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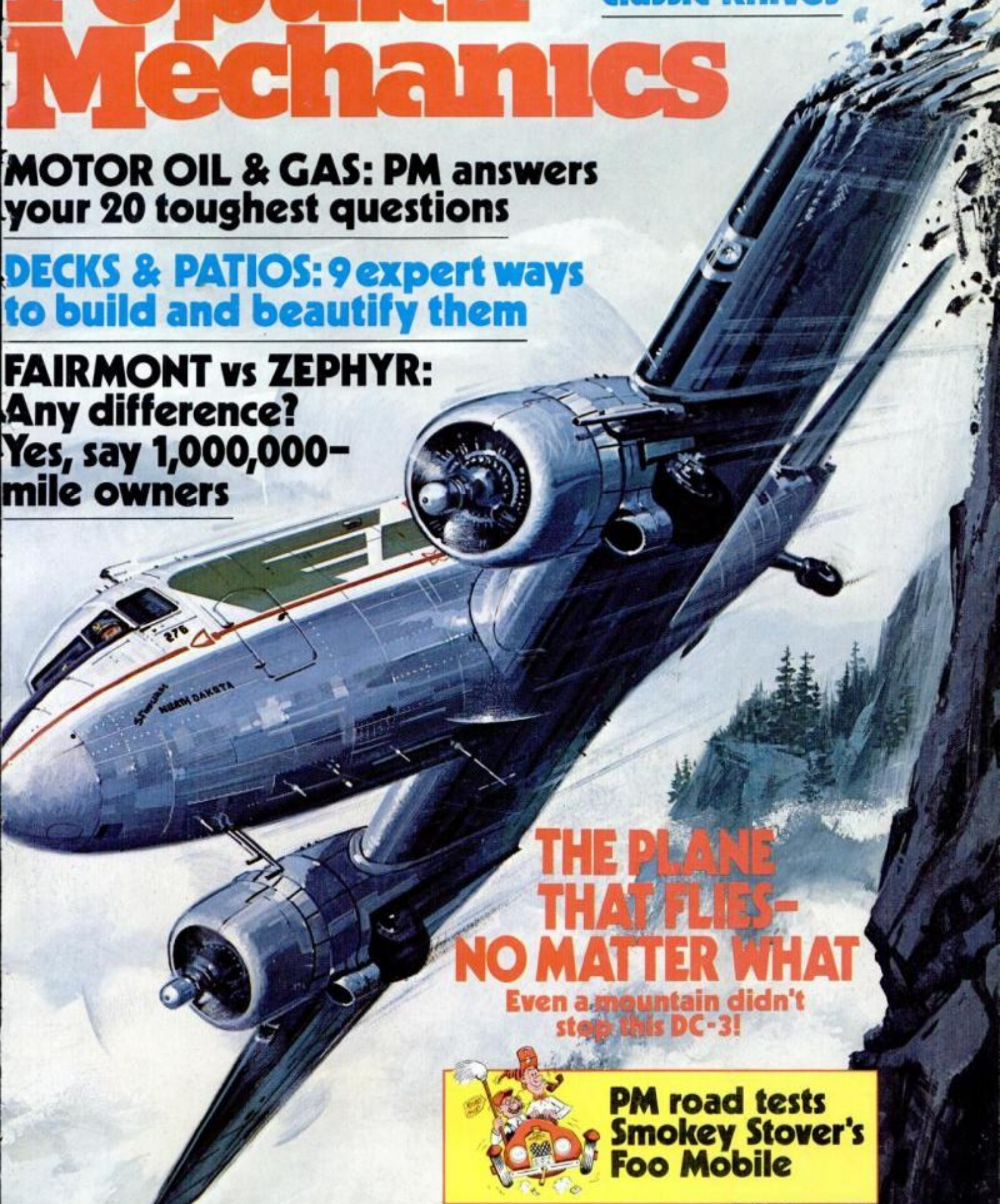
# Popular Mechanics

Kits for making classic knives

**MOTOR OIL & GAS: PM answers your 20 toughest questions**

**DECKS & PATIOS: 9 expert ways to build and beautify them**

**FAIRMONT vs ZEPHYR: Any difference? Yes, say 1,000,000-mile owners**



**THE PLANE THAT FLIES—NO MATTER WHAT**

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**PM road tests Smokey Stover's Foo Mobile**

**What it's like to have a live-in computer**

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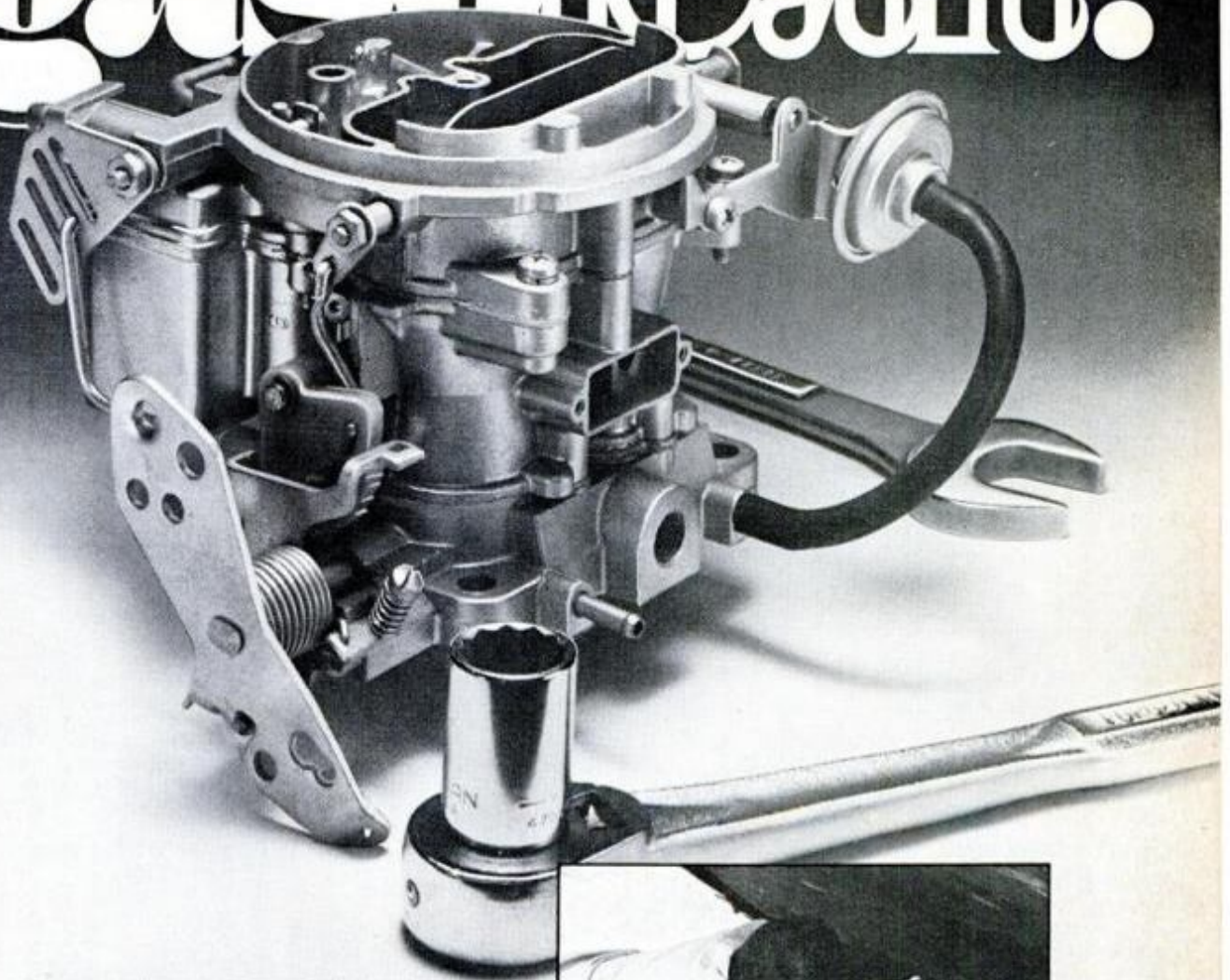
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# gas mileage.

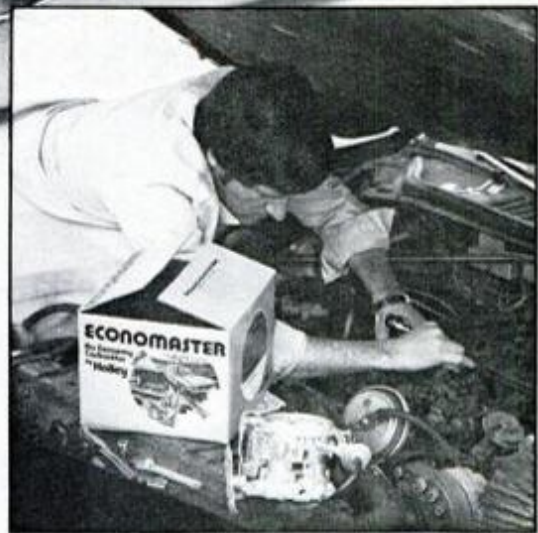


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# Popular Mechanics®

## On the cover

When a Frontier Airlines DC-3 caromed off an Arizona mountaintop—and kept flying minus several feet of left wing—it was just another episode in the history of an aircraft that has become a legend in its own time.—page 89.

—Painting by Ed Valigursky



JUNE 1978

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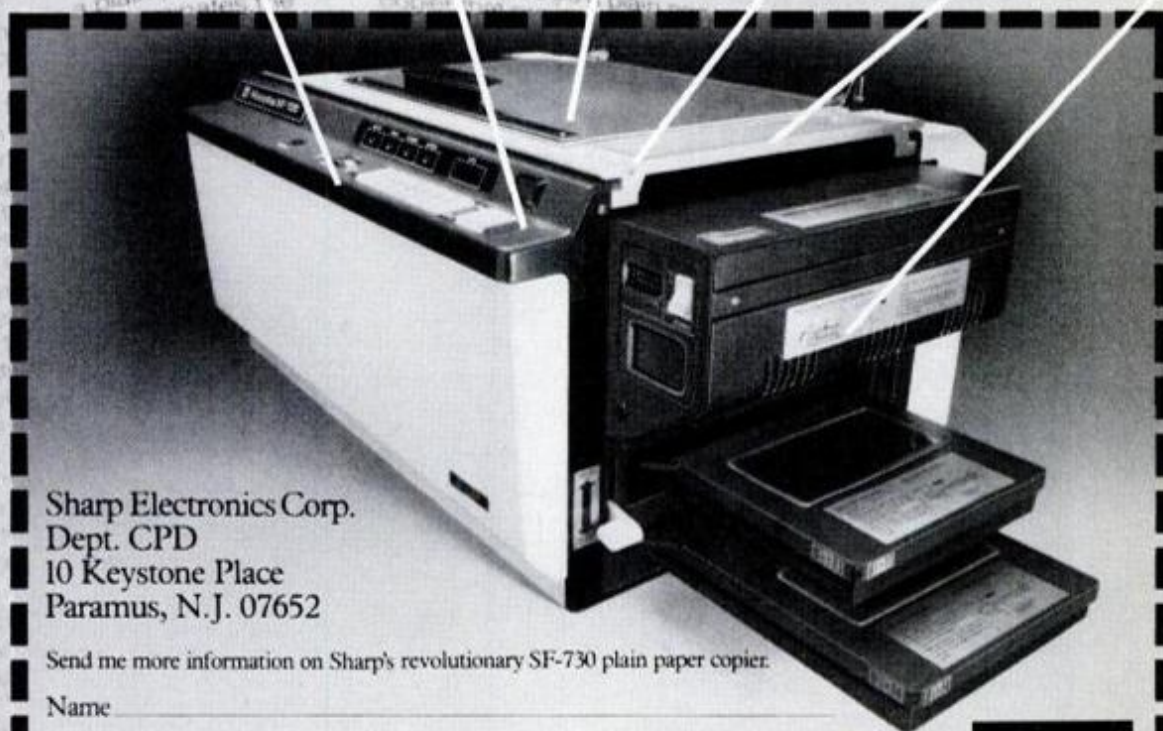
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| XEROX   | NO                    | YES                    | YES                  | YES              | YES                        | YES                                     |
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# WITH WHAT MINOLTA KNOWS ABOUT CAMERAS AND WHAT YOU KNOW ABOUT YOURSELF, WE CAN MAKE BEAUTIFUL PICTURES TOGETHER.

If you've considered buying a 35mm single lens reflex camera, you may have wondered how to find the right one out of the bewildering array of models and features available.

And with good reason, since the camera you choose will have a lot to do with how creative and rewarding your photography will be.

What you pay for your camera shouldn't be your only consideration, especially since there are some very expensive cameras that won't give you some of the features you really need. So ask yourself how you'll be using the camera and what kind of pictures you'll be taking. Your answers could save a lot of money.

## How automatic should your camera be?

Basically, there are two kinds of automatic 35mm SLR's. Both use advanced electronics to give you perfectly exposed pictures with point, focus and shoot simplicity. The difference is in creative control.

For landscapes, still lifes, portraits and the like, you'll want an *aperture-priority* camera. It lets you set the lens opening, while it sets the

shutter speed automatically.

This way, you control depth-of-field. That's the area of sharpness in front of and behind your subject. Many pro photographers believe that depth-of-field is the most important factor in creative photography.

At times you may want to control the motion of your subject. You can do this with an aperture-priority camera by changing the lens opening until the camera sets the shutter speed necessary to freeze or blur a moving subject. Or you can use a *shutter-priority* camera, on which you set the shutter speed first and the camera sets the lens automatically.

Minolta makes both types of automatic camera. The Minolta XG-7 is moderately priced and offers aperture-priority automation, plus fully manual control. The Minolta XD-11 is somewhat more expensive, but it's the world's only 35mm SLR with both aperture and shutter-priority automation, plus full manual control. The XD-11 is so advanced that during

shutter-priority operation it will actually make exposure corrections you fail to make.

## Do you really need an automatic camera?

Automation makes fine photography easier. But if you do some of the work yourself, you can save a lot of money and get pictures every bit as good.

In this case, you might consider a Minolta SR-T. These are semi-automatic cameras. They have built-in, through-the-lens metering systems that tell you exactly how to set the lens and shutter for perfect exposure. You just align two indicators in the viewfinder.

## What to expect when you look into the camera's viewfinder.

The finder should give you a clear, bright view of your subject. Not just in the center, but even along the edges and in the corners. Minolta SLR's have bright finders, so that composing and focusing are effortless, even in dim light. And focusing aids in Minolta

*Minolta makes all kinds of 35mm SLR's, so our main concern is that you get exactly the right camera for your needs. Whether that means the Minolta XD-11, the most advanced camera in the world. Or the easy-to-use and moderately priced Minolta XG-7. Or the very economical Minolta SR-T cameras.*







Automatic sequence photography is easy when you combine a Minolta XD-11 or XG-7 with optional Auto Winder and Electroflash 200X.

viewfinders make it easy to take critically sharp pictures.

Information is another thing you can expect to find in a well-designed finder. Everything you need to know for a perfect picture is right there in a Minolta finder.

In the Minolta XD-11 and XG-7, red light emitting diodes tell you what lens opening or shutter speed is being set automatically and warn against under or over-exposure. In Minolta SR-T cameras, two pointers come together as you adjust the lens and shutter for correct exposure.

**Do you need an auto winder?** You do if you like the idea of sequence photography, or simply want the luxury of power assisted film advancing. Minolta auto winders will advance one picture at a time, or continuously at about two per second. With advantages not found in others, like up to 50% more pictures with a set of batteries and easy attachment to the camera without removing any caps. Optional auto winders are available for both the Minolta XD-11 and XG-7, but not for Minolta SR-T cameras.

**How about electronic flash?** An automatic electronic flash can be added to any Minolta SLR for easy, just about foolproof indoor photography without the bother of flashbulbs. For the XD-11 and XG-7, Minolta makes the Auto Electroflash 200X. It sets itself automatically for flash exposure, and it sets the camera automatically for use with flash. An LED in the viewfinder signals when the 200X is ready to fire. Most

unusual: the Auto Electroflash 200X can fire continuously in perfect synchronization with Minolta auto winders. Imagine being able to take a sequence of 36 flash pictures without ever taking your finger off the button.

**You should be comfortable with your camera.**

The way a camera feels in your hands can make a big difference in the way you take pictures.

The Minolta XD-11 and XG-7, for instance, are compact, but not cramped. Lightweight, but with a solid feeling of quality. Oversized controls are positioned so that your fingers fall naturally into place. And their electronically controlled shutters are incredibly smooth and quiet.

Minolta SR-T's give you the heft and weight of a slightly larger camera, but with no sacrifice in handling convenience. As in all Minolta SLR's, "human engineering" insures smooth, effortless operation. **Are extra features important?** If you use them, there are a lot of extras that can make your photography more creative and convenient. Depending on the Minolta model you choose, you can get: multiple exposures with pushbutton ease



(even with an auto winder). A window to show that film is advancing properly. A handy memo holder that holds the end of a film box to remind you of what film you're using. And a self-timer.

**What about the lens system?**

The SLR you buy should have a system of lenses big enough to satisfy your needs, not only today, but five years from today.

The patented Minolta bayonet mount lets you change lenses with less than a quarter turn. There are almost 40 Minolta lenses available, ranging from 7.5mm fisheye to 1600mm super-telephoto, including macro and zoom lenses and the world's smallest 500mm lens.



The electronic viewfinder: LED's tell you what the camera is doing automatically to give you correct exposure.



The match-needle viewfinder: just align two indicators for correct exposure. Because you're doing some of the work, you can save some money.

**What's next?**

Think about how you'll use your camera and ask your photo dealer to let you try a Minolta. Compare it with other cameras in its price range. You'll soon see why more Americans buy Minolta than any other brand of SLR. For literature, write Minolta Corp., 101 Williams Drive, Ramsey, New Jersey 07446. In Canada: Minolta Camera (Canada) Inc., Ontario. Specifications subject to change without notice.

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**WE WANT YOU TO HAVE THE RIGHT CAMERA.**

# LETTERS TO THE EDITOR

## Relative error

You seem to report that Dr. William Barclay explains the decrease of humidity as the room temperature is increased by heating in the winter (*Science Worldwide*, page 14, Mar. '78) as due to "removal of moisture." Heating the air does not significantly remove moisture; however, at the higher temperature, the maximum possible moisture content (saturation density) is higher and therefore the relative humidity decreases.

PROF. MARIO IONA  
DEPT. OF PHYSICS AND ASTRONOMY  
UNIVERSITY OF DENVER

## Bookshelf budget

In the project presented in *Low-Cost Bookshelves You Can Build in a Hurry* (page 88, Jan. '78), the author calls for seven 12-foot pieces of 1x12 pine shelving. It is impossible to use only seven 12-foot pieces; you need an extra 8-foot piece to complete the project.

Also, the project cost more than the \$60 stated in the article. The shelving alone, at 65 cents a foot, comes to \$60.

LESLIE KAYE  
SPRING VALLEY, N.Y.



Reader Torok's custom bookshelves.

You're right. An additional 8-foot length is required to complete the shelf pattern as shown in the plans. However, the real advantage of this design is that you can arrange the shelves to suit your needs. So if you prefer an open wall system, with plenty of space for oversize objects, you might need less shelving than specified.

Currently, this project should cost about \$80, using shelving grade, 1-inch pine. But with today's soar-

ing prices, this estimate also may soon be outdated.

I was very impressed with the low-cost bookshelves. I designed and built a unit for my 15-year-old daughter's bedroom. I laid out to scale all the various units I wanted to place on the shelf and designed it around them. Results are as per the enclosed photo. Total time spent was about three weeks. My daughter was well pleased for her birthday.

FRANK J. TOROK  
ALDEN, N.Y.

## More on power robots

The article entitled *Next: Power Company Robots that Turn Your Appliances On or Off* (Feb. '78, page 114) was quite informative. However, it created the impression that the Honeywell BOSS system monitors only a building's demand rate and sheds low priority loads as peaks are being approached. Actually, this is only one of BOSS's many capabilities.

Since 1967, BOSS has provided energy management, building operation and monitoring, efficient use of manpower, and fire and security protection in a cost-effective manner. From 26 centers around the country, BOSS reduces energy consumption in buildings of various shapes, sizes and uses by from 15 to 30 percent.

MICHAEL J. GRANDINETTI  
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## Spread the good word

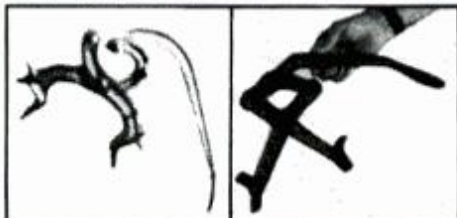
While reading *Can You Name These 'What's-Its'?* (page 90, Feb. '78), I recognized one object that I use every day. The tool, number eight in the article, is a tire bead spreader. The toothed jaws are placed between the beads of a tire and the handle pressed down until the jaws are locked and the tire beads are apart for easier inspection and repair. The enclosed picture shows the modern version of the tool with stepped jaws for different width tires.

Good luck with your remaining "what's-its."

ANDY ASBERRY  
ARLINGTON, TEX.

Reader Asberry is one of almost 300 what's-it buffs who wrote to PM or the Smithsonian with possi-

ble identifications. With their help, the following what's-its have been positively identified: No. 5 is a heat engine used for demonstration purposes; No. 8 is, indeed, a



New tire spreader (left) vs. old.

tire bead spreader; 11 is a lemon squeezer; 14 is part of a rope-making machine (someone sent in a six-inch length of rope made on one as proof); and 15 is a wild turkey call, versions of which are still made today. "Our faces were red on that one," admitted Warren Danzenbaker of the museum.

## Peugeot person's plaudits

Shame on PM for not sending us the Peugeot Owners Report questionnaire, the results of which were reported in the March issue (page 122). My wife and I have logged over 53,500 miles in Peugeots in the last year and a half. We currently own a 1976 504 diesel, a 1967 404 and a 1960 403 that we are restoring. We previously owned a 1975 504 and a 1971 sedan with four-speed column shift.

Needless to say, we are "Peugeot people." My wife is 28, I am 29. We definitely will buy another Peugeot, although we plan to drive the diesel indefinitely. Thank you for the Peugeot Owners Report and an excellent magazine.

JAMES D. SCHLICK  
BLOOMINGTON, IND.

Thanks, Jim, for your letter (which also included a lot of data about your Peugeots). You weren't included in the owners survey for one reason: the survey was for the '78 Peugeots, which you don't own.

We obtain the names of car owners we wish to survey from the R.L. Polk Co., which culls them from new-car registrations in all 50 states. We then send out our survey questions and our statistician compiles the returns. The people surveyed are not necessarily PM readers, of course.

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# HOMEOWNERS' CLINIC

## QUESTIONS ANSWERED

### Wrought with rust

*I can't stop my wrought-iron railing from rusting. My wife and I grind, wire-brush and sand the rail. I have tried all various "name" brand products, following their instructions to a "T". A short time later the rust is back, in new places, in the same places and all over. We're fed up. If you say so, we'll rip it out and put up a brick wall.—Adolph Kranz, New Hyde Park, N.Y.*

Living on Long Island, you have a good deal of moisture in the air. Moist air causes rust to form on the surface of iron or steel through oxidation. I have checked your plight with paint manufacturers and steel fabricators, and have come up with a couple of possibilities. Rust will usually start at the welds if they have not been properly cleaned prior to priming. Since it appears from your letter that you've done this, another possibility is the drying time allowed for the rust-resistant primer. This should harden at least three days to make certain that the finish coat doesn't "cut" through and mix with the primer, causing it to lose its effectiveness. One other product you might try is OSPHO, manufactured by the Skybryte Co., 3125 Perkins Ave., Cleveland, Ohio 44114. Follow instructions on the container. OSPHO contains phosphoric acid, sodium dichromate, wetting agents and extenders and upon application causes iron oxide (rust) to chemically change to iron phosphate, an inert, hard substance that turns the metal black. It sells for about \$3.50 per quart and is recommended by paint manufacturers. Wear rubber gloves and goggles while applying it.

### Ceramic tile on exterior wall

*We are remodeling our bathroom. Someone told us not to tile the exterior wall, as expansion and contraction will cause the tile joints to open. This will allow water penetration behind the tiles, and they will fall off. Is this true?—Mrs. Arven Lind, Atlantic, Iowa.*

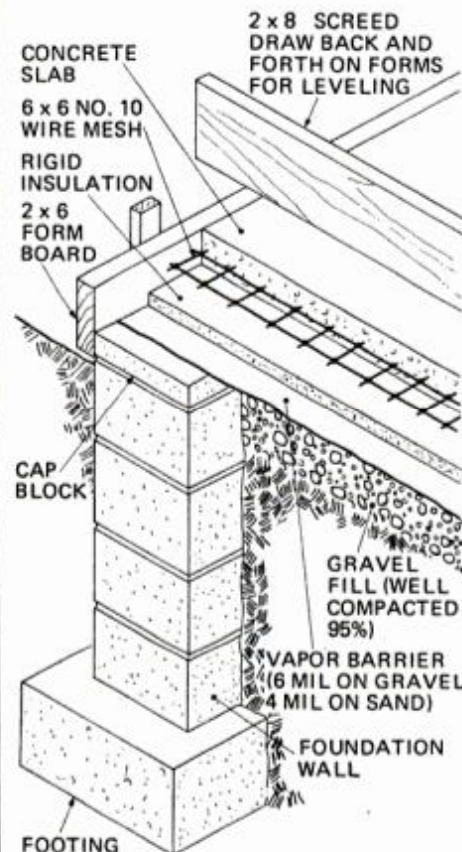
Nope, never heard of this one. Keep several things in mind, though. First, insulate the exterior wall. Next, if the tub alcove includes a window, seal it off and install an exhaust fan. Lastly, if plumbing pipes must be in the

exterior wall, wrap them with insulating tape. Make certain the pipes are between the wall insulation and the tile base (not flat against the wall sheathing).

### Pouring a concrete floor

*How shall I pour and level a concrete floor for the rural home I contemplate building?—George B. Mathison Jr., Slidell, La.*

The elevation of the slab of a



Typical concrete floor slab and wall.

home is always predetermined by the footings and foundation walls. These are set by four corner batter boards. The grade (level) is most easily set by renting a surveyor's level, or by using an 8-ft. straight-edge and a 4-ft. level.

Obtain footing widths from your local building department, since widths are based on loads and bearing capacity of the soil.

After the footings are poured and the block foundation wall set (level), fasten and brace a 2x6-in. form to it, allowing for at least a 4-in.-thick slab. The inside of the foundation (slab) area, must be thoroughly compacted, including a 4-in. porous base. Cover it with a 4-mil polyethylene vapor barrier, and

set 2-in. by 2-ft. rigid insulation flat around the perimeter.

Using a mix of 1 part cement, 2 parts sand and 4 parts stone, pour 2 in. of concrete. Set 6x6-in. No. 10 wire mesh; finish the pour to the form top. Make certain the concrete doesn't set between the 2-in. pours. Level the concrete with a screed.

Two strong recommendations: 1. Most of Louisiana construction requires piles and grade beams. Consult a professional engineer. 2. Pouring concrete is a tremendous physical endeavor. You might want to consider hiring a contractor.

### Shrinking and swelling doors

*Our old house has three doors that shrink so they won't stay shut in winter and swell so they stick in summer. Is there a solution, such as sealing them in winter?—M. Sargent Jr., Westport, Conn.*

Older houses usually have raised panel doors with stiles and rails that will swell and shrink with changes in relative humidity. Doors should be sealed. (Most suppliers will not guarantee a door against warping that hasn't been sealed on all surfaces and edges.)

Two notes about sealing doors: 1. Water-base paint is not a sealer. 2. A door should be sealed in the period between summer and winter when its size is just right.

In older homes, however, all framing is affected by humidity changes. Investigate using a dehumidifier in the summer (if your house isn't airconditioned), and a humidifier in the winter. **PM**

Do you have a home maintenance or repair problem? Send it to Homeowners' 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.



# Silent and Sound reasons to buy a Kodak Moviedeck projector.



Simulated  
Projected Image.

Whether you have sound or silent movies, Kodak projectors have everything you need to make showing your movies easy. Like:

1. Watching your movies without setting up a screen or turning down room lights. Our unique pull-out viewing screen is ideal for small audiences. You also have the option of projecting your movies onto a traditional screen.
2. Bright, sharp images.
3. Automatic threading and automatic rewind that make Kodak projectors really easy to use.
4. Showing super 8 and 8 mm movies at the flip of a single switch on all Kodak projectors.
5. Replaying previous scenes in just seconds, and a choice of fast or slow motion on some models.
6. Low-profile design and smoke-tinted dust covers that make these projectors easy to look at.

Ask your photo dealer for a demonstration of Kodak silent or sound movie projectors. They're easy to use and easy to look at, and that's some image!

**Kodak**  
**Moviedeck® projectors**



# If you don't get cast iron, don't pay for cast iron.

It's worth remembering if you're in the market for a 10" radial-arm saw. And it may not seem like there's a whole lot of difference between them.

It's understandable. Compare features and, if you don't count small extras like our lower leaf blade guard and metric scale, they're almost exactly alike.

Almost. But not quite.

It's easy to miss unless you know just what to look for, but there's one feature that can affect your work nearly as much as all the rest put together.

The composition of the column support and track. Cast iron? Or die-cast aluminum?

Ours are cast iron.

The reason is performance.

The best possible performance.

First, cast iron is heavier than aluminum.

Second, cast iron doesn't expand like aluminum when it gets hot.

Third, cast iron doesn't deflect as easily as aluminum under the same loads.

Fourth, cast iron dampens vibration better than aluminum.

Fifth, cast iron wears better than aluminum.

Now, knowing all that, you should also know that you can probably buy somebody else's radial-arm saw for a few dollars less than the Rockwell 33-215.

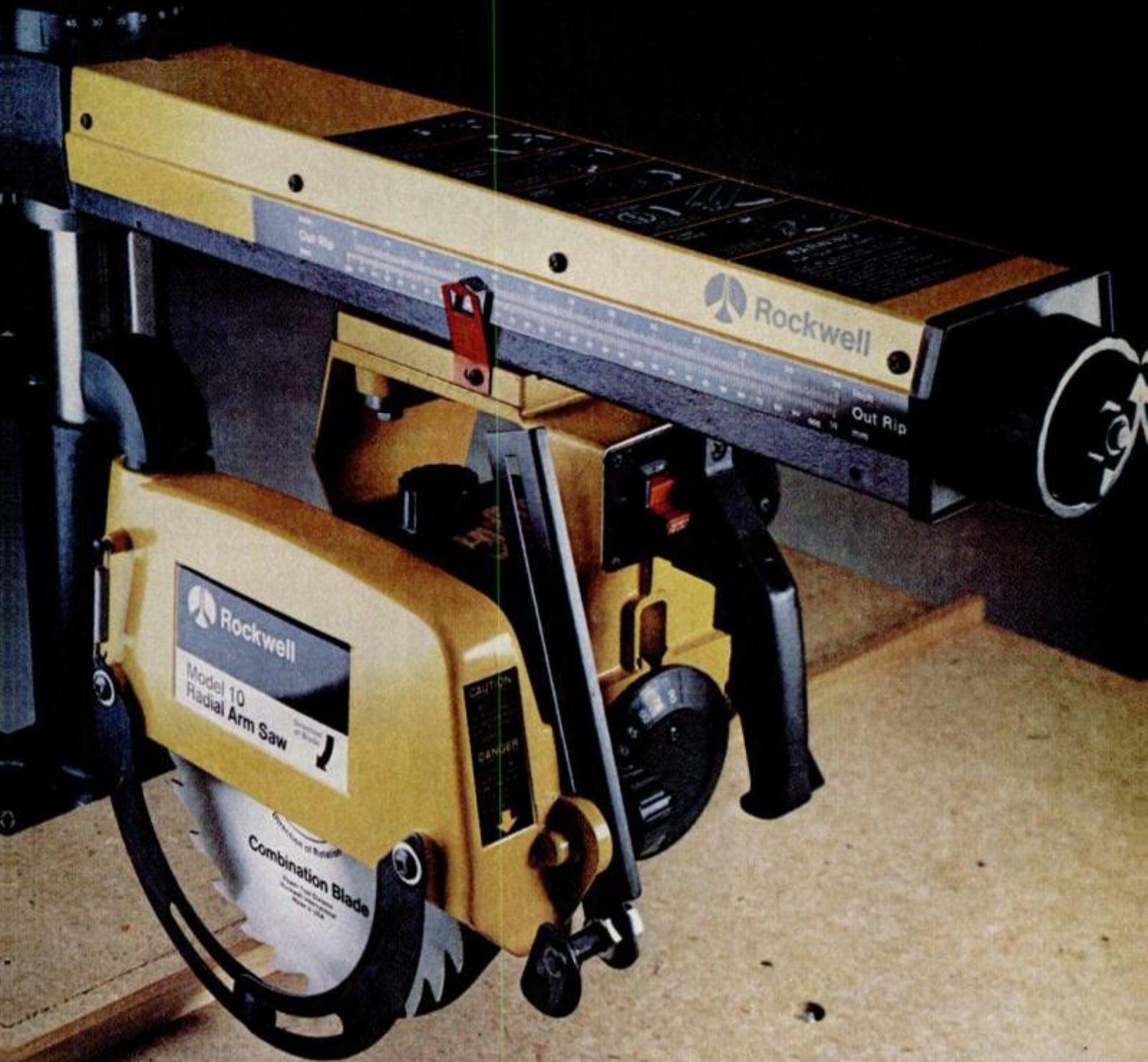
But even if it were \$100 less, you'd still have to ask yourself a pretty important question.

Can your work really afford it?



Rockwell International

# Introducing the cast-iron Rockwell 10" Radial-Arm Saw.



See the Yellow Pages under "Tools-Electric" for your nearest Rockwell dealer. Or write Power Tool Division, Rockwell International, 6263 Poplar Ave. Memphis, Tenn. 38138.

# PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

## Read pesticide labels

Though modern pesticides do a great job of controlling roaches, flies and other insects, they can also hurt children, pets and others who aren't aware that the stuff is around. Different pesticides contain varying amounts of toxicity. The most toxic are labeled "DANGER-POISON"; those with less toxicity with "WARNING"; while "CAUTION" identifies the least harmful types. For more information, send a postcard to Consumer Information Center, Dept. 611F, Pueblo, Colo. 81009. Ask for the free booklet, *Pesticides . . . Read the Label First.*—H.W.

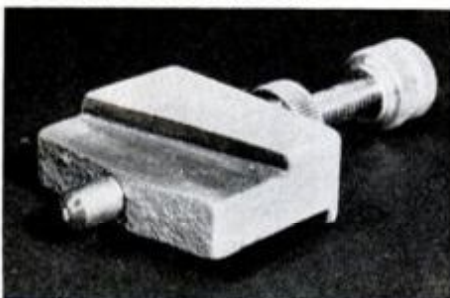
## Better texture painting

Textured paints—which hide minor surface imperfections—have long been used by paint smearers like

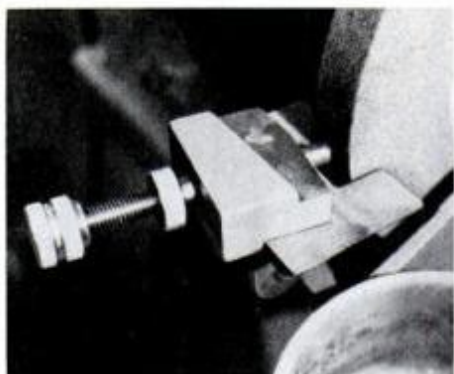


myself. A new latex type paint from United Gilsonite Laboratories, Scranton, Pa. 18501, does that, yet offers the user the chance to obtain a wider variety of textured effects on interior surfaces. Paint is applied by either a brush or low-nap roller—H.W.

## Accurate wheel dresser



Simple tool does a first-rate job.



To use, grinder is placed on toolrest.

You can get more mileage from a properly dressed grinder wheel. This \$31.95 (ppd.) tool from H.G. Geiger Mfg. Co., 416 Mill St., Bronson, Mich. 49028, lets you keep your wheel in tip-top shape. To use it, the dresser is positioned on the toolrest and the grinder started. The adjustable knob is turned slowly to advance the diamond stud against the wheel. Knob is locked, dresser moved back and forth.—H.W.

## All-purpose adhesive



Carded, .11-oz. (3-gram) tube is \$1.98.

Though I doubt that I will ever have to suspend a tractor from a helicopter, I often need an adhesive that will repair household items securely. A typical example is the cup shown, an item that has been in the family for years. To replace a chip, I recently used Eastman's 910 Adhesive—a product that will work on ceramics, auto parts, models, jewelry and other materials. The result was good; the piece stayed in

place even after washing in a dishwasher.—H.W.



910 adhesive rescued this old Bosco cup.

## Water saver kit



Kit comes packaged like jewelry.

The Wrightway Mfg. Co., 371 East 116 St., Chicago, Ill. 60628, recently introduced an Ecology Water Saver Kit (\$12.95) with a pushbutton shower head, basic aerator and swivel aerator claimed to reduce water consumption by 33 percent.

The pushbutton shower head flicks water on and off as desired during soap-down. Temperature buildup is prevented by allowing a slight flow of water through the head while the button is in the off position.—H.W.

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.



# Enjoy Salem Lights



**Enjoy the only  
low tar menthol cigarette with  
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Warning: The Surgeon General Has Determined  
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LIGHTS: 11 mg. "tar", 0.8 mg. nicotine av. per cigarette  
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nicotine av. per cigarette, by FTC method.

IT'S NEW  
**NOW**

**Two-story tent is cartoppable**

Five minutes after stopping your car you can be in bed inside a waterproof tent, claim the makers of the Auto Camper. The two-story tent, now on the market in Australia, is unfolded downward from its roof rack and pegged into place. Support struts are already sewn in and the fiberglass mounting base doubles as a sleeping surface on top of the car. A double mattress and other equipment can be carried inside the folded camper. It comes in two sizes; larger unit shown costs about \$855. Camaco Proprietary Ltd., 2 Oaklands Ave., Ferntree Gulley 3156, Australia.



**Electronic game needs no television**

Space Blaster projects target onto a wall instead of a TV screen. A bull's-eye is signaled by visual and sound effects. Powered by 8 "D" cells (not included), it costs \$45-\$60. Coleco, 945 Asylum Ave., Hartford, Conn. 06105.

**Light-powered calculator**

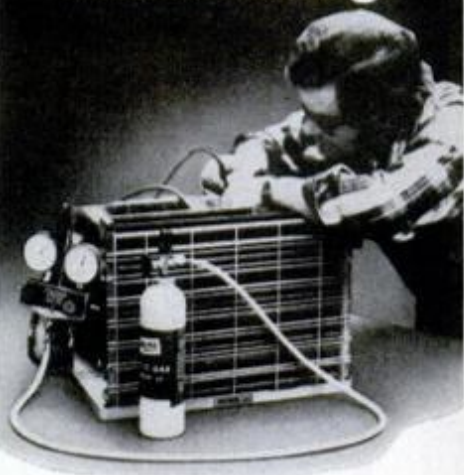
Photon's photocells work in any light; it needs no battery or on-off switch. It's \$40 from Teal, Inc., 251 East Victoria St., Carson, Calif. 90749.



**For paddlin' fun**

Made for recreation or rescue, 19-pound Paddle Pal is an 11-foot piece of molded polystyrene reinforced with aluminum tubing. It's \$75 (\$90 with folding paddle). Pal Makers, 214 Dexter, Elk Rapids, Mich. 49629.

**Learn Solar Technology**  
with NRI's  
home study course in  
**Air Conditioning, Refrigeration and Heating.**



**Learn a New Career at Home in Your Spare Time**

Get into the well-paid field of air conditioning, refrigeration, and heating with practical at-home training from NRI. Developed with technical assistance from the York Division of the Borg-Warner Corporation, your NRI program includes the latest advances to prepare you to service home and commercial air conditioners, refrigeration units, and heating systems...even heat pumps and solar heating.

**Includes Actual Air Conditioner for Trouble-Shooting Practice**

In addition to NRI's "bite-size" lessons for faster, easier learning, you get practical hands-on experience. NRI training kits include a Circuit Demonstrator, Control Simulator, joint-making demonstrator, leak detector, system analyzer, even a 5,000 Btu window air conditioner to experiment on and use.

**Optional Resident Training at Famous York Institute**

Graduates of the Master Course may take advanced training at the York Institute Resident School at no extra charge. Working with expert instructors on a wide range of equipment, you'll receive practical experience equal to months of on-the-job work.

**RUSH FOR FREE CATALOG**

Just check the postage-paid card. No salesman will call.



# If it feels like somebody else is making all the money, maybe it's time you looked at NRI home training for TV and audio technicians.

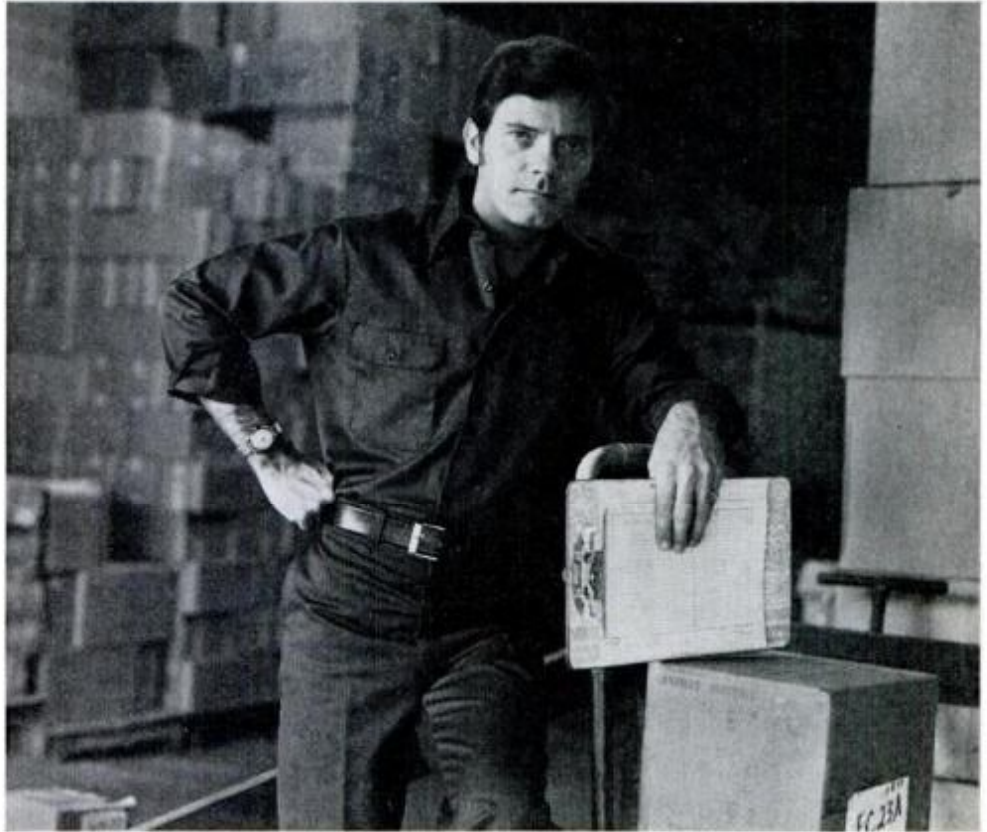
No matter how hard you try, there are some jobs that just seem to go nowhere. And others so monotonous, they drive you up the wall. While all around, you see people enjoying what they do and making a good living at it.

## **NRI Can Set You Free**

There's a way out of the rut. NRI home-training in TV and audio servicing. At home, in your spare time, you can learn to become a TV electronics technician. Qualified to hold down a good paying job as a serviceman or troubleshooter. Even start your own full- or part-time business. And you learn at your own pace without quitting your present job.

## **Learn by Doing, Actual Bench Experience**

NRI is more than book learning. Sure, we give you all the fundamentals and theory. But it's reinforced with practical experience every step of the way. In our Master Course, you build actual electronic circuits and test them. You construct a 4-channel audio center, a 25" diagonal solid state



color TV, introduce and correct typical service problems. You even assemble test instruments that you use for learning and earning.

Your equipment includes a transistorized Volt-Ohm Meter, TV color pattern generator, advanced design 5" triggered sweep oscilloscope and CMOS digital frequency counter... the basic tools of the pro. In addition, you build the 4-channel audio center and 25" color TV while performing more than 35 in-set, power-on experiments that give you real bench experience while you learn.

## **Ask the Professionals**

A documented national survey confirms for the second time that almost half the professional TV servicemen have had home-training. And among them, they recommend NRI as first or only choice by more than 3 to 1! That's because NRI training works, as

it has for 63 years and more than a million students.

## **Send for Free Catalog... No Salesman Will Call**

Get all the facts on how NRI career training can mean new opportunities for you. Send for our free catalog describing lessons and equipment, other courses in digital computer electronics, CB radio servicing, communications, and more. No salesman will call. Mail the postage-paid card today and see if you can't make more of yourself in this wide-open field. If card has been removed, write to:



**NRI Schools**  
McGraw-Hill Center for  
Continuing Education  
3939 Wisconsin Avenue  
Washington, D.C. 20016

# ALL OUTDOORS

## Scenery pollution

Environmentalists always seem to be against something, trying to restrict this or that, or trying to keep the average guy out of someplace so a limited few can enjoy one special activity. We've always felt the outdoors big enough for multiple usage for a majority to enjoy. But now we've joined the fanatics.

On a recent cross-country trip with camera in hand, we found that almost every time we framed a scene of a New England church, Midwest farmhouse or mountain corral, a utility pole stood right in the middle. All country roads and many village streets were fenced with those endless miles of wire and ugly uprights.

We're not in favor of turning off the lights or pulling the phone plugs across the continent. But how about rules that call for all new utility lines to be run underground? It would be more expensive, but the wires would be less susceptible to ice and windstorm damage. The Friends of the Subsoil and the Champions of Telephone Pole Termites will object, but the landscape should benefit.

## Travel tips

For everyone except the hiker, costs of getting from here to there are going up. Flying is best if your time and your baggage are limited and your budget can stand the expense. Trains and buses cost less and allow more luggage. A car still is superior if you have a lot of gear, want door-to-campsite delivery convenience and don't mind driving.

Outdoorsmen should be aware of the special problems they may have because of the antihijack regulations of the airlines. Hunters know they cannot board a plane with an airgun or firearm in their carry-on luggage. Fishermen, however, are going to run into similar trouble if they try to hand-carry a favorite tacklebox onto a flight and it contains a fillet knife bigger than a folding pocketknife. Either pack the knife in check-through cargo-compartment luggage and hope it doesn't go astray, or leave it home.

For car travel, a gun should be unloaded, and some states require a rifle or shotgun be disassembled as well. Handguns are even more restricted; check local regulations.

Airport security guards will tell you their fluoroscope baggage ex-

aminer will not fog your camera film unless it passes through a dozen times. Professional photographers will tell you horror stories of ruined film when the sensitivity of the machine was cranked up. Play it safe and: buy one of the special leadfoil-lined bags at your camera store; put your film in a transparent plastic bag and hand-carry it with you through the metal detector; or ask for hand inspection of your camera case.

## Notes to shooters

For fans of the .22-cal. cartridge—and that must be nearly every shooter at one time or another—there is more good news. Winchester-Western is introducing a new Super-X Xpediter cartridge that claims ultra-high velocity without pressure limits that exceed long rifle standards. Any rifle or handgun with .22 caliber long rifle sporting chamber can use the new hollow-point 29-grain Lubaloy-bulleted cartridge. From a 24-inch barrel, the Xpediter has a muzzle velocity of about 1680 feet per second (fps) and 182 foot pounds of energy, compared to 1280 fps and 138 foot pounds for a standard high-velocity long rifle. Mid-range trajectory is 2.5 inches at 100 yards, an inch less than with the standard long rifle load.

Owners of last year's Crosman Arms Model 1377 "American Classic" and Model 1322 "Medalist" single shot pump-up pellet pistols should check with their dealers or a Crosman service center. Those distributed during 1977 and January 1978 may have a grip screw that can work loose and cause discharge or malfunction. A toll-free call to 800-638-2666 (in Maryland: 800-492-2937) will get the address of the nearest service center for no-charge adjustment.

## Outdoors with a difference

Individuals, couples and families can again try a special kind of vacation this year sponsored by the National Wildlife Federation, the nonprofit conservation education organization. The six-day events, called Conservation Summits, will be held in the Blue Ridge Mountains of North Carolina June 26 to July 2, the Rocky Mountains in Colorado July 6-12, and the Adirondacks, New York, July 31-August 6. Classes on outdoor skills are com-

bined with activities and hikes that put the skills into practice. For information on the low-cost events, write National Wildlife Federation, 1412 16th St. N.W., Washington, D.C. 20036.

*Volunteer Vacations in Forests and Parks* is a \$2.95 publication of the American Hiking Society describing jobs and projects available for outdoorsmen. The directory can be ordered from Signpost Publications, 16812 36th Ave. W., Lynnwood, Wash. 98036.

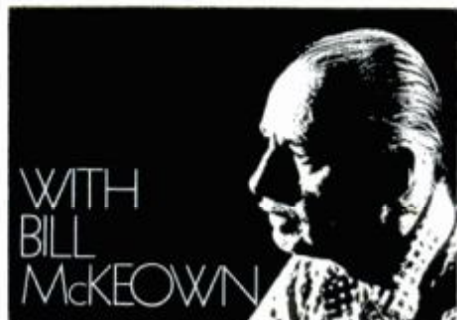
## Where to get it

We've found several good new mail order sources of hard-to-find outdoor items. For fishermen who want to make or repair rods and lures, there is Boyd Pfeiffer's 48-page Component Parts Catalog. It's free from Tackle Crafters, 9306 Joey Drive, Elliott City, Md. 21043.

Mort Jarashow has started a "supermarket" for campers at 195 West Shore Ave., Bogota, N.J. 07603. His \$1 catalog covers a good variety of gear for backpackers and car, RV, boat and bike campers.

To pick your own idea of perfect weather, or to know what to expect and wear where you've decided to go anyway, check the latest *Climate Advisor*, \$7.90 postpaid from Climate Guide Publications, Box 323A, Station C, Flushing, N.Y. 11367. Over 350 locations in the United States, Canada, Mexico and the Caribbean are charted.

And for boatmen still fitting out, fixing up and adding on—those never-ending pastimes—Defender Industries, 255 Main St., New Rochelle, N.Y. 10801, has issued their latest \$1 *Marine Buyers Guide*, a catalog that lists just about every item of power and sailboat hardware plus those hard-to-locate items like flotation foam, various plastics to cover a hull, and assorted resins to apply them. For each, the catalog gives useful where-and-how-to-use instructions. **PM**



Give Dad a distinguished name.  
After all, he gave you one.



**Seagram's V.O.**

Bottled in Canada. Preferred throughout the world.

CANADIAN WHISKY. A BLEND OF CANADA'S FINEST WHISKIES. 6 YEARS OLD. 86.8 PROOF. SEAGRAM DISTILLERS CO., N.Y.C. Материал, защищенный авторским правом

# For 13 years in a row, the best-selling (Maybe it's because the Wagonmaster

**Pinto. The most cargo  
room for the money of  
any small wagon.\***

Since its introduction in 1972,  
Pinto Wagon has outsold every  
other sub-compact wagon.



**Fairmont.  
The most cargo  
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of any mid-size wagon.\***

It's the newest better idea from the  
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out for yourself.

\*Based on comparison of EPA Cargo  
Volume index and sticker prices.

**AT FORD DEALERS**

# Ford Dealers have had a wagon lineup.

(offers so much room for the money.)



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The new Super Wagon seats  
up to 15 with three optional  
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wagon seats five, with  
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The LTD Wagon's EPA Cargo Volume  
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by any other wagon.

**THE BETTER IDEAS KEEP COMING.**

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# MILLION DOLLAR SHINE.



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For sporting weekends or family travel Cobra offers all the features and value you expect in a quality recreation vehicle. Choose from luxurious Supreme or family priced Fiesta motor homes, mini motor homes, fifth wheels or van conversions. All are protected by Cobra's proven Owner Satisfaction Plan warranty.

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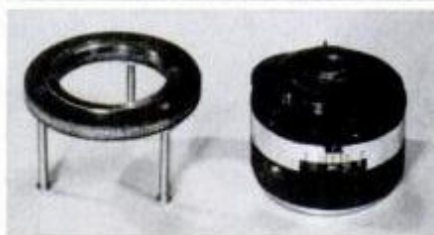
# PHOTO HINTS

## Cable-release keeper



The best way to keep a long, springy cable release under control in your camera bag is to coil it into a flat, round plastic box—the kind electrical tape is sold in is ideal.—*Frank H. Day*

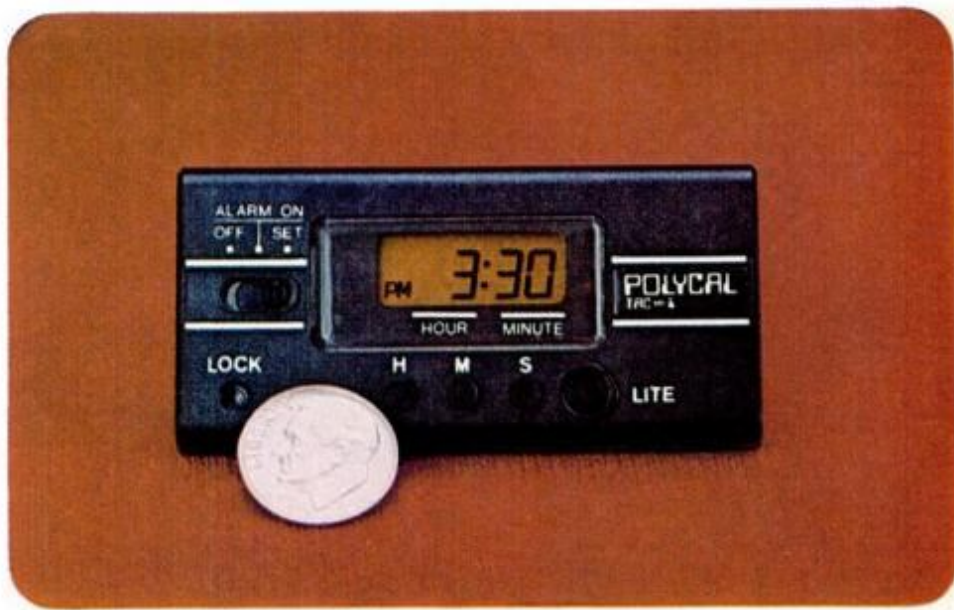
## Camera lens as magnifier



Your removable camera lens is also a high-quality magnifier. A 50-mm lens provides about 6X magnification, a 28-mm about 10X. The lens can be hand-held, but a tripod stand is more convenient. Camera dealers can supply a flange that accepts the lens thread or bayonet and can be fastened to a body ring that has tapped holes for machine-screw legs. Take care not to damage the lens's diaphragm-control pin. Set the lens at infinity and adjust leg length until you get a sharp image of a printed page. Focus normally for objects that have thickness.—*Walter E. Burton*



You can add a touch of space-age elegance as you protect your home with the world's first microprocessor wall switch from JS&A.



The new JS&A Travel Alarm will fit in your briefcase, pocket or purse and it takes up as much space as four quarters.

# The Winners

*These two items are the best selling new electronic products. Can you figure out why?*

New products often surprise us. We never quite know why one product stands out and becomes a big seller.

In our recent catalog, our Security Switch and Mini Travel Alarm were in greater demand than any other item. Both are new innovations using newly developed technology, and both are being sold by the thousands. See if you can understand why:

## THE MINI TRAVEL ALARM

It's small. And because it's small, it fits anywhere. In your briefcase or in your pocket.

The new JS&A Travel Alarm measures only  $\frac{3}{8}$ " x  $1\frac{1}{4}$ " x  $2\frac{1}{2}$ " and has a small easel support on the back. Just set the alarm, and the electronic beep will wake you up. The clock movement is totally solid-state, and a built-in night light lets you view the time in the dark.

But the JS&A Travel Alarm does more. First, it makes a great pocket watch. The small imitation black leatherette carrying case that comes with the unit has a window so you can view the time even when the unit is in its case. Secondly, it tells accurate time—within fifteen seconds accuracy per month. And finally, it's inexpensive—only **\$29.95** complete with carrying case and two readily-available hearing aid batteries. It makes a perfect gift for your secretary, business associates, best customers, and friends.

There is also a deluxe version with a built-in timer and dual time zone capability. You can now display one time while keeping the second time in memory.

The Travel Alarm can be ordered by calling our toll-free number below or sending your check for \$29.95 for the regular version or \$39.95 for the deluxe version. Please add \$2.50 postage and handling.

## THE SECURITY SWITCH

It's just another very clever application of solid-state technology for the home or office.

You know those security timers that turn your lights on and off while you're away? They are supposed to deter burglars and vandals because they make your home look lived in.

But any halfway experienced burglar can see the difference between the lights you use when you're home and the lights you use when you're away.

Now a new space-age device programs your lights to respond to a pre-determined, yet random living pattern. And unlike the devices that fit into an electrical outlet, this device simply slips into your existing wall switch.

A built-in LED digital clock displays the time. When you leave, you turn the switch on. You can choose between five different programs depending on the room you're in. You tell the built-in microprocessor-based computer circuit which room you're in by entering a number. Then the lights controlled by the switch in that room turn on and off just as if the room were being used on a daily basis.

Because it's random, the unit will turn on and off at varying times on different days but always during the approximate times they would normally go on if you were at home.

To install the unit, you simply turn off the fuse for that outlet, remove your present light switch, and replace it with the new one. There's no soldering required—just twist on a few wire nuts and you're finished.

The switch can be overridden and used just like a regular light switch by pressing a button to turn on the light. One of the nice features of the system is its appearance—that of a space-age switching system—sure to be a conver-

sation piece in any room.

The only drawback is that in a power failure, the lights go on and stay on after the power outage. But this could also be considered an advantage as it would warn your neighbors to stop by and check out your home.

The Hutec security switch costs only **\$39.95** plus \$2.50 for postage and handling per order. It is well worth a test. If you like the switch, order some for your entire home. Even if they just replace your existing switches, you'll have the only home on the block with a digital watch in each one of your light switches.

## DISCOVER THEM YOURSELF

Both of the above products are available with a 90-day parts and labor warranty and our 30-day guarantee of satisfaction. If you are not completely satisfied, return them within 30 days for a complete refund. Illinois residents please add 5% sales tax. The most you pay for postage and handling is \$2.50 per order, no matter how many items are in the order.

JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected. We personally stand behind the quality and the service of both products.

It took our catalog to help us discover two of America's hottest new products. Discover them yourself—at no obligation, today.

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## For cement projects great or small, **SAKRETE** Mixes do them all!

Use the quality brand the pros prefer — SAKRETE. Just add water — and get down to the business of building.

Beautify your home with a patio, a decorative block wall or a garden pool, and save up to 80%. Since you mix only what you need, you can work at your own pace, a bag or two at a time.

Make the most of your time and money. Enjoy outdoor living and increase the value of your home. And you will take professional pride in a job well-done with SAKRETE Mixes.



FREE BOOKLET with step-by-step directions for 20 projects, available at your SAKRETE Dealer.



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Insist on

# SAKRETE

Concrete and Mortar Mixes  
The pros' choice

## If you thought "Swiss-Precision" could only be found in watchmaking, then you don't know about our power tools.

Only you know how good your tools have to be. When it comes to woodworking machinery, they should be better than you are — even if you're already an accomplished craftsman. Therefore, you owe it to yourself to learn more about our Swiss-made line of INCA stationary power tools which we sell throughout these 50 states.

Take the 10" Cabinetmaker's Saw, for example. It has a 20mm (25/32") arbor at the blade for strength and rigidity where it counts. The table castings are tough, precision milled alloys and the guide rails are aircraft quality extrusions. All the major rotating parts are dynamically balanced. The bottom line is a machine that takes higher loadings and gives you less vibration with a truer running saw blade.

In fact, every one of our INCA saws, jointers, planers and shapers are built to quality standards which are becoming increasingly hard to find in this country. That's because they're made with the same pride of workmanship as the Swiss put into their watches.

Our catalog is a good place to begin your comparisons. We want you to be as good as you can get.



Garrett Wade Company, Dept. PM-6-8  
302 Fifth Avenue, New York, N.Y. 10001  
National Distribution

Gentlemen:

- Send me your INCA catalog. Enclosed is \$1.  
 Here's another \$1 for your 108-page catalog of quality hand tools.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

## HINTS FROM READERS

### Clamping with sand



Hold small parts together for welding or soldering by working them into sand kept in a small box in your shop. You can work without being restricted by clamps.

—Howard E. Moody

### Drive screws in tight places

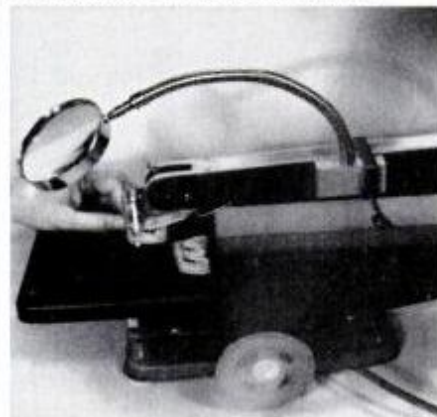
When you have to install a screw in a hard-to-reach place, simply dab one drop of contact cement into its head and let it dry a minute or two until tacky. The screwdriver will stick to the cement, helping you start the screw.—William J. Kearns

### Tightening with tissue

When screw holes have enlarged and screws won't hold, shred tissue and mix it with white glue. Fill the opening with the mixture and allow it to dry. Now the replaced screw will hold tightly.

—Helen LeMunyon

### Magnifier for delicate work



Fine-line sawing is easier when you look through a magnifying lens. I drilled a hole in a block of wood to attach a gooseneck magnifying lens. Then I clamped the block to a jigsaw with a C-clamp.

—Ken Patterson



## Pay & Benefits

If you enlist in the Army, you'll start with good pay; a long list of skill-training courses to choose from; 30 days paid vacation each year; the opportunities to travel, to continue your education, and to qualify for veterans' educational benefits. For more information about all the opportunities in today's Army, send the postcard. Or call 800-431-1976 toll free. In NY call 800-243-5614.

# Europe.

"I'd worked on a farm after high school. And I'd watch people leave my town, travel, and come back different — better, I thought. And I wanted to do that. I enlisted in the Army for Europe. On the plane over, about halfway across, all the GIs got real quiet, thinking what it would be like. They were scared, really. But you can always find something here that's a little like home, whether it's farms, or rock music, or just making friends. In Europe you'll work, and have fun — all you've got to do is do it!"

*SP4 William E. Kincaid  
Schwabach, Germany*

**Join the people  
who've joined the Army.**

# APPLIANCE CLINIC

## QUESTIONS ANSWERED

### Grandpa of a washer

*I've been trying to repair my Frigidaire automatic clothes washer (WCI 59) and haven't had any luck. The machine labors in the agitating cycle and soon pops the motor safety shutoff. During the spin cycle, the tub doesn't spin. I've disassembled the unit and looked for broken parts, but without success. What's keeping this machine in a bind?—Joseph V. Schember, Erie, Pa.*

Probably the brake assembly is engaged or partially engaged. Or there may be a bad bearing (perhaps the mainshaft bearing) that is causing the tub to bind.

Price the cost of repair versus the cost of buying a new machine. Unless you can repair it yourself, this thing could cost you a small fortune; that is, if you can find a serviceman experienced enough to work on this washer. After all, the model designation indicates it's almost 20 years old.

### Luck with Electrolux

*I would like to make a point concerning the Electrolux vacuum cleaner that I'm sure will benefit many of your readers. I sell and repair this machine, and realize that many users have trouble with the automatic system that turns off the machine when the bag gets full. Trouble is the system often shuts down the machine before the bag is full.*

*The cause of the problem is normally one of two things: 1. the control is not set correctly; 2. the machine is used to sweep up material that clogs the pores of the bag, such as flour, plaster, grass and rocks. Grass and rocks get into the machine when the unit is used to clean automobile interiors. When the pores of the bag get clogged, the machine automatically shuts off.*

*I would like to make the following suggestions:*

*1. Have the control dial set on "3" most of the time. Change it only when dirt other than normal household dirt is picked up.*

*2. Such dirt is flour, sugar, talcum powder, outside dirt, ashes, grass, rocks, leaves, cat litter and dirt from airconditioner filters. When vacuuming these materials set the control dial to "6."*

*3. Check the machine every year*

*for possible blockages. Remove the screws and lift up the plate inside the cover. Remove the plate by pulling off the hose. Now remove all hoses and clean them out with a pipe cleaner and soapy water.*

*4. Use only Electrolux bags, which contain a cotton filter.*

*If these procedures are followed the Electrolux will work fine for many years.—Thomas Gasko, Crestwood, Mo.*

Thanks for this sound advice.

### Calling Mr. Ripley

*What can be done about a Kenmore clothes dryer that, believe it or not, leaks water from the bottom while drying clothes?—Bill Richko, New York.*

It's believable—it's believable. But don't blame the dryer. Look to the clothes washer and the fact that it's not doing a good job wringing water out of the clothes. The too-wet clothes are put into the dryer. As they tumble around, they eject water that flows out through the unsealed drum. The most common reasons for clothes not spinning dry enough are a broken or slipping drive belt, a loose motor pulley, a defective drive clutch or a malfunction of the "spin" brake or transmission.

### Diplomatic mission

*About four months ago, we noticed that the oven liner of our three-year-old General Electric self-cleaning range (J356R) was chipping above the heating coils. It is not possible that anything, such as a pan, could have caused the damage. I received no satisfaction by writing GE and asking how to stop the damage from spreading. A late model unit should not need a new oven liner this soon. Can you help me?—Gary White, Bloomsburg, Pa.*

A friend or ours at a regional GE service facility says, "Once in a while we find a liner that doesn't stand up under the stress of self-cleaning heating and cooling."

According to this GE representative, there is no way to repair or halt the damage. Unfortunately, the oven liner is warranted for one year. So you have a problem that may eventually entail your having to replace this liner at your own expense.

Before you do, my GE source suggests that you contact the re-

gional service facility in your area and diplomatically explain your problem. Direct your plea to the customer relations department. Maybe in the interest of fostering good will, something can be worked out.

You'll find the type of GE facility that you need located at 5660 Rising Sun Ave., Philadelphia, Pa. 19120.

### Mistaken identity?

*After almost five years of excellent service, our Hotpoint heavy-duty clothes dryer (DLB 2680 LBCWH) ruined a tub of clothes when the three-prong safety thermostat failed. A Georgia Power Co. serviceman installed a new thermostat, which bore part No. WE 4X429. The old thermostat had a different number. A month later, the same problem occurred, and the same part and one connector were replaced. A month after that—same trouble. This time the same part and two connectors were replaced. Wires have been checked for possible shorts. Where can I get that original thermostat?—F. Angeletti, Decatur, Ga.*

I don't know, but it doesn't matter. WE 4X429 is the Hotpoint number for a safety thermostat in your dryer. The only problem is that WE 4X429 is one of four different thermostats in the dryer. So, what if WE 4X429 is being used in a place where another thermostat should be used? It will probably serve for a while, but eventually fail.

But assuming that WE 4X429 is, in fact, installed in the right position, there is a good reason why it is failing. Perhaps there has been a change in the resistance value of the wiring on-line with this thermostat. If so, the thermostat's performance will be affected. The wiring, therefore, may need to be replaced.

By the way, why are you still calling a Georgia Power Co. serviceman rather than an authorized GE-Hotpoint serviceman? Wouldn't you like to have another opinion? **PM**

---

*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.*

Central air conditioning can be cold comfort if it costs too much to operate.

# Introducing the Sears Green\$avers

These days, it can take a lot of green to cool your home. Because energy costs money. So depend on Sears. We're experts at controlling the cost of temperature control. We'll help you keep a lid on the expensive energy your home's air conditioning and heating systems use.



## Meet our GreenSaver Central Air Conditioning System.

It's the new Sears Best Central Air Conditioner, the most energy-efficient line we've ever offered. The Green\$aver is engineered to coax the cool out of every kilowatt. And that can help hold down your electric bills.

## Is your present cooling system too energetic?

Sears has a record of the Energy Efficiency Rating (EER) of virtually every central air system recently made by American manufacturers. So we'll give you an honest evaluation of your present system's EER. That could be where the money's been going. And, whether you're thinking of putting in central air conditioning for the first time or simply replacing your condensing unit, Sears will help you make sure you're getting your money's worth out of your electricity.

To cool your house comfortably and economically, Sears has air conditioning systems, evaporative coolers, heat pumps, power ventilators and the energy-conserving Thrif-T Thermostat. We'll recommend the Sears products that will do the best job for you, and we'll arrange installation as well. You can buy both the units and their installation on one of Sears convenient credit plans.



## We have a GreenSaver Furnace, too.

It's Sears Best Furnace, with electric spark ignition that eliminates wasteful pilot

flames and optional automatic vent damper that helps keep heat and dollars from escaping through your flue. The perfectly balanced mate to our summer Green\$aver. An excellent replacement for your worn-out furnace. We're very cool people to talk to about home comfort. So come to Sears Home Comfort Department, and ask us for a free estimate or advice.

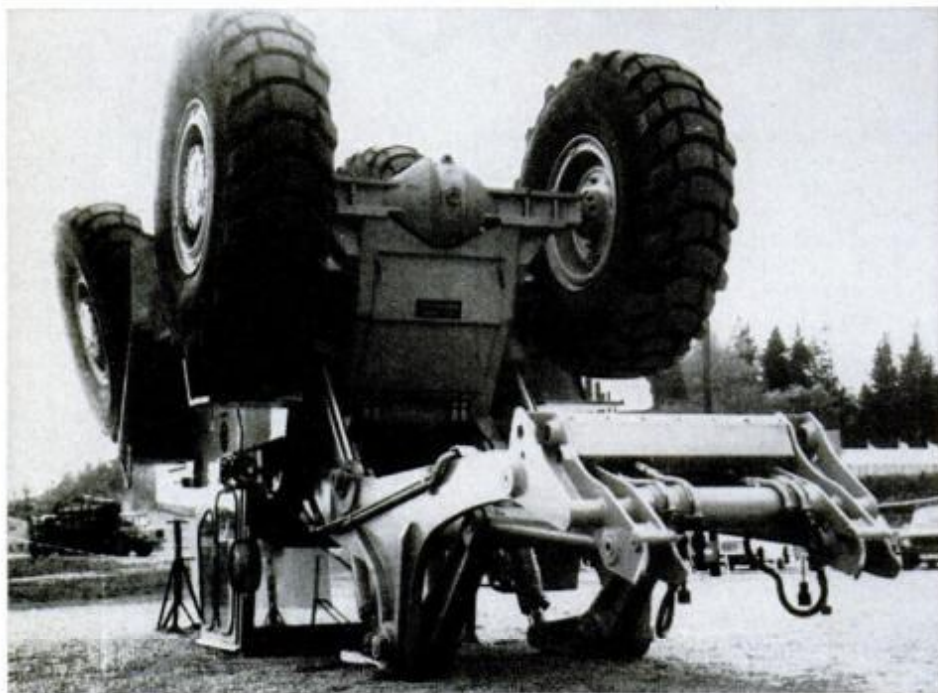
## Home comfort doesn't have to cost a fortune.

# Sears

© Sears, Roebuck and Co.  
1978



# IT'S NEW NOW



## Flipped out

Looking like a giant insect struggling to right itself, this 9½-ton Volvo quarry vehicle was flipped over to show the cab is strong enough to resist falling rock.



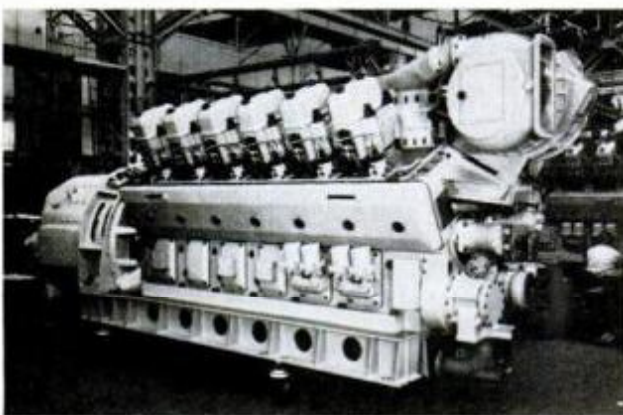
## Chevette's automatic seat belt

A GM employee is shown entering a Chevette equipped with GM's automatic safety belt system. The belt, now available, is one of the devices developed to meet government passive restraint rules.



## Ain't nothin' but a flyin' hound dog

NASA's pilotless Mini-Sniffer has a range of 1500 miles at 20,000 feet; with a non-air-breathing hydrazine engine and 6-foot propeller, a ceiling of 100,000 feet is expected. Sniffer will be used for surveillance and monitoring atmosphere.



## Massive diesel for a locomotive

Each cylinder of this V12 four-stroke turbocharged diesel has four valves and displaces almost 900 cu. in. The Swiss-made Sulzer engine puts out 3240 hp at only 1000 rpm and is designed for long life and easy maintenance. The engine powers Morrison-Knudsen's 279,000-pound TE 70-4S locomotive to speeds up to 70 mph.



## You can't buy one until fall . . .

. . . but at \$50,000, the Trebron is not for everyone. The handcrafted luxury car features a turbocharged V6 engine and a top speed near 200 mph. The doors on the fiberglass body open upward.

# INTRODUCING NEW TURTLE EXTRA.®

**With specially formulated wax and polymers that cling to a car's surface.**

To demonstrate this clinging action, we waxed the car below with Turtle Extra. Then before we buffed it, we actually sank it in 35 feet of water in Silver Springs, Florida.

As you can see, after hours under the water, the Turtle Extra is still clinging to the car's surface.

Turtle Extra is the thickest, richest, most effective liquid car wax we've ever made.

There's never been a car wax like Turtle Extra.

**Turtle Extra won't run out on you.**

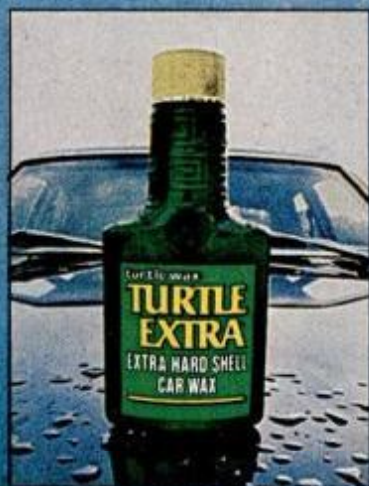
You get more than a great shine. When waxed and buffed, this unique formulation of wax and polymers forms a strong protective shield on your

car, protecting it from rain, sun, sand, salt—all kinds of dirt and weather.

As long as your car is shining, you know that Turtle Extra is there protecting your car's finish.

Turtle Extra is the newest member of the Turtle Wax family of products that help beautify and protect your car.

**No. 1 in Car Waxes.**



**INNOVATION**

# Coleman® Charger® SP: Rechargeable sealed power means you won't be left in the dark.

Pack a portable Charger SP from Coleman. It's a different, better concept in electric lanterns. Better for dependability. Better for economy.

The Charger SP gives you *sealed power*... just like the new generation of automotive batteries... so it's virtually maintenance free. It's ready to go as soon as it leaves the store. You'll never have to fill it.

Charger SP works three ways. From its sealed power battery. From any 110-volt out-

let. From a 12-volt car battery system, plugged into the cigarette lighter.

It also *recharges* from either 110-volt or 12-volt current... up to 150 times.

Your approximate operating cost for 2000 trouble-free hours is just \$1.50. Compare that with lanterns that need replacement batteries, at costs ranging well over \$300 for 2000 hours of light.

And like you'd expect from Coleman... it's rugged. It's

built into a high-impact energy absorbing outer case, with a shatterproof lens. Use it anywhere, even when it's turned upside-down.

Take it camping. Keep one in your car for roadside emergencies. Keep one handy at home. Depend on the Coleman Charger SP... for performance and economy.

*Remember: Coleman equipment can come in handy in storms, blizzards and power losses too.*



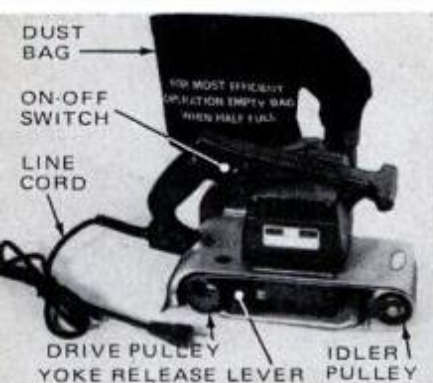
**The great outdoors  
is too good to miss.**



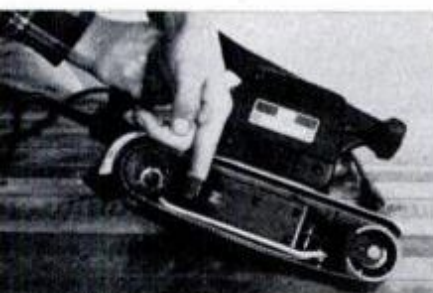
The Coleman Company, Inc. • Wichita, Kansas



# PM LOOKS AT SEARS 4-IN. BELT SANDER



Front pulley is pressed against bench to release tension on belt to be removed.



Fingers are kept clear, lever is pulled out to apply tension to the new belt.



Since tool is a workhorse that makes lots of dust when using a coarse-grit abrasive; dust collector is a lung saver. Photo, right, shows dust made in three minutes.

## SPECIFICATIONS

### Model 1178 Dustless Belt Sander

Electrical: Double-insulated, 110/120-v., 60 Hz., a.c., 900 w. UL listed, 6' two-wire neoprene line cord.  
Belt size: 4x24" (4x6" sanding surface).  
Motor: 1½-hp, no-load speed of 1300 f.p.m., 100 percent ball and roller bearings.  
Price: \$94.50.  
Manufacturer: Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684. Available at Sears' stores or through the catalog.

The newest belt sander from Sears is far from cheap, but if you spend a lot of shop time sanding wood, this tool could pay for itself in a hurry. Since I already own a heavy-duty Porter Cable 3x24-incher, I had a good yardstick to compare Sears' best sander to. Like most rugged belt sanders, this one takes getting used to; it takes armpower to lift and heft it. But once it touches the work, you will find the lifting was worth it.



New belt is slipped over both pulleys, arrow on inside must point to the front.



If belt runs inward or outward, tracking screw is turned to correct belt's travel.



Its 4x24-in. belt travels at a 1300-foot-per-minute no-load speed. The actual sanding area is 4x6 in. That means you are sanding 24 sq. in. of surface, a good reason to buy the model equipped with a dust-collector attachment—even though this will add about \$15 to the tool's cost. —Harry Wicks, Home and Shop Editor

**UNIQUE!**

## Coleman® Roundabout: It's a cooler and then some!

There's never been a cooler like the versatile Roundabout. The lock-top hatch opens wide for big loads... there's room enough for quart bottles to stand upright... a removable tray keeps food dry.

You can also use it as a jug. And it's handsome enough to join any party as an ice bucket.



Best of all, it's a Coleman Poly-Lite,® tough enough to go wherever your good times are.

**Coleman**

The Coleman Company, Inc.  
Wichita, Kansas



# McCulloch. You've got to saw it to believe it.



## You get more features for your money with McCulloch's Mac 140 and Pro Mac 10-10.

These two McCulloch chain saws are loaded with the kind of features that make backyard projects a whole lot easier.

Take the Mac 140, for instance. It's got Chain Brake/Hand Guard to reduce the hazard of kick-back. Big 14" sprocket tip bar. Auto-Sharp to sharpen the chain with a press of a button. Both automatic and manual bar and chain oiling. Plus a handy carrying case. You can't buy another chain saw with all these features at any price.

Or the Pro Mac 10-10, built for heavy-duty cutting. Its powerful 3.3 cu. in. engine and 16"

sprocket tip bar will make short work of just about any job. Plus Chain Brake/Hand Guard and automatic and manual oiling. It's McCulloch's best selling saw.

Put one of these McCulloch chain saws to work. Whether you're cutting firewood or fenceposts, McCulloch will sink its teeth into your home cutting jobs.

*How about a McCulloch for Father's Day?*

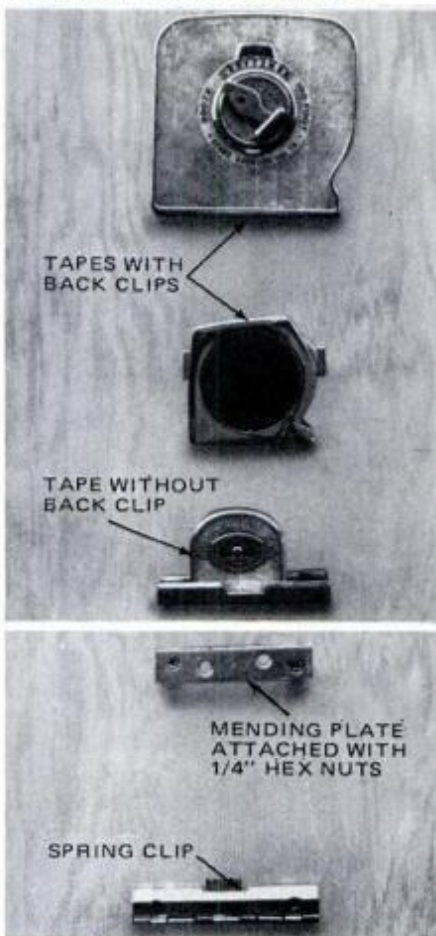
*Pretty sharp idea!*



**KEEPS AMERICA BUZZIN'**  
McCulloch Corporation  
Los Angeles, California 90009

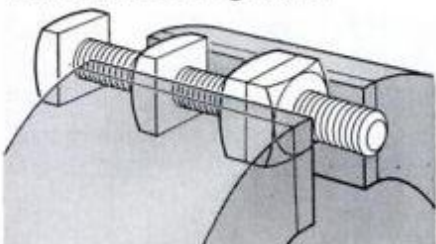
# HINTS FROM READERS

## Mounts for measuring tapes



Attach mending plates to a wall by  $\frac{1}{4}$ -in. hex nuts and washers as spacers to store steel tapes with back clips. To store tapes without clips invert and screw a spring clip from a clipboard to the wall; rest the tape in the clip jaws.  
—E.V. Reyner

## Make bolt cutting easier



Three nuts hold a bolt or threaded rod securely in a vise for sawing or filing. Place them on the bolt, one alone and the other two tightened together.—Bob Tom

## Camper's soap dish

Modify a plastic coffee can lid to make a soap dish for camping trips. Simply heat the tines of a fork and prick a number of drain holes in the lid.—Mary Roach

# The best pocket knife around is an open and shut Case.



A pocket knife can be almost part of you. So it should be the right style. And made to last a lifetime.

Case has been making knives that last a lifetime for better than 130 years. And we make them as tough and reliable today as we did years ago . . . putting more than 150 hand operations into each knife.

There are more than

100 Case pocket knives to choose from. With different numbers of blades, different blade styles and different handles. One of them is the knife you want to carry.

Ask about Case pocket knives at your hardware or specialty store. And ask about our lock-blade and hunting knives too. An open and shut Case is something to have in your pocket.



The world's finest cutlery

W. R. Case & Sons Cutlery Company  
Bradford, Pa. 16701

# Take the Wheel in Style!

There are a lot of new driver conveniences in the 1978 Pace Arrow. There's a new automotive styled dashboard. Dual swivel sunvisors. Even an optional driver's door. Add rugged steel cage Vacubond™ con-

struction to Pace Arrow's tradition of style and comfort and you have a new standard in vacation pleasure. See all this affordable luxury at your Pace Arrow Dealer. Soon.

For more information, write Dept. PM, Fleetwood Enterprises, Inc., Box 7638, Riverside, CA 92523



THE 1978

# PACE ARROW®

Protected by a Full One Year Ownercare Warranty.

BY FLEETWOOD



## BETTER ENGINE PERFORMANCE COMES IN BIG QUART CANS

RISLONE has been working for more than 40 years for two reasons. 1. It is an Engine Treatment designed to eliminate causes of many engine problems: varnish, gum and sludge. RISLONE promotes better oil circulation, lubrication, cooling and gas mileage by keeping internal engine parts clean and smooth functioning. And 2. The BIG QUART of RISLONE gives you twice as much product as in mini-cans.

Best yet, a RISLONE quart costs only a couple of dimes more than mini products, and replaces a quart of oil. That makes RISLONE a big bargain on your auto retailer's shelf. Get more for your money in volume, in quality, in performance!



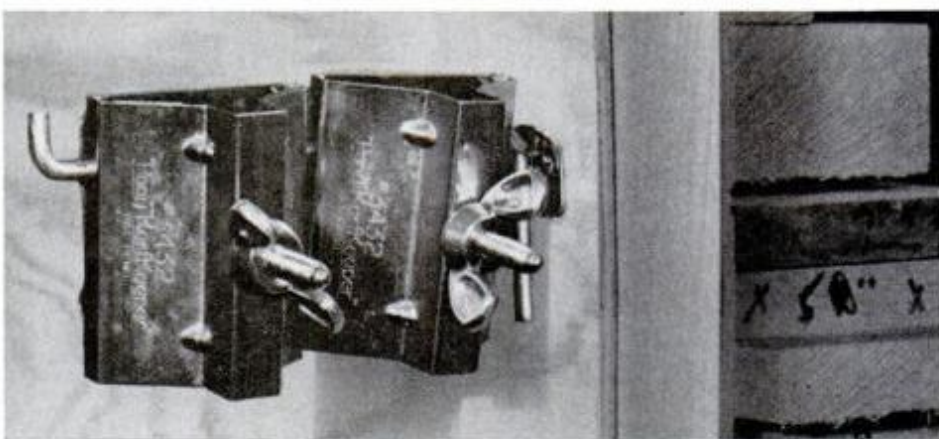
**FREE:** 32 page LUBE TIPS Booklet. Information, ideas and discussion about lubrication, problems and performance. Send self-addressed stamped envelope 4½x6½ or larger.

### THE SHALER CO.

Waupun, Wisconsin 53963

In Canada: Warren Packaging Co. Ltd. Scarborough, Ontario

## PM LOOKS AT STORAGE ORGANIZERS



Wall hanger is great for storing odd-shaped shop tools such as KerfKeepers.

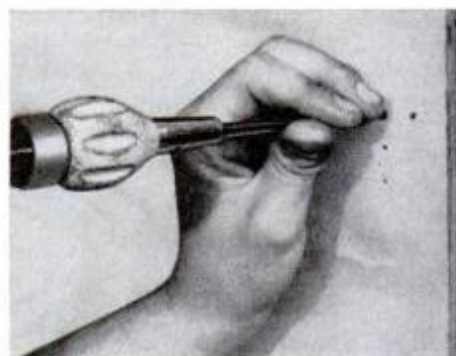
For years manufacturers have been flooding the market with all kinds of devices and hardware to simplify household storage. The result is that there is a large assortment for you to choose from. Some are quite good, while others are a waste of money.

The latest entry into the field is a product labeled Organizers, from Gerwin. Designed for use in garage, workshop, laundry and other busy areas of the home, these devices are practical and, happily, extra easy to install. The line is offered in two assortments; the

deluxe package contains eight storage hooks of a design that permits them to be swung aside when not in use. The second assortment consists of various plastic trays, tool holder and a small parts kit. What I particularly liked about the system is that it is usable on both Peg-Board and solid walls. For installation on the latter walls, screws are anchored in studs. Prices of the fixtures range from 99 cents to \$2.99 each. For nearest local Organizer dealer, write Ray Perry, Customer Service, Universal-Gerwin, Coopersville, Mich. 49404.—H.W.



To hang fixture, start by marking pilot holes for the wall mounting plate.



To create starter holes in soft plywood, tap awl with hammer; or use drill.

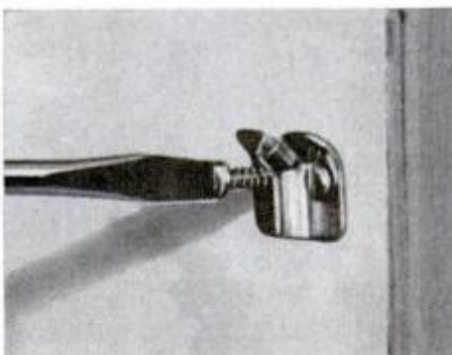
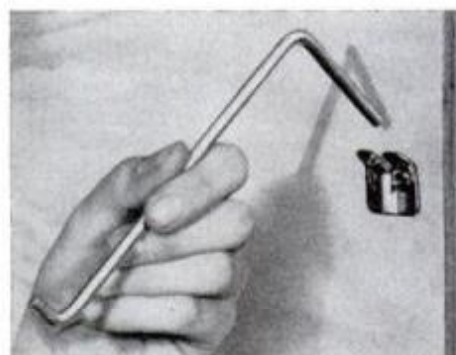


Plate is fastened with pair of sheet-metal screws for solid holding power.



Fixture is then slipped into bracket for use as in the photo at top of page.



# GROUP RATES EVERY TIME YOU TRAVEL.

The bigger your family, the more you need to take the Bus. The 1978 Volkswagen Bus. It's the one vehicle that lets you carry the most for the least.

In fact, the '78 VW Bus is 70% roomier inside than a full-sized domestic station wagon. With practically as much room as a van. So it can carry a family of seven in comfort. With enough room left over for your luggage, groceries, pets, or just about anything else your group wants to get away with.

Yet, with all the carrying space, the '78 VW Bus costs only a little

more to buy than the average station wagon and less than most big station wagons. And to run, it's ahead by miles. Because the '78 Bus' peppy, fuel-injected, two-liter engine is quieter and delivers an estimated 25 mpg on the highway, 17 in the city, according to 1978 EPA tests. (Of course, actual mileage may vary depending on how and where you drive, optional equipment such as automatic transmission, and the condition of your Bus.)

When it comes to versatility, nothing compares to the Bus. Its rear hatch and big sliding door

make it a snap to load. The rear seat folds down for even more cargo space. And the Bus' eight picture windows give everyone in your group a great view of the world. With all that space inside, the VW Bus is still small enough outside to be parkable in spots that regular station wagons have to pass up.

So if you want to take your group out in style, comfort and economy, remember, it's more fun to take the Bus. The 1978 Volkswagen Bus. It gives you group rates every time you travel.



©Volkswagen of America, Inc.



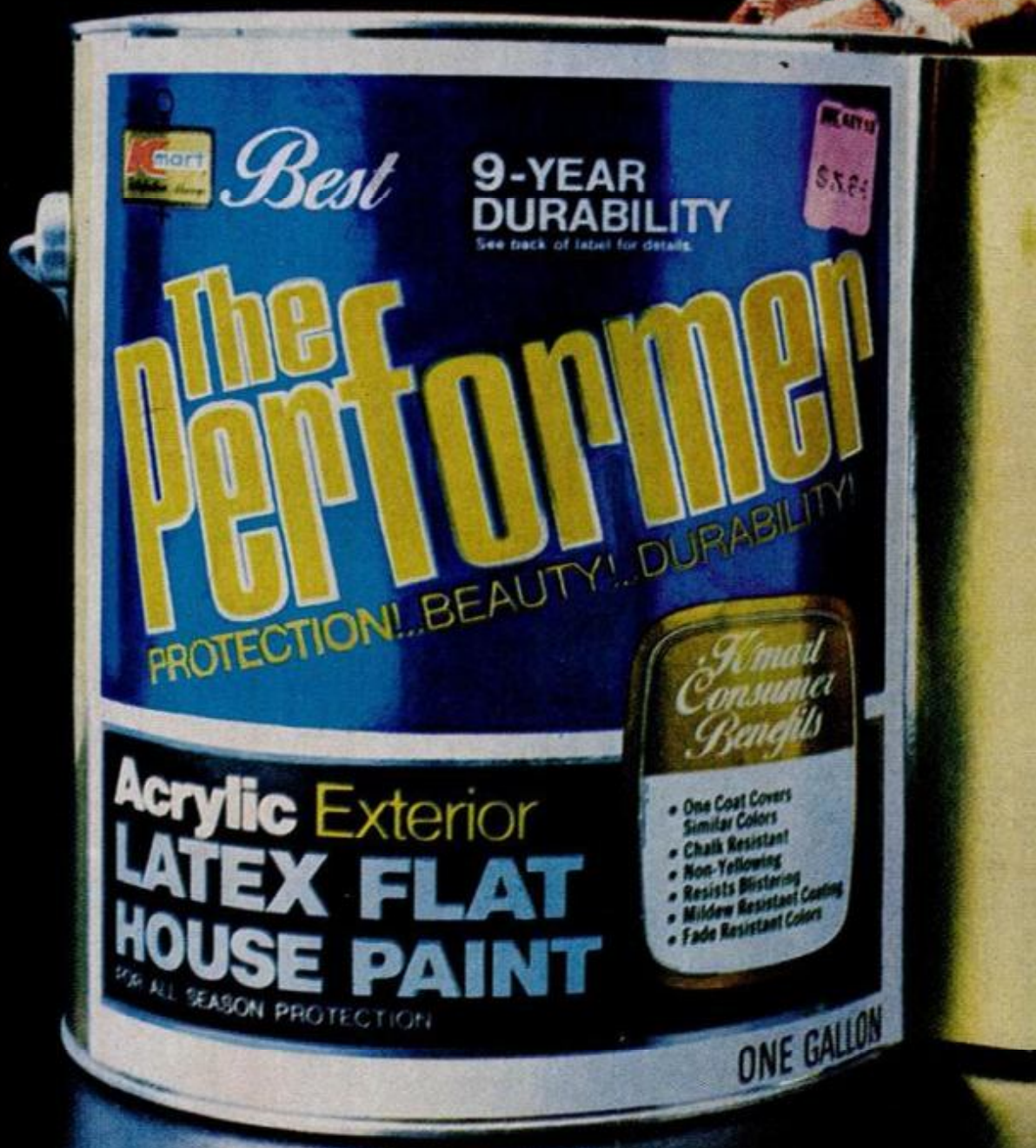
**IT'S MORE FUN TO TAKE THE BUS.**

# COMPARE THE PERFORMER LABEL. THEN COMPARE THE PRICE.

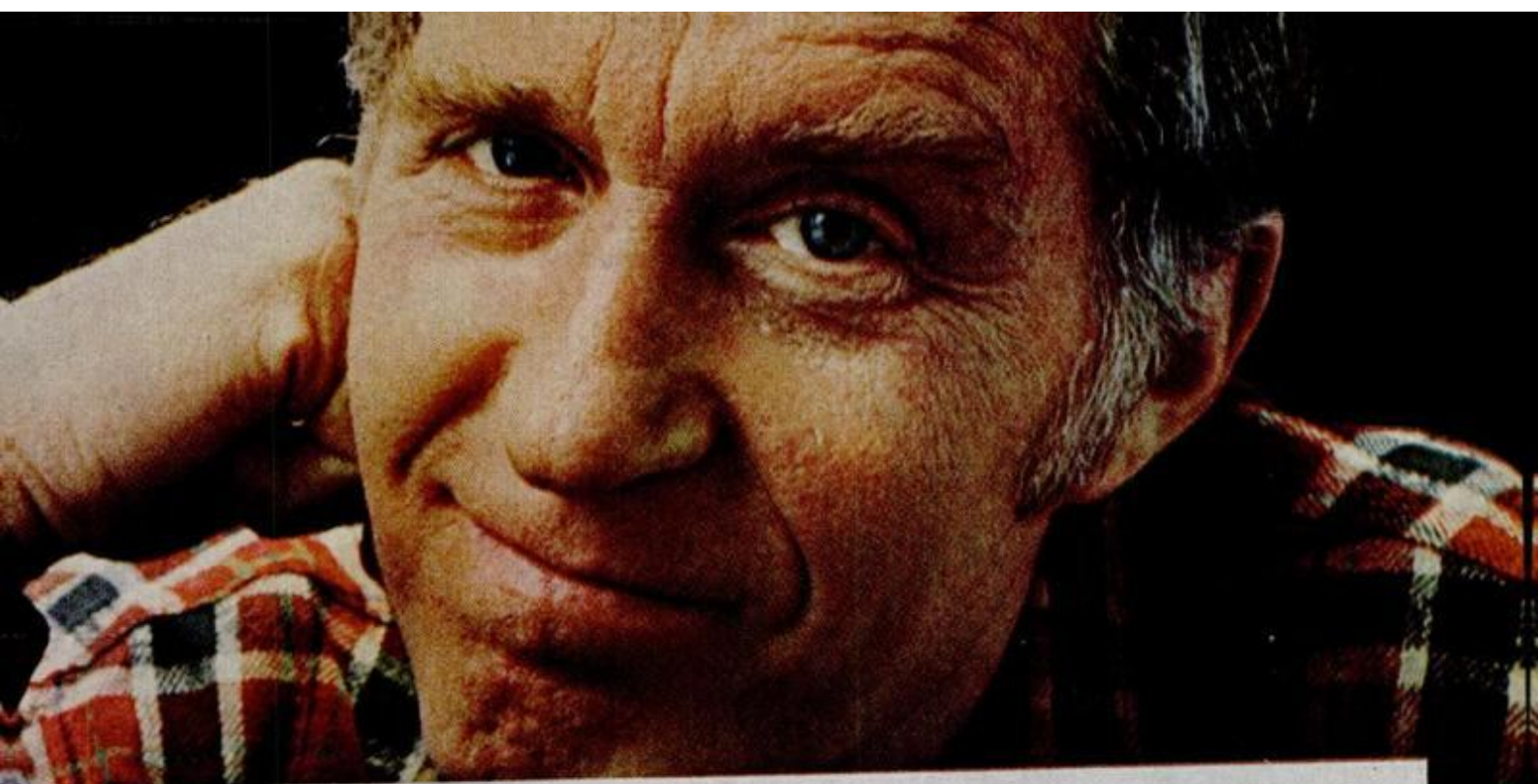
Our exterior paint has a label worth comparing. Because K mart's Performer offers a durability promise. It covers washing, fading, blistering, yellowing, mildew and more. The Performer goes on so easily and gives you a tough, latex finish in over 50 imag-

inative colors to complement any home.

And K mart's Performer carries a K mart price. Next time, make your exterior paint our exterior paint. The Performer. A durable paint at a K mart price. Available at over 1,200 K mart stores across the U.S.A.



**A premium paint at a K mart price.**



*Satisfaction Always*

### LIMITED WARRANTY

This K mart Latex Flat House Paint when applied according to label instructions will cover similar colors in one coat when applied at 400 sq. ft. per gallon (except rough or textured surfaces.)

This K mart Latex Flat House Paint when applied two coats according to label instructions will have the following qualities for the years stated:

- **Durability** — the product will perform as stated below and be in a suitable condition for repainting — **9 years.**
- **Chalk Resistant** — will not chalk stain trim, brick or other surfaces below — **9 years.**
- **Non-Yellowing** — will not turn yellow with age — **9 years.**
- **Resists Blistering** — will not peel from properly prepared surfaces — **9 years.**
- **Washable** — normal dirt deposits can be removed if washing instructions are followed — **7 years.**
- **Fade Resistant** — will not noticeably fade — **5 years.**
- **Mildew Resistant Coating** — paint film is protected from mildew growth for **3 years.**

When applied according to directions, if paint fails to perform as specified above, K mart's obligation shall be limited solely to refund of the purchase price.

The tough PERFORMER delivers a durable latex finish in fade-resistant colors . . . designed for the outdoor life.

*For maximum beauty and durability . . . just follow these simple steps . . .*

**WHERE TO APPLY:** Wood, metal, masonry — both new and previously finished.

**COVERAGE:** Covers similar colors in one coat. Apply at approximate rate of 400 sq. ft. per gallon. Use quality tools such as GOLD LINE Rollers and K mart brushes.

**HOW TO PREPARE FINISHED SURFACES • Wood and Metal** — Correct and repair. Remove loose paint. Wash off dirt, dust, excessive chalk. Scrub overhangs, eaves with household cleaner in water to help prevent "tissue peeling." Rinse thoroughly, let dry. Lightly sand glossy surfaces.

**HOW TO PREPARE UNFINISHED SURFACES • Bare Wood and Metal** — prime with appropriate primer. On new construction, prime bare wood immediately. Before using caulk or putty, spot prime open nail holes, cracked seams. Paint directly on clean, bare galvanized metal.

**HOW TO PREPARE MASONRY AND ASBESTOS SIDING:** Surfaces must be cured, clean, firm and poured concrete weathered several years or sandblasted. Treat porous and sandblasted surfaces with appropriate surface conditioner. Remove loose paint, chalk. Remove thick layers of flaking paint with power wire brushing or sandblasting. Patch holes, cracks; caulk seams, joints. Treat repaired and porous masonry with surface conditioner. Previously painted surfaces in good repair do not require conditioner. Paint directly firm, clean, nonchalky surfaces. Surfaces should be dry or damp (not wet) before applying finish.

**HOW TO PAINT EFFECTIVELY:** Stir paint well. Apply with quality painting tools such as GOLD LINE Roller or K mart nylon or polyester brush. Do not thin paint, except for spray application. When spraying, thin sparingly with water. **DO NOT APPLY AT TEMPERATURES BELOW 50°F. THE PERFORMER DRIES BEST AT 65°F. OR HIGHER.** Two coats are recommended over new surfaces. When re-coating, allow at least two hours drying.

**HOW TO CLEAN-UP:** Clean up hands and equipment with soap and water.

3/76

HOW TO PREPARE YOUR HOME FOR



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Action shots!  
Shade shots!



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cameras

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Action shots!



Shade shots!



## New Kodak Ektra 2 cameras.

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# WORKSHOP MINICOURSE

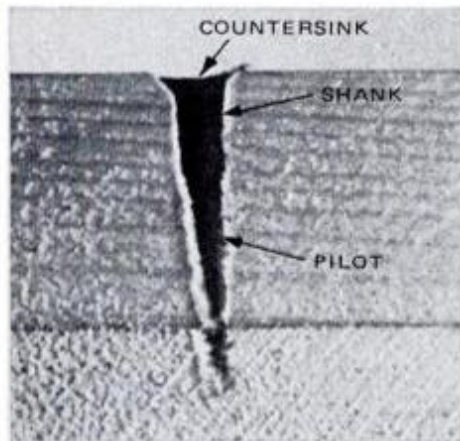
## SCREWDRIVER BASICS

Since it is used as frequently as—if not *more* often than—any other hand tool, the ordinary screwdriver probably takes more abuse than all the others. Common abuses include use of the wrong-size driver to turn a screw home, and prying with it as when opening a paint can. And fledgling woodworkers have been known to use the tool in place of a cold



Typical screwdrivers you should have in your toolbox: from left, driver with 6-in. shank for most tasks; cabinet screwdriver with thin shank for use in deep, counterbored holes; driver for Phillips screws; short, stubby screwdriver for hard-to-work-in spots.

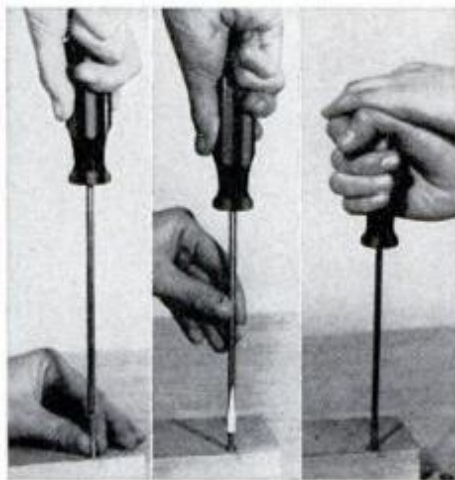
chisel. The most common misuse of the screwdriver, though, is mismatching the screwdriver to the job. If you use too small a screwdriver in a large screw's slot, you stand a good chance of damaging



Clearance hole (for shank) is a must when fastening two pieces of wood.

the driver's blade. And you are likely to mar the wood surrounding the screwhead if the blade is too large for the screw. You might also snap off the screwhead.

Always pick the driver to match the screw. If you lack a Phillips screwdriver when one is needed, don't try to drive the screw with a narrow conventional driver: Be-

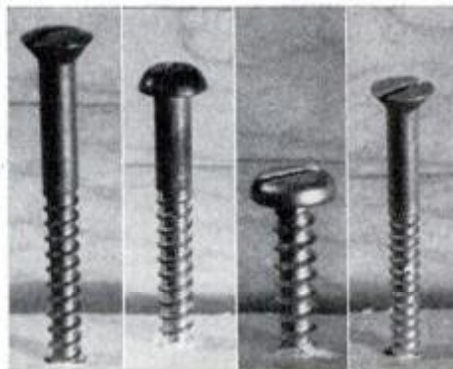


The right way to drive a screw: left, insert tip of screw into pilot hole, and the screwdriver tip in screw's slot. Hold the screw perpendicular with one hand, use the other hand to make certain screwdriver is in same axis as the screw. Center, use one hand to keep blade steady while the other turns the screwdriver handle. Finally, use both hands as shown to get good power for seating the screw securely.

sides burring the screwhead you will damage the driver tip. Using the wrong type screwdriver will almost always cause screwhead damage. And that can mean sheer frustration later when you have to remove that damaged screw.

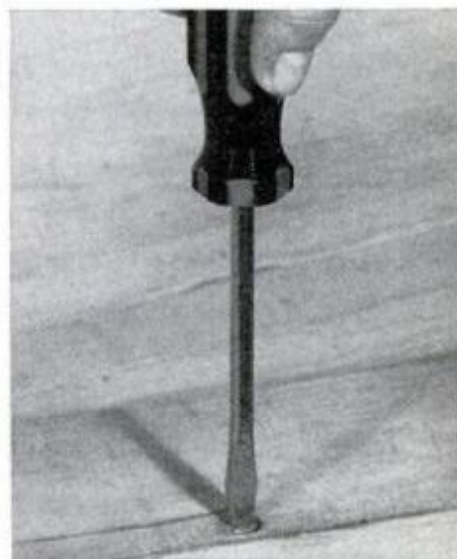
The average home-repair toolbox should contain the four screwdrivers shown. With this assortment you can handle most household tasks. A good fifth screwdriver to have on hand is one that has a length of squared shank beneath its handle. This portion of the shank can be gripped with a wrench when you have to back out a stubborn screw.

Get into the habit of making a pilot hole before driving *any*



Most commonly-used screwheads, left to right—oval, round, pan, flat.

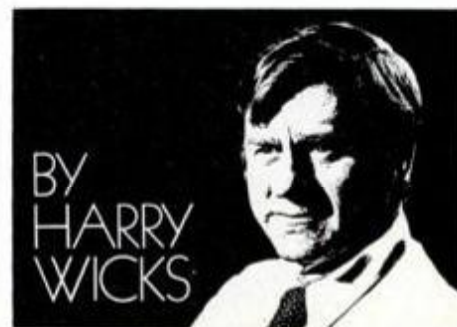
screw; this is a must, not a matter of preference. When working with small screws and softwoods, the pilot hole can be made with an awl or ice pick. In hardwoods, and when the screw location is near the end of the board, always use a drill regardless of wood type. The bit should be sized so that the



Screwdriver blade should be sized to screw. If it's too big the workpiece will be chewed; too small both screw and the driver take a beating.

screw's thread will bite into wood. For example, if you hold the screw and bit lined up with the bit between your eye and the screw, only the screw's threads, some shank, and head should show.

But when you are joining two pieces of material together, you must also drill a clearance hole for the shank. Here a hole equal in diameter to the body shank is bored in the *leading* (top) piece of wood. As the screw is turned home its head will draw the leading piece to the second piece of wood. To aid driving screws apply either wax or soap to the threads.



BY  
HARRY  
WICKS

# The Trailer People's Trailer.

The tradition of Terry craftsmanship and beauty goes back more than thirty years. And this year, that tradition continues. There are gorgeous new interiors—including V-grooved wainscote paneling and handsome wooden valances.

There's also a new, spacious one-piece, rolled-edge countertop in the galley. See all the new Terry features—at your Terry Dealer. And check out the brand new Terry 32' luxury 5th wheel model!

For more information, write Dept. PM, Fleetwood Enterprises, Inc., Box 7638, Riverside, CA 92523 



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*Auto Editor, Popular Mechanics*

**The Auto Editor** of *Popular Mechanics Magazine* evaluated the BikeBug as an alternative to mopeds... and his choice was the BikeBug! His two-page Product Report, (Dec. '77), was based solely on quality, design and performance. Price was never a consideration, even though mopeds cost hundreds of dollars more (Complete reprints with our free brochures).

**The BikeBug engine** and front-wheel-drive unit bolts in minutes to the front fork of any bike, from 10-speeders to adult tricycles. It runs up to 24 mph, gets 215 mpg, operates quietly, starts automatically, has a One-Year Warranty, and allows normal pedaling, even with the engine running.

**For superior all-round performance, regardless of price, it's the BikeBug.** And *Popular Mechanics* agrees.



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(N.Y. Residents add tax)  Check  Cashier's Check  Money Order

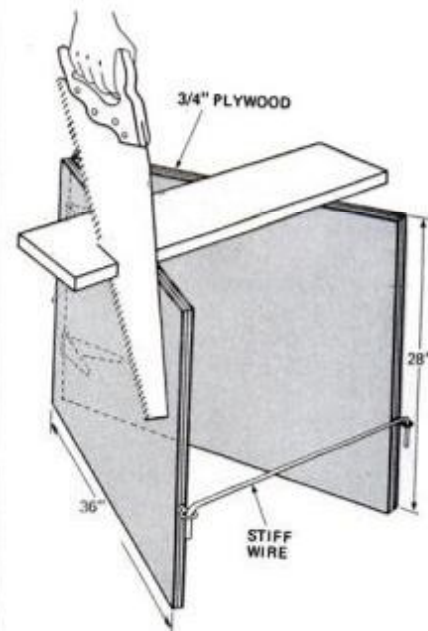
## HINTS FROM READERS

### Instant thumbscrew



Make a thumbscrew from a slotted-head bolt, washer and quick-setting glue. Squeeze glue into slot and insert the washer. File or cut the washer edge flat so it sits securely.—*Walter E. Burton*

### Versatile sawhorse



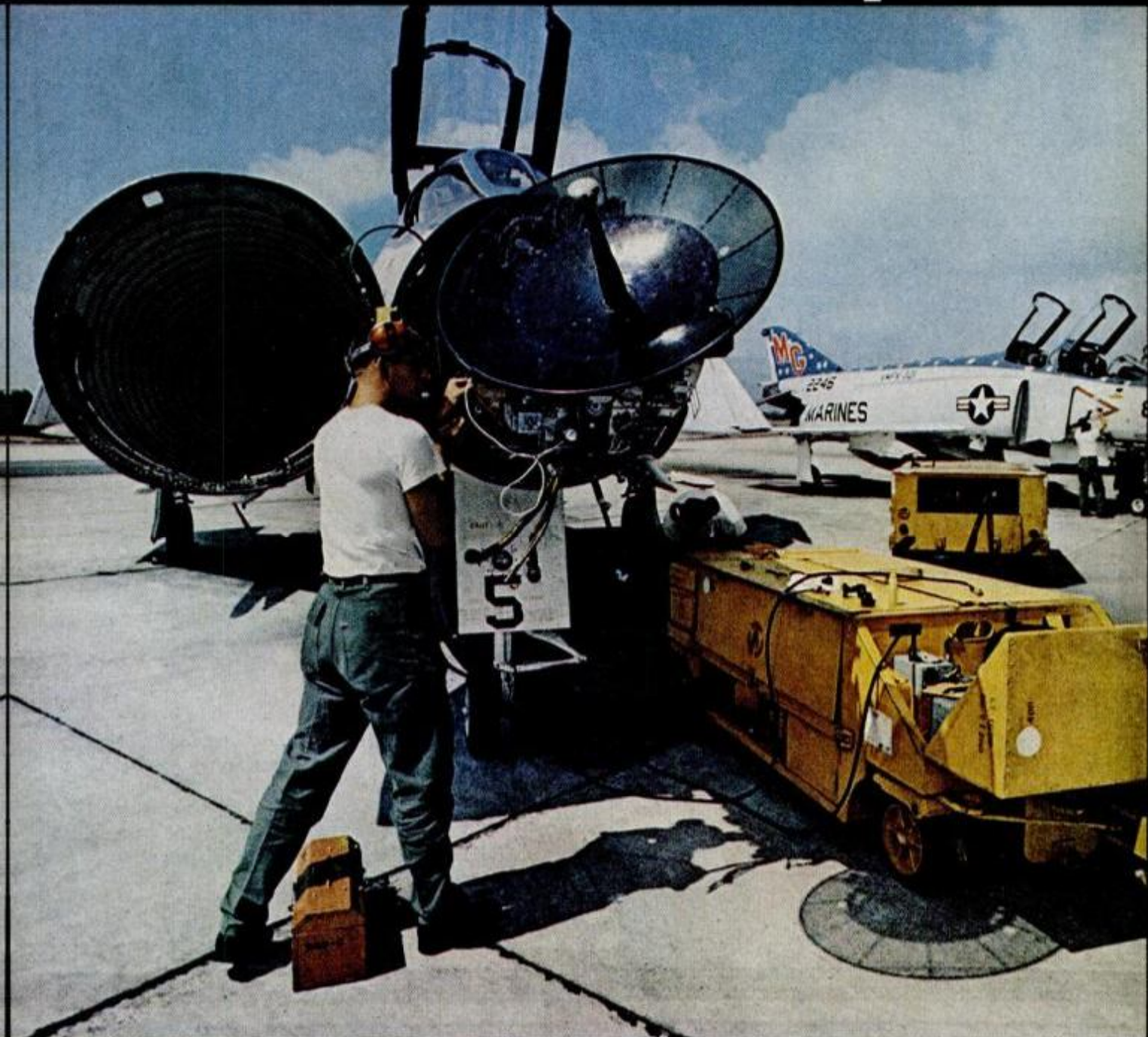
Make a folding sawhorse by hinging two pieces of plywood. Add a screw eye to each unhinged end and rig a stiff wire support so the pieces are 45° apart.—*Bob Tom*

### Bracket for small-parts jars



The 90° brackets in a child's construction set make ideal hangers for small-parts jars. Bolt brackets to lid centers and hang jars from "L" hooks.—*Ken Patterson*

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Respect. It's been part of the Marines for over 200 years. It comes from a job well done. And whether that job is leading a squad of 12 Marines, or mastering a complex radar system, we'll make sure you get the skills to do it best. If respect is part of your job requirements, mail the card. Or call 800-423-2600, toll free. In California, 800-252-0241.

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# CAR CLINIC

SOLUTIONS  
FOR MECHANICAL  
HEADACHES

BY  
MORT SCHULTZ



## Penguin-toed Skyhawk

*My aggravating problem concerns a 1975 Buick Skyhawk that for almost three years has been wearing tires prematurely. The dealer has given me the runaround, and the condition has cost me over \$500 for tires and one alignment after another.*

*Now, an independent mechanic tells me that special parts from the Moog Co., which include offset lower control arm bushings, will clear up the trouble. He tells me it isn't possible to effectively adjust positive camber to compensate for the car's I-beam, which bends out and tips the tires to cause rapid wear. This mechanic says Buick is aware of the problem, but no one I've contacted at the dealership or in Detroit will acknowledge that it exists. How can the problem not exist when a company such as Moog manufactures parts to remedy the problem?—Eugene C. Okin, Hartsdale, N.Y.*

The problem exists! But whether your dealer knew how to correct the trouble according to Buick's prescribed procedure is another matter. A Buick official says that the trouble is not because of camber, but because of toe-in.

Assuming there's no damage to the front end, he says that the solution lies with disregarding written front-end alignment specifications. Set toe-in *exactly* at 0 inch—not  $\frac{1}{8}$  inch or even  $\frac{1}{16}$  inch from 0 as the service manual says. Then, inflate front tires (cold) to two pounds more than the specification in your owner's manual.

## High roller

*My 1973 Ford F-100 pickup has had a very bad vibration between 45 and 60 mph from the first day of purchase. The dealer changed the driveshaft, balanced wheels, adjusted this and that, and changed the tires before he told me to get lost. Is there anything you can advise that may help?—Wallace Wiele, Washington, Mo.*

Back in 1974, Ford issued a super service bulletin that deals exclusively with light-truck vibration. The bulletin's number is 38A (2/22/74). Any shop attempting to solve a vibration problem without abiding by the diagnosis procedures outlined in this bulletin is shooting craps. My advice is to bring this bulletin to the attention of your dealer's service department.

## Sealed with a kiss

*The four-cylinder engine in my 1973 Pontiac Astre is really starting to leak oil from around the aluminum head. When I first bought the car, I had to add a quart every week. I changed the gasket, but this hasn't helped. The oil is definitely leaking from the head. Ideas, please.—Leo Scalia, Montreal, Que.*

Here's one. Buy a tube of rubber silicone sealer made by Dow, GE or 3M. You can try to seal the area without removing the head by cleaning the surface and laying a bead around the joint. However, it would probably be better to take off the head, clean surfaces, apply

the sealer to both sides of the gasket, and install the gasket and head. The sealer is used to fill voids through which oil might leak.

## Comforting thought

*Here's an idea that may literally save do-it-yourself readers of Car Clinic a pain in the neck. In this auto shop, we found that lying on a creeper under a car for an extended period almost always results in a stiff neck. We removed those low profile head rests and replaced them with tufted car seat head restraints, which we obtained in auto salvage yards.—Ed Mayover, Sarasota, Fla.*

Good idea. Thanks, Ed.

## Blowing ballast

*I have a 1973 Dodge pickup truck with an electronic ignition system (225-cu.-in. engine). In the five years I've owned this vehicle, I have replaced the electronic control unit four times. Can you tell me what the Dodge dealer can't—that is, why these units fail? He says the problem is "unusual," which hardly helps.—Larry Hynael, White Castle, La.*

One good reason for damage to an electronic control unit is a bad ballast resistor. The ballast resistor has a dual role. During low speed operation, current is maintained on one side of the resistor for a period of time. This allows the resistor to heat up, which increases resistance. This increased resistance reduces voltage in the ignition primary circuit, protecting the ignition coil from high voltage.

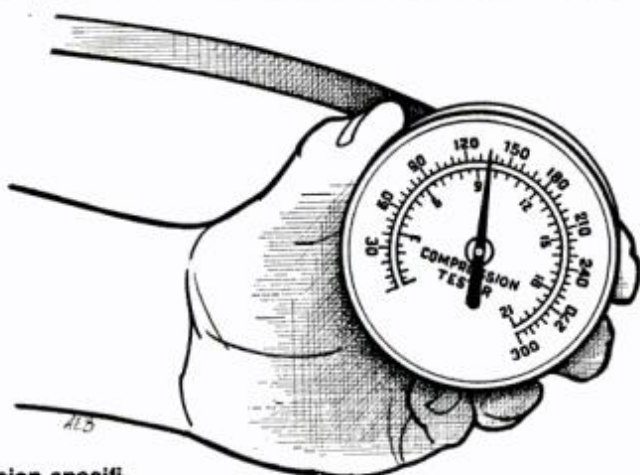
The other job performed by the

*(Please turn to page 50)*



## Understanding compression

There may be more to interpreting compression than simply comparing compression gauge readings with the manufacturer's minimum compression specifications. Many engine manufacturers state in specification charts that compression pressure of the lowest-reading cylinder should be more than 75 percent of the highest reading cylinder. For example, if the reading of cylinder showing the highest compression is 135 p.s.i., then reading of cylinder showing the lowest compression should not be below 101 p.s.i. Failure of an engine to meet this standard denotes a serious internal defect.





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Whether you're after a championship or not, you can always depend on Pennzoil quality. Quality that is found in the whole family of Pennzoil products. For your car, truck, boat, plane, motorcycle. In fact, Pennzoil makes a lubricant for almost every kind of engine.

So remember Pennzoil, the ask-for motor oil.  
For quality performance.



## CAR CLINIC

(Continued from page 48)

ballast resistor is to limit voltage to the electronic control unit during engine starting. This is a protective function. It isn't often that the ballast resistor is too weak to do this. But if the resistor isn't performing this function as it should, the electronic control unit will fail.

Replace the ballast resistor. It may solve your problem.

### Full of fish

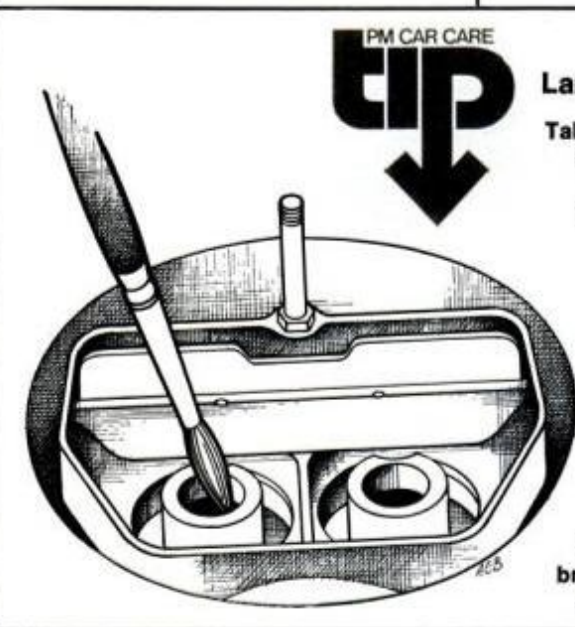
I'll bet you'll get more than one letter taking issue with you for calling sidewall cracking of radial tires a "flake" (Car Clinic, page 30, Jan. '78). When I bought my '76 Oldsmobile Omega, I shot \$162 extra for a set of Uniroyal F78x14 raised-letter steel-belted radials. Since 18,500 miles, the tires have been cracked so badly on the sidewalls it's downright frightening. The Olds dealer referred the problem to Uniroyal, which "generously" offered to give me a new set of the same tires for only \$100 more. Some fluke.—Dale Howay, Battle Creek, Mich.

Some fluke is right, Dale. I did get more than one letter taking me

to task for that dumb crack. More than one? Dozens! Some readers told of blowouts they experienced with tires that had sidewall cracking. Complaints weren't confined to Uniroyal but also included Goodyear, Bridgestone and Sears. Now that *Car Clinic* readers are forewarned, thanks to people like you, they should be forearmed.

Explanation for the cracking? Here's what Goodyear says:

"In most cases, cracking in the sidewall rubber is caused by an ozone condition. Ozone is a form of oxygen produced by electricity. Every effort is made to prevent this from happening; however, it sometimes occurs and in varying degrees in different sections of the country. The sidewall rubber on a tire is actually a protective covering for the carcass and all of the strength of the tire is in the fabric.



### Language lesson

Take note, those who think "venturi" is an Italian word for airconditioning. A venturi is the constricted, throatlike passage in a carburetor that increases the velocity of the air passing through it. When the venturi walls get coated, the result is passage of a richer-than-normal fuel mixture to the engine. This coating is a result of dirt particles that cling to oxidized gasoline vapors. What do you do about it? Remove the air cleaner. Look straight down into the venturi's throat. It should be shiny. If it isn't, swab the throat thoroughly with a small brush that you have dipped in some lacquer thinner. That should do it.



# CRUEX<sup>®</sup> RELIEVES JOCK ITCH

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Itching? Chafing? Rash? Get fast relief with Cruex, the leading Jock Itch product in America. Cruex soothes. Relieves. And it's medicated to fight the causes of Jock Itch. Use Cruex aerosol or squeeze powder for easiest application, or new formula Cruex cream for more concentrated medication. Get Cruex. There's nothing like it for Jock Itch.

# With Elmer's Carpenter's Wood Glue you don't need a pro's hands to give it the pro's touch.



Elmer's® Carpenter's Wood Glue is a special wood glue for all your woodworking projects. It penetrates well in hard and soft woods and forms a heat and water resistant bond that's stronger than the wood itself.

It's also better because it "grabs" immediately and dries fast. Yet it allows realignment before it sets. So you can join surfaces as soon as it's applied.

Elmer's Carpenter's Wood Glue is also sandable, paintable and gumming resistant. Its non-toxic\*, solvent-free formula also washes off your hands and project with water. So you won't get light spots when you stain near glue joints.



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\*As defined by Federal Hazardous Substances Act.

Superficial cracking in the sidewall will not detract from the overall strength of the tire."

## Public pubs

*I am interested in owning a copy of a workshop manual for the 1977 Mitsubishi Celeste, known in the United States as Plymouth Arrow. I wish to inquire if you know of any publisher who has produced such a manual.—Elias V. Guerrero, Pasay City, Philippines.*

Chrysler Corp. has a liberal policy concerning the distribution of publications to the public. You can order the manual for the Celeste (Arrow) from PDM Services, Chrysler, Box 02807, Detroit, Mich. 48202. It costs \$10.

Other publications that are available are shop manuals for domestic passenger cars from 1963 to 1978; shop manuals for import passenger cars (Arrow, Colt, '78 Challenger and Sapporo, Cricket) from 1971 to 1978; shop manuals for light-, medium- and heavy-duty trucks from 1965 to 1978; shop manuals for Sportsman vans and sport utility vehicles from 1964 to 1978; shop manuals for motor homes and mini motor homes from 1970 to 1978; owner's manuals for all vehicles

except the 1966 Chrysler, 1971 Colt and 1972-73 Sportsman; and technical service bulletins book form) for 1975, 1976 and 1977 models.

Allow 30 to 45 days for delivery.

## Star lore

*I can't budge the rear brake drums on my 1974 Pontiac Firebird, so I can inspect the linings. I've pried, tapped, pulled, applied heat, cussed and prayed. What now?—J. B. Burford, Laurel, Md.*

Try backing off the brake shoe adjustment. The linings may be binding the drums in place.

You gain access to the adjusting screw star wheel by knocking out the lanced area or removing the hole plug in the backing plate. Hook the actuator lever with a piece of wire and pull it off the star wheel. Now, engage the teeth of the star wheel with a screwdriver and rotate the wheel upward. This will back off the brake shoes and free the drum.

## 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.

## SERVICE TIPS

■ The Consumer Product Safety Commission has banned patching compounds that contain "respirable free-form asbestos," which is considered a highly carcinogenic substance. According to the Automotive Parts and Accessories Assn., the ban does not "at this time extend to automotive patching compounds containing asbestos," so they are still on the market.

■ This applies to the fuse panels of Ford, LTD II, Thunderbird, Mercury and Cougar with airconditioners manufactured before October 1977. The location of the airconditioner clutch circuit is marked as being connected to the back-up/turn signal fuse when, in fact, the air conditioner clutch circuit is connected to the windshield wiper fuse. This means that if the compressor clutch doesn't work, you should replace the windshield washer fuse. Picture the poor guy who tries to track down the cause of the problem without knowing this.

■ Here's the latest information on Chrysler's battle of the pump. As the company puts it, "to improve vehicle driveability and vehicle reliability" that suffer when the accelerator pump cup swells, a new pump cup and retainer have been issued. This one applies to 1975 through 1977 models equipped with Carter Thermo-Quad carburetors. The package has part No. 4094867. **PM**

# IMPORTS & MOTORSPORTS

## Mirage from Mitsubishi

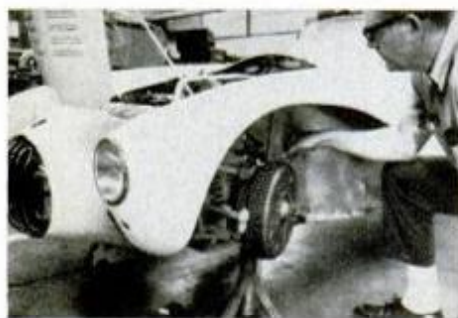
Hot on the heels of its Challenger and Sapporo, Mitsubishi Motors has another new car for Chrysler. The Mirage, Mitsubishi's first front-wheel-drive car, has just made its debut in Japan and is shown here in its top-of-the-line form: the 1400 GLX. We haven't seen this mini yet, much less driven it, but if it's as nicely put together as are the Dodge Challenger and Plymouth Sapporo, the Mirage'll make its mark here. It, too, will be powered by engines with the slick MCA-Jet System (page 104, Oct. '77 PM). In Japan, transversely placed, 1200 and 1400-cc versions power the Mirage. Here, the 1600-cc, jet valve, Silent Shaft Four will certainly be used.

Another feature of the Mirage is a manually engaged overdrive on third and fourth gears. This setup, named Super Shift, will be like having six forward speeds. Other mechanicals include front disc brakes, radial tires, rack-and-pinion steering and four-wheel independent suspension. The car is on a wheelbase of 90.5 inches, overall length is 149.2 inches, width is 62.4 inches and weight about 1700 pounds.

Look for the Mirage to arrive here this fall as a '79 model in the Colt lineup. It should be priced to compete with the king in this class, the Honda Civic.

## Pickling with relish

One thing you have to learn to become a full-fledged car nut is how to pickle an engine. You must know how to lay up your cars properly for those months or years you'll be overhauling or restoring. The



Osca sports racer, vintage 1954, gets a brake overhaul from Richard Ford of the Briggs Cunningham Auto Museum.



Fwd Mirage will be captive import in Dodge Colt line and some day may be built in a U.S. assembly plant.

same is true for auto museums.

The Briggs Cunningham Auto Museum in Costa Mesa, Calif., has its own preservation techniques, one of which is especially intriguing. All cars in its collection are getting brake overhauls that involve replacement of conventional polyglycol brake fluid with Dow Corning silicone fluid. If you've worked with conventional fluid, you know what a great paint remover it is—so you can't be sloppy! Silicone fluid won't remove paint or absorb moisture.

Accumulated moisture in brake systems often causes galvanic and electrolytic corrosion of wheel and master cylinders. When that happens to parts on one-of-a-kind cars, you can't buy replacements. So it's a good tip for longer car life.

## 1978 Alfa Romeo



### Spider Veloce in FI Brabham-Alfa paint.

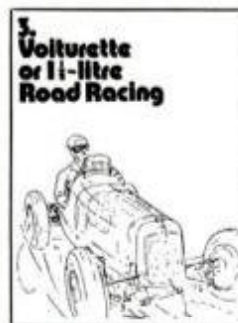
This year Niki Lauda is on the Grand Prix circuit with Alfa power in defense of his World Driving Championship, having switched from Ferrari. So it was to be expected that Alfa Romeo would celebrate the fact. They have transferred the color scheme on Lauda's Brabham-Alfa Formula 1 car to their '78 Spider Veloce and added some racy hardware to make a "Niki Spider."

The more recent additions to the Alfa line are the Sport Sedan and Sprint Veloce, introduced as Alfetta models in 1975 (page 92, Nov.

'75 PM). They've been refined since then with the sedan receiving the most attention for '78. All share the sweet, fuel-injected, dohc, aluminum, two-liter Four with five-speed gearbox. Prices (East Coast), start at \$8000. I like Alfa's ad slogan: "For people who consider driving an art."

## Motorsports in the Thirties

I had no idea when I was a wee lad that John Dugdale, the reserved and most gentlemanly publicity manager for British Leyland, was scooting around England and the Continent in all manner of racing cars and rubbing elbows with the



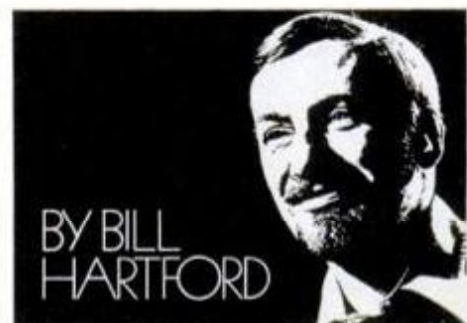
3. Voiturette or 1.1-litre Road Racing

Dugdale's sketch for Chapter 3.

speed heroes of the day—until I read his fascinating book, *Great Motor Sport of the Thirties — A Personal Account*. We all wonder what the world was like at the time of our birth, and this volume has filled me in on racing in Europe at the time of mine. The chapters are arranged by forms of the sport: rallies, sports car racing, voiturette, track, Grands Prix and speed records. Two Continents Publishing, 30 East 42nd St., New York, N.Y. 10017; \$13.95.

## Safe driving incentive

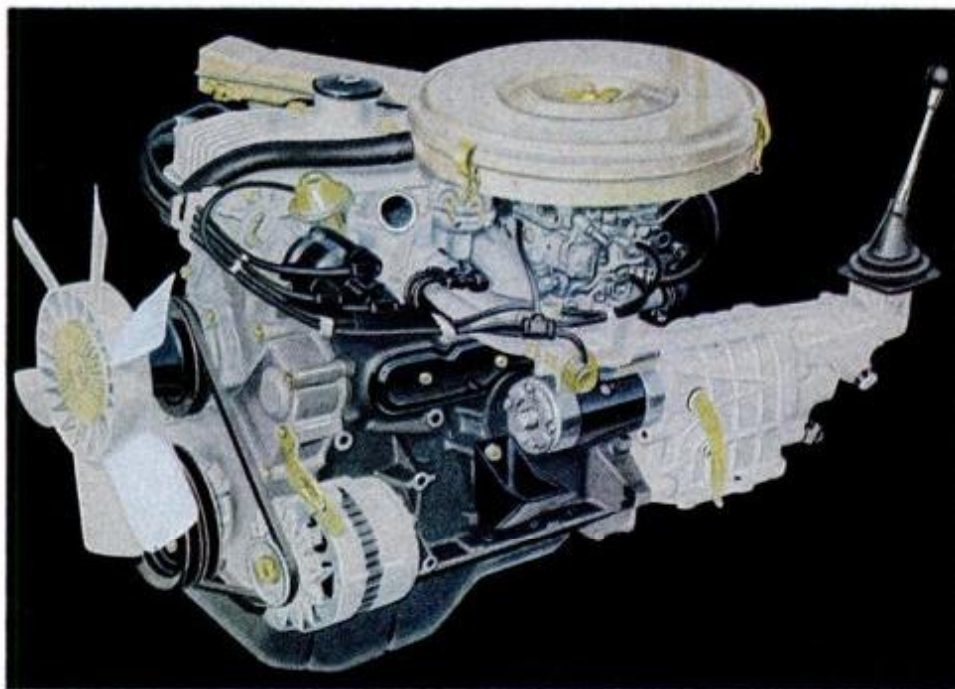
Have you had to renew your driving license recently? Many state motor vehicle bureaus are sending out little cards with license renewal forms. One look at the card and you'll buckle up and drive with the utmost concentration. These little cards, which you can elect to sign and send back, could be more effective than any safe-driving campaign in getting folks to shape up and drive right. What is it? An organ-donor card. **PM**



BY BILL HARTFORD



# Introducing our two-barrel, four-cylinder, twelve-valve, smooth-running, low-emissions wonder.



If you're really into cars and driving, you should know more about our amazing new MCA-Jet System with Silent Shaft. We think it's one of the most significant engine developments to come down the pike since the first American high-compression V8.

First off, it offers all the advantages of a four-cylinder engine... but without the vibration usually associated with the proverbial "four-banger." Its unique Silent Shaft design (available only with the five-speed manual and automatic transmissions) is the reason. Two counterbalancing shafts rotate in opposite directions to cancel out the noticeable power pulses inherent in normal four-cylinder designs.

Now comes the MCA-Jet

part of our system. MCA stands for Mitsubishi Clean Air. The MCA-Jet System meets... even exceeds... the stringent emissions requirements now in effect in both Japan and America. Without loss in performance, too. A revolutionary new cylinder-head design that incorporates a third, or "jet," valve does the job. This valve introduces an extra swirl of air into the combustion chamber

which swirls the fuel-air mixture and promotes a faster, more even, thorough burning of the mixture at ignition.

The MCA-Jet System. It's a simple, yet highly sophisticated, answer to a very complex problem. The kind of answer you would expect from people who care about cars and driving as much as you do.

A cutaway of our amazing little engine.



Induction and compression phase.



Ignition and combustion phase.

## MCA-JET SYSTEM.

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**MITSUBISHI**  
MOTORS CORPORATION

# Horse and buggy buffs



Front wagon of trek is a scale reproduction hauled by a matched Shetland team.



Two participants drive through obstacle course before gymkhana in "show buggy."

Now it's something known as "buggy nuttery." In certain parts of the country, largely west of the Mississippi, the new art form is the "sporty" way to take a weekend drive if you're fed up with sports car rallies, and prefer hay-fueled to fossil-fueled transportation.

Purist buggy buffs usually acquire their hardware from the cobwebby recesses of family barn lofts, or at antique auctions if there are no barns in the family. Less fussy folk may settle for a good reproduction. Some do-it-yourself *Popular Mechanics* types have even designed and built duplicates of classic wagons and carriages in order to join the week-end trekkers on their "drives" into the past.

Enthusiasts usually rally at the ranch or farm of a fellow buff, where they stage a gymkhana competition in buggy-handling on an obstacle course they set up, and wind up with a cross-country outing.

A typical Sunday "buggy drive" was held recently on the Scottsdale, Ariz., ranch of Bud Brown, an expatriate from New York State who took to the open-sky-horse-country after graduation from Dartmouth.

Two years ago, to mark the U.S. Bicentennial year, he and his wife drove their covered wagon behind a mule team all the way from Yuma, Ariz., to historic Valley Forge, Pa., on an "Eastward Ho!" trek. Bud, by the way, is 73. His wife, Brownie, is 70.

The Brown buggy rally began as buffs arrived, unloaded wagons from their carry-all trucks, backed horses from van trailers, harnessed and hitched up, and showed off their rigs on warm-ups through the sage brush. The wagon master gave the "Wagons ho!" and participants lined up for a go at the obstacle course, set up on the "back forty."



A "burro buggy" takes the obstacle course (top), with junior riding next to "dad." Rallyers help unload a 1/2-scale Clydesdale wagon from its gas-buggy transport.



View from driver's seat behind buckboard in a "buggy with the fringe on top."

Rallyers took turns walking and trotting their rigs through the course, backing and filling into narrow "stalls," weaving through tight spots around the desert cacti and the like.

Some people might say that such genteel competition lacks the white-knuckle thrills of the up-to-date counterpart, in which brute-powered all-terrain gas-buggies vie for the honors. But just try to tell that to a horse-and-buggy buff. He might point out that his hay-burners don't tear up the landscape the way some machines do. More-



Four passengers in "light spring wagon" head across desert for ride and picnic.

over, there's a lot more to maneuvering a one- or two-hp rig than just flipping the old steering wheel.

Following the gymkhana, picnic lunches were put aboard and the buggies set out across the desert to a flat, grassy area with a mountain backdrop for scenery. Here, rigs were drawn into a semicircle, lunch baskets brought out, animals watered and fed, and everyone visited around, admiring each others' wagons and draft animals. No one complained about the lack of marauding Indians.

When the festivities were over, horses were harnessed up again and, at the wagon master's "Wagons ho!" the buffs headed back to their parked 20th century gas buggies, where horses and rigs were loaded aboard for the trip home. **PM**



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ANHEUSER-BUSCH, INC. • ST. LOUIS

# What to do when your food processor stops



**A**lthough food processors are selling like crazy, there is little talk about how to fix 'em when they break down. Many manufacturers are being close-mouthed about repair procedures. Here PM let's you in on some good news: Repairing a food processor is as easy as whipping egg whites in one.

Since replacement parts are somewhat hard to get, it would be a good idea to call your dealer to see if parts for your machine are available. If they aren't, you may be able to substitute a "universal" part. Disassemble the unit, find the defective part and take it to a store that's listed in the classified directory under "Electric Appliances—Small—Supplies, Parts."

## Units are similar inside

Hamilton Beach is one maker that did provide us with useful information. There isn't much difference between their unit and most other makes when it comes to troubleshooting and repair. However, there is one notable difference between some units: Most use a cogged belt and two pulleys to drive the shaft. But some use a gear train.

Except for this, internal mechanisms are much the same from unit to unit. Parts include a universal motor; a rectifier (diode) that converts incoming a.c. to d.c., which is needed to run the motor; on-off and safety switches; and a power cord. These are the parts that cause problems.

## Two common problems

There are only two major problems that occur with any degree of frequency:

1. The motor won't run although the on-off switch is "on" and the bowl and bowl cover are locked in place. Locking the bowl and bowl cover in place trips the safety switch to "on."

2. The motor runs, but the shaft and blades won't turn.

## Motor won't run

The causes are the following:

- No power
- Defective power cord
- Defective on-off switch
- Defective safety switch

- Defective rectifier
- Defective motor

**Caution:** Observe safety practices when troubleshooting and repairing. For example, don't leave a blade or disc attached.

Start by plugging the processor into another outlet in a different part of the house. If the motor starts running then your problem is with a defective house line—not with the unit.

Check the power cord for damage: Turn on the machine. If there's no sign of life, flex the cord over its length. If there's sporadic action, replace the cord.

Next, unplug the unit, remove the assembly screws from the underside of the bottom housing and separate the top and bottom housings. Don't force them apart. If they still hold tightly together, look for hidden screws—for example, under a nomenclature plate which you may have to pry off.

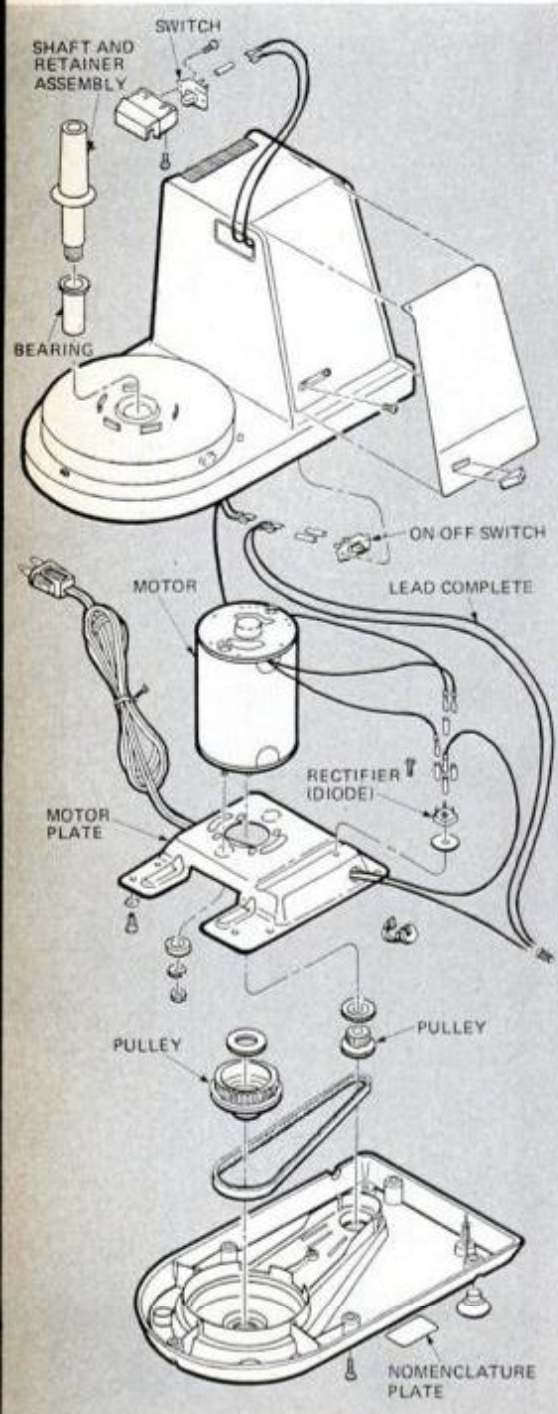
Check all connections for any that may have come loose. Also look for burned insulation on wire leads. Replace defective leads.

When you test the *on-off switch*, the power cord has to be plugged in with the safety switch engaged. When you test the *safety switch*, the power cord has to be plugged in and the on-off switch has to be "on." Test these switches by carefully using a jumper wire to bridge the switch terminals (or remove the switch leads and temporarily tape them together). If the processor comes to life in either case, replace the switch involved.

At this point, only a small rectifier and motor remain as causes for failure. Replace the rectifier. It isn't expensive. With luck, the motor will run now. If not, you probably need a new motor.

## Shaft won't turn

A bent shaft could cause this malfunction, but a bent shaft is not a common occurrence. It is more likely that the belt has broken or one of the pulleys has stripped. If your food processor uses a gear-driven shaft, one of the gears probably has stripped. The solution, in any case, is to find the defective part and replace it.—Mort Schultz



# You're gonna love our Great Little Car. Mazda GLC 5-Door Hatchback.

Great little piston engine. Great little goodies. Great little price.



Introducing the Greater Little Car. The GLC Deluxe 5-door Hatchback. \$3770\*\*! A roomy new Deluxe GLC in a whole line of roomy GLCs for 1978.

The GLC 5-door is for those who believe the only thing better than a GLC hatchback with three doors is a GLC hatchback with five.

It has GLC's split rear seat, standard. Which lets you take a back-seat passenger along, along with two weeks' groceries or golf clubs or luggage or what have you. Both seats folded down reveals a plushy carpeted deck. Very nice.

There's a nifty little button under the dash that electrically unlatches the hatch. (You may open the hatch from the outside, too.)

It has three transmissions to choose from. 4-speed is standard, while easy automatic and frugal 5-speed are available.

There's simply much more than you'd ever expect in a car its size. But, for not much money. And that's the case with every GLC model: the GLC Standard 3-door Hatchback, GLC Deluxe 3-door Hatchback, and GLC Sport.

Mazda's Great Little Car is a great little car. You're gonna love it.



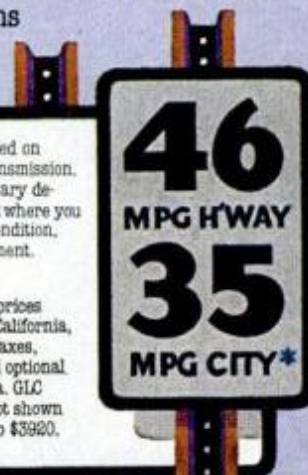
SPLIT REAR SEAT



CHOICE OF TRANSMISSIONS



REMOTE HATCH RELEASE



\*EPA estimates based on optional 5-speed transmission. Your mileage may vary depending on how and where you drive, your car's condition, and optional equipment. 42/35 mpg Calif.

\*\*POE Los Angeles prices (slightly higher in California, and other areas). Taxes, license, freight, and optional equipment are extra. GLC prices for models not shown range from \$3245 to \$3980.

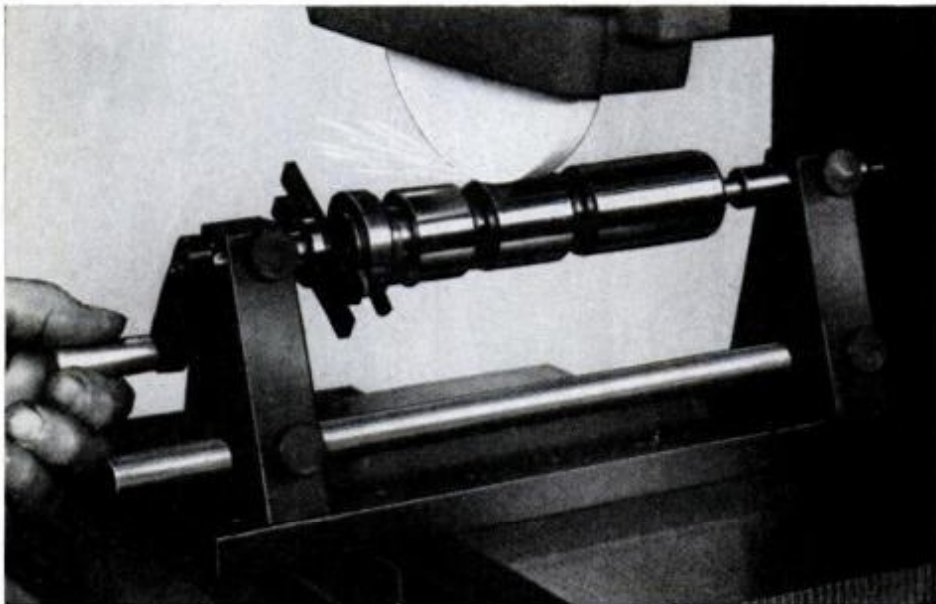
**mazda**

**GLC. Now, four great little cars in all, from \$3245.\*\***

# IT'S NEW NOW

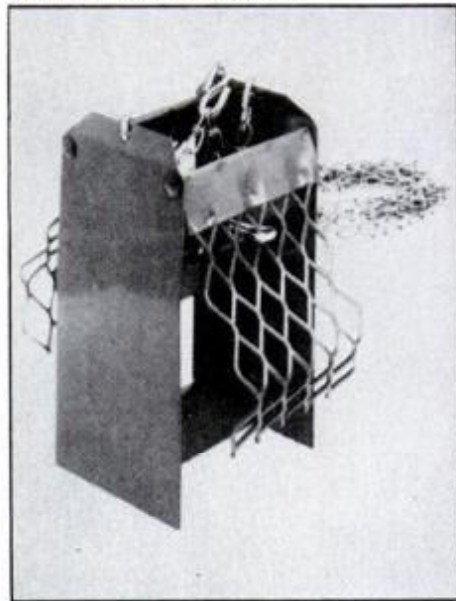
## Not the same old grind

A surface or cutter grinder becomes a cylindrical grinder with the Mini-Grinder. The \$175 unit is said to grind within  $\pm .0001$  inch and perform like much more expensive machinery. Metro Tool Co., 7325 North Hamlin Ave., Skokie, Ill. 60076.



## Flue bug

Combustible deposits in chimneys must be regularly cleaned to prevent fires. Jiffy Chimney Cleaner can clean masonry or steel flues 7 to 12 inches wide. About \$40. Oak Grove Enterprises, Box 47A, Foristell, Mo. 63348.



## Through the door, coldly

Frigidaire's top refrigerator features the Refreshment Center, which dispenses ice, two aerated beverages or chilled, filtered water. The unit is said to reduce energy waste from door openings. Model FPE20TJB is about \$920.

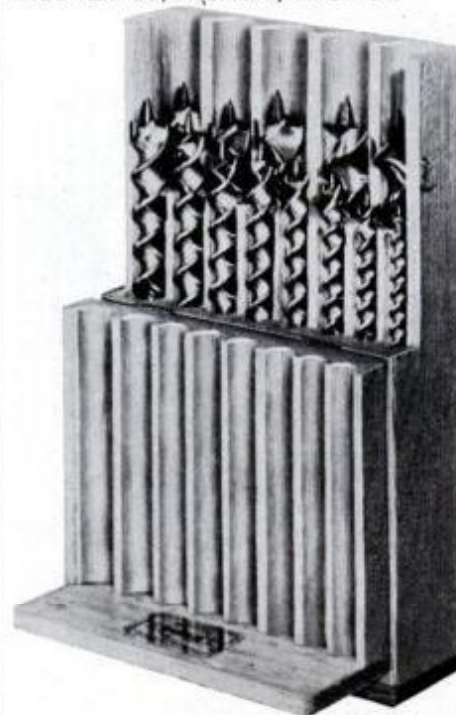


## Soil storer

Store different soils and such in the Barry Bench. Gravity-feed hopper dispenses soils at work level from compartments. Shelf slides out; unit assembles easily, maker says. The 24x30x60-inch model is \$154. Keep It Green, 2000 Arrow Lane, Riverwoods, Ill. 60015.

## New-old drill bits

Greenlee sold hand-finished double-twist auger bits like these for over 70 years. Now they've been reintroduced at customer request. A 13-bit set sells for about \$95, with wood case included, at hardware stores. Greenlee Tool Co., 2136 12th St., Rockford, Ill. 61101.





**Thank goodness  
the best things never change.**

Like the feeling you get every time  
you share the sounds and the smells of  
a misty morning.

Like the feeling you get every time  
you taste Smooth as Silk Kessler.

Consistently smooth. Sip after sip.  
Year after year. Money just can't buy  
a smoother whiskey.

**SMOOTH AS SILK  
KESSLER**



# ADVANTAGE:



Free Wheeling Van with additional factory options, owner-added stripes.



## 4-SPEED OVERDRIVE

Ford's new optional 4-speed manual overdrive transmission reduces piston travel per mile for less engine wear. Fully synchronized in all forward gears.

**SPACE** Loads of livin' room up front and back. Even a new tilt steering wheel option! Plus swivel Captain's Chair option.





# FORD!

For up-front comfort, and advanced van design, nothing comes close to Ford. If you're *really* into vanning, you're into Ford!



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**VARIETY** Want a van *already* customized inside and out? "Cruising" Van's for you. Comes with new trick paint, plus carpeting on floor, insulated woodgrained wall panels and full-length headliner. Or go Pinto Cruising Wagon—with wagon up front, wide-open van room in rear.



**Built  
Ford  
Tough**

Of all Ford Trucks registered over the last 12 years, 93 out of 100 are still on the job. (Based on cumulative registrations as of 7/1/76.)

# THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

## Thumb wheel ratchet



Thumb-wheel ratchet is for tight places.

I found S-K Tools' new quarter-inch thumb wheel ratchet terrific for reaching into cramped spaces. It gives good leverage and maneuvers in the tightest places you'll encounter under your hood. Thumb-wheel set comes in



Ratchet comes with sockets and extensions.

an 8-piece pouch—six sockets plus the ratchet and a short extension. All are compatible with your present quarter-inch tools. We have seen S-K Set No. 4908-78 in auto parts stores for \$12. Or order from S-K Tool Group, Dresser Industries, 3201 North Wolf Rd., Franklin Park, Ill. 60131.—M.L.

## Battery corrosion terminator

In the old days, half the times I had no-start problems, with various cars, the culprits were dirty battery posts and terminals. That was before discovering the many



Terminal cleaner.

ways you can treat your posts. One is with a spritz of VRS battery terminal cleaner. It wipes out that buildup of white corrosion and prevents future buildup.

VRS aerosol can (7 oz.) is \$3.50 from Valley Research Systems, Box 294, Hewlett, N.Y. 11557.—M.L.

## Synthetic chamois

"Okay, what's in the tube?" ask friends who see the product container labeled "Fireman's Friend." There's no way to know that it's a synthetic chamois. It got its name because its first users were firemen, say the distributors. (Well, you've never seen a dirty fire engine, have you?) This "high-quality plastic-sponge "skin" or



"Fireman's Friend" is synthetic chamois.

"total towel" as it's variously called by its makers, is 17 by 27 inches and costs \$9—cheaper than a real chamois skin. Yes, it works almost as well, is tough and durable, doesn't dry out in time like an animal skin, doesn't rot, is grease resistant and is conveniently stored wet in its own case. But, no, it doesn't feel and smell like the real thing and I'm enough of a sensualist to stick with chamois. Fireman's Friend, Inc., Box 64, Elmhurst, Ill. 60126.—B.H.

## \$1 a peek

You really can't put a price on any extra margin of safety you can get



Broaden your vision with stick-on mirror.

on the road. This Blind Spot Mirror is only a dollar but it might make a big difference—between a whopping body damage repair bill, or life and death. It sticks on the outside edge of your rear view mirror and is angled outward so it expands your field of vision, perhaps just enough to pick up that passing car before you attempt to change lanes and run smack into it. DEL-CO, Inc., Box 233, Westchester, Ill. 60153.—B.H.

## Super filter

We haven't run it in our car long enough to check out Fram's claim that it lasts 50 percent longer than its conventional air filter, but that's the promise, and the new filter's construction is certainly impressive. Extra Life air filters use two elements to trap 99 percent of airborne dirt, according to Fram. And the price is no high-



Extra Life filter uses two elements.

er than the conventional filters: \$5 to \$8.50, depending on the size of your car. Fram Corp., Providence, R.I. 02916.—B.H.

## Super fluid

A can of D.L.F. has a lot of uses around the garage. The D.L.F. name stands for Dries-Lubricates-Frees. It frees frozen locks. It dries ignition systems—just spray on



D.L.F. spray.

plugs, points, inside distributor cap—and it lubes while it works. Costs \$3.55 for 14 oz., \$2 for 5 oz. Woodhill Permatex, 18731 Cranwood Pky., Cleveland 44128.—B.H.

# WHY OUR OIL SHOULD BE STANDARD EQUIPMENT ON ALL SMALLER CARS.

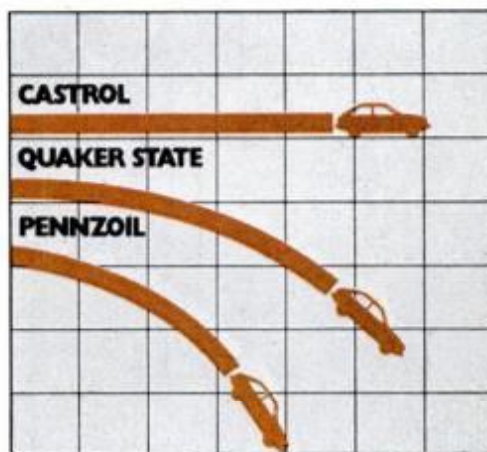
Smaller cars demand even more of a motor oil than big cars do. Their 4 and 6 cylinder engines run at considerably higher revs throughout their entire performance range. So there's more heat and friction in the engine.

All this can cause extra wear, tear, and 'shear' (thinning out of the oil)—what engineers refer to as "viscosity breakdown." As the viscosity of the oil breaks down it loses more and more of its ability to protect a smaller car's engine from its own self-destructive tendencies.

That's why Castrol is so essential for smaller cars.

Unlike ordinary oils Castrol doesn't break down. After an incredible expenditure of time and money Castrol engineers developed a unique motor oil formulation using a special viscosity modifier that prevents Castrol from thinning out under intense heats and pressures.

Then they added additives and detergents that keep sludge from forming as the oil cools down. Additives that give



To prove that Castrol is better suited for smaller, hotter, higher-revving engines we tested Castrol against Quaker State and Pennzoil. As the graph above plainly shows, only Castrol didn't break down.

Castrol the strength it needs to keep cleaning and lubricating the narrow passages in smaller engines. (And if Castrol can do all this for smaller engines, imagine what it can do for bigger, less demanding ones.)

To prove how good our oil really is, we tested Castrol against the two leading brands: Quaker State and Pennzoil.

The test was conducted in a laboratory by an independent testing firm. Each one of the oils was an SAE-approved 10W-40. After the equivalent of roughly 2,000 miles they found that while Quaker State and Pennzoil had both shown significant breakdown, Castrol hadn't broken down at all.

So while there are lots of oils to choose from, only one should be standard equipment on smaller cars. Castrol—the oil that doesn't break down.

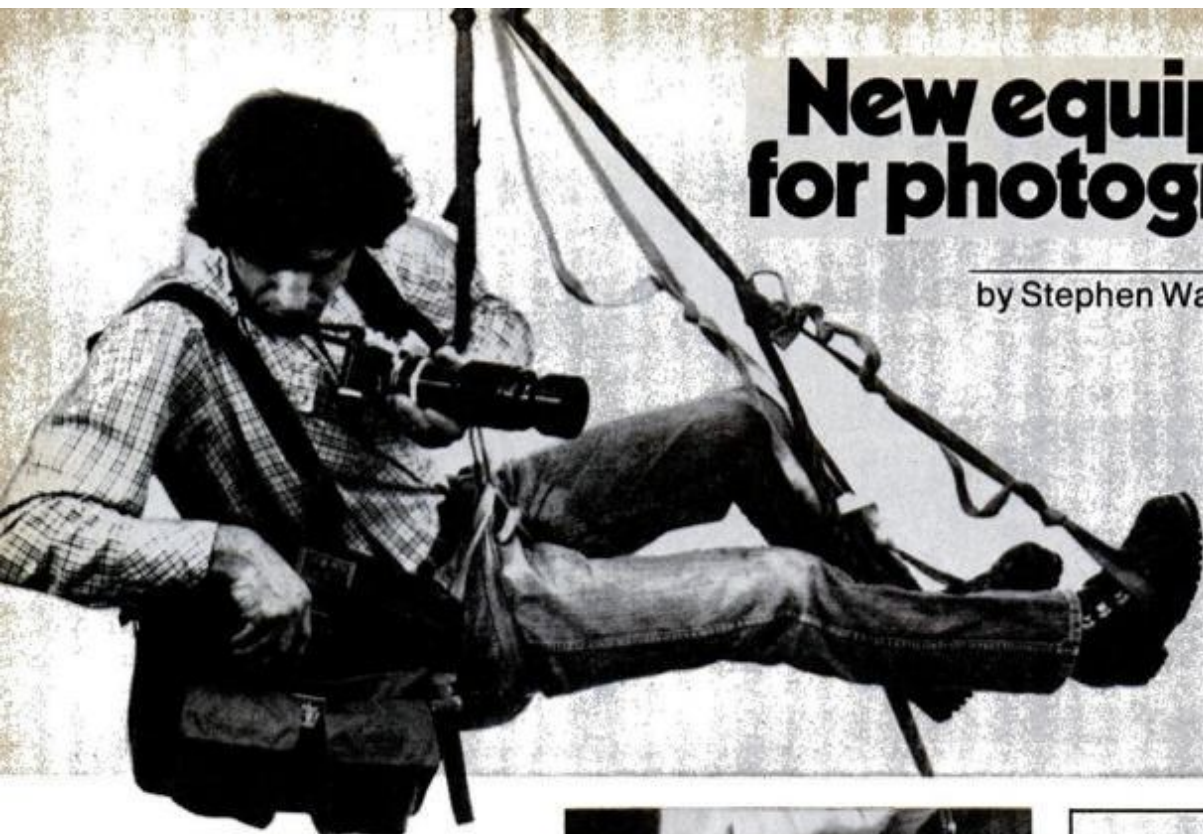
After all, if your motor oil breaks down, who knows what could break down next?



**Castrol**  
**THE OIL ENGINEERED FOR SMALLER CARS.**

# New equipment for photographers

by Stephen Walton



Pro-Pack bag designed by a mountaineer-photographer has rearrangeable dividers that let user create compartments he needs. Four models cost \$105 to \$147. Tenba, 510 Broadway, N.Y. 10012.



Kodak Ektra pocket cameras adjust automatically for ASA 400 film, have action-stopping shutter speeds keyed to it. Three of four models have the folding cover-handle shown; two are dual-lens, normal-and-telephoto cameras. List prices range from \$19.95 to \$49.95.



Dispenser for 35-mm film clips to belt, pocket or camera strap, feeds from bottom with space for exposed rolls at top. Smoke-colored plastic keeps supply visible, is said to protect it from sunlight. Price is \$5.95. Pace Photographic Products, 2204 Morris Ave., Union, N.J. 07083.



Compact, automatic-exposure Nikon FE features meter sensitivity from EV 1 to EV 18, interchangeable screens, depth-of-field preview, exposure memory lock, multiple-exposure control. Teamed with MD-11 motor drive shown, it can shoot up to 3.5 frames per second. Flash syncs at up to 1/125 second. Prices from \$460.



Minolta XG-7 accepts all Rokkor and Celtic lenses for auto-exposure operation. Compact camera has electromagnetic shutter release, LED shutter-speed scale in finder, shutter lock that prevents over-exposure, self-timer with flashing LED indicator; takes lightweight winder, winder-synched flash. Priced from \$450.



Digital darkroom timers from Vivitar: Model at left, \$69.95, times up to 99½ seconds. Process Time Commander (right), \$99.95, handles three linkable timing programs, optional temp probe.



Kit has materials for making direct-positive tintypes with your camera; \$10.95 at dealers or ppd., Rockland Colloid Corp., 302 Piermont Ave., Piermont, N.Y. 10968.



One of two new Sunpak pocket cameras with built-in electronic flash, 2000 E has flip-up finder, automatic exposure with speeds from 1/15 to 1/500 second.

# You can do it.



**Measure it.**



**Cut it.**



**Plane it.**



**Hammer it.**



**Join it.**



**Shave it.**



**Level it.**



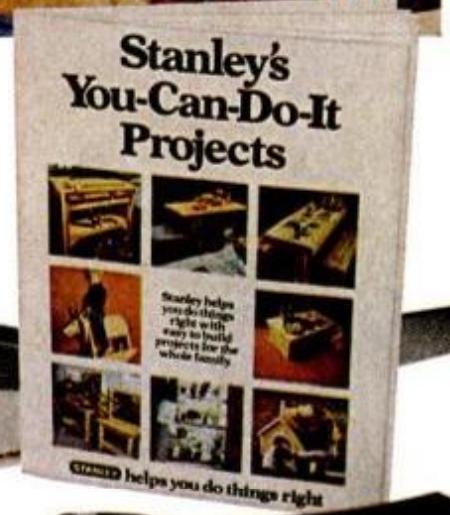
**Sure, you can!**



"I did it over a weekend," writes Bob Chambers, Seattle, Wash. "If I could do it, anyone can," says Al White, Manchester, N.H. And, from David Harris, Bowie, Md., "My doubts dissolved once I started. Just followed the Stanley plans set."

In letter after letter, everyone agrees — Stanley, the do-it-yourself company, has great plans for you. And the quality tools that help you do things right. As for this big "You Can Do It Projects" book, a \$2.00 value, get it for sending \$1.00 to Stanley Tools, a Division of The Stanley Works, Dept. PM2, New Britain, CT 06050.

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Most stolen cars are simply *driven away*. But when you have Auto Guardian, your engine will *not start* until your 4-digit code is entered in the attractive Micro Control Unit. An exclusive SAVE feature lets you grant temporary, key-only use of your car to a mechanic or parking lot attendant. You need never disclose your code.

Auto Guardian Electronic Anti-Theft Engine Interlock fits any 12-volt negative ground vehicle. Complete kit easily installed by any handy person. Full instructions included.

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**Five Function LED** with each Auto Guardian ordered at the Introductory Price of **\$82.95\*** before July 31, 1978. All Metal Case — Specify Color. Phone orders: **215-368-8050** Allow 3 - 4 weeks for shipment.

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- Money Order Enclosed for \$ \_\_\_\_\_

Name \_\_\_\_\_

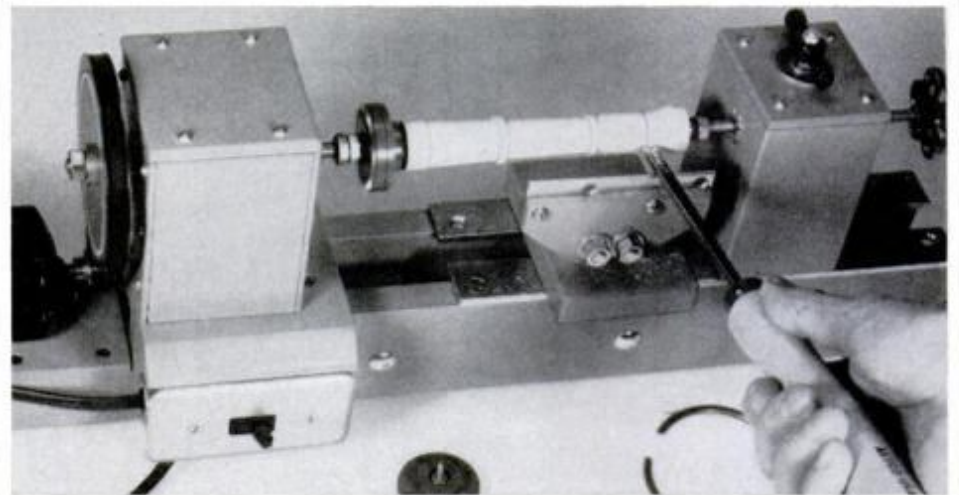
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Watch Color  Silver  Gold

# PM PLAN OF THE MONTH

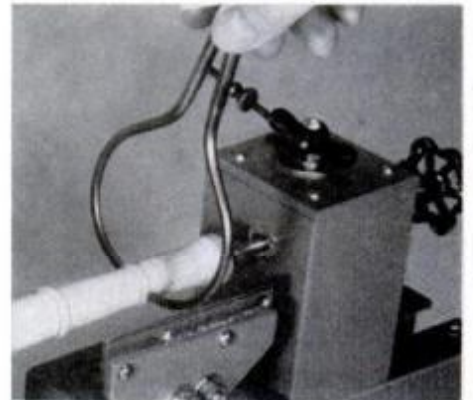
A SIMPLE WOOD LATHE YOU CAN BUILD



**A** wood lathe is one of the most exciting tools in any shop. Richard Cutler's design for a small lathe calls for inexpensive materials (primarily hardboard, particle board and clear, 1-in. stock). It can be completed in four or five evenings. It even boasts a ball-bearing headstock made from the front axle assembly of a bicycle.

Wherever rigidity or long-wearing surfaces are necessary, metal parts are used, but no metal work is required aside from a little filing and soldering. Special tools aren't needed either—and all the hardware is standard. A sewing machine motor powers the lathe and a speed-reducing drive pulley that you make yourself provides enough torque to really make the chips fly.

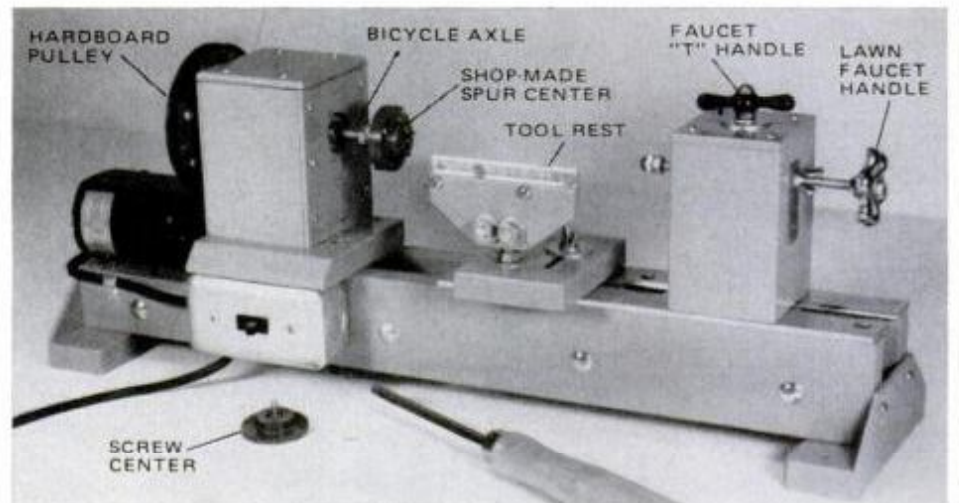
Aside from being useful for hobbyists, this would make a great father-son project because it illustrates the creative thinking that goes into designing a tool. **PM**



Lathe is ideal for toy or model building—can turn small parts accurately.

**HOW TO ORDER PLANS**

For complete plans and instructions on how to build lathe, send check or money order for \$5.95 to Popular Mechanics, Dept. WL, Box 1014, Radio City Station, New York, N.Y. 10019. Please allow two to three weeks for delivery. For first-class mail, include an additional 75 cents.



Overall length of lathe is approximately 2 ft. with about 10 in. between centers.

6 YEARS OLD. IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC.,  
DETROIT, MICH. 86.8 PROOF. BLENDED CANADIAN WHISKY. © 1978

# Bonnie and Clyde led us on a wild chase to the site of their last known hideout. Nearby we hid a case of Canadian Club.

It had been 44 years since Bonnie Parker and Clyde Barrow sped through this northern Louisiana wilderness on their last run from the law. Tracking their legend even now is a wild and wooly chase over lonesome red clay roads which run deep in tangled pine forests.

## We met folks who'd seen them.

Finally our search led to where an old squatter's cabin had once stood. Bonnie and Clyde were known to have holed up here in their last days, and local folks told us they'd seen the two lurking hereabout back in '34. So having found the long-lost hideout, we trekked into the brush and buried a case of Canadian Club.

## Start at "the end of the trail."

To find that C.C., start your trail exactly where Bonnie and Clyde's ended. Find the road they took to their fateful rendezvous with the law—and head in the opposite direction, all the way to



the next parish. Go past the "three R's" place, and where David's lad abides, turn onto a red dirt road. At the black gold storage place, head north.

## Look for a warning.

Two hard left turns and a short drive will bring you to an old sawmill. Continue till you are warned about digging and stop (if you're warned more than once, you've gone too far). On your right is an overgrown trail. Follow it to two former money-makers. From one of them, take a bearing of 160 degrees, and take a pace for each of the 120 years people have been enjoying Canadian Club. Now take 44 more in any direction but the one you've come from to where three stumps form a triangle.

We hope you brought ice and glasses, for within that triangle, just one foot down, lie 12 bottles of the world's finest tasting whisky. But if the rigors of the hunt seem too great, you can find the same great taste at your favorite tavern or package store by simply saying, "C.C., please."



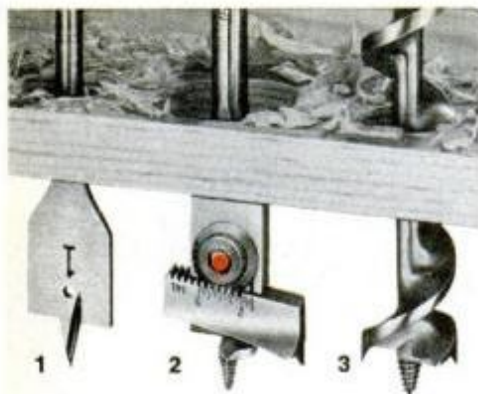
# Canadian Club

"The Best In The House"™ in 87 lands.

Материал, защищенный авторским правом



Bonnie and Clyde.



## Irwin makes your 'Popular Mechanics' projects easier!

**1. Irwin Speedbor® "88" wood bit** for all electric drills. Spade-type head, original hollow ground point starts and cuts clean and fast in any wood, 17 sizes, 1/4" to 1 1/2". Available individually or in workshop sets.

**2. Irwin No. 22 "Micro-Dial"® hand brace** expansive bit bores 35 standard holes 7/8" to 3". Just dial the size you need. No. 21 bores 19 standard holes, 5/8" to 1 3/4".

**3. Irwin 62T Solid Center hand brace bit** delivers double-cutter boring action. Medium-fast screw pitch. Balanced cutting head. 18 sizes, 1/4" to 1 1/2". Available individually or in sets.



**Speedbor "88" Sets**  
Get 6- or 13-bit sets in metal workshop organizer racks.

### New Protective Plastic Pouch!

Speedbor "88" 1/4" shank wood bits for electric drills are available individually in new easy-to-store protective pouches . . . to help you care for them as you do all your other fine, quality tools.



### Strait-Line® Chalk Line Reel Box.

Every serious do-it-yourselfer should have an Irwin 50 or 100 ft. self-chalking line box. Easy action reel. Leak-proof, damage-resistant aluminum alloy box fits hand or pocket.

### Irwin Screw Starter



Marks, starts and threads hole for screw to enter non-metal materials the easy way, with hardly any effort. Can also be used as a "marking tool" when drilling holes. Handiest tool in years for home and workshop.

Available from your hardware or building supply dealer, and home center stores.

All items above are available in metric sizes.  
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**IRWIN®** every bit as good as the name  
at Wilmington, Ohio 45177, since 1885

# PM LOOKS AT 2 TOOLS FOR HOME PLUMBERS

**W**hen I set out to fix anything to do with my plumbing system, it sometimes feels as if I'm getting ready to jump into a snake pit. Here are two new tools, recently tested in the PM workshop, that I plan to take along the next time I tangle with a home repair.

## Pipe cutter for tight places

Dub this ratcheting pipe cutter the acrobat of your plumbing tool kit. It needs only 2 1/8-in. clearance in hard-to-get-at spots such as under sinks and inside floors, walls and ceilings. The cutting stroke can be as short as 10°—whereas many



Ratcheting pipe cutter reaches tight areas easier, cuts with less effort.



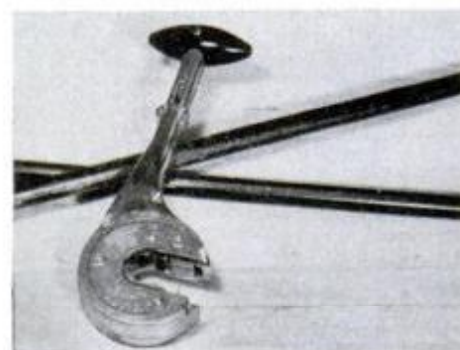
Clean threads of fitting by squeezing grip to engage cutters, then twist.

conventional cutters must be moved a full 360° around the pipe.

The Kelly Kutter is 13 in. long, is made of cast aluminum and weighs 2.3 lbs. It costs \$49.95 ppd. from Kelly Kutter, 3644 Eastridge Dr., San Jose, Calif. 95122. Extra cutting wheels are \$1.20 with purchase.

## Internal thread renewer

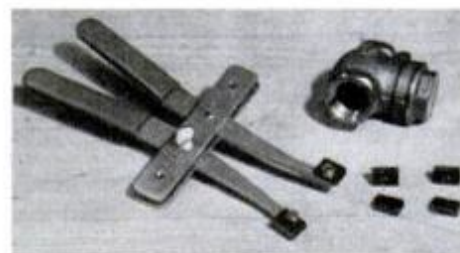
The internal threads on old pipe fittings or castings can be quickly restored or cleaned with a new



Tool handles same pipe materials as conventional cutters, sizes 1/4 to 1 in.

hand tool called the Internal Thread Cleaner and Restorer.

All it takes for the job is a light pressure applied to the grip and a continuous twisting motion to clean gummed-up, battered or corroded threads. Refitting will then be easier and the new joint will be less



Hardened steel thread cutters (8, 11 1/2, 14 threads per inch) come with the tool.

susceptible to leaks. Cross threading is impossible.

The tool adjusts for use on all standard pipe diameters from 3/4 to 6 in.—and is a lot less expensive than buying a set of taps to do the same job. It's priced at \$17.95 with standard thread cutters from Frank's Manufacturing Co., RD. 1, Box 325-A, Oxford, Pa. 19363. Optional coarse and fine-thread series cutters as well as metric sizes are \$1.50 per set.—J.P.

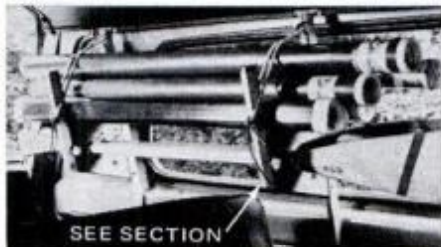


# HINTS FROM READERS

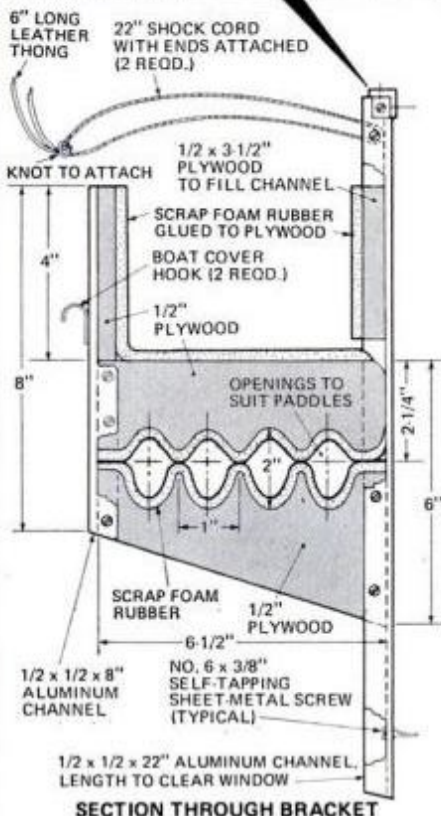
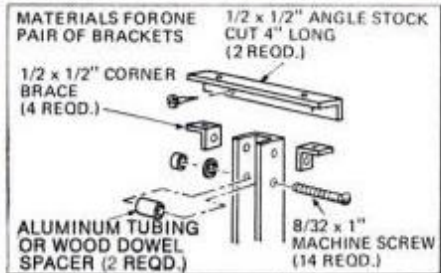
## Rod and paddle brackets

Stow canoe paddles and fishing rods securely out of the way when transporting them. Use two simple brackets that adapt to a station wagon or van. Required materials are: 5 ft. of  $\frac{1}{2}$ -in. drapery-type aluminum channel, 4  $\frac{1}{2}$  x  $\frac{1}{2}$ -in. corner braces,  $\frac{1}{2}$  x  $\frac{1}{2}$  x 8-in. angle stock,  $\frac{1}{2}$ -in. plywood, 14  $\frac{8}{32}$  x 1-in. machine screws, two  $\frac{1}{2}$ -in. spacers, two boat-cover hooks, self-tapping metal screws, two shock cords, white glue, scrap leather and foam rubber. Brackets have no loose parts to get lost.

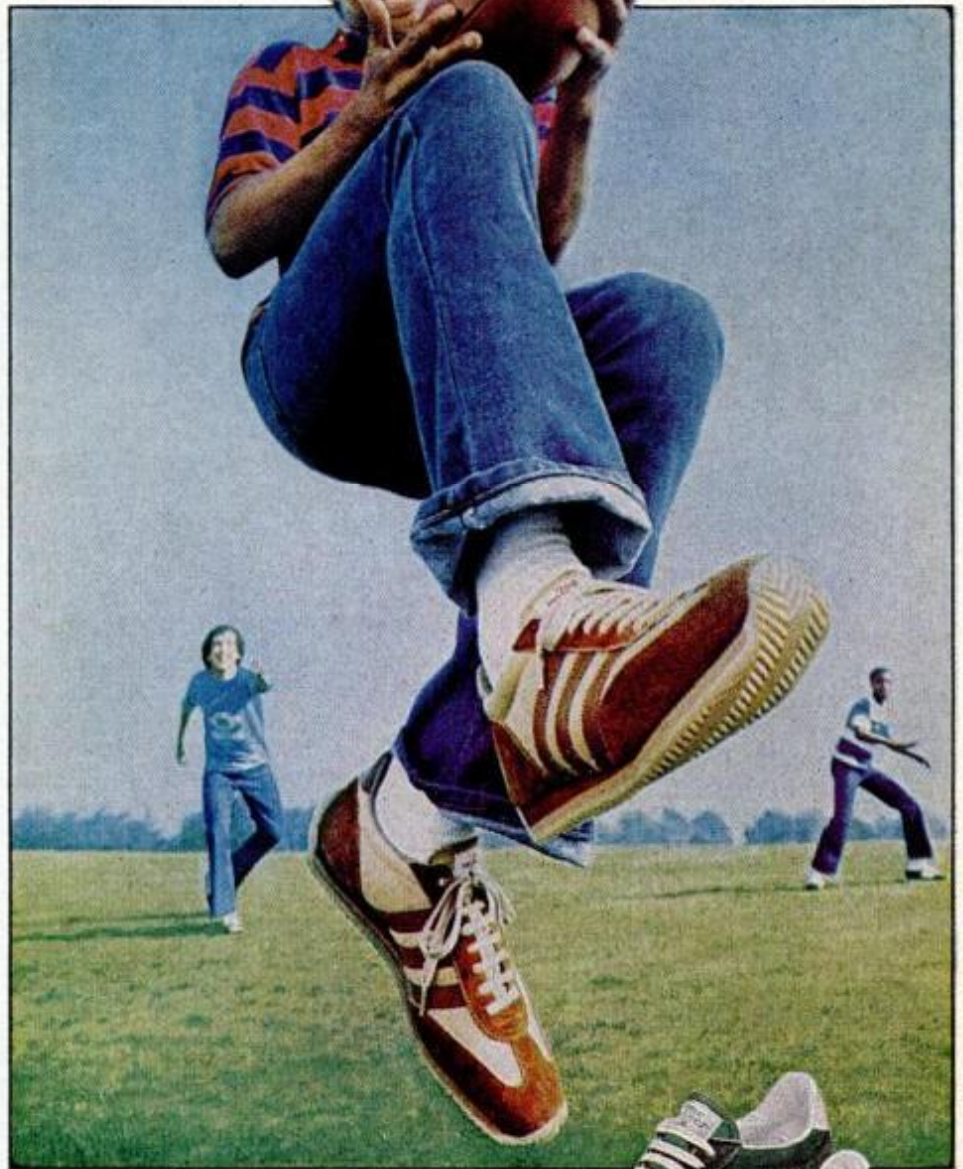
—Harold O. Davidson



SEE SECTION



# Get the feel of a WINNER.



## The Winner II Sportshoe

Nylon with split-suede trim upper. Padded tongue and collar. In blue, beige, red and green. See the entire line of Winner II Imported Sportshoes at The Shoe Place.

Sears

©Sears, Roebuck and Co., 1978



# SCIENCE WORLDWIDE

## Keep the lead out

Now that outdoor barbecues in all parts of the country are going full blast again, here's a timely warning from the American Medical Assn.: Don't use the Sunday paper's magazine section to start the charcoal in the grill. Those pretty color pages are loaded with lead and when they burn they lace your hamburgers with the toxic metal.

According to an AMA spokesman, colored inks with the highest lead content are, in descending order, yellow, red, green and blue. Black-and-white newspaper pages are considered safe as there is little lead in black printer's ink.

## New, faster cruise missile

Although the cruise missile currently in our arsenal is still in the test stage, the next generation of this weapon is already in the works. Called the Advanced Strategic Air Launched Missile (ASALM), it's a supersonic bird powered by a rocket ramjet propulsion system. Not only will it travel



ASALM after its launch from bomber.

a lot faster than the current model, it will be capable of both air-to-ground and air-to-air missions. It'll be launched from bombers.

The ASALM missile shown in the drawing above is being developed by the McDonnell Douglas Corp. The development schedule calls for this entry to be pitted against another contractor's version in a competitive fly-off beginning in January 1979.

## Reviving a dying lake

Medical Lake, a popular recreation spot in eastern Washington, was dying. It was choked with algae, growing profusely because of excess phosphorous in the water. When the algae died, they sank and decayed, releasing more phosphor-

ous and depleting all the oxygen in bottom waters during the summer.

Following lab tests of the water, researchers from Battelle Memorial Institute's Pacific Northwest Laboratories decided to use aluminum sulphate (alum) to combat the problem. For the alum to mix properly and capture enough algae to be effective, the chemical had to be spread throughout the lake at a certain rate and depth. They designed and built an underwater dispenser shaped like a pontoon.

"We hoped the treatment would break the lake's internal phosphorous cycle," says Battelle's Anthony F. Gasperino. "The alum forms an insoluble floc—a white, cottonlike mass—in the water." With the damaging phosphorous locked in, the floc eventually sinks to the lake floor, forming a chemical barrier against the phosphorous released from lake sediments.

"There has been a 90-percent reduction in phosphorous," Gasperino recently reported. The researchers hope the treatment will last from three to five years, but they plan to monitor lake water yearly.

## Spinoff from Apollo program

Lunar rock specimens, taken from samples brought back by the Apollo astronauts, are now available for study by high school science students, according to a NASA announcement. Specimens are encased in clear plastic and come with a scientific analysis, slides, audio cassette and a film on lunar science. Schools should write to NASA, Public Affairs Office, Code AP4, Johnson Space Center, Houston, Tex. 77058.

## New way to probe heart

A new method of detecting cardiac abnormalities—measuring the magnetic fields of the heart—is being tested by a team of physicians and physicists at California's Stanford University Medical Center. A magnetometer called a SQUID (for superconducting quantum interference measuring device) measures magnetic fields produced by the flow of ions—charged particles—through heart muscle cells. Ionic flow, which occurs during muscle contraction, also generates the electric fields measured in the electrocardiogram (EKG).

According to one of the researchers—Dr. Donald Harrison, head of



SQUID zeroes in on weak magnetic field.

the division of cardiology—the EKG can't disclose certain conditions that involve abnormal electrical conduction through the heart. "Magnetocardiography may be helpful in diagnosing potential heart attacks which result from these conduction abnormalities," he explains. "It will complement but not replace the EKG."

The magnetic fields produced by the heart are difficult to measure because they are a million times weaker than the Earth's magnetic field, according to the researchers. Previous efforts to pick up the tiny cardiac fields were hampered by interference from power lines and other sources. At Stanford, this background "noise" was eliminated by placing the patient at the bottom of a 25-foot well lined with magnetic shielding. Now, however, the SQUID magnetometer permits examination at ground level without magnetic shielding. In addition to Stanford, several other scientific centers are also investigating the new technique. **PM**



BY  
JOHN F.  
PEARSON

# "Hot weather is coming. When should I change my oil?"



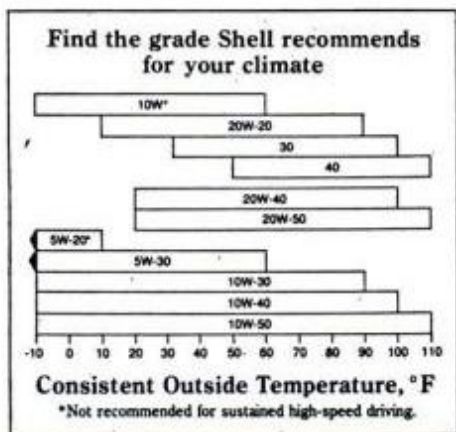
The Shell Answer Man helps you choose the right oil at the right time - winter or summer.

You don't have to change your oil just because the weather is warming up. Maybe the oil you've got will continue to do just fine.

## The viscosity grade may tell the story

Numbers like SAE 10W, SAE 30 and so forth are viscosity grades. They tell how thick the oil is. And how well it protects at different outside temperatures.

Check your present oil on the chart. If it's okay for the kind of hot



weather you're expecting, leave it in there until your next regularly scheduled change.

But if you see that it won't protect

when the temperature goes up, switch to a grade that will.

## Multigrades vs. single grades

While a high viscosity grade protects in a hot engine, and a low viscosity grade flows freely for quick starts, a multigrade oil gives you the advantages of both.

As the chart shows, multigrade oils will protect your engine in summer heat and winter cold.



## Check the Shell line for the right motor oil for your car

Shell X-100® single grades motor oils are available in SAE 10W, 20W-20, 30, and 40. Each meets the warranty service requirements of every U.S. and most foreign cars.

Shell X-100 Multigrade is an SAE 10W-40 all season oil. It offers excellent high-temperature protection plus good low-temperature starting. Meets or exceeds warranty requirements for every U.S. and most foreign cars.

Shell Super X® motor oil earns the 10W-50 rating, the widest multigrade range you can buy. Helps protect today's hotter running engines. Recommended for use in extreme conditions such as towing. Exceeds warranty requirements for every U.S. and most foreign cars.

## Owners' manuals and oil changing

The temperature outside isn't all you have to consider.

You should change oil when your

owner's manual says to. And most owners' manuals have three separate recommendations.

First, they recommend you change oil every so many miles. That's the number most owners remember.

Then a time interval is usually added to that. Something like "change oil every 5,000 miles or three months, whichever comes first."

That time limit is every bit as important as the mileage limit. Because if you reach the time limit first, it probably means that you're doing a lot of short trip driving.

That uses up your motor oil's protective additives. And since the oil doesn't get heated up on short trips, sludge and acids build up. So pay attention to time as well as mileage.

## How severe is "severe"?

Finally, in addition to the regular time and mileage limits, your owner's manual probably tells you to change more often for "severe service."

That doesn't just mean driving in Baja torture tests. Stop and go driving in hot weather is tough on a car's engine. It's usually included under "severe." So are trailer towing and driving in dusty areas.

## Get more money-saving answers free in the "100,000 Mile Book"

Like all the Shell Answer Books, it's eight pages of useful information, accompanied by full-color photographs and illustrations. This one is especially designed to help you get the most out of your car.

You'll read tips from six veteran mechanics on how to get 100,000 miles out of your car without its showing it.

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Come to Shell for answers

# 8 new electronic gadgets

by Stephen Walton



■ VideoBrain computer runs entertainment, educational and home-management programs, in color and sound, when connected to TV. Uses plug-in cartridges, needs no user programming. Unit lists for \$499.95; cartridges from \$19.95. VideoBrain Computer Co., 105 South Wolfe Rd., Sunnyvale, Calif. 94086.

■ A chess opponent with four game-playing levels and two levels for problems, CompuChess can play black or white, makes a random choice when



equally sound moves can be made, incorporates castling, en passant captures, pawn promotions. Price is \$169.95; Staid, Inc., Box 65, Largo, Fla. 33540.

■ Microprocessor-controlled video programming system from Panasonic stores time, channel and day of the week for 10 separate TV programs, turns TV set or



videotape recorder on and off and repeats a full week's schedule until it's changed by the user. The system allows override, has clock display with electronic chime. Price, availability to be announced.

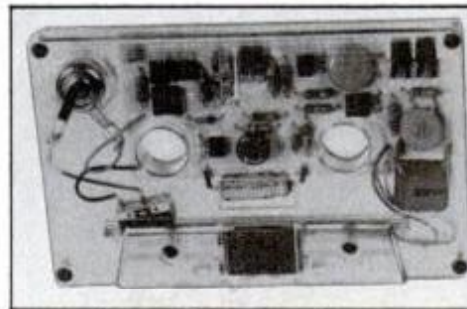
■ Add-on wireless remote control is easy to install on any TV set, uses ultrasonic pulses to switch up or down to any of 10 VHF and/or UHF channels se-



lected by the user, shows channel chosen as one-digit code number on LED display. Costs \$99.95. GP Electronics, Box 261, Middletown, N.J. 07748.



■ Latest economy Anytime watches include men's and women's continuous-readout liquid-crystal-display models with tritium backlighting for night visibility (suggested retail: men's \$19.95; women's, \$24.95). LCD watches without backlighting and new ladies' LED watches. Texas Instruments Inc., Inquiry Answering Service, Box 53, Lubbock, Tex. 74908.



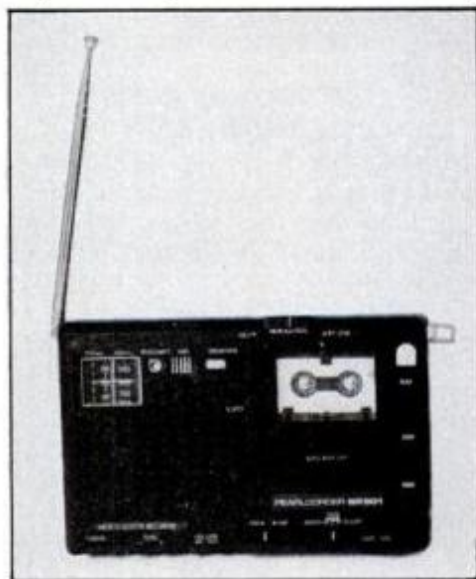
■ Demagnetizing heads of cassette tape players and recorders can be a nuisance, especially in portable models and auto units where the heads are hard to reach. TDK's demagnetizer goes into the deck like a cassette. Battery powered and self-contained, it lights an LED when demagnetization is complete. About \$20.

■ To restore extra-low frequencies to music without boosting turntable and other unwanted noises, Dbx's \$199 Boom Box synthesizes signals an octave below a recording's lowest bass, puts them into a program through stereo system's tape-



monitor loop. It's said to increase bass-reproduction accuracy, even let you feel air motion of lowest notes.

■ Pearlcorder SR 501 combines 60-minute Microcassette tape recorder with AM/FM radio. Features include capstan drive, automatic level control,



built-in electret condenser mike, tape counter, tone control, sleep switch, LED battery check. Retail price is \$199.95. Olympus Corp. of America, 2 Nevada Dr., New Hyde Park, N.Y. 11040.



# THE NEW-SIZE MALIBU WAGON.

## Chevrolet's new friend of the family.



**NEW SIZE.** Trim exterior dimensions make this tidy new wagon easy to maneuver in city traffic and park.



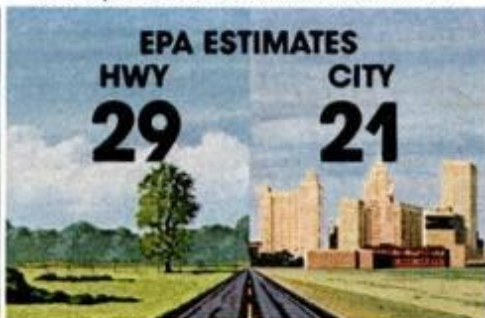
**ROOOOOMY.** Generous interior takes good-size loads. Over 43 inches of load space between the wheel wells.



**NEW TWO-WAY HATCHGATE.** Top hatch lifts up. Bottom gate drops down. Easy to operate.



**EASY LOADING.** Load space is easily accessible even if somebody parks too close.



**NO OTHER 6-CYLINDER MID-SIZE WAGON HAS BETTER MILEAGE FIGURES.** That's because of Malibu Wagon's new weight-saving design and efficient new V6 powerplant. EPA estimates of 29 mpg highway, 21 mpg city are with standard 3.3 Litre (200 Cu. In.) V6 and manual transmission. Power train not available in California. Your mileage may vary depending on how and where you drive, your car's condition and available equipment. (Malibu is equipped with GM-built engines produced by various divisions. See your dealer for details.)



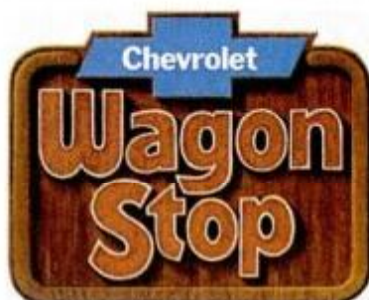
**EXCLUSIVE GM PERIMETER FRAME.** Of all mid-size wagons, only GM-built mid-size wagons offer this rugged feature.



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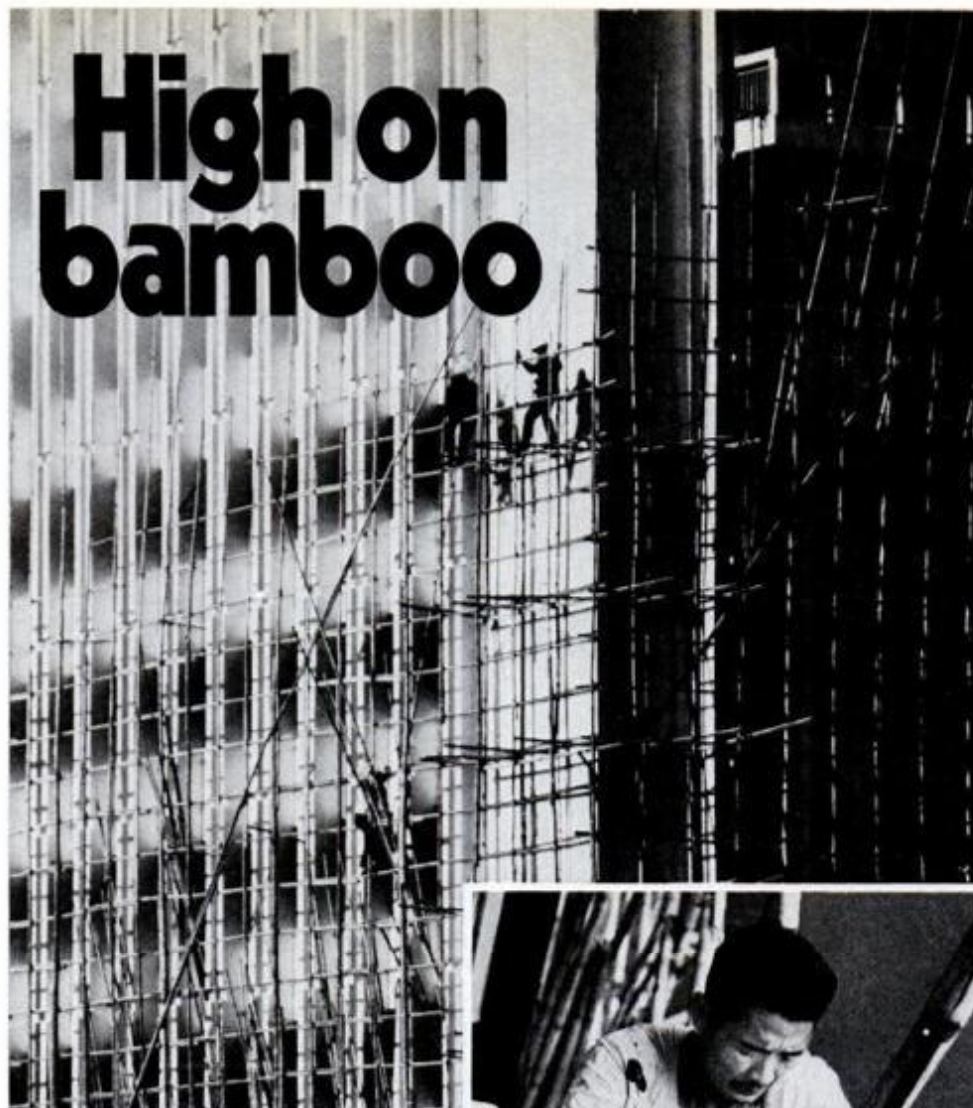
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# High on bamboo



Bamboo scaffolding climbs the face of a Hong Kong skyscraper (top). Joints are bound with strips of bamboo bark. A worker (right) presses his cheek against the structure in order to steady himself.



**S**caffolding workers are the laboring elite of Hong Kong's craftsmen, earning \$30 or more per day. Reason: The scaffolding is made entirely of bamboo, joints wrapped with strips of bamboo bark—not a nail or clamp anywhere. It accompanies every skyscraper's upward climb, often beyond the height of the building itself so that workmen can finish the roof.

Though wages are high by Hong Kong standards, there are only a few hundred bamboo scaffolders in the whole area. A scaffolding ap-

prenticeship extends over a three-year period.

The craftsmen distrust power tools and labor-saving devices. A toolkit for each consists of a knife and an old handsaw. Each of the thousands of poles making up a scaffold is hand-carried to the top of the structure, regardless of the height to which it may soar. Larger structural poles may run 6 inches in diameter and 25 feet long.

The worker straddles a horizontal bamboo bar, and travels along the one beneath it tightrope-walking-



Hong Kong scaffolders use no planks. They cling to a bamboo jungle gym.

fashion. Since both hands are used for tying joints, the men steady themselves by pressing a cheek against the pole on which they are working.

Though the bamboo caging on a real high-rise has a rickety, frail appearance, it is actually extraordinarily strong—a fact proven many times during Hong Kong's typhoon seasons.

Not long ago, two skyscrapers were going up in Hong Kong beside each other, one surrounded by a bamboo scaffold; the other by standard iron pipe with threaded joints. A typhoon struck and, when the storm abated, contractors returned to the sites to find steel caging on the ground like a jumble of jackstraws. The bamboo, thanks to its resiliency, was still intact and workable.

Bamboo scaffold craftsmanship had its origins a thousand years ago in Kwantung Province, to which many modern day Hong Kong scaffolders trace their heritage. **PM**



Towering bamboo caging is stronger than pipe scaffolds during typhoon season.



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But it took hours of hard work.

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Please rush \_\_\_ *Pro Sharpener(s)* at \$12.95 each plus \$1.95 postage and handling per unit (\$3.00 outside U.S.) Send check, money order or Master Charge. No C.O.D.'s.

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# Sand small pieces by the book

You can make a handy sanding book to conveniently smooth small pieces of wood or plastic. The shop-made tool folds for compact storage between projects. Mount sheets of sandpaper or abrasive cloth of different grit sizes on the inside surfaces of the hinged pieces of plywood and you're ready to sand.

The sanding book shown is made of two 1/2 x 8 x 10-in. plywood pieces joined by a pair of small butt hinges (use 1-in. or larger) mounted on the inside surfaces. The hinge leaves aren't recessed into the wood because some clearance is needed for the abrasive-sheet thickness. The sandpaper sheets shown, one-medium-grit and the other fine-grit, are fastened with No. 2 upholstery tacks; or use 1/4-in. staples.

Don't use glue or the abrasive will be difficult to remove when it has to be replaced. Instead of one abrasive sheet per side, try using two or three strips of different grit. Sand by running the work across the abrasive surface.

When not in use the plywood panels can be closed for storage.—  
*Walter E. Burton*



Fasten sandpaper to the plywood with upholstery tacks or 1/4-in. staples.



Open the sanding book and rub your work-piece back and forth on the desired grit.



# Ski-about fish-about runabouts.

SuperSport™ 18  
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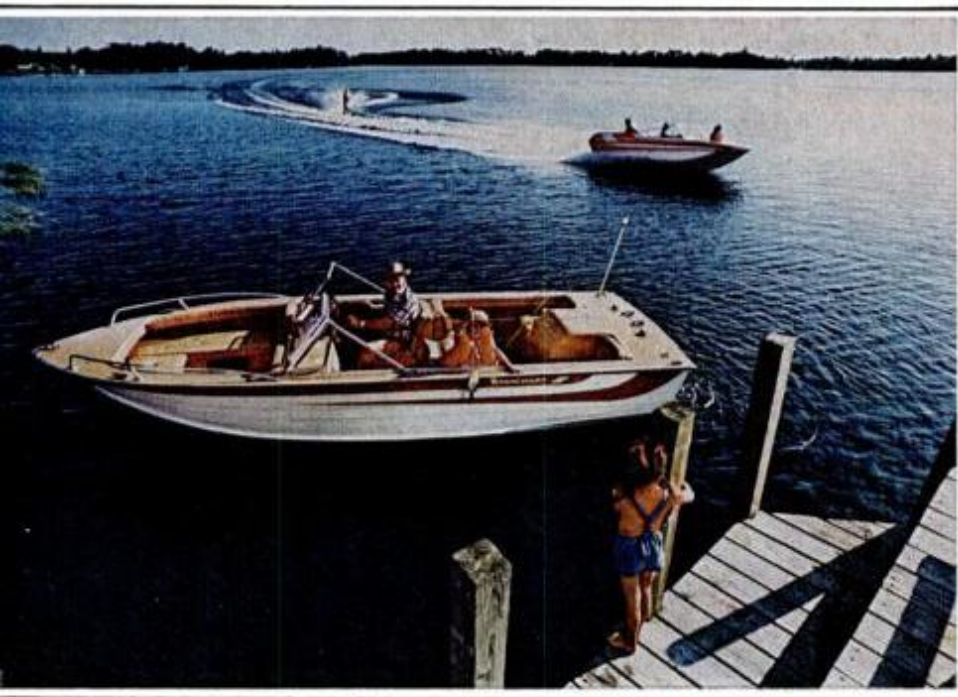
whether you're pulling tandem skiers or running over a light chop.

Starcraft offers more boats for more kinds of boating than any other manufacturer. Aluminum and fiberglass. From canoes to cruisers.

For specific product information and the name of the dealer nearest you, write:

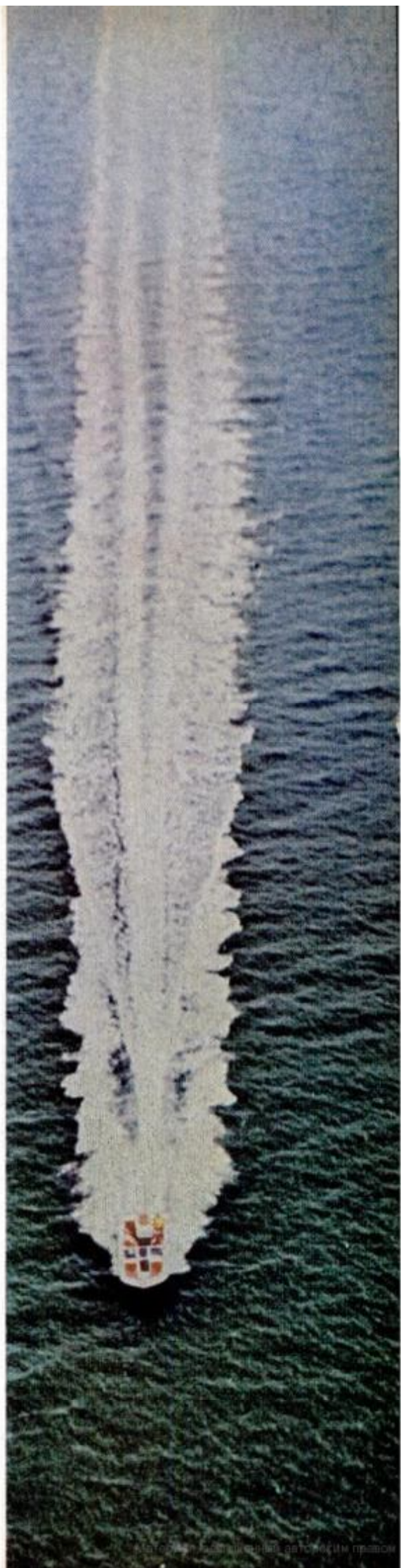
Steve Tracey, Dept. M1  
Starcraft Company  
2703 College Avenue  
Goshen, Indiana 46526.

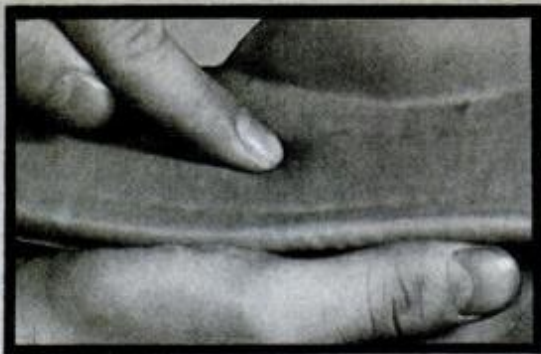
**From the fiberglass TriStar to the aluminum SuperSport, we've got a boat for you.**



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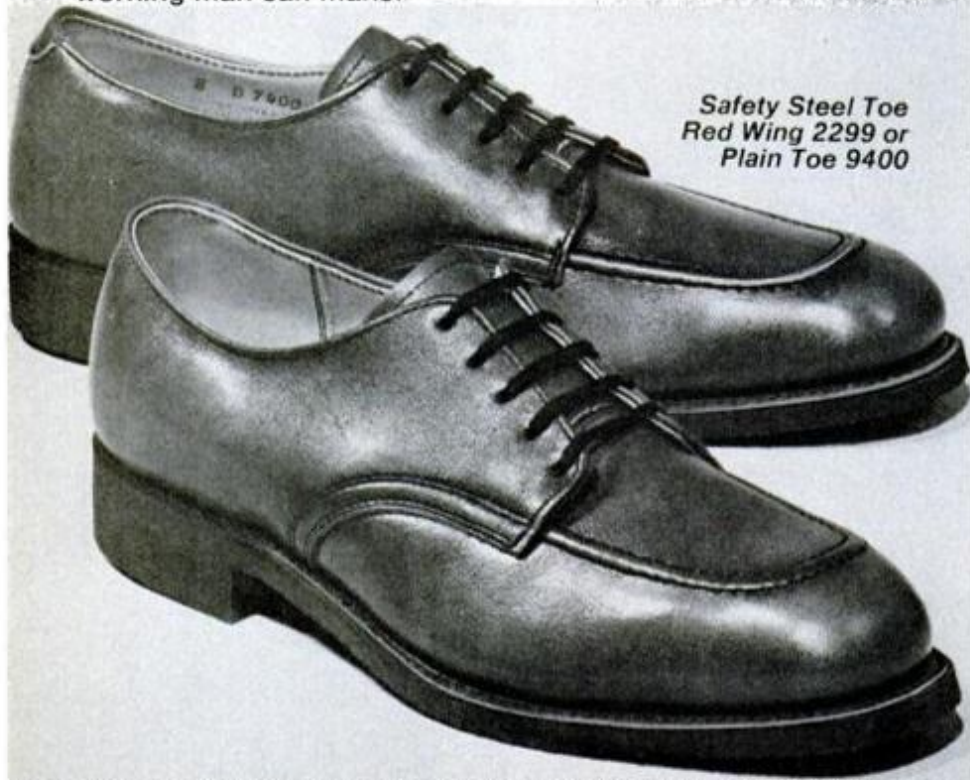


# Get this cushion insole comfort in Red Wing Work Oxfords

*(plain or safety steel toe)*

Your feet will feel comfort the second you step into them and onto this cellulose cushion insole—a layer of extra comfort between your feet and hard surfaces. At the end of your working day, the comfort will remain—thanks to many fatigue fighting features. Among them, a ground cork material under the insole that shapes itself to your foot for a remarkable "custom-fit" feeling. And a triple-ribbed tempered steel shank which gives the good fit solid support.

Your Red Wing dealer can fit you professionally in Red Wing Work Oxfords with a plain or safety steel toe—from a wide range of sizes and widths. Find him under "Shoes" in the yellow pages—it's one of the most comfortable steps a working man can make.



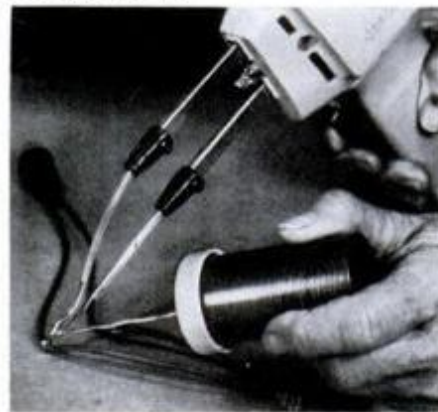
*Safety Steel Toe  
Red Wing 2299 or  
Plain Toe 9400*



Red Wing Shoe Company, Red Wing, MN 55066

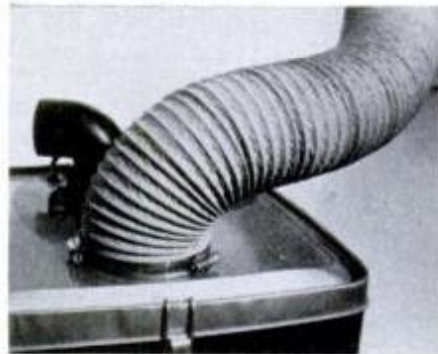
## HINTS FROM READERS

### Solder feeder



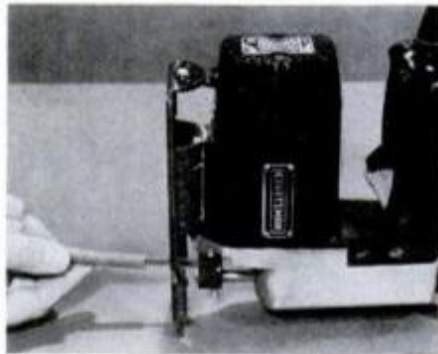
Direct wire solder accurately by using this feeder. Shape the solder around a drill bit into a roll. Fit roll into a pill bottle and feed the solder through the bottle cap.—*D.W. Roberts*

### Hose-clamp stretcher



Make a large clamp from smaller ones to use on a dust collector or clothes dryer hose. Thread the strap of one clamp normally used on plastic pipe under the screw of the next. Add clamps as needed. Buy them at hardware or plumbing supply stores.—*R.S. Wilkes*

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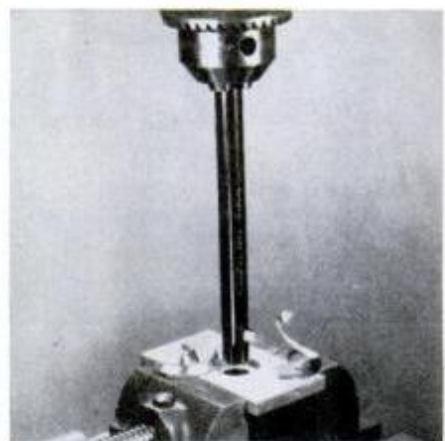
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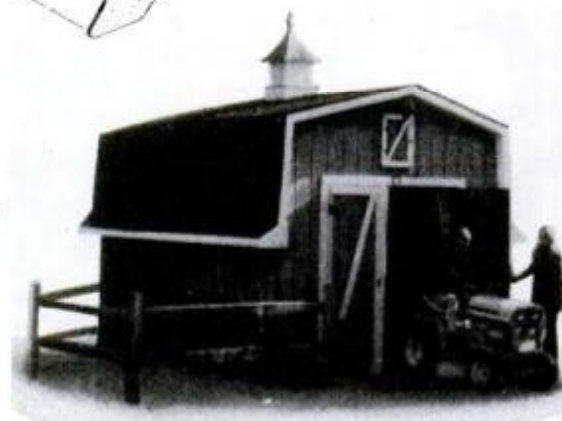
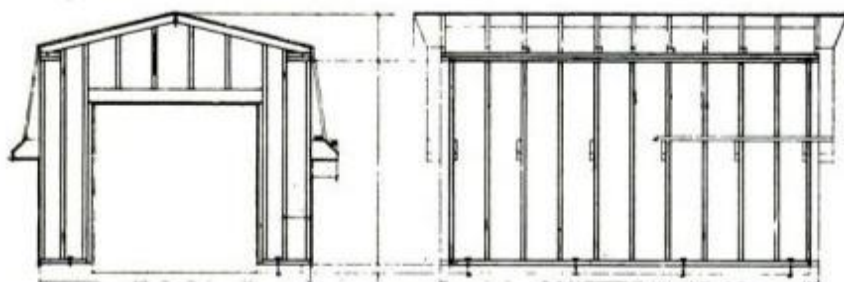
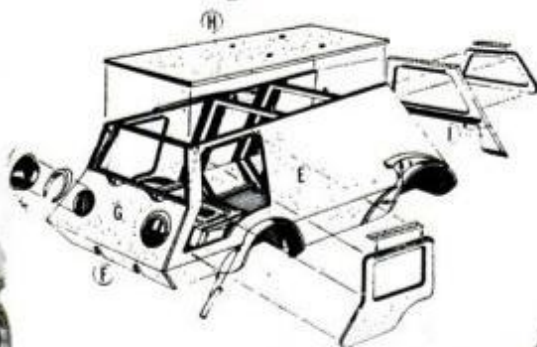


# IN THE AIR, ON LAND



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**BOONIE BUG**



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(Featured in Dec., 1973 issue)

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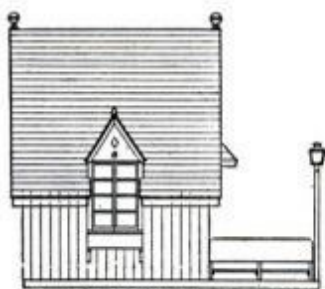
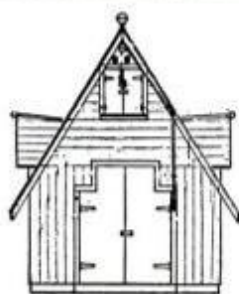
it looks small. More than enough room for bicycles, lawn furniture, garden tools or use it as an office workshop or potting shed. Two sets of plans included, one for yourself and one for your building department. **\$5.95**

(Featured in August, 1972 issue)

**STORYBOOK PLAYHOUSE**—Put up a shed and the neighbors may hate you, but build this handsome little house and you'll be the hero of the neighborhood—especially among the small fry! This compact structure looks more like a storybook cottage than a tool-house—but you can readily use it for storage. In fact, wide barn-type



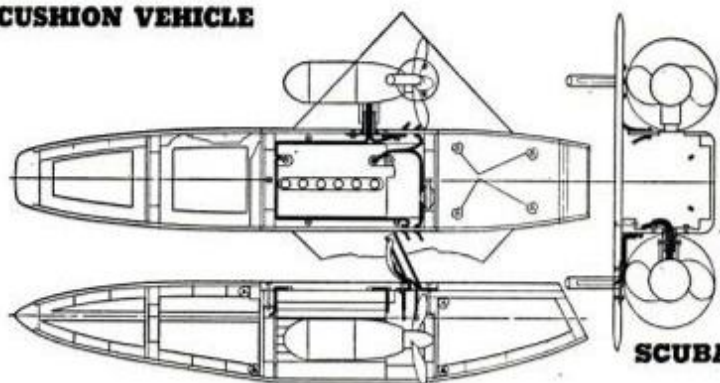
# AND UNDER THE SEA



**STORYBOOK PLAYHOUSE**



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**SCUBA-TOW**



doors in the back lead to a special tool-storage room walled off from the playrooms. You can hang a lot of garden tools inside and still provide plenty of play space. An extra set of plans is included for a building permit. **\$5.49**

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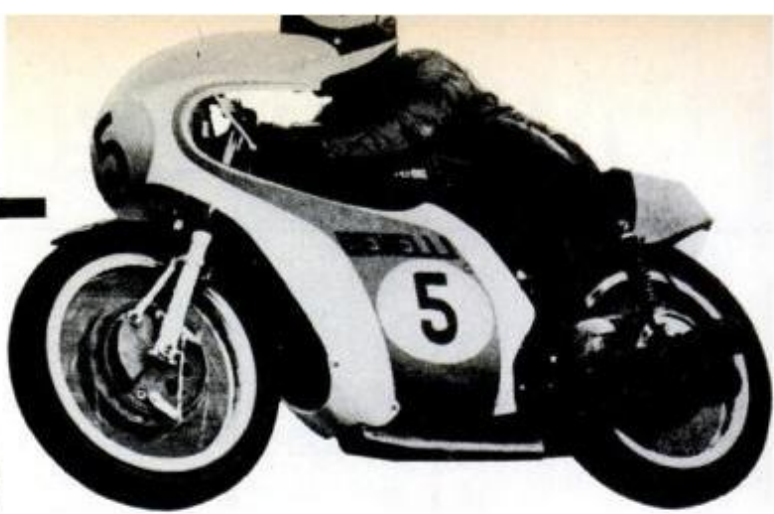
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Plans, Projects Publications

# Air turbulence—how to cope with the invisible threat



by Bill Hampton

If you're like most motorcyclists, you're a fresh-air fanatic. You enjoy having the airstream slap your face and tug at your body. Slipping through the wind on a two-wheeler, you experience a sensation both relaxing and exhilarating.

But air can get unruly. Enough,

in fact, to cause you and your machine to part company under the right conditions.

What are the right conditions?

For one, take a large vehicle like a tractor-trailer truck or bus whizzing close by you out on the highway. Then add something like a strong crosswind into the bargain. And let's say you're traveling on a slippery or unstable surface to boot.

If all these conditions occur at the same time, you could be in trouble.

## The push and pull

Any vehicle in motion will cause a certain amount of turbulence while penetrating the air. But when a large vehicle, like a tractor-trailer or a bus, passes close by, it kicks up all kinds of violent air waves and whirlpool currents.

It can also induce a phenomenon known as the Bernoulli effect. What happens is that when air speeds up, it creates a pressure drop, or suction effect. As the vehicle whizzes by you, a drop in air pressure occurs between it and you. Because air pressure on the *outer side* of your bike is greater than that on the *inner side* between you and the passing vehicle, it tends to push you over toward the low-pressure side.

If a strong crosswind is blowing from the high-pressure side, your motorcycle can suddenly be push/pulled over into the other lane—and into an oncoming vehicle.

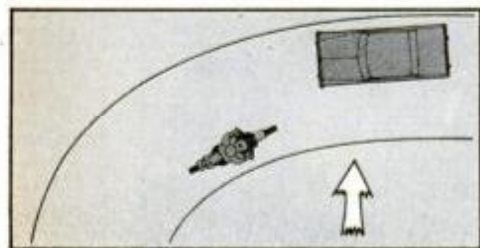
You're especially vulnerable to this phenomenon if you're riding a lightweight bike in high-speed, large-vehicle traffic. Even if you're on a large bike, you have to be careful. Carrying a passenger and high-mounted touring gear adds lots of surface area for air turbulence to act against.

## Tips on position

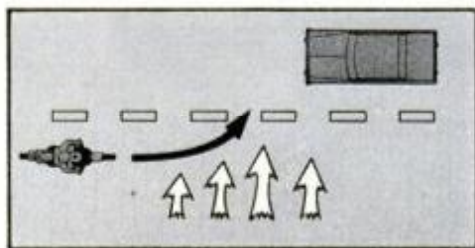
There are ways to minimize the dangers of air turbulence. For example, lane position is important.

Unless you're getting set to pass another vehicle in front of you, keep in the right side of your lane. You want as much room as possible between you and other vehicles. And on multi-lane freeways, ride in a lane compatible with your speed. If you're on a lightweight bike traveling slowly, you can get zapped by a large vehicle passing you on the *right* side, if you're not riding in the slow lane where you should be.

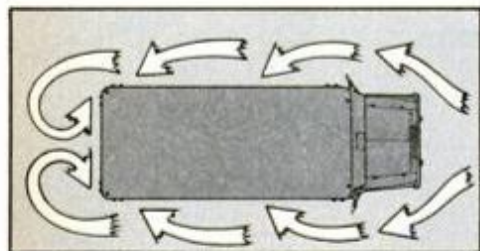
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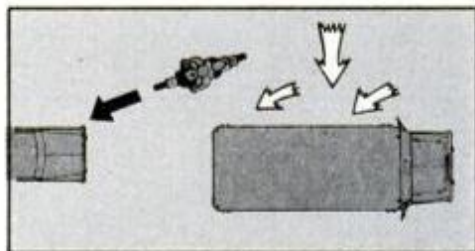
Tailwind becomes a crosswind when you make a right-hand turn. Crosswind can push you right over to the other side of the road and into the path of oncoming vehicles, so be ready to compensate.



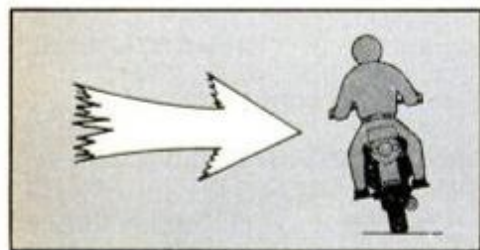
Crosswinds fluctuate in intensity and if you're not constantly ready for unexpected gusts, they could push you into the oncoming lane. Also, don't forget that wet paint markings on road can be slippery.



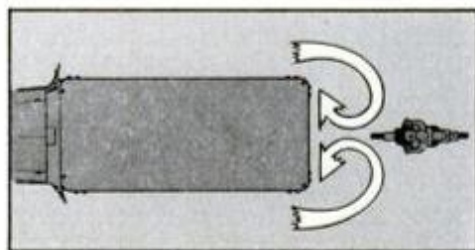
Amount of air turbulence from fast-moving trucks and buses is often underestimated. Pressure differentials added to wind gusts compound the problem for two-wheelers in the vicinity of the big rigs.



Low-pressure or suction area is created by passing truck and can affect your path of travel. This pressure differential is known as the Bernoulli effect and is discussed in detail in the text.



Strong crosswind blowing persistently from the left will cause you to set up a lean to counteract it. If building or other obstacle blocks this crosswind, you could suddenly swerve left, so look out!



Drafting a large vehicle is extremely tempting. The strong suction effect behind this truck can give you a nice, easy ride, but the consequences of a sudden slowing of the truck could be disastrous.

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# DETROIT LISTENING POST

## GM's high-mileage cars

Within the next two years, with the '79 or '80 model cars, every GM division except Cadillac is expected to offer at least one car capable of giving 25 to 30 miles to the gallon in city driving, 35 to 40 on the highway. This will be GM's response to the improved mileage Ford and Chrysler will show as a result of resizing their big cars.

## Turbine engine for AMC?

American Motors has confirmed a report carried in DLP almost a year ago, in the July 1977 issue. The company is working with Williams Research Corp. on a gas turbine for a passenger car. Williams has been building experimental turbines for more than 20 years. AMC announced a contract with Williams last year to put a turbine in a bus or utility vehicle. But nothing was said then about a passenger car.

## GM to cut oil changes

Starting with the '79 or '80 cars, GM will go to a 15,000-mile oil change, but will still recommend once-a-year change if you don't drive 15,000 miles a year. However, the mileage interval will be twice as long as the every-7500-miles change on GM's current cars.

## More aluminum parts

The Aluminum Assn., a group that promotes use of that metal in cars and other products, discloses Chrysler will go to fabricated aluminum wheels and chrome-plated aluminum bumpers for its '79 R-body cars. The Rs are Chrysler's big jobs. The association also predicts more cars will go to aluminum deck lids and hoods in '79—meaning GM and Ford makes, although they are not identified by name.

## Super transmission coming

GM is very high on the new automatic transmission coming on its 1980 cars. The unit will be really new, no carry-over components. It will be smaller and lighter than any automatic GM has produced, and fuel economy will be close to that of a manual shift. If that's so, GM will have a sure winner.

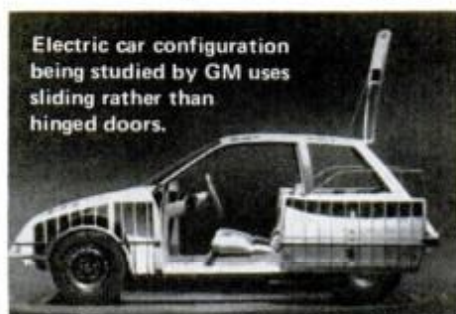
Although sales of manual transmissions are zooming, many car buyers don't like the do-it-yourself

shift. The reason sales are up is that the companies are force-feeding manuals by not offering automatics on certain cars. They do this to keep their mileage figures up to the required government level.

## Second diesel from Olds

"Wait 'til next year." That's the word from Oldsmobile on its diesel engine. There will be two '79 diesels—the 350-c.i.d. V8 that came out last fall, plus a conversion of the division's 260 V8.

Olds will fall about 35,000 units short of its production target of



105,000 diesels this year. The company got off to a slow start on the oil burner because it didn't want to risk turning out bums that would have to be recalled.

Olds now thinks it has a good handle on manufacturing the engine and will shoot for 100,000 diesels in '79 for a two-year total of 170,000. Whatever the number, Olds will have to share its output with other GM divisions. GM also has it in mind to sell the engines to outsiders, contingent on Olds producing diesels in large volume.

## Rating cars on repairability

Would you be influenced in buying a car based on what it costs to repair? The National Highway Traffic Safety Administration is going to do a study to rate cars on repairability after they have been in a crackup. The insurance industry has been compiling this information for years, and your insurance man can tell you almost to the penny what it will cost to repair the car if you're involved in a collision. If you ask him. The industry has the info, but doesn't do a good job of making it available to buyers.

## Service gripes rankle readers

"How can you write such far-out junk?" That's how Paul Nease, of

Pomeroy, Ohio, started a letter taking me to task for the lead item in the January column. The item quoted the service chiefs of the four U.S. car firms on when they expect to build a car that won't require service during the first year of operation.

Paul's complaint—and others—was that Detroit should live up to the 12/12 warranty before talking nonsense about a no-service car.

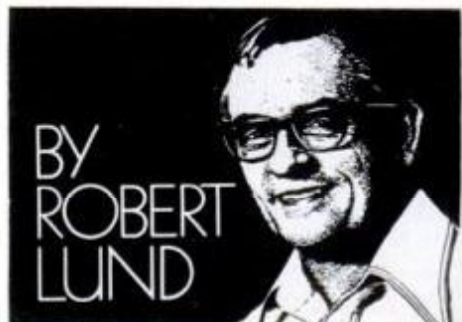
Come on, guys. Don't get sore at me. I just ask the questions and write down the answers. The service guys in Detroit do the best they can considering the constraints they are under. They do not have the final word on anything. The higher-ups call the shots.

Part of the problem is that the higher-ups, the really big wheels, have no idea of what goes on in the real world because they never take a car in to be repaired. Only advice I can offer if you have a service problem is to raise the roof about it. Rant, rave, phone, write letters to anybody and everybody. The squeaky-wheel-gets-the-grease technique. Good luck.

## Save those service records

P.S. to the above. Save all service records on your car as long as you own it. Don't pitch out anything relating to service done even after the warranty expires.

Twice in the past few years GM and Ford have been caught paying off on repairs after cars were out of warranty. The companies say they no longer have secret warranties. I take their word for that, but there have been instances where they have made good on service problems after the warranty period because owners were able to produce detailed maintenance histories proving they had followed all factory recommendations on service. **FM**



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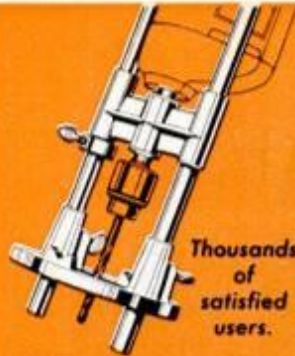


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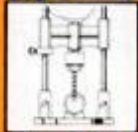
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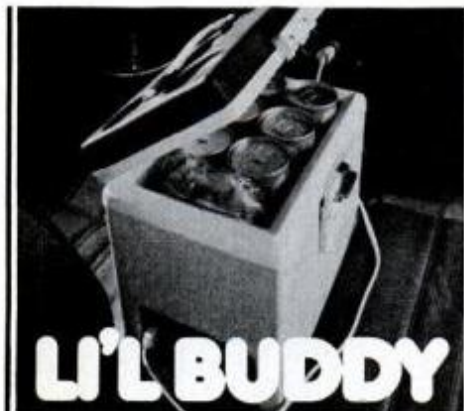
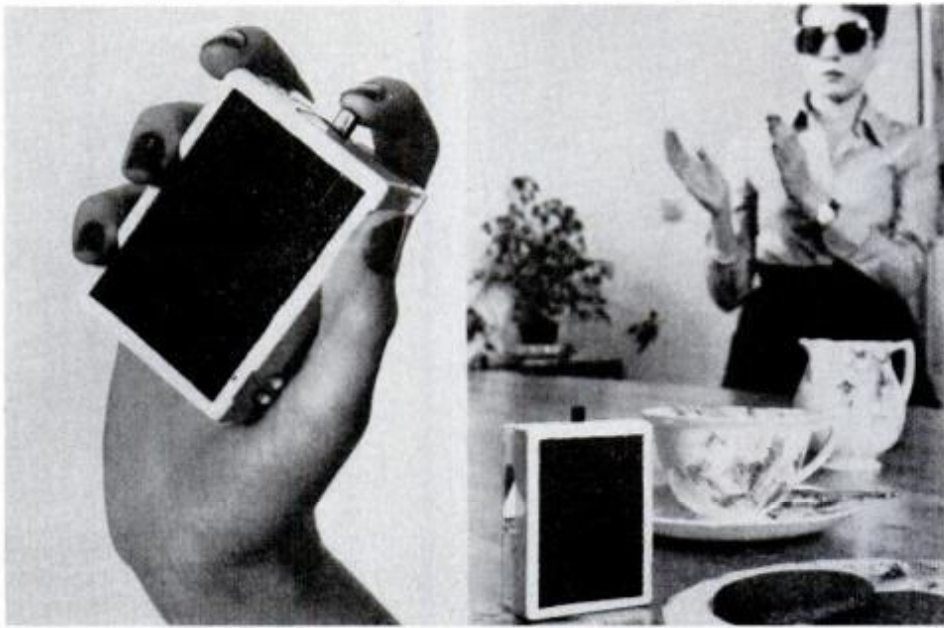
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## Beeper for the blind

Blind people can locate an object more easily with this British device next to it. A handclap within a 20-foot radius of the Homer triggers a 3-second beep. It's powered by a standard 9-volt battery. Cost is about \$11 from Castleham Industries, Collett Close, St. Leonards-on-Sea, East Sussex TN38 9QS, England.



## LI'L BUDDY

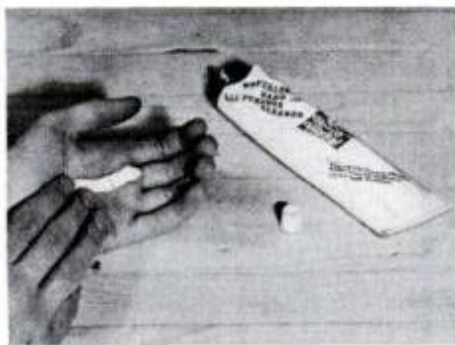
A great traveling companion in your car, boat, plane, truck or camper. Just plug it into your cigarette lighter and space age technology provides you with 38° cold or 130° heat.

- Big enough for 16 oz. 6-pack with extra compartment for lunch meat or cheese
- Solidly built—2 tone high-impact polystyrene with one inch polyurethane insulation, seamless anodized aluminum liner, solid state thermo electric 12 volt motor with 2 way switch for hot or cold (optional AC converter)
- Money Back Guarantee—If you are not completely satisfied after 30 days we refund your money.

**\$59<sup>95</sup>**

LI'L BUDDY, P.O. Box 12, Miami Springs, Fla. 33166  
Please send me two-tone  Green.  Blue.  Brown.  
My check  or Money Order  for \$59.95 is enclosed  
Charge to my  Master Charge  Visa  Am. Express  
Include your card no., expiration date & signature.  
AC Converter  \$14.95 (included in my payment)

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City/State/Zip \_\_\_\_\_



## Come out smelling like—fruit?

Really Works is a citrus-based waterless hand cleaner that is biodegradable, nonpolluting and water-soluble, the maker claims. A 5-ounce tube lists for \$2.39. Vin-Dotco, Inc., Arbor Office Center, Clearwater, Fla. 33516.

## Utility cart folds for easy storage

When the five-bushel-capacity Stow-A-Way utility cart is not in use, it folds from its usual 23-inch width to only 10 inches. Cost is about \$60 from Stow-A-Way, Inc., Box A, Hesston, Kans. 67062.



## Easy to build model ships

These 1/24th-scale models are made much as real ships are. No parts are molded or precut. Yet construction is not difficult, the maker claims. About \$20 from Replica Seacraft, High Ridge Park, Stamford, Conn. 06905.

# SuperSander™

**It outperforms  
ordinary  
sandpaper  
up to 10 to 1.  
And that's a  
promise.**

SuperSander cuts faster. Lasts longer. And resists tearing better than ordinary packaged sandpaper. Try it.

You'll agree SuperSander is the best sanding product you've ever used, or Carborundum will give you your money back.

Look for SuperSander belts, sheets and pressure sensitive discs wherever you buy power sanding supplies. Or write for the address of the SuperSander dealer nearest you.

The Carborundum Company  
Consumer Products Division  
P.O. Box 337  
Niagara Falls, New York 14302

**CARBORUNDUM**



**M**itered joints demand accuracy. Even a slight miscalculation will inevitably compound itself into a conspicuous, wedge-shaped gap in your finished work. Not only is this frustrating and shoddy-looking, but it's also expensive if you choose to try again and redo it.

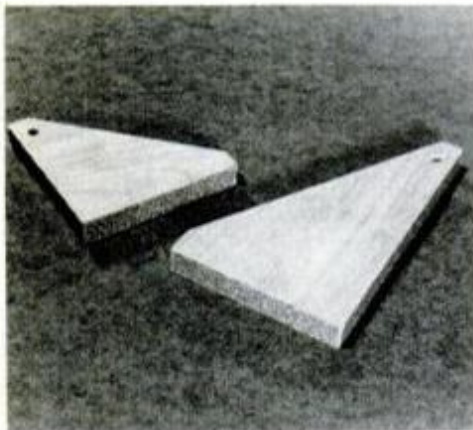
A set of blocks for common angle cutting will take only half an hour to make from scrap plywood. They'll help you minimize waste and save hours of job time. No longer will you have to adjust and readjust your miter gauge every time you change from making a right-hand to a left-hand cut. Set it at 90° and move the miter gauge and block from one side to the other—or remove the block to cut at 90°.

The photos show how to hold and use the blocks. *Note: The blade guard has been removed for photo clarity only.* Be sure the block does not contact the blade—the garnet paper will dull it.

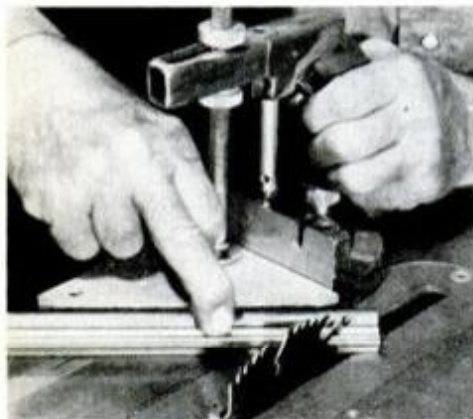
To make the blocks, cut a 6x8-in. rectangle and a 6x6-in. square from 3/4-in. plywood. Make certain one corner of each is a true right angle. The easiest place to get a perfect 90° corner is from the mill-cut corner of a plywood sheet. Lacking that, set your gauge with a dependable square and cut your own. Also check your



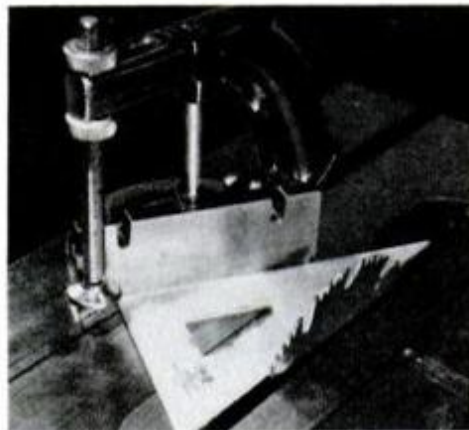
Angle blocks save time, assure accuracy. Blade guard is removed for photo clarity.



Garnet paper edging helps keep block and workpiece from slipping or "creeping."



Safely position fingers when mitering narrow picture frame moldings as shown.



For true angles on the blocks, use draftsman's triangles to set miter gauge.



The 45° angle block makes mitering door or window casings quick and easy.

blade with the square to be certain you are making a true vertical cut.

Next, reset your miter gauge to the block angle you intend to cut first (45° or 30°). Use the appropriate draftsman's triangle with its long side butted against the fully exposed width of your blade (see photo). On a set-tooth blade, where teeth alternately point in opposite directions, be certain that contact is made at equivalent points on two teeth pointing in the *same* direction. The miter gauge is then set flush to the opposite side of the triangle as shown at left.

Proceed to make your cuts. Trim 3/4 in. off all acute angle corners to provide additional clearance between block and blade while cutting. Use contact cement to adhere 5/8-in.-wide strips of 80-grit garnet paper to edges. Finally, drill a hole in one corner of each block for hanging near your saw.

These blocks can also be adapted for use on a radial-arm saw. Simply place a board between the fence and the block to provide clearance for the cut-off end. The advantage is that you won't have to lift and swing the blade out of the 90° groove, then lower it into the angled groove each time the direction of cut is changed.—*Frank H. Day.*



# How to make a good drink great.



Make any drink with Seagram's 7 and make it a great one. For a smooth, refreshing 7 & Cola, pour 1½ oz. Seagram's 7 over ice in a tall glass. Fill with cola and garnish with lime.

**Seagram's 7 Crown**  
Where quality drinks begin.



# Come to Marlboro Country.



Marlboro Red or Longhorn 100's—  
you get a lot to like.

7 mg. tar, 1.0 mg. nicotine av. per cigarette, FTC Report Aug. 77

Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

# The glory days of a grand old lady

Still flying after more than 40 years, the venerable DC-3 brought us mass air travel, fought in three wars and may have survived more perils than any other type of aircraft.

First DC-3 to fly was this DST (Douglas Sleeper Transport) built for American Airlines. Historic maiden flight was made December 17, 1935, lasted 1 hour, 40 minutes, was described as "routine." Craft slept 14 in train-type upper and lower berths, was later converted to coach seating up to 30 passengers.

by Bill Kilpatrick

At 1:23 p.m. on Easter Sunday, April 21, 1957. Frontier Airlines Flight 7, a twin-engine DC-3 bound from Prescott to Phoenix, Ariz., roared off from Prescott's Municipal Airport on a routine hop that was to become a living nightmare. Aboard were 23 passengers, pilot Dale Welling, copilot Herman Wrasse, and flight attendant Donna Bailey.

The approximately 80-mile, 40-minute flight would see them flying at an altitude of 6500 feet between two mountain ranges—the Bradshaw Mountains on the right, the New River Mountains on the aircraft's left.

Weather conditions, although less than ideal, were well within federal VFR (Visual Flight Rules) minimums. There were scattered clouds at 1500 feet, broken clouds at 3000 feet and solid overcast at 10,000 feet. Visibility was 20 miles, and there were light, scattered rain showers. There was also some slight turbulence, enough so that Welling elected to keep the seat belt sign on. Far ahead and to the southeast, he and Wrasse noted a beginning buildup of converging cloud layers.

As Flight 7 approached a town called Bumble Bee, about halfway between Prescott and Phoenix, the weather started to close in. The overcast was down to 7500 feet, and intermittent rain showers began to restrict visibility. To the

right, the Bradshaw Mountains could still be seen quite clearly.

Beyond Bumble Bee, near an area of the New River Mountains called Look-out Point, Welling observed that the weather was becoming marginal for

VFR flight. Still, he felt they could proceed visually to a point known as the Knob Intersection, about 28 miles ahead, where they would then go on instruments. Accordingly, he radioed air traffic control requesting an appropriate instrument clearance. The time was 1:39 p.m.

Welling then noticed that his airspeed was beginning to fall off and that, gradually, he was losing altitude, both of which he at first attributed to the turbulence the aircraft had been experiencing throughout the flight. He cranked in more power, but that failed to check the aircraft's slow descent toward a low cloud bank directly ahead. He poured on even more coal, but still the DC-3 continued to settle. Realizing he was in a severe downdraft, Welling shoved the throttles to full power and felt the aircraft's nose rise slightly as it passed into the cloud bank.

Copilot Wrasse received the requested instrument clearance at about 1:44 p.m., noting at the time that the altimeter indicated 4500 feet. Moments later—engines straining in the effort to gain altitude—Frontier Airlines Flight 7 smacked into a mountain.

Welling felt the aircraft lurch sharply up and to the right, then tumble over on its left side. Instinctively, he cut power to the right engine and kicked in full right rudder in an attempt to skid



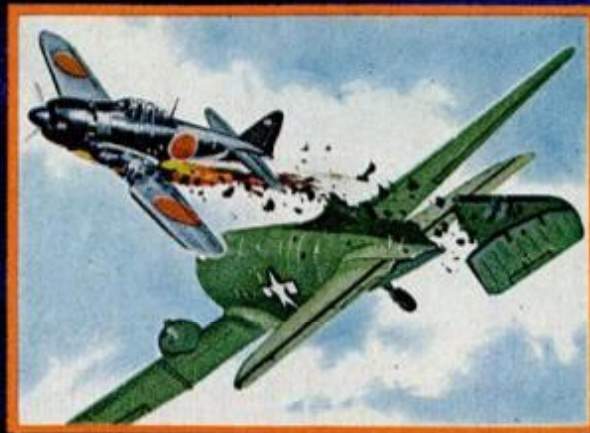
Lined up to unload (top), C-47s (cargo versions of DC-3) played major role in famed Berlin Airlift in 1948, breaking Russian blockade of city. Above, a DC-3 lives on as a sleek, new trimotor turboprop.



*Buried for months in snow on a glacier in Iceland, a C-47 was abandoned by the Air Force as hopelessly unsalvageable. But the owners of Icelandic Airlines dug it out and flew it home—on engines and batteries still able to operate after the long freeze.*



*Military DC-3s (C-47s) were a hardy lot. In World War II, a Japanese kamikaze pilot tried to shoot one down, then, unable to do so, rammed it. The kamikaze crashed; the undaunted C-47, shorn of much of its cabin, staggered on home, a bit drafty but safe.*



*In another wartime skirmish, a Japanese Zero collided with a C-47, slicing off most of its rudder. The Zero plunged to earth, while the tailless C-47 managed to wallow back to base, being officially credited with an enemy "kill" by downing the hapless Zero.*



In the early days of air travel, little could approach the glamor, excitement and sense of adventure of a nighttime flight, as depicted in the scene shown here. You could board an American Airlines DC-3 sleeper on the East Coast, retire in the comfort of a Pullman-style berth, and awake the next morning on the West Coast—a truly magnificent way to cross the country in an era when the trip by train or car could take nearly a week.





**New beak for an old bird:** Yep, it's a DC-3, though you have to look closely to tell. This modernized version, Tri Turbo-3, sports three turboprops in place of two original piston engines—with one perched smack on the nose, giving the normally docile craft a sharp-beaked, hawkish look. The three Pratt & Whitney PT-6s, turning five-bladed props, develop 3600 hp for a cruising speed of 230 mph and 3000-mile range. The developers, Specialized Aircraft, Camarillo, Calif., hope it will add another 25 years' life to the 2500 or so aging DC-3s still flying. Cost of remodeling: about \$575,000.



**Hair-raising experiences**

Incredibly, Flight 7 wobbled on, landing safely at Phoenix at 2:05 p.m., about two minutes behind schedule. The flight had covered about 84 miles, at least 37 of which were among the most hair-raising miles ever flown.

Flying hair-raising miles, however, was—and still is—nothing special in the illustrious career of what, in many respects, is the most remarkable aircraft ever built. Since it first flew on Dec. 17, 1935, at Santa Monica, Calif., the "all in a day's work" exploits of the DC-3 have become part of aviation lore throughout the world.

**Not much she couldn't do**

Known in various versions as the C-47, the R4D, the C-53, the Dakota or Dak (by the British), the Skytrain, the C-49, the Doug, the Old Three, the Gooney Bird, and by many other designations and nicknames, the DC-3 has earned a worldwide reputation for dependability and durability under impossible conditions. Some of the things it has done in the air, some of the situations it has survived, approach the realm of the unreal. No aircraft in history has been so abused by man and nature and yet come off so well.

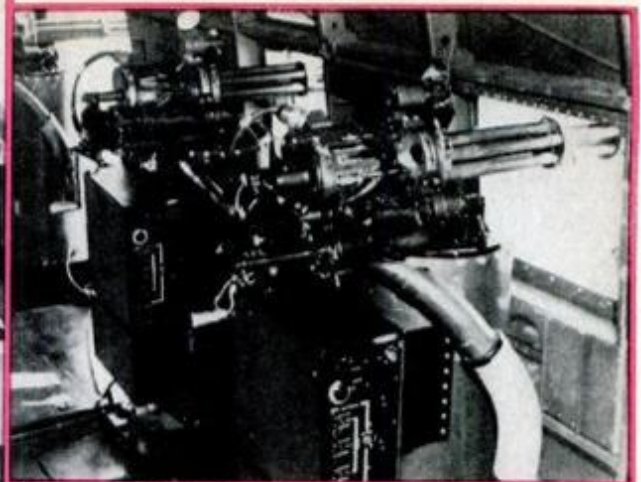
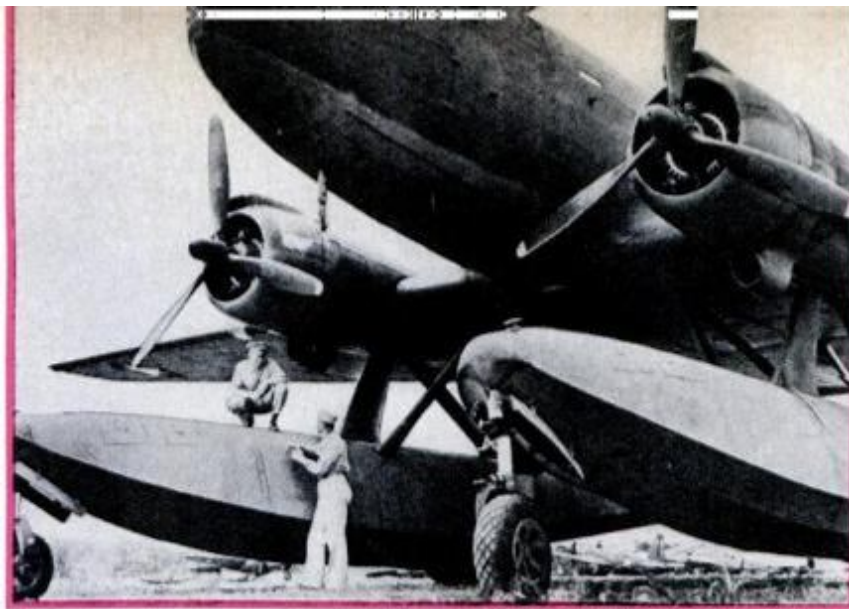
Designed originally to operate at a gross weight of 25,000 pounds, the

the aircraft back up to level flight. Despite its being wracked by severe vibrations, the DC-3 responded to the controls and staggered up and away from the point of impact. Welling had no idea what had happened, no idea what loomed ahead.

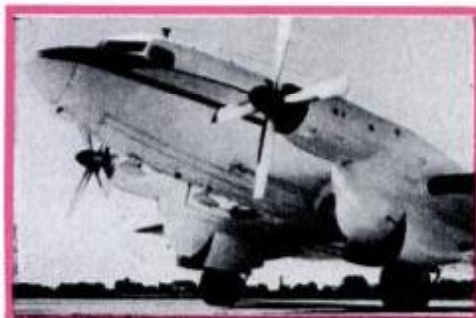
All he could do was wrestle with the controls as the aircraft fought to climb. A few seconds later, out of the cloud bank and into the clear, Welling looked out and saw that nearly nine feet of the left wing had been sheared off!



DC-3s boasted crew of three—pilot, copilot and one real, live stewardess. On short hops, you got a sandwich and apple; longer flights included luxury of a hot meal. First DC-3s were outfitted as sleepers with Pullman-style berths (center left). In later versions, seats replaced bunks (top left). After World War II, many went into corporate service with plush interiors (bottom left).



Military version of the DC-3—the famed C-47—carried everything from armored vehicles, artillery and troops to whole airplanes. They'd strap the wings of a P-40 under its fuselage and roll the fighter into the cargo hold. Where there was water but no landing strips, they stuck on floats (above) to give the transport amphibious operation. It flew paratroopers into battle—and ferried the wounded gently home. In Vietnam, some were even fitted out as gun platforms (top right) with rows of multi-barreled guns firing out of windows that used to provide scenic vistas for prewar civilian passengers.



Another modified DC-3 is this Super Turbo-Three with longer "stretched" fuselage and turboprop engines. It's designed for short-haul commuter runs and cargo jobs.

DC-3 has repeatedly been overloaded—particularly by the military, and especially over the Burma Hump during World War II—to gross weights of 31,000 pounds and more, yet has still managed somehow to heave itself off the ground. There has never been, apparently, anything within loose reason the Old Girl couldn't do, no indignity she couldn't somehow surmount:

■ A midair collision clipped five feet from one wing of a Capital

Airlines DC-3, yet its pilot brought it down reasonably intact, its passengers and crew safe.

■ In China during the early days of World War II, a Japanese bombing raid blew all of one wing off a DC-3 parked at an airfield. Undaunted and critically in need of transport aircraft, the Chinese nailed a 5-foot-shorter wing of a DC-2—the only roughly similar spare available—onto the damaged DC-3 and, adjusting for a tendency to roll to the right, operated it for many more flight hours.

#### Downed a Zero fighter plane

■ In the China-Burma-India Theater during the war, a C-47 (military version of the DC-3) had the distinction of being the only Allied transport plane to be credited officially with downing an enemy aircraft. An attacking Japanese Zero slammed into its tail, slicing off all but a foot-and-a-half of its rudder. The Zero careened and crashed, but the C-47 weaved home to its base and was soon back in service.

■ Another C-47 also downed an enemy aircraft, but apparently was not officially credited with the "kill." An attacking Japanese kamikaze pilot first attempted to shoot down the lumbering, unarmed C-47. After several unsuccessful passes, however, he rammed the defenseless transport, leaving a huge, gaping hole in the top of the fuselage. The kamikaze went down in flames; the

(Please turn to page 156)



Old DC-3s never die, but they become some strange things, including restaurants and bars. Now Smokey Rolland, a retired flagpole painter in Cardiff, Calif., is turning a junked DC-3 fuselage into—would you believe?—a motor home. Powering the 42½-foot-long camper has yet to be worked out, but the interior (right) is already comfortably equipped with reclining lounge chairs (from a 727), bunks, complete kitchen and bath facilities. Is a DC-3 street-legal? Rolland will soon find out.

Photos: The San Diego Union

# Pedal-pushers hit the road

Bike touring  
isn't just for youthful  
athletes and cycling fanatics—  
it's for everyone.

by Dick Teresi



Uphill with full load: handlebar bag, panniers, sleeping bag. Triangular fanny bumper reflects for safety.



Three touring moods: left, the serenity of a country road; top, the camaraderie of group cycling; and above, the misery of climbing a hill in the rain.

**B**icycle touring is beautiful, romantic and healthy. Cycling gives you a sense of freedom and adventure that car travel cannot. It lets you see the countryside up close, lets you explore back roads and places you would not visit otherwise. On a bike colorfully packed with gear you draw friendly attention, so you tend to meet people as you travel. And you develop a closeness to those with whom you're cycling.

Bike touring is perfect for a vacation or even just a weekend. In fact, you've probably already considered its possibilities. So why haven't you tried it? Here's why:

- You don't think your body can handle it.
- Bike touring is for kids, and you're not a kid.
- Bike touring means camping. And you're very fond of hotels. In fact, you developed a psychotic fear of tents in the Army.
- You also fear the unknowns of





Background: a cyclist climbs a long hill in Montana's Glacier National Park. Clockwise from above: helmeted biker takes a swim; woman enjoys a scenic rest stop; cyclists ride ferry for reduced rates; and the time-honored task of map reading.



Tandem touring makes efficient use of pedaling power, but requires great coordination of both riders. Not for beginners.

cycling: how to find your way over country roads, where to eat, where to find shelter.

■ Finally, you're not a nut. And cyclists are nuts. They wear funny striped shirts, silly little hats; they sit on hard, skinny seats and like it!

Frankly, these are all pretty good reasons. Or rather, they used to be. Because bicycle touring is changing fast. A recreational activity that was once the domain of athletic teenagers and a few fearless, fanatic adults, bike touring is now opening up to the rest of us.

### Set your own pace

Organizations have sprung up over the past few years that have taken many of the fears out of cycling. There are organized tours—many tailored to adults—that cover as little as 10 to 20 miles per day. Some arrange for overnight stays in hotels, inns or other shelters so camping isn't necessary. "Sag wagons" are

becoming more popular. These are vans or station wagons that carry all personal gear so bikers need not weigh down their bicycles with heavy packs. Sag wagons can also give a lift to sagging cyclists who need a break, and carry spare parts and tools for on-the-road repairs. And new cycling maps—with details you absolutely need but cannot find on regular highway maps—are now available.

"A novice's main worry," says John Freidin, director of Vermont Bicycle Touring (VBT), "is whether he can physically make it, whether he can keep up." This fear, in most cases, is unjustified. Freidin, whose organization led 2200 cyclists through rural Vermont last year, estimates that 98 percent of his riders completed the route they had chosen. Freidin's customers are not kids, either. The bulk of them are between 25 and 45 years old, many making their first bike trip.



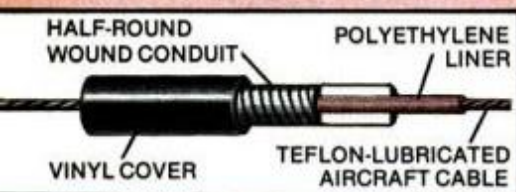
Short day trips with light loads build up the cyclist's stamina for the long haul.

## Upgrade your bike...

Here's the latest in bicycle equipment. Most items may be purchased separately at sporting goods or specialty bike shops as replacement parts to upgrade your present bike.

**Teflon-coated brake cables.** Regular brake cables get very sticky with age and are hard to lubricate. But permanently lubed Teflon-coated cables slide back and forth inside a plastic-lined housing cutting friction by a claimed 40 percent—meaning smoother, faster, safer braking. There are two brands: Elephant and Ultra-Glide.

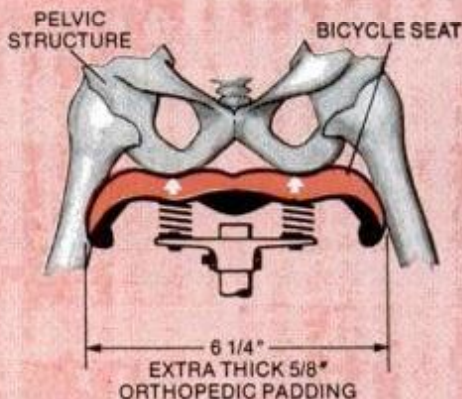
**Comfortable saddle.** Saddle sores have driven many tender souls away from cycling. If this is your problem,



Teflon-coated brake cables are permanently lubricated; reduced friction—up to 40 percent—means much less effort.

bicycle experts recommend the new Avocet touring saddle. Its special contour gives pelvic bones extra support while minimizing contact between soft parts of the crotch and the saddle. There's also a wide-profile woman's saddle.

**Easy shifting, Part 1.** Many novices can't get used to the way you shift a 10-speed: you must always be pedaling as you change gears. Shimano has introduced a system called the FF (front freewheeling) that let's



Avocet touring saddle is designed to provide critical support points for human pelvic structure and cut fatigue.

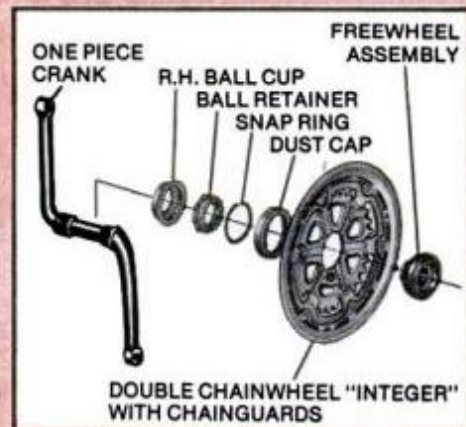
you shift while coasting... or even backpedaling! The system is somewhat complicated because it has an extra freewheel up front in the chainwheel, making it very difficult to add to your present bike. But many brands now offer the FF as standard.

**Easy shifting, Part 2.** Shimano also makes the Positron, a derailleur that has definite click-stop positions on its lever for each gear, like a car. A conventional derailleur has no definite positions (you must move the lever until you feel the chain fall on the right gear—often difficult for the beginner). The Positron may also be shifted more than one gear at a time or even while the bike is stopped. It's often combined with the FF system (above) as standard equipment or may be purchased separately.

**High-pressure tires.** The higher a tire's air pressure, the harder it will be and the faster it will roll. Stan-

dard tires may be inflated to 70 pounds per square inch. But now there are tires that will hold 90, 95, even 100 pounds. They are also lower in profile so less rubber meets the road. Many brands available.

**Antipuncture treatments.** The biggest repair problem is still the flat



Shimano front chainwheel "freewheeling" system allows gear shifting free of pedal movement—even on hill climb.

tire. While nothing will make a tire puncture-proof, there are many sealants that will improve a tire tube's puncture resistance. Most work on a similar principle: a fluid—often containing fibers, minerals and sometimes a vulcanizer—is injected through the valve into the tube. When a sharp object punctures the tire, the fluid seals the wound and prevents a flat. Does it always work? No, experts say, but sometimes it's better than nothing. However, a tube so treat-

The secret, if you're a beginner, is to plan an undemanding route. VBT this year is offering 115 supervised trips of varying difficulty. There are weekend, three-day, five-day and week-long tours, costing from \$77 to \$259. No camping is necessary. Cyclists stay overnight at country inns. Sag wagons are provided on all tours of three days or longer.

Bikecentennial, perhaps the most publicized touring organization in the country, is also reaching out to beginners. In 1976, Bikecentennial pioneered the TransAmerica Bicycle Trail—a 4250-mile route of mostly scenic, low-traffic roads stretching from Oregon to Virginia. Though Bikecentennial made its reputation leading some 3000 cyclists over this 90-day cross-country trail, it's now offering seven shorter routes in various parts of the United States. Three of these supervised trips take eight days or less. Some require camping, but others book cyclists into hotels.

For many bicyclists touring means independence—not having to stick with an organized group. There's also good news for these individuals.

Bikecentennial sells special, ultra-detailed maps so you can plan your own trip anywhere along its 4250-mile trail. There are also maps available for other areas: in Oregon, Montana, Kentucky and Virginia. The maps give directions from a cyclist's point of view and feature very detailed drawings of difficult intersections or other problem areas. Camping sites and grocery stores are well marked. Accompanying guide books point out historical landmarks, prevailing weather and wind conditions and warn of special problems, such as a scarcity of campgrounds, grocery stores or water.

Bikecentennial also serves as a clearing house of information for its members (anyone can join; dues are \$12 a year for individuals, \$17 for

families). Members can find out about touring services (bike trip organizers, bike trails, public cycling programs) in their part of the country by writing Bikecentennial (address on page 200).

Vermont Bicycle Touring will also plan individualized trips for people, supplying customized maps and booking cyclists into hotels.

### Cycling in style

No discussion on cycle touring is complete without mentioning the International Bicycle Touring Society. The IBTS, founded in 1964 by California surgeon Clifford Graves, is for adults only (21 and older). The society runs 21 different tours in the United States and Europe, and is unusual in that all organizational duties are done on a volunteer basis—there are no paid leaders.

Though the society warns its members they must be prepared to

*(Please turn to page 198)*

## ...and go touring

ed is sometimes hard to patch.

**Small panniers.** In 1970, Hartley Alley, a veteran cycle tourist, designed TC panniers, the first really modern bike bags—waterproof, easy to attach, lots of outer pockets, with mating zippers that could be joined together into a single piece of airline carry-on luggage. But they're basic-



Handlebar bags provide place for things you want to get quickly, but too much weight can affect steering, unless . . .



. . . you mount bag behind seat with an accessory called Seat Post Thing.

ly for the long-distance cyclist and cost \$55. Now Alley's come up with smaller panniers, using the same design, for the front of the bike. However, they can just as easily be used on the rear for short hauls. For a catalog, write The Touring Cyclist Shop, Box 4009, Boulder, Colo. 80306.

**Fanny pads.** Alley also makes Fan-



ny Pads: four-inch square adhesive, felt pads. Saddle sores? Just pop one on where it hurts.

SPT. That stands for Seat Post Thing. It's made by Eclipse and it's a clamp that attaches to your seatpost and lets you suspend a handlebar or other type of bag behind your saddle. Normally, bags that hang behind the seat tend to dangle annoyingly. But SPT is rigid. Available at bike stores.

**Instant tent.** Take the four-pound FasTent out of its stuff sack, throw it on the ground and it immediately springs open. An internal steel coil unfolds as the tent is pulled taut and staked at the corners. Available at camping outlets.

**Slick touring derailleur.** The touring cyclist has always had to settle



Eclipse rain cape uses elastic loops to keep it snugged down front and back.



for second best when it comes to derailleurs because good racing derailleurs handle only higher gears. Touring derailleurs that will shift into lower gears (they need to be longer to do this) are generally not as well made. But recently Sun Tour introduced the Cyclone GT, a touring derailleur patterned after the same design and made of the same alloy as its Cyclone racing derailleur. PM has tested the Cyclone GT over mountains, through prairies, in rain and in snow. It shifted smoothly at all times with little need of adjustment.


# America— Can you dig it?

You can. Dedicated amateurs find plenty of archaeological thrills in their own U.S. back yards.

by Maggi Stevens


A few bits of broken pottery or rude stone tools can often provide valuable clues to the nature of the oldest, most mysterious American cultures.





To most of us, the very word "archaeology" projects the stereotype of some bespectacled, pith-helmeted professor rooting around at the base of a pyramid, just as one of the hired native diggers has noticed something and shouts, "Ef-fendi, come quickly! . . ."

Well, on-site archaeology *is* often exciting, but it does not have to be so exotic or exclusively populated by professors and paid hands. A lot of amateur "diggers" are doing important and interesting work right here in the United States, virtually in their own yards; many initiates become fascinated in short order.



I had gone on my first dig only a few months before on a chance invitation, yet the moment I saw the Suma site, set in a clearing amid tall pines on the New Jersey bank of the Delaware River, I knew I was hooked. Once, 7000 years ago, an Indian tribe called this place home. Its members hunted and fished, and fought off their enemies in this sheltered glade; they built their fires in carefully constructed pits, made

fine arrow points and swift canoes.

Therefore, while some people prefer to practice tennis lobs or down martinis, I now grovel in dirt, irrevocably addicted to shoveling, sieving and cataloging.

My membership in the Orange County Archaeological Society of New York State, was a big step. Hoping to excavate something—anything—somewhere, I had joined various historical organizations. Alas, the local ladies did nothing but sip tea and attempt to improve social standing. A fortunate meeting with an old acquaintance changed all that. He took me to meet a mastodon.

Unrelenting rain had turned the earth to liquid mud. "Dig now or not at all," admonished the farmer, whose plowing deadline was already past.

So dozens of us volunteers, well garbed in oilskins and boots, slipped and slithered in the muck of a dark and seemingly bottomless pit. Gently we passed the ancient cargo of bones to the surface, faces anointed with sweat and rain. This muddy vision was my introduction to the mastodon Sugar (named after nearby Sugar Loaf Mountain), who now resides in resurrected splendor at Orange County Community College.

Sugar's rescuers (all members of the Orange County association) proved a delightful cross section of society. Mistakenly, people tend to think only in terms of professors and esoteric university programs when excavation is discussed. In actual fact, archaeology is a relatively young science (in this country) not yet stifled by the stuffiness of the academic establishment. Factory workers and engineers, farmers and ex-

KEN BARR

ecutives discuss such topics as the dating of post molds (marks left by ancient wooden structures), or the most efficient way to fell a tree. They may have but one thing in common—reverence for the past and knowledge of what it means to the future.

### Cadaver brought police raid

My own initiation into amateur archaeology became a baptism of fire. Once, while digging on New York City's Staten Island, there was a police raid!

Tipped off by a concerned citizen, the gendarmes converged on the site from all directions—lights flashing, sirens wailing. They, the medical examiner and the coroner demanded to see the cadaver we had reportedly discovered. When our professor refused to give up his find, the law got nasty. Holsters were pointedly fingered. Handcuffs and notebooks appeared. The skeleton must be brought to the station for identification by the next of kin.

Seemingly in vain did our academician protest that this was a primitive skeleton, likely to disintegrate if handled carelessly. Patiently he explained that the poor fellow was at least 500 years old and

belonging as he did to an extinct tribe, it was unlikely that descendants would be located, let alone next of kin.

We'll never know whether the professor's reasoning finally prevailed or whether the sight of our motley group armed with picks and shovels made the police eventually retreat. But retreat they did. Putting away their guns, they shuffled back to their vehicles and sped off.

Several weeks later at the Suma Indian site by the Delaware River, I was assigned to spend the night with my friend Nancy standing guard against marauding potholers—an unscrupulous lot who destroy unique archaeological tracts in search of marketable artifacts. They had been unusually active on this site.

For those who've spent a night alone in a forest with a disabled companion (in the excitement of her first find she had tripped on a tree root and plunged headlong into a six-foot pit) and one disoriented dog—my advice is DON'T. Midnight found my friend zonked out on a combination of cognac and painkiller, while my city-bred spaniel barked himself into frenzied hysteria each time he heard a leaf rustle.

Flames from the campfire transformed shadows into malevolent Indian spirits come to avenge the wrongs inflicted on their race. Mere rabbits became menacing monsters. If I didn't die of heart failure, I knew I would succumb to witchcraft.

### Difficult—and delightful

Thus, digging can prove simultaneously difficult, ridiculous, and delightful. Few amateur archaeologists dig to satisfy the desire for personal possession. Most are curious and love puzzles—the kind that have pieces missing. Most are ready to grasp a chance to touch history. We can only read that the Egyptians fed their pyramid laborers radishes, onions and garlic—but we discover for ourselves that the Munsie tribe adored oysters. One of our group describes his digging dedication in a simple sentence: "It's the thrill of picking up a tool that someone happened to drop 5000 years ago."

For me personally, it's in part the fantasies I spin: What fabulous treasure was traded for the alkaline pipe from Georgian England found beside an Indian hearth? What is the significance of a stone tablet bearing not hieroglyphics, but col-



### And now... it's 'urban' archaeology

Test trench (left) is begun near the Rogers Locomotive & Machine Works (below) in Paterson, N.J., one of earliest American industrial towns and hotbed of urban archaeology.

For the city dweller there's another form of archaeology fast gaining in popularity: urban (or industrial) archaeology—devoted to the investigation and preservation of this country's industrial past. Amateur groups are now working in many developed areas; what's more, the Federal Government is giving some pro-



umns of lines rather like those on an accountant's pad? Why was that crystal quartz so intricately carved? For whom was it made?

Unfortunately many beginner's guidebooks still encourage an amateur to dig alone. This is very much frowned upon by authorities in the field. The past is a dwindling resource, and just as oil is likely to run out by the year 2000, so, if we continue excavating at our present rate, will our archaeological sites.

According to Dr. Elizabeth Dumont of Fordham University, "The keyword in archaeology today is conservation rather than excavation. In 50 years our present methods are going to belong to the Stone Age."

She cites an example: Scientists have just discovered, contrary to established belief, that decayed plant material *does* leave permanent traces. They take the form of shiny crystalline structures called phytoliths. These inorganic molecules can determine not only the exact type of prehistoric vegetation, but even what ancient man may have had for dinner.

"It's not only the stone artifacts or ceramics that are important," continues Dr. Dumont, "it's the con-

text in which they are found. Whenever a shovel is placed in the ground this is destroyed. One can never 'redig' a site."

### Regional differences

In the western United States, Indian tribes developed a sophistication resulting in decorative handicrafts that often reflected a strong Asian influence. But in the East, many tribes, (such as the extinct Early Woodland Indians who once roamed the north coastal states) left behind only a simple legacy of stone tools and plain pottery. One might think such primitive tribes would be of less interest, but some archaeologists maintain the reverse is true—the less known about a culture, the greater the surprise and excitement when excavating. In the West we can still see impressive stone dwellings of early man but in the East only careful on-site digging can reveal whether a group lived in a bark shelter or a 60-foot communal longhouse.

Soil is another variant. If it is claylike, a site is measured off into squares and dug in carefully calculated layers. The earth is then thrown into a giant sieve for screening. Sandy soil is treated dif-

ferently. It's often placed in flat dishes and sifted with the fingers. If the sand is very fine, it is impossible to dig a deep square without the sides collapsing.

### Tools and equipment

Digging is not an expensive pursuit; the tools of the trade can be found at home. Items such as a toothbrush, whiskbroom, work gloves, shovel, pencil and notebook, measuring tape, trowel, a ball of string and Popsicle sticks (for marking off levels) are all the initiate will need. Probably the most costly item is the tin box (the kind that fishermen use) that archaeologists keep for storing their bits and pieces.

One recent excavation of an Indian burial site in Latin America holds the top three elements of a TV special—sex, mystery and violence. Two bodies were unearthed buried in an embrace. The smaller, with arm flung across the face as if for protection, appears to have been a female aged around 14 years at the time of death. Both bodies were pinned down with heavy stones. This did not follow the tribal burial pattern. All the others were buried in fetal position and accompanied by a bun-

*(Please turn to page 182)*

jects financial support. Excavations for construction projects in major cities these days are often likely to bring out at least a few amateur archaeologists to inspect the site for potential artifacts.

Site preparations several years ago for Detroit's new Renaissance Center hotel and office complex unearthed so much 18th and 19th century chinaware and household goods (in what had long been a rundown section) that local universities got quite excited.

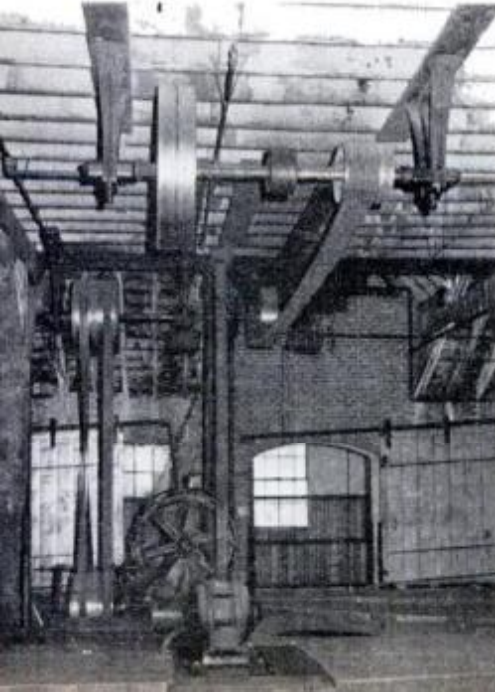
Paterson, in northern New Jersey, offers one of the best examples of this

trend (see photos). As America's first planned industrial city, its original blueprints encompassed the talents of both Alexander Hamilton and Pierre Charles L'Enfant (who designed the city of Washington). Once Paterson's Great Falls raceway and power system (a network of waterways) supported numerous mills

including the Rogers Locomotive Works, silk and textile industries and the Colt gun mill.

Edward Rutsch, a contract archaeologist, has led several "expeditions" in the area and not too long ago found one of the first Rogers locomotives. "This form of archaeology does not always involve digging," says Rutsch, "Often it's just studying the spatial remains of an old factory, or examining a few pieces of broken china."

People who would like to become involved can write to the Society for Industrial Archaeology, Smithsonian Institution, Washington, D.C., an organization dedicated to the preservation and protection of our industrial past. They organize tours and expeditions, distribute information, and nominate bridges and buildings for the National Register.

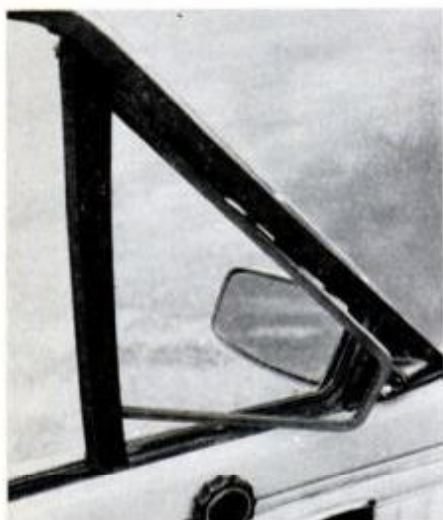


Industrial "digs" do not always involve pick and shovel; exploration of old factory spaces, like the Rogers Locomotive Works, can yield some important finds. At right, an excavated mill flume.



**F**or two such similar cars, owners certainly point out a few striking differences. For example, according to the Zephyr/Fairmont owners we surveyed, the Zephyr comes out better by 10 percentage points on workmanship. Twice as many Zephyr owners scored their cars as excellent.

The Zephyr also rated higher in dealer service. And when we asked for a list of specific complaints, 24.7 percent of Mercury Zephyr owners had none, com-



Ventipanes, at \$60 extra, open with knob, which makes operation unhandy.

## PM OWNERS REPORT: FORD FAIRMONT AND MERCURY ZEPHYR

pared with 18.8 percent for the Ford Fairmont. But Fairmont fared slightly better in front-seat comfort and satisfaction with repairs.

Otherwise we might as well have been asking questions about one make of car instead of two.

Why did owners settle on these two FoMoCo compacts?

"We were looking for size and gas mileage," answers a New York salesman, "and were actually ready to buy a new Toyota Corona. But for the same price we chose a Zephyr sedan with the six-cylinder engine."



Rear bench will seat three, although center rider's legroom is restricted.

"To improve gas mileage," says a South Carolina insurance agent, "and to have a car I can fit into—I'm 6-7 and weigh 290 pounds."

"Because I wanted a small, inexpensive station wagon of U.S. manufacture," adds a retired Florida school teacher.

What traits or features do Fairmont and Zephyr owners like best?

"I appreciate the fact that Ford has designed a good utilitarian

BY MICHAEL LAMM WEST COAST EDITOR

## New FoMoCo compacts do everything well, yet owners would like better mileage

Trunk, while shallow, holds more than most.

Large glass area, thin pillars help visibility.

Grille, tail lamps, and "gills" differentiate Zephyr (shown) and Fairmont.



Galvanized rockers fight rust.

Photos by the author



car that fits the needs of a family of five. It's energy-conscious and conservation-oriented, which we appreciate; also it's a comfortable, attractive car."—New Mexico bookkeeper.

"I find the Fairmont's brakes excellent. The car is easy to handle and park. The Six is simple and easy to work on. I do my own minor tune-ups and change oil and filters regularly myself."—Illinois retiree.

"Sharp-looking, peppy with the 200-cu.-in. Six, economical to operate."—Michigan park manager.

Gas mileage differences between the Six and V8 are almost nil. Owners of the Four, however, report a significant jump: three and six miles per gallon better in



Trunk demonstrates ample floor space, but won't carry grocery bags upright.

city and highway driving, respectively, than the larger engines.

Relatively few buyers, though, opted for the Four (9.0 and 9.5 percent), so we didn't get enough reaction to comment on engine power or vibration.

Of those who did buy the Four, 66.6 percent also chose the four-speed manual transmission,



Comfortable front seat, good dash layout earn praise from most owners.

## What the twins are like

The new-for-1978 Ford Fairmont and Mercury Zephyr are almost identical twins. They differ only in grilles, tail lamps, interior trim and price. Model for model, the Zephyr costs about \$120 more.

These cars replace the Maverick and Comet. Lightweight, efficient and uncomplicated, the Fairmont and Zephyr share variable-ratio, rack-and-pinion steering, disc front brakes, a flow-through ventilation system that really works, a large greenhouse with thin pillars for maximum visibility, and modified MacPherson-strut front suspension systems.

Three different engines are available, all tried and proven. The most popular, a 200-cu.-in. Six, dates back to Falcon days. The 302 V8 has likewise been around a while, and the versatile little ohc 140-cu.-in. Four also powers Pintos, Bobcats and Mustang IIs.

Wagon versions of the Fairmont and Zephyr use a one-piece liftgate with a fixed rear window. This gives a low loading sill, and with thin bed walls there is maximum width provided for a bulky cargo. Even the four-door sedan has 16.8 cu. ft. of trunk space.

Sport coupes—the Fairmont Futura and Zephyr Z-7—are also available. These come with bucket seats, special trim and distinctive roof lines.

## A NATIONWIDE SURVEY BASED ON 1,013,634 OWNER-DRIVEN MILES

Mercedes-like mirrors cost \$13 extra.

Both cars come with three engine choices.

Owners feel gas filler should be on driver's side.



Quick handling, easy parking result from rack-and-pinion, variable-ratio power steering.

Unitized body keeps down squeaks and rattles.

which helps explain the big jump in gas-mileage figures.

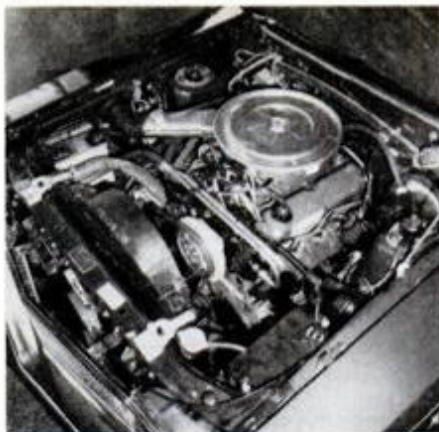
Of specific complaints, the one most often repeated involved gas mileage, as it does with most of the cars we survey. Owners get worse mileage than the EPA.

A New York supermarket manager and Zephyr owner sums it up for about 18 percent of our respondents: "I bought this car based on advertising and EPA mileage claims but am getting 6 to 10 mpg less than expected. I had a factory rep check mileage with a flow meter. He registered 26 mpg—the EPA highway figure—but at 35 mph. No way will this car get anywhere near that figure in average driving. And my habits are conservative, to say the least!"

Other complaints—more minor and less frequent—include: "Controls mounted on the steering column tend to be confusing," notes a Kentucky market researcher. "The horn, dimmer switch, turn signals, windshield wiper and washers are on two stalks. I sometimes forget where the horn is in an emergency."

"The Zephyr's glovebox is pitifully small, the plastic ashtray seems like a bad joke because it fell off the first time I tried to open it, and the Mercedes-copy vent window handles are extremely unhandy," says a Texas housewife.

Workmanship was judged significantly better by Zephyr owners than owners of Fairmonts. A Mississippi traffic clerk mentions, "Mercury always makes a fine car."



Mpg difference between Six and V8 is slight; ohc Four gets best mileage.

"My Fairmont rattles at highway speeds," says a Texas water superintendent, "and the plastic dashboard squeaks constantly."

An Alabama diesel mechanic: "I find my Fairmont put together well, without gaps and mistakes I saw in so many cars I tried out."

Comfort opinions for both front and rear seats ranged considerably above most smaller cars we've surveyed recently. Even rear-seat legroom got good marks—a comparative rarity nowadays. A Texas retiree comments, "Our Fairmont has a good ride, and I've been told by several people that it feels better than most cars they've ridden in."

Dealer service garnered good marks from both Zephyr and Fairmont owners, with Mercury dealers coming off slightly better. "Best dealer I've had in 40 years," beams a Florida mechanic. And an Illinois widow agrees: "The local Ford dealer always does his

best to give us good service."

As we've noticed several times, small-city dealers tend to give better service than those in metropolitan areas.

We finally asked owners to suggest improvements—ideas large and small to add to Ford's "better ideas." Here's a sampling:

"The trunk is plenty wide and long, but it's too shallow to carry grocery bags upright," states a Michigan homemaker. "Maybe if they moved the spare and made that area deeper it would help."

An Indiana farmer suggests: "Bring back drip rails over the doors, and make the vent panes standard equipment instead of \$60 extra. They used to be free."

"Make the glovebox bigger," says a Florida stockbroker. Several people said they'd like dome-light switches for all doors.

Taken as a whole, the Zephyr and Fairmont please their owners mightily. Grumbles are minor.

"This car has fulfilled all my expectations," reports an Indiana sales rep. "I feel this is finally a step in the right direction for sensible family sedans."

"We love our Zephyr!" declares a Michigan photographer. A Minnesota office manager agrees: "This is our fourth Ford product and the best to date. It's so easy to park and handle, and it fits into our small garage. Today, Monday, Jan. 9, 1978, here in northern Minnesota, the temperature outside is 24° below zero. My Zephyr started without a whimper. That's one reason I stay a Ford customer. It's just the car for me." **PM**

## SUMMARY OF 1978 FAIRMONT AND ZEPHYR OWNERS REPORTS\*

|                                 | Fairmont | Zephyr  |                                     | Fairmont | Zephyr |                                       | Fairmont | Zephyr |   | Fairmont | Zephyr |
|---------------------------------|----------|---------|-------------------------------------|----------|--------|---------------------------------------|----------|--------|---|----------|--------|
| <b>Total miles driven</b>       | 532,934  | 480,700 | <b>Why did you choose this car?</b> |          |        | <b>Workmanship opinion:</b>           |          |        | <b>Dealer repairs satisfactory?</b>         |          |        |
| <b>Average miles per gallon</b> |          |         | Economy                             | 58.3%    | 49.6%  | Excellent                             | 10.1%    | 20.5%  | Yes   | 62.3%    | 51.7%  |
| 140-cu.-in. Four                |          |         | Size                                | 23.3     | 32.4   | Good                                  | 46.3     | 45.3   | No  | 37.7     | 48.3   |
| In town (EPA)                   |          |         | Styling                             | 16.7     | 33.8   | Average                               | 23.5     | 20.5   | <b>Dealer service opinion:</b>              |          |        |
| 22 autom.                       | 19.1     | 21.3    | Roominess                           | 13.3     | 10.1   | Fair                                  | 10.7     | 8.1    | Excellent                                   | 27.1%    | 35.2%  |
| Long trips (EPA)                |          |         | Price                               | 0.0      | 9.4    | Poor                                  | 9.4      | 5.6    | Good  | 35.7     | 32.4   |
| 33 autom.                       | 26.0     | 26.5    | <b>Specific likes:</b>              |          |        | <b>Comfort opinion (front seats):</b> |          |        | Average                                     | 16.3     | 14.8   |
| 200-cu.-in. Six                 |          |         | Handling                            | 52.9%    | 52.6%  | Excellent                             | 34.8%    | 29.6%  | Fair  | 10.9     | 9.2    |
| In town (EPA)                   |          |         | Economy                             | 34.3     | 36.2   | Very good                             | 43.0     | 42.0   | Poor  | 10.1     | 8.5    |
| 19 autom.                       | 16.8     | 17.0    | Styling                             | 31.4     | 41.4   | Good                                  | 21.5     | 23.5   | <b>Number of vehicles owned:</b>            |          |        |
| Long trips (EPA)                |          |         | Roominess                           | 17.9     | 20.4   | Fair                                  | 8.1      | 4.9    | This one only                               | 54.0%    | 46.9%  |
| 26 autom.                       | 20.8     | 20.6    | Comfort                             | 17.1     | 19.1   | Poor                                  | 2.7      | 0.0    | Two cars                                    | 39.3     | 45.1   |
| 302-cu.-in. V8                  |          |         | Ride                                | 0.0      | 19.7   | <b>Comfort opinion (rear seats):</b>  |          |        | Three cars                                  | 4.0      | 6.2    |
| In town (EPA)                   |          |         | No complaints                       | 18.8%    | 24.7%  | Excellent                             | 19.4%    | 20.5%  | Four or more cars                           | 2.7      | 1.9    |
| 16 autom.                       | 16.5     | 15.7    | Gas mileage                         | 18.0     | 17.8   | Very good                             | 42.5     | 45.2   | <b>Makes of other cars owned:</b>           |          |        |
| Long trips (EPA)                |          |         | Poor workmanship and quality        | 12.5     | 6.8    | Good                                  | 24.6     | 21.9   | Ford  | 35.3%    | 20.9%  |
| 23 autom.                       | 20.4     | 19.8    | Rattles                             | 9.4      | 6.2    | Fair                                  | 9.7      | 9.6    | Mercury                                     | 0.0      | 26.7   |
| <b>Body style choices:</b>      |          |         | Glovebox too small                  | 0.0      | 5.5    | Poor                                  | 3.7      | 2.7    | Chevrolet                                   | 19.1     | 16.3   |
| Four-door sedan                 | 40.1%    | 36.9%   | <b>What changes would you like?</b> |          |        | <b>Had any mechanical trouble?</b>    |          |        | Dodge                                       | 11.8     | 0.0    |
| Station wagon                   | 36.7     | 33.1    | No changes                          | 13.6%    | 15.8%  | Yes                                   | 52.1%    | 48.4%  | Volkswagen                                  | 11.8     | 0.0    |
| Two-door sedan                  | 23.1     | 30.0    | Bigger glovebox                     | 9.8      | 11.6   | No                                    | 47.9     | 51.6   | Buick                                       | 0.0      | 9.3    |
| <b>Engine choices:</b>          |          |         | Better gas mileage                  | 0.0      | 11.0   | <b>What type of trouble?</b>          |          |        | <b>Age distribution of owners:</b>          |          |        |
| 140-cu.-in. Four                | 9.0%     | 9.5%    | Better-quality materials            | 6.8      | 10.3   | Transmission                          | 17.3%    | 17.1%  | 15-29 years                                 | 12.6%    | 10.2%  |
| 200-cu.-in. Six                 | 70.8     | 63.9    | Change horn position                | 8.3      | 8.9    | Carburetor                            | 6.7      | 10.5   | 30-49 years                                 | 41.5     | 42.4   |
| 302-cu.-in. V8                  | 20.1     | 26.6    | <b>Transmission choices</b>         |          |        | Electrical                            | 9.3      | 9.2    | 50-plus                                     | 45.8     | 47.5   |
| Three-speed automatic           | 91.9%    | 90.7%   | <b>Why did you choose this car?</b> |          |        | Cold starts                           | 6.7      | 0.0    | <b>Would you buy another of these cars?</b> |          |        |
| Four-speed manual               | 8.1      | 9.3     | Economy                             | 58.3%    | 49.6%  | Brakes                                | 0.0      | 7.9    | Yes   | 73.6%    | 81.3%  |
|                                 |          |         | Size                                | 23.3     | 32.4   | Power steering                        | 0.0      | 7.9    | No  | 26.4     | 18.8   |
|                                 |          |         | Styling                             | 16.7     | 33.8   |                                       |          |        |   |          |        |
|                                 |          |         | Roominess                           | 13.3     | 10.1   |                                       |          |        |   |          |        |
|                                 |          |         | Price                               | 0.0      | 9.4    |                                       |          |        |   |          |        |
|                                 |          |         | <b>Specific likes:</b>              |          |        |                                       |          |        |   |          |        |
|                                 |          |         | Handling                            | 52.9%    | 52.6%  |                                       |          |        |   |          |        |
|                                 |          |         | Economy                             | 34.3     | 36.2   |                                       |          |        |   |          |        |
|                                 |          |         | Styling                             | 31.4     | 41.4   |                                       |          |        |   |          |        |
|                                 |          |         | Roominess                           | 17.9     | 20.4   |                                       |          |        |   |          |        |
|                                 |          |         | Comfort                             | 17.1     | 19.1   |                                       |          |        |   |          |        |
|                                 |          |         | Ride                                | 0.0      | 19.7   |                                       |          |        |   |          |        |
|                                 |          |         | <b>Specific dislikes:</b>           |          |        |                                       |          |        |   |          |        |
|                                 |          |         | No complaints                       | 18.8%    | 24.7%  |                                       |          |        |   |          |        |
|                                 |          |         | Gas mileage                         | 18.0     | 17.8   |                                       |          |        |   |          |        |
|                                 |          |         | Poor workmanship and quality        | 12.5     | 6.8    |                                       |          |        |   |          |        |
|                                 |          |         | Rattles                             | 9.4      | 6.2    |                                       |          |        |   |          |        |
|                                 |          |         | Glovebox too small                  | 0.0      | 5.5    |                                       |          |        |   |          |        |
|                                 |          |         | <b>What changes would you like?</b> |          |        |                                       |          |        |   |          |        |
|                                 |          |         | No changes                          | 13.6%    | 15.8%  |                                       |          |        |   |          |        |
|                                 |          |         | Bigger glovebox                     | 9.8      | 11.6   |                                       |          |        |   |          |        |
|                                 |          |         | Better gas mileage                  | 0.0      | 11.0   |                                       |          |        |   |          |        |
|                                 |          |         | Better-quality materials            | 6.8      | 10.3   |                                       |          |        |   |          |        |
|                                 |          |         | Change horn position                | 8.3      | 8.9    |                                       |          |        |   |          |        |

\*Percentages might not equal 100% due to rounding or insufficient data.

# IT'S NEW NOW



## Six of one, two dozen of other

Honda CBX, with an engine developed from Grand Prix racers of the '60s, can do quarter mile in 11.6 seconds and can reach almost 140 mph. The 1047-cc powerplant has six cylinders, 24 valves, 103-hp output at crankshaft and three hydraulic disc brakes. This newest Japanese superbike is available for approximately \$3700.



## Feeling no pain

The Dermatron uses a small electric current to drive anaesthetic below the skin. The device was designed especially for patients who must usually undergo many painful injections, like dialysis patients. It has been used during removal of warts and similar minor surgery. Motion Control Inc., 1005 South 300 West, Salt Lake City, Utah 84100.

## Master spies, please note

Phone privacy impervious to computer-based code-breaking is claimed for the Datacom MA 4207 phone scrambler. Nicad-powered, it's under 20 pounds, costs \$8500. HLB Security Electronics, 211 East 43rd St., New York 10017.

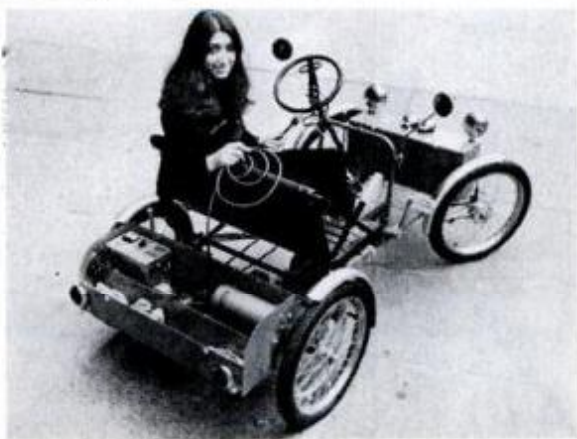


## Tells folks you need help

With your house keys in its dish, the Electek sounds an alarm when you are at home but have been inactive for longer than a preset time. The alarm alerts friends, relatives or neighbors that you may have had an accident or sudden illness. Monitor plus mat switch is about \$225 from K.C. Herrick, 2160 Mastlands Dr., Oakland, Calif. 94611.

## Electric buggy built for two

While the Side-by-Side may not offer the neck-snapping acceleration of a motorcycle, neither is it the cause of as much noise or air pollution. Top speed for the buggy is about 15 mph; an overnight charge yields a cruising range of about 30 miles at 8 to 10 mph. In emergencies, the vehicle can be pedaled. Street-legal machine costs \$2000. Hammacher Schlemmer, 147 East 57th St., New York 10022.



## Crank your way into shape

Hop, skip and jump your way into condition with the Skip-A-Loop. Made of two plastic tubes joined by a rigid crank, it helps develop arm-foot coordination. About \$6 from GTR Products, 42 Jackson Dr., Cranford, N.J. 07016.

Slice the price more than in half by making your own pocket, boot, Bowie, hunting or survival replica.

by Sid Latham

**Y**ou can still own quality blades and classic knives—at a reasonable cost—if you make them yourself from a kit.

The great American knife-collecting boom began in the late 1960s and shows no signs of slowing down. Ten years ago there were less than 30 knifemen around to take your order for a handmade model. Now the number has passed 300 and is still growing.

The reason, of course, is that

collectors have entered the market and prices have risen to the point where only those with fairly hefty wallets can order a knife from a top maker. Materials have jumped in price, too, and the exotic steels and rare handle materials add their share to the total cost. It's a far cry from the days when a handful of men were grinding out steel for sportsmen who just wanted a good knife to take into the field. Then a handmade knife could be had for around \$35; now the price has jumped to well over \$100, with many collectors' items selling for \$300 to \$500 and up.

Today's answer is to choose a kit from one of many companies now making them. There are no mysteries or special skills required—just care and patience. Kits are now available in pocket and hunting

models, survival and combat knives. Some come with completely heat-treated blades with silver-soldered guards, various spacers, and Micarta handles predrilled to receive a threaded tang ready for bolting.

### Kits save big money

One top supplier is the A. G. Russell Co. in Springdale, Ark., offering both production knives and kits. Blades include the unusual laminated Morseth types that old Harry Morseth used in his quality knives for many years. Prices for these kits, depending on blade length, run around \$31 to \$36, with a 7-inch skinning blade going for \$42. The \$31 kit we show being finished here would cost \$65 completed from the factory as the Ozark Hunter, and the large skinning blade would be \$100 to \$125 as a military survival knife. For the man who wants something historical, Classic Arms provides Bowie knife and Arkansas Toothpick kits; numerous other companies offer kits ranging from boot knives to military models.

Assembly of a knife kit is easy because there is no profiling of the blade or drilling holes into metal, no soldering or heat treating. Most of the difficult work has already been done for you, yet there is some freedom for you to custom-fit and personalize the handle.

Tools required are quite basic: a wood rasp, some fine sandpaper to work the handle down to a smooth finish, metal files to take down the butt cap and smooth out the guard. You can use your workbench vise to hold the knife.

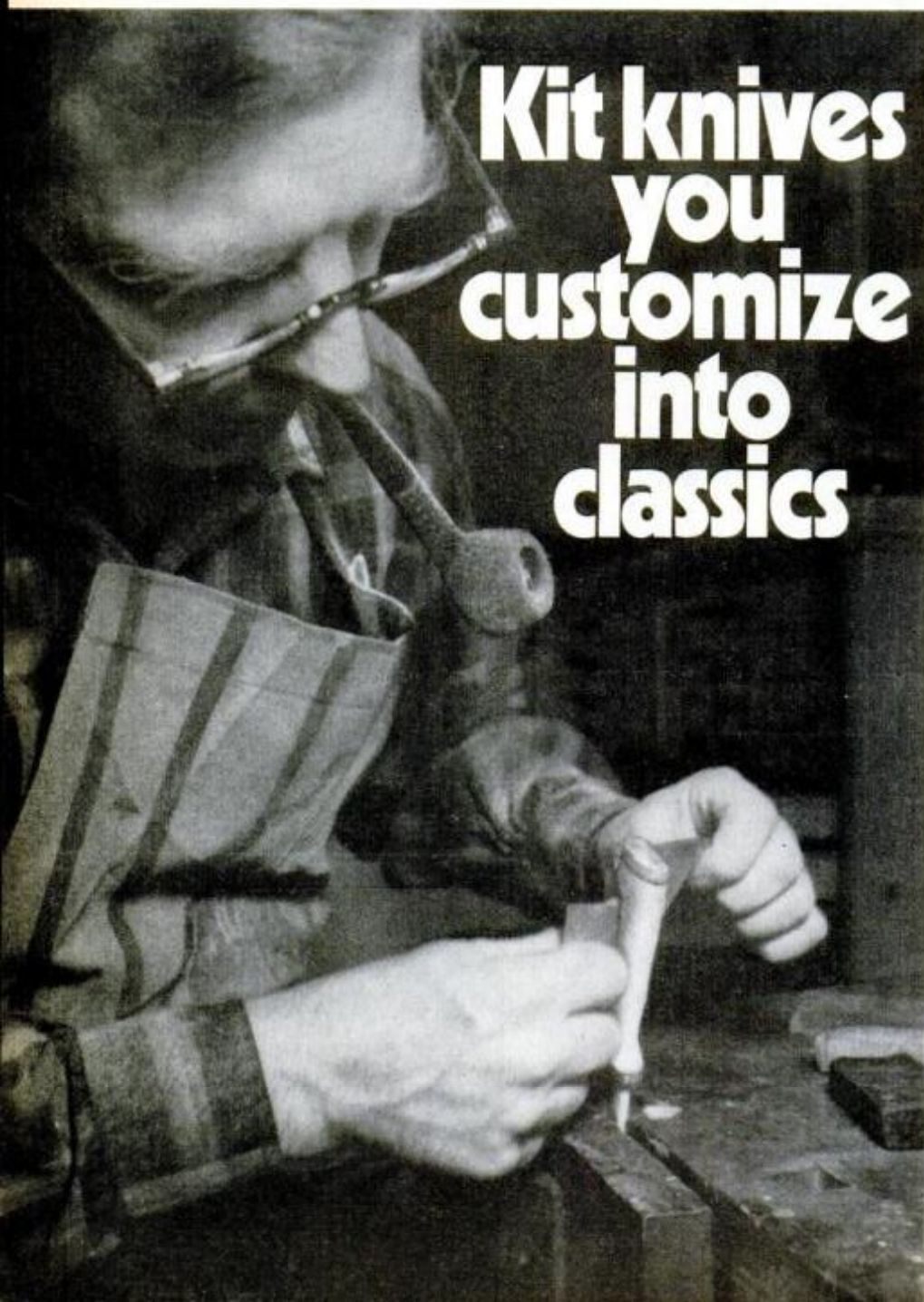
In addition, you will need a good industrial-grade epoxy. This is not included in your kit, but professional knifemakers always epoxy all the various bits and pieces together. Don't gamble that a butt cap nut won't work loose. The epoxy also helps seal out moisture.

### Check how parts fit first

Lay out the parts to the kit and study where each one goes. If the tang will fit completely inside the grip rather than being sandwiched between two pieces, cut holes in the various liner pieces and slip these over the tang. Snug them up against the guard. Next put the tang through the handle and add any additional spacers that may be used before finishing it off with the top piece or butt cap. Screw this down tightly and check for perfect fit, adding or removing spacers as needed.

Now take everything apart again, laying out each piece in order so the

In two evenings, New York lawyer Bob Heidell crafted this Morseth Ozark Hunter model.

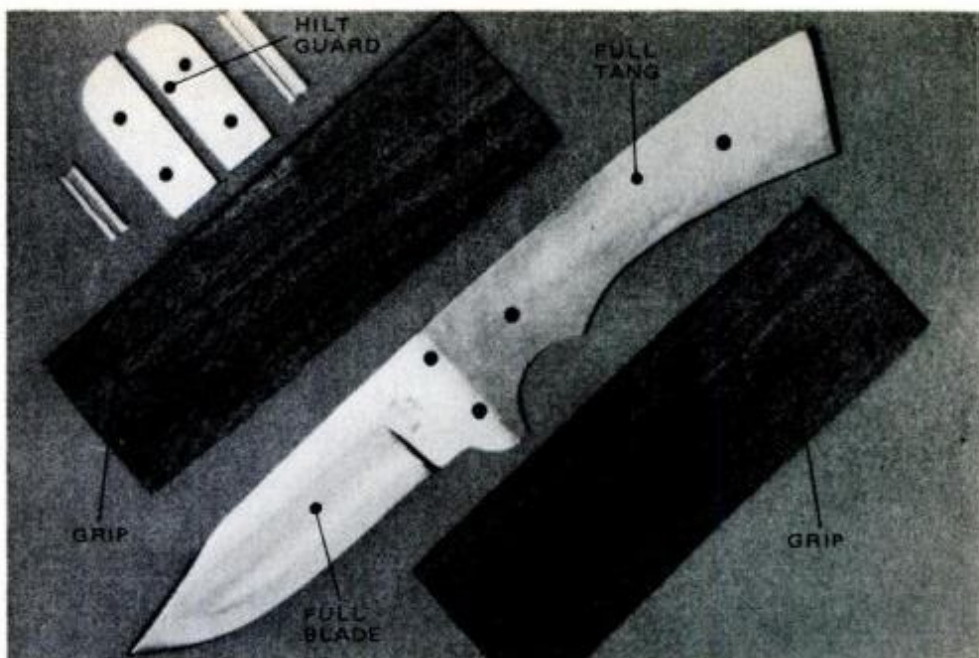


**Kit knives  
you  
customize  
into  
classics**

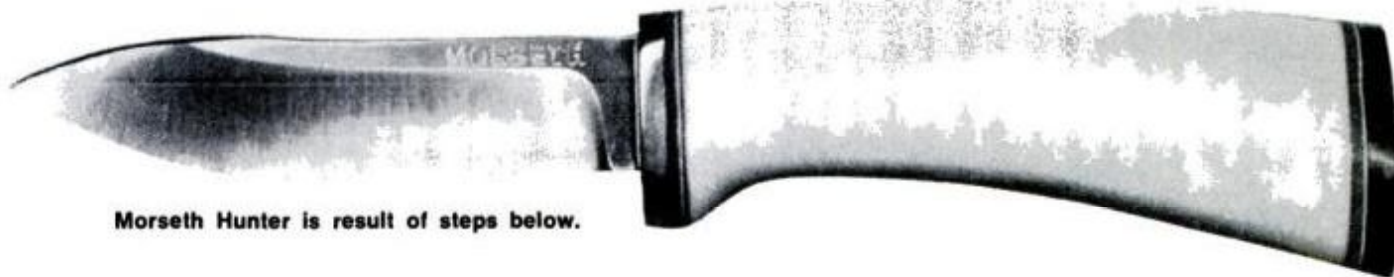
components can be reassembled correctly. Cover the blade with masking tape to protect it from scratches and your hands from cuts as you work. Mix up a good batch of epoxy and cover both sides of the spacers and both ends of the handle block. Smear the epoxy over the tang, the threaded part of the end of the tang, and the inner part of the butt plate nut.

Assemble everything in sequence. Then put on the butt nut and screw it down slowly until epoxy begins to run out from between all parts. Now set everything aside and allow the epoxy at least 24 hours to harden completely.

The next evening, the knife will be ready for shaping. Again, this is not difficult, but should be done carefully and with patience. Sketch out the grip shape with pen or pencil on the handle block and begin



Many models, as in this \$18 kit from Rigid Knives, come already heat-treated, drilled.



Morseth Hunter is result of steps below.

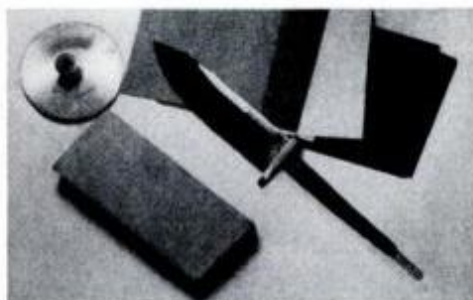
to file it down to your outline marks with a rough bastard file. This is easiest if you first clamp the blade in a large vise. When the handle shape begins to work down to where you like it, take metal files and work both the guard and butt cap down to shape.

### Slim shape gives best grip

At this stage, Andy Russell, head man of Morseth, advises, "Don't be afraid to take the handle down real good. Work it down so it's slim and trim. The mistake of most novice knifemakers is having a handle that's too big and bulky for comfort. An oval shape is ideal since it will fit the hand better."

When handle, butt and guard have been shaped, finish up with progressively finer grits of sandpaper or emery cloth. Taper the sides of the handle, smooth and round the corners, and buff the work to a high finish.

Suppliers of kit knives include: A. G. Russell Co., 1705 Highway 71 N. Springdale, Ark. 72764; Indian Ridge Traders, Box 865, Royal Oak, Mich. 48060; Van Sickle Cutlery, Box 3801, San Antonio, Tex. 76901; Ka-Bar, Box 406, Olean, N.Y. 14760; Rigid Knives, 9919 Prospect Ave., Santee, Calif. 92071; Atlanta Cutlery, Box 839, Conyers, Ga. 30207. **PM**



Kit from A.G. Russell includes blade and threaded tang, Micarta handle, spacers.



Spacers are selected to fit against nickel silver hilt, butt nut, and cut for tang.



Knife is assembled with handle between spacers, and nut tightened to check fit.



With parts disassembled, each is coated with epoxy resin and fitted back together.

Blade, taped for protection, is clamped in vise for rough shaping of the handles.

Rough shaping is followed by metal filing, sanding, final buffing of custom handle.





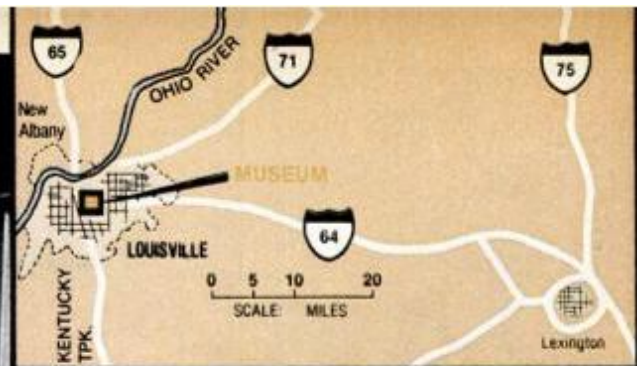
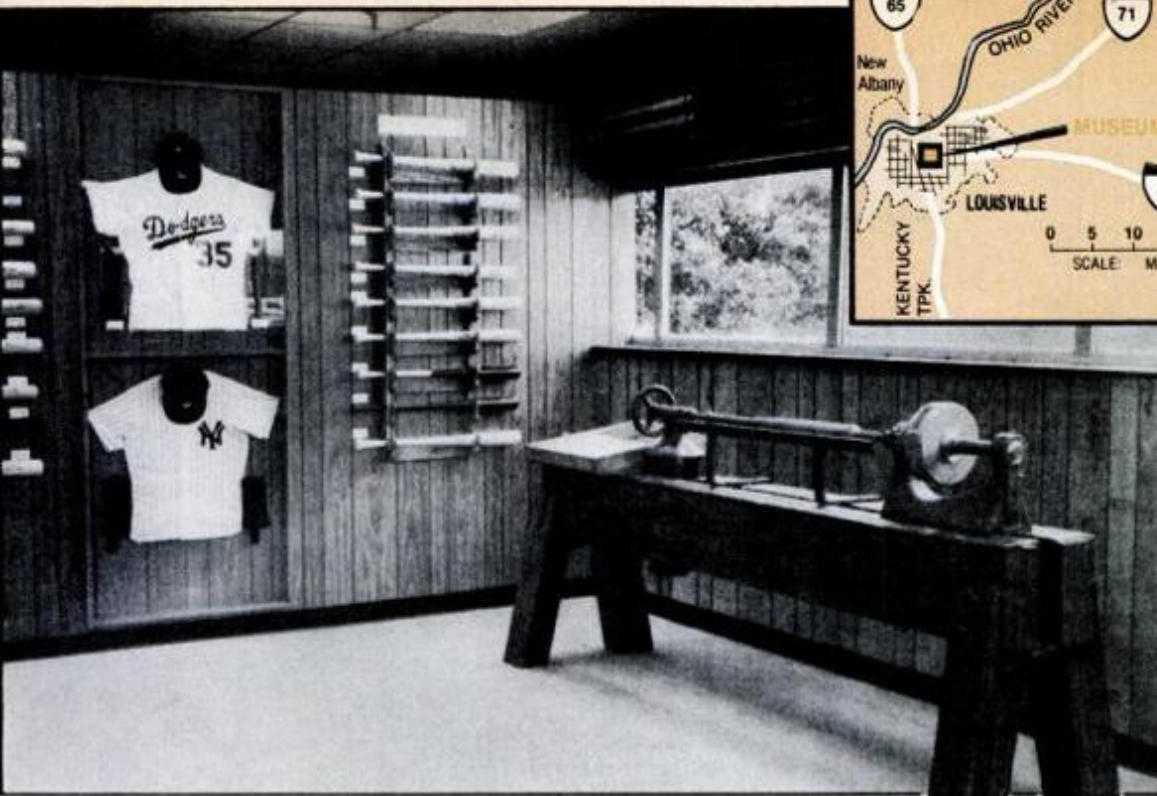
## Chesapeake Bay Maritime Museum

Now part of the museum in St. Michaels, Md., this great old lighthouse once stood on iron pilings that were literally screwed into the Bay's mud bottom to mark Hooper Strait.

# A PM TOUR OF AMERICA'S OFFBEAT MUSEUMS

A short detour off the Interstates can show  
you what made this country tick

by Roy BonGartz



## Baseball Bat Museum

Baseball's official Hall of Fame is elsewhere, but the Hillerich & Bradsby Co. in Louisville, Ky., not only enshrines baseball bats but shows you how a piece of ash is formed into a potential lethal weapon (in the hands of the Bambino) or, in the more current case of Reggie Jackson, a tool with which a man can earn a few million dollars.

Every American city and town wants something to be proud of. This need for self-esteem combined with nostalgia for our early works and deeds underlie an amazing current boom in museums. Many of them are just off the beaten track and receive little public notice or attention; however, if you're planning a driving vacation this summer, they can provide experiences well worth the short detour.

Celebrating every conceivable accomplishment, the museums range in subject matter from the Cobblestone Museum to the Detachable Collar Museum, from the Ice Machine Museum to the Dish Museum. There are so many museums of early American industry, military endeavor and every art and craft and style of life, that if you visited a different one every day it would take you around 20 years to see them all.

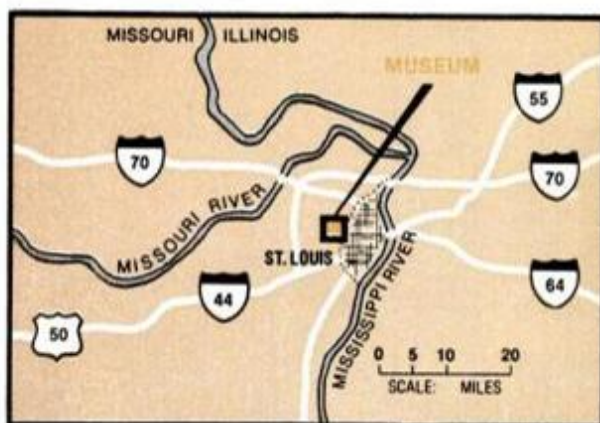
Obviously you have to pick out a few good ones, perhaps missing others equally fascinating among the more than 7000 existing American museums. Here are some choices to interest lovers of inventiveness and Americana, with a few noted for originality or strangeness. To simplify matters a bit, all sites listed are within half an hour's drive—or less—from an Interstate highway.

The appeal of authentic Americana draws visitors to one class of museums and restorations that reflect the beginnings of American industries. Early iron furnaces, notably those at Batsto, N.J., and Hopewell Village, Pa., and the original American iron works at Saugus,

Mass., are examples. Saugus, 10 miles north of Boston, was America's first factory town, and the restored water wheels in the mill-race once again move the huge bellows that fanned the coals. Here you see the quarter-ton iron hammer that once rose up and dropped on hot iron being wrought some 330 years ago—the most sophisticated installation of its kind at that early date, 1648. Saugus was able to give the colonists a certain independence

from England by producing excellent iron, and many who learned the ironworker's trade here founded later furnaces in New Jersey and Pennsylvania. Open every day, the restoration is run by the National Park Service.

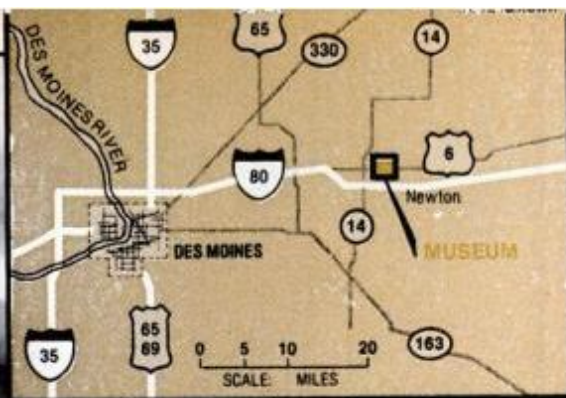
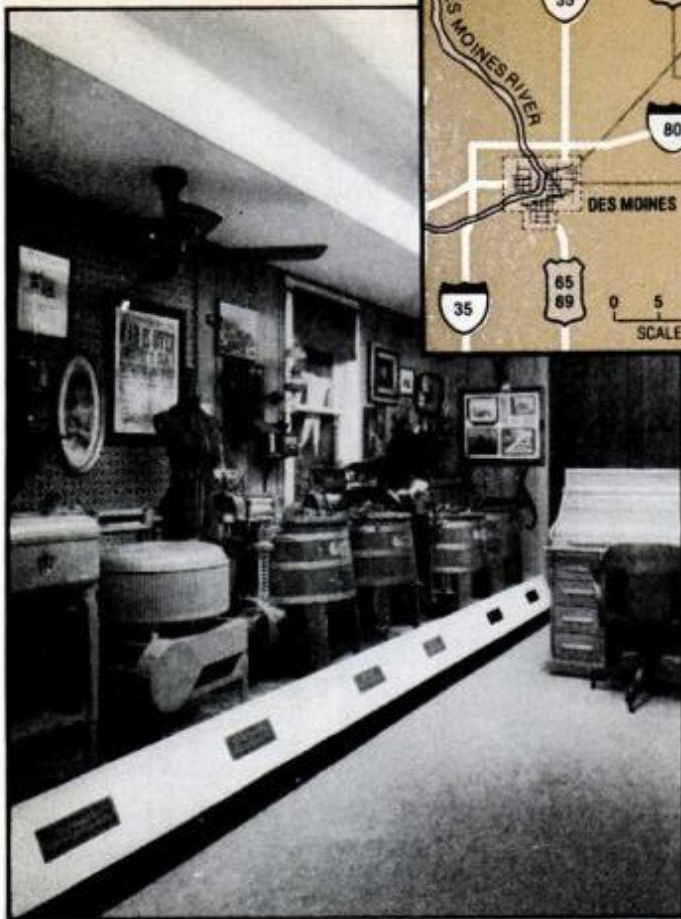
The Whaling Museum on Johnny Cake Hill in New Bedford, Mass., also takes us back to an early calling. You climb aboard the *Lagoda*, a half-scale model of a whaling vessel with every bit of equipment in place—incidentally, it's the world's largest ship model. Some 800 logbooks,



## The National Museum of Quackery

In an earlier day, the more complicated a machine appeared, the more miracles claimed for it. And if it used electricity, it could cure anything. A number of these testimonials to our one-time gullibility—and, sadly, occasional desperation—are to be seen at the St. Louis Medical Society's quackery collection.





## Maytag Historical Center

While many companies understandably view the historical impact of their own products as somewhat larger than the record shows, at Maytag's washing machine museum in Newton, Iowa, some of the fascination rubs off on visitors. Imagine the hubbub when the wringer washer burst on the domestic scene in 1939; marvel at 1914's gasoline-powered model.

Indian dugout, made by pegging five logs together and hewing them to shape with adzes. Today rejuvenated sailing canoes race on the Bay's estuaries.

As our industrial establishments become firmly established over many generations they look back to their origins and provide public displays of early tools and methods. Among the most pleasant is one of the nation's oldest wineries. Thomas, in Cucamonga, Calif. Its museum has many artifacts of wine-making from pioneer days and earlier times of the Spanish colonists—and, yes, there is a tasting room.

The Winchester Gun Museum, which claims to be the world's greatest collection of its kind, was moved from the Winchester factory in Connecticut two years ago to a new home in the Buffalo Bill Historical Center in Cody, Wyo. With a display of some 5000 firearms, the history of projectile arms is traced back to Chinese pieces 2000 years old. Originally begun in 1860 by Oliver F. Winchester, founder of the Winchester Repeating Arms Co., the collection includes European and American

many illustrated with drawings of whaleboats and harpooners, give sharp insight into the day-to-day lives of whalers. A tremendous mural, more than a quarter of a mile long, painted in 1848, shows New Bedford at the height of its prosperity. Comments a museum official, "During the whaling era, New Bedford's local history was world history."

Early American tools and implements, collected by the famed artist of barns and covered bridges, Eric Sloane, are shown at the Sloane Stanley Museum in Kent, Conn. Saws, planes, hammers and axes dating back to early colonial days make a display that combines the artist's interest in form with the workman's interest in utility.

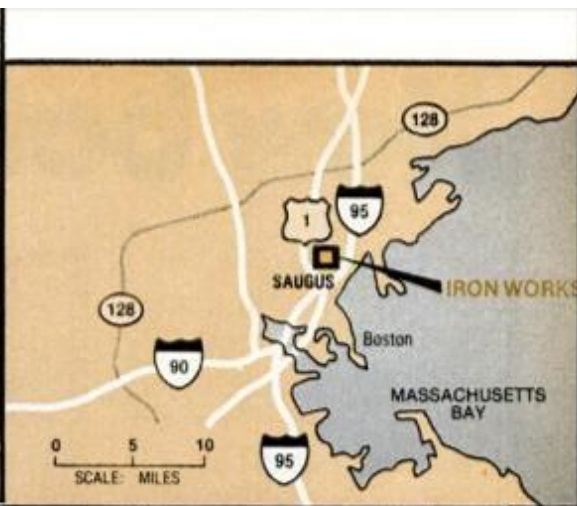
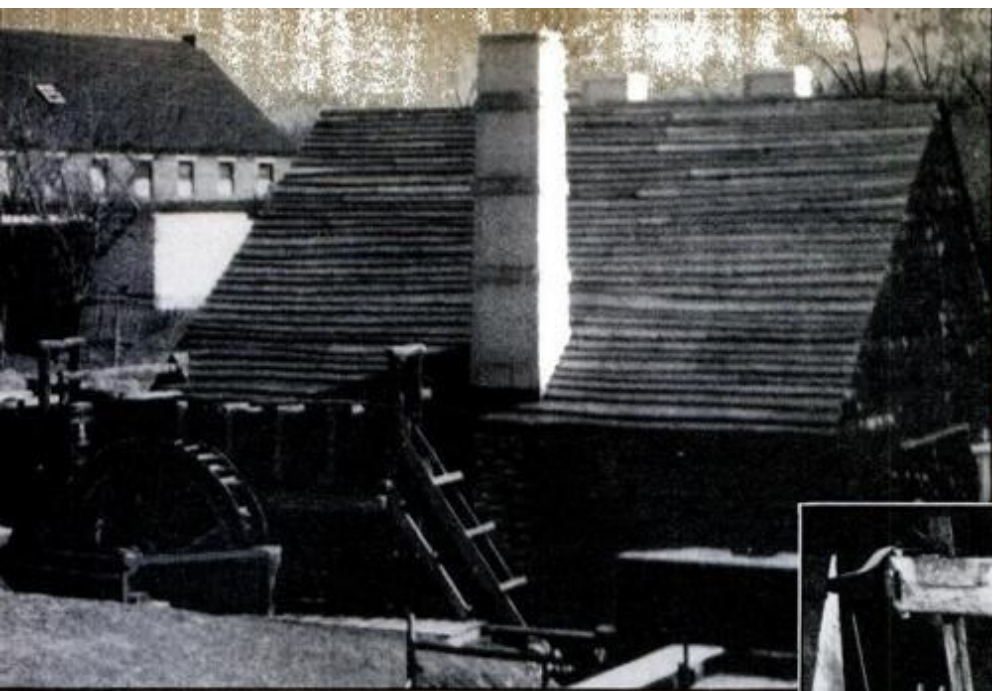
A buxom carved figurehead of maidenly form greets you at the Chesapeake Bay Maritime Museum in St. Michaels, Md., where visitors may board the old lightship *Barne-gat*, riding at anchor, and a traditional Chesapeake Bay sailing "skipjack," the *J.T. Leonard*, built in 1882, at dockside. A fine view along the Miles River is available from the balcony of the museum's wood-frame, screw-pile lighthouse with its six-foot French lens and the great crane that used to haul up drums of lighting oil. Originally, its iron pilings were literally screwed into the bay bottom. Outside is a unique collection of local log canoes, the colonists' early version of the

## Winchester Gun Museum

One of the most wide-ranging assemblages of firearms in the world is in the Winchester Gun Museum, now in Cody, Wyo. Among the many imbued with Americana: a brass Gatling gun that General Custer decided not to drag along to the Little Big Horn.







## Saugus Iron Works

The ability of the American colonists to forge superior iron tools, which they did in Saugus, Mass., as early as 1650, was of paramount importance in developing a sense of independence from England. Other forges worth seeing are at Hopewell Village, Pa., and Batsto, in New Jersey's pine barrens.



guns back through the centuries.

A temporary exhibit in October and November will show early firearms advertising posters done by such famed artists as Frederic Remington, A.B. Frost, Philip R. Goodwin and N.C. Wyeth.

With a little imagination you can begin to sense the fear of being blown sky high at the wonderfully restored Du Pont gunpowder mills at the Hagley Museum in Greenville, Del. Up to about 1920, earth-shaking explosions used to rip regularly through the mill valley killing both workers and Du Ponts. The

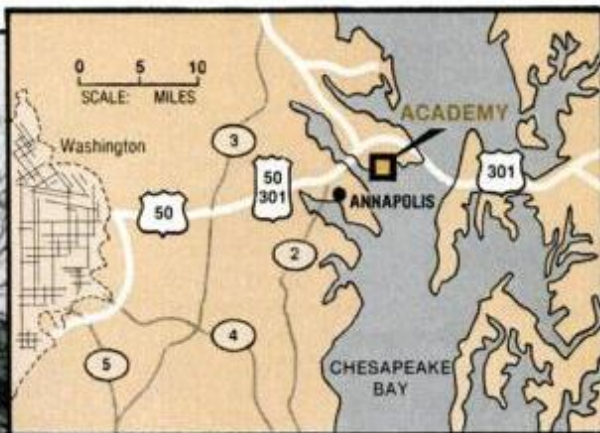
latter, beginning with Eleuthère Irenée du Pont de Nemours in 1802, had made it a point of *noblesse oblige* to live in mansions situated well within range of the crushing blasts. The mill buildings are thick-walled and stand in pairs facing the river, with a water wheel in between to run grinding and mixing machinery. Horses went unshod, and workers used wooden tools. The tiniest metal scrap, however, could spark an explosion in the mixing process. Powder workers never talked literally of being killed, but used the phrase "to go across the

creek." During World War I, 347 workers died making gunpowder.

At the World of Rubber at the Goodyear factory in Akron, there is an animated figure of Charles Goodyear, who invented vulcanization by chance when he dropped some latex on a hot stove; he is seen in a replica of his workshop. Also shown is a rubber plantation, a couple of Goodyear entries in the Indianapolis 500, an artificial heart and a moon tire show. There's a factory tour at 1:00 p.m. on weekdays.

Out in Newton, Iowa, the Maytag

*(Please turn to page 195)*



## U.S. Naval Academy

West Point offers perhaps the more majestic autumn vista, but on a summer day, historic Annapolis, Md., has sights and interests galore. One is the Naval Academy's Museum (left) in Preble Hall, where traditions unfold in art and artifact.

# Now bottoms up's illegal

The Coast Guard is out to outlaw drowning; 1978's boat-building laws could help.

by Bill McKeown  
BOATING EDITOR

**C**an new laws save more lives afloat? We should start finding out on Aug. 1. On that date it will be against the law for builders to turn out boats in the popular size of under 20 feet and over 2 hp if they behave as most boats have for the last 10,000 years.

Ever since some hollowed-out-log flipped and dumped a caveman overboard, boatmen have been learning that a hull that tips too far will fill with water and turn over. Boats of wood stay afloat if they are not heavily loaded, but modern metal and plastic craft with no flotation can sink like stones. Air chambers can keep a hull afloat, and big ships use watertight bulkheads and hatches to seal off sections of the hold if one part is punctured.

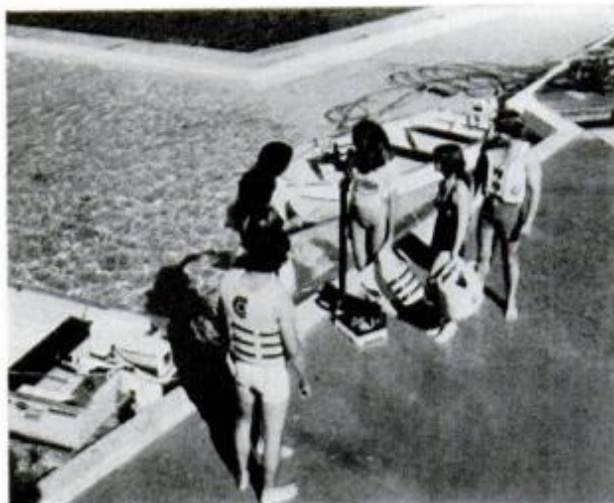
Compartmenting a small boat wouldn't leave much room for passengers, but since 1973 pleasure-craft builders have been required to produce floatable hulls—usually with foam flotation sandwiched between inner and outer layers of fiberglass, especially in the bilge under the cockpit flooring. The foam helps seal the hull together and provides extra strength and safety at the same time.

We've learned a lot about safety on the water in just the last ten years:

■ Even if you're a good swimmer, don't head for shore if it is any distance away. Instead, stay right with your boat where you are more likely to be seen and rescued.

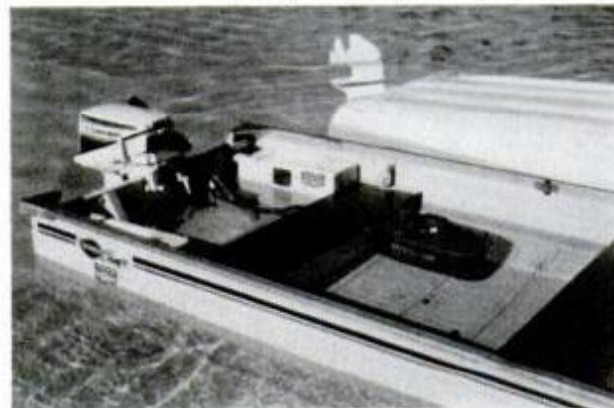
■ Even a good swimmer can drown quickly in cold water, and the exertion of swimming through cold water can speed up a critical lowering of body-core temperature.

■ Even a boat that stays afloat may not make much of a life raft when it is upside down, has a slick bottom with nothing to hold on to, and cannot be righted because all that



Submersion test teams, three to a boat, weigh in so that each test hull will support equal amounts of live and dead weight when flooded for stability check. All crews are good swimmers but wear life jackets.

PM photos: Jerry Imber-Cypress Gardens



Goal of new Coast Guard rule is to regulate the "mono-hull outboard motor boats which compose the vast majority of the recreational boat population," boats less than 20 feet and over 2 hp, such as this Mirro Craft.

bilge flotation foam is now up top. All the life preservers carefully stowed under the foredeck and in lockers or beneath the seats are now completely out of reach.

On April 29, 1976, the Coast Guard reported it was proposing standards "to increase the survivability of boaters following a boating accident by requiring manufacturers to design certain boats less than 20 feet in length to float in an approximately level attitude when swamped, thus providing a platform from which the occupants can be rescued."

Previous standards, the Coast Guard noted, required a boat "to contain an amount of flotation that is determined from a complicated formula based on the estimated weights and densities of its different components. Experience has shown, however, that this approach is not satisfactory. Boats that have been

constructed in accordance with the present standard have a tendency to capsize and float bow-high when swamped. This has made it difficult for survivors to hang onto and remain with the boat and almost impossible for them to right the boat and climb back on board."

So the CG started doing some homework "pertaining to fatalities that resulted from boats capsizing, flooding, sinking, or striking floating objects. The result showed that a large percentage of the fatalities investigated during the analysis period would not have occurred had the boats involved in the accidents been equipped with 'level flotation'."

The interesting new rules cover pages of instructions that boat builders must understand and follow, but the Coast Guard's hopes and goals are high. Its conclusion:

"In general, boats that are constructed in accordance with the proposed regulations will have these advantages:

1. They will float in a level attitude when swamped, thus providing a platform on which the occupants can remain safe until rescued.

2. Each occupant can remain in the swamped boat with approximately 50 percent of his body out of the water, thus lessening the danger of hypothermia (subnormal body temperature resulting from exposure to cold water).

3. The powerhead of the motor, in most cases, will remain out of the water when the boat is swamped. If the motor can be started with a pull starter, the boat and its occupants may be able to return safely to shore under the boat's own power."

## Testing the new specifications

The first company to get into production using the new regulations for all its outboards, and extending to hulls up to 25 feet and to stern-drives as well, was Mirro Marine, maker of fiberglass Cruisers and Rally models, plus aluminum Mirro Craft boats. Now the firm has two years of experience building to the new rules.

To find out just how the specifications are likely to work, we

arranged to drown a couple of the aluminum Mirro Craft 14-footers.

For a fair test, the boats were identical models but one with upright flotation and one with hull flotation. A 15-hp Johnson outboard was mounted on each and six "passengers" were divided into two crews of approximately equal weight.

To make this a safe test, the excellent swimmers from the Cypress Gardens, Fla., water ski show were chosen, and each wore a life vest as well. To simulate the results of leaving the drain plug out of the boat or getting swamped by a large wave, we used a fire hose and pump.

### Floating fuel tanks

Both hulls, as they filled, behaved approximately the same way. Motor starter batteries, if they had been aboard, would have drowned out first. The fuel tanks, though nearly full, both began to float. Passengers sensed a sluggish, unstable feel to the boat. But as the upright flotation model sank down to gunwale level, it lost its tendency to tip and became stable. The conventional model, though it also sank no farther, now had a tendency to roll. As it tipped to one side, passengers would lean to cor-



Under controlled conditions, in the Cypress Gardens Aquarama pool, identical 14-foot hulls with 15-hp outboards are flooded with a fire hose while stability of top and bottom flotation is compared.



As boats start to sink, starter batteries would have been drowned out, fuel tanks begin to float, righting tendencies of hulls become more sluggish. Boats without under-gunwale flotation tend to roll more.

rect the heel and the hull would slowly roll to the other side, but farther, with no corrective leveling. In moments, the boat had started a roll that the crew could not stop in time and the hull tried to turn turtle. Now the boat did become stabilized, but upside down, with passengers trying to hold onto a bottom that had become the slippery top. Life jackets, if they had been loose inside the boat, would have been floating away free, or trapped and useless up inside the boat. Attempts by the crew to right the capsized hull seemed funny in the pool, but could have been tragic out in open water. The other Mirro Craft floated evenly upright, however. Its crew restarted the motor, and with the combined speed of the outboard plus hand bailing were able to start emptying out the water. It was apparent that with bailing scoop or pump, the hull could be emptied in calm water or the craft powered back to shore.

At present, the new law "does not apply to sailboats, canoes, kayaks, inflatable boats, submersibles, surface effect vessels, amphibious vessels, and raceboats," according to the Coast Guard. But it looks as if the rest of us will have an even better chance of getting safely back to shore. **FM**



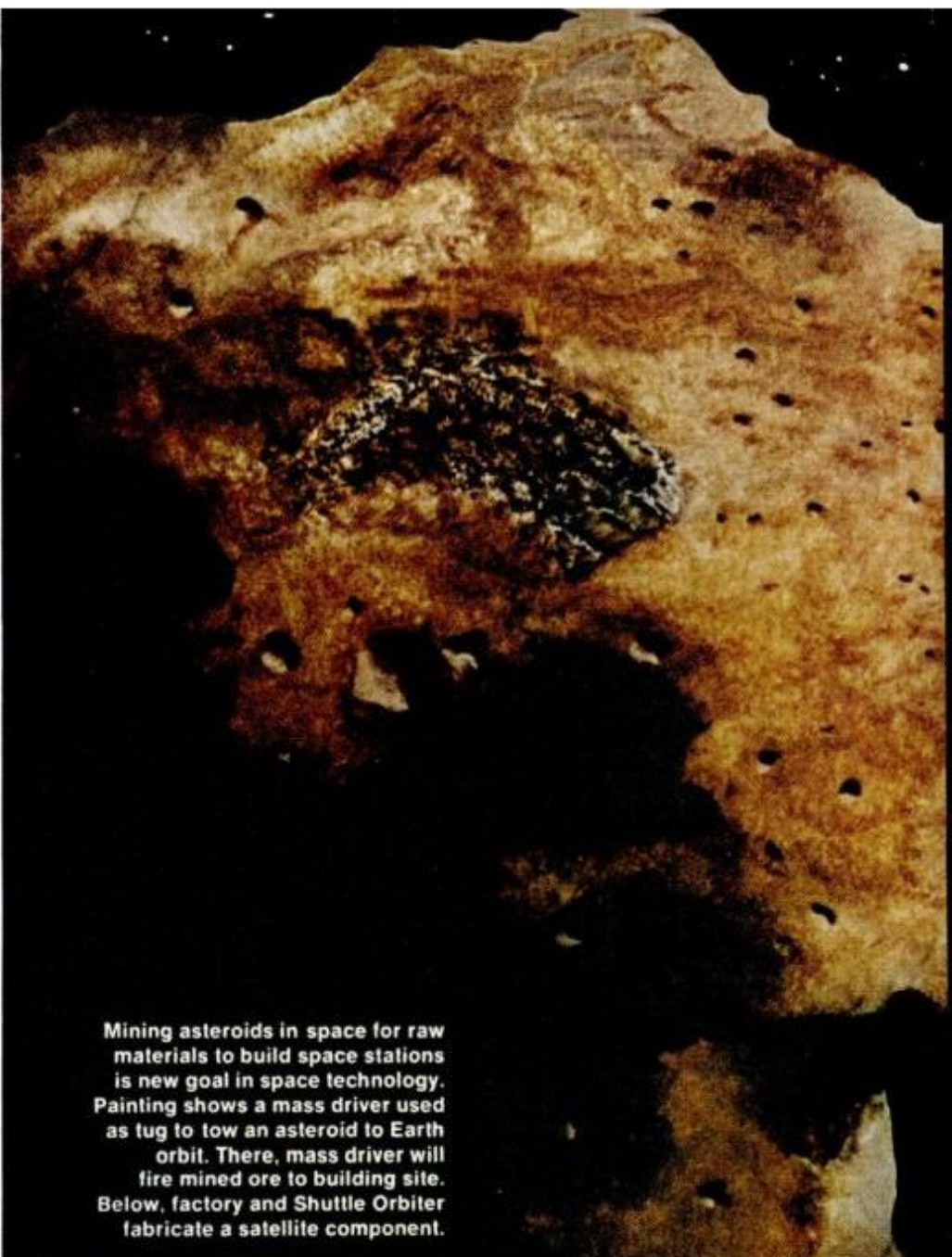
Conventional flotation boat (inset) starts to capsize; can't be kept upright. It won't sink but drowns engine, makes poor raft.

Upright-flotation hull floats, lets riders stay aboard partly out of cold water as motor is rope-started, driven to shore.

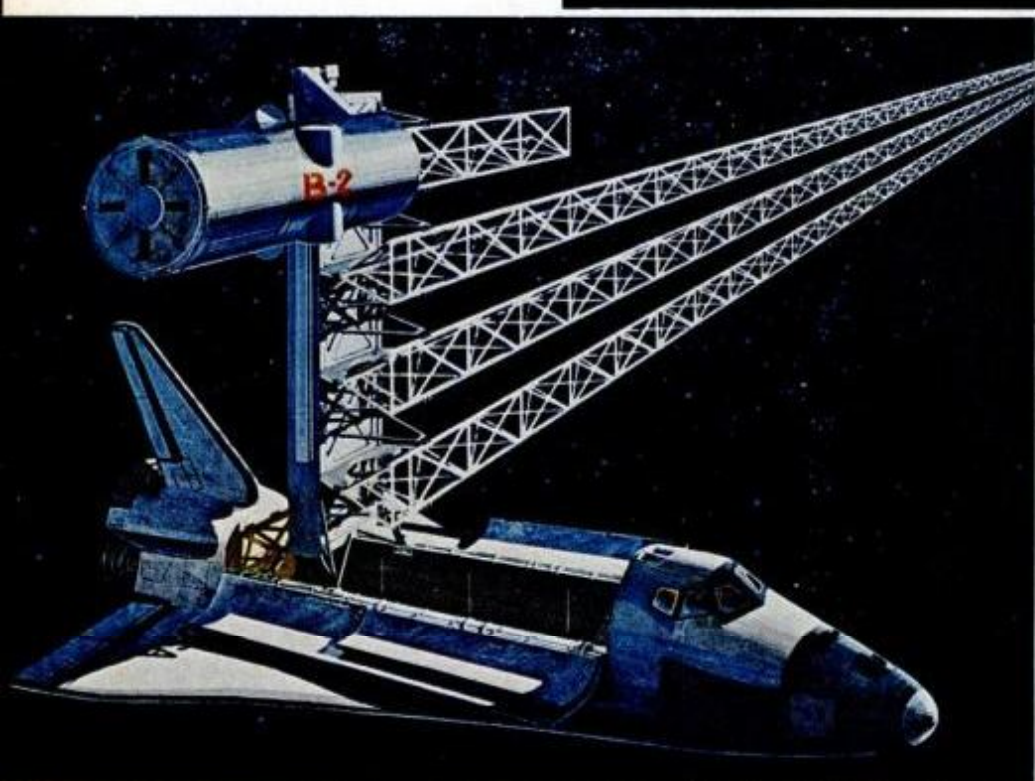
**A** year from this month a squat, stubby, 75-ton spacecraft with trimmed-down excuses for delta wings will be tipped up on its tail on a NASA-Kennedy Space Center launch complex. At the end of a standard countdown, the ugly duckling of the Space Age will blast off missile-fashion and rocket itself in an Earth orbit some 100 miles in space. There, it will circle the Earth as a space station satellite for a month or more. Then, missions accomplished, it will descend into the atmosphere and use its wings to make a proper runway landing—a little “hot,” perhaps, but otherwise like any standard, fixed-wing airplane.

If all goes well, the Shuttle Orbiter's trial run, scheduled for the fall of 1979, is expected to signal the start of regular round trips to and from Earth orbit at less than one third the current cost of such missions.

While the United States has not yet committed funds beyond that first Shuttle flight, fully developed plans are in the mill for an eventual fleet of five such spacecraft, leaving weekly, to lift passengers and pay-



Mining asteroids in space for raw materials to build space stations is new goal in space technology. Painting shows a mass driver used as tug to tow an asteroid to Earth orbit. There, mass driver will fire mined ore to building site. Below, factory and Shuttle Orbiter fabricate a satellite component.



load cargoes into orbit for a wide variety of mind-boggling space projects. Objectives already call for the Shuttle to deploy, service and repair communications and Earth-sensing satellites. Other missions will involve experiments for orbiting space labs, including manufacture of special electronic, medical and pharmaceutical supplies; mining of the moon, collection and

Plans are now being made to mine the moon and asteroids for material to build huge satellites where people will live, work and produce superior products for Earth.

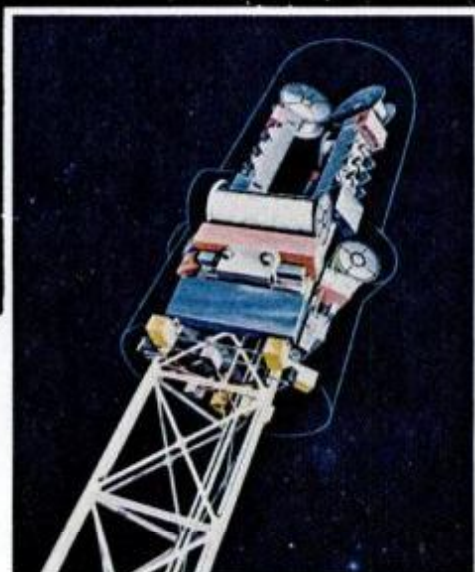
# OUR NEXT STEPS IN SPACE:

## ZERO-G FACTORIES AND ASTEROID MINES

by Richard F. Dempewolff

mining of asteroids; parts manufacturing and assembly of test prototypes for vast solar energy satellites in geosynchronous orbit that will beam power to Earth by microwave; space habitats and space hospitals for workers; even tourism and recreation (May '75 and June '77 PM).

Science fiction? Hardly. Already manufacturing experiments per-



Artist's concept shows a beam-builder at work assembling a final longitudinal member for a Solar Space Power Satellite.

formed on the Apollo-Soyuz flight, in Skylab and on other missions have demonstrated the advantages of fabricating products demanding high purity and structural conformity in the near-perfect vacuum and zero gravity of space—conditions that can't be reproduced on Earth.

Prof. Harry C. Gatos of Massachusetts Institute of Technology's

Metallurgy and Materials Science Department put it in a nutshell recently when he told the House Committee on Science and Astronautics: "We've hardly begun to realize the potential of most materials. For example, steels are 100 to 1000 times less strong than theory predicts; turbine blades of jet engines do not function at temperatures . . . where the efficiency of engines would be appreciably higher; wires of heart pacemakers or bone prosthetics fail much sooner than they should . . ."

Major problem for earthbound manufacturers of everything from metals to medicines is gravity. Many materials that call for high purity and uniform structure require extremely delicate blending of parts. Gravity, for instance, makes the production of those superquality alloys for jet engines impossible. The various ingredients have different densities, and gravity-caused convection currents produce unwanted layering as the different elements solidify, thus fouling the perfect blend required for great strength and high-temperature integrity. Gravity also makes it necessary to use a container for the material, which introduces impurities that can cause shape distortions, among other things.

Similar "stratification" problems haunt the producers of crystals for superquality electronic equipment; and "crucible contamination" is the bogeyman of ultrapure glass-mak-

ing for such things as laser optics.

In outer space, however, the gravity gremlin vanishes and so does the need for containers. Ultrahigh vacuum is available for free, as is a range of temperature from absolute zero to the searing heat of the sun's surface.

Last year, during the flight of a Space Applications Rocket (SAR), molten beryllium in an electric furnace was successfully suspended in an electromagnetic field, and allowed to solidify in a pure homogeneous mass. Similar melts suspended in mid-space were produced successfully in Skylab experiments.

### Growing purer crystals

In other Skylab experiments, the astronauts grew single-crystal semiconductor material of such purity and uniformity that scientists now envision possible production of thin slices of the material, less than an inch in diameter, on which some 750,000 devices (such as transistors, diodes, capacitors and resistors) can be incorporated.

"Such a device," says Dr. Gatos, "could serve as the lens of a television camera requiring no lights to function, but just heat radiated from the objects or people."

Such ultrapure crystal also promises the development of superquality solar cells, lasers, microwave guides, LEDs, holographic equipment, fiber optics, computer memories and other electronic devices that would make our Earth-manufactured versions seem Stone Age by comparison.

Applied to communication satellites, such devices, according to a recent study by the Aerospace Corp., could provide microwave links that would enable limitless numbers of people to communicate worldwide via low-power Dick

**Components for giant power satellites are assembled in low Earth orbit; crews live in cylindrical habitats made from used Shuttle booster tanks. Finished units are jettied to high geosynchronous orbit.**



Tracy-type wristwatch radio terminals.

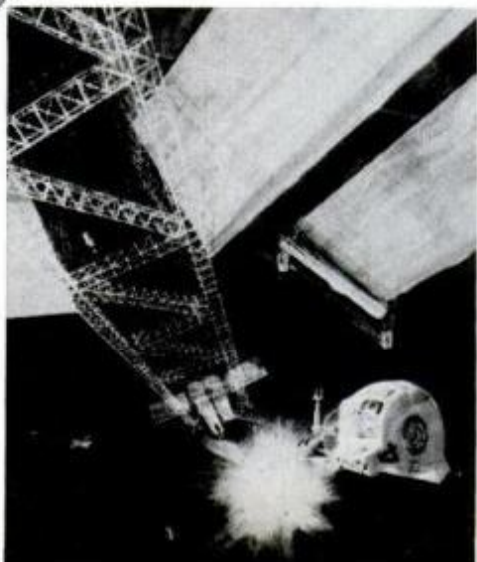
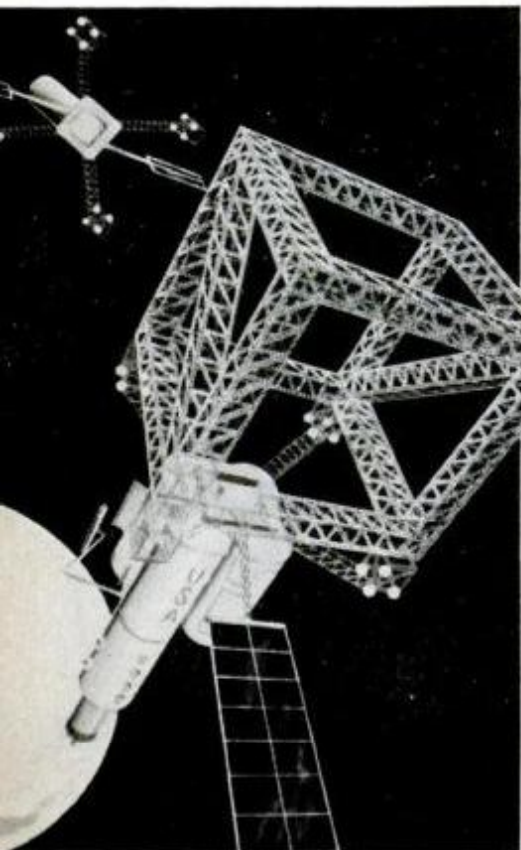
And it doesn't stop with electronics. During the Apollo-Soyuz mission, a rare enzyme used in the treatment of circulatory blood clotting was successfully separated from human cells with such simple efficiency that the cost per dose would be reduced from \$1000 to \$100 if it could be produced in space continuously. Abbott Laboratories, developers of the separation experiment, is hoping to do just that.

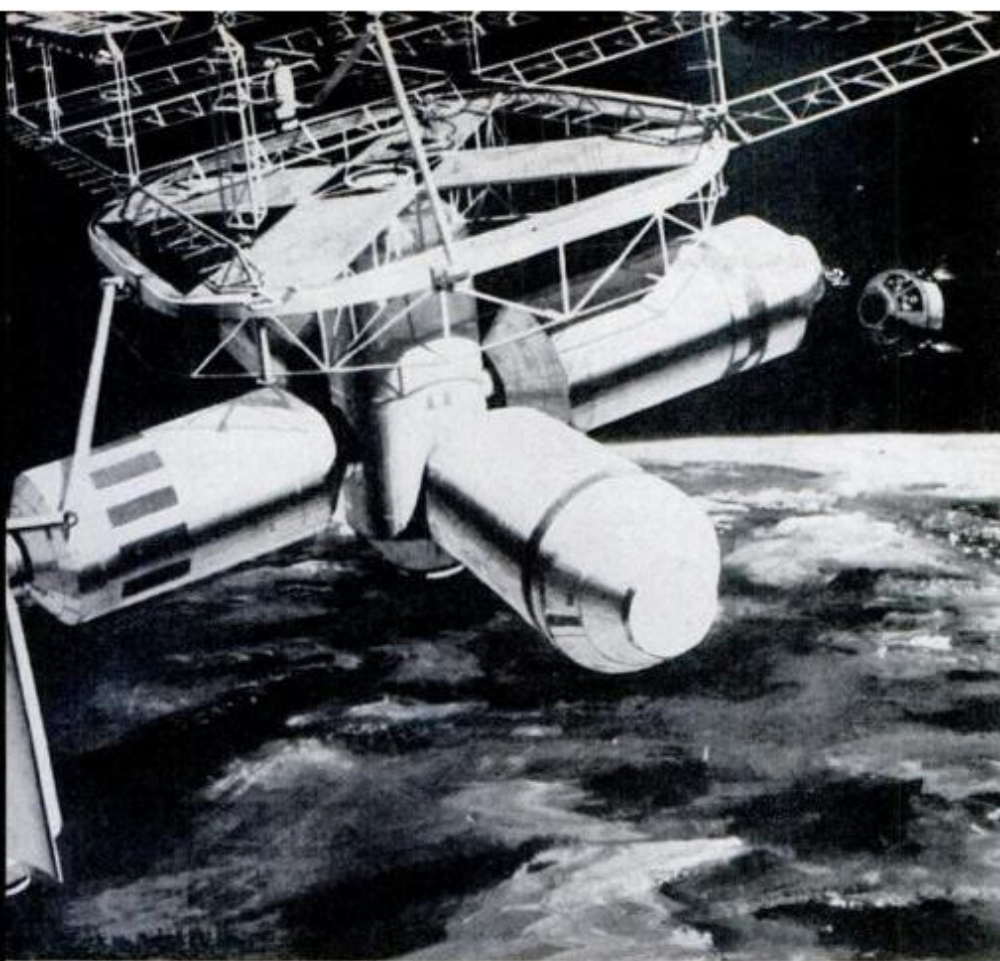
Many other pharmaceutical companies are readying processes for improving blood separation, vaccines, immunoglobins and other biomedical preparations in the zero gravity environment of outer space.

### Superconducting wire

Meantime, the European Space Agency (ESA)—a 10-nation consortium—is building in Paris a \$500 million space laboratory for the Shuttle. Half the experiments the lab will carry are industry-oriented. One involves a process for fabricating wire of superconducting alloys that would carry high voltages at  $-239.9^{\circ}\text{C}$ ., the temperature of liquid hydrogen, for high-efficiency power transmission on Earth. Such superconducting material also would make high-speed trains, suspended electromagnetically in mid-air, something more than daydreams.

While the scramble to fabricate





**Modularized space platform completes assembly of solar power station. Modules house equipment, habitats and pilot plant laboratories. Shuttle arrives (left) with fresh module in cargo bay, for re-supply.**

out there than by lofting every nut and bolt through Earth's gravitational field.

"The moon consists of 20 to 30 percent metals; in some places it's aluminum rich. There's also glass—all materials that would be useful in constructing Solar Satellite Power Stations and space habitats.

"Asteroidal resources," he adds, "include nickel, iron and many other useful minerals. And those passing close to Earth are abundant. An object the size of Phobos, a Mars moon measuring some 20 kilometers (km.) across, could provide 10 million tons of material—enough for 100 satellite power stations."

Key to this approach is an elec-

better materials in space for use on Earth gathers momentum, another whole group of scientists is busy with dramatic plans for mining the moon and the asteroids for raw materials that would be used to manufacture vast structures in space—for use in space.

An early objective for such celestial materials, these men point out, could be the giant solar-power satellites suggested a decade ago by Dr. Peter Glaser, Arthur D. Little vice president. The vast (22-square-mile) space platform photovoltaic collectors, in equatorial orbit some 22,000 miles in space, would convert sunlight into electricity and beam it to earthbound "rectennas" by microwave, where it would be received, rectified and fed into our power grids at a rate of about 5000 megawatts per satellite.

**Lofting 22 million pounds**

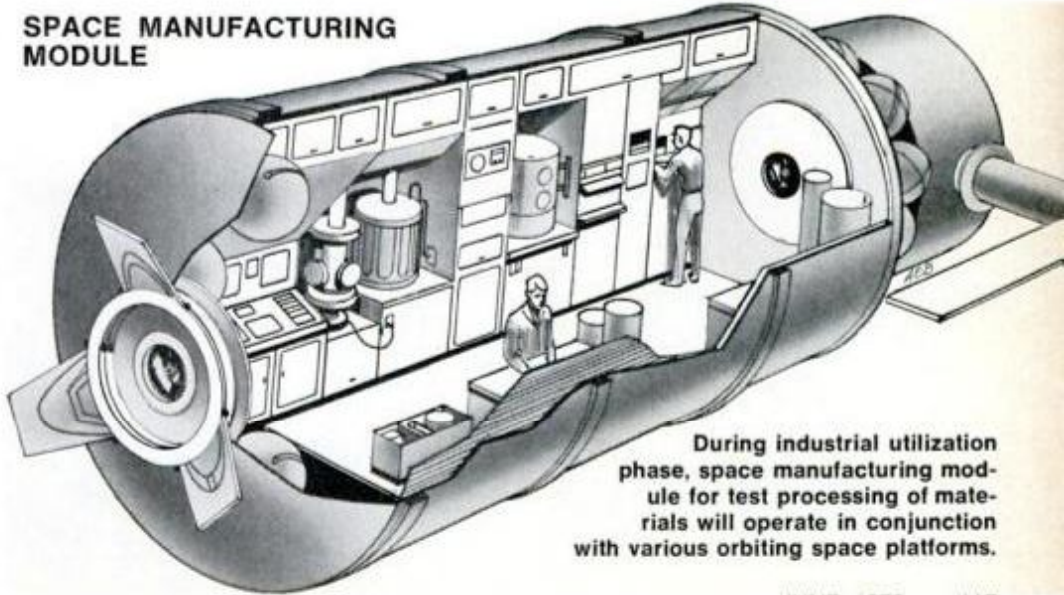
Original plans called for transporting into orbit materials for these, and similar power satellites, from the ground by reusable Heavy Lift Launch Vehicles. One such monster, already on the drawing boards at Boeing Aerospace, would weigh 22 million pounds at liftoff and carry a payload of some half a million pounds into low Earth orbit, where the power satellites would be assembled and later propelled, under their own power, to high permanent equatorial orbit.

While lofting materials from

Earth could be done economically, according to Dr. Glaser, Boeing, Grumman, and others involved in the business of space, some pioneers think it would be a lot better to mine the moon and asteroids for raw materials, and manufacture satellite components and support structures in space factories, right on site. Dr. Gerard K. O'Neill, professor of Physics at Princeton, and his scientific colleague, Brian O'Leary, are leading proponents of the latter method.

"We're too hung up on Earth," explains O'Leary. "If we ever hope to utilize space and its many advantages, we must have better ways of providing materials and machinery

**SPACE MANUFACTURING MODULE**



**During industrial utilization phase, space manufacturing module for test processing of materials will operate in conjunction with various orbiting space platforms.**



**Skylab II science pilot, Dr. J. Kerwin, blew gravity-free bubbles through straw. High-strength soap film was long-lived.**

tromagnetic catapult called a "mass driver," developed and scale-prototyped at Princeton by O'Neill and a colleague, Henry H. Kolm, of Massachusetts Institute of Technology, together with student volunteers

*(Please turn to page 170)*

# SMOKEY STOVER

## HOPPIN' HUBCAPS— A TWO-WHEEL CAR!

HACK YES,  
SMOKEY,  
IT RUNS  
LIKE A TOP  
EASY ON  
GAS  
TOO!



You drive this two-wheel Foo Mobile like any car with steering wheel and gas pedal—it even has a spare tire.





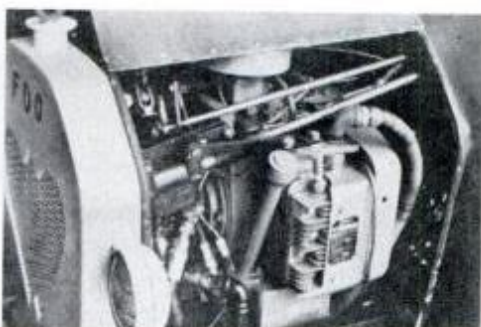


Remember the two-wheel car in *Smokey Stover*? Well, it's come to life! The comic-strip car inspired a fan to design and build one just like it. In a road test, PM discovered that it really rides without tipping over—and we also learned the secret of its balance.

by Bill Hartford  
AUTO EDITOR



Pete Schlatter (left) enjoys confounding cartoonist Bill Holman with his car.



Under hood is small Onan motor that provides hydraulic drive for the two-wheeler.

Car builder Pete Schlatter is unflappable as author finds out just how untipable is the car. How does it do the neat balancing act? See page 172 for cutaway drawings.



When Pete Schlatter sent me photos of his two-wheel car and asked me if I'd like to test drive it, I said "Yes," and reached for my crash helmet. I have a pretty good sense of balance and have driven some strange vehicles, but I didn't see how I could master this mechanical wonder without going on my head a few times.

Before our scheduled test-drive day, Pete had answered over the telephone all of my questions except the big one: "How, just how does it run without tipping over?" He said he'd let me figure out that one when I was looking at his "Foo Mobile" in the metal.

Foo Mobile? If you remember *Smokey Stover*, which first appeared in 1935, you'll remember the two-wheel Foo Mobile that Bill Holman created for his famous comic strip. It was this comic strip that inspired Pete Schlatter, a mechanical wizard from Indiana, to dream about building a Foo Mobile of his own some day. It was just a dream for many years until one day: "Eureka!" and he went to work.

Pete sent pictures of his car to Bill Holman, who was amazed. For him the Foo Mobile was an incredible,

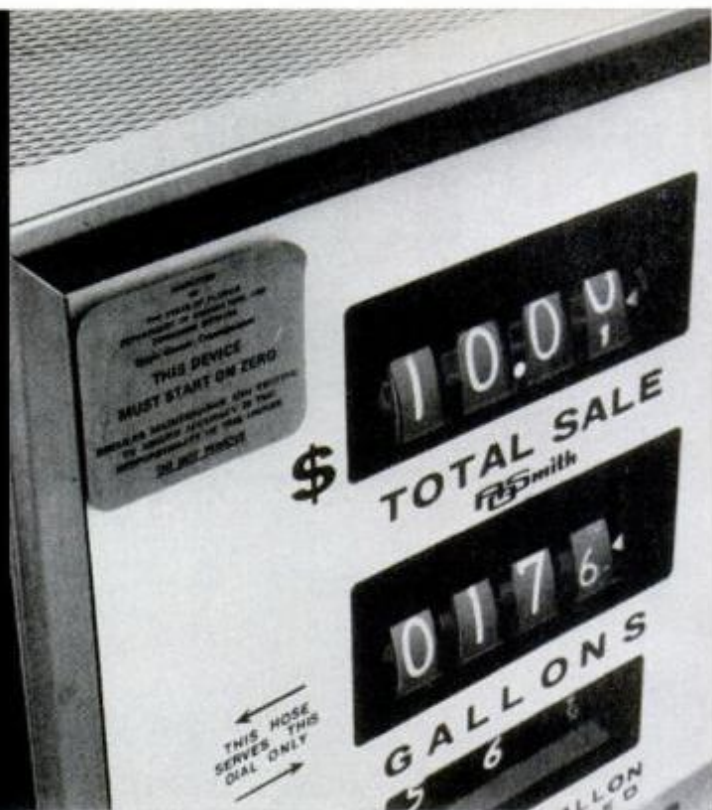
[\(Please turn to page 172\)](#)

# How much do you know about gasoline and engine oil

# ?

The higher your score, the more money you'll save.

by Mort Schultz



It's about time you dropped "fill 'er up" from your vocabulary: You can save a couple of cents per gallon if you pump your own at self-service islands.

And don't let gas station attendants "show" you that you're down a quart—check the oil yourself. They may not have fully seated the dipstick.

That's the kind of old-fashioned good sense and self defense that come from having a high gas and oil I.Q. To make sure your oil and gas I.Q. is up to date, take this quiz. It's the second we've run this year on automotive subjects. The first, on tires, appeared in March.

## QUESTIONS

**1. As far as consumers are concerned, the most important difference between brands of gas is:**

- a. Use of detergent additives.
- b. Octane rating.
- c. The grams of dirt per gallon.

**2. To determine which brand of gas has the octane level your engine requires, you should:**

- a. Fill the tank and drive the car.
- b. Consult your car owner's manual.
- c. Ask your mechanic.

**3. Engine knock (ping):**

- a. Is harmful to engine in any form.
- b. May be acceptable if mild.
- c. Is the same as preignition.

**4. Light knock has been described by GM President Elliott S. Estes as, "The sound of fuel economy—not the sound of trouble." This means that:**

- a. By letting engines knock lightly, the oil industry can conserve petroleum.
- b. Engines which knock lightly consume less gas than engines that don't knock.
- c. A light knock will cause a driver to tune up the engine, which is a fuel economy measure.

**5. As far as the consumer is concerned, octane is designated by which of the following:**

- a. RON.
- b. MON.
- c. Antiknock index.

**6. Some service stations have stickers on pumps that reveal the octane value. Others don't. This means that:**

- a. Under the law, the use of stickers is left to the discretion of the individual service station.
- b. Service stations that do not display stickers are violating the law.
- c. Stickers are used by some oil companies and not by others. It has nothing to do with the law.

**7. Off-brand service stations generally sell gas for several**

**cents a gallon less than name-brand service stations, because:**

- a. Off-brand gas has a lower octane.
- b. Off-brand gas is old gas.
- c. It is the best way off-brand service stations have of competing with name-brand stations.

**8. In what year will lead no longer be added to gas?**

- a. 1979.
- b. 1982.
- c. No specified date.

**9. What is MMT?**

- a. An additive put in lead-free gas to raise octane.
- b. Methylcyclopentadienyl manganese tricarbonyl.
- c. An additive in gas that is suspected of raising the level of hydrocarbon emissions.

**10. Service station dealers who allow leaded gas to be put in cars designed for unleaded gas are:**

- a. Subject to having their licenses revoked.
- b. Subject to a \$10,000 fine per violation.
- c. Not subject to penalty.

**11. Viscosity refers to:**

- a. The viscous fiber in motor oil.
- b. An oil's resistance to flow.
- c. Cleansing quality of motor oil.

**12. The chief difference between multiweight oil and a com-**

parable quality single-weight oil is:

- Price.
- Detergent content.
- Lubricity.

**13. Service stations carry oil bearing the designation For Service SE. This oil is:**

- For use in four-cylinder engines.
- As a lubricating oil for chassis and body points.
- For use in post-1972 vehicles.

**14. The oil put in a new engine at the factory is:**

- Conventional oil designated For Service SE.
- Light weight "break-in" oil to overcome new-engine resistance.
- Heavy weight "break-in" oil to provide better lubrication for new engines.

**15. One of these is valid:**

- Try not to mix brands of motor oil.

- The designation "W" in SAE 20W-20 means "wide use."
- The best time to check oil level is when the engine is hot.

**16. Supplemental engine oil additives are recommended by U.S. car manufacturers for use:**

- Always.
- Sometimes.
- Never.

**17. Motor oils for turbocharged engines fall into which one of these categories?**

- Specially formulated.
- Extended drain period.
- Conventional.

**18. If you use a synthetic motor oil, which claims to protect an engine for 15,000 miles between oil changes, in your new car, which of the following statements applies? (Car is used under normal, not severe, conditions):**

- Change oil and oil filter as spe-

cified in owner's manual to keep warranty in effect.

- Car manufacturers have waived warranty requirements for synthetic oils. Follow the oil company's recommendation.
- Car manufacturers have waived warranty requirements insofar as the oil filter is concerned. Change oil at the interval spelled out in the manual, but you don't have to change the oil filter for 25,000 miles.

**19. One result of prolonged engine cranking to start in cold weather may be:**

- Oil foaming.
- Dilution of oil by gas.
- Loss of oil.

**20. The primary purpose of motor oil is to lubricate engine parts. Another purpose is:**

- To seal internal areas where combustion leaks may occur.
- To cool the engine.
- To clean the engine.

## ANSWERS

1. b. All fuel refiners use additives and take precautions to guard against contamination. But octane rating is another matter. There is variation in octane rating from brand to brand.

Octane rating is a measurement of resistance that gas has to forces that cause it to explode. A properly consumed fuel mixture burns smoothly from the tip of the sparkplug to the farthest reaches of the cylinder. A mixture that can't withstand engine heat or compression will begin to burn when the sparkplug fires, but will then explode. Detonation, as this explosion is called, can be mild or severe, depending on how much unburned fuel remains in the cylinder when it occurs. Severe detonation can shatter sparkplugs and damage valves and pistons.

Detonation increases pressure in the engine. Pressure causes the cylinder head and other parts to vibrate, which is heard as pinging (knocking).

Gas having higher octane ratings resists detonation-causing forces better than gas having lower octane ratings. Yet octane in excess of that which an engine needs is unnecessary. Octane doesn't provide power or fuel economy, as some believe. Since gas having a higher octane is more expensive than gas having a lower octane, buying gas having excess octane is a waste of money.

2. a. According to Elliott M. Estes, president of General Motors, "We have considerable car-to-car variation in octane requirements as they (cars) come off the production line, and this increases with miles." Thus, the octane rating recommended in your owners manual is a minimum recommendation. It may suit your neighbor's car, but not yours, although you have identical vehicles.

Keep in mind that brands of gas of the same grade (unleaded regular, leaded regular and premium) vary in octane rating. If your engine pings or begins pinging as mileage accumulates, change your brand. A variation of as little as

one-half (0.5) point can make the difference.

3. b. According to GM fuels researcher Nicholas Gallapoulos, in referring to knock caused by detonation, "Light knock is not harmful to an engine."

Light knock is defined as ping only when the engine is under heavy acceleration. Unacceptable knock is constant ping.

As we pointed out, engine knock that is caused by detonation can be reduced or eliminated by switching to gas having a higher octane rating. You can help matters along by reducing forces that cause detonation—that is, by tuning the engine to specification, by trying to lessen engine operating temperature, and by making sure hotter-than-necessary sparkplugs aren't being used. Retarding ignition spark by 2° may also help.

The only time these methods



Electronic gasoline pumps are gradually replacing the older types of pumps designed to read out the price and gallons mechanically.



Posted octane number, or antiknock index, is average of Research and Motor octane numbers; must be on all pumps.

won't lessen or eliminate knock is when knock is being caused by preignition. Preignition is premature ignition—that is, ignition of the fuel mixture before the spark-plug fires. A hot spot inside the engine, such as a piece of red-hot carbon, causes preignition.

Unlike detonation or knock, there is no such thing as mild



Pump-your-own islands at gas stations save you a couple of cents per gallon. Pump operation is easy to master.

preignition. The condition is serious in all forms, because it causes major engine damage. Immediate steps should be taken to find and alleviate the cause.

4. a. There are two ways of increasing octane rating. One is to add a metallic substance, such as lead. However, the use of lead is being curtailed, because it damages the catalytic converter, which is the primary piece of emission control equipment in a modern car. Also, lead particles ejected into the atmosphere are thought to be a health hazard.

The other way to raise the octane rating is by reprocessing. Gas is a blend of several hydrocarbon elements, such as paraffin, olefin, and aromatics. Some have a higher octane (resistance to detonation) than others. To raise octane by reprocessing calls for introducing more higher octane elements. This requires the use of more petroleum. It is also the reason why Amoco unleaded premium, which has an octane rating of 95 plus, and Shell unleaded regular, which has an octane rating of about 93, cost more than other unleaded fuels which have lower octane ratings.

5. c. Antiknock index signifies the octane value of gas. It is a

numerical result obtained by averaging RON (research octane number) and MON (motor octane number). RON and MON are testing methods of establishing the octane rating of gas. Thus, gas having a RON of 91 and a MON of 83 would have an antiknock index of 87.

We use the example of 91 (RON), 83 (MON) and 87 (antiknock index), because an ongoing attempt by car manufacturers to design engines that meet this octane requirement that began back in 1971.

6. b. Service stations not displaying antiknock index (octane value) stickers are violating the law. However, "This law is not being enforced," says a spokesman for the Department of Energy.

As this quiz was being prepared, the law stated that service stations had to display stickers on every gas pump. Stickers, which must have lettering at least 1/2 inch high, have to specify the maximum retail selling price as well as the antiknock index. The law was about to be replaced by another which mandates service stations display signs that are large enough to be seen from the road. These signs are to give the antiknock index and price.

The new law will be enforced by the Federal Trade Commission. According to one source, a violation may result in a \$500 fine.

7. c. Off-brand gas is the same as major-brand gas and can be used in your engine as long as it doesn't cause heavy pinging.

8. c. No date has been set for the total phase-out of lead. However, a "lead phase-down" will take place Oct. 1, 1979. At that time, the amount of lead the refineries can add to their total production output cannot exceed 0.5 gram per gallon.

Owners of cars that run on leaded regular gas should not find this difficult to live with. The low-lead (0.5-gram-per-gallon) gas will probably suffice if timing is retarded 2° and the engine is mechanically in shape.

However, owners of cars with high-compression engines that require leaded premium will face a problem. Unless modification kits are introduced for their engines, these owners will have to use high octane unleaded gas (Amoco premium, for example) or take whatever mechanical steps are feasible

to lower compression. This may entail purging all carbon from the engine and installing a thicker head gasket.

9. a, b and c. MMT is all three. It is also a center of controversy. When the Environmental Protection Agency (EPA) forbade the use of lead additives in gas for 1975 and succeeding model vehicles, oil refiners found that MMT would boost octane, obviating the need for reprocessing (see question 4). Adding 1 to 1 1/2 grams of MMT to a gallon of gas allowed refineries to make unleaded fuel that wouldn't detonate severely.



Oil cans are marked Society of Automotive Engineers plus viscosity number single-weight or multigrade.

However, General Motors claims that MMT plugs up catalytic converters and exhaust systems, and doubles the hydrocarbon output.

According to David Finley of the EPA, "MMT seems to cause additional engine deposits that result in higher hydrocarbon emissions, but this has not been established with any degree of certainty."

The present law (adopted Nov. 30, 1977) allows .0625 gram of MMT per gallon of gas, which increases octane by one to two numbers. As of Sept. 15, 1978, the law says MMT will no longer be added unless refiners can prove that this additive does not harm the environment.

10. b. The stiff fine can be meted out to a service station whether car owners use "full serve" or "self serve" islands.

The law applies as long as a car has a filter inlet designed for an unleaded gas pump nozzle, or has a label stating that only unleaded gas can be put in its tank.

11. b. Viscosity, or weight, refers to an oil's resistance to flow at different temperatures. It is an important consideration in selecting a motor oil for an engine.

You can determine the viscosity of a particular can of oil by looking on the can itself. The viscosity

(Please turn to page 188)

IT'S NEW  
**NOW**

**Tempest in a bathtub**

Jacuzzi's Prima VI whirlpool bath features a control console fully plumbed into the tub; it needs no separate fittings. Positioned within easy reach of the bather, the console includes controls for water temperature and air/water mixture. The 6x3-foot tub is contoured at both ends. About \$1460 from Jacuzzi, 298 North Wiget Lane, Walnut Creek, Calif. 94596.



**Web of intrigue**

Duck and frog imitators can complete their costumes with Aqua-Hands. Surfers, divers and swimmers can use them to reduce stroking effort. A custom-built pair is \$20; standard sizes, \$16. Ocean Motion Research, 1370 Vine Ave., Martinez, Calif. 94553.

**Well spoken**

The steel spokes on the Auto Hoe tiller are guaranteed not to bend or break for 25 years. It's claimed Auto Hoe can till the hardest soils up to 6 inches. The 3-hp model is \$219 with shipping. Auto Hoe, Box W121NR, DePere, Wis. 54115.

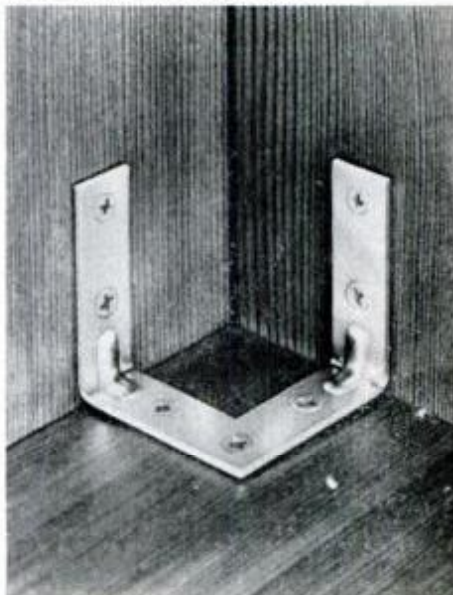


**Talk with the fish**

Sea Voice uses a diaphragm and rubber bladder to enable divers to converse underwater for up to 15 seconds at 25 meters, the maker claims. It's \$36 from Sea Sonics, Inc., 1224 Algonquin Rd., Box 94458, Schaumburg, Ill. 60195.

**Positive reinforcement**

This three-surface corner brace of zinc-plated steel can be used to reinforce cabinets, drawers, boxes or anywhere three wood surfaces join at right angles. Cost is \$1.06 for two. Stanley, Box 1800, New Britain, Conn. 06050.



# How to troubleshoot your

We discussed the AMC and Chrysler systems in April. Here we

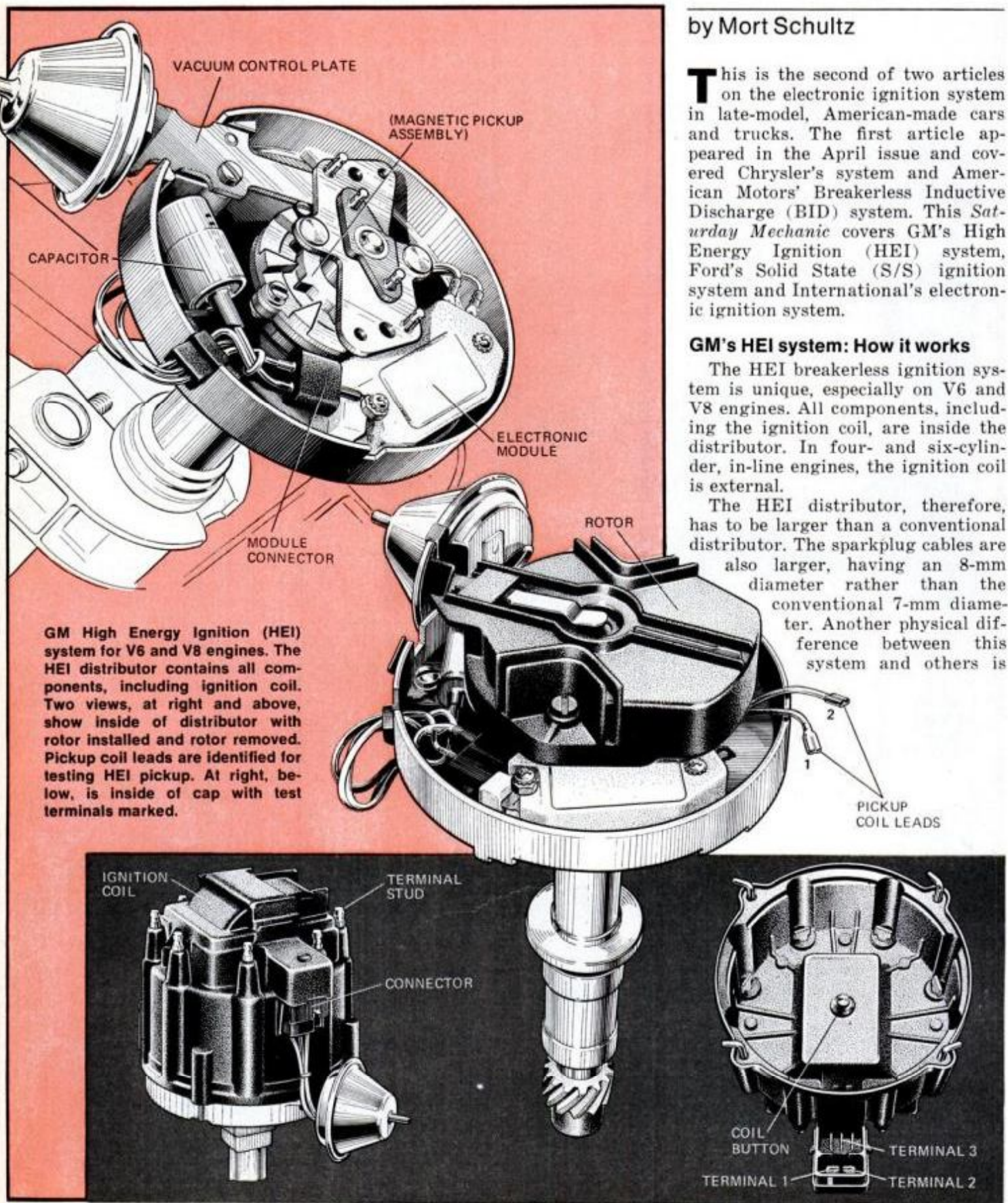
by Mort Schultz

**T**his is the second of two articles on the electronic ignition system in late-model, American-made cars and trucks. The first article appeared in the April issue and covered Chrysler's system and American Motors' Breakerless Inductive Discharge (BID) system. This *Saturday Mechanic* covers GM's High Energy Ignition (HEI) system, Ford's Solid State (S/S) ignition system and International's electronic ignition system.

### GM's HEI system: How it works

The HEI breakerless ignition system is unique, especially on V6 and V8 engines. All components, including the ignition coil, are inside the distributor. In four- and six-cylinder, in-line engines, the ignition coil is external.

The HEI distributor, therefore, has to be larger than a conventional distributor. The sparkplug cables are also larger, having an 8-mm diameter rather than the conventional 7-mm diameter. Another physical difference between this system and others is



GM High Energy Ignition (HEI) system for V6 and V8 engines. The HEI distributor contains all components, including ignition coil. Two views, at right and above, show inside of distributor with rotor installed and rotor removed. Pickup coil leads are identified for testing HEI pickup. At right, below, is inside of cap with test terminals marked.

# electronic ignition system

conclude with GM, Ford and International.

the presence of terminal studs on the distributor cap to which spark-plug cables are connected.

The ignition coil in V6 and V8 engines, which is in the distributor cap, is smaller than a conventional ignition coil. However, it has more primary and secondary windings and is built like a true transformer with the windings surrounded by a laminated iron core. (A conventional ignition coil has the iron core surrounded by the windings.)

The ignition coil is replaced by removing it from the distributor cap. Keep in mind that there are a number of different ignition coils made for the HEI. They all work the same way, but you must use the correct one in your car. Order a replacement by the number embossed on the coil.

The other parts of the HEI system include a rotor that's just like the rotor in a conventional GM

distributor; a magnetic pickup assembly that contains a permanent magnet, a pole piece with internal teeth and a pickup coil; and an electronic module.

You will also find a capacitor in the distributor. It is used for radio-noise suppression and has no bearing on ignition.

The movable magnetic pickup assembly is on the distributor shaft. When the teeth of the timer core that rotate inside the pole piece line up with the teeth of the pole piece, an induced voltage in the pickup coil signals the electronic module to open the ignition coil primary circuit. This interruption of primary current causes a high voltage to be induced in the ignition coil secondary winding. High voltage is directed through the rotor and spark-plug cables to the sparkplugs.

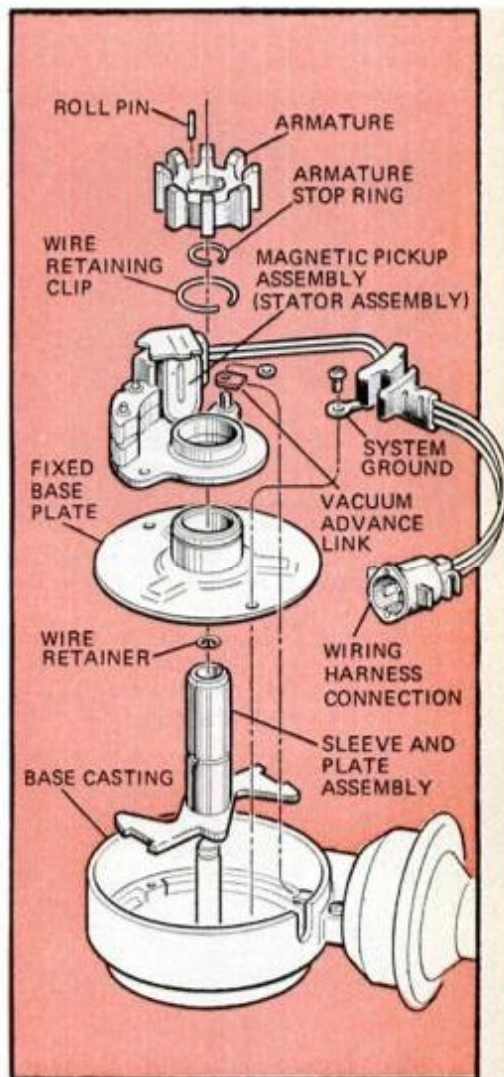
## GM's HEI system: Finding a problem

GM has a set troubleshooting procedure that is logical, simple and requires only a volt-ohmmeter. First, analyze the problem: Either the engine won't start or it will run rough. Then be sure the connector on the side of the distributor is secure and that all sparkplug cables are tightly connected. If this doesn't solve the problem, probe deeper:

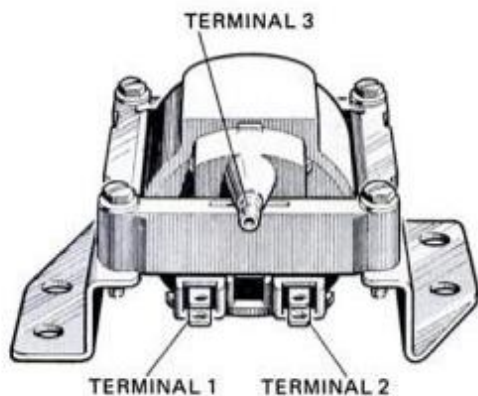
### (A) Engine won't start

1. Connect a voltmeter between the BAT terminal lead on the distributor and ground. Turn on the ignition switch.

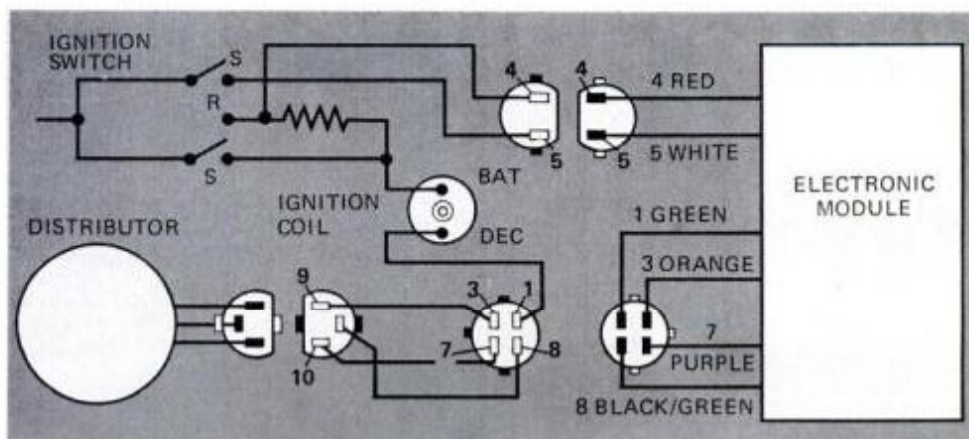
If the voltage reading is zero,



Ford Solid State (S/S) ignition system distributor is detailed here. The armature and stator perform the same switching function as the breaker points do in a conventional ignition system.



The HEI external coil is tested with an ohmmeter at the terminals marked.



Ford S/S ignition schematic shows wiring for 1976-77 models but can be used to

pinpoint wiring connections for your car using the color code.

there is an open circuit between the BAT terminal and the battery.

2. If the voltmeter records battery voltage, remove a sparkplug cable and hold it 1/4 inch from ground using a pair of insulated pliers. Crank the engine.

If a spark occurs, the cause of the trouble is not inside the distributor. Look for bad sparkplugs or a fuel system breakdown. If there is no spark, distributor components should be tested (C, below).

### (B) Engine runs rough

1. Make sure fuel is reaching the carburetor.

2. Check vacuum hoses for leaks.

3. Start the engine. Look and

listen to see if arcing is occurring. You can usually see or hear sparks jumping to ground through a defective cable. Replace the cable.

4. Check ignition timing and centrifugal advance with a stroboscopic timing light.

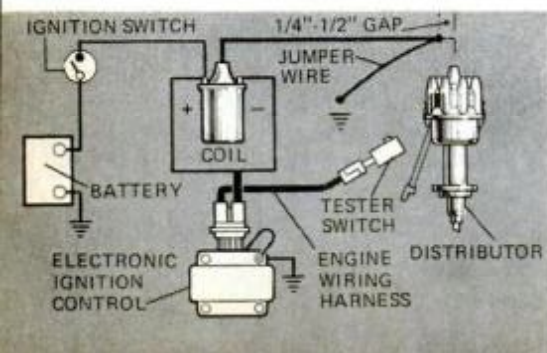
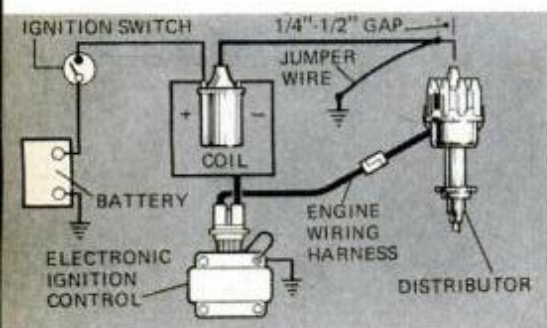
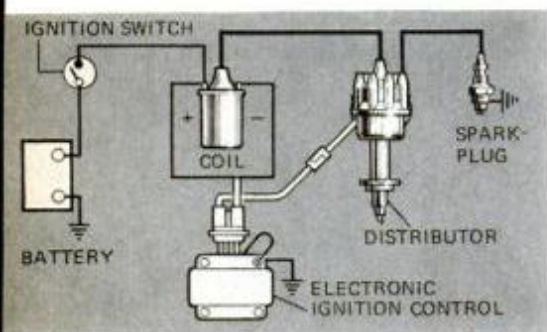
5. Remove sparkplugs and check for correct gap and other conditions that cause misfiring, such as fouled, glazed or damaged firing ends.

If the cause of the problem isn't found, test distributor components (C, below).



Air gap adjustment between sensor and trigger wheel of the International system.

International electronic ignition system is in top schematic. Hookup for check of secondary circuit components is below and that for sensor checkout is at bottom.



### (C) Testing distributor parts

1. Remove the distributor cap, which is held by four fasteners. Depress each fastener and twist one-half turn.

2. Examine cap terminals, ignition coil button and rotor pickup for burned areas, which indicate arcing. Replace a damaged component.

3. If the ignition coil is inside the distributor cap, connect an ohmmeter between terminals 1 and 2 in the distributor cap. The meter should read zero or nearly zero. If it doesn't, replace the ignition coil.

Now, connect one ohmmeter lead to the ignition coil button in the distributor cap. Connect the other lead first to the No. 2 terminal and then to the No. 3 terminal. Take both readings with the ohmmeter scale set on its high scale. If *both* readings are infinite, replace the ignition coil.

To replace the ignition coil, re-

move the three screws holding the coil to the distributor cap. Remove the ground wires from the coil, push the coil leads from the underside of the connectors and remove the coil.

4. If the ignition coil is an external unit, connect an ohmmeter between the No. 1 terminal and ground. With the ohmmeter on its high scale, the reading should be infinite. If it isn't, replace the coil.

Connect the ohmmeter leads between the coil's No. 1 and No. 2 terminals. With the ohmmeter on its low scale, the reading should be zero or nearly zero. If not, replace the ignition coil.

Connect the ohmmeter leads between the No. 2 and No. 3 terminals. With the ohmmeter on its high scale, the reading should *not* be infinite. If it is, replace the ignition coil.

5. Connect a vacuum source to

[\(Please turn to page 178\)](#)

## QUICK CHECK CHART—FORD S/S IGNITION SYSTEM

| Test Condition                            | Test Voltage Between                           | Reading in Volts Should Be                   | Action to Take  |
|---|--|--|---|
| Key On                                    | Red wire socket and ground                     | Battery voltage $\pm 0.1$                    | Check red wire and connectors through ignition switch   |
|   | Green wire socket and ground                   | Battery voltage $\pm 0.1$                    | Check green wire to ignition coil and test coil         |
| Cranking                                  | White wire socket and ground                   | 8 to 12                                      | Check white wire and connectors through ignition switch |
|   | Purple wire socket and orange wire socket      | Any direct current fluctuation (0.5 minimum) | Test distributor components                             |
| Test Condition                            | Test Resistance Between                        | Reading in Ohms Should Be                    | Action to Take  |
| Key Off                                   | Purple wire socket and orange wire socket      | 400 to 800                                   | Test magnetic pickup                                    |
|   | Black wire socket and ground                   | 0  | Test magnetic pickup                                    |
|   | Purple wire socket and ground                  | 70,000 or more                               | Test magnetic pickup                                    |
|   | Orange wire socket and ground                  | 70,000 or more                               | Test magnetic pickup                                    |
|   | Red wire socket and ignition coil tower        | 7000 to 13,000                               | Test coil   |
|   | Green wire socket and red wire socket          | 3.0 to 4.0                                   | Check harness, ignition coil                            |
|   | Red wire socket and ignition coil BAT terminal | 1.0 to 2.0                                   | Check resistance wire                                   |
|   | Ignition coil primary terminals                | 1.0 to 2.0                                   | Test coil   |
|   | Orange wire socket and orange wire socket      | 0  | Check wire and terminals                                |
| Purple wire socket and purple wire socket | 0  | Check wire and terminals                     |   |



# They laughed when I sat down at the computer...

... but I'm really enjoying programming my machine

by Stephen Walton

**W**hen I first told people I was going to buy a microcomputer, they asked me what I was planning to do with it. About all I could say was, "Learn how to use it."

I've had my computer for six months now. The problem in trying to explain what I'm doing with it is that there are too many answers: I'm stretching my mind. I'm entertaining myself. And, most important, I'm learning programming—the art of bending the machine to your will. It's a new kind of how-to skill, and I'm having a lot of fun.

## After 20 years

More-or-less intelligent machines have always fascinated me. When I was 12 I had a Brainiac "computer," a hardboard panel and six hardboard wheels full of holes, 10 light bulbs, a C battery, and a lot of contacts and wires that you had to rearrange every time you wanted the machine to do something new.

Time passed. About 20 years' worth. As of last summer, I'd been following the development of hobby computers and envying people I knew who owned them. Not that they ever had much to say about what their machines actually *did*. But a new generation of home computers, the plug-ins, was coming along; these were complete small systems that came factory-assembled, didn't require home-brew interfacing, and, most important, offered a high-level computer language permanently stored in the machine and ready to use as soon as you turned the system on. (A high-level computer language is a way of



Author loads one of his programs, stored on a cassette, into his home microcomputer.

talking to a machine a human being has a chance of understanding.)

## Busted at blackjack

The Radio Shack TRS-80 was the one I could afford that had the abilities (including expandability at the right prices) I wanted. I got one, hooked it up, loaded the blackjack game program-tape that comes with it and lost a few hundred imaginary dollars, enraptured.

Then I really got into it, staying up all hours with the machine, running through the preliminary manual, then doing my own stuff.

Programming a computer is a terrific kick—at least when the programs are the ones *you* choose to write, and the machine is right

there for you to try them out on. (For the big-machine professionals it may be a different story.)

## What it does

You're about to say, yes, but what does your computer *do*? Okay. It does *not* start the percolator, turn down the furnace, or put out the cat; if I wanted those things done, I'd use \$10 timers instead of tying up a \$600 computer. It does a few practical things, though:

- Balances my checkbook and it keeps track of spending in 32 different budget categories. (It's not the unit's fault, but the results I get are usually not inspiring.)

- Gives me an "intelligent" budget worksheet that lets me put in expenses with odd frequencies—every two weeks or twice a year, for example—and gives me a summary with every item shown in weekly, monthly and annual terms, and totals likewise. (Since my expenses tend to exceed my income, this isn't one of my favorite programs.)

- Leads me quickly through calculation of my net worth.

- Lets me scale any set of measurements up or down as I please, with results given in common fractions rounded to the nearest 1/64 inch, if I choose. This program could be a boon to a model railroader or other scale modeler, could even be used in custom-sizing a piece of furniture.

- Helps plan business and pleasure trips.

## High-order foolishness

Mostly, my computer plays games with me. Foolish? Perhaps yes—but



Through the first turn and into a bend—blips show where my simulated race car is and has been. I put in accelerations and program figures out and shows what happens to the car.

## HOW A COMPUTER PROGRAM WORKS

```

10 REM DEMONSTRATION PROGRAM
20 PRINT "THIS PROGRAM SHOWS HOW SOME BASIC STATEMENTS WORK."
30 PRINT
40 PRINT "WHAT'S THE VALUE OF A"
50 INPUT A
60 INPUT "WHAT'S THE VALUE OF B?" B
70 PRINT "A + B = "A+B
80 IF A+B > 10 THEN 110
90 PRINT "A + B IS NOT GREATER THAN 10."
100 GOTO 120
110 PRINT "A + B IS GREATER THAN 10."
120 Y = 1 : N = 0
130 INPUT "DO IT AGAIN?" R
140 IF R = 1 THEN 30
999 END
>

```

### The program

To show how a program works, we'll go line by line through a simple one written for demonstration purposes. The program is on the left, the results of running it are on the right. Line numbers in the program are multiples of 10 to leave room—in case you should discover that you need to put new lines between existing ones. Each line is a program statement—it tells the computer to do something. You can put more than one statement on a line, but the lines then become harder to read. Here we go: 10—doesn't tell the computer to do anything. REM, short for "remark," statements are ignored when the program is run. But they're very helpful for identifying programs and explaining their workings to other programmers and for labeling parts of a program, reminding you of what's going on in the lines that follow. 20—tells the computer to print whatever follows in quotation marks. 30—When nothing in quotes follows the PRINT statement, a blank line is produced. 40—Here the PRINT statement and the text in quotes tell the user what kind of information he's about to be asked for.

50—tells the computer to get some information from the user; in this case it's a number that will be referred to as "A." A question mark always results from an INPUT statement; the number 3 was typed in by the user during the program run. 60—does the same thing 40 and 50 did but more neatly and economically. The semicolon keeps the question mark and the user input on the same line the text "WHAT'S THE VALUE OF B" was printed on. Here the user entered 5 as the value of B. 70—prints what's in quotes, "A+B=", stays on the same line because of the semicolon, then prints the value of A+B. When the computer is told to print anything that isn't in quotes, it evaluates it (if possible) and prints the resulting number. 80—first makes the computer find out whether the statement "A plus B is greater than 10" is true. In this case it's not, and the computer proceeds to the next line number. 90—makes the computer print an appropriate text. 100—tells the computer to skip to line

120 and do next what it finds there. 110—We'll come back to this one. 120—combines two statements on one line by separating them with a colon. The statements aren't equations, they're a way you assign numerical values to letter variables. 130—prints the words "DO IT AGAIN" and gets a number we'll call R from the user. Because of the assignments in line 120, the computer will take "YES" for one and "NO" for zero. 140—tells the computer to go to line 30 and work from there, if R is one. 999—tells the computer that it has finished the program. In the run shown, the user's response to 130 was "yes," so the computer went back to line 30, and the user put in values of A and B that totaled more than 10, so the computer went to line 110 and printed the appropriate text. At the bottom of the screen, it's waiting for the user to type in a value for R. If the user types in a zero or the word "NO," the computer will drop to 999, learn that the program is finished, and announce that it's ready for new instruction.—S.W.

```

THIS PROGRAM SHOWS HOW SOME BASIC STATEMENTS WORK.

WHAT'S THE VALUE OF A
? 3
WHAT'S THE VALUE OF B? 5
A + B = 8
A + B IS NOT GREATER THAN 10.
DO IT AGAIN? YES

WHAT'S THE VALUE OF A
? 3
WHAT'S THE VALUE OF B? 8
A + B = 11
A + B IS GREATER THAN 10.
DO IT AGAIN?

```

### The run

THIS PROGRAM CHANGES A SET OF MEASUREMENTS FROM ONE SCALE TO ANOTHER.

DO YOU WANT DECIMAL OR COMMON FRACTIONS (NEAREST 64TH) IN CONVERTED DIMENSIONS? COMMON

THERE ARE THREE WAYS TO ENTER THE SCALING RATIO:

1. STRAIGHT NUMERICAL RATIO OF NEW SIZE TO ORIGINAL
2. NEW SIZE AS PERCENTAGE OF ORIGINAL SIZE
3. A KNOWN PAIR OF DIMENSIONS—OLD AND NEW.

WHICH METHOD? 1

WHAT'S THE RATIO? 1/12.

```

RATIO OF NEW SIZE TO OLD: 8.33333E-02
(0 END; ENTER 0 FOR ORIGINAL DIMENSION.)
ENTER A KNOWN NUMBER, E.G. 3 5/8 AS 3*5/8.
ORIGINAL      NEW
?14*3/4              1 15 / 64
?6                  0 1 / 2
?1*5/8              0 9 / 64
?1                  0 5 / 64
?0
WHAT TO DO ANOTHER SCALING?

```

My ratio has been converted to 0.0833333 displayed in scientific notation. Zero input at bottom makes the program ask whether I want to start again or quit.

foolishness of a high order nevertheless.

A computer makes games possible that can't be practically played without it. It's an untiring opponent or an untiring referee—sometimes both at once. It adroitly handles complications no one would put up with in an ordinary board game. Its flair for drawing pictures on a TV screen, and withdrawing them, opens still more possibilities.

The games I've played are fun to play—real mind-stretching fun—and they've been challenging to program. They offer immediate gratification the practical programs can't touch. They give you new worlds to deal with—you're in charge, but you still can't overrule cause and effect. They let you "try on" situations you might never experience first hand (or want to experience).

My sources for ready-made games

Start of dimension-scaling program gives me choices to make; my inputs follow the question marks. Note that the desired ratio can be entered as a fraction.

EXPENSE # 1 -- FREQUENCY:

- 1 WEEKLY
- 2 BIWEEKLY
- 3 SEMIMONTHLY
- 4 MONTHLY
- 5 QUARTERLY
- 6 SEMIANNUAL
- 7 ANNUAL

AMOUNT?196.88

FREQUENCY?4

ANOTHER?YES...

| #     | WEEKLY  | MONTHLY | ANNUALLY |
|-------|---------|---------|----------|
| 1     | 45.4338 | 196.88  | 2362.56  |
| 2     | 12      | 52      | 624      |
| 3     | 5.76923 | 25      | 300      |
| 4     | 4.15385 | 18      | 216      |
| 5     | 18      | 43.3333 | 520      |
| 6     | 1.28846 | 5.58333 | 67       |
| 7     | 6.73877 | 29.1667 | 350      |
| 8     | 4.46154 | 19.3333 | 232      |
| TOTAL | 89.8377 | 389.297 | 4671.56  |

FOR A CHANGE, TYPE 1; AN ADDITION, 2; SUBTOTALS, 3; ELSE 0.

This program is designed to help work out a family or business budget. It starts by asking the amount of an expense and how often it occurs, then asks whether there's still another expense to consider. If there isn't...

... the program shows you a summary like the one above, with each expense and the total given three ways. Then you get to make changes or additions, or take a subtotal of any group of expenses. This isn't a program you run for entertainment.

to adapt have been books like *What Do You Do After You Hit Return?* and *101 BASIC Computer Games* and magazines like *Creative Computing* (all available at computer stores). But the greatest pleasure has come from writing game programs rather than just playing with them. When I was programming an interstellar-empire game (be Darth Vader's boss!), I wound up making a model of the economy and politics of a group of 100 or more star systems. I had to decide what actions by the ruler would stimulate or depress the economy, and which actions might annoy his subjects to the point of active rebellion. This is a program that I'm still refining, after eight versions. It points up what someone once said about a computer being like a spouse—it helps you solve problems you never had before you had one.

My one-car auto-race game (picture on page 127) started simple and got complicated. It's pretty good as a simulation inasmuch as you really do have to follow the fastest line through each curve to get the best possible time for a lap. It turned out that it was helpful to see where you'd already been, not just where you were. But showing past positions on the monitor screen and removing them—oldest first—when their usefulness had expired proved a problem. I had a way of doing it that was eating up the computer's memory space and interrupting the game. I've solved that one, but only recently.

My "Space Duel" game lets two players take turns at the keyboard, each issuing secret commands to his one-man battleship. Then the com-

puter figures the results of their movements and their offensive and defensive actions as though both sets of commands had been given at the same time. Doing this without a computer would be tedious.

I've programmed half a dozen original games that I'm proud of. Since this kind of impracticality has been fascinating to me, I suspect it might interest others, and I'm exploring ways to sell my games.

A word about math: programming isn't really mathematics, as the computer advocates will be quick to tell you. But you'll find yourself getting into math, slipping into it, as you try to carry out ideas of your own on the computer. You'll find yourself sharpening your mathematical skills—almost painlessly, because the computer's quick response to your instructions provide powerful motivation.

Learning a language like BASIC—for now the *lingua franca* of microcomputers—is duck soup when the computer is right in front of you to experiment on, and you've got a half-decent manual to work from.

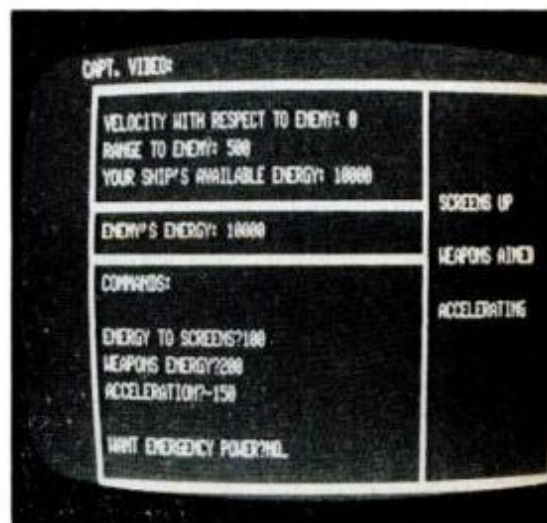
### Automatic reinforcement

The learning process is quick because the computer reinforces it: if you do something right, you're rewarded—it runs; if you do something wrong, you're punished—it doesn't run, or doesn't run as you wanted it to, or you get an error message.

What I've been working with is very simple, compared to what's available now in systems from other manufacturers and in expansion goodies from Radio Shack for the TRS-80. When I can afford it, I'll

beef up what I've got so that I can work with longer and more complicated programs, get them in and out of the machine faster, and hold large files of information for virtually instant access. I expect eventually to have a full-fledged word-processing system for writing—I'll write, revise and correct on the monitor, and commit nothing to paper until I have a finished draft. That's the practical application I'm looking forward to.

The microcomputer is very different from the big machines that send us our gas-and-electric bills. It's a personal tool and toy, and a kind of imagination amplifier. The things you and I will be doing in 5 to 10 years with our own computers are probably beyond our present imaginings. It will be interesting. **PM**



Printing and graphics combine to produce a "data panel" for each player of the author's "Space Duel" game. Confirmations of the player's commands appear in right-hand rectangle after he enters numbers.

# Basics of the lost art of blacksmithing

Tips and techniques from a professional blacksmith: We've also included 3 projects for you to try.

by Penelope Angell  
ASSISTANT HOME AND SHOP EDITOR

In recent years more and more people have been learning basic blacksmith techniques, for practical reasons as well as to experience the pure pleasure of working at the blazing forge. A woodworker who wants a special gouge forges his own and also mends broken tools. A person who restores furniture spends his time fashioning period hardware instead of hunting for it.

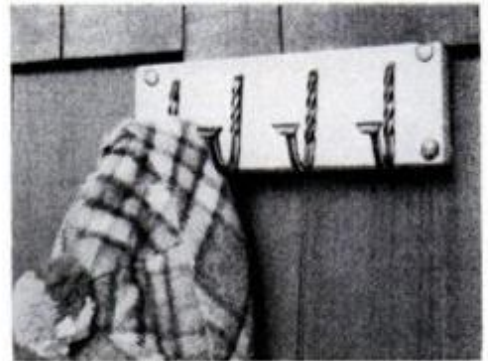
Steve Kayne, a professional blacksmith and teacher, learned the craft from his grandfather. Here, blacksmith Kayne, who appropriately lives in Smithtown, N.Y., offers some tips to aspiring blacksmiths.

Using your "ingenuity is essential to the success and enjoyment of blacksmithing," according to Kayne. This extends to devising work methods and creating tools and designs. To make your time at the forge safe as well as satisfying, Kayne gives these safety pointers:

- Always wear safety glasses or protective goggles.
- Since hot oxide flakes off the metal as it's hammered, you may want to wear close-fitting leather gloves.
- Wear heavy pants (without cuffs) that fit over your shoes.



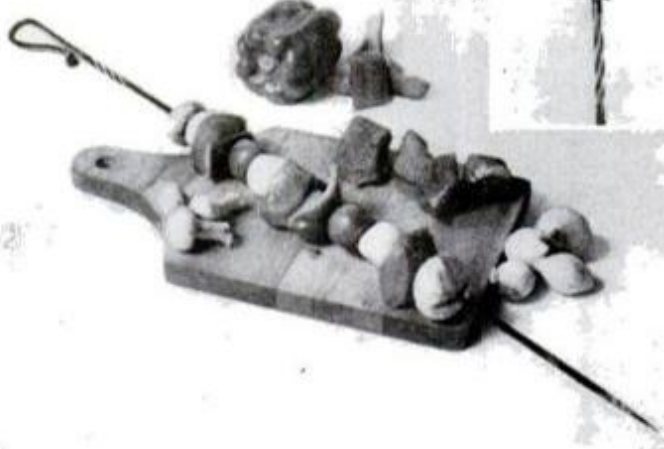
Decorative twist, arrowhead design and curled tip accent the plant hanger.



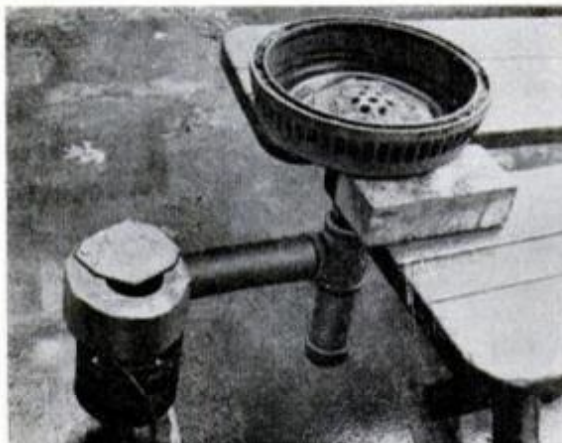
These hooks have their own spikes to eliminate need for fastening hardware.



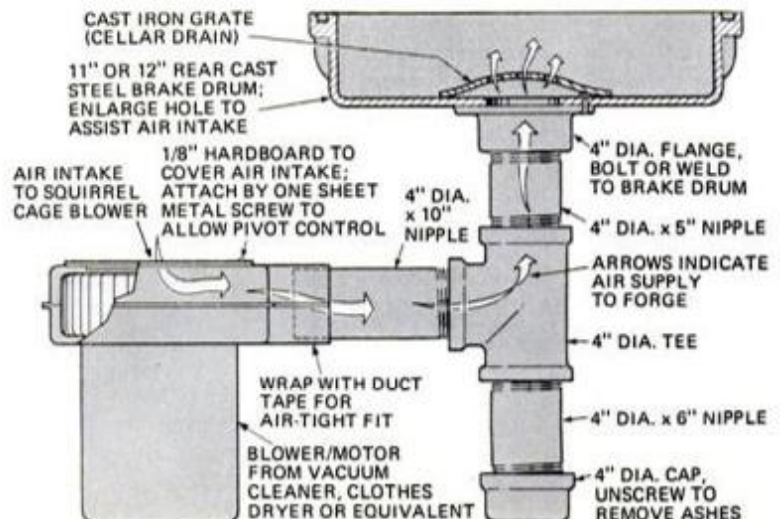
Introduce something new in your barbecues by making shish kebab on your own skewers. Hanger keeps them in an attractive manner. Miniskewers are novel hors d'oeuvre servers.



PM photos: Robert Golden



You can prop the forge on fireproof bricks between two benches. Or make a simple stand for it with 2x4s supporting the fireproof bricks.



Don't wear synthetic materials that burn or melt readily.

### Tools and equipment

A forge, anvil, tongs, hammer, chisel and cooling tub will get you started blacksmithing. If you do any woodworking, you may have a heavy-duty drill press that's also helpful. A machinist's bench vise will come in handy, too.

Used blacksmith equipment is available at secondhand shops, junkyards and flea markets for the hunting. As you develop your skills, however, part of the satisfaction of smithing will be in making tools.

**Forge.** These range in price from \$50 for a small used forge to over \$1000 for a large stationary one. You can build a simple, inexpensive and good forge for outside use as shown on the facing page. Any forge used indoors should be vented to the outside and positioned away from combustible material.

**Anvil.** Since you shape hot steel by hammering it on the anvil, yours

must have sufficient mass to withstand the hammering. Anvils weigh from 35 to hundreds of pounds. One in the 125-lb. area should be adequate. Used anvils are scarce but available. You can also use a section of large-gauge railroad rail.

Whether or not an anvil rings is significant only as music to the blacksmith's ears. However, it is important that the anvil rebounds the hammer when struck. Secure the anvil to a solid stand with bolts or spikes so the anvil face is level with your knuckles when your hands are at your sides. Situate the anvil so you can turn to the forge with minimum movement.

**Hammers.** Most cross-peen and straight-peen blacksmith hammers range from 1 to 4 lbs. Many are on shelves in secondhand shops. Or you can buy them in hardware stores. If needed, shave the handles to fit your hand well when firmly held.

**Tongs.** Each pair of blacksmith tongs is made to hold only one size of steel. For example, 1/4-in. tongs

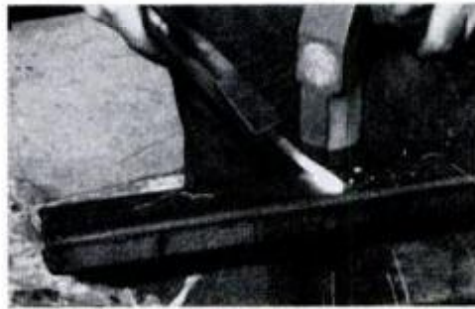


Kayne cuts steel with cross peen hammer and chisel, striking it on both sides.

### COAT RACK HOOKS



1. Heat 2 in. of 1/4x6-in. rod cherry-red. More heat lightens color, risks burning.



2. Hammer steel to button shape (see text). Railroad rail serves as an anvil.



3. Curl the button by extending it over anvil edge, hammering as you move it.



4. Heat steel, place 1 1/2 in. beyond anvil horn, hammer to bend. Shape on horn.



5. Heat the end opposite the curl, draw to point (see text). Hammer a 90° bend.



6. Heat twist area to cherry-red. Hold with vise and tongs; pull as you twist.

hold 1/4 x 1/4-in. sq. steel and 1/4-in. flat steel. So the number of tongs needed depends on the number of different steel sizes and shapes you work. Used tongs are available.

**Other tools.** You can use a beer keg or 30-gal. drum filled with water as a tub for cooling hot steel, special chisels with hammer-like handles to cut steel and a sturdy machinist's vise.

### Coal

Special coal called blacksmith's coal is used in the forge. It's available in 100-lb. feed sacks at about \$7 a sack. A coal supplier in your area can probably direct you to a dealer in blacksmith coal. Or check a local racetrack for the coal source the farriers use in shoeing horses.

### Steel

A welding shop or business that makes iron railing will often sell several feet of steel. It is available in larger quantities at a steel supply house. Hot-rolled mild steel is the best type for these projects. It is sold in 20-ft. lengths with round, flat and square shapes.

### Starting the fire

Here's a simple but sure procedure for starting a forge fire:

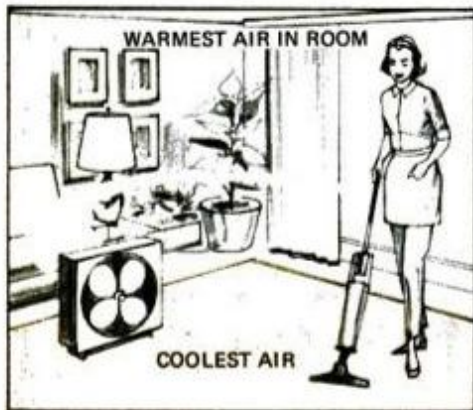
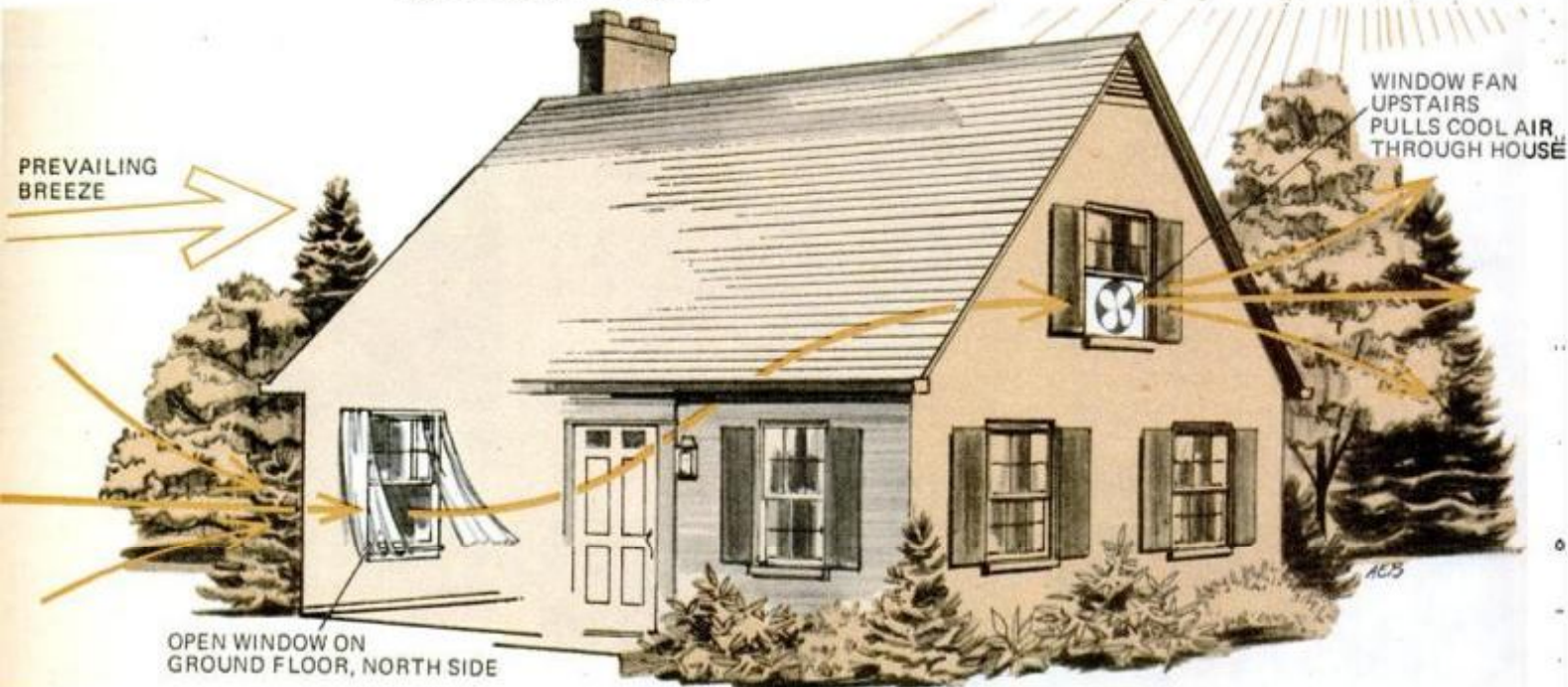
Crumple six sheets of newspaper, put them in the firebox over the air intake and light them. Place coal sparingly on the papers so the fire won't smother, then turn on the air.

(Please turn to page 146)

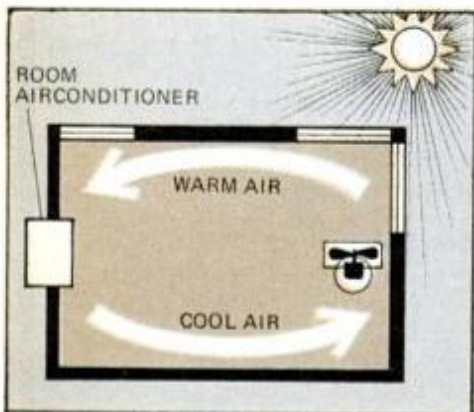
# Fans: Still a good way to stay cool

Since electric rates began to soar, the 'old-fashioned' fan has become the low-cost way to beat heat

by Gurney Williams



Air moving at 2.3 mph feels 10° cooler to an active, lightly clothed person.



Circulation strategy: Set fan parallel to wall. Air flows in circle around room.

When it's cooler outdoors than indoors, a window fan located upstairs can pull in cool outside air and exhaust warm air to ventilate the house as shown above.

Portable electric fans have come a long way from the old open-prop models that roared like stunt planes and, after a few crashes to the floor, moved as much air as a youngster blowing out birthday candles. Today's fans are much safer. They also whirr without blanking out conversation and cool at a fraction of airconditioning costs.

Fans are a hot item this year. Manufacturers report that they can't make enough units to meet the demand. When electricity rates began to soar a few years ago, portable-fan sales took off, too, as homeowners began to substitute fans for airconditioning.

Basic fan structure hasn't changed. An electric motor turns a prop, jetting air at up to 500 cu. ft. per minute—about six mph.

## New fan features

Attention to safety has helped change fan design. Within the past five years, Underwriters Laboratory, the nonprofit organization that tests and approves electrical appliances, has tightened standards. For example, UL has developed a

probe modeled after children's fingers to test how easy it is to get at revolving blades.

Another type of probe is jammed into an operating fan to test whether a disintegrating blade will shoot out shrapnel-like fragments. UL has also tightened stability requirements. UL-listed fans today are less likely to injure small children or be bent out of shape in a fall.

Modern fans also offer a few more control features. The antique version generally ran at one speed and that was full blast. New fans are built to run at two or three speeds and to reverse the airflow. Oscillating fans swivel through 90° turns. Some window fans are equipped with thermostats to cut them off in the middle of the night when the house is well cooled.

## Types of fans available

Each of several broad categories of fans is designed for a particular use, so define your needs before trying to choose a fan.

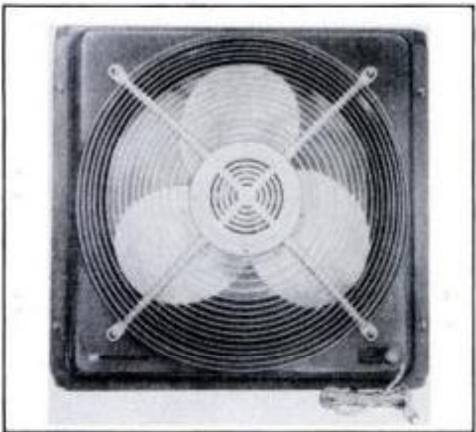
Oscillating fans turn back and forth, slowly changing the direction of airflow. Placed in a corner near



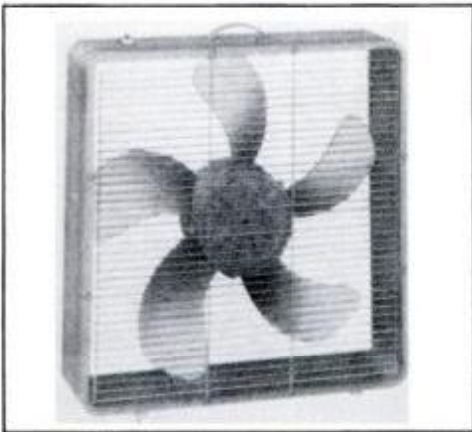
Oscillating fan by Superior Electric, \$27, has a large base to withstand tilting.



Thermostat on Lakewood's box fan, priced at \$60, stops fan when temperature falls.



Sides on Superior's window fan, \$80, extend to 37 in. to fit many window widths.



McGraw-Edison's box fan, \$26, has two speeds and a lifetime-lubricated motor.



Lasko's oscillating fan on a stand works well in a large room. Price is \$115.

an airconditioner they can direct cool air toward every part of the room. Superior Electric Products Corp., Cape Girardeau, Mo. 63701, makes four oscillating fan models with an overheat cutoff mechanism to protect the motor. Lasko Metal Products, 820 Lincoln Ave., West Chester, Pa. 19380, makes an oscillating fan on a stand. Retail prices for oscillators range from about \$25 to over \$100. But with careful shopping you should be able to find oscillators and other types of fans at discount prices.

**Floor or box fans** are set into rectangular housings, many with suitcase-type handles like the one above by McGraw-Edison, 1801 North Stadium Blvd., Columbia, Mo. 65201. These can be used to move air from a room with an airconditioner into an adjoining room. And when set in a window at night, one will pull cool air through the house. Lakewood Engineering and Manufacturing Co., 212 North Carpenter St., Chicago, Ill. 60607, makes a fan with a thermostatic control that turns the fan off when temperatures fall below a preset level; a pilot light shines to show that the fan will go back on when the temperature rises.

**Window fans** are built into telescoping frames to match different window sizes. All UL-listed models are rain-safe: The lab subjects fans to an extensive spray test. Prices on these fans range from \$50 to \$85, which is generally higher than for floor fans.

**Hassock fans**, shaped like small barrels, draw air in from all sides at the bottom and direct the flow up and out in a trumpet-bell pattern through vents in the sides. The theory is that the coldest air settles near the floor and, if it is lifted, all levels of the room will be cooler.



This hassock fan by Lasko, ticketed at \$50, doubles as a seat, air circulator.

Hassocks also double for seating. UL-listed models must be able to bear 400 pounds without cracking.

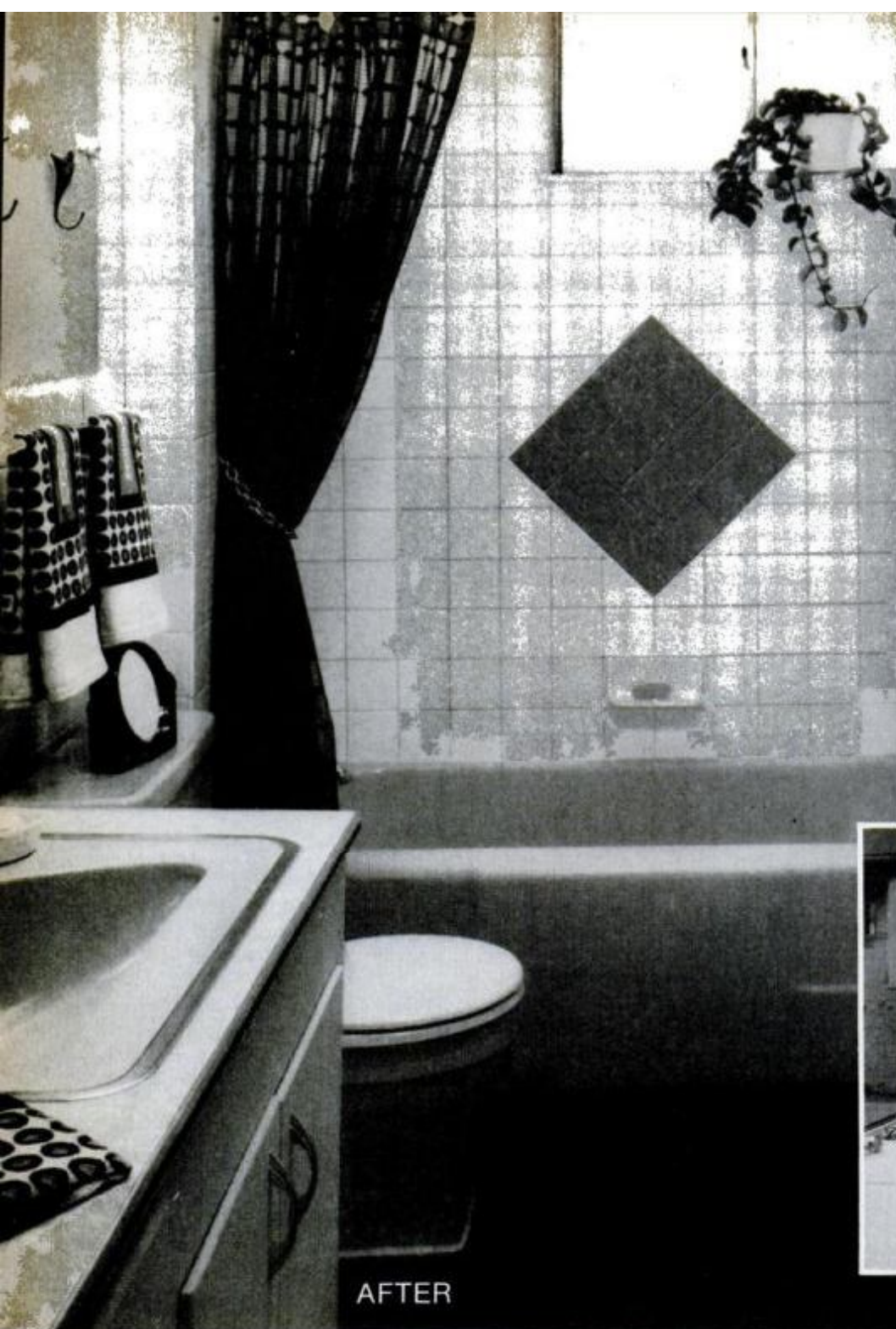
### Rating fan efficiency

Unfortunately for consumers trying to choose a fan, there is no reliable grading system for fan efficiency. Some manufacturers do supply a cubic-feet-per-minute (c.f.m.) rating, showing the volume of air the fan will push per minute. Theoretically, c.f.m. divided by watts gives an efficiency index—the higher the quotient, the more efficient the fan is in using energy. Other manufacturers complain with good reason that c.f.m. ratings aren't very useful since companies use different methods of measuring air volume.

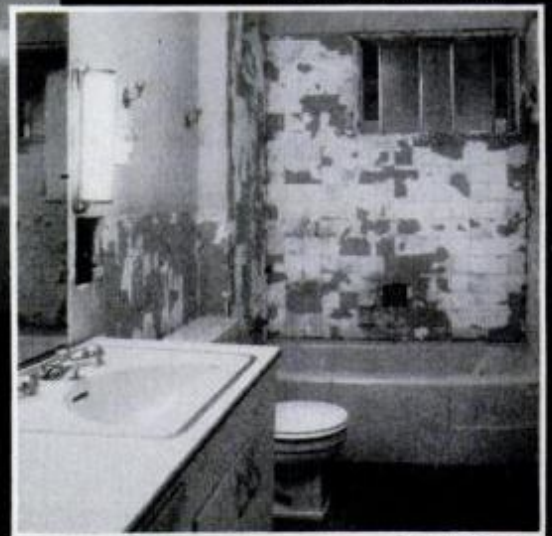
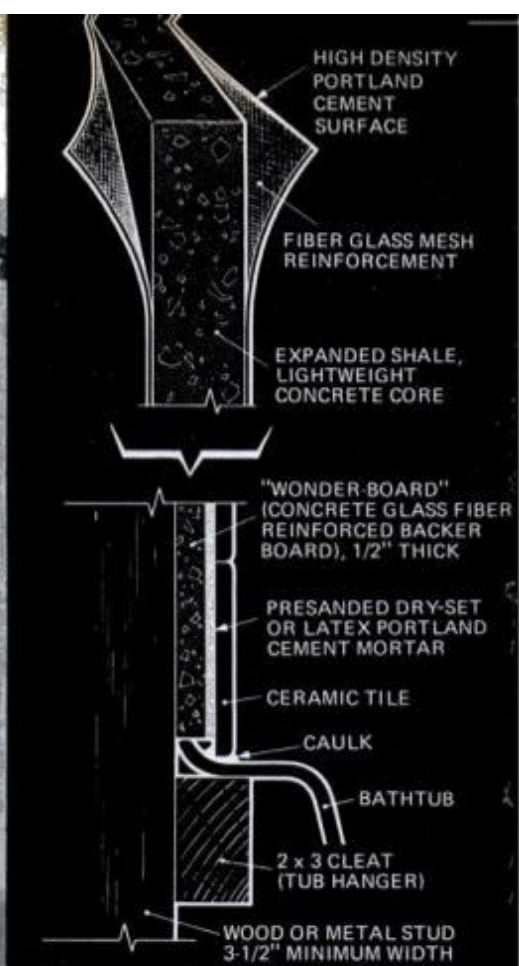
The number of blades on a fan is no indication of its quality or performance. A three-bladed fan can move more air than a five-bladed one, depending on the pitch and size of the props.

There is one *test* that you should apply to any fan before taking it home—turn it on in the store. Fans are not alike in breeze power, noise and vibration levels, despite the generally improved motors today. Listen to the fan at all speeds and

*(Please turn to page 184)*



AFTER



BEFORE

# Backup board for ceramic tile assures a no-fail job

The stability of the material behind the tiles determines a job's success.

The problem of tiles dropping off walls is common in bathrooms where ceramic tile is installed over gypsum wallboard or gypsum plaster. A new type of backup board can end all those problems, and it's easy to apply.

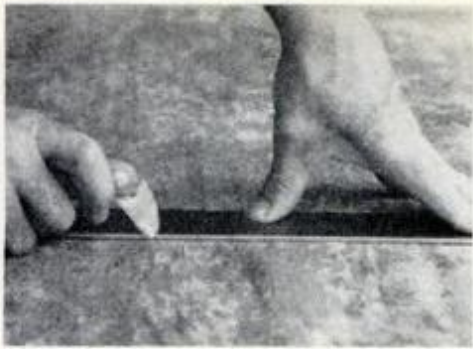
Wonder-Board, a panel that's claimed by its maker to be unaffected by moisture, is made of lightweight concrete reinforced with fiberglass. It won't shrink, swell, delaminate or decay.

PM readers are the first to know about the product. It's now available at most American-Olean dealers—those who haven't yet received it will be stocked by Sept. 1. A 2-in.-wide

*(Please turn to page 207)*



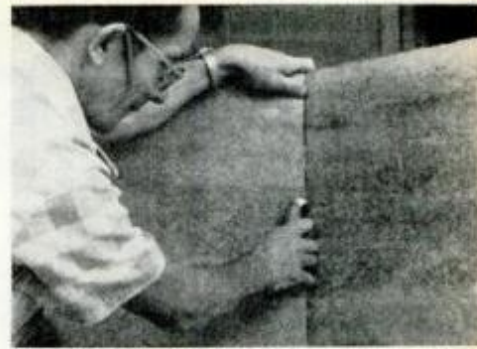
## Installing backup material



**1** Score Wonder-Board with a knife. Cut through fiberglass to cement core.



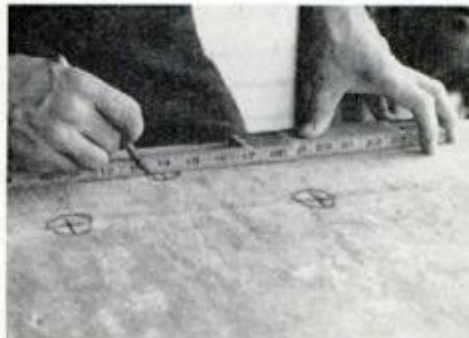
**2** After the board has been scored, snap it in two parts along the line.



**3** Cut through the bottom fiberglass layer from the other side.



**4** Measure the wall to locate needed pipe holes on the board.



**5** Using a pencil, mark the pipe holes to be bored in the Wonder-Board.



**6** Bore or cut holes a bit oversize to permit shifting panel if needed.



**7** Before fastening board to wall, check accuracy of the hole locations.



**8** Nail backup board to the studs. Position nails within  $\frac{1}{2}$  in. of board edge.



**9** Installation is complete. Bottom edge of the board is set on the tub's lip.



**10** Next, cut fiberglass tape to lengths needed for all joints and corners.



**11** Embed tape in corners and on the seams using a dry-set mortar.



**12** Horizontal and vertical joints are mortared, taped, dried overnight.

# 11 ways to take the **HAZARD** out of your home workshop

by Joseph R. Provey  
ASSISTANT HOME AND SHOP EDITOR

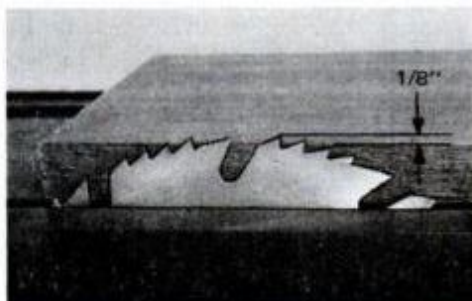
Follow good safety practices with a radial-arm saw: Use goggles to protect eyes from flying particles; wear earmuff-type protectors to reduce saw screech to a safe level; keep sleeves buttoned, and hold work securely as the saw blade is pulled through.

**H**igh speed cutting edges, kicked-back objects, short circuits and slippery floors do not cause shop accidents—you do. Realizing this fact is the biggest step you can take toward making your shop a healthy place in which to work.

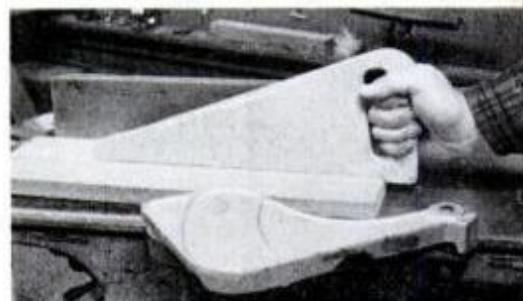
## Living with power tools

According to the U.S. Consumer Product Safety Commission (CPSC), 17,000 persons each year are treated for injuries associated with electrically activated drills, sanders, routers, lathes, grinders, jointers, planers, shapers, welders and soldering guns. Power saws, however, are by far the most likely power tool to be involved in a severe shop accident—approximately 37,000 injuries are reported by hospitals annually. Most are a result of either contact with the blade, electrocution and shock, or projectiles from the material being worked with, usually wood. Investigations prove that most of these mishaps didn't "just happen." Only *you* can take the precautions necessary to prevent them.

1. Study the rule box on this page and post safety reminders wherever you feel they may help. For instance, a sign saying, REMOVE CHUCK KEY, posted at your drill



Set blade depth as shown for safe cutting. Guard is removed for photo clarity only.



A push block is a must for safety, and superior results, when planing thin stock.

## RULES FOR AVOIDING POWER TOOL ACCIDENTS

- Be sure electric tools are double-insulated or grounded. A ground fault interrupter is the best protection.
- "Idiotproof" your shop—if it's accessible to untrained persons and young children—by keeping blades and other sharp accessories out of reach. Install central switch for turning off power to shop circuit and lock it when you leave.
- Wear appropriate personal protective equipment. Dress comfortably in snug fitting clothing or use a shop apron. Remove jewelry and secure long hair. Do not wear gloves—they can be snagged by cutters, blades and drive belts.
- Plan your setup carefully: Jigs, clamps, fences and guides, used correctly, make the job easier and safer.
- Keep all guards, shields and anti-

kickback devices in place and in operating condition. Replace fatigued springs which no longer snap guards back.

■ Remove chuck keys and wrenches before turning on power. To make this a habit, create a handy place to hang or store them.

■ Be aware of your hands and body. Use a push stick or planing block on narrow or thin work. Never over-extend your reach. Stand aside while starting motors—and stand clear of the path of potential kickbacks.

■ Keep power cords out of the way. Keep (and store) extension cords away from oil, heat and sharp objects.

■ Wait until blades or bits are completely stopped before making adjustments. Unplug tool to prevent inadvertent start-ups.

press—may keep you from being hit by a ricocheting key.

### Hand tool savvy

Hand tools are involved in the majority of shop accidents. More than 30,000 people received hospital emergency room treatment for hammer injuries last year alone. Screwdrivers, manual saws, drills and chisels were not far behind. Aside from hammer-and-thumb type slips caused by miscalculation or loss of concentration, many were the result of misuse and poor technique.

2. Choose the right tool for the job. Improvisation, however ingenious, can lead to danger. Study your hand tools' capabilities and learn their limitations as well. Read relevant literature and make practice runs when performing an unfamiliar operation. Seek personalized instruction when necessary. Three booklets on the *Proper Uses and Common Abuses of: Striking and Struck Tools; Screwdrivers, Vises, Clamps, Snips, Tool Boxes;* and *Wrenches and Pliers*, can be obtained for 50 cents each from the Hand Tools Institute, 331 Madison Ave., New York 10017.

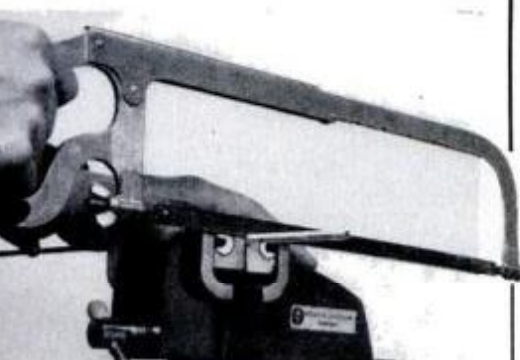
3. Well-maintained hand tools shorten job time and are safer to work with. A modest investment in a grinder—or even just in manual jigs for sharpening twist drills and chisels—will keep you from forcing a dull tool to accomplish a task.

4. When things start going wrong, take a break. Don't let yourself be pressured into trying a

*(Please turn to page 166)*



Choosing the right screwdriver prevents damage to workpiece, blisters and unnecessary strain; also spares screwhead.



Clamping workpieces securely will make cutting them a lot easier and safer.



When using sidewall of grinding wheel to sharpen twist drills, protect your eyes and face from flying fragments.



Carry portable power tools with fingers off the activating switch or trigger to prevent inadvertent start-ups.

## PERSONAL SAFEGUARDS



Respirator and neoprene gloves prevent lung and skin absorption of toxic mists, vapors and compounds.

The most expensive tool imaginable is worthless next to you—and yet the most mistreated and abused "machine" in many home shops is the human body. The products shown here (and throughout this article) represent a small investment when compared to the money you are apt to pay for health care and insurance. It's foolhardy not to acquire a basic inventory that includes such items as goggles, face shield, a supply of lens cleaner and tissue, muff or plug-type ear protectors, dust mask and respirator with appropriate filter replacements, work gloves and other specialty items necessary for jobs you're likely to do.



Dust mask will keep dust from sanding operations out of your lungs. Wash and/or replace filters as needed.



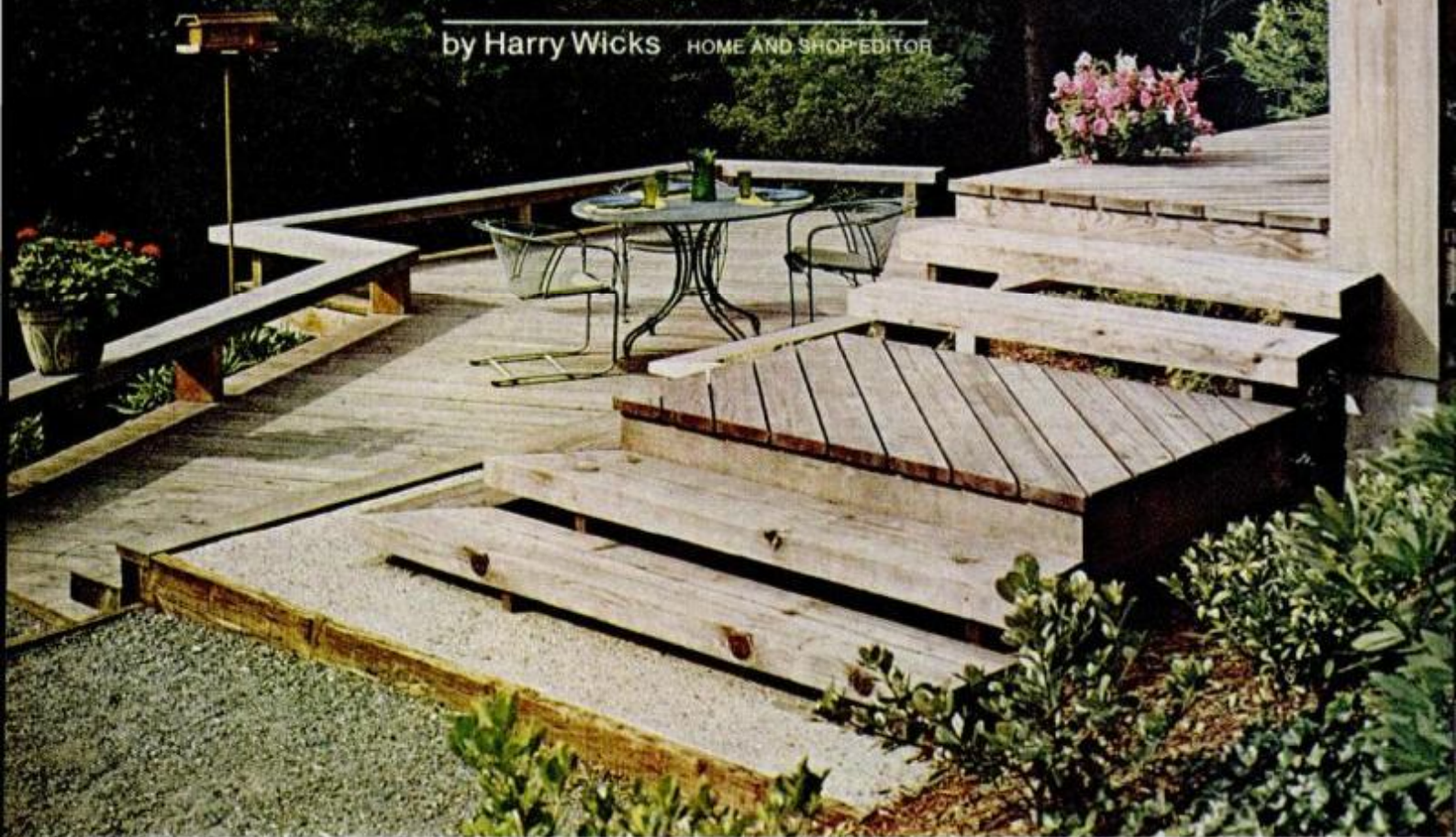
Common shop eye gear (clockwise from top): face shield, impact goggles, safety glasses, welding cup goggles, chemical splash goggles. Right, plastic box keeps shop first-aid kit dry, dust-free, includes tweezers, scissors, rubbing alcohol, disinfectant, bandages.



# 9 ideas for decks and patios

A well-designed deck adds beauty and value to a home. Here are some good ideas for upgrading yours.

by Harry Wicks HOME AND SHOP EDITOR



**M**ost homeowners know that the decks or patios extending from their homes give useful living space at a fraction of the cost of a room addition. Wise homebuilders know this too, of course. That's why so many of them affix small decks to their new homes. Such decks are generally modest-sized and lack the extra touches of built-in benches and the like that could make them outstanding.

And many homeowners who built their own decks over the years now have the extra cash and time to upgrade what they already own. In short, there are lots of good-looking, functional decks in existence that could be made even better with a





**Sprawling deck (far left) is built of fir and pine. Grand-scale steps create an attractive focal point, can be added to existing decks. Deck near left is of a garden-grade redwood lumber with 2x6 decking applied on the flat on diamond-shaped lower level. Mitered steps accent deck angles.**

**Construction heart-grade redwood trellis shades garden deck for simple, striking design and outdoor living comfort. Trellises, deck sections, butcher-block pattern steps are taken from Design-a-Deck Plans Kit of the California Redwood Assn. To order, see page 141.**



**Ground-level ramp of 2x6s connects back-yard deck to front entry. It also converts awkward side yard to private garden. Note the rounded corners.**



**The look of an on-ground deck was considerably enhanced when handsome redwood benches and contemporary rail were added.**

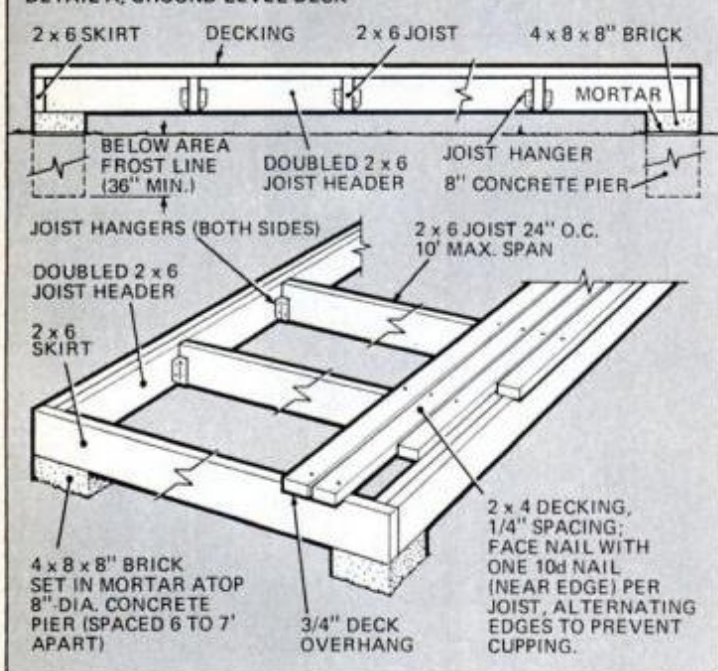


well-planned improvement or two. For that reason, on these pages we have zeroed in on a number of solid add-on ideas that will make any deck a standout.

Carefully study your deck to decide just what features will, in fact, be an actual improvement. Is there sloping ground adjacent to your existing deck? If so, consider installing a small deck over that area. Bear in mind that even a small deck can add useful space (for entertaining, perhaps?) over an otherwise unusable piece of property. Also, take a good look at the furniture on your deck or patio; if it looks weary and in need of replacement, maybe now is the time to

Ground level deck is probably the easiest type to build because it simply rests atop bricks placed on concrete pier footings. For longer life, treat all wood near ground annually with preservative.

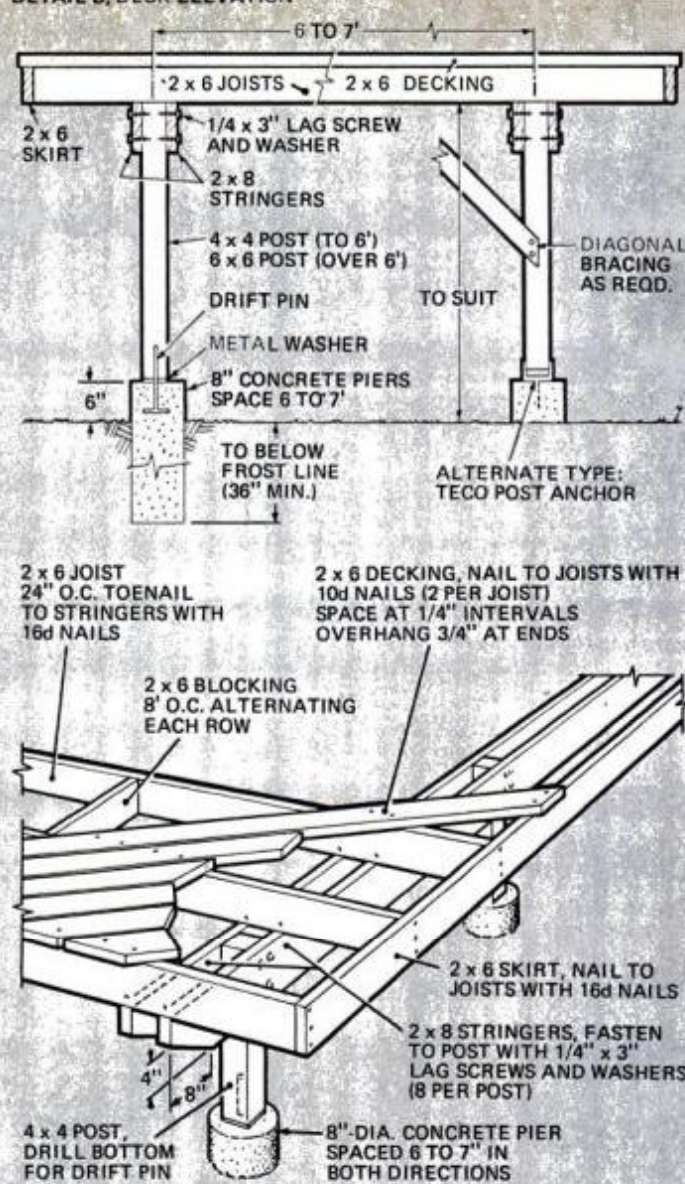
DETAIL A, GROUND LEVEL DECK



Clean lines of these contemporary steps add visually to deck. Stairs' open design permits easy access for cleaning beneath. Steps (like the deck) rest on concrete piers.



DETAIL B, DECK ELEVATION



consider installing carefully planned built-in benches and planters. Perhaps you should think about adding a ground-level walk or bigger and better-looking steps.

### Plan your patio carefully

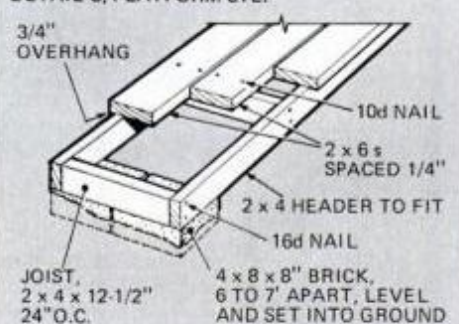
Good design starts with drawing your patio improvement project to scale. Using standard graph paper ruled with eight squares per inch, draw in the existing patio/deck shape, and the shape of the abutting house wall, if necessary. Indicate the locations for proposed steps, planters, benches and the like.

You would be wise to make elevation scale drawings if you plan to build one of the benches or steps shown. This way you can make certain that your addition is sized to suit your deck. It is also easier to compute a materials list from an accurate drawing.

### Choosing deck materials

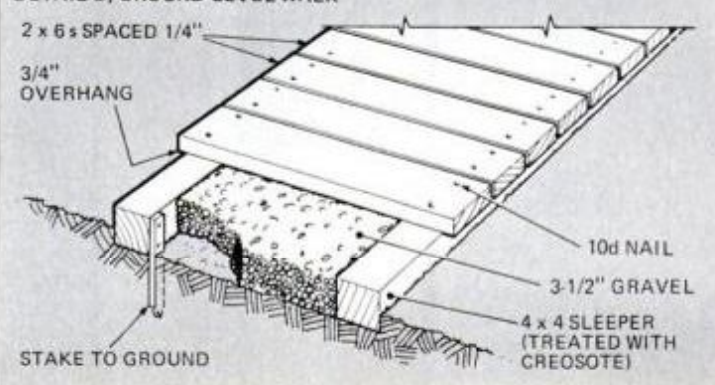
Make no mistake about it, if you want your deck and its attachments to be as long-lasting as possible—

DETAIL C, PLATFORM STEP



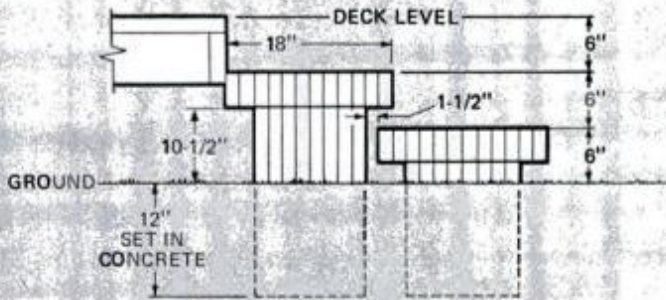
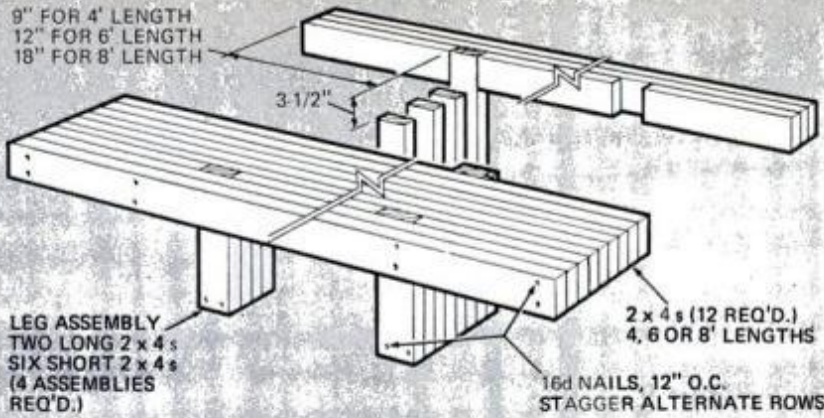
Stair tread boards, like deck boards, are spaced for positive water runoff.

DETAIL D, GROUND LEVEL WALK



Build on-grade walk by nailing 2x6s to 4x4s. For maximum life, creosote the 4x4 sleepers. Space between sleepers is filled with gravel.

DETAIL E, BUTCHER BLOCK STEP  
(MAY BE USED AS SEATING ALSO)



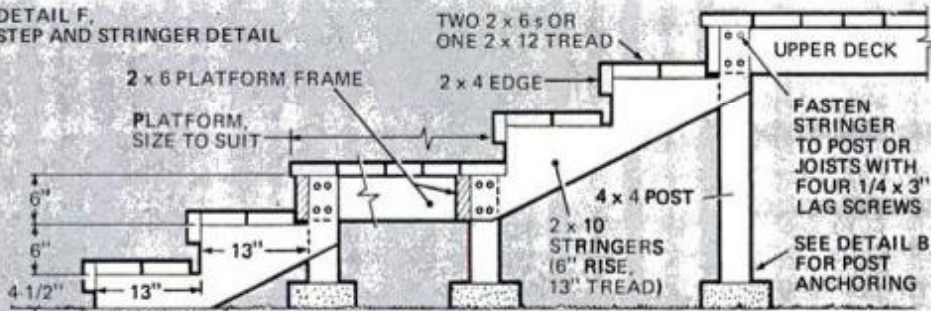
Butcher-block-type slab can be used for bench and/or step building as in drawing.

eyes and skin when applying the stuff.

For superior resistance to rot and deterioration, investigate the possibility of using Wollmanized lumber for your deck. Since the chemicals used in this material give the lumber a greenish cast, you may opt to use the Wollmanized lumber only where the deck or its fitments are close to the ground. On top—i.e., the decking—you can apply a quality grade of redwood, fir, spruce or pine and let it weather to a beautiful silver gray.

*Note: When working with a treated lumber such as Wollmanized, remember that the sawdust created by cutting and sanding carries the chemicals too. Thus, make certain you wear goggles and face mask to protect your eyes and lungs.*

DETAIL F, STEP AND STRINGER DETAIL



### About hardware

You don't need a great deal of hardware in order to build a deck or [\(Please turn to page 150\)](#)

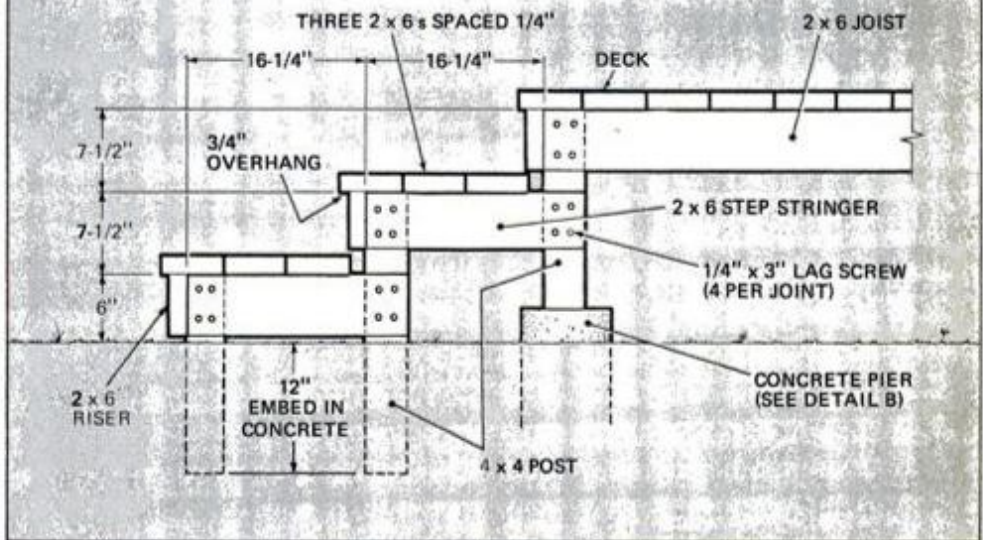
### HOW TO ORDER A PLANS KIT

To order Redwood Design-a-Deck Plans Kit, send \$4 to the California Redwood Assn., Dept. POPMEC, 1 Lombard St., San Francisco, Calif. 94111.

Good method for building slab-type step will work for one step or twenty.

and with today's lumber prices it's a sure bet that you do—select all of the materials with care. The best choices for deck and patio construction are weather-resistant woods such as cedar, pine and redwood. No matter which type you select, it is well worth the investment to buy enough wood preservative to adequately coat all surfaces. Redwood and most of the western softwoods are usually treated with a clear preservative, while cedar posts and sleepers can be soaked with creosote. No matter which you select, make certain you wear a long-sleeved shirt, goggles and gloves to protect

DETAIL G, PLATFORM STEPS



You can create sturdy multiple steps by lagscrewing horizontal stringers to 4x4 posts embedded in concrete piers. The treads are cut from the same dimension stock as the stringers.

Deck photos: California Redwood Assn. and Western Wood Products Assn.  
PM Technical art: Eugene Thompson.

# Build PM's handsome home phone center

For a no-maintenance finish, both table and chair are covered with plastic laminate. The table stores telephone books, too.

By Harry Wicks HOME AND SHOP EDITOR



Clean lines make this furniture set a welcome addition in most contemporary homes. All paraphernalia for phone use—pads, pencils, personal directories, Yellow Pages—are conveniently corralled.

**T**hough some may not care to admit it the telephone plays a very important role in our daily living. As a result the phone often occupies a prominent spot in our homes, frequently in not-so-tasteful fashion. For that reason we asked designer Gary Gerber to come up with a home phone center that can be easily duplicated by readers.

The finished product is the handsome table and chair set above. It's made of sturdy  $\frac{3}{4}$ -in. A-D plywood,

with all exposed surfaces covered with a high-pressure plastic laminate for looks and durability. The design is a simple one; actually, the units are very similar in construction. The major difference is the shelf that's added to the table to accommodate directories, pads, and Yellow Pages.

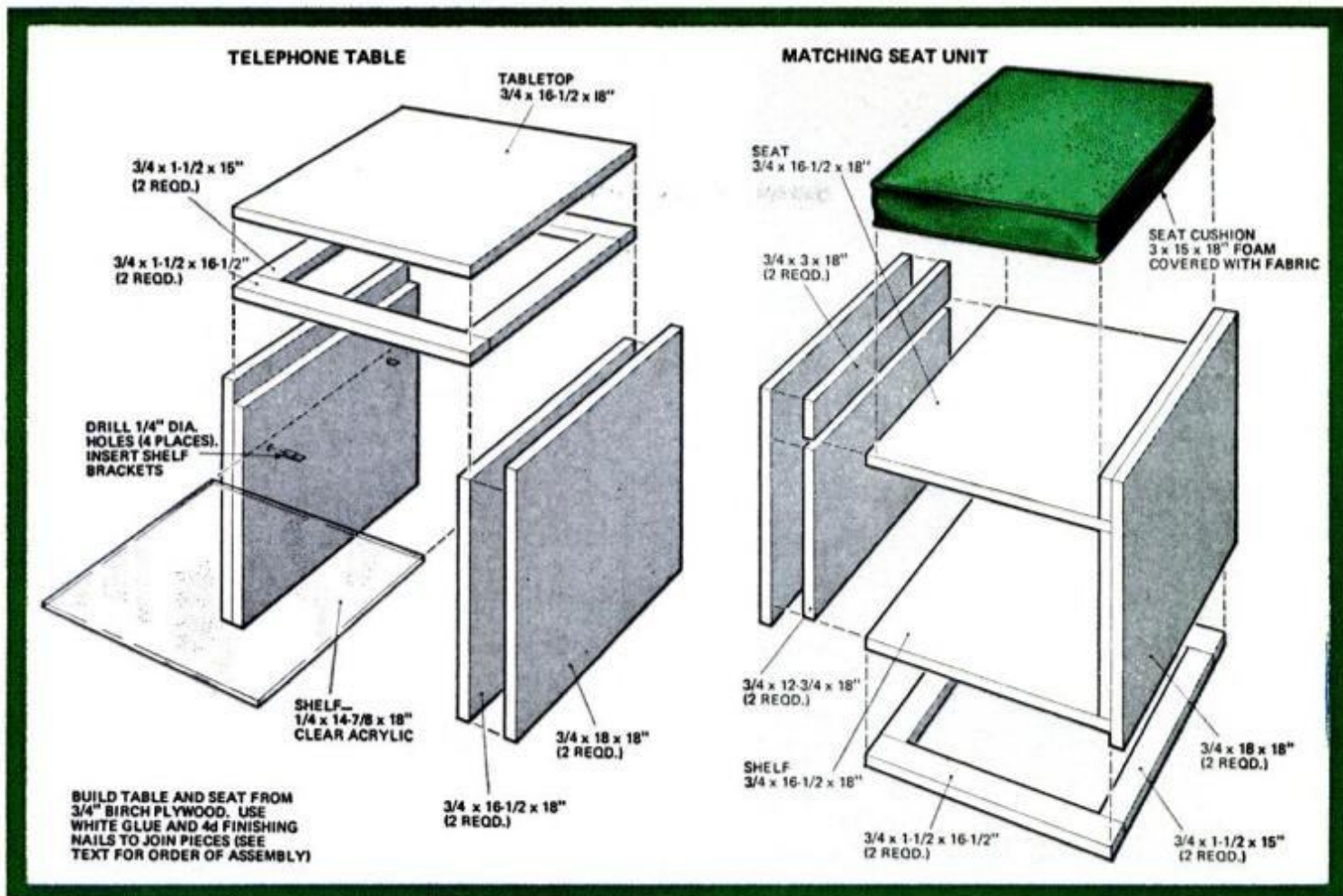
#### General directions

Working with plywood requires some special attention. To cut it, for example, you should use a smooth-cut-

ting plywood blade and a slow feed rate to avoid excessive splintering along the saw kerf. The easiest way to handle a large sheet of plywood when cutting it down to smaller pieces is by placing the sheet on three 2x4s laid across a pair of sawhorses. You can then set your portable saw blade to cut to a depth of about  $\frac{13}{16}$  in.—that is, just through the plywood and into the 2x4s.

Assemble the pieces using flathead wood screws buried in countersunk





predrilled holes. Use white glue when assembling and immediately wipe off all glue squeeze-out with a water-dampened cloth—or the glue will haunt you later when applying the plastic laminate.

Make certain that all plywood surfaces are kept clean, and give them a final sanding with 120-grit abrasive after assembly is completed. Remember that plastic laminate will delaminate eventually if applied to a dirty or oily surface.

### Where to start

The material that you need for the project is spelled out below. Though actual sizes are given, to be safe, purchase the plywood and plastic laminate slightly larger than desired size so you can trim the pieces to the actual sizes yourself. Since high-pressure plastic laminates are sold in

factory-sized sheets, we have listed the sheet sizes you will need to cover both pieces. If you want to save both time and money, you can paint the table and chair and eliminate the plastic laminate.

### Building the projects

To avoid confusion as you work, label the parts lightly with a pencil as each piece is cut. Cut all parts for the table first and assemble them without glue for a test fit. When satisfied with the fit, permanently assemble the table using white glue and flathead screws in predrilled, countersunk holes.

*Note:* It will speed the chore if the plastic laminate is applied to all inside surfaces before assembly. The outside surfaces can be laminated after assembly.

When the table is assembled, carefully mark locations for the shelf supports and bore holes of a diameter to suit the shelf clips you are using. To avoid drilling through the sides, use masking tape as a stop gauge on your drill bit.

### The chair

The construction procedure for the chair is identical to that for the table. To make assembly easier, attach the filler frame at the bottom before starting assembly. Then attach the sides, lower insides, shelf

and upper insides, in that order. For strength where plywood butts plywood—i.e., the sides—join the parts using white glue and 1/4 in. No. 8 fh screws in countersunk, predrilled holes.

### Working with laminates

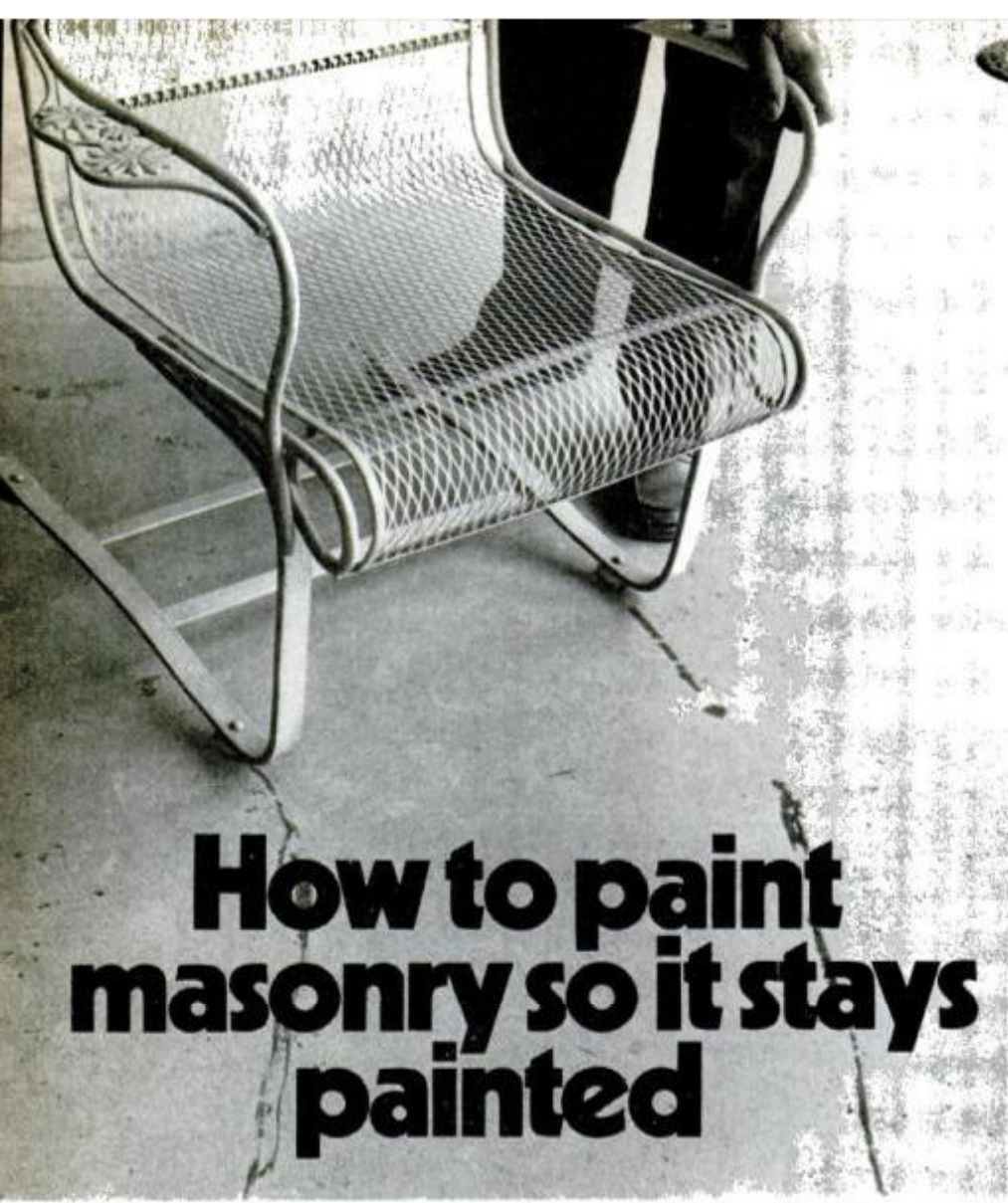
Lay out *all* parts on each sheet before making any cuts, to be sure of getting all parts from it. Measure parts exactly and then add at least 1/8 in. to both length and width of every piece. (When properly bonded to its mating piece of plywood, the laminate should overhang all edges at least 1/16 in.)

Apply contact cement following all directions on the can—and work in a well-ventilated room. After adhesive has dried to the touch, position a kraft paper slipsheet, or strips of 3/4-in. lumber spaced 12 in. apart, on the wood surface. Carefully align the laminate over the slipsheet or strips, pull out one strip or a small amount of slipsheet to contact the laminate to the plywood at one end. Immediately after bonding the laminate, apply pressure to entire surface by tapping with a block of wood and hammer. To trim overhang, use either block plane and smooth file, or a router with carbide cutter.

The cushion is a straightforward sewing job as can be seen in the photo on the facing page. **FM**

### MATERIALS LIST—HOME PHONE CENTER

| No.  | Size and Description (Use)                       |
|--|--|
| <b>Table</b>   |  |
| 2  | 3/4 x 18 x 18" plywood (sides)                   |
| 3  | 3/4 x 16 1/2 x 18" plywood (insides, top)        |
| 1  | 3/4 x 1 1/2 x 6" pine (subtop)                   |
| 1  | 3 x 14 7/8 x 18" Plexiglas (shelf)               |
| 1  | 42 x 60" plastic laminate sheet                  |
| <b>Chair</b>   |  |
| 2  | 3/4 x 18 x 18" plywood (sides)                   |
| 2  | 3/4 x 12 3/4 x 18" plywood (lower inside panels) |
| 2  | 3/4 x 3 x 18" plywood (upper inside panels)      |
| 2  | 3/4 x 16 1/2 x 18" plywood (shelf, seat)         |
| 1  | 3/4 x 1 1/2 x 6" pine (bottom filler)            |
| 1  | 3 x 15 x 18" foam rubber (cushion)               |
| 1  | 36 x 54" fabric (cushion)                        |
| 1  | 42 x 60" plastic laminate sheet                  |
| Misc: White glue, sandpaper, contact cement, 1 1/2" No. 10 fh screws, 1/4" No. 8 fh screws, 4 shelf support clips. |  |

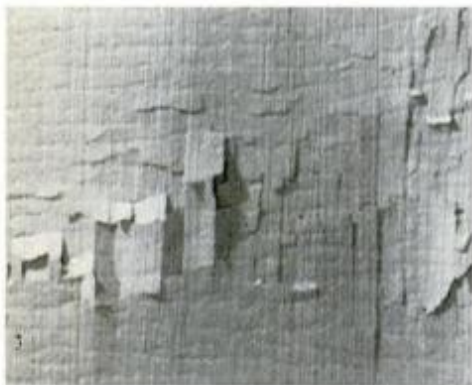


# How to paint masonry so it stays painted

**POOR ADHESION.** Paint scuffs under furniture due to a hard surface beneath paint.

## Some symptoms of trouble

Photos: United Gilsonite Laboratories



**FLAKING.** Chunks lift off, caused by surface water, frost or wrong paint.

**FINE BLISTERING, FLAKING.** Bare spots appear; may be due to surface moisture.



**ALLIGATORING.** Check-lines are usually due to hard paint on soft undercoat.

**BLISTERING AND PEELING.** Diseased paint lifts off surface and crumbles away, due to moisture in concrete that dissolves alkali, carries it under paint.



It's not uncommon for a homeowner to put the wrong paint on concrete—in the wrong manner. Here's the right way to do it.

by Richard F. Dempewolff

**M**any homeowners who have painted a concrete patio deck later have been plagued by any of several "diseases" to which some painted concrete and masonry surfaces fall heir. What causes the blistering, flaking, alligatoring or poor adhesion on some concrete surfaces? And can you do anything about it?

The symptoms may be due to one or more of the factors we'll cover here. You can do something about it in most cases.

Ninety percent of all failures in painted masonry surfaces, says Robert Toothill, lab chief at United Gilsonite Laboratories in Scranton, Pa., are due to what's known as *effluorescence*. "Most concrete, mortar and cement," he explains, "contains alkali. Any moisture present dissolves the alkali, and this solution eventually wicks to the surface where the moisture evaporates. The salts are left behind on the surface. This process causes the white material you often see on bricks." Those salts, trapped beneath paint, destroy its adhesion.

Moisture may come from uncured concrete, it may wick up from wet soil beneath the concrete, or it may have been absorbed through the surface before painting, or through improperly applied paint.

Here is a list of familiar trouble symptoms, their causes, and what can be done about them.

**1. Blistering and peeling.** Cause: Either effluorescence, surface moisture or "dusting" (concrete surface powders, due to rapid curing). In effluorescence beneath oil-base paints the alkali salts may soften the paint to a soapy consistency; rub it and it emulsifies. Paint chemists call this *saponification*.

**Cure:** Strip off paint with a good chemical stripper that will also remove the sealer (if any) beneath it—or rent a commercial floor sander with extra-coarse-grit abrasive to remove all paint and sealant, and score the concrete surface as you go to insure better adhesion for the new coating (see [photo sequence, page 176](#)). Prepare the surface with a deep penetrating sealer, according to man-

(Please turn to page 176)

# Merit Taste Boosts Low Tar Acceptance.

**'Enriched Flavor' delivery overcoming indifference to low tar smoking.**

After years of broken promises, smokers have every right to be disappointed with low tar cigarettes.

Low tar cigarettes that talk "good taste." Talk. But don't deliver.

MERIT with 'Enriched Flavor' tobacco is changing the minds of smokers. Chipping away at low tar prejudice.

Why? MERIT delivers.

By packing MERIT with flavor-rich ingredients found in cigarette smoke, researchers were able to deliver taste way out of proportion to tar. Tests proved it.

#### **Taste-Test Results**

MERIT and MERIT 100's were both tested against a number of higher tar brands.

Thousands of smokers were involved.

Overall, these smokers reported they liked the taste of both MERIT and MERIT 100's as

much as the taste of the higher tar cigarettes tested.

Cigarettes having up to 60% more tar!

Only one cigarette has 'Enriched Flavor' tobacco.

And you can taste it.



Kings: 8 mg "tar," 0.6 mg nicotine av. per cigarette, FTC Report Aug '77  
100's: 11 mg "tar," 0.8 mg nicotine av. per cigarette by FTC Method.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

© Philip Morris Inc. 1978

# MERIT

Kings & 100's

## BASICS OF BLACKSMITHING

*(Continued from page 131)*

When the fire begins to roar, add more coal.

The next time you light a fire discard the hard clinkers (stony material formed of coal impurities) and reuse the coked coal which looks like black popcorn. Impurities have been burned out of the coked coal so it will make a cleaner fire than fresh "green" coal. Also remove ashes from the previous fire.

Control the fire by packing coal—if possible either coke or a mixture of coke and green coal—around the [\(Please turn to page 148\)](#)



3. Heat the opposite end of the steel and shape an arrowhead about 1½ in. long, hammering squarely over the surface.



1. Draw out one end of an 18-in. length of 7/16-in.-square steel; make a curl. Hammer a 45° angle 4 in. from the end.

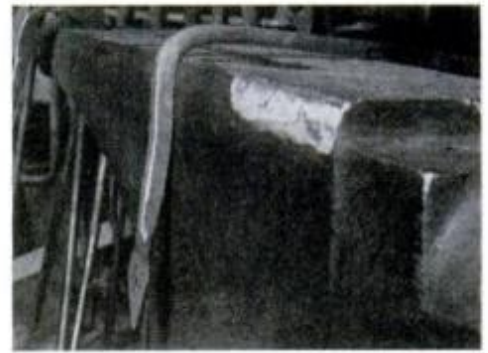


4. Drill a hole in the arrowhead and one 4 in. from the arrowhead tip for attaching the plant hanger with screws.

## PLANT HANGER



2. Bend the steel so the curl will be on the outside. Reheat steel as needed. With tongs, bend other side of loop.

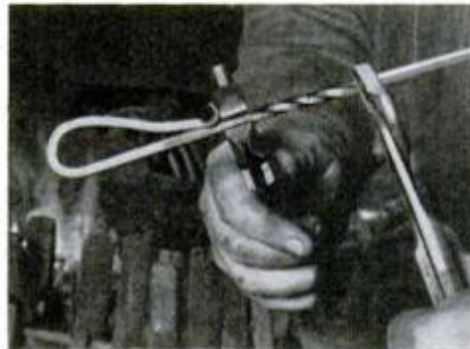


5. Make a 90° bend 5 in. from the arrowhead tip so arrowhead is above loop. [See hanger, page 130.](#) to position twist.

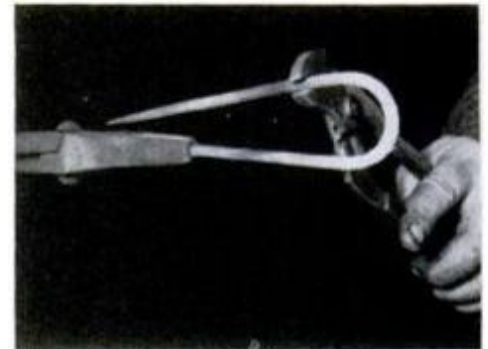
## BARBECUE SKEWERS AND HANGER



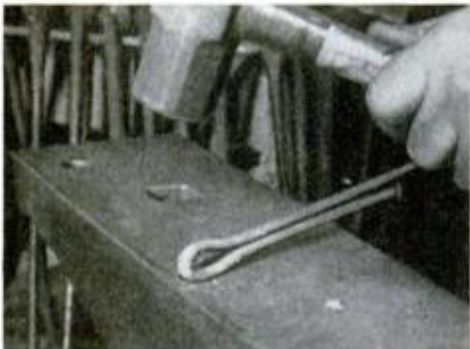
1. Skewers are 3/16-in.-square steel 20 in. long. Point one end. Forge a button on handle; curl. Loop handle with tongs.



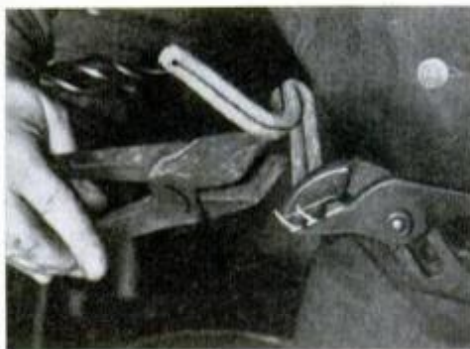
2. Use two pairs of tongs or pliers to make a decorative twist as an alternative to using tongs and a vise shown earlier.



3. Make the skewer holder of ¼-in. round steel cut to 15 in. Draw out both ends; heat the center and bend in half.



4. Reheat the metal as needed and hammer to close the steel together. Begin to shape the heart [\(see photo, page 130\).](#)



5. As you work, reheat the steel so it maintains color. Shape the heart and bend the points slightly upward.



6. After the heart shape is formed begin to open the holder. Don't stint on applying force; the steel won't snap.

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## BASICS OF BLACKSMITHING

(Continued from page 146)

forge periphery and wetting it with water. This will contain the heat in the fire and help coke the green coal. Rake coal into the fire as needed.

### Forging techniques

"Blacksmiths go to hell for hammering cold metal and not charging enough" is an old smithy saying. Take it to heart and *don't hammer black steel*—work only on steel that has turned cherry red in the fire. Take it from the fire before it begins losing color and becoming white hot. Here are two operations that you can use on many projects.

■ **Shaping a button.** This is an attractive finishing touch used on the coat hooks. Heat 2 in. of steel rod until it is cherry red. Place about  $\frac{3}{4}$  in. of the rod on the anvil near the edge closest to you. Hammer directly down on the steel, striking it squarely. The steel will flatten into a button shape. Reheat the steel and place about  $\frac{3}{16}$  in. of the button over the farthest edge of the anvil. Give it a series of strikes, at the same time moving the button forward, causing it to curl.

■ **Drawing out.** Drawing steel shapes to a point is a technique used on all projects here. Heat about 2 in. of steel rod. When it is cherry red place it on the anvil with the top near the far edge. Strike the steel with your hammer near the tip, then rotate it 90° and strike it. Rotate the rod to the original position and strike it again. As you hammer, the steel will lengthen and "draw out" to a point. When the color is lost, return the rod to the fire. Watch carefully that the thin tip doesn't burn. Sparks indicate when it is overheated. Draw the tip to a square-tapered point.

If you want a round tip, hammer the edges, forming four, then eight then 16 edges to arrive at a round taper. The drawn-out tip of the plant hanger is curled similarly to the button described above.

■ **Finishing the steel.** After your projects are forged, wire brush the scale from them. While the steel is hot, wipe on vegetable oil or beeswax for a burnt oil finish. Use black paste shoe polish for dark finish. **PM**

**Equipment sources:** Buffalo Forge Co., 465 Broadway, Buffalo, N.Y. 14204; Centaur Forge Ltd., Box 239, Burlington, Wis. 53105; Steve Kayne Hand Forged Hardware, 17 Harmon Pl., Smithtown, N.Y. 11787; Mankel Blacksmith Shop, 7836 Cannonsburg Rd., Cannonsburg, Mich. 49317.

**References:** Artist-Blacksmith Assn. of North America, 345 West Putnam Ave., Greenwich, Conn. 06830, publishes quarterly newsletter; *Designs at the Forge and Hand Forged Hardware*, Steve Kayne; *The Blacksmith's Craft*, Council for Small Industries in Rural Areas, 11 Cowley St., London, England SW1P, 3NA; *The Making of Tools and The Modern Blacksmith*, Alexander G. Weygers, Van Nostrand Reinhold Co., New York.



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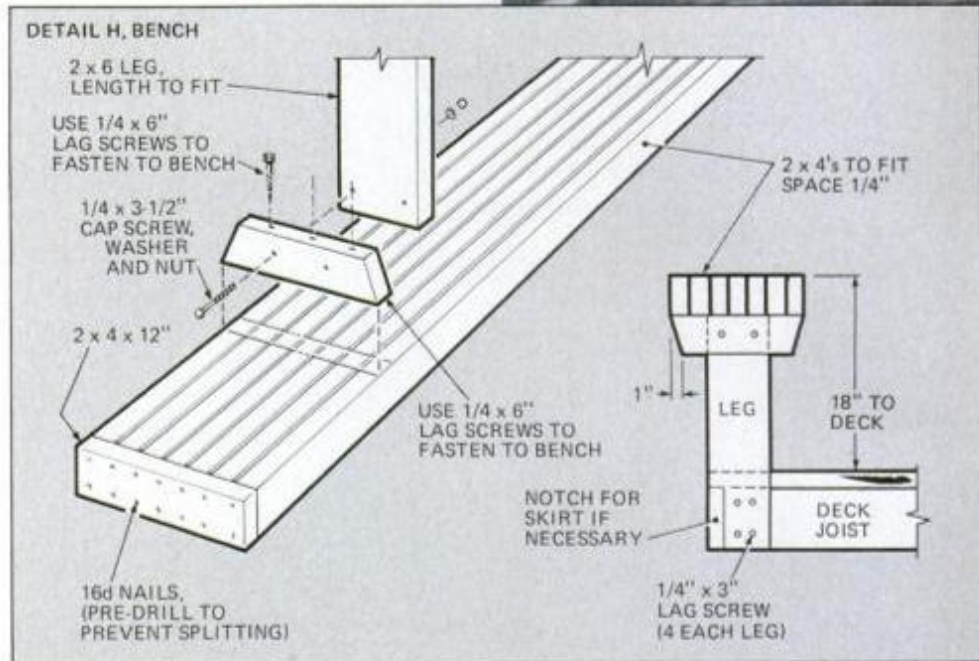
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Built-in benches are constructed of the same grade of redwood as the deck. For rigidity, bench legs are lag-screwed to deck joist; seat cleat is also screw fastened.



its fixtures—hangers, bolts, lag screws and nails will pretty well cover about all you will need. Just make certain all hardware is hot-dipped galvanized. If it isn't, your deck and built-ins will soon be marred with unsightly rust stains. Do follow good carpentry practice and bore pilot holes for nails that will be installed near the ends of boards; failure to do so is sure to result in the boards splitting as the nails are driven.

### Building steps

Chances are, any deck other than a ground-level one will be improved with steps. The steps might be a simple platform-like structure that splits an extra-high rise from lawn to deck surface. Or, it might be a multi-step stairway that is built like conventional stairs. The easiest types of stairs to build are those with treads nailed directly to stringers—see sketch, page 141. For stair safety reasons, you should be familiar with some of the important basics of stair construction:

- The treads should be a minimum of 10 in. wide.
- Risers should be no more than 7 in. high but can be as low as 4 in. (Note: A step's rise includes the thickness of the tread.) If you have any doubt about riser height—whether to build one step or two—it's a pretty safe bet that you should make two steps, rather than building one high one. In any event, never

vary riser height from step to step or you will create a "tripper." All steps in a run should be as nearly identical in riser height as possible in order to assure maximum stair safety.

### Exterior finishes

One of the joys of using wood for outdoor projects is that the material is easy to finish. It has been my observation that all woods used outdoors—redwood, cedar, pine, fir and spruce—finally weather to an attractive soft, silver gray when left unfinished. This aged, weathered look is a sheer delight.

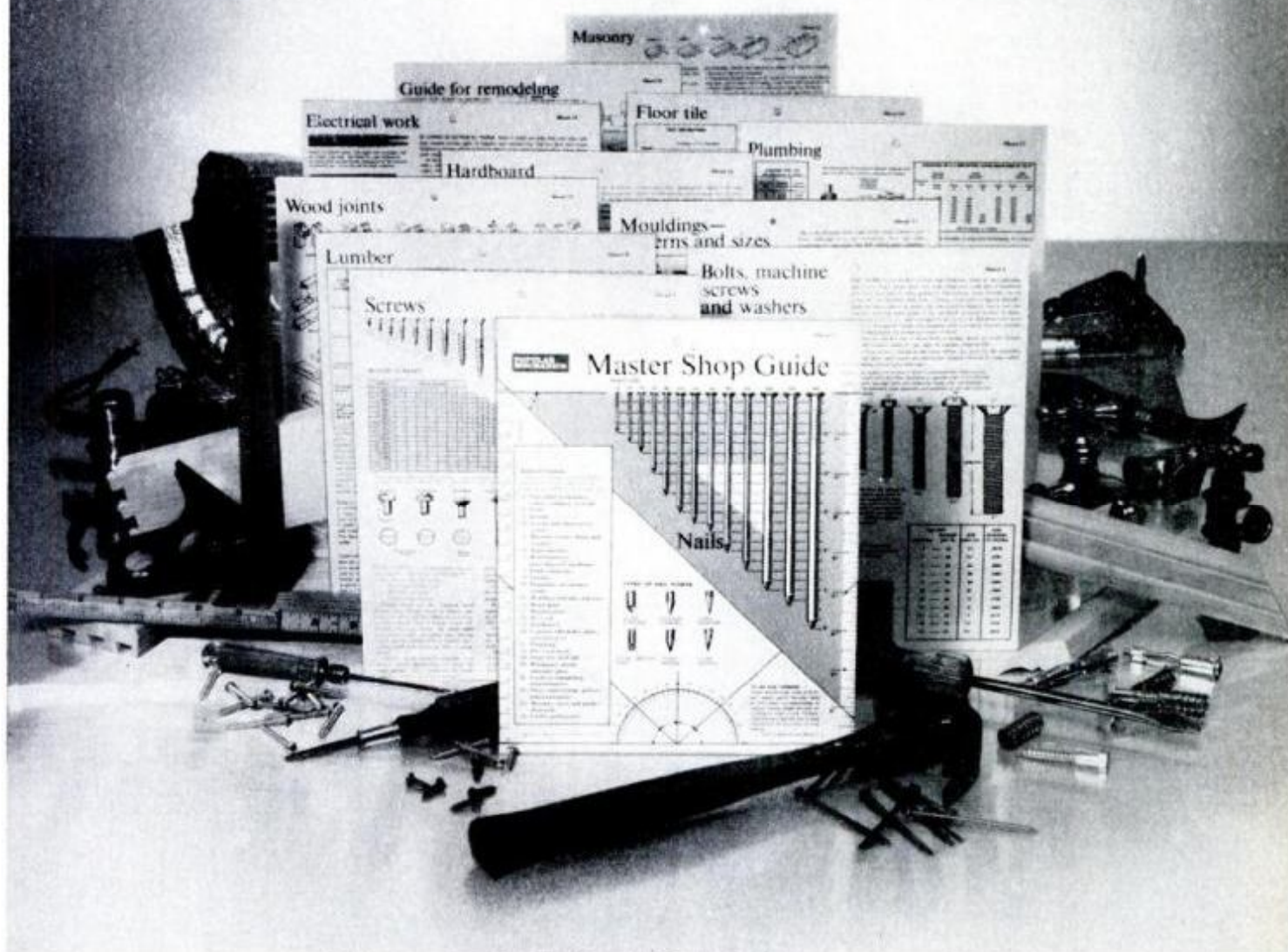
If you want to speed up the aging process you can use a bleach. In general it is best to use a commercial two-part bleach; some must be intermixed while others are applied in successive steps. No matter which type you buy, be advised that all of them contain strong chemicals, so make certain you wear both rubber gloves and safety goggles when applying them. You would be smart to wear old garments, too, because the bleaches will attack most fabrics.

On a deck you can apply the bleach with a hefty bristle brush and then allow it to dry on the surface until the desired effect is reached. The instructions on the package will tell you if rinsing is needed to stop the bleaching action. At any rate, you should make certain all areas that might be contacted by humans

(Please turn to page 152)



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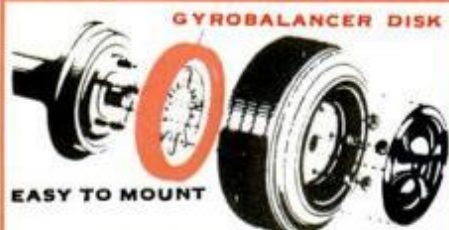
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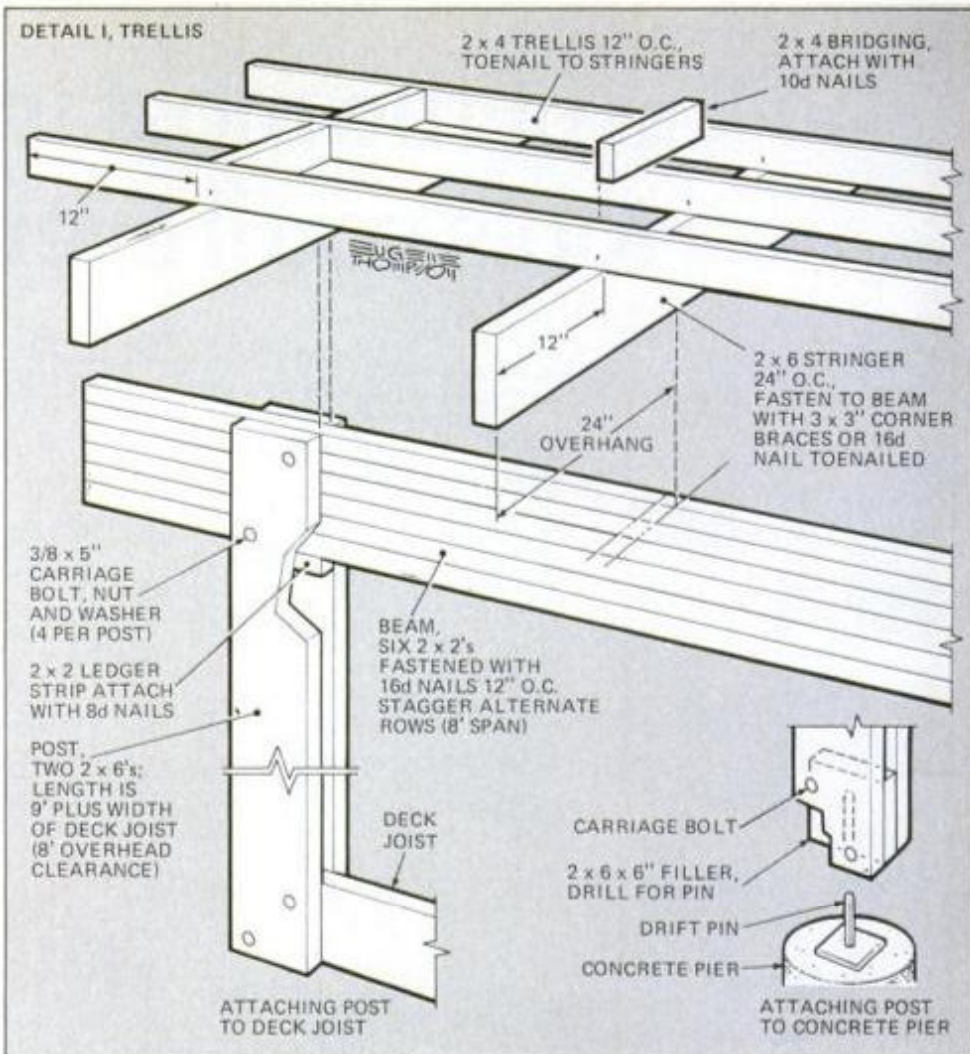
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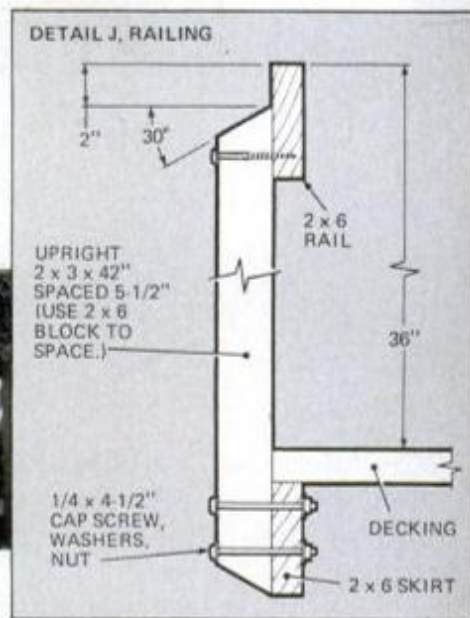
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If you prefer your deck to be a certain color, you will have to apply either semitransparent or opaque exterior-grade stain. Happily, if you buy a quality stain you will find that both types are easy to apply. Both also give very good protection for the wood.

New wood should be clean and dry for best results with either type stain. Any surface dirt, stains, grade stamps and the like must be removed before you apply stain.

Wood textures are generally enhanced by a semitransparent stain; opaque stain is preferable when you want to hide knots and other blemishes.

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C-47 merely shrugged and continued on its way. An account of the incident describes the remainder of the flight as uneventful though a bit drafty.

Japan, to a summer cabin in Pakistan. In California, a man named Smokey Rolland is converting a DC-3 fuselage he found in an Arizona junkyard into a motorized camper (see photos, page 93).

**Landed gently sans crew**

■ Then there was the C-47 that ran out of fuel. Its crew bailed out, only to learn later that the aircraft had landed gently all by itself in a meadow several miles from where they'd deserted her.

With the possible exception of Lindbergh's Spirit of St. Louis, no other aircraft has been more celebrated in story, song and pilots' lore than the DC-3.

No less an authority than Gen. Dwight D. Eisenhower called it "one of the most important weapons" for victory in World War II. Former Air Force Secretary Harold E. Talbott said it "unquestionably ranks as the best single airplane ever built."

But the aircraft could do more than soldier; it was a commercial success as well. A single DC-3 once made the difference between an airline's survival or failure:

In 1950, a fledgling Icelandic Airlines was perilously close to financial disaster with its principal asset—a four-engined DC-4—down for good on a glacier in Iceland called Vatnajökull. A ski-equipped USAF Air Rescue Service C-47 with only about 10 hours on it was dispatched from the NATO base at Keflavik to pick up the stranded DC-4 crewmen. The rescue plane, however, itself became bogged down in the glacial ice, necessitating the evacuation of all personnel by a ground party. Before a salvage mission could be mounted, bad weather closed in, burying the C-47 under so much snow that only the tip of its rudder was visible from the air. The USAF abandoned the plane.

**Airline gets a 'free' plane**

But two intrepid Icelanders—Alfred Eliasson and Kris Oleson, the then-hard pressed owners and operators of Icelandic Airlines—didn't give up. They bought the salvage rights to the abandoned C-47 for \$600 and, in the following spring, dug it out with shovels and a bulldozer. After hauling the aircraft 43 miles down the glacier to an improvised airstrip, Oleson climbed up into the cockpit and discovered, happily, that despite the aircraft's being buried in snow for months, its batteries had enough juice left to turn over and start both engines. He flew it back to Icelandic's headquarters at Reykjavik and the airline suddenly had itself a valuable new asset.

The plane was then flown to England for modification to commercial airline use. But before the

(Please turn to page 158)

■ Another Chinese DC-3, grounded because of engine trouble, was strafed by five Japanese fighters that put more than 3000 bullet holes in its wings and fuselage. Its engines more or less repaired and the bullet holes patched with canvas and improvised glue, the plane took off and ran into a rainstorm. The engines were running roughly, belching out huge streaks of blue and orange flame, and the rain soon washed away the cobbled-up bullet-hole patches, setting up a loud, eerie whistling noise as the aircraft staggered homeward. A patrol of six enemy fighters jumped the stricken transport, but suddenly broke off the attack without firing a shot. Safely down, the plane's crew monitored a Tokyo broadcast that described a new Allied secret weapon that "spouts streams of flame and screeches in horrible tones as it flies."

■ Designed to carry a maximum of no more than 30 passengers, one C-47 in Burma during the war somehow managed to board a total of 74, including the then-Lt. Col. Jimmy Doolittle, who was en route home from his famous bombing raid on Tokyo.

■ In Brazil, a DC-3 once wallowed into the air with 93 flood victims aboard, a feat that effectively contradicts aerodynamic principles as basic as two plus two equals four.

**Broke the Berlin blockade**

The stories can go on and on, each more incredible than the last. In addition to its essential mission of transporting passengers and cargo, the DC-3 has served as a flying hospital, a glider, an airborne command post, an amphibian, a ski-plane, a flying cannon platform, a fire-fighter, an agricultural spray plane—even a bomber. In June, 1948, 30 years ago this month, the DC-3, as the backbone and workhorse of the famed Berlin Airlift, helped keep an entire city alive.

Fuselages of DC-3s have been converted to restaurants in Sweden and South Africa, to a small inn in



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## THE GLORY DAYS OF A GRAND OLD LADY (Continued from page 156)

work could even begin, Iberia, the Spanish airline, offered Icelandic \$75,000 for it, just as it sat. Including the salvage fee, rescuing the C-47 had cost Icelandic about \$6000. The Spanish offer was too good to refuse, and Icelandic found itself not only out of the financial woods, but with enough cash left over for a down payment on a replacement DC-4.

### Airborne 'Pullman car'

The DC-3 began its career as the DST (Douglas Sleeper Transport), a luxury "Pullman car" airliner built for American Airlines. It featured seven upper and seven lower berths plus a private cabin in front. Soon, however, it became apparent that by removing the bunks a DC-3 could carry 21 passengers in three rows of seven seats, a significant increase over the capabilities of other airliners then in service. By stretching things a bit here and there, later versions packed in as many as 30. Thus, at about \$110,000 per copy, evolved what within a few short years became universally known as "the machine that taught the world to fly."

For passengers, the DC-3 represented a dazzling improvement in service. Gone were the cold feet, the vibration, the debilitating effects of constant loud noise, and, for the most part, the box lunches. Instead, travel in a DC-3 could mean hot meals served on trays, comfortable seats, a heated passenger compartment, soundproofing and speed... anywhere from 165 to 180 mph. At that rate, passengers could fly coast-to-coast in 15 hours, making only three enroute stops.

For pilots, the DC-3 meant constant-speed props, an autopilot, powered brakes, controls that didn't demand a linebacker's strength and endurance, an airplane they could fly with both ease and confidence, the latter despite wings that tended to flex and flap like so much limp clothesline.

### Overwhelming success

For the airlines, the DC-3 staunchly an alarming flow of red ink. It was, as C.R. Smith, then president of American Airlines, once said, "the first airplane that could make money by just hauling passengers."

In short, it was an overwhelming success. First placed in nonstop service between New York and Chicago on June 25, 1936, it was by 1938 the standard equipment of all major U.S. airlines. It was also being

operated in a number of foreign countries. In fact, the world's airlines were—almost literally—lined up waiting at the doors of Douglas Aircraft, which couldn't fill the orders fast enough. By World War II, over 90 percent of the world's air travel was on DC-3s.

In all, excluding an indeterminate number of carbon copies built by the Russians during the war, just under 11,000 DC-3s in various versions were built, the last one rolling off the assembly line in 1946. Only a couple of years ago, Douglas—now a division of McDonnell Douglas Corp.—estimated that about 3000 DC-3s were still in worldwide commercial, military, government and private service. Today, an occasional DC-3 shows up on the used-aircraft market and sells for about \$20,000.

These surviving DC-3s, are, of course, getting well up there in accumulated flight hours, some having 70,000 and more. One of the highest-time aircraft—perhaps the reigning champion of all DC-3s—is out to pasture at Henry Ford's Edison Museum in Dearborn, Mich. Donated to the museum by North Central Airlines, it retired with 84,875 air hours.

### New beak for old bird

Even today, DC-3s are proving remarkably adaptable. In California, for example, an outfit called Specialized Aircraft Co. has fashioned an ancient DC-3 airframe into a flashy trimotor turboprop, putting a new beak on the bird. One Pratt & Whitney PT-6 engine is mounted smack on its nose, along with two more in the regular engine nacelles in the wings.

With this kind of rejuvenation, the DC-3 may never fade away. Social scientists of the future may one day reckon its impact on 20th century society to be about on a par with television and the automobile. In any case, the DC-3 will live as long as there are airmen around to tell stories about it.

A retired airline pilot with many hours at DC-3 controls, tells about checking out a young Navy lieutenant one sunny afternoon before the U.S. entry into World War II. Seated on the copilot's side, the young fellow looked out to his right and noted the extent to which the DC-3's wings flexed on takeoff. "Wow," the kid said, "look at it breathe!"

Yeah, look at it breathe. There's life in the Old Girl yet.

(Please turn to page 160)

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## Fond memories of the famed DC-3



Len Morgan, a captain with Braniff Airlines, is a 40-year veteran of aviation and author of the book, *The Douglas DC-3*, published by Arco. Here he reminisces about his days as a young pilot learning to fly the great DC-3.

by Len Morgan

On my den wall are displayed sticks and control wheels from aircraft it has been my good fortune to fly—the B-25, B-17, P-51, DC-4, Connie, DC-7, Electra, 707 and so on. I started collecting too late, however. There's one more souvenir I must find before the chance has gone forever—a control wheel from a DC-3. That would be the prize of them all.

I was 15 when we moved to Louisville. Bowman Field, a square mile of grass with a small brick terminal, became my second home. Nothing was more intriguing than the new DC-3s with which American and Eastern served the few brave souls who dared to fly. Newspapers always described them as "huge"—which, by standards of the 1930s, they were. One day they let me sit in the copilot's seat of an American "Three." I gazed in awe at the array of handles and gauges and a big silver prop on the right engine. It was a moment to be treasured.

At 20, I was again invited to take the right seat in an American Three, this time to learn the copilot's trade. The Three had been a "flagship" until the Army commandeered it, stripped it of its plush appointments and gave it a coat of olive drab. We took off from a steamy base in central Africa and slowly climbed across the rain forest. In an hour I had it down cold. I could extend and retract wheels and flaps, monitor engine health, hold it straight and level and call off air-speed readings on final—about all a copilot was supposed to know then. All the brains were in the left seat; we lackeys called ourselves commissioned ballast.

### 'I saw it perform miracles'

The C-47 (military designation for the DC-3) was at first a disappoint-

ment. It seemed clumsy, ridiculously complex, underpowered, and it flew as if tied together with rubber bands. Then I saw it perform miracles. We hauled people—troops, USO entertainers, correspondents, the wounded. And things—food, engines, land mines, ammunition, jeeps, tires, beer, in fact anything that could be cut apart at one end and welded back together at the other end—like a railroad locomotive. And a P-40; they'd strap the wings underneath the fuselage and put the whole fighter inside our C-47.

We flew to places you've never heard of in weather you'd never believe—tropical deluges so heavy they drowned both engines, sandstorms so fierce they reduced over-haul time to 200 hours.

The C-47 protested and groaned like a creature alive, struggling out of short strips and staggering along at full throttle, refusing to climb, yet refusing to give up. It ran hot, it ran rough, its long wings flexed alarmingly in storms, it sank back to earth with a great sigh, it moved the loads and brought us back for more, magnificent flying machine that it was. Donald Douglas must have shaken his head in disbelief at the reports sent home about his docile airliner.

After the war I joined an airline that was still flying Threes on short hauls. Fours and Sixes had taken over the prestige runs. What a contrast with the military was this white-collar flying—nice, clean cockpits, radio aids that worked, long, smooth runways, ground crews to load and fuel, a stewardess to fix coffee and good hotel rooms. We droned along enjoying the view, content in the work, making a few dollars at it—a most pleasant way to earn a paycheck.

The Three performed well with 21 fares and a surprising volume of freight. It was easy to fly, stable, and could continue flight on one engine at maximum weight. If an engine packed up leaving a small airfield, however, you had to do everything just right. The ship demanded a pilot's very best when the chips were down. Taxiing was a knack in itself, requiring coordinated use of rudder and throttles with minimum braking. You "flew" from chocks to chocks. A true DC-3 artist was a craftsman of the first order, a wonder to watch. Our ships had no autopilots so it was hand flying all the way. We'd file visual flight plans in good weather, climb to 300 feet above cruising level, then drift back down to pick up speed and get her "on the step." We flew as high as 12,000 feet.

Prop synchronization was done by ear and a tiresome day it was when one kept wandering off speed. The fuel selectors were used as footrests, the elevated knee being a natural brace for

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the arm holding the wheel, but care was needed to prevent shutting off fuel on your side. It was funny only when the captain's foot slipped.

Trimming for hands-off flight was no trick, but it all went for naught when a 110-pound stew began serving lunch. Forward pressure, back pressure until she was done. "Here comes our coffee," the pilot flying would say before the door opened, rolling in a half turn of elevator trim if it was her custom to stay for a cigaret. A scoop in the nose was the sole source of fresh air so on hot days we'd climb with cockpit side windows open, the reason some of us are hard of hearing now.

### Engines spoke in subtle ways

I can still hear that pair of Pratt & Whitney 1830s roaring—and winding down on the ramp with a rattle of reduction gears. Piston engines spoke in subtle ways and it was wise to pay attention. An intermittent tremor felt through the rudder pedals, a minor compass swing in smooth air, the not-quite-right bark of exhaust could be a warning long before anything showed up on the gauges.

Landings were usually made on the mains with tail low. A three-pointer was not difficult, but you had better have her no more than six inches above the concrete when you set her down. We used full flaps in all but extremely strong winds and left them down until clear of the runway. The pilot who yanked flaps up on contact was usually afraid of the plane—afraid that the lift of the flaps might make her come unstuck again and difficult to control. Crosswinds required expert cross-controlling, and the man too quick at unlocking the tailwheel eventually had a wild ride over airport property not normally used by airplanes.

### Rough-air flight was tough

Flight in rough air was sheer hard work; ice and thunderstorms could be nightmares. The least of our trials was getting soaked to the skin. The windshield caulking leaked badly and poured cold water into your shoes. But who remembers the bad? My fond recollection is of padding through a calm autumn evening with cockpit lights turned down low, the familiar glittering landmarks sliding toward us on schedule, the welcoming glow of our final destination just visible on the horizon. Ah, but those were great times!

As the new Convairs arrived, the old Threes were sold to begin new careers with feeder lines. One day they were all gone, the colorful chapter was complete, and we moved ahead in an industry that spends little time looking back. Only a few snapshots, entries in logbooks and memories remain.

Does anyone know where I can find a DC-3 control wheel? **PM**



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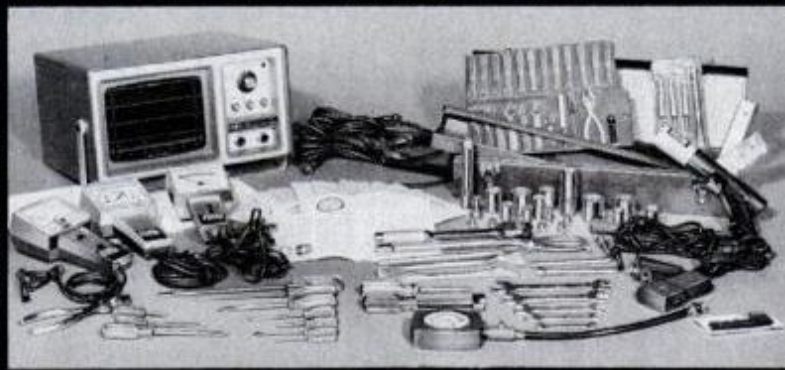
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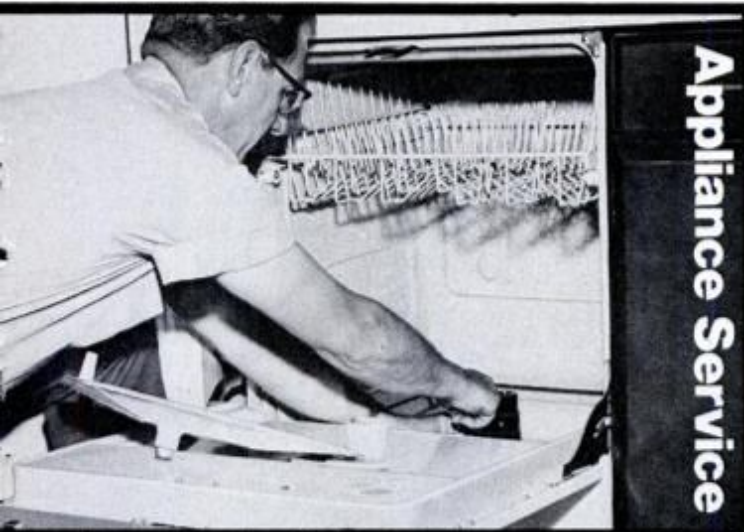
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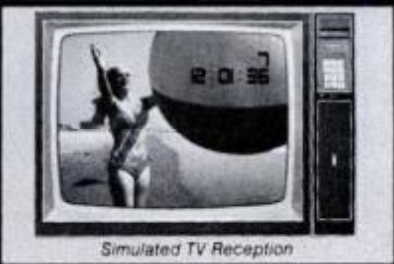
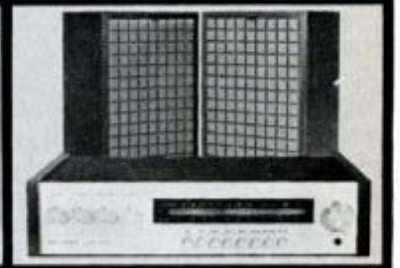
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## TAKE HAZARD OUT OF YOUR SHOP

(Continued from page 137)

quick, often disastrous, remedy. Impatience causes accidents.

5. One of the most severe hand tool accidents occurs when metal is struck against metal and a chip, such as a nailhead, flies into the eye. The importance of protective eye-wear cannot be overemphasized.

### Design a safe shop environment

While a good project design is usually the first concern of serious craftsmen, the design of their shops is often given little thought. Check the following safety criteria.

6. Comfort is critical to safety and efficiency. Keep your shop at a good working temperature. I prefer about 60° F. Choose a shop heater with care and follow the maker's instructions when installing. Some gas-fired garage heaters, for example, must be vented to be safe.

7. Adequate lighting also raises your shop's comfort—and safety—index. Use at least two 33-in., 25-watt fluorescent tubes, mounted about 4-ft. above each work station. Baffles and louvers, like the egg-crate designs, reduce glare. As an alternative to fluorescents, use a 150-watt, R-40 flood or spot lamp (with reflector built in) with an adjustable holder. Clamp it so no

glare or shadows fall on the work.

Paint walls and ceiling with light, low-gloss washable colors. Keep bulbs and bulb covers clean. Add protective plastic sleeves to fluorescent tubes (see list, left below) to contain glass fragments and gas should the tube be broken.

8. Place wall-mounted louvers or an exhaust fan opposite an operable window. A power vent and a supply of fresh air are musts in rooms used for painting and finishing to prevent fire or explosion. Good ventilation (and an appropriate respirator) also prevent inhalation of toxic fumes. Many chemical products are very hazardous—so heed manufacturers' cautions. For example, an ingredient in some paint removers, methylene chloride, forms carbon monoxide in the blood if inhaled.

9. Empty sawdust and combustible waste at the end of every workday.

10. Obtain two all-purpose fire extinguishers. Mount one in a central location and the other near an escape route—not next to flammable materials where you might not be able to reach it during a fire.

11. Study your shop floor plan. Does the traffic pattern allow easy, free movement? If not, can it be rearranged? Can unnecessary clutter be removed? A real danger is being startled while you work. Can you rearrange power tools so you face the direction of likely approach? If not, consider locking the door while you work—although this has drawbacks if you work alone.

In any case, act now to take the hazard out of your shop. Don't leave your welfare chance. **FM**



Antifatigue mats placed at work stations are great leg savers—especially if your shop has a concrete slab floor.



Author demonstrates emergency eyewash bottle—a precaution in addition to goggles—which quickly flushes out particles.

### SAFETY EQUIPMENT MAKERS

Most of the health and safety items shown in this article are available at local retail outlets. If you have trouble locating a particular item, write the manufacturer for the name of the nearest dealer.

**American Optical Corp.** Safety Products Div., Southbridge, Mass. 01550. Safety eyewear, ear protectors, respirators, hard caps.

**Airomat Corp.** 2920 Engle Rd., Fort Wayne, Ind. 46809. Anti-fatigue mat, \$2.97 per sq. ft. (single ply).

**Bausch & Lomb**, Dept. 3506, Box 450, Rochester, N.Y. 14602. Safety eyewear.

**Bel-Art Products**, Box 12, Pequannock, N.J. 07440. Emergency eyewash station (bottle, mirror, wall mount) \$12.50.

**Justrite Mfg. Co.**, 2454 Dempster Ave., Des Plaines, Ill. 60016. 10-gal. automatic oily-waste can, \$31.50.

**Kidde-Belleville**, Consumer Service, 675 Main St., Belleville, N.J. 07109. Fire Away 110 (shown), \$19.

**Norton Co.**, Safety Products Div., 2000 Plainfield Pike, Cranston, R.I. 02920. Safety and welder's spectacles, goggles, helmets, hand and face shields.

**Pitway Corp.**, Box 471, Aurora, Ill. Wireless smoke alert system (shown), \$179.90.

**Sellstrom Manufacturing**, Sellstrom Industrial Park, Box 355, Palatine, Ill. 60067. Safety equipment to protect eyes, ears, face, head and lungs.

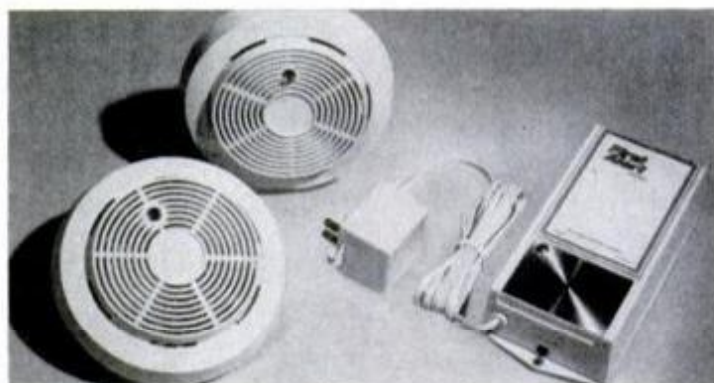
**Thermoplastic Processes, Inc.**, Valley Rd., Stirling, N.J. 07980. Fluorescent safety sleeves, safety engineered fluorescent trouble lights and miscellaneous lighting safety equipment; clear plastic globe and base shown, \$10.35.



Keep bare bulbs from shattering with clear or low-glare safety globes.



Container for oily wastes confines highly combustible material until it can be safely removed from the shop and left out for trash pickup.



Pressure gauge on extinguisher (left) indicates when it needs to be recharged. Remote signaling detectors (above) with bedside alarm are ideal for shops that are out of earshot.

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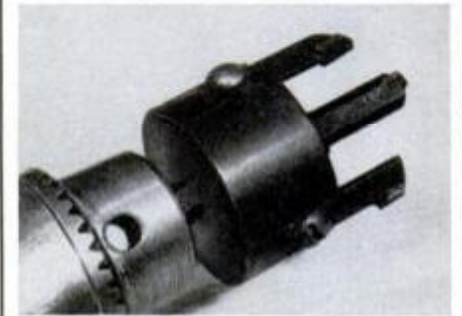
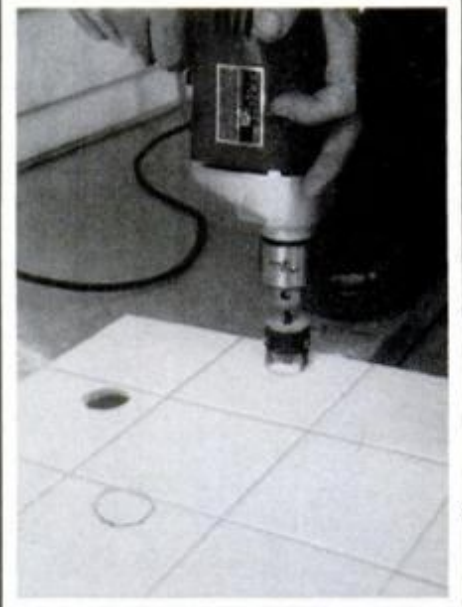
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I found the best way to use the bit was to first use a punch or awl to slightly score the glaze at the center of the point to be drilled—to prevent bit drift. Next, using a variable-speed drill, start slowly and then increase the speed. The saw is at tile dealers, or write American-Olean Tile Co., 1000 Cannon Ave., Lansdale, Pa. 19446. The complete bit is \$41.75; replacement blades, \$16.68.—H.W.

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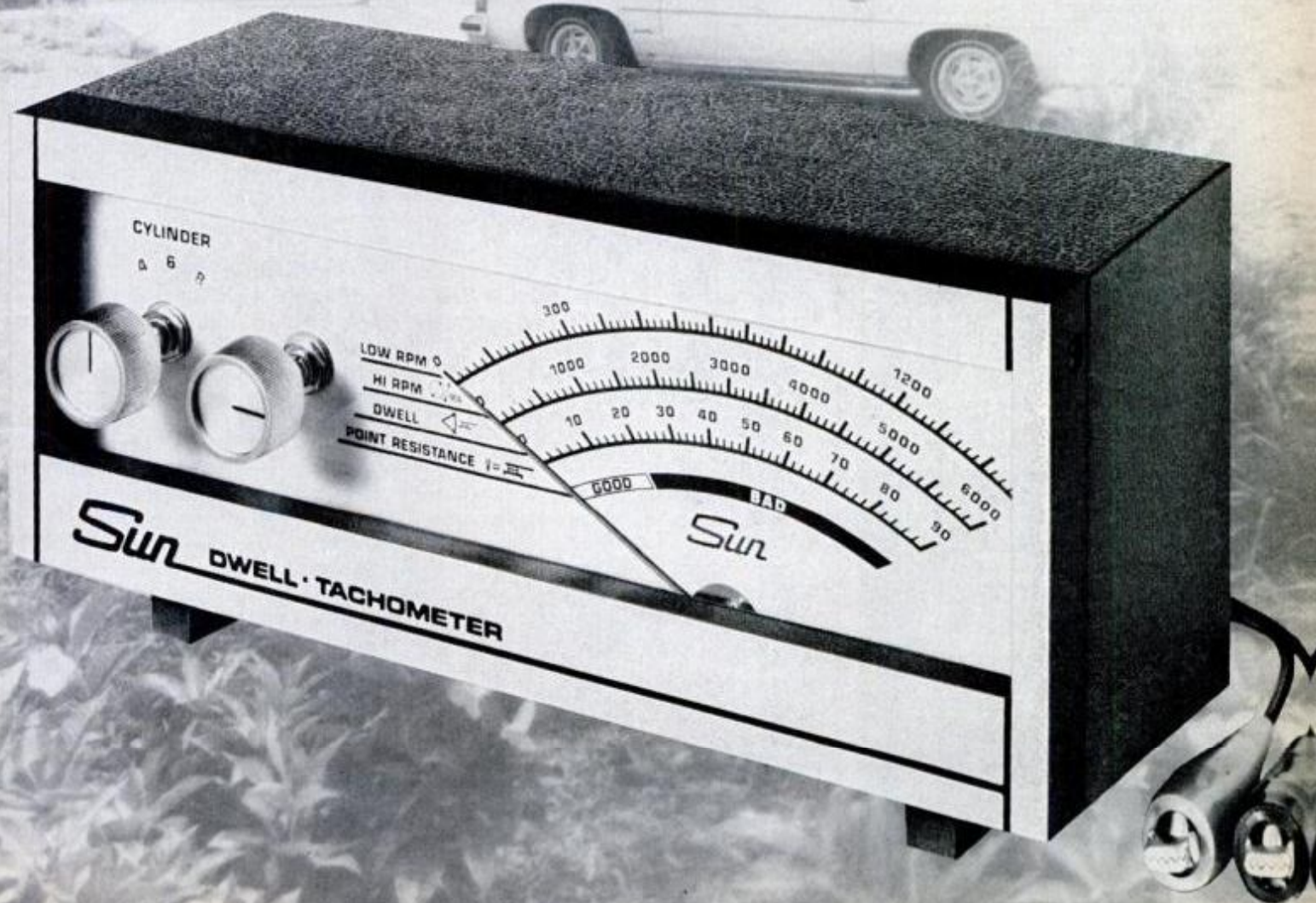
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(Continued from page 117)

from M.I.T. The operational unit, several miles long, is similar in concept to a linear particle accelerator. It would use solar-derived electric power to accelerate bundles of compacted moon ore to escape velocity, firing them into space toward  $L_2$ —a "stability point" of neutral gravity in the solar system some 63,000 km. beyond the moon. From there, the ore would be transferred to a space manufacturing site. Propulsion for this flight would be provided by using moon debris as a reaction mass, thrusting it from the driver's rear end, like rocket fuel.

Already on the drawing boards are module factories operating solar electric furnaces to melt the ore; extrusion mills in cylindrical enclosures with a "shirt-sleeve" environment, that would squeeze out endless lengths of structural members. Insect-like beam-crawlers would creep along the girders, assembling parts, extending the structures into the void. Long, beam-like cranes would carry assembled components into position. Hovering around the skeletal structures like so many bees around a disturbed hive, utility vehicles with robot-like arms would jet materials to the builders.

While some materials for early structures would undoubtedly be ferried into low Earth orbit by Shuttle and later jettied to higher orbit, both O'Neill and O'Leary see the mass driver as, eventually, the basic tool and transport "carry-all" for all outer space operations.

Beauty of the system, Dr. O'Neill explains, is that it can be used not only to hurl loads into space in one direction, but by using the loads themselves as a reaction mass they can push something in the opposite direction.

Since the Shuttle is designed only for low Earth orbit, O'Neill proposes that, on arrival in orbit, its burned-out fuel tanks (which would otherwise be discarded before return to Earth) be pulverized to provide reaction mass for a mass driver that could then transport supplies from the Shuttle on up to orbiting power-satellites, and even trundle mining equipment up to the moon.

**Mining on the moon**

During NASA-Ames Air Force Base studies two years ago, scientists blueprinted possible moon mining procedures. O'Neill and O'Leary envision the actual digging as a gradual open-pit excavation method, using bulldozer-like equipment. Ma-

terials would be bundled into buckets for the mass driver, a long tube bristling with solar collector panels. Downrange, the ore would pass through "flying spot scanner" tunnels designed to aim the packages of ore to the target collection point in space, with an accuracy of  $\pm$  one meter. Between them, these structures resemble nothing less than a setting for *Star Wars*, sitting out on the bleak lunar surface.

**Rocket fuel from the moon**

Other space experts—Rockwell International's Krafft Ehrlicke, for one—propose using small nuclear explosives to break up lunar surface rock, and to create steam from molecular water in man-made moon cavities, for power generation. The resulting water condensate then could be converted to hydrogen and oxygen for rocket fuel, they say.

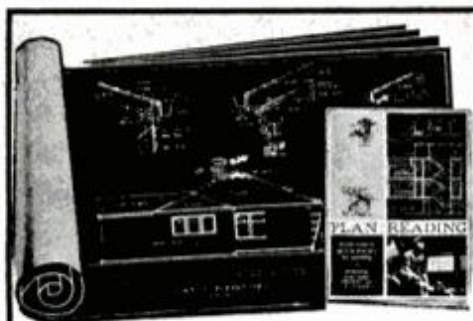
Whichever system is used, the mass driver would figure in the operation. Plans call for the crews to live in comfortable habitat modules. At the base's operations center, a circular affair on a pylon, men at control panels reminiscent of "ground control" at the Johnson Space Center, would monitor on color video screens the mining and emplacement of ore in mass driver buckets. The ore would be accelerated to escape velocity—2.3 km./sec. on the moon's surface. Estimated throughput could start at 10,000 or more tons per year, according to Dr. O'Neill, escalating to hundreds of thousands of tons as the system grows.

**Catching asteroids**

Asteroid retrieval, dealt with at NASA-Ames studies last summer, is something else.

Brian O'Leary points out that there are some 35 known Earth-approaching asteroids, and probably hundreds of others that could be discovered in short order by even a cursory sky-watch. They would provide more than enough material for all the space platforms we might ever want.

"Instead of using a mass driver to send materials to lunar orbit, then to the moon, then to launch lunar materials into space, then transfer them to a space manufacturing site for processing," he says, "you'd take the same mass driver and go into spiral orbit toward an asteroid, taking advantage of a gravity boost from the moon en route. You'd arrive at the asteroid perhaps a year or so later."



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the National Aeronautics and Space Administration to launch a lunar polar-orbiting satellite that would be able to sense the entire lunar surface for the locations of minerals and water.

A stepped-up search has been recommended for astronomical observatories across the country to locate and analyze Earth-approaching asteroids.

NASA expects to see a basic space station in orbit by the mid-

1980s. Plans for one already exist. Designers of the big power satellites see a full-scale unit in orbit in the 1990s. The Princeton group envisions large space colonies with working populations by the turn of the century.

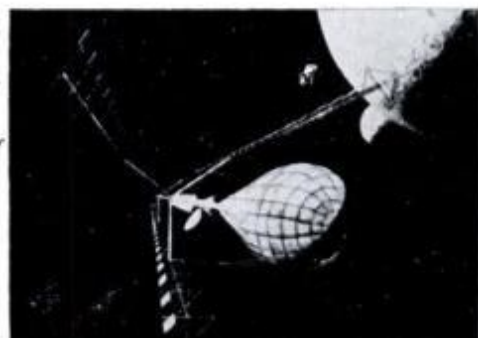
Whatever your own feelings in the matter—and considering the state of resources and potentials on Earth today—think twice before betting that the space planners won't meet their deadlines. **PM**

From there, the scenario envisioned by the Princeton group goes something like this:

Assuming an asteroid some 100 yards across, weighing a million tons, astronauts would enclose it in a huge plastic net and bag, and check it for cosmic radiation.

### Asteroid gets a crew

Temporary crew quarters would be burrowed into the asteroid itself, and mining equipment from the cargo compartment on the mass driver would be set up to provide asteroid material for mass driver



Mass driver towing bagged asteroid gets a moon gravity boost on way to Earth orbit.



Lunar ore launched by mass driver flies through optical scanners for precise aim.

reaction in order to ferry the asteroid to Earth orbit.

Solar panels along the mass driver's reaction tube would provide the energy to propel the reaction material out the driver's rear end.

The driver and asteroid would swing in toward Earth orbit, getting a final gravity assist from the moon. Along the way, materials would be separated and processed, with residues being fed to the mass driver's reaction motor. Water and volatile materials would be stored for use at the manufacturing site.

At least half the original asteroid would be left, and delivered "in the bag" to the manufacturing center.

How far off is all this "pie-in-the-sky"? Not out of sight, by any means. Already, plans are afoot for

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One thing the American Bicentennial Everest Expedition had along was a Honda EM-400 portable generator. At the 18,000-foot base camp, the little Honda put out dependable power for charging batteries, running a soldering iron—even powering the radio to keep up vital communications.

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small tools and accessories around the home or campsite. It also puts out 12 volts of DC power, so it will charge your car battery as well. It's simple to use; the quiet Honda engine is a four-stroke design so you never have to pre-mix fuel. And at a mere 39 pounds, it's easy to store and move.

Check out the Honda EM-400 at your Honda generator dealer today. It's a nice companion to have, whether you're climbing a mountain or just getting the odd jobs done at home.

## HONDA GENERATORS

For optimum performance and safety we recommend that you read the owner's manual before operating the unit. For the Honda dealer nearest you, call collect (213) 381-2201. Honda also makes a line of tillers, outboard engines, general purpose engines and water pumps.  
©1978 American Honda Motor Co., Inc.

## SMOKEY STOVER'S 2-WHEEL CAR

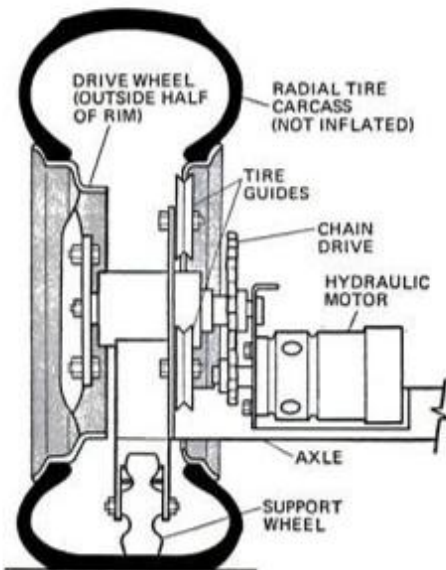
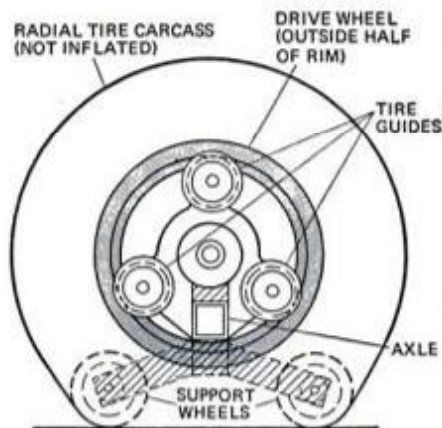
(Continued from page 119)

the Foo Mobile was an incredible, impossible machine that existed only in his comic strips. Bill insisted on being on hand for test-drive day, and I asked this incorrigible punster (who's no youngster) what inspired his creation. "Easier to draw two wheels than four," was his twinkled-eyed reply.

When Pete wheeled up in his car, I went to work on it: no trick suspension, no gyroscope, no nothing that would reveal the secret. I gave up and just had fun driving it. Top speed is only 4 or 5 mph and Pete envisions it only as a fun car for parades and other such uses. He's working on a set of plans for anyone interested. You can write Schlatter's Inc., Box 548, Francesville, Ind. 47946.

Oh yes, the secret: If you had X-ray vision you'd see it right away as in the drawings below! **PM**

### SECRET OF THE SMOKEY STOVER CAR



Radial tires with their distinctive bulge or flat look inspired Pete Schlatter's "Eureka!" A radial has a long enough footprint so that two support wheels 13 inches apart can be hidden in a tire carcass. So, the amazing two-wheeler is actually a four-wheeler on a 13-inch wheelbase!

## HINTS FROM READERS

### Storing paint

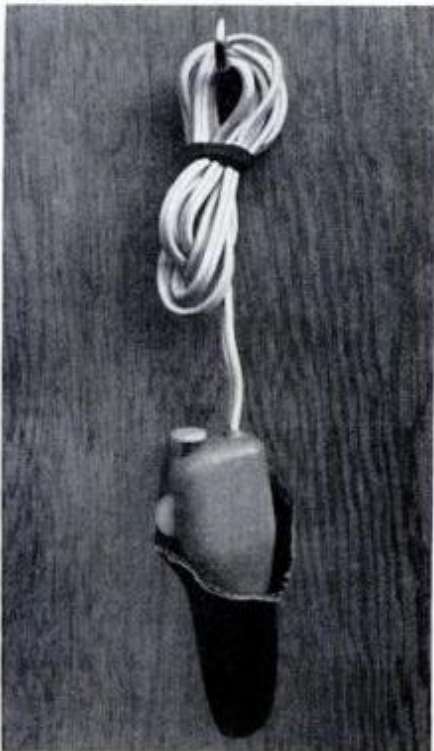


Before you store paint in screw-top jars, place some plastic from a bread wrapper over the jar. It prevents paint from adhering to the cap and makes opening the jar easier.—*Harold Neibert*

### Saving drill bits

To save bits when boring in hard steel, first soften the metal where you will drill. Center-punch for the drill point. Then cut off the head of a nail and round the point. Place the nail in the drill chuck and run the rounded end against the indent. Friction causes heat buildup which softens (anneals) metal. Let spot cool before boring hole.—*S.L. Koester*

### Engraver storage holster



The thumb of an old leather glove stapled to a wall in a convenient spot is a good storage holder for an electric engraver. Secure cord on a screw hook.—*E.V. Reyner*

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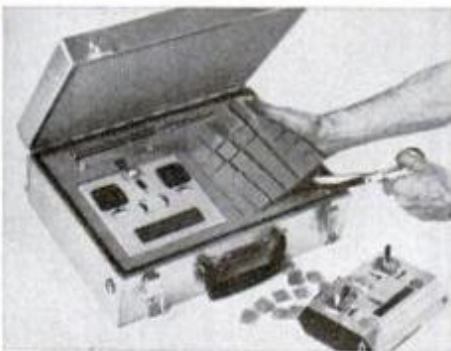
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### Hardened case

Drive a car over this case and its contents would be unharmed, maker claims. Form compartments with pre-cut foam. 6x12x17-inch case, \$93. Kalispel Metal Products, Box 267, Cusick, Wash. 99119.

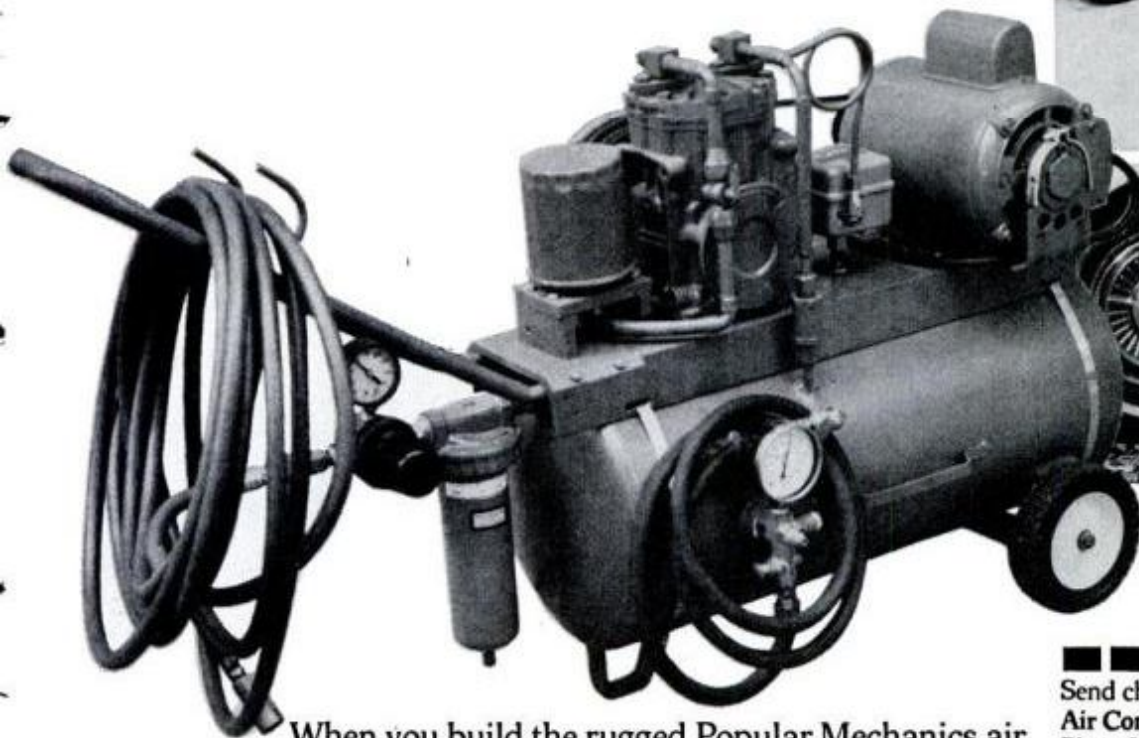
### Get a grip on your glasses

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## HOW TO PAINT MASONRY

(Continued from page 144)

ufacturer's instructions. Let this dry before applying a good latex or other paint specified for concrete by the same maker. Apply no more than two coats. (Note: If a concrete deck is on soil that regularly traps water, trouble may recur in a short time. Paintmakers recommend getting rid of the moisture source, or stripping the surface and leaving it bare.

**2. Bubble blisters.** Cause: Hot weather. The paint dries faster than the solvent can evaporate, so it expands under the paint and lifts dome-shaped blisters which are known to the trade as "solvent blisters."

**Cure:** Strip blistered areas as described in No. 1, and repaint in cooler weather at a time when the sun does not strike the surface directly.

**3. Flaking.** Cause: Surface moisture followed by frost; too many coats of paint (no more than two coats are recommended for a bare masonry surface), or poor paint structure (brittle or shrinking undersurface).

**Cure:** Same as for No. 1.

**4. Alligatoring.** Cause: A rare phenomenon on concrete, due to either too much zinc oxide in paint, or a top surface paint that's harder than the base coat—such as an enamel applied over a flat finish, or applied over wax, grease or oil spills.

**Cure:** Remove as much old finish as possible in the damaged area and refinish as indicated in No. 1.

**5. Poor adhesion** (paint scuffs easily, strips when furniture is dragged over it, as shown at the top of page 144. Cause: Concrete may be too dense or hand-troweled to a high finish; it may be of a poor mix, with too much sand, making a "punky" surface. Dusting also may be the cause.

**Cure:** Same procedure as No. 1. If the problem is too high a finish, use extra-coarse sanding discs to remove old paint and to score the surface. With punky or floury concrete surfaces, ask your paint dealer to prescribe a good concrete protector-sealer before applying any paint. (See additional tips for hard-surface preparation on page 177).

**6. Chalky (powdering) paint surface.** Cause: The sun is breaking down the paint.

**Cure:** Wire-brush and vacuum all chalky areas, wash with detergent. Apply a concrete protector or a low-solids varnish, to recombine the

## How to test for moisture-wicking

PM photos: Black Star



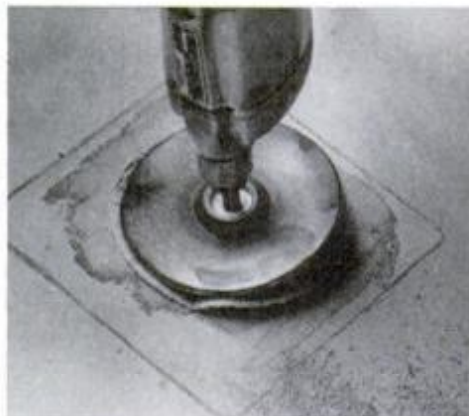
Pick a bare spot where blistering has occurred and mark off patch for removal.



Cover area with any good commercial paint remover and let it sit until it acts.



Thoroughly strip all paint from patch with a scraper, exposing bare concrete.



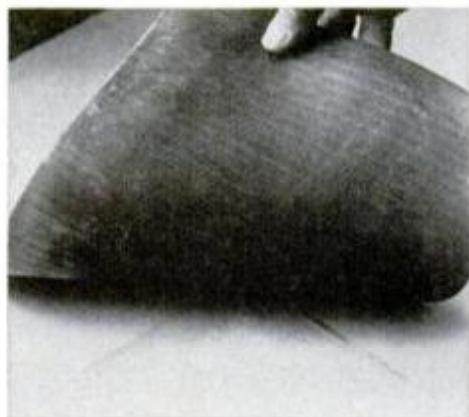
Use electric disc sander with coarse grit to score troweled concrete surface.



Cover exposed concrete with etching acid to extend scoring and rinse thoroughly.



If rubber mat placed over etched concrete overnight is wet, you're in trouble.



If the mat comes up dry, your trouble may be a hard-troweled finish or dusting.



In cases of blistering and poor adhesion, answer is sanding, total refinishing.

chalk, before applying fresh concrete paint.

How can you determine if moisture and effluorescence are, indeed, the causes of a concrete paint problem? Paint and masonry experts suggest the following standard procedure for concrete patios, which are the primary victims of these troubles:

1. Pick a spot where the paint has deteriorated.
2. Strip a section with either a good paint remover or by sanding it with extra-coarse grit on an electric hand sander.
3. If surface is hard-troweled (a dense, polished finish) use etching acid to deepen and extend scoring produced by the sanding.
4. Rinse the area of all acid and allow it to dry thoroughly.
5. Lay a rubber mat on top of the bare concrete and leave it there overnight.
6. If, when you lift the mat in the morning, it is wet underneath, moisture is wicking up through the concrete. If the mat is dry underneath, moisture and/or effluorescence is not your trouble.
7. Whether it is or isn't wet your best bet is to use a commercial floor sander as described before.

If moisture is found, it is very important that a deep-penetrating concrete protector-sealer be applied (in the driest weather possible) before painting. This will block upward flow of water through pores in the concrete. For best results, experts recommend that the paint be applied with a brush or airless spray—not with an air spray or roller.

Needless to say, brick, block and other masonry structural materials (especially in basement walls) also are subject to effluorescence and other problems damaging to paint. While most natural fieldstone is free of paint problems, the mortar holding the stones together may not be.

Most of the good paint makers have specially prepared paint formulations with built-in resistance to alkalinity as well as waterproofing sealers made especially for waterproofing porous masonry walls. Usually these are substantially different chemically than paints and sealers recommended for concrete decks. It is important to describe to your paint dealer the details of your particular problem, and ask him to recommend materials you need to prepare the surface and refinish it so that it will stay put. **PM**



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## ELECTRONIC IGNITION SYSTEMS

(Continued from page 126)

the vacuum advance. If the vacuum advance doesn't move the vacuum control plate as vacuum is applied, replace the vacuum advance.

Disconnect the pickup coil leads to the electronic module and connect an ohmmeter to lead 1 and ground. Set the ohmmeter on the middle scale and operate the vacuum advance, using the vacuum source, to the full range of travel of the vacuum control plate. If the meter doesn't show an infinite reading at all times, replace the pickup coil.

Connect the ohmmeter to leads 1 and 2. Apply vacuum. If meter reads less than 500 ohms or more than 1500 ohms at any time, replace pickup coil.

You have to take the HEI distributor off the engine to replace the pickup coil. With the distributor out of the engine, drive the pin from the distributor shaft gear, remove the rotor, remove the shaft assembly from the housing, and take off the thin "C" clip to release the pickup coil.

6. If everything to this point checks out, there remains only the electronic module as the cause of your problem. It may be tested with HEI tester J-24642, which is available from Kent-Moore Tools, 1501 South Jackson St., Jackson, Mich. 49203.

However, the process of elimination has made it practically a sure thing that the electronic module is to blame, so you may want to replace it and avoid the cost of this instrument. The module is held by two screws, and you don't have to remove the distributor from the engine to remove the module.

## How Ford's S/S system works

The S/S system consists basically of a distributor, coil and electronic module.

The distributor, which looks like a conventional ignition system distributor on the outside, has an armature and magnetic pickup (stator) as its current-producing parts.

The armature rotates on a sleeve and plate assembly that's attached to the distributor shaft. The stator is stationary. It's attached to a fixed base plate.

The armature and stator perform the same switching function as breaker points in a conventional distributor. As the teeth of the armature pass the core of the stator, a pulse is produced that signals the electronic module to turn off primary ignition current. This induces secondary voltage in

the ignition coil, which fires the sparkplugs—just like in a conventional system.

The ignition coil of Ford's S/S system is colored blue. Notice also that one tower terminal is marked BAT (battery), and the other DEC (distributor electronic control).

These special markings are used to emphasize that the coil's output and performance characteristics are different from a conventional coil's. You should not use a conventional ignition coil with the S/S system or the S/S system's coil with a conventional ignition system.

The electronic module is the control unit for the system. It is sealed and can't be repaired.

Electronic modules from one year to another are different. Modules for 1974 and 1975 models have four-terminal connectors that plug into the ignition switch harness and three-terminal connectors that plug into the distributor harness. However, the arrangement of terminal pins differs. Thus, electronic modules used in 1974 and 1975 models are not interchangeable.

In 1976 and 1977 models, four-terminal connectors that plug into the ignition switch harness are also used. However, two-terminal connectors are used at the distributor harness. The 1978 models employ a variation of connectors. So remember: If you have to replace an electronic module, get the right one. The wrong one won't fit.

## Ford's S/S system: Finding a problem

When an engine problem (hard starting, missing) occurs that may be ignition-caused, test the battery first. Then, make sure all harness connections are tight. A loose connection is the most common cause of a problem with the S/S system.

Disconnect the distributor connector and hook up a voltmeter between the two parallel blades. Place the voltmeter scale at 2.5 volts. Crank the engine.

The voltmeter needle should fluctuate. If it doesn't, look for damage inside the distributor, particularly a bad distributor cap and rotor, loose armature, broken armature teeth and misaligned roll pin. Make sure, too, that the armature rotates when the engine is cranked. If it doesn't, the sleeve and advance plate assembly are probably damaged. If visual distributor checks don't reveal the reason for the voltmeter needle not fluctuating, replace the magnetic pickup assembly.

If the voltmeter needle fluctuates

(Please turn to page 180)



# If you buy battery cables at the super store, better buy a spare

When the man who helps you in the Automotive Department is an expert in lettuce, pears and collard greens, he may not be too fast with the right answers about car parts. His battery cables may not be too swift, either. Here's what you can wind up with sometimes when you buy battery cables at the super store.



Look at those battery cables again. Our cable on the right has nearly twice as much copper wire as the super store cable on the left. What fools you is that the super store cable uses more insulation, which costs much less than copper.

Sorensen cables have the same amount of copper as the cables on your car when it was new.

There are other tricks, like using a cheap, thin steel ring terminal that will corrode easily.

Bargain cables may cause you starting problems.

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## ELECTRONIC IGNITION SYSTEMS

(Continued from page 178)

during the test, check out the secondary circuit. Remove the high-tension coil lead from the distributor cap and hold it about 3/16 inch from ground as you crank the engine. Use insulated pliers to avoid shock.

**Caution:** Do not perform a spark intensity test at the sparkplugs. It may create an arcing condition inside the distributor that will cause damage.

If you get spark when doing this test, the cause of the problem you are having will be found in the secondary circuit. Check sparkplugs, cables, rotor and distributor cap.

If you don't get spark, the trouble is in the primary circuit. Turn your attention to the electronic module.

The easiest way to test the module is to borrow a module you know is good. Unplug the old module (don't remove it from the engine) and plug in the new one.

Do another spark intensity test. If spark occurs, it verifies that the old module is bad. Now you can take it off the engine and install the new one.

To install the new module, dip both ends of each connector in Lubriplate DS. Make the connections and wipe off excess lubricant.

If you have failed to uncover the cause of the trouble to this point, it is located at one of a number of wires or terminals, or the ignition coil. As you did with the electronic module, the coil may be tested by substituting a coil you know is good.

Testing primary circuit wires and terminals is done with a volt-ohmmeter. Use the quick check chart (page 126) to make connections and check results.

Remember what we said before—that connector arrangement differs from year to year. However, each wire is color-coded, and color-coding is the same from year to year.

Therefore, the placement of the red wire, for example, in its connector will differ from one model to another. But the purpose of the red wire is the same, and it is tested the same way. This holds true for all wires, which have the following purposes:

■ **Red wire**—The ignition switch supplies current to the electronic module through this wire when the engine is running.

■ **White wire**—The ignition switch supplies current to the electronic module through this wire when the engine is being cranked.

■ **Orange and purple wires**—These wires transmit signals from the distributor to the electronic module.

■ **Green wire**—This wire receives primary ignition current from the ignition coil.

■ **Black wire**—This wire is connected to the green wire inside the electronic module to complete the primary circuit.

■ **Blue wire** (used only in seven-terminal setups)—This wire functions like a fuse to provide protection for the system.

### How IH's electronic ignition system works

This system consists of a distributor that contains a sensor and trigger wheel, a standard ignition coil and an electronic ignition control unit. The system is similar to Chrysler's (page 121, April '78 PM), except that primary current is regulated inside the electronic control unit, and a ballast resistor isn't used.

A signal is sent to the control unit when a tooth on the trigger

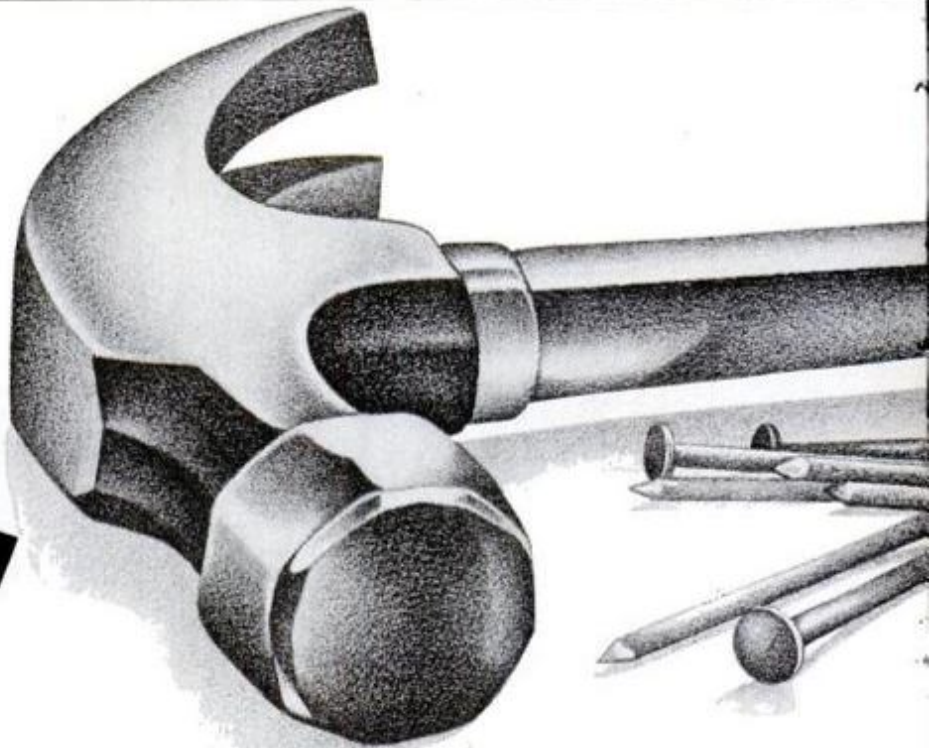
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wheel lines up with the sensor coil. The control unit opens the coil primary circuit, inducing high voltage in the coil secondary winding. This provides voltage to the sparkplugs through the rotor, distributor cap and sparkplug cables.

### Trouble-shooting IH's electronic ignition system

Parts cannot be repaired. If tests uncover a malfunction, the part causing the trouble has to be replaced.

Make tests with a d.c. voltmeter, 12 to 18 inches of jumper wire with an alligator clip on each end, pair of insulated pliers, and SE-2503 tester switch which you can order from National Industries, Inc., 2745 Gunter Park Drive W., Montgomery, Ala. 36109.

Proceed as follows:

1. Check battery voltage. Recharge or replace a low battery.
2. Replace damage primary and secondary wiring and make sure connections are tight and free of corrosion.
3. Connect the voltmeter between the coil positive terminal and ground. Turn on the ignition switch. The voltmeter should record battery voltage. If it doesn't, look

for a high resistance condition between the battery and coil.

4. Disconnect a sparkplug cable. Using the insulated pliers, hold the cable's terminal end near ground while cranking the engine. If there is spark, check the sparkplugs. If there is no spark, reconnect the cable and proceed.

5. Disconnect the coil cable from the center tower of the distributor cap. Attach the jumper wire to the cable at a point  $\frac{1}{4}$  to  $\frac{1}{2}$  inch from the metal terminal. Attach the other end of the jumper to ground. With the coil cable suspended away from ground, crank the engine. A spark should *not* jump between the cable terminal and jumper wire clip. If it does, the distributor cap or rotor is damaged.

6. Disconnect the distributor wire connector near the distributor and attach the tester switch. Turn the ignition on and press the tester switch. If a spark appears between the coil cable terminal and jumper wire alligator clip, replace distributor sensor and adjust trigger wheel-to-sensor air gap (see below).

7. Connect the voltmeter between the coil negative terminal and ground. With the ignition switch on, you should get a reading of 5 to

8 volts. A reading that is under 5 or over 8 indicates a bad ignition coil.

8. Press the tester switch. Voltage should increase to battery voltage and drop back to 5 to 8 volts when the tester switch is released. If not, replace the electronic ignition control unit. However, if voltage fluctuates as it should, but no spark appears between the coil cable terminal and jumper wire alligator clip, replace the ignition coil.

9. To adjust the air gap between the sensor and trigger wheel, loosen the sensor mounting screw and rotate the trigger wheel until one tooth is aligned with the center line of the sensor. The trigger wheel should be perpendicular to the flat surface of the sensor.

With a plastic feeler gauge of the correct size (see the vehicle's emission control decal), move the sensor in or out to set gap. Tighten the mounting screw and recheck the setting.

Connect a dwellmeter and start the engine. If dwell is not according to the specification on the emission control decal, move the sensor toward or away from the trigger wheel. Moving the sensor toward the trigger wheel decreases dwell; moving it away increases dwell. **PM**

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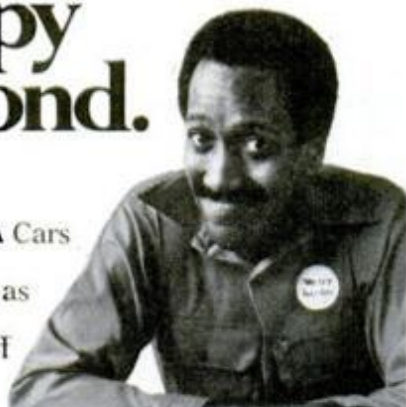
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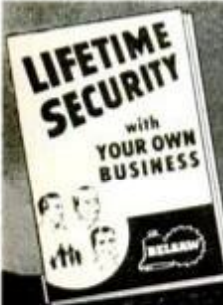
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## AMERICA—CAN YOU DIG IT?

(Continued from page 101)

dle of ancestral bones usually painted in red or yellow ochre. So was it murder or a tribal execution? Was the couple being punished for unlicensed sex or were they both pitiful offerings to a vengeful god? Each site represents another question, another adventure. **PM**

### How to get involved in amateur archaeology

Most states have either a state archaeologist or a state preservation officer who will give advice on how to go about joining a reputable group. Some states even go as far as having special training programs for beginning archaeologists. If you have an interest in obtaining specific information on your locale, the Anthropology Department at a nearby university may know how to contact people in your area. Local museums are another source for information. The following are some of the more active societies spread across America:

Arizona Archaeological and Historical Society

Arizona State Museum  
University of Arizona  
Tucson, Ariz. 85721

Society for California Archaeology  
Dept. of Anthropology  
California State University (North)  
Northridge, Calif. 91324

Society for California Archaeology  
Dept. of Anthropology  
California State University (South)  
Chico, Calif. 95926

Mr. Robert McKay  
Maine Archaeological Society  
Stillwater, Me. 04489

Massachusetts Archaeological Society  
Bronson Museum  
Attleboro, Mass. 02703

Mr. Jan Streiff  
Minnesota State Archaeological Society  
Dept. of Anthropology  
University of Minnesota  
Minneapolis, Minn. 55455

Missouri Archaeological Society  
15 Switzer Hall  
University of Missouri  
Columbia, Mo. 65201

Ms. Ada Woods  
Montana Archaeological Society  
1212 First St. W.  
Billings, Mont. 59102

New York State Archaeological Assn.  
Rochester Museum and Science Center  
Rochester, N.Y.

Ms. Dorothy Phillips  
Oklahoma Anthropological Society  
2217 Arlington Dr.  
Oklahoma City, Okla. 73108

Mr. J. Walter Joseph Jr.  
South Carolina Archaeological Society  
340 Cherbourg Pl.  
Aiken, S.C. 29801

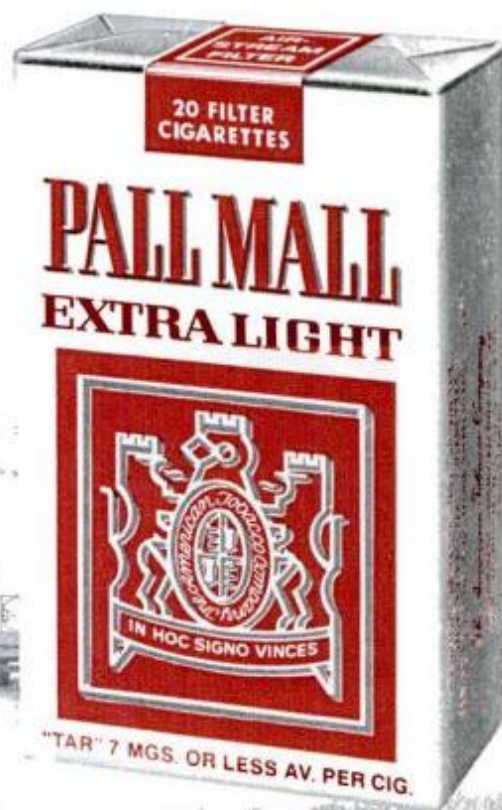
West Virginia Archaeological Society  
West Virginia Geological Survey  
Morgantown, W.Va. 26505

Wisconsin Archaeological Society  
Milwaukee Public Museum  
Milwaukee, Wis. 53233

Decisions...decisions... Make your decision

# PALL MALL EXTRA LIGHT

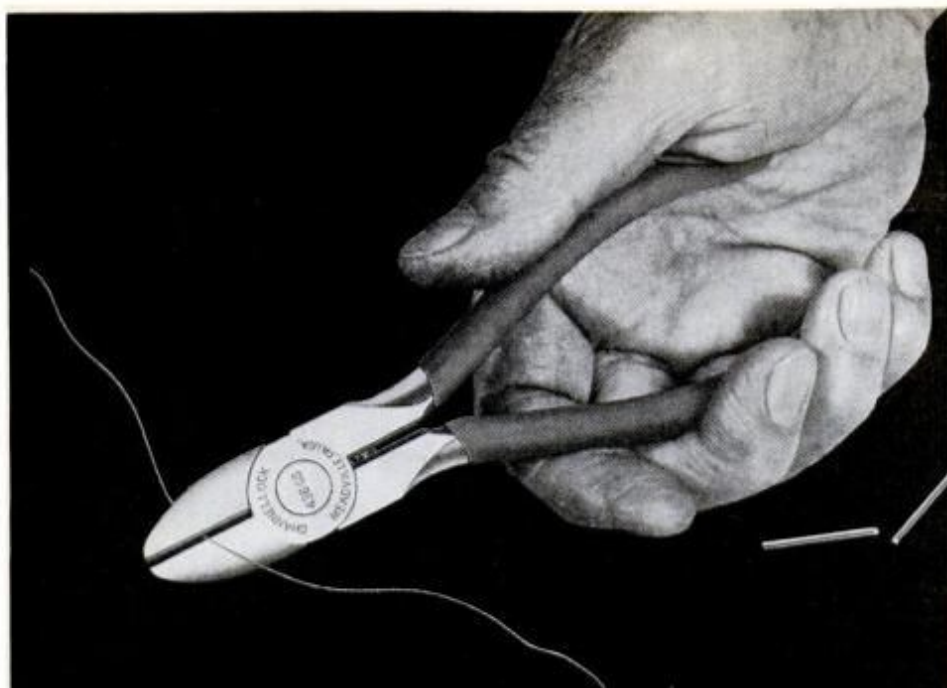
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**FANS: GOOD WAY TO STAY COOL**

(Continued from page 133)

get a feel for the airflow before you make your purchase.

**Directing a fan's airflow**

There are two main strategies for using airflow to cool you off: "Circulating," a system of moving the existing air in the house, and "ventilating," a system of pulling in cooler, outside air and exhausting warmer air.

**Circulation** moves the air, ideally the coolest air in the house, as rapidly as possible around a person to speed up moisture evaporation on the skin. Surprisingly, air moving at 200 cu. ft. per minute—a mere 2.3 mph—feels 10° cooler to a person who is wearing light clothes and is active. The coolest air tends to settle near the floor and the warmest air rises to the ceiling. According to Patrick Reynolds of the U.S. Department of Energy, a good general approach to tap into the coolest air is to set up the fan as close as possible to the floor and point the flow toward yourself.

A second strategy suggested by Hershel Rich, Phil Rich Fan Manufacturing Co., Houston, is to aim a fan *parallel* to the wall and establish a circular flow of air around the perimeter of the room. It can take several minutes to get a steady breeze going, but if the fan is placed properly and furniture doesn't disrupt the flow too much, a breeze will curl around every corner and return to the back of the fan, where it supports the motor's work.

**Ventilation** cools by pulling in outside, cooler air. Under ordinary circumstances, ventilating is most effective at night when it gets rid of heat accumulated during the day.

The most efficient ventilation takes advantage of any outside breeze. Set a fan in a window to exhaust air in the same direction as the outside flow. If the breeze is from the south, point the fan north. Open several side windows and close the rest to establish a single current of air. If your home has more than one floor, put the fan on an upper floor and open several downstairs windows.

To keep your fan in top shape, disconnect from power, remove the grilles once or twice a summer and clean the blades and motor without getting water in the vent holes. Oil it following maker's instructions.

A fan can also work for you in winter by blowing heated air that rises to the ceiling down into a room. The result: Lower thermostat settings and added fuel savings. **PM**

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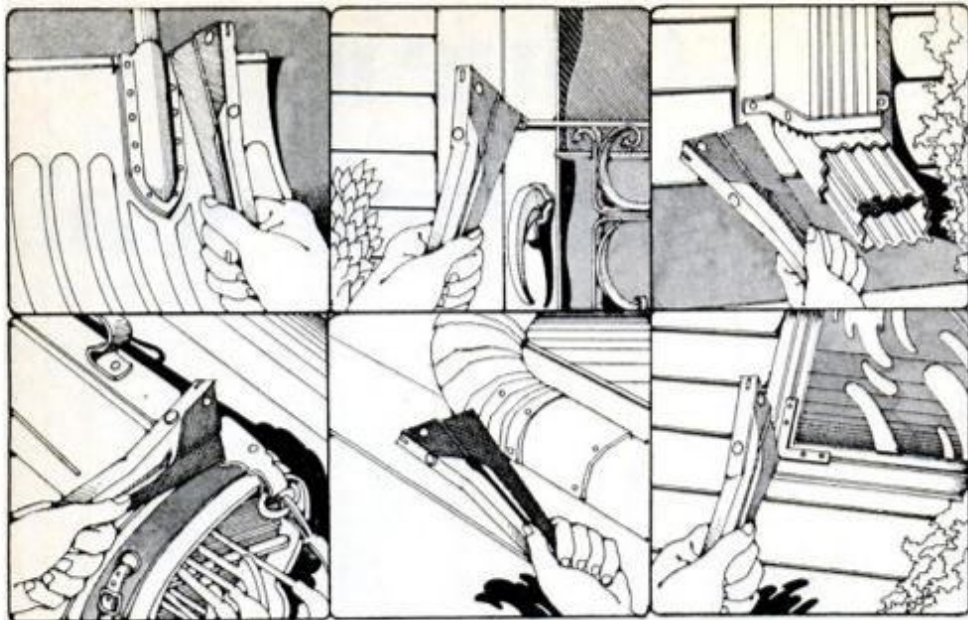
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### AIR TURBULENCE

(Continued from page 78H)

Don't tailgate large vehicles, either, in hopes of picking up a little speed by drafting them. And when passing a large vehicle in front of you, swing far enough out so you're not in its turbulence zone.

Whenever you expect to get hit with a blast of air, get a firm grip on the handlebar. Also grip the gas tank with your knees and *scrunch* down. The idea is keep as much of your body in contact with the bike as you can and present a low target to the airstream.

Air turbulence effects can be further minimized by a well-designed fairing. For best results, frame-mount a fairing. If attached to the handlebar, a fairing or windshield can set up vibration that affects steering or handling.

### Coping with crosswind

As we mentioned, a strong crosswind can accentuate the Bernoulli effect. Even if it's not dangerous, a crosswind can be annoying. You compensate for a steady crosswind by leaning into it, and in time you do it subconsciously. But a crosswind can be treacherous.

Let's say you've been riding along for miles, leaning into a strong crosswind. Then you suddenly come into a buildup area, with structures that block the crosswind. If you don't catch yourself, you may find yourself veering off the road, or into the other lane, depending on where the wind is coming from.

An especially dangerous place where you have to be alert to strong crosswinds is on an open bridge over a body of water. Even if it's a relatively windless day on land, there's usually a certain amount of air turbulence near water.

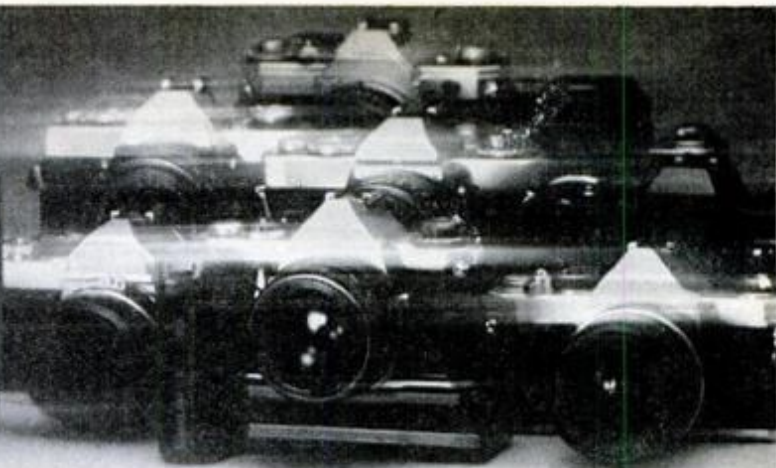
How about a tailwind or a headwind? Either one becomes a crosswind when the road changes direction abruptly.

In an open area, a strong tailwind could become a troublesome crosswind in a right turn and push you over toward the other lane. By the same token, a strong headwind could do the same in a left-curve.

Air turbulence isn't always dangerous, of course, but it can cause fatigue. During extended riding, the constant buffeting by wind can dull your senses and judgment. Despite all that fresh air striking you, it's possible to become drowsy and run off the road.

Coping with turbulent air is one of motorcycling's many challenges. Just be on guard for this invisible phenomenon. It's sneaky! **PM**





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# OLYMPUS

*(Continued from page 122)*

number is always preceded by the initials SAE which stand for the Society of Automotive Engineers. The SAE devised the numerical system of designating motor oil viscosity. The higher the number, the greater the resistance to flow.

There are single-weight (viscosity) motor oils and multiweight (viscosity) motor oils. Single-weight oil's protect engines over a limited temperature range. SAE 30 oil, for example, is too thick to protect an engine adequately when the ambient temperature falls below 30° F.

Multiweight oils offer protection over a wider temperature range. SAE 10W-30, for instance, will protect an engine to a temperature as low as -10° F.

**12. a.** For example, in my area the difference between less expensive Shell X-100 single viscosity and more expensive Shell Super X multiweight motor oils is 40 cents. Both meet the warranty service requirements of U.S. carmakers.

**13. c.** The API formulated designations SE, SD, SC and SB constitute another important consideration when buying oil API is the American Petroleum Institute.

Symbols signify service classifications. They are a way of specifying if an oil has the ability to protect a particular class of engine. Oils contain more or fewer additives to compensate for peculiar engine conditions.

Take SE. Oil designated For Service SE has been formulated to protect engines built from 1972 to the present. In 1972, engines were equipped with exhaust gas recirculation (EGR) systems to lessen the output of air-polluting nitrogen oxide (NOx).

However, the soot manufactured in the combustion process because of EGR systems would have interfered with the lubricating properties of oils that preceded the formulation of SE. Oil having additives to combat this contamination were developed to prevent excessive engine wear. "For Service SE" oil is available in both single- and multiviscosity.

The following summary outlines which designated oil to use in which model engines:

- For Service SE—1972 to present day models.
- For Service SD—1968-1971 models.
- For Service SC—Pre-1968 models.

If your engine consumes oil and needs an overhaul, use oil designated For Service SB until the overhaul is done.

For Service SE oil is the most expensive; For Service SB oil is the least expensive. The price for the others falls between these.

**Important:** If you can't get the oil specified for your engine, buy the next highest grade.

**14. a.** Manufacturers haven't used "break-in" or "flush-type" oils in new engines for several years. The oil in a new engine is the same quality SE oil you buy from your neighborhood service station. It does not have to be drained before the oil change interval stipulated in the maintenance chart in the car owner's manual.

**15. a.** According to Ford Motor Co., "It's best not to mix different brands of lubricants and oils, because sometimes they are not compatible and deteriorate when mixed. Stay with one brand to assure compatibility."

The designation "W" stands for Winter, meaning that the oil is suitable for use in cold as well as warm weather.

Engine temperature should have no bearing on when to check an engine's oil level. The best time to check oil level to get the most accurate reading is when oil has drained back into the crankcase. When you pull into a service station, fill the tank—then check the oil.

**16. b.** "Sometimes," because that is what GM and Chrysler state. As far as we've been able to determine, Ford and AMC don't offer a recommendation.

GM says: "The regular use of supplemental additives is not recommended and will increase operating costs. However, supplemental additives are available that can effectively and economically solve certain specific problems without causing other difficulties. For example, if higher detergency is required to reduce varnish and sludge deposits resulting from some unusual operational difficulty, a thoroughly tested and approved additive—GM Super Engine Oil Supplement—is available at your dealer."

Chrysler says: "It is not necessary to add any materials to crankcase oils for most types of vehicle operation. In some instances, such as infrequent operation or short trips only, and during break-in after a major engine overhaul and/or new piston installation, addition of special materials containing anti-

rust and antiscuff additives are beneficial. A suitable product for this purpose is available under part No. 3419130, Crankcase Conditioner."

**17. c.** At present, there are no specially formulated motor oils for turbocharged engines. They use the same oil that conventional gas engines use.

However, oil in a turbocharged engine should be drained more frequently than oil in a conventional engine, to avoid the danger of contamination. For example, Buick recommends that oil in its 1978 Regal and LeSabre V6 turbocharged engines be replaced every 3000 miles. The oil filter should be replaced when oil is changed.

Incidentally, the same advice applies generally to diesel engines. That is, conventional oil is used and drain periods are shortened. Consult your owner's manual for the manufacturer's specific recommendations.

**18. a.** Mobil, which produces Mobil 1 synthesized engine oil, says: "If your car is under warranty, you should change your oil according to your car manufacturers' instructions."

Ford says this in regard to synthetic motor oil: "Our warranty coverage should not be affected as long as the oil meets Ford specification ESE-M2C101-C, and the oil change intervals specified in the vehicle owners' manuals are followed. Oil filter usage should not be affected so long as the filter change intervals specified in the owners' manuals are observed."

The other car manufacturers have issued similar statements.

**19. b.** In cold weather, the combination of a richer fuel mixture, more prolonged cranking periods and a reduced amount of driving will allow some gas to remain in an unburned state. This fuel can drain into the crankcase and mix with oil.

Gas that contaminates oil will reduce the oil's effectiveness, subjecting the engine to greater wear. To offset this possibility, drain oil and change the oil filter more frequently. Once every 3000 miles is an ideal time.

**20. a, b and c.** Oil provides a seal between pistons and cylinder walls. It assists the cooling system by absorbing and carrying away engine heat. It holds dirt, water, metal particles and other foreign material in suspension to be drained from the engine when oil is drained. **PM**



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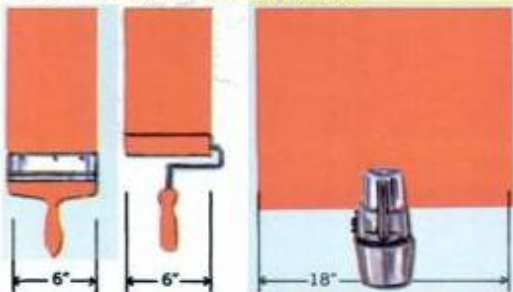


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Paint radiators and pipes



Paint shutters, exteriors



Wax floors



Paint louvered doors



Disinfect rooms

## PM TOUR OF OFFBEAT MUSEUMS

(Continued from page 111)

Historical Center shows 32 washing machines, including a 1907 Pastime with a hand-operated wooden dolly, the first Maytag with an electric motor, from 1911, and the first gasoline-powered machine, of 1914.

Since military equipment becomes obsolete faster than almost any other of our country's fabulous output of goods, it is not surprising to find a number of centers where old Army and Navy items are displayed



"From the small of my back take the crankshaft,

"And assemble the engine again!"....

World War II planes are here as well: the last P-36 Hawk of the type that engaged the Japanese at Pearl Harbor; the Curtiss P-40 Warhawk and the B-17 Flying Fortress among them. Vietnam craft are displayed, as well as "the world's most exotic airplane," the XB-70 Valkyrie that gets lift from its own supersonic shock wave, and a formidable, towering row of missiles.



### PM'S PICK OF THE OFFBEAT MUSEUMS

1. Iron forge, Batsto, N.J.; 2. Hopewell Village, Pa.; 3. Saugus, Mass.; 4. Whaling Museum, New Bedford, Mass.; 5. Sloane Stanley Museum, Kent, Conn.; 6. Maritime Museum, St. Michaels, Md.; 7. Thomas Winery, Cucamonga, Calif.; 8. Higgins Armory, Worcester, Mass.; 9. Winchester Gun Museum, Cody, Wyo.; 10. Hagley Museum, Greenville, Del.; 11. Goodyear's World of Rubber, Akron, Ohio; 12. Maytag Historical Center, Newton, Iowa; 13. Air Force

Museum, Dayton, Ohio; 14. U.S. Military Academy Museum, West Point, N.Y.; 15. Coast Guard Academy, New London, Conn.; 16. U.S. Naval Academy Museum, Annapolis, Md.; 17. Museum of Atomic Energy, Oak Ridge, Tenn.; 18. Camel Corps exhibit, Fort Tejon, Calif.; 19. Live Steam Museum, Alamo, Tex.; 20. Museum of Quackery, St. Louis, Mo.; 21. Hillerich & Bradsby bat museum, Louisville, Ky.; 22. Soaring Museum, Elmira, N.Y.

with loving care. We have special museums devoted to the Signal and Quartermaster Corps, the Artillery, the Seabees, the Infantry, the airborne divisions, and General George Patton, to name only a handful. One of the very best is the six-million-dollar Air Force Museum in Dayton, Ohio, housed in an 800-foot arch-roofed structure sheltering more than 100 aircraft. (The place is twice as wide as the Wrights' initial flying distance.) The first U.S. military craft, Signal Corps Airplane No. 1, built in 1909, is here in reproduction, near an original Curtiss "Jenny" trainer. A Spad VII recalls a song sung in France by U.S. volunteers in 1914, who cheered:

"Take the cylinders out of my kidneys—

"The connecting rods out of my brain—

Among many historical treasures at the U.S. Military Academy, West Point, N.Y., are 300-pound links of the chain colonists strung across the Hudson River here to stop the British fleet. At New London, Conn., you can board the *Eagle*, the beautiful sailing bark the U.S. Coast Guard Academy uses for training cruises—provided she is in port. A major attraction at the U.S. Naval Academy historical museum in Annapolis, Md., is a spectacular diorama that honors John Paul Jones' initial American sea action aboard the *Bonhomme Richard* against the *Serapis*.

At the American Museum of Atomic Energy, in Oak Ridge, Tenn., demonstrations and walk-in exhibits show the harnessing of atomic power and methods of using

(Please turn to page 196)

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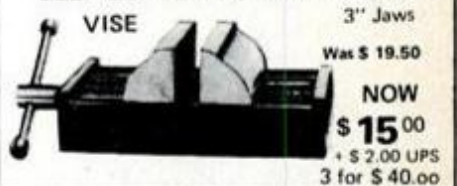
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## PM TOUR OF OFFBEAT MUSEUMS

(Continued from page 195)

solar and geothermal energy. Radiation detection is shown, mechanical hands manipulate materials in a "hot" cell, an atom smasher is operated, and visitors see how to make a spintharoscope through which to see the scintillations of live radium.

Out at Fort Tejon, Calif., an innovative military use of a special sort of energy is celebrated in the history of the U.S. Camel Corps, which carried military supplies from Texas to California in the 1850s. In the original officers' barracks at the western terminal of the Camel Express, visitors can see displays of old camel bells and saddles, and documents of the fabulous experiment.

Every vocation seems to have its museum: an orange museum in Florida, a sod museum in Nebraska, a flint museum in Ohio, a cemetery museum in California. The Live Steam Museum in Alamo, Tex., claims to be the only one of its kind in the world. A couple of dozen old engines of varying design and use—a tractor, a cotton gin, an oil pump, an electric generator, a locomotive—are tested out on "Steam Up Days" throughout the year and can be seen anytime. The National Museum of Quackery (on the premises of the St. Louis Medical Society, St. Louis, Mo.) has scores of weird devices of medical chicanery from past and present: phony electric diagnostic machines, cure-all ray-emitting gadgets, and the famed orgone box of Dr. Wilhelm Reich that was supposed to cure cancer with "cosmic energy."

Louisville, Ky., is proud of its baseball bat museum in the world's largest bat factory, the Hillerich & Bradsby Co. Among the thousands of famous bats is one Babe Ruth used to belt 21 of his home runs—for each homer he carved a notch in the handle—until he cracked it on the 21st. The bat Hank Aaron used in hitting homers 698, 699 and 700 is also shown.

To wind up this tour on a definite upward-looking note, there is the new home, just opened this summer, of the National Soaring Museum in Elmira, N.Y. Besides a Soaring Hall of Fame and a number of famous gliders early and current, the museum has a significant array of sailplane instruments and a definitive collection of films and books.

Whatever your secret fascination, chances are there is a museum ready for you. If it's not already built, it's a good bet some group is working on it.

PM

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## PEDAL-PUSHERS HIT THE ROAD

(Continued from page 97)

ride 50 miles a day, it believes cycling should be done with style. Club members are often professional people—doctors, lawyers, businessmen—and generally do not favor staying in cut-rate hotels or eating in fast-food joints. As an example, one of their famous trips of the past was labeled the "Truffle Tour of France" and included much wine tasting and extravagant dining. Even so, IBTS's one- to three-week tours usually cost no more than \$35 a day.

Okay, we've covered just a few of the organizations that are making the world a better place for bicyclists. Now here are some tips to help get you started on your own bike tour. It's really quite simple.

### You'll need a bike

The standard touring bicycle today is the 10-speed. But if all you have is an old three-speed, why not give it a try for a two-day trip and see how it holds up? You'll have at least one built-in advantage. Three-speeds invariably come with fen-

ders; few 10-speeds do. Fenders are great in the rain. You can always spot fenderless cyclists by the muddy stripe up their backs caused by a rear wheel throwing up road water.

If you're going to buy a 10-speed, be prepared to spend at least \$135 to \$150 to get one that's tour-worthy. And be sure to ask your bike dealer what the "gear value" of the lowest gear is. He'll cite you a figure in inches. The lower the figure, the lower the gear and the easier it will be to pedal your bike up hills. A rule of thumb is to get a bike with a low gear under 40 inches. Thirty-five or lower is even better for the beginner.

Ask the dealer if he can slap on a pair of cheap fenders—unless you plan to tour only in arid regions. And get a carrying rack for the rear of the bike. You'll need this for your . . .

■ **Rear pannier bags.** These are the two bags which will hold most of your gear. They attach to each side of your rear carrying rack. Panniers come in a variety of sizes and styles and cost from \$25 to \$60. Check for three things: The bags should be made of waterproof nylon, have outside pockets for small items and at-

## AN OLYMPIAN'S RULES

Oliver Martin Jr. is the national road coach of our U.S. bicycle racing team. In the summer of 1976 he took his team to the Olympic Games where it placed higher than any other modern American team.

When it comes to bike racing, Oliver Martin knows about winning. But there's one other thing he also knows well—*falling*. In 13 years of racing, Martin estimates he has had major crashes at least seven or eight times—and more spills while training than he can remember.

Accidents are inevitable for the racer because of the high speeds and wild competition. But the bike tourist need rarely fall, especially if he follows Martin's advice. Here's what he had to say about eight important bike safety topics:

■ **Paying attention.** "The biggest problem is lack of attention," says Martin. "Anything can happen on a bike. You can hit a rock, a dog can run out, another rider can bump into you . . . and you have to maintain control at all times."

■ **Speed.** The faster you go, the more care you must take, says Martin, who also points out that many new riders don't see their bikes as vehicles capable of real speed and therefore real danger. A cyclist going down a steep hill can approach 50 mph. But Martin also tells cyclists to be careful at any speed. Recently Coach Martin saw a racer fall while slowly circling a track. He was going only about



Oliver Martin Jr., road-racing coach of the U.S. Olympic cycling team.

three mph, yet he broke his jaw in five places.

■ **Brakes.** Martin tests his brakes at the start of every ride. He hits both brakes at low speed to make sure they're adjusted well enough to skid the tires. (Brakes can be adjusted by pulling the cable more taut to bring the brake pads closer to the rims, or by replacing the pads themselves if they are worn.) He also wipes the brake pads and rims clean with a cloth so no slippage occurs.

tach and detach from the bike easily. ■ **Handlebar bags** must pass the same tests as pannier bags. Handlebar bags are for carrying items you want to get at fast while riding: food, wallet, camera and film, a sweater. For this reason, be sure the bag opens away from you. A handy feature is a transparent plastic map holder on the top of the bag so you can read as you ride. Handlebar bags cost from \$10 to \$25.

There are also bike bags that hang behind the saddle and *front* panniers that attach to a rack installed over the front wheel, but these are clumsy for most people.

### A total cost of \$200 to \$250

If you buy the cheapest acceptable tour-worthy 10-speed (about \$135), rack (\$7), panniers (\$25) and handlebar bag (\$10), you'll have an initial investment of \$177. You can squeak by for that, but a total of \$200 to \$250 would be more realistic. If you plan to start out with a sag-wagon tour, you could skip the panniers and just buy a handlebar bag, throwing the rest of your gear into a bag to be carried by the wagon.

For those who have never camped, it's sometimes wise to make that first bike trip a *noncamping* one with nights spent at hotels or inns. But if you do camp, of course, you'll need a tent and sleeping bag. The ones made for backpackers are ideal. Backpackers and cyclists have at least one common need—light-weight equipment. As a rule, the lighter the tent or sleeping bag, the higher the cost (same as for the bicycle itself). Two-man tents weigh in these days at three to eight pounds; sleeping bags weigh about half as much. When two people travel together it usually works out fairly if one carries the tent and the other, both sleeping bags.

You'll probably want two accessories for your sleeping bag: a foam sleeping pad (or air mattress) and a waterproof stuff sack. This latter item is controversial because many experts say a waterproof sack doesn't let the bag breathe and it then gets clammy inside. On the other hand, a sleeping bag becomes awfully soggy when it gets rained on. An alternative is to keep the bag in a

*(Please turn to page 200)*

## FOR SAFE CYCLING

■ **Going down a hill.** Steep hills or mountains can be especially scary to the beginner—especially if you've got 30 pounds of gear in your bike bags. The first thing you should do is give your brakes a quick squeeze before making your descent to be sure they're working. After that, Martin says the most important thing is to *stay away from the side of the road!* True, most bike safety manuals tell you to hug the right side of the road in most instances. But throw this rule out the window when it comes to hills. By staying toward the middle you can swerve either way and are less likely to hit rocks, gravel or other road garbage.

What about traffic coming up behind you? "Don't worry about it," says Coach Martin. Your main concern should be controlling the bike. Besides, you may be outrunning any other vehicles.

■ **Blow-out or flat tire on a hill.** If your *front* tire goes flat you've essentially lost your steering. Martin advises riders to pump the rear brake (never the front) and to bring the bike to a stop while keeping it in as straight a line as possible. Remember, he says, that the tire is flat so you have no gripping rubber on the sides. If you try to turn you'll fall. If the flat is in the *rear* you're in better shape because you can still steer. Martin warns, however, that the rear wheel will lose traction and can start sliding, so he advises moving forward

slightly on the bike. And use the front brake only.

■ **When you really have to stop.** In an emergency, hit both brakes hard simultaneously. And if things are really desperate, you'll stop faster if you purposely flop yourself and your bike on the road. Martin recalls racing with the Army team in California back in 1968. They were coming down a steep descent toward Malibu Beach when one rider's rear tire blew out as he approached a sweeping left turn. The racer flopped to keep himself from going off the road. "He left some epidermis on the pavement," says Martin, "but he survived." When Martin and the others looked over the shoulder of the road they discovered an 800-ft. drop—with a wrecked car at the bottom in which several teen-agers had been killed the previous weekend.

■ **And if you do fall.** The biggest mistake a cyclist can make, according to Coach Martin, is to keep his hands on the handlebars. "When you realize you're going to fall, get a hand off the bars and try to come down on your forearm and then roll." If you freeze on the handlebars, you're likely to come right down on your shoulder, and possibly break your collarbone.

■ **Helmets.** You don't see many racers in hard helmets, but Martin recommends them for the tourist. While too cumbersome to race in, they can save your skull. **FM**

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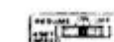
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## PEDAL-PUSHERS HIT THE ROAD

(Continued from page 199)

conventional breathable stuff sack and slip it inside a plastic garbage bag at the first sign of rain.

### And if it rains . . .

. . . you get wet. One way or the other. There is no perfect rain outfit. Those that seal off every part of your body do keep out the rain, but also retain perspiration, so you end up wet anyway. The best advice: Get out of the rain; find shelter. But often you can't, so you can try one of two get-ups, both of them compromises:

■ **A hooded poncho**, or rain cape, protects your torso and part of your head. If you don't like wet legs you can combine a poncho with rain chaps. A poncho solves the sweat problem. It's roomy and lets air circulate, but the wind can swirl it up around you (the funhouse effect) and the rain can splash up underneath.

■ **A rain suit** comes with separate pants, jacket and hat. It keeps you dryer than a poncho, but allows your legs less freedom and, because it encloses you totally, is much hotter (the steam bath effect).

### Do you need a striped shirt?

No. You don't need any of those special and expensive clothes that bike racers must wear and fanatic tourists like to affect: wool shorts padded with chamois, tight jerseys with bright stripes, hats with pushed up brims, or those racing shoes with metal cleats that are impossible to walk in. Any comfortable clothes are fine. Sneakers with semihard soles seem to work for most people—as do regular leather shoes.

The first thing to prepare for a trip is your body. Of course, if you've been physically inactive for a few years, it's wise to check with your doctor before setting off. But taken easily, cycling is a great exercise for the heart, lungs and circulatory system. In fact, it's one of the exercises recommended by the American Heart Assn. for maintaining a healthy heart. The AHA even recommends it for patients recuperating from a heart attack, provided they are under the supervision of a physician who prescribes the level of activity.

The more cycling you do before a trip, the more you will enjoy it when you go. And people planning to pedal 50 miles a day had better work up to it gradually. But frankly, it doesn't take a superior physical specimen to do it. A month or two of weekend cycling should be enough. And if you're an avid jogger or swimmer, perhaps even less. As for 10- to 15-mile-per-day trips, you can prob-

ably jump right in with practically no preparation.

Age is rarely a problem. Bikecentennial has had riders up to 86 years old. A 67-year-old man finished its entire 4250-mile Trans-America Trail (as did two 9-year-olds).

### Loading bags and bike

We haven't mentioned all the things you should pack for a bike trip, but such lists are readily supplied by touring organizations.

As for packing stuff in your panniers, just let common sense prevail. Put items you need often at the top of your panniers or in their outer pockets. Since it's easy to forget what's where, you might take the time to make two lists: items in the left pannier and those in the right. Put each list in the top of the main compartment of each pannier. Another precaution is to line the main compartments with plastic garbage bags. "Waterproof" nylon sometimes surrenders to the rain. And, of course, get equal weight in the two panniers—this is easier than riding a bike that lists to one side.

Don't put too much weight in your handlebar bag. It seriously affects the steering. Tents and sleeping bags, should be secured to your carrying rack with elastic shock cords.

### Take a shakedown cruise

Take a short, trial ride with the bike fully loaded before setting off on any trip. This is really essential. You'll be amazed at how many problems—albeit minor—you'll find and correct. For instance, you may discover that the heels of your shoes bump your panniers when you pedal. You can fix this by adjusting the panniers, changing shoes, or maybe even getting a longer rack. Problems like this are easily solved at home—but can ruin an entire vacation if you wait until you're on the road.

But don't let these things keep you from cycling. Lots of people will help you. Here are some of them:

**Bikecentennial**, Box 8308, Missoula, Mont. 59807.

**International Bicycle Touring Society**, 846 Prospect St., La Jolla, Calif. 92037. Trip information supplied to members only—dues, \$7 per year. Minimum age, 21.

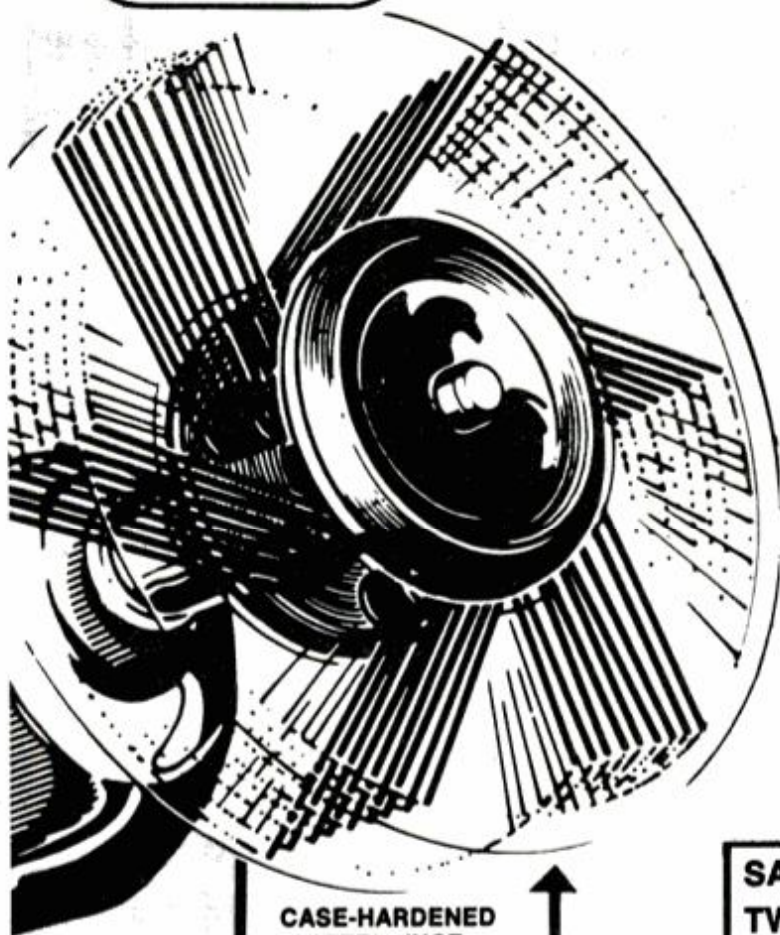
**Vermont Bicycle Touring**, R.D. 2-H, Bristol, Vt. 05443.

**American Youth Hostels, Inc.**, National Campus, Delaplane, Va. 22025. Sponsors many trips in the United States and abroad. Geared mostly towards younger riders, it's a good information source. Check your phone book for a local chapter before writing the national headquarters.

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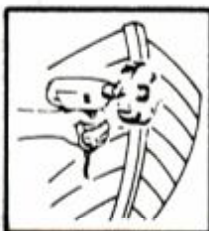
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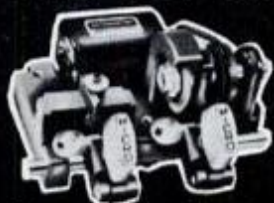
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## Installing ceramic tile



**13** Remove pipes. Apply thin layer pre-sanded dry-set or latex cement.



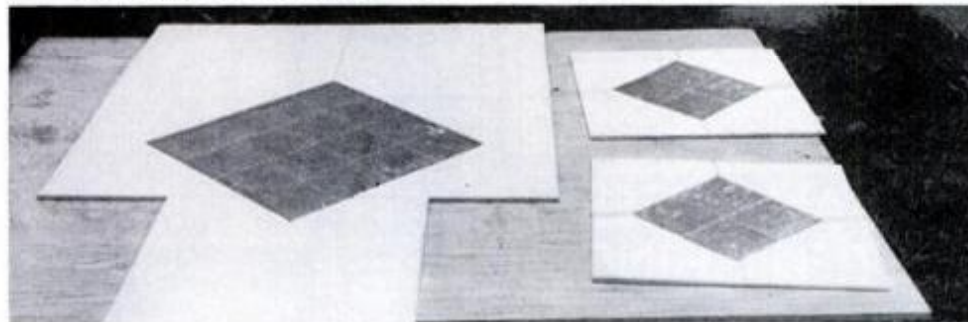
**14** Mark pipe holes on tile. Test-fit by holding tile sheet in position.



**15** Drill pipe holes in tile. This one is Redi-Set pregrouted sheet tile.



**16** Install pre-drilled tile on wall and then replace the water pipes.



**17** For interesting pattern fit tile sheet of contrasting color diagonally to

the surrounding sheets. Tile cutter cuts the surrounding sheets to fit.



**18** After pre-cut sheets of tile are in place, insert the diamond section.



**19** To install soap dish, punch holes in board with a hammer, screwdriver.



**20** Apply silicone rubber liberally to Wonder-Board and install dish.



**21** Grout all joints between sheets with same silicone used in sheets.

## BACKUP BOARD FOR CERAMIC TILE

(Continued from page 135)

fiberglass tape that seals joints and corners is also available.

The concrete-fiberglass panels are less than half the weight of the conventional installation of paper, metal lath and Portland cement plaster. They also eliminate the inconvenience of cutting and nailing the paper and metal lath, mixing mortar, troweling on two coats, and the messy cleanup after using wet mortar.

The board is timesaving and easy to use. You can score, snap and nail or screw it to the studs in less time than it takes to apply conventional materials. After the corners and joints are mortared and taped, you're ready to apply tile.

A quality ceramic tile properly installed with dryset or latex Portland cement mortar over Wonder-Board is an attractive, low-maintenance and long-lasting wall covering for areas subjected to moisture, water and steam.

Boards are available in 1/2-in. thicknesses in 30x60-in. panels, and 36-in. widths 48, 60 and 72 in. long. The material is also available in a 3/8 x 36 x 60-in. panel for installation *only* over plaster, gypsum board, plywood or other equally solid backing. With the thinner 3/8-in. panel you must use fasteners that are long enough to pass through the backing material and anchor firmly in the wall studs. This thinner board is good for remodeling surfaces that present a bonding problem and where space is tight. **PM**

### Caring for ceramic tile walls

A periodic dusting or vacuuming removes loose surface dust from tile walls. You can remove stubborn smears and smudges with a sponge dampened with either water or a general purpose cleaner.

To clean the entire tile area use a solution of 1/4 cup general purpose cleaner such as Mr. Clean or Fantastic per gallon of water (1 to 48). Use two containers, one for fresh solution and one for dirty solution. Apply liquid with a clean cloth, working from the bottom of the wall upward to prevent streaking. Work small areas at a time. For a uniform appearance clean the entire section.

Rub stubborn spots with a nylon scouring pad. *Don't use steel wool*—it will leave rust specks. Let the wall dry. Rinsing isn't needed.

For heavy-duty cleaning, follow the preceding procedure but use a more concentrated cleaning solution: 2 cups general purpose cleaner per gallon of hot water.

To prevent mildew, coat glazed tile walls with a residual disinfection solution of 1/4 cup liquid Lysol or other disinfectant per gallon of water. Let dry.

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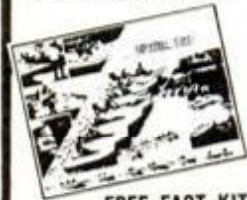
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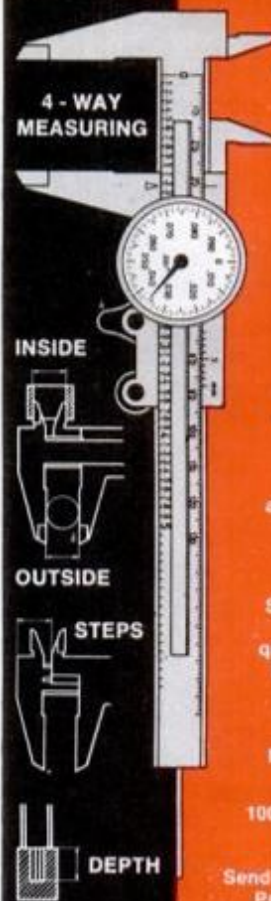
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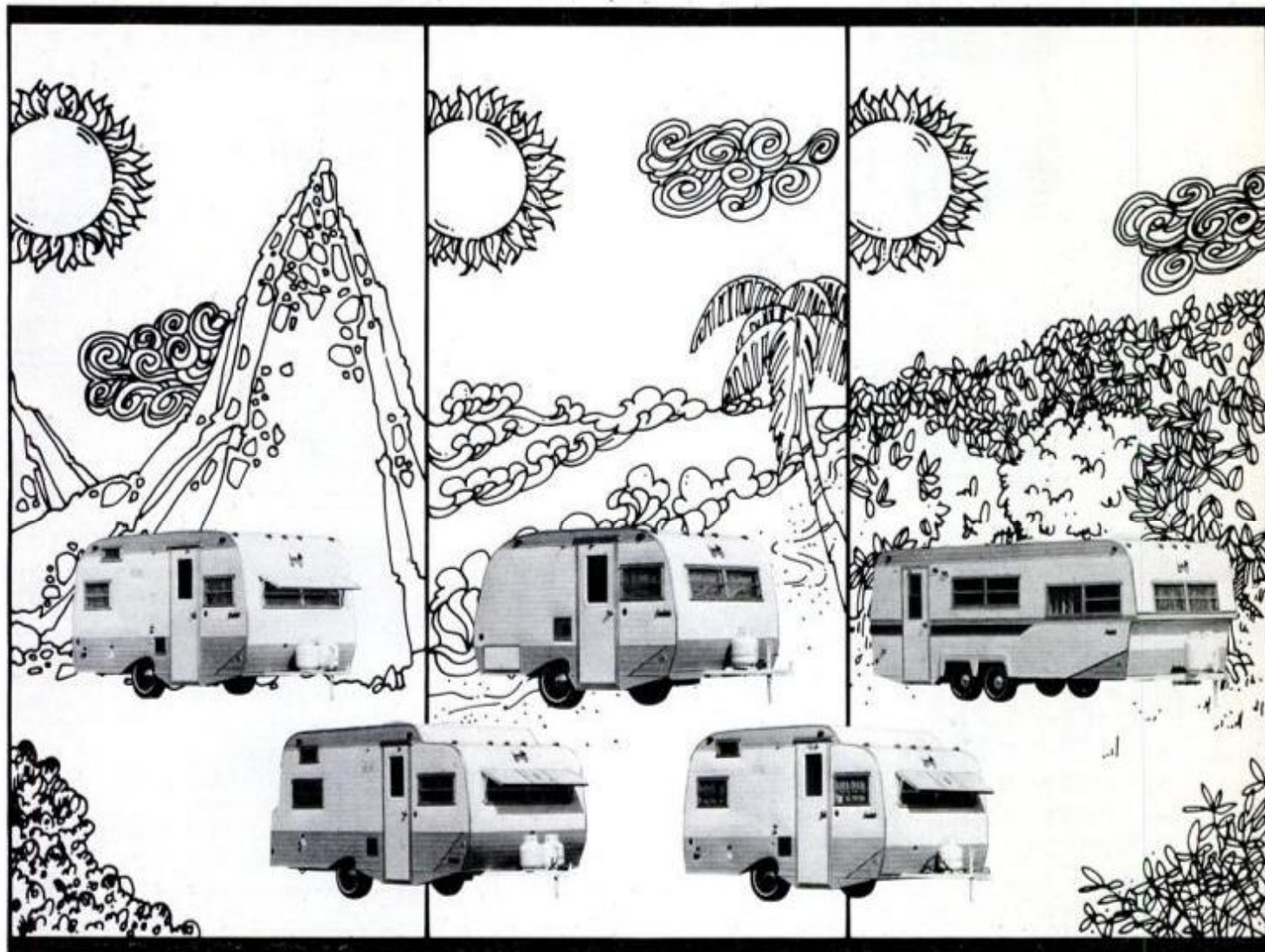
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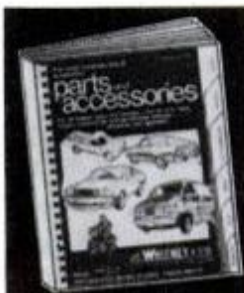
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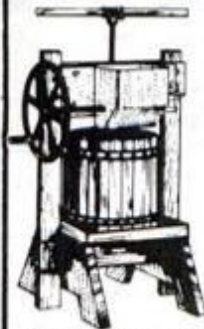
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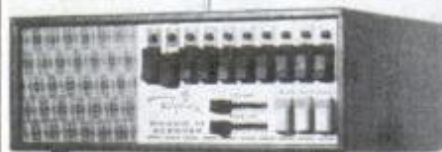
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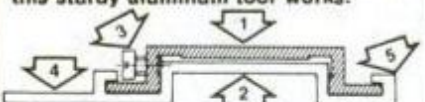
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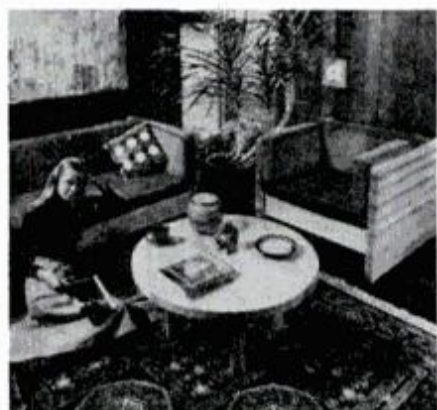
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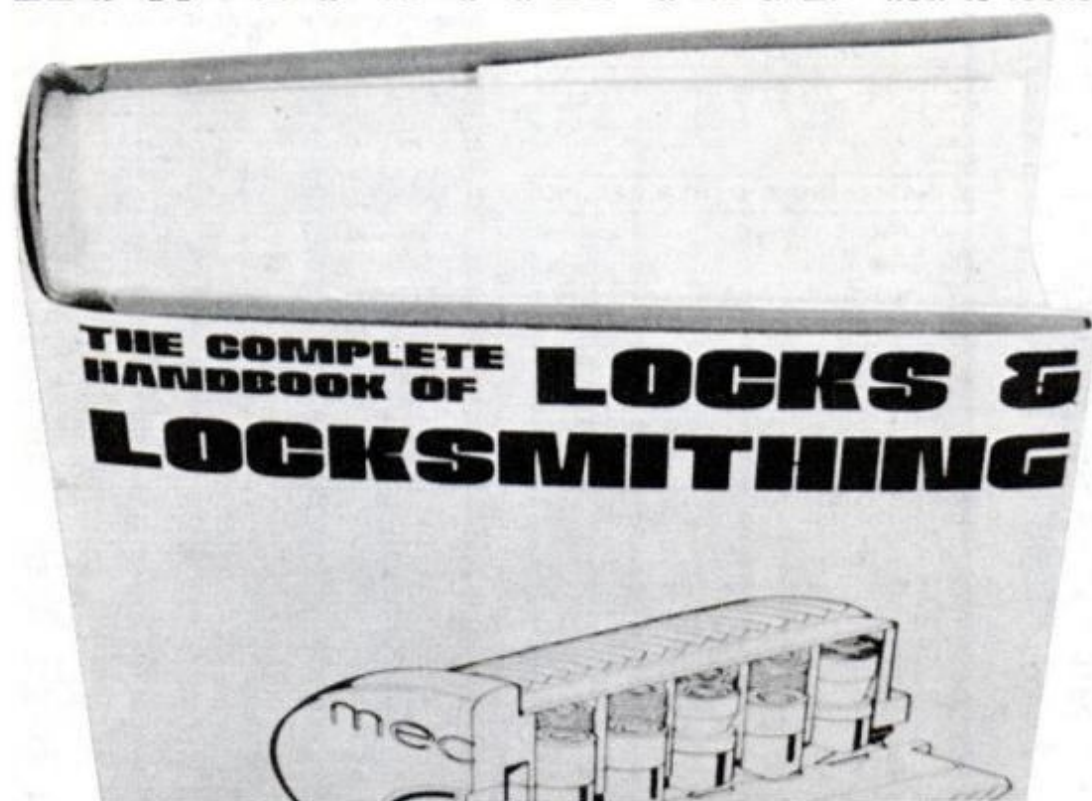
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