

# POPULAR MECHANICS

JUNE 1971  
50 CENTS

Build This Safe, Simple

Scuba

Sub:

\$400

Page 94



Vandals? Prowlers?

Our \$30 'House Watcher' Stops 'Em Page 120

What Your '72 Car Will Look Like

Gremlin and Dart Owners: 'Great on Mileage, BUT—'

Dream Workshop  
Full of Ideas for You

10 Steps to a  
Crystal-Clear Pool



WHOOOSH HHHHHH

# How to make fresh filter cigarettes for less than 20¢ a pack\*



1. The LaRedo Filter Blend Kit contains the cigarette-making machine and enough paper tubes, filters, carry-around packs and tobacco for your first five packs. Cost: under \$2.\*



2. Open up the vacuum-packed LaRedo tobacco. That "whoosh" sound tells you you're about to make the freshest filter cigarette you ever tasted.



3. First, place one of the ready-made paper tubes on the end of the machine. You'll find the machine easy to use. And, it's so sturdy, it's guaranteed for two years.



4. Drop a filter into the small slot in the machine. This is the same kind of filter used in best-selling factory-made cigarettes.



5. Fill the big slot with the fresh LaRedo tobacco. Then get set to turn out a filter cigarette that looks factory-made.



6. Hold the paper tube. Push the lever. Pull the lever back, let go of the tube, push again. The cigarette will fall free of the machine.



7. There is your first filter cigarette made with LaRedo. Fast and easy. No factory-made filter cigarette tastes so fresh, costs so little.



8. Light up. Enjoy the freshest tasting filter cigarette ever. LaRedo refills to make five more packs, cost less than \$1.\* Less than 20¢ a pack!\*

\*In most areas of the country—based on manufacturer's suggested retail price.

# LaRedo FILTER BLEND

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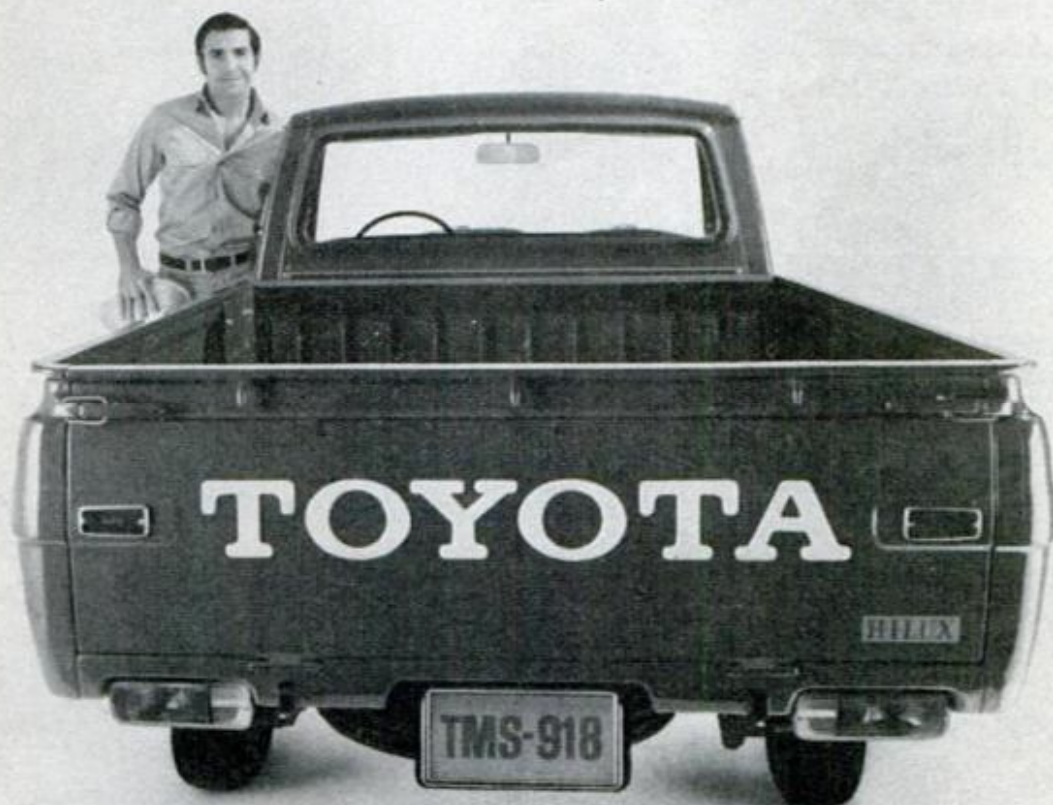


Kit

Refill



# Most people buy small trucks for the same reasons they buy small cars.



They eat less gas. Occupy less space. Are cheaper to maintain. Easier to handle. And cost much less to begin with.

In addition, some small trucks (namely our small Toyota half-tons) can do just what bigger half-tons do. We can carry a full 1,000-pound load in our 6-foot bed. And we can do it at highway speeds.

We've got an efficient 108-hp OHC engine. With 5 main bearings to help your engine live a longer, more rugged life.

And a heavy-duty suspension system for a solid ride. Empty. Or full-up.

And as you might have noticed, our small Toyota truck comes with a small Toyota price. \$1,978.\* Which includes a 4-speed synchromesh transmission. 6-ply tires. Flo-thru ventilation. Padded dash.

And some things a lot of bigger, more expensive half-tons don't have. Like a front towhook. Tie hooks all around the bed. And a spare tire under the truck that you lower with a hand crank.

Actually, there just might be more reasons to buy a small truck than there are to buy a small car.

## Toyota Half-Ton. \$1978\*

\*Manufacturer's suggested retail price. Freight, dealer preparation, options and taxes extra.



**You're whizzing along  
and there it is.**

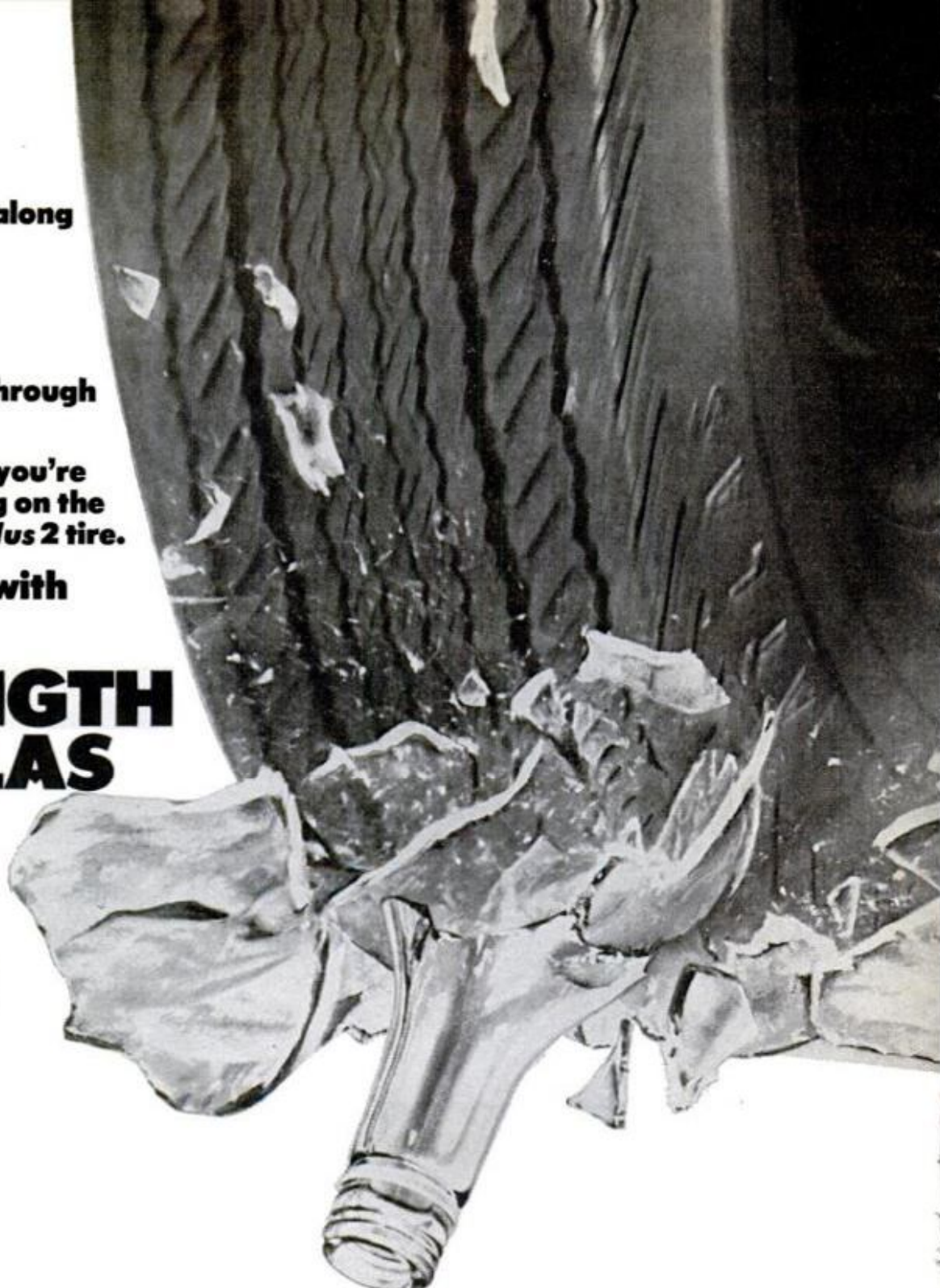
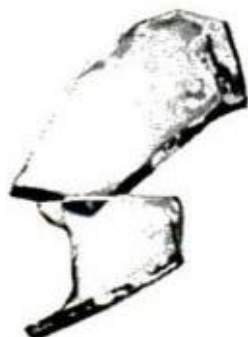
**Glass.**

**Crunch.**

**You feel it right through  
the seat.**

**At times like this you're  
glad you're riding on the  
Atlas Plycron 2 plus 2 tire.**

**The tire built with  
THE  
STRENGTH  
OF ATLAS**



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ATLAS  
PLYCRON 2 plus 2\***

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This one



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Cover Photo by Bruce Mozert at Silver Springs, Ocala, Fla.

*Build This Safe, Simple Scuba Sub for \$400*

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**How to Steer Clear!** Split-second action that can avert highway disaster.

**Wings of Brave Men.** The new USAF Museum is a great show for air buffs.

**Portable TVs You Can Play on a Picnic or Patio.** Run on batteries, they play anywhere.

**Shot in the Dark.** Night photography often is more dramatic than daylight.

**Small-Scale Car, Big-Scale Thrills.** It's Heath's new radio-controlled racer.



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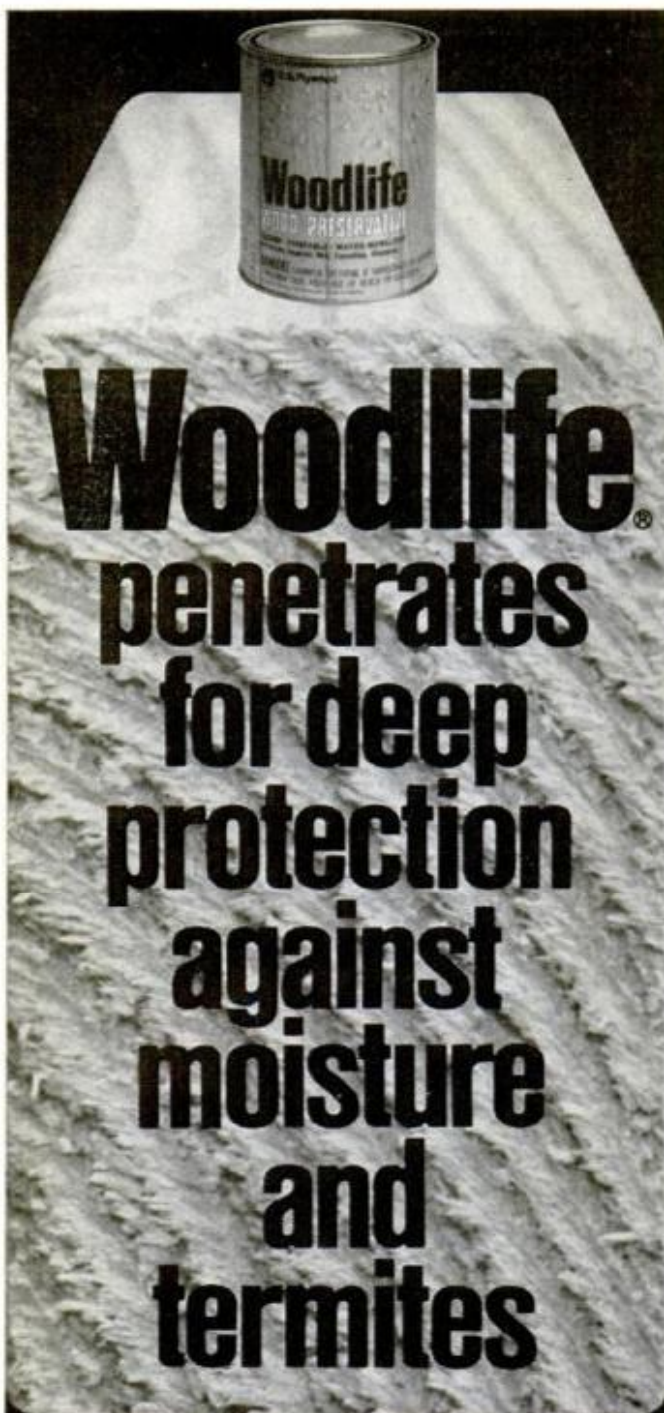
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## LETTERS TO THE EDITOR

### Engine cleanup

If that article, *How to Clean Up Dirty Mechanical Problems* (page 116, April PM), wasn't the silliest thing I've ever read!

Here's my way: Go down to the local car wash, raise the hood and blast the engine with soap and water. Then wash the rest of the car. Next, raise the hood again and rinse the engine. Now close the hood and start the engine.

I've been doing this since the first car wash appeared and have yet to see an American engine that wouldn't go. Several of my cars ran up 100,000 miles for me.

AURORA, COLO.

EDWIN J. SANDE

### Flat-tire happiness

Your tip about flattening tires (*Letting Air Out*, page S5, May '68 PM) got me out of a slippery dirt road jam during a rain. I was so grateful I could have cried. The driver behind me didn't soften his tires and fishtailed up the hill and smashed a fender. My car took off like a rocket under full control.

HILO, HAWAII

REV. STEVENSON LEONG

### Might as well stay at home

"One man's wilderness is another man's back yard," the opening statement of *How to Outfit for a Wilderness Canoe Trip* (page 100, April PM), is a good description of how ludicrous that whole article is! Why didn't the author just pick his house from its foundation and have a house mover follow him to his camping site so he could have *all* the comforts of home? What about a fish sounder, automatic casting rod, chauffeur for the wagon, chef for the cooking and a tractor to clear a path through all that *tough* wilderness? Wilderness trip—crap!

LAS VEGAS, NEV.

KEN HARKINS

Author Nick Karas, who's been canoeing all his life, simply reminds voyageurs that the farther from home you are, the more things you'll need. If the list seems too extensive, don't bother toting everything—but be darned sure you know what you're doing out there in the wilderness!

### Driving tips

*Ten Driving Tips That Could Save Your Life* (page 69, April PM) is exactly  
[\(Please turn to page 8\)](#)



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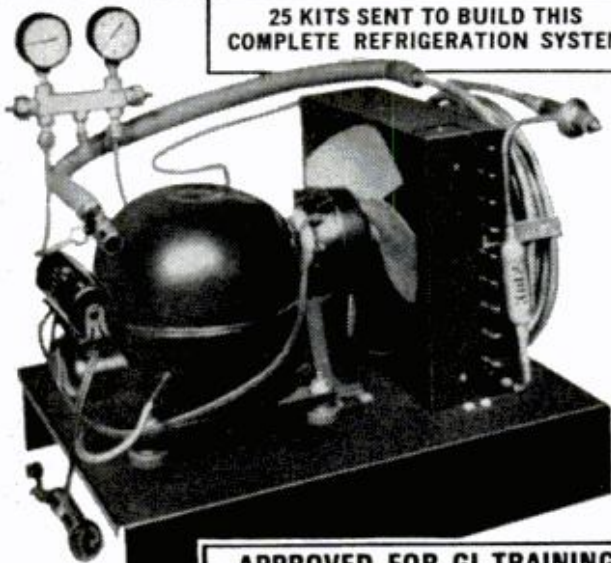
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## LETTERS

(Continued from page 6)

what its title states. Author Fales' thoughts parallel those of the professional driver.

INTERSTATE BUS  
DRIVERS ASSN.  
SILVER SPRING, MD.

ROBT. J. BEARD,  
EXEC. VICE PRES.

Every driver should read it! I, a professional driver, would like to add one more tip. When signaling for a turn, *don't* start your turn signal and pump your brakes at the same time. Both taillights will blink on and off—and completely confuse the driver behind you.

MADISON, WIS.

WILBERT J. MEIER

The *only* idea with which I could possibly disagree is the notion that driving in fog with emergency flashers on is a good idea. Recently, in heavy fog, I was passed by a car with flashers going. He was indeed visible—and hypnotizing. Those red flashing lights *demand*ed my attention. After a few miles of this, I pulled off the road to let him get out of range.

GRAFTON, WIS.

MICHAEL A. CARY

Parking lights are just that, and in many states it is illegal to drive with parking lights on. I feel that people should be told that if conditions require lights, they should turn on their headlights.

SEATTLE, WASH.

A. J. WYLIE

Under item No. 5 ("When you're making a right turn from a fast road. . ."), I would like to add that well before making the turn, I speed up a bit to increase the distance between my car and the cars following. In addition to giving car turn signals, I give arm signals.

DALLAS, TEX.

E. P. ALDREDGE

## Tall swinger?

If that *Old-Time Yard Swing* (page 140, April PM) is really 10 feet tall, that pretty model in the photo must be 7 feet tall. Is it? Is she?

SCARSDALE, N. Y.

W. C. LEE

*No. No. When first published in 1918, that "All-Time Great" swing was 10 feet tall. We decided that was too tall for today, and made it 8 feet. But we forgot to change the plans. (The swing hangers should be shortened to 88 inches, too.)*

## Sub builder

I've finished my submarine (*One-Man*

(Please turn to page 10)



# Which is the real you

?



## The rip-roaring **Tricart**<sup>TM</sup>

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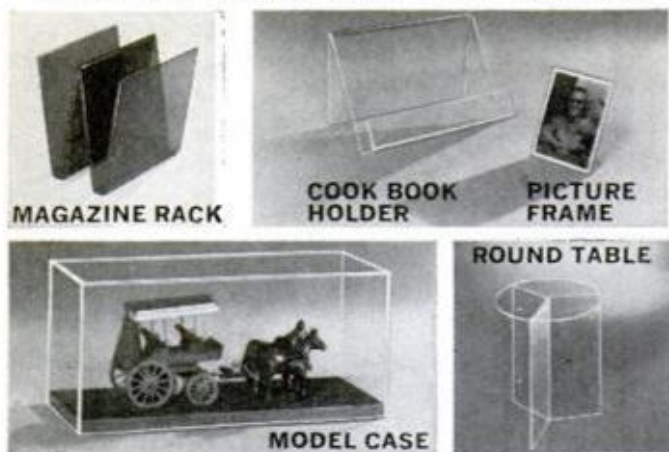


Which is the real you? Let us know which SPD fun machine you're interested in, and we'll send you colorful literature. Write to: Special Products Division, New Holland Division,  SPERRY RAND Corporation, P.O. Box 246, Lebanon, Ohio 45036. We'll also send you the name of your nearest SPD dealer.





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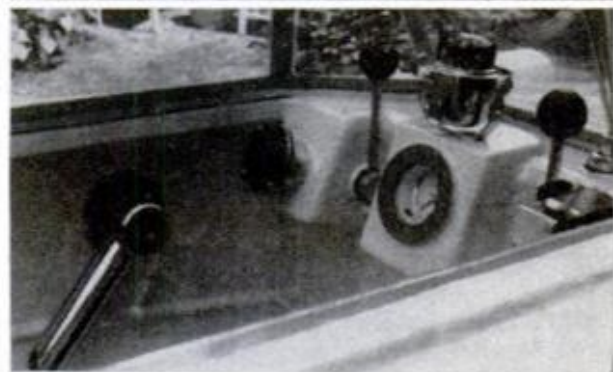
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## LETTERS

(Continued from page 8)

Sports Submarine, page 90, June '68 PM) and it functions perfectly.



The submarine, with the four accumulators I used plus the ballast, is rather heavy—so I built a trailer for it.

In the front hull section I have two scuba tanks; the air-pressure gauge is located on the sub's instrument panel.

I've also built into the sub a timer that will bring it to the surface if I leave the sub and don't return for one hour.

COPENHAGEN, DENMARK      JAN E. JENSEN

See page 94 for the 1971 model of the homebuilt submarine—a two-man craft.

### Not jet powered

By referring to jet-propelled boats as *New Jet-Powered Boats* (page 115, March PM) you've committed a grievous offense against the cause of technical accuracy—compounded by the reference in a caption to a 265-hp jet engine.

NAPLES, ME.

RICHARD J. SAWYER

Right you are. These are jet-propelled boats powered by auto engines. ★★★

POPULAR MECHANICS



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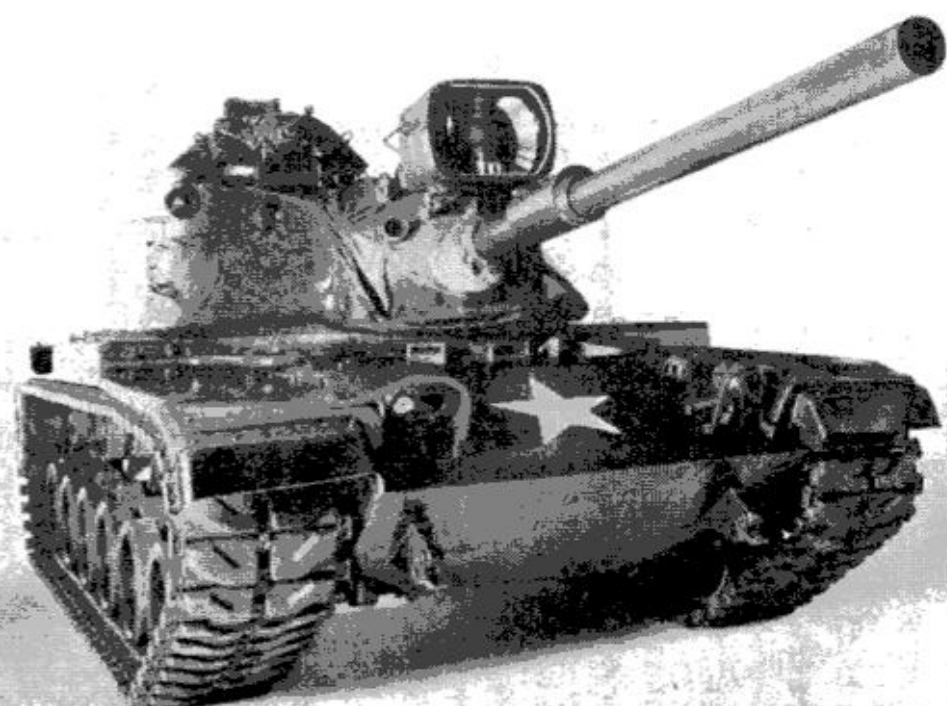
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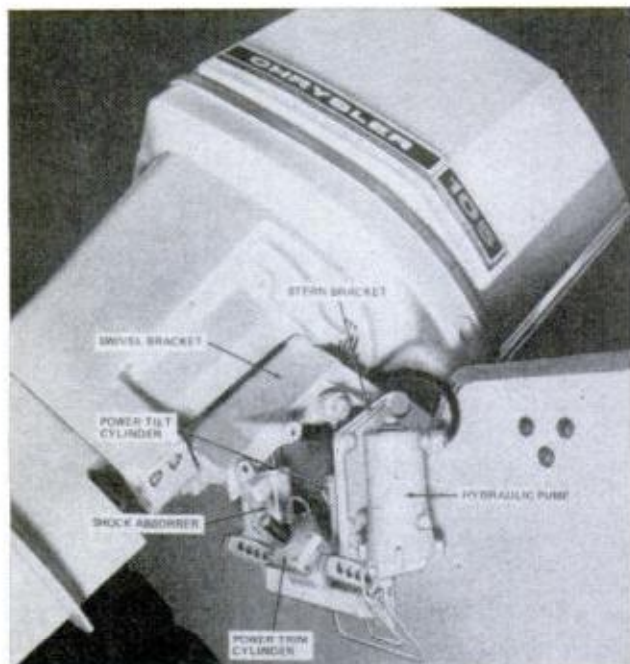
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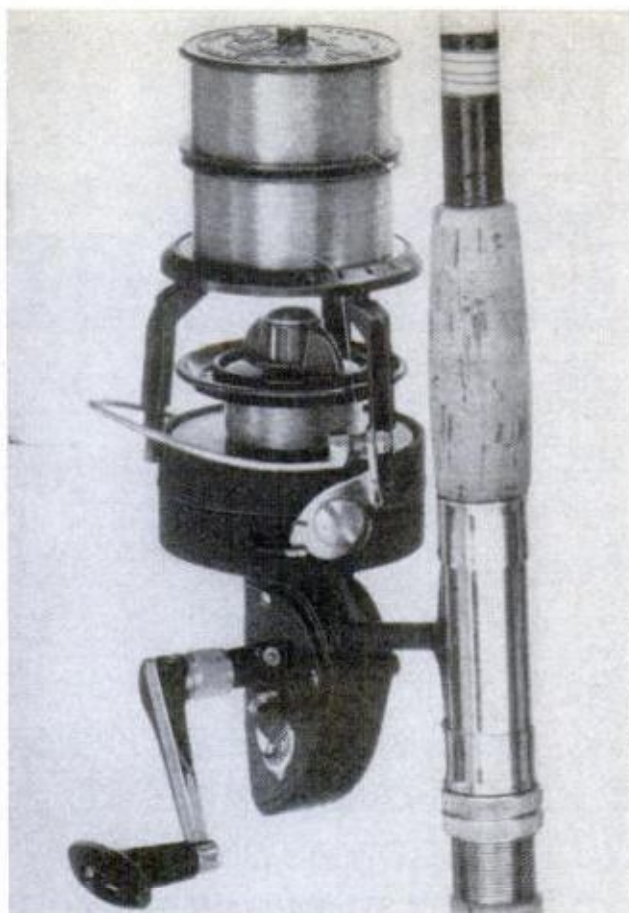
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**ALL-SEASON RECREATION VEHICLE** which travels on both snow and water is being developed by Massey-Ferguson. The new MFX 4000 (still experimental) has a 55-hp VW engine. Write to the maker at 1901 Bell Ave., Des Moines, Iowa.





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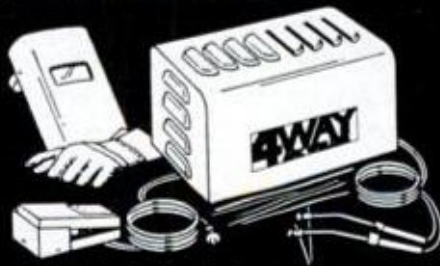
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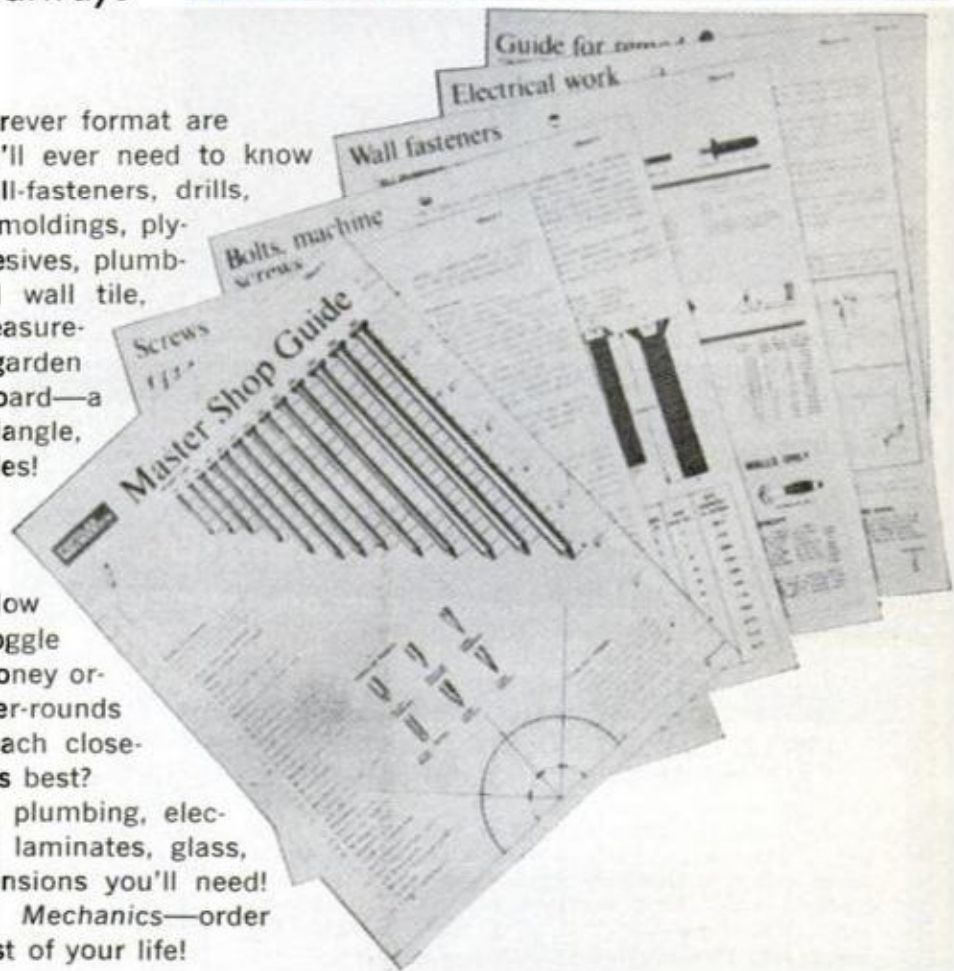


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**Earthquake drills—like fire drills—**should be held in California schools, and food and medicines should be stockpiled in that state. That's the opinion of University of Michigan physicist Peter A. Franken, who says the February quake in the Los Angeles area had no connection with the major disaster that long has been predicted for central and southern California. The San Andreas fault, which runs along the California coastline, was responsible for the 1906 quake that wrecked San Francisco and for dozens of lesser tremors since then. Most major quakes in this system occur about every 50 years. The longer the period between major quakes, the more severe they tend to be. "Thus," says Prof. Franken, "an enormous amount of stress has been built up. The central and southern California region is at least as dangerous, and quite possibly more, than it was immediately prior to the 1906 quake."

**Good news for cholesterol-conscious Americans** comes from Kansas State University where researchers have fed hens a special diet that results in eggs with 35 percent less cholesterol than is contained in eggs produced by the same birds when on standard feed. Key ingredient in the diet is sitosterol, a fatty substance found in soybeans that is used as a drug in lowering blood and tissue cholesterol levels in humans. Eggs produced on the experimental diet are said to be indistinguishable from other eggs by weight, yolk appearance or shell quality. Cholesterol, a substance found in all animal fats, is associated with cardiovascular diseases.

**The highest telescope on Earth—**not counting the orbiting jobs—is in operation atop Hawaii's extinct Mauna Kea volcano. At 13,796 feet, the observatory is situated above 40 percent of the atmosphere, which distorts telescopic images. Completed in 1970, the observatory boasts an 88-inch reflector 'scope.

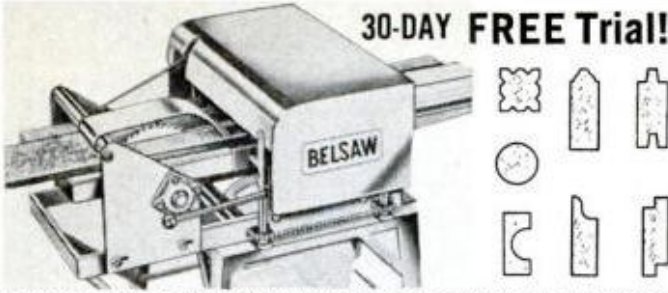
**Chances of a primitive form of life on Mars** appear brighter with a recent report from a research team at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "Our findings," say the investigators, "show that organic material is probably being produced by sunlight on the surface of Mars." The scientists radiated crushed glass and soil with ultraviolet light while the substances were contained in an atmosphere duplicating that of Mars. The result: organic compounds—such as formaldehyde and glycolic acid—that are believed to have been precursors of biological molecules on Earth.

**A revolutionary light-amplifying system** that employs a laser has been invented by Stanford University researchers. There are two glass cells (an illumination cell and an amplifier cell) filled with an organic dye that can be excited by the light of a laser. Excitation of the dye molecules causes light to be emitted from the illumination cell—light that is used to illuminate an object under observation. After reacting with the object, the light passes into the amplifier cell. Here, the dim light energizes the molecules of the dye to the point where they, too, emit light. The result: a bright, full-color image of the object. A typical application, according to the researchers, is encountered in looking at a living organism, say an amoeba, through a microscope. If the amoeba is too brightly lighted, it gets cooked. If there is not enough illumination, it is hard to see. With the new system, a microscopist illuminates the amoeba with dim, cool light and observes it under bright light.

**An antiseptic that actually helps to guard against tooth decay** may be available in the future. That word comes from scientists working for the National Institute of Dental Research, Bethesda, Md. One antiseptic under test can break up plaque on hamster teeth. Plaque is a gelatinous formation of bacteria that's associated with tooth decay. ★★



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# DETROIT LISTENING POST

BY ROBERT LUND

**MOST '72 CARS WILL BE INTRODUCED IN MID-SEPTEMBER**, if the auto companies hold to their present plans. This could change, depending on how sales go and other factors, but there shouldn't be any holdup in launching the new cars due to problems involving production equipment, because this won't be a year of big changes for most makes. Only exception will be some Ford products scheduled for a major reworking.

**THERE'S NO PROSPECT OF REVERSING THE SMALLER-CAR TREND** with impact-resistant bumpers coming, according to auto designers working on '73 and later models. Even if buyers suddenly lost interest in compacts and started clamoring for king-size cars, they say that telescoping bumpers could add three to four inches both front and rear—six to eight inches overall. That's just too much overhang to tack on a standard-size car. But it could be added to a compact or mini so the car could still be squeezed in an average-size garage or parking space.

**DON'T DISMISS CHRYSLER AS A CONTENDER IN THE SMALLER-CAR DERBY**, despite cancellation of its mini-car program. Big C is obviously thinking in terms of smaller cars—smaller than standard, but not mini size. Every 10 days the company runs the sales figures through a sieve, siphons off the small jobs and analyzes the results. If the handwriting on the wall means anything, Chrysler's standard-size cars will be whittled down the next few years in keeping with the trend to more modest-size automobiles.

**AUTO COMPANIES CONTINUE TO PROTEST** against installing air bags without more time for testing, but Detroit obviously doesn't hold much hope of winning the argument. This is based on the fact that most automakers will go to modular instrument panels in late 1973—on the '74 cars. All Chrysler makes will have modular panels after '73. That indicates air bags.

**SPEAKING OF AIR BAGS**, a supplier company that's done a lot of development work on air cushions says a replacement bag could cost more than the factory-installed original, if you have the misfortune of being involved in a crack-up serious enough to inflate the bag. The reason: In an accident of sufficient force to activate the bag, there's usually deformation of the instrument panel. This means the panel has to be repaired or replaced before a new bag can be installed.

**PONTIAC'S MADE IT OFFICIAL** that it will put an electronic fuel-injection system on a few of its '72 cars—but not necessarily at the beginning of the model run—and extend the item to other cars in '73. That's not exactly news, because GM's interest in f.i. has been known for a long time. But this is the first confirmation from a company source.

**HAS GM FINALLY GIVEN CHEVROLET APPROVAL** to bring out a mid-engine Corvette? The keep-a-tight-lippers at Chev aren't saying, but there's a report from a u.r.s. (usually reliable source) that Chevrolet is working the car up for late next year. That would make it a '73. But that may be cutting it a bit thin, considering the tooling involved, and it might be early in the 1973 calendar year, instead of the beginning of the model year, before you see a sample on the road.

**THOSE BASIC CARS**—plywood sides, tarpaulin seats, two-gear transmissions—Ford

*(Please turn to page 26)*





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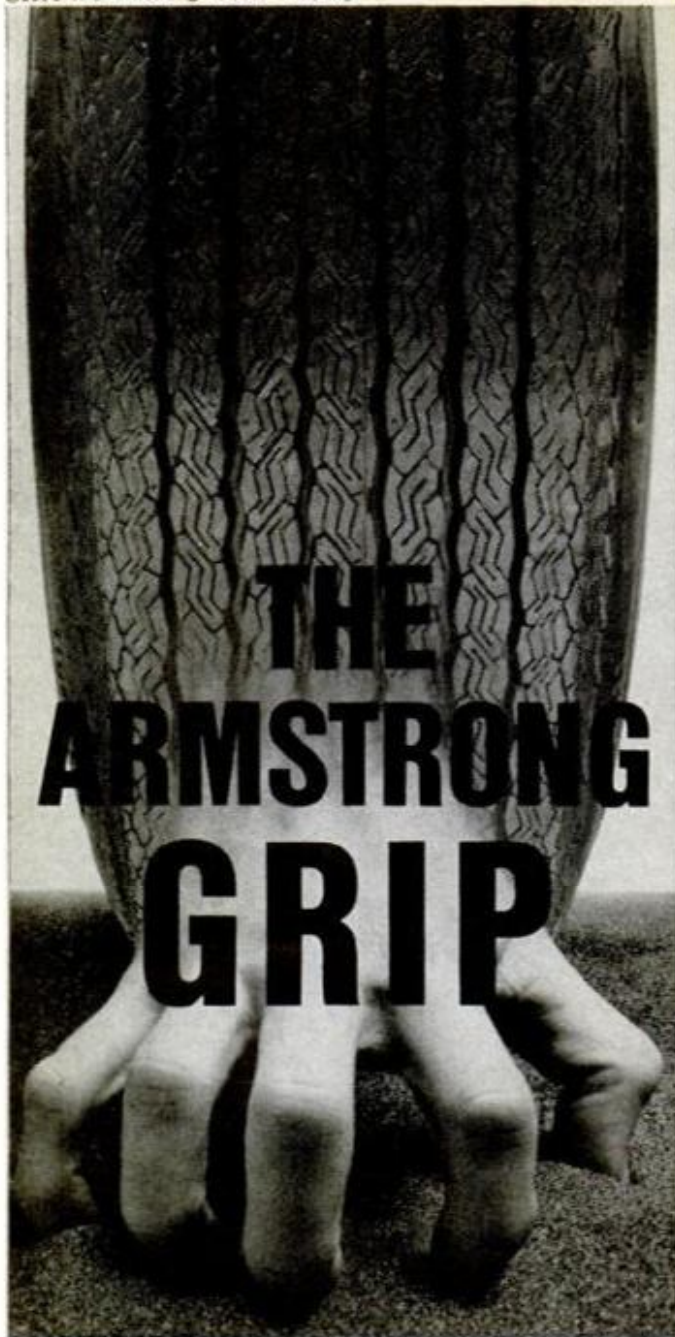
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## DETROIT LISTENING POST

*(Continued from page 24)*

and GM are working up to sell in underdeveloped countries will not be imported into the United States. Not by the auto companies, anyway, although that doesn't preclude some private entrepreneur bringing a few in for the novelty trade. The smaller the car and the less equipment it carries, the less Detroit makes on it. Some Motown mossbacks are still fuming over the fact that VW, Toyota, et al, cat-and-moused Detroit into manufacturing smaller cars. It stands to reason the industry isn't going to put any penny candy on the counter that might take your eyes off the two-pound box of bonbons.

**ROUGH COST FIGURES** are being compiled by the automakers on safety and antipollution equipment the government wants installed on 1973-74 cars. The producers won't release the estimates for publication, but a composite of two different figures *PM* obtained from industry insiders comes to \$631 at retail. That doesn't include new hardware automakers have developed that they would like to put on cars, but isn't mandatory by government edict.

**ON THE SUBJECT OF PRICES**, if you buy your car on time and budget a part of your pay for the finance company, you can figure the monthly payments will be substantially higher in 1973-74 or, second choice, it will take an extra six months to a year to pay it off. That's the word from the finance companies. They figure prices will go up \$500-plus to cover the additional gear coming on cars as a result of government standards that will become effective over the next few years. The finance houses will try to get you to increase the monthly payments, instead of stretching the payments over a longer period of time. They don't like to write installment contracts beyond 36 months. The reason the money sources are reluctant to go to 42 or 48 months is that there's a toss-of-the-coin point along the way where the resale value of the vehicle is less than the buyer owes on it. If the customer decides he doesn't want to complete the contract—pay it off—the finance company is left holding the bag on what is usually a badly beat-up car.

**END OF THE CONVERTIBLE?** If Cadillac drops its convertible at the end of the '72 model year—considered a strong possibility—that will mark the end of the body style among U.S. car producers. Converti-

*(Please turn to page 28)*



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## DETROIT LISTENING POST

(Continued from page 26)

ble sales have been slipping for several years, due to the increased popularity of airconditioning and as a result of charges that the soft top, even when reinforced with roll bars, is a hazardous vehicle to drive.

**FOUR-SPEED FLOOR SHIFTERS** have decreased in sales to a point where several car divisions may discontinue the option at the end of the current run. One division general manager tells *PM* if volume drops to 5000 units this year, that will be the end of the item. Insurance companies equate floor shifters with speed and jump the premium on cars with the equipment.

**CAR DESIGNERS** are beginning to give the sales departments some static on the practice of slapping identifying names, numbers, emblems and do-dads on car exteriors. The graffiti used to mean something, because the tag-ons went only on performance cars or those carrying deluxe equipment. Now even the plain pieces come with tacked-on symbols, medallions or letter-numeral combinations. Sales departments favor the labels and would like to see them continued. But designers say they've been overdone to a point where they're just clutter, argue for dropping everything except the name of the make and series.

**UNIFORM INTRODUCTIONS OUT?** Some automen would like to see the practice of early-fall introductions of new cars scrapped in favor of announcing new machines whenever they're ready. But the answer is up to GM. Its rivals say that company's influence on buyers is so strong that it would be a long risk not to have something new when GM has something new. GM has traditionally favored once-a-year introductions, but has recently shown signs of backing down from that position.

**IT'S NOT ALL FUN AND GAMES** making cars. Switchboard operators in Detroit auto plants and office buildings have been supplied with a form called the "Bomb Threat Checklist" for use if a caller phones in to report a bomb on the premises. The sheet carries a long list of check-off boxes to help the operator pinpoint location of the bomb and to note any clues that might identify the caller—vocal characteristics, speech, language, accent, background noises, sex, approximate age and whether the call is local, long distance or originates from a booth. ★ ★ ★





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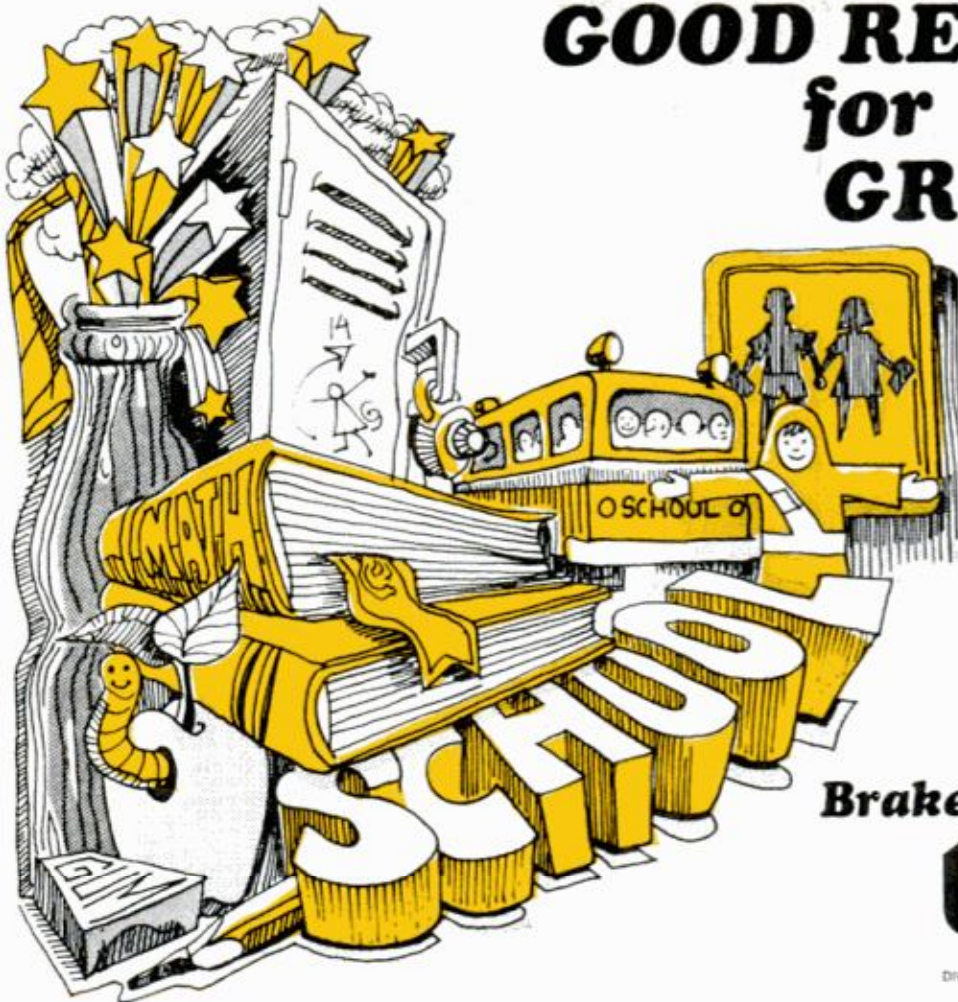
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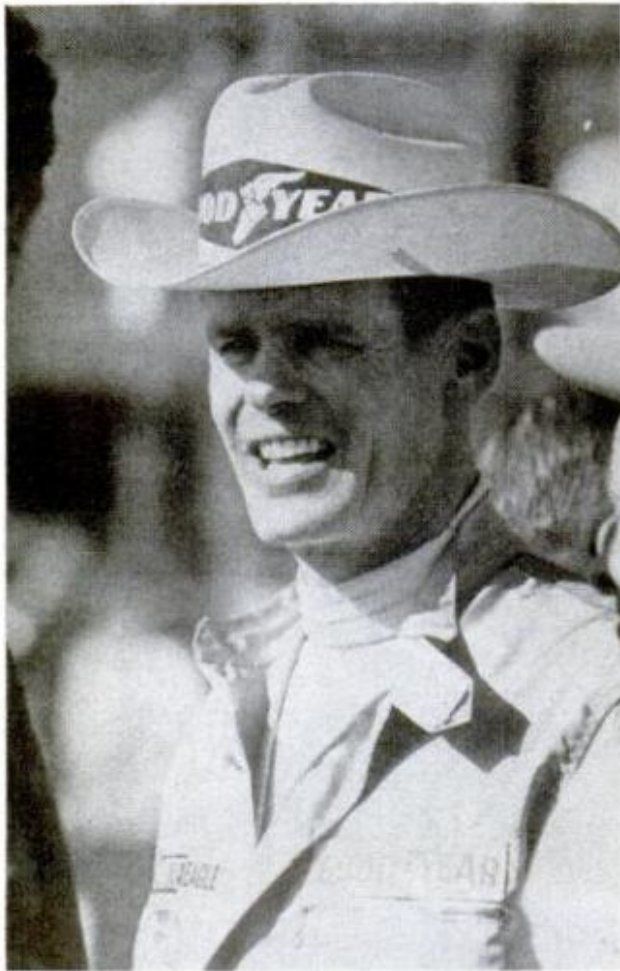


# Drivin' with Dan

As an ex-driver, do you find races more interesting from the pits? What do Ford and Offy racing engines cost? An Indy chassis? Why use a rear airfoil? Dan Gurney answers these and other automotive questions

**Q.** *It's a proven fact that cold-air induction systems on Detroit supercars work at the drag strip, so how come NASCAR and Trans-Am race cars don't make use of this free extra horsepower?—Thomas Langston, Glendora, N.J.*

**A.** We used it on our Barracuda Trans-Am cars. Mustang, Camaro, Javelin and others also used it. The rules govern the configuration that will be allowed. NASCAR rules



**BOBBY UNSER** set new track record of 132.201 mph in taking the pole for U.S. opener of USAC season at Phoenix. Bobby had the race in the bag until the last ten laps, when brother Al passed to win. Manager Dan, too excited just to stand by, handled the gas during the '68 Indy winner's pit stop in the Gurney Eagle-Offy. Teammate Swede Savage placed third

probably apply the same sort of limits. Almost all the cars mentioned above find that they must use air cleaners out of necessity, not because of the rules.

**Q.** *Do you find races more, or less, interesting than you expected from the pits now that you are retired as a driver?—Shirley Simpson, St. Paul, Minn.*

**A.** Good question. Although I'm not driving now, I am still very involved in trying to do something constructive in the pits during the races that I have attended since retiring. I find the races very interesting, but less so than from the driver's seat. Being in charge of pit strategy involving pit stops and driver pit-board communication is a very hectic and confusing thing if you are trying to stay ahead of the game. Things happen very fast and the complexion can change very much in a moment.

**Q.** *How beefed up are the spindles, differential gears and rear axles on Trans-Am cars? They don't use stock parts, do they?—Jack Kmecik, Grand Forks, N.D.*

**A.** I don't think many of them are stock for the model being raced though they may often be derivatives of parts from heavier stock model cars in the line. The idea is to beef things up only if it is absolutely necessary. They attempt to keep the cars as light as possible, yet strong enough to go the distance.

**Q.** *How much do Ford and Offy engines cost and about how much does a modern, new Indy type chassis cost? Finally, do you intend to race again? I miss you.—Chris Pirog, Allentown, Pa.*

**A.** Approximately \$28,000 for Ford and  
*(Please turn to page 34)*



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ntally opposed. It  
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rive can give.

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r safety?  
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pendent suspension on  
all 4 wagon wheels?

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hatch lift up,  
but...

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## DRIVIN' WITH DAN

*(Continued from page 32)*

**\$23,000 for Offy.** A new chassis costs roughly \$25,000 to \$30,000. No, I don't intend to race any more, though it is not easy to avoid the urge.

**Q.** Do you think that the idea of eliminating dirt races and road races from the USAC national championship is a good one?—Dale Smith, Evansville, Ind.

**A.** In many ways yes, and I say that even though road racing has always been my first love. It is too much to try and do everything all at once, really well. Championship racing is Indy, Ontario, Pocono, Milwaukee, Trenton, Phoenix, Michigan and so on. Television is easier to set up for these oval races. The cost of trying to make dirt and road races as well would be prohibitive. Racing is more competitive and costly than ever before.

**Q.** Why is a rear airfoil necessary? I can see a front foil holding down the nose of a car, but it seems that one in the rear just creates excess air resistance.—John Glanville, Darien, Conn.

**A.** Naturally, it does create more air resistance, but just as the front wing holds down the front, the rear one holds down the rear. Racers strive to maintain a good balance all the time.

**Q.** What does it take to be hired as a test driver (nonracing) by a car or tire maker?—Tony Manucci, Harris, N.Y.

**A.** I can only guess. I'd suppose that it would require an apprenticeship in the testing department of one of these companies and promotion from within.

**Q.** Why do mini-sized Detroit cars all seem to have four-cylinder engines? Can't they make a small, efficient V8?—Mark Porter, Orange, Calif.

**A.** Cost would be number one but also, a Four at those sizes has excellent overall characteristics. It may be the best configuration for the job, anyway. ★★★

*If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' With Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 52).*



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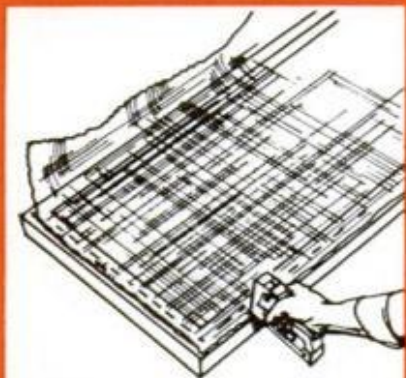
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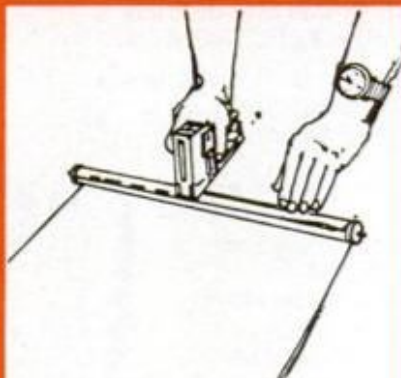


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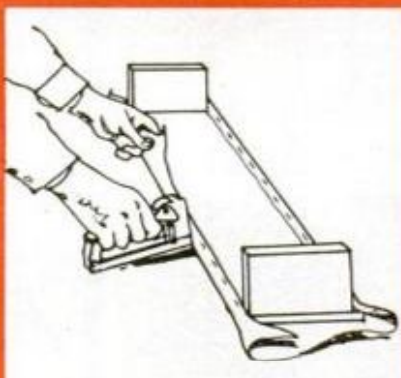
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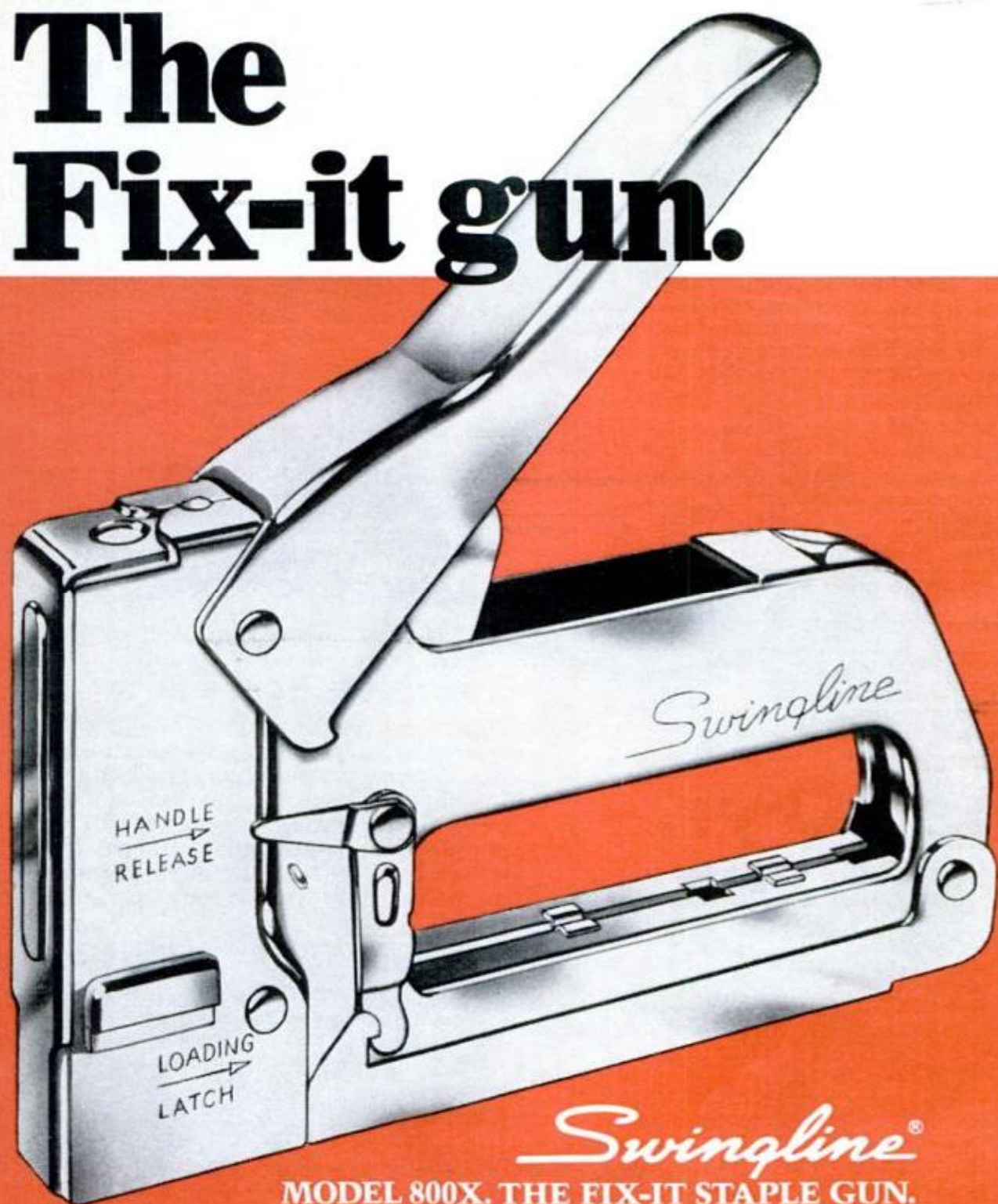


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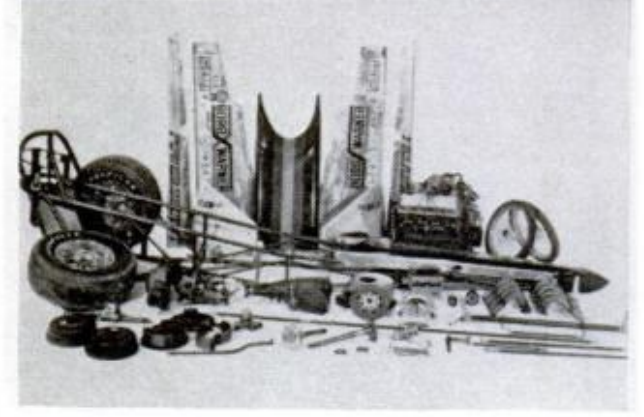
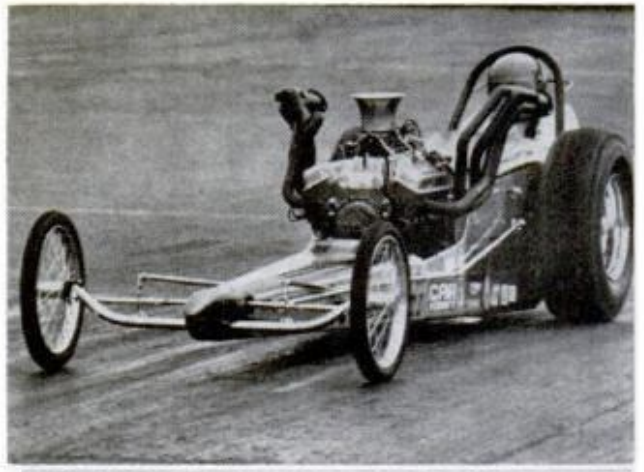
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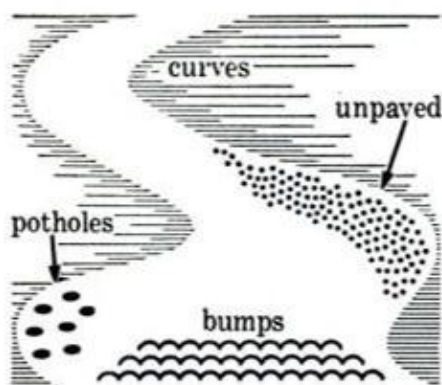


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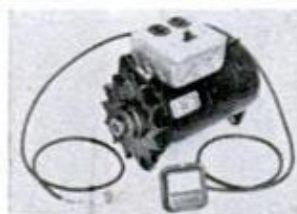
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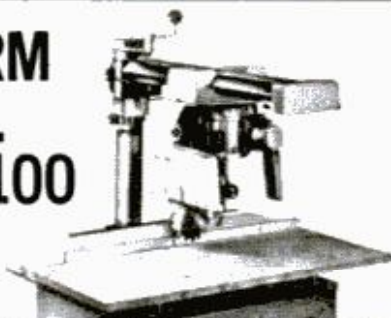
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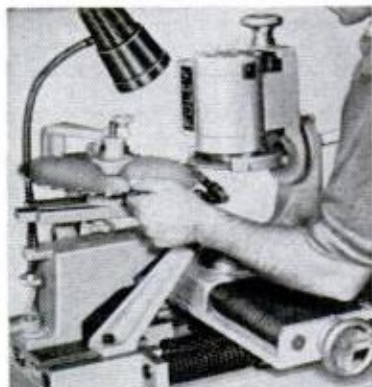
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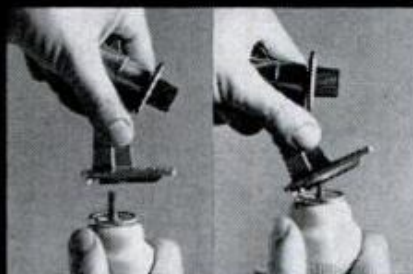
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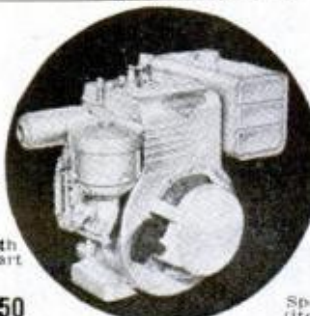
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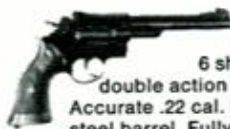
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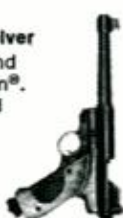
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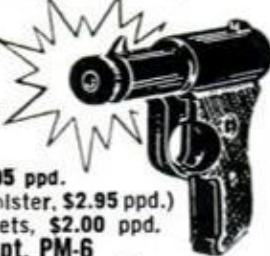
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New GLAS-GUARD tire: 2 fiberglass belts and 4 nylon cord body plies.

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The fiberglass belts fight tread-wearing squirm to give you long mileage.

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# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Noisy little beast

*My 1970 Plymouth III with 318-cu.-in. engine has a rear-end noise that comes on at about 35 mph and a vibration noise that seems to come from beneath the car. The latter can be heard at low speeds only when the engine is cold. The dealer has installed two new rear ends—now says there will always be some noise. Is this true? Are the problems related?—Joseph Powers, Homewood, Ill.*

You're speaking about two different problems. Each is characteristic of the car so you'll have to live with them. That high-pitch whine comes from the ring and pinion. The vibration sound (rumbling, really) is an exhaust roar that disappears as the engine warms up and the fuel mixture leans out. Close your ears—both noises, even in concert, aren't that tough to take.

## Flake off

*The power-steering belt of my 1966 Buick Special squeals. It has been adjusted with a gauge and is as tight as a violin string. I put on a new cog belt every year and squirt belt dressing on it every two weeks. The squeal remains. Why?—Michael Kerpsar, Rochelle Park, N.J.*

Because it isn't the belt—it's the pulley. I'll bet it is flaking or the groove is badly worn. Next time you remove the belt, hold it up to the light. You may see tiny metal particles, which indicate pulley damage. You have a choice—live with the squeal or replace the pulley.

## Compression and temperature

*Should a compression test be taken with the engine cold, warm or hot?—Leonard Epifanio, Santa Monica, Calif.*

Under normal conditions, it doesn't matter. Compression should be within 20 pounds of manufacturer's specifications at any engine temperature, assuming that the test is being made in an area where air temperature is 60° to 90°F. The only time that engine temperature does make a difference is when you're trying to find out if excessive compression is causing a hard hot-start problem. If too much

carbon gets too hot, it leads to an increase in compression and makes the engine hard to start when it's hot. A compression check for this problem should be taken with the engine hot. Incidentally, to make an accurate compression check, the throttle and choke should be open, all sparkplugs should be removed, and the battery should be at or near full charge.

## Weak-hearted water pumps

*What's with manufacturers nowadays? I have a 1969 Chevrolet Chevelle with a 350-cu.-in. engine. In 15 months (11,000-plus miles) I've been through two water pumps. A friend has gone through four of them in less than 8000 miles. I think I'll take up walking.—Robert Wheeler, Parkersburg, W. Va.*

Water-pump failure has been a problem in the 1969 Chevrolet. You may be able to lessen the rate of occurrence by making sure that fan blades aren't bent, that there isn't excessive runout of the water-pump pulley and fan clutch (if the car has one), and that coolant is up to level (low coolant can cause cavitation which can damage the water pump seal). If you have had a nonfactory airconditioner installed, check that the pulley isn't oversize or out-of-balance.

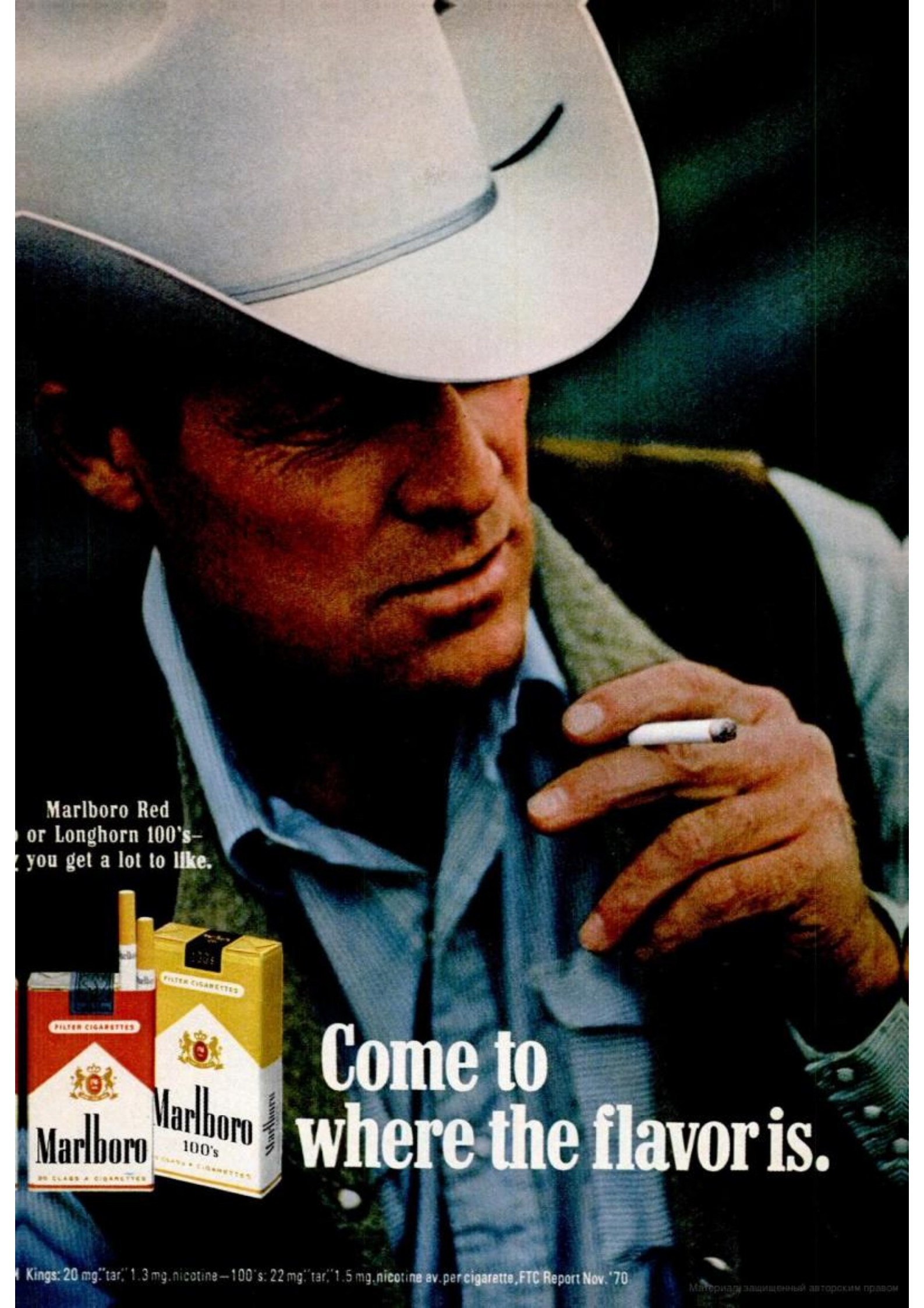
## Another oddball

*I have a 1969 Dodge with 318-cu.-in. V8 engine, 31,000 miles, and a queer problem. I use SAE 10W-40 Mobil motor oil that is changed every 2000 miles. Sometimes I can go the full 2000 without having to add a quart of oil. Then, suddenly, I will have to add a quart every 300 miles for about 1000 miles. Things will straighten out, and the engine won't use oil again for a few thousand more miles. My dealer is completely stumped. So am I.—Thomas Nagle, Ardoch, N.D.*

And so am I! The only logical reason I can figure for this goofus is that maybe you're varying your driving speed. In other words, maybe during that period of high oil consumption, you're pushing it to speeds of 90 and 100 miles per hour. I've been to North Dakota and know that

*(Please turn to page 56)*



A close-up photograph of a man wearing a white cowboy hat, a blue dress shirt, a green patterned vest, and a dark tie. He is looking down and to the right, holding a lit cigarette in his right hand. The background is dark and out of focus.

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



**Come to  
where the flavor is.**

Kings: 20 mg. tar, 1.3 mg. nicotine—100's: 22 mg. tar, 1.5 mg. nicotine av. per cigarette, FTC Report Nov. '70

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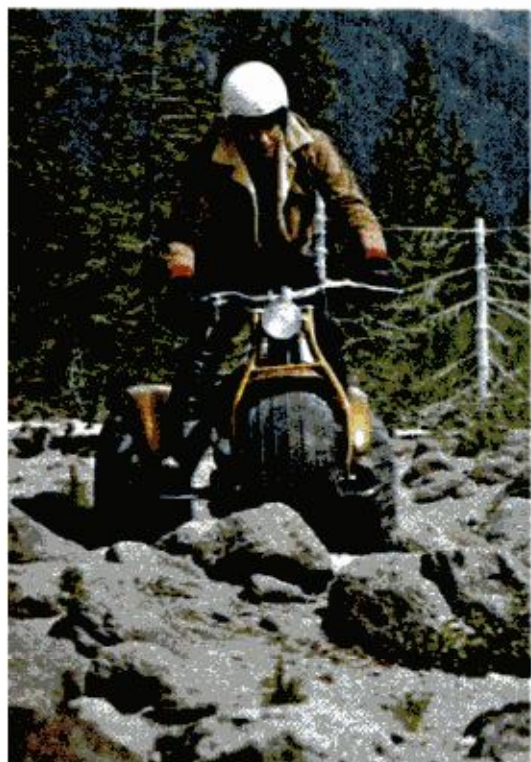


This funny-looking bike skims across sand dunes. Rolls over rocks. Fords streams. Splashes in the surf. Whips through the snow. Smooths out the roughest trails. In fact, goes just about anywhere off the road. Even fits in the trunk of your car. And features all the great things Hondas are famous for. A peppy four-stroke overhead cam engine. The most depend-



Lighting equipment optional at extra cost. Always ride safely and wear a helmet. The Honda ATC 90 is manufactured for off-the-road use only; American Honda warns against





able motorcycle engine built. A fully automatic clutch and dual-range four-speed trans that make it a cinch to ride. A USDA-approved spark arrestor/muffler so it's very nice to your ears and to the environment. An ignition cut-off switch

and a parking brake for safety. And a nice low price to fit your budget. Everyone in the family will love riding it. It's more fun than a luge buggy, snowmobile and trail



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## AUTOMOBILE CLINIC

(Continued from page 52)

highways are so little traveled that North Dakotans aren't adverse to doing this. At high speeds, pressure could be pushing oil past the rings. Sound plausible?

Speaking of pressure, maybe the crankcase vent valve is causing the trouble. Chrysler advises replacing it every year.

### Smoke screen

*My 1967 Oldsmobile Cutlass with 300-cu.-in. engine emits black smoke from the exhaust almost constantly. In fact, soot is left on the driveway as the car warms up, and sparkplugs have been fouled with soot. Plugs have been cleaned and reset; the carburetor has been adjusted. Please help.—Frank Vitale, Bridgeport, Conn.*

Did you forget to service the exhaust emission system? When it gets clogged, an excessive amount of carbon (you call it soot) will be created. Clean out the system and replace its valve. If the problem persists, check the operation of the automatic choke. The engine may also have worn valve-stem seals that allow oil to be sucked into the combustion chambers.

### Hesitant fastback

*I own a 1969 four-speed Volkswagen fastback with 12,000 miles on the speedometer. My problem is with the electronic fuel-injection system. There is a definite hesitation of two to three seconds as the engine goes up through the gears from a dead stop. It is a hazard, but the dealer claims that it is normal although the condition, he says, has been corrected in the 1970 models. My question is this: Can I apply the 1970 remedy to my 1969, and how do I get the dealer to cooperate?—William Borchering, Cincinnati.*

First of all, your dealer is wrong. The changes made to the 1970 fuel-injection system were not because of a hesitation problem, but because of a cold-starting problem. Thus, replacing black boxes and wires isn't going to help you. It's tough to pinpoint the cause of your problem without doing an on-vehicle test, but it is probably inside the electronic fuel-injection control box with the heat sensor or with the pressure sensor. Most VW dealers have special testing equipment to

check this system. If your dealer can't help you, direct the problem to the VW distributor for your area. His name and address are in the owner's manual.

### Buggy bulkhead connectors

*My 1963 Impala and 1965 Chevelle have the same problem. Connections jiggle loose from the bulkhead connector plugs. What can I do?—Leo Tapia, Whittier, Calif.*

Bulkhead connector plugs on the engine side of the firewall are held to the bulkhead connector (that's the fuse panel) by arrowhead-shaped retainers. The arrowhead must protrude completely through the loops on the top and bottom of the connector plugs for full engagement. This may be hard to do by yourself because insulation on the firewall keeps this connector from protruding enough into the engine compartment. To assure full engagement of the retainer, have someone inside the car push forward on the bulkhead connector as you install plugs from the engine side.

## Service Tips

● **Straight stuff on tires** comes from the National Highway Safety Bureau: Do not mix different types. The bureau states that "intermixing of tires can and often does change the handling characteristics of a car from a stable condition to a wandering, fishtailing, unstable condition." If you're using a belted-bias-ply tire on one wheel, use it on all. The same holds true for radial and bias-ply types.

● **1971 Mercury Cougars** with 351-2V or 4V engines may be "growling." The cause is grounding of the muffler outlet pipe against the right rear shock absorber. There's a fix. It's outlined for your dealer in service bulletin 12 (12/28/70).

● **Chevy has the better idea** this month. The company has determined that a great many refrigerant-hose failures in cars equipped with airconditioning are caused when battery acid drips on them. The cars specifically involved are the 1969-71 Chevrolet and Chevelle, and the 1970-71 Monte Carlo. The company suggests that you wrap the hoses in a double thickness of vinyl electrician's tape. ★★★

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**GOT A PROBLEM WITH YOUR CAR?** Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.



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is simplicity itself.



Maverick, the "simple machine," answers a lot of questions: Fewer repair bills? Simple. According to an independent survey, Maverick has the lowest frequency-of-repair record of any American car. Better gas mileage? Simple. In simulated city/suburban driving, the standard 100-horsepower-six engine delivers an average of 22 miles per gallon. Less servicing? Simple. One-sixth as many lube jobs and one-half as many oil changes as the leading import. See Maverick in 2-door, 4-door or sporty Grabber model, with six or V-8. At your Ford Dealer's.

MAVERICK



MAVERICK The Simple Machine



THE OVERWHELMING RESPONSE by Popular Mechanics readers to the Pollution Fighters' Newsletter indicates much more than a superficial interest in the current environmental crisis. They want to know more about pollution problems and about ways they can help. And they're interested in technologies with "Zero Environmental Impact." Below is a description of an environmental study now in progress along with several new books which will give you answers to some of your questions:

NEW YORK—Rick Band, detective, dashes out of headquarters in hot pursuit of a jewel smuggler. He drops his cigaret to the ground. . . . Does that casual bit of littering by a TV detective ultimately damage the environment? Television's effect on viewers' attitudes regarding the environment is the subject of an 18-month study presently being made by the Ford Foundation. Under the direction of Richard D. Heffner, the project's major concerns are pollution and waste, use of resources, nature and outdoor life. Heffner and his staff tape 400 televised hours a week with recorders attached to five color television sets and then analyze programs by the minute to discover how TV shapes values.

NEW HAVEN, CONN.—Restoring our natural environment can only be accomplished through a new consciousness, according to Charles Reich, in his current best seller, The Greening of America (Random House, New York). He sees this new way of thinking as seeking to bring back the natural environment America has mistreated. The change in attitude, he says, is neither antitechnological nor antimachine; rather, that machines must serve man, not do a disservice by destroying his environment. In his opinion, there must be an individual awareness of our ecological dilemma—what has happened to the "green"—accompanied by a desire for the environment to be restored.

PAEONIAN SPRINGS, VA.—With the belief that man must adopt a new set of values if he is to survive, Arthur Godfrey has edited a book of selections from Rachel Carson, Paul Ehrlich, Edward Abbey, Aldo Leopold and others. Entitled The Arthur Godfrey Environmental Reader, it serves as an introduction to books like Silent Spring, Desert Solitaire and A Sand County Almanac. Godfrey notes that man is listed as an endangered species—the next 30 years being most critical. His plea: "Anyone care to join me as a Volunteer for Survival?"

NEW YORK—One of the more comprehensive environmental readers to appear within the last year is The Environmental Handbook edited by Garrett De Bell. It includes selections from Rene Dubos, John W. Gardner, Paul Ehrlich, Robert and Leona Train Rienow, plus two sections on eco-tactics—one for individual action and the other for political action. The book also has an extensive bibliography of ecological books and films. ★★★



# According to most house paint ads, the quickest and easiest job is all you care about.



# The Dutch Boy believes you care about something else: a paint job that will stay looking good a long time.

We won't kid you and say there's nothing to it. Painting a house—even painting it with Dutch Boy® Latex House Paint—takes planning and work.

If the surface is new, or if it was painted with latex house paint before, your surface preparation may involve very little beyond resetting nails, puttying nail holes, or removing chalk.

If your house was painted with oil paint before, or you don't know if it was and can't find out, you should consult your Dutch Boy dealer and he will advise you as to what methods of surface preparation may be in order.

Two things particularly contribute to the long-lastingness of Dutch Boy Latex House Paint. One is that since the paint "breathes," moisture can't get trapped under it. The other is that the acrylic resin base of Dutch Boy Latex House Paint has the ability to lock in colors and consequently, the colors last for the life of the job and the job lasts longer.

If you've got shutters and trim that you want to look glossy, although you want the rest of the house flat, your

Dutch Boy dealer can sell you flat and glossy colors designed to work together.

And the painting of gutters and drain pipes is no problem, either. Dutch Boy Latex House Paint clings to aluminum, galvanized and copper surfaces for the life of the paint job—no special primer is needed.

As to the quickness and ease of the painting itself, Dutch Boy Latex House Paint actually flows on easier without dragging or sticking. It doesn't leave lap-marks when you stop and start, so that if you want, you can paint every weekend for the whole summer. Paint before and after the rain. And no matter what kind of a mess you make (and you can make a mess) it will wash up with soap and water.

But we're never going to tell you that painting a house is so much fun you'll feel like running out and doing it again. You have kids to raise and living to do and our main job is to help you forget about us for a long time.

**NL**  
INDUSTRIES





# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Noisy condominium

*I live in a condominium and noises are my problem. I like my neighbors and don't wish to offend them. Is there any practical way I can dampen the ordinary sounds of living that come through the wall between us? Also, my living-room window fronts on a parking space. How do I go about soundproofing it?—P.L., Fla.*

Much depends on room arrangement, room size, window size, noise volume at a given time, whether you are a late riser, and so on. You refer to "ordinary" sounds, so I assume the decibels are relatively low, perhaps rising to higher levels mornings and evenings.

You can achieve a measure of peace and quiet, but only at some sacrifice of convenience and living space, by hanging lined, full-length draperies or tapestries from ceiling to floor along the separating wall. They will act like soundproofing "curtains" in a conventional soundproofed wall. Hang the same fabric on a traverse rod at the window to soften the racket from the parking area.

For maximum effect, use a heavy, lined fabric and hang them with ample folds. Window drapery should extend about a foot beyond the trim at top and sides and within 1½ inches of the floor. Hanging of such draperies will have the general effect of reducing room size, even though they harmonize with your furnishings.

## Discolored slate floor

*I've just moved into a home with a slate-floor entry. A yellowish stain that covers several slates seems impossible to remove with ordinary household cleaners. I don't know what caused it. Can you suggest how to remove this stain, and what to use?—S.H., Pa.*

This sounds like a not-so-common household problem having no simple solution. Have you tried a medium solution of trisodium phosphate—a couple of heaping tablespoonfuls to the gallon of water? Wear rubber gloves and apply with a scrubbing brush. After scrubbing, flush and wipe up with clean water.

If a second application shows no appreciable result, try an abrasive, such as fine

pumice, mixed with a light oil to make a brushable paste. Brush this on the affected area and rub with a small wood block to the bottom of which a piece of felt has been attached with thumbtacks. Use straight back-and-forth strokes, but vary the direction at each pass so that the affected surface gets equal abrading. After one rubbing, wipe up the abrasive "cream" and go over the surface with a paper towel to pick up the oil. This should show an improvement, if not completely remove the stain. If surface is still cloudy, apply another rubbing.

Immediately after this stain has been removed, wipe away excess oil with a clean cloth dampened with a few drops of turpentine and apply a nonslip wax to the entire slate floor.

## Septic tank and detergents

*I have a septic tank and have been told that household wastes that include detergents will affect its operation. What must I do to maintain efficiency? What chemicals are to be used and in what amount? Or must we stop using detergents completely?—H.H., Kans.*

Ordinarily, present-day detergents in an average household do not measurably affect operation of a properly installed septic tank of ample capacity. Chemical compounds are available (you should be able to obtain them locally) that are designed to speed disposal action in septic tanks. They should be used judiciously, according to instructions given. Be careful not to introduce an undue amount of kitchen fat into the disposal system; in time, this may cause trouble. Dispose of the fat in a separate container that goes with the garbage.

## What's 'whitewood'?

*Recently I've looked at some unpainted furniture with the idea of finishing several pieces by myself. My dealer refers to the wood as "whitewood." What's he talking about, and what wood do I get if I buy it?—K.G., Ill.*

As a rule, you'll get either selected white pine or what is known to the trade as yellow poplar. However, the more expensive pieces of unfinished furniture are often made from a hardwood, with birch being probably the most common used. In general, the dealers use the term "whitewood" to describe their unfinished furniture, while the manufacturers and cabinet-makers are more likely to use the phrase "in the white." ★★★



# Never a rough puff



## Come all the way up to KOOL

### COOL OFFER!

Price includes delivery of the sailboat pictured at right. Complete with 30-lb. polystyrene hull, all fittings, sail, and instructions.

Allow 6 weeks for delivery. Offer expires December 31, 1971, is limited to U.S.A., and to persons age 21 or over.

Important: Make certified check or money order payable to: Kool Sailboat Offer, Mail to P.O. Box 3000, Louisville, Kentucky 40201.

Please send me \_\_\_\_\_ SEA SNARK(S). For each boat I enclose a carton end flap from Kool plus \$88.  Certified check.  Money order. I am 21 years of age or over.

Name \_\_\_\_\_

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Because Kool smokers like the smooth taste, we thought they might like smooth sailing. So we're offering the popular Sea Snark sailboat. Ordinarily about \$120, this unsinkable 11-ft. boat is yours for only \$88 and one Kool carton end flap. So get Kool and stay cool, with the Sea Snark, and the taste of extra coolness.



# Uncommon carriers

Uncommon cargoes? Don't flip. Datsun gives you two great ways to haul.

Seals to Sasswood—the tough Li'l Hustler Pickup. Penguins to Potentates—try the more luxurious 5-Door Wagon.

Both give you 96 horsepower overhead cam engines. Potent in the short haul, reliable in the long. Both have some six feet of bed and floor space.

The Li'l Hustler, for example, has a flat loading tailgate. Slide on a spinet or generator. Hay bales or surfboards. Tie them down—there are plenty of built-in hooks. Slip into the all-vinyl

upholstered cab, flick the neat 4-speed stick and away you go.

And whatever you stash in the easy-load Wagon, you don't have to worry about the easy-to-clean vinyl upholstery. You just relax in full-reclining front buckets. Cool it under tinted glass (all standard equipment). And if shifting the full-synchro 4-speed isn't your style, liberate a hand and foot with the optional 3-speed automatic.

Carry out your plans in a Datsun. The number one selling import truck's just \$1916.\* The perfect-size 5-Door Wagon just \$2350.\*

**Drive a Datsun...then decide.**

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# Detroit Preview: What's New for '72



FORD TORINO has a new impact-absorbing S-frame, coil suspension in rear, longer wheelbase for four-door models

**There's more good sense than new sheet metal as carmakers concentrate on improvements that will save lives and money**

By ROBERT LUND, Detroit Automotive Editor

**E**VERY YEAR, after the new cars come out, Volkswagen prints up a funny folder explaining how the "new" VW can be distinguished from the old, all the way back to 1949. Things like putting air intake slots on the engine lid—1970's big improvement over 1969. Or installing a hood-release latch on the '68 model.

Three of the four domestic auto companies may have to follow VW's lead and issue how-to-tell-'em-apart instruction books when the '72 cars

come out. The only all-new machines out of Detroit this year will be from Ford. And maybe a combination car-truck from American Motors. The others will be improved, beefed up, dolled up, mended and amended. But nothing that'll knock your eye out.

Why no zingers out of GM, Chrysler and AMC? How many reasons do you want? The auto companies have been hurting financially. If buyers don't have it to spend, they get a tune-up, rotate the tires and run the hose over



it. *Reason No. 2:* The cost of tooling to bring out a completely new car has soared to a point where even GM gulps when it gets the bill. The other companies go into a state of shock. *Reason No. 3:* The Government's done so much pussyfooting and equivocating on standards and proposed standards that the auto firms are reluctant to bring out new bodies they'll have to live with for three or four years until the standards are nailed down. *Reason No. 4:* New cars inevitably mean higher prices. There's strong opposition to present prices, as evidenced by the number of owners stretching an extra year or two out of their old cars. Obviously, this isn't the time to kick prices up another \$100.

In addition to holding back on new stuff, the auto companies are also retrenching on the old—dropping models. Chrysler says it will weed out 30 cars. GM may drop that many or more. Ford will dispense with the four-door T-bird and thin Torino and Montego down to four cars per line. American Motors may be the only company to offer as wide a variety of wares in '72 as in '71.

But if you've got a favorite car, don't worry about it falling victim to the hangman. A lot of the weeding out will consist of things like limiting the availability of optional engines—choice of two, instead of three or four—and making you take a bench seat instead of offering both a bench and buckets. Cars will still be built to individual

specifications. But there will be restrictions on the variety of special gear you can order.

There's no major industrywide trend in the works for '72. The hot hardware you've been reading about in *Detroit Listening Post* and elsewhere—electronic fuel injection, energy absorbing bumpers, more service-it-yourself features and air bags, for example—won't be along until 1973, on the '74 models, or later. But there's some gear coming in '72 that most cars will have in common.

● *Disc brakes.* Cars that don't have discs now will switch to them in '72. If there are exceptions at the beginning of the model run, discs will be incorporated as a running change during the course of the year.

● *Better match-up of bumpers* among cars in the same family. If you're driving a GM product, for instance, and smack into another GM car, you'll "kiss" bumpers instead of overshooting or undershooting the opposing bumper and mangling body metal. It will be at least another year before there's a complete matching of bumpers on all cars.

● *Seat-belt retractors at outboard locations,* along with a light on the dash that flashes when the belts aren't fastened. All '72s are expected to carry these retractors.

● *Windshields made more vertical, pushed out and away from the driver toward the hood*—on cars where the body structure will allow it. The goal



THUNDERBIRD is longer, wider, lighter with more legroom and Michelin radial-ply tires now standard  
POPULAR MECHANICS



LINCOLN-MERCURY MONTEGO has 114-in. wheelbase in two-door models, 118-in. in four



Art Concepts by Dale Gustafson

is to get the windshield farther away from the front seat to reduce head injuries in accidents.

Those are the you-do-it-and-I'll-follow-suit items coming on the '72 cars. Here's a rundown on what's in the works company-by-company.

**American Motors:** This was the year AMC planned to knock your eyes out with an all-new line of big cars: Ambassador and Matador. But that program has been shoved into next year. (Also on tap for next year—but no refunds if the company changes the timetable—is a new mini in the 1800-pound class.) For this year, AMC will settle for mostly cosmetic changes. An identification gimmick here, a new strip of chrome there.

AMC's also putting together a surprise package—a compact truck. It will be a pickup built on the Hornet shell. This fall, if everything jells.

**Chrysler:** Somebody at Chrysler has apparently worked out a theory that two-doors are for the young set and four-doors for the old folks. With this in mind, Big C is socking most of its '72 restyling money into sporting up its full-size two-doors. But Chrysler doesn't have a bundle to spend on bending the metal this year, so the changes aren't going to be spectacular.

Chrysler's been trying to scotch a rumor that Imperial, never a big seller, is in danger of being exiled to that vast parking lot in the sky where

Edsel, Nash, Studebaker, Packard and other illustrious names rust in memory. The company says it's keeping Imperial in the catalog and to prove it will be around for awhile, Imperial will have more of its own sheet metal in '72. The car has been sharing sheet metal with the Chrysler, and will continue to do so, but not as much as in the past.

Chrysler has decided to get out of the zip and zoom business and will drop most, maybe all, of its low-volume performance cars in '72. To fill the void, the company will offer a line of do-it-yourself performance kits for customers who want more punch than they can get out of a standard production car. Big C will also offer a new superengine, a 400-c.i.d. job it is working up off its 383-c.i.d. block. But you'll have to buy a big car to get it.

If you've ever driven a Dart or Valiant with a manual transmission out in the boondocks where the roads are rough, you may have had the disquieting but not dangerous experience of having the gearshift slip out of gear. That can't happen on a '72 car because of a new intermediate torque shaft, one end of which will be attached to the frame, the other to the clutch housing.

There's been a lot of activity at Chrysler on two-speed axles. Develop-

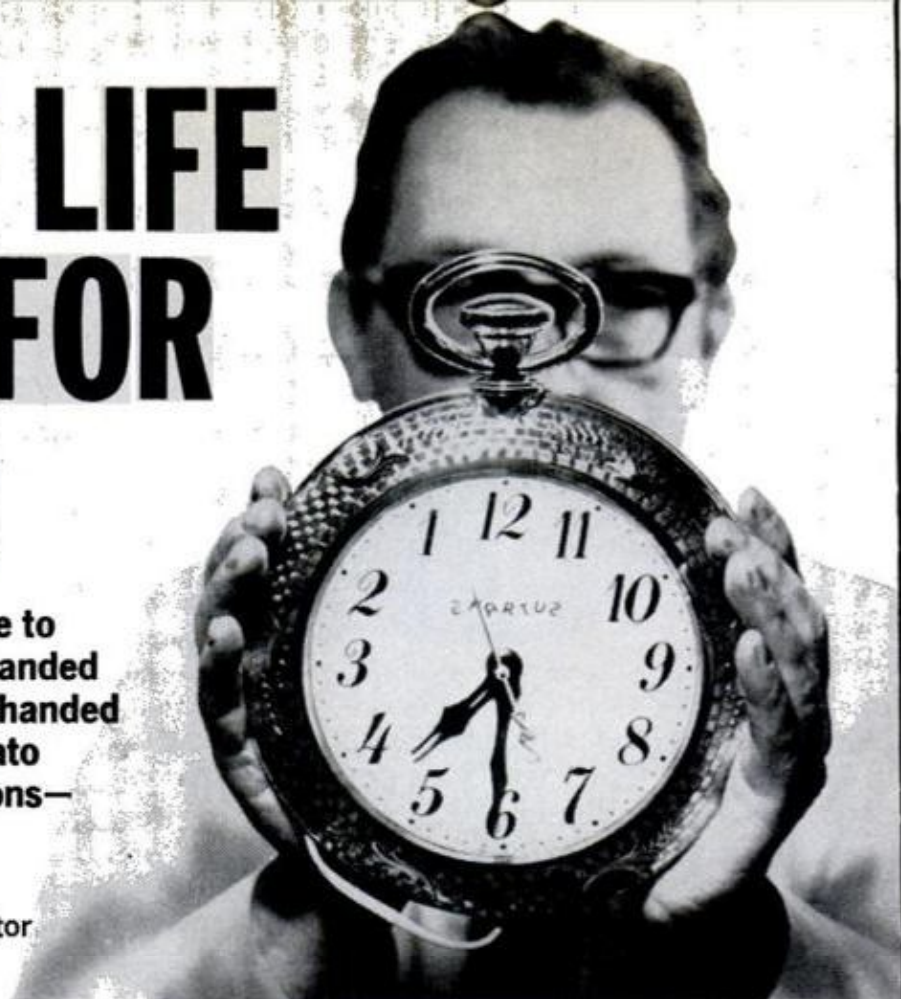
*(Please turn to page 190)*



# MAKING LIFE EASIER FOR LEFTIES

No longer do port-siders have to adapt completely to a right-handed world. Now they can buy left-handed pens, watches, scissors, potato peelers, cameras, electric irons—and even mustache cups.

By JOHN F. PEARSON, Science Editor



**I**F YOU'RE LEFT-HANDED, you know only too well that this is a right-handed world. Many things in daily use—from can openers to school desks—are designed for right-handers. If lefties tend to look awkward, it's because the vise is at the wrong end of the workbench or the potato peeler has its edge on the wrong side of the blade.

That's the contention of June Gittleston, a blonde in her twenties who is working to make life easier for her fellow lefties. About a year ago, she opened The Left Hand, a New York shop specializing in goods for left-handers.

For men there are things like left-handed golf clubs, archery bows, spinning and casting reels, baseball mitts and boomerangs (with wings pitched opposite to those of standard jobs). There are men's watches with the stem on the left side,



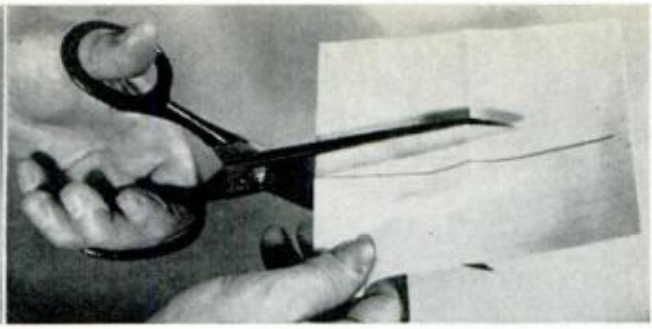
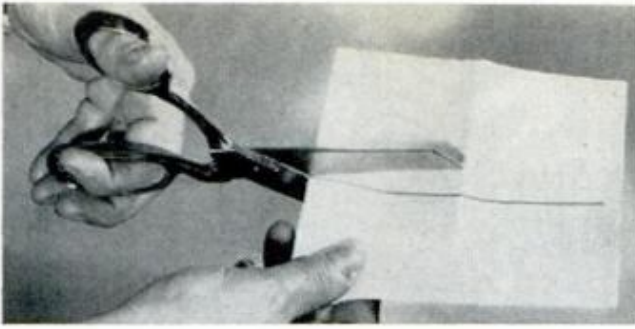
**LEFTIES CAN WEAR** this watch on the right wrist and still work stem without going into contortions



**SOUTHPAW CRICKET BATS** and sailmaker's palms are found in London shop, forerunner of American store

POPULAR MECHANICS





**WHEN LEFTY USES STANDARD SCISSORS** (right), top blade tends to hide line of cut and grip is uncomfortable. Problems are solved in reversed-blade model (left). Clock (opposite page) runs counterclockwise. It's not simply a gag item, says June Gittleston, but it's actually easier to read for the left-hander

port-side mustache cups and, for wine fanciers, corkscrews requiring a counterclockwise twist.

The ladies can obtain essentials like sewing scissors, pinking shears, potato peelers and electric irons. When a lefty uses a standard iron, the cord gets in the way. On a left-handed iron the cord is attached on the left side, away from the work area of the ironing board.

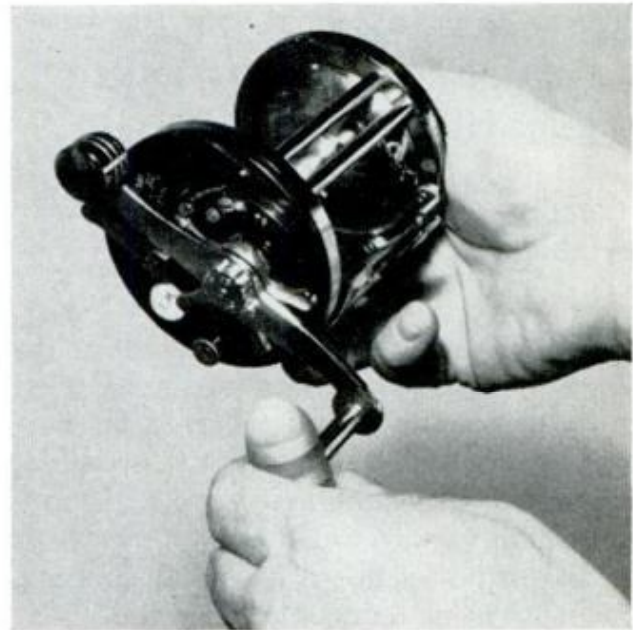
The shop sells a 35-mm Exa camera, said to be the only one made for lefties. Its shutter release is on the left side. Also available are fountain pens with nibs angled to make writing easier for left-handers who write in an "upside down" manner, and guitars for people who find fingering difficult on conventional instruments.

Left-handers are one of the world's neglected minority groups, says June Gittleston. Historically, they have been derided or regarded with suspicion. The French word for left is *gauche*, but it also means awkward (its only meaning in English). The word *sinister* comes from the Latin, meaning "on the left hand." It wasn't too long ago that most schools forced lefties to write with the right hand, causing psychological problems.

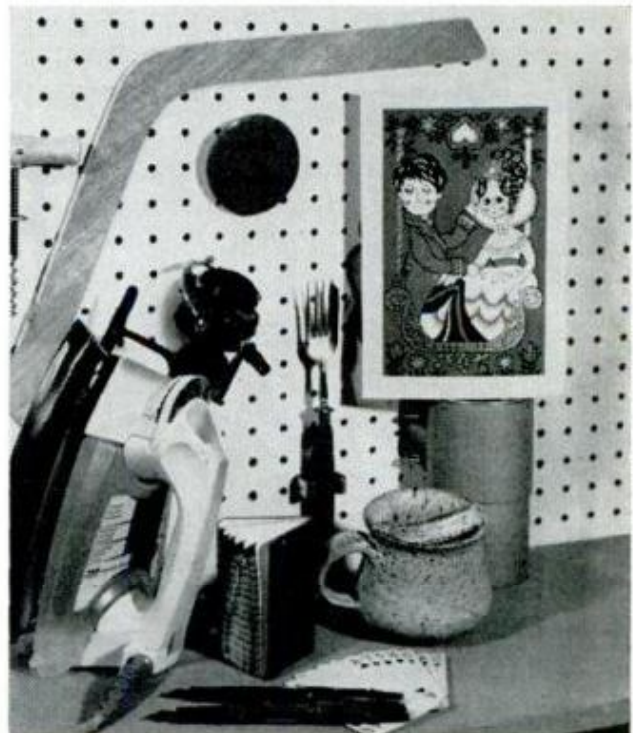
June decided to aid the lefty cause after a trip to London, where she visited a shop called Anything Left-Handed, a pioneer in the field. "I decided I could do that, too, only better," she says. "The proprietors weren't even left-handed."

Much of her business is done by mail. If you need a left-handed item, write to: The Left Hand, 145 East 27th St., New York, N.Y. 10016. ★ ★ ★

JUNE 1971



**NO NEED FOR SOUTHPAW ANGLER** to look awkward—not if he has a left-handed casting reel like this

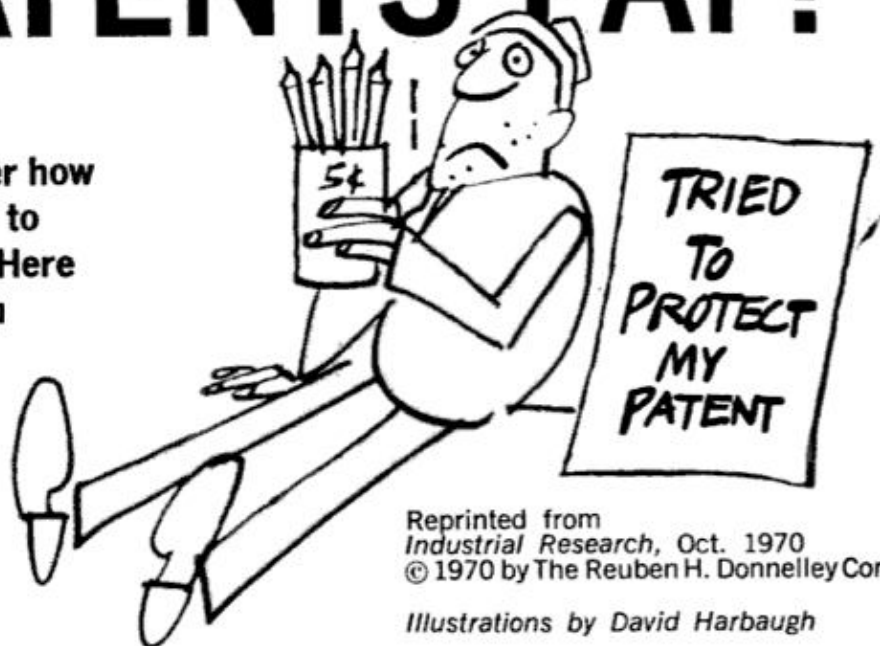


**UNUSUAL ARTICLES** in this grouping include left-handed address book, greeting card, mustache cup



# DO PATENTS PAY?

They may not, no matter how much they're supposed to protect your invention. Here a patent expert tells you what you can—and can't—expect for your money and good faith



Reprinted from  
*Industrial Research*, Oct. 1970  
© 1970 by The Reuben H. Donnelley Corp.

Illustrations by David Harbaugh

By FRANK M. BUTRICK

**I**N 1960, an ingenious Clevelander invented and patented a device used in setting up jigs and fixtures on machine tools. When his patent was issued, he proceeded to manufacture and market the device.

The unit was not a financial success, but the basic concept intrigued most men who saw it—so much so that within a very few years the inventor had accumulated three competitors, all simply making copies of his product. Two of these were small firms, like the patent owner, and the third was a very large one.

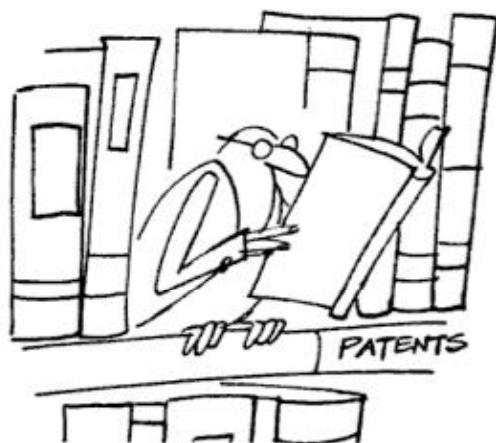
The first competitor was successfully frightened off with a couple of nasty letters from the inventor's attorney.

The second one had to be sued. The patent owner spent over \$3000 and never even got to court. The infringer was able to prove that he had netted less than \$1000 profit, and the patent owner settled for \$1500, a bad bargain. But when he took on the giant firm, things got rougher. He gave up when his legal fees passed the \$5000 mark, again without getting to court.

Ironically, what none of these people knew was that the patent had been anticipated by prior publication in the "Gadgets" section of a magazine, *The Tool Engineer*, in 1949. Not only that, but in two subsequent issues other contributors to this magazine had submitted improvements on the idea originally published.

In short, there were three prior publications. So, in spite of the time, money and energy expended by individuals in three firms, the patent was worthless in the first place.

Is a patent worth having? Yes—IF and the if is a big one—IF the only infringers are likely to be smaller than yourself, with smaller legal budgets. IF the long price has been paid for an absolutely exhaustive search of prior



"And if somebody roosted in a well-stocked library . . ."

The author, a former patent consultant, is assistant marketing manager of the National Twist Drill & Tool Co.

POPULAR MECHANICS



American patents. IF an equally exhaustive search has been made of foreign patents. And IF somebody roosted in a well-stocked library long enough to assure the applicant that his idea has not previously been published in any of the thousands and thousands of technical books, papers, magazines and trade journals.

Or, looked at another way, IF the applicant is reasonably certain his potential competitors are no more willing to make such a serious search than he is.

Part of the routine process of getting a patent is a patent search—prior-art research, normally conducted by the patent attorney or his office or agent, to see if the subject of the application has



*"You could easily exceed the 17-year patent life just searching."*

been anticipated in an earlier patent. Individuals and industry spend many, many thousands of dollars each year going through this process. Each of these individuals and corporations assumes when his patent is issued that he has, in effect, a license to make the product described and to exclude others from doing so.

Yet how valuable is such a patent? Apparently this is left up to a court (after expensive litigation) to determine because a patent is worthless if it defies a number of prohibitions:

1. The idea must not be the mere exercise of ordinary engineering skill.

2. The idea must not be the substitution of new devices, materials, or com-



*"Every library is a time bomb."*

ponents for those used in the past.

3. It must not be mere enlargement of a previous device.

4. It must have more than just change in form, proportions, degree, or arrangement—especially when no new principles or functions are involved in the device itself.

5. It must not be just unification or multiplication of parts, converting from manual to power, making a device movable, adding or omitting parts or functions, and so forth.

In short, only a search of formidable thoroughness through previous patents gives any assurance that a given patent is valid—and it has to be taken to court for an opinion, in order to be certain.

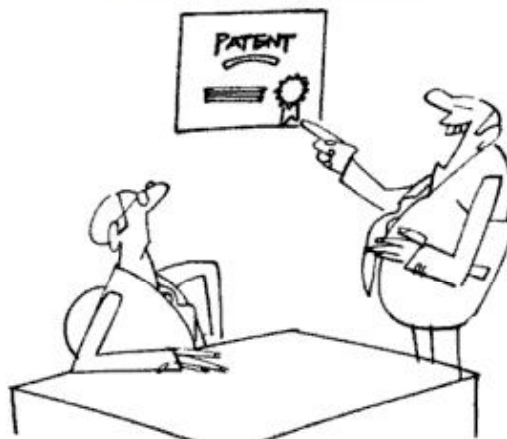
To strictly satisfy the law, the inventor must do the following:

1. Be certain that his idea was not known, or used by others.

2. Make a search through *all* patents in this *and* all foreign countries!

3. Make a search through *all* applica-

*(Please turn to page 168)*



*"Patents can be fun—but one should not take them too seriously."*



# A KILLER SHARK MAY SAVE YOUR LIFE

Sharks can be killers. But researchers hope that from sharks may come immunity to many diseases—and a cure for cancer

PHOTO BY FLIP SCHULKE, BLACK STAR

By GRAHAM YOUNG

**T**HE SINGLE RUNWAY of Bimini International Airport sparkled in bright sunlight. I had flown to Bimini to visit the Lerner Marine Laboratory, famous for its study of sharks. It seemed impossible that from this tiny, out-of-the-way island could come great steps in the fight against cancer.

A crowded bus bounced us from the airport to the lagoon side of South Bimini, and a small, down-at-the-bow launch chugged us across the channel to North Bimini. There, near Bailey Town, I got my first view of the sprawling docks, pens and research facilities of the Lerner Marine Laboratory, a field station of the American Museum of Natural History doing pioneer work with sharks as laboratory animals.

The original Lerner, destroyed by a hurricane, was started in 1948. It, too, had laboratories, shark pens and docks, but on a smaller scale. Bob Mathewson, the energetic director of the new laboratory, rebuilt the long, low buildings with their tropical-style eaves and central breezeway. Now spacious laboratories flank airconditioned offices. Fish and specimen tanks line up behind them under an open-sided shelter.

Mathewson took me on a tour of the installation, then brought me up to date on what his people were doing in shark research. All research is com-

paratively recent, but over the past 10 years the use of sharks as experimental animals has greatly increased. Experimentation with sharks is helping solve problems in human physiology, immunology and virology so that for all its sinister reputation the shark may prove to be more of a benefactor than a menace to man.

National Institutes of Health Researchers are using sharks in their studies of cerebrospinal fluid, cell metabolism and cancer. Much knowledge of kidney physiology, osmoregulation and metabolism is coming from experiments carried out with the aid of the spiny dogfish, a species of shark, at the Mount Desert Island Biological Laboratory in Maine.

Mathewson then gave me the run of the docks and shark pens where I met Dr. Michael Sigel, professor of microbiology at the University of Miami School of Medicine and a research associate of the Lerner Marine Laboratory. Dr. Sigel, with the aid of his island laboratory assistant, Morris Bowleg, was preparing sharks for blood tests.

Each shark in turn was netted, lifted onto the dock and placed in a bath of anesthetizing fluid. A tag attached to a fin was checked and the number on it recorded. The docile shark was then transferred to the operating table. Dr.

POPULAR MECHANICS





**SHARK PENS** at Lerner Marine Laboratory on North Bimini Island fence in specimens used in medical research. At right, anesthetized shark has blood sample removed for studies of cancer prevention in humans

Sigel inserted a hollow needle into a blood vessel just below and in front of the tailfin and drew off the necessary sample.

Over a period of several years, these blood samples have revealed the remarkable story of the shark's double system of immunity, which is infinitely more protective than the more advanced system of immunity known to exist in man.

Sharks have specific antibodies such as our own, which provide protection against specific infection, and then they also have nonspecific antibodies which can defend their system against *any* foreign invasion. This means that if a foreign substance or virus is introduced into the shark's system, it does not usually become ill, as we might, while developing an antibody specifically to deal with that invader. It has another line of defense that destroys the danger while the shark also develops a specific antibody.

Cancer cells, for example, when mixed with shark-blood serum, are killed; so are bacteria and viruses. Discovering the exact nature of this immunity is a prime part of Dr. Sigel's current research program. Further immunological studies of sharks may lead to a better understanding of cancer immunity in man.

However varied and important the bulk of marine research may be, that concerning sharks is bound to grip the public imagination. Dr. Perry W. Gilbert, possibly the most quoted shark expert in the world today, is a research associate at Lerner where he performed much of his early work. He is now director of the Mote Marine Laboratory where I discussed shark research with him. Mote was founded by the noted shark-behaviorist, Dr. Eugenie Clark. From the work of these scientists, as well as many other researchers, emerges what is probably the most complete story of the shark available today.

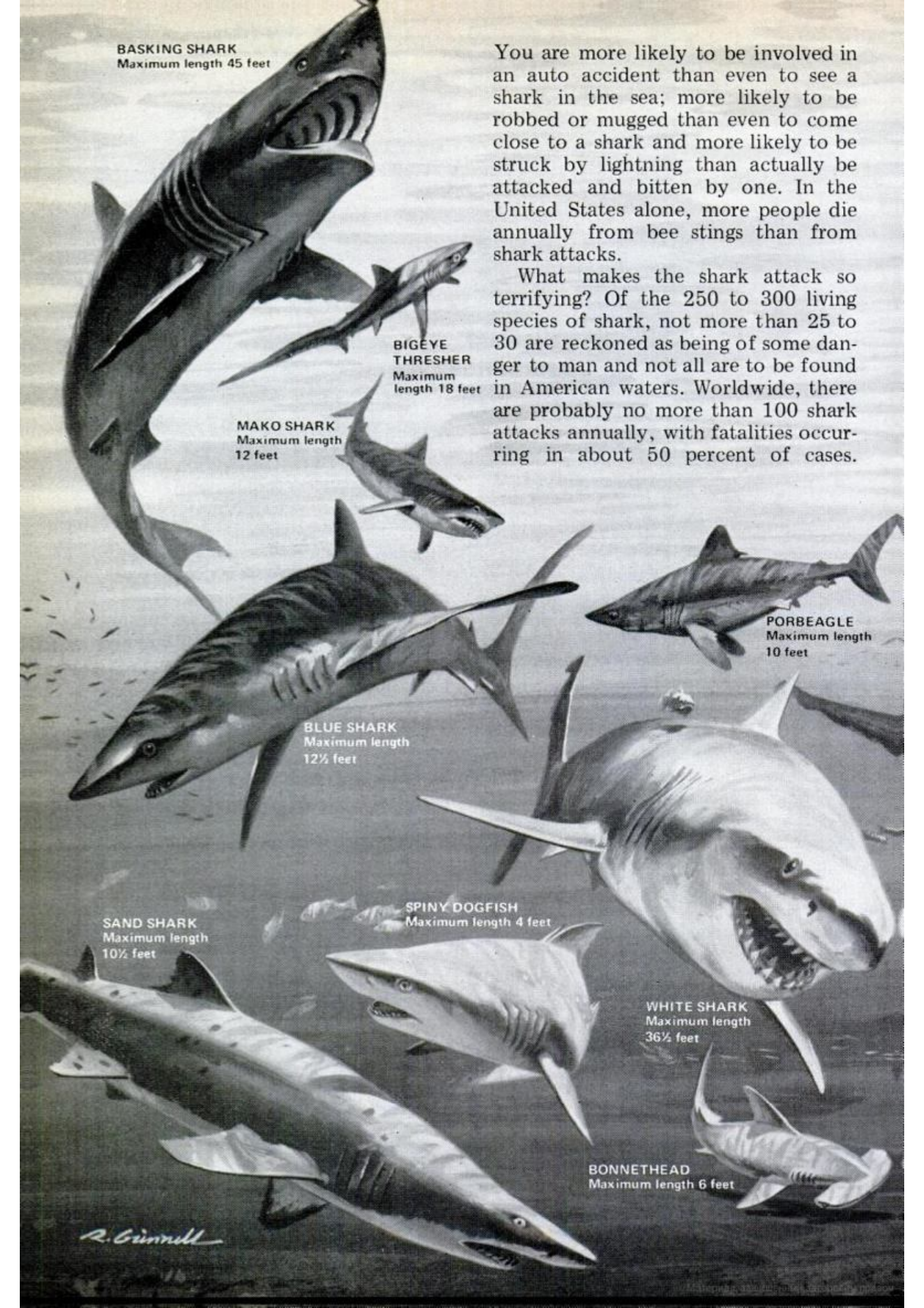
Sharks are found just about everywhere there is water, including many rivers and even some fresh-water lakes. They are common and deadly in such tropical rivers as the Zambezi and the Amazon, as well as in Lake Nicaragua—but a fatal attack is also on record in Matawan Creek, N.J.!

What then are the chances of being attacked right here around the shores of the United States?

What can be done in the event of an attack and how likely is an attack to prove fatal?

However terrifying the possibility of shark attacks sounds, there is solid comfort to be derived from statistics:



A detailed black and white illustration of various shark species swimming in the ocean. The sharks are shown in various orientations, some with their mouths open showing teeth. The background is a simple representation of the sea with some small fish scattered around.

**BASKING SHARK**  
Maximum length 45 feet

You are more likely to be involved in an auto accident than even to see a shark in the sea; more likely to be robbed or mugged than even to come close to a shark and more likely to be struck by lightning than actually be attacked and bitten by one. In the United States alone, more people die annually from bee stings than from shark attacks.

What makes the shark attack so terrifying? Of the 250 to 300 living species of shark, not more than 25 to 30 are reckoned as being of some danger to man and not all are to be found in American waters. Worldwide, there are probably no more than 100 shark attacks annually, with fatalities occurring in about 50 percent of cases.

**BIGEYE THRESHER**  
Maximum length 18 feet

**MAKO SHARK**  
Maximum length 12 feet

**PORBEAGLE**  
Maximum length 10 feet

**BLUE SHARK**  
Maximum length 12½ feet

**SAND SHARK**  
Maximum length 10½ feet

**SPINY DOGFISH**  
Maximum length 4 feet

**WHITE SHARK**  
Maximum length 36½ feet

**BONNETHEAD**  
Maximum length 6 feet



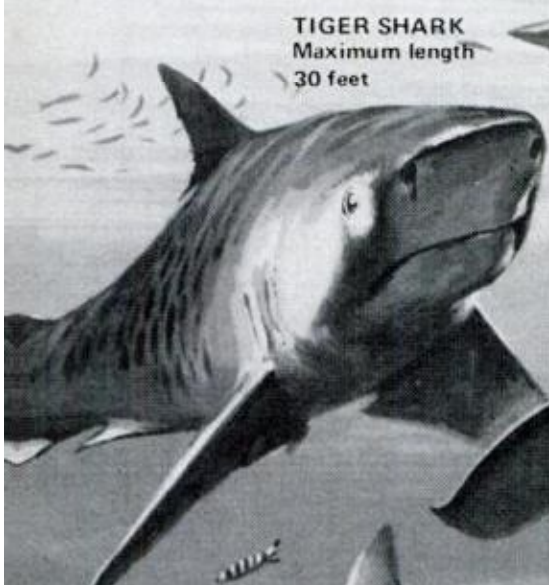
The most dangerous species are those which, when fully grown, range in size from approximately 8 to 18 feet. The nine sharks that have worldwide reputations as man-eaters are the great white, bull, tiger, great hammerhead, lemon, white tip, mako, dusky and blue. There may be more and they are all probably dangerous before maturity, say from five or six feet up. Excepting perhaps for the great white, the aggressiveness of these species varies widely from area to area. The bull shark, for example, which may be the greatest attacker around the coasts of Africa, has a far milder reputation in American waters.

The largest of all, the basking and whale sharks, are not dangerous to


man for they stay closely to a diet of plankton and small fish even though they may reach a length of as much as 45 feet.

Because most of us swim close to shore and in the warmest water we can find, the Greenland, porbeagle, six-gilled and seven-gilled sharks are no real menace, preferring either very cold waters or the deep oceans. In fact, there are no records of attacks by the Greenland shark at all and the only recorded attacks by six and seven-gilled sharks are in aquariums! However, these four sharks may be considered of potential danger to downed fliers or shipwrecked sailors in cold areas of ocean far from land.

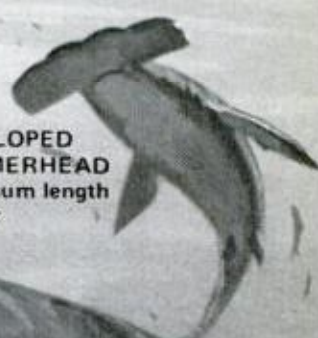
Yet even the mildest and smallest



**TIGER SHARK**  
Maximum length  
30 feet



**SMOOTH DOGFISH**  
Maximum length 5 feet




**SCALLOPED  
HAMMERHEAD**  
Maximum length  
13 feet




**SMOOTH  
HAMMERHEAD**  
Maximum length  
14 feet



**THRESHER  
SHARK**  
Maximum length  
20 feet



**SANDBAR SHARK**  
Maximum length 7-2/3 feet



**DUSKY SHARK**  
Maximum length 11-2/3 feet



shark will defend itself if attacked or provoked. There is a case on record of a lowly dogfish that turned on its young tormenter and inflicted severe arm bites.

Obviously, it is not enough just to leave sharks alone. Many methods of control have already been tested over the past several years, but to date none of them has proved entirely practical or effective.

The old, rigid sharkproof enclosure or fence is largely out of favor because it is at the mercy of storms and shifting seabed. It also limits the swimmer to relatively small areas and is expensive to maintain. The modern practice of "meshing" large beach areas involves the use of tough, flexible gill-nets placed in a staggered pattern out beyond the breaker line offshore. Sharks are caught while swimming through the

net system. While this does not eliminate sharks from the area entirely, it so reduces their numbers that it also reduces their hazard to swimmers. Whenever meshing has been tried, shark attacks have been spectacularly lessened in the immediate vicinity and in some cases eliminated.

Commercial shark fishing can also be employed to thin out the shark population. Intensive fishing in and around the area to be protected has the same result as meshing. The advantage of this system is that it is self-sustaining from the sale of sharkmeat and livers. A disadvantage is that fishing boats cannot operate in bad weather, allowing sharks back into the area.

Bubble screens released from underwater pipes connected to air compressors may work in deterring certain

*(Please turn to page 170)*

## HOW NOT TO BECOME SHARK FOOD

1. Swim in the clearest water you can find, where there is more chance to see and be seen by a shark. A man in the water is a large and unknown quantity to a shark. This alone may discourage him.
2. Use the buddy system; don't swim alone.
3. Never enter the water with an open cut or wound.
4. Swim rhythmically; don't splash. A shark reacts to irregular splashing in the same way it does to the floundering of a wounded fish. If a shark is sighted, don't panic. Swim powerfully but *rhythmically* for the shore or the nearest boat.
5. Wear a face mask, snorkel or scuba outfit. Clearer vision and greater maneuvering power beneath the surface are added safety factors; so is a *dark* wet-suit covering body, arms and legs. With scuba, retreat from sharks along the bottom where you're safer than at the surface.
6. Spearfishing under water is always potentially dangerous. A wounded fish struggles and bleeds, attracting sharks. Immediately put a speared fish into a boat, on nearby rocks or on the beach. Never attach a catch directly to belt or body.
7. Shark hunting is not recommended even with power head, spear gun or bang stick.

Anything but an immediately fatal shot leaves the dangerous combination of a wounded, vicious shark and a diver trying to reload in a hurry.

8. Bright colors attract sharks more than dark ones, as do shiny buckles, wristwatch bands or metallic objects that reflect light and flash under water.

9. Leave sharks alone in the water. However small or harmless, they can all bite savagely when provoked. From early evening until dawn, sharks are more active and aggressive than they are by day.

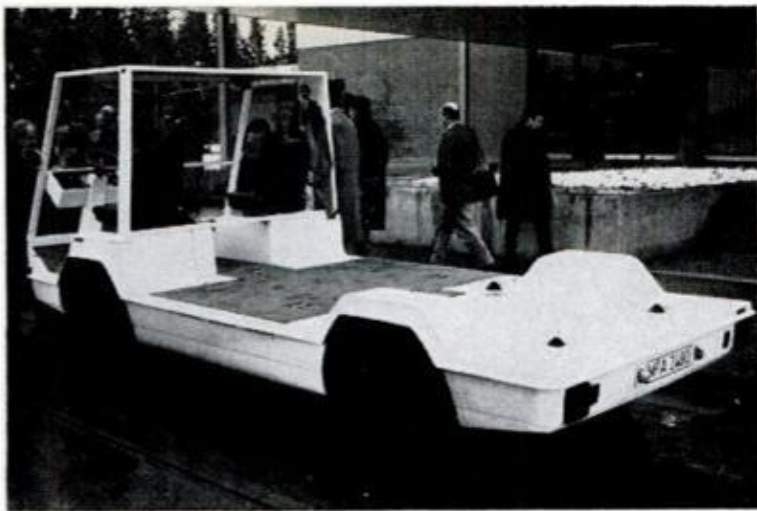
10. Sharks are scavengers and regularly cruise bodies of water where refuse is dumped. Estuaries, bays and rivermouths used as anchorages are all high-risk areas.

11. Diving from docks or ships is not recommended. There are cases on record of sharks attacking such divers almost the moment they hit the water.

12. Don't be embarrassed to ask whether sharks have been reported in the area.

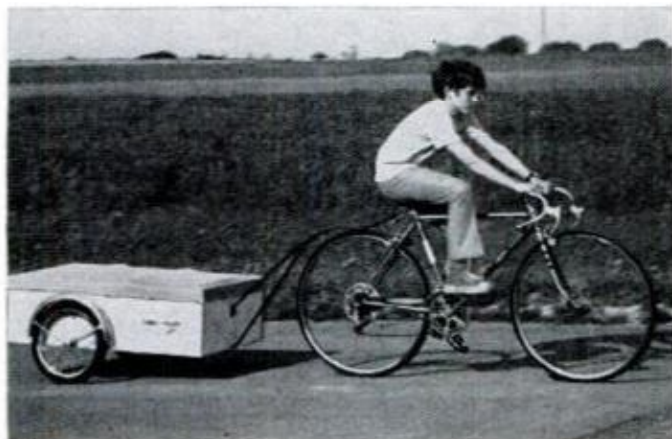
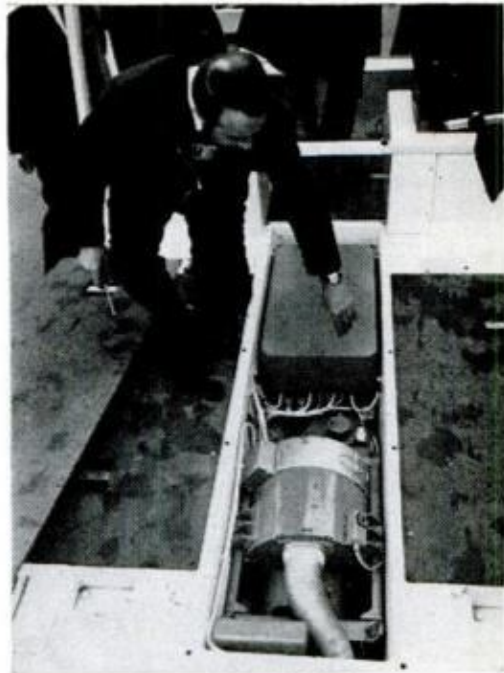
13. If a shark does approach, face it at all times. If it comes closer, try fending it off or banging it hard on the nose with anything handy. In the face of possible attack, don't give up; many sharks have been driven away by a sharp blow on the nose, even from a fist.





## German firms make electric truck

Shown recently in Munich, a new battery-powered, flat-bed truck is described as an "experiment to reduce air pollution." The three-ton vehicle is a product of several German firms working together. Its motor (right) is installed under the truck bed.

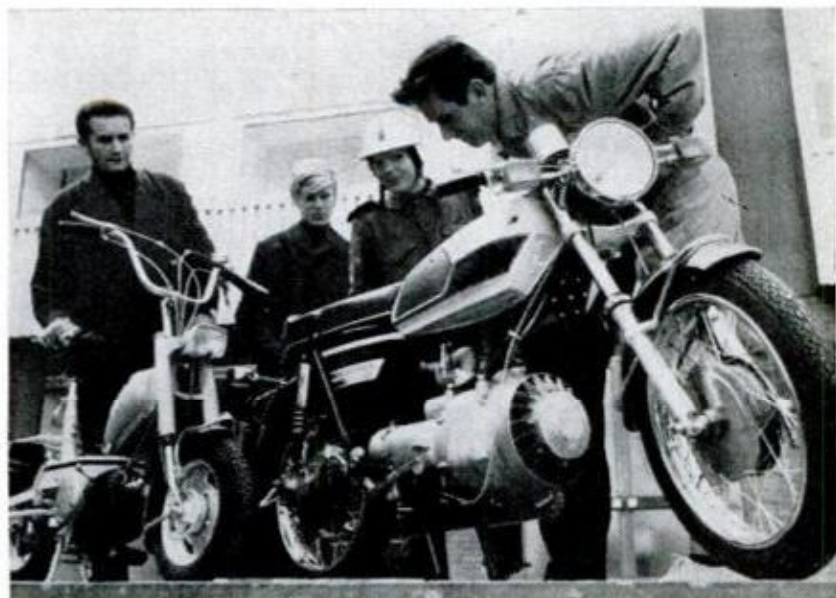


## Single-place bicycle camper comes as a kit

Bicyclers can have the comforts of trailer camping in Bike Mate Jr., a 50-pound camper that comes as a kit. The plywood, aluminum and canvas unit is 40 inches long and extends to 6 feet for sleeping. The kit is \$139.95; Wheel Mate Corp., Box 34, East Petersburg, Pa. 17520.

## Rotaries in cycles

Wankel rotary engines have been adapted for use in motorcycles by a German firm. Two prototype machines, recently shown at an international fair in Cologne, can travel at speeds up to 80 mph. The manufacturer is NSU Werke, a well-known carmaker.





# PM OWNERS REPORT DODGE DART

A Nationwide Survey Based on  
741,000 Owner-Driven Miles

# An



**A**FTER EXTENSIVE shopping and test driving, we decided it was the best car in its class." So said a Maryland analyst about his Dart Demon, adding, ". . .at the time, GM was on strike, so we looked at VW, Toyota, Datsun, Pinto, Maverick, Comet and Renault. For comfort and performance at about \$2500, the Demon appeared far superior."

In addition to these cars the analyst checked out, direct competition in the Dart's wheelbase class (108-111 inches) includes Hornet, Valiant, Nova and Ventura II. Its price range contains some two dozen makes and four dozen models, domestic plus foreign, yet last year Dart placed 10th in the U.S. sales race (Maverick took 3rd, Valiant 7th and Nova 8th). So owners of new Darts had plenty of decisions to make.

"What originally attracted you to the Dart?" we asked on a recent questionnaire.

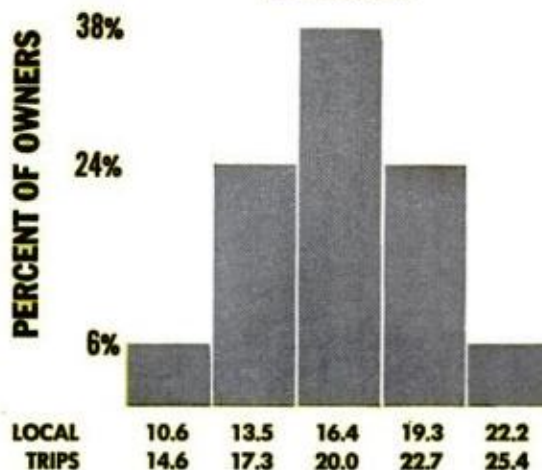
"Low maintenance and excellent dealer service," answered a Pittsburgh potter. "I had 100,000 miles on my 1965 Dart; no trouble, and the dealer is

great," wrote a Pennsylvania steelworker. "Easy for my wife to park, and that's important," said a Jersey police lieutenant. And an Ohio insurance agent mentioned, "I liked the styling and had heard others remark about how long they've gone without problems."

The Dart is one of those untemperamental, predictable machines that does what it's supposed to, and owners agree that it does it well. The Demon and Swinger coupes are far enough out

**DART FUEL MILEAGE CHART**

225-cu.-in. Six





# Almost Quirkfree Car ...But Not Quite

By MICHAEL LAMM, West Coast Editor

Photos by the Author



**OWNERS WOULD LIKE A FLAT DASH TOP**, the wiper switch relocated and the washer pedal taken off floor

to satisfy most drivers' urge for the exotic (only 24.1 percent chose four-door sedans). Flashy performance wasn't what Dart buyers were after. A mere 0.4 percent ordered the 340-c.i.d. V8 and/or four-speed. The majority chose the respected, reliable, amply willing and economical 225-inch Slant Six.

In response to "Have you had any mechanical troubles so far?" 67.4 percent said they'd had none—an above average record. Of those who said yes: "Cotter key broke on gearshift lever.

Fixed it with a bobbypin." "Seat latches do not catch properly." "Minor adjustments on side windows and heater cable." "Transmission cooling line came loose." "Dealers replaced both rear shocks and wiper motor." "Carb needed adjustment." Most mechanical ills were of this minor nature, easily corrected by the dealer.

One unusual area that came in for nagging complaints were the windshield wipers and washer. "Wipers stop for no apparent reason," said an Alabama busi-

**TORSION BARS** up front and asymmetrical leaves behind provide good comfort plus level cornering

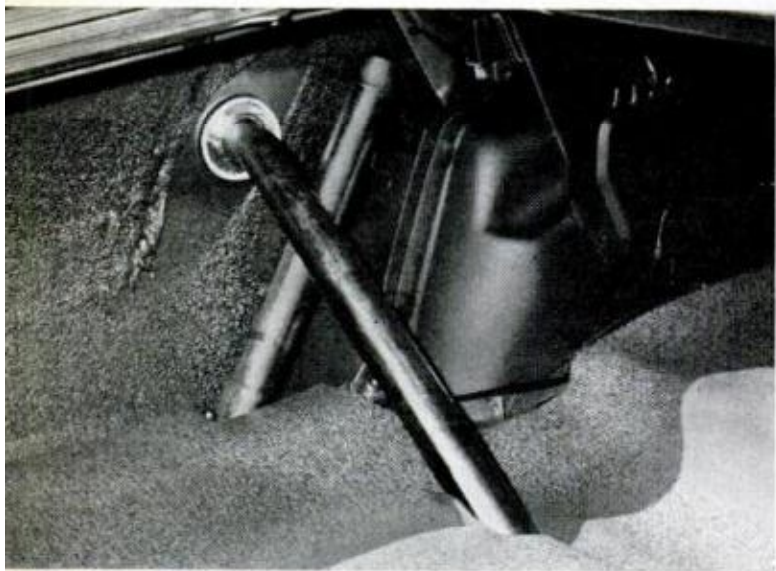
**VINYL SIDE MOLDING** (optional) wards off dings. Snow piles up on the rear bumper, hides taillights



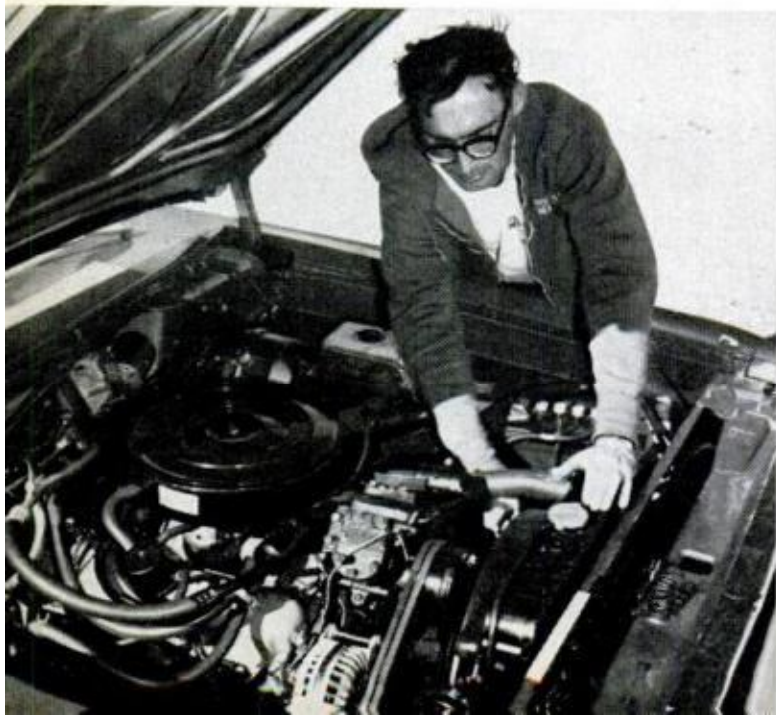




**AMPLE TRUNK** accepts flat luggage, but some owners said they'd prefer space added to rear seat



**GAS FILLER** clutters trunk. Cylinder in corner is vapor separator attached to 17-gallon gasoline tank



nessman. "Relocate wiper blades to improve vision."—Pennsylvania industrialist. "Left wiper does not clear far enough into left corner."—Michigan lathe operator. "Wiper switch is directly behind shift lever, so to turn it on you have to reach through or around the wheel."—Missouri locomotive engineer. Several owners also mentioned the tiptoe (floor-mounted) washer pump, saying it gets in the way and is unhandy to press. The Dart does offer an electric washer, but most salesman don't push it.

Then we asked, "In general, what do you think of your Dodge dealer's policies as to courtesy, sales methods, fair dealings, etc.?" Replies: "Excellent." "Courteous, low-pressure, as fair as any (i.e. buyer beware!)" "Friendly and truthful." "Most outstanding dealer I've known. Salesman continues to handle requests long after sale. Service manager will talk to you!" "Unfortunately it's necessary to shop around because first offers are never fair to the purchaser." "All sales policies are just a game. You have to beg to find out the best deal." "Ruthless, misleading, unfair! I will never buy another car from this dealer nor recommend him to anyone." "Courteous, fair, considerate, patient, eager for the customer to be satisfied."

What do you think of the quality and workmanship of your new Dart? "No complaints." "Poor." "Fine." "Satisfactory." "Typically American—no pride." "Fair, but a little cheap on the dashboard." "Very good." "Good for price of car." "Quality control could be better—paint, especially." "It could be improved, but for the money and compared to other makes in the same class, it's above normal." "Poor, but no worse than expected." "Excellent—my Dart was built in Canada, which may be why." "Fair—interior ornamentation and plastic poorly aligned; paint runs in a couple of spots."

What would you like to see changed

**225-C.I.D. SIX ENGINE** was choice of majority with 318 V8 second. Only 0.4 percent had 340-c.i.d. V8

POPULAR MECHANICS



## Summary of 1971 Dart Owners Reports\*

|                                  |         |
|----------------------------------|---------|
| <b>Total miles driven</b> .....  | 741,114 |
| <b>Average miles per gallon:</b> |         |
| 198-cu.-in. Six,                 |         |
| local driving ..                 | 17.3    |
| long trips .....                 | 19.2    |
| 225-cu.-in. Six,                 |         |
| local driving ..                 | 16.4    |
| long trips .....                 | 20.0    |
| 318-cu.-in. V8, local driving .. | 14.5    |
| long trips .....                 | 17.4    |
| <b>Engines:</b>                  |         |
| 198-cu.-in. Six .....            | 13.9%   |
| 225-cu.-in. Six .....            | 57.4    |
| 318-cu.-in. V8 .....             | 28.3    |
| 340-cu.-in. V8 .....             | 0.4     |
| <b>Transmissions:</b>            |         |
| Automatic .....                  | 83.7%   |
| 3-speed manual .....             | 15.9    |
| 4-speed manual .....             | 0.4     |
| <b>Series:</b>                   |         |
| Demon coupe .....                | 35.1%   |
| Dart 4-door sedan .....          | 9.6     |
| Dart Custom 4-door sedan ..      | 14.5    |
| Swinger hardtop .....            | 40.8    |
| <b>Why the Dart?</b>             |         |
| Styling .....                    | 28.1%   |
| Economy .....                    | 26.8    |
| Past experience .....            | 25.9    |
| Size .....                       | 23.2    |
| Price .....                      | 12.3    |
| Reliability .....                | 7.5     |
| <b>Specific likes:</b>           |         |
| Handling .....                   | 57.6%   |
| Style .....                      | 40.1    |
| Economy .....                    | 35.9    |

|                                     |       |
|-------------------------------------|-------|
| Comfort .....                       | 14.2  |
| Ride .....                          | 13.2  |
| Performance .....                   | 13.2  |
| Size .....                          | 12.7  |
| Power .....                         | 12.3  |
| <b>Specific dislikes:</b>           |       |
| Poor gas mileage .....              | 10.6% |
| Rattles .....                       | 10.6  |
| Poor workmanship .....              | 7.8   |
| Poor materials .....                | 6.4   |
| Bad dealer service .....            | 6.0   |
| <b>What changes would you like?</b> |       |
| Better workmanship .....            | 9.5%  |
| Better wipers .....                 | 8.9   |
| Rear vision .....                   | 8.4   |
| More legroom .....                  | 7.8   |
| More headroom .....                 | 7.8   |
| Bigger trunk .....                  | 6.7   |
| Change seat style .....             | 6.2   |
| <b>Had any mechanical trouble?</b>  |       |
| No .....                            | 67.4% |
| Yes .....                           | 32.6  |
| <b>What kind of trouble?</b>        |       |
| Brakes .....                        | 13.0% |
| Carburetor .....                    | 10.4  |
| Transmission .....                  | 10.4  |
| Electrical .....                    | 9.1   |
| Wheel bearings .....                | 7.8   |
| Cold starts .....                   | 6.5   |
| <b>Did you repair it yourself?</b>  |       |
| No .....                            | 97.4% |
| Yes .....                           | 2.6   |
| <b>Dealer repairs satisfactory?</b> |       |
| Yes .....                           | 58.7% |
| No .....                            | 41.3  |

|  |       |
|--|-------|
| <b>Is the Dart your only car?</b>                          |       |
| Yes .....  | 51.7% |
| No .....   | 48.3  |
| <b>Other cars owned:</b>                                   |       |
| Dodge .....  | 37.8% |
| Chevrolet .....  | 15.0  |
| Ford .....   | 11.5  |
| Plymouth .....   | 10.6  |
| Pontiac .....  | 9.7   |
| Volkswagen .....   | 8.8   |
| <b>Accessories/power options:</b>                          |       |
| Automatic transmission ..                                  | 83.7% |
| Power steering .....                                       | 51.9  |
| No accessories .....                                       | 38.1  |
| Airconditioning .....                                      | 31.2  |
| Vinyl top .....  | 18.6  |
| Whitewall tires .....                                      | 14.0  |
| Tinted glass .....   | 11.2  |
| Power brakes .....   | 9.1   |
| <b>What accessories/options would you order next time?</b> |       |
| The same .....   | 57.1% |
| Airconditioning .....                                      | 12.0  |
| Power brakes .....   | 10.6  |
| Power steering .....                                       | 8.8   |
| Rear defroster .....                                       | 5.5   |
| <b>Age distribution of owners:</b>                         |       |
| 15-29 years .....  | 28.5% |
| 30-49 years .....  | 38.2  |
| 50-plus .....  | 33.4  |
| <b>Would you buy another Dart?</b>                         |       |
| Yes .....  | 77.9% |
| No .....   | 22.1  |

\*Percentages might not equal 100% due to rounding and/or insufficient data.

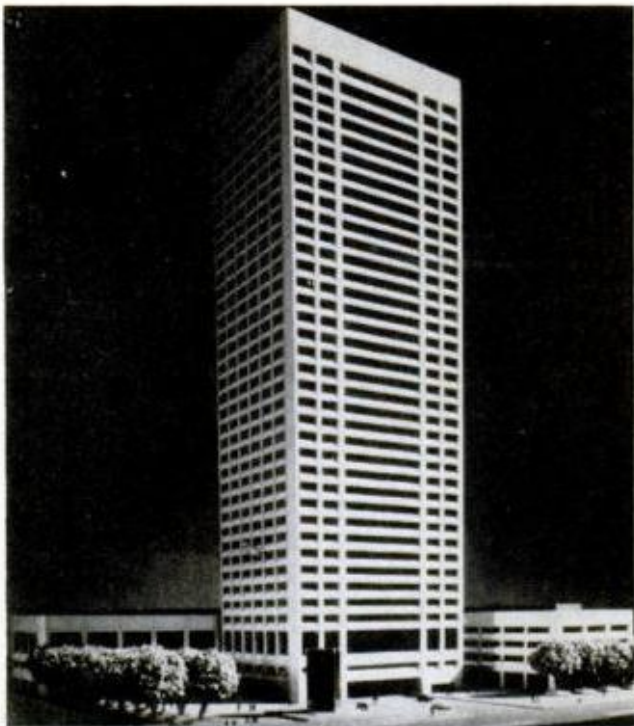
in your Dart? "Add front vent wings." "More rear legroom." "Cars should be built with 1935 rear seats. Who needs all that trunk when a large back seat would be twice as practical." "Drop the price." "Make the dashboard top flat so it forms a shelf." "Better workmanship." "Something to indicate center of the hood as a guide." "Seat belts are now separate for shoulder harness and lap; should be combined." "Move shoulder harness forward four inches for better comfort." "Two inches more headroom." "Move windshield washer pedal or give us a better system."

*How about specific complaints?* "Lots of wind noise at speed." "Tall driver can't see high-beam telltale." "Lousy wipers." "Gas filler slops gas, brakes are slow to react." "Amount of pedal pressure required to stop car." Rear window collects snow, as does bumper, which obscures taillights." "Wind noise, and at 78 mph rear end starts to float and bounce in crosswind." "One-year warranty." "Too many safety straps—

eight on the front seat alone." "Rear passengers can't see over high front seatbacks." "Can't open windows in rain; no vent to exhaust smoke." Of all Dart owners, 24.3 percent said they had no complaints.

Finally, we asked, "All things considered, what are your specific praises of the car?" "The Slant Six—the body will never last as long." "Solid, economical." "Good performance, looks, gas mileage, easy to handle and park." "Handles nicely, excellent in winter driving, well balanced all around." "Like the roadability on turns and comfortable ride due to torsion bars." "Good gas mileage." "I like everything about it—handling, size, style, power, performance." "Excellent handling, especially on ice and snow." "It serves its purpose." "It's the right size for commuting; the 225 Six is real gutsy, with reasonable economy. As far as I'm concerned, the Dart is just what the Volvo used to be before it went American." ★★





## Freezing for building

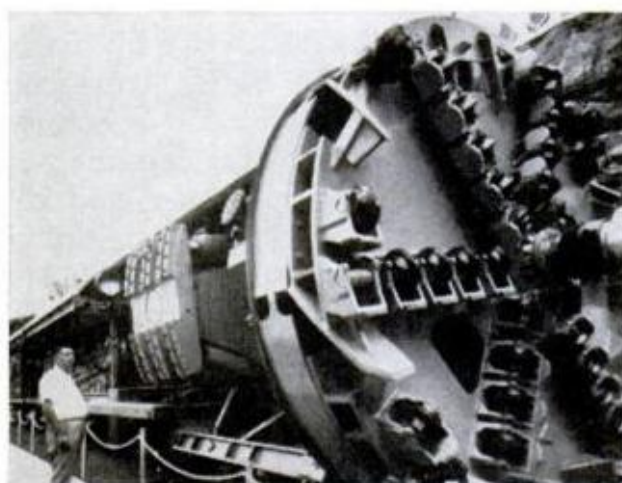
Engineers used the novel method of freezing the ground before drilling holes for concrete pillars that support the new Marine Midland Center (model, above) in Buffalo. Around the site of each of 24 pillars, pipes (upper right) carried refrigerant down some 40 feet to bedrock; then holes were drilled (right) and concrete poured. The frozen earth kept ground water out of the excavations.



## Spectra I

Spectra I is a two-engined mini-hovercraft that will travel over land, water and snow at speeds up to 60 mph. The craft, which has a 25-hp propulsion engine and a 20-hp lift engine, is manufactured by MHV Industries, Ltd., of Ottawa. It was first introduced in 1969, but since that time has been modified; improvements include a new neoprene skirt to reduce spray over water.

80

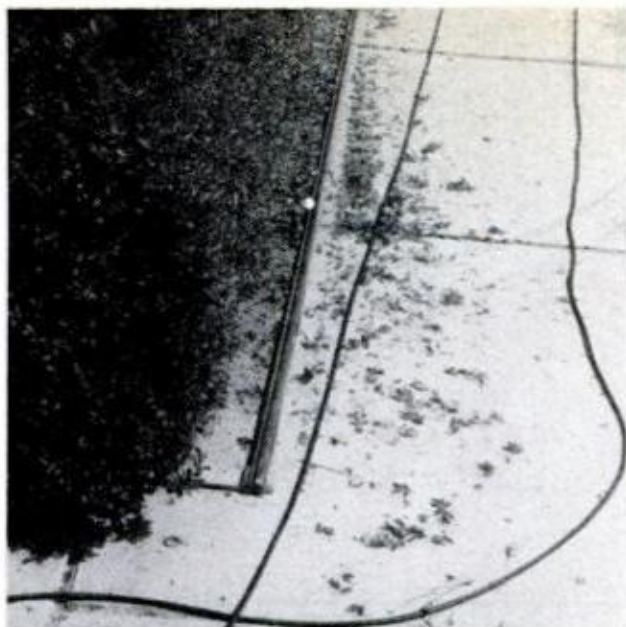


## 'Mole' digs in South Africa

An eight-mile-long tunnel is being drilled through a mountain in South Africa to form a link in a new canal under construction in the Orange River Project. The "Rock Mole," a giant tunnel-drilling machine (shown), was recently imported from the United States to cut through the mountain. Its drill points are arranged in a circle and can cut through rock at a rate of 10 feet an hour.

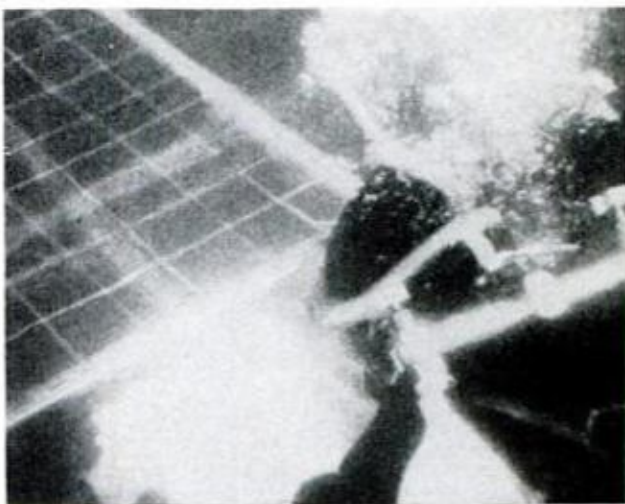
POPULAR MECHANICS





## Hedge trimmer on a track gives a straight cut

A homemade, three-wheeled rig that's guided by a wooden track (left) enables S. E. Hebert, Grosse Pointe Woods, Mich., to come up with a perfect hedge trim every time. An arm on the device adjusts to hold electric trimmers horizontally or vertically. With two wheels of the rig in the track, it makes a straight cut as Hebert pushes it.



## Scuba archeologists learn to map underwater 'finds'

One of the techniques taught by Dr. John Weachter to underwater archeology students in England's Institute of Archeology is that of carefully plotting underwater "finds." A 40-foot-square grid is marked out over a simulated wreck with stakes and tape. Using a plastic board and grease pencil, students dive on the "wreck" and map the artifacts on their boards.



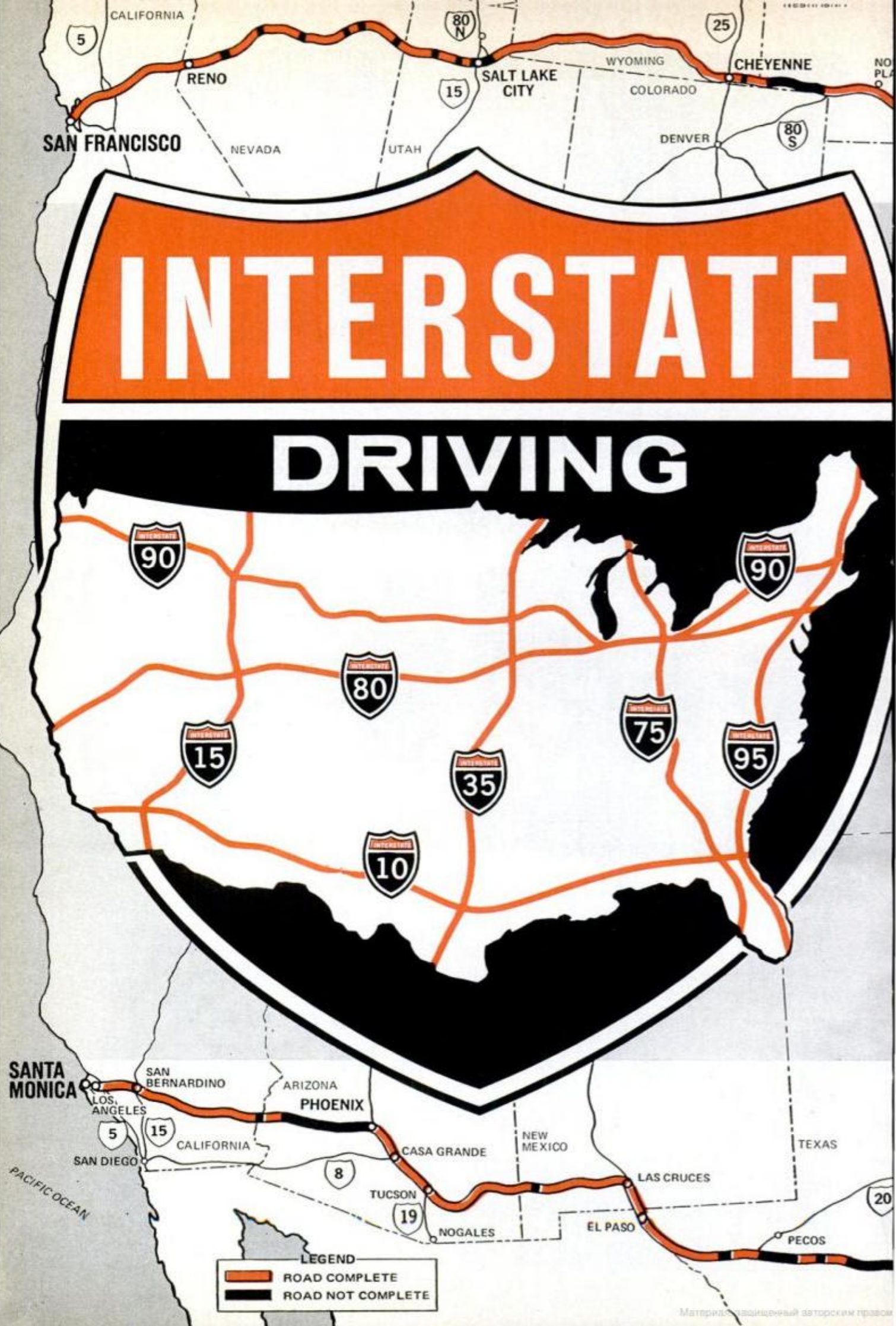
## Sports or cargo ACV

Two versions of the Hoverover air-cushion vehicle—a two-seat sports ACV and a single-seat cargo-carrying machine—are being produced by Canahover Div. of Bogue Electric Manufacturing Co., Paterson, N.J. The two models are virtually identical; the industrial version, however, has a cargo well aft of the operator. The craft is powered by three engines, two of which provide thrust through ducts at the rear. The third engine supplies lift. The 16 $\frac{1}{4}$ -foot vehicle travels 40 mph over land, 35 mph over water.



# INTERSTATE

# DRIVING



**LEGEND**  
— ROAD COMPLETE  
— ROAD NOT COMPLETE





# How to Plan Ahead and Get the Most From the Interstate Highway System

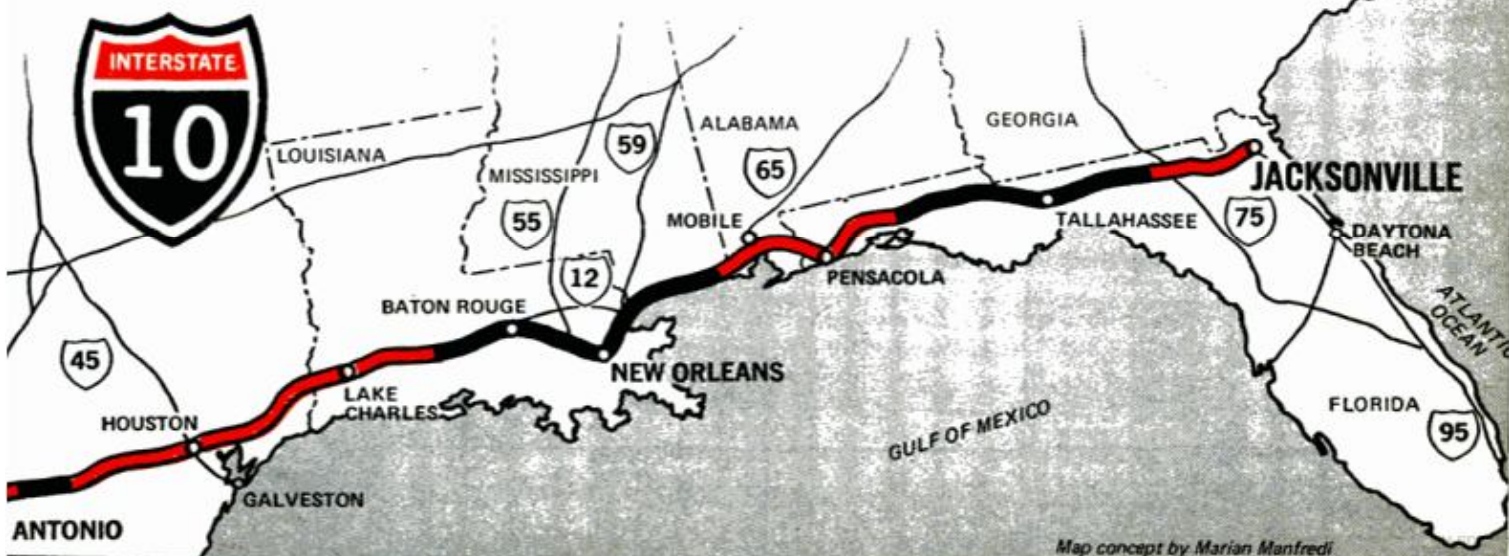
By MICHAEL LAMM, West Coast Editor

**A** SURE WAY TO MISADVENTURE is to just grab a map and go. Long-distance vacation driving should be the family's adventure of the year, but can turn sour and result in many a midnight ride in search of motel or campground—if you don't do your homework.

Only 10 or 15 years ago daily driving range was uncertain; it was hard to estimate how many miles you could cover a day and where to plan your overnight stops. Today, the near-complete Interstate Highway System promises a more certain and greatly increased range. You can go faster and farther on a vacation or business trip. In 1956 travelers on pre-IHS routes averaged 1300 miles on 10-day vacation trips. In 1970, a survey showed that drivers now average 2400 miles on 10-day trips—an increase of almost 100 percent. Stretches that used to take all day 15 years ago now take only a few hours. You bypass or whiz across cities and towns; hills are gentle grades; the roads are wider, and you're well separated from the glare of oncoming headlights; interchanges are limited access; signs and markings, nationwide, are uniform and logical. Logical, that is, once you know the code.

*If you know the sign numbering system, if you compute your fuel consumption and plot your day's driving, and if you pick the right maps and guides and know how to use them—you can roll up the miles without a single time-consuming delay and arrive at your motel or campground on schedule.*

**HOW TO READ INTERSTATE SHIELDS:** Interstate routes have either one or two-digit numbers: even for east-west, odd for north-south. You will find shields, though, with three-digit numbers. If the first figure is even, it designates a loop through or belt around a big city (example, Interstate 240 around Memphis). Three-digit numbers with the first figure odd denote spur routes—offshoots that may or may not connect with adjacent Interstates. Long-distance Interstate shields are red-white-blue; white-green shields mark routes that serve business areas from Interstate interchanges.



Map concept by Marian Manfredi





**I-80** is the longest Interstate, bisecting the country in nearly a straight (that is, for a highway!) line in its run from New York to San Francisco (see map on pages 82-83). It has, however, in a New Jersey portion of its 2910-mile length, an incomplete section that forces you to leave the fast, smooth new concrete and get into a super bottleneck. It's a heavily traveled stretch, and you won't be alone in the crawl along Route 46 through Hackettstown.

There's a 100-mile stretch of I-80 between Laramie and Rawlins, Wyo., that, contrary to some maps, is open. The National Safety Council's map carrying a 1971 copyright, for example, shows the stretch incomplete. Most maps are published annually. Some oil company maps will be hot-off-the-press at newsstand time of this issue of *PM*. Some will be marked '71/72', but even they may be inaccurate in their projections of IHS opening dates. Since incomplete little bits and pieces of Interstates—such as those on I-80 between Salt Lake City and Reno—are opened when ready without much fanfare, oil company touring services are not always aware of the openings, and even their master maps can't be kept up to date.

Driving unopened portions of I-80 between Salt Lake City and Reno causes little lost time since you use the original U.S. 40 with no appreciable detours.

**I-10** is the southern comfort route—if you've got airconditioning in your car! When complete, I-10 will connect Jacksonville, Fla., with Los Angeles. Several long stretches, however, are yet to be completed. Most formidable are a 200-mile stretch across the Florida panhandle; a shorter but more confusing section both east and west of New Orleans; and a long haul (350 miles) through Texas between San Antonio and El Paso. A length of I-10 running west from Phoenix for about 100 miles is also not open, but is not a particularly difficult drive. From just before the California border—formed here by the Colorado River—you've got clear sailing all the way to Santa Monica where

#### INCOMPLETE INTERSTATES

Among incomplete sections of the Interstates shown in the accompanying maps, some are under construction, others are in the engineering right-of-way stage, and a small percentage are in a preliminary status with public hearings being conducted on route locations. Predicted dates of opening that appear on many maps are subject to innumerable variables, from weather to shortage of construction materials. As sections are opened, they are recorded by the U.S. Department of Transportation, Federal Highway Administration, Washington, D.C.







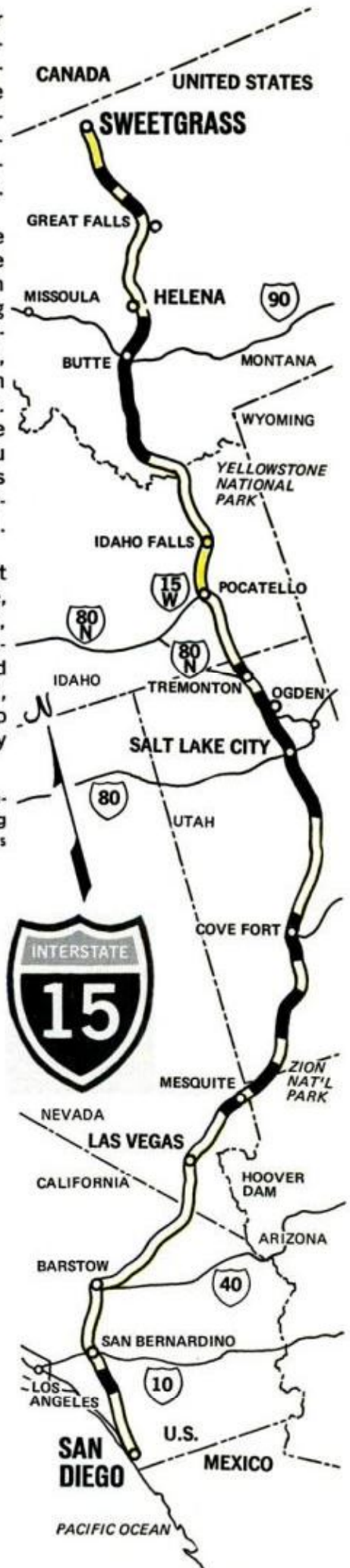
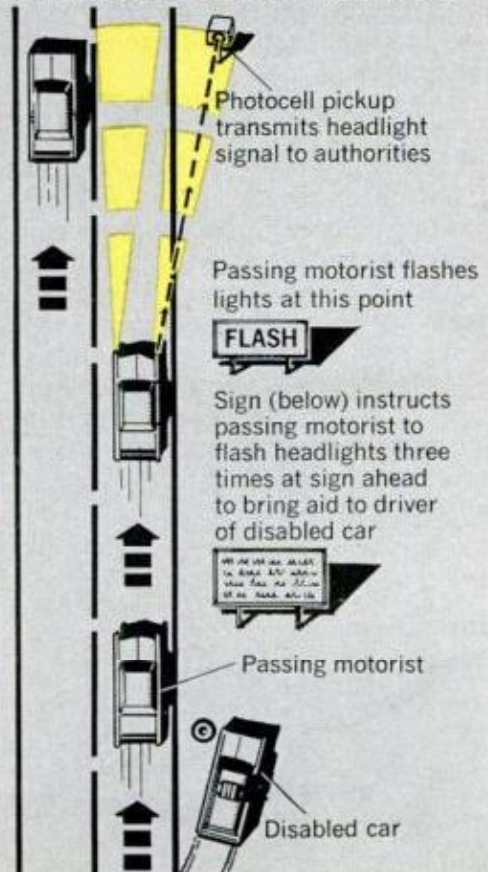
I-10 terminates and connects with another highway in the Interstate System: I-5. Running north-south, all the way from the Canadian border to San Diego, I-5 is part of the complex Interstate system. Generally, however, other Interstates are shorter interconnections rather than the long, coast-to-coast or border-to-border routes shown here.

**I-95** connects the outback of Maine with the glitter of Miami. It's the longest of the odd-numbered, north-south Interstates. It's the route of vacationing Easterners, with Florida the favorite destination. Several small gaps still dot the route, but the most formidable incomplete stretch is that through South Carolina and Georgia. The over-200-mile break forces you to use U.S. 15 and 17 for the leg which takes you through Savannah. For now, this break leads experienced Florida commuters to use alternate Interstates such as I-75, 85 and 81.

**I-75** also ends in Florida at Tampa. It begins at Sault Sainte Marie, Mich., and runs through Detroit, Toledo, Cincinnati, Knoxville, Chattanooga and Atlanta, on its nearly complete, southward course. Three gaps—in Northern Michigan, Tennessee and Georgia—are currently no more than 50 miles each and are bridged by

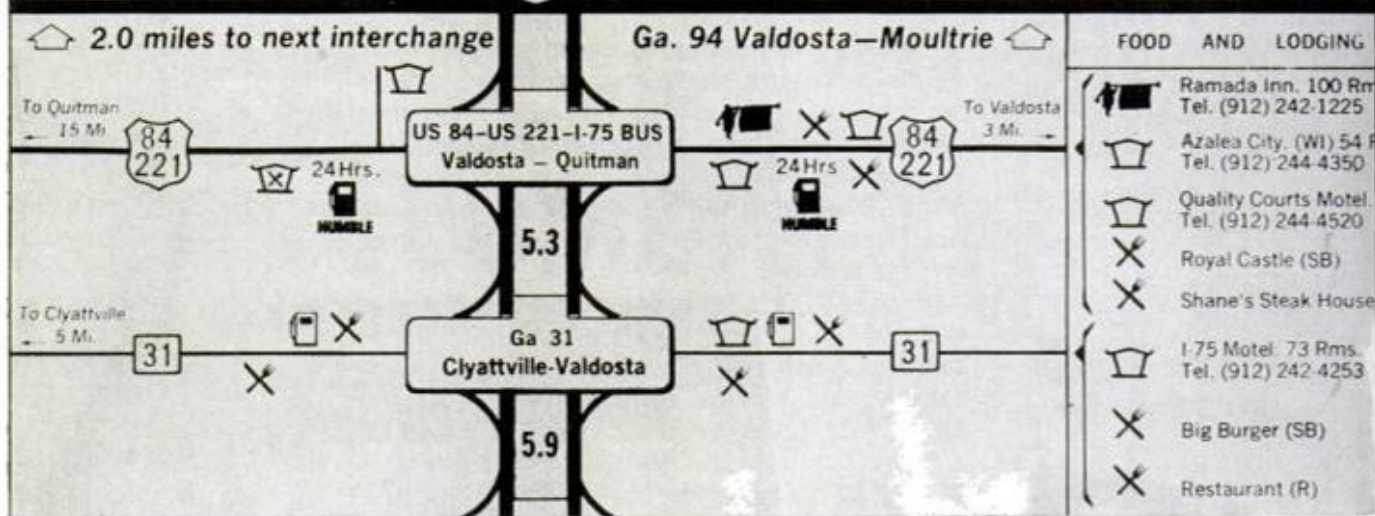
**COMMUNICATIONS MONITORING** of Interstates includes CB radio and systems such as this enabling passing motorists to send aid to disabled vehicles

### FLASH AND TELL





# Interstate Pictograph



**STRIP MAPS** for Interstate routes are available from various sources. The best is the "Interstate Pictographs" presentation of Humble Travel Club, currently available only for New York to Florida via two routes, I-95 and I-95/85/75. Typical section, shown here, illustrates how each interchange sign is shown as it actually appears on the road. All services half a mile in either direction of the interchange are detailed

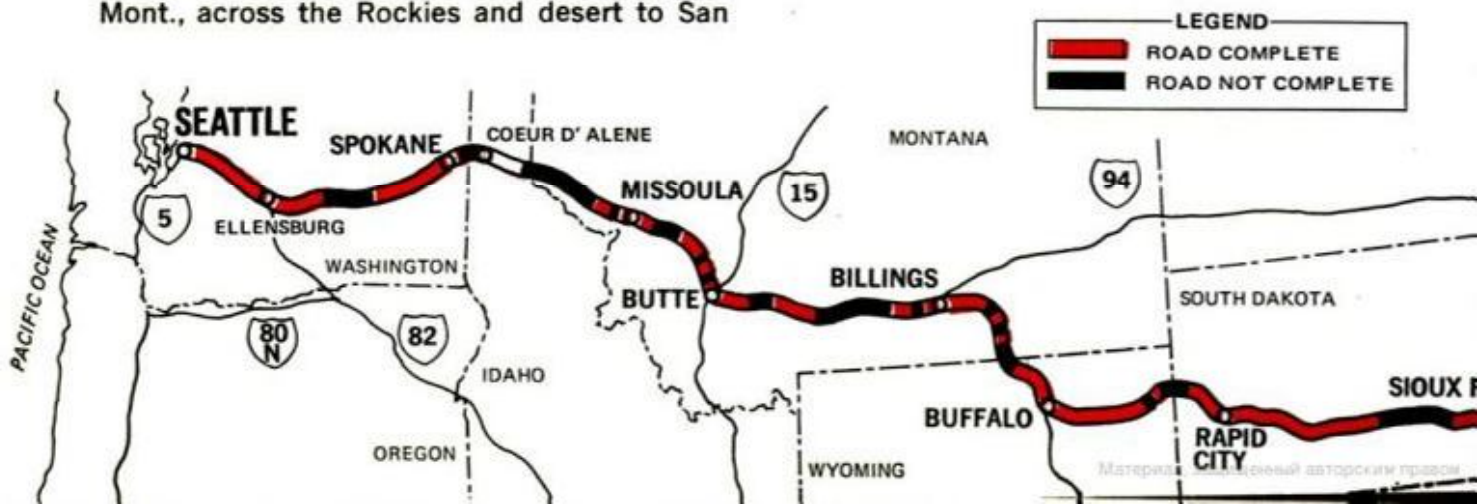
local roads that closely parallel the portions of I-75 under construction.

**I-35** is the midwest's north-south express route from Duluth to Laredo and all points between—the Twin Cities, Des Moines, Kansas City, Wichita, Oklahoma City, Dallas/Fort Worth, Austin and San Antonio. To provide service to both Fort Worth and Dallas, I-35 splits just north of the two cities into 35E and 35W. If neither is your destination, 35W through Fort Worth is the more direct. Of the gaps in I-35, some are under construction, others have only proposed route locations. One such stretch between Kansas City and Wichita can be bridged using U.S. 50 through Waverly and Lebo or a combination of I-70 and the Kansas Turnpike if you want the faster, although slightly longer, route.

**I-15** when complete, will make the long, rugged trail from Sweetgrass, Mont., across the Rockies and desert to San

Diego, a much smoother trip. I-15 replaces U.S. 91 which is the original route and the one still used between gaps in Interstate construction. The two biggest incomplete stretches—between Helena and Idaho Falls and between Salt Lake City and Las Vegas—are formidable obstacles to setting driving time records, but at least are not sprinkled with construction flagmen pointing to detours.

**I-90** provides clear sailing for any Bostonian on his way to Seattle—until he gets to the Wisconsin-Minnesota border at La Crosse, that is. I-90 is complete to that point but from there on it's more westward whoa than westward ho! Alternating complete and incomplete sections from the Mississippi westward keep you bouncing from wide, high-speed I-90 onto U.S. 16 and 10 and back again. Definite route locations of I-90 have been determined, construction is under way and sections will open as soon as ready. ★★ ★





## CAMPING AND TRAILERING

IF YOU PLAN TO CAMP or trailer along the Interstates this season, the following guides and directories will come in handy:

**Campground Atlas of the U.S. and Canada.** Lists over 16,000 campgrounds on detailed maps. \$3.95. Kalmbach Publishing Co., 1027 7th St., Milwaukee, Wis. 53233.

**Campground & Trailer Park Guide.** Lists more than 15,000 campgrounds in the United States and Canada. \$4.95. Rand McNally & Co., Box 7600, Chicago, Ill. 60680.

**Campground Guide for Tent and Trailer Tourists.** Lists facilities in the United States (including Alaska) and Canada. \$1.50. Campgrounds Unlimited, 505 Main St., Blue Rapids, Kans. 66411.

**Camping in the National Park System.** 20 cents. Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

**Camping Maps, U.S.A.** \$3.95. **Camping Maps, Canada.** \$2.95. **Private Campgrounds, U.S.A., and Overnight Trailer Parks.** \$3.95. All from Glenn & Dale Rhodes, Box 2652, Palos Verdes Peninsula, Calif. 90274.

**Camping the National Forests.** 20 cents. Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

**Don Parry's Guide to Northeast Camping Areas.** \$2. Outdoor Publishers, Box 155, Rocky Hill, Conn. 06067.

**Kampgrounds of America, Inc.,** Box 1138, Billings, Mont., 59103, issues free directory of its privately owned campgrounds.

**National Assn. of Campers & Hikers,** 7172 Transit Rd., Buffalo, N.Y. 14221, distributes **Camper Guide** to members. Family membership is \$5; renewal, \$3 per year.

**Red Cross First Aid Textbook.** 75 cents. Available at any local Red Cross chapter

**Sunset Western Campsite Directory.** \$1.95. Lane Bock Co., Menlo Park, Calif. 94025.

**Travel Trailer Guide.** \$3.95. Lists and maps over 15,000 U.S. trailer parks. Rand McNally & Co., Box 7600, Chicago, Ill. 60680.

**Travel Trailer Park Guide.** \$1. Mobile Homes Manufacturing Assn., 20 North Wacker Dr., Chicago, Ill. 60606.

**Woodall's Mobile Home & Travel Trailer Park Directory.** \$2. Trailer Travel Magazine, 740 North Rush St., Chicago, Ill. 60611.

**Woodall's Trailering Parks & Campgrounds.** \$3.95, plus 55 cents postage. Woodall Publishing Co., 500 Hyacinth Pl., Highland Park, Ill. 60035.

## MAP AND GUIDE SOURCES

ALL MAJOR OIL COMPANIES issue state and regional maps that include the Interstate Highway System, but listed below are special maps and guides that focus on the IHS specifically. Many are free for the asking.

Most major oil companies also provide trip-planning and travel services, sometimes to all credit-card holders, more often to members of their "travel clubs." If you're planning a long trip, joining such a club can be well worth the nominal cost. For one thing, they usually hand out quite comprehensive atlases and guides.

The list below is representative of what is available. In addition, car-rental agencies, RV dealers, automakers' public relations departments and motel associations offer free maps and guides.

**American Oil Co.** Dealers distribute four free regional map/brochures that include Interstate strip maps. Each shows mileage tables, motel listings, reservation information, interchanges and indicates toll roads and incomplete sections of the IHS.

**Conoco.** Dealers distribute free 16-page **Touraide Interstate Travel Guide**, which has four maps, comprehensive travel details (mileage charts, temperature, humidity tables).

**Humble Oil Co.** Humble Travel Club provides perhaps the most complete, detailed strip maps available. The first (and, so far, only) "Interstate Pictograph" gives mile-by-mile account of two IHS routes to Florida from New York. It shows motels with numbers of rooms, restaurants, cafes, campgrounds, major intersecting routes, mileages between cities and interchanges and much more.

**Marathon Oil Co.** dealers distribute a map of Interstate 75 with Marathon station locations. Marathon Travel Bureau distributes Rand McNally **Road Atlas and Travel Guide**.

**Mobil Oil Co.** Among several major oil companies that distribute **Travelaide Interstate Map and Directories**. These consist of nine individual strip maps that focus on specific Interstate routes and areas, with very complete, detailed listings of sights, facilities, connecting routes. Mobil also puts out **Mobil Travel Guide** series in seven regional editions, rating over 23,000 hotels, motels and restaurants in the United States and including road atlas.

**National Advertising Co.,** a subsidiary of 3-M, publishes and distributes very comprehensive maps with fold-out guides to sights, motels, restaurants, local attractions. Maps include mile-by-mile accounts. Available free at many service stations. Comes in editions for nine regions, but does not cover entire country.

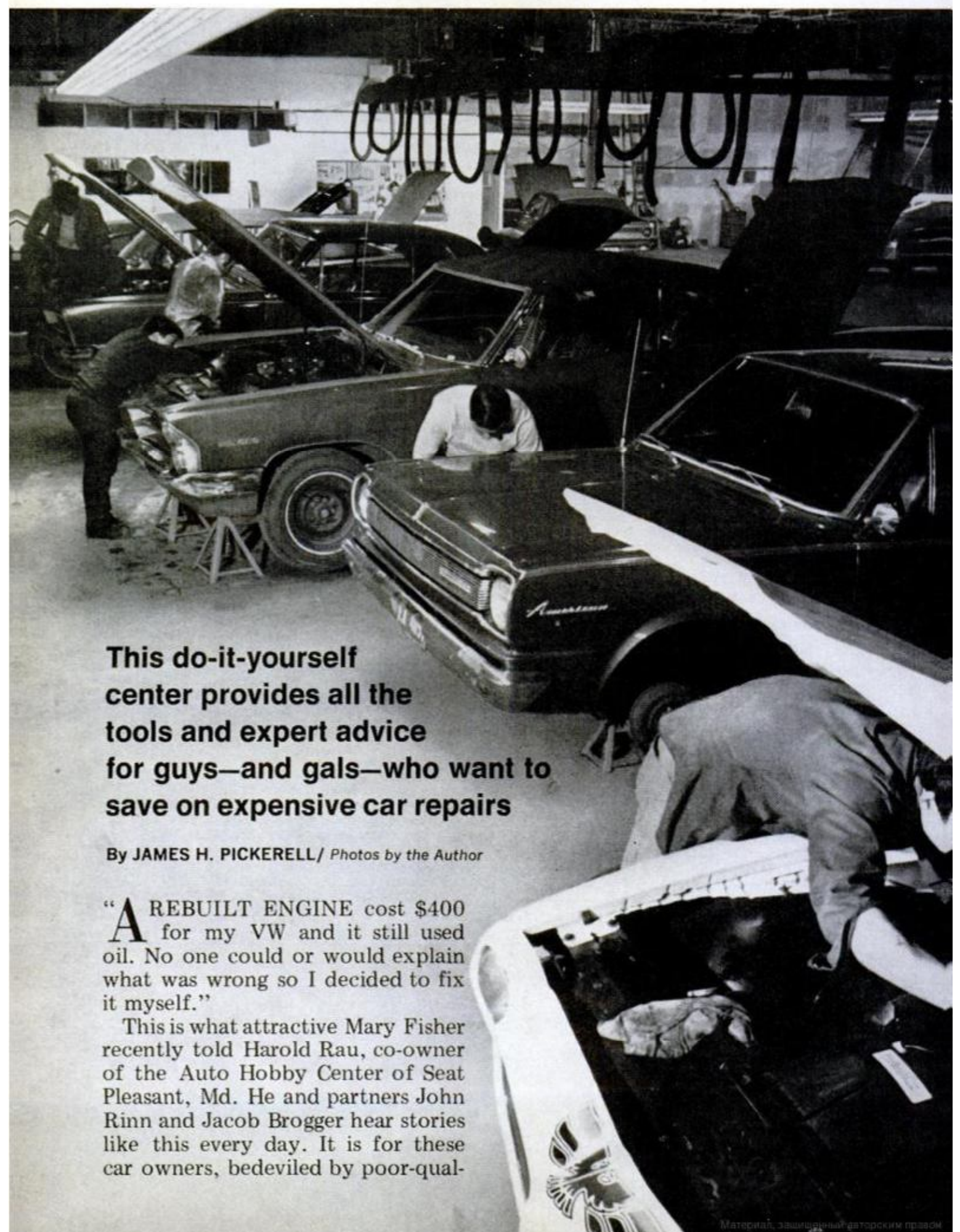
**Rand McNally & Co.** This famous mapmaker publishes maps and travel guides for many major oil companies and others. Some books and atlases are available at bookstores: **Road Atlas & Travel Guide, Campground & Trailer Park Guide, Road Atlas U.S./Canada/Mexico, Pocket Road Atlas, U.S.**

**Texaco.** Distributes very comprehensive Rand McNally **Travel Atlas**. Includes city maps, events calendar, national parks, map of Mexico. Texaco also publishes **Travel Tips** plus individual state maps, distributed free to motorists.





# New Garage Where You



**This do-it-yourself center provides all the tools and expert advice for guys—and gals—who want to save on expensive car repairs**

By JAMES H. PICKERELL / Photos by the Author

**A** REBUILT ENGINE cost \$400 for my VW and it still used oil. No one could or would explain what was wrong so I decided to fix it myself."

This is what attractive Mary Fisher recently told Harold Rau, co-owner of the Auto Hobby Center of Seat Pleasant, Md. He and partners John Rinn and Jacob Brogger hear stories like this every day. It is for these car owners, bedeviled by poor-qual-



# Pocket the Labor Costs

ity, high-cost repair work that they started a do-it-yourself emporium.

A tune-up at the Center, for example, costs about \$20—as compared to an average of \$62 in local garages. A brake job, estimates customer Conrad Faunce, cost him under \$30 as compared to \$60 outside. And, “One of the nice things,” Faunce adds, “is that you’ve got both a man to steer you straight and special tools like a brake-shoe micrometer and a hone for cleaning brake cylinders.”

For just \$2 an hour the customer has the use of all the basic tools in American, metric and British sizes, dwell meters, tachometers, timing strobe lights, brake-drum micrometers, valve-spring compressors, clutch-alignment tools, brake tools, engine packing seat tools, hose-clamp pliers and oil-filter wrenches. Then there are two A-frame hoists and a 30-ton arbor press.

The expert advice comes from Rinn, a retired Navy flyer, and Rau and Brog-

ger who are both retired Air Force colonels. After opening the Center a year ago, they are now operating with 15 bays, have added a parts department and are doing a thriving business. “We’re open from 10:00 a.m. to 10:00 p.m. seven days a week,” says Rau.

Amateurs are encouraged to hire professionals for complex jobs such as valve grinding, welding or boring cylinders, but they can save a lot by tearing down and rebuilding the engine.

The customer gets his parts at discount: sparkplugs, oil and air filters, car-tuning kits, alternators, generators, pistons, rings, valves, exhaust systems, headers, manifolds, wheels and tires.

With the proven popularity of the Auto Hobby Center the next step will be to set up others. “The best thing about the Center is that I’ve learned enough to avoid getting taken,” says Susan Eberly, a young Washingtonian. “My only problem now is that my boyfriend wants me to fix his car!” ★★



**VW THAT USED OIL** brought Mary Fisher to the Center where Harold Rau explained the problem to her

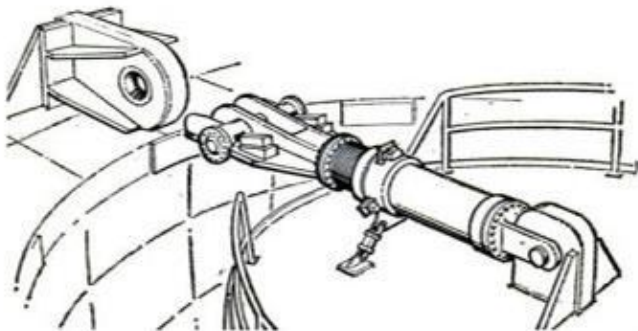
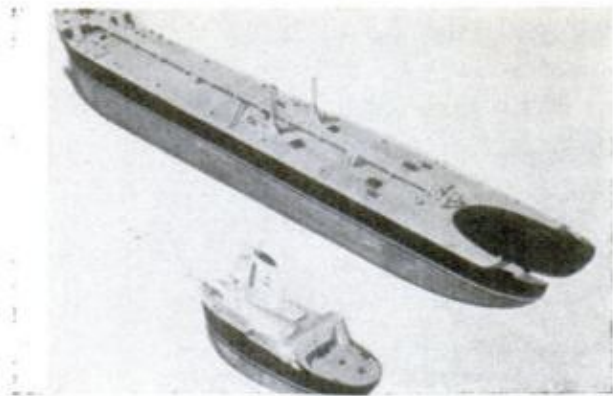
**DO-IT-YOURSELF** transmission job becomes possible with everything from creeper to wrenches at hand



**PULLING ENGINE** is easy as Bill Smith, manning the chain, demonstrates with the help of Bobby Morris







### Tug-barge is seagoing 'ship'

An 11,600-bhp "pusher" tug, now being built for the Ingram Corp., will fit into a slot in a giant barge to form a unit that is a maneuverable, seagoing "ship." Key to the combination is a set of Pine hydraulic cylinders that join tug and barge (drawing).



### High-powered mailbox

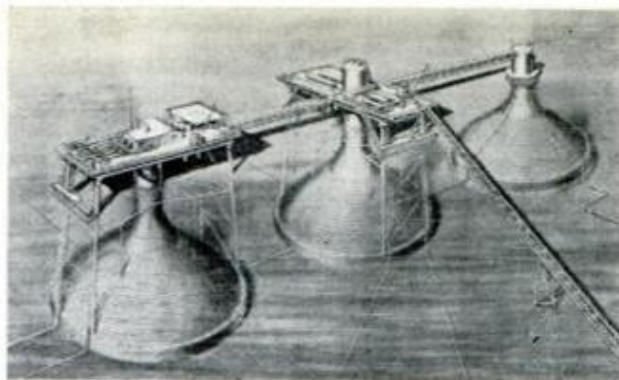
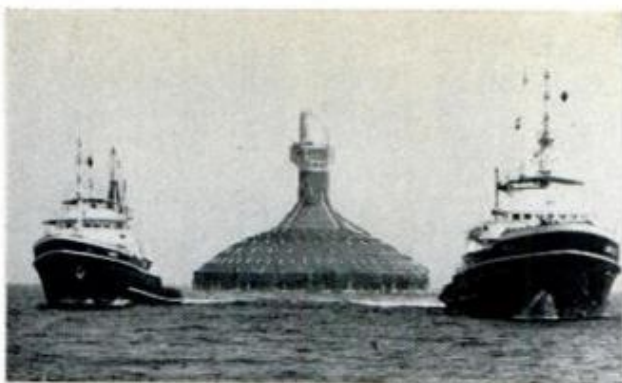
During his years as a professional soldier, Henri Simone of Ekeren, Belgium, gathered a large collection of military souvenirs. One of the items, a bomb that he got at an airfield near his home, now stands in his yard where it serves as a mailbox.



### Driverless grader is fast and accurate

Following a line (barely visible in the photo) that runs along its work area, a driverless road grader has demonstrated on a construction job that it can work faster and with more precision than a man-controlled machine. Because the sensor-controlled grader is more accurate (it never strayed more than one-eighth inch from the roadway), it can move faster and thus do more work than a machine with a driver. The robot grader is the invention of Bobby Brown of Norfolk, Va.





## Undersea tanks store oil from the Fateh field

When expansion of the Fateh offshore oil field is completed in 1973, three 20-story-high storage tanks, anchored to the floor of the Arabian Gulf, will be the heart of the complex. One tank, shown being towed to the site, is already in use. Each tank holds 500,000 barrels.



## Jolly white giant is a playground

Inspired by the famous "White Figures" that are carved into the chalky soil all over England, architect Brian Yale designed the Long Man of Lansbury to decorate the roof of a London shopping center. The 168-foot figure incorporates a playground for children.



## Inventor says rollers can replace ribbons in typewriters

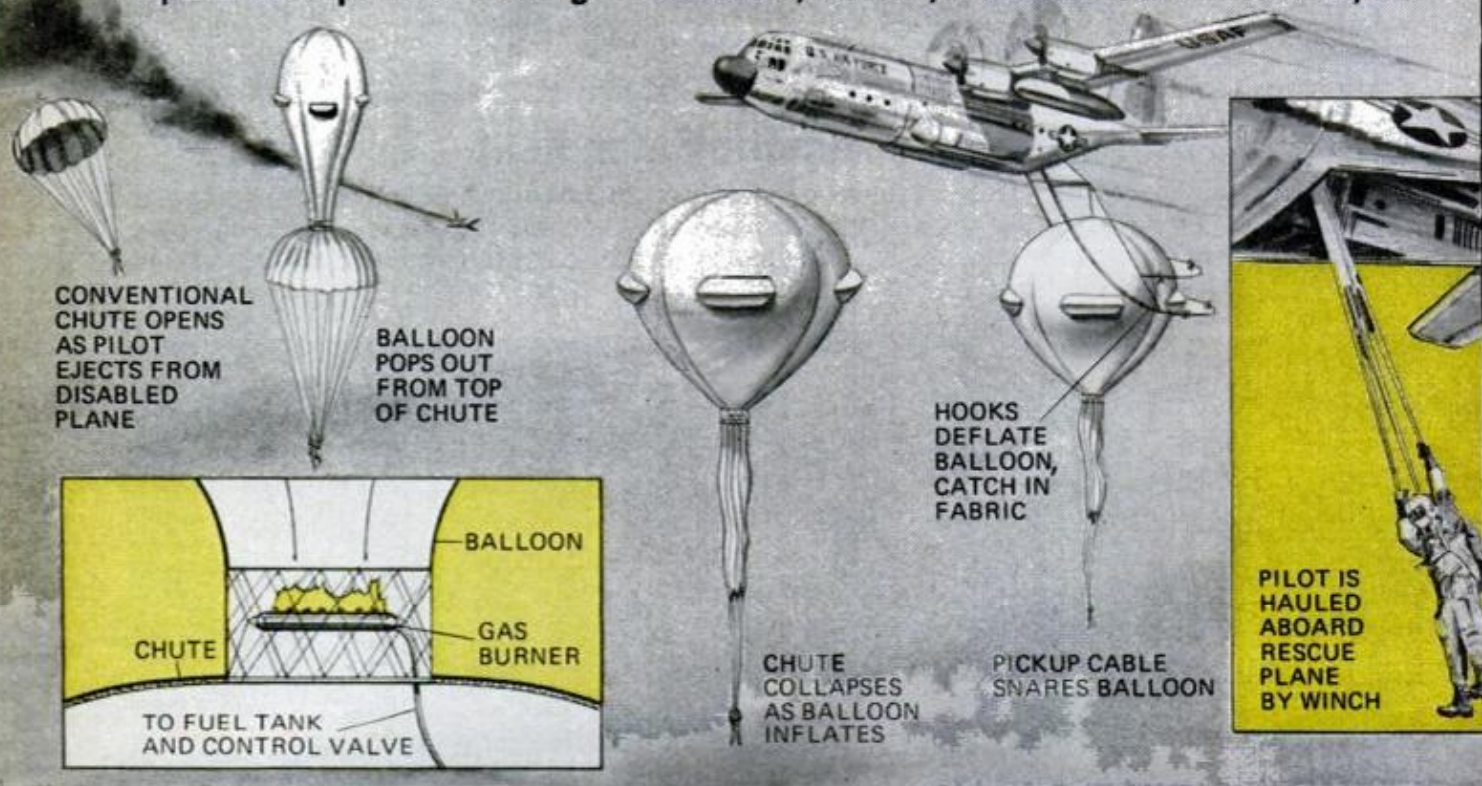
The Micro-Well, which retains ink by a controlled capillary action, has 50 to 100 times the inking capacity of the familiar inked ribbons of office machines, according to inventor Samuel Redman. At right, he demonstrates that a very slight squeeze releases ink; on a typewriter (left) the ink would release onto the typeface. Elastolabs Corp. is the maker.



# Just patented

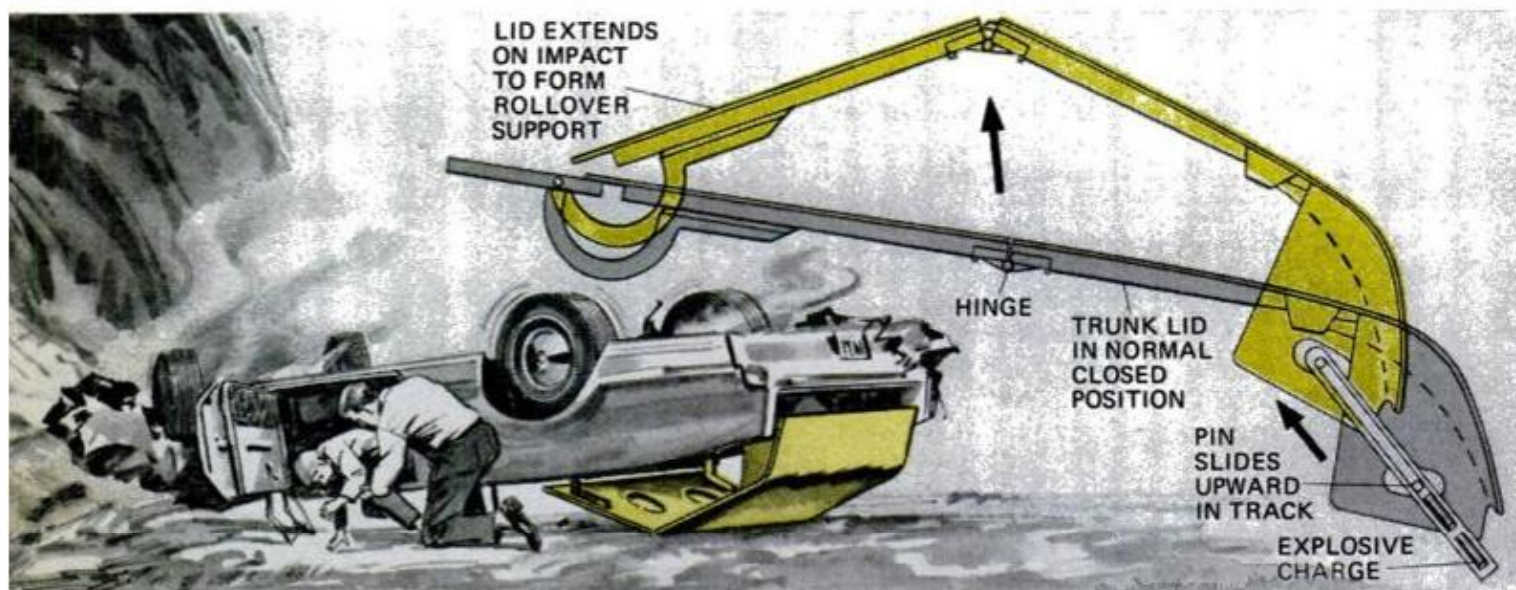
PM'S PICK OF THE NEW INVENTIONS

Prepared in cooperation with Roger S. Shashoua, Director, International Inventors Assn., Inc.



1. **PICKED UP IN MIDAIR**, fliers parachuting from a disabled plane could be saved from falling into enemy hands with this daring plan for airborne rescue. As soon as a chute opens, a second bag is released at the top, filling quickly with air. A small gas burner at the base, controlled by the flier, heats

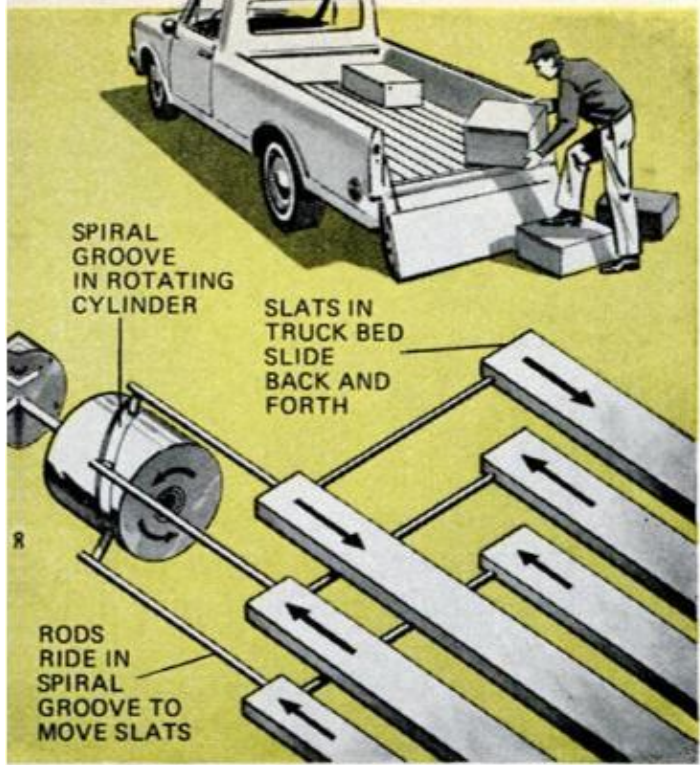
the air, producing, in effect, a hot-air balloon. The balloon slows the chute's descent so that a pickup plane trailing barbed cables can snare the fabric with its hooks and haul the airman aboard to safety. In the event that no pickup plane is near, the flier can shut off the gas burner and then descend normally



2. **POP-UP ROLL BAR** keeps you from being crushed or trapped under an overturned convertible. The trunk lid is hinged in two sections so it's forced upward in a crash, forming a V-shaped support to raise the rear of the car off the ground. This plus

the windshield provides sufficient clearance underneath to permit occupants to crawl out unharmed. The device is actuated automatically by an impact-sensitive explosive charge. In normal use, the lid swings up on its rear pivot for access to the trunk





**3. SELF-LOADING PICKUP TRUCK** fills itself as you put cargo in at the rear. Its moving floor consists of slats driven back and forth by rods riding in a spiral-grooved drum. The slats are arranged in sets of three so that two are always moving forward while the third returns to the rear. This produces a conveyor-like action that draws cargo into the truck. For quick unloading, the slats are reversed

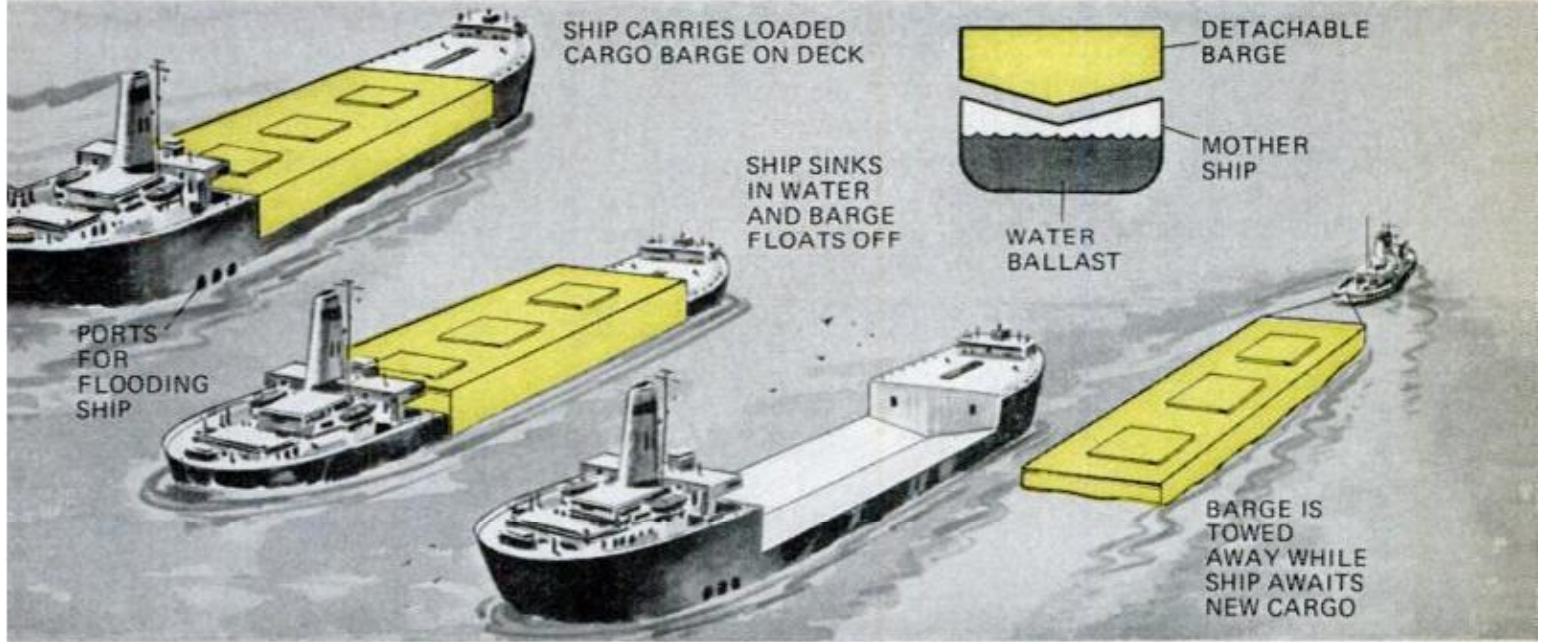


**4. WALKING ON STEEP SURFACES** would be a cinch with these strap-on "roof shoes" to keep your feet level. Designed for roofers, painters and TV installers, the angled supports can be adjusted to suit different roof slopes and have foam rubber pads on the bottom to prevent slipping, even on wet surfaces. The pivoted foot plates can be quickly reversed to permit walking either up or down a roof



**5. UNLOADING CARGO** from this novel freighter is simple—you just sink the ship out from under it. The cargo-carrying section is designed as a separate, removable barge. When the ship reaches port, water ballast compartments are flooded, lowering the hull beneath the barge. The barge floats off free and

is picked up by a tugboat for delivery to points along inland waterways. The system saves unloading time and speeds the shipment of cargoes to inland ports. The barge's V-shaped bottom locks into a similarly V-shaped recess that's cut into the ship's hull to hold it securely in place during the voyage



Inventors of the items shown on these pages are as follows: 1. Fred R. Nebiker, Akron, Ohio (No. 3,508,725); 2. Fu-Shueng Chang, Melvindale, Mich. (No. 3,508,785);

3. Olof A. Hallstrom Jr., Tillamook, Ore. (No. 3,534,875); 4. Herbert Stokes, Abergele, North Wales; 5. Arthur William Vienna, Encino, Calif. (No. 3,508,514).



# Build This TWO-MAN SUB for \$400



The submariner's world is like nothing you've ever experienced. And the thrill is even greater when you build the boat yourself!

By W. KENT MARKHAM

Photos by Bruce Mozert

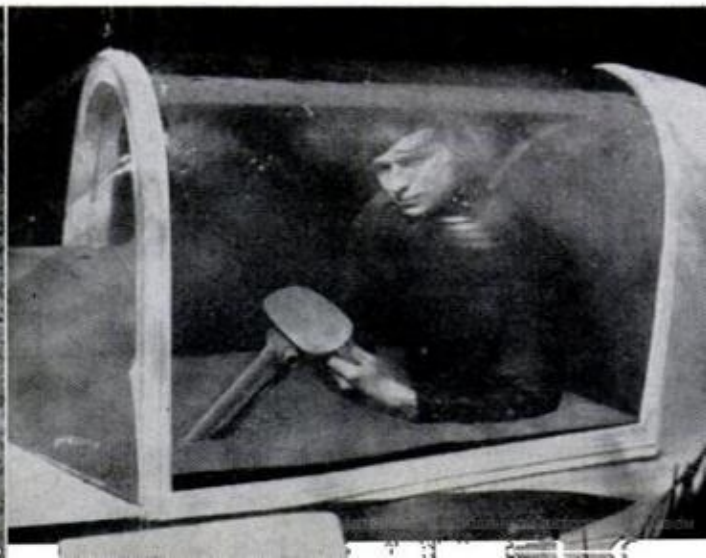
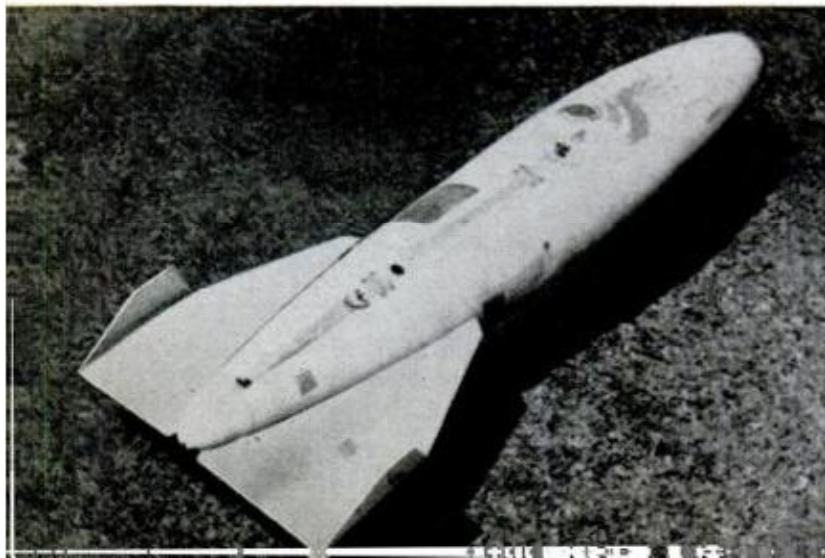
**L**ET ME PUT YOU in the driver's seat of a new mini-sub for the next few minutes. First, visualize the crystal clear water of Silver Springs, Fla.: about 100 yards wide and 65 feet deep at the main spring, which flows from an underground cave.

Once you have been checked out on the basic operating procedures of the sub, you wade out to the surfaced craft. Then, after reaching down and opening the entry hatch, you fill your lungs with air, lower your body underwater and swim into the opening. Once your head pops up inside, you find yourself in an air pocket. Next, you straddle the battery compartment and pull the adjustable seat back to a comfortable position.

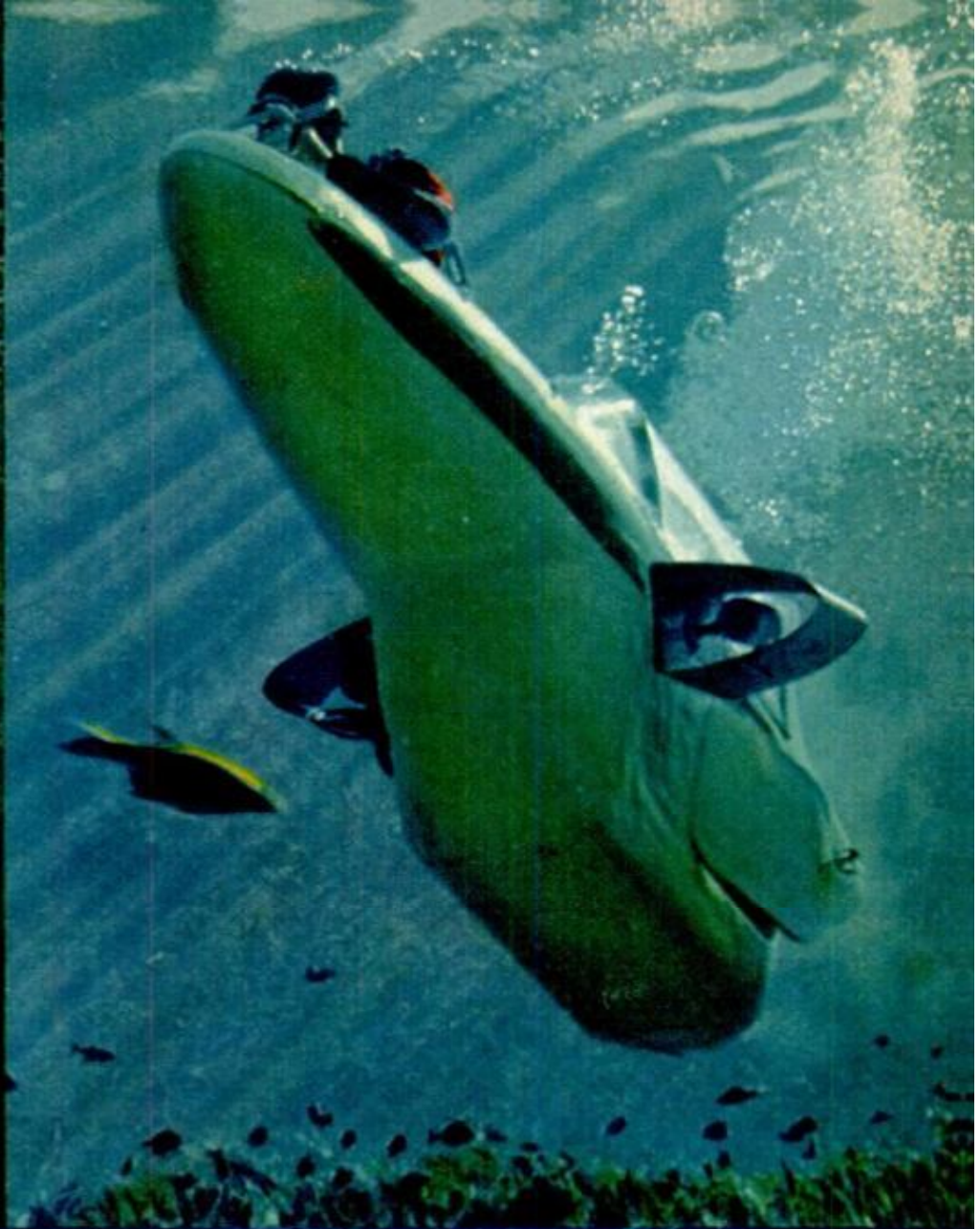
Your diving buddy removes the forward hatch and climbs aboard wearing full scuba gear—he must since he rides outside. The skipper, however, is inside the air pocket and out of water from the waist up. When your buddy motions that he is ready, you grab the control handles and flip on both motor switches. Instantly the sub responds with a slight lunge forward, and within several seconds you are moving along at four to five mph.

When the controls are moved forward (tilting the motors), a lot of propwash is kicked up. The craft strains to go under, but it is much too buoyant. To counter this you use the variable buoyancy valve on the right side. When the pipe is brought up to a 45° angle, you'll hear much gurgling and notice the sub getting

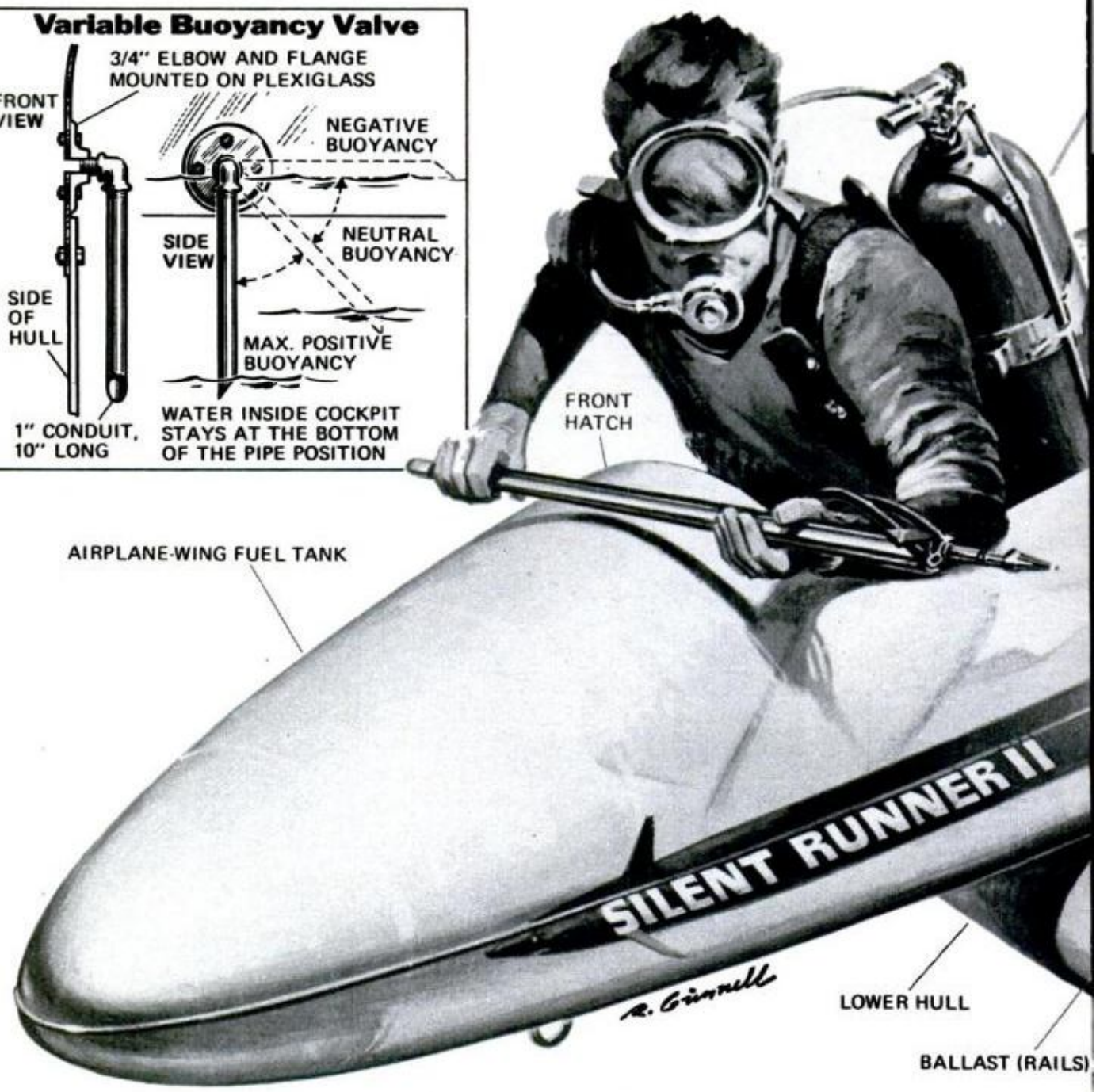
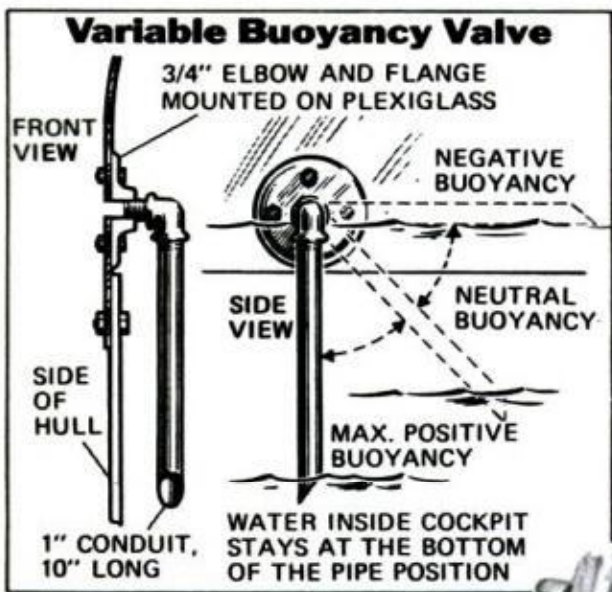
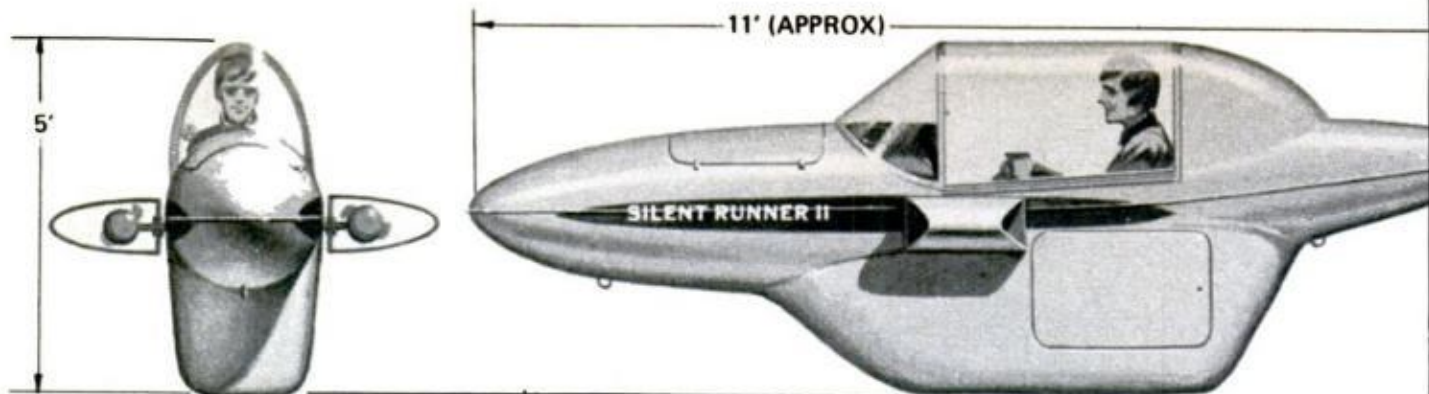
**HULL IS DISCARDED FUEL TANK;** other materials were purchased locally. Skipper (below, right) is half in and half out of water in the airtight cockpit, while his buddy rides outside (see opposite page)











lower and lower in the water. Air bubbles pour out of the side, and for a second you wonder if something is wrong. For the first few seconds underwater, hundreds of tiny air bubbles rise off the entire hull surface, but they quickly disappear.

In these waters, your first reaction is likely to be to the fantastic beauty of the springs. The subtle shades of blue and green against a white sand bottom are breathtaking.

Your buddy riding up front acts as a [\(Please turn to page 172\)](#)



# TWO-MAN SUB



VARIABLE  
BUOYANCY  
VALVE

1/4" ACRYLIC PLASTIC

COMPASS

AIR BOTTLE POSITION.  
(STANDARD 72-CU.-FT.  
CAPACITY)

ENTRY HATCH

## PLANS AVAILABLE

If you are interested in building the Two-Man Sub, you can obtain basic working drawings, construction photos and detailed building instructions by sending \$10 and your name and address to: Popular Mechanics Magazine, Dept. Sub., 224 West 57th St., New York, N.Y. 10019.

*Popular Mechanics* disclaims all responsibility for the quality, condition, design, workmanship and materials of the submarine built from these plans, and for its proper or safe functioning as a submarine.

MOTOR  
COVER  
DIVE  
PLANE

BATTERY  
COMPARTMENT

Patent No. 3,416,478  
granted Dec. 17, 1968

**BALLAST TANK** is assembled from plywood and metal. With sub upside down (below, right), tank is fastened to hull. When all parts are in place, craft is fibreglassed and finished with owner's choice of bright paints





# A Look Under the Hoods

If the reciprocating-

Power takeoff gear meshes with larger gear in reduction gear box.

Vapor inlet from boiler

Turbine nozzles

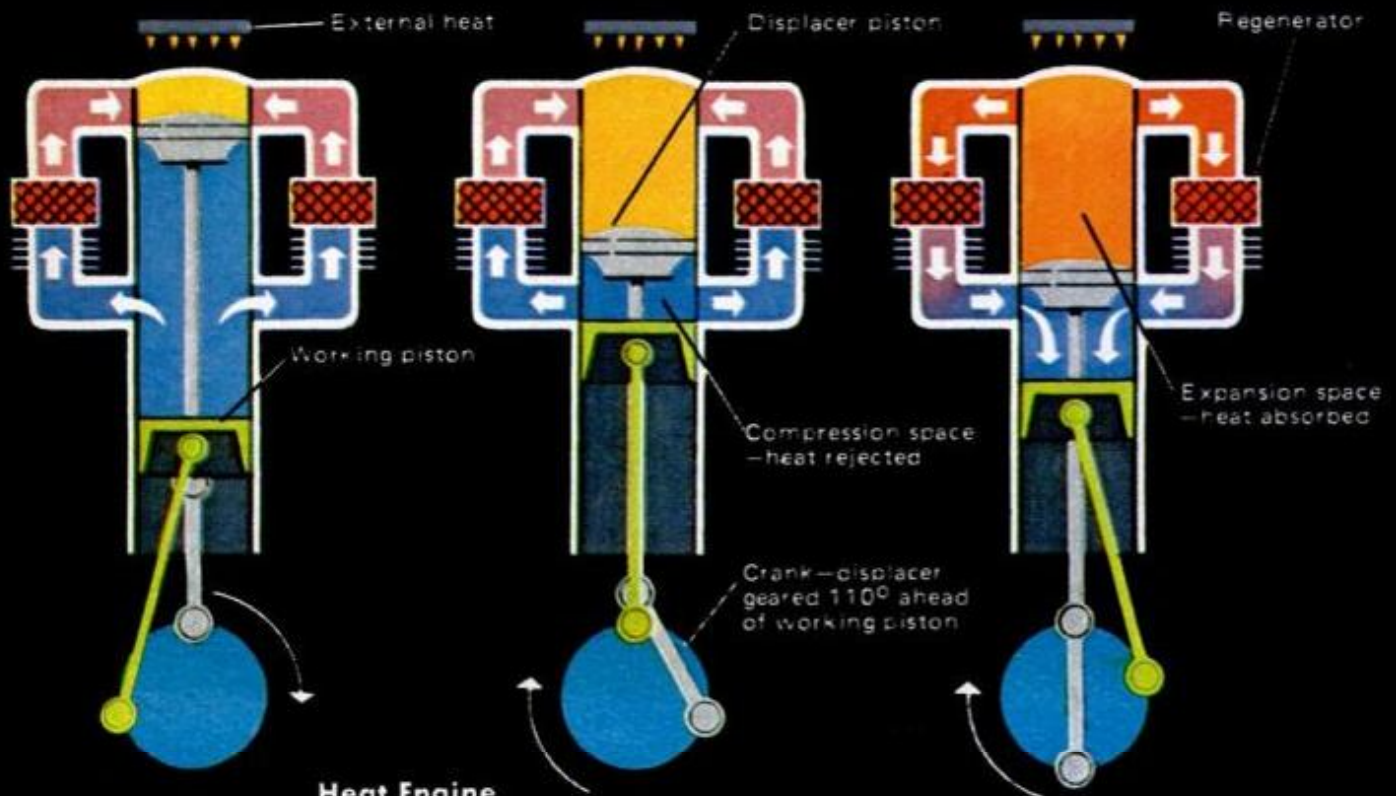
Turbine wheel

To condenser

Exhaust vapor

## Vapor Turbine

Clean, efficient external combustion of fuel heats fluid in a boiler. The resulting vapor does work on a turbine wheel, condenses and returns to boiler (Rankine heat cycle). The Lear vapor turbine shown here weighs 23 pounds and generates over 200 hp. It takes little space under hood, leaving room for boiler, condenser, accessories, reduction gearbox to automatic transmission. Key to successful operation is high-density fluid instead of water.



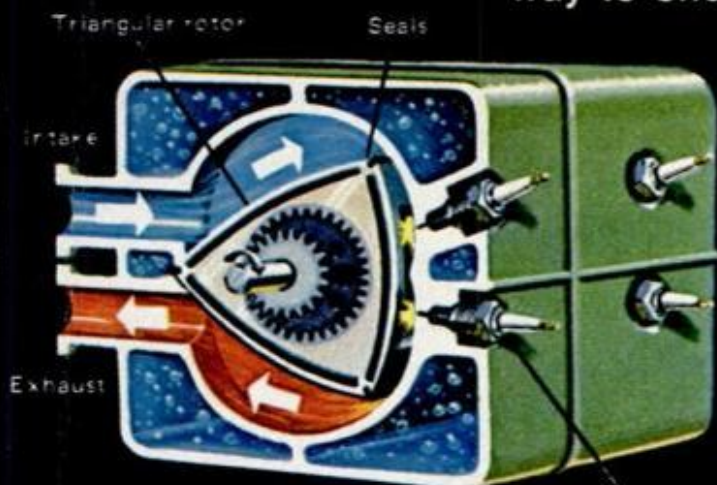
External combustion of fuel to heat air which expands and moves a piston is a simple principle that's more than a century old. Heat is applied to one end of cylinder; by thermodynamic principle (Stirling cycle) it expands and is displaced to other end, driving a working piston. Being a reversible process (arrows), work is done over and over again by air or other gas in the closed cylinder. Principle has been used in small stationary engines but not researched for application in vehicles until recently.



# of Tomorrow's Cars

AUTOMOTIVE

piston, internal-combustion engine can't come clean, it'll have to give way to one of these alternate power sources

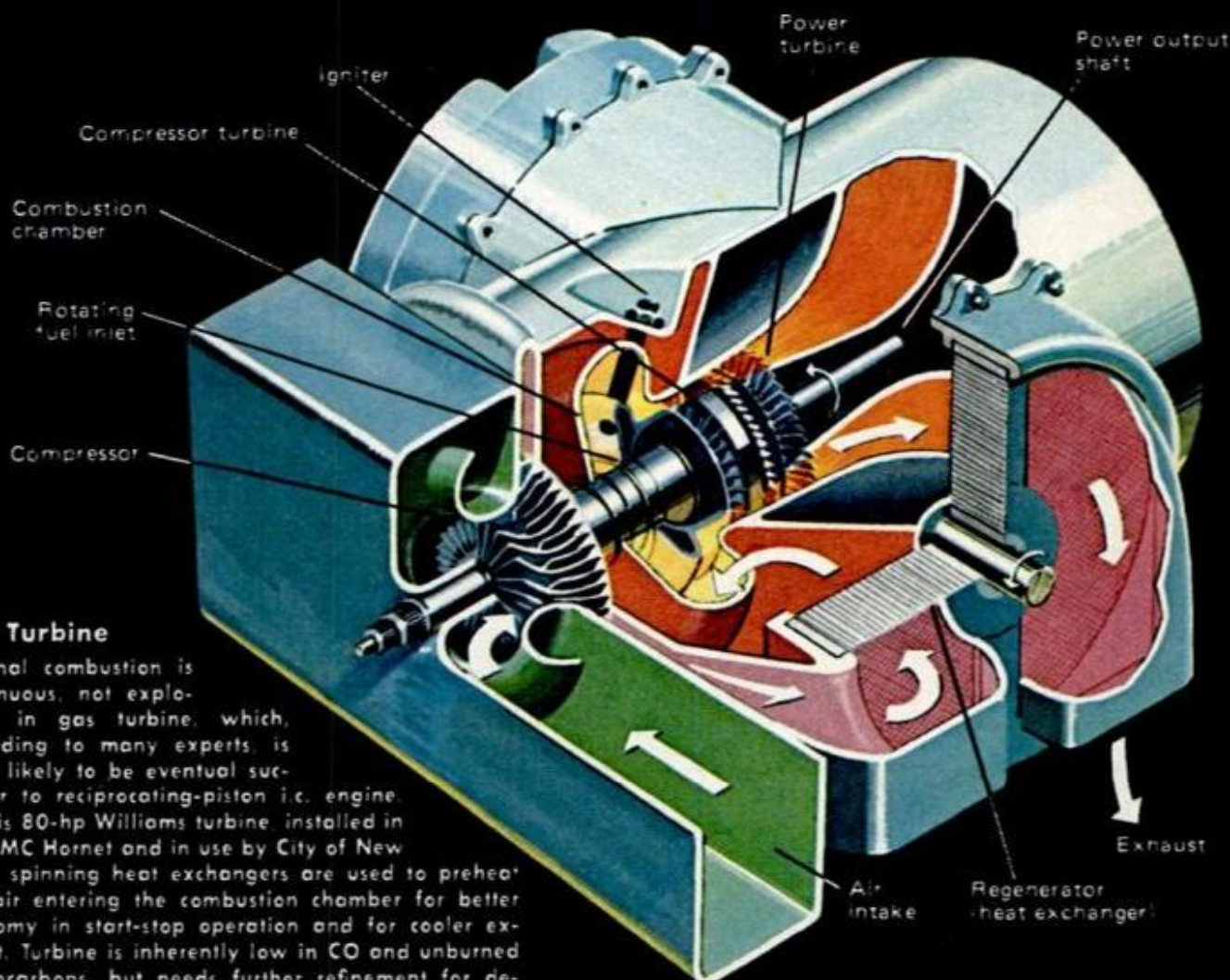
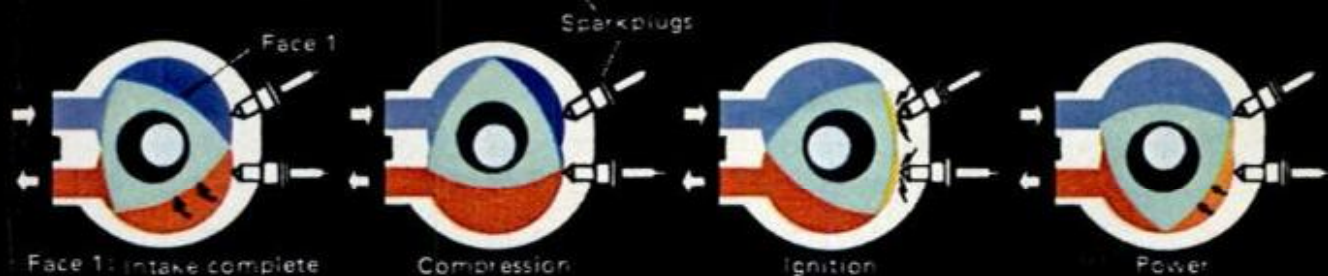


By BILL HARTFORD, Auto Editor

Art Concepts by Ed Valigursky

## Wankel Engine

Rotary-piston, internal-combustion engine has three power "strokes" per revolution. Three faces of rotor form chambers as it revolves. Fuel charge is taken in, compressed and ignited. Combustion pressure drives rotor around, and then gases exhaust. Exhaust is naturally low in oxides of nitrogen, high in carbon monoxide and unburned hydrocarbons. High power/weight ratio, small size of engine, however, leave plenty of room under hood for thermal reactor catalytic converter approach to reduce these emissions



## Gas Turbine

Internal combustion is continuous, not explosive, in gas turbine, which, according to many experts, is most likely to be eventual successor to reciprocating-piston i.c. engine. In this 80-hp Williams turbine installed in an AMC Hornet and in use by City of New York, spinning heat exchangers are used to preheat the air entering the combustion chamber for better economy in start-stop operation and for cooler exhaust. Turbine is inherently low in CO and unburned hydrocarbons, but needs further refinement for decreasing emission of oxides of nitrogen.

Please turn page →



# Wanted: clean air. Will the automakers be forced to tool up for a piston-free future?

**S**NIFFERS are up your tailpipe and the handwriting is on the factory walls: Make clean cars or get out of business! Detroit has until 1975 to almost totally eliminate emissions of carbon monoxide (CO) and hydrocarbons (HC), and until 1976 to cut emissions of nitrogen oxide, known as NO<sup>x</sup> in the trade. The automakers will have a one-year grace period if the Federal Environmental Protection Agency determines that they've been working in good faith, really trying.

Detroit has been trying harder than ever in recent years and succeeding fantastically in scrubbing its internal-combustion baby. With a belief that lots of overtime and \$200 million will make it cleaner than clean, the automakers are sticking with reciprocating pistons, for the next several years at least.

Sticking with Detroit are the manufacturers of hang-on hardware, catalytic converters and afterburners that may be saviors of the piston, for the next few decades, anyway. Exhaust gases passing over the catalyst produce a chemical reaction that converts the CO, HC and NO<sup>x</sup> to water, carbon dioxide and nitrogen. Key to this system are the various exotic and expensive catalysts which deteriorate rapidly from lead in leaded gasoline. Hence the transition to unleaded fuel. Without lead, the industry hopes converters can be made to last 50,000 miles without maintenance as required by the Federal Clean Air Act.

The hang-on hope for the reciprocating piston will, however, stuff the engine compartment of the typical, accessory-laden family car almost to bursting. Enter the Wankel, the most immediate threat to pistons for mass-

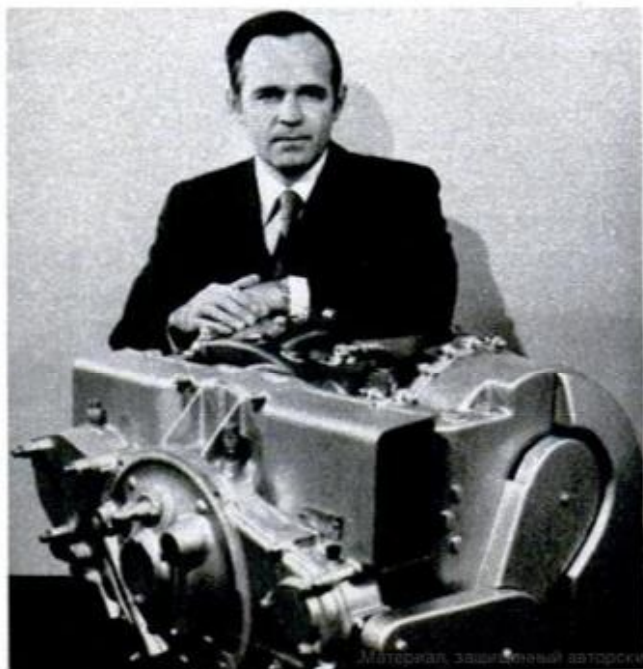
production, passenger-car service. The ingenious engine of Felix Wankel is increasingly referred to as a "rotary" engine, features a high power-to-weight ratio and, therefore, horsepower for horsepower, takes less space under the hood—space needed for emissions reducing hardware. The Wankel, in addition, has few moving parts, is vibration-free, is easy to manufacture and offers long service life and reliability.

## GM and Ford look to Wankel

No wonder GM is paying \$50 million over the next five years for the rights to the engine and Ford is trying to buy into the Japanese Toyo Kogyo Co., Ltd., manufacturer of the Mazda automobile. Toyo Kogyo bought rights to the Wankel in the early '60s, has developed it further, cleaned it up and is selling it in Mazda cars in California, Washington, Florida and Texas. A Wankel-powered addition to Detroit's lineup appears certain for the seventies. Bendix is already working on a fuel-injection system for the engine.

The gas turbine, an internal combustion engine inherently low in HC and CO, is considered most promising as an ultimate replacement for the spark-piston engines. Ernest Starkman, GM's Environmental Activities head, sees

**GAS TURBINE**, ready for installation in passenger car, is shown by Sam Williams, president of Williams Research. Although going into production for use in GM and Ford trucks, powerplant is not yet ready for mass production in passenger-car applications







this occurring before the century is out. A clean one could be mass-produced in five years, says Chrysler, but at a cost of almost \$10 billion. GM and Ford have developed the gas turbine to the point that it will be installed in their trucks this year.

Smaller manufacturers have also focused on the gas turbine and its low emissions and mass-production potential. Sam Williams of Williams Research, world's largest producer of small jet engines, feels that the switch to turbines will come as early as 1975, the time when Detroit realizes it'll cost more to continue cleaning the piston engine than to produce a gas turbine. His 80-hp unit will be evaluated for performance and emissions characteristics after use in New York City tests over a two-year period.

#### **Lear's vapor turbine**

Critic of both industry footdragging and inappropriate and inadequate government spending in the search for clean power sources is Bill Lear of Lear Motors. He should, by newsstand time, be driving around in what appears to be a conventional Chevy Monte Carlo, but is very unconventional under the hood.

Lear's vapor turbine may be regarded as a variation of the steam engine: The difference is that a fluorinated hydro-

**VAPOR TURBINE** of extraordinarily small proportions that will do work of over 200 horses is shown by Bill Lear of Lear Motors. It has been installed in full-size car for tests, and Lear is confident the tests will show it to be the powerplant of the future

carbon fluid (dubbed Learium), not water, is used. The result of boiling is not steam, but a vapor of the fluid. The vapor drives a turbine wheel, not pistons. The fluid is boiled and condensed in a closed system. Under the hood, the Learium Turbine System's power output is determined by the size of the boiler and condenser that can be accommodated. The turbine itself, connected to a conventional transmission via reduction gearbox, is the smallest under-hood component.

As an external-combustion (e-c) power source, the Lear turbine can be fueled with any number of volatile fluids. Burning is clean and efficient—like boiling water on your gas range.

Lear is prepared to go into the car business making thousands of Learmobiles just to demonstrate the feasibility of his powerplant, though, finally, he'd like to license his system to Detroit.

#### **Stirling in a bus**

A most improbable external-combustion engine, a Stirling engine, named after the man who refined this concept of the heat engine in the 19th century, has been installed in a bus by the Philips Co. in Holland. In the engine, a burner, again using any fuel, heats an enclosed chamber of helium. The helium expands and moves a piston. The helium cools and is displaced back to the hot end of the engine. The temperature changes are rapid, causing the gas to contract and expand rapidly. The four-cylinder powerplant develops 180 hp and is regarded as having greatest potential for recreational vehicles, trucks and buses.

Until the engines of the future go into full-scale production, various emissions-reducing approaches to i-c will continue: use of alternate fuels, L-P gas, for example.

Obvious by its omission here is the

*(Please turn to page 168)*





# **BOATING**





While it isn't the prettiest product in boating circles, the Land N' Sea Craft is the best answer PM has yet seen for a combination motor home and water cruiser.



By **GEORGE W. REIGER**, Boating Editor  
Photos by Diane Beeston

**G**REAT CONCEPT—this combination on-the-road camper and houseboat—but she's too boxy to ride well in rough water." I made that comment to myself the day before our boat test. Was I glad I didn't say it aloud!

The following afternoon we ran full throttle beneath the Golden Gate Bridge and charged miles out onto the broad Pacific. We tried the deep ocean swells and we worked the heavy chop

around the Gate. But nowhere could we make things too tough for the monohedron deep-V hull. At one point we even discussed the possibility of running many miles farther offshore to the Farallon Islands. But our photography boat, although especially built for offshore work, was not holding up as well as we were, and we decided not to chance it. Our little "breadbox" had to be content with running circles around her companion.

The Land N' Sea Craft evolved from one man's dissatisfaction and another's skill. Alex "Sandy" Kaye has always enjoyed inland cruising, but he wanted a compact yet livable boat he could take with him on the road. Trailerable houseboats he looked at lacked qualities for safe and comfortable boating.

Brand A had insufficient cabin space, no storage room and no place to entertain guests. And its after deck was too small to provide any lounge area.

Brand B lacked power to get up on

## IN A BREADBOX

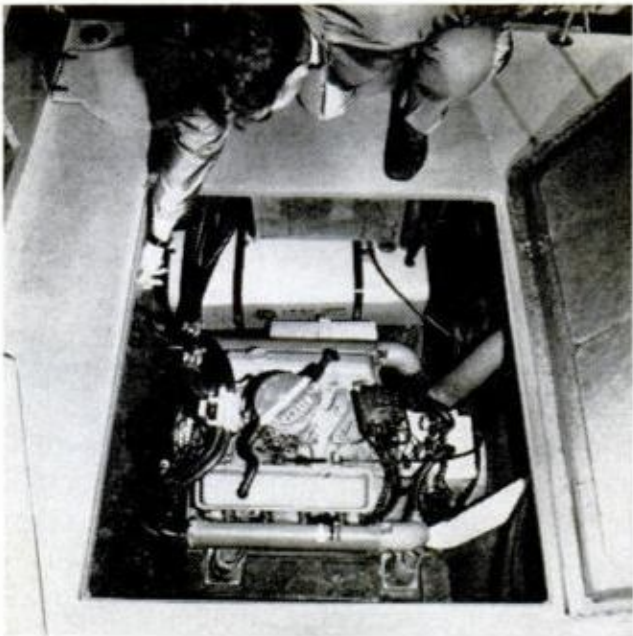


**LAUNCHING AND LOADING** the boat is no trouble, but, with shallow ramps, it's best to watch tides  
JUNE 1971



**BOB ANDERSON**, Pat O'Hanlon and Dave Fugere help plan our run on the Bay and out through the Gate





**HATCH OPENING** to powerplant leaves enough room to get down and work on the engine from either side



**AUTHOR PUTS HIS ALL** into a clay pigeon for Pat. Trap is increasingly popular as a boating activity



**INSTRUMENT PANEL** and steering wheel are adequately mounted for most people, though as usual, author had some difficulty with his 6-foot-3 frame. Skipper's seat (right) folds down to make the boat's seventh bed

plane and was so poorly muffled and insulated that skipper and visitors had to shout to be heard while under way.

Brand C scrimped on built-in flotation, and her galley consisted only of an alcohol stove, icebox and sink with a hand pump. There was no sideboard for preparing food. Worst of all, she was difficult to maneuver at high speeds and unstable in rough weather.

So Sandy found a boat designer, 77-year-old Charles "Bert" O'Hanlon, and told of his requirements. Their joint effort is the 28-foot Land N' Sea Craft.

The evening before the test, Bert's son, Pat, and I visited John and Ruth Margraff aboard their Land N' Sea houseboat which they use as a weekend retreat and summer home. They gave us a guided tour of their floating cottage, and I saw how Sandy and Bert had solved some space problems.

By doing away with walkways along the outside, the designers were able to provide maximum living and storage space within an eight-foot beam—a width still trailerable without special highway permits. An extra foot or two lengthwise was provided by putting the pilot's seat practically over the bow.

But I was still concerned about handling on the open sea. Despite the deep-V character of the hull, the boat draws only 14 inches of water (a bonus for picnicking along deserted beaches—just pull the boat ashore), but I was worried that the boat's height (enough





for 6 feet, 5 inches of headroom in the forward cabin) might raise the center of gravity so that passengers riding topside might make things dangerous in bumpy weather. Other small houseboats had capsized under such conditions.

The next day we launched north of the Richmond-San Rafael Bridge and ran south past San Quentin prison and Angel Island into Belvedere to meet our photography boat. Then began the real boat testing. I'm sure that my four companions—including the boat's owner, Ray Shepherd, thought the intention of all my racing, braking and sudden turning around San Francisco Bay was to break a few dishes, cause a few bruises and maybe even throw somebody overboard!

None of this happened; the expected hard, slamming ride in heavy swells while I sat at the wheel over the bow never materialized. We rode *through* the waves; not up and down on them.

Inspired by the success of *PM's* trip, Bert and Sandy invited a Los Angeles customer to San Francisco, gave him his ordered boat and persuaded him to run it back to Los Angeles off the California coast. The boat confronted some 12-foot seas and took a little longer to make the journey than expected, but she still made it from San Francisco in 40 hours' running time with stopovers at Monterey and Santa Barbara. And while ocean touring isn't a regular feature of every boater's season, it's nice

to know Land N' Sea has the capability to make it. As Sandy proudly says: "We're the only trailerable houseboat that's ever made such a trip."

Even with a 215 OMC V8 powerplant and stern-drive unit, the claimed weight for the boat is just two tons—no trouble trailed behind a V8-powered car. Since the boat was designed for travel and camp use, too, one valuable feature is its foldaway step section built into the stern transom. This eliminates unwieldy and possibly dangerous step-ladders at the campsite.

The 54-gallon fuel tank allows a long day's running in conjunction with the economical inboard/outboard system. But I sense limitations with the 30-gallon fresh-water tank as standard equipment. Thirty gallons won't go far with sink and shower use in an active camping and cruising craft.

Land N' Sea also offers a flying-bridge model with a venturi wind deflection system that eliminates the need for a windshield. Air enters the venturi at the front base of the bridge and is funneled up so that it emerges from a top slot moving three times faster than it went in. If you're cruising at 20 mph, the vertical airstream in front of the console is rushing up to 60 mph, and you have an effective screen against wind and even light rain.

Base price is \$10,974. For more data, write Land N' Sea, 1813 South 10th St., San Jose, Calif. 95112. ★ ★ ★



**FOLDWAY STEPS** prove designers' intention to see this boat used as a genuine camping vehicle ashore  
JUNE 1971



**FILL 'ER UP.** Hauling the houseboat is no more of a nuisance than pulling any trailer of similar size



# BOATOWNER'S GUIDE TO REPAIR COMPOUNDS

By HENRY B. NOTROM

**P**OLYSULFIDE SEALANT is the greatest thing to hit boat building since cotton caulk. It's used for fastening structural members, for sealing double planked or lapstrake hulls, for surfacing defects and for bedding. And now it's in cartridges and cans for easy use as a repair compound. There aren't many repairs this material can't do.

So why are so many other types of repair compounds on dealers' shelves? Because polysulfide is so expensive that it would quickly put a guy into drydock if used for every little job. For example, why pay \$15 for a quart of polysulfide to bed-in some cleats and deck hardware when an ordinary bedding compound selling for \$3 a quart will do just as well?

But a word of caution: Each repair material mentioned on the following pages differs somewhat from manufacturer to manufacturer. Before using one, read label instructions to assure that you get all the benefit that product has to offer.

**ADHESIVE POWER** of polysulfide sealant makes it ideal compound for fastening structural members



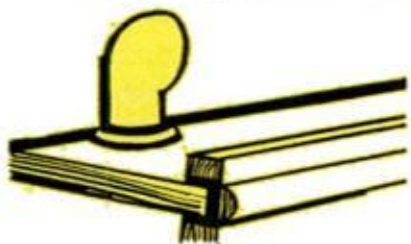
**ATTACH HARDWARE** with bedding compound by spreading mixture on object before screwing in place





## WHAT TO USE WHERE

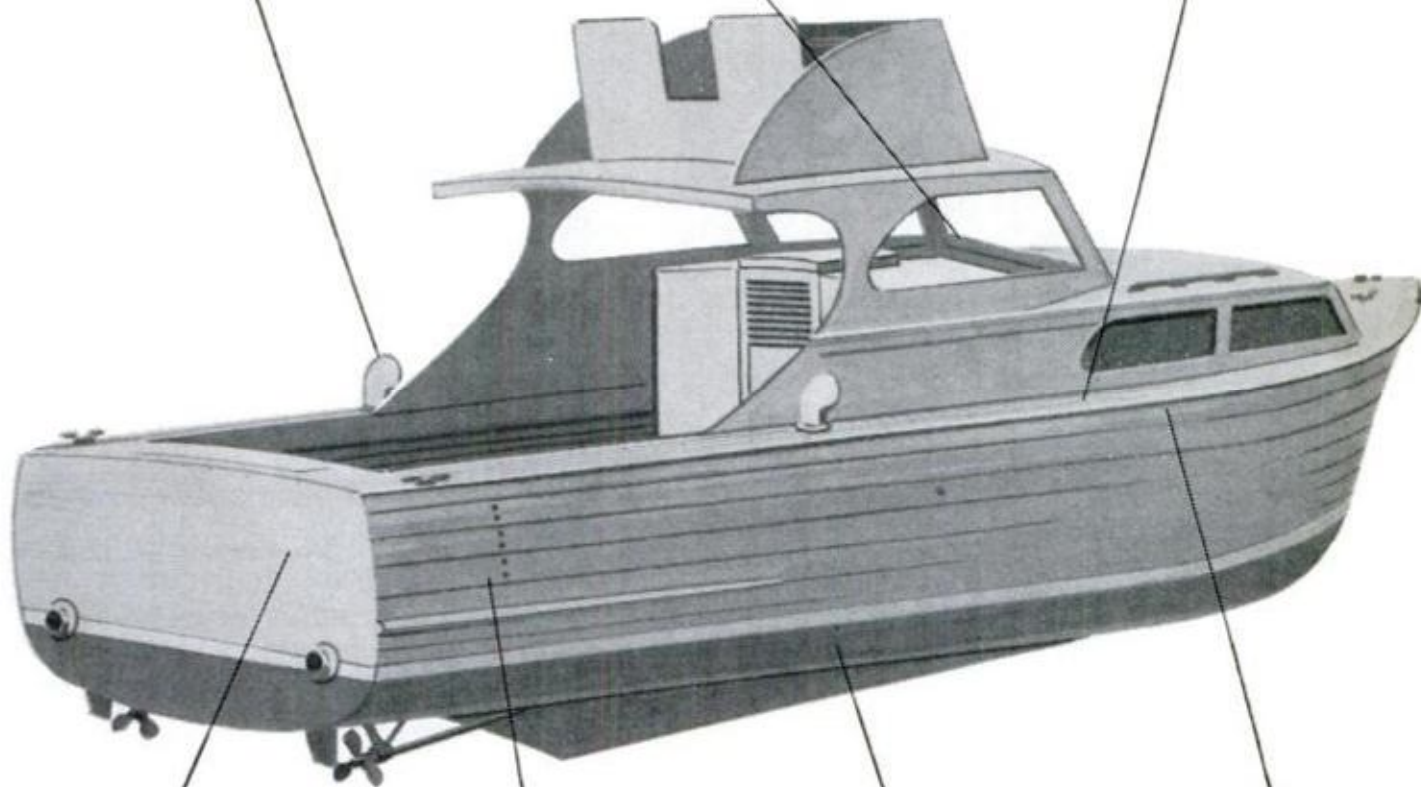
Bedding compound or silicone rubber as bedding and sealer for fixtures, fittings and hardware



Bedding compound or silicone rubber sealer for all joints (it's especially adhesive on glass, wood)



Surfacing compound for small imperfections; trowel cement for larger repairs before painting



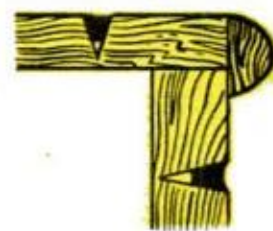
Wood filler for closing open-grained woods, especially areas of bright-work, before finishing



Surfacing compound or synthetic rubber sealer for plugging screw holes



Polysulfide seam sealer for any repair or seam work below the waterline



Elastic seam compounds (topside) for filling of cracks and deck seams

**Bedding compounds** are elastic, non-shrinking materials that keep water from seeping in around fixtures and in through joints. They're highly adhesive and bond wood to wood, and metal to wood. They also make an effective seal around glass.

Specifically, bedding compound is

used to fix cleats, stanchions, windlasses, winches, searchlights and other hardware to decks and hulls. In most situations, the compound is applied with a putty knife.

Bedding compounds cost about \$1 for a half pint, \$1.50 per pint, \$3 per quart and \$10 per gallon. Assuming a  $\frac{1}{32}$ -





**SILICONE RUBBER SEALANT** is often used to seal windshield joints because it adheres so well to glass

inch thickness, a quart will cover about 15 square feet of solid area.

**Glazing compounds** are of two types: oil-base and resin. The former will fill hairline cracks and minor grain imperfections in plywood and is only suitable for use above the waterline.

Resin glazing compound is used for repairing gel-coat damage in fiberglass hulls and is made up of two types: polyester and epoxy. Both types come in repair-kit form, with polyester costing around \$5.50 and epoxy about \$7.

Polyester and epoxy are two-part materials, consisting of a base compound and catalyst that have to be mixed thoroughly before use. Once mixed, the materials have to be applied or discarded. They have a brief potlife and can't be stored.

Polyester can be used for virtually all gel-coat repairs, except those few

where the damaged area is relatively small and will come under exceptionally high stress. Then the superior holding power of epoxy may be required.

**Seam compounds** that are designed for use above the waterline only, such as for filling deck seams, are less expensive than those intended for use below the water. A quart, for example, costs about \$3.

Polysulfide seam sealer has taken center stage as the material to use for sealing seams of planked or lapstrake wooden hulls. When you use polysulfide to seal seams, you don't need cotton caulk or lead putty. Polysulfide is the closest thing to a permanent seam sealer ever developed.

The material comes in one and two-part forms. The one-part compound is available in caulking cartridges or cans for application with a putty knife. The two-part material consists of a base compound and catalyst that have to be mixed. It, too, can be applied with a caulking gun or knife.

The big difference between one-part and two-part polysulfide is curing time. Depending upon temperature, two-part polysulfide cures in 24 to 48 hours. It takes three to seven days for the one-part material to cure, again depending on the temperature. Polysulfide should not be applied below 50°F.

The success of resealing a seam depends on the preparation of the surface. All of the old seam filler has to be cleaned out, and the sides of the seam sanded clean and bright. Oil and grease are removed with toluol, acetone or the solvent recommended by the manufacturer of the compound.

Keep in mind that both teak and Douglas fir should be covered with a primer that's recommended by the manufacturer of the compound. These two woods are too oily to permit maximum adhesion of polysulfide. All other woods need no priming.

If you're going to paint over a polysulfide seam compound be sure that the paint you use is compatible with the compound. Consult the label. If the



two are not compatible, the paint will peel and blister along the seam.

The following formula will help you in estimating how much seam compound you need for a job:

$$\frac{W \times D \times L}{7} = \text{Quarts needed}$$

W=seam width in inches

D=seam depth in inches

L=length of seam in linear feet

**Surfacing compounds** generally have a vinyl-resin base that makes them quick-drying (in 15 to 30 minutes) and impervious to water. This allows the compound to be used for fairing surface imperfections in wooden hulls as well as on decks, cabin-trunks and coamings. However, when large surface areas must be repaired, trowel cement should be used since it is easier to spread.

Specifically, surfacing compound can be used for filling scratches, cracks and nicks, and as a plug compound for sealing up nail and screw holes. It resists impact, doesn't become brittle or chip, and won't shrink.

Surfacing compounds are available in white for use under pigmented finishes and in mahogany for use beneath varnish. Their price is about the same as that of bedding compound.

**Synthetic rubber (silicone) sealer** is an excellent, but expensive, repair material that can be used above or below the waterline as a bedding, glazing or

surfacing compound. It adheres well to glass, fiberglass, plexiglass, metal, painted and varnished wood, plastic, canvas and sailcloth. However, it can't be painted.

Many boatowners employ silicone rubber as a last resort when regular compounds are found wanting. A 3-ounce tube sells for about \$2.

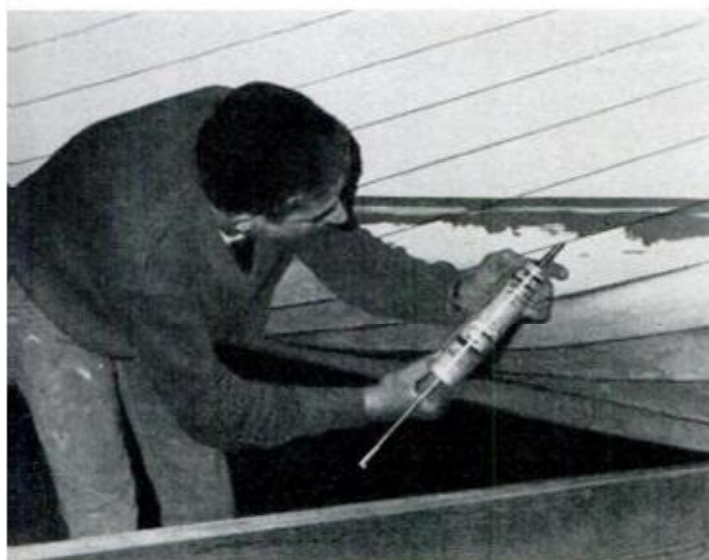
**Trowel cement** is used for smoothing large area surface irregularities prior to painting a wooden hull to give a smooth, professional finish. Keep its availability in mind should you ever have to refinish the entire hull of your boat or a large part of it.

Trowel cement is applied with a wide-bladed scraper. It is forced into defects, and the surface is power sanded after cement dries. This is followed by an application of undercoating, another application of trowel cement where needed to correct defects that still show, and painting.

**Wood fillers** are used to fill the grain of open-grained woods to provide a smooth surface for paint or varnish. They are employed in particular on a boat's brightwork, such as the transom and railings, before these parts are refinished. Thus, unless you have a new boat that hasn't been painted, you'll have use for wood filler when you sand the brightwork down to bare wood for refinishing. ★★★

**MAJOR ROLE** of highly waterproof and elastic polysulfide compound is to seal seams below waterline

**USE SURFACING COMPOUND** to plug small holes. It falls out with age so inspect the repairs regularly





# OUTDOOR TIPS

By LEFTY KREH



## Jazz up your Jitterbug!

The Jitterbug is one of the finest and probably the most popular night-fishing surface lure used for freshwater bass. The trouble is, bass often strike the lure and miss the hooks. If you substitute "flat-fish-type" hooks for the front treble, you'll find your odds will improve. Nearly everything gets caught!



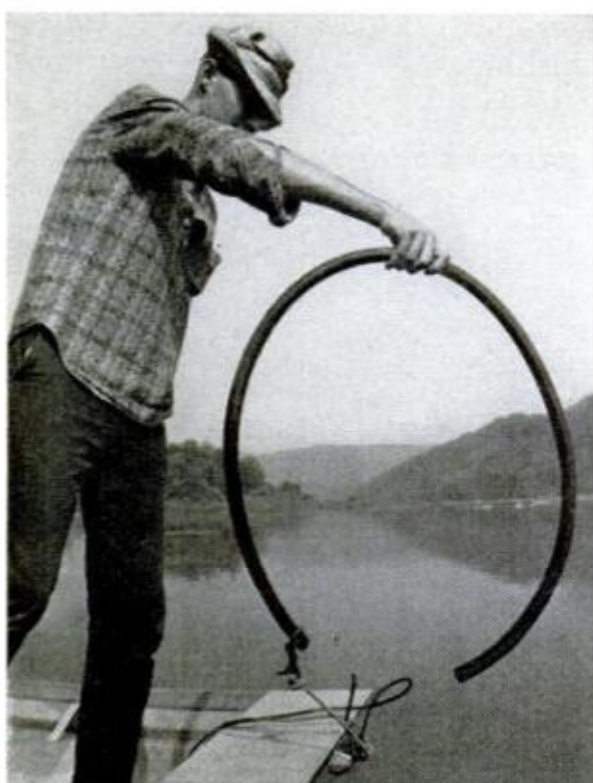
## Tired batteries?

If you're suffering from this common malady, you're probably flicking on your flashlight switch without knowing it, subsequently losing all juice before you need it. To prevent this inadvertent power drain, insert one battery so that it cannot activate others in the tube. When you need the light, it's easy to return the batteries to their correct positions.



## Snagproof knot for boots afield

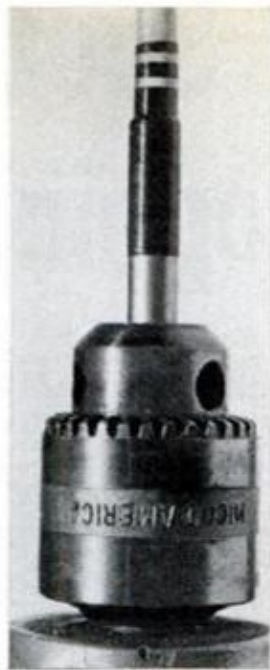
Fed up with your bow slipknots always catching in underbrush? Buy new rawhide laces, shave tips to a point and hold a lit match under the ends to harden them. Then lace the strings to normal highest position and loop the string ends through eyelets (above). Drop the ends through the opposite loops and pull them to tightness desired.



## Sea anchor for float trippers

Fishermen who drift rivers fight a constant battle to keep their boats drifting correctly. You can solve this problem with a 6-ft. length of old garden hose tied to a rope (left). The more rope you pay out, the slower the boat goes. If the river is swift, a short piece of anchor chain will do a better job. And the slower you drift, the better you will be able to retain control of your position in the stream.



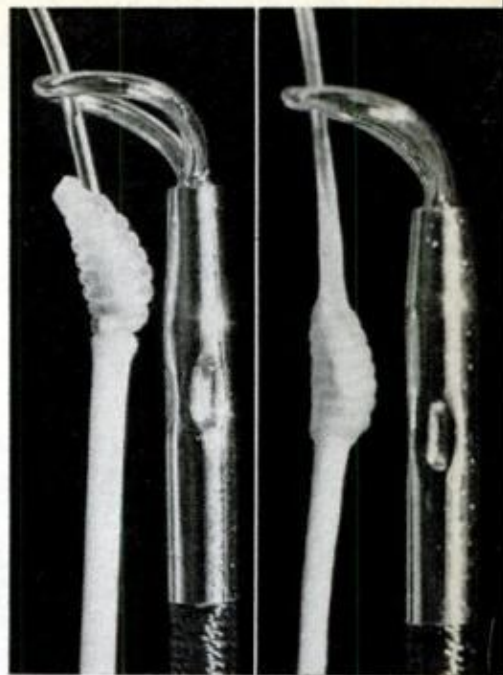


### How to repair a worn ferrule

A metal ferrule for a fishing rod that's been bumped about and now has trouble fitting its female counterpart can be repaired by placing it in a drill chuck and tightening it (left). Three equal sides of compression provide the centering you need.

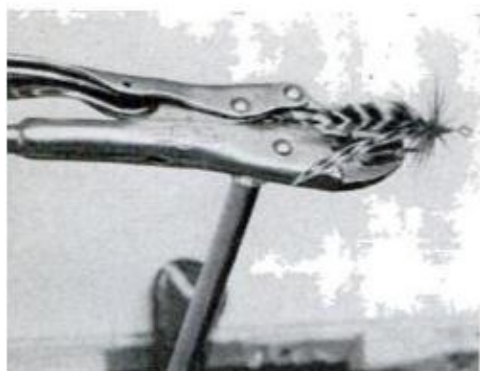
### Coat your nail knots

The nail knot is commonly used to connect a fly line to a leader. Even a trimmed end (near right) can catch your rod tip, thus losing a fish. Several coats of rubber-based glue (e.g. Pliobond) form a "football" connection (far right) that easily slips through guides.



### Better way to wear boots

Result of a relatively brief hike through brush is shown on model's left leg (right in picture at far right)—a collapsed legging. Boot on right leg is still upright. If you want to keep them up where they'll neither bag, sag nor get a wet lining, then fold over and snap the boots up (near right)—an old trick originated by coon and 'possum hunters.



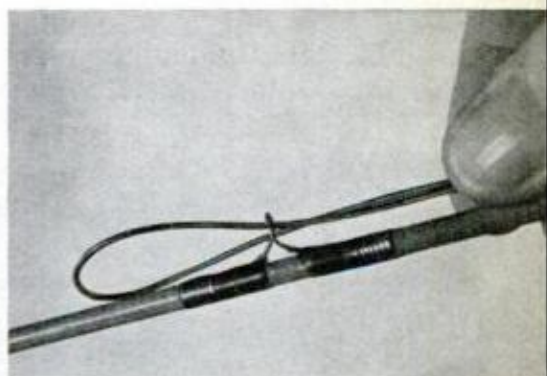
### Makeshift fly vise

A perfect vise for tying big flies is a small pair of locking pliers welded to a rod that's attached to a C-clamp. This will handle No. 4 to No. 9/0 flies with ease and it's fully adjustable. With it you'll have an all-purpose angling travel tool.



### Where's the tippet?

This question is often asked by fly fishermen after reeling the tiny tippet end into the line coils of their reel. You can solve this problem by slipping the last ten inches of leader through the spool's side. It stays and is ready for use whenever you are.



### Threading a fly rod

Double your fly line when threading the rod so that in the event your fingers should slip, the loop will not slide back through the guides. This is one heck of a lot quicker, easier and simpler than threading the thin, hard-to-see leader. ★★★



## PM OWNERS REPORT AMC GREMLIN

A Nationwide Survey Based on  
1,350,000 Owner-Driven Miles

By **MICHAEL LAMM**, West Coast Editor  
*Photos by the Author*

# Blind Spots Eye-Popping

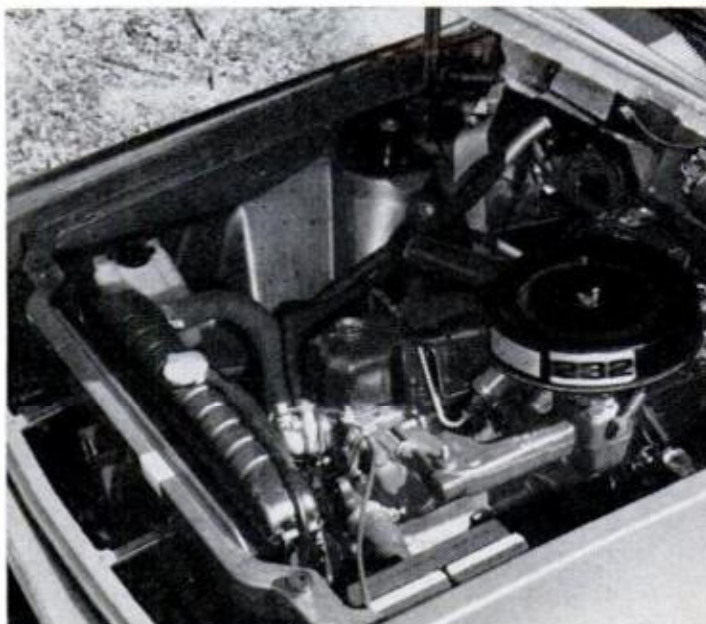


**APPEARANCE PACKAGE INCLUDES STRIPES.** Unique styling attracted many buyers, but economy topped likes

**T**HERE'S A DEFINITE FLAIR about the Gremlin—a unique personality, owners say. Asked why she bought her Gremlin, a Virginia computer operator said, "It reminded me of the original Mustang in the sense of being something completely different. It has an air about it."

A schoolteacher: "Was looking for a car different from all the rest." A North Carolina news editor: "Style—it's the ugliest

most beautiful car I have ever seen." And we received any number of similar responses: "Different." "Cute." "Very sporty." "The car looks so friendly—I love my Gremlin." "This is a car that is long overdue," wrote an Iowa graphic artist. "Its unique styling has a place—the mini-wagon concept is great for commuting, and at the same time it has pizzazz. Could become an American tradition."





# in Visibility, But Economy!

But owners had other reasons, too, for buying new Gremlins: "Economy; also I was offered \$500 more in trade by the AMC dealer." "Pinto looks too cheap; Vega won't go through a car wash; Gremlin gives more for the money." "Easier to handle in heavy traffic and parking." "Fun to drive; fun to be seen in." "I wanted a small car and more of a sports model." "I bought it mostly for the different styling and larger capacity as compared to my VW trade-in."

*What are the Gremlin's best-liked features?* "Very comfortable for driver and shotgun passenger." "Easy on gas, handles easy." "My car has stood out all winter in minus 25° temperature and I have had no trouble starting it every time." "Big engine in a small car." "Space in back with easy access through liftgate." "Peppp-py." "Good handling, smooth ride." "I like the size, handling, and go power." "It has enough engine to handle automatic transmission, power steering, and airconditioning without pooping out—still gives pretty fair gas mileage." "More horsepower and more weight (for safety) than comparable minicars." "Folding rear seat and opening

window makes shopping easy." "It's just big enough for my drums, my girl and St. Bernard and me to sneak through traffic."

"Performance at highway speed is outstanding, as is handling." "Stability excellent." "Easy to manage in traffic." "Can't ask for more scat." "Very nice car for teen-agers; also for errands; but will be ready for bigger car soon." "Fast handling on so short a wheelbase—great—and three turns lock to lock—even with the stock big-Six I can beat any Maverick in town."

*What do Gremlin owners complain about?* "Rear window gets dirty too quickly. It needs a spoiler to force air down over it." [There are scoops available optionally for \$20, but most salesmen never bother to tell prospective buyers.] "Rear side windows do not roll up and down." "Blind spots are a hazard—those wide side panels."

"I wish the factory would offer disc brakes. Drums are marginal even with the stock 258." "In a panic stop, the rear end comes around—very dangerous." "Hard to handle in an emergency stop." "Several articles I have read commented on the [Gremlin's] undesirable braking tendencies. I agree that the brakes have an unusual feel, but there is nothing inadequate about them—merely a matter of developing a workable technique."

"I would like synchromesh on low gear." "Poor traction on snow." "Paint is chipping where flying rocks hit body behind front tires." "How about a door on that hole they call the glove compartment?" [A door is part of the optional \$25 interior appointment package or available sepa-



**GREMLIN SHARES GAUGES** with the Hornet—in fact, shares everything except rear sheet metal and wheelbase. Owners like dash layout (left, opposite page), but complain that glovebox (not shown) lacks door

**LARGER 258-CU.-IN. SIX** (right, opposite page) gets better mileage than the 232! Either engine gives big-car performance, is easy to work, can handle automatic, power steering and airconditioning

**COMFORTABLE SEATS UP FRONT** (near left), lots of legroom, but the wheel's too low, say the owners. When front buckets are pushed far back, there's too little rear kneeroom, a crimp shared by most minis





**OWNERS WOULD LIKE TAILGATE** in addition to rear liftgate. Some complained of dust and splatter obscuring this window; they'd like deflector to draft-clean the glass (it's optional). Rear seatback folds forward, but there's no good way to conceal cargo



rately for \$7.85 over AMC parts counters.] "The fold-down rear seat rattles and so far no one can make it shut up!" "It needs an overhead light when you open the door." [Here again, one is included in the optional \$25 light group, as are warning buzzers and lights for low fuel, headlights on, and emergency brake on.] "No room in the back seat." "Too hard to reach hand-brake release and window cranks when belted in with shoulder harness."

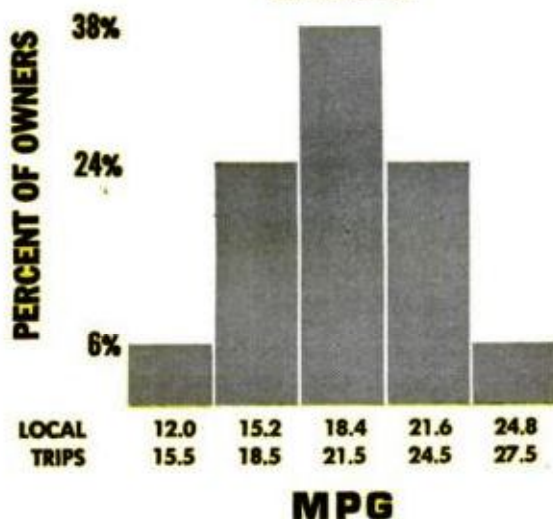
"Needs about 100 more pounds over the rear wheels." "I would like for not only the back window to open but the whole back—like in a station wagon." "Gas mileage could be better."

What do owners think of their Gremlins' workmanship? "The best of any." "Very poor." "It is solidly built—doors close like a luxury car." "For the price we paid, the quality is outstanding." "Somewhat disappointing—trim strips missing, paint drips on door, lighter has never worked." "Very good for a mass-produced car." "As good as expected with union-made products." "Acceptable for a nation of minimal quality control." "Excellent." "Very cheap." "Fair." "Seems rather thrown together." "Interior panels are constantly popping screws." "The inside could be improved as far as the plastic interior goes." "Above average compared to the other U.S. cars I looked at, namely Pinto and Vega."

What about fuel economy? "I drive 70 mph and still get 20-22 mpg." "Gas mileage is lower than I expected—hoped for 22-25 mpg but get only 17-19." "The man at the gas station says I don't stop as often as I used to." "It doesn't get the 28 mpg my 1965 VW used to, but it's still very

### GREMLIN FUEL MILEAGE CHART

232-cu.-in. Six





## Summary of 1971 Gremlin Owners Reports\*

|                                  |           |
|----------------------------------|-----------|
| Total miles driven               | 1,350,208 |
| <b>Average miles per gallon:</b> |           |
| 232-cu.-in. Six,                 |           |
| local driving                    | 18.4      |
| long trips                       | 21.5      |
| 258-cu.-in. Six,                 |           |
| local driving                    | 19.2      |
| long trips                       | 21.6      |
| <b>Engines:</b>                  |           |
| 232-cu.-in. Six                  | 67.3%     |
| 258-cu.-in. Six                  | 32.7      |
| <b>Transmissions:</b>            |           |
| Automatic                        | 41.7%     |
| 3-speed manual                   | 58.3      |
| <b>Models:</b>                   |           |
| 4-passenger                      | 94.7%     |
| 2-passenger                      | 5.3       |
| <b>Why the Gremlin?</b>          |           |
| Economy                          | 47.3%     |
| Styling                          | 33.2      |
| Size                             | 32.6      |
| Price                            | 10.7      |
| <b>Specific likes:</b>           |           |
| Handling                         | 62.4%     |
| Economy                          | 45.7      |
| Style                            | 32.2      |
| Power                            | 26.0      |
| Comfort                          | 18.1      |
| Size                             | 15.7      |
| <b>Specific dislikes:</b>        |           |
| Poor gas mileage                 | 14.6%     |
| Light weight                     | 13.6      |
| Rattles                          | 8.9       |

|                                      |       |
|--------------------------------------|-------|
| Poor brakes                          | 7.1   |
| Workmanship                          | 6.5   |
| Poor headroom                        | 6.5   |
| Poor legroom                         | 5.4   |
| <b>What changes would you like?</b>  |       |
| Better rear vision                   | 14.8% |
| More headroom                        | 10.3  |
| Seatback shape                       | 9.1   |
| More legroom                         | 7.1   |
| Better brakes                        | 5.3   |
| Different styling                    | 5.0   |
| Better suspension                    | 4.7   |
| <b>Had any mechanical troubles?</b>  |       |
| No                                   | 58.7% |
| Yes                                  | 41.3  |
| <b>What kind of trouble?</b>         |       |
| Carburetor                           | 24.3% |
| Electrical                           | 14.5  |
| Brakes                               | 13.8  |
| Transmission                         | 5.9   |
| Cold starts                          | 4.6   |
| Windshield wipers                    | 4.6   |
| <b>Did you repair it yourself?</b>   |       |
| No                                   | 89.0% |
| Yes                                  | 11.0  |
| <b>Dealer repairs satisfactory?</b>  |       |
| No                                   | 50.7% |
| Yes                                  | 49.3  |
| <b>Is the Gremlin your only car?</b> |       |
| No                                   | 59.5% |
| Yes                                  | 40.5  |
| <b>Other cars owned:</b>             |       |
| Chevrolet                            | 21.2% |
| Ford                                 | 16.3  |

|  |       |
|--|-------|
| Plymouth   | 13.2  |
| American Motors  | 13.2  |
| Pontiac  | 12.8  |
| Dodge  | 6.6   |
| Volkswagen   | 6.6   |
| Buick  | 6.6   |
| <b>Accessories and power options:</b>                      |       |
| Radio  | 65.9% |
| Automatic transmission                                     | 41.7  |
| Luggage rack   | 31.9  |
| Bucket seats   | 22.2  |
| Oversized tires  | 16.7  |
| Bumper guards  | 15.3  |
| Whitewall tires  | 14.7  |
| Airconditioning  | 14.4  |
| Light group  | 11.1  |
| Power steering   | 9.2   |
| Tinted glass   | 8.1   |
| <b>What accessories/options would you order next time?</b> |       |
| The same   | 51.6% |
| Airconditioning  | 11.1  |
| Radio  | 6.3   |
| Oversized tires  | 4.6   |
| Power steering   | 4.0   |
| Bucket seats   | 3.7   |
| Light group  | 3.4   |
| Luggage rack   | 3.1   |
| <b>Age distribution of owners:</b>                         |       |
| 15-29 years  | 52.7% |
| 30-49 years  | 34.4  |
| 50-plus  | 12.8  |
| <b>Would you buy another Gremlin?</b>                      |       |
| Yes  | 68.7% |
| No   | 31.3  |

\*Percentages might not equal 100% due to rounding and/or insufficient data.

economical to drive." "We got tired of bankrolling a 1968 muscle car." "I recently drove the Gremlin from Battle Creek to Milwaukee and back—486 miles—on a single 21-gal. tankful of gas; was not tired because Gremlin rides better than many medium-sized cars."

As for *economy of maintenance*, a Minnesota toolmaker wrote: "I own a 1968 Rambler American and have put 65,100 miles on it with no mechanical troubles. This car still has the original shocks, brakes, clutch, battery, and starts and goes every day even in Minnesota's bitter cold. If the engine will last in my American, it should last in the Gremlin. I wanted a smaller car built in the U.S.A."

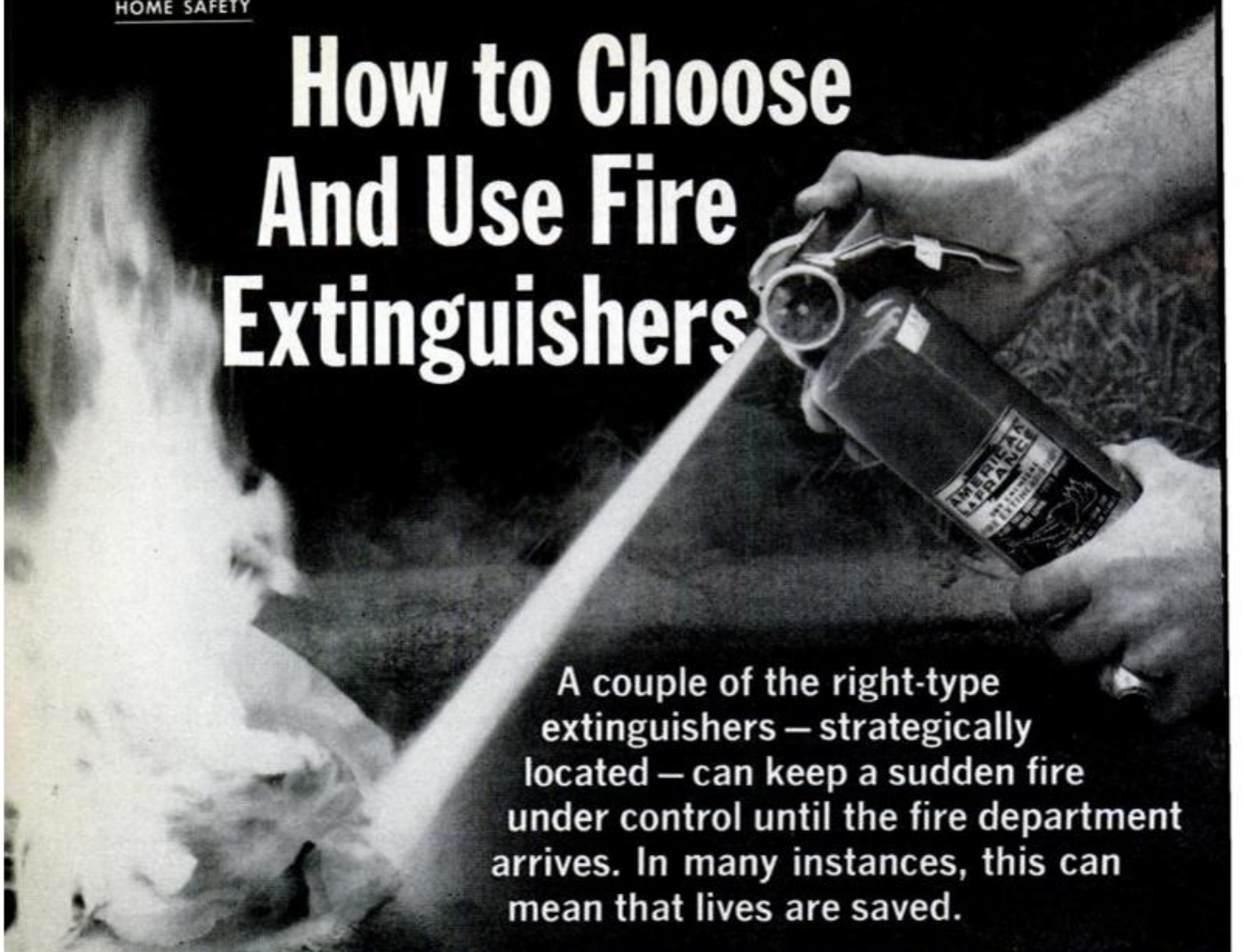
And on the topic of *initial purchase price*, these comments: "We needed two cars at the same time and could buy twin Gremlins for the cost of one big car." "Don't like AMC's package deals—in order to get one accessory you have to buy many. This forces you to buy things you don't want or need." "I feel I paid too much (\$2440.05) for a 'low-priced car' with only automatic, radio and an *optional* rear seat!" "Options ran the bill up—I

guess when one buys a \$2000 car he should expect to spend \$1000 on options." "Promotional material is misleading—\$1999 will not get the car out the door." "I was shopping for price. AM dealer gave me \$400 more on my trade than any competitor offered."

And to wrap it up, these parting shots: "Only minicar I could get *without* bucket seats." "Only compact in its class with a six-cylinder engine." "Gremlin would be better with front-wheel drive to put traction where the weight is." "Several of my friends have purchased Gremlins on my recommendation." "Service is excellent—local dealer is trying very hard to establish himself in youth/performance market." "After test driving the Maverick, Pinto, Toyota, Datsun, Duster and VW, I found the Gremlin a better car overall." "The dealer is good generally—not as flashy as the bigger dealers, but okay." "I got irritated because I bought the car—I picked it out and brought my husband in for his opinion—and then they show him as the legal owner. Slight case of liberated woman vs. male chauvinism, I guess. These dealers should get smart." ★ ★ ★



# How to Choose And Use Fire Extinguishers



A couple of the right-type extinguishers — strategically located — can keep a sudden fire under control until the fire department arrives. In many instances, this can mean that lives are saved.

By STEVEN J. HOWARD

**I**F A GREASE FIRE breaks out in your kitchen, are you equipped to put it out? Do you know the three most common types of household fires and the quickest way to put each out? Since there are about 300,000 home fires annually, it makes good sense to equip your home—and family—with the extinguishers and the knowledge to combat common household fires.

Because fire can, and often does, travel extraordinarily fast, there is a procedure that fire departments strongly urge homeowners to follow:

First, evacuate the house.

Second, call the fire department.

Third, fight the fire if—and that's a big if—you have the right equipment to do so without endangering your life.

Besides an ordinary garden hose and water for use on many types of fire, this

means you must have fire extinguishers carefully placed for maximum safety.

Fire extinguishers for the home are those that will put out class A, B and C fires. These classifications were devised by the National Fire Protection Assn. to distinguish the combustibles which feed a fire. Thus, unless you have a multipurpose fire extinguisher, you must know the class of a fire to fight it.

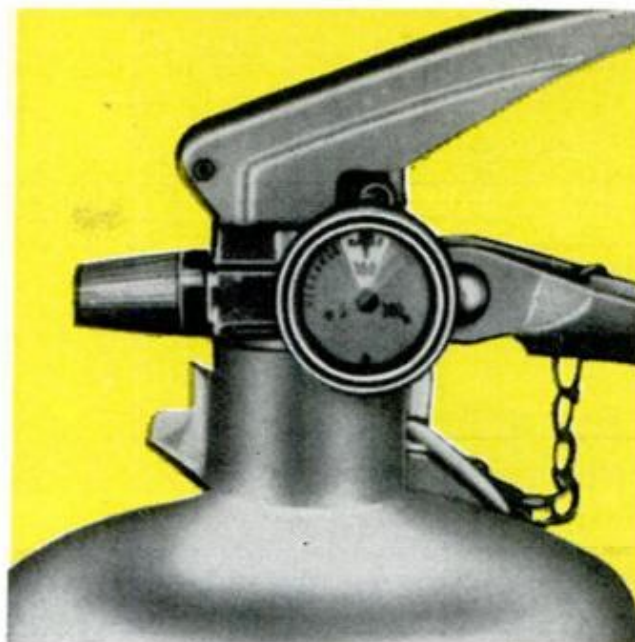
**A, B and C Fires.** Class A feeds on wood, cloth, paper and rubber; class B on flammable liquid and grease blazes, and class C fires are electrical. If electricity is turned off, a class C fire is converted into a class A or B fire. (A fourth classification of fire (D), which feeds on combustible metals such as magnesium, sodium, titanium and zirconium, is unlikely to occur in the home.)

You have three options in protecting





**EXTINGUISHER** (left) is for A fires, uses water. The other (B-C type) fights grease, electrical fires



**GAUGE OR INDICATOR** on any extinguisher you buy is a must. Indicator tells when repressurizing is due



**MULTIPURPOSE EXTINGUISHER** states on nameplate that it is usable for class A, B and C fires



**SOME TYPES** have an indicator located at top of cylinder to show when the pressure is inadequate

your home against the first three fire classes. One is to use a multipurpose extinguisher that fights all three. Your second choice is to use two different kinds of extinguishers. The third is to set up a water hose and supplement it with fire extinguishers to combat class B and C fires. Each option offers certain advantages the others don't and each has some special limitations.

For example, the multipurpose extinguisher, which uses monoammonium phosphate as the extinguishing agent, offers the very important advantage of speed. You can grab it and use it without stopping to think whether a fire you are fighting is of the A, B or C type. It extinguishes all three.

But you should recognize that monoammonium phosphate extinguishers that weigh 4½ pounds and more are the only

ones listed by the Underwriters' Laboratories as "multipurpose." Those of smaller size have shown limited effectiveness against a class A fire and are listed as BC extinguishers.

You can use a smaller size monoammonium phosphate extinguisher against a class A fire, but you will also have to use water to completely extinguish a blaze of any proportion. Some misleading advertising of small-size monoammonium phosphate extinguishers would have you believe otherwise.

Of the three options, equipping a home with multipurpose extinguishers is the most expensive. For example, a three-bedroom house with den, basement and garage, requires a minimum of four multipurpose extinguishers to provide for minimum protection: one for the bedrooms, living room, dining room and den;





**CARBON DIOXIDE** is used in B-C extinguishers. This type requires that you get close to the fire and direct spray at base of the flame



**CYLINDER** in this type of extinguisher is replaced, rather than recharged

one in the kitchen; one in the garage, and one to protect the basement.

In choosing between the three options, there is an additional characteristic of the multipurpose extinguisher to consider. When monoammonium phosphate hits flame, it forms a tacky crust that smothers the fire. This crust has an insulating effect on electrical contacts that could damage electrical equipment if you have to fight a class C fire.

The second choice of home fire-extinguisher protection involves the use of two different types of extinguishers: A and BC. To use them, you must stop and think if the one you've picked up is the right one for the fire at hand.

For example, class A extinguishers recommended for home use employ water as the extinguishing agent. Never use a class A extinguisher on a class B or C fire. Water will spread a fire that is being fed by cooking fat, gasoline or other flammable liquid. It presents danger of shock and electrocution if used on electrical fires.

Class A fire extinguishers are of two types: stored pressure, which keeps contents under pressure at all times, and pump tank. A pump tank extinguisher is a 2½ or 5-gal. container of water that you manually pump to bring water to bear on the flames through a hose. A stored-pressure class A extinguisher of 2½-gal. size weighs less than a pump-tank type, which makes it easier to handle. However, a pump-tank extinguisher costs less.

Additionally, the extinguishing agent for a pump tank is right in your kitchen or bathroom. If you discharge a pump-type extinguisher, you simply refill it at the sink. (A stored-pressure extinguisher has

to be refilled and repressurized by a fire equipment service shop.)

BC extinguishers use carbon dioxide, sodium bicarbonate, potassium chloride, or potassium bicarbonate as the extinguishing agent. Carbon dioxide doesn't leave a residue like the chemical powders. However, its range is more limited; you have to get in closer to fight a fire.

However, a carbon dioxide extinguisher costs practically twice as much as a dry chemical BC extinguisher of comparable size. And it has another drawback: It has to be weighed and possibly repressurized every six months by a fire equipment service shop. Thus, homeowners are better off if equipped with dry chemical extinguishers.

Incidentally, in an emergency you can use a BC-type extinguisher against a class A fire. The chemical agent will knock down the flame, giving you time to get water to the blaze.

Buying individual class A and class BC extinguishers for the home is less expensive than buying multipurpose extinguishers. Again, assuming that same three-bedroom home mentioned earlier, you will spend \$65 to \$85 for minimum protection, depending on whether you get a stored-pressure or pump-type, class A extinguisher, as follows:

- One class A extinguisher to cover the bedrooms, living room dining room and den. Cost: \$20 to \$40.
- Three BC extinguishers to protect the kitchen, garage and basement against flammable liquid fires and all areas of the home against electrical fires. Cost: \$15 each—\$45 total.

The third and least expensive option



open to you is to equip the house with a garden hose for class A fires and with BC fire extinguishers. Make sure the hose is long enough to reach the farthest part of the house. You can store it rolled up near the water source, such as in a kitchen cabinet beneath the sink. But you should bear in mind that a fire may keep you from reaching the hose.

The hose should have a nozzle so that a high-pressure spray can be played on the fire, and the connection should be of the quick-connect type. They're available in hardware stores for about \$2.

The coupling has two parts: a female adapter connected to the hose, and a male adapter that connects to the water faucet. Unfortunately, this awkward piece of hardware must stay connected to the faucet to assure quick hook-up in case of fire.

In selecting multipurpose or BC fire extinguishers, there are several important points to note, such as size. BC extinguishers contain a charge of anywhere from 1 to 30 pounds. Naturally, the greater the charge that an extinguisher has the greater amount of extinguishing agent that can be brought to bear on a fire. But, of course, large-charge extinguishers also weigh more.

The Fire Equipment Manufacturers Assn. says, "Pick the largest extinguisher that can be handled by everyone in the family who may have to fight a fire."

Incidentally, the numeral classification that precedes the letter classification on a nameplate, such as 2BC, indicates the size of the Underwriters' Laboratories (UL) test fire which the extinguisher can handle. The numeral is academic since no authoritative agency has established standards for the home which use UL-test-fire sizes as a basis.

Make sure that class A stored-pressure, multipurpose and BC extinguishers have direct reading gauges or indicators that tell if the extinguisher is pressurized and ready for use. One type of indicator is a button-type device that you press in to test the extinguisher. If it pops out, pressure is okay. If it stays in, the extinguisher should be repressurized.

You may encounter cartridge-type extinguishers. These have gas stored in a separate container that must be ruptured before the extinguisher can be used. They are not recommended for home use

by the Fire Equipment Manufacturers Assn. because they don't have pressure gauges or indicators and must, therefore, be weighed periodically. Select extinguishers that specify they have been listed by the Underwriters' Laboratories (which has set standards of construction and performance).

As for non-UL-listed equipment, the National Fire Protection Assn. says: "Beer-can-size extinguishers are a poor choice. These are tin cans, aerosol containers, plastic shakers, or squeeze bottles that hold less than a pint of liquid or 12 to 16 oz. of a dry powder. Besides their small capacity, these devices are of uncertain reliability and their range is dangerously limited."

An extinguisher is worthless if you can't get to it, so keep these points in mind:

Mount extinguishers so they're near an escape route. This gives you flexibility. You can fight the fire or get out if heat and smoke become intense.

Don't locate an extinguisher in a stairwell. Rising heat may make it inaccessible.

In garages, workshops and kitchens, avoid putting the extinguisher on a wall nearest a likely fire source. For example, don't mount one over the stove.

Become familiar with the use of your extinguisher by reading instructions on

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### **Mount extinguishers near an escape route. You can fight the fire or get out . . .**

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the nameplate. And check that gauge or indicator often to make sure the equipment has sufficient pressure.

Although do-it-yourself repressurizing kits are available, do not attempt to repressurize a stored-pressure extinguisher yourself. It's too dangerous. Containers have exploded and caused injury. Leave this job to a fire equipment servicing company.

Some extinguishers use replaceable cylinders which can be safely handled. If the extinguisher loses pressure, the spent cylinder is unscrewed from the valve assembly and a new cylinder attached in its place. ★★ ★





**7 a.m.  
to  
10 a.m.**

7:00 Radio and bedroom light go on  
7:15 Bathroom light goes on  
7:30 Kitchen light goes on  
8:00 Bedroom light goes off  
8:00 Kitchen light goes off  
9:00 Bathroom light goes off  
9:30 "Shadow" lamp goes on

10:00 Bathroom light goes on  
11:00 Bedroom light goes on  
11:00 "Shadow" lamp goes off  
12:00 Bathroom light goes off  
12:30 "Shadow" lamp goes on  
1:00 Radio goes on  
1:00 Bedroom light goes off

**10 a.m.  
to  
2 p.m.**



**2 p.m.  
to  
7 p.m.**

2:00 Bathroom light goes on  
3:00 Radio goes off  
4:00 Bathroom light goes off  
4:30 "Shadow" lamp goes off  
5:00 Bedroom and kitchen light go on  
5:15 Living room light goes on  
5:30 Bathroom light goes on  
6:00 Radio and "shadow" lamp go on

# Build PM's \$30



**7 p.m.  
to  
11 p.m.**

7:00 Bathroom light goes off  
8:00 Bathroom light goes on  
8:00 Kitchen light goes off  
10:00 Kitchen light goes on  
10:00 Bathroom light goes on  
10:00 Radio goes off  
10:30 Kitchen light goes off  
11:00 Bedroom light goes off

12:00 Bathroom light goes on  
1:00 Living room light goes off  
1:00 "Shadow" lamp goes off  
1:00 Bathroom light goes off  
2:00 Bedroom light goes on  
3:00 Bathroom light goes on  
3:00 Bedroom light goes off  
4:00 Bathroom light goes off  
7:00 Radio and bedroom light go on

**12 p.m.  
to  
7 a.m.**







# 'House Watcher'

**This electric control box turns on lights and radio at intervals around the clock to give your home a lived-in look when you're away**

By WAYNE C. LECKEY, Home and Shop Editor

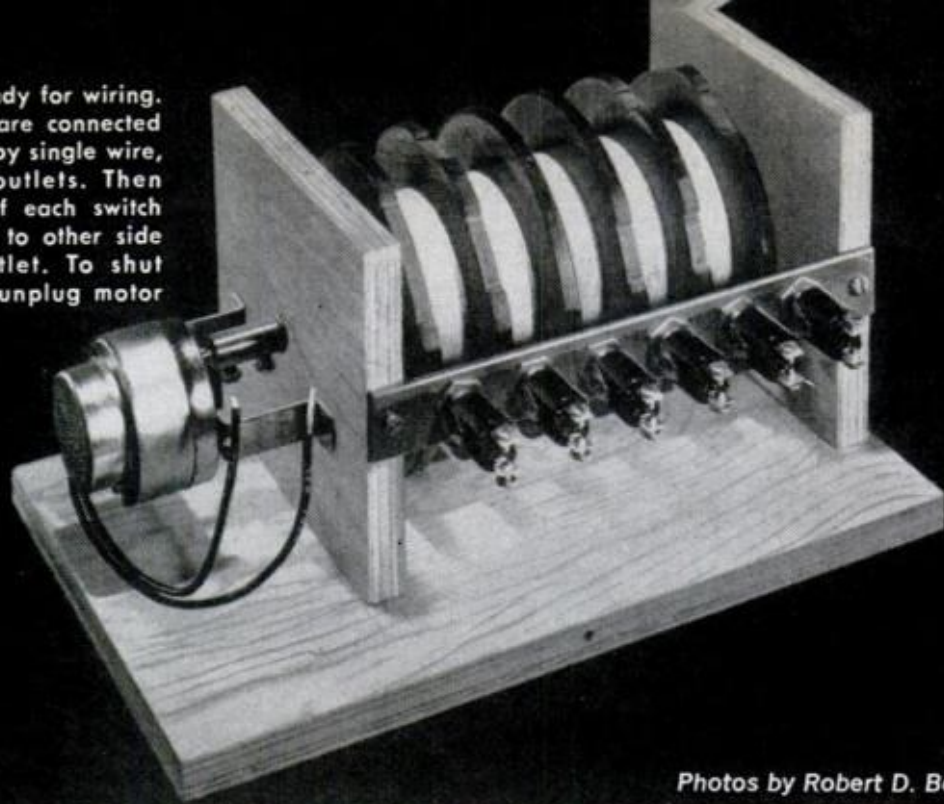
*Illustration by Ed Valigursky*

A SINGLE LIGHT burning night after night in the same room in your home is enough to tip off a prowler—that you're away. But when lights go off in one room and on in another, when a radio can be heard playing at some hours and not at others, and shadows can be seen moving across the windows—even a burglar who's been told you're away can't be sure enough to risk a break-in.

The device shown above is not just a "timer"; there is nothing like it on the market that will operate at several programmed intervals in a 24-hour period. *Popular Mechanics* presents this ingenious control as a project you can build yourself. The homebuilt concept you see here was developed through the cooperation of the inventor, Howard Natter of Yonkers, N.Y., who has agreed



**CHASSIS** ready for wiring. All switches are connected on one side by single wire, as are all outlets. Then other side of each switch is connected to other side of each outlet. To shut off control, unplug motor



Photos by Robert D. Borst

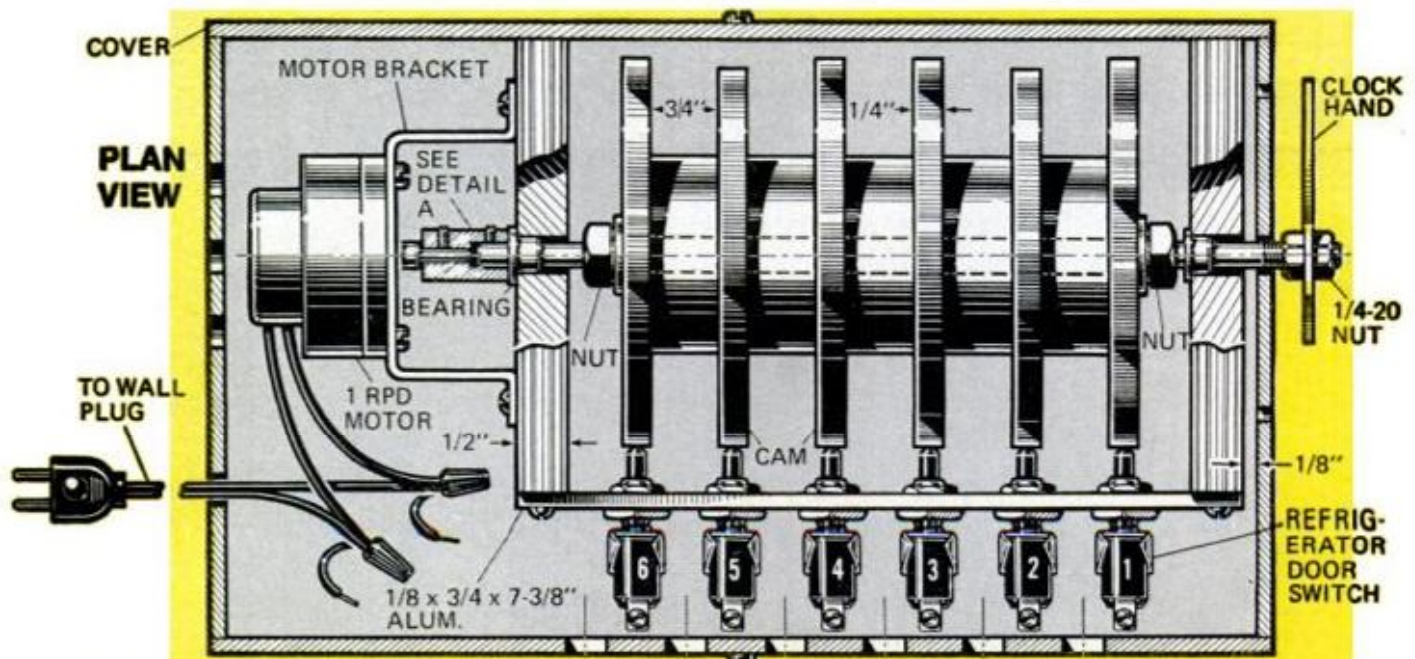
to let PM readers build a unit for their own use but not for sale.

Here is how it works: When you are getting ready to leave home, you place the control in the center of the house and near a wall outlet. Then table lamps (and a radio) in bedroom, bath, living room, kitchen and family room are plugged into the control with extension cords. In bath and kitchen, where normally there are no table lamps, it will be necessary to use spare lamps during your absence.

Now when you are ready to walk out the door, you set the clock hand (the top of the dial represents midnight; the bottom, noon) to coincide with the hour of

departure and plug in the control. This starts a 1-rpd (revolution per day) motor which slowly turns six cams. Each cam controls its own lamp, or radio as the case may be, and triggers a refrigerator-door switch which turns the lamp on and off as dictated by the configuration of the notched edge. When 24 hours are up (one revolution of the cam), the cycle repeats and continues for as long as the control is plugged in.

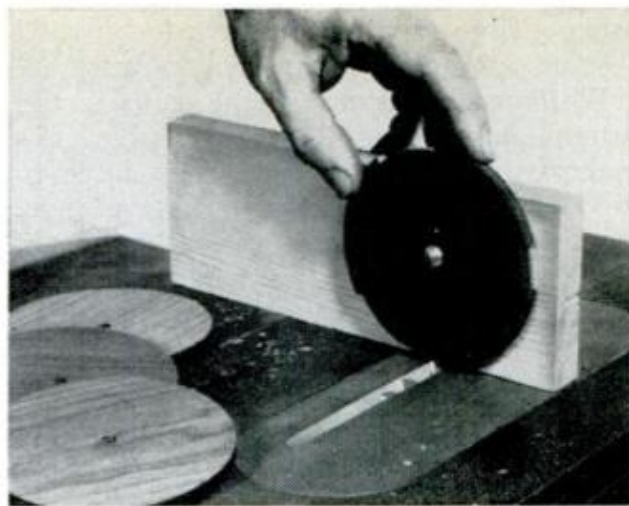
The size of your home, as well as the location of the rooms, will dictate the length of the extension cords; a two-story home will require longer cords than a one-story dwelling. But lamp-cord wire is





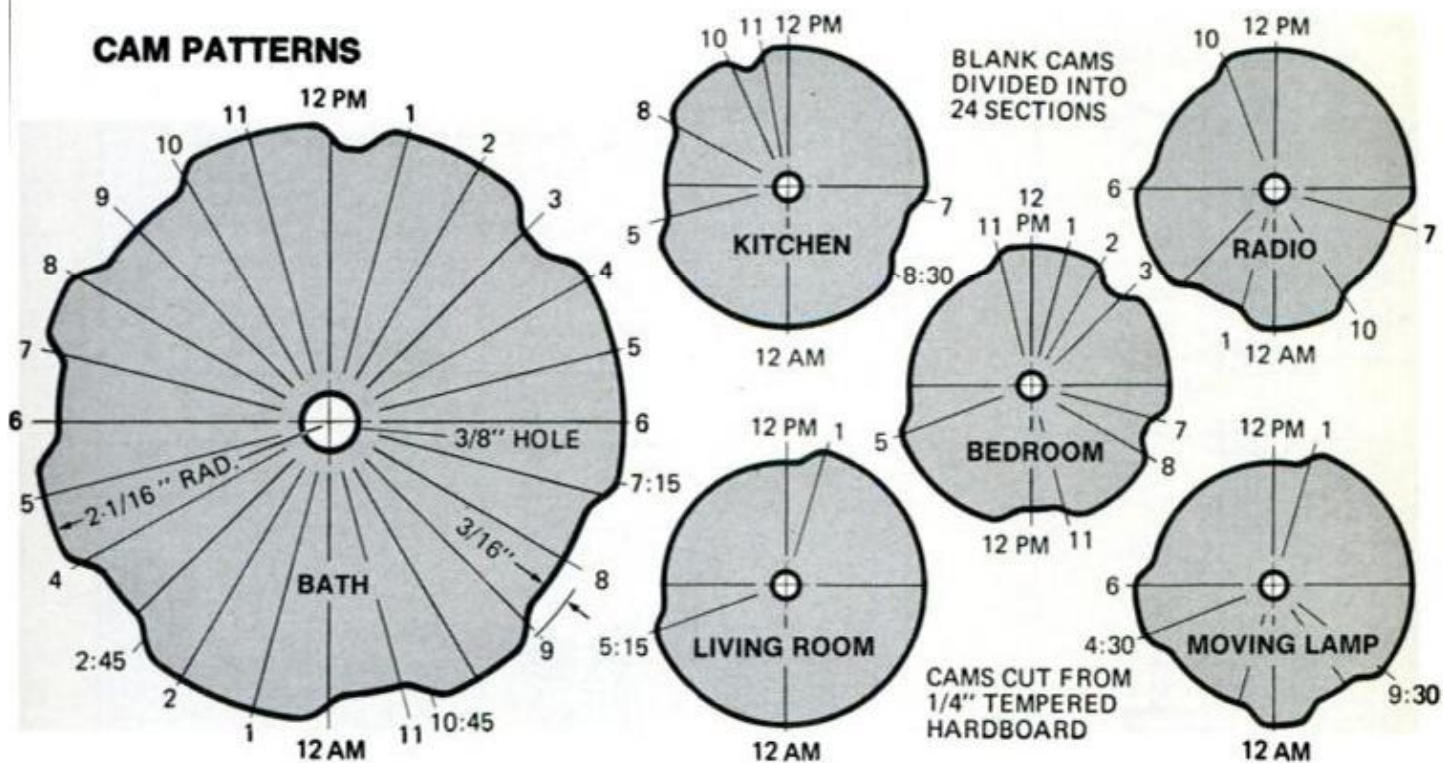


**CUT CAM BLANKS** from tempered hardboard with a circle cutter in drill press. To play safe, clamp work

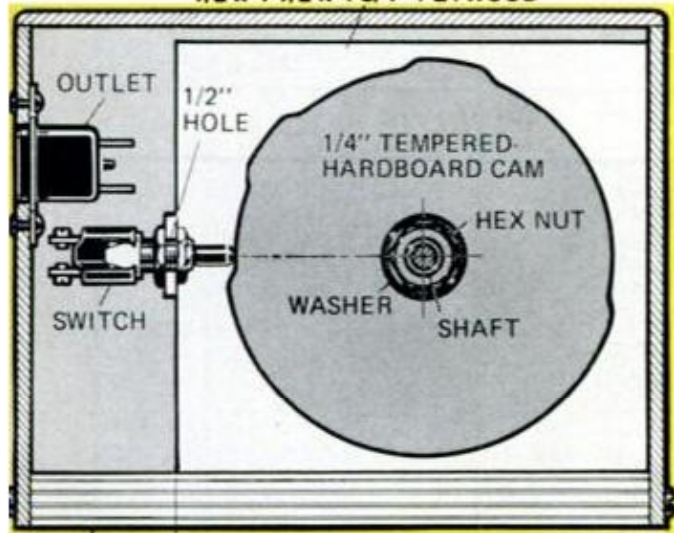


**CUT NOTCHES IN CAMS** by mounting blank over top of saw blade and slowly turning it to remove waste

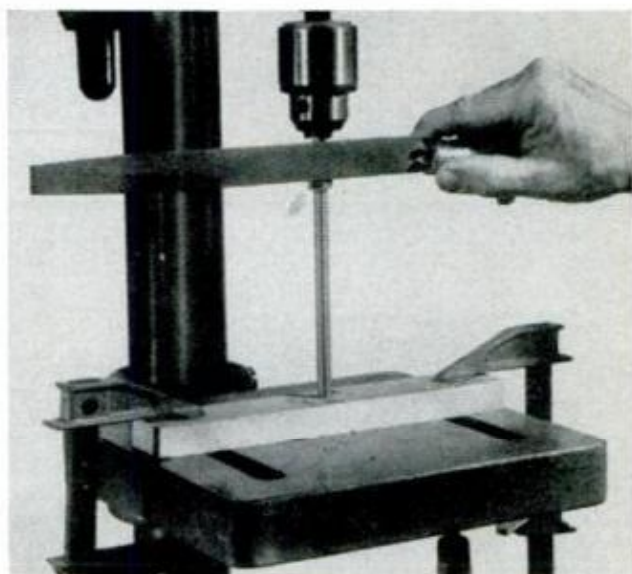
### CAM PATTERNS



1/2 x 4-1/2 x 4-3/4" PLYWOOD



**END VIEW**  
(END REMOVED)



**ENDS OF CAMSHAFT** can be filed down in drill press. Lower end turns in wood block clamped to the table



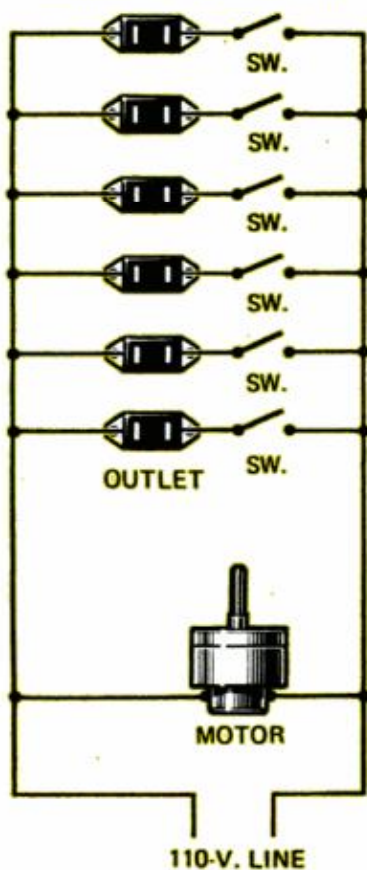
inexpensive, even if you have to buy 100 feet or more, plus plugs and sockets.

While we programmed the cams in the original control to follow a somewhat normal pattern of living, you don't have to follow the same cam patterns we give. You can design them to suit yourself. Nor do you need to have the cams control lights in the same rooms we suggest. You may prefer to have a light go on in the basement or in the garage. However, it's best to have no more than six extension cords operating off one circuit, even if all six lamps may never be on at one time.

In addition to light and sound, you can use moving shadows to fool a snooper. They can be created by a "psychedelic" lamp which is designed to be turned slowly by the heat of the bulb. Placed near a curtained window, but hidden from direct view, such a lamp will produce moving shadows that, to an outside observer, will make it appear that someone is walking around in the room. A common color wheel of the type frequently used to spotlight a Christmas tree will do the trick just as well.

For obvious reasons, you should tip off

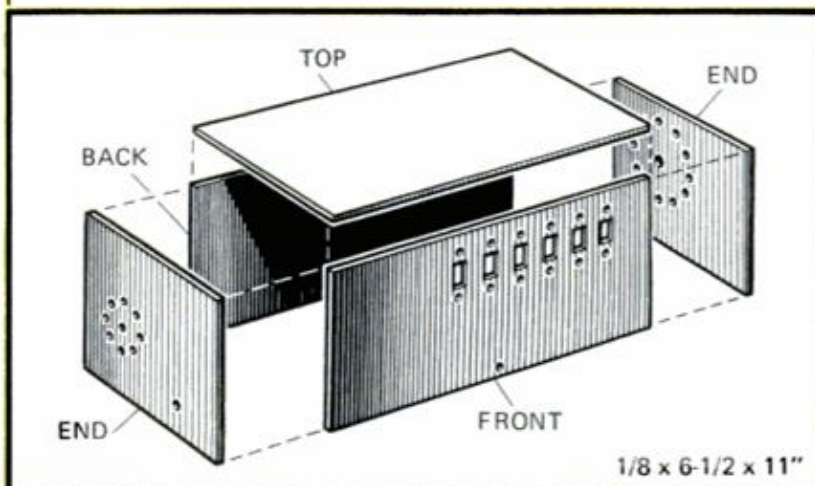
### WIRING DIAGRAM



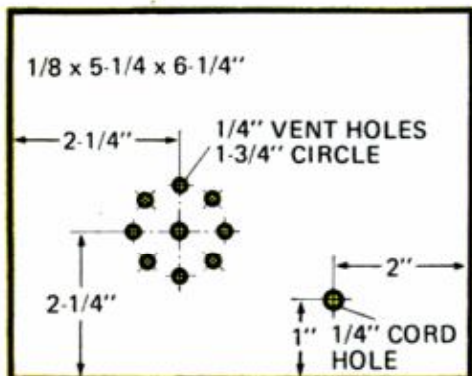
### COVER PATTERNS



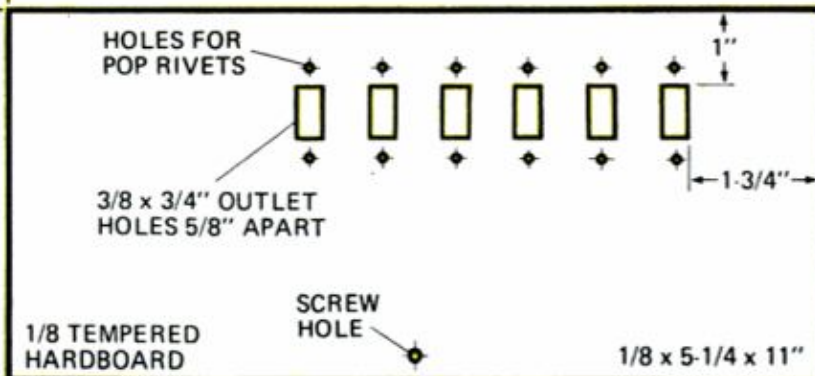
BACK



TOP



LEFT END



FRONT

Technical Art by Peter Trojan



your neighbors to your "house watcher" so they won't think someone is in your house when they see lights.

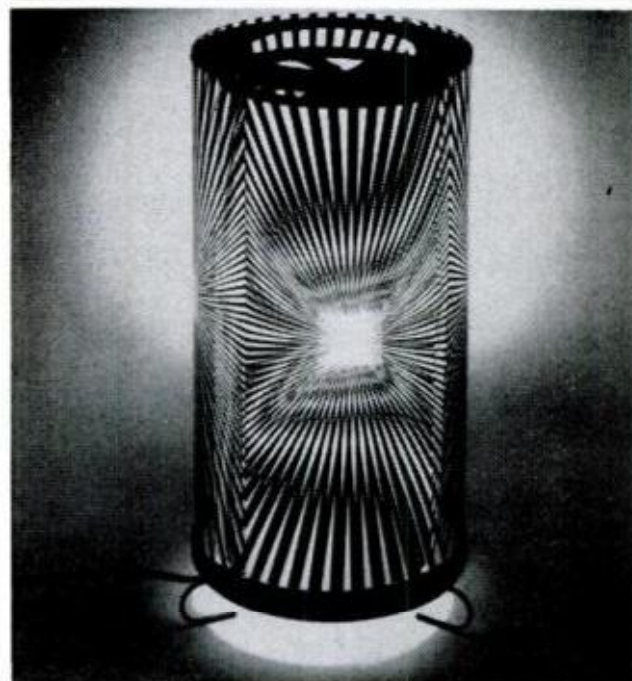
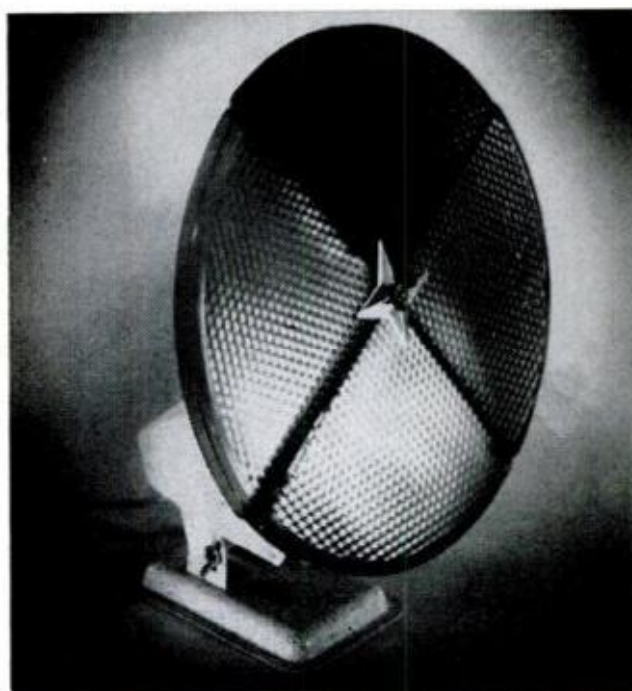
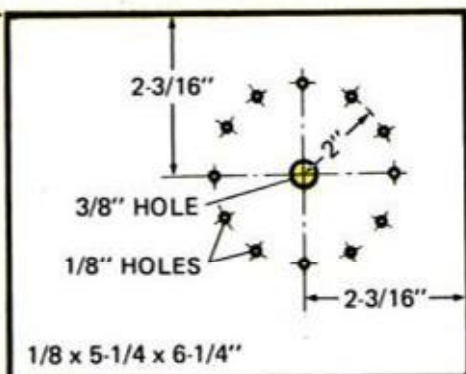
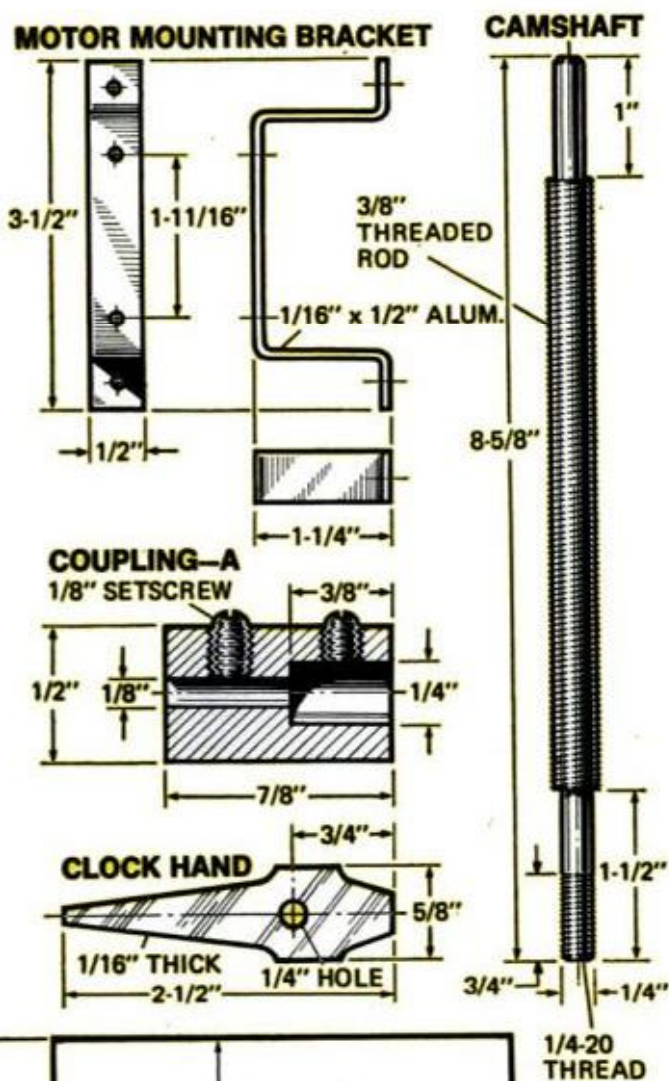
The cam assembly consists of six discs cut from 1/4-in. tempered hardboard (Masonite or Marlite) spaced 3/4-in. apart, and mounted on a 3/8-in. threaded rod that is turned down at each end. Turning down the ends to fit 1/4-in. bearings can be done in a lathe, or by chucking the rod in a drill press and "turning" it down with a file as shown in the photo, page 123.

The right-hand end of the shaft is threaded 1/4 -20 for a distance of 1/2 in. for

two nuts which hold a clock hand. The hand is used to set the cams so they will turn on lights at the desired hour. Twelve holes drilled in the cover serve as a dial for setting the hand. A nut and washer at each end are used to tighten the cams and spacers on the threaded shaft. Thickness, not profile, is important, so the spacers need not be discs; square blocks will do. Note that the midnight (12:00) point at the top of each cam must align when the six cams are tightened on the shaft.

The cams are cut with a circle cutter

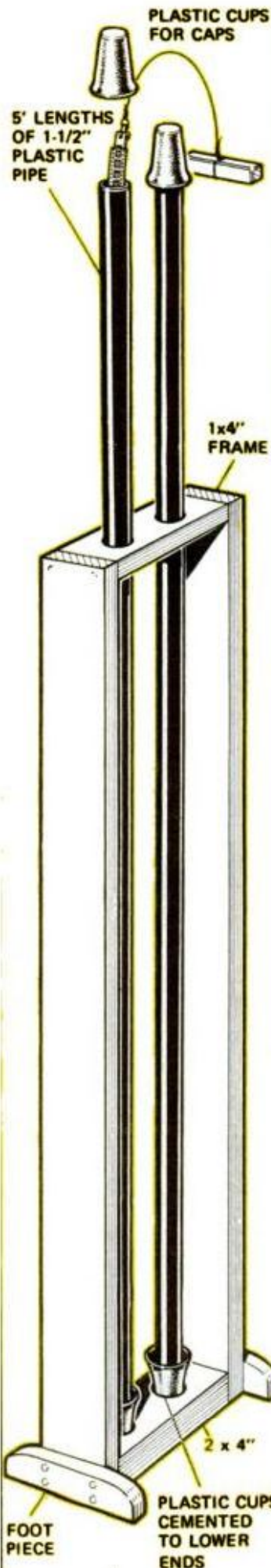
*(Please turn to page 174)*



**SHADOWS ARE PRODUCED** with lamps such as these. Color wheel at top is normally used to spotlight a Christmas tree. Both can be purchased locally or from the Cam Timer Co., 400 Walnut St., Yonkers, N.Y.

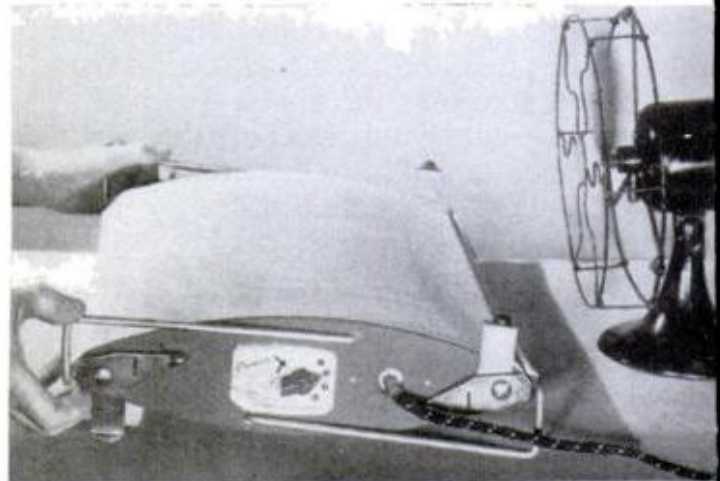


# PHOTO HINTS



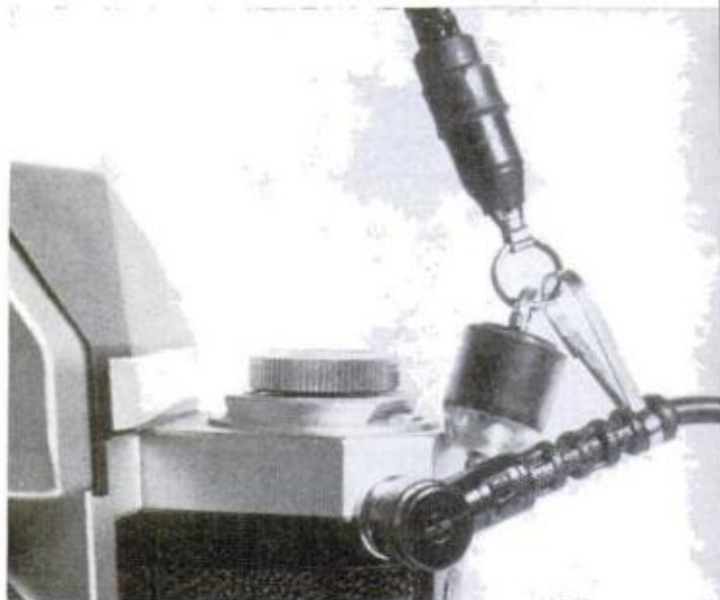
## Developing tanks from plastic pipe

Two lengths of 1½-inch plastic pipe will make a pair of deep developing tanks for 35-mm film, saving the fuss of loading reels. Five-foot sections will handle 20-exposure rolls. The ends are capped with plastic drinking cups. Cement on bottom ones; top ones are just pressed on. Be sure the cups are opaque or paint insides black to keep out light.—*L. H. Houck, Jefferson City, Mo.*



## Fan speeds print drying

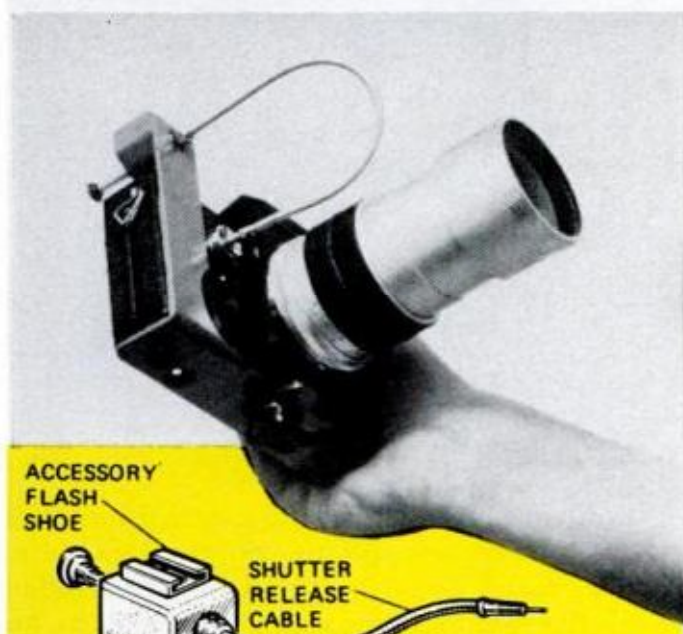
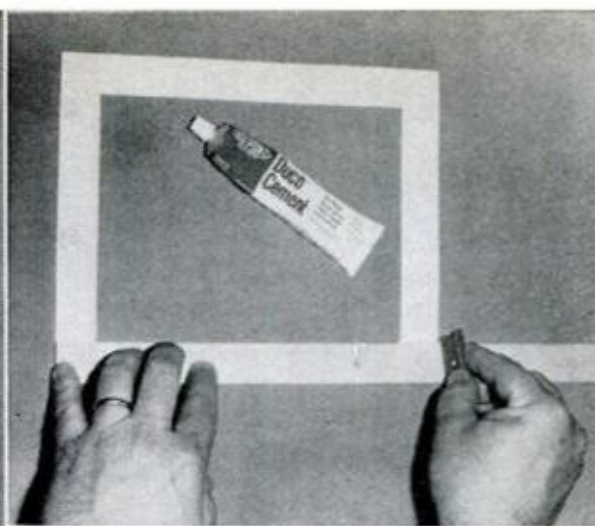
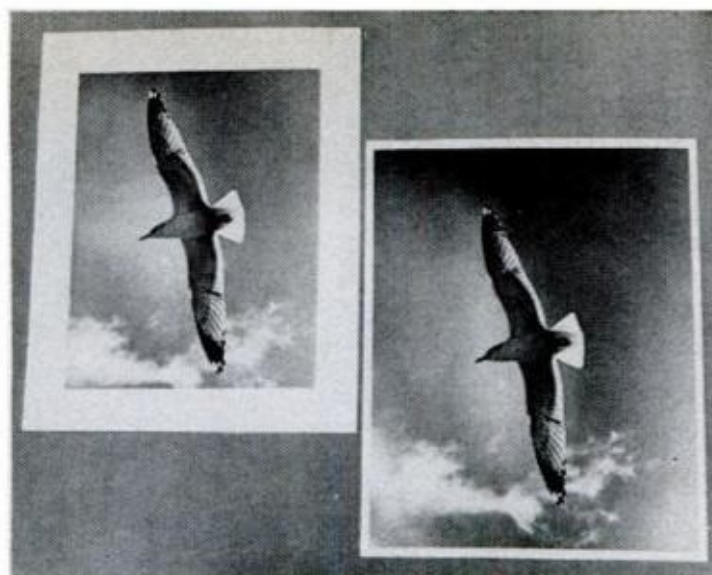
A household fan positioned to blow a stream of air across the cloth apron on an electric print dryer, as shown above, can substantially shorten print-drying time. This works especially well in humid weather when moisture is slow to evaporate.—*Walter E. Burton, Akron, Ohio*



## Clip takes flash-cord strain

Flash sync cords frequently work loose and pull out of the camera socket, especially when the flashgun is used off-camera. A spring-type snap fastener slipped over the cord and clipped to the neckstrap ring will take the strain and keep the cord from pulling out.—*C. Boyd Pfeiffer*





ACCESSORY  
FLASH  
SHOE

SHUTTER  
RELEASE  
CABLE

EPOXY  
PUTTY  
FORMED  
INTO  
BLOCK

CUT OUT  
AS NEEDED  
TO OPERATE  
CONTROLS

1/4"-20  
SCREW  
TO FIT  
CAMERA  
SOCKET

1/8" SHEET  
ALUMINUM  
SHAPED  
TO FIT  
CAMERA  
BOTTOM



### For an added touch, give your prints wide borders

Adding a wide white border around your prints can improve their appearance greatly by creating the effect of a mat, as if the pictures were mounted or framed. To see the difference, compare the two photos at upper left, one with standard 1/4-inch borders and the other with one-inch-wide margins. With an adjustable easel, all you have to do is set it to mask off the desired amount at the edges. If you're using a fixed-frame speed-type easel, you can create the same effect by cutting a mask to fit over it, as shown here. Make the mask from heavy cardboard or thin strips of balsa wood. Trim it to fit snugly inside the lips on the easel. One-inch borders are fine for 8x10 prints; use narrower widths for smaller sizes.

—Bob Corley, Jacksonville, Fla.

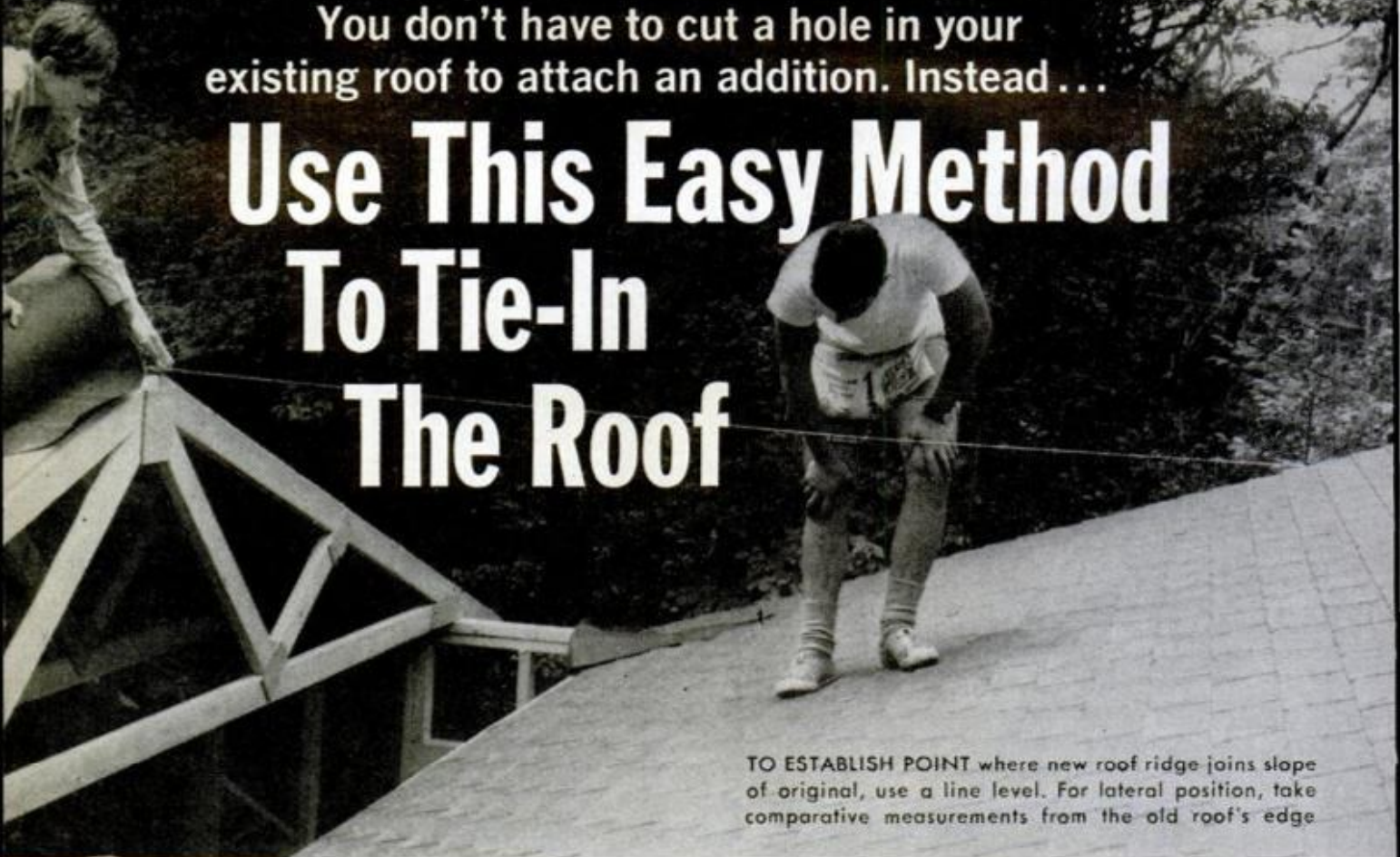
### Camera-hugging flash bracket

Most flash brackets stick out at the side and make a camera awkward to hold. This one, bent from 1/8-inch aluminum, is shaped to hug the camera's contours so nothing protrudes. It also incorporates a handy shutter-release cable and has holes in the bottom plate so you can operate the reloading controls without removing it. Form epoxy putty into a small block to support the cable's plunger.—John Schwartz, New York City



You don't have to cut a hole in your existing roof to attach an addition. Instead...

# Use This Easy Method To Tie-In The Roof



TO ESTABLISH POINT where new roof ridge joins slope of original, use a line level. For lateral position, take comparative measurements from the old roof's edge.

By RICHARD F. DEMPEWOLFF

**I**F YOU'VE HESITATED to add an extension to your home because you feared the chance of leaks where the roofs will meet, take heart. You can make the connection without cutting into the roof at all. You simply remove a strip of shingles, leaving the felt in place, and spike a pair of shoe planks (plates) right to the old roof. The rafters for the tie-in section are then seated and nailed to these shoes. If you want access between the old and new attics (usually for ventilation), it can always be cut in later between a pair of rafters or trusses.

The advantage of this trick is not just its simplicity. The big bonus is that you won't have to sweat out any sudden rains that might pour into a roof opening and destroy ceilings, walls and furniture.

If you have no need for totally unobstructed attic space between the new and old sections, you can save much labor with this system. It can't be used, however, if your plans require cutting into any rafters or trusses.

On the *PM House* wing (see *We Added On and Saved—So Can You*, page 104, May '71 *PM*), we framed the entire addi-

tion without touching the original building—with two exceptions. So that the new wall plates could be tied in to the header of the original house, gutters had to be removed and slots were cut into the roof overhang.

Trusses were installed starting at the far end of the addition and working toward the original house; each was braced in plumb position by tacking it to a plank nailed to those behind it. The ultimate anchor was the framed gable end wall of the structure. Last truss installed was 2 ft. from the wall of the old house. The ends of its top cord were mortised to the top cord overhang ends of the two trusses of the original house that it contacted.

The roof of the new wing was then sheathed and felted, up to the last truss. Next, that part of the old roof overhang within the walls of the new structure was sliced off. To do it, we removed the shingles, set the shoe of the portable circular saw to the pitch of the roof and followed a chalk line  $\frac{1}{16}$  in. beyond the wall of the building for safe clearance. A handsaw completed the cuts through the overhang rafters.



Plates and ridgeboard for the tie-in roof section were placed as shown in the photos, using 2x12 lumber for the plates, a 2x8 for the ridgeboard and 2x6s for rafters. The end of the ridgeboard joining the roof of the original building is angle-cut to the pitch of the old roof. The mitered end should come right to the point formed by the plates at their peak. The other end is butted and toenailed to the peak of the last truss.

Rafters are angle cut and secured to the ridgeboard in the standard manner. But to seat them properly on the plates, you must make a compound cut. First, angle-cut the end to the pitch of the new roof. Then set the circular saw to the roof pitch of the original building and cut away the high side of the rafter along the previous cut. The length of these rafters is measured from the edge of the ridge board to the outer edge of the plate, at the exact interval position.

With rafters in place, the tie-in frame is sheathed and felted and valleys are flashed before shingling. The 36-in. aluminum isn't hard to handle if you uncurl and bend it before placing it. It is easily uncoiled by drawing it over the edge of your worktable. Crease it along the center line by laying it on a flat surface such as your garage floor and use a 2x4 as a straightedge to make the initial bend. A gentle curve is better than a sharp crease, and precision isn't absolutely necessary; it will form itself to the two pitches when pressed in place.

You'll need help placing the flashing. On the roof, slip one edge under the loos-



**JUNCTION LINE OF ROOFS** is obtained by stretching mason line from peak point to the point at edge of old roof where end of the last new truss meets it



**STRIP OF SHINGLES** 18 in. wide is removed, mostly inside the mason line, to provide a good, firm seat for the 2x12 plates that will be laid flat against the old roof and firmly spiked into truss rafters

**USING SHINGLE RIPPER**, all nails are removed within 18 in. outside the mason line so flashing can be slipped under the shingles. Notice slot cut in original overhang (lower left) to permit wall plate tie-in







**RIDGEBOARD IS EXTENDED** from peak of last truss to point where plates meet. Rafters are placed on 2-ft. centers. Check slope with level before fastening

**THREE-FOOT-WIDE ALUMINUM FLASHING** is slipped beneath asphalt shingles and sealed with mastic, as are shingles. New side is cemented before shingling



ened old shingles and fasten in place with aluminum nails. The edge of the flashing is sealed with roof cement, as is each course of shingles as you lay and nail them in place (with aluminum nails) over the flashing. (Editor's note: Dab roof mastic over any exposed nailhead.) At the peak, the flashing is bent and formed over the ridge and up under the shingles above it. (All this requires a little persistence and a lot of vocabulary.) The top of the opposite valley flashing will lap the first. Don't spare the mastic. You can get it off yourself with a little kerosene later, but be sure to wear your oldest clothes so that you can throw them away when the job is finished.

Sealing the other side of the flashing to the new roof is easier. This roof can then be shingled in the standard manner, terminating at the flashing gutter with 4 in. of metal showing.

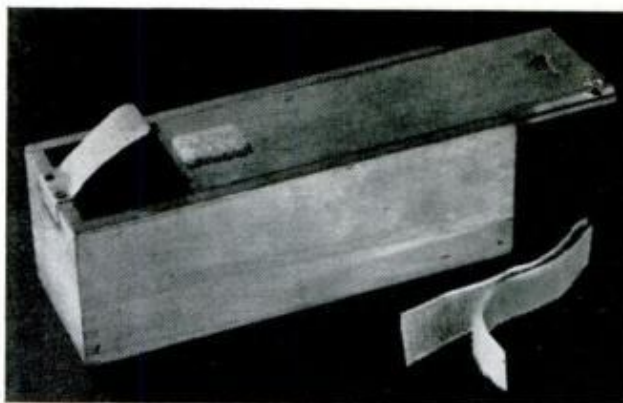
Edges of the new shingles, cut to the angle of the slope, are also sealed with mastic. While sealing is the messiest, most aggravating part of a roofing job, it is most important if you want to be sure of a weatherproof, troublefree addition. And, if you take time to do it properly, you will never regret the frustrations. ★★★



# HINTS FROM READERS

## Tape keeps sliding lid closed

The sliding lid on a wooden small-parts box had an annoying tendency to work itself open whenever I moved the box. To prevent this, I simply installed a latch made from "hook and eye" tape (Velcro). Actually a pair of tapes intended for garment fastening, Velcro is available at sewing supply stores. When pressed together, it holds firmly.—*W. E. Burton, Akron, Ohio*



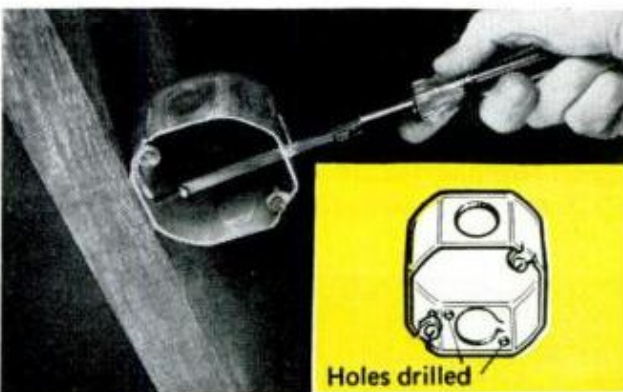
## Clean brushes with less solvent

When my wife recently discarded an old frying pan, I salvaged it for use in my workshop cleaning paintbrushes. By tipping the pan slightly, I can entirely immerse the bristles in a small amount of solvent by laying the brush on its side. When in this position, the bristles are also much easier to "comb" with a wire brush.—*Al Stencel, Detroit*



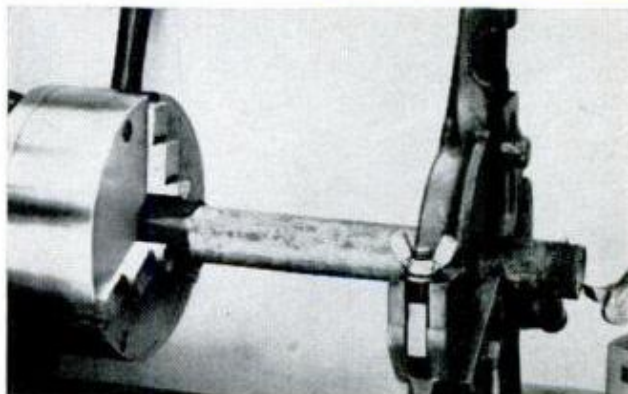
## Easy junction-box installation

When you want to install an electrical junction box flush with the underside of a joist, here's a way to save the cost of a hanger. Remove one knockout plug and, on the opposite side, drill two small holes to receive screws. Now you can insert a screwdriver through the knockout to fasten the box and then attach the cable.—*Bernard H. Serota, Philadelphia*



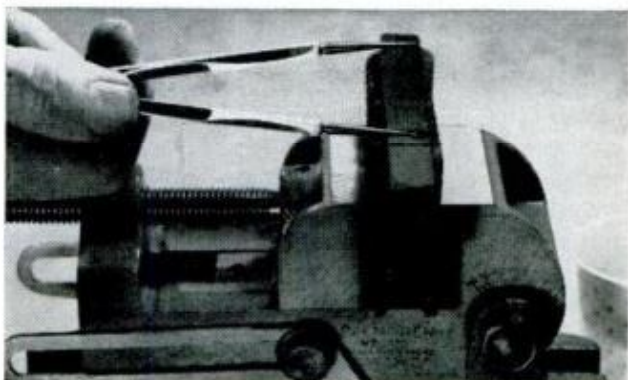
## Rubber holds lathe work

If one end of a slightly bent or irregular piece of pipe is clamped rigidly in a lathe chuck and the other end is supported by a steadyrest, considerable stress may be induced on the chuck or other parts. To help reduce the wobble, insert a layer of inner-tube rubber between chuck jaws and the work. Latter can then move slightly in jaws.—*B. W. Ervin, Kent, Ohio*



## Groove in oilstone adds to utility

If you cut a groove in the edge or other surface of a not-too-hard abrasive stone, you'll find it handy for sharpening or polishing points on scribes, dividers and slender rods. You can form grooves in softer stones using an old hacksaw blade or sharp corner of a file. To dress to a semicircular cross section, use a small pin-punch.—*W. B. May, Oak Park, Ill.*







**MORE CONVENIENT** than the ordinary stationary sink aerator, the Swirlerator Sink Cleaner allows you to direct a soft, yet firm, spray of water by simply flexing the center portion at the area to be rinsed clean. With instructions and all necessary adapters, it's available in red, ivory, black, yellow and green. Retail for 98 cents from Jaclo, Inc., 35 Lafayette Ave., Brooklyn, N.Y. 11217.



**MOUNTING PHOTOS** was never so easy as it is now with Vue-All Magik Spray Photo Mounting Adhesive. Just spray it on, lay the photo down, rub and presto, it's mounted. If you change your mind, just peel off your print and reposition it as often as you like without spoiling the photo. A 10-oz. aerosol can sells for \$3.95 from Vue-All, Inc., 49 West 45th St., New York, N.Y. 10036.

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## EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



**ELIMINATOR II**, a gas-powered dragster, features authentic AA/Fueller styling and scale-model speeds up to 300 mph. Designed for tautline racing, the model deploys a drag chute and shuts down the engine automatically after passing over a preset tripping bead. It's priced, ready-to-run, about \$18. Made by the Cox Manufacturing Co., 1505 E. Warner Ave., Santa Ana, Calif. 92702.



**CLEAR AWAY WEEDS**, stray grass, growth between flagstones and along borders of shrubs and lawns with the Flame Gun. It requires no cords or batteries, and less than two pints of kerosene provide 30 minutes of steady flame. Also great for removing icy patches from walks or driveways during the winter. \$17.98 plus \$1 postage and handling from Hobi, Inc., Dept. PX-5, Lake Success, N.Y. 11040.

POPULAR MECHANICS

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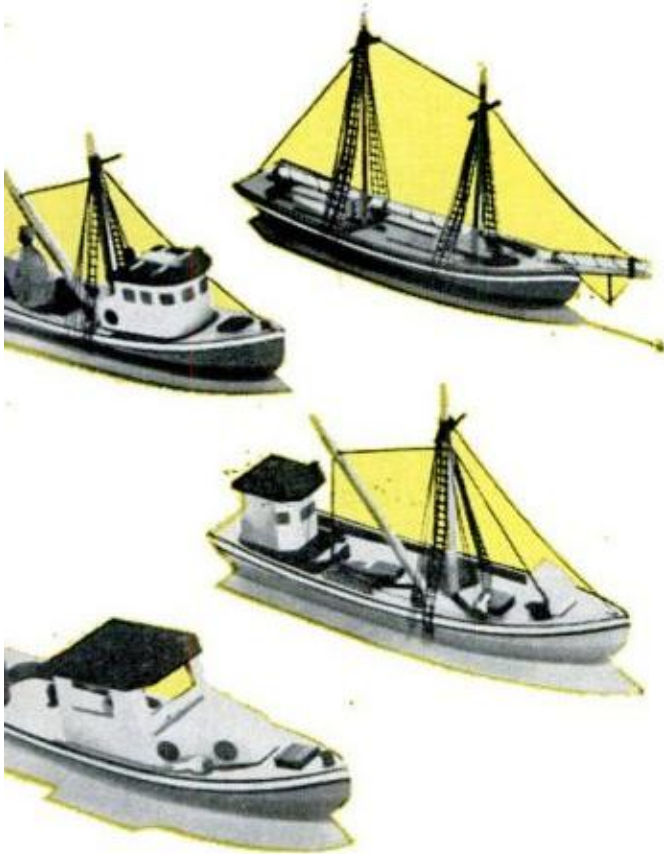




**CUTTING TASKS** will be easier and go faster with a Quick Clip cutter. Positive spring action instantly reopens the blades after each cut, making them ideally suited for cutting thread, wire, film and ribbon. Suggested retail price is \$4.95 for the cutter at department, hardware and fabric stores. Made by J. Wiss & Sons Co., 400 West Market St., Newark, N.J. 07107.



**ONE OF THE STRONGEST EPOXY** industrial adhesives made is now available in kit form to the homeowner and hobbyist. The kit contains a 2-oz. tube of epoxy resin, hardener, aluminum mixing pans, wooden applicators and instructions. "Epoxy 1177" will bond wood, concrete and other porous materials. Distributed by W. J. Ruscoe Co., Box 2746, Akron, Ohio 44301 and priced at \$4.



**START YOUR COLLECTION** of these beautifully handcrafted Mini Boats. Each model is made of wood, finely detailed and painted. Ideal for gift giving, the 8-inch lobster boat, dragger and schooner each sell for \$2.75 postpaid. An assortment of miniature lobster traps, clam baskets and buoys is also available. Made by C. Brower and Son, Pownal, Me. 04069.

JUNE 1971



**CLEAN YOUR PAINT ROLLER** thoroughly with Kleen-A-Roll, an attachment developed for your electric drill. It squeezes the fuzz 2000 times to remove deep-down, fresh-paint pigment. Comes with drive mandrel, a bucket-support bracket, a clear plastic tube to tell you when your roller is clean and a dynel roller cover for \$4.74. Made by Kleen-A-Roll, Box 272, Summit, N.J. 07901.

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# \$45 Worth of Beauty and Convenience... You Can Build for \$21

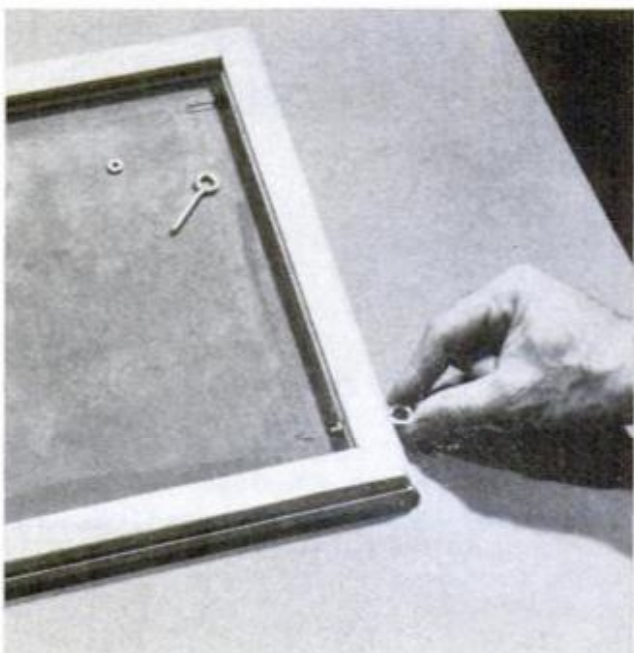
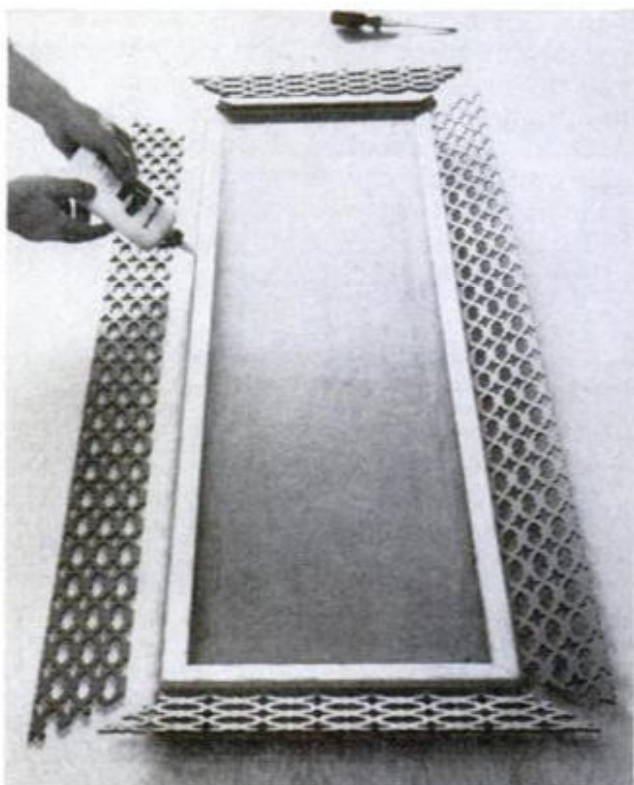
By ROSARIO CAPOTOSTO

**Dress up your foyer with this eye-pleasing pier set**

**W**HEN WE FINISHED dressing up our foyer (see *Make a Grand Entry*, page 144, March PM), I thought the project would end there. But my wife was so pleased with the results that she started dreaming up ways of utilizing what, at that time, was a stretch of wasted wall just inside the living room. We finally decided to add a wall-hung pier set for those last-minute appearance checks that always seem necessary before we leave the house.

The filigree of the frame is the same material I used in the entry divider. (It's made by Masonite Corp., 29 North Wacker Drive, Chicago, Ill. 60606.) And a piece of scrap Marlite wall paneling was used to back up the mirror. Though my cost was about \$21, yours might be lower if you happen to have a mirror lying about that you can adapt to your setup. I've spotted similar pier sets in shops in my area priced in the \$45 to \$50 range. But I haven't seen any that I like better than the modern set I made.

On the prototype shown, the same hardwood framing that was used for the room divider served perfectly for the mirror frame. I simply enlarged factory grooves in the wood frame to accept a 1x4-ft. mirror that I bought. (If you wish, you can



**LAY THIN BEAD OF GLUE** in mirror frame grooves (upper right) and insert mitered filigree surround

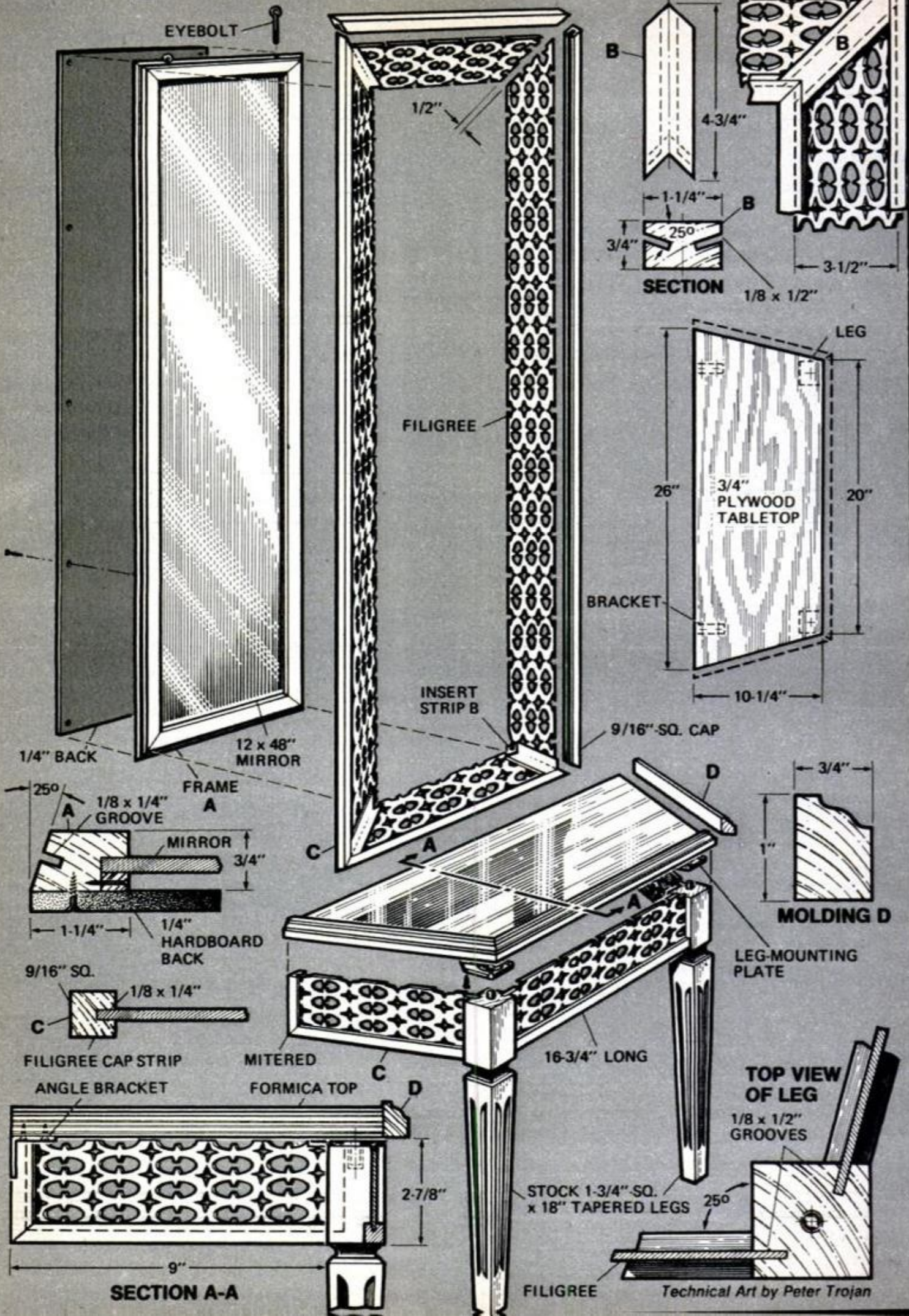
**STURDY EYEBOLTS** installed through the frame edge hang unit (right). Add mirror backing panel next







# Filigree Pier Set





run a rabbet in the framing strips and use a cleat to hold the mirror.) Next, make a 25° bevel cut to remove some of the excess width along the solid edge, leaving about 1 in. across the face. Then plow a 1/8-in. groove about 1/4 in. deep perpendicular to the beveled edge. This groove receives the filigree.

Miter the corners of the strips to form a frame around the mirror, and for rigidity, back up the mirror with a piece of Marlite or hardboard as mentioned above.

Glue and screw three sides of the frame only to this backing. The bottom frame is joined with screws only so that the mirror can be inserted after most of the carpentry is completed. And, if your mirror should ever become cracked, this makes replacement a simple task.

To hang the frame, two eyebolts are installed on the back and fitted with an appropriate length of picture wire. Make certain that these bolts do not enter the groove that is intended to receive the mirror, and install them before inserting the mirror.

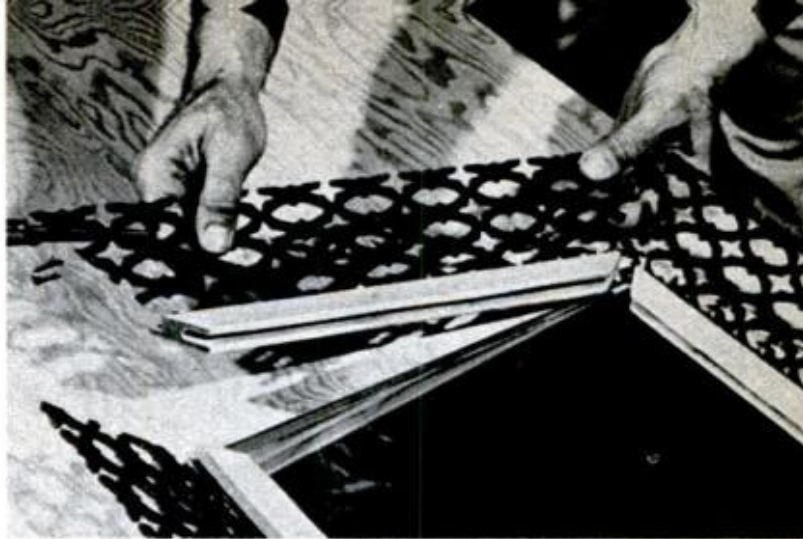
To attach the mitered filigree sections, squirt a bead of white glue in each outside groove. Notice in the photo at the right that the mitered filigree ends do not meet. This is to insure room for the reinforcing corners. Here you should allow about a 1/2-in. space which will be bridged by the insert.

Cutting these inserts is truly an exercise in angle cutting. The lead end is an inside miter while the tail end is the reverse. The tail end also slants back 25° toward the bottom to assure a good fit at the frame corner. Finally, two angled grooves along the sides permit it to slide over the mitered filigree. Since the face of the insert is left flat it won't fit flush with the 9/16-in.-sq. strip which surrounds the outer edge of the filigree and is not intended to. Glue the inserts in place first and add the square strips last.

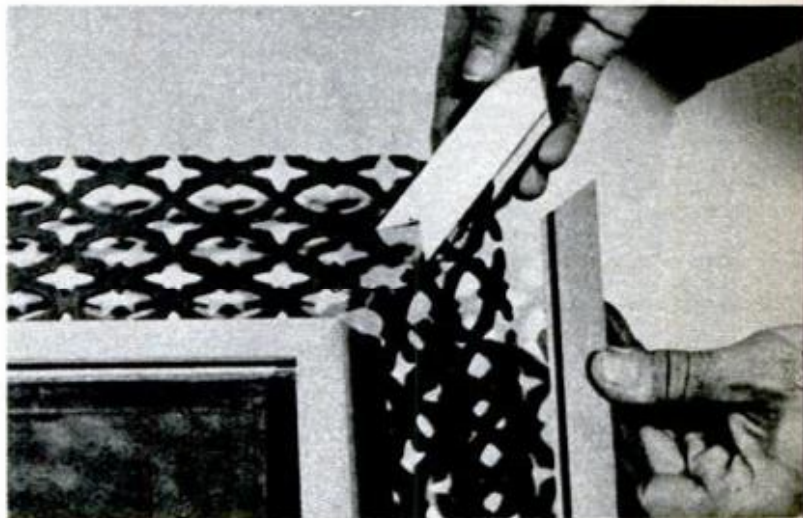
The table is made using a pair of factory-made legs purchased at a lumberyard and a 3/4-in. plywood top. Grooved slots cut into the leg tops secure the filigree. A piece of molding (D) was used to enclose the table top which I first covered with white paneling. You could use decorative laminate here.

The console can be stained or painted. I sprayed mine all white to contrast nicely with a green wall in back. ★★★

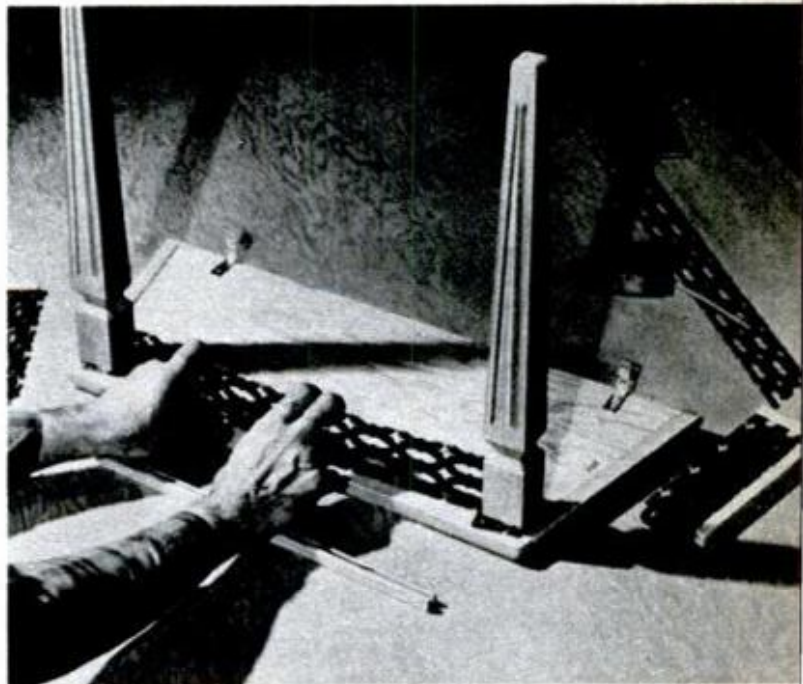
JUNE 1971



**INSTALL MIRROR** before final section of the frame is placed. This last piece goes in without glue so that replacement is easy if the mirror ever cracks



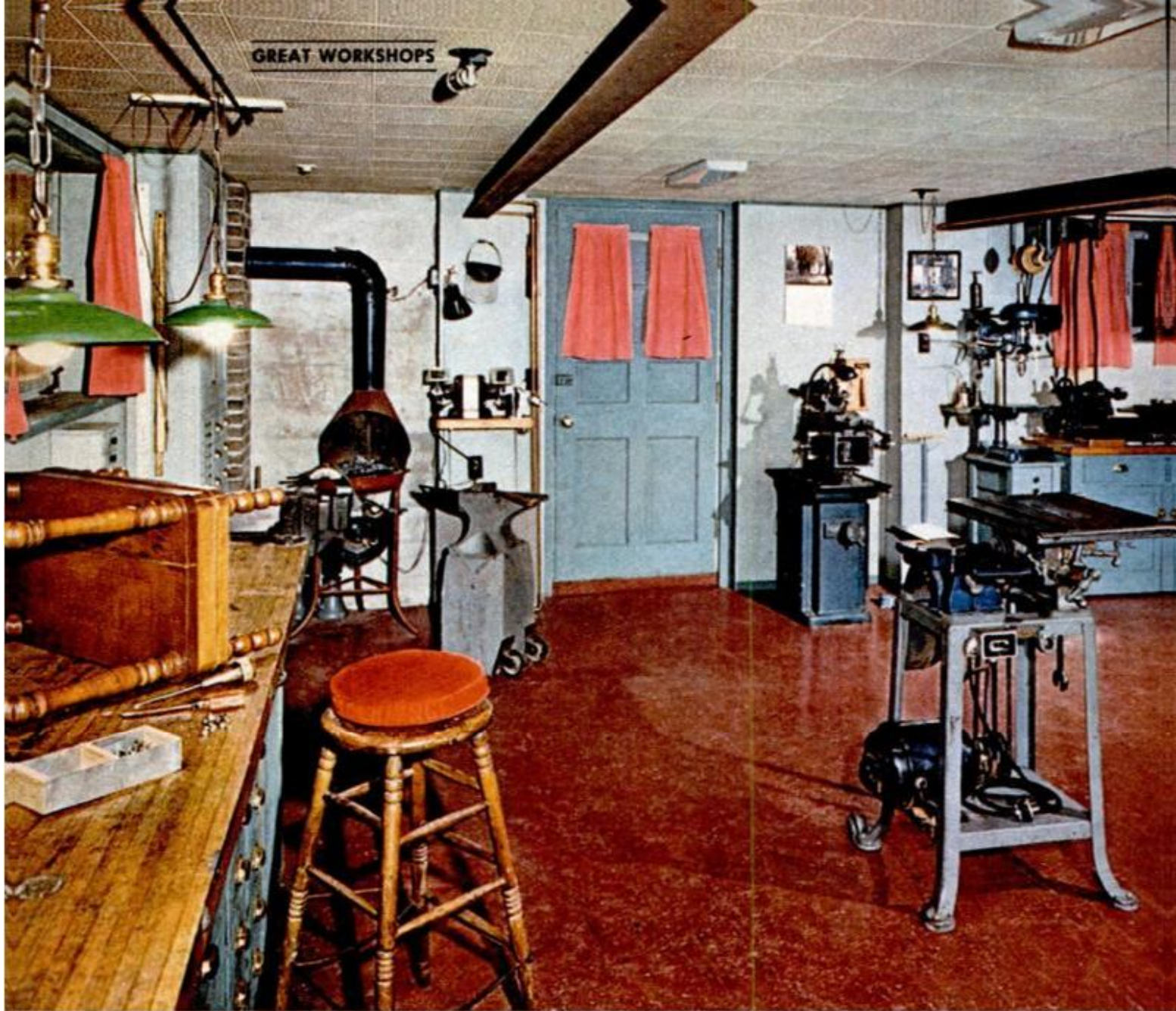
**ARROW-SHAPED REINFORCING CORNERS** are exercised in angle cutting (see text for details). Glue is used in grooves here; edge cap goes over insert next



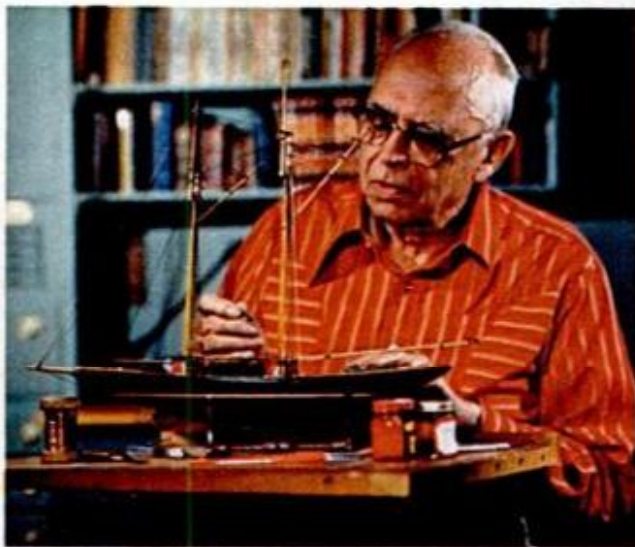
**FACTORY-MADE TAPERED LEGS** must have grooves cut in at top to receive the filigree. The latter is cut slightly long, then bowed and sprung into place

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**SPACIOUS SHOP** has all the comforts and equipment that all workshoppers dream about. Owner Phil Stevens rightfully takes pride in everything about it from the detailed model he is working on to well-organized storage drawers for the small hand tools shown at left. The layout is Stevens's seventh







# A WORKSHOP CRAMMED WITH IDEAS YOU CAN USE

We published Al Meagher's dream workshop in Minneapolis last June and asked our readers for more like it. Maine subscriber Phil Stevens accepted the challenge . . .

By HARRY WICKS, Workshop Editor  
Photography by Robert D. Borst

OF ALL THE ARTICLES published in the Home and Shop section of *PM* during the past 12 months, none has created the reader response that the dream workshop (*Is This the World's Best Workshop?*, page 146, June '70 *PM*) did. It's not hard to figure out why: *PM* readers are doers. And because of that, they are constantly looking for better ways to do everything around the house, including improving their workshop layouts. Phil Stevens in Portland, Me., took some snapshots of his shop—which is the seventh version that he's had—and sent them in for our opinion.




Editorial consensus was that his shop was indeed one that our readers would like to look at. So I packed my bag and headed

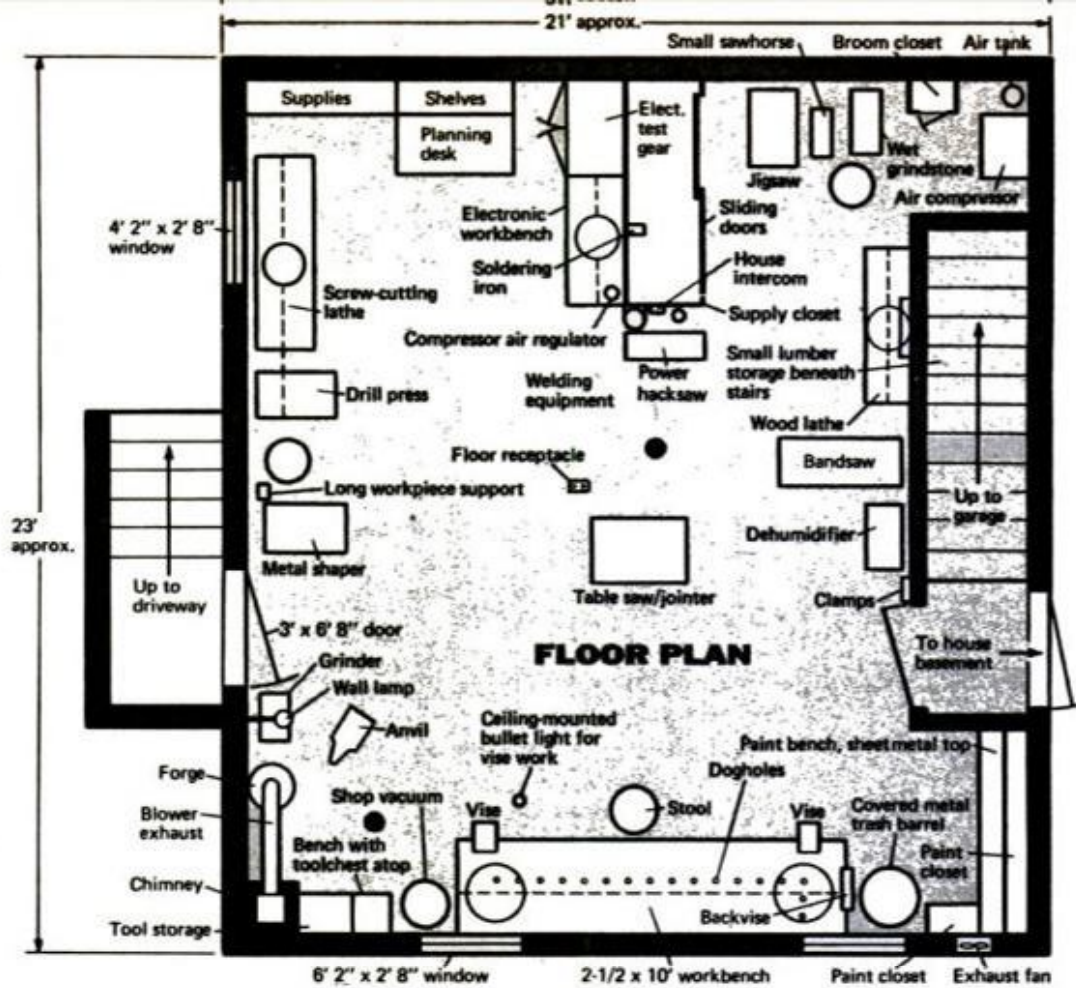


# Workshop Floor Plan

Stevens' fully equipped shop has all the room a do-it-yourselfer dreams about. Notice that door leading outside is a full 3 ft. wide. This permits the owner to cart big projects in and out effortlessly. Key below explains lighting arrangement shown in art

Technical Art  
By John Lind

-  Traveling light fixture
-  Fixed ceiling fixture
-  Fire alarm, throughout house



north. My immediate impression of Phil's setup was of the efficiency and neatness of the storage units he has custom-designed and constructed. Though his shop is an active one, each tool has its own spot to return to upon completion of a project.

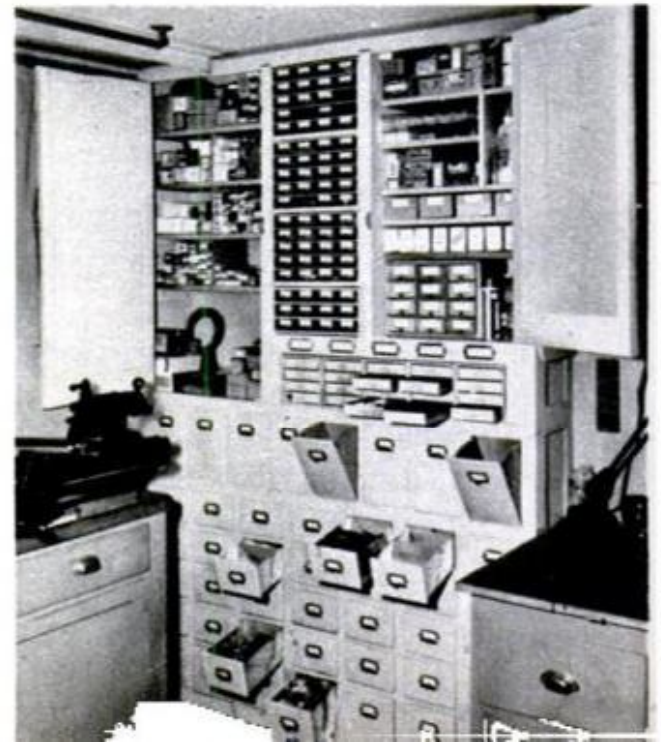
By profession, Phil is an electrical engineer. By choice, he's a dedicated do-it-yourselfer. He does all the minor repairs around his home, and a stroll through the

house revealed shop-built furniture in every room.

Phil's interests are varied. If he sees a boat he likes, he fashions a scale model. But he doesn't limit himself to small projects. For example, when he and his wife returned from an Alaskan trip (they're avid travelers) he decided to carve a totem pole. For a design, he turned to his well-organized files (which are cata-

**ISLAND CLOSET** is over 4 ft. long, gives ample and well-organized storage for the large shop items

**NUMBER OF ITEMS** stored in this cabinet would be difficult to count. The tilt-down drawers hold nails





logued) and dug out drawings that had been featured in advertising by a cigar-maker. His creation appears on page 143.

Though Phil is active in a local amateur theatrical group—working on scenery and lighting—he says he still never finds enough time to spend in his shop, which he affectionately refers to as a “tinker shop.” He started his first shop while still in high school, and, over the years, experience taught him that there is a best place for each tool or part. It borders on understatement to say that his present shop is extraordinarily well-organized, used frequently, yet still neat.

The supply cabinet shown on page 140 for example, holds thousands of items. From the tilt-out drawers for nails and screws, to conventional drawers for small parts and equipment, his setup betters most hardware stores I’ve seen. And, like most workshoppers, he is a “saver” by nature. Everything finds a home until it is used. The difference between Phil and people like myself is that he catalogs it so he knows just where to find it when he wants it.

It’s just about impossible to list all the features in Phil’s shop that attracted and fascinated both the photographer and myself. Those I think most workshoppers will be interested in are shown in the photos and floor plan on these pages. In particular:

● *“Traveling-light” setup.* Over the workbench and other long work areas such as the lathe, he has devised a simple meth-

**BOX FOR TURNING CHISELS** is wall-mounted over lathe, features a sloped bottom that spills shavings



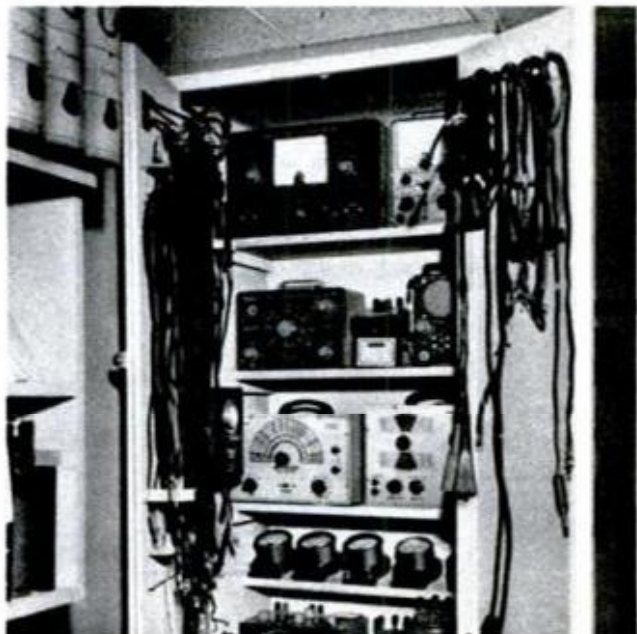
**USING CONDUIT, elbows, pipe flanges and chain,** Phil rigged four lights to slide over the work areas

od for moving the light. If you look carefully at the color photo on pages 138-139, you’ll notice he has a swivel-arm light rigged so that it can be swung over table saw or power hacksaw.

● *Fire protection and storage.* Since he has a forge in his shop, Phil wisely installed a fire-alarm system and tied it into the house system.

His wife calls him a “tool nut.” (Editor’s note: A description that most *PM* readers and editors are proud of.) For example, a while back he acquired the works from an old wooden clock. They

**ELECTRONIC TEST GEAR** is all stored in one closet. Workbench to right is used for radio and TV repairs









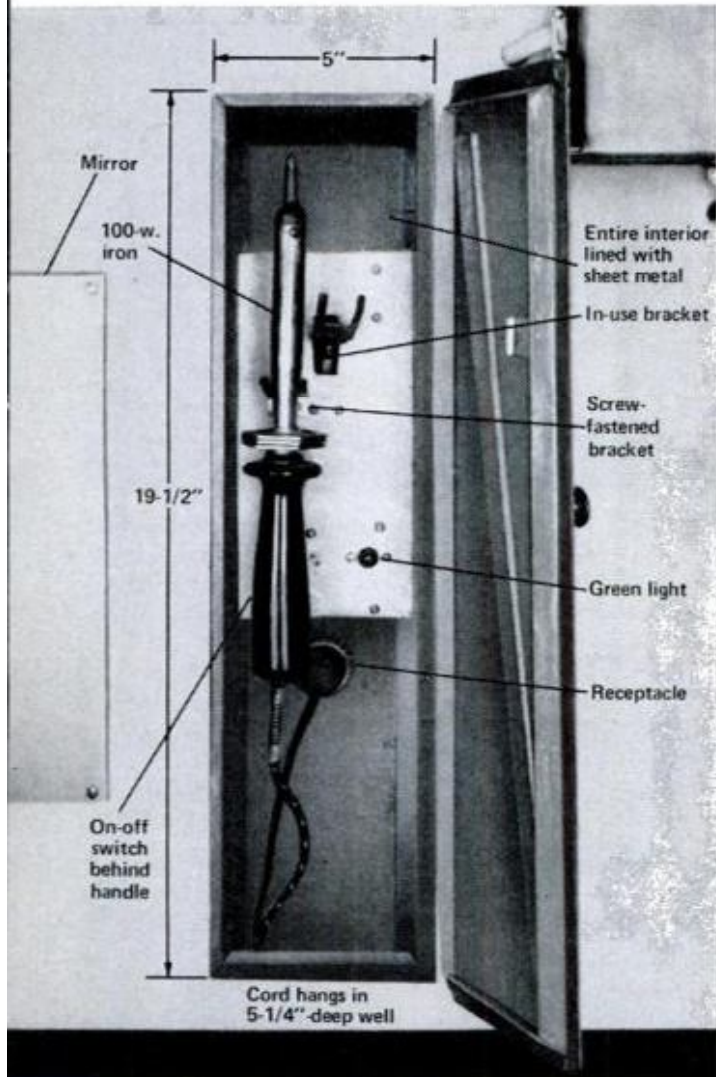
were broken and incomplete. He got "a big kick" out of repairing what he had on hand and hand-fashioning what was missing and building a new case from scratch.

His projects are diversified. On his Plymouth, for example, he has added a beeper to his automatic signal arm. Thus, when he turns a lazy corner that doesn't return the blinker to "off," the beeping reminds him to do it manually. At the other end of his workshop-talent spec-

**THE CALL'S STILL OUT.** If you know of a shop you think our readers would like to see, send a brief letter and several snapshots to: Workshop Editor, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

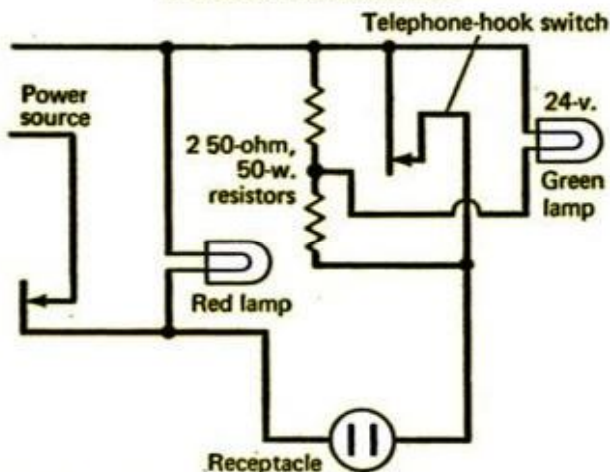
trum, is the special table he built to hold his slide projector.

Originally Phil had his shop in the basement, where he also had a darkroom and a painting area (he and his wife both work in watercolors and oils). He felt boxed in, so he built an addition: a two-car garage with basement below and storage area above. If pressured, he'll admit that the want for a dream shop, more than a home for his car, probably was the deciding factor to do this. It gave him what he had always dreamed of—a workshop crammed with ideas he collected over the years. ★★★

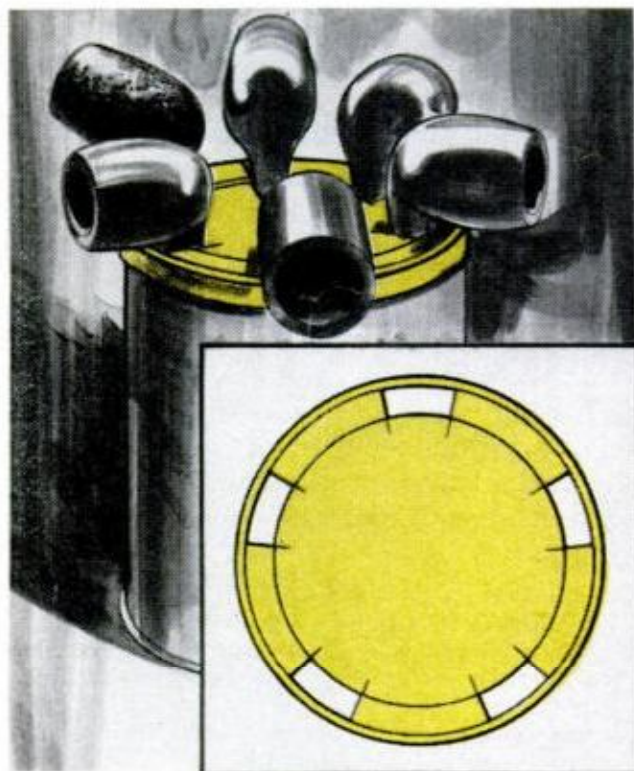


**SOLDERING IRON** is built into wall (left); when it's in use a telephone switch reduces heat to half. Wiring diagram shows how it is connected to power. Wall mirror saves Stevens from having to rotate heavy chassis to work on the back. Owner shows author the totem pole (below) he carved upon return from Alaska. From top, symbols are raven (knowledge), bears (strength) and the beaver (industry)

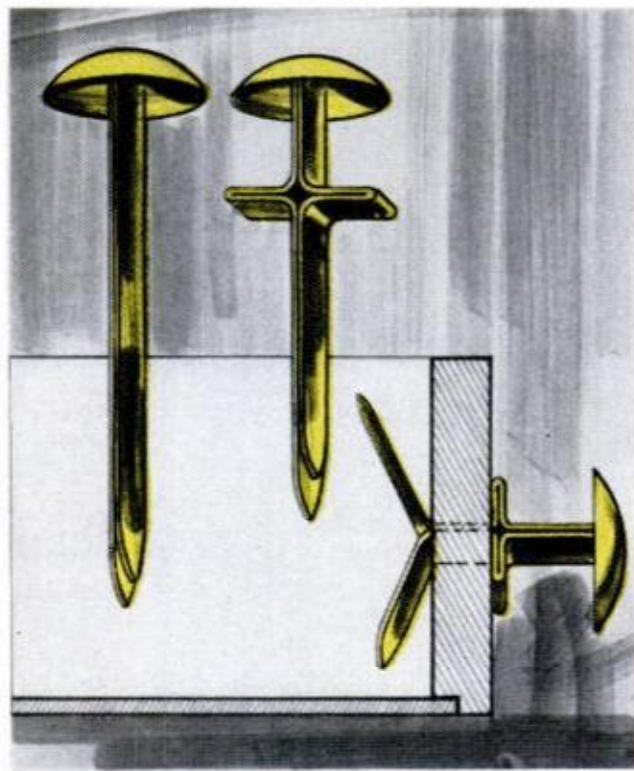
**WIRING DIAGRAM**



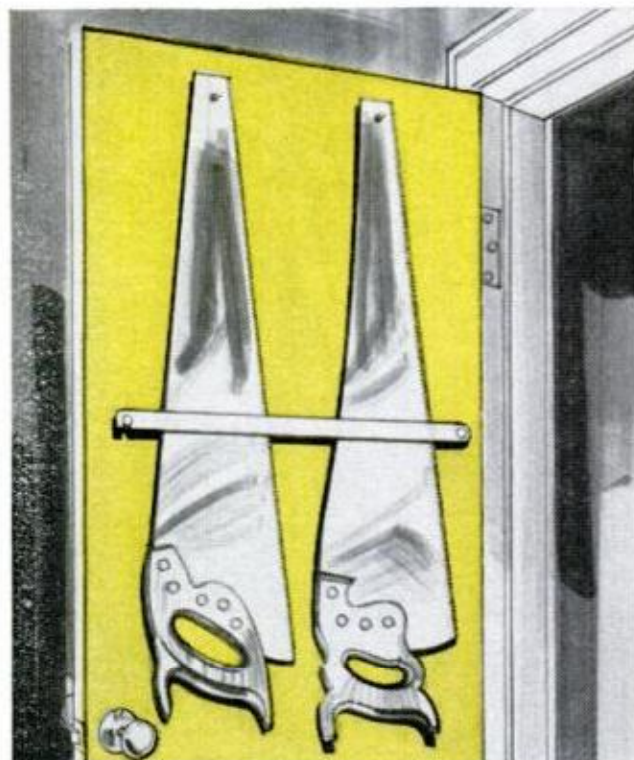




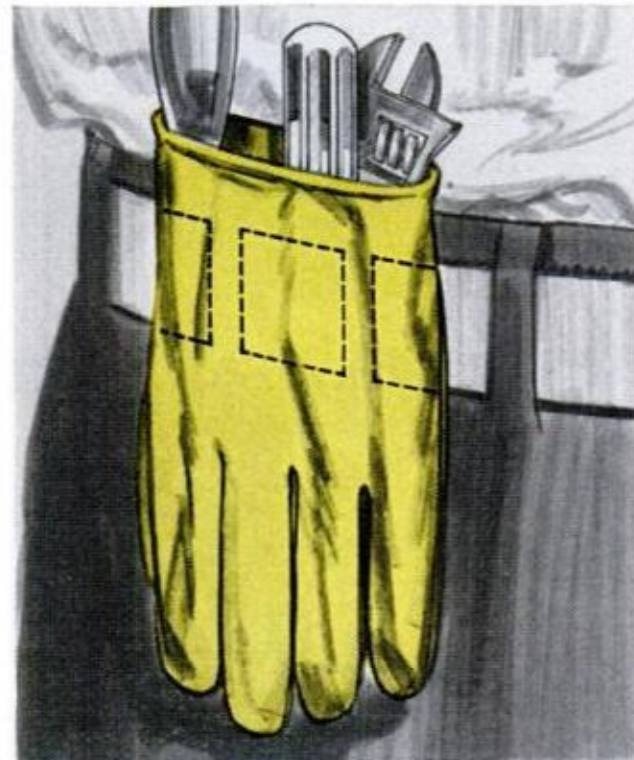
**INEXPENSIVE PIPE CADDY** can be fashioned from a coffee can that has a plastic lid. Cut square holes in the lid for pipe stems and decorate the can to suit your fancy.—*John N. Sisevich, Upper Lake, Calif.*



**DRAWER PULLS** for lightweight, cardboard drawers can be created from standard 2-in. roundhead brass paper fasteners. Simply crimp them as shown, insert and bend legs.—*A. J. Stephenson, Royal Oak, Mich.*



**HANDSAWS CAN BE STORED** on the inside of a closet door to protect teeth. Drill a small hole near the ends, suspend from a brad and use pivoting wood strip to lock saws in.—*R. Hertzberg, Flushing, N.Y.*

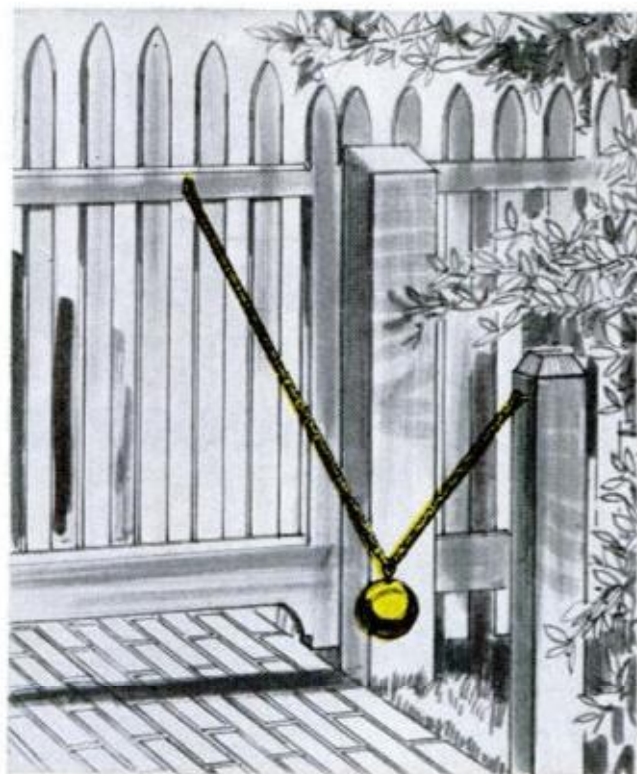


**MATELESS GLOVE** can be put back to work as a belt-toolholder if used as pictured. Make two slits for slipping the holder onto your belt, and use the holder to tote small hand tools.—*Frank Shore, New York*

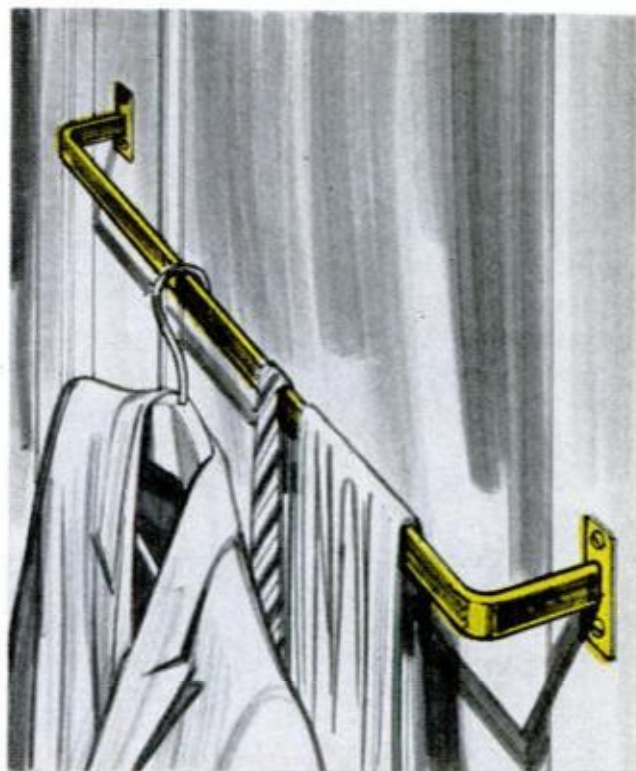


# HOME PROBLEMS

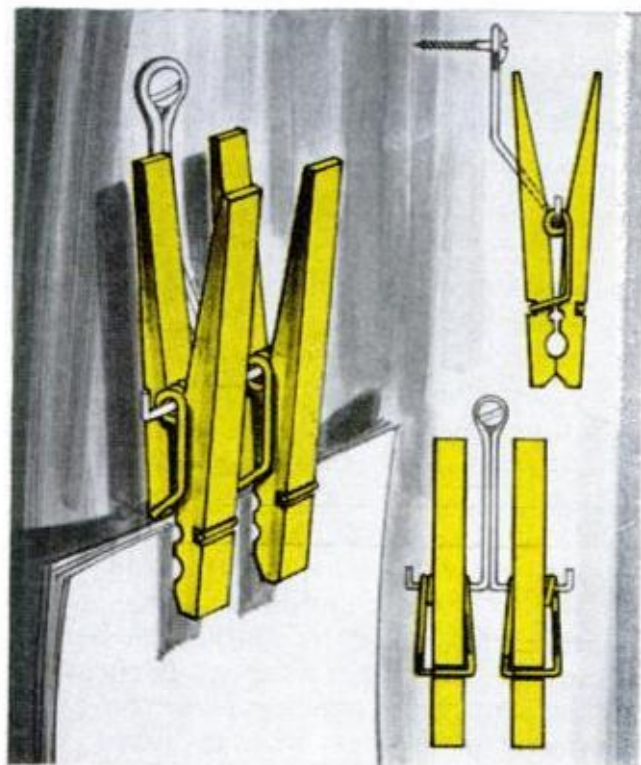
Illustrations by Adolph Brotman, Worman Associates



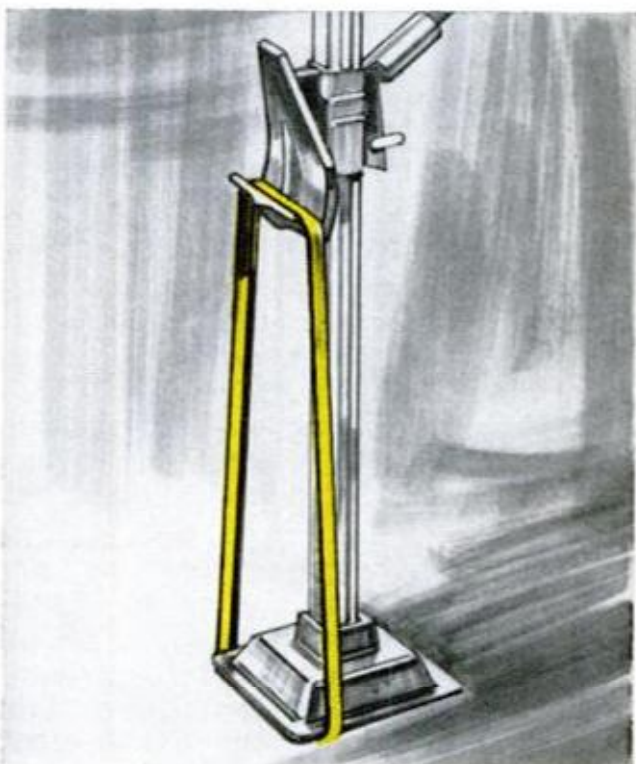
**SELF-CLOSING GATE** can be made—a la Williamsburg, Va.—with a ball and chain arrangement. Use a galvanized chain and, if a heavy ball isn't available, substitute a brick.—Harry G. Remington, New York



**CURTAIN RODS** that are no longer needed for their intended purpose can still be put to work. Mounted inside a closet door, one will provide ample room to store belts and neckties.—Frank Shore, New York



**HANDY MEMO HOLDER** can be rigged using a couple of spring-type clothespins and bent coathanger wire. Latter prevents pins from falling apart and gives loop for wall fastening.—N. Murray, Ogdensburg, Wis.



**V-BELT** can be stretched if you need a bit more diameter, by using a bumper jack. Left stretched tightly in the hot sun for a couple of days, it will pick up about an inch.—George Mayerchak, Minneapolis





# How to Save 1½ Gallons Of Gas Every Tankful

By MORT SCHULTZ

**TOO RICH FUEL MIXTURE** can be determined at a glance. Black soot on sparkplug tips is the sure evidence

A SIMPLE ENGINE TUNE-UP will decrease a car's fuel consumption by 8.2 percent, according to the Champion Spark Plug Co. Assuming that your car has a 20-gallon fuel tank, you would theoretically get an additional 1.64 gallons of gas at each 20-gallon fill—for an average 18-gallon fill, that's an extra 1.48 gallons.

Multiply this by the price you pay per gallon and you'll see the annual savings are not to be sneezed at. If you fill up 40 times a year averaging 18 gallons, you'd save nearly \$24 where gas costs 40 cents per gallon. If your fills average 16 gallons, you'd save more than \$20.

Champion tested 200 cars, including foreign makes, in 18 cities. They were selected at random in supermarket parking

lots. Each lucky owner got a free tune-up.

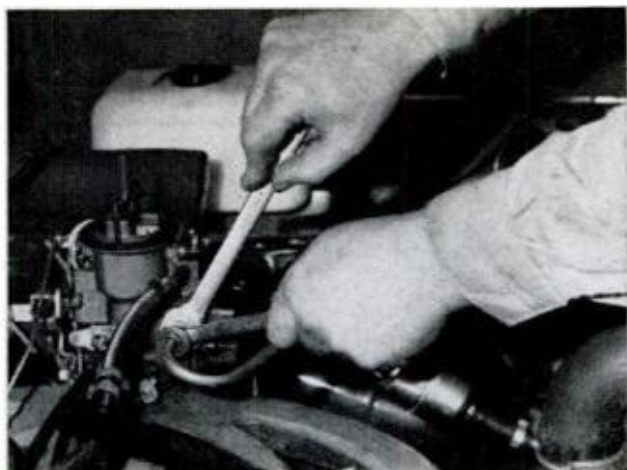
The same conditions were used throughout the test. Cars were run on a tape-controlled dynamometer for 17 minutes at speeds of 30 to 70 mph. Testing was supervised by NASCAR officials.

The cars were first operated in their untuned condition, then given a tune-up consisting of new sparkplugs, distributor points, condenser, air filter and other parts that were damaged and needed replacement. Ignition timing and carburetor were set to manufacturer specifications.

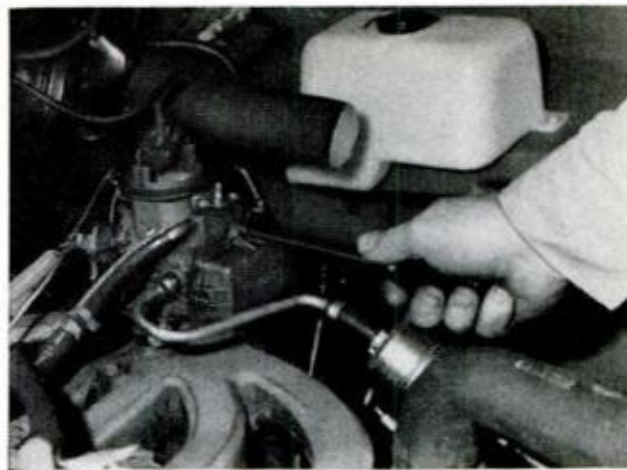
The cars were again run on the dynamometer and fuel savings noted. The tuned cars also indicated a 9.8-percent decrease in distance required for passing and a 10.4-percent rise in power output.

As far as you're concerned, there's





**FUEL LEAKS** from fuel-line connections are usually obvious, but not always. Tighten all connections



**CARBURETOR ASSEMBLY BOLTS** should be tightened to minimize leaks. Replace bowl gasket if needed

another big plus in a gas mileage tune-up: You can do it yourself and save anywhere from \$10 to \$25 charged by mechanics.

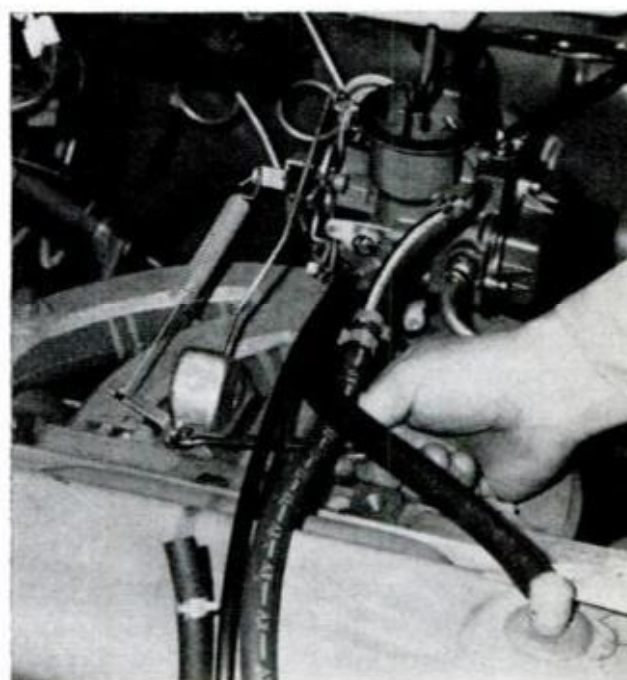
Start by stopping leaks. Gas lost before it reaches the engine is money out the window. Tighten fuel-line connections at the carburetor and fuel pump. Be sure that carburetor assembly bolts are tight and give the carb mounting bolts a turn.

Start the engine and trace the fuel line from the carburetor as far back as you can to see if a pinhole has developed. Check the fuel tank and filler neck for leaks, especially at seams.

Above all, be sure that the gas tank cap is always tight. Don't trust gas station attendants to give it that extra twist. Do it yourself. Gas fumes that escape from around a loose cap represent lost money. They also pollute the air.

An engine is operating efficiently when it fully compresses a properly formulated fuel mixture and provides ignition at the exact time under sufficient temperature to obtain complete combustion. In other words, you need compression, the right air/fuel mixture, proper engine temperature and complete ignition. Fuel that remains unburned after ignition takes place will be exhausted and wasted.

Test the compression of each cylinder. Warm the engine and remove the spark-plugs. No cylinder should read less than 80 percent of that of the highest-reading cylinder. If one or more do, there is a bad or burned valve in that cylinder, or a broken piston ring. That can kill an engine's gas mileage. For example, suppose the cylinders (in order from 1 to 8) show pressures of 136, 138, 135, 144, 102, 137, 140 and 141. Since 80 percent of 144 (the highest-reading cylinder) is 115, cylinder No.



**CHOKE ADJUSTMENTS** should be made for economy. On this Holley, unbolt cover, lift control from seat

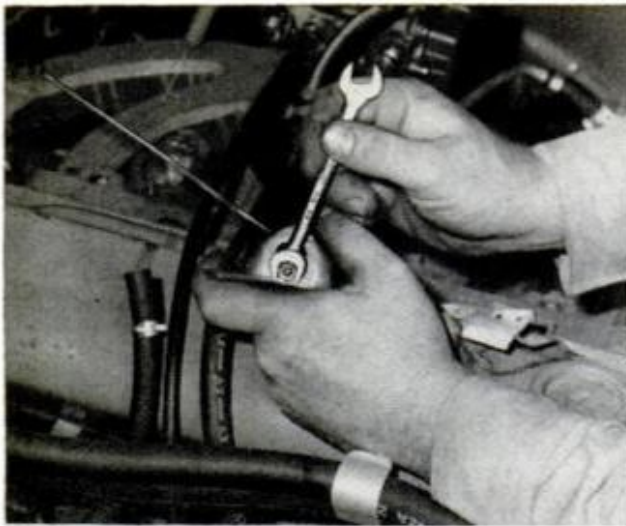
5 (reading 102) is too low.

Low overall compression—that is, low-reading of all cylinders—generally indicates worn piston rings. Manufacturers claim that a reading of 20 pounds below that specified can be considered low. However, the long valve overlap characteristic of today's high-performance engines may not let you get specified compression on the gauge or even 20 pounds less. These gauges are not finely calibrated, accurate or tight sealing instruments.

You can find the compression specification of your engine in the service or owner's manual, or look it up in an auto reference book at your library.

A cylinder-leak test is a more accurate method of determining overall engine condition and should be performed for you





**CHOKE CONTROL** is adjusted by loosening adjustment nut and setting pointer to desired index mark



**CHECK GASKET** under the air filter on the air horn. Replace it if it is in less than perfect condition

by a mechanic if you're doubtful about overall compression, especially if the engine has started to use oil.

Each piston in turn is brought to top dead center, and compressed air is shot through an adapter which is screwed into the sparkplug port. Excessive leakage is indicated if the test gauge shows a reading of more than 20 percent.

As long as sparkplugs are out of the engine, examine them. If they are worn or damaged, fuel consumption will be excessive. You can waste up to a gallon in 10. Worn plugs cause an engine to misfire under load, preventing complete combustion.

If sparkplug tips are covered with black, sooty deposits, one of two problems (maybe both) exist: The engine is operating at a temperature that is too low to assure complete combustion, or the fuel mixture is too rich.

If water jacket temperature is too low, fuel that concentrates itself near the cylinder wall in particular, where it's cooler, isn't getting hot enough to burn. It will be lost through the tailpipe. This raw fuel works past pistons and washes oil off cylinder walls, which hastens wall and piston wear. When it is exhausted, unburned fuel (hydrocarbons) contributes to air pollution.

The major reason for low engine temperature is short-trip driving. The engine has no chance to fully warm up. You can't do much about this, but you can do something about another cause—a faulty thermostat or no thermostat. The coolant isn't retained in the block, long enough and warm-up time is greatly increased.

If you don't have a thermostat in your engine, get one. Most engines need thermostats rated at 180° to 195°F. If you have a thermostat and the engine isn't warming up properly, remove it and place it in a pan of water that has a thermometer in it. Heat the water, keeping an eye on the thermometer and thermostat. The thermostat should open at whatever temperature rating has been stamped on its housing.

Check the fuel system next. You're seeking a condition producing an over-rich fuel mixture that won't have enough oxygen to burn completely. Part of every charge that's drawn into the combustion chambers won't produce power and will be blown out the exhaust system in an unburned state.

If the carburetor hasn't been serviced in a long time and gasoline consumption has been getting progressively worse, it should come off the engine for thorough cleaning and adjustment. Depending on the type you have, adjustments include the accelerator pump stroke, idle vent, fast idle speed, choke unloader, dashpot, float, idle mixture and vacuum break.

Even if the inside of the carburetor is in A-1 shape, letdowns here and there can be causing excessive fuel consumption. For example, have someone press down on the accelerator pedal as you watch the accelerator linkage. Is it binding or sloppy? Clean dirt from it. If the stroke isn't smooth and unhesitating, linkage of some carburetors can be adjusted by loosening the adjustment nut and taking up on the linkage.

How about the automatic choke? Is it





**VENTURI WALLS** accumulate deposits that affect fuel consumption. Clean them until smooth, shiny again



**MANIFOLD HEAT-CONTROL VALVE**, often neglected, must move freely. If stuck, use solvent to free it

set at the leanest setting for proper operation? Find out by readjusting the choke a notch at a time to the lean side and testing to see at what point the engine, when cold, won't start promptly or will stall after starting.

Some chokes are adjusted by means of an indexed choke stove cover on the carburetor. Just loosen the screws and turn the cover.

The choke shown in the photos is positioned in the manifold crossover. To adjust it, remove the choke control from the crossover, loosen the thermostatic-spring adjusting nut and turn the index.

One more check on the carburetor: Examine the air filter. Your engine needs at least 9000 gallons (volume equivalent) of air for every gallon of gasoline! If this air is blocked off because of a dirty air filter, the fuel mixture will become too rich and you'll be making more frequent trips to the gas pump.

Tap the filter on the ground. If dirt falls from it, get a new one or wash it if it's a permanent type.

Examine the air-horn gasket. If it is frayed or broken, dirty air will sneak into the carburetor although the air filter might be brand new. Replace the gasket. It costs but a couple of cents at an auto parts store.

During its car tests, Champion discovered that gasoline mileage improved 1.6 to 2.6 percent when the carburetor venturi was cleaned. This involves the use of nothing more than a small brush and some carburetor cleaner or lacquer thinner.

Deposits that accumulate on the venturi wall from oxidizing gasoline vapors build

up and restrict the intake of air. Look down the throat. If it has a dark covering, brush it out with cleaner until walls are smooth and shiny.

If the manifold heat-control valve is stuck in the closed position so that no heat can reach the fuel to vaporize it when the engine is cold, excessive gas will be used. Check this valve often.

Move the counterweight by hand to see if it's free. If not, give the valve shaft a shot of manifold heat-control valve solvent, but make sure the manifold is cool. If this doesn't free the part, try to tap it free with a small hammer. If it's still stubborn, replace it.

Check and set the distributor breaker points, make sure the spark advance unit is operational, examine high-tension cables for leaks and be certain that the coil isn't weak.

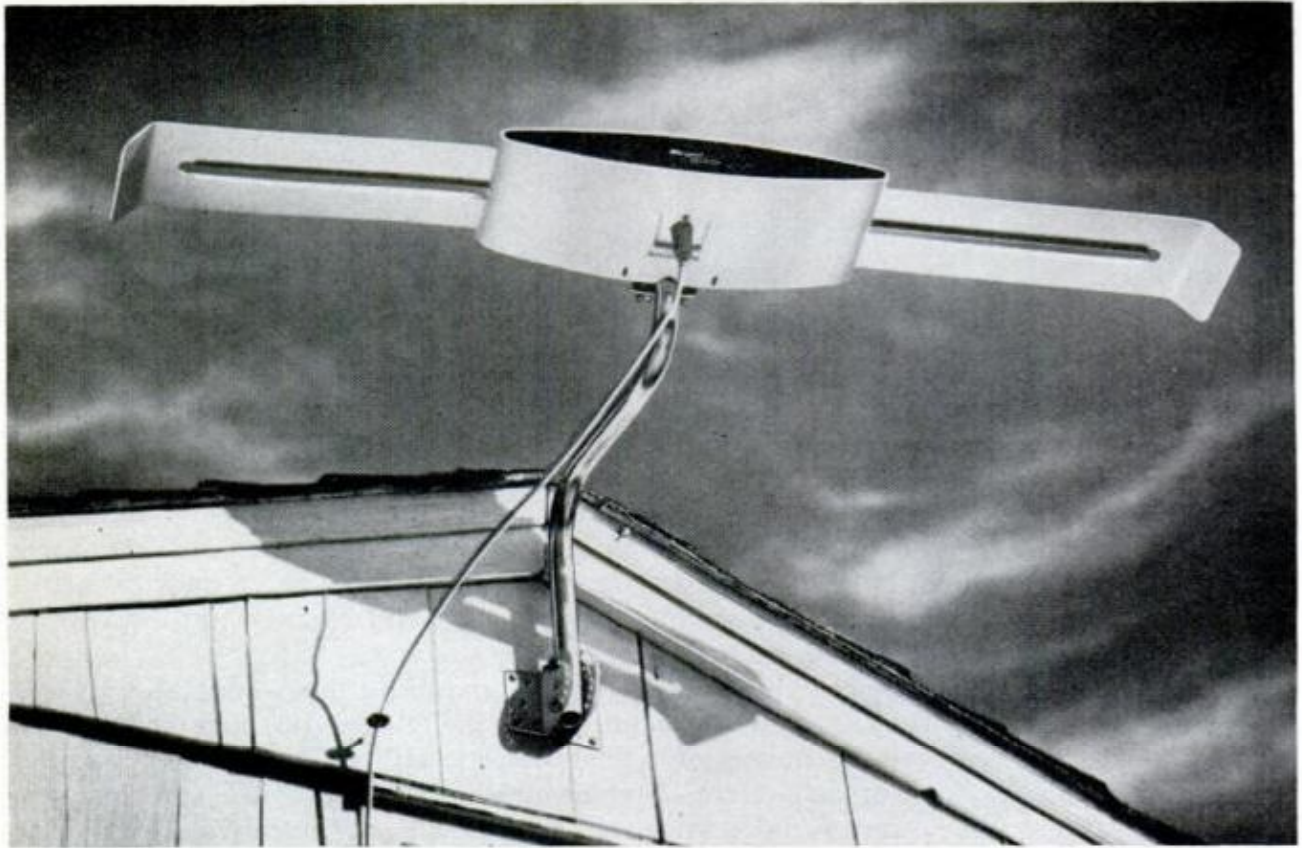
Above all, be sure that the ignition timing is on the nose. Retarded timing in particular will result in increased fuel consumption.

Now, *drive* with fuel economy in mind, and you'll get better mileage. Remember that the more you lean on the accelerator pedal, the more gas your engine consumes; and the more you allow the engine to idle without going anywhere, the more gas it wastes. In many communities it is now actually illegal to idle your engine for longer than a specified period because of the automobile emissions' contribution to air pollution.

Perform all of the above steps to better fuel economy and you'll be getting your "money back"—on every gallon you would have wasted by not doing the job. ★★★



# NEW IN ELECTRONICS

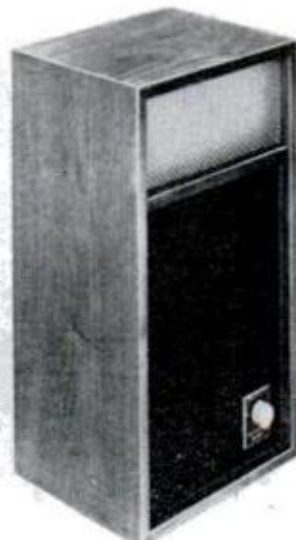
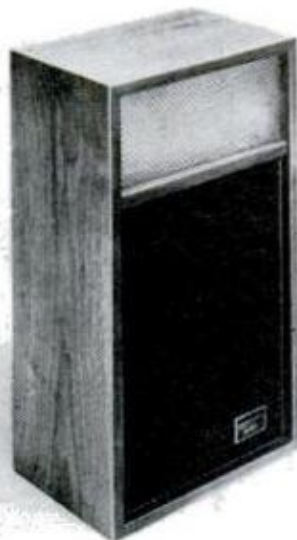


## New Look in TV Antennas: Light,

IT MIGHT BE a graceful gull swooping low over your roof with down-tipped wings outstretched, but it isn't—it's a TV antenna. In place of the usual forest of rods and spars is a slim, streamlined plastic housing with two thin, winglike aluminum arms. Total length: a bare 46 inches.

Developed by Winegard, the trim new antenna design is called the Sensor. Its

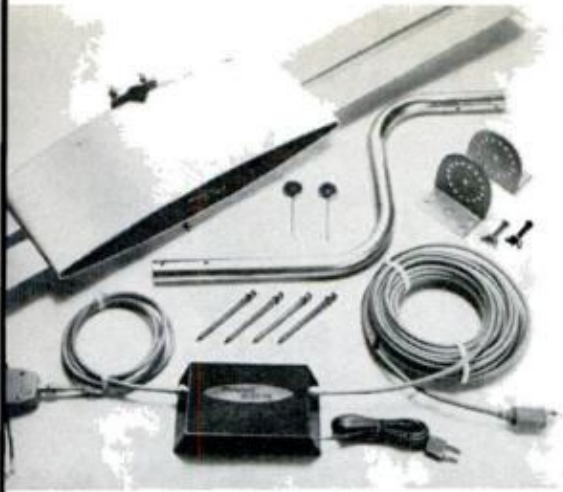
secret lies in a small solid-state amplifier housed inside the antenna and powered from indoors. A 117-v. power supply plugs into a wall outlet and sends low-voltage d.c. up the lead-in to the amplifier. This is isolated from the downward-flowing TV signals so there's no interaction between the two. The amplifier boosts incoming signals and, with the two arms, creates, in



**YOU GET A LIGHT SHOW** along with music from these twin stereo speakers. Built into each is a plastic screen displaying colored lights that dance in time with music's tempo. Psychedelic effects are created by frequency-sensitive color organs connected to speakers. Each enclosure has an 8-inch woofer and a tweeter. Sold in pairs, \$149.50. Benjamin Electronic Sound Co., 40 Smith St., Farmingdale, N. Y.

POPULAR MECHANICS





**COMPLETE KIT** (left) includes everything needed for installing the Sensar—all-purpose mast with adjustable mount, 50 feet of coaxial lead-in, 117-v. power supply, and band separator for attaching to VHF and UHF terminals on back of the TV set. The S-shaped mast can be mounted many ways—on an end gable (see opposite page), on roof itself, outside a window or in an attic.



**ANTENNA'S SMALL SIZE** and compact shape make it ideal for mobile use. Photos at right show how it can be attached to a pick-up camper without snagging trees and bridges. For traveling, it's just lowered snugly against camper's roof. For viewing, it's raised and rotated as desired. Adapter (left) powers antenna from 12-v. battery for use in boat or camper.



## Powerful, Easy to Put Up

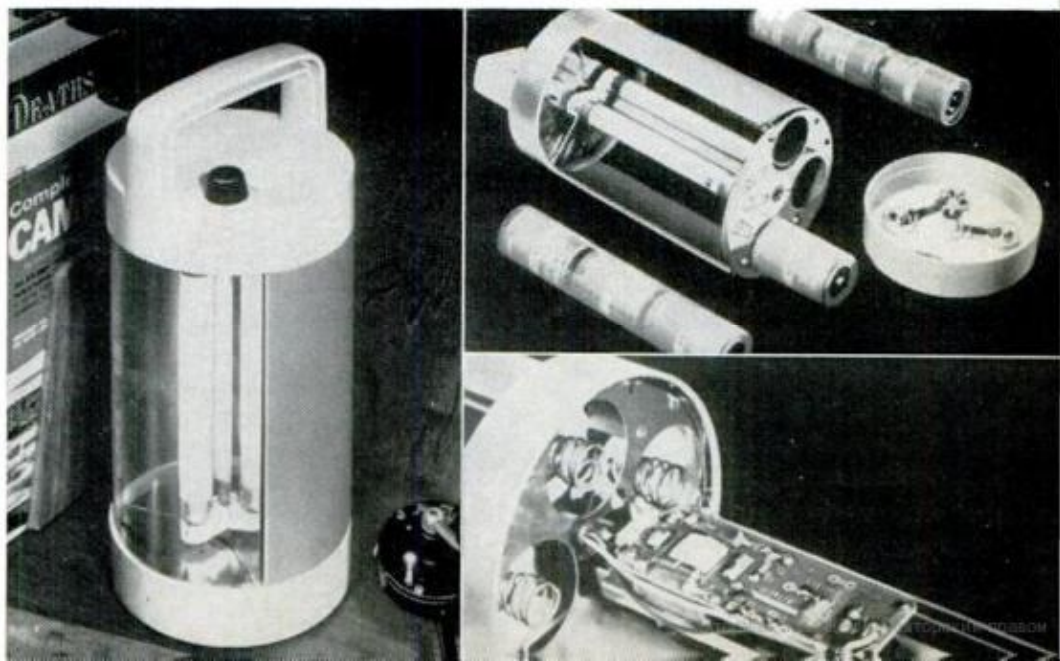
effect, a tuned circuit that makes the antenna highly sensitive despite its small size. It can pull in TV stations 40 miles away and works equally well on color or black-and-white. It also covers all VHF and UHF channels from 2 to 83.

The antenna is so small and handy it can be put up virtually anywhere, even taken with you in a boat or camper. For

mobile use, there's an accessory power supply that works on any 12-v. d.c. source. An installation kit includes the mounting hardware, connecting cables and all other necessary parts. Shielded 75-ohm coaxial cable is used for lead-in to give strong, clean signals. Complete package sells for \$49.88. Winegard Co., 3000 Kirkwood St., Burlington, Iowa 52601. ★★★

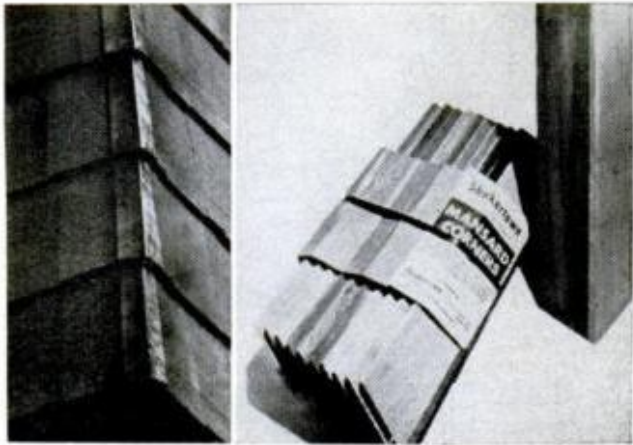
### NOVEL CAMP LANTERN

is first one to give fluorescent light from ordinary flashlight batteries. Smartly styled, it runs on nine D-cells whose 12-v. d.c. is converted to a.c. and is stepped up to 100 v. by a tiny transistor circuit (below, far right). This powers a 4-watt fluorescent tube giving a broad, bright beam for camping and emergency use. \$24.95, Hitachi Sales Corp., 48-40 34th St., Long Island City, N. Y.





# New Building Products for Home



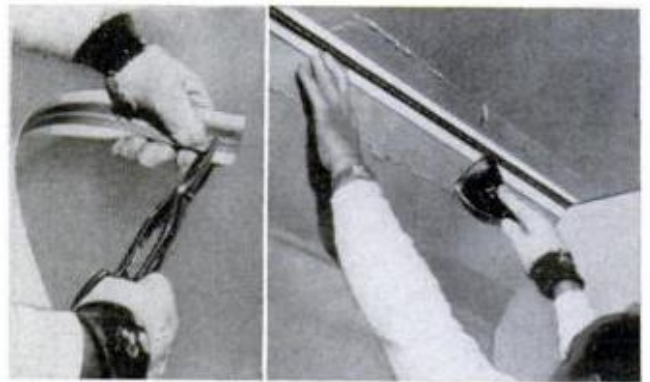
**CEDAR SHAKE AND SHINGLE CORNERS** for finishing mansard roof lines have been introduced by Shakertown Corp., 4416 Lee Rd., Cleveland, Ohio 44128. Special corners eliminate matching and lacing, are claimed to insure a true fit and reduce application costs. They're bundled in 20-unit packages. Write to the maker for your nearest dealer.



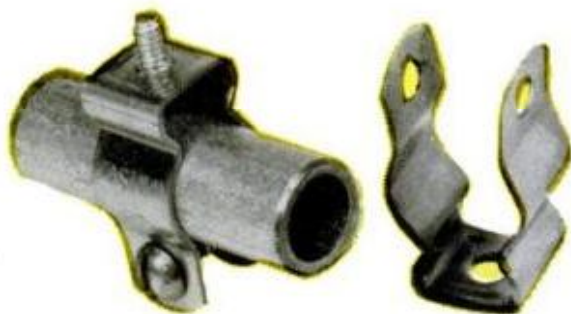
**CONVENIENCE SINK** is produced in a range of 12 bright colors, features a 10x12-in., specially fitted, hardwood cutting board and a pop-up drain in the 17 x 19 $\frac{3}{4}$ -in. basin. Laminated-maple cutting board resists warping and has special cutout to make it easier to clean vegetables and meats. Kohler Co., Kohler, Wis. 53044, is the maker.



**TILE GROUT** comes ready-to-use directly from the container and can be matched to tile being filled. The chalk-white grout can be tinted by hand (above) or by using universal tinting colors and an electric paint blender at store where you buy it. For information, write Robert Brown, Marketing Manager, Red Devil, Inc., 2400 Vauxhall Rd., Union, N.J.



**NEW DRYWALL TAPE** makes difficult angles, such as kneewall and ceiling joints in an attic, a snap because it readily conforms to the desired angle. The tape can also be used for joining new (patched sections) drywall to existing plastered walls. For a free sample and a brochure, write to Goldblatt Tool Co., 511 Osage, Kansas City, Kans. 66110.



**CONDUIT FASTENERS** for copper and plastic tubing and electrical conduit come in four sizes from  $\frac{3}{8}$  to 1 $\frac{1}{4}$  in. The steel hangers are cadmium-plated for maximum protection and are size-marked for quick identification. They can be nailed, bolted or screwed to wood or steel supporting surfaces, are also available with  $\frac{1}{4}$ -20 threaded bolt and cost 5 to 10 cents each at hardware stores. Fastway Fasteners, Inc., 1817 Iowa Ave., Lorain, Ohio 44052.



# Improvement



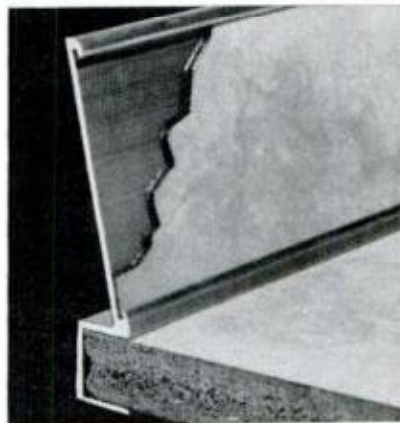
**ANCHOR CEMENT** is claimed to be fast, easy solution for home-repair jobs. Dubbed Speed Demon Setting Anchor, it sets rock-hard in about 15 minutes and can be used to patch basement floors, sidewalks, loose posts and railings. In  $\frac{3}{4}$  and  $2\frac{1}{4}$ -lb. sizes for 80 cents and \$2 respectively. Red Devil, Inc., 2400 Vauxhall Rd., Union, N.J. 07083.



**GRECIAN-STYLE STORM DOOR** comes in a variety of finishes, with etched initials and colored and leaded lights. Priced to sell for about \$70, doors are available 32 to 38 in. wide and 78 to 84 in. high. Other features: recessed hinges and three-dimensional kick plate and insert design. Brite Aluminum Products, 2155 Wabansia Ave., Chicago, Ill. 60647.



**CULTURED STONE PANEL** designed for many interior and exterior applications is available in 4x8 size, and weighs about one third less than stone. Claimed to be wear and weather-resistant, Stonehenge can be used for remodeling or new construction. To locate the supplier nearest you, write to Johns-Manville, Dept. PM, 22 East 40th St., New York, N.Y.

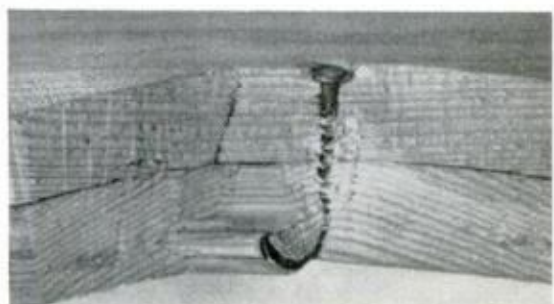


**WATERPROOF JOINT** at back of a countertop is provided by the Sure-Fit No. 3000 backsplash. An aluminum extrusion that fits over the existing counter, it comes in 12-ft. lengths designed to receive a 3-in. strip of laminate. Sold at building material and floor-covering stores. B & T Metals Co., Dept. D, 425 West Town St., Columbus, Ohio 43216.



**PREFORMED PANELS** made of lightweight Featherock, an unusual type volcanic stone about one-fifth the weight of granite, is bonded to a hardboard backing for easy installation. Charcoal or silver-gray, 3x4-ft. panels have two finishes: natural bold and smooth sawn. For availability, write to Featherock, Inc., 6331 Hollywood Blvd., Los Angeles, Calif. 90028.

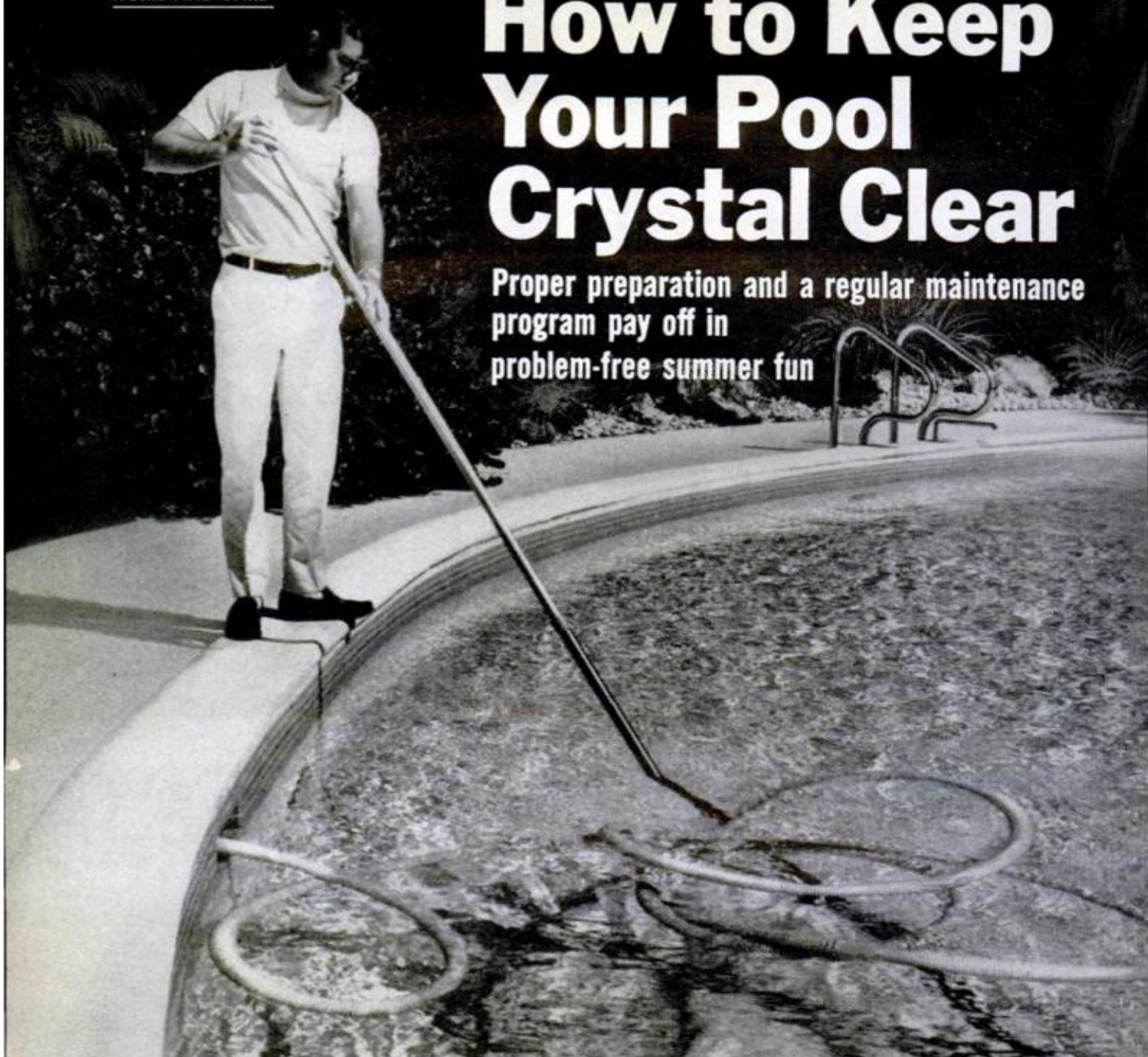
**ELIMINATE CLINCHING NAILS** by hand by using the latest nail offered by Duo-Fast Fastener Corp., 3704 River Rd., Franklin Park, Ill. 60131. Designed for industrial use with the Duo-Fast Automatic Nailer, the nail clinches itself "fish-hook" fashion when driven through two wood members held against a steel surface. Ideal where structural strength is a must, the nails come in 6d and 8d sizes on strips for easy loading.





# How to Keep Your Pool Crystal Clear

Proper preparation and a regular maintenance program pay off in problem-free summer fun



**N**OW IS THE TIME to put your back-yard swimming pool in serviceable condition. Insufficient or careless preparation can cause a future breakdown, so flip a coin into your pool—if you can't see whether it's heads or tails, it's time for a cleaning.

This quick check is one of several simple steps for pool care recommended by Adolph Kiefer, champion swimmer and member of Sears sports advisory staff. Whether your pool is above or in the ground, there's a simple kit of test tubes and chemicals that will determine its water condition and the treatment called for. You can get it at shops handling pool equipment and supplies or at Sears.

**Vinyl pools.** Most of this country's 3-million residential pools have plastic liners. Such pools are easiest to restore to service. If you took the manufacturer's advice about closing one last season, reopening it will take about 30 minutes' labor.

Manufacturers recommend that plastic-lined pools be kept filled all year. If there's a cover over yours (pools *should* be covered during the off-season), use a vacuum to siphon off water collected on top of it. Let leaves that fall on the cover dry for a day and they will be easier to brush off. Remove, dry and store the cover.

Before starting the filter, follow its maker's advice about start-up maintenance, but





**IF CRACKS ARE EVIDENT** in a concrete pool, first drain the pool, then patch and thoroughly clean it

don't forget to check the gasket of the multiport valve assembly and apply a water-seal lubricant to sliding surfaces. Clean the hair and lint trap and fill the pump strainer with water. Apply a drop or two of heavy lubricating oil to the motor.

If the filter is noisy when starting, shut it off immediately. It may have a bad bearing that will cause the motor to burn out if equipment is kept running. Allow the filter to run for two hours. During the last few minutes, switch it to backwash position. After this, chlorinate the pool to a level of about 1.0 p.p.m. (parts per million). The chlorine level can be as low as 0.6 p.p.m., but it should *never* exceed 2.0 p.p.m.

Since there should be no dirt, debris, mud or algae in the pool because it's been covered, as soon as filtering and chlorination are completed, you can start to swim.

If the pool hasn't been covered, run the filter continuously for two straight days. Then give it a heavy dose of chlorine through the skimmer to kill all algae and bacteria. If you use two pounds of chlorine, allow 24 hours for the job. If you use five pounds, you can cut the time to 12 hours.

Rub pool walls with a pool brush. Hook up your vacuum and sweep the bottom with filter set in waste position. Remove the scum line at the water level around



**SKIMMER BASKET** should be removed and cleaned. If it appears defective, replace it with a new one

the pool's perimeter with a whitewall-tire or household cleanser.

Inspect the plastic liner for tears. Successful liner repair requires a perfectly clean surface. The way to get it is with a fusion patch. You can buy two types of patches for vinyl lining repair. One has a self-adhering contact back—use this for the fusion patch. The other needs to be glued before it is pressed into place. Either is okay for the finish patch.

Apply the fusion patch and then rip it off. This removes a layer of the vinyl and, with it, surface dirt. Now apply the finish patch.

Vinyl patches can be applied without draining water from the pool. Even if the liner is torn where you can't reach it without going under water yourself, you still don't have to drain the pool if you can hold your breath long enough or have scuba gear. If the tear is on the bottom, stand on the finish patch for about 30 seconds after it's been applied to make sure it adheres.

A vinyl liner being pierced by a stone beneath the liner is the biggest headache you can face. Here you can try a double patch; if it doesn't work, you'll have to drain the pool to get the stone out.

Tears larger than 6 inches are a major problem. The pool must be drained below the damage. Try to salvage the liner by





**FILTRATION IS IMPORTANT** in preparing your pool for the season. Here, a powdered filter aid is added

working a patch beneath the tear and putting another over the top.

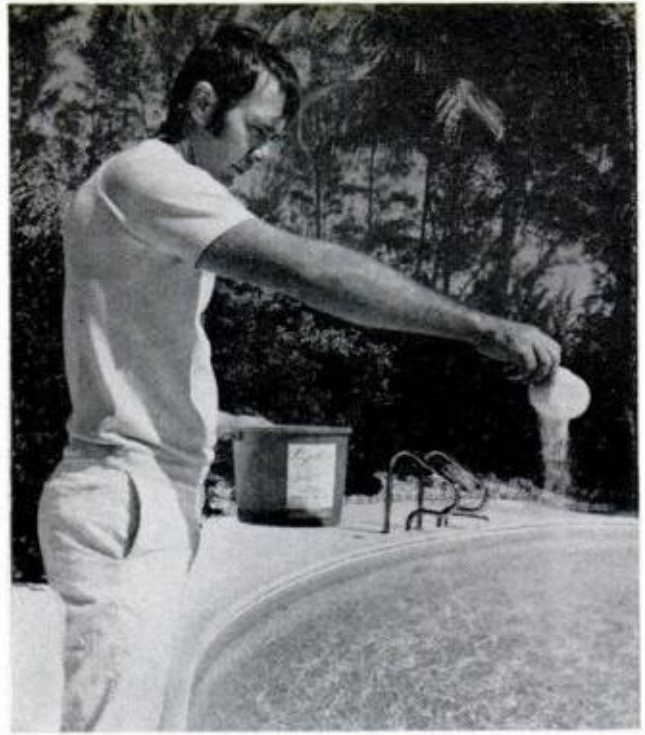
**Concrete pools.** Most swimming-pool paints, whether rubber-based or catalyzed epoxy, will usually provide at least two years of service. (Epoxy coatings have been known to last up to five years.) Don't apply a new coat until the old coat is almost down to the concrete.

Unfortunately, epoxy is tougher to use than rubber-base paint. It's a two-component enamel with a pot life of about eight hours once the two parts are mixed. Rubber-base paint, a one-part enamel, can be stored indefinitely.

Don Wright of the H. C. Harrington Co., a Pittsburgh, Pa., distributor of pool supplies, says that many pools have too much paint on them—some as much as  $\frac{3}{4}$  of an inch. He contends that if you have a good base coat, subsequent coatings should be applied when needed to highlight the color. The paint should be thinned down to provide the color effect without building upon the thickness, if possible. Consult the label on the paint can or write the paint manufacturer for thinning data.

The most important thing is to make sure the paint you use is compatible with the paint applied previously.

When you have finished painting, save an empty can for reference when you have to repaint. If you're not sure what's on the pool now, apply a 6-inch patch of



**KEEP POOL WATER SLIGHTLY ALKALINE.** After testing, add small amounts of chlorine, as indicated

new paint and let it dry. Then give it a twist with your thumb. If the patch comes off, the paint is not compatible.

Before painting, examine the surface for cracks. Don't take a chance that paint will fill a hairline crack. It won't; the crack will only get worse. Open a hairline crack to about  $\frac{3}{8} \times \frac{3}{8}$  in. and clean out all particles and dust. Fill it with an underwater epoxy sealer or elastic material known as an *elasticermeric* that will "give" with the forces that caused the crack so it won't reopen.

**CHECK MOTOR AND ALL FITTINGS** to insure that parts are leakfree; replace any defective pipe





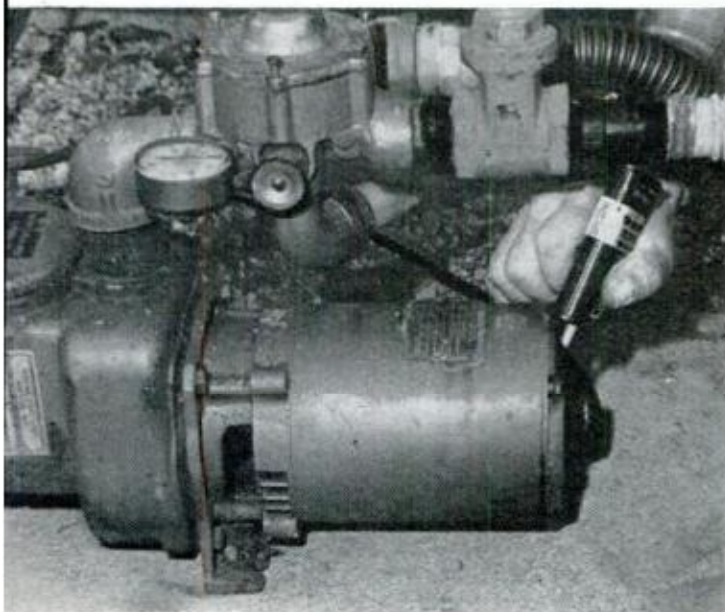


**BESIDES WEEKLY CLEANING**, help keep algae growth under control by addition of algae-killing chemicals

Fill larger cracks with dry oakum and lead before the patching is applied. If the concrete can't be salvaged, or if the water is leaking through cracks, you can have a plaster coating applied and a vinyl liner put on. However, be sure the liner fits precisely with no folds or laps.

If the old paint is in pretty good shape, scrub it down with a nonsoapy detergent and rinse. If you see any mildew (dark areas), use a cleaner that contains sodium hypochlorite or trisodium phosphate to kill the fungus.

**KEEP MOTOR IN SHAPE** by applying small amount of heavy lube. Usually one or two drops are sufficient



**USE SKIMMER** to remove leaves from pool. Use vacuum cleaner to remove sediment collected on bottom

If the old surface is too bad to repaint but not bad enough to cover with vinyl, all paint should be removed down to bare concrete. Sandblasting is the fastest way but, if you want to take the time, this can be done with a power sander. After the paint is removed, fill cracks, etch the concrete with a 10 percent solution of muriatic acid (*wear rubber gloves, boots and goggles*), rinse-wash with trisodium phosphate, rinse again, let it dry and repaint.

Some important tips on painting:

- Make sure all pits and crevices are covered.
- Never apply paint to a damp surface.
- Paint when the temperature is above 50° F.; in shade if possible. Applied in sunlight, paint will set too quickly, leaving lap marks or blisters.
- Allow plenty of time for the paint to dry before filling the pool—at least a week if the weather is warm and dry; more if not. Most paint failures occur because of impatience.
- To avoid lines, start at one end in a corner. Paint from the top down, and from left to right to keep from dripping on a freshly painted surface.

Some major sources for pool equipment and maintenance supplies:

- Johns-Manville, Celite Div., Dept. PM, Box 290-C, New York, N. Y. 10016.
- Sears, Roebuck and Co., 303 East Ohio St., Dept. PM, Chicago, Ill. 60611.
- KDI Sylvan Pools, Inc., Executive Offices, Dept. PM, Route 611, Doylestown, Pa. 18901 (Concrete pools only).

★★★



# 'Wings' For Nuts and Bolts



VERY OFTEN, an advantage in shopwork is a nut or bolt that can be hand-tightened or loosened without using a wrench or screwdriver. To serve this need for easier turning, wingnuts and bolts with knurled, ribbed or lever-type heads were developed. But in home shopwork such devices are not always at hand so it's desirable to make a substitute when needed. Seven such subs that multiply finger power are:

1. Nut with a T-handle formed by driving two drill-rod sections into opposite sides up to the threads.

2. Similar handle made for bolt by driving rod or nail section tightly into hole drilled through head.

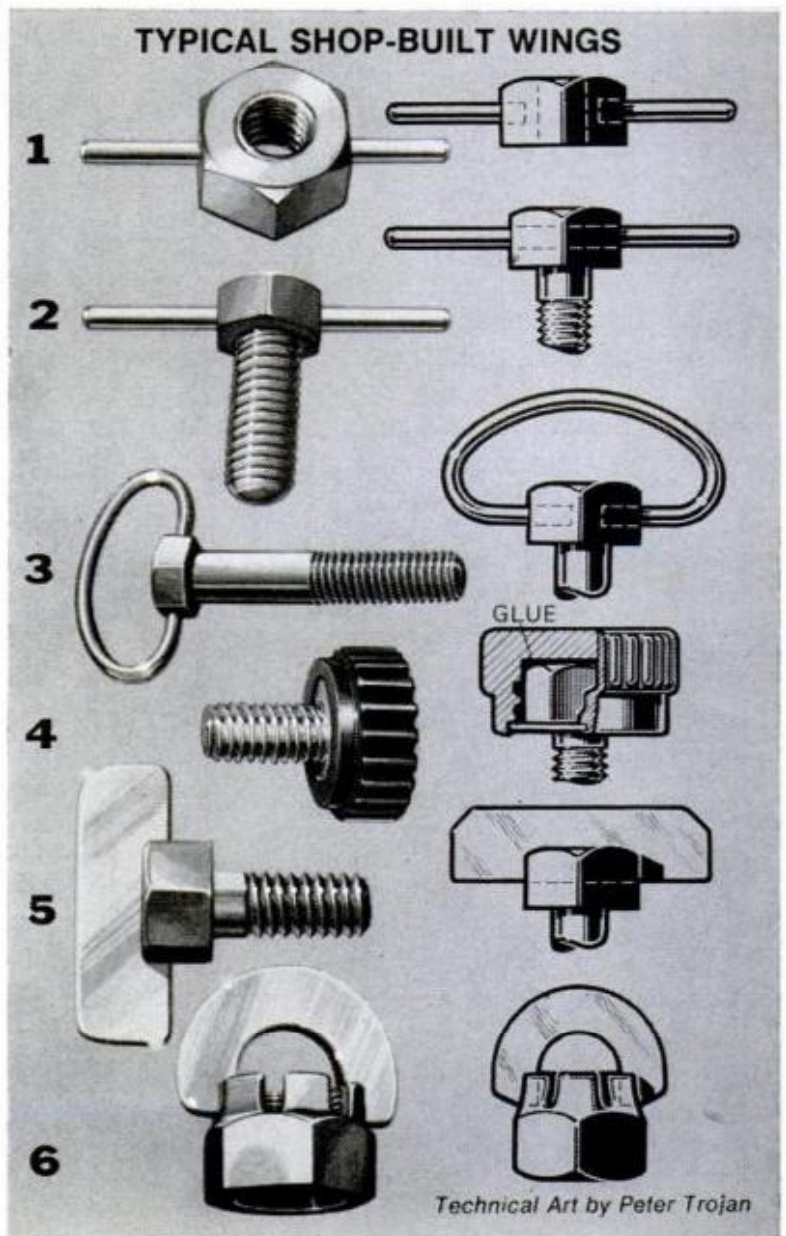
3. "Pocket-watch" stem handle for bolthead, with rod shaped like loop.

4. Fancy knurled-head bolt made from an old plastic bottle cap. After fitting cap over head, fill it with a "liquid-metal" preparation (such as Devcon) converted to "putty" by mixing in very fine sawdust.

5. Slotted-head capscrew converted into a wingbolt by inserting and soldering a piece of stiff metal into the slot.

6. Castellated nut equipped with a "wing" (section of metal washer).

7. Lathe-carriage lock-bolt (see photo above) fitted with a lever-type handle.—Walter E. Burton





# HINTS FROM READERS

## Improvised letter scale

You can weigh your own letters by using a round pencil and 12-inch ruler, plus coins that equal one ounce (five nickels and a penny are within a few grains). Center ruler on pencil and place coins over the 10-in. mark. Then center your letter over the 2-in. mark. If it tips the "scale," it weighs over an ounce.

—William Slamer, Menomonee Falls, Wis.

## Drill-press column stop

If you install a sturdy hose clamp on a drill-press column below the table, it will limit table movement downward. It also serves as a stop in case the table is accidentally loosened enough so it can drop. The clamp shown is a worm-gear type and is easily loosened and tightened whenever you want to adjust the clamp's position.

—Walter E. Burton, Akron, Ohio

## Keeping a cooler seat

Any time you have to park your car in direct sunlight for an extended time, you're sure to return to a "hot seat." But if you take time to cover the car seats with aluminum foil, much of the sun's heat is reflected away and the surface below stays cooler. Foil-surfaced paper shown came from packages of photographic paper.

—W. B. May, Oak Park, Ill.

## Cushioning rubber stamps

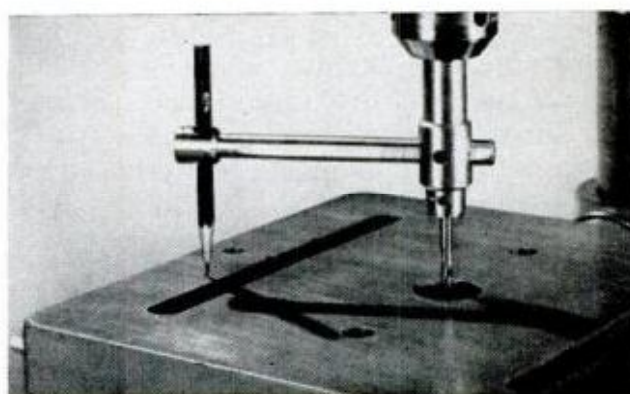
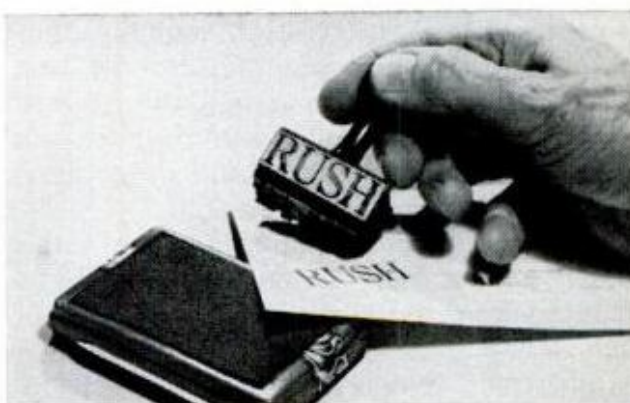
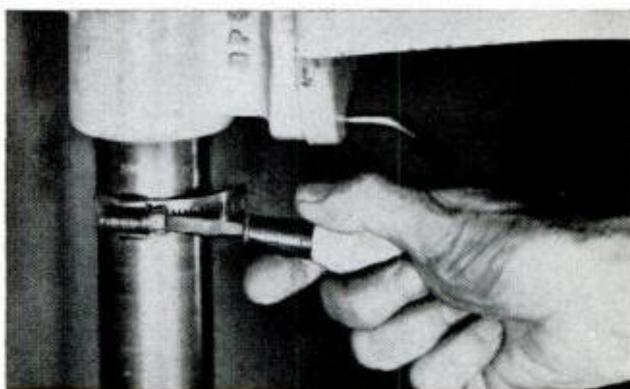
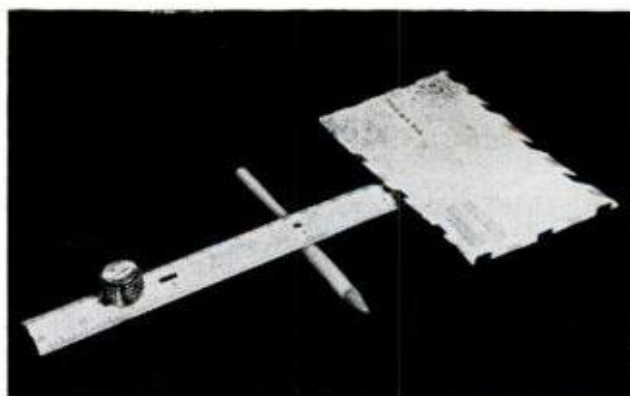
Sometimes a rubber stamp will make a better impression if the material being stamped is placed on a resilient support such as several thicknesses of a handkerchief. For a more permanent cushion, apply one or more layers of self-adhering felt to the inkpad cover as shown. Work to be stamped is then laid on the closed box.

—B. W. Ervin, Kent, Ohio

## Leveling drill-press table

Here's a fast, simple way to be sure your drill-press table is at a right angle to the spindle. Replace the tool bit in an adjustable circle cutter with a sharp pencil. Then, bring the spindle down until the point barely touches the table. Revolve spindle by hand until pencil grazes table evenly through a full circle.

—Bert Slanhoff, Scarsdale, N.Y.





# TIRED OF TURNING METALS? TRY RIGID PLASTIC

By WALTER E. BURTON/ Photos by the Author

**It comes in various forms, including fittings which offer you a head start—and it's readily handled on the lathe**

**I**F YOU'RE WEARY of turning steel and brass on your home-shop lathe, you can find diversion and challenge in working with an interesting nonmetal material—rigid PVC (polyvinyl chloride). It comes in various forms including sheet, pipe and fittings. In addition, there are other plastics rigid enough to be machined—such as acrylics (Plexiglas).

Shapes readily handled on the lathe, which can be used as good starting points in making various items, include pieces of rigid plastic pipe and such fittings as couplings, male and female adapters, clean-out plugs and fittings. Many local building-supply stores handle them, sometimes in a choice of colors such as white, gray, and ivory. Also, local distributors and fabricating shops often can provide sheet stock and scrap pieces of plastic materials they handle.

From such odds and ends, you can make various ornaments and novelties; even useful items such as washers and shade pulls. Or a trivet or trinket box (made from a Tepco fitting and plug) as shown in

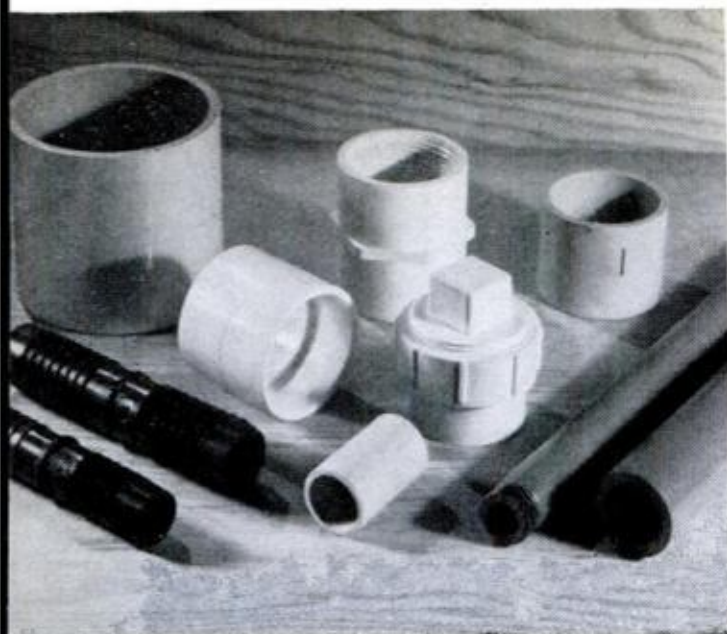
the drawing at right. The photos show a few lathe-turned items produced from random plastic parts (mostly of rigid PVC) found at local stores and in a shop scrapbox.

In production machining of rigid plastic materials, specially sharpened tools often are used. Some plastic compounds are so abrasive that tungsten-carbide tools are needed. But for limited machining of rigid PVC on a home-shop lathe, tools normally used for metals will do.

First, in turning plastics be sure that the workpiece is securely mounted in the lathe—that chuck jaws grip it firmly and that there is no unsupported overhang that is likely to cause trouble. Keep cutting tools sharp. Until you get the “feel” of the material and operation, it's good to use slow spindle speeds and a careful feed. Then judge whether you will gain by increasing speed and feed. Don't let chips accumulate.

In doing the work illustrated, ordinary lathe tools ground for machining brass and steel were used and worked well. Edges

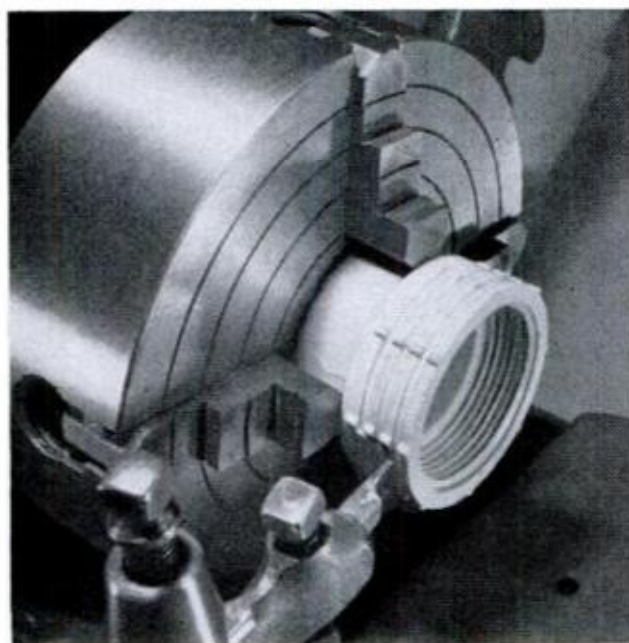




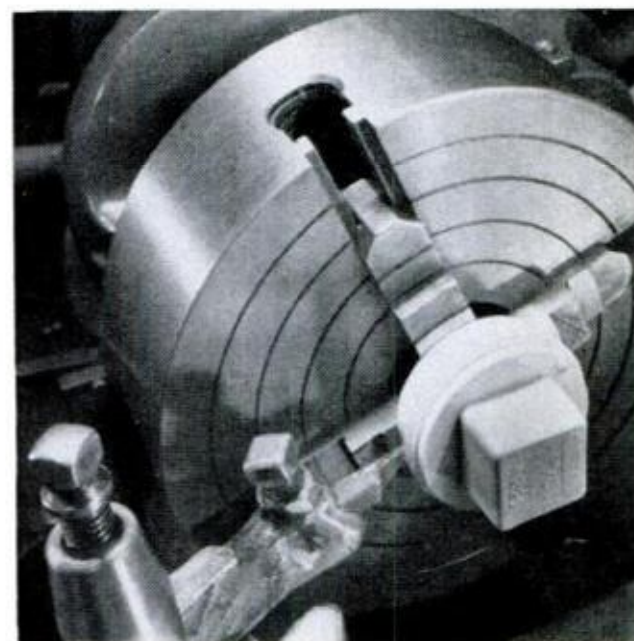
**STOCK ITEMS** are easily handled on lathe. Two black couplings in foreground are for flexible plastic pipe



**TO PREVENT WALLS** from being crushed, simply cut a plug from  $\frac{3}{4}$ -in. plywood to fit the pipe's i.d.

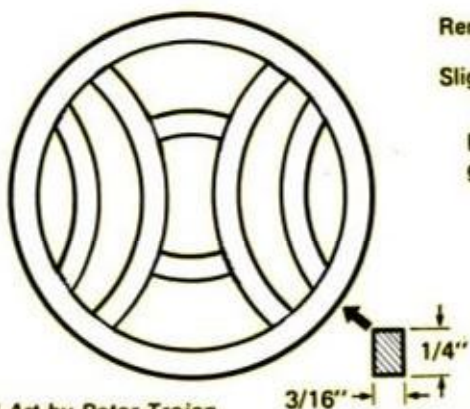


**USE PARTING OR GROOVING BIT** to cut decorative grooves in a small fitting that will be trinket box

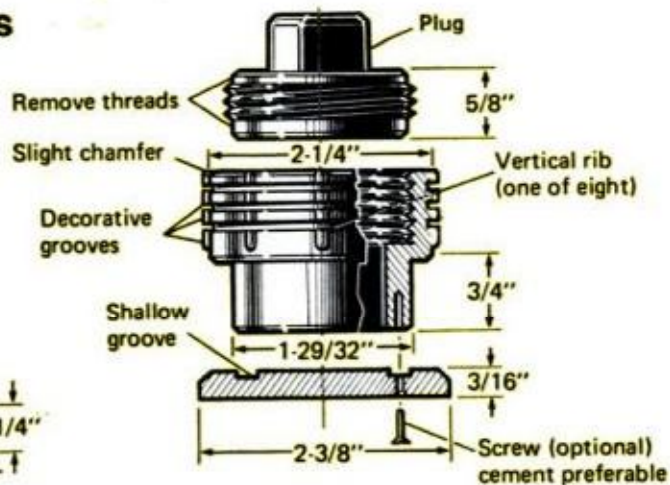


**REMOVAL IS EASIER** if all but a few turns of threads at the top are machined off the jewel-box cover

### TYPICAL RIGID-PLASTIC PROJECTS



Technical Art by Peter Trojan





were kept keen by frequent honing. Tools generally were set with cutting edges in line with the workpiece center, as in threading. Those ground with zero or slightly negative rake and plenty of clearance seemed to work well in many cases.

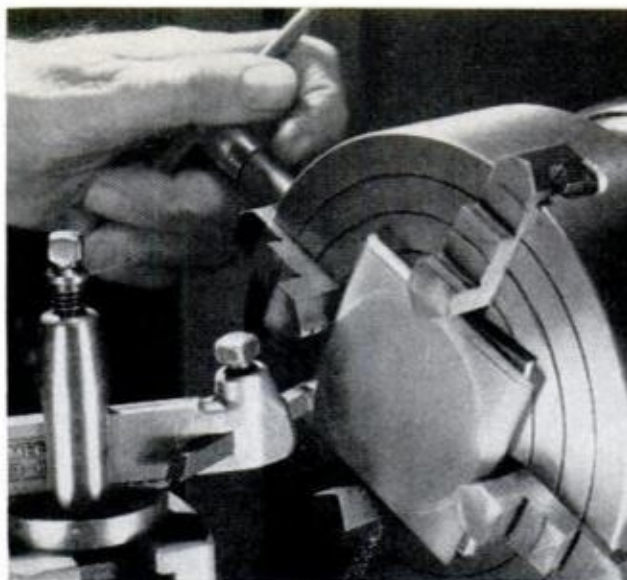
In cutting the key-chain links with a thin-blade parting tool, the lathe was run at the lowest of its four direct (nonbackgeared) spindle speeds. This produced free-flowing chips and a cut surface having a good finish that required little further treatment other than knocking off sharp edges.

Chips often come from the tool in long, uncurled ribbons and may collect in loose bunches which have to be cleared at intervals. Chips from any plastic accumulating on or near the lathe, should be removed frequently. Besides being messy, they might be a fire hazard. If the plastic produces a nose-irritating dust, use a breathing mask.

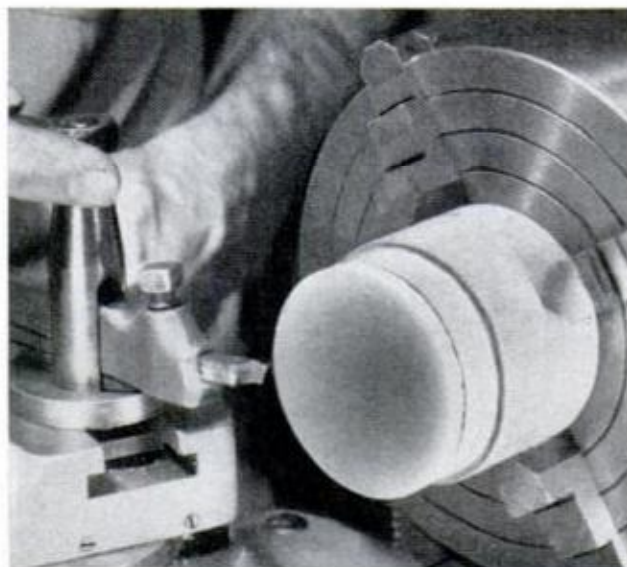
Some stringy chips may wind around the work, like thread on a spool, and have to be removed when they become a nuisance by obscuring the cut or tool. When rounding sharp edges with a file (single-cut files are preferred), a by-product may be very fine, clinging "whiskers." To rub them off, hold a piece of felt against the revolving work. All lathe work on the items in the photos was done without use of cutting fluid.

*Mounting work in lathe:* Under chuck-jaw pressure, a tubular piece can distort so readily that it is impossible to get a firm bite on it. A remedy is to insert a wooden plug in the end gripped by the chuck. For a large diameter, this can be a disc of  $\frac{1}{2}$  to  $\frac{3}{4}$ -in. plywood jigsawed or turned to a light drive fit. For a small pipe or tube, a dowel may do. Rigid plastic materials can be marred by rough chuck (or vise) jaws; a layer or two of masking tape or other padding around the o.d. where the jaws will bite is advisable.

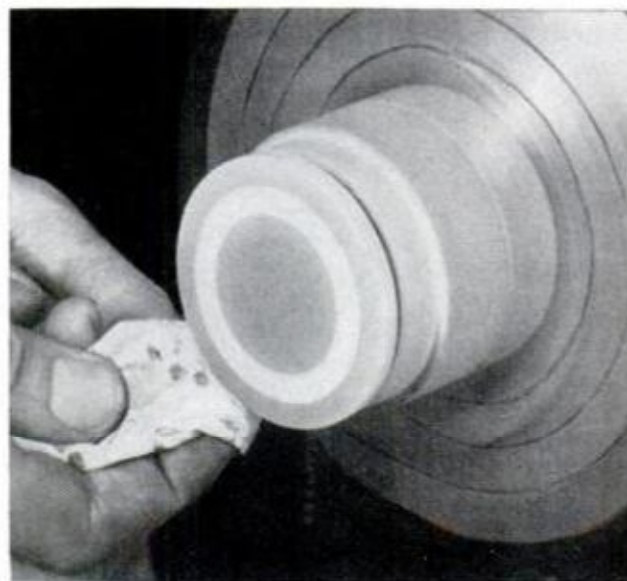
Unsupported projection of a workpiece from a chuck should be kept as small as feasible. For threading and other operations near the ends of somewhat long tubes, rods and pipe sections, a center rest with jaws as near the outer end as possible is a good bet. Tubes and pipe sections can be center-supported like rods if their i.d. is not greater than the diameter of the pointed portion of the center; or they can be plugged and mounted between centers,



**CUT BOTTOM FOR BOX** from sheet plastic using a cutoff tool. Next, you can cut the scrap away by hand



**FASTEN DISC** to the chucked wooden mandrel using contact cement with a piece of paper between them

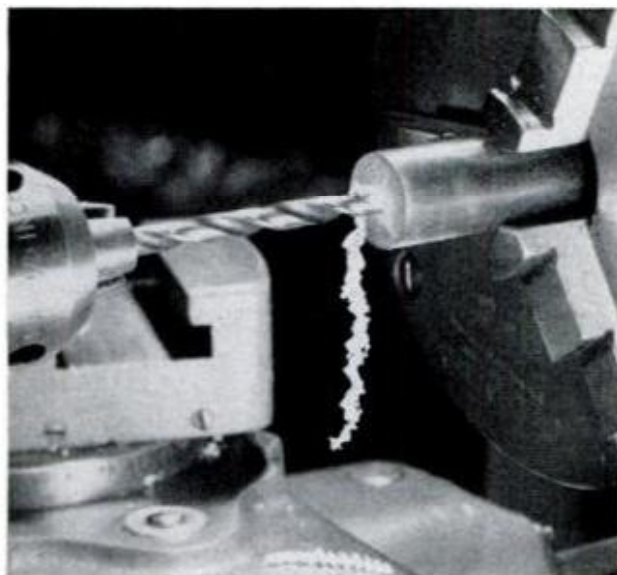


**TO POLISH DISC**, use a soft rag and powder (Bon Ami used here). Notice groove to receive round wall

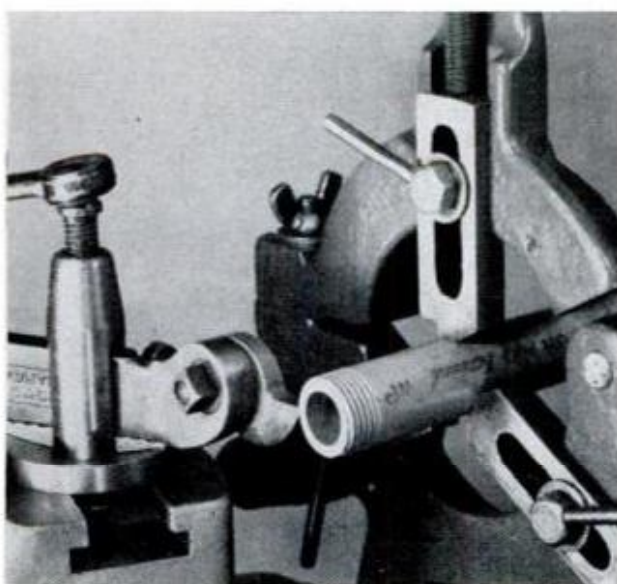




**PLASTIC COUPLING** of type used to join flexible plastic pipe is softer than PVC, but still machinable



**AS YOU DRILL HOLE** in end of cast-resin rod, the chips are almost white—though rod is amber color



**IN THREADING END** of rigid PVC pipe, with aid of a center rest, a conventional threading tool is used

like metal rods. Centers are lubricated with oil.

Corners, edges and surfaces can be smoothed with fine abrasive sheet. The degree of polish obtainable is best found by tests on the material being worked. Some plastics will require more polishing to bring out a desirable sheen. Merely burnishing with a wooden stick or one charged with an abrasive may be sufficient; this is one way of smoothing bottoms of deep grooves and the like. Bon Ami powder on a cloth or felt pad will polish some plastics spinning in a lathe; it was used for the base of the trinket box shown. Other polishes, such as those for brass or aluminum, could be tried. It's fun to experiment on scrap with various abrasives.

Finished plastic can be decorated with paints or lacquers. Hobby shops usually carry paints for the plastic-model trade. A gold paint was used in the grooves turned on the trinket box.

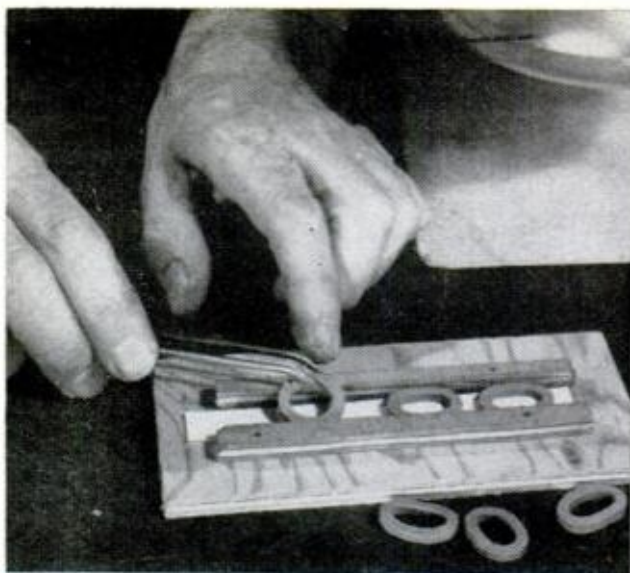
An attempt to knurl a rigid PVC pipe resulted in a shallow pattern consisting essentially of grooves in cross-hatch arrangement. The material tended to give under knurl pressure, and well-formed diamonds could not be produced. However, the resulting diamond-hatch of lines was attractive and could serve as a slip-resistant grip surface.

Off-the-lathe treatment of turned items may include cutting, drilling, boring, milling, filing, bending and cementing. In the home shop, rigid PVC can be worked successfully enough with ordinary on-hand, "nonlathe" tools intended for wood or metal. For hand-sawing, try a dovetail saw or small hacksaw; for splitting rings to make the key chain, a jeweler's saw is preferable.

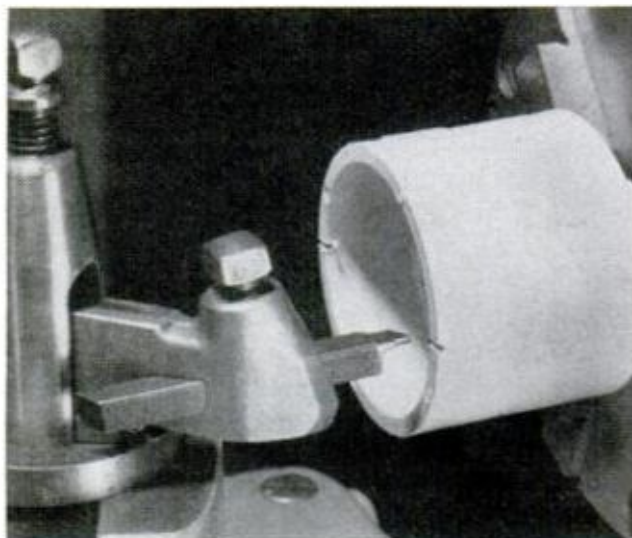
Because rigid PVC is not a good thermal conductor, the frictional heat generated by drilling or another operation may build up rapidly in a tool. Drill bits and other cutters should be watched for signs of overheating. As suggested earlier, tools should be sharp so that they produce less friction. Plastics containing fillers dull edges rapidly. A drill bit may seem to cut easily and penetrate with little resistance, but it should be withdrawn frequently, especially from a deep hole, for cooling and chip removal. Well-polished bit flutes offer less resistance.

For a threaded hole in a plastic material,

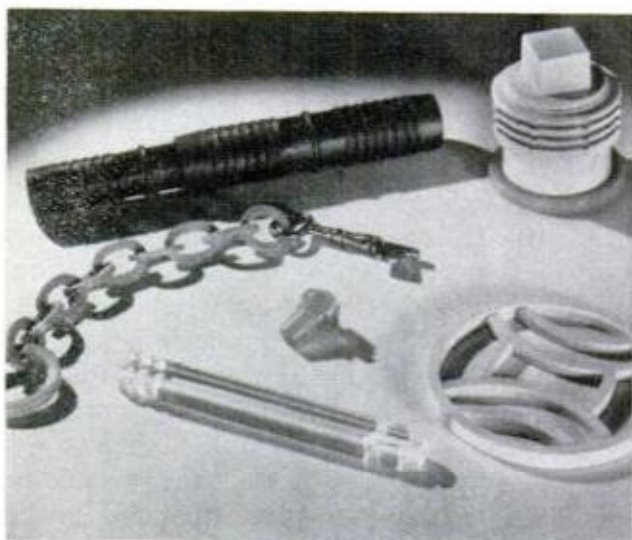




**ELONGATED LINKS** were formed by heating with lamp, then letting them cool between strips of wood



**GROOVES** can be cut in plastic using lathe as shaper. Here, cross-slide is moved back and forth, while side-mounted cutoff bit plows grooves across edge



**EXAMPLES OF LATHE-TURNED PLASTIC:** Black couplings were machined to slide together like telescope tube; trinket box was made from cleanout plug, oversized key chain is of two diameters of rigid pipe

you may use a slightly larger drill than for metal, to prevent excessive thread height. When there is a great deal of threading to be done, you may grind the tap (or die) teeth to a slightly negative front-angle rake.

If necessary, a plug can be installed to stiffen the wall of a pipe or tube for lathe-threading. Such threading may weaken the material; if the wall is thin, joining parts with cement generally is preferable. Suitable cements are sold by sources of rigid pipe and fittings.

Rigid PVC, a thermoplastic material, can be heat-softened. In its soft state, it can be bent, stretched or otherwise modified; upon returning to room temperature, it will be rigid again. For example, rings cut from a rigid Koroseal pipe for making the oversize key chain shown were softened by placing them a few inches from a 250-w. reflector heat lamp for a minute or so. Then they were made into elongated links by squeezing them between two parallel wooden strips. Alternate links were split with a jeweler's saw, snapped through adjacent links, and rejoined by cementing.

Softened PVC should be handled carefully so that its surface is not damaged; if cooled against a rough board it may show the embossed texture of the board surface.

Though rigid PVC was used mostly in the sample projects, other plastics can be worked on a lathe, among them cast or molded resins. Some tough, somewhat softer plastics, such as those used for couplings for bendable polyethylene pipe, can be machined, but you may have to guard against a tendency for them to bend too readily. PVC stock pieces may vary in properties; there are extra-rigid grades for severe service. When turning such materials, the lathe operator usually has little difficulty in detecting differences in their response to tool action.

But whatever the particular piece of PVC or other plastic, it is interesting to determine what can be done with it on a lathe. The venture can be useful, for rigid plastic parts, besides being somewhat easier to obtain and easier to machine than metal ones, may have certain properties that no metal can boast—such as a desirable resistance to oils, grease, water, weather, as well as most chemicals likely to be encountered. ★★★



# New tools you should know about



**LOW-COST FACE PROTECTION** offered by Willson Products Div., ESB Inc., Box 622, Reading, Pa. 19603, is Protecto-Shield E, with plastic visor length of 4, 6 (shown) or 8 in. Prices range from \$3.65 to \$5; guard has adjustable headgear and 4 $\frac{1}{4}$ -in. green plastic brow guard with adjustable nylon joints.

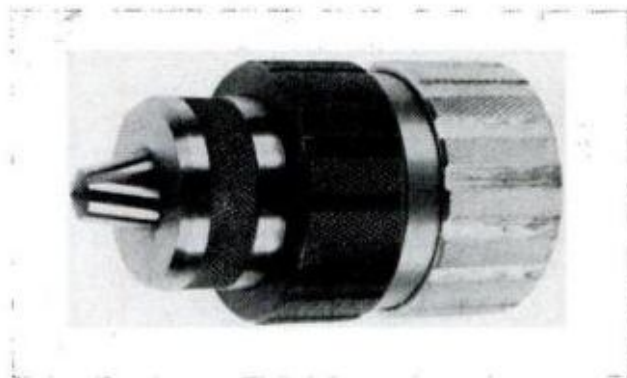


**FLAP-TYPE GRINDING WHEEL** can be run backward over a sharp file to form any shape of contour desired. Grind-O-Flex wheel can be mounted on salvaged washing-machine motor (above) to cut cost. Write for Bulletin 18 to Merit Abrasive Products, Inc., 201 West Manville St., Compton, Calif. 90224.

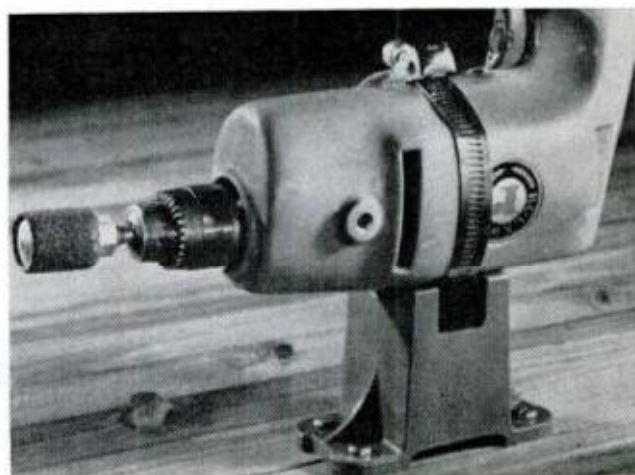
**STURDY DRILL STAND** makes it easier to grind, buff, sand and wire-brush with any portable electric drill because both hands are free. Stand is screw-mounted on flat surface and clamp is secured around drill easily. Model 415 M, \$1.69 postpaid. Arco Tools, Inc., 421 West 203 St., New York, N.Y. 10034.



**IMPELLER-TYPE PUMP**, operating in any  $\frac{1}{4}$ -in. drill, will drain bowls, sinks and home aquariums; comes with three sizes of plastic tubing for varied uses. At most well-stocked hardware stores for \$14.95. For nearest dealer, write the maker, North & Judd Manufacturing Co., New Britain, Conn. 06051.



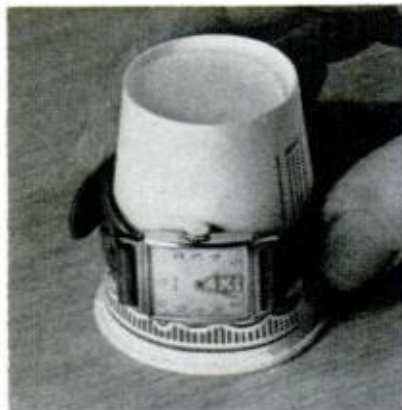
**KEYLESS DRILL CHUCK** is claimed to have accuracy within .0005 in. on a tapered arbor and .005 in. on a threaded arbor. It's designed on the toggle-and-wedge principle; you simply insert tool, tighten the shell, then lock tool by turning sleeve counterclockwise. Sizes to fit  $\frac{1}{2}$  through  $\frac{3}{4}$ -in. drills from \$17.40 to \$29.50 postpaid. P. A. Ausley & Associates, 1344 Eastbrook Blvd., Winter Park, Fla. 32789.





# HINTS

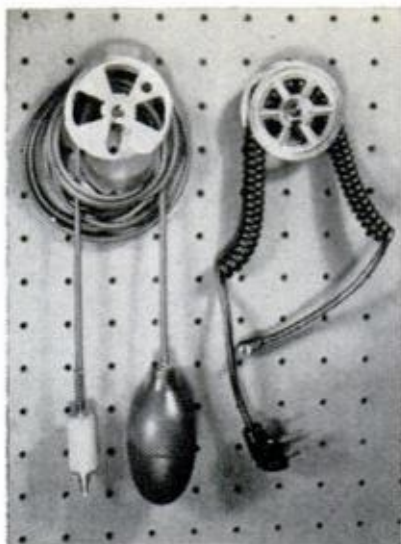
FROM READERS



## Parking your watch

A handy overnight keeper for your wristwatch is an ordinary paper cup in an inverted position, especially if the wristband is a strap type that will buckle and tighten when it's positioned. Your watch dial remains convenient for viewing, too.

—B. W. Ervin, Kent, Ohio



## Ribbon-spool hanger

If you mount an empty typewriter-ribbon spool on the wall with a screw through its center, you will have a dandy hanger to store small items such as electrical cords, flexible tubing and the like. Paint spools in matching or contrasting color.

—W.E. Burton, Akron, Ohio



## Spring-clip tightener

Here's an easy way you can handle those strong spring-steel clips, which have an annoying tendency to slip from your grasp with most types of pliers. Just slip two 5-in. lengths of  $\frac{1}{8}$ -in. pipe over ends; then use the pipes as you would the pliers.—Harold Neibert, Davenport, Iowa.

## Removing mortar from ceramic tile

Twice in the last year I have read queries in syndicated columns asking how to remove mortar from 15 to 20-year old ceramic tile, and both times the answer was "no can do." Recently, however, after cutting out some tile for new doorways, I soaked them in water and then placed them in the freezer overnight. The mortar came off as easily as putty. Try it; the trick works.—J. H. Jackson, Portland, Me.

## NEXT MONTH IN SHOP AND CRAFTS

**THE CLASSIC LOOK OF WROUGHT-IRON FURNITURE.** Last year, *PM* brought you up to date on tools available from England that let you tackle ornamental scrollwork projects. Next month you'll find four ironwork projects—an ice-cream-parlor chair, knickknack shelf, patio table and a patio arm chair—you can build for \$15. Take on these projects and your yard furniture will be the talk of the neighborhood.

**MAKE A BALL-TURNING ATTACHMENT FOR YOUR LATHE.** Machining a reasonably perfect ball-shaped knob or neat convex segment on a decorative spindle or handle is somewhat less than easy when you're using conventional lathe tooling. You'll find complete instructions for building an attachment that makes these lathe operations a snap in the July *PM*.

**FROM KIT TO CAMPER—\$800.** A handsome, sturdy outfit, this camper fits neatly in all major makes of pickup trucks. And you can assemble it in your spare time. You'll find all the details in next month's issue of *PM*.

**A JEWELRY BOX FOR YOUR QUEEN.** It's an inlaid beauty made of rare woods and it features a Swiss musical movement which tinkles merrily each time the lid is opened. Your July *PM* will have complete information for building this heirloom to add to your family's collection.





Wayne C. Leckey  
Home and Shop Editor  
Popular Mechanics



Jim Hall (Top)  
Designer of the  
Chaparral 2J, world's  
most advanced racing car



Larry Steckler  
Editor  
Radio-Electronics

## Match wits with the experts and win a \$1000 shopping spree.

Three top pros challenge you to come up with an imaginative use for General Electric Silicone Seal or Silicone Lubricant. Something they may not have thought of.

With the sealant, home-and-shop expert Wayne C. Leckey dabbed rubber "feet" onto a trinket chest, sealed a rain gutter and caulked a bathtub. With the lube, he sprayed a fishing reel, some stuck drawers and all of his tools.

On his Chaparral 2J, Jim Hall used Silicone Seal to make formed-in-place gaskets, to seal all electrical connections, and as an adhesive to hold components to the body. Then he spray-lubed the throttle linkage, suspension ball joints, wheel lugs and battery terminals.

Using the seal, electronics expert Larry Steckler repaired a speaker cone, and sealed an antenna lead-in feedthrough and outdoor antenna terminals. With the lube, he sprayed telescoping auto and TV antennas, a record changer mechanism and slide, and an antenna rotator.

**Now here's what you can do:** send in another use for either product, different from those mentioned above, and enter our sweepstakes. (To win, all you must do is fill in your name and address and the name and address of the store where you saw GE Silicone Seal and GE Silicone Lubricant on display.)

**Grand Prize:** \$1000 worth of anything from your favorite store carrying GE Silicone Seal and GE Silicone Lubricant. Next 100 prizes: \$25 worth each. Next 1000 prizes: one-year subscriptions (or renewals) to the magazines from which you clip your official entry blank.

**GE Silicone Seal:** The most reliable adhesive/sealant/insulator/moisture-proofer/instant rubber. Guaranteed for 10 years. Ignores temperatures from  $-60^{\circ}\text{F}$ . to  $500^{\circ}\text{F}$ . Won't harden, soften, crack or shrink. Ever. Dab it on, overnight it becomes a strong, flexible, permanent rubber. In white, black, clear and metallic. In 3-oz. tubes and 12-oz. cartridges.

**GE Silicone Lubricant:** The slipperiest stuff in a can. Longest wearing, strongest moisture resister, best corrosion fighter. Age, water and temperature ( $-70^{\circ}\text{F}$  to  $400^{\circ}\text{F}$ ) can't hurt it. *First lube of its kind that can be painted over.* Really works on just about everything, even aluminum. (Not recommended for TV tuners.) In 6-oz. aerosol cans.

GENERAL  ELECTRIC

### OFFICIAL RULES—NO PURCHASE REQUIRED

- (1) On Official Entry Blank or plain piece of 3"x5" paper, print your name, address, zip code and the name and address of your favorite store carrying GE Silicone Seal and GE Silicone Lubricant. Include suggestions for new or different uses for either product, and name of magazine in which you saw this ad.
- (2) Enter often, but mail entries separately to: MATCH WITS, P.O. Box 250, Murray Hill Station, New York, N.Y. 10016. Entries must be postmarked by July 5, 1971 and received by July 12, 1971.
- (3) Winners selected in random drawings by an independent judging organization. Decisions final. All prizes awarded. Only one to a family.
- (4) **BONUS PRIZE:** If you win the Grand Prize and your entry includes a new or different use, you receive a Bonus Prize of \$100.
- (5) Any resident of the U.S. is eligible except employees and their families of General Electric Company Silicone Products Dept. and its agencies. Void where prohibited. Subject to all federal, state and local laws and regulations.

### OFFICIAL ENTRY BLANK

#### MATCH WITS

P.O. Box 250, Murray Hill Station  
New York, N.Y. 10016

Here's what I did with (check one)  GE Silicone Seal  
or  GE Silicone Lubricant: \_\_\_\_\_

(attach extra sheet of paper for additional uses)

Name \_\_\_\_\_

Address \_\_\_\_\_

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

Name and address of my favorite store carrying GE  
Silicone Seal and GE Silicone Lubricant: \_\_\_\_\_



Popular Mechanics



## DO PATENTS PAY?

*(Continued from page 69)*

ble publications in this *and* all foreign countries!

When a patent attorney makes a "patent search," how hard does he look? With no disrespect intended, a patent attorney must operate at a profit and yet must charge a price clients consider reasonable. So the patent attorney, like any other businessman, must tread a narrow line between doing the best possible job and doing a reasonably priced job.

In short, the average patent search probably will turn up a dozen or fewer prior patents. Most of even this superficial searching is done under adverse circumstances—hurriedly, and by people who may have a broad technical knowledge but are unlikely to have a deep knowledge in the specific engineering or scientific concepts involved.

Further, a search usually goes back only a few years. It will include at least a cursory examination of patents still in effect, but few people are naive enough to believe that they are paying for a search of all possible prior patents of all countries, regardless of how old. In short, a patent search is usually so incomplete that it is of no value.

Remember that United States patents are approaching the 4-million mark and about 10 foreign countries are in the 1.5-million range. Many of these foreign patents are duplicates, but the total number of the world's patents still probably is in the neighborhood—and it's a big neighborhood—of 20 million. You could easily exceed the 17-year patent life just searching.

There are many fields in which we operate today that are new. But while the fields may be new, many of the problems being solved are old ones. The field may be aerospace, but the patent application may be for a mechanical latch or a pressure-proof seal or a timing device. Problems in these areas were being solved 100 years ago—and patented. You can't really expect a patent attorney to look that far back.

And foreign patents: It must be assumed that no attempt at all is made to search through foreign patents. It will not be known if the idea was anticipated in London or Hamburg or Vienna three (or 30) years ago because the patent attorney is not paid to look there. But a competitor, blocked by your patent, might!

And as to prior publication—this is Pandora's box. There is no practical way of knowing what may lurk in the world's consumer, trade, and technical journals,

which number into the thousands in this country alone. Reliable estimates place U.S. business publications alone at 2300. It is impractical to even think in terms of looking—and yet every library is a time bomb, just waiting for a competitor to find something that can blow up in the inventor's face.

All of which brings one to the conclusion that it might be relatively easy to dislodge any apparently impregnable patent, that is to say, one owned by a competitor. Pack a lunch box and head for the nearest major public library. Take a large stack of old magazines in the field involved and begin looking.

It may take days—perhaps weeks—but there is so little new under the sun that the odds are all in favor of finding out that somebody beat your competitor to the idea back in 1932 (or whenever). Take the result of your search to a good attorney; he probably can make a successful case in support of the claim that your competitor's patent is invalid.

A patent is a beautiful thing when properly framed and hung on the office wall. But the true practical value of the patent is very suspect. If the patent has been assigned to one of the nation's 500 largest, it is probably a good patent, simply because it can be defended to whatever financial extent is found desirable. But if the assignee is not a gigantic corporation—and particularly so if the patent embodies something that can be marketed at a good profit and thus is attractive to larger firms—the thoughtful inventor will make certain that his brother-in-law is an attorney.

Patents can be fun—but one should not take them too seriously. ★★

## TOMORROW'S CARS

*(Continued from page 101)*

electric vehicle. The reason it's not mentioned is that the power requirement for a mass-produced, electric passenger car of practical performance and range is greater than can be supplied by existing battery systems.

In use, electric vehicles produce no emissions. However, electric utilities do. The answer, of course, is an extensive pollution-free charging capability such as is possible with controlled thermonuclear fusion, or the continued development of fuel cells that produce electricity by chemical action.

In any event, neither appears likely before the end of the century, but electric propulsion will continue to grow, powering small, limited-range, special-purpose vehicles.—B.H.

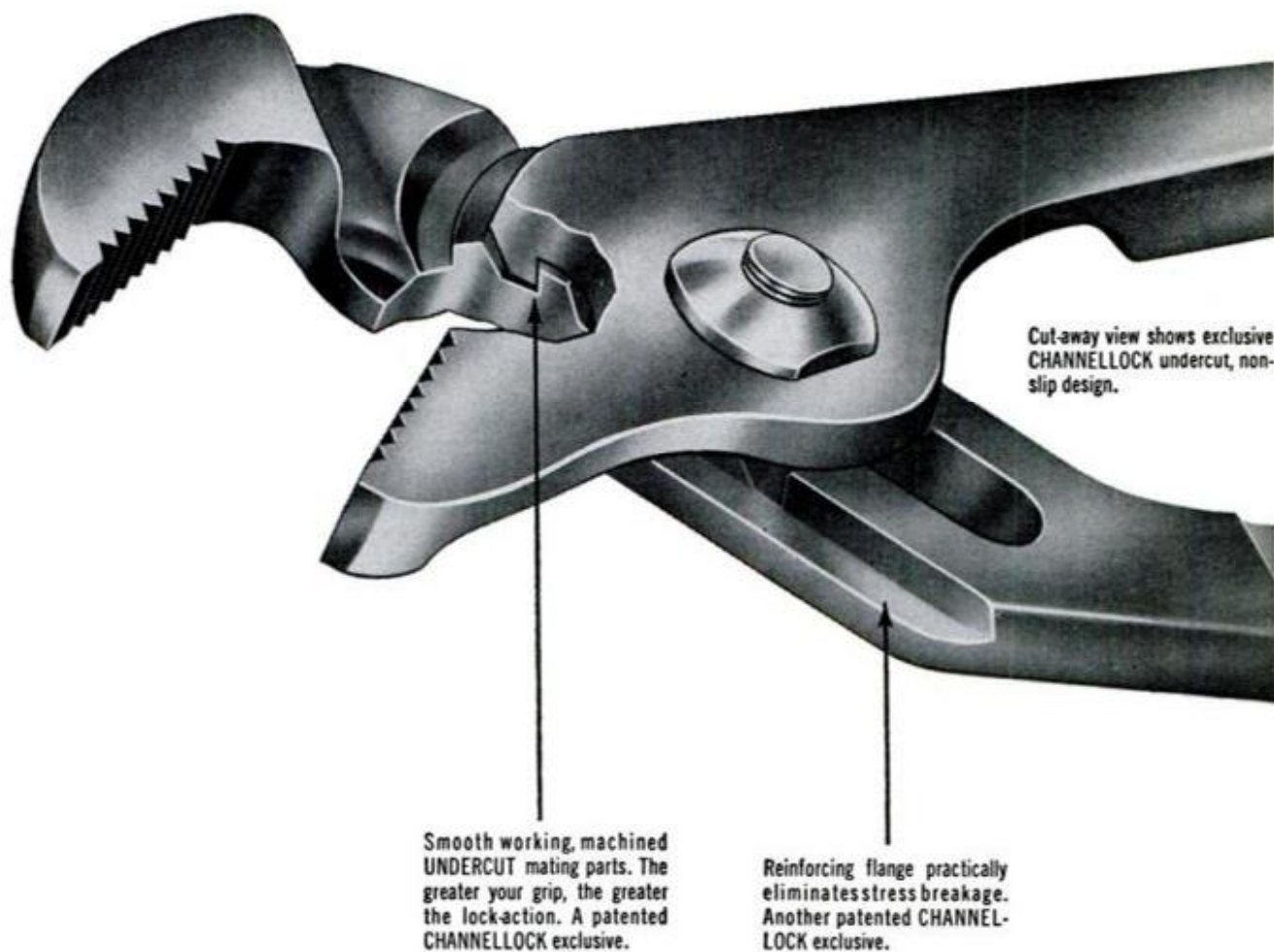


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## SHARKS MAY SAVE YOUR LIFE

*(Continued from page 74)*

species of sharks and have had some success. At Lerner, however, one was tested on a group of tiger sharks 5½ to 13 feet long and proved unreliable. Initially, 35 sharks turned back from the bubbles, while 51 passed through. The sharks, however, quickly adjusted and the majority ignored the bubble screen as a barrier after the first hour.

In South African waters a form of electrical barrier is being tested. Electrode arrays buried just beneath the sandy bottom are connected to a power source on shore by heavily insulated cable. The aim is to create an intolerable field in the waters above and so make them impassable to sharks. Maintenance and providing adequate current have proved too high in cost in the present model, but findings indicate that it otherwise fulfills its purpose most effectively.

The smaller, portable shock-repeller,

---

### **Characteristically, a shark ... may have a bite pressure of 20 tons per square inch.**

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usually operating on a pulse principle, may work well under some conditions. However, one such model tested, while it turned away lemon sharks, actually ended in attracting tiger sharks to the area close to the device!

In the past 10 years, more than 200 chemical compounds have been tested on sharks in Pacific waters as well as in the Caribbean and the Bahamas. But no chemical, including the copper acetate used in the shark chaser developed for the Armed Forces in World War II, has yet succeeded in repelling sharks that were in a feeding frenzy. A sufficient and lasting concentration is presently possible only in terms of truck loads, at which strength it is also highly dangerous to man.

High-frequency sound has so far failed to repel sharks, but low-frequency sound has had some success in shark attraction. Research here is not yet considered to be conclusive.

For downed airmen, the Navy has developed an antishark bag of tough, dark green plastic. Folded, it forms a small packaged attached to a flier's or sailor's life jacket. In use, it is a seven-foot-deep bag supported at the open top by an inflatable collar.

A ditched airman first lets the bag fill

with water, then inflates the rings and climbs in, supported by his life jacket. Any blood or body fluids are contained in the bag where they cannot attract sharks. Scott Johnson, the designer, has tested the bag while surrounded by eight-foot sharks that ignored him.

Mathewson told me he is working on a chemical attractant that may stimulate the shark's mating instincts. This is basically a compound of urea that, when placed in one area, will attract all the sharks in the vicinity, thus keeping other work areas or swimming areas free of the menace. Major testing has already begun on this project.

Sharks used to be classified with the true, or bony fishes. Now science has come to recognize that along with their relatives, the skates and rays, the elasmobranchs stand as a major group on their own. Sharks evolved some 300 million years ago, and their general design has proved so efficient that, even with smaller brains than warm-blooded mammals, they have easily survived without significant change for the past 80 million years.

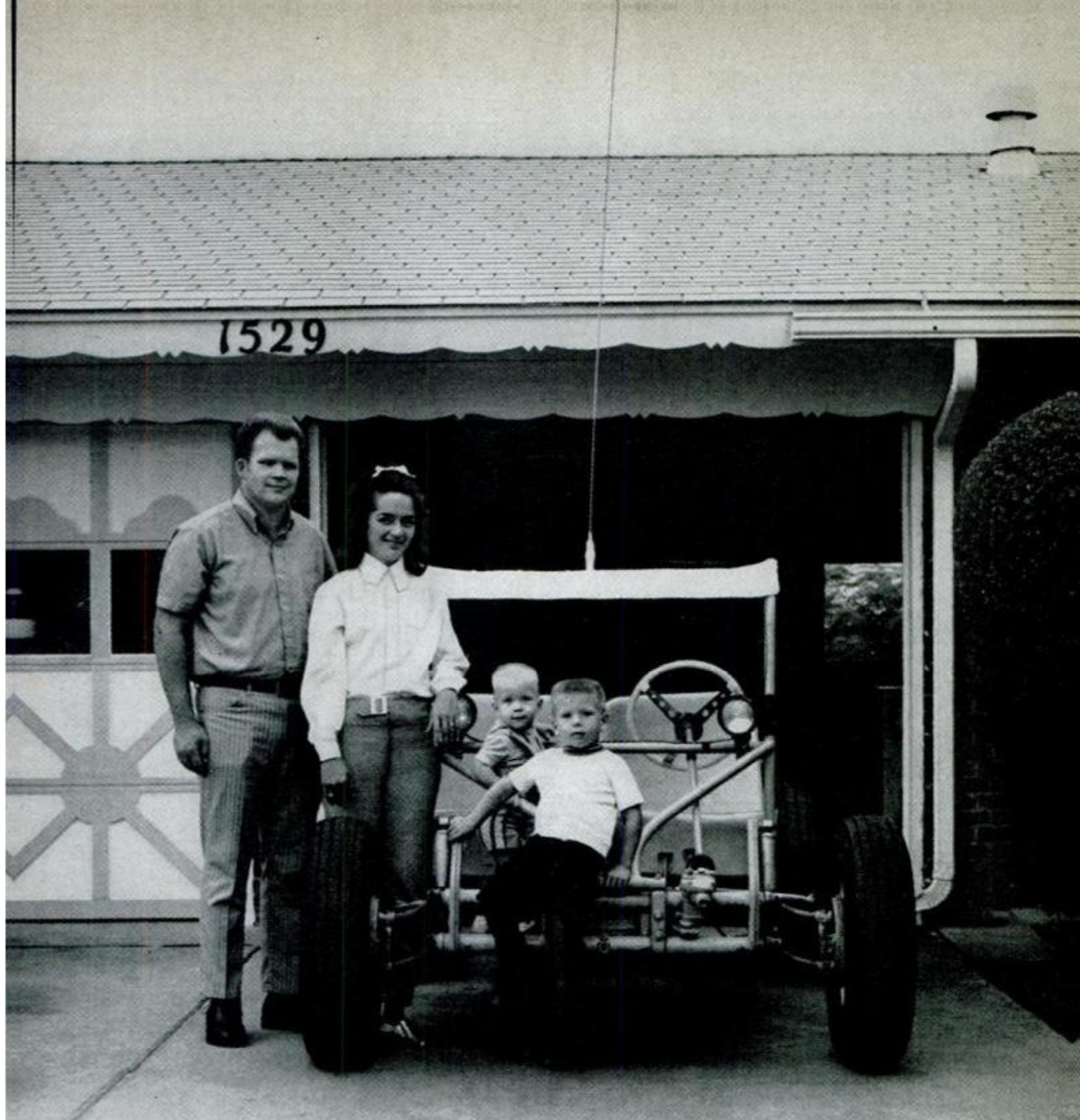
While it is probable that a shark's brain functions mainly in an instinctive manner, sharks are capable of learning new patterns of behavior. Dr. Eugenie Clark trained one shark to react to a certain set of conditions and then changed the conditions. This so distressed the shark that it developed the equivalent of a nervous breakdown.

Characteristically a shark, in this case an eight-foot blue, may have a bite pressure of 20 tons per square inch. This raises the interesting question of why nature has so overendowed the shark with everything it needs for survival except great brain capacity and, whether, after all, great brain capacity is necessary to successful survival.

The shark, for all its durability, makes tasty and excellent eating high in protein value. We in America insist on wasting gastronomic delights that other nations enjoy with relish and benefit to themselves. As population growth continues, however, and man turns more than ever to the sea for food, the shark, which is not a rapid breeder, may become a threatened species.

So, for marine ecological reasons as well as medical and nutritional ones, science seeks methods of shark control rather than shark elimination. The health of the sea depends in part on this scavenging predator, and in spite of its danger to swimmers the future health of man himself may in part also depend upon the shark. ★★★





## Buggy with lots of horses.

Johnny Sheets may live in Oklahoma City, but his heart is in the desert.

"There's one near here called Little Sahara," he says. "And that's where you'll find us in our dune

buggy most weekends."

Last winter Johnny built the dune buggy, souped up its Volkswagen engine and put in Champion Spark Plugs.

"Lots of Volkswagens

come with Champions," he says. "I just stuck with a good thing."



Toledo, Ohio 43601

**20 million people have switched to Champion Spark Plugs. This one didn't have to.**



## TWO-MAN SUB FOR \$400

*(Continued from page 97)*

lookout. You see him motioning for you to turn left. He has spotted something on the bottom. You cut the left motor switch and the craft turns in that direction (with only the right motor running). At the same time the motors are tilted downward, driving you closer to the bottom. As you circle lower you spot a beautiful rock formation and decide to set her on the bottom. When almost there, you move the valve up again to a horizontal position. Again the gurgling air bubbles pour out of the opening and the boat gently settles on the bottom with a slight bump. If he wants to, your buddy can climb out and swim over to investigate.

On this, your first trip, you're at about 35 feet. And this is plenty deep for your shakedown cruise. After you are fully acquainted with the controls and boat characteristics, you can try greater depths.

When your shipmate returns to the craft

**ABOUT THE AUTHOR:** A teacher at John Gorrie High School in Jacksonville, Fla., Kent Markham has stirred considerable student interest in oceanography with the cooperation of Principal Don Cross. The Two-Man Sub was, in fact, tested by several of the author's students.

and you are ready to surface, you simply pull the valve down in a vertical position and click the motors on. Surprisingly, nothing happens. Then you realize she is still set for negative buoyancy. You remember that to blow in fresh air, you must depress the purge valve in front of the regulator (single hose type). Within seconds the sub has positive buoyancy and lifts off the bottom and, since the motors are already running, she moves both forward and up. When you grab the controls and pull back, your ascent will be speeded up since the motors are aimed in that direction. Since surfacing too fast can be dangerous, the controls should be regulated to slow the rate of rise.

You may recall the article *Build Yourself This One-Man Sports Submarine*, (page 90, June '68 PM). Plans were made available and response to the article was tremendous. Eventually, do-it-yourself boat builders sent photographs of subs that they built, and many writers indicated a strong interest in a two-man version.

Since the cardinal rule of diving is never to dive alone, and because of the many requests, PM gave me the go-ahead to deliver a two-man vehicle. Although the two subs differ in outward appearance,

they work on the same basic principles with regard to gas laws and mechanical construction: The glassed-in area is an air pocket, and air pressure inside keeps out the water. Air is supplied from one standard 72-cu.-ft. scuba tank using a single hose regulator. Depth limit is the same as with scuba diving or about 130 ft. The propulsion units are two electric trolling motors, and current is supplied from four 6-v. automotive-type batteries. The motors develop one hp each. Maximum running time on a full charge is about five hours.

The sub shown has been operated by a number of people, including qualified divers, nondivers, oceanographers and junior and senior high school students. All were impressed with its performance, handling and capabilities.

Though construction of the sub is relatively simple it does require some honest effort. Don't expect to build it over a weekend. All parts can be bought at a hardware store, lumberyard and junk yard with the exception of the motors. I started with a surplus aircraft wing tank (any stripped-down tank with a 2-ft. dia. will do) and added some fiberglass sections. These fuel tanks come in a variety of shapes and sizes, and almost any of them could be used. For ballast, I used 300 lbs. of train-track rails. Building cost will vary, but should total about \$400, depending on location.

States vary in their requirements for registering a motor-driven boat. To be safe, check your state division of marine vehicles to learn if your sub must be registered. ★★★

## NEXT MONTH IN PM

### **The Wings of Brave Men**

Include the new Air Force Museum in your summer travel plans. You'll see the world's most complete military aviation collection.

### **Portable TVs You Can Play Anywhere**

They don't just have a handle—they run on batteries, play anywhere, come in color.

### **'Packaged' Money-Making Ideas**

Many men have turned ideas to profit by using readily available materials and components.

### **Small-Scale Car, Big-Scale Thrills**

Heath's gleaming new radio-controlled model racer hits 200 mph in scale speed. You can build it from a kit.

### **\$1200 Camper From a Kit for \$800**

You can save a third the cost of a factory-made pickup camper by building this 9-footer from a precut kit and equipping it yourself.





Transport 500 Wide Oval, Traction All Season  
— Firestone Tires

## Two new truck tires from Firestone. The more you drive, the more you need them.

Bring on the heavy loads. Bring on the ruts and potholes, the mud and snow. And the super-highway speeds. These two new tires from Firestone, the mileage specialist, are the answer. The top of the line for pickups, pickup-campers and other light trucks.

The Transport 500 Wide Oval puts more rubber on the road for more stability and a whisper-smooth ride. And up to 50% more mileage than the Firestone tire it replaces.

The Traction All Season runs cat-sure, cat-quiet on the highway. Now get off the highway and feel its rugged lugs pull your rear wheels through mud or snow.

Get them at your Firestone Dealer or Store. Specify them when you buy a new light truck. The more you drive, the more you need them.

**Firestone**  
The mileage specialist.



## PM's \$30 'HOUSE WATCHER'

(Continued from page 125)

chucked in a drill press. Each one is divided into 24 equal divisions to represent 24 hours. Since a refrigerator-door switch works the opposite of most switches (it's off when depressed), low spots on the cams are located at points where you want the switch to remain on.

Such places around the perimeter of each cam are formed by mounting the blank disc across the top of the blade of your table saw. The cam is held by a 1/4-in. bolt inserted through a hole in a wood scrap which, in turn, is screwed to the face of the miter gauge. Then with the blade raised about 3/16-in. above the saw table, two cuts are made across the edge of the disc and the material between the cuts is removed a little at a time by slowly turning the disc right and left. With each pass the work is advanced a bit more into the spinning blade until the full depth of cut is reached.

Round all cuts as the patterns show so the switch buttons will ride up smoothly on the cams. Since the circle cutter makes only a 1/4-in. hole, the center hole will have to be redrilled with a 3/8-in. bit.

The cam assembly is supported by a wood cradle consisting of two identical end pieces screwed to a 1/2 x 6 1/8 x 10 5/8-in. plywood base. Holes for the bearings are identically located by drilling through both end pieces at one time.

The six refrigerator-door switches are mounted 1 in. on centers along a metal strip so they align and bear against the cams. Since it doesn't require much pressure on the switch buttons to break contact, you'll want to adjust the switches

so they bear the minimum. The two nuts which hold each switch make it easy to move them in or out.

The motor is coupled to the camshaft by a sleeve fitted with two setscrews. This is made from a short length of 1/2-in. rod, one end being drilled for the 1/8-in. motor shaft, the other for the 1/4-in. camshaft. The motor is supported by a U-shaped bracket bent as shown from a thin metal strip.

A lift-off cover is made from 1/8-in. tempered hardboard and serves to hold the six outlets in a row along one side. Square-corner holes for the outlets are drilled and filed in the hardboard and Pop rivets are used to fasten the outlets in place. Elmer's glue is used to glue the parts of the cover together and two screws hold the cover to the wood base.

If you paint the cover, spray it before riveting the outlets in place. Finish your timer by labeling each outlet.

Strands of common lamp cord peeled apart can be used to wire motor, switches and outlets, following the diagram. You'll need to leave enough slack in the wires, however, to permit slipping the cover over the chassis.

If you have trouble buying the motor, outlets and switches locally, you can get them as part of a kit that also includes the turned-down threaded rod, bearings, nuts and washers, switch and motor-mounting strips and coupling. The kit is priced at \$24.95 postpaid from Cam Timer Co., 400 Walnut St., Yonkers, N.Y. 10701. If you prefer, a ready-to-assemble kit with all parts machined, including the cams and spacers (you make the wood base and cover yourself) can be ordered for \$34.95. ★★★

## Keep Your Copies of PM

**W**HERE did you see that article on making a power hacksaw? Now that you're ready to build a screened patio, where's the PM article that tells you how? You vaguely recall seeing a great idea for lifting a tilted section of concrete walk—but in what issue?

If you already are saving copies of PM, it sometimes may be frustrating to have handy such authoritative information and useful ideas, yet have difficulty finding a particular

article when you're ready to go to work.

In December, PM will make available an inexpensive *Annual Index* combined with an attractive shelf cover to hold all 12 issues of 1971. Whenever you want to refer to an article you slip off the cover and check the "Instant Index" that's bound inside. Thoroughly cross-referenced, it will help you find any of the hundreds of valuable PM articles in seconds. If you're not already saving PM:

- Start saving your copies now.
- Watch for announcement of the *Annual Index* in the December issue.



On his last outing, Studs Merkel wowed the gang with his own special, triple-filtered cigarette.

Now everybody will be smoking special, triple-filtered cigarettes.

...almost everybody



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**Camel Filters.**  
**They're not for everybody.**  
**(But then, they don't try to be.)**



20 mg. "tar," 1.3 mg. nicotine av. per cigarette, FTC Report Nov. '70

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ON-THE-GO

# CAMPING

BY V. LEE OERTLE

**MORE MODULAR CAMPERS COMING.** The next great "boom" in RV equipment will include one-piece bathrooms, all-in-one galleys, double-deck bedrooms and even add-on sun-decks. These superlight, tough and well-designed *modules* are being inserted in all kinds of trailers, campers and motor homes. The day is fast approaching when the buyer can order virtually any combination of these modular cabinets to custom-build a particular type of camping vehicle. Basic sizes will fit many popular chassis—all the buyer need do is juggle them to suit. Exciting!

**INDIAN FRONTIERS ABLAZE AGAIN?** Perhaps so—the word is that the Bureau of Indian Affairs is planning a tremendous new campground for vacationers on Utah Indian Lands in the vicinity of fantastic Monument Valley, in Southern Utah's eastern corner. This astonishingly colorful country, scene of countless Western movies (*Cheyenne Autumn*, *The Searchers*, among others) has enormous natural appeal. What better way for the Indian operators to capitalize on it than with their own private campgrounds?

**NEW TRAILERING BROCHURE** from Chevrolet includes towing charts with specified weight limits, and is most informative literature on the subject ever provided by Chevrolet Div. Among other things, it warns against the use of copper tubing for trailer-brake connections. It reminds trailer-towers to use a load-equalizer hitch for trailers weighing over 2000 pounds and warns that axle-mounted hitches are *taboo*. Get the brochure free from your Chevy dealer.

**CLAMP-ON ROOF SLEEPERS FOR VANS** are grabbing the 1971 spotlight. The new styles stretch from over the cab back over the rear bumper. The full-length sleeping accommodations provide space for six adults, extra headroom, and extra storage space overhead. We predict that the permanently attached rooftop camper (such as recently announced by Dynacoach Motorhomes, Inc., 6421 Industry Way, Westminster, Calif. 92682) will replace the pop-top as the new favorite of van camping enthusiasts. It's a matter of *space*, pure and simple—the full-length tops have more to offer.

**FOUR-DAY TEN-HOUR WORK WEEK A BOON!** More large companies are making a switch to the four-day work week this summer, a move that will maintain job hours, while reducing commuting time per week and air pollution. Best of all this plan offers an *extra free day* for recreational travel. If all the industrial giants switch to this four-ten-plan in the future (and it is a possibility) then watch recreational travel spurt in a record boom. A year would suddenly contain about 50 three-day weekends plus vacation time for every factory worker! We're all for it. Those who have tried the new system are universally enthusiastic.

**SELF-SERVICE FOR RECREATIONAL VEHICLES?** A major oil company is rumored to be in the process of opening self-service centers where coach-owners can rent tools, repair RV equipment, dump holding tanks, and replace worn parts—entirely on the self-service principle. Just as in a supermarket, the customer will be charged for expenses as he leaves the premises.

**FRONT WINDOWS HAVE BEEN ELIMINATED** from some trailer models to create sleeker, maintenance-free exteriors. On those long caravans and off-road trips the stones kicked up by a towing vehicle often do expensive damage to the trailer. Front windows may be shattered or sheet metal dinged and battered. By eliminating the front-window pane and concentrating on huge sidewall glass areas, no interior illumination is lost. Look for more models to appear with the all-metal nose cone this season. ★★



# Engine Vitamins.

New high performance Gas Booster from Du Pont. It supplements your car engine's gasoline "diet". Like vitamins do for you.

Gas Booster fights engine flu brought on by fuel system gum and deposits. You know the symptoms... rough idling... loss of pep and power... that general run-down feeling.

Gas Booster *protects* new engines against engine flu. It helps cure this problem in older engines by removing power-robbing deposits. Helps nourish tired engines back to a peppier performance.

Add a can of Du Pont Gas Booster "vitamins" to your next tank of gasoline. No prescription necessary.





# FREE PLAN *How to Start* Your Own Business



Start a steady repeat CASH business in your basement or garage. Earn \$3 to \$6 an hour in your spare-time! Excellent profits in saw sharpening business! Automatic Foley Saw Filer, easy to operate, files combination saws, hand, band, and circular saws. No experience needed. H. C. Deibert wrote us: "Since I got my Foley Filer 5 years ago, I have averaged 4½ saws each day since I started."

Every saw you sharpen brings you more customers. "I rented a two-car garage and have all the work I can do," writes Charles H. Smith.

## FREE BOOK *Shows How to Start*

Fact filled booklet tells you how to start a sparetime business immediately; how to get new business, how to advertise. Rush coupon now; get "Money Making Facts" and details on Easy Payment Plan. No Salesman will call.

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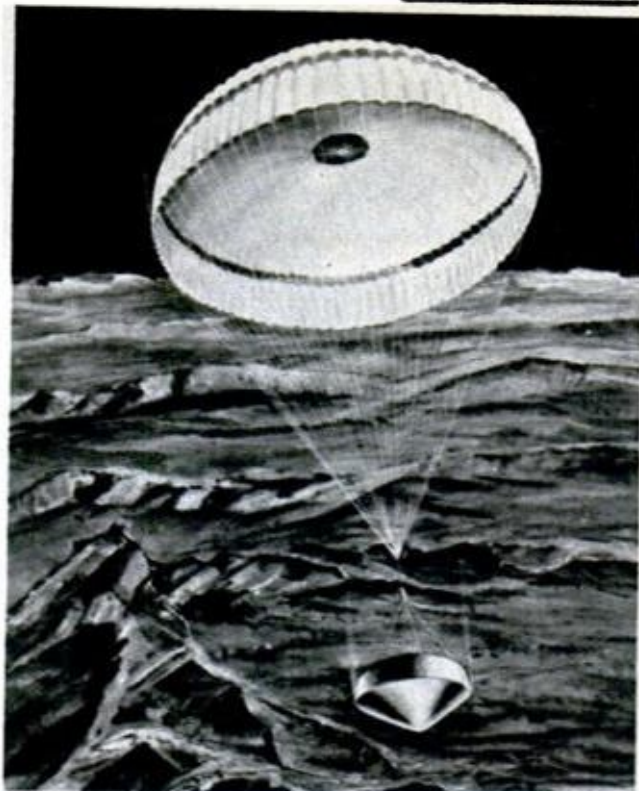


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## NEWS BRIEFS



### Chute will slow Mars lander

A 53-foot parachute will slow the Viking lander as it enters the thin atmosphere of Mars; retrorockets will bring the vehicle to a soft landing. The deceleration subsystem is being built by Goodyear Aerospace Corp. for NASA's two Viking launches in 1975.

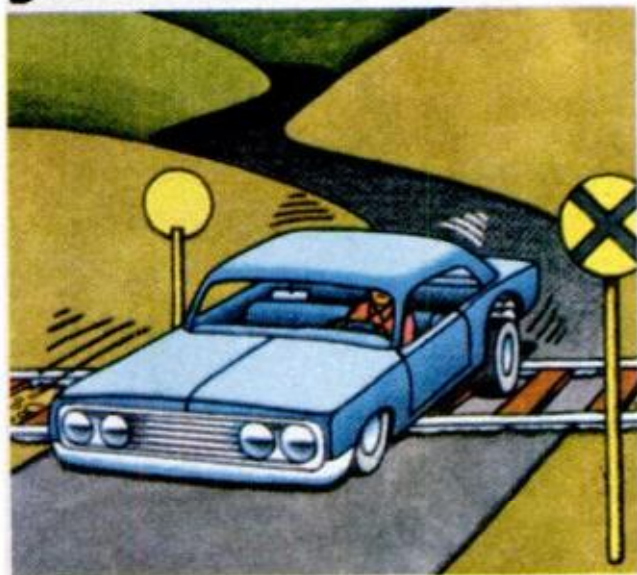


### Scale bikes for young racers

California kids are getting a chance to race bikes on two-thirds-scale copies of racing machines that are being built in Stanton by Dick Rucker. Rucker's 56-pound prototype (foreground) is powered by a Hodaka 100-cc engine and uses a stock, five-speed Hodaka transmission. The wheels are a mixture of bicycle and motorcycle parts.



# How to road test your shock absorbers.



Try these things next time you're in your car.

When you go over a railroad crossing, does the front end continue to bounce up and down?

Cruise through an S-curve. Does the car lean and sway excessively?

Then, find yourself a little chuckhole. See if that sets your wheels dancing.

Now, the symptoms in your car may not be violent—they may even be *hard* to spot—but big or little, do you know what causes these problems?



Well, the answer might be worn shock absorbers.

You may need Delco Pleasurizers,

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## New subway in Mexico City

Riding quietly and smoothly on rubber tires, cars of Mexico City's new subway system can reach speeds of some 50 mph. Each car has a capacity of 170 passengers—38 seated and 132 standing. Because most of the area's subsoil characteristics prevented conventional tunneling, much of the 26-mile system was built in open excavations, then covered. In building the system, extensive use was made of Du Pont elastomers—neoprene window gaskets and door seals in the cars and "Hypalon" in the power cables.



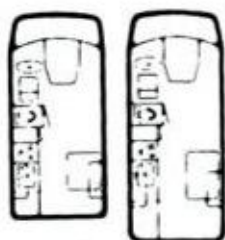
## Canned gifts

Customers in Seibu Department Store in Tokyo can have any small item they've bought as a gift canned instead of gift wrapped. The "instant canning" costs 22 to 28 cents.

POPULAR MECHANICS



**Chevy Van/Sportvan:**  
**You can get in more of everything**  
**-including vacations.**



**Two new sizes,**  
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We've gone to greater lengths for camping enthusiasts. Both Chevy Van and Sportvan offer two wheelbases, up to 125 inches.

There's nothing like them for camper conversion—self-contained camping at least expense.

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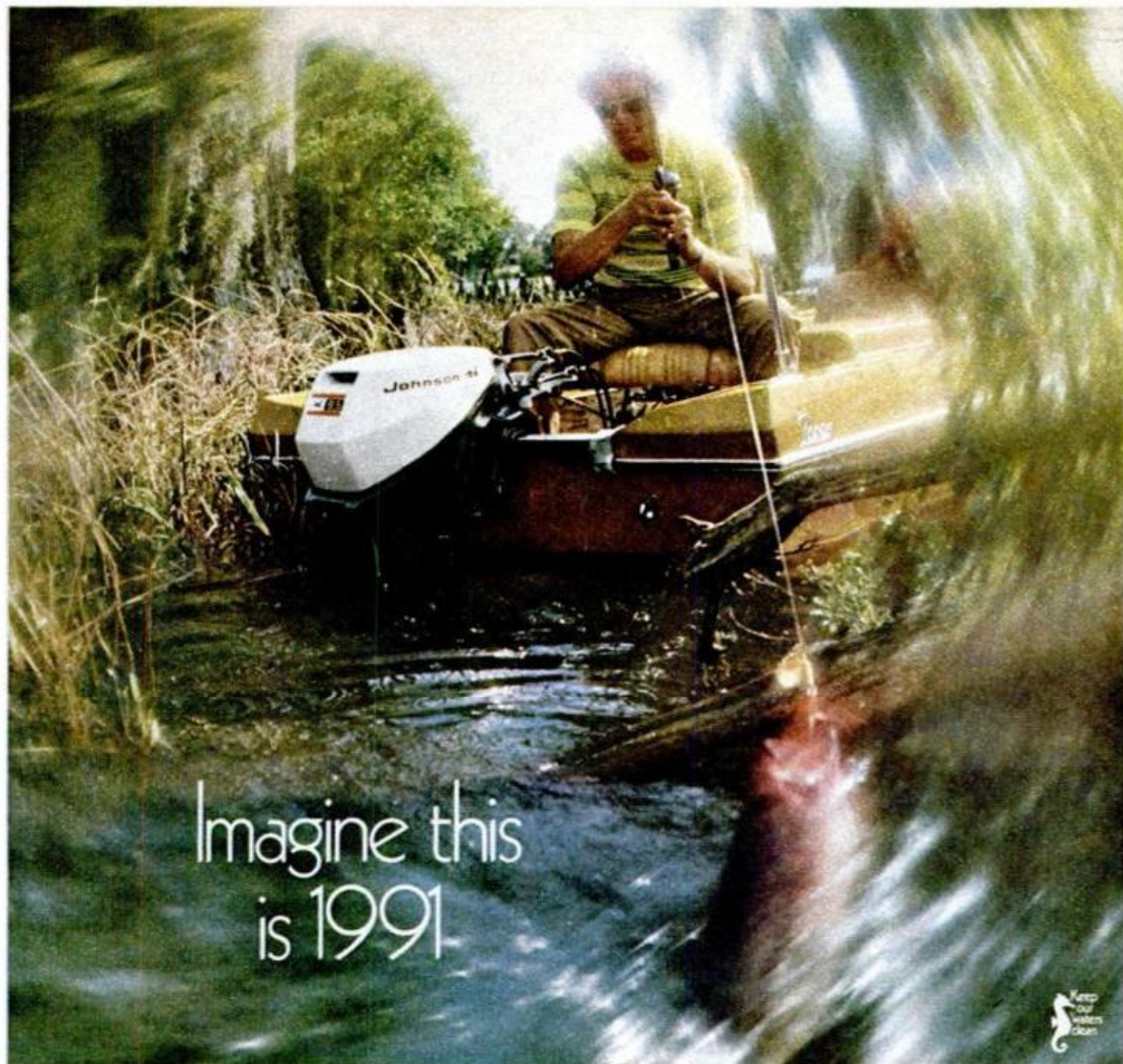
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### Driveway through her house

When Mrs. Joan Thomas of Wisbech, England, wants to park her car in the back yard, she opens up a couple of large doors in her home, rolls up the rug—and drives the car through the hallway. And when it's raining, she works on the car indoors (bottom photo). Mrs. Thomas added the big doors in the hallway when parking restrictions forced her to keep the car off the street.





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Because our "fishing" outboards last so long some of our loyal customers only buy a new one after 20 years. Long life dependability is one reason why Johnson has, for years, been the largest selling outboard in the world.

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## Blacksmith's fence

After 70 years as a blacksmith, Henry Jones built himself a retirement gift—a fence that displays all the tools and products of his trade. It's in Eckington, England.



## Plastic-coated Piccolo

The AWS Piccolo is an updated version of Germany's well-known Goggomobil. Its body is plastic-coated sheet steel, and engine options are 250-cc and 400-cc powerplants.



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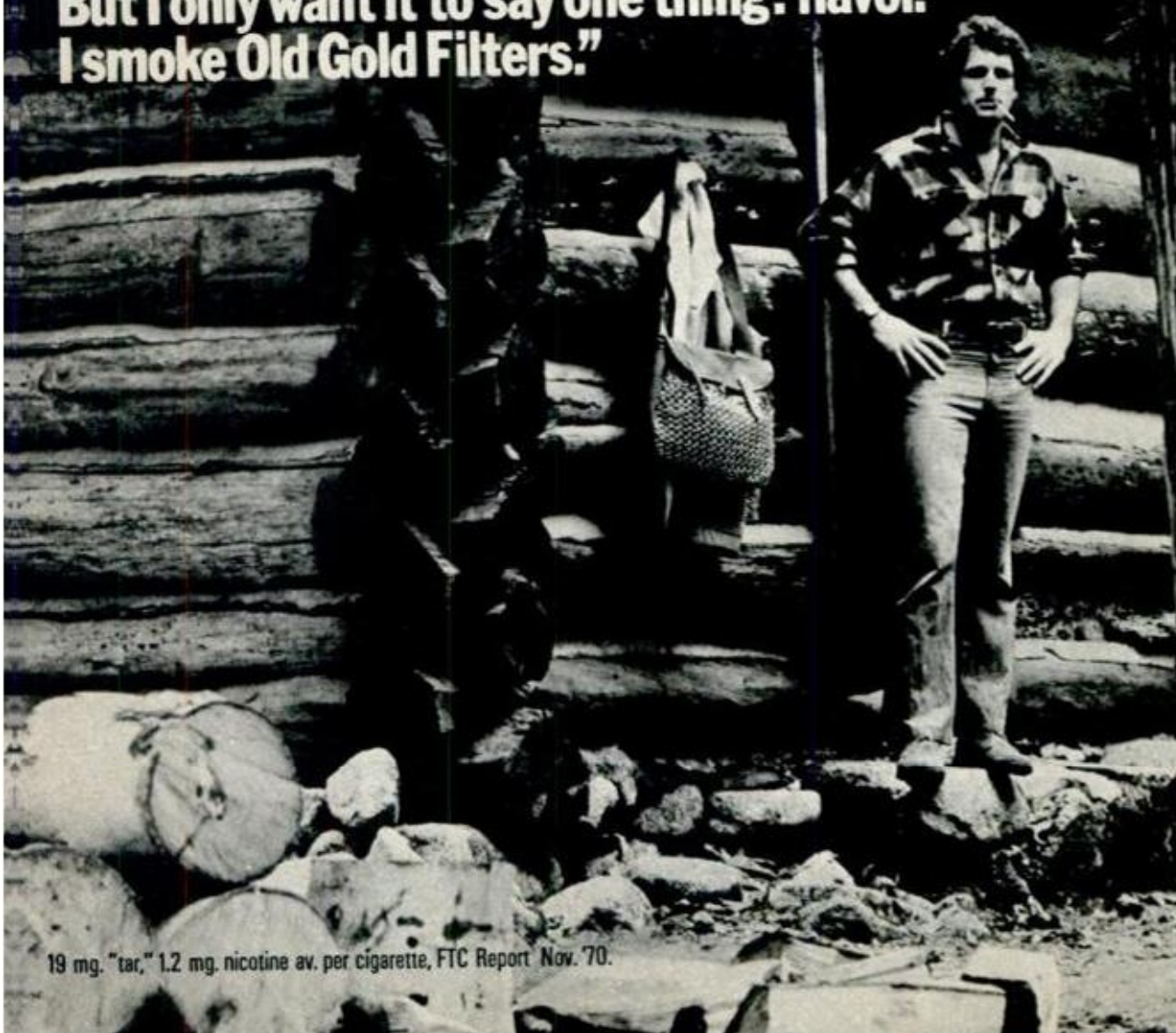
The 1850-ton Uzushio is Japan's largest post-war submarine and the nation's first undersea vessel to be built in a teardrop shape. Built by Kawasaki Heavy Industries, it is powered underwater by batteries.



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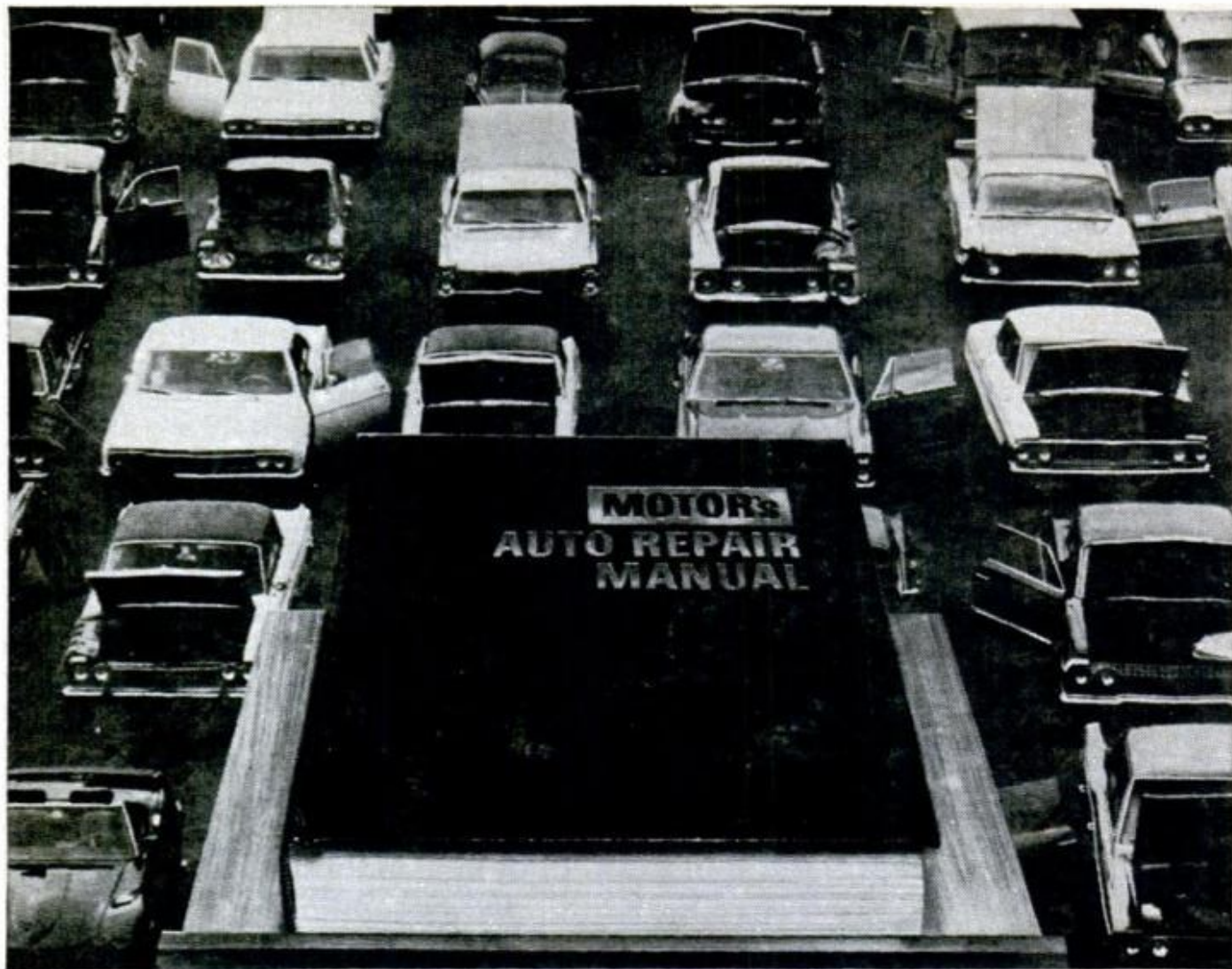
**"I want my cigarette to talk tobacco to me.  
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| RAMBLER    | AMERICAN    | LINCOLN     |
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| BUICK      | CORVETTE    | CADILLAC    |
| (SPECIAL)  | MUSTANG     | MARK III    |
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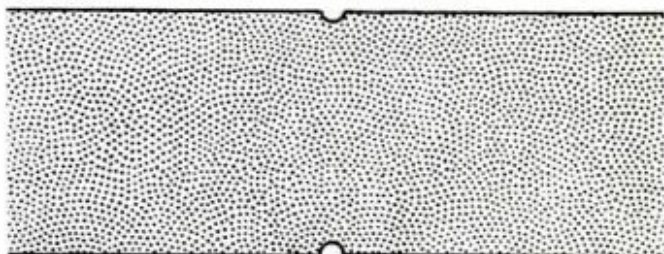
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## DETROIT '72 PREVIEW

(Continued from page 65)

ment work. But late information is that this has been washed out for '72.

**Ford:** Ford will have more new toys than any other kid on Detroit Street starting this fall. Torino, Montego, T-bird, and Mark III will have new bodies. They'll be body-and-frame instead of the unitized construction used in current cars. Torino and Montego will come on two wheelbases—114 inches for two-doors, 118 inches for four-doors. The wheelbase on T-bird and Mark III will be stretched from the present 117.2 inches to 120½.

The model lineup on Torino and Montego will consist of two-door hardtop, two-door fastback, four-door thin pillar and station wagon. T-bird will be limited to one body style, a two-door. The four-door will be dropped.

The four new cars will have several features in common. (1) Plastic instrument panels. (2) Mini steering columns. This item first appeared on Pinto. Instead of the usual tubular steering column going all the way to the floor, the tube goes only as far as the dash, where it is hooked up with a thick stranded cable that takes an S-bend down to the gear. The advantage of this is that in a severe accident, it's virtually impossible for the column to penetrate the chest. (3) Cross-flow 28-inch radiators. The widest radiators Ford has now are 26 inches and they are downflows. (4) The brake booster will be linkless and have a direct drive to the piston, instead of an intermediary link. (5) A new transmission, labeled the C-6.

Montego and Torino will get power disc brakes in '72, replacing the present mechanical discs. The cars will have baccarian (two humps) bench seats. The humps will be integral with the seat, not hang-ons.

Torino will be a real greenhouse of a car. Ford's target for Torino is Chevrolet's Chevelle. Using Chevelle as a model, the '72 Torino will have four more square feet of windshield than Chevelle has this year. Mark III also gets another piece of glass, an opera window in the C pillar, like Cadillac's Eldorado.

Ford is expected to drop concealed headlamps on all cars except T-Bird and Mark III. The flap that conceals the lamps on Mark III will have a small grillwork design.

T-bird will have a 400-c.i.d. engine, thanks to an assist from GM, which will supply a Frigidaire/AC compressor.

One of the novelties Ford will have next year is a remote-control electric door lock. If you turn the key halfway in the

lock on the driver's side, to the first "notch," you unlock the door on the driver's side. If you turn the key all the way, you open all four doors. Miniature rotary motors will be mounted in each door. This item will be standard on T-Bird and Mark II and introduced as a running change on Torino and Montego.

Ford thinks it has the stuff to flick some dust in GM's eyes in the new car year.

**General Motors:** If the daddy bear of the industry has anything excitingly different for '72, word hadn't leaked out when this preview piece was written. GM will make changes, of course, but the real bell-ringers won't be ready until a year from now. Maybe a new mini—1800 pounds powered by a Wankel. Maybe a mid-engine Corvette. Maybe a smaller Cadillac (but not what you'd call a mini). Probably electronic fuel injection. Definitely a compact Olds (off the Vega shell). But that's '73 calendar year, '74 model year, material.

GM intended to redo its intermediates this year, but that got sidetracked last fall when the company was KO'd by a three-month strike. Six months later, there's still a waiting list for some GM cars. Why change 'em if you can fill all the orders you've got for the present product?

GM will make identification changes for '72 so there will be incentive for GM regulars who buy new cars every year to order up a new one.

Along with the once-over-lightly, GM will make under-the-skin improvements. Thicker bumpers, for one thing. This is an interim step until the company can bring out energy-absorbing bumpers a year from now. Olds may have something even better, a new way of hanging the bumper so the supporting device takes the punishment in an accident instead of wrinkling the bumper.

All GM makes except Cadillac and Buick Electra will sport new plastic grilles. Buick will also have a plastic hood, but only for its intermediate. Ribs formed in the plastic will run the length of the hood.

Chevrolet is working on a four-door version of Vega and a mini pickup truck off the Vega chassis. But these don't look imminent, although the truck could come out in the course of the model year.

That's the picture. Except for the new wares from Ford, it doesn't shape up as a whoopee year. But whoopee costs money. Lack of it should be good news to those of you planning to buy new '72 cars.

It probably means car prices will remain relatively stable. And there's a twist for you—a new model year without prices going up the size of a week's pay. ★★★



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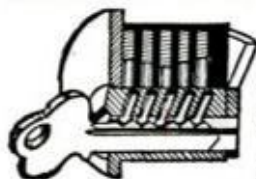


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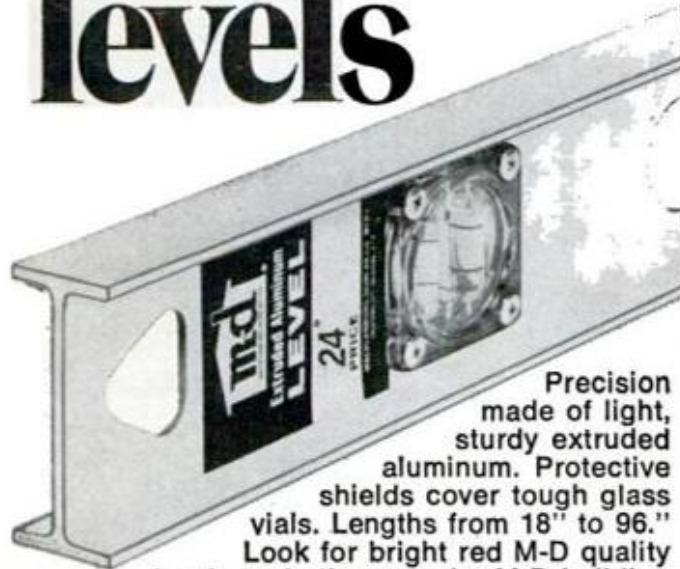
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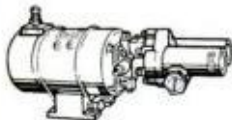
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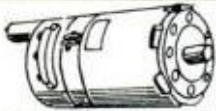


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(Continued on next page)



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(Continued from page 196)

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\$500 MORE Monthly. Raise Rabbits, Chinchilla, Other small animals for us. Equipment, Breeders, Instructions Supplied. Fox River Valley Research Farms, Dept. PMO-061, McHenry, Illinois 60050.

SAWDUST, TIN-CANS, NEWSPAPERS. Glass. Rags. Rubber. 324 Uses. Instructions \$3.00. Satisfaction guaranteed. Charles Company, 42-GWR, Norwood, Ohio 45212.

MAILORDER—New Concept! Amazing re-copy, resell information service!! Write: J&D, 1442PM Berkshire, Grosse Pointe, Michigan 48230.

OWNER-Manager Wanted, "Nationally advertised" business in Your area. Seven superior, "on-location" services . . . homes, offices, motels, shops, institutions. Successful worldwide. Gross \$15,000-\$30,000 yearly with First serviceman. Additional servicemen's machines furnished. Large profit Each serviceman. Little over \$1000 establishes urgently needed, growing, lifetime business. No shop, no experience needed. (Starting spare time, business profits increase job salary.) We train . . . help finance . . . guide . . . back you. Interesting, exciting, gratifying career. Inquire Today while territory open. We'll mail information. Duraclean, C1-166, Deerfield, Illinois.

PROFIT With Popular Mechanics' subscription plan. No investment, no experience needed. Earnings begin immediately when you obtain subscription for Popular Mechanics, Good Housekeeping and others. High commissions, bonus. No experience needed. Deal directly with the publisher. Write Popular Mechanics, Room 6B, 250 West 55th St., New York 19, N.Y.

MAILORDER Moneymaking Kit. Start home. Capital unnecessary. Free details, Pictures. Prudential, Box 327PM4, Boston 02199.

QUICK Dropship Mailorder Profits. 1971 Methods. Camar, 40-PM Driftway, Danbury, Connecticut 06810.

\$5.00 HOURLY Making Simple but Astounding Wood Novelties, Samples, Instructions on Two Sure-Fire Leaders—\$2.00. Kentucky Hills, Pine Knot, Kentucky 42635.

EARN BIG MONEY. Thrilling HOME mail-order business. Details \$1.5¢. Andrew Sales, Box 152A, Blue Island, Illinois 60406.

EARN \$60.00 Daily manufacturing Concrete Fence Posts. Practically no investment. Send stamped-addressed envelope. American, Excelsior Springs, Mo. 64024.

\$25.00 HOUR Repairing Vacuum cleaners! Baron, Box 863, Portales, New Mexico 88130.

FREE 1971 Full-Color Catalog waiting to bring you spare-time cash. Sell Advertising Book Matches. Every business a prospect . . . no investment. Complete selling instructions furnished to beginning sales people. Build steady, repeat business. Big cash commission. Dept. MX-671, Superior Match Company, 7530 South Greenwood, Chicago, Illinois 60619.

I MADE \$2,000.00 Monthly by mailorder—evenings only. You can too! Free proof! Kingman, Box 7227D, Erie, Pa. 16510.

FREE FRANCHISE JOURNAL Magazine with over 100 franchise opportunities in every issue. Franchise Journal, Dept. G, Box 1790, Newport Beach, Calif. 92663.

(Continued on next page)



## BUSINESS OPPORTUNITIES

(Continued from preceding page)

**MAKE A Years Income in 8 weeks** Camping. No selling. Capital or Land necessary. Write Edru's, Route 5, Box 5733, Gig Harbor, Washington 98335.

**250,000 NEW MOTHERS EVERY MONTH!** Bonanza for Bronzed Baby Shoes! \$50.00 a day profit. No investment, no inventory. Full or spare time. Exciting details Free. Senti-Metal, 1919 Memory Lane, Dept. 8F, Columbus, Ohio 43209.

**HOW To become financially independent.** New Book will amaze you. Write for free details. Dept. 1302C, Box 45, Commerce, Oklahoma 74339.

**SIMPLE** Easy way to acquire adequate income for life. Details free. Camellia Cottage, Box 223-A, Lake Charles, Louisiana 70601.

**MAILORDER!** How to prepare your own catalog for pennies! Free Catalog! Obie-MKZ, Brooklyn, New York 11219.

**MAILORDER—Profitable products, drop-shipped.** No merchandise investment. Everything supplied—catalogs, ads, mailing lists. Gif-Guide, 1137½ Crenshaw, Dept. 283, Los Angeles 90019.

**I BEAT The Horses!** Guaranteed you can! Strauss-CZ, Brooklyn, New York 11219.

**MAILORDER!** \$8,000.00 Year! Starting Capital \$6.00 at Home! . . . FREE Proof! Alvin Whitmire, Clinton, South Carolina 29325.

**STRIKE IT RICH AT HOME!** 622 Proven Plans. Details free. Opportunity, Box W-22, La Mesa, Calif. 92041.

**MAKE Up To 900% Profit** with your own Magnetic Sign Shop! Rapidly growing demand for 3-Dimensional Magnetic Signs on cars and trucks! Start in garage, workshop, or kitchen. Full or spare time. Write today for free details. Nationwide Plastics, Dept. 38, 4200 Panamint, Los Angeles, Calif. 90065.

**CLIP Newspaper items.** \$1.00-\$5.00 each. Details free. Walter, Box 1360-PA, Erie, Pa. 16512.

**PIANO Tuning Learned Quickly At Home!** Tremendous field! Musical knowledge unnecessary. GI approved. Information free. Empire School, Box 327, Miami, Florida 33145.

**\$400.00 MONTHLY** Raising giant fishworms. Soilless method. Charlie Morgan, Bushnell, Florida 33513.

**EARN Money** raising fishworms for us! Write: Oakhaven-38, Cedar Hill, Texas 75104.

**400,000 BARGAINS** Below wholesale! Many free. Liquidations . . . closeouts . . . job lots . . . single samples. Free details. Bargainhunters Opportunities, Box 730A, Holland, Michigan 49423.

**WANT To make big money at home?** \$10.00 profit in an hour possible with invisible mending. Make tears, holes disappear from clothing, fabrics. Steady year-round demand from cleaners, laundries, homes. Details free. Fabricon, 1585 Howard, Chicago 60626.

**ADVERTISING BUSINESS—YOU Own it.** \$350 First Week or Money Back. Electric Neon Action ad Clock, 229 W. Illinois, Chicago 60610.

**SELL Lifetime.** Metal, Social Security Plates. Big Profits! Sample and Sales Kit Free. Russell, Box 286-PM, Pulaski, Tennessee 38478.

**COPUBLISH "Mail Sale Advertiser,"** leading mailorder paper. Copy and details 25¢: U.S.A. only. Vanroy Shirk, Lebanon, Pa. 17042.

**\$200.00 DAILY** In your mailbox! Your opportunity to do what mailorder experts do. Free details. Associates, Box 136-A, Holland, Michigan 49423.

**DRAFTSMEN!** Operate own DRAFTING SERVICE! Full, Part Time: Experience unnecessary; Details: Roberts Drafting, 1741 Circle Road, Baltimore, Maryland 21204.

**RAISE Rabbits** for us on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio 43050.

**MAIL ORDER** Sell books. Fascinating, profitable, details. Jobre, Box 27, Great Neck, N.Y. 11023.

**WORLD'S Largest supply.** Merchandise 25% to 40% under wholesale. Bankrupts. Closeouts 10¢ on dollar. Imports. Hong-kong clothes. Automobile discounts. Free details. International Buyers, Box 16386 MM, Portland, Oregon 97233.

**HOLLYWOOD CEMENTCRAFT:** Offers Highly Profitable Home Business. Experience Unnecessary. Unlimited Unique Pottery Designs Easily Made Without Moulds. Bird-baths, Fountains, Wishing-Well's. Waterfalls, etc. Chemical Coloring Formulas. Marble-glazing. FREE Illustrated Brochure. CONCRETE FACTS, 602 Athens Street, Altadena, California 91001.

**SELL Books** by mail. 400% profit. Royal, Box 450-X, Cleveland, Ohio 44127.

**FREE Catalogs.** Repair air conditioning refrigeration. Tools, supplies, full instructions. Doolin, 2016 Canton, Dallas, Texas 75201.

**ADDRESSERS** And mailers needed. Send stamp for information. Lindbloom, 3636 West Peterson, Chicago 60645.

**SELL Beautifully colored Social Security Plates.** Big Profits! Free Sample. Paul Wright, 1075 Ringwood Avenue, Pompton Lakes, N.J. 07442.

**CLIP Short newspaper items.** To \$10.00 each. Details free. Foster, 272-M6, Brooklyn 11235.

**BUILD Custom Cases** at home for profit. Get orders by mail. We supply materials, instruction—everything. Free home business details. Custom Case Supply Co., 6961 CPF Hayvenhurst Avenue, Van Nuys, California 91406.

**TAKE Catalog orders.** We drop-ship 1001 best selling specialty products. Guaranteed lowest below wholesale prices. Fantastic spare-full time home business. Free book shows you how. SMC, 6963 SPF, Hayvenhurst Avenue, Van Nuys, California 91406.

**VENDING Machine** big catalog. Rake, 523 A Spring Garden, Philadelphia, Pa. 19123.

**I MADE \$40,000.00 Year** by Mailorder! Helped others make money! Start with \$10.00—Free Proof. Torrey, Box 318-Y, Ypsilanti, Michigan 48197.

**MAIL Baby Catalogs** Imprinted with your address to New Mothers for Big Profits! Details 25¢. Volz PM, Ypsilanti, Michigan 48197.

**MAIL Order Collection Agency** can make you \$1000.00 monthly. Free Details. Continental, Box 2023-A, Des Moines, Iowa 50310.

**MAKE Money** from old tires. Operators clearing \$800, weekly. Equipment costs \$1500. Get facts. S & S Patents, Inc., 3752 N. Damen, Chicago 60618.

**MAKE \$46** From square foot plywood: jigsaw or bandsaw necessary. Free details. Woodar, Bridgewater, Mass. 02324.

**BOOKKEEPERS** Earn \$500.00 week. Operate Bookkeeping Tax Service. Details free. Universal, Box 664-M, Springfield, Missouri 65801.

**\$60.00 DAY.** Manufacturing concrete Posts. Blocks. Mold Equipment Catalog \$1.00 refundable. Carlayne, Route One, Box 95, Rapid City, South Dakota 57701.

**FRANCHISING?** Amazing New Way to own your own business. Send for free copy. Modern Franchising Magazine—P, Des Plaines, Ill. 60016.

**CALIFORNIA MANUFACTURER NEEDS** Man to assemble our product and be local agent, experience unnecessary. May start while presently employed. Five-figure income for responsible applicant. S.K.R.M. Manufacturers, 2347 West 238 Street, Torrance, California 90501.

**1000% PROFIT** Bronzing Shoes. Free Literature—N.B.C., Box 11069-PM, Kansas City 64119.

**BOTTLES Are Valuable!** Free Information—Bottle Treasures, 7311 Van Nuys, Van Nuys, California 91405.

**MAILORDER Book Publisher** Wants Dealers. Jan Enterprises, 76P, Wild Rose, Wisconsin 54984.

**SUPERIOR Auction School.** Nation's top Auctioneers own and instruct. Box 1281, Decatur, Ill. 62525.

**\$200.00 SPARE Time** earnings with your Tablesaw. Write: Workshop Five, 3800 Harney, Vancouver, Washington 98660.

**\$25.00 HUNDRED Addressing.** Possible Year 'round. Complete instructions 25¢ for registration, postage. Cove, Box 1348-B, Clearwater, Florida 33517.

**VACUUM Plastic Molding & Liquid Plastic Casting—At Home!** Make Hundreds of full 3-D plastic products. Big profit in spare time. Facts. Nationwide Plastics, Dept. CY, 4140 Eagle Rock Blvd., L.A., California 90065.

**MAILORDER Records** help get increased business! Complete 32 Page Record Book shows your inquiries, orders, advertising, expense, etc. Only \$1.00. C. A. Martin, Popular Mechanics, Dept. PM-356, 224 West 57 Street, New York, New York 10019.

**\$600.00 PROFIT!** Mailing 100 Catalogs. Sample, complete instructions, only \$1.00. Digest, Box 839-PMS, Long Beach, New York 11561.

**HOMEWORKERS—Mailing** wanted. Free Details. Allen, 2418A Lori, Santa Ana, California 92706.

**CASH In!! Big Profits!!** Mail own imprinted Baby Catalogs to New Mothers. Always booming market. Sample catalog, full particulars 25¢. BRD Company, Box 6502 A3, Long Beach, California 90815.

**FAST CASH SELLING ADDRESS LABELS** WITH Customers Photo. 500 Only \$2.95 Postpaid. Also Business Cards, Postcards, Note Pads. All With Photos. Free Details. Foto Products, Box 163, Brooklyn, New York 11209.

**I'LL HELP YOU MAKE TO \$5,000.00 YEARLY** Sparetime with "proven", home mail order business! Particulars free! UNICUS, Box 223-PM, Brooklyn 11204.

**MAKE Magnetic Signs.** Big Profits. Details, Universal, Lenora, Kansas 67645.

**MAIL ORDER RATE & DATA GUIDE.** A comprehensive time saver. Clearly lists ad costs, deadlines, and circulation facts of more than 900 proven, response getting publications. Send \$1.00 to: M.O.R.&D.G., 123 West 28th St., New York 10001.

**WE NEED GINSENG GROWERS!** \$3,000-\$30,000 Annually! We Buy Your Crop. Send \$2.00 For Seed Sample And Information. Glass! Ginseng Exchange, Box 336, Rochdale Station, Jamaica, New York 11434.

**\$10.00 DAILY** Mailing Circulars. Information, send stamped, addressed envelope. Tayco, Box 8010-PM, Stockton, California 95204.

**FREE REPORT!!** 609 Unusually successful businesses, indoor-outdoor, evenings!! Write: Associated, Box 238-B61, Lafayette, California 94549.

**1,000,001 PROFITABLE** Mailorder opportunities. Free list! Specialty, Box 45PM, Lakeside, Iowa 50588.

**VACUUM Sign making machine.** \$65.00. Homecraft, 2350 W47, Denver, Colorado 80211.

**MAILORDER Offers** Galore. your name listed nationwide 25¢. Receive opportunities, catalogs etc. Doorbar-PM, 3364 Northwest 35 Street, Ft. Lauderdale, Florida 33309.

**WOODWORK Profits!!!!** Tablesaw, jigsaw, etc. . . . Guaranteed manual, \$3.00 . . . Woodcraft, 956 Springdale, Atlanta, Georgia 30306.

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## BUSINESS OPPORTUNITIES

(Continued from preceding page)

**\$1,000.00 PROFIT** From 1,000 Mailings! George, Box 2188-PM, Cypress, California 90630.

**SELL AMERICA'S "Fastest Moving" Line** Antiqued "Parchment" Reproductions!! Documents, Posters, Money!! Garen's, Xenia, Ohio 45385.

**BECOME PROFESSIONAL DRIVING INSTRUCTOR.** Earn \$10.00 hour, \$400.00 week. Part time—full time business yourself. Write: Howard David, 1818 Everts, Philadelphia, Penna. 19152.

**MAKE Magnetic car signs.** Write Route 1, Box PM-49A, Bardstow, Ky. 40004.

**YOUR OWN BUSINESS.** Report shows how. Details absolutely free. Halmar, Box 161-PM, Mesquite, Texas 75149.

**ESTABLISH Profitable Mailorder Business.** Everything furnished. Vikari's, Box 1312PM, Salt Lake City, Utah 84110.

**\$1000 DAY—150% Profit.** Selling by mail. No investment in inventory. Part time-full time. Unlimited potential. Complete details \$1.00. National, Box 72121, Chicago, Illinois 60680.

**BIG Profits, Sell Lifetime Social Security Plates, Sample, Goldthwaite, 220-PM Lawrenceburg, Tennessee 38464.**

**HOMEWORKERS** Wanted mailing circulars. Adams Services Inc., 4431 Oleander, Bellaire, Texas 77401.

**\$1000 WEEKLY in YOUR Mailbox!!** Do What Mailorder Experts Do. Amazing Trade Secrets. Free Details. International, Box 418-PM, Riverdale, New York 10471.

**MAKE RUBBER STAMPS!** Easy profitable hobby or full time business, low starting cost package, free details. Barco Type, 237 S. Evergreen, Bensenville, Ill. 60106.

**SECURITY Of Office Cleaning Service.** No experience necessary. We will show you step-by-step how. Business of your own, no franchise. Information: Hart Enterprise, Dept. A, Box 5245, Mission Hills, Calif. 91340.

**CASH In Big!** Mail your own imprinted Baby Catalogs. Always Profitable. Sample catalog, complete profit details, 25¢. Drane, Box 152PM6, Paoli, Penna. 19301.

**\$70 to \$200 WEEKLY—Home, Spare Time Simplified Mail Bookkeeping.** Immediate Income. Easy. Auditax, Box 34741A, Los Angeles, Calif. 90034.

**\$600.00 WEEKLY** Mailing illustrated letters featuring real merchandise. Everything furnished, write: Sichert, Box 44, Miami, Fla. 33161.

**ADVERTISING Speciality dealerships.** 25% commissions. Start part time. Details 10¢. Profit Tools, Box 46, Oshkosh, Wisconsin 54901.

**SENSATIONAL** Net profit \$20,000 to \$50,000 in advertising business. Full or part time. Send \$1.95 or details. G.E.M. Enterprises, Box 28, Boone, Iowa 50036.

**LEARN HOW** Ken Brown Made \$4000. Profit Part Time (1970) Rebuilding Kirby Sweepers. Free Details. Dolken Co., Box 912 Conway, Arkansas 72032.

**\$600—UP Monthly.** People needed to raise laboratory animals for us. Huge market. We supply equipment, breeders and instructions. Details 25¢. National Research Farms, PNMB-6, Box 309, Milwaukee, Wisc. 53201.

**TEACHER** buys true Home Business experiences. Henry Farr, Garnerville, N.Y. 10923.

**\$48,000.00 YEARLY** No Investment. Free Proof & Details. Idnach, Box 10067-D, San Antonio, Texas 78210.

**I GROSSED \$112,000.00** Year By Mail-order. Helped: "Men"—"Women". Make Money—Started With \$40.00—Free—Proof. Williams, POB 44646E, Los Angeles 90044.

**\$250.00 ASSURED, SIMPLIFIED MAIL-ORDER,** Mailing 1000 envelopes. Immediate income. Proof. Torrey, 629-BD, Franklin, Clearwater, Florida 33517.

**SELL** Printing by mail. Marketing-C56, Box 332, Bergenfield, New Jersey 07621.

**MAILORDER!** Make money mailing Baby Catalogs to new mothers. Free Details. Lubars, 210-PM Fifth Avenue, New York, N.Y. 10010.

**FRUSTRATED?** Unique Report highlights selected opportunities. Information rushed. Sherwood Publications, Box 517A, Brundidge, Alabama 36010.

**VENDING Machines.** No selling. Routes earn amazing profits. Big catalogue Free. Parkway Corporation, 715PBM Ensor Street, Baltimore, Maryland 21202.

**FREE!** "The Future Millionaire." 24 page publication containing 137 little known secrets on how to make money. Cossman, 13451-K Ventura, Sherman Oaks, Calif. 91403.

**\$1,000.00 WEEK EASY YOUR Own** advertising SPECIALTY BUSINESS. Buy direct! HAVE Hundreds of SALESMEN Working for you! Brooks, P.O. Box 126B, Brooklyn 11229.

**HOW TO GET RICH!!** Free "Success-method Details"! Associates, Box 212-B6, Stoneham, Massachusetts 02180.

**WORLD'S Biggest Wholesale Bargains!** 165 free catalogs. Mailorder dropshippers. Your business imprint. Closeouts. Automobiles. Free "Digest." Vault International, Box 7284M, Lexington, Kentucky 40502.

**FOR Your Drive In Fast Food Business** Write: Box 85, Novelty, Ohio 44072.

**HOMEWORKERS!** \$100.00 Weekly addressing for firms. Begin immediately. Details—send stamped, addressed envelope. Hamilton, 272-TM6, Brooklyn 11235.

**\$2000.00 MONTHLY.** Easily Done. Ropchan, Box 5341-P, Sherman Oaks, California 91413.

**START Your Own Travel Business!** Free Details! Moore Tours, Box 35665-M6, Dallas, Texas 75235.

**FORTUNE** Developing cheap recreational land. Fantastic future! Free Details. Elesco-PM6, 8539 Rosalie, Brentwood, Missouri 63144.

**THINK PROFITS!!** Audio Transducer converts walls/ceilings into stereo speaker! Particulars 10¢. Tradewind, Box 8866-6PM, Stockton, California 95204.

**SERVICE** Needed, your area competition rare. TS, Box 564, Buena Park, Calif. 90620.

**BARGAIN ENCYCLOPEDIA.** 50,000 Low cost items. \$2.00 Postpaid. Winchester Enterprises, 2807PM Hargrave Street, Philadelphia 19136.

**FREE BOOK** "999 Successful, Little-known Businesses." Work Home! Plymouth, 47L, Brooklyn, New York 11218.

**HUGE Profits!** Mail order importing. Free information. ITIS, PM-6, Box 454, Hollywood, Calif. 90028.

**MAIL Galore!** Money-making offers! Your name on national mailing lists, 25¢. Three months, 50¢. Sullins, Box 206-M, Forsyth, Georgia 31029.

**NET Over \$400.** 1st week or money back. Your own display neon clock ad business. PAM Services, 416 Chez Patee, Hazelwood, Missouri 63042.

**Molding Rubber Liquid Plastic.** Hobby Supplies. Details 10¢. Chaney's, 5415-L San Jose Blvd., Jacksonville, Fla. 32207.

**MAKE MONEY AT HOME METALLIZING.** Baby Shoes, Plastics, Novelties, Gold, Silver, Bronze. Free Facts. Kiktavi, Box 2127-A, Inglewood, Calif. 90305.

**EARN Money** as mailorder dealer. Free catalog, discount sheet, on Americana Posters, Books. Antiqued reproduction 1840 \$1,000 bill for 25¢. Authentic Distributors, Box 414P, Saint James, New York 11780.

## MONEYMAKING OPPORTUNITIES

**CONSTANT Repeat Business.** Mosquito-Pruf formula \$2.00 Reliable 24 hour protection. Franklin Assoc., Box 3401, Fort Worth, Texas 76105.

**JOBBER** Wanted. Wood Novelties. Samples of Two Sure-Fire Money-makers—\$2.00. Kentucky Hills Industries, Pine Knot, Kentucky 42635.

**FREE.** Learn dozens of easy ways to make money full or part time. Write for Free 5 month subscription. Salesman's Opportunity Magazine, Dept 17-FM, 1460 Hancock Center, Chicago 60611.

**\$500 MORE Monthly.** Raise Rabbits, Chinchilla, Other small animals for us. Equipment, Breeders, Instructions Supplied. Fox River Valley Research Farms, Dept. PMM-061, McHenry, Illinois 60050.

**MAKE \$1.00 Per Sale** selling engraved metal Social Security plates. Free Sales Kit. Engravplates, Box 10460-7301A, Jacksonville, Florida 32207.

**HIGHER INCOME,** Security and power. 256 page book "Thinking Big" reveals secrets that make men rich." Send \$2.00 for #WB-123. K. Scott, Drawer 147, Dept. PM571, Monroe, N.C. 28110.

**TURN FREE Bottles into \$\$\$.** Fantastic sideline. Details \$1.00, (refundable). Electric Bottle Kutter, Box 119, Reseda, Cal. 91335.

**TOYS, Novelties, Gags, Closeouts, Imports, Bargains.** Hundreds of Money-Making items. Free Wholesale List. House Of Jacks, 509 Sixth Avenue, Paragould, Arkansas 72450.

**COMPUTER** Secrets! high earnings, how to start with no experience. Stamped envelope. Compuplace, 429-Pem Windsor Way NE, Renton, Washington 98055.

**MAKE \$5,000 Yearly,** sparetime, raising mink, chinchilla, nutria, etc. Free booklet reveals proven plan. Write: Furs, Dept. E, Bewdley, Ont., Canada.

**SELL Sensational Car Thief Signal.** Samples for trial. Northwest Electric, Ave. 727, Mitchell, S.Dak. 57301.

**BLACK WIDOW Spider Ranchers** needed! Guaranteed Market! Complete details \$1.00 (refundable). NBWC, Box 476 RPM-6, Rialto, California 92376.

**SWEEPSTAKES** Contests. How to Win. Write for free particulars. General Contests, 1609-18 East Fifth, Duluth, Minnesota 55812.

**\$25,000 POSSIBLE!** Be your own boss! Amazing book tells how to start a business. Guaranteed. Send \$2.00 now. Dept. 1302B, Box 45, Commerce, Oklahoma 74339.

**CASH Prizes** offered each month in a new contest magazine. For free copy write Multigames, Dept. P, Box 307, Ypsilanti, Michigan 48197.

**UP TO \$40 a day** tying fishing flies at home. Easy to learn. Write: FLYCO, P.O. Box 481M, Albany, Oregon 97321.

**INSTANT Money!** Plastics are the wave of the future. Big profits now! At home! Spare time. Materials costing 11¢ bring back \$2.58 profits immediately! Free information. Rush name on postcard to: Warner, Room LC-2-AF, 1512 Jarvis, Chicago, Illinois 60626.

**SELL Lifetime Metal Social Security Plates.** Sample and Sales Kit FREE. Lady McGuire, Box 3333PM, Anderson, S.C. 29621.

**CIGARETTES** 12¢ A pack. Improved roller makes 20 filtertip, plain, king or regular for 12¢. Facts free. Green River Tobacco, Box 953, Owensboro, Kentucky 42301.

**EARN \$240.00 A month** at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1532 Howard, Chicago 60626.

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## MONEYMAKING OPPORTUNITIES

(Continued from preceding page)

**MAKE** Statuettes, novelties, imitation marble. Sell to stores or start gift shop. Free details. Marbleizing, 41 Waverton, St. Louis, Mo. 63124.

**HOW To Make money** writing short paragraphs. Information free. Barrett, Dept. C-27-S1, 6216 N. Clark, Chicago 60626.

**FREE** Copy of world's leading contest magazine! Write Prizewinner, Box 11569, St. Petersburg, Fla. 33733.

**SCIENTIFIC** Messages: Big Earnings uncrowded profession. Learn spare time at home. Diploma awarded. Free catalog. Write Anderson School, Dept. G-1C, Princeton, Illinois 61356.

**HOW TO GET RICH!!** Free "Money-making Brochure"! Success International, Box 2447-C, Livonia, Mich. 48151.

**\$200.00 FROM** Sheet 1/4" plywood (scrap). Details 25¢. Novelties, 610 So. 24th, Elwood, Indiana 46036.

**VENDING** Machines. No selling. Routes earn amazing profits. Big catalogue free. Parkway Corporation, 715PM Ensor Street, Baltimore, Maryland 21202.

**LEARN** The secrets of repairing junk batteries "Fabulous Profits" at home. Battery Shop, Route 1-188 D, Blythe, Calif. 92225.

**MAKE \$12.00** Dozen Lacing Billfolds. Details Free! (Stamp Appreciated.) Redikut's 40, Richland Center, Wisconsin.

**PENNY STOCKS** Have big profit potential. Free information. Penny Stock Reporter, 608 N. Guadalupe, PM, Redondo Beach, California 90277.

**CLIP** Newspaper Items \$1.00-\$5.00 each. Free Details. Dall, Box 147-PM, Hanson, Mass. 02341.

**"CAMERA** Profits." Five Easy Plans; Plus 250 Markets For Your Photographs. \$1.00. Satisfaction Guaranteed! Camfield's-A, Box 1746, Indianapolis, Indiana 46206.

**MONEY MAKERS:** Groups, Individuals. Write: Boyer, Dept. PM, Yatesboro, Pennsylvania 16263.

**MAKE MONEY** Addressing, mailing, etc. Golden opportunity! Send stamp for money-making folder. Hicks Service, 37-215, Los Angeles 90037.

**HOMEWORKERS** Wanted to stuff envelopes. Send self-addressed stamped envelope. Tayco, Box 8010-PM, Stockton, Calif. 95204.

**MONEY** Can be made at home. Easy pleasant work. No experience needed. Mastercraft, 962 Eva Ave., Akron, Ohio 44306.

**CREATE MONEY-Making** invention ideas by the hundreds! Guaranteed new method! Sell your ideas! Free details. KM Publications, Box 3727-P, Anaheim, California 92803.

**MONEY** in your spare time. As a dealer for our complete line of stationary products, in your home. High profit potential. Enquiry loses nothing and can bring needed money. Thetford Press, 520 5th Ave., New York, New York 10036.

**MAKE \$20,000 Year!** with Mailorder Insurance promotions! Booming Market Wholesaling! Ready mailing copy! Promotions, R7, Rome, Georgia 30161.

**UNUSUAL** Lucrative home business. Small basement production requires no investment, skill. Amazing literature free. Barta-RKM, Box 15083, San Francisco, California 94115.

**CLIP** Newspaper Articles. \$1.00-\$5.00 each. Details free. Sullins, Box 206-MP, Forsyth, Georgia. 31029.

**"HOMEWORKERS.** Make \$50. mailing 150 envelopes. Rush 25¢ postage. Gemco, B-21244A, Indianapolis, 46221.

**GUARANTEED** Money Maker—Computerized horoscopes—Free details—Heller International, Box 260, Times Square, N.Y.C. 10035.

**BIG Profits!** Toys, Novelties. Information Free! M. Comby, Conover, North Carolina 28613.

**SELL** Your Photos. Booklet tells how, where. Color Slide Markets. Only \$1.00. G. G. Enterprises, 301 Meridian, Alhambra, Calif. 91801.

**ROULETTE.** Mathematically derived betting technique. \$1.00 Doug Larson, 34350 Dequindre A116, Sterling Heights, Michigan 48077.

**LEARN** Profitable POODLE DOG Grooming. Details. Sierra Enterprises, P.O. Box 131A, Sebastopol, California 95472.

**SAMPLE** "Sweepstakes Bulletin" 25¢ Benro Enterprises, Box 6656PM, Philadelphia, Pennsylvania 19149.

**\$600—UP** Monthly. People needed to raise laboratory animals for us. Huge market. We supply equipment, breeders and instructions. Details 25¢. National Research Farms, PNM-6, Box 309, Milwaukee, Wisc. 53201.

**STEADY INCOME** FOR YOU From a new Baby Catalog to New Mothers. Personalized with your imprint! Wiseowl 86 Atlantic Stamford, Connecticut 06901.

**EARN** Money Addressing!! Details, Mail Stamped Self-Addressed Envelope. Write! Happy, Box 1161CC, Battle Creek, Michigan 49016.

**EARN UP TO \$700 A MONTH** AS A TAX PREPARER. Learn tax preparation at home in your spare time from H&R Block, America's largest tax service. No previous experience needed. An ideal course for men and women of any age. Job opportunities for qualified graduates. No salesmen will call. Send for free information today. Write: H&R Block Tax Training Institute, Dept. 301-C6, 4410 Main, Kansas City, Mo. 64111.

**ATTRACT** Riches. Use Metaphysics. Free details. Marvco, Box 429-P, Rockdale, Texas 76567.

**GET** World's Biggest Wholesale Import Catalog. Write: World, Medina, Washington 98039.

**MAILORDER** Secrets exposed. Details. Stapleford, Box 1093, Bristol, Connecticut 06010.

**FREE** Sample Kit. Sell Lifetime Beautiful Social Security Cards. Bilbrey Sales, Route #1, Crossville, Tennessee 38555.

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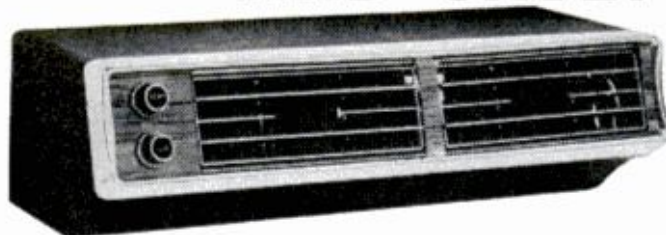
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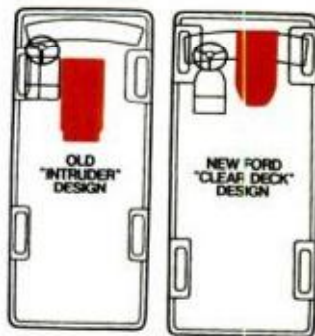
## Ford Econoline



Sales leader for  
10 straight years.

### Engine clear forward

The engine is moved forward in Ford's clear-deck van—all the way out of the cargo area. Clear floor space behind driver's seat measures over 8½ ft. in Econoline Van . . . over 10 ft. in the Supervan.



### Easy, out-front servicing.

Simply raise the convenient outside hood and your routine service points are right at hand: radiator, oil level, battery, windshield washer reservoir, voltage regulator, wiper motor, brake master cylinder. Better ideas make servicing fast, easy.

### Strong, smooth-riding Twin-I-Beam

The independent front suspension that has revolutionized truck riding qualities. Two forged steel I-beam axles give it strength . . . big coil springs give it a smoother ride.



### Biggest payload of all

Husky construction and high capacity axles allow you to carry a heavier load than any other van. Maximum payload of 4320 lbs. is largest in industry.

| Model | Max. Payload | Max. GVW  |
|-------|--------------|-----------|
| E-300 | 4320 lbs.    | 8300 lbs. |
| E-200 | 1800 lbs.    | 5400 lbs. |
| E-100 | 1120 lbs.    | 4500 lbs. |

### Shorter outside, easier to park.

Overall length of Econoline Vans is significantly shorter than other makes. This means easier parking and better maneuverability in city delivery operations—time saved on every trip.



### Wider at top for built-ins

Body sides are more vertical, wider apart at top than other vans. So built-in units fit better and leave more aisle. Modular units, designed to fit and work together allow you to custom design almost any interior you need. Job packages, such as insulated florist's van, are also available.



### Driver's "walk-thru" to rear

Econoline's forward engine position clears the deck for the driver, too. He can easily step from his seat into the rear load area and exit through side or rear doors.

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**FORD**



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