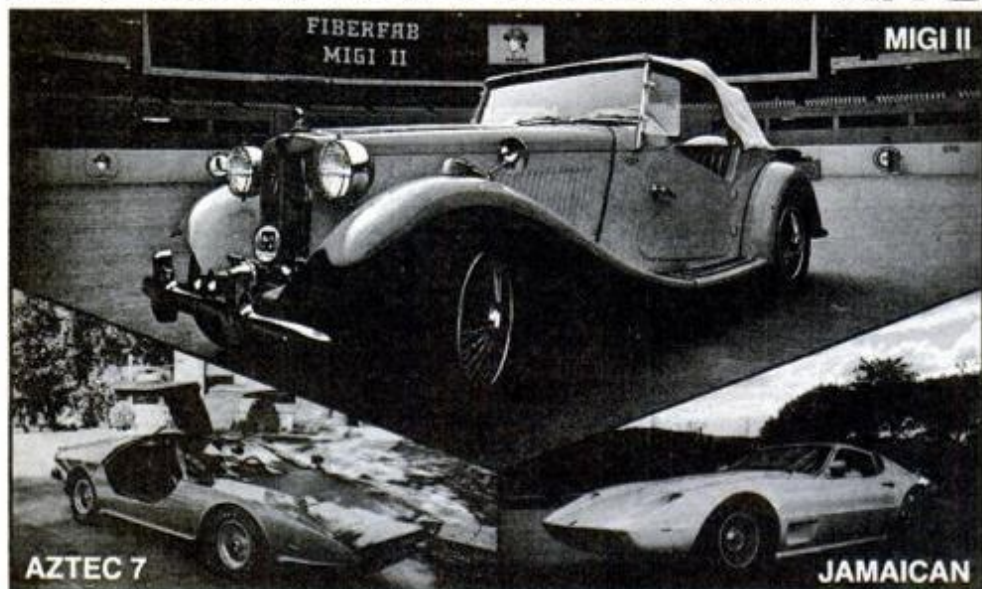
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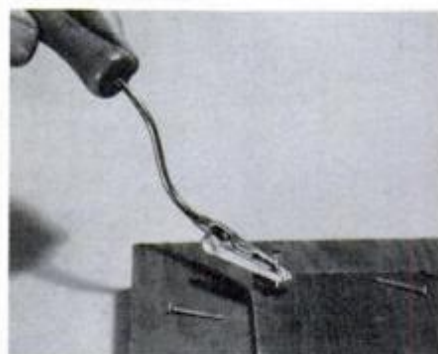
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Thumb saver



Make this simple gadget to hold nails, brads and screws in awkward places. Use a small wooden handle, No. 6 copper wire and an alligator clip (discard setscrew). Bore hole in handle, bend wire and glue in place. Solder wire to clip. File off teeth on one jaw for better grip. Once you start brad, remove clip to avoid damage.—*August A. Freda*

Caulking-gun cap



A large-size, screw-type solderless connector makes a handy seal for a caulk gun. After using gun, wipe off excess caulk and screw on cap.—*Ralph S. Wilkes*

Safe battery changer



Using tweezers with plastic tips to change digital-watch batteries prevents shorting and battery damage.—*Gerald E. Zuhlke*

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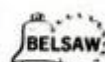
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16 HOME SECURITY PRODUCTS

(Continued from page 90)

truder who has momentarily gained your confidence. Don't buy products that are merely cosmetic. The mounting hardware should be substantial. See-through-the-door devices should feature one-way, wide-angle viewing and be impossible for the intruder to remove from the outside.

Foiled at your door, a burglar might try a window, basement vent, garage or patio door. A keyed dead-bolt lock on a sliding door beats a broom handle wedged in the door's

track, since it can't be flicked out of the way with a snaked-in coat-hanger wire. The key, however, should be left hanging nearby for quick exiting.

Deadbolts, like Stanley's patio door bolt, are also available for sliding, awning and double-hung windows you want burglarproofed.

Residential alarm systems

The latest wireless, contact-type designs have dispensed with the nuisance of having to run wires behind baseboards and through walls, (typical installation for systems wired directly to a control box). In-

stead, a wireless system has several battery-powered transmitters located near doors and windows. Each transmitter is wired to one or more magnetic switch detectors (see diagram, page 91). When an intruder is detected, the transmitter sends a radio signal to a receiver, which in turn sounds a built-in alarm. It can also be hooked up with an auxiliary alarm or to a message-sending device which can call for help.

If you have more than two or three points of possible entry to protect, choose a system that lets you connect more than one magnetic switch to a transmitter. Sears has such a system.

The alternatives to wireless electronic alarms are generally characterized as motion detectors. They use ultrasonic waves, microwaves, radar, or infrared light to detect an intruder. The basic drawback to these systems is that they can only be used while the room or rooms are unoccupied. They provide reliable security while you're asleep or away from home.

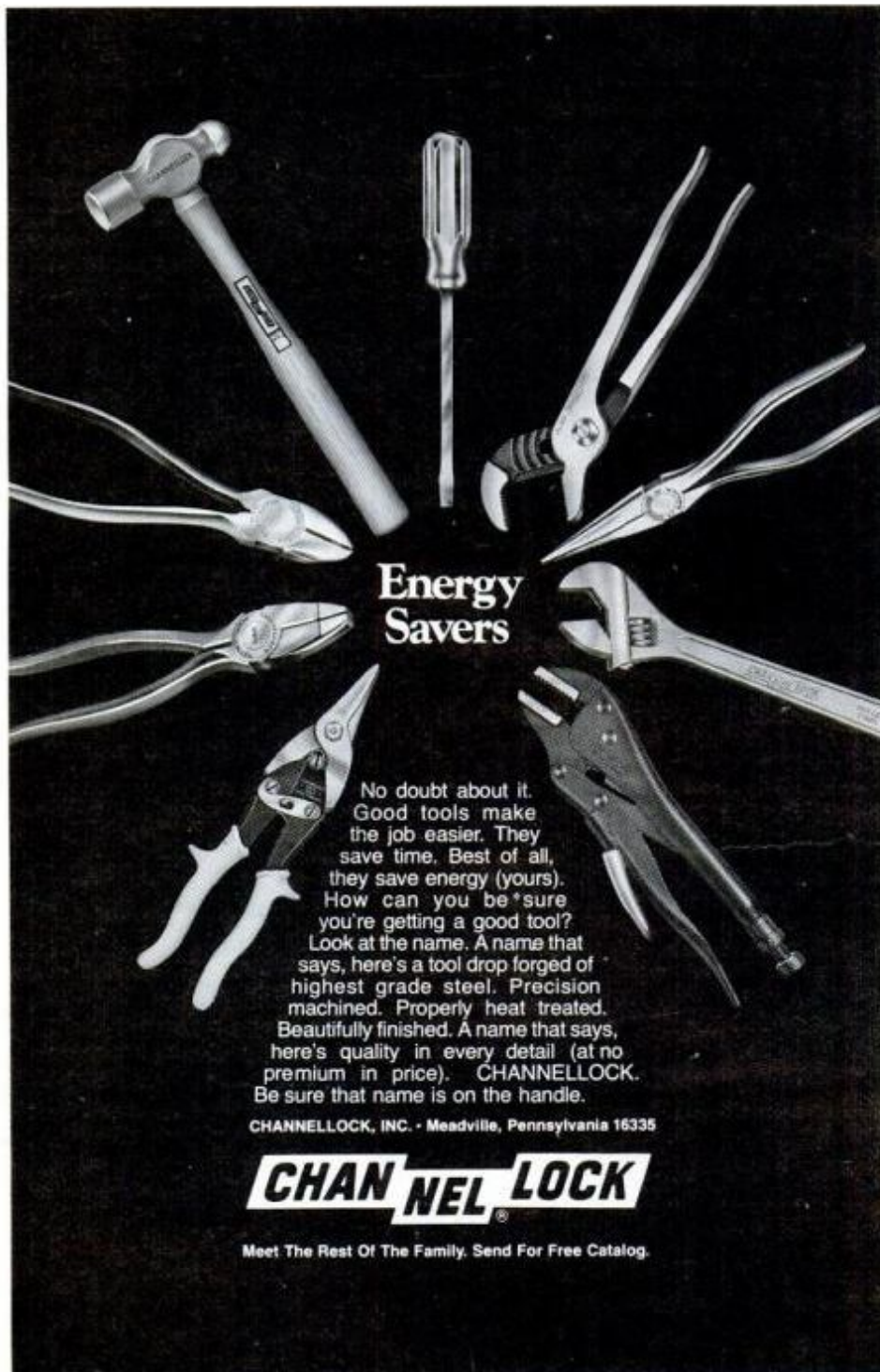
Consider the options

When shopping for any electronic alarm systems, consider the following options: Exit/entry delay timer that lets you get in and out of the protected zone without sounding a false alarm, but also lets you override the delay to an instant alarm mode for night protection; capacity for smoke detector tie-in; battery standby in case of a power failure; test switches; auxiliary sirens or bells (interior or exterior); hook-up capacity for reporting systems; a panic switch transmitter which enables you to signal your receiver to sound an instant alarm; an automatic alarm cut-off; an on/off reset key switch which prevents a burglar from finding the control box and flicking off the alarm.

Reporting systems

Aside from sounding an alarm, most security systems have optional components that let you send prerecorded or preprogrammed messages to the police, friends or neighbors, or to the central station of a professional guard service. The tie-in may be via a telephone line or radio. In some areas, cable TV lines are used.

Hookups to central alarm stations are more reliable than electronically activated phone dialers with taped messages. The price of a hookup to a central station such as American District Telegraph (ADT) costs about \$15 monthly, with a \$65 installation and equipment-rental fee.—*Joseph Provey, Assistant Home and Shop Editor.*



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ROLLING BOMBS THAT RIDE OUR RAILS (Continued from page 60)

aged tank car filled with LPG?

"That depends on conditions, but at least one hour," Proefrock states. "The important thing is that when you approach the wreck, you make sure no one does anything foolish."

As an overturned LPG freight car is approached, a Hazmat expert keeps his ears tuned for hissing, which means that pressurized LPG may still be leaking. If the area seems secure, salvage operations begin.

As a precaution, a ruptured tank car is filled with water to neutralize remaining vapors. Intact derailed cars are lifted by sidebooms and put back on the track. Hazardous (and nonhazardous) cargoes of overturned freight cars and tankers that may be damaged are unloaded or pumped out into railway cars or trucks that have been brought to the scene. Damaged track is ripped out and panel rails (39-foot sections complete with ties) are laid so the railroad can resume operations.

Lots of heavy equipment

Each of Hulcher's 19 divisions is equipped with two No. 583 Caterpillar sidebooms that can lift railroad cars weighing 100 tons; a winch-equipped No. 977 Caterpillar front-end loader used for pulling and scooping; five tractor flatbeds for hauling heavy equipment and components for the Caterpillars; a tractor-trailer that serves as a kitchen and toolshed; two lighting units and generators on pickup trucks for night work; and one or two pickups to transport personnel. The company also has two airplanes at Virden to fly supervisory personnel to the scene of an accident.

The first I heard of Hulcher was in a newspaper account relating the events at Youngstown, which is in the Florida panhandle a few miles north of Panama City. The derailed tank car that sprung a leak allowed thousands of gallons of pressurized liquid chlorine to spread over the small farming community.

The area was left looking like the scene from a World War I movie portraying the aftermath of a poison gas attack. At Youngstown, some victims were found with clothing pulled over their heads as futile and pitiful protection against the deadly liquid chlorine.

Two breaths can kill you

Chlorine is used in bleaching and water purification. Liquid chlorine becomes a yellowish-green gas when exposed to air. The smell is sweet and tingling. Two breaths of the

concentrated gas can kill you.

"This death is horrible," says Al Smith of the U.S. Environmental Protection Agency. "It literally burns your lungs out."

Four teenagers were trapped in their car minutes after the derailment when gas choked off air to the car engine, causing it to stall. They died before they could get the car doors open. The gas was so strong coins in their pockets disintegrated.

It was three days after the derailment before Proefrock felt it safe enough to have his crew handle the ruptured tanker, which lay beneath hundreds of pounds of wreckage. Although fumes had subsided, some 4000 of the original 10,000 gallons of chlorine remained in the tanker. Getting wreckage away from the tanker was the first intricate task.

"If the tanker moved as we pulled off wreckage, hundreds more gallons of chlorine could have been released. Removing that wreckage was like playing pickup sticks," Proefrock recalls.

As the crew removed wreckage a piece at a time, other members of the salvage party dug a 10-foot-deep pit and filled it with caustic soda, an agent that neutralizes chlorine. This was in preparation for the second intricate task—using the Caterpillars to slide the ruptured tank car, inch by inch, toward the pit, then pumping out the chlorine into the caustic soda.

More wrecks than meet the eye

Derailments of the type that occurred at Waverly and Youngstown generally make front-page news only when they involve casualties. Those not resulting in deaths or serious injuries go unreported or receive little notice. This is why the number of railway accidents that actually occur comes as a surprise to most people.

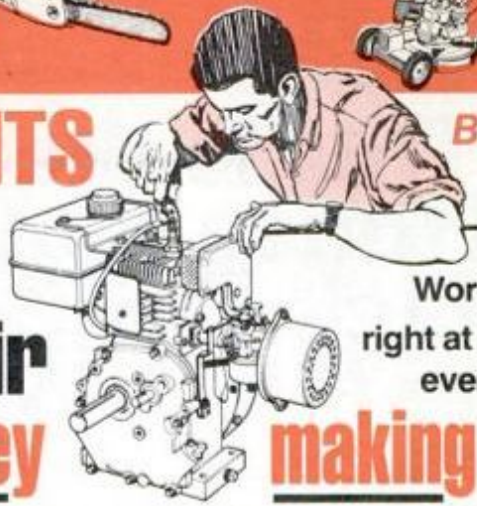
"Train accidents are generally attributable to track, equipment and human factors," says Federal Railroad Administrator John M. Sullivan. Some accidents result from vandalism. The Youngstown derailment has been tagged as such.

Track-caused derailments comprise 43 percent of the total accidents. Their number can be reduced by increased surveillance and better maintenance.

Vandal accidents usually involve damaged track. A lot of thinking has gone into efforts to detect vandalized track before a derailment occurs. Obviously, increased polic-



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ROLLING BOMBS

(Continued from page 154)

ing has been proposed. Another idea is to emplace sensors in track, tying them to a central "Go," "No-Go" control panel.

Program for improvement

A full-scale tank-car modification program is now underway, aimed at preventing tankers from spilling hazardous materials when derailments take place. The timetable for this program is as follows:

■ By January, 1979 (this month): Replace all 70T U-1 wheels, which are cast-steel wheels containing carbon. A total of 270,820 70T U-1 wheels were produced from 1958 to 1969. Their high carbon content reduces wheel wear, but also increases the likelihood that a wheel will crack because of heat generated during heavy braking. The 70T U-1 wheel is being replaced by a wheel containing less carbon—only .75 percent.

New safety couplers are also being installed on 20,000 uninsulated pressure tank cars. The new couplers are designed to prevent one tank car from overriding another, causing a puncture.

■ By December, 1979: Install head shields in 3000 tank cars used exclusively for anhydrous ammonia service and the 4000 railroad tank cars that are used to transport liquid gas.

Anhydrous ammonia, a deadly corrosive, is widely transported. At Pensacola, Fla., in November, 1977, two locomotives and 35 cars of a Louisville & Nashville freight train derailed. Two tankers carrying anhydrous ammonia were punctured. Two people died and 46 were overcome when the gas spread to a nearby residential area.

The head shields being installed are steel coverings placed at the ends of tank cars. The steel, it is felt, will prevent puncturing of the ends during a derailment.

■ By December, 1980: Apply a thermal coating to all flammable-gas tank cars and jacketed insulation and heat shield protection to the remaining fleet of liquid-gas cars to reduce the danger of these cars exploding if they are exposed to a nearby fire.

As for the human factor element involved in derailments, Sullivan pulls no punches: "I believe rail safety should be no less important than aviation or highway safety," he says. "We want to be fair, but we intend to be tough. We are going to have a better, safer rail system in this country."

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APPLIANCE CLINIC

(Continued from page 16)

man says the coil can't be adjusted. Is he right?—Gerard J. Pesman, Bozeman, Mont.

Yes, but he hasn't given you the whole story. There is a resistor coupled to the heating coil's temperature sensing unit (the bimetal thermostat control). This resistor dictates how long the coil will remain on or off. The interval may differ from one resistor to the next. If you're unhappy with how the coil is heating, the only way to change the resistor is to change the temperature sensing unit once again. The resistor cannot be replaced by itself. But before replacing anything, keep in mind that the "warm" index on the control knob is only a guide. Try to obtain a lower heat by setting the knob below "warm."

Sweating refrigerator

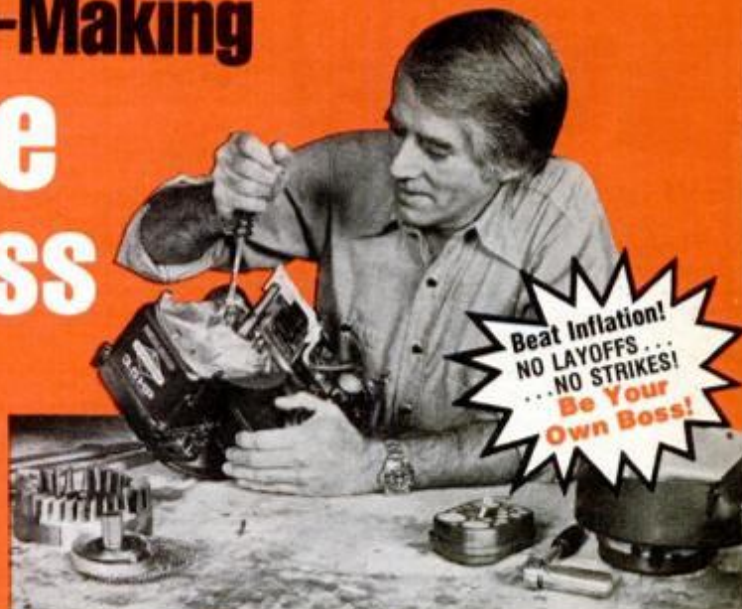
What can I do about a Frigidaire refrigerator that sweats profusely at the top of the refrigerator compartment below the freezer? The Styrofoam insulation between the two compartments keeps icing up. When we remove the ice, the refrigerator doesn't sweat again for several weeks—until the ice reforms again. The air circulation fan has been replaced, and the drain holes aren't plugged. Can this be repaired?—K.P. Moreau, Groves, Tex.

It can, but you need to find a serviceman who knows how to troubleshoot, unless you feel confident doing the repairs yourself. Your problem is probably caused by one of three conditions. If you have each repaired when all three aren't needed, it could really cost you. Here, in order, are the most likely causes your serviceman should look into:

- Wet Styrofoam insulation. Maybe someone spilled something that drained onto the insulation. Once the Styrofoam gets wet, you must replace it to cure the sweating.
- A malfunctioning defrost mechanism. Test the defrost cycle. It should last for a maximum of 21 minutes and be limited to the temperature stamped on the limit thermostat switch. The limit will be written in code, either L30 or L40, meaning the defrost temperature is limited to a minimum of 30° or 40° F. If there proves to be a problem with the defrost cycle, this limit thermostat is usually found to be the reason, but also check the main defrost heater.
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SPAREtime or FULLtime
as a Small Engine Repair Expert!



ALL TOOLS, MATERIALS AND EQUIPMENT COME WITH YOUR COURSE
HERE'S WHAT YOU RECEIVE

- 3 1/2 HP Briggs & Stratton Engine
- Foley's In-Depth Training Manual
- Factory manuals from major manufacturers
- All the specialty tools you require to perform repair work from simplest tune-ups (at an average of \$15-\$20) to major engine overhauls that will pay you handsomely.

Earn Money Fast!

Long before you complete your studies you'll be able to begin earning money on tune-ups and minor repairs. And sooner than you think, you'll be through the course and qualified to perform all major repairs and overhauls that really bring in the cash. To help you start earning fast, as part of your training you receive the specialized tools and equipment you'll need to service these engines, including the 3.5 HP Briggs and Stratton 4-cycle engine... all yours to keep at No Extra Cost.

No Experience Needed — Any Age Can Succeed

If you can read, you can master this craft right at home in your spare time with Foley's time-tested "hands on" training methods... even while working at your regular job, without missing a single paycheck. Age, education or minor physical handicaps are not a barrier, and you need no previous experience or special mechanical training. Each lesson explains every part and procedure clearly in everyday language with plenty of pictures and diagrams to plainly show each phase step by step. You

learn everything from simplest troubleshooting and tune-ups to complete overhaul on all 2-cycle and 4-cycle engines.

Foley Will Help You Every Step of The Way

For more than 50 years Foley has been helping men, probably much like yourself, build their own successful service shops... and we can help you, too. In addition to the finest training available in learning to repair engines, you also receive valuable business building guidance. You learn how and where to get business, how much to charge, and where to get parts at wholesale... all the shortcuts and inside "tricks" you'll need to get your business off to a fast and profitable start.

FREE INFORMATION KIT

Tells how to quickly start your own business, how to grow, how Foley will finance you, and how you can inspect Foley's Small Engine Repair Course on our 15-Day NO RISK Trial Offer.

ACT NOW!

NO OBLIGATION!
NO SALESMAN
WILL CALL!

RUSH
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Over 65,000,000 Small Engines in Use Today

Yes, small engine repair is a wide open field. With over 65 million small engines in use, and a million new units being built each month, there's a lot of business and big profits available for qualified men who can service and repair them. But industry growth has been so fast that there is a severe shortage of small engine repair pros. That's why NOW is the time for you to get into this profitable and enjoyable field, and find out how Foley's home study training course can easily teach you the skills that can soon have you earning hourly rates equal to any other skilled craft... up to \$18.00 an hour. And that's just your labor charge — parts, engines and accessory sales means even more profits... profits YOU earn and keep in YOUR pockets.

Be Your Own Boss in A Fulltime Business of Your Own

As a fulltime business, small engine repair offers many advantages. When you're the boss, you work the hours you want. There is never a worry over a strike or layoff, and you earn year round profits repairing items such as chain saws, tillers, garden tractors, lawnmowers, mini-bikes, mopeds, go carts, edgers, power rakes, generators, paint sprayers, abrasive saws, snowblowers, snowmobiles... all these items and more. A good small engine man usually has a weeks work backlogged even during 'slack' periods and is three to four weeks behind during the summer. There is no huge investment in equipment, no expensive inventory. You can work right out of your garage, basement, spare room... even a van makes a suitable mobile shop.

Or Make Extra Cash Working Part Time

It's the ideal sparetime business too. In just evenings and weekends you can earn plenty of extra cash to build a 'rainy day' or retirement fund, or use the extra money NOW to provide your family with the 'extras' you want them to have. Many men begin by working just their idle hours until their shop grows to the point they can switch to fulltime. When it's your business, you make the decisions and the choices are up to you.

Act Today for A More Secure Tomorrow

Find out how Foley training can start you on the road to being your own boss in a recession-proof, money-making business of your own. Just fill in and mail the coupon below (or send postcard) to receive full information and your FREE School Information Kit by return mail.

Do it TODAY! Send to —

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Small Engine Repair Division
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Minneapolis, Minnesota 55418

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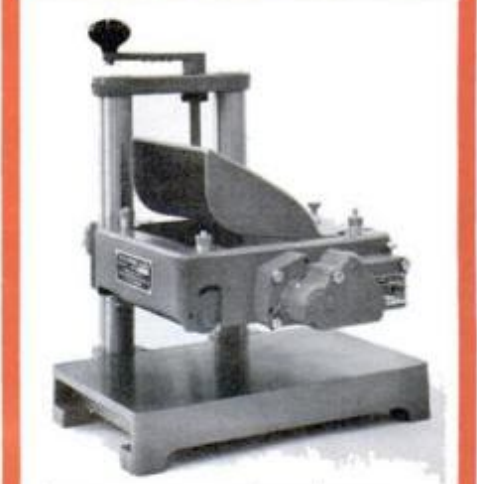
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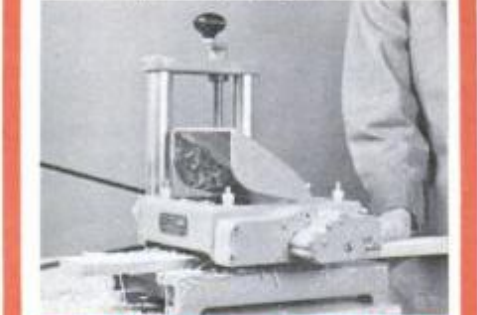


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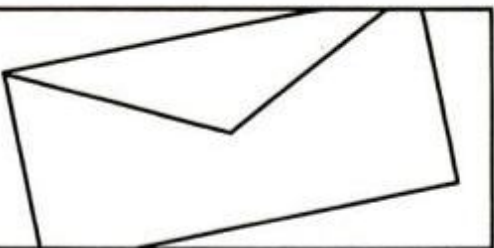
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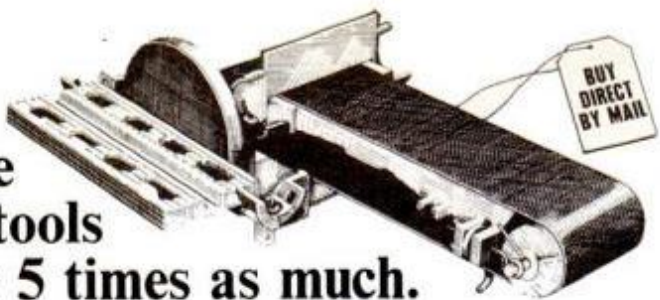
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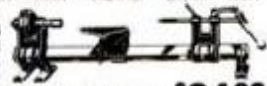
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0503	BLAZER, CHEV 59-77 for all 2 & 4 whl dr mds	\$7.95
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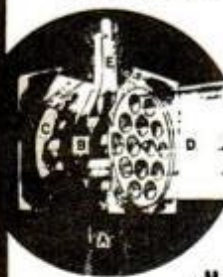
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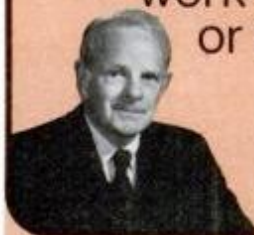
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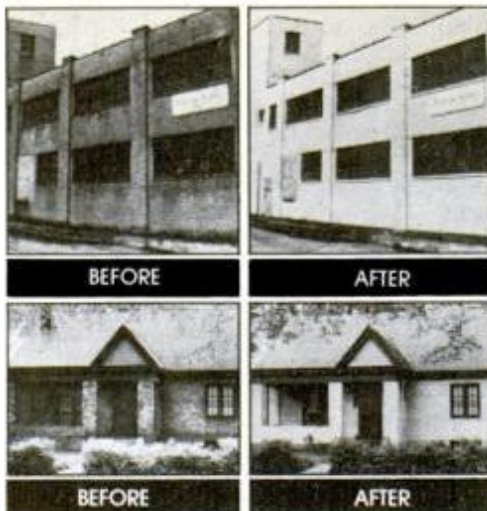
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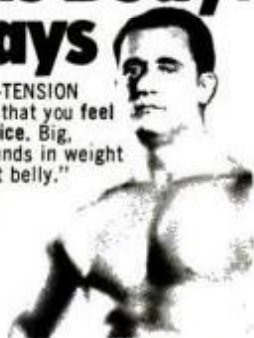
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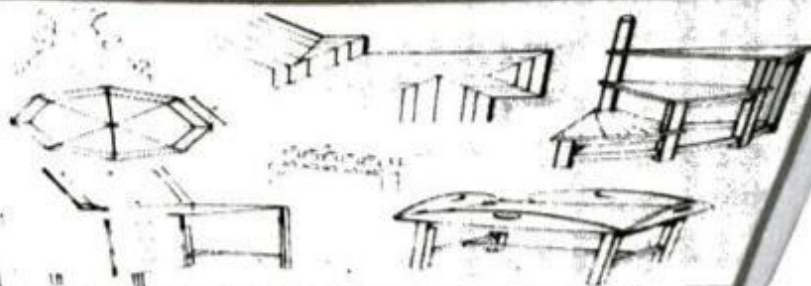
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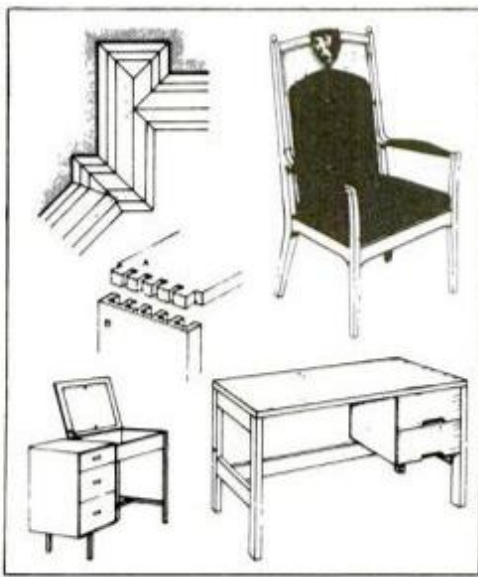
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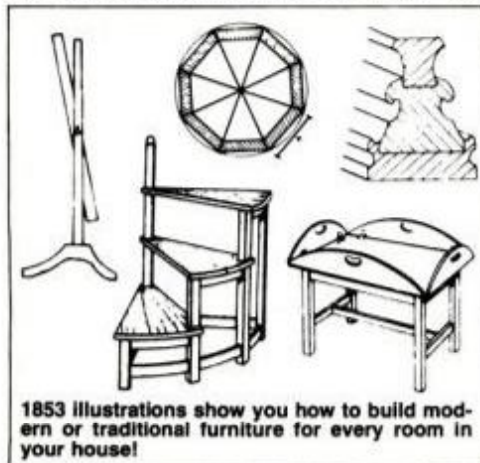


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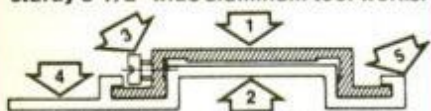
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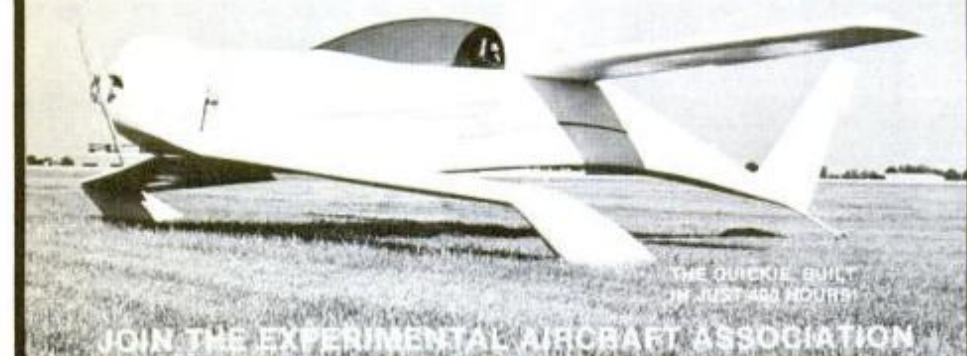


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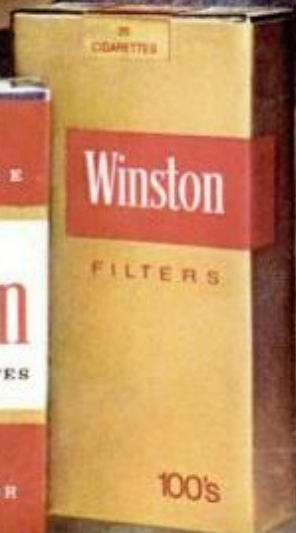
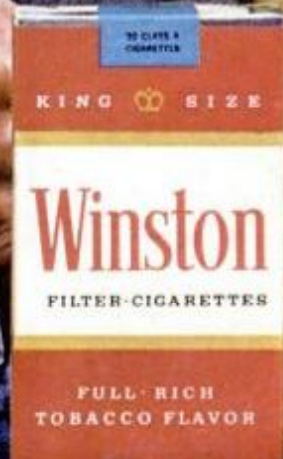
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100's: 19 mg. "tar", 1.3 mg. nicotine,
KING: 20 mg. "tar", 1.3 mg. nicotine,
av. per cigarette. FTC Report MAY '78.

**“Winston has
the one thing I want
in a cigarette, and
that one thing is taste.”**



Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

King

100's