

FORD and CHEVY MINI-CARS: DDT for the Beetle?

# POPULAR MECHANICS

JULY 1970  
50 CENTS

How to  
Match  
A Trailer  
To Your  
Car

Dune Buggy?  
Sports Car?  
**BOTH!**

How to  
Put a Roof  
On Your Patio

Protect  
Your Boat  
From Lightning

**New This Month: Pollution Fighters' Newsletter**

**Detroit's New Road-Racing Free-for-All** By DAN GURNEY

**TO BUILD OR MAKE** | 'Heirloom' Wall Barometer - Boat Electronics Kit Projects - Early American Bedroom Set - Miniature 'Steam' Engine



# MILLER MAKES IT RIGHT!

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robust,  
deep-down good!  
So make your move to Miller.

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**Caution:**

**The Spoiler®  
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**Gillette**

**10 BLADE**

This One



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**This Atlas fiberglass belted tire can't stop gobbling up miles—thousands more miles than even our best selling tire.**

The new Atlas Plycron 2 plus 2\* fiberglass belted tire was subjected to one of the industry's toughest road testing programs. Results: The Atlas Plycron 2 plus 2 delivered an average of 35%† more miles than even the famous Atlas Plycron—traditionally, the tire that has outperformed 4 ply major brand replacement tires in mileage tests.

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**ATLAS**  
**PLYCRON 2 PLUS 2**

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†Average of all tests run simultaneously by independent test fleet during last 12 months.



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## AUTOMOBILES AND DRIVING

- 22 Detroit Listening Post
- 28 Drivin' With Dan
- 64 Automobile Clinic
- 71 How to Match a Trailer to Your Car
- 74 Trans-Am: The Secret Word Is Competition!
- 78 Dune Buggy or Sports Car? It's Both!
- 84 Detroit's Minis: How Much Muscle?
- 88 The Face in the Mustang Window
- 106 PM Owners Report: Mercury Cougar
- 116 PM Owners Report: Dodge Polara
- 120 What You Need in a Roadside Emergency Kit
- 136 Saturday Mechanic: How to Fix Your Automatic Transmission

## HOME AND YARD

- 68 Homeowners' Clinic
- 140 Exciting New Products
- 156 Solving Home Problems
- 158 Airconditioners for Problem Windows
- 162 Put Your Patio Under Cover
- 166 Add a Cold-Water Bubbler to Your Kitchen
- 168 New Building Products You Should Know About
- 172 A 'Well-Oiled' Home Runs Smoother
- 175 Make This Decorative Yard Ornament

## PHOTOGRAPHY

- 132 How to Choose the Right Film for the Best Picture

## SPACE, AVIATION, MILITARY

- 104 How the Jets Kicked the Smoking Habit

## REGULAR FEATURES

- 6 Letters
- 32 Pollution Fighters' Newsletter

## BOATING, OUTDOOR RECREATION

- 12 On-the-Go Camping
- 71 How to Match a Trailer to Your Car
- 78 Dune Buggy or Sports Car? It's Both!
- 100 Could Lightning Strike Your Boat?
- 112 Fish Without a Friend
- 124 Why Is Your Motor Missing?
- 126 Boating Instruments You Can Build From Kits
- 130 Blinking Beacon to Guide You Home
- 143 Build a Turtle Boat for the Fun of It!

## SHOP AND CRAFTS

- 142 Hints From Readers
- 146 Build This Early American Bedroom Set (Part 1)
- 150 Make This Handsome Banjo Barometer
- 153 Hints From Readers
- 154 Mini 'Steam' Engine Made With Simple Hand Tools
- 160 Hints From Readers
- 161 New Tools You Should Know About
- 165 Hints From Readers
- 176 Hints From Readers
- 177 'Toothbrushes' Keep Cutters Clean
- 178 12 Great Lathe Tricks
- 182 Hints From Readers

## ELECTRONICS, RADIO AND TV

- 38 Wrist Computer Tells Time Without Hands
- 123 Mini-Speaker From a Spray-Can Cap
- 126 Boating Instruments You Can Build From Kits
- 130 Blinking Beacon to Guide You Home

## SCIENCE AND INVENTIONS

- 20 Science Worldwide
- 82 Just Patented: PM's Pick of the New Inventions
- 96 The Lab That Hops on Happenings

Cover Photo by Joe Munroe

*Dune Buggy or Sports Car? It's Both! (Change it from one to the other in 30 seconds flat!)*

## NEXT MONTH IN POPULAR MECHANICS

**How the 1971 Cars Will Really Be Better.** Exclusive report on '71 engineering.  
**What to Do If Your Car Goes into Water.** You *can* escape from a submerged car.  
**A Pocket Polaroid?** Preview of a shutterless, shirt-pocket camera.  
**Owners Report on the Ford Thunderbird.** They tell likes and dislikes after driving it.



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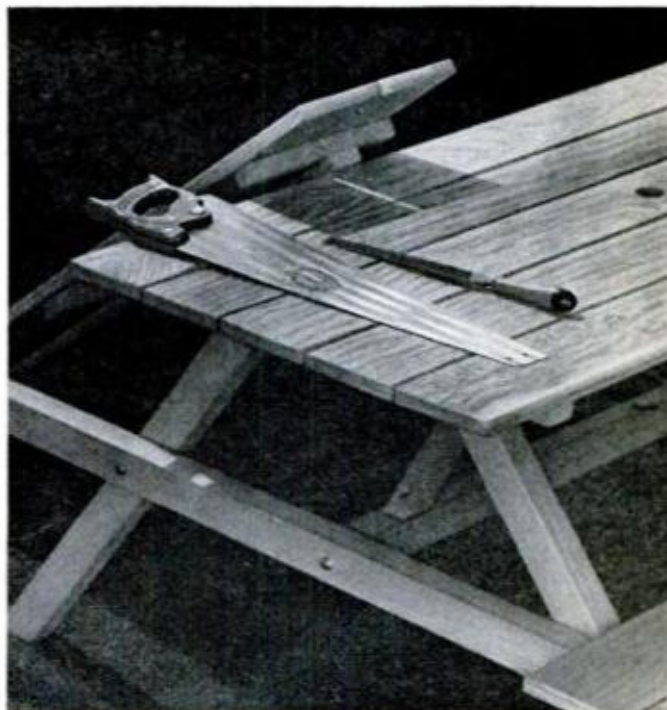
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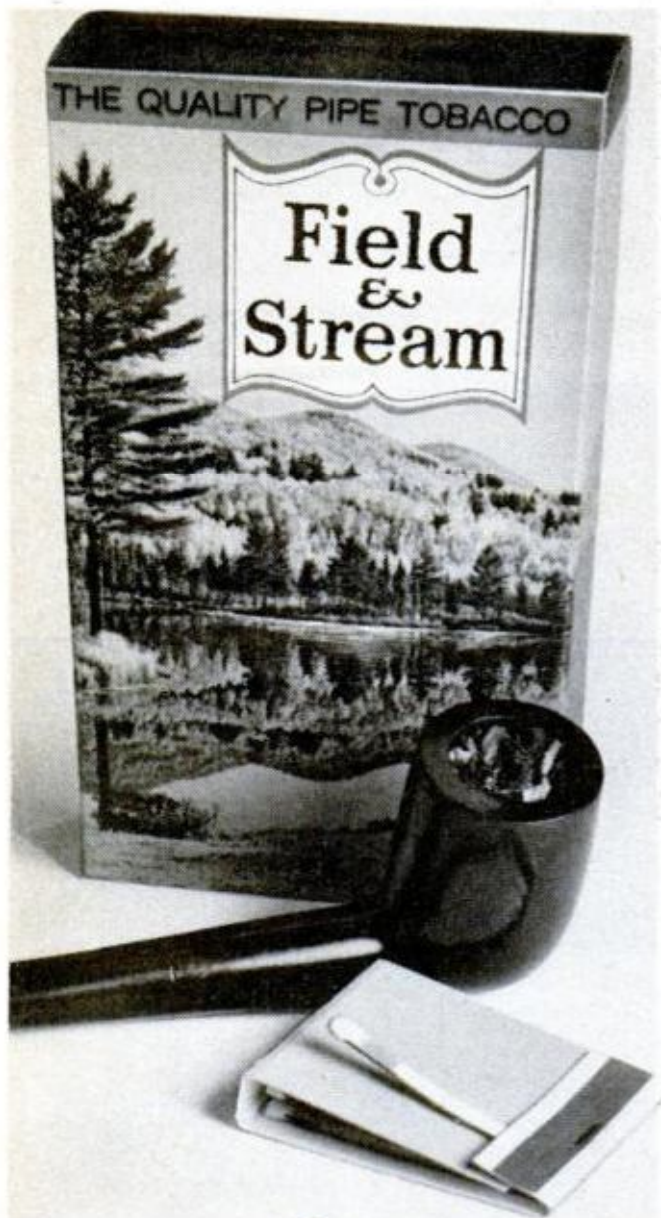


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Field & Stream  
doesn't remind you  
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## LETTERS TO THE EDITOR

### High marks for Mark III

A number of months ago your former automotive editor wrote an article on the new Lincoln Continental Mark III (*It's Superbird!* page 20, March '68 PM), saying that only older men would buy it and it was worthless in panic stops; he added many other downgrading remarks.

I am 55 years old and have driven my Mark over 30,000 miles on all types of roads, including the Canadian highways. I have found it to be the greatest car I ever owned, with absolutely no problems of any kind.



Enclosed are pictures of my 16-year-old son hauling saw logs out of the Mississippi River with the car.  
ROCHESTER, MINN. H. C. HOAGLAN

*Log hauling was not part of our test procedure, but maybe it should have been. At any rate, it's good to hear from a thoroughly happy car owner.*

### Gremlin got him

I would like to express my appreciation for the article on AMC's new Gremlin (*The Gremlins Will Get You If You Don't Watch Out!* page 106, April PM). It helped immensely in the decision to buy one.

FORT MITCHELL, ALA. DON R. DOUGLAS

### Revolting situation; no volts

It occurred to me that the inventor overlooked one important item in the *World's Most Thieftproof Car Lock* (page 38, April [\(Please turn to page 8\)](#))



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"I now earn three and a half times my former pay."—Robert Fisher, Holbrook, Arizona.



"Salary is now well over double the amount when I enrolled."—M. R. Picht, Madison, Wis.



"My salary has quadrupled since starting the course."—George R. Kelly, W. Bridgewater, Mass.



"My salary now is over two and one half times more."—James M. Umphlett, Cody, Wyo.

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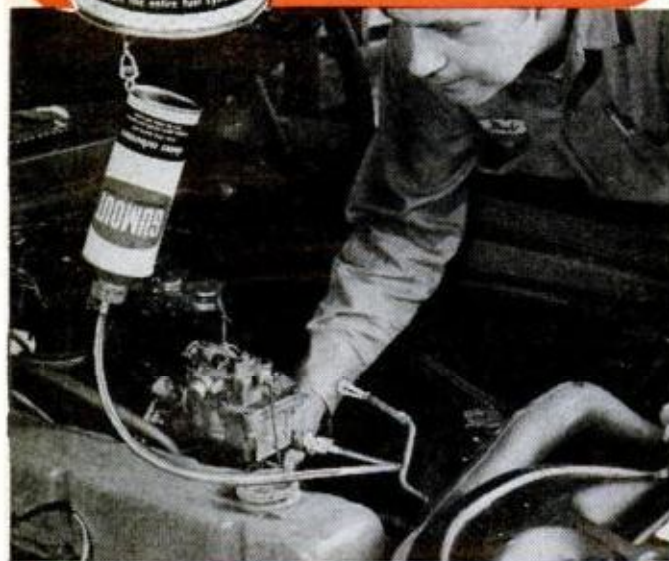
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■ Either way, use GUMOUT regularly to keep your car off the sick list.

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Pennsylvania Refining Company  
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Also available in Canada.

## LETTERS

(Continued from page 6)

PM). Suppose his battery goes dead! He has no power to operate the hood latch, so he can't gain access to the dead battery. What a revolting situation! (Sure is theft-proof, though.)

NEW YORK VERNON D. CHRISTIANSEN

*The system draws such a small amount of current that, in most cases, there would be sufficient residual charge in a "dead" battery to permit releasing the hood latch even if the car won't start. In an extreme emergency, the system can be actuated by plugging an external source of 12-v. d.c. into the cigaret-lighter socket.*

### Biggest walking dragline

I believe that your News Brief, *Largest Walking Dragline* (page 143, May PM) was in error. There is a much larger walking dragline here in the United States.

It is "Big Muskie" in the Muskingum coal fields of Ohio. It has a 220-cu.-yd. bucket and can handle a load of 325 tons.

It is the 4250W Model Bucyrus-Erie walking dragline. It would make a very interesting story.

MARION, IOWA DARRELL W. POTTS (AGE 7)

The machine you showed working in the coal fields of Australia is able to lift 195 tons (130 cu. yd.) and travel at 800 feet per hour. "Big Muskie," the largest dragline, is owned by the American Electric Power Co. system and is located in the coal fields near Cumberland, Ohio. It can walk 897 feet per hour.

CANTON, OHIO DENNIS G. SANDERS

### Too close a shave

In your April article, *How to Keep Your Tape Recorder Humming Happily* (page 160), I'd like to correct the caption on page 162 under the sequence of photos entitled *How to Use a Splicing Block*. Splicing tape for use with 1/4-inch tape is 7/32-inch wide (not 3/16). This was established around 1948.

It might interest you to know that I designed, in 1965, a prepared splice called Editab, millions of which have been used in tape splicing.

MOUNT VERNON, N.Y. JOEL TALL, PRES.  
JOEL TALL, INC.

### Wobbler producer

Many thanks for the fine article, *How to Make a Wobbler Minnow Lure* (page 152, April PM). I am on my second dozen and making a jointed version also.

MILWAUKEE, WIS. THOMAS E. CROWLEY

POPULAR MECHANICS





## Fight sticky situations with tools coated with no-stick TEFLON-S.\*

Tool blades coated with industrial strength TEFLON-S are battling blades. TEFLON-S is no-stick. Grass, dirt, sap slide right off. It's also abrasion resistant, and self-lubricating.

With TEFLON-S, tools cut grass, bushes, trees, hedges—cleaner, smoother, easier, faster. Seasons of use can't dull the liveliness of the no-stick surface. Rust can't get a grip on TEFLON-S because moisture runs off.

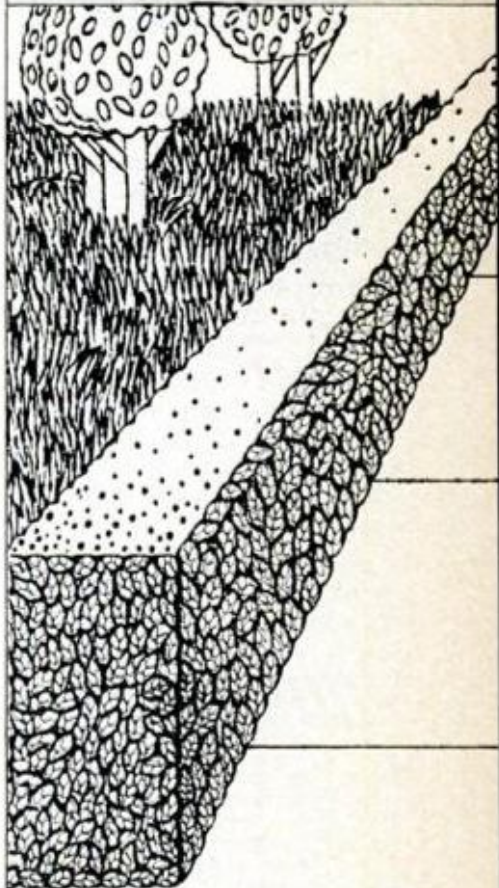
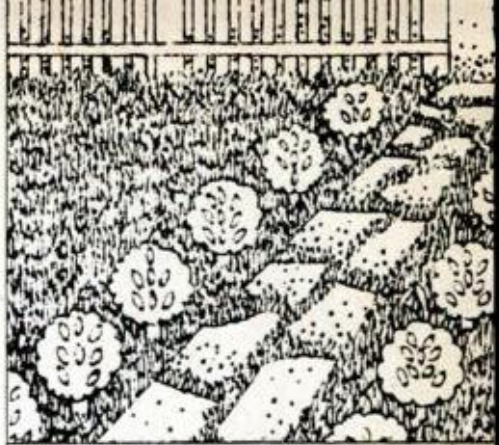
You get out of a lot of the work of gardening. Get more done in less time. And forget about cleanup. There are new tools coated with industrial strength TEFLON-S: an electric hedge trimmer, for example. A wide range of pruners, hedge clippers and other labor-saving tools.

Look for the TEFLON-S quality seal at your store. It's on the best-performing tools you can buy—tools that fight for you.

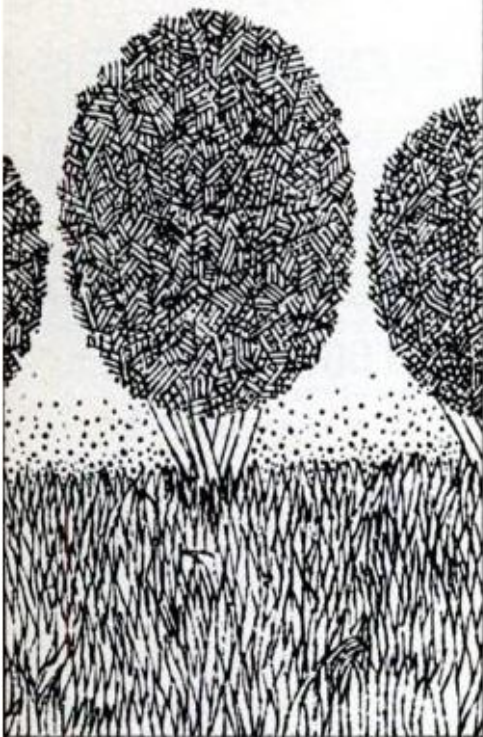
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Floor shift \_\_\_\_\_ Steering column shift \_\_\_\_\_

Smog pump \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_

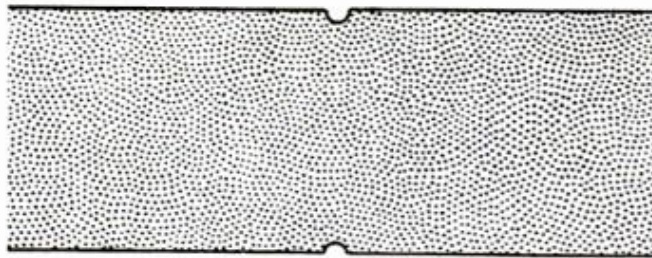
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POPULAR MECHANICS



# State troopers do not endorse products.

## But this one thinks Lifesaver Radials are too good not to be talked about.

This trooper is masked, and his uniform disguised, because neither he nor his state can lend their names to any commercial product.

This man's life depends upon his tires. He puts over 50,000 high-speed miles a year on them.

He's concerned with highway safety. And because he knows your life depends upon your tires, he agreed to give his expert testimony.

"I was off to the side when this guy raced past me. I floored it to catch up. And there I was going into a double curve — we call it Deadman's Curve — at 115 miles an hour. But I never swerved out of my lane. It was like riding a rail.

"After that, I'm getting a set of these radials for my own car. I have good reasons . . . my wife and kids."

You can hear the same kind of stories from troopers across the country riding on B.F. Goodrich Radials. The same tires you can buy. Of course,



you'll seldom need the maximum performance troopers need, even for short periods of time. But it's nice to know these tires can deliver it.

We call the newest BFG Radials *Lifesavers*. With good reason. Lifesavers corner better. Take curves better. Stop quicker. They handle better at high speed than any fiberglass-belted tire . . . even our own.

They run cooler because they're made with Dynacor® Rayon Cord. They're the safest tires we've ever made.

The radial construction of Lifesavers is unique. The sidewalls flex, keeping all the tread on the road all the time. And the Dynacor Rayon belt stabilizes the tread for extra strength and mileage, 33% stronger than fiberglass tires, 40,000 miles or more on a set.

BFG *Lifesaver* Radials. They're like no tires you've ever ridden on. They're the tires your life should be riding on.



### The New BFG Lifesaver Radials. Your life should be riding on them.



ON-THE-GO

# CAMPING

BY WADE MITCHELL

**YEAR OF THE TRADE-IN!** Surveys have indicated that travel trailer owners trade models about every three years. With perhaps a million older trailers plying the highways, an unprecedented number of used models should be available this season. That would be good news to buyers. Used trailer coaches have been scarce, have commanded high prices even in poor condition. Reason: With proper care a travel trailer suffers almost no real deterioration. Tire wear, perhaps, is the only visible indicator of mileage.

**ORDER IHC VEHICLES WITH FACTORY-INSTALLED HITCHES!** Yes, you can now order your International Travelall Model 1000, 1100, and 1200 series with a load-equalizing trailer hitch installed right at the factory. This arrangement was made possible through Reese Hitch Co. Only the tow-bar assembly is factory-installed, but that saves considerable delay, particularly in areas where hitch shops are hard to find. By the time this sees print, Buick dealers will also probably enjoy this factory-option: tow-bar assemblies factory-installed.

**CAR-TRAILER HOOKUP FROM ANY ANGLE.** New equalizing hitch for trailer towing eliminates spring bars, provides sway control, an "automatic disconnect" feature and a swivel-type connector that allows hookup with trailer parked at almost any angle. Basically a cam-action design, the new hitches are called the Robot Queen and the Robot King. Priced from \$144.50, the new models will handle tongue loads from 500 to 850 pounds or trailers up to 30 feet long. The manufacturer is Valley-Tow-Rite, Inc., 27 E. Vine St., Lodi, Calif. 95241.

**VANDALISM ON THE INCREASE IN PARKS.** Park rangers report that roughly \$300,000 in damage is caused by vandals in California forests alone. They have progressed from picnic-table theft to the defacing of scenic and historical markers, the destruction of fire-lookout towers and the removal or damaging of trail signs. Archeological discoveries are being defaced with paint-splattered messages spread across the rock cliffs. In Utah, one band of vandals tried to dynamite loose a big Indian petroglyph to take home. They got a mountain of crushed rocks and left a destroyed historical monument!

**EQUALIZER HITCH PLATFORM FOR 1970 CHEVROLETS.** In what we believe to be the first factory recognition of special hitch problems, Chevrolet now offers a new load-equalizing hitch platform as a dealer-installed accessory. Prepunched holes in the frame make attachment of the hitch easier. Two holes are then drilled in the rear bumper and eight bolts complete the mounting. No welding is required, and the platform assembly can be removed quickly. Chevrolet officials claim that this new platform "will eliminate the inconvenience and delay of having a specialty shop install reinforcing members to accommodate an equalizing hitch."

**HAVE YOU EVER SEEN AN \$18,000 TORONADO?** Well, now you can. Ramona Motor Coach Co. is marketing a new motor home built on a basic Toronado chassis which is reinforced, lengthened and improved for carrying an 8500-pound coach. Wearing big 10 x 16.5 tires on a wheelbase stretched to 173 inches, the Tra Voy motor home (as it's called) has some impressive advantages over conventional designs. Front-drive eliminates the floor hump, vibrations and noise common to floor-tunnels. An unusually low silhouette is then possible which lowers center of gravity. The big 375-hp Toronado V8 makes the Tra Voy perhaps the world's most powerful motor home. We predict a host of imitators within the next 12 months. (Ramona Motor Coach Co., 158 West 5th, San Jacinto, Calif.)

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JOE WEIDER  
PRESENTS

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**BEFORE**—James Parker at a thin 158 pounds. **AFTER** 14 days on the Crash-Weight Plan, Jim weighed 175 pounds.

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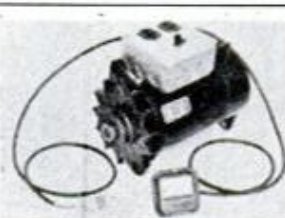
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  - Other (tell us)



**Papaya beats surgery when it comes to relieving low-back pain**, according to Dr. Max Negri, a California orthopedic surgeon. Injections of an enzyme contained in papaya succeeded 88 percent of the time in alleviating pain caused by ruptured spinal discs, reports Dr. Negri, whereas surgery has a success rate of only 70 percent. Papaya, a tropical fruit, is used commercially as the basis for a meat tenderizer.

**Old steel is better than new steel** when it's used to build a body counter for detecting radiation in humans. That's why 60 tons of steel that once was part of HMS Cressey, a British heavy cruiser, now make up the bulk of a body counter in a West German clinic. Six-to-eight-inch plating from the Cressey, torpedoed and sunk during World War I, was salvaged in 1961. This steel is ideal for radiation-detection hardware because it was made before the atomic era and therefore is not contaminated by atomic fallout, as is all steel manufactured after 1945, when the two A-bombs were dropped on Japan.

**An aircraft canopy that breaks into tiny, blunt-edged particles** upon impact, permitting the pilot of a disabled plane to eject right through it, has been developed by Corning Glass Works, Corning, N.Y. Made of a special glass, the canopy is also designed to withstand the mechanical loads experienced in flight. Ejecting through glass is faster than ejecting after a plastic canopy has been blown off, the way the current system works. It's also safer in the long run. When a pilot has to eject through a malfunctioning plastic canopy, there's a high probability of severe, even fatal, injuries.

**Brain surgery on mosquitoes isn't easy.** But it's being done by the University of Georgia's Dr. Arden O. Lea, an entomologist probing the egg-laying mechanisms of salt-marsh mosquitoes. The removal of brain tissue and glands at the base of the neck leaves a still frisky but sterile bug. The subjects are anesthetized and imbedded in modeling clay. Then they're submerged in a salt solution to keep brain tissue from drying out. Dr. Lea works under a microscope with scalpel and forceps made from jeweler's tools. The bug is able to fly and bite—strictly a female capability—within minutes after the operation. But its egg-laying days are over.

**The world's most powerful continuous-beam laser**—capable of producing 30 kilowatts of power in a narrow beam and 60 in a broader beam—has been developed by Avco Research Laboratory, Everett, Mass. Reported to be three times as powerful as any continuous-beam laser in operation, the Avco "gun," theoretically, produces enough energy to propel a sports car. It's thought that the new laser may have military applications.

**An oil rig may begin drilling in the Antarctic in 1971**—but the drillers won't be looking for oil. They'll be seeking knowledge of the history of ice layers, geologic sediments and deep ocean marine life. Plans for drilling through the Ross Ice Shelf were developed by the National Academy of Sciences. "Three holes are being considered," says Dr. S. Z. El-Sayed, a Texas A&M scientist involved in the project. "One to be used by biologists requires extreme care to prevent contamination of the water under the shelf. Glaciologists would obtain ice cores from another hole, which would penetrate only partially into the shelf." The third drilling will pass through to the bottom, providing samples of sediment.

**Sixty-six persons lost their lives in 602 tornadoes** that struck the United States in 1969, according to the Commerce Department's Environmental Services Administration. A state-by-state tornado count shows that only Alaska, Connecticut, Delaware, Hawaii, Nevada, New Jersey, Oregon and Rhode Island escaped these deadly storms last year. The 66-tornado-related deaths are well below the national yearly average of 119. ★★★



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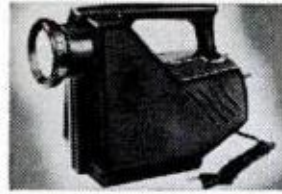
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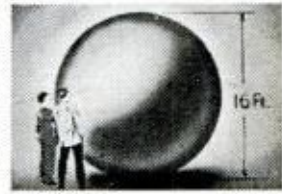
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# LISTENING POST

BY ROBERT LUND

**DETROIT MAY BE IN LINE** for neatest-medical-feat-of-the-year award for conducting a post-mortem before the patient is born. Two months before the new cars come out, there are already misgivings about some '71 products. They're too big and bulky. The way small cars—compacts, intermediates and imports—are selling, the handwriting's on the wall. Little is in, oversize and opulent are out. It's too late to put the new heavyweights on a diet, but they'll be scaled down for '72. Obviously, no one's going to say this flat-out—The first law of survival in the wheel trade is that you sell the now merchandise and worry about the next throw of the dice when the time comes.

This brings up a point industry critics fail to reckon with when blasting Detroit for not making changes as fast as the advisors-without-portfolio think it should. It takes two to three years for the automakers to turn around. "Bunk," the critics respond, "do it now." But there's no way to do this considering the lead time required between engineering an idea and putting it on the road. If there were, Detroit wouldn't be stewing now about cars that have yet to be made.

**AMERICAN MOTORS** beat the Big Guys again in announcing it has a car that'll operate on both natural gas and conventional gasoline. AMC has been showing a Gremlin with the either-or fuel system. But GM has one, too—Pontiac, we suspect. The cars are experimental and there are no plans to put them in production soon.

**IF ANTI-POLLUTION GROUPS** want an early reading on how serious and sincere Americans are about cleaning up the environment, Detroit will be in a position to report in a few months—long before measurable reaction will be available from other sources. The auto companies are offering emission control kits for pre-1966 cars. (Beginning with the '66s exhaust control systems were made standard on all cars.) The kits go at cost—about \$10, plus installation—but producers recommend a tune-up at installation time, so they're talking more like \$50 than \$10. "There's no inducement for car owners to have the kits installed," GM president Ed Cole points out, "other than an individual desire to help clean up the air."

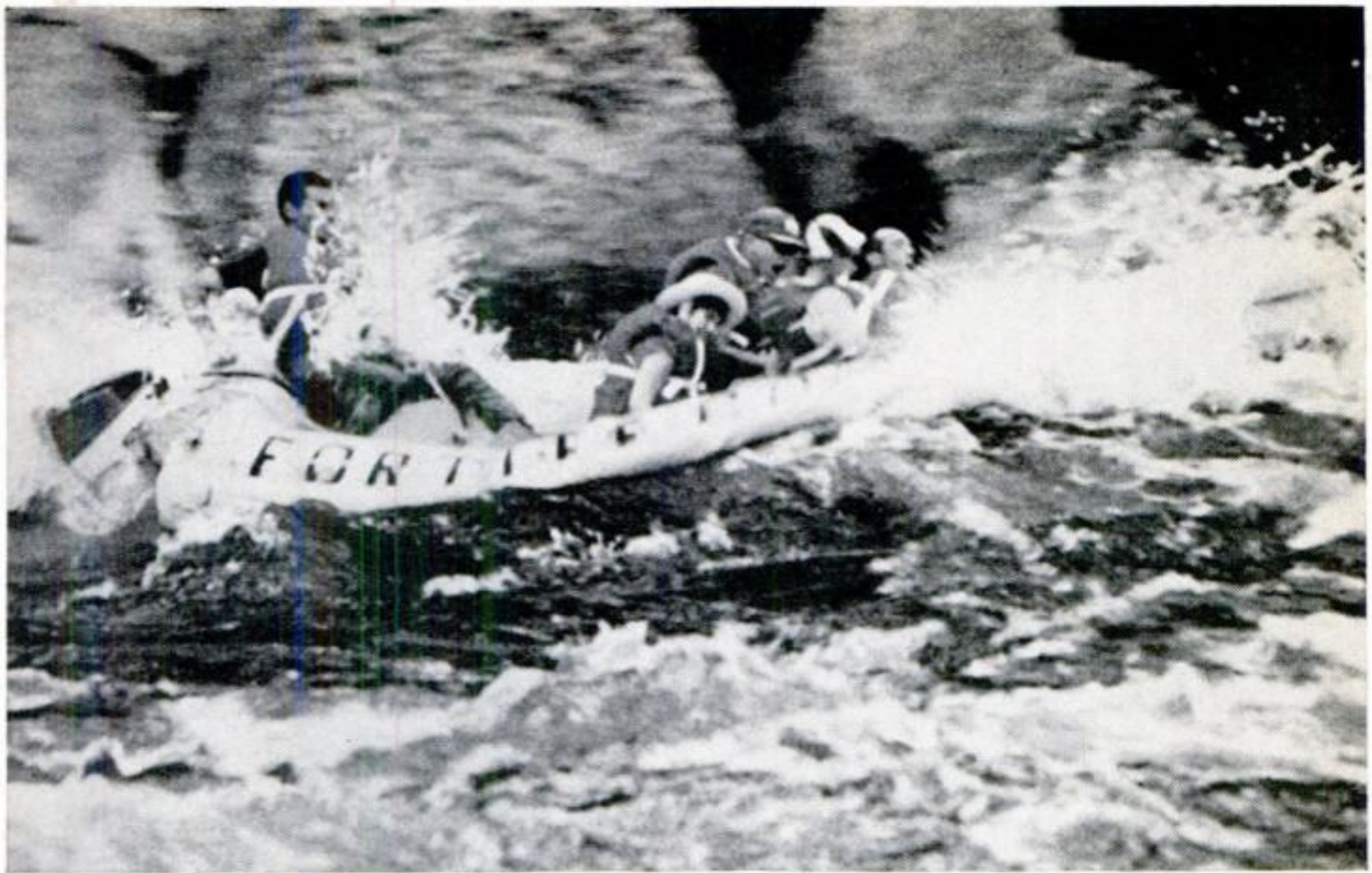
Upwards of 60,000,000 cars without emission control equipment are on the road. How about it, would you invest \$50 of your own money as a contribution to cleaner air? Whatever the extent of industry-generated pollution, part of the overall problem is still millions of people adding their "litter" bit of pollution. How about making installation tax deductible as an incentive?

**THERE'S A GREAT OLD STAPLE** on the late, late show in which the magnificent W. C. Fields decides to rid the world of "road hogs," as W. C. called 'em. Fields comes into a fortune—the title of the picture is *If I Had a Million*—buys a fleet of junkers and journeys forth in search of dumb drivers. When he finds one, he aims his car at the scoundrel and pursues him until he wrecks both vehicles, his own and his foe's. The only damage W.C. suffers through countless crack-ups is to his stovepipe hat.

That's a long build-up to get to the point, but a few years from now you may be able to emulate Fields and emerge as unscathed as he did. The auto companies already have bumpers capable of withstanding 5 mph collisions without damaging the vehicle or injuring passengers. They're being tested and will be along next year, the '72 cars. Air bags will also come next year or the year after, when they'll be required as standard equipment. Finally there's an improved version of the bucket seat in development for '73 cars that will encase your shoulders. It's a high-backed seat—the add-on headrest will be dropped—that curves in slightly at the elbow, leaving your arms free, and wraps around your shoulders. The wraparound section will provide a cushion for the body in side-of-the-car accidents, over and above the protection afforded by impact

*(Please turn to page 24)*





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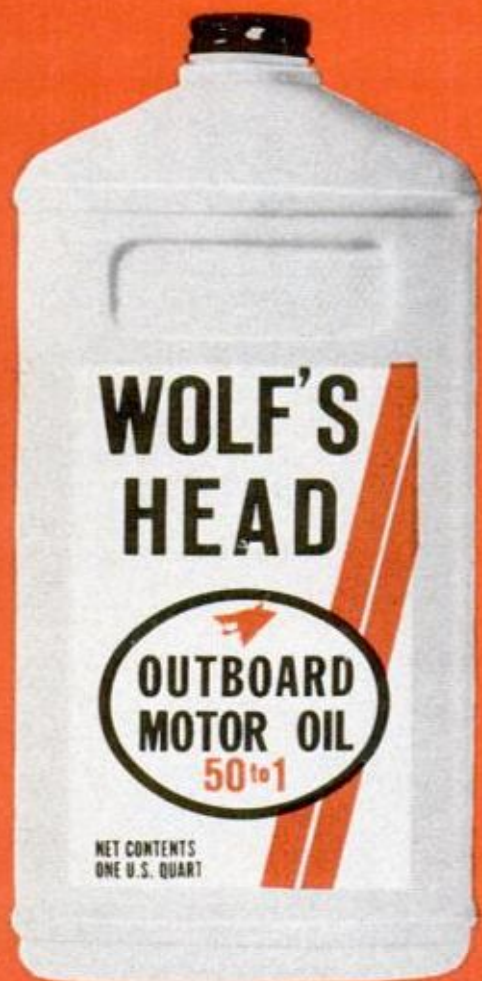
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## DETROIT LISTENING POST

*(Continued from page 22)*

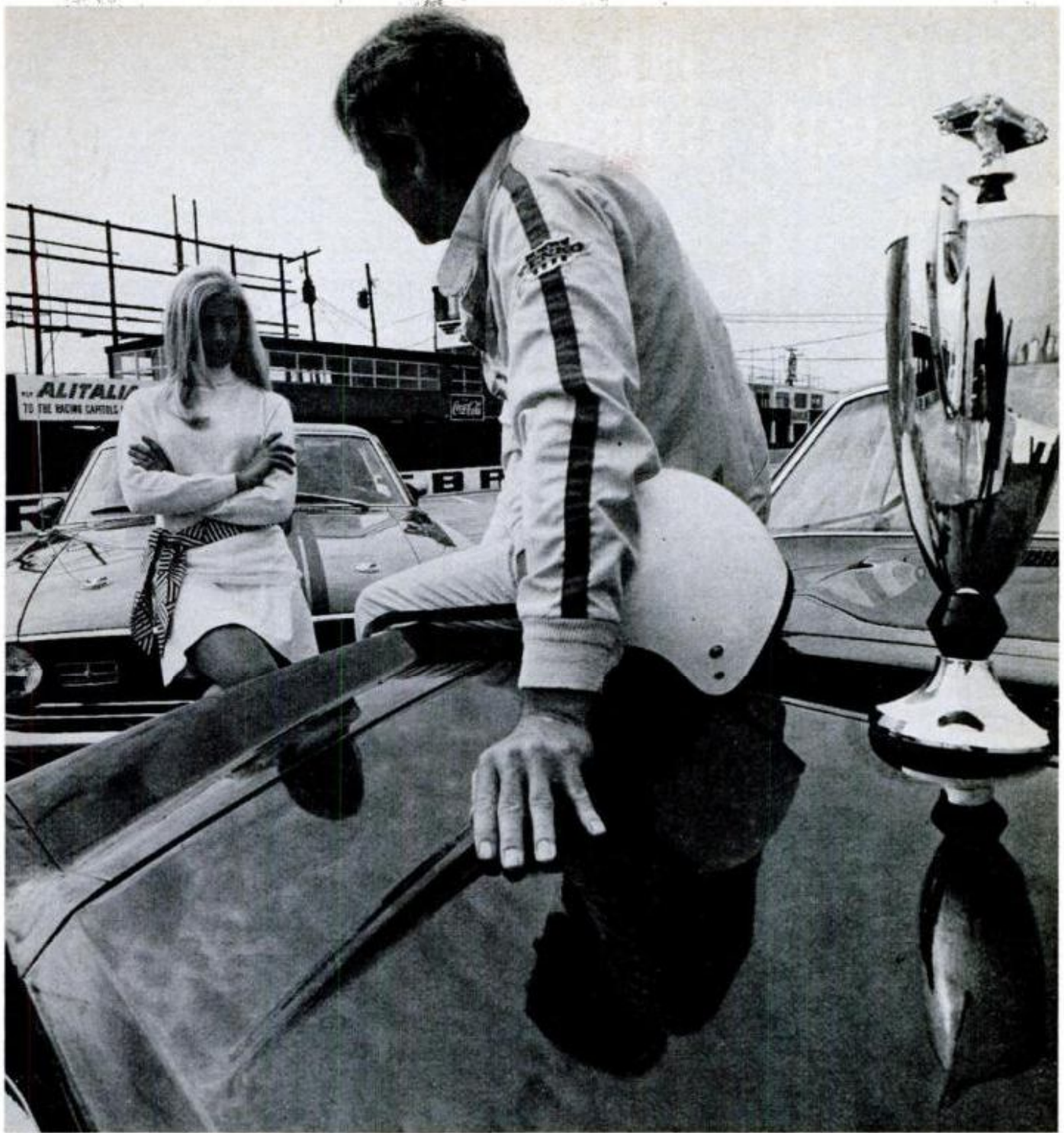
beams built into car doors. You might even get a break on car insurance.

**IF YOU'RE ONE** of those fans who take in the auto shows to check out the idea cars, you won't find many one-of-a-kind machines at the '71 shows. There'll be some dolled-up production cars, but not what you'd call harbingers of cars to come. This is normally the peak time of year for working up eye-catchers for shows. But a check around town reveals nothing in the works for '71. GM is mocking up a couple of futuristic recreational vehicles, but no passenger cars. This has been a lean year in sales for the auto companies. So to avoid making things any tougher for the standard merchandise, you won't see any showpieces until sales improve.

**WHY IS AN AUTOMOBILE** shaped like an automobile? Why not like a banjo or a supermarket cart or a wheelbarrow? Why are cars oblong? Why not triangular, diamond-shaped or oval? If you're interested in car design and the evolution of wheeled vehicles, you'll enjoy a booklet Ford has prepared on the subject from an Egyptian chariot dated 1300 B.C. to a futuristic job labeled 198X A.D. It's breezy reading and includes several pages of how-to-do-it information on making model cars. Ford published the piece for teachers, but at LP's request it has set a few aside for *PM* readers (limit of one to a customer). Write Public Relations Dept., Design Center, Ford Motor Co., Box 2110, Dearborn, Mich. 48123 and ask for a copy of "Automotive Design."

**CHEVROLET DEALERS** are due to get their first shipments of GM's small car, Vega 2300 (alias XP-887), the end of July. If you can't wait for the official unveiling Sept. 10, you might try scouting a Chevy dealer. Dealers have been cautioned to keep the car under wraps, so you'll have to do some sleuthing. But there are only so many places to conceal a car and what with bulging inventories of '70 models crowding storage lots, dealers will be hard-pressed to find sites for stashing away the samples. The first copy or two usually goes under a tarp in the service department, the bump/paint shop or the back of the used-car lot. A favorite device of big operators who carry a large inventory of new cars is to plant the hold-for-release merchandise dead center in the storage lot and surround it with current model cars. But watch those "No Trespassing" signs. ★ ★ ★





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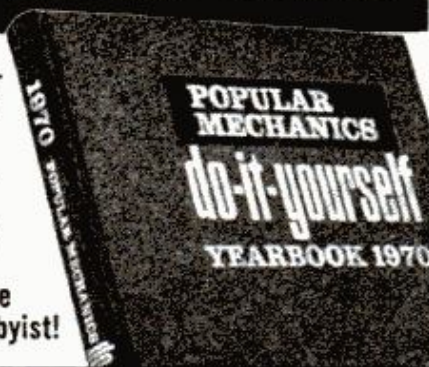
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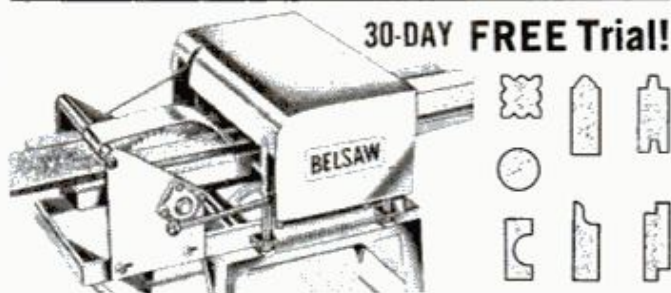
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The Tracker. A tire that runs with the tread firm against the road. Two strong fiberglass belts circle the tire, like hoops, under the tread. To hold the tread grooves open as the tire rolls to fight squirm.

That's why The Tracker tire wears more evenly, and delivers 40% or more mileage than our best non-belted tires for light trucks. Better wet traction, braking and cornering ability, too.

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Nyloglas tire: Four nylon cord body plies and two fiberglass belts that extend around the tire to help hold the tread firm and fight squirm.

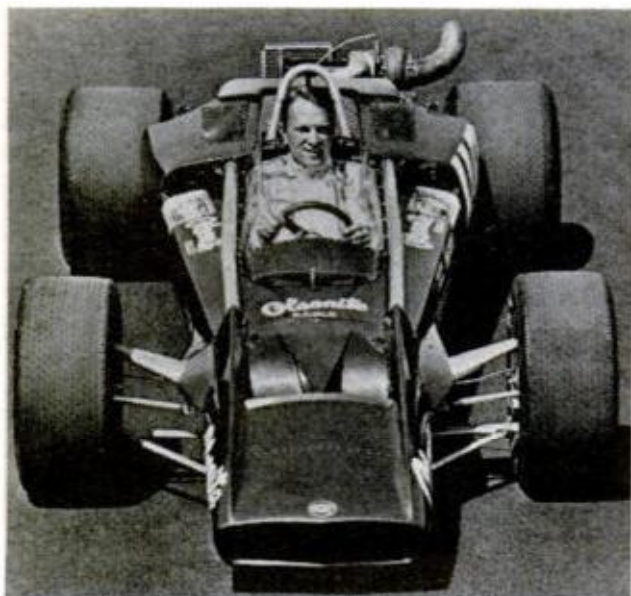


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# Drivin' with Dan

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**ALL-NEW OLSONITE EAGLE** with Dan at the wheel was pictured during practice for the 1970 Indy 500. Car is powered by four-cylinder, turbocharged Offy

**Q.** *I am studying auto mechanics in vocational school. Are there ever any opportunities open to be a member of a major-league, auto-racing pit crew?*—Wayne Geisel, California, Ky.

**A.** Yes, there are often opportunities. You must find the opening yourself though. Then work hard, learn as much as possible. It is not an easy life, nor is it all glamor and excitement, although there is plenty. You need that burning desire to win.

**Q.** *What happened to your rear brakes in the 1970 Riverside 500 stock-car race, and why did running with front brakes only slow you down so much?*—Richard Legner, Princeton, Ill.

**A.** We broke a brake fitting which was installed in error instead of a standard part. The Petty crew managed to replace it and, although we didn't have time to bleed the brakes, they were working satisfactorily after that. (I was about seven laps behind by then.) I was wrestling with another problem

(handling); that is why I was slow. Even though the front brakes do most of the stopping, the rear brakes help a lot, maybe 20 to 30 percent of the total.

**Q.** *If a boy is interested in cars, do you think his parents should encourage him? I have wanted a car to work on but my parents won't consent. It would be in the woods away from everyone. Please help me convince them.*—Mark Kolesar, Ironwood, Mich.

**A.** My advice is, don't give up! Your parents are doing what they feel will be best for you, but they can be swayed if you are determined enough. Use your ingenuity. Find out why they won't consent. Henry Ford or Walter P. Chrysler may have had the same problem, for all we know!

**Q.** *Now that you are on our side, why don't you build a Plymouth for the Sebring 12-hour race instead of drive a foreign car like the Matra I saw you in?*—Frank Colvin, Castlehayne, N. C.

**A.** Chrysler (Plymouth) is directly linked with Matra through its ownership of Simca in France. Matra and Simca are working together. We are hard at work on our Barracuda Trans-Am racing right now (see page 74), so we don't have time for anything else at the moment.

**Q.** *I understand Chevrolet is replacing the 302 and 427 engines which cleaned up in Trans-Am, Can-Am and drag racing last year with 350 and 454 engines. Do you think the larger motors will perform as well?*—Jimmy Nussbaum, Bethesda, Md.

**A.** The 350 will not be allowed in Trans-Am where the displacement limit is 305. The 454 should be good. Chevrolet hasn't had much opposition in Can-Am, so I'd say they will

*(Please turn to page 30)*





# What you should know about spark plugs.

by Paul Hornung and Roger Maris.

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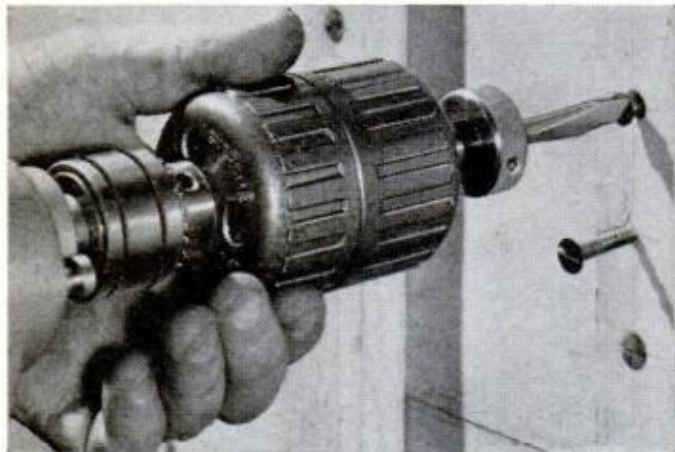
Or ask Paul and Roger. They know. They won.





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## DRIVIN' WITH DAN

*(Continued from page 28)*

**win again. In drag racing, the Hemi Chrysler is still plenty tough.**

**Q.** *Did the two-way radio you mentioned in your April column do away with blackboard signals from the pits? Do you think this will happen?—Michael Cook, Calumet City, Ill.*

**A.** No, it didn't; yes, it could. It is all very tricky and also expensive, and it does have certain advantages, but the simple old pit board is very adequate in most cases.

**Q.** *What kind of performer do you think the new Barracuda with a 426-hemi, four-speed engine will be, and how about the hemi-engined Superbird which Plymouth will be selling to the public?—S.J.R. MacMillan, Toronto.*

**A.** They should be excellent. The Superbird is reported exceptionally steady at freeway speeds due to its aerodynamic body shape.

**Q.** *In 1962 you tried to qualify a rear-engine turbine at Indy. Could you explain how that car differed from the later turbines?—Scott Bargaenquast, Brookfield, Wis.*

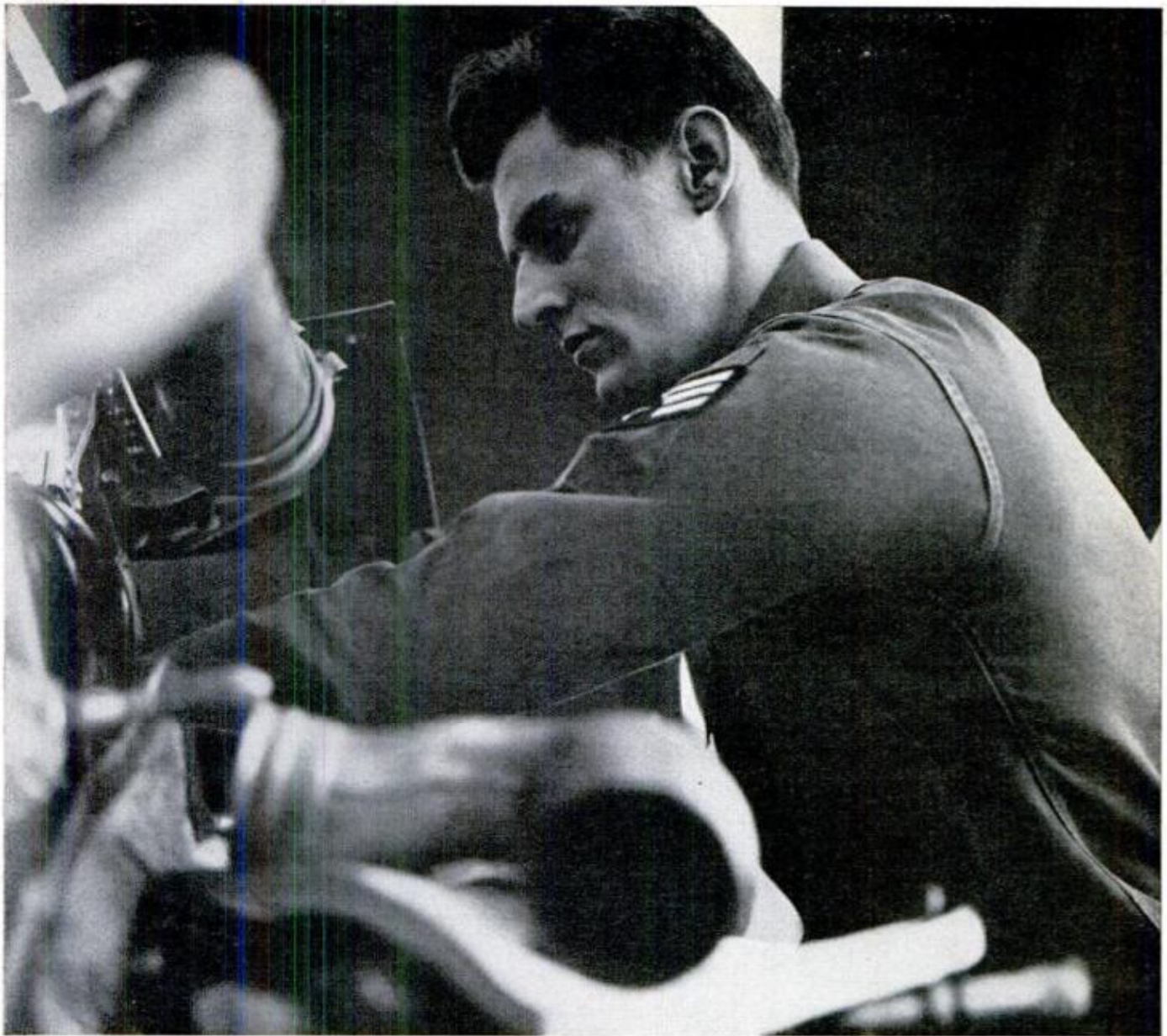
**A.** The chassis was a stretched Lotus copy which was owned by Jack Zink of Tulsa, Okla., and built by his chief mechanic, Dennie Moore. The powerplant was a Boeing design rated at about 350 hp. The biggest problem was in handling although the horsepower was also inadequate.

**Q.** *I am interested in engines and auto racing. Can you recommend some good books on these subjects?—Jerry Schuriterman, St. Henry, Ohio.*

**A.** I have never run across any "super books" that adequately cover the subjects you mention, so I find that I read about everything I can get my hands on, including most American weekly and monthly publications, plus some from England, France, Germany and Japan. Hard-cover books are great for fundamentals, but the latest tricks become obsolete quite quickly. ★★★

*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 64).*





# What did you do exciting this weekend?

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We may drag through the week, but we look forward to the weekend. But they're not always that much fun. Sometimes, in fact, weekends are a drag. Grass cutting. Sunday drives. Repair the plumbing.

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UNITED STATES AIR FORCE



HOBOKEN, N.J.—A Stevens Institute of Technology doctoral candidate, Steven Cerkanowicz, recently demonstrated the rapid ignition of a mixture of fuel and air by a beam of ultraviolet light. Utilization of this clean-burning technique could replace the conventional sparkplug, even be used for further burning of exhaust in a photocatalytic reactor muffler.

BOSTON, MASS.—This state's model program for safe pesticide disposal has set up 18 collection centers for DDT and other nonbiodegradable substances. A superhot incinerator will destroy the chemicals which cannot be disposed of by conventional burning, dumping or pouring down the drain. The Audubon Society has an additional dozen collection centers.

CAMBRIDGE, MASS.—The 1970 Clean Air Race, organized by Massachusetts Institute of Technology and California Institute of Technology, is scheduled for Aug. 24. The race, similar to an earlier contest (Across the USA With MIT's Electric Car, page 52J, Nov. '68 PM), focuses public attention on the low-pollution potentials of unconventional propulsion systems for automobiles by encouraging inventiveness among college engineering students. Some 40 vehicles, including electrics, gasoline-electric hybrids, steam cars, gas turbines and gas-fueled internal-combustion designs, should be running. General Motors Corp. recently posted awards to go to the schools of successful qualifiers.

ANN ARBOR, MICH.—Students in the Mechanical Engineering Dept. and student members of the Society of Automotive Engineers at the University of Michigan conducted a free tune-up clinic as part of their Environmental Action (ENACT) program. The minimum-emission tune-ups cut carbon monoxide and unburned hydrocarbons by half, on the average, at idle.

GARDEN CITY, N.Y.—"The technology and hardware for fighting all types of pollution is, of course, essential," observed Robert Rosenfeld, assistant professor of mathematics at Nassau Community College, on Earth Day 1970. "But attitude and example in our personal lives are of primary importance. It's not only a matter of not littering and not wasting and overconsuming: In our aerosol-can society we disrespect nature, set a bad example for our children and show a disregard for the ecological balance of Spaceship Earth every time we do things like spray poison to 'flush out' a colony of bees just because . . . because why?"

DO YOU KNOW about some action being taken to fight pollution that we don't know about? In your community? On the job? Tell us about it. Write Environment Editor, Popular Mechanics, 224 W. 57th St., New York, N.Y. 10019.

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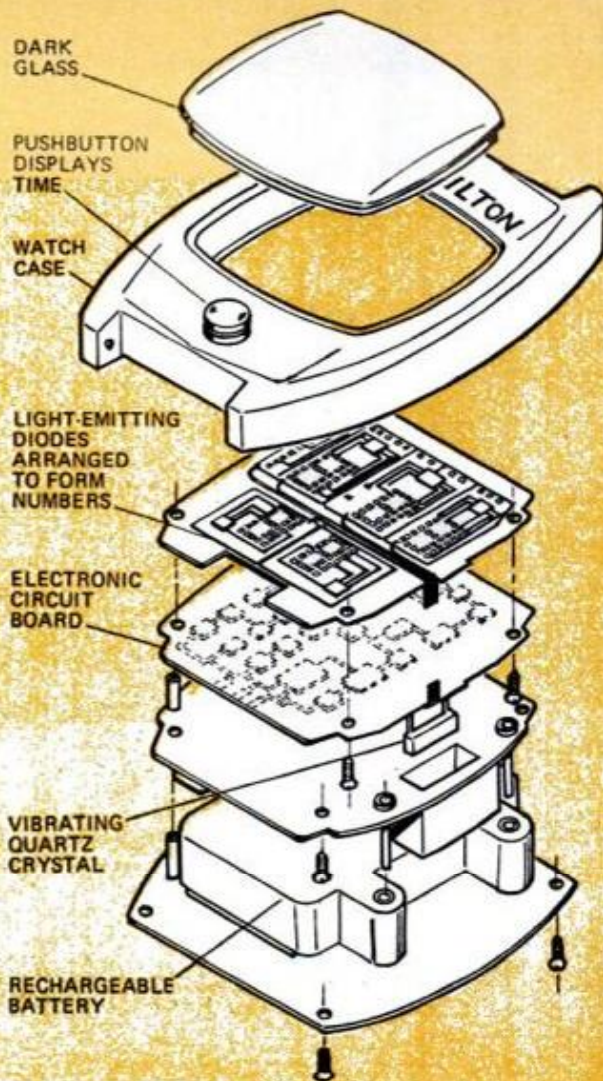
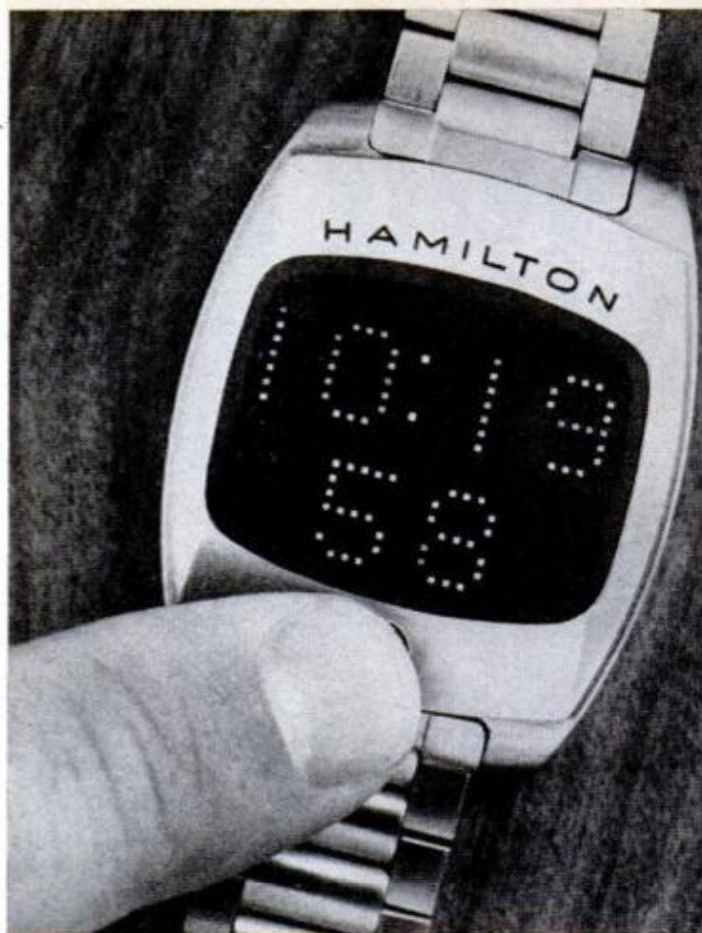
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# I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

## I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

## A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

## Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

## Does Happiness Hang on Your Decision?

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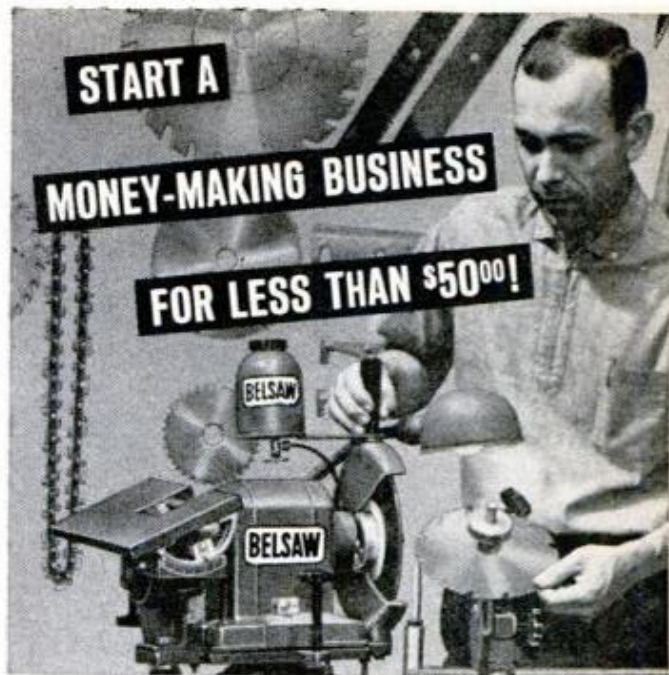
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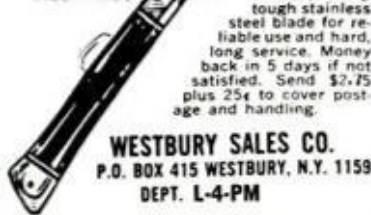
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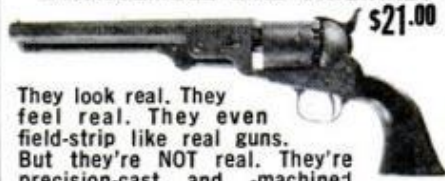
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(Continued on next page)



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(Continued from preceding page)

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(Continued on next page)



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(Continued from preceding page)

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# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Fiddling while valves burn

*Why does my 1967 Ford burn valves—first at 22,000 miles and now at 36,000? It receives regular tune-ups, premium gas and love.—James C. Wilson, Collierville, Tenn.*

Love's not enough. Valves will burn when there is a restriction in the exhaust system. Check the manifold heat control valve in particular; it might be stuck in a partially closed position.

## Pressure point

*I'm afraid to turn the steering wheel of my 1968 Chrysler as far as it will go. I've had the power-steering hose split. Mechanics tell me that the system builds up too much pressure when I turn the wheels. I can't understand why Chrysler would engineer a car this way.—C. D. Nolan, Valdosta, Ga.*

They didn't. There is a pressure-relief valve in the power-steering pump which, if it were working, would keep pressure at an even keel. However, when the valve sticks, which is apparently what has happened in your case, pressure builds up to more than 1200 psi when the wheel is turned to the limit. That's enough to blow the hose, so have the valve replaced.

But first make sure that the car is equipped with a Hypalon power-steering pressure hose (part No. 2537613). An ordinary hose can't withstand the higher temperatures of power-steering fluid, especially if your car is equipped with an air conditioner, and could split.

## Fair-weather friend

*Our 1967 Opel Kadett station wagon has a rainy weather problem. It just won't start in wet weather. We've installed a new battery, points, plugs, condenser, rotor and distributor cap. Can you offer any suggestions?—Jared. Wallace, Westminster, Calif.*

Replace the sparkplug wires, which have probably become porous because of engine heat and are absorbing moisture. Use a top quality resistor-type wire.

If this doesn't do the job, a wet-weather-starting ignition kit is available from

Buick-Opel dealers that will improve the car's ability to start in damp weather. It consists of new high-output coil, separate resistor and new primary wire.

## Body makeup

*The problem is with a vinyl woodgrain panel of my 1969 Pontiac Executive station wagon. It's been scraped and the white underlayment shows. Is there a less expensive repair than replacing the panel?—George Woerner, Sioux Falls, S.D.*

Try dabbing on brown liquid shoe polish. But be artistic; do it with finesse.

## Switch to discs?

*I would like to install disc brakes on my 1966 Chevrolet. Is this a bolt-on job?—Doyle B. Sessions Jr., Hanceville, Ala.*

Not on your life. You'll have to replace spindles, wheel bearings, backing plates, brackets, master cylinder and practically everything else. Cost will be about \$300. In addition, you'll have to switch to 15-inch tires, because that's the size of Chevy disc-brake components. In other words, forget it!

## Dilution dilemma

*I don't have the trouble now, during warm weather, but in the winter my 1968 Volkswagen suffers from gasoline diluting the motor oil. My dealer tells me I have to live with the problem because of the short distance I drive to work (three miles) each day. He suggests I drain the oil every 1000 miles instead of every 3000. Is he right?—Stephen M. Hesccko Jr., Hellertown, Pa.*

You'd better believe it. All cars have the same problem in winter, but it's more apparent with a car like a VW because of its small (2½-quart) crankcase. An excess of fuel gets into the cylinders because the choke stays on longer during cold weather. Much of this fuel remains in a raw state due to the low engine temperature maintained while driving short distances. This fuel drains into the crankcase and dilutes oil. This is why all auto manufacturers advise you to change oil

*(Please turn to page 66)*





# This new Remington 20 gauge is a lot more than a lightweight.

It's a Model 1100...now in a lightweight 20 gauge field model.

Anybody who has ever shot an 1100 knows that this gas-operated automatic is more dependable than anybody ever thought an automatic could be. The action functions without a hitch—shot after shot—smooth and sure.

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Remington builds thousands of firearms a year. One at a time.

\*Minimum Fair Trade retail prices in all states included in Remington's Fair Trade program. In other states, these are recommended minimum prices.



## AUTOMOBILE CLINIC

(Continued from page 64)

more frequently during short-distance, cold-weather driving. It's good advice.

### Artificial respiration

*I have a 1967 Cougar. Every time I go through water of any depth the ammeter shows about a 15-amp. discharge, the lights dim, and the blower on the heater quits. I've tried taping the alternator terminals and various other things. Any suggestions?—John J. Fish, Memphis.*

Yes. Tighten that fan belt as much as she'll go. If the belt is the least bit loose, it will slip when it gets wet. Same advice goes to Phil Udaskin of Watertown, N.Y., who wrote about a similar problem with his 1968 Ambassador.

### Flipped lids

*I have a 1968 Plymouth with a 318-cu.-in. engine. The bolts holding down the valve covers keep working loose and must be retightened every 3000 or 4000 miles. The dealer says that's the nature of the 318 and nothing can be done about it. Do you have any ideas?—Chris J. Kandell Jr., Carsonville, Mich.*

Cork has a tendency to shrink under heat, especially if the gaskets weren't treated properly to begin with. Those gaskets and covers should have been checked for alignment and torqued before the car was delivered to you and retorqued at the first service. You have a choice now of replacing the gaskets and starting from scratch or leaving things as they are.

### Bowled over

*I have a 1969 Dodge Dart that is murder to start after it sits idle for more than a day. I follow the recommended starting procedure, and the car has been back to the garage several times without success. What can it be?—Ellsworth H. Reeve Jr., Bay Shore, N.Y.*

A leak-down condition in the carburetor that allows gas to drain out of the carburetor bowl. For quick starts, that bowl must be filled. I'd check for a needle valve that's not seating properly. Most times, though, the trouble is caused by a crack somewhere in the carburetor. In

that case, you'll have to replace the carb.

### Untrained seals

*I have a 1966 Ford Falcon with a sparkplug problem. After only 600 miles, those plugs get cruddy and cause a bad engine miss. I've tried different plugs and gasolines, new wires and new distributor cap. Any suggestions?—Marshall E. Shires, Clifton Forge, Va.*

Replace the valve-stem seals. Your car probably has at least 40,000 miles on the odometer. At that mileage those neoprene seals have had it and are allowing too much oil around the intake valves where it's fouling up the plugs.

### Cooling with the shakes

*My 1969 Chevrolet Impala has an annoying vibrating noise when the air conditioner's on while speed is between about 23 and 40 mph. Do you know a remedy? My dealer doesn't.—Charles M. Woodfin, E. Gadsden, Ala.*

Your car may have a 350-cu.-in. engine, because the problem has been common with this motor. Tell your dealer to read service bulletin 69T40 (9/8/69). It tells him to replace the a/c hoses, add brackets to the compressor and other things to eliminate the vibration.

## Service Tips

● The 1970 Chevrolet owner's manual is in error on page 72 where it says the recommended oil filter for your Chevy is an AC type PF 24. The correct filter is an AC type PF 25.

● The 1970 Ford line of cars incorporates changes in the radiator filler neck and radiator cap to keep the cap from being removed without a positive stop. It's a safety requirement. To remove the cap, rotate it counterclockwise to a stop position, press it downward beyond the stop index, and continue rotating until cap is fully disengaged.

● 1970 Dodge Challengers with manual gearboxes that are experiencing slow or no clutch pedal return should be brought back to the dealer. He'll install a new clutch over-center spring (part No. 2950921 for cars with 318-cu.-in. engines; part No. 2950922 for those with 340- and 383-cu.-in. engines). This will increase clutch pedal effort slightly. ★ ★ ★

---

**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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Both the Sea-Horse 115 and 85 deliver high excitement in a sleek, low profile. Their efficient V-4 powerheads combine quick acceleration with the kind of staying power you could only get from a Johnson. Underneath our low-down lids, you'll find solid state Power/Pulse ignition and a pair of two barrel carbs. Underwater, our V's feature a low-drag, one-piece gearcase. And at the business end of all this go-power, you can now match the prop to your boat with a choice of 6 standard propellers and 3 optional high performance bronze wheels. To give you full play over all this power and performance, the 115 and 85 both feature Johnson's exclusive

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# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Blacktop over concrete

*My concrete driveway, about 40 ft. long, is cracked in several places. There's a full-length curbing on one side, a concrete walk on the other. The curb is about 3 in. higher than the driveway and the walk about 2 in. higher. Can the driveway be blacktopped?—B.K., Ohio.*

You've no doubt driven on older highways that once were concrete and now are blacktopped. The fact that the curb and the walk are raised above the driveway surface makes it all the more certain that blacktopping would be successful and durable, since the edges of the topping would be adequately supported. However, you should be reasonably certain that the drive is not continuing to settle due to an inadequate gravel base, that the concrete is not broken into movable pieces, and that any cracks are not offset appreciably. Offsets at the edges of cracks exceeding ½ in., and any loose pieces that rock when your car passes or when stepped on must be patched with new concrete before blacktopping. A hot-mix topping laid by a contractor having equipment for quick application and rolling is recommended.

## Frosty metal door

*The door to my patio from the family room is metal framed. When cold, it's covered with frost. During the day this often melts and runs down on the floor. The moisture is on the inside. How does it get in and how can I prevent it from forming the frost?—T.R., Ky.*

It doesn't "get in," as you put it. It's already inside the room. You're looking at condensate that forms on the surface of the metal that's at a lower temperature than the air with which it is in contact; so much lower that frost forms on cold days and nights.

I assume the door is weatherstripped and closes tightly. A tight-fitting storm door would probably minimize the formation of condensate to the point where it is no longer damaging. Some homeowners with this trouble on both metal sashes and doors apply adhesive tape to the exposed metal frames. This usually prevents the trouble. Even colored tape does not

enhance the appearance of window sashes or doors but perhaps it is better than mopping water off the floor.

If your home is heated by a gas-fired furnace, especially one of the floor type, make sure it is adequately vented to prevent excessive moisture inside the house. Other sources of moisture are uncontrolled furnace humidifiers, boiling teakettles, frequent showering, unvented washers and dryers.

## Those balky old clocks again!

*I have a very old steeple clock that runs too fast; it gains five to ten minutes in three or four hours. I've lowered the pendulum weight as far as it will go but this seems to have little effect. Can you tell me what's wrong before I throw the thing out?—T.E., Ore.*

Don't throw it out; chances are there's a lot of good timekeeping in it yet. Assuming that the movement is still in reasonably good condition and that the pendulum weight, or bob, is of a size suited to this particular clock, the chances are the pendulum rod is too stiff. If you remove the dial, you'll see that the rod is suspended on a slotted post and that the upper end of the rod is flattened to a uniform thickness for about 1 in. or so from the end. It's unlikely that this is the original rod; more likely, it's a replacement. Rods are supplied in two standard thicknesses at the upper end: .003 and .004 in. For a steeple you should have the former. Both .003 and .004-in. rods are available from dealers in clock movements and parts.

It's possible to reduce the thickness of the flat sufficiently by rubbing with a fine abrasive. It's a matter of cut-and-try until you get just the right amount of "spring" so that adjustment of the bob will "slow" the pendulum sufficiently to permit accurate timekeeping.

## Paint plastic tiles?

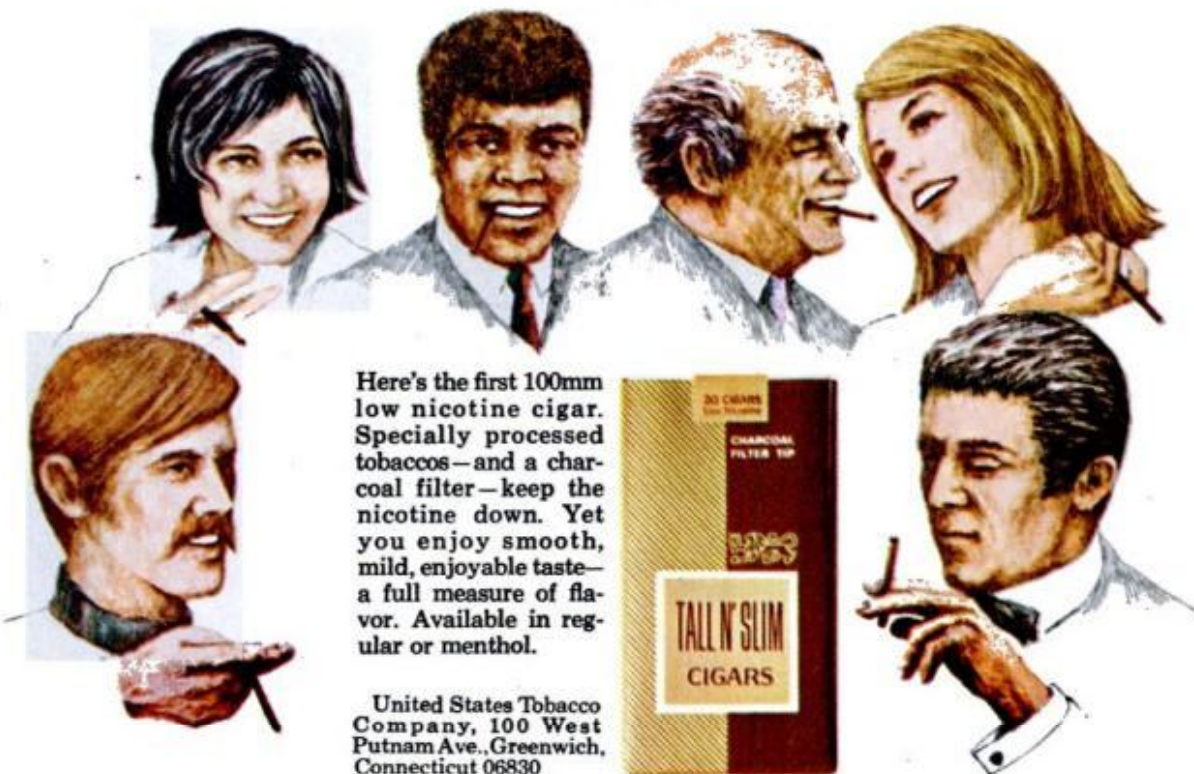
*I'm changing the color of my bathroom and the plastic tiles don't go with the change. Can plastic tiles be painted?—C.S., Fla.*

Yes, but paint will change the appearance of the tiled portion of the walls; that is, painted tiles just don't look like tiles. Why not make sure you like their appearance by painting a small area of the tiled wall first? If you like what you see, then well and good. Before painting, be sure to roughen the surface of the tiles with coarse steel wool or sandpaper; otherwise the paint may peel. ★★★




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Tall N' Slim Cigars blend more flavor—with less nicotine.



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United States Tobacco Company, 100 West Putnam Ave., Greenwich, Connecticut 06830



## NEWS BRIEFS



### Is this the way to treat a Rolls-Royce?

Being put through torture tests in a rock quarry in England is the 1969 Rolls-Royce Silver Shadow that, late in April, set out on the 17,000-mile route of the Mexico World Cup Rally. Among the modifications for the rugged trip through Europe and South America was the rerouting of the car's exhaust pipes over the roof so rocks wouldn't damage them.



# Which hand was sprayed with Off!™... 5 hours ago?



It shouldn't be too hard to guess. We'll even give you some clues. Off! has diethyl-toluamide (a fancy name for the most effective mosquito repellent ingredient ever developed).

We tested Off!, with diethyl-toluamide, in our labs. And in test after test, Off! not only kept mosquitos from biting immediately upon application—but up to five full hours later.

Off! comes in spray, foam or concentrated liquid. It repels mosquitos, chiggers, gnats and ticks hour after hour.

(Congratulations. You guessed right. The hand on the left was sprayed with Off!)

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# How to Match A Trailer to Your Car



**Have a new car? Or a new trailer?  
Here's how to make sure they're suited for one another**

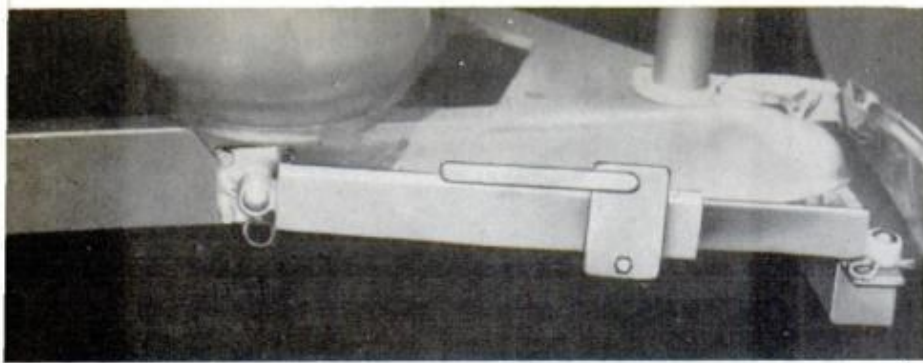
**By V. LEE OERTLE**

**M**AYBE YOU DIDN'T KNOW IT, but carmakers now rate each new model according to its trailer-towing performance. Such factors as rear-end sag, drawn weight, engine heating, traction and stability are of real concern to Detroit, as they should be to you. Problems have been considered that were rarely encountered in ordinary driving.

The term *trailer tongue weight* indicates the trailer load that is actually *carried* on the coupler—the weight which must be carried by the car. In past years tongue weight has been rather loosely estimated at about 10 percent of the gross trailer weight. In other words, a 3000-pound travel trailer could be expected to have a tongue weight of about 300 pounds. But tongue loads can vary, all the way from 5 percent of the gross trailer weight to as high as 20 percent. An ideal average would range between 12½ and 15 percent.

In many ways, the tongue weight of a trailer has a more drastic effect on your car than the total drawn weight. Even though many trailers have tongue loads as low as 150 to 300 pounds, remember that this weight is dropped onto the rear of the towing vehicle several feet behind the rear axle. The leverage effect is such that 200 pounds, back there, could be equal to 400 to 500 pounds of downward pressure. The result is that the suspension system is overloaded in one spot, creating (a) rear-end sag





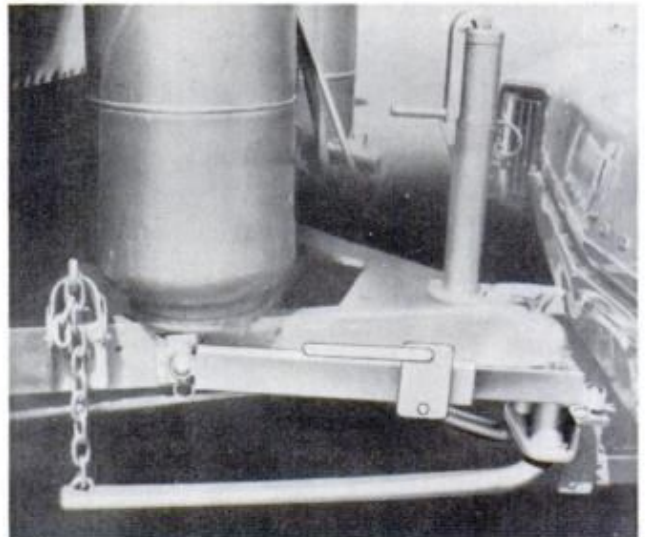
**HERE ARE TWO DEVICES** you can use to help stabilize and distribute tongue loads. The Sway-Control unit at left dampens fishtailing while underway. It's also considerable help over rough terrain. At right is a close-up of a typical load-equalizer hitch which evenly distributes the tongue load. Sway-Control is also attached. In combination, these accessories go a long way toward providing you with an easier, as well as more secure, ride

that (b) reduces ground clearance, and (c) throws the headlight beam skyward and (d) depresses the rear springs to the point where little impact resistance is left. Tire loading becomes critical. Some American cars come with only enough tire capacity for a normal six-passenger cargo. Add 300 to 500 pounds of tongue load and use larger tires.

There are several solutions to the "overweight" problem. Here are some:

- Use an approved load-equalizer hitch. (More on this later). It spreads the tongue-load strain over a greater area.
- Install wider, stronger tires.
- Install heavy-duty springs, or use additional overload springs.
- Replace standard shock absorbers with the heavy-duty type to help steady the load and reduce impact resistance.

You can solve all those problems easily: Order the *trailer towing package* when you purchase a new car. The package will cost a lot less than if you add the heavy-duty equipment later. It includes larger tires, wider wheels,

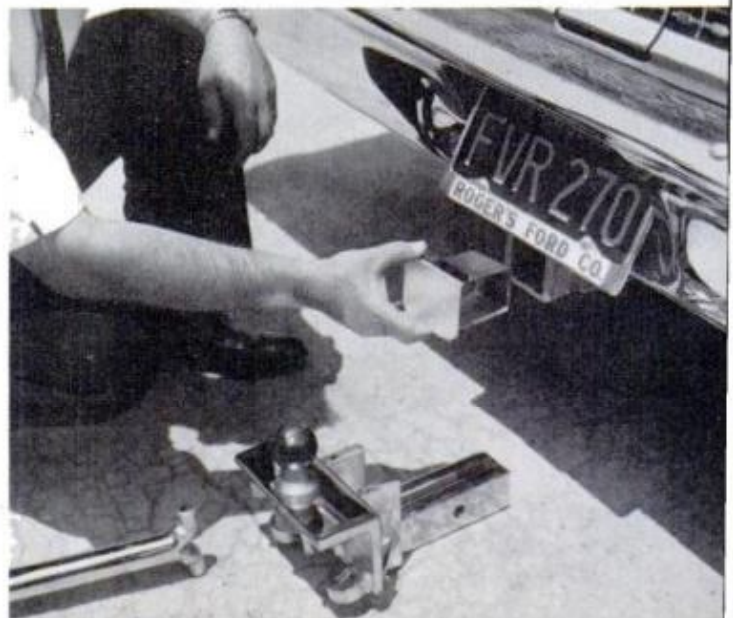


beefed-up suspension system, larger engine, three-speed *automatic* transmission, heavy-duty electrical system including a bigger battery, and a cooling system with extra capacity. Sometimes a heavy-duty frame is in the package, though this depends on the maker. The package is a bargain any way you look at it. A car fitted with it will be a better handler and a safer automobile.

Here are general suggestions about

*(Please turn to page 186)*

**ANOTHER CROSS BRACE** and the hitch below will be attached at four points on frame for extra strength. Right, new type load-equalizer hitch has removable head to be stowed in trunk when not in use, replaced by chrome-plated cover for smooth looks





# Trailer Towing Chart

\*Allowable Gross

Trailer Weight (Lbs.)

## American Motors

Ambassador	3500-5000
Rambler Rebel	3250
Javelin	2000
Hornet	2000

## Chrysler Corp.

Imperial	5500
Dodge (Polara-Monaco)	5500
Charger	4000
Coronet	4000
Dart	2000
Plymouth Fury	5000
Belvedere	4000
Valiant	2000
Barracuda	2000

## Ford Motor Co.

Maverick	2000
Ford (Galaxie, LTD, Custom 500, XL)	5000
Fairlane (all series), Torino, Brougham, GT)	3500
Falcon (all series)	2000
Mustang	2000
Thunderbird	3500
Bronco	3500
Lincoln Continental	5000
Mercury	5000
Montego-Cyclone	3500
Cougar	2000

## General Motors Corp.

Buick Special—Skylark	3500
LeSabre, Wildcat	5000
Electra, Riviera	5000
Sportwagon	5000
Blazer (4 wheel)	4000
Chevrolet (Biscayne, Bel Air, Impala, Caprice)	6000
Chevelle (300 Deluxe, Malibu, Nomad, Estate Wagon)	5000
Chevy II (Nova)	4000
Camaro	1000
Cadillac	5000
El Dorado	2000
Oldsmobile (98, 88)	5000
Vista Cruiser	3500
4-4-2	3500
Cutlass Supreme, F-85	3500-5000
Toronado	3500-5000
Pontiac (Catalina, Executive, Bonneville, Grand Prix)	6000
Tempest (Custom, Safari, GTO, LeMans)	3500

## International Harvester

Travelall	5000-10000
Scout	4000

## Kaiser-Jeep Corp.

Jeep Wagoneer	3500-5000
Universal Series Jeep	3500

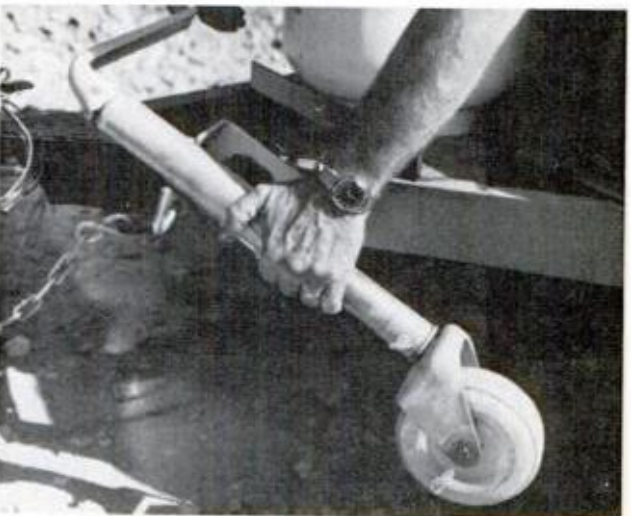
\*Maximum load allowed only when approved heavy-duty "Towing Package" equipment has been installed—all models.



**TRAILER DOLLY WHEEL** makes setting up camper a cinch: drop down, crank into place; aids in detaching vehicle



**IF YOU WON'T BE USING** your trailer ball awhile, best remove it to avoid damage or possible theft



**BEFORE STARTING**, remember to lift trailer wheel out of way. Safety chain must be tight enough to keep tongue off pavement in event hitch-ball breaks







**SWEDE SAVAGE** hotshoes through Laguna Seca's final turn in the blue No. 42 AAR Barracuda. Behind him, Bob West driving the yellow No. 50 Camaro shows the race fans how the haybales and guard rail work

## *Trans-Am:* The Secret

**We drivers are competing fender-to-fender for the glory; the Detroit ponycar makers, for the winning points and the prestige; while the fans at SCCA Trans-American events get a road-racing show they'll not soon forget!**

By **DAN GURNEY**

*Photos by Richard George*

**T**HE CHECKERED FLAG FELL on the opening Trans-Am of the season at Laguna Seca as Parnelli Jones's Mustang crossed the start/finish line. Forty seconds behind was Mark Donohue's Javelin; in a second Mustang, a lap back, was Parnelli's teammate, George Follmer; Swede Savage's Barracuda was six seconds behind Follmer; two more laps down was Milt Mintner's Camaro; Sam Posey's Challenger was back another lap in sixth.

The 13-race manufacturers' championship was under way. The points tallied: Mustang 9, Javelin 6, Barracuda 3, Camaro 2, Challenger 1. The Firebird of Jerry Titus finished seventh just out of the points-paying positions.

POPULAR MECHANICS





**PARNELLI JONES** (top, right) grins in victory circle after winning race at record 91.275 mph average in Boss 302 Mustang. Our AAR crew (below) refuels Swede's Barracuda before his dash to fourth-place finish

## Word Is *Competition!*

The competition was as fierce as we all had anticipated!

I was forced to watch the finish from the pits: My Barracuda's clutch went on the 21st lap of the 90-lap event. Swede Savage's Barracuda, however, went the distance, and he brought it in fourth—quite a performance in view of the competition.

Not only are the other top-dog drivers among America's best road racers, but the teams behind each are taking enormous pride in building the best Trans-Am car of 1970. The intensive effort in preparing these cars and testing them before the race is a professional endeavor indicative of the high stakes for the manufacturers. Factories

don't like to lose; they're out to win!

Parnelli Jones, 1963 Indianapolis winner, may well be America's hardest-charging racer, whether on ovals or road courses. No. 1 on the Ford Mustang team, he won the first two races of the season—at Laguna Seca and Lime Rock. George Follmer is driving the second car. The Mustangs are being prepared by Bud Moore and his crew who look back on a four-year Trans-Am racing background.

The Javelins of American Motors, racing three years in the Trans-Am series, have been quite competitive. With Trans-Am champ Mark Donohue and co-driver Peter Revson taking over under Roger Penske's most expert di-





**RIGHT ON THE TAIL** of George Follmer's third-place Mustang before I had to pull in with a broken clutch

rection, the Javelins will be formidable indeed.

This team's performance in 1970 has been the subject of much speculation. It's unusual to forsake Chevy for American Motors as the Penske team has done. The big question is how much of its success the past two years was Penske/Donohue and how much Chevrolet Camaro?

The Chevrolet Camaro team that won the championship in 1968 and 1969 is now in the capable hands of Texan Jim Hall and his company whose contributions to racing are numerous. The Chaparral with its automatic transmission and suspension-mounted wings is



**PLYMOUTH'S RETURN** to Trans-Am racing means we've got some catching up to do, but we've got the team and hardware to do it with. It's anyone's series

one. This is Jim's first attempt at Trans-Am racing. He's driving one of the Camaros and Ed Leslie a second. Both had bad luck the first time out, chalking up DNF's (did-not-finish). But Ed was second and Jim fourth at Lime Rock.

It was Milt Mintner's fifth-place finish at Laguna Seca in an independent 1969 Camaro that put Chevrolet in the point standings.

The Dodge team, all new, is headed by Ray Caldwell of Autodynamics. Number 1 driver is effervescent Sam Posey, one of the young lions of American road racing. He finished sixth at Laguna Seca, moved up to third at Lime Rock.

Pontiac may very well be the dark horse of the 1970 season with a brand new Firebird and new engine. The potential is there: It has an experienced crew and in my judgment Jerry Titus is an outstanding and very underrated road racer. He was top winner on the Mustang Trans-Am champion teams of 1966 and '67.

Last, but not least, we come to the Plymouth Barracuda team and All-American Racers. It's the first venture for my company in the Trans-Am. I've run in it on several occasions, but never in a full series. A Barracuda, too, has run: A 273-CID-powered car finished second in the 1966 Championship, but both race series and car have changed completely since then, and 1970 marks

**POPULAR MECHANICS**



the company's first full-blown effort.

We decided to go with Plymouth and Plymouth with us last October. When our relationship was announced, Glen E. White, vice-president of Chrysler Corp. and general manager of the Plymouth Div., said: "We know what we are up against in the Trans-Am Series, and we know that we are getting a relatively late start. There is a tremendous amount of work required to make the Barracuda competitive this year after a three-year absence from the racing scene." I was aware of this, but I felt we had an excellent car to start with, and I had a lot of confidence in AAR's ability to clear the hurdles.

All American Racers is entering two cars in all the Trans-Am races. One will be driven by me and the other by Swede Savage. Swede has been with us for two years now and is beginning to be heard from. He has progressed through various departments of AAR much as a student would at a university. I think he has the makings of a future champion. He is 23 now and, despite his youth, has many years of racing experience. He got his first factory ride in a Holman & Moody stock car in 1967 and has since driven for AAR in Can-Am and USAC Championship road races with good results.

Trans-Am cars start out as production automobiles. Our Barracuda was simply lifted from Chrysler's assembly line at Los Angeles and delivered to Santa Ana. It is a basic Barracuda on a 108-inch wheelbase. Though in appearance and in major technical areas it's the same car as the road version, certain changes were made to conform with SCCA rules.

The most significant is installation of a roll cage. This offers extra strength and protection for the driver in case of a crash, and it adds much to the car's rigidity. We developed our roll structure from computer data at Chrysler. We

*(Please turn to page 181)*

**COMPETITION STACKS UP** with six manufacturers represented. Ponycars from top to bottom: Pontiac Firebird, Plymouth Barracuda, Chevy Camaro, Dodge Challenger, Ford Mustang, American Motors Javelin  
JULY 1970





AUTOMOTIVE



# Dune Buggy



**A ONE AND A TWO:** Add front and rear body sections to the Virgo dune buggy and it's in street clothes ready to go!





**REAR BODY PANEL** conceals the machine's Volkswagen engine, but taillight lenses are a giveaway



**RAGTOP SUPPORT BAR** slips through two holes in the rear body panel, can be removed when the top is off

# or Sports Car? Both!

**Versatile vehicles are the coming trend, but here's one that has already arrived!**

By MICHAEL LAMM, West Coast Auto Editor

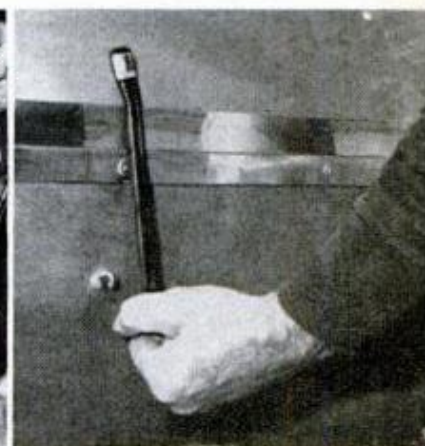
**H**ERE'S A STRIPPER that goes from sportster to dune buggy in half a minute flat.

During the week, you use it for the usual running around. It's street-legal and all-weather. Then on weekends, whip off the fiberglass front and rear body sections and *shazam!* you're ready for off-road sandstorming.

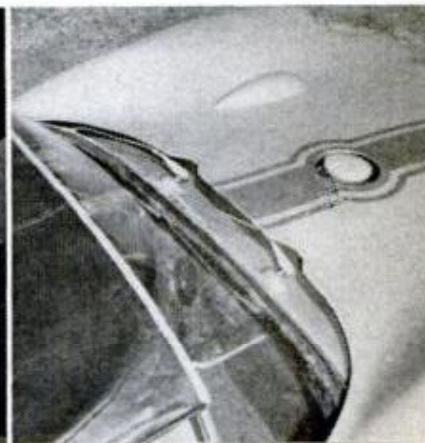
Virgo comes in either do-it-yourself kit form or ready-made. It's a novel idea from Zodiac Motors of California. Inventor-builder Beau Hickory, long-time race-car designer/driver, considers normal dune buggies self-limiting—too seasonal. In the Virgo, he says, you get the best of three worlds: all-weather street sportster, dune bug, economy car.

The 1300-pound Virgo uses stock Beetle components, including an unshortened VW chassis. After discarding the standard body and reinforcing the platform with square tubing, you merely bolt the fiberglass Virgo underpinnings in place. These include new gas tank, seat frames with upholstery, dash, and such miscellaneous fixtures as bayonet fittings for lights.

That part complete, it's a simple mat-

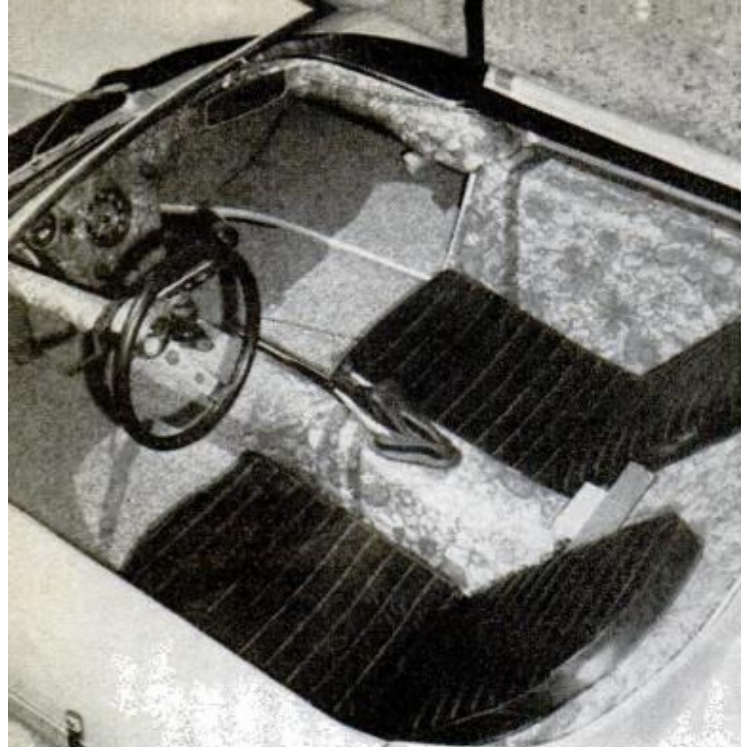


**SIDE GLASS** is secured in place by aluminum brackets. Several rubber hold-down straps secure front and rear fiberglass panels to unshortened VW chassis



**QUICK-CONNECT PLUGS** hook up power to the lights for street running. Fuel tank fill is external, pops through front panel, becomes part of hood design





**SNAP-IN SEATS** assume shape of the fiberglass body. The sideglass (below) forms an airtight seal with the wraparound windshield. On cool or windy days, the sideglass is protective enough to leave off the top. As emphasized at bottom, the Virgo swings low!



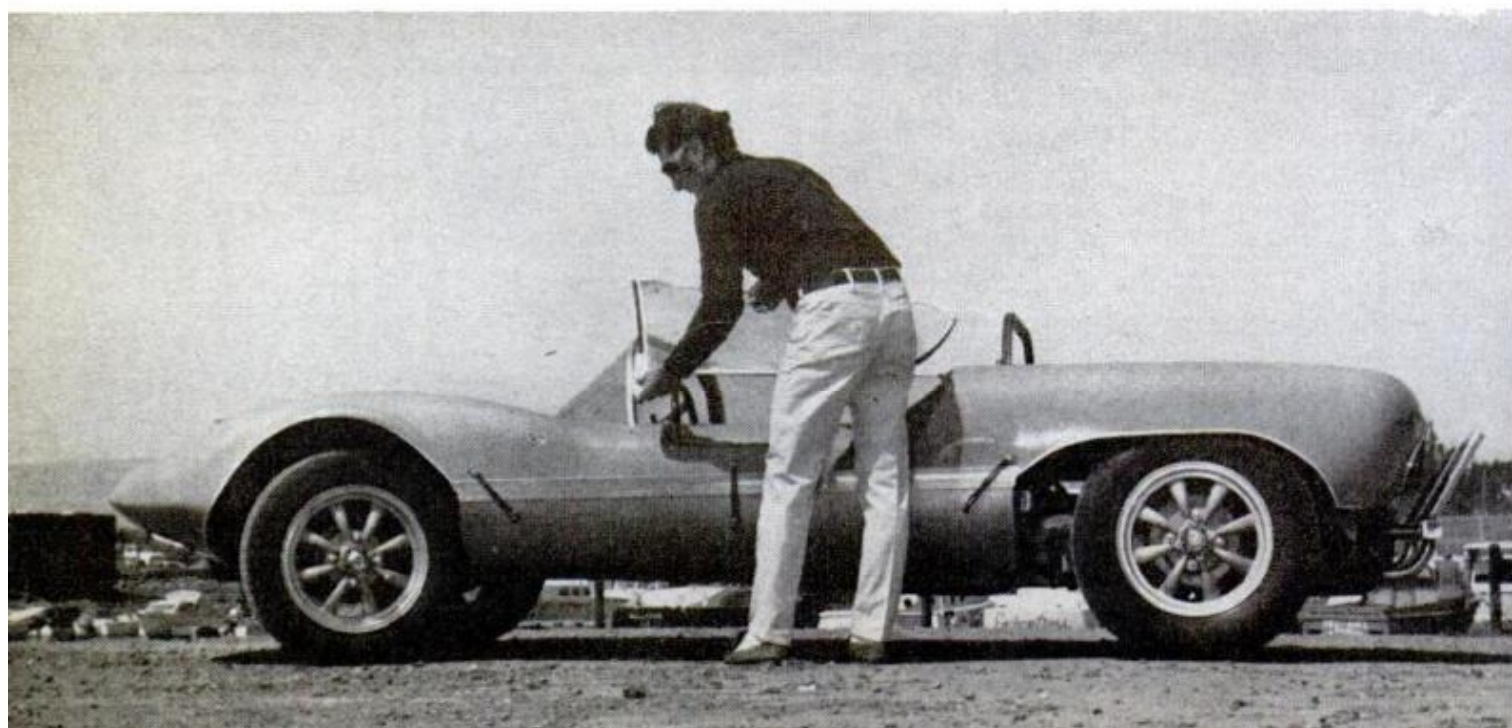
ter to lift on the front and rear body sections. Each weighs about 45 pounds. Nose and tailpieces both fit into channel-section stainless-steel trim strips that run from wheelwell to wheelwell. Final fastening of the body panels is by two wingnuts and six rubber hold-down straps.

Minus its outer skin, the Virgo has a flat cargo deck for luggage. With the nose and tail in place, this area becomes stowage for top and side curtains. When raised, the top is supported by two aluminum stays. When folded, the top stays make a neat compact package.

In kit form, which *excludes* upholstery and wraparound (Opel) windshield, the Virgo retails for \$695 f.o.b. South San Francisco. Prices for the assembled car, streetable and ready to roll, begin at \$1750. This latter price includes a 40-bhp VW engine, all-synchro gearbox, upholstery and paint.

Optional extras include: special wheels, top, side curtains, rear bumper-cum-muffler and adapters for headlights on the buggy version. If you want to go all the way, Porsche and Corvair-engined Virgos are available on special order at up to \$5000. These engines fit neatly in the rear in place of the original four cylinder Volkswagen power plant.

For full particulars, write to Zodiac Motors, 375 Oyster Point Blvd., South San Francisco, Calif. 94080.

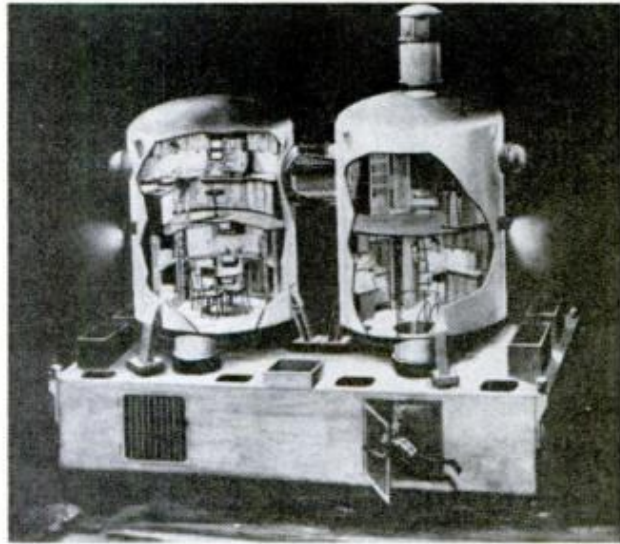






**Battery-powered bicycle**

Twenty batteries housed under the seat power this new Japanese electric bike. The streamlined two-wheeler can travel 30 miles on one charge and has a top speed of 12 mph.



**Undersea lab for aquanauts**

This twin-domed Tektite II, an updated version of last year's Tektite I, will serve as undersea laboratory for scientist-aquanauts doing marine research off the Virgin Islands.



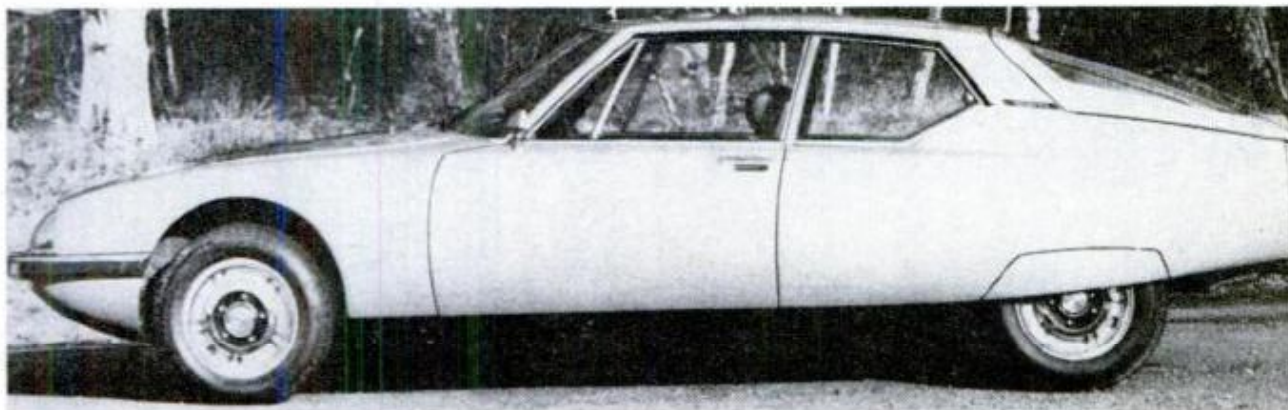
**Model of things to come**

Long and slim, the scale model above gives an advance look at Russia's newest deep-diving bathyscaph for underwater exploration.



**They're telephone workers?**

Not from outer space, these telephone men wear aluminum-mesh suits to guard against radiation while working on microwave towers.



**French sports car has Italian horses under the hood**

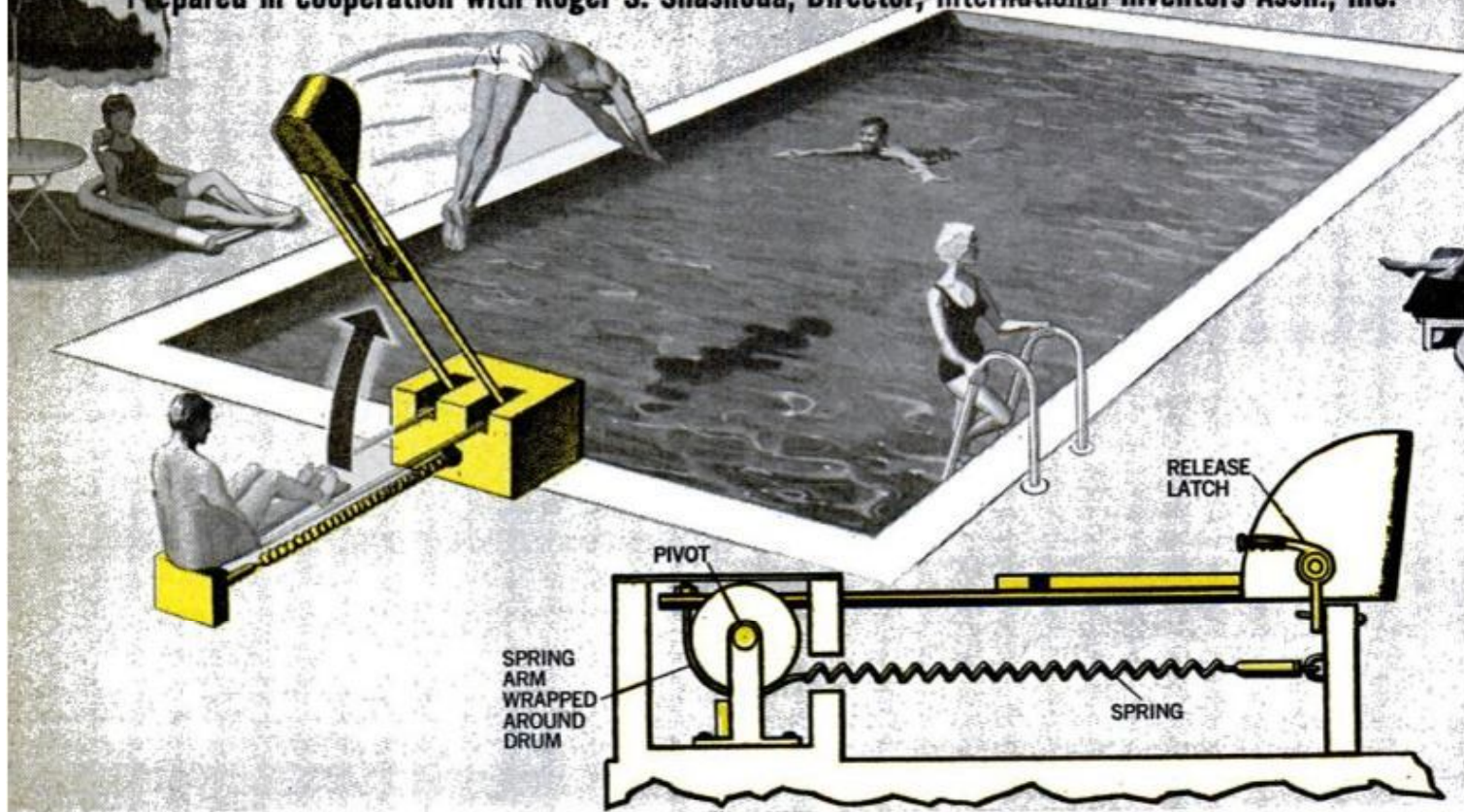
It's a Citroen on the outside with a unique new, four-cam V6 Maserati engine inside. The unusual French-Italian prototype has supersmoothair-and-oil suspension, can hit up to 136 mph.



# Just patented

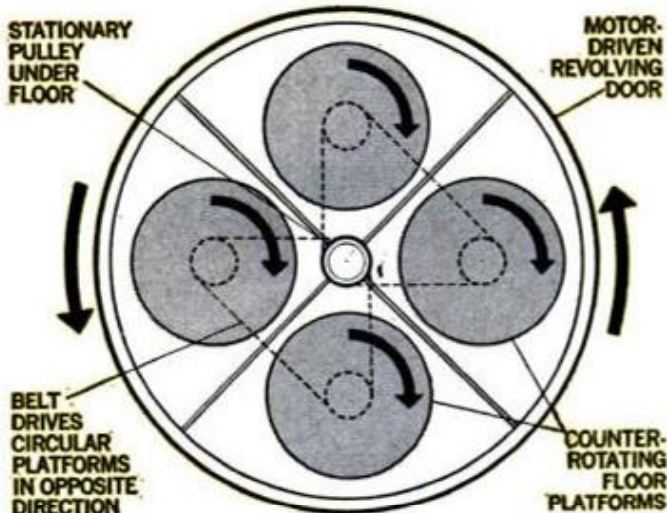
PM'S PICK OF THE NEW INVENTIONS

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



1. A NEW KIND OF DIVING THRILL is the object of this unusual swimming-pool catapult. You sit in the bucket seat, pull a release latch and a powerful spring hurls you up and out over the water. Basic—simple in construction, the device gives you a

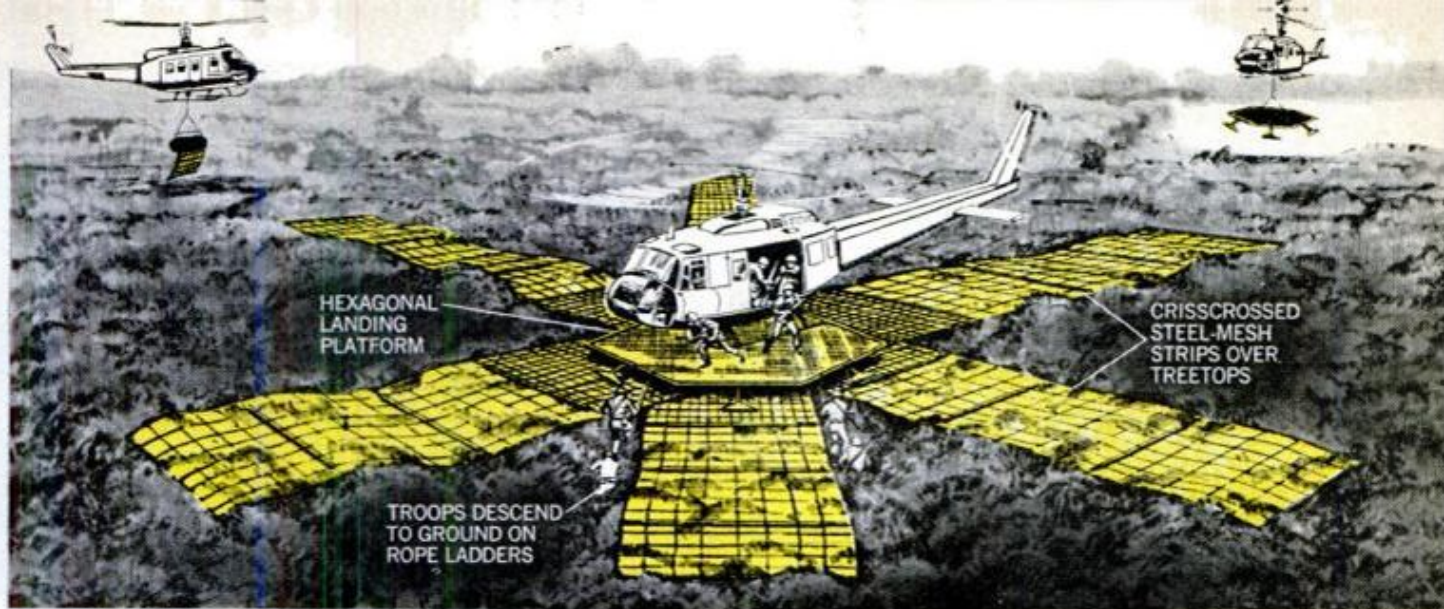
longer, more exciting ride through the air than a conventional diving board and eliminates the need for tall diving towers. The spring mechanism can be adjusted to assure safe catapult distances and to compensate for the differences in weights of divers



2. MOTOR-DRIVEN REVOLVING DOOR turns by itself so you don't have to use your hands when you're loaded down with packages or luggage. It also travels at a fixed speed so impatient persons can't push it too fast. An ingenious system of counter-rotating floor platforms keeps you facing in the same direc-

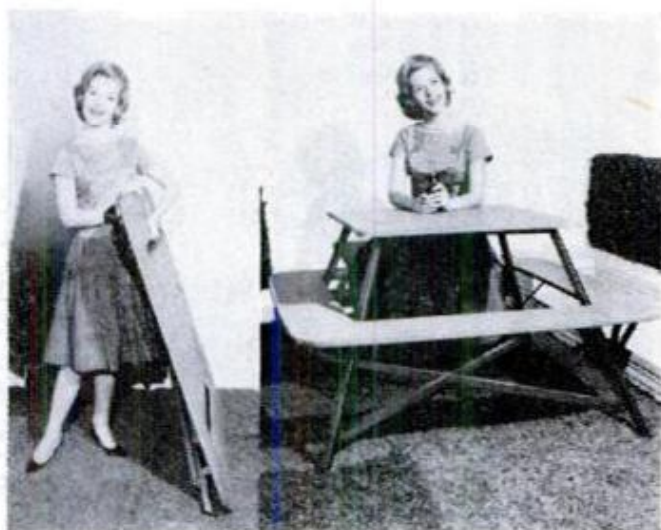
tion as the door moves—you just walk straight in and straight out without having to turn around. The floor discs are connected by drive belts to a central column that remains stationary. This has the effect of rotating the discs backward as the door swings forward, aiming you the same way throughout





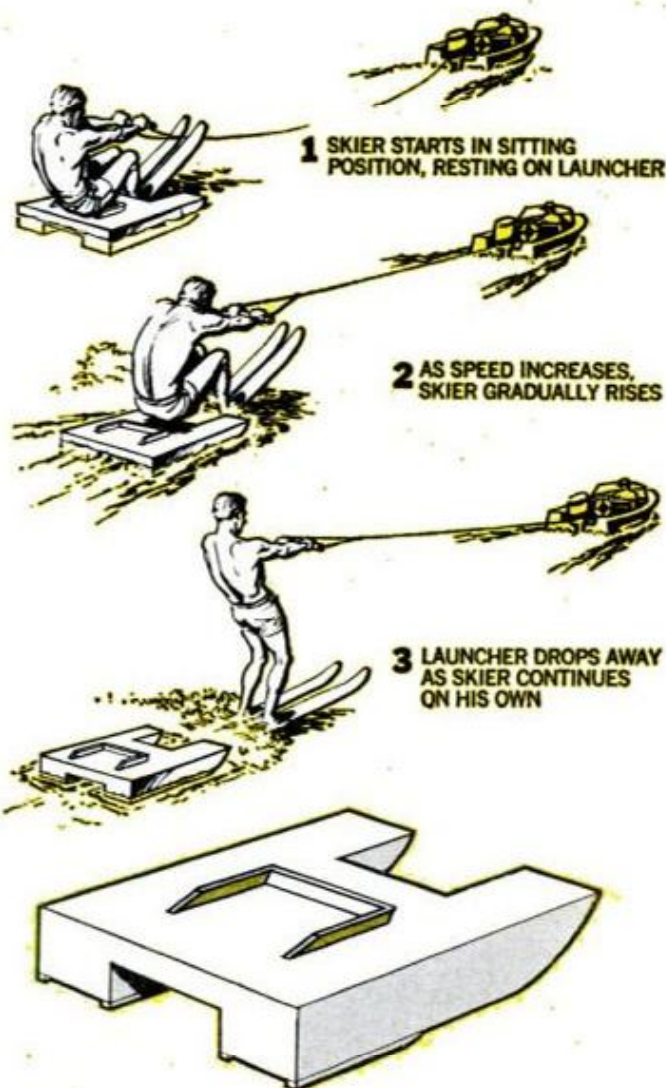
**3. TROOP-CARRYING HELICOPTERS** land right on the tops of trees in this system for speeding soldiers to densely wooded battle areas. The copters unroll strips of steel mesh over the trees, crisscrossing them like a spider web. The mesh catches in

the branches, anchoring itself firmly in place. A hexagonal platform is then lowered onto the center to form a stable landing pad. As each copter settles on the pad, its troops disembark and climb down rope ladders to the ground, ready for action



**4. COLLAPSIBLE PICNIC TABLE** above carries its own built-in bench along with it. The interconnected legs fold underneath like a card table's, at the same time telescoping the tabletop and surrounding seat together so they lie flat, one inside the other. The novel four-sided bench and table combination is designed for quick setting up and easy storing, thus eliminating the problem of what to do with separate seats when a table is put away. The same folding leg system can be applied to circular, oval, rectangular and other table shapes

**5. EASIER STARTS FOR WATER SKIERS** are possible with the clever launching aid shown at right. The skier is pulled through the water sitting on the device, with its twin pontoon-like floats straddling his skis. As his speed increases, he gradually pulls himself up on the skis and the launcher falls away to the rear, safely out of his path. The invention is intended to be of special help to beginning water skiers who have difficulty taking off from the customary abrupt start



Inventors of the items shown on these pages are as follows: 1. William F. Whaley, Moorhead, Minn. (No. 3,466,053); 2. Donald Alfred Riddle, National Commercial Bank of Scotland, Ltd., 62 Lombard St., London E. C3, England (No. 3,440,759); 3. William H. Wainwright, 61 Highland St.,

Cambridge, Mass. (No. 3,456,909); 4. Henry P. Glass, 245 Dickens, Northfield, Ill. (No. 3,096,866); 5. Edward N. Esmy, 301 Fair Oaks Ave., Rochester, N. Y. (No. 3,358,304). The International Inventors Assn., Inc., is located at 1350 Avenue of the Americas, New York, N. Y. 10019.





FORD PINTO, skillfully designed, manages to combine appealing style with a better-than-VW people package

## Detroit's Minis: How Much Muscle?

Can they sock it to the imports? Stay small, functional, inexpensive to operate? Satisfy the American driver's ego?

By ROBERT LUND, Detroit Auto Editor

**S**OUNDS LIKE the same old story: Ten years ago American automakers brought out the Corvair, Valiant, Falcon and Lark. They were the cars that were supposed to join American Motor's Rambler in clobbering the imports. The confrontation wasn't that dramatic. The imports got their ears pinned back for a few years, but by 1963 the American "small" cars had ceased to be small in size, price and operating costs. Foreign cars, clinging to the idea of frugal functionality, bounced back with a stronger lock on the small-car market than they'd had pre-1960.

Now it's 1960 all over again. Gremlin, the American Motors entry, is already scooting around the countryside. Next up, probably the fourth week of August, will be GM's Vega 2300. Ford will follow with Pinto in early September, and Chrysler bring up the rear of

the perambulator parade next summer.

What do Son of Corvair, Son of Falcon et al portend for car buyers? Will Junior go the way of old Dad, becoming more corpulent and costly, more maxi and less mini? If you pop for one



**THE PINTO** is neither fastback nor notchback. Ford hopes to clout the imported competition with a car that has everything they have plus sexy style

POPULAR MECHANICS



of the new numbers, what are the chances of getting hung up with an "orphan" at trade-in time, an automobile drifted so far from the original concept that nobody wants it? That happened with the original American compacts. And what effect will the new breed of undersized autos have on regular-size cars, used vehicles and the promise of a replacement or supplement for the piston engine?

The auto companies say they aren't going to make the mistake with the minis they made with the compacts—getting people warmed up to the idea of smaller-size cars and then abandoning would-be buyers to the imports.

There's no reason to doubt Detroit's sincerity, but . . . manufacturing and merchandising automobiles is a seat-of-the-pants business. If chromed behemoths are what sells, that's what the companies build.

But there are hard-nosed reasons to believe the minis will enjoy a longer life than the compacts. Here are the mathematics behind that prediction:

- The importers have Detroit scared stiff. Foreign car firms sold 1,118,000 automobiles in the United States last

year, 11.5 percent of the pie—up from 10.3 percent in 1968. A full percentage-point gain in sales in a single year in Detroit's scheme of things is on a par with winning the Nobel Prize, Academy Award and Mother-of-the-Year rolled into one.

"It isn't enough just to cut them (foreign cars) down to size as we did with the compacts in the early sixties," a Ford executive declares, "and then go back to selling the big stuff. We have to produce small cars on a continuing basis. If we don't, Germany and Japan are going to own the store and everything in it."

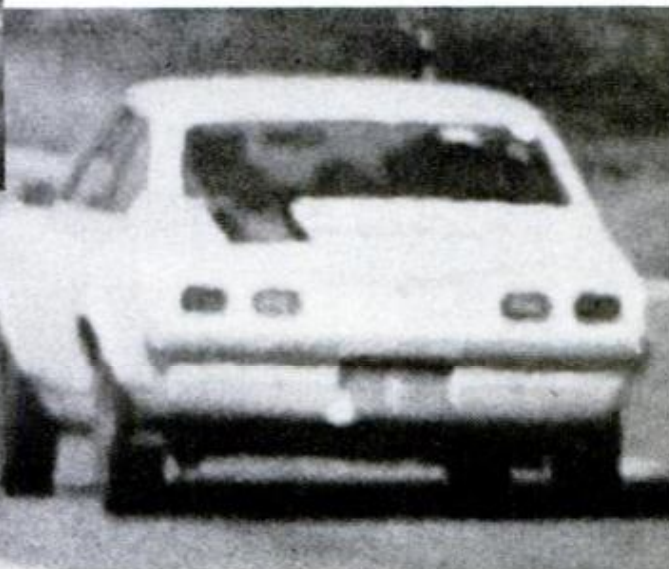
- Detroit would like to give the invaders a taste of their own medicine—sell American cars overseas. But you can't sell big Fords, Chevys and Plymouths in countries where wages are a third or fourth of the going rate in the United States. If Detroit is going to reverse the traffic in foreign trade, it must offer smaller automobiles, low initial price and low operating costs.

- Detroit is worried over threats to ban private passenger cars in cities. Politicians and antiautomobile groups are pushing this proposal. Smaller cars will relieve some of the traffic congestion and, hopefully, some of the anti-automobile sentiment. (American Motors figures 450 Gremlins can be parked in the space required to park 300 conventional-size cars.)

- Detroit is in a cold sweat over the



VEGA 2300, to stay same for four years, has been rolling up lots of test miles. In these sneak pics, the hatchback sedan was caught from rear; station wagon version was shot broadside.





technology of solving pollution problem of the internal-combustion engine. Automakers are convinced they can solve it given time. But there's an impatience in the land to solve it right now. Auto engineers say that's not possible—but the industry believes it can take some of the heat off by bringing out small cars.

"Small cars burn less gasoline and can reduce the problem of car emissions," says American Motors board chairman Roy Chapin Jr. "Research and technology will provide a solution to this problem in the long run. But, meantime, we can reduce—substantially reduce—the amount of contaminants in the air by increasing the percentage of small, high-gas-mileage cars on the highways."

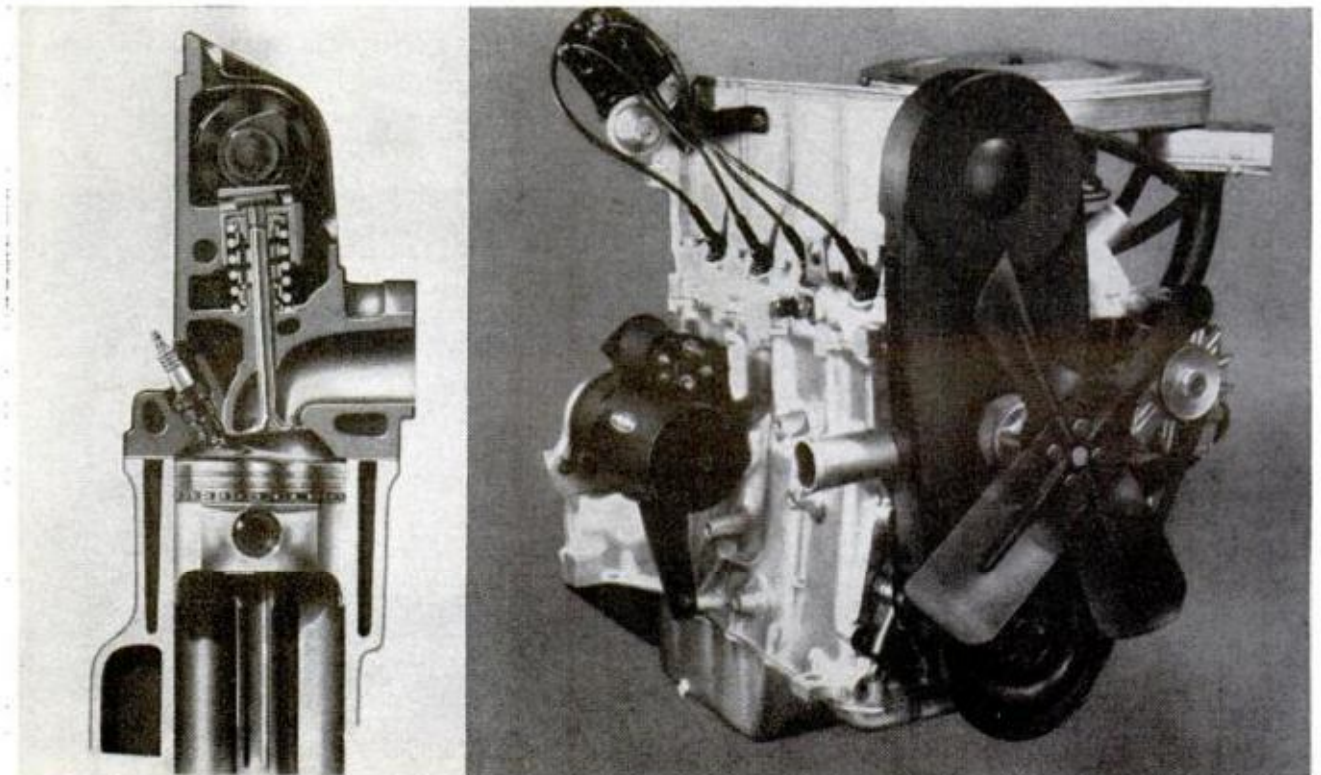
● Car ownership in the United States is reaching a point where the auto companies are becoming concerned about exhausting the supply of customers. (If you doubt that, count the number of people you know who really need a new car.) The replacement market is good for about 7 million new cars a

year. But Detroit wants to do better than that. One way of moving more merchandise is to sell more cars per family—the two and three-car family idea. But how many households can tie up \$3000 to \$4000 per car in two or three automobiles? More often than not, the second set of wheels is a used car or import. But suppose it could be purchased new for \$1800 to \$1900? Enter the domestic mini car.

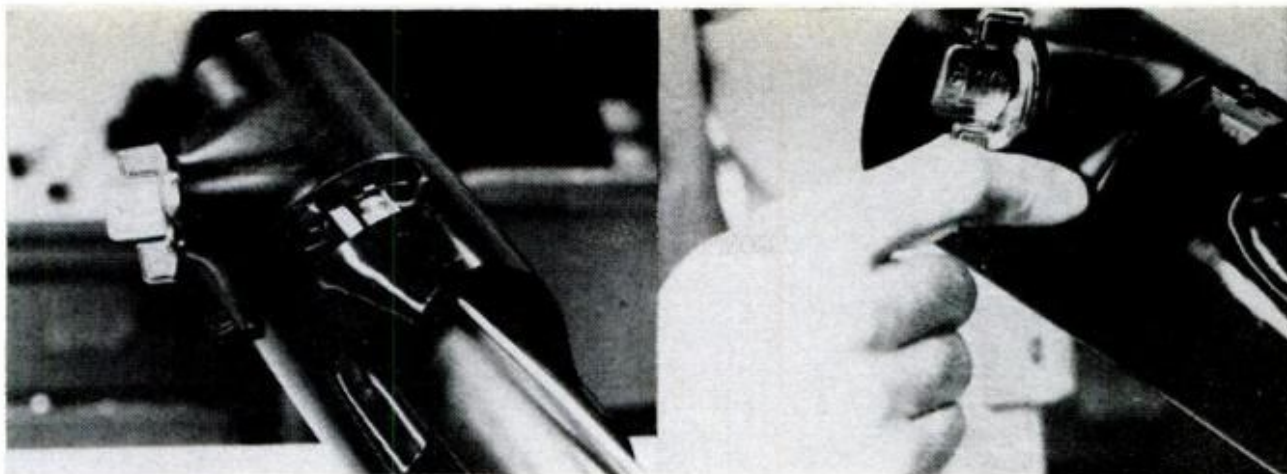
● Auto company seers—economists and market analysts who crystal-ball the future—believe the hour of the small car has arrived. No one reason for this—but many: prices, pollution, traffic congestion, invasion of imports.

AMC's Roy Chapin believes that more than half of all cars sold in the United States will be intermediate-size or smaller by 1975. "Gremlin and the other new domestic cars to follow will be in the single fastest-growing segment of the car market in the first half of the 1970s," he predicts. "By 1975, they should achieve a sales volume of about 700,000 to 800,000 units annually. We think the total 1975 market for

**CHEVY TECHNICAL TOUR DE FORCE** is this four-cylinder, overhead-cam powerplant designed for its mini car. Enclosed in the dark cover on the front of the engine is a fiberglass-reinforced rubber timing belt that drives the camshaft. A detail of one of the cam lobes and valve setup is shown at left. The 140 cu.-in., 330-pound engine is unique in not needing iron cylinder liners; block is die-cast of high-silicon aluminum alloy, bores are etched and pistons have a microscopically thin iron coating to accomplish the feat







**STEERING COLUMN LOCK** on Chevy mini must be depressed before removing key to lock manual transmission

compacts, the new U.S. small cars and imports will reach 2.4 million units—just about evenly divided between domestic cars and foreign cars.”

The message that Chapin and the other powers of Piston Place want to get across is that the anti-Beetle machines and Toyota-tamers coming out of Detroit this year are not finger-in-the-dyke cars that will be kissed off in a year or two. The minis will not be orphaned because your friendly, neighborhood dealer, abetted by Detroit, prefers to push the big stuff, forcing the “peasants” to buy VWs.

That snobbish attitude unquestionably had something to do with the downgrading and eventual defeat of the compacts. But it wasn't the only reason Detroit ignored the demand for small cars. More importantly, American automakers have been saying for 20 years they can't compete against foreign wages. U.S. factory workers make three to four times as much as their counterparts on assembly lines overseas.

GM executives have been particularly vocal on this point. Now GM is determined to prove otherwise by putting up the most automated, untouched-by-human-hands assembly plant in the world at Lordstown, Ohio. Used to produce GM's small car, it will make extensive use of robot equipment. The robots, dubbed Unimates after the Bethel, Conn., company, Unimation, that produces the mechanical mannequins, are said to be about four feet high. Their “feet” are platforms rough-

ly 4 by 5 feet. According to one report—GM hasn't disclosed any particulars—the robots have arms 7 feet long. The “hand” can be equipped with a variety of devices, enabling the machine to duplicate anything a human hand can do.

The Unimates can be shifted from one operation to another after a single run-through to set up a new pattern for the machine to follow. GM reportedly hopes to attain a line speed of about 100 cars an hour at Lordstown. This is twice the speed at which most auto plants produce cars.

Ford is going a different route to bring labor costs on its small car in line with wages paid by the foreign firms it will be bucking for business. At least one and possibly two of the engines Ford will use in its mini will be made overseas, in Germany and/or England. Ford is also checking out the possibility of producing parts in Japan.

If your reaction to all this is an unconcealed yawn—who cares about the problems the car companies have building automobiles to a price to compete with Europe and Japan?—don't make the mistake Detroit made with the compacts—writing off the minis because they don't do anything for your adrenal glands. The new generation of miniatures is almost certain to have an impact on the type car you buy next, and possibly on what you pay for it. And it isn't too farfetched to speculate that the hot-selling Gremlin and the other up-and-comers could

*(Please turn to page 192)*





# The Face in the Mustang Window

**T**OWARD 4:00 O'CLOCK on Saturday afternoon, Feb. 21, 1970, in Miami, Mark Smith, 17, drove a friend's Mach I Mustang to the edge of a seawall at the Sky Harbor Marina to wash it. Mark gets spending money by washing cars. His father runs the marina on Just Island in the Miami River near Northwest North River Drive.

His girl was in the car. Nancy Burns, 17, wanted to help, but she was wearing new purple slacks and a white top, and Mark didn't want her to get dirty. "All

right, I'll sit in the car," Nancy said.

She watched him uncoil a white rubber hose used by yachtsmen for washing down their decks. The car was a sleek 1969 fastback, bright blue. Its huge rear window sloped so that it was more skylight than window. Nancy was one of those sun-washed Florida blondes who look good in such cars. Full of fun and spunk, and cool, she was also a Red Cross-trained swimmer. Sitting in the right-hand bucket seat, she heard the hose splashing on the car and





**The water was 15 feet deep, muddy and murky, and time was running out on 17-year-old Nancy Burns**

By E. D. FALES JR. / Illustrations by Ed Valligursky

smiled at Mark through the window.

Mark had parked the Mustang at a 45° angle to the river. Its left front wheel, nearest the water, was resting on a three-foot-wide concrete seawall. The top of the wall was six feet above the water. The river was 15 feet deep. The car's other wheels were on the rich green grass of the marina.

The Mach I was dirty. It took Mark, working barefoot, a half hour to wash it. At 4:30 he coiled the hose and hung it on a piling. As he reached for a

JULY 1970

sponge he'd put in a bucket by the car's left side, he noticed Nancy had all of the windows shut tight. A few yards beyond the car, he saw his father working with a friend on his own 42-foot yacht, *Pocahontas*.

It was at this time that Nancy, bored with sitting in the car, reached for the radio switch. To get power to the radio you turn the ignition key left to the "accessory" position. By mistake she turned it right to "start."

Mark had just picked up the sponge;

89





"I've got to hang  
onto this car.  
It can't go!"

in amazement, he saw the Mustang crawl forward. A stick-shift model, it had been left in low gear and was being propelled by its starter motor. He grabbed the left door handle, got the door open and was trying to get his foot on the brake when he saw Nancy also try to reach it. Frantically, she swung her left leg across the console. What happened next could have happened with any car with a manual transmission. Somehow Nancy's foot pushed down on the accelerator. Mark felt the car leap ahead. He heard the unmistakable zroom of the big engine. Puffs of exhaust blew toward his father's green bungalow among the palms, 300 feet away. And the car began to go over the edge. The left front wheel went over first. Next, the right front wheel bumped over. Mark, trying to hold the car back by pulling on its door frame, heard the underpinnings scraping on the edge of the concrete. Then the car paused.

Standing on *Pocahontas*, Mark's father, John Smith, also saw the car move. Its rear wheels came off the ground, and the rear section began to lift. For seconds it teetered, no longer pushed by its rear wheels. Smith saw his son wrestling with the car, half in the door, half out. As it scratched forward, pulled down by the weight of the engine, its door brushed a tall wooden post, Miami River piling No. 135. The piling squeezed the door shut, shoving Mark outside. The car's nose tilted down more steeply.

There was no time to run around the tilting rear end to the other door. Mark thought, "I've got to hang onto this car. It can't go!" He hurled himself onto the top, smashing a dent in the roof. Headfirst, he dropped down on Nancy's side and fell to the concrete. The car was at a 45° angle, rear wheels spinning.

**It submerged  
like a  
sinking ship,  
tail up.**

In an instant, Mark recovered his footing, reached the door and was reaching into the cockpit for Nancy when the dive came. He was shouting: "Get out! Get out!" From the boat, his father, leaping ashore to help, saw the car stand almost on end, then slip slowly into the polluted river, like a sinking ship, tail up. The greenhouse-type rear window went down last except for the small patch of blue that was the Mach I's abbreviated trunk. A great gulp of air came up.

Then the water closed over the spot, and Mark was gone, too, dragged down with the car. When it hit the water, the pressure slammed the door shut, pinning his right foot to the doorframe, trapping him on the outside of the car.

It was approximately 4:32. Mark's father ran for his bungalow. Clawing at the telephone, he dialed "0" and pleaded, "Operator, call help—quick." He told her a car and two people had gone off the wall.

**M**IAAMI'S FIRE DEPARTMENT, under Chief Lawrence Kenney, holds the national Class 1 rating, an honor

POPULAR MECHANICS



shared only with Los Angeles, Memphis and Bakersfield. When trouble strikes, it *clicks*. An "EM" alarm—three bells—clanged in Miami's West Side Station 16 on W. 23rd St. The "EM" also rang in Rescue Two Station two miles farther north.

An "EM" is an emergency rescue call. Ladder 16, noted officially as Lad 16, siren hooting, roared out at 4:33, followed by Eng 16. On the left footboard of Lad 16 rode Fireman Larry Norton, a former lifeguard. The radio call that followed the alarm had said two persons had sunk with a car. Norton was thinking, "Someone will die. When several people go in with a car, someone always does."

Holding on with one hand, he began to untie his shoes. It was a rough run, three-quarters of a mile through narrow streets. In mid-position on the tailboard, Fireman Dan Green also loosened his shoes and handed his watch to a buddy.

A mile away Police Accident Investigation Officer Dieter Buerger was returning from an auto crash when he heard the "EM." He stopped his car on Miami's busy 20th St., thinking: "The Fire Department's Rescue Two will be coming this way."

Lad 16 and Eng 16 reached the marina in three minutes. The trucks were blocked by a weak bridge, so the men jumped off and ran. They saw people milling around the marina seawall. Kicking off their shoes, but still clad in shirts and trousers, they began to dive off the dock, one by one.

Back on 20th St. Officer Buerger waited until he heard Rescue Two. He cleared an intersection, let them pass, then roared ahead to clear others. The bulky van, full of scuba gear, oxygen tanks and other rescue equipment, reached the marina just two minutes behind the trucks. The lighter van came straight across the weakened bridge. Frantic people were pointing to the river. Its two-man crew saw only a few bubbles—and a rope.

**W**HEN THE CAR dragged Mark underwater, the door tightened like a clamp on his foot. He fought hard to kick free, but the door refused to yield. A white turtleneck sweater, heavy with water, imprisoned his arms.

Choking, he managed to pull his right foot away, only to discover that he was still trapped by his left pants leg. He pulled and tore the cloth until it finally broke loose from the door, then he swam to the surface.

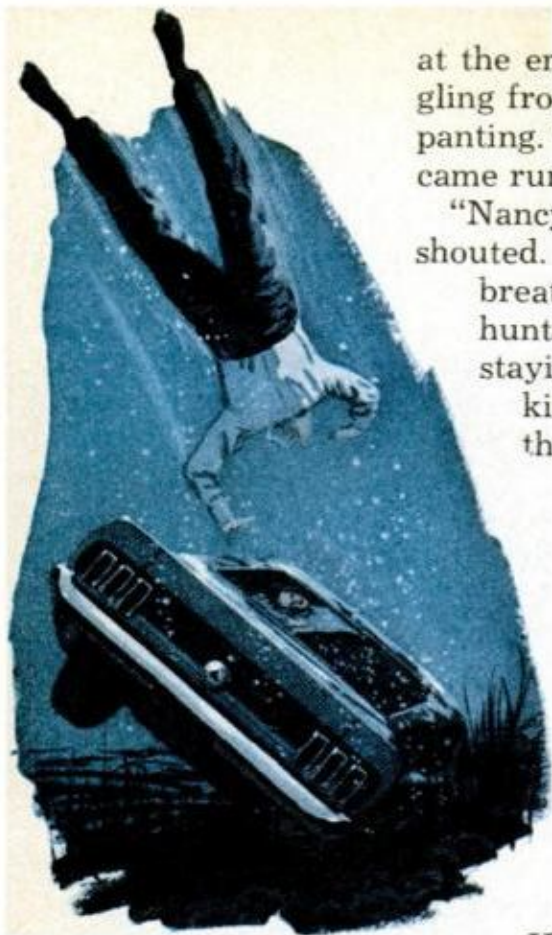
His right foot was badly bruised and cut. As he surfaced, he looked

**Norton was thinking, "When several people go in with a car, someone always dies."**

**AFTER THE ORDEAL:** Mark Smith (at left), Nancy Burns and her rescuer, Larry Norton







He knew he had to work fast. It took three seconds to find the driver's door.

**"The car went in the river. My girl's in it!"**

at the empty dock. He saw an eight-foot piece of rope dangling from pile 135. He grabbed it, hiked himself up and lay panting. Then he was on his feet, wild with anxiety. People came running.

"Nancy's down there. Somebody's got to get her!" he shouted. He stripped off the wet sweater, gulped a few breaths, and dove, swimming down in broad arm sweeps, hunting the car. He failed to find it, and went deeper, staying under until his lungs nearly burst. Then he kicked to the surface and again dragged himself up the rope. There was little chance Nancy was alive now.

He felt sick and confused. "I don't know what I'm going to do," he thought, "What should I do?" He paced the wall, shaking like a leaf.

Among those who now ran up was an Australian yachtsman, Desmond Batts. He had a coil of half-inch nylon line. When Mark saw the rope he knew it would never lift the car. Then he remembered: Working under a houseboat nearby, trying to find a leak, was a diver whose name he did not know. As it happened, the houseboat belonged to his friend, Bruce Johnson, whose car he had been washing.

He ran a block to the houseboat. When he saw Bruce he gasped, "I need your diver—quick. Your car went in the river. My girl's in it." The diver walked over, and Mark's heart sank. He'd taken off his gear.

Then came, for Mark, one of those Alice-in-Wonderland moments that occur during disaster when no one seems to move or do anything. Time stopped. He heard his friend turn to his wife and ask, "What did he say?"

"Bruce thinks I'm kidding," Mark realized.

"But it's real," he said. "Your car went in the river, and Nancy's in it. She's been down a long time. Come on!"

Still unbelieving, the two men came. They must have run; to Mark they seemed to be strolling. Abruptly he remembered there were two heavy diving tanks at his father's house. Shaking, weak, he ran to the bungalow, hefted 72 pounds of tanks and ran with them to the dock. The diver was already in the water. He came up, unable to find the car.

Then the Australian tried. Tying his rope to the piling, he threw the coil, then dove in. It was this man, Desmond Batts, who first found the car. It lay invisible in murky blackness, 15 feet down. By feel, he knew one door faced up. He pulled but it wouldn't budge. He tied the rope to the door handle and came up. Someone took the rope and ran it to the rear bumper of a Chevrolet. Someone else started the car. The rope tightened, then snapped.

Mark wanted to dive again, but he was in such obvious shock and exhaustion that friends held him back. He knew it was all over. If any air had remained, Nancy would have used it all now.

Then he saw firemen and police coming on the run. Ar-



iving close together, they found confusion. No one really knew what had happened. Some told them no one was in the car. Fireman Dan Green called, "Where's the car? Is anybody in it?" Mark yelled: "My girl's in it!" and pointed to bubbles still coming up. Another fireman, Bob Lane, dove in first. Dan Green almost landed on him.

Lane, thin, serious-faced, descended along the rope left by the Australian. He couldn't see the car but found the latch and tried to open the door. It wouldn't budge. He went up, got air, came down again, but still the door resisted. He went up again, saw three firemen now in the water: Sam Givens, Paul Dammann and Green. They took turns going up and down the rope. Just before Green dove, someone passed down a hammer. Others shouted, "Don't break the window! There may still be air!"

When Dan Green dove he, too, found the door jammed. He could tell that it was the driver's door. Puzzled, he thought, "Well, we've got to break the window." He gave one more try and found why the door was resisting. *He was standing on it.* The car, then, must be tipped up on the right side. But when he got his own weight clear and tried again, the door still wouldn't budge. The knot on the handle was blocking the latch-release button.

To cut the rope would free the button, but divers might no longer be able to find the car. Further, he knew that the current was starting to tug at the car. Without the rope, it might slip away.

He went up again. A wrecker had arrived; a hook and cable were being lowered. They'd have to smash the window, insert the hook and rip the door open. Paul Dammann, a skilled underwater man, was putting on a tank. The rescue squad now was passing out wet-suits, foot-fins and masks.

But, meanwhile, Fireman Larry Norton, medium height, wiry, black-haired, the former lifeguard, had begun a remarkable series of eight dives—without mask, fins or tank.

**W**HEN NANCY BURNS, sitting in the Mach I at the marina, felt the car move, she lunged in vain for the brake. She felt the front wheels bump over the wall. The car began to tilt.

She thought, "*Too late!*" She saw Mark's startled face at the driver's door, saw him pushed aside by the piling. Next she heard him on top; denting the roof. Her left hand hurt. She'd injured it somehow.

As the car tilted, she braced her feet and leaned back. Then she saw Mark's blue-jeaned legs outside the right window. He was clinging to the car and opening her door. She heard him call, "Get out!" and she started to obey. But she realized the door was closing and would trap her. "I'll never make it," she

**"Don't break the window! There may still be air!"**

*He fought for a footing to kick off sharply and push her to the surface.*





thought. The door slammed on Mark's foot and she saw it dragging Mark into the water.

She saw waves coming up the windshield. She was standing on the firewall now, then on the dashboard. She saw the sudden dark, the awful dirtiness of the water. And then the door closed. "Mark's gone," she told herself. It began to be a dream. After Red Cross lifesaving, she had sometimes dreamed she herself was drowning. This was that dream again.

Then she remembered the "bubble of air." In an "all-emergencies" course at Shenandoah Junior High she had been told that a bubble of air may remain trapped in a car. She'd also been taught: "*Stay calm in any emergency.*" It got darker. Water rose around her waist and chest. When it got over her head the "bubble of air" began to seem theoretical. It dawned on her that she had only a short time to live.

She was surprised to realize that the sinking had been no great thing. The car had not made much of a splash. She thought, "It was smooth and easy, like a good diver entering the water." The car descended like a slow elevator. She was not aware when it hit bottom, perhaps because the Miami River, like most city rivers, has no firm bottom, only layers of spongy filth.

Nor did the water come in with a rush. It came in fast, but *where* it was coming from she could not tell. Certainly it was pouring in through the air vents, the small cockpit-to-engine apertures and her door, which seemed not to be latched tight. When water reached her shoulder, she thought, "It's rising above me and is taking me up with it. I'm floating." In the blackness she lost her sense of up. She did not know that the car had turned on the passenger side, burying her door deep in slime.

She tried to swim to the rear of the car but found her way blocked by the headrests, which reached almost to the roof. She tried to remove them but decided they were locked in place. Holding her breath, she turned on her side and squeezed *between* the headrests. Her head was under water, but suddenly she rose to a clear place and could take a breath. She was in the back seat, against the left side. She knew she'd found the air bubble at last. Not knowing the car lay on its side, she was puzzled because there was air only behind the driver's seat. The bubble clung close under the roof and stretched back into the "greenhouse." She crawled farther up into this area.

For a few moments she lay against the back seat, floating and thinking. The car no longer seemed pitched so far forward; the water seemed to be coming in more slowly. She began to know more about the air bubble: it began down near her waist over the middle of the back seat and seemed about six feet long, two feet wide, 18 inches deep. Lying in the bubble, she could touch the submerged front seat with

**Nancy saw the sudden dark, the awful dirtiness of the water.**

**She tried to swim to the rear, but found the way blocked by the tall headrests.**

[\(Please turn to page 188\)](#)





### Portable car wash

Portapump is an English device that an apartment dweller can fill with 1½ gallons of water, pressurize with a hand pump and then carry to his car to wash it on the street.



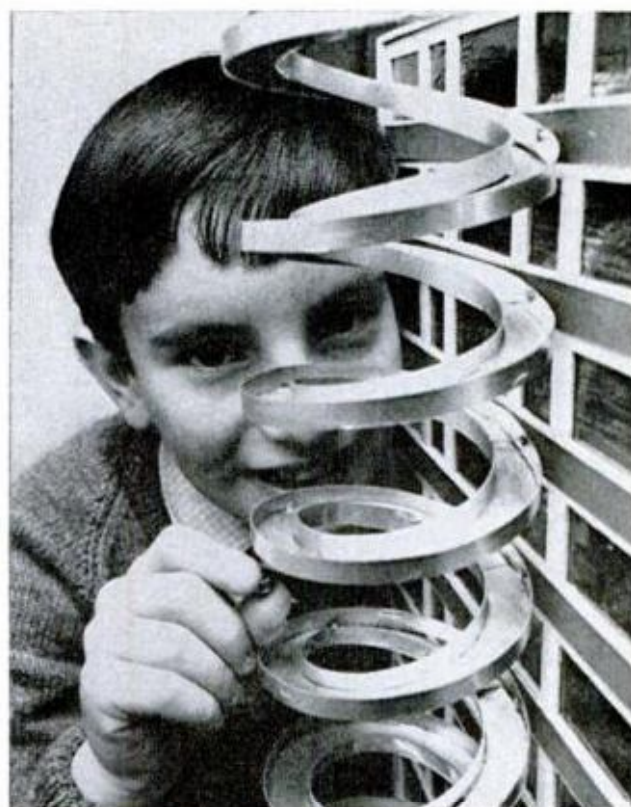
### Skiing without snow

For skiers who lack snow, Frenchman Raymond Laspales has invented skis on bicycle wheels. He found in tests that he could attain 37 mph on snowless slopes.



### Flies from Ireland to England

Shown at the beginning of his balloon flight from Ireland to England is Capt. Ray Munro of the Royal Canadian Air Force. Bad weather battered his balloon, but he made it.



### Spiral escape

Ten-year-old Richard Fane has roused the interest of English fire safety officials with his idea for a spiral fire escape. Occupants could get on the slide at each floor.





THE SCIENCE "WIRE SERVICE"—only organization of its kind in the world—is directed by Robert Citron

**A volcano erupts in the Philippines . . . a fireball streaks to earth in Europe—and word is flashed to the Center for Short-Lived Phenomena in Massachusetts**

# THE LAB THAT HOPS



THOUSANDS OF PHOTOS RECORDED ERUPTION of Mount Mayon, Philippines. Smoke cloud rose 30,000 feet





DEAD WHALES LITTER FLORIDA BEACH after herd drove ashore. Scientists at scene couldn't explain event

# ON 'HAPPENINGS'

By JOHN F. PEARSON  
Science Editor

**I**N 1963 THE EARTH'S CRUST cracked near Iceland and, amid explosions, hissing lava and awesome jets of steam, the island of Surtsey was born in the Atlantic Ocean.

It was an epochal event. Summoned by telephone and radio, American and Icelandic scientists rushed to the scene. For the first time in history, scientists were on hand to record the birth of a volcanic island and to lay the groundwork for unique geological and biological investigations. The beginnings of life on a barren rock could now be observed in a test tube called Surtsey.

The experience deeply impressed American scientists, who realized the event might have gone unreported had it occurred in a more remote part of the world. There was, they decided, a need for an international system to alert scientists quickly so they could "cover" unusual natural events while they were happening.

The idea didn't become reality until Jan., 1968, when an organization with a mouth-filling name—the Center for Short-Lived Phenomena—was established in Cambridge, Mass., sponsored by the Smithsonian Institution. Dr. Sidney Galler, the Smithsonian's assistant secretary for science, was the driving force behind the development.

JULY 1970



CLAY LANDSLIDE in Swedish wooded area cut off a road and blocked Norsalv River, causing flooding

The Center shares space in a building with the communications equipment of the Smithsonian's Astrophysical Observatory, which operates a clearinghouse of information about new astronomical discoveries.

Robert Citron, a former manager of

97



several Smithsonian satellite tracking stations overseas, was appointed director. Without a staff at the start, he swung into action just in time to disseminate reports on two volcanic eruptions—in the Pacific and in Antarctica.

Since then the Center has reported over 250 events, including earthquakes, landslides, volcanic eruptions, fireballs, meteorite falls, oil spills, fish kills, insect invasions, rare animal migrations and other phenomena. Events are numbered and given a title, which in some cases has the ring of a magazine cover line: *Amazon River Porpoise Disappearance, Japanese Bamboo Kill, Lost City Fireball, Victorian Mouse Plague.*

Initial reports come in from over 2000 correspondents in 122 countries, including Russia. If the report calls for immediate action, Bob Citron and his current staff of six get on the phone—the Center has nine lines—or send cables over 15 Teletypes at their disposal. According to Citron, they can contact almost any inhabited place in minutes.

Routine for all events, urgent or not, is the airmailing of an information report to correspondents and subscribers. A fast offset-printing operation makes it possible to have cards in the mail

within two hours after a report comes in. In 1969, over 500 different event cards were printed and a total of 390,000 mailed. Subscribers include libraries, museums, universities, news media and commercial enterprises.

Bob Citron, a calm, soft-spoken man in his late thirties, works in an office with an entire wall given over to a world map. On it, events are flagged. At his elbow is a battery of phones.

In an interview, I asked him to describe a typical "hot line" operation.

"Well, let's say a volcano erupts in Central America and a scientist there cables us," he said. "We, in turn, cable other scientists in the area and make inquiries by phone and radio. We contact U.S. installations in the particular country, requesting additional information on a continuing basis.

"We alert volcanologists and geophysicists all over the world, as well as biologists and ecologists who are particularly concerned about effects of volcanoes on plant and animal life."

The Center does what it can to help researchers attempting to reach an area. In some cases, Smithsonian scientists may fly to the scene of an event.

The Center maintains communica-

**OIL SPILLS** concern Center because of effects on sea life. Seal was victim of California oil spill



**ISLANDS ARE SOMETIMES FORMED** by submarine volcanic eruptions like this one in the South Pacific





tions with the area throughout the lifetime of the event, relaying daily status reports to scientists. Once the event is over, it issues a final summary.

In April, 1968, Mount Mayon, an 8000-foot volcano on the island of Luzon, the Philippines, began "spewing steam and molten lava and shooting balls of fire 3000 feet into the air," causing the evacuation of 70,000 people.

The Center maintained contact with the area during the several weeks the eruptions lasted. A Smithsonian volcanologist flew to the Philippines and spent nine days observing and collecting samples. He came back with a raft of dramatic pictures, many taken by a cooperating U.S. Air Force photo team. In all, the Center issued 35 event information cards on the eruption.

The Center really buzzes when a report involves a fireball. This phenomenon occurs when a large particle from space enters Earth's atmosphere at a relatively slow speed. It burns, creating a fiery trail of great brilliance. Part of it may survive and hit Earth.

The Lost City Fireball—Jan., 1970—was spotted by the cameras of the Smithsonian Astrophysical Observatory's Prairie Network—a system of 16

**ONLY SURE WAY** to kill Pacific starfish is by chemical injection. Starfish threaten coral reefs



JULY 1970

The image shows three overlapping event notification cards. Each card has a header with 'EVENT' and a date. The top card is for 'MOUNT MAYON VOLCANIC ERUPTION' on '06 JANUARY 1970'. The middle card is for 'FLORIDA REACHED MALE MORTALITY' on '11 JANUARY 1970'. The bottom card is for 'VICTIMIAN WIDE PLATE' on '21 JANUARY 1970'. Each card contains a brief description of the event and a form with fields for 'TYPE OF EVENT', 'DATE OF OCCURRENCE', 'LOCATION OF EVENT', 'CENTRAL AMERICA', 'REPORTING SOURCE', and 'DEPARTMENT OF GEOLOGY, BAYNE STATE UNIVERSITY'. The bottom card also includes 'SMITHSONIAN INSTITUTION' and 'LAWRENCE R. KING' as the reporting source.

**EVENT NOTIFICATION CARDS** are printed by a high-speed process and airmailed to list of subscribers

unmanned Midwest camera stations.

Dr. Richard McCrosky, network science director, used photos from two widely separated camera stations to calculate the fireball's path. He plotted the probable point of impact near Lost City, Okla.

Gunther Schwartz, field manager of a camera station at Lincoln, Neb., drove 450 miles to Lost City, and found a meteorite on a road less than half a mile from the predicted impact point. Snow that covered the rest of the road had melted around the 22-pound "stone." It had a "black, burnt crust," Schwartz reported, "and was like no other rock in the area." Two other pieces of meteorite were found nearby.

Earlier, the Center had been instrumental in the recovery of five other fresh-fallen meteorites in different areas. Quick recovery is important; it allows study of a meteorite before its low-level radioactivity is dissipated.

Reports disseminated by the Center helped generate concern about a population explosion among the "crown of

*(Please turn to page 195)*

99



# Could





# Lightning Strike Your Boat?

**Sudden summer storms pose a burning threat to all boaters**

By JIM MARTENHOFF

*Illustration by Ed Valigursky*

IT WAS A SNUG ANCHORAGE, and the couple aboard the sloop paid small heed to darkening skies. The man routinely checked his anchor line as rising winds whipped sheets of rain against the boat, and the rumble of thunder echoed in the cove. He rejoined his wife in the cozy cabin below.

Their sense of security was suddenly shattered by an ear-cracking clap of thunder and a brilliant, blue flash as lightning struck the sailboat's tall mast.

The bolt ran down mast and shrouds, fusing turnbuckles and hardware, burning, scarring—jumped to the chainplates, knocking a hole in the hull above the waterline, and then discharged into the water. Side flashes destroyed navigational lights and burned out all wiring.

The man and his wife were unharmed, but they described their experience as "terrifying." It was also expensive. Dam-

age was heavy and the repair bill high.

This incident is not rare. Boats, especially sailing craft with tall masts, virtually invite lightning. In the days of wooden ships and iron men, the British Navy counted 58 warships damaged by lightning in one five-year period.

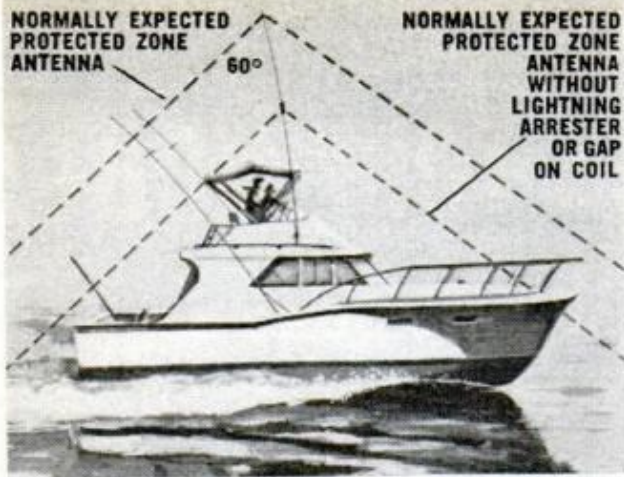
Kite-flying Ben Franklin solved the problem when he invented the lightning rod and suggested its use by ships. The earliest naval version was a copper chain hoisted to the masthead during electrical storms. The lower end dangled over the side into the water.

Captain Cook had such a chain aboard during one of his voyages of exploration and described how it "conducted the lightning over the side" without harm, while a nearby Dutch vessel in the same anchorage had her masts "shivered to pieces."

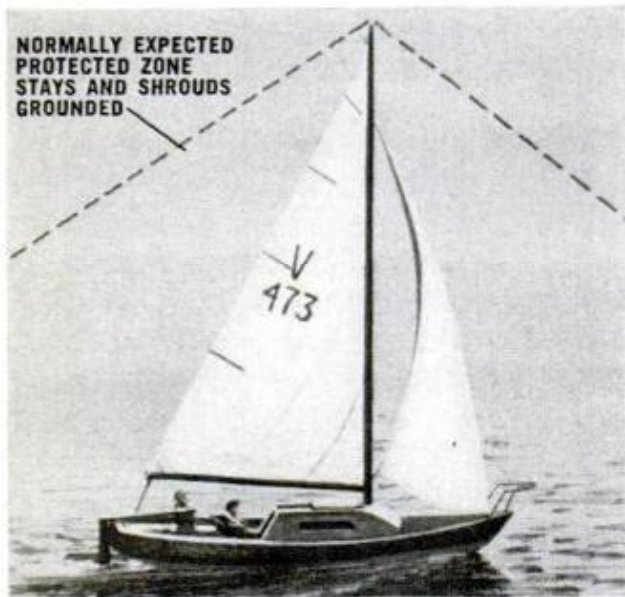
Today's boating boom is reviving the







**ANTENNA OR MAST-EQUIPPED BOATS** have built-in safety cones for lightning protection ranging from 60° to 45° angles. Latter is nearly 100 percent safe



**LIGHTNING PROTECTION IS ASSURED** in small sailboat with such commercial aids as this "deStriker"



problem. As more boats join the nation's recreational fleet the number struck by lightning increases. Damage can be extensive, but fortunately, loss of life is rare. In fact, there are no figures on such fatalities. The Department of Health, Education and Welfare lists only 110 deaths due to lightning in 1966, the last year for which they have published statistics. Only 24 of those deaths were in "recreational and sports" activities, which includes anything from golf to camping.

However, what evidence is available suggests that fishermen are more apt to be killed by lightning than almost any other outdoor group. Wet fishing rods held aloft during storms invite lightning. All tall objects—radio antennas, masts, fishing outriggers—are vulnerable. The taller the object, the greater the hazard. It has been calculated that the electrical potential of a tall object is roughly equivalent to 150 volts for every 36 inches. Thus, a six-foot man has a difference in potential between head and feet of almost 300 volts.

No boat owner can afford to ignore the possibility of a lightning strike. But how do you protect yourself? Ben Franklin suggested the answer: "Vessels . . . having a sharp pointed rod fix'd on the top of their masts, with a wire from the foot of the rod reaching down, round one of the shrouds, to the water, will not be hurt by lightning."

Ships in his day were of wood, and all rigging was rope. But today nearly every sailboat has metallic standing rigging, and lightning protection has been simplified. The backstays, forestays and shrouds serve as conductors. Connect them electrically at the lower end and ground them overside. If the rudder is metal, the system can be grounded to the rudder post. Or perhaps a metal centerboard will serve.

A grounded conductor, or a lightning-protective mast, will generally divert to itself direct hits which might otherwise fall within a cone-shaped space, the apex of which is the top of the conductor or lightning-protective



## LIGHTNING SAFETY STANDARDS

Does your boat meet the standards for lightning protection brought out by the following questions and answers provided by the American Boat and Yacht Council in its *Safety Standards for Small Craft*? (Copies of this publication are available for \$5 from ABYC, 15 E. 26th St., Room 1603, New York, N.Y. 10010.)

**Q.** What is the general principle underlying a lightning protection system?

**A.** A grounded conductor, or lightning protective mast, will generally divert to itself direct hits which might otherwise fall within a cone-shaped space, the apex of which is the top of the conductor or lightning protective mast and the base is a circle at the surface of the water having a radius of approximately two times the height of the conductor.

**Q.** What degree of protection can you expect from a grounded conductor or lightning protection mast?

**A.** The probability of protection is considered to be 99.0 percent for a 60° angle measured from the centerline of the cone's apex to the cone's surface and 99.9 percent when height of the mast is increased so that the 60° angle becomes 45°.

**Q.** How heavy should the conductor be and how should it be led?

**A.** To provide an adequately grounded

conductor or lightning protective mast, the entire circuit from the top of the mast to the ground should have a conduction equivalent to a No. 8 AWG copper conductor and the path to ground followed by the conductor should be effectively straight.

**Q.** How can you reduce side flashes?

**A.** If there are metal objects of considerable size within a few feet of the grounding conductor, there will be a strong tendency for sparks or side flashes to jump from the grounding conductor to the metal object at the closest point. To prevent damage from such side flashes, an interconnecting conductor should be provided at all places where they are likely to occur.

**Q.** How can you protect a small boat from lightning?

**A.** Small boats may be protected by means of a temporary lightning protective mast which may be erected under lightning conditions. Grounding provisions may be made by means of flexible copper wire and a submerged ground plate of approximately one square foot in area.

mast and the base of which is a circle at the surface of the water having a radius of approximately two times the height of the conductor. The probability of protection is considered to be 99.0 percent for the 60° angle shown in the illustration. The probability of protection can be increased to 99.9 percent by increasing the height of the mast so the 60° angle becomes 45°.

Even grounding a single pair of metal shrouds or stays may be enough to protect the boat. Your protection might be as simple as a length of No. 8 AWG copper wire clamped to the lower end of the stays and dangled overboard.

This system has the advantage of being simple and easily rigged when needed. But there's a serious disadvantage: If you delay and lightning strikes while you're in the process of clamping

on the cable, you could be killed. Three sailors in America's infant Navy were killed by lightning while in the act of hoisting Dr. Franklin's electrical chain to the masthead.

To save yourself from injury, better have a permanent system installed, including a connection for the tracks on the mast and boom to the common ground. Be careful in making joins not to form a galvanic couple that will accelerate corrosion.

Powerboats with radio antennas also have built-in protection. But the antenna should have a transmitting-type lightning arrester. Also, check the loading coil on the antenna. It must have a bypass gap. If it doesn't, your protective "mast" ends at the coil.

On some cruisers, even small ones, there may be a decorative mast used

*(Please turn to page 191)*





# How the Jets Kicked the Smoking Habit

COMPOSITE PHOTO shows 727's black exhaust on take-off and "clean" 727 after JT8D engines were modified

By MORT SCHULTZ

**I**F AIR POLLUTION fighters win, all jet engines will soon be virtually smokeless. The first one to be successfully redesigned is the Pratt & Whitney JT8D, the most widely used aircraft engine. More than 5000 of them are in use on Boeing 727s and 737s, Douglas DC-9s and Sud Aviation Caravelles.

Smoking was reduced by redesigning the combustion chamber so that pockets of rich fuel could be safely leaned out. This chamber, between compressors and turbine in the JT8D, consists of nine cans—or combustors—arranged around the engine. Since February, all new JT8Ds have been equipped with redesigned burner cans.

Engineers are now seeking to make JT3D engines—used by Boeing 707s and 720s, and Douglas DC-8s—less smoky. The answer to the smoke problem is the same as for the JT8D; that is,

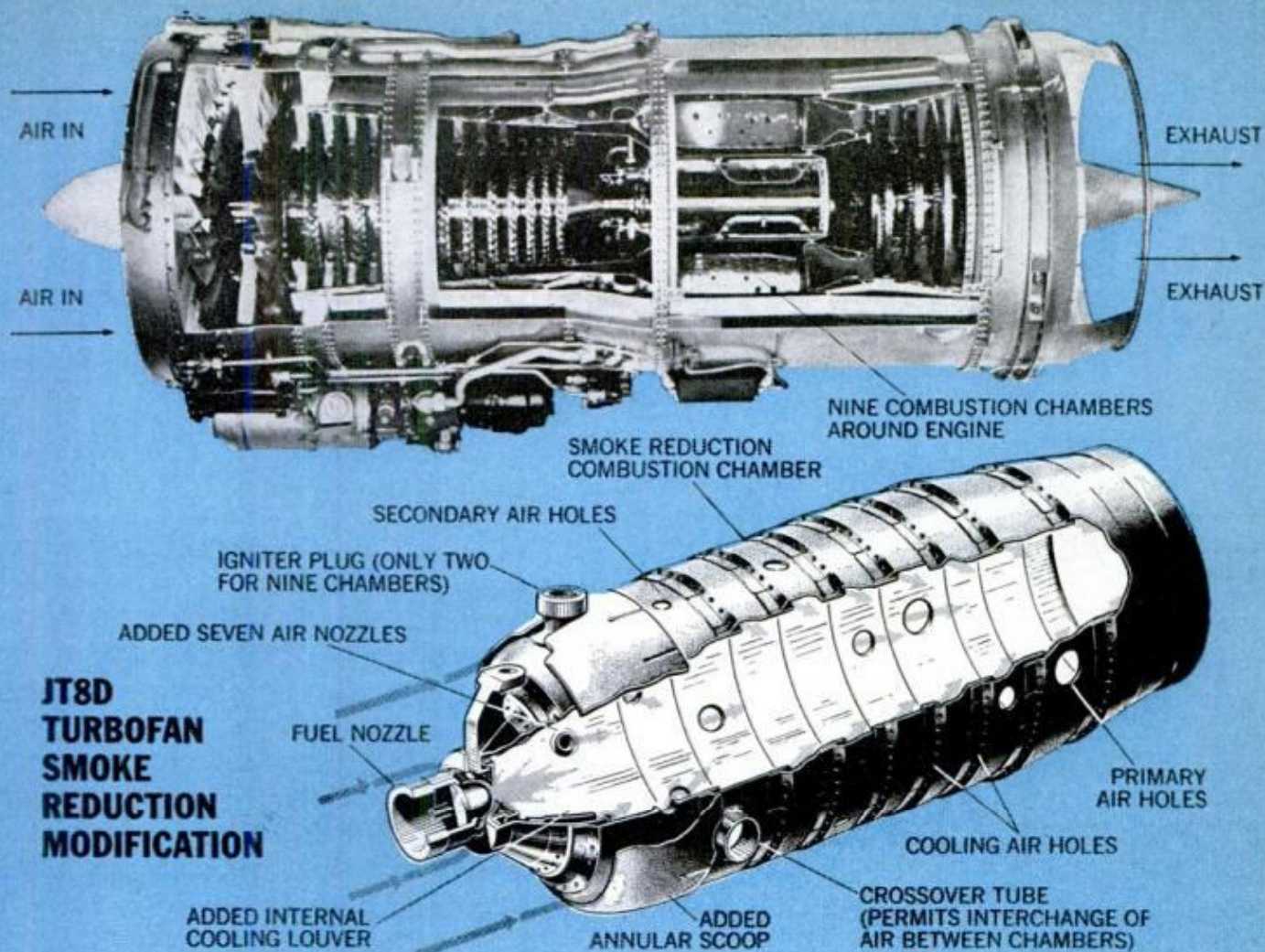
you redesign the combustion chamber to lean out rich fuel pockets. But the JT3D burner section is different, so the job presents new problems.

For instance, engineers must determine just how much air to mix with the fuel. This is critical—the wrong combination can produce starting and stalling problems. And what would happen if a flameout occurred at 30,000 feet? Would the engine be hard to restart?

Engineers weren't sure so they experimented. Changing to other fuels, such as naphtha with a fuel additive, was unsuccessful. One additive that reduced smoke—a manganese-based material called CI-2—left hard deposits on fuel nozzles and turbine vanes and blades that could be removed only after the engine had been torn down.

There was one other way to reduce smoke—redesign the burner can. It





took four years, but the solution is surprisingly simple.

The new burner has seven tubes and an annular scoop to direct more air inside the can. The fuel nozzle has also been redesigned for an increased supply of air and a change in the airflow pattern that leans out the fuel-rich pockets in the burner can's primary zone where injected fuel is first burned.

Smoke results when these pockets, starved for air, cause the fuel to decompose and produce carbon particles.

"We had to lick such problems as determining the exact size of the tubes, how many to make, where to put them, and the distance of the air scoop from the can's body," says Joe Faitani of Pratt & Whitney, one of the chief engineers on the project.

"If the tubes were too small, there would be too much smoke. If too large, we would lean out the fuel-rich pock-

*(Please turn to page 199)*



PRATT & WHITNEY ENGINEER indicates annular scoop added to the old combustion chamber (right)



# Good Goer, Great Looker, but Only Average Workmanship

By MICHAEL LAMM, West Coast Auto Editor / Photos by the Author



SOME OWNERS wanted side trim to guard against parking nicks. Others said tire spray sandblasts paint

**T**HIS YEAR, Cougar and Mustang are not the look-alikes they used to be, and while they still share plenty of basics, there's no doubt which is which.

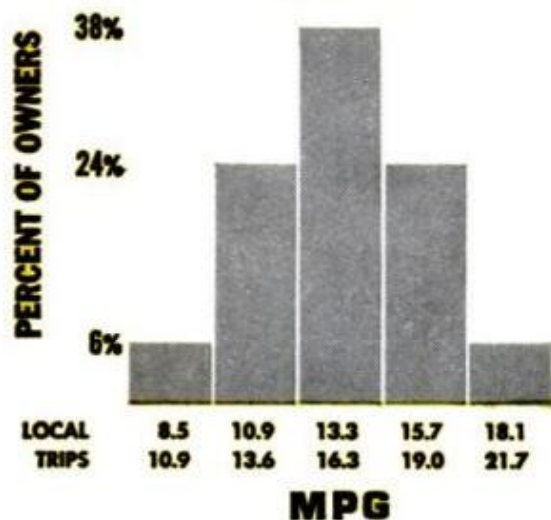
Aside from obvious styling differences, the Cougar is longer (8.7 inches) wider (3.6 inches), roughly 400 pounds heavier due in part to more insulation and sound-deadening. The standard

Cougar also costs nearly \$400 more than the base Mustang, but for that you get the two-barrel, 351-cu.-in. V8 instead of Mustang's 200-cu.-in. Six, more luxurious appointments, greater silence and, presumably, more prestige.

For 1970, the Cougar comes in three series: Standard, XR-7 and Eliminator. The XR-7 is essentially a trim-and-insignia group incorporating grille changes, full instrumentation, leather seat trim and more deluxe interior decor. Yet the XR-7 shares all the standard Cougar's mechanical aspects, with no unique engines or special power equipment.

The Eliminator offers engines and performance options unavailable elsewhere in the line, including five distinct powerplants. There's the Boss 302 at 290 bhp, the re-engineered 351 at 300 bhp (as against 250 for the standard 351), two versions of the ground-shaking 428 and the limited-production, 375-bhp 429. You pay for all these, naturally, which may explain

**COUGAR FUEL MILEAGE CHART**  
 351-cu.-in. V8







**XR-7 CONTAINS** full complement of gauges, including tachometer and an invisible (to driver) rally clock



**NO TRUNK ROOM**, as usual, but few complained. In California it's even smaller due to evap control

the small percentage (2.7) of Eliminator owners in our survey.

Most Cougar owners have only praise for their cars. Complaints tend to be minor. Even workmanship complaints, which top the list of gripes, were largely for failure to measure up to the complaining owners' expectations.

We've decided to let Cougar owners tell the story in their own words since this worked well with the 1970 Mustang Owners Report (page 128, May PM). Again, we've tried to balance questionnaires for a fair sampling. Questions are in italics; owner comments in roman (regular) type.

Our first questionnaire comes from a U.S. Navy officer stationed in San Francisco. *Mechanical troubles?* Yes, buzzer that signals when lights are on (when opening door), continues to buzz while driving at night. Also power steering squeals when wheel is turned to full lock. *Repairs satisfactory?* Haven't taken car in yet—5041 miles. Have to make appointment and leave car all day. Big bother. *How do you rate your dealer?* Satisfactory. A bit pushy, like most. *Why did you buy a Cougar?* Mainly size, but looks and high resale value also. Very impressed with interior. *How's workmanship?* Good, but not much better than others. Numerous small things can be seen, such as misaligned parts, but nothing major. *Is Cougar comfortable?* Front, yes; rear, something else. All but impossible back there. *Specific complaints?* Inaccessible controls, especially heater and air knobs. *Specific*

*praises?* Style, maneuverability, size, handling, long-distance comfort.

Here's one from a 25-year-old Ohio schoolmarm. *Mechanical troubles?* None except loose connection at taillight, squeaky brakes. *Repairs okay?* Excellent. *Dealer?* Superb. I am a novice, too. *Why Cougar?* Wanted a solid car that would withstand an accident and not fold up like an accordion. Also wanted sporty looks and luxurious interior. *Workmanship?* Superbly crafted. Interior is like a baby Continental. *Comfort?* Plus-super-comfortable. Cougar outdid itself on the seats. Cocoon-type seatback saved me from whiplash. Was rammed in back on expressway by a BIG Pontiac. Seats and seatbelts saved me. *Complaints?* Engine starts a little rough. *Praises?* Solid body construction, excellent performance, engine provides leeway for escaping expressway near-misses. Beautiful interior enhances pride.

A young California architectural engineer had this to say. *Mechanical troubles?* Noisy clutch on airconditioner compressor. *Repairs satisfactory?* No. They said they replaced compressor but obviously did not. Will take it back. This is warranty work. *Dealer?* Very courteous, fair sales methods. On service, same old story. If owner pays, good work; if warranty pays, work is unsatisfactory. *Why Cougar?* Best of its kind. *Workmanship?* No new car has quality of five years ago, but for now it's better than any U.S. car made. *Comfort?* Needs more room. I'm 6-4, 225 pounds. *Complaints?* Dealer em-

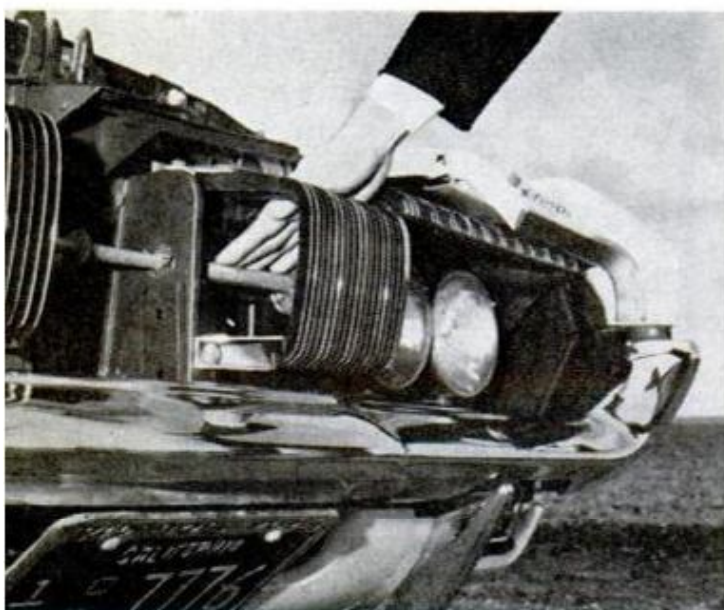




**COMPETITION HANDLING PACKAGE** costs \$31, adds to cornering power but makes soft ride a bit harsh



**XR-7 HAS MAP POCKETS** on seatbacks, leather upholstery trim, sumptuous interior, cramped rear area



**VACUUM OPENS** headlight doors, with enough reserve for six winks after engine is shut off. Lids are connected by rod, so if one sticks, other does too

108

plays small-minded people in service department. When paying over \$4000 for a car, you expect warranty to be honored—not a lot of runaround.

Here's a joint reply by both parents of a teenaged daughter owner in Kansas. The car is a 429-cu.-in. Eliminator, the mother a housewife, her husband a physician. *Mechanical trouble?* Hard to start—have to choke it. *Dealer?* He is excellent to us. He ought to be—we also own a Continental, Ford wagon, and Mustang. *Why Cougar?* Heavier car. Style. Our daughter wanted four on the floor. We bought the Cougar for her. She loves it. I would never buy one for myself [mother speaking]. That, kids, is a real generation gap. *Workmanship?* Good. *Comfort?* Front, fine; rear, rotten. I [dad speaking] have yet to see a two-door with room in the back seat. We traded a Mark III because of that. *Complaints?* This car has strictly a racing-car motor. We knew this when we bought it. Too hard to start. Dad says he wouldn't have it if they gave it to him. Teen-aged son wanted one, too, but doesn't like console, so he is going for a new LTD. *Praises?* Looks.

Following are comments from an Ohio psychologist who owns a 351 convertible with four-speed. *Mechanical*



**INERTIA CATCH** in seatbelt doesn't always reel end back properly, so it catches in door or seat. The seatback release is placed awkwardly near floor

POPULAR MECHANICS





**COUGAR'S RELATIVELY LIGHT REAR** breaks away easily on gravel, ice. Owners like sequential turn signals

*troubles?* Clutch assembly improperly put together. *Repairs okay?* Clutch plate and entire linkage replaced free. Took two trips, though. Clutch still not entirely satisfactory. *Dealer?* He tries hard but has incompetent help. *Why Cougar?* Better price than Mustang. Also have been happy with my four-door Merc. *Workmanship?* Very good. *Comfort?* No complaints although rear

seat is cramped. But I bought Cougar essentially as a two-passenger car. *Complaints?* Four-speed trans should have reverse trigger. Too easy to stuff in reverse by mistake. *Praises?* Sharp looking, handles well, comfortable to drive.

A Minnesota accountant puts it thus: *Mechanical troubles?* Starter drive

*(Please turn to page 193)*

### Summary of 1970 Cougar Owners Reports\*

**Total miles driven** ..... 1,297,287

**Average miles per gallon:**

351-cu.-in. V8,  
local driving 13.3  
long trips 16.3

**Engines:**

302-cu.-in. V8 ..... 4.3%  
351-cu.-in. V8 ..... 91.7%  
428-cu.-in. V8 ..... 3.2%  
429-cu.-in. V8 ..... 0.7%

**Transmissions:**

Automatic ..... 91.5%  
3-speed manual ..... 4.4%  
4-speed manual ..... 4.0%

**Body styles:**

2-door hardtop ..... 89.6%  
Convertibles ..... 10.4%

**Series:**

Std. Cougar ..... 57.6%  
Cougar XR-7 ..... 39.7%  
Eliminator ..... 2.7%

**Why the Cougar?**

Style ..... 71.2%  
Size ..... 20.5%  
Past experience ..... 10.1%  
Performance ..... 8.6%  
Handling ..... 7.2%  
Reputation ..... 4.7%

**Specific likes:**

Styling ..... 58.7%  
Handling ..... 52.2%  
Comfort ..... 33.3%  
Ride ..... 24.4%  
Performance ..... 17.8%

Power ..... 11.6%  
Size ..... 9.1%

**Specific dislikes:**

Workmanship ..... 12.4%  
Gas mileage ..... 11.2%  
Rattles ..... 6.6%  
Rear legroom ..... 6.2%  
Trunk space ..... 5.8%  
Headroom ..... 4.6%  
Glovebox size ..... 4.6%  
Rear visibility ..... 4.6%

**What changes would you like?**

More legroom ..... 9.0%  
Seat style ..... 8.6%  
Ashtray location ..... 8.6%  
Dash layout ..... 6.9%  
Transmission ..... 6.9%  
Better workmanship ..... 5.3%  
Front vent panes ..... 4.5%

**Had any mechanical troubles?**

No ..... 62.7%  
Yes ..... 37.3%

**What kind of trouble?**

Electrical ..... 24.3%  
Carburetor ..... 9.7%  
Power steering ..... 8.7%  
Transmission ..... 5.8%  
Airconditioning ..... 5.8%  
Brakes ..... 5.8%

**Did you repair it yourself?**

No ..... 97.1%  
Yes ..... 2.9%

**Dealer repairs satisfactory?**

Yes ..... 65.6%  
No ..... 34.4%

**Is the Cougar your only car?**

No ..... 58.4%  
Yes ..... 41.6%

**Other cars owned:**

Ford (full-sized) ..... 27.2%  
Mercury ..... 23.4%  
Chevrolet products ..... 13.9%  
Falcon ..... 8.9%  
Lincoln ..... 8.2%  
Oldsmobile ..... 5.7%  
Mustang ..... 5.7%  
Miscellaneous ..... 7.0%

**Accessories/power options:**

Automatic trans ..... 91.5%  
Power steering ..... 66.8%  
Radio ..... 62.5%  
Power brakes ..... 54.2%  
Airconditioning ..... 48.6%  
Stereo tape deck ..... 27.7%  
Vinyl top ..... 24.5%  
Console ..... 21.3%  
Tinted glass ..... 18.6%

**What accessories/options would you order next time?**

The same ..... 68.4%  
Airconditioning ..... 10.3%  
Stereo tape ..... 7.0%  
FM radio ..... 5.2%  
Tilt steering wheel ..... 3.7%  
Power brakes ..... 2.9%

**Age distribution of owners:**

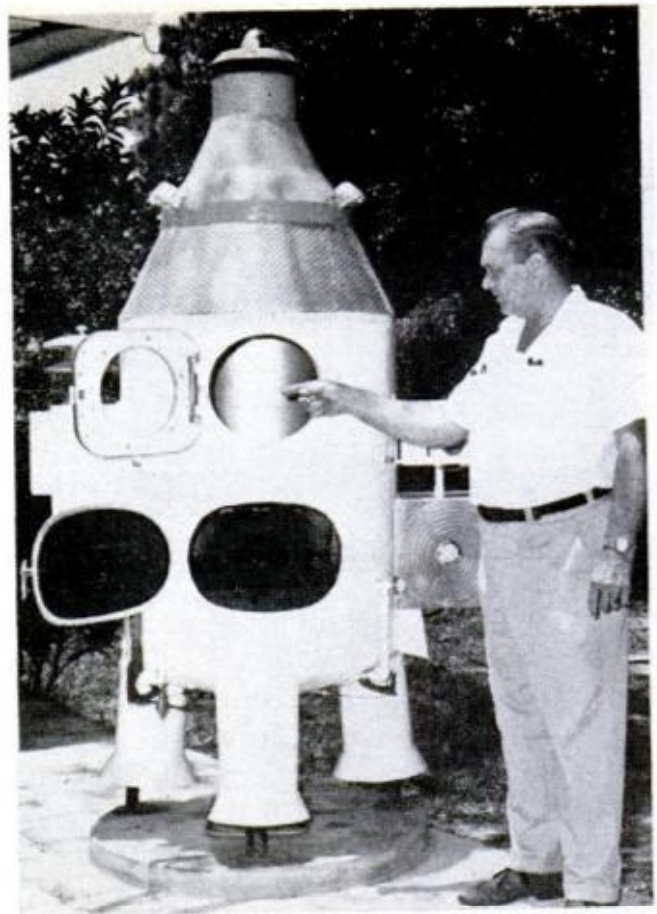
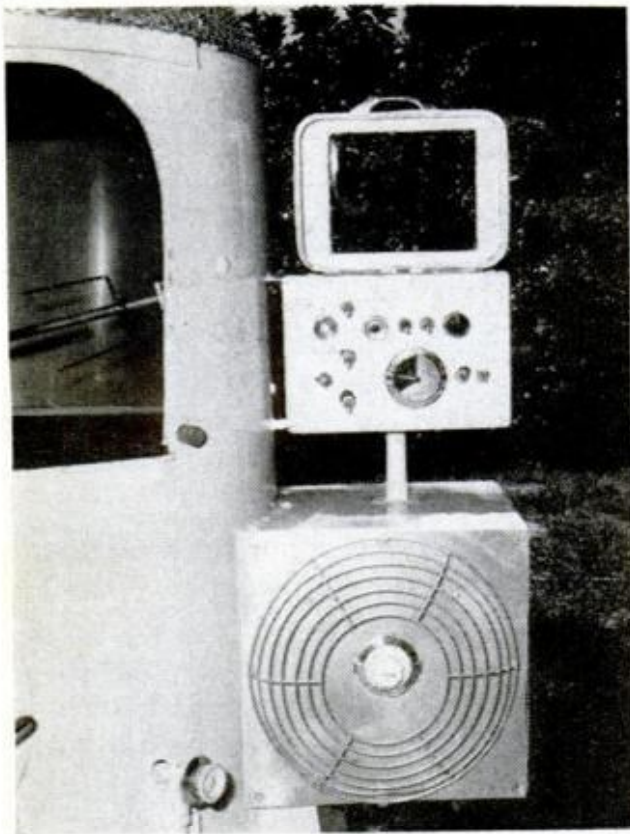
15-29 years ..... 38.5%  
30-49 years ..... 38.4%  
50-plus ..... 23.0%

**Would you buy another Cougar?**

Yes ..... 83.6%  
No ..... 16.4%

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





## Outdoor cooking is a real blast

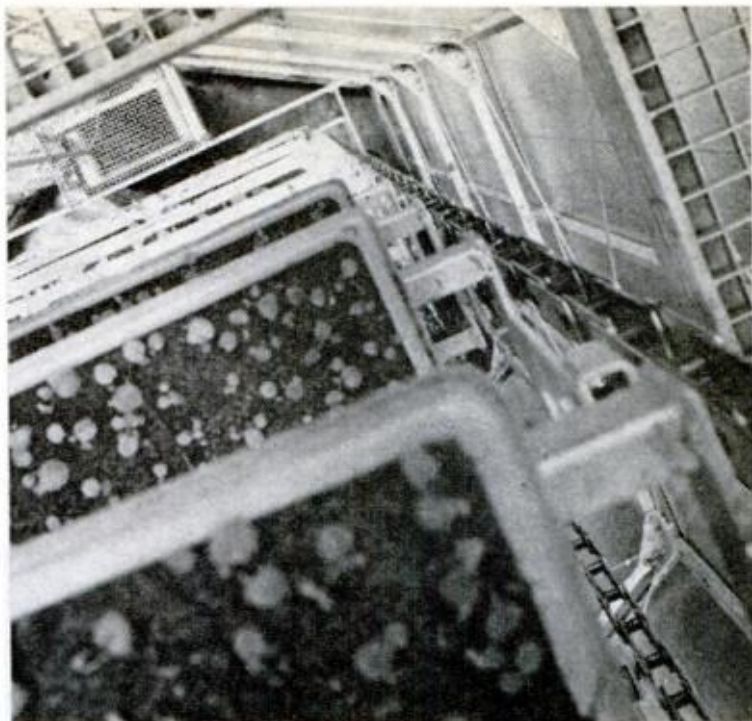
Lights flash, things buzz and "it does everything but leave the pad," but the most important thing about Joe Anthony's rocket-shaped barbecue is that it cooks like a dream. A former NASA electrician, Anthony built the barbecue using a car door handle, dishwasher parts, washing machine, deep fat fryer, lunch bucket, vacuum cleaner, bug catcher, barn-door hinge, paint-roller tray and Christmas-tree lights. He alone knows how to operate it.



## Who'd want to get up?

Heralded as an "antidote to modern living," the Super Bed (really twin beds labeled *His* and *Hers*) has enough gadgetry to keep you occupied for days in the event you don't want to get up some morning. Remote-control switches operate TV, intercom, curtains, mattress heaters, even swing beds apart. Other appointments include electric razor, massager, automatic teamaker and silver service.





## Skyscraper greenhouse has a 'Ferris wheel' inside

When he found he didn't have enough land to grow all the plants he needed, a West German nursery owner expanded upward. His "Flower Tower," which carries the growing plants in trays that revolve slowly on an endless chain, can hold about 25,000 plants and seedlings.



## Magnets are eye-openers

Afflicted with a disorder (myasthenia gravis) that resulted in loss of muscle strength in his right eyelid, Peter Jackson was unable to hold that eye open—until doctors came up with an ingenious solution. They pasted a magnet on his eyelid and another on his glasses; the magnets now hold the eye open.



## One-of-a-kind old-timer

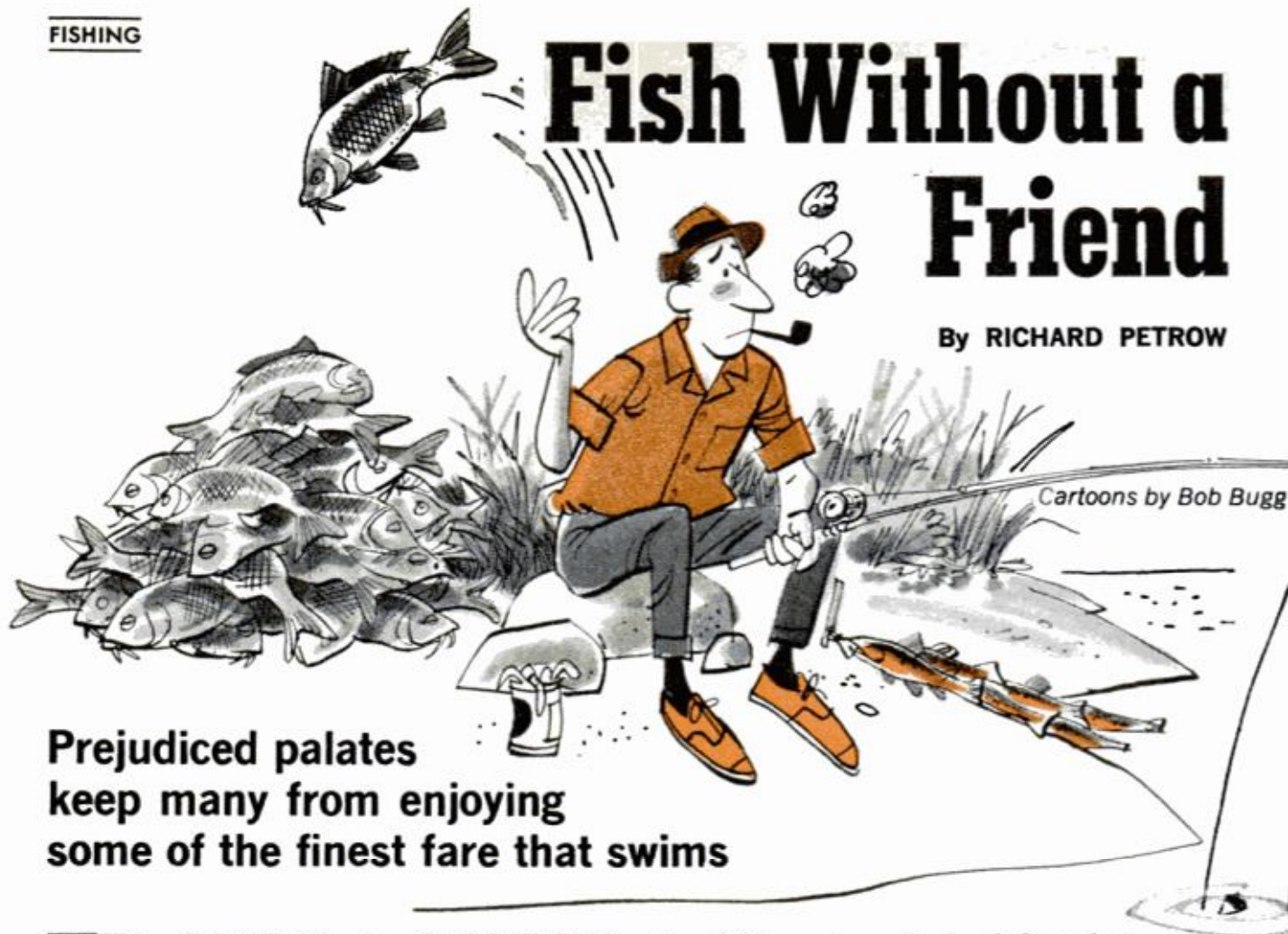
This 1913 Nazzaro, the only one of its kind in the world, is owned by West Australian Percy Markham, and it has been valued by vintage-car experts at \$36,000. The car, designated a "short-chassis sports racer," was driven by its designer-builder, Felice Nazzaro, to victory in the 1913 Targa Florio and the 1914 Coupe Florio. Its top speed is close to 80 mph.



# Fish Without a Friend

By RICHARD PETROW

Cartoons by Bob Bugg



**Prejudiced palates keep many from enjoying some of the finest fare that swims**

**T**HE BOWFIN—A GAMEFISH? Catfish and carp—good eating? Not 20 years ago, the average American would have turned up his nose at such thinking. He *knew* that the only fish worth catching, bragging about and eating were trout, bass and the panfish. Even pickerel and pike were dubbed “snakes” or “hammer handles” and treated with contempt in many parts of the country. But all that’s changing. Sport fishing for and the farming of channel catfish has become big business. Even the lowly bullhead is coming into its own as a fun and food fish. All catfish are ugly—and delicious. Now, too, many angling journals are beginning to soft-sell the fighting qualities of gar, bowfin (*amia calva*) and carp.

While love and respect may be a whole new thing for the likes of the alligator gar, carp fanciers have seen support for their favorite fish before. The carp was first introduced to America from Europe precisely for reasons touted today as a “fresh recognition” of the fish’s “potential.” Fish culturists of

the 19th century helped distribute carp throughout the New World, believing they would become the foundation for a vast game and food fishery. But since native bass and trout were initially more plentiful, few anglers bothered to eat the carp they caught. Then as carp began to squeeze out the more desirable species, carp became rather more notorious than respected.

But some men must fish and if carp are the only available fish in an otherwise polluted pond, then carp it will be. An entire generation of anglers is discovering that not only are carp strong fighters but when they’re prepared as in the Jewish delicacy, gefilte fish, carp are darned tasty as well. They can also be prepared by skinning the fish and cutting away the dark meat along the side. Then cut the remaining white flesh into chunks and cook in a pressure cooker to separate meat from bones. Roll meat into patties and fry like croquettes. Umm, delicious!

“A dog day!” exclaims the punster fisherman, who expects to find a cod



on his hook but instead brings up a spiny dogfish (*squalus acanthias*). In American waters saltwater anglers regard dogfish as a mild menace. These fish steal bait, eat other hooked fish, tangle gear, rip nets and bite through line as though snapping cotton thread. Off the Massachusetts coast, fishermen annually take more than 20 million dogfish, most of which are killed before being dumped back over the side. Since they have no commercial value in America, dogfish are definitely *piscona non grata*!

But European fishermen are worried because there are too few dogfish; they consider the dogfish a gastronomical delight.

The British use it in their national dish, "fish and chips," and sell it in markets as "flake" or "rock salmon." They insist that it tastes every bit as good as halibut.

Italians make a dogfish dish called *pieces paulmo* and flavor it with garlic (naturally!)

Even the dogfish eggs are utilized in Norway where they're sometimes substituted for hen's eggs in puddings.

Only in the United States have dogfish never fared well as sea fare. During periods of food shortage, like that experienced during World War II, some Americans ate dogfish under such euphemisms as "tenderloin of sole," "grayfish," "Cuban cod" and "Victory cod." And as long as they didn't know what they were eating, they relished it.

Disgust with dogfish as a possible source of food is obviously a matter of mind over palate. Its fillets are bone-free and its flesh is white and flaky. Its flavor is mild, and when it's fried, there's never a fishy smell. A re-

search panel at the University of Washington found that fish eaters preferred fishsticks made from dogfish to those bought in the local market.

If the spiny dogfish is unwanted, consider the plight of its larger cousin—the shark. Commercial fishermen detest sharks because one of these critters can destroy hundreds of dollars worth of nets with a few sweeps of its powerful tail and several snaps of its jaws. And sport anglers hate sharks because these fish so often turn potential triumph into despair by biting chunks from an otherwise prize catch.

Yet from 1939 to 1950 almost everybody wanted sharks. Those were the years of the Great Shark-Liver Boom. With the outbreak of war in Europe, cod and consequently cod liver oil became increasingly difficult, not to say hazardous, to come by. When it was discovered that shark liver was particularly rich in vitamin A, a major fishery for the critters sprang up practically overnight. Livers of sharks sold for as much as \$18 a pound, and if a large shark had a 5½-pound liver, this meant nearly \$100 to the fishermen.

When vitamin A was synthesized in the early 1950s, the shark-fishing industry came to an abrupt halt. Today, the shark is once more considered the most "useless" fish in the oceans. It is, on







Sharks! Who needs them? Who wants them?

American tourists love to bring them home from trips to the Caribbean.

There is no accounting for people's tastes in fish and other sea food. Consider the large "spider" crab of European waters. They're related to the Alaskan king crab. Yet in the waters off Cornwall, England, where they abound, the crabs are regarded as nuisances, good for nothing but cluttering up lobster pots.

A few hundred miles away in Brittany, however, French fishermen eagerly bring these crustaceans to market.

Spider crabs are on the best menus in France and many a wise old gourmet prefers them to lobster. To see a happy Frenchman sit down before a spider-crab dinner and begin dipping the claws and legs into a rich sauce of mayonnaise and lemon juice, sucking out the firm white meat, makes you wonder if the French disdain for English eating habits doesn't have some validity after all!

Moving closer to home, we have the story of the common blowfish, *spheroides maculatus*. Also known as the puffer or swellfish, it is easy to recognize this self-inflating creature.

Haul him out of the water, tickle his belly, and he'll blow himself up into a hard balloon twice his normal size. It's a great defense for him at sea. Ashore, the blowfish has, perhaps, given more children more pleasure than any other fish along the Atlantic coast.

Yet until recently blowfish were considered to be a big nuisance to bottom fishermen. From Cape Cod to Florida you could hear the screams of fishermen who went out after flounder or fluke, blackfish or sea bass, and who began pulling in blowfish instead.

Today there probably aren't many salt-water anglers who won't happily boat and keep a blowfish. They know it has a solid chunk of white meat that is easy to prepare and delicious to eat.

No one knows how the blowfish's reputation changed from nuisance to a highly respected food fish. But if it happened to the blowfish, who is to say that the same thing won't happen to all the other wonderful fish that no one wants?

*Squalus acanthias*, anyone?

the contrary, one of the most useful. Every part can be utilized.

Sharkskin leather is tough, pliable and resistant to abrasion. The skin of the tiger shark, for instance, has a tensile strength six to ten times greater than that of ox hide.

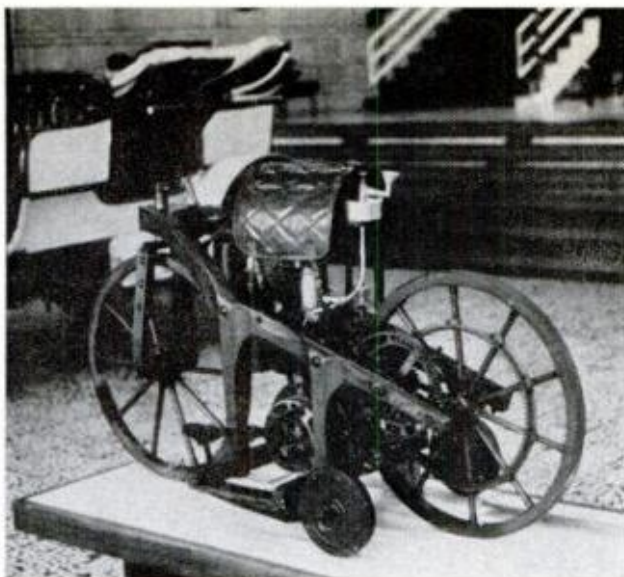
Shark flesh, properly prepared, makes a delicious meal. The white meat of the bull shark tastes like swordfish. Almost all sharks are eaten in some part of the world, and shark fin soup is a great delicacy of the Orient. Even the teeth have value.

You could hear the screams of fishermen who . . . began pulling in blowfish



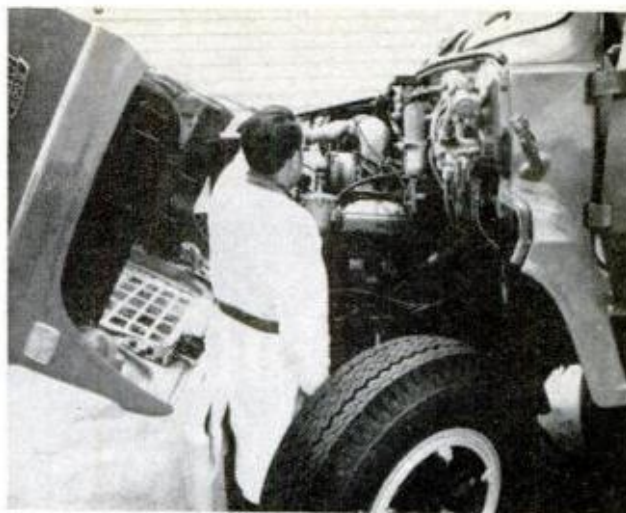
POPULAR MECHANICS





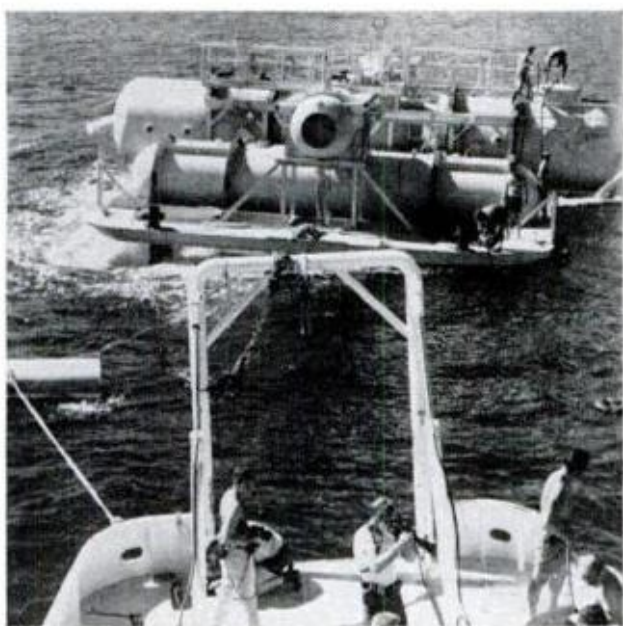
## World's first motorcycle

The tiny .264-liter engine of Gottlieb Daimler's pioneer two-wheeler put out  $\frac{1}{2}$  hp at 700 rpm. His son, Paul, rode it 6 kilometers on Nov. 10, 1885. PM Editor Bob Crossley took this photo in the Daimler-Benz Museum at Stuttgart last fall.



## Easy-to-get-at engine

Tilting the fiberglass front end of Ford's new Louisville Line trucks exposes the engine completely and speeds service by permitting the mechanic to work standing up; he doesn't have to crawl all over the engine.



## Habitat ready for habitation

Shown being prepared for a test dive is Habitat II, a 200-ton underwater home and laboratory developed by the Makai Range, Inc., at the Makapuu Oceanic Center, Hawaii. Six men can live 14 days in Habitat at a depth of up to 580 feet. The underwater lab will be available to research teams the year round.

## Warm waistcoat

Even in a bikini, she's warm in the snow because she's wearing a new battery-powered electric waistcoat. The garment is the invention of two Renfrew, Scotland, businessmen.

JULY 1970



## Anti-trouble bubbles

Rioters could be stopped by long-lasting soap bubbles, says Dr. Aristid Grosse of Temple University. The bubbles are made from a solution with synthetic polymers added.





**PM OWNERS REPORT**  
**DODGE POLARA**

A Nationwide Survey Based on  
1,380,000 Owner-Driven Miles

**P**OLARA OWNERS aren't flashy by nature or unusual in their demands, so they normally remain cool and objective about their cars. They want sane, sensible, economical transportation. Mostly that's what they have been getting all these years. Half have owned Dodges before — 49.7 percent, a creditable record of loyalty.

# Once Dodge Always Dodge, But Why Don't They Make 'Em Like They Used To?

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

One retired gentleman said he'd been buying Dodges since 1917; another since 1921. Yet it isn't merely blind loyalty that keeps them coming back. All these repeat buyers feel they have been getting good cars, good deals and good service all along. They register only a few complaints even now, but the mood seems to be changing. Some 17 percent mentioned they were unhappy with the way their new Polaras had been put together. They seemed to feel Dodges used to be made of better stuff and assembled more carefully. "I had two

**HALF OF BUYERS** owned Dodges before, 17 percent remembering previous models as put together better than this year's







**STYLING CAUSES** no special fever in owners. They consider Dodge's looks sensible but not sensational

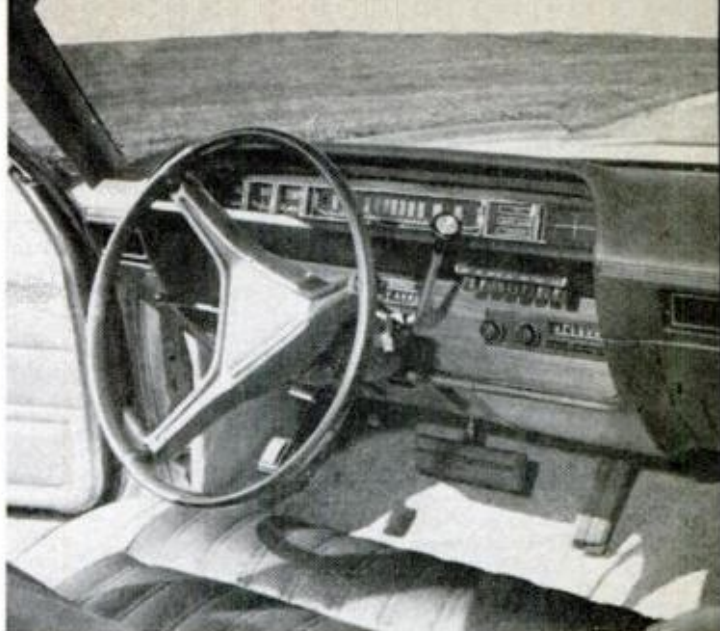
Monacos and then two Polaras after that," says a retired New Yorker, "and I found the Monacos smoother and quieter. The car I liked most in my 40 years of driving, though, was a 1953 DeSoto sedan." A TV technician writes, "Not comparable to my 1956 Dodge for gas mileage and handling." And a California educator says, "I wish I had my 1967 Charger back."

Not all sales were made, though, on the basis of past experience. Other reasons for choosing Polaras included these: "Recommendations from friends and members of the highway patrol."—California physician. "Because I liked the styling."—Minnesota engineer. "Felt it was the best model in the price range we could afford."—Ohio housewife. And here's a refreshing reason from a North Carolina letter carrier: "I walked into our local Pontiac dealership to buy a new Pontiac. It was raining. I was wet and muddy. The salesman told me to come back Monday. So I bought a Dodge."

Most owners experienced no mechanical difficulties with their new cars; 56.4 percent said, "No troubles at all." That figure, though, is about average for American-built cars. The Dodge Challenger and Plymouth Barracuda *Owners Reports* in the June and May issues of *PM*, respectively, registered 56.1 and 56.5 percent "no troubles" replies, so apparently Chrysler Corp. quality is very consistent.

Those who had to go back soon for

JULY 1970



**OWNERS SAY** ashtray, wiper switch are hard to reach, steering wheel obscures high-beam light. Otherwise they praise roominess and comfort of bench seating, forward vision, attractive upholstery



**FOR ONCE**, enough room here to play Monopoly. Wagon owners say there's as much space in third seat





## Summary of 1970 Polara Owners Reports\*

**Total miles driven** ..... 1,380,056

**Average miles per gallon:**

318-cu.-in. V8	local driving	12.8
	long trips	16.0
383-cu.-in. V8	local driving	12.3
	long trips	14.9
440-cu.-in. V8	local driving	11.4
	long trips	14.1

**Engines:**

318-cu.-in. V8	34.6%
383-cu.-in. V8	61.2
440-cu.-in. V8	4.2

**Transmissions:**

Automatic	99.6%
3-speed manual	0.4

**Body styles:**

4-door sedan	39.8%
2-door hardtop	28.8
4-door hardtop	22.5
Station wagon	8.9
Convertible	0.7

**Series:**

Polara	66.9%
Polara Custom	33.1

**Why the Polara?**

Past experience	49.4%
Style	16.5
Size	9.4
Service	8.6
Ride	6.0
Economy	6.0
Price/deal	5.6

**Specific likes:**

Comfort	37.0%
Handling	35.8
Ride	34.2
Styling	28.1
Performance	10.2
Size	10.2
Roadability	6.9
Power	4.1

**Specific dislikes:**

Workmanship	17.0%
Economy	13.0
Rattles	7.5
Wind noise	6.7
Service	5.5
Hard to start	4.4

**What changes would you like?**

Dash layout	10.6%
Workmanship	9.2
Ashtray location	6.5
Rear vision	6.0
Style	5.5
Return to vent panes	5.1

**Had any mechanical troubles?**

No	56.4%
Yes	43.6

**What kind of trouble?**

Carburetor	26.5%
Electrical	18.2
Windshield wipers	8.3
Transmission	7.5
Brakes	6.6

**Did you repair it yourself?**

No	95.6%
Yes	4.4

**Dealer repairs satisfactory?**

Yes	70.5%
No	29.5

**Is the Polara your only car?**

Yes	54.0%
No	46.0

**Other cars owned:**

Dodge products	50.4%
Chevrolet products	18.4
Ford products	16.0
Plymouth	6.4
AMC products	4.8
Pontiac	4.0
Oldsmobile	4.0

**Accessories/power options:**

Automatic trans	99.6%
Power steering and brakes	79.3
Radio	56.4
Airconditioning	54.0
Lighting group	16.5
Tinted glass	12.9
Rear defroster	12.9
Vinyl top	11.3
Remote outside mirror	10.9
Rear speaker	7.7
Power windows	2.2
Power seats	1.1
Power door locks	0.4

**What accessories/options would you order next time?**

The same	73.3%
Airconditioning	8.5
Rear defroster	4.9
Stereo tape	3.2

**Age distribution of owners:**

15-29 years	9.4%
30-49 years	43.6
50-plus	47.1

**Would you buy another Polara?**

Yes	85.6%
No	14.4

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

service complained mostly of carburetor maladies. "Choke sticking" led the list. Also, "Throttle linkage had to be replaced right away. It would not accelerate smoothly." The choke trouble caused some of the owners to complain about hard starting and poor gas mileage.

Of more exotic woes: "Car came off assembly line without an ounce of grease in the rear axle. Almost lost dif-

ferential before discovering cause of noise and growling." Or, "Brakes feel bumpy—washboard feeling when I push pedal."

The dealer, though, usually comes through with quick, satisfactory repairs. It's much easier to knock the dealer, the salesman, and the mechanic than to build any of them up. We asked, "In general, what do you think of your Dodge dealer's sales policies as to cour-

**MOST POLARAS** are bought with 2-bbl. 383-cu.-in. V8. This gives adequate performance, averages 12-15 mpg







**NOT MUCH GLOVEBOX**, gripe some owners, but they've never seen competition's. Doors seem unduly thick and heavy. Tall drivers tend to knock knees on airconditioner outlet when climbing into or out of seat

tesy, sales methods, fair dealings, etc.?" Here's a sampling of replies.

"Very good."—New York engineer. "Unbelievably lousy."—California teacher. "Local Dodge dealer enjoys good reputation for service; that's why I bought Polara."—Iowa nurse. "Salesmanship excellent, but service terrible. Service manager is a big liar."—Alabama grocery owner. "Front wheels shimmed at 70 mph. Dealer said I'd have to live with it, which is a lot of bull. Paid to have them balanced, but they still shimmy. Getting runaround from both dealer and tire manufacturer."—Ohio plumber.

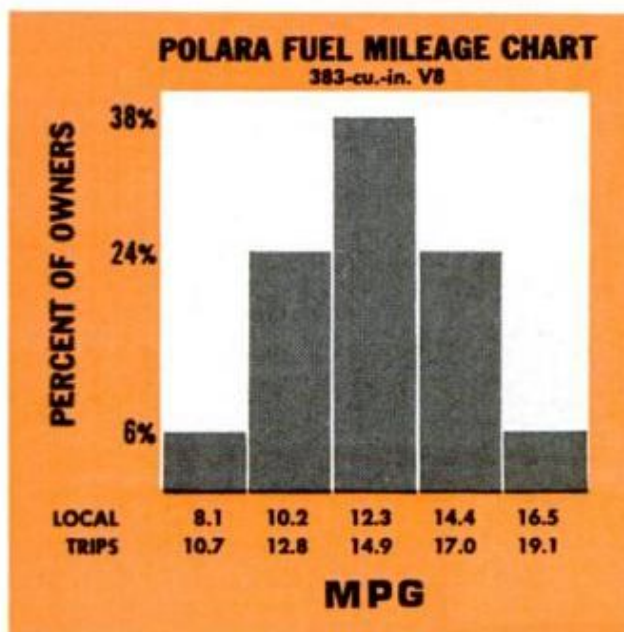
Polara owners consider their cars far above average in comfort, ride and handling. A Minnesota mathematician writes, "I have been extremely happy with my Polara in that it has proven to be an even better car than expected. The torsion-bar suspension makes handling exceptional, and riding comfort is by far the best I have experienced in any car. I have, as yet, not had even minor mechanical problems." And a South Carolina real estate broker says, "Braking in tight traffic with optional front disc brakes is tops. Appreciate easy steering and torsion suspension keeping car stable on curves and mountains."

But there's a flaw in the suspension department. "Rear springs weak," says a North Dakota farmer. "They bottom

*(Please turn to page 194)*



**GOOD-SIZED TRUNK** holds plenty. The gas filler under license makes topping tough, should be moved





# What You Need in a Roadside Emergency Kit

The best time to take inventory is before the long, hard driving of a summer vacation. The vacation you save may be your own

By ALEX MARKOVICH

**A**LL TOO VIVIDLY I remember that day when I ran out of gas in the tunnel, halfway between New York and New Jersey. Rush hour. No shoulder. No can of gas in the trunk.

Even more recently, late one Saturday night, my battery succumbed. No jumper cables handy. This is learning the hard way that a few spares, tools, and odds and ends carried in the car can save lots of time, inconvenience and money.

Of course it's not practical to keep a

spare for every vital part in your car. You have to figure the odds, bearing in mind that when a car breaks down, almost always it's one of three basic problems: ignition, fuel or overheating.

Usually in these cases a permanent or at least a temporary fix can be made at the roadside. Even if you can't tell a nut from a bolt, carrying spare parts makes sense; they may enable a mechanic to get you on your way without too much delay.

What do you need? The old standbys





that most motorists know about (but few carry) include spare distributor points, condenser, fan belt, a can of gasoline.

The points and condenser are inexpensive, and they won't cost you extra in the long run; next time you tune up your engine, use the spares. If the parts you remove aren't too far gone, save them for an emergency.

Don't forget to include the following in your toolkit: wrenches to fit your sparkplugs and ignition nuts, a set of screwdrivers with shockproof handles, a feeler gauge for setting sparkplug and point gaps and a small fine file. (Recently, reader David Augenstein wrote *PM* with an emergency tip for setting point gap: The pull-off tab on aluminum cans is about .017 inch thick!)

If your car is over three years old or an import, or if you drive through remote areas, you also should carry an extra distributor cap and rotor arm, some high and low-tension cable, and a knife for cutting the cable and stripping the insulation.

A spool of 14-gauge insulated wire is helpful for dealing with various problems in the electrical system. The easiest way to repair a defective circuit without special equipment is to replace old wire with new. Also, drop a few solderless terminals and some plastic tape into your toolbox. And carry several spares of each capacity fuse your car uses. You may blow out one or two before you locate the short.

Though you may never use your spare fan belt, it's cheap insurance. Again, make sure you have wrenches to fit the generator or alternator mounting bolts.

If you carry extra gas in your trunk, keep it in a metal can especially designed for the purpose. If you're nervous about carrying gas in your trunk, at least take along an empty one-gallon can. Many service stations won't lend you one, or demand a steep deposit.

An inexpensive item that pays for itself the first time you use it is a set of battery jumper cables. If your battery goes dead, you may have trouble getting another motorist to give you a push and risk damaging his own car. And some cars with automatic transmissions cannot be push-started at all. Jumper cables are so quick and easy to hook up that even many women drivers carry them.

Always carry a spare for every vital bulb in your car, including a sealbeam headlight. I know from personal experience that this pays. Once, years ago, I was stopped by the police because of a burned-out headlight; I avoided a summons by offering to change the defective sealbeam on the spot!

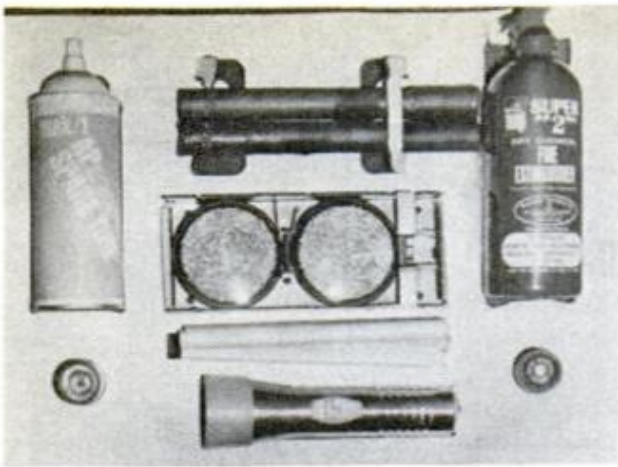
If your car is equipped with an electric fuel pump, as many foreign cars are, and its breaker points are replaceable (check this in your owner's manual or ask your mechanic), carry a spare set of points.

Another important and inexpensive item

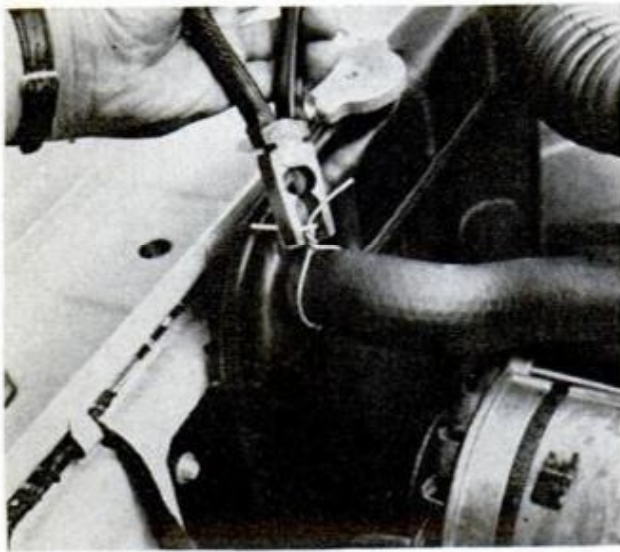
## SOME ROADSIDE SPARES—TAKE WHAT YOU CAN

Gas can	Plastic fuel line	Lug chains
Jumper cables	Bar of soap (seals small leaks)	Lightweight coveralls
Fan belt	Radiator hoses	Cleaning cloth or rags
Distributor points, cap, condenser and rotor arm	Piece of soft wire (in place of hose clamps, and to hold loose tailpipe or muffler)	Ice scraper
Flashlight	Radiator cap	Short-handled shovel
Flares and reflective devices	Sandpaper (clean battery clamps)	Water for radiator (in deserts)
First-aid kit	Tire gauge	Ignition wrenches
Rope for towing	Spare wheel lug	Screwdrivers
Fire extinguisher	Distilled water	Sparkplug wrench
Sparkplugs	Brake fluid	Jack
High and low-tension cable	Engine oil	Block of wood (base for jack)
14-ga. insulated wire	Spare keys	Wheel chocks
Solderless terminals	Dry hand cleaner	Knife for cutting cable and insulation
Plastic electrical tape	Penetrating oil	Wrenches to fit carb and fuel-line fittings
Fuses (1 of each capacity used)	Tire inflator	... and one thin dime for the telephone
Spare bulbs (1 each)	Tube or tubeless patches	
Fuel pump (or replaceable points for electrical pump)		





**SOME EMERGENCY EQUIPMENT** comes in kits. This one, from Alpha Diversified Service, holds "must" items. Things for your toolbox include wire (below) to secure parts like radiator hoses and mufflers



is a length of plastic fuel line, handy if the line in your car becomes clogged or cut. And be sure you have wrenches to fit the carburetor and fuel-line fittings.

And while we're discussing vital fluids, pick up an extra bar of soap next time you shop. Rub it in to seal small leaks in the fuel tank or radiator. For a better job, reinforce the soap with a couple of strips of electrical tape.

The radiator requires few precautions. Besides a spare fan belt, keep a couple of extra radiator hoses handy, especially if the ones in your car are of an odd size or shape. Don't bother getting spare clamps to secure the hoses. A piece of soft wire twisted around the end of the hose with pliers will do in a pinch. Wire also is useful for tying down loose mufflers and tailpipes and other parts otherwise hanging by a thread.

One important spare that even the experts often forget is a radiator cap. When

a radiator boils over, often the pressure is great enough to blow off the cap. Even if you find water nearby, a radiator that isn't pressurized will quickly boil over again.

Inexpensive miscellaneous items include a sheet of medium-grit sandpaper for cleaning battery clamps, a wrench for loosening the clamps, an accurate tire gauge (which should be used only when the tires are cold), an extra wheel lug in case one gets lost while you change a flat, and some penetrating oil to free corroded parts.

If you're at all fussy about your car, you'll want to have some distilled water on hand for filling the battery; impurities in tap water eventually can cause a short circuit. Though distilled water usually is sold in glass bottles, you can repour it into a thoroughly cleaned plastic detergent bottle to avoid breakage.

You also should have a small container of quality brake fluid so you won't need to mix brands or risk having the reservoir filled with a dangerously inferior brand. A quart or two of engine oil, too, can be carried along.

A pair of inexpensive, lightweight coveralls may not get you started any faster after a breakdown, but they can save an expensive suit or a night out on the town. And a container of dry hand cleaner helps avoid soiled upholstery.

Should you hide a set of keys? One of my neighbors keeps his in the windshield washer reservoir—fine if your hood has an external release or your doors are designed so you can't lock yourself out. Small magnetic key boxes are popular. Every man will have to decide this one for himself.

You're the best judge of which of these spares and tools you need for your kind of driving. But several items should be carried by *every* driver. These include a safe, sturdy jack (and a block of wood to place under the jack), flashlight, flares (warning device in lead photo uses a 3M reflective coating), first-aid kit sturdy tow rope, and small dry-chemical fire extinguisher.

You can probably continue this list—blankets, ice scraper, chamois, and so on. But don't forget the most useful emergency tool of all—a dime. Tape it underneath your instrument panel so, as a last resort, you can telephone for help! ★★★

POPULAR MECHANICS



# Mini-Speaker from A Spray-Can Cap



IT'S ONLY 2½ inches in diameter, but it booms out a surprising amount of sound for its size. And it's colorful, too—red, yellow, blue, green, white—any shade you want. What it is is a plastic spray-can top fitted with a tiny permanent-magnet speaker. It's ideal for use with pocket transistor radios and other small portables that have a jack for attaching an earphone. When the radio isn't traveling, you can plug in the speaker and keep it on a bookshelf, kitchen counter or bed table. Though small, the speaker will greatly improve the sound of a transistor radio as well as add a novel appearance.

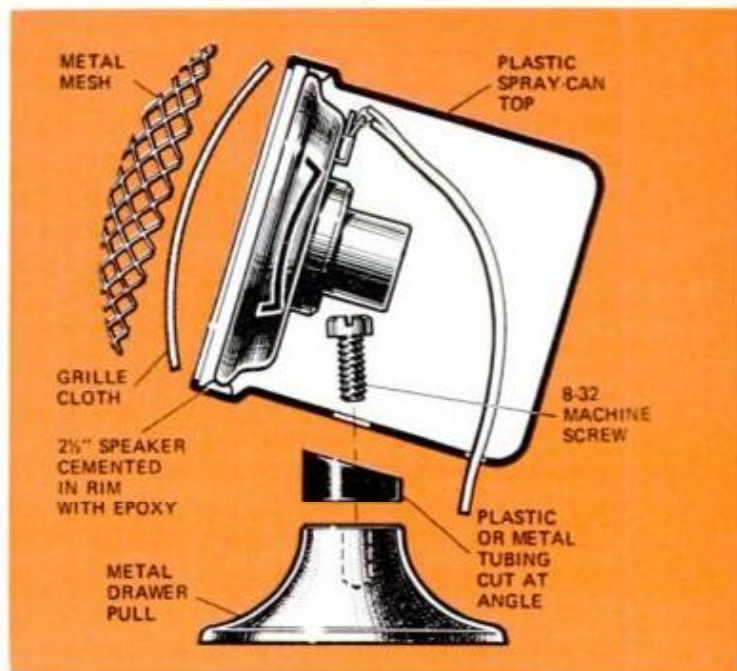
Plastic caps come on household spray cans in every color of the rainbow. Their inside rim is a perfect fit for a 2½-inch round speaker, cemented in with epoxy or silicone adhesive. A metal drawer pull makes an attractive pedestal. For a slight upward tilt, cut a ring from metal or plastic tubing to form a sloping collar.

The grille is a piece of speaker cloth covered with metal mesh. Form the mesh around a tennis ball to give it a little curvature and cement it and the cloth into the cap's rim over the speaker. Speakers of the type shown are readily available from mail-order houses like Allied Radio in Chicago and Lafayette Radio in Syosset, N. Y. The one used here is Lafayette No. 99E60386 and sells for 99 cents.

—Rudolf F. Graf and George J. Whalen

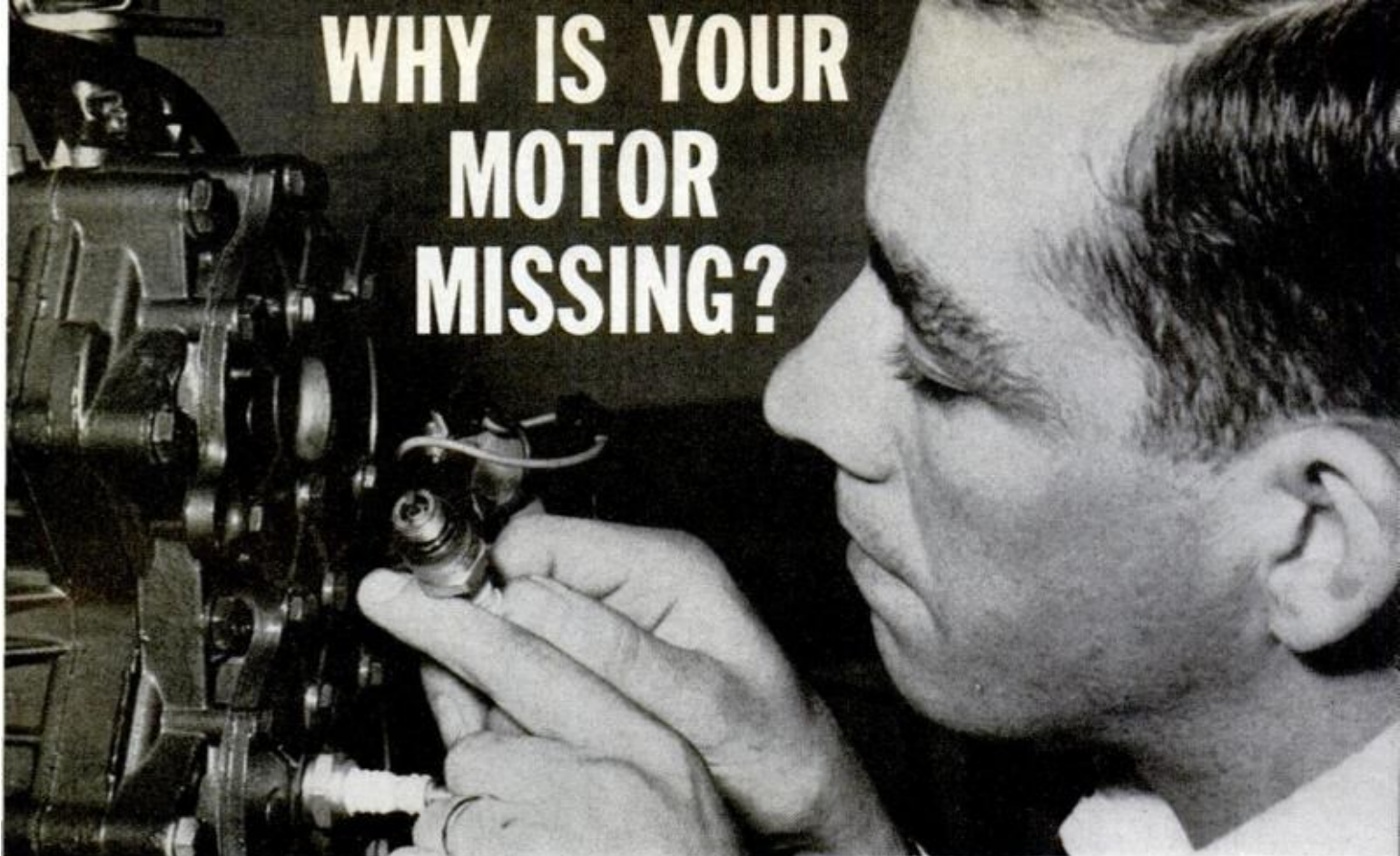


**MINI-SPEAKER** is an ideal companion for a pocket radio. Most such portables have a miniature phone jack for an earphone. Solder a matching plug onto the speaker leads for quick connection and removal





# WHY IS YOUR MOTOR MISSING?



**CLOSELY EXAMINE** tips of your sparkplugs for essential clues as to why your outboard may be misbehaving

**This time we're not discussing theft —but something almost as critical to performance of your outboard engine**

**By MORT SCHULTZ**

**A**N OUTBOARD THAT'S MISSING practically dares you to find out why. Technically, a missing condition is attributed to a breakdown in the ignition system. Obvious reasons are bad sparkplugs, a weak coil or condenser, poor breaker points, loose or bad wiring, or a weak cutout-switch spring (on some engines).

An engine that won't idle smoothly resembles a miss, but technically it isn't classified as such. Rough idle is usually caused by a nonignition factor, such as a faulty carburetor adjustment. Since there is a similarity, let's cover both.

First thing to do when an engine develops a miss is to pull sparkplugs for a close-up examination. If there's water on electrodes, the head gasket could be blown between water jacket and cylinder. This causes a miss at any speed! Verify it by pulling the starter cord slowly. If there's no snap to the engine, you have a loss of compression, caused by a blown gasket.

If tips of sparkplugs are dry or badly eroded and there're tiny blister bubbles or cracks along the porcelain, one of three things is causing your trouble: a too lean fuel mixture, a spark advanced too far due to fouled ignition points, or an overheated plug.

Dump old fuel and mix a new batch properly. Make sure you're using the right plug. If conditions still don't square away, pull the flywheel or open up the distributor for a look at ignition points.

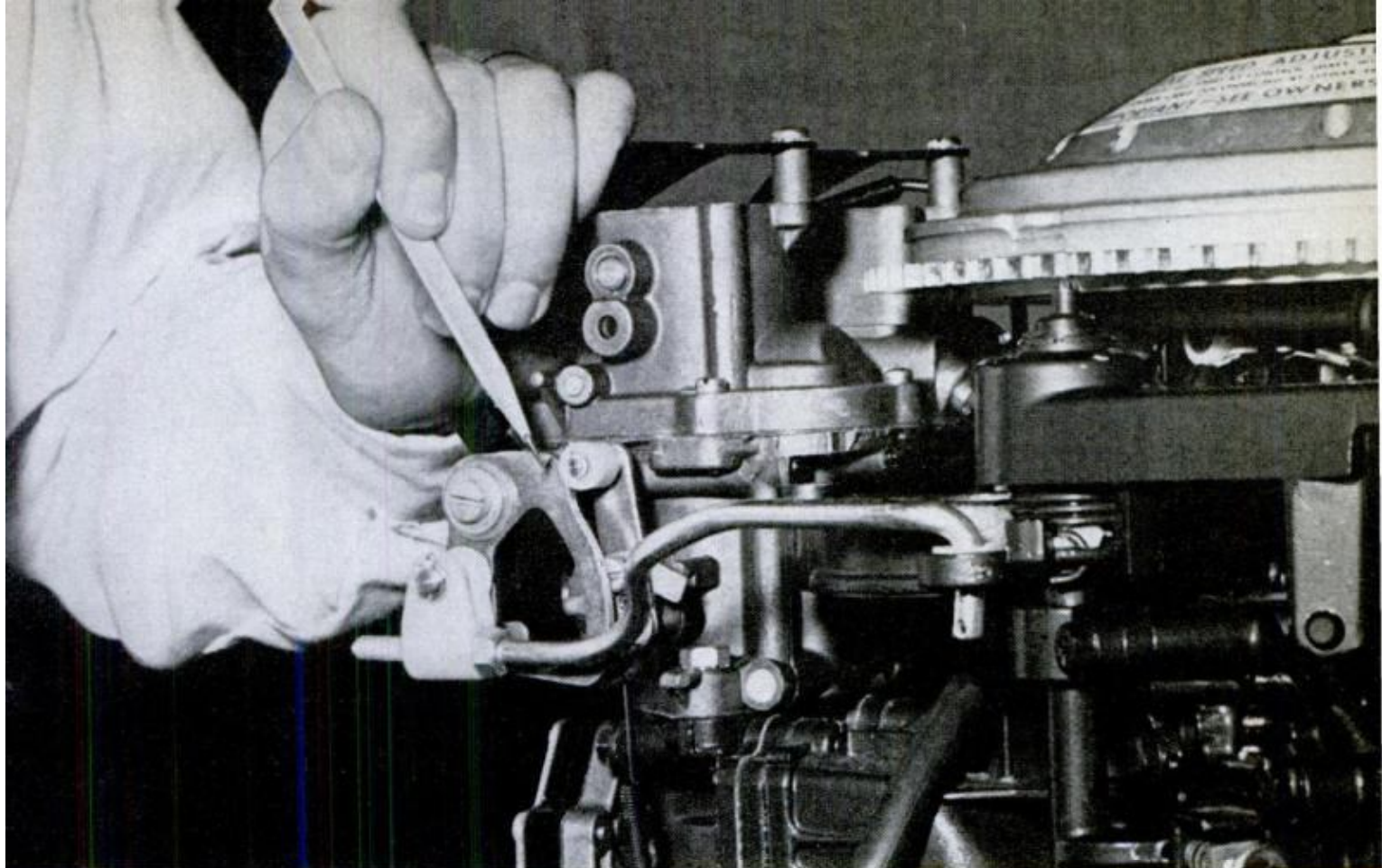
A deposit between ground and center electrodes means there's a carbon build-up in the combustion chamber which will cause a high-speed miss. Buy a good quality engine cleaner from a marine dealer and use it as directed.

If missing occurs at low speed or idle, and sparkplugs are oil-fouled, fuel hasn't been mixed properly, plugs are too cold for the engine, or there's a plugged crankcase bleeder, clogged check valves or blocked breather line.

Dump fuel and mix a new batch. Check plug specifications against the book. Clear out bleeder, check valves and/or breather lines with compressed air.

Naturally, a major cause of missing at any speed is dirty and improperly gapped





**MARK ON THROTTLE CAM** (at pencil tip) should align with cam follower to adjust ignition-carburetor synch

plugs. Always give them a check while they're out of the engine.

A hard-to-correct miss at low speed or idle is often caused by leaky crankcase halves or leaking top and bottom crankcase seals. If there is excessive oil over the top of the engine and breaker-point assembly, it means the top crankcase seal is probably bad. If there's a leak between crankcase halves that has to be patched, you'll spot bubbles of oil while the engine is running.

Another prime reason for low speed or at-idle missing concerns the reed valve. If the engine continually spits at low speed and you have to open the carburetor low-speed adjustment screw excessively to compensate, there's an air leak at the reed-valve plate gasket.

If the low cylinder isn't firing, the reed valve has gone bad. Normally when this happens, fuel will shoot out the front of the carburetor.

A low speed or idle miss sometimes occurs when the carburetor and ignition are out of synch. The mark on the throttle cam has to be aligned properly with the cam follower; otherwise the engine will operate under lean fuel conditions. Checking and adjusting this synch is done

differently for different engines, and you'll need a service manual.

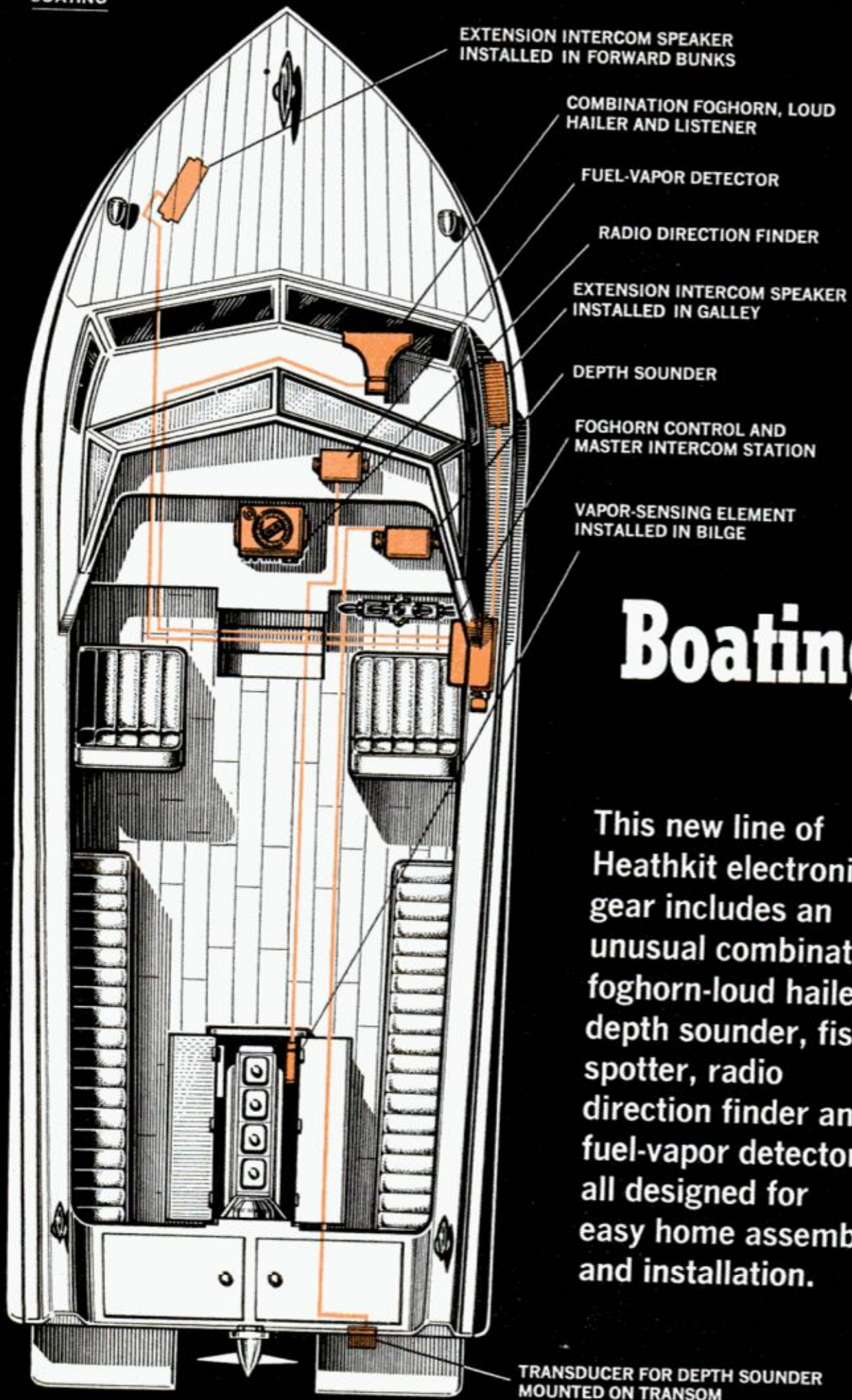
A high-speed miss has its own set of probable causes. One is water in the fuel. Check the filter bowl; you may see water inside. If you don't have a filter bowl, shine a flashlight into the gas tank. A water bubble means trouble, so dump the bad mixture.

If missing is caused by an exhaust leak through a cracked exhaust cover or baffle gasket, water will get into the cylinder. This is definitely your problem when you find droplets of condensation on the tips of your sparkplugs.

Another cause of high-speed miss is a poorly grounded magneto or distributor. To check, you'll need a metered series of resistance tests. If you have a distributor setup, check for a loose breaker plate. While the engine runs, put hand pressure on the underside of the plate. If running smooths out, you've found the trouble.

Finally, if the cause of missing hasn't been located, check ignition points for condition and proper gap, run meter tests to check for a weak coil or condenser, examine ignition wiring carefully for breaks and looseness, and check carburetor idle for lean and rich conditions. ★★★





# Boating

This new line of Heathkit electronic gear includes an unusual combination foghorn-loud hailer, depth sounder, fish spotter, radio direction finder and fuel-vapor detector—all designed for easy home assembly and installation.





WEATHERPROOF  
HORN-SPEAKER



RADIO  
DIRECTION FINDER



FOG HORN AND  
INTERCOM CONTROL



DEPTH SOUNDER



FUEL-VAPOR DETECTOR

# Instruments You Can Build From Kits

By SHELDON M. GALLAGER / Photos by Robert D. Borst

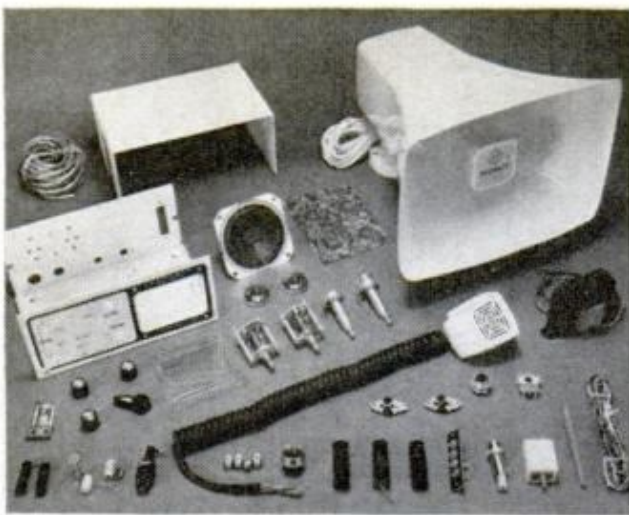
**M**ARINE ELECTRONIC INSTRUMENTS are usually thought of as expensive toys for wealthy yachtsmen. Not any more. Now you can build your own equipment from kits at prices that make it possible to put a fish locator in a rowboat or a radio direction finder in a runabout. Heath's newest line of electronic kits includes five handsomely packaged instruments engineered especially for the small-boat owner. There's a depth sounder, a fish spotter, a radio direction finder, a fuel-vapor detector and a novel foghorn-hailer that performs five functions in one.

The instruments are designed for fun as well as serious marine use. The radio direction finder, for instance, tunes in regular AM commercial broadcasts for entertainment afloat along with other bands for marine and shortwave listening. It thus serves as a general-purpose boat receiver as well as an important safety and navigational aid.

Three of the five instruments—the depth sounder, fuel-vapor detector and foghorn-hailer—are held in swiveling gimbals and can be tilted to any angle for easy reading of their dials. The gimbal brackets also permit flexible mounting in a variety of ways above or below shelves, against bulkheads or hanging under a cabin roof. The cabinets are smartly styled in white with black and aqua trim.

The most ingenious and versatile of the five is a combination instrument that performs a variety of communication jobs. It's a foghorn, a regular boat horn, a





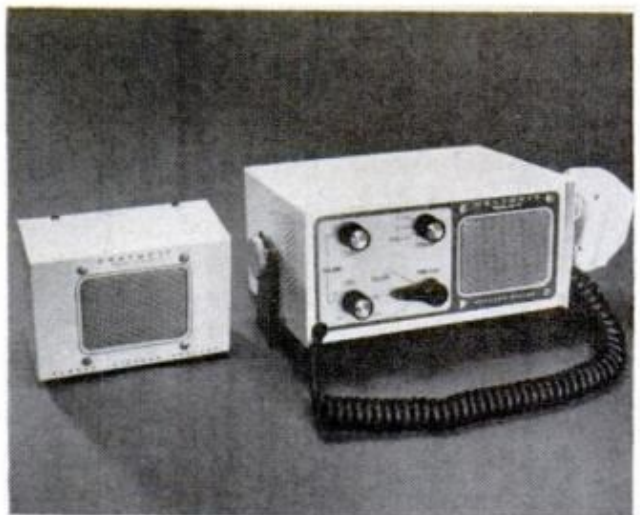
**COMBINATION FOGHORN-HAILER** is a trim little multifunction control that gives you a boat horn, foghorn, loud hailer, ship intercom system and amplified listening device all rolled into one. Sep-

arate remote speaker, shown in photo at right, connects to main control for intercom use. Control has its own built-in speaker, microphone in clip and knobs for selecting function, volume, foghorn rate

loud hailer for calling to other boats, an intercom for your own boat and an electronic listener for picking up weak sounds over the water. After each foghorn blast, it automatically returns to the listener mode so you can detect bell buoys or other boats more clearly at night or in fog. It operates on 12-volt d.c. and can be assembled in seven or eight hours—an easy weekend job. The kit, including a weather-proof horn-type speaker, is \$84.95. Remote intercom speakers are \$9.50 each.

The fuel-vapor detector is designed for boats with inboard engines where gas-fume accumulations can be dangerous. It gives both a visual and high-pitched audible warning when vapor concentrations reach a hazardous level. The kit is \$42.50.

Biggest assembly job is the radio direc-



tion finder. This takes 20 to 25 hours, but is well worth the time considering what you get. Four bands tune in regular AM commercial stations, marine weather and Coast Guard broadcasts, navigational beacons and shortwave. A rotating antenna on top lets you zero in on shore stations to plot your position and course when you aren't relaxing to popular music.

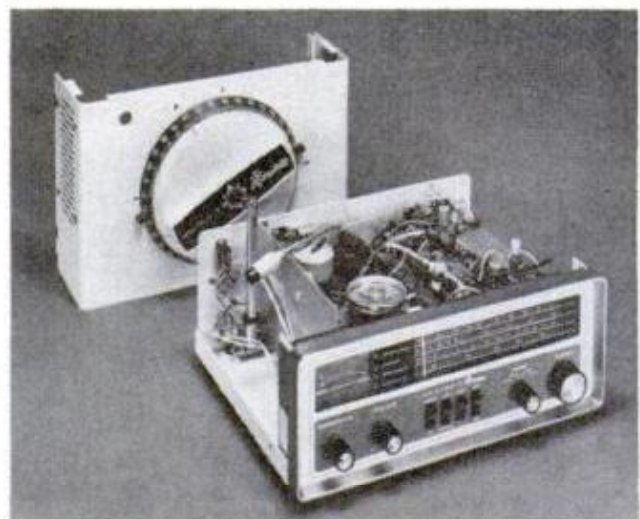
A novel power system makes the RDF a versatile portable as well as a ship's radio. The main supply is from built-in batteries, but these can be recharged either from the boat's d.c. electrical system or from 115-volt a.c. This means you can take the radio out of the boat when you leave and use it at home or in a summer cabin on house current. The RDF kit is \$124.95.

The depth sounder and fish spotter are

The depth sounder and fish spotter are



**YOU CAN FIND YOUR WAY** in fog or darkness with this radio direction finder. Besides serving as a general-purpose radio for entertainment, it tunes in marine navigation beacons, weather bul-



letins, shortwave and emergency Coast Guard broadcasts. Rotating antenna coil on top can be aimed at shore stations to indicate course directions for safe navigation in bad weather or unfamiliar waters

**POPULAR MECHANICS**

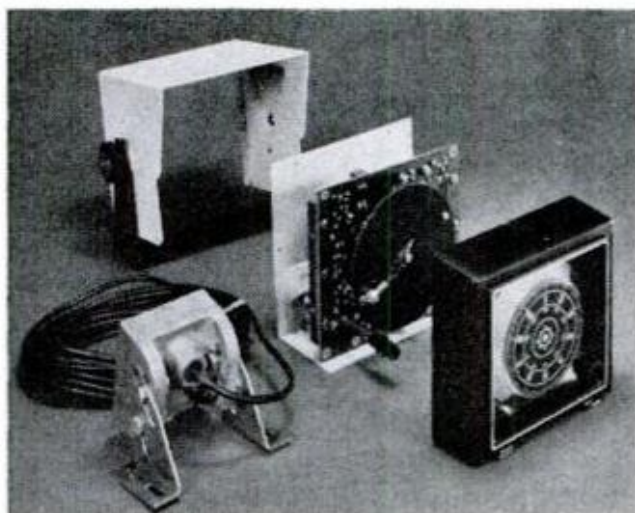




**FUEL-VAPOR DETECTOR** has both meter for visual indication of fumes and Sonalert alarm for audible warning. Sensing element, on long cable, is mounted in bilge. Close-up of sensor is at right, below

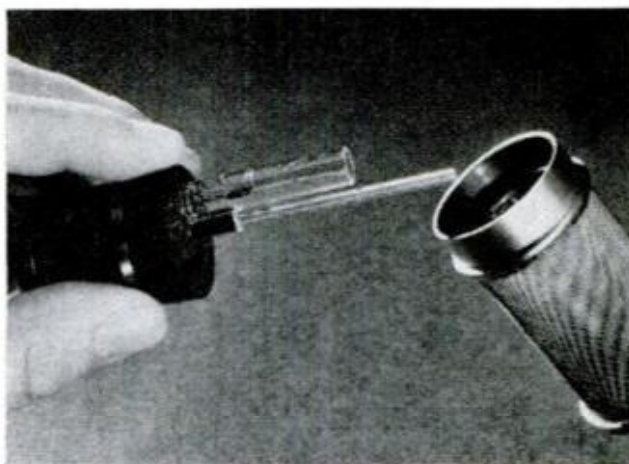
basically the same but packaged differently for convenience. For use primarily as a depth indicator, the mechanism is designed for permanent mounting and operates on the boat's 12-volt electrical system. For use as a fish locator, it comes in a handy portable carrying case with self-contained batteries. This makes it easy to tote along in a small fishing boat.

In either version, the unit sends out sonic pulses through a transducer. The pulses bounce off the bottom or schools of fish, and the time it takes them to return indicates the depth on a dial. The circuit board is similar for both models and is a relatively simple wiring job. Prices are \$69.95 for the depth sounder kit and \$84.95 for the portable fish spotter version. Heath Co., Benton Harbor, Mich. ★★★



**DEPTH SOUNDER** at left, above, has hooded, gimbaled housing made for fixed installation. Its transducer (left foreground) mounts permanently on the transom. Fish-spotting version at right is similar, but comes in portable carrying case with tilt-up top and self-contained batteries. Its transducer (right foreground) is held in a clip on the transom and can be removed quickly for storing in the case

JULY 1970



**SENSING ELEMENT** for gas-fume detector consists of glass tube with tiny platinum wire filament inside, heated by electricity. If vapor is present, filament burns hotter, triggering the alarm circuit



but comes in portable carrying case with tilt-up top and self-contained batteries. Its transducer (right foreground) is held in a clip on the transom and can be removed quickly for storing in the case



# Build a Blinking Beacon To Guide You Home

This simple flasher turns on automatically as night falls to help you find your way back to your dock or campsite.

By JAMES G. BUSSE



**I**F YOU'VE EVER GROPED your way back to your dock in fog and darkness after a day of fishing or cruising, you know how welcome a light would be to help guide you home. The trouble is, you can't turn a light on in the morning when you leave and expect it to burn all day without running down the batteries.

The beacon shown here is different—it thinks for itself. As darkness falls, it turns on automatically and blinks at a steady rate to mark your dock or mooring. It can also be used to light your way back to a campsite in the woods at night.

The beacon is controlled by a light-sensitive photocell. When the light falls below a certain level, the photocell triggers a silicon-controlled rectifier (SCR) and the beacon begins to blink. Any battery-powered lamp or lantern that operates on  $4\frac{1}{2}$  to 6 volts can be used. The one shown is a common self-flashing type sold for emergency highway use. It costs only a few dollars and is available at auto-supply and discount stores.

The parts you add for the control circuit are mounted on a piece of perforated phenolic board cut to fit inside the circular lamp housing. It's not necessary to disturb the existing wiring to the switch and batteries. Merely disconnect the two wires that go to the bulb socket and insert the



control circuit. It is necessary, however, to determine which of these wires is negative and which positive and hook them up as indicated in the diagram to preserve proper polarity.

In most cases, the center contact on the bulb socket is positive and the shell nega-



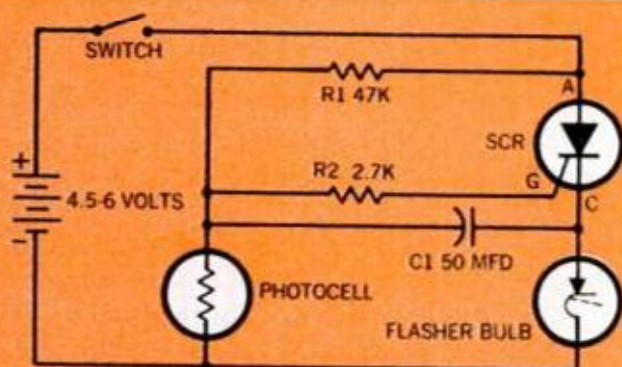
tive. In some lamps, only one wire goes to the socket and the shell is grounded directly to the metal housing. In this case, the ground is generally negative and you can connect the negative circuit lead to a similar ground on the housing. If the lamp you buy is not a flasher type, substitute a blinker bulb of the proper voltage. Use a GE 406 blinker for 4½ volts (three D cells) and a GE 407 for 6 volts (four D cells or 6-volt battery). Use heatsink clips when soldering the SCR, photocell and capacitor to protect them from heat damage.

The control circuit stabilizes the bulb's flashing cycle and slows it to a steady two-second rate. This eliminates the wild, erratic flashing most blinkers give and extends the life of bulb and batteries. For this to work, some of the bulb's light must reach the photocell so the cell can break the circuit after each flash, introducing a brief delay.

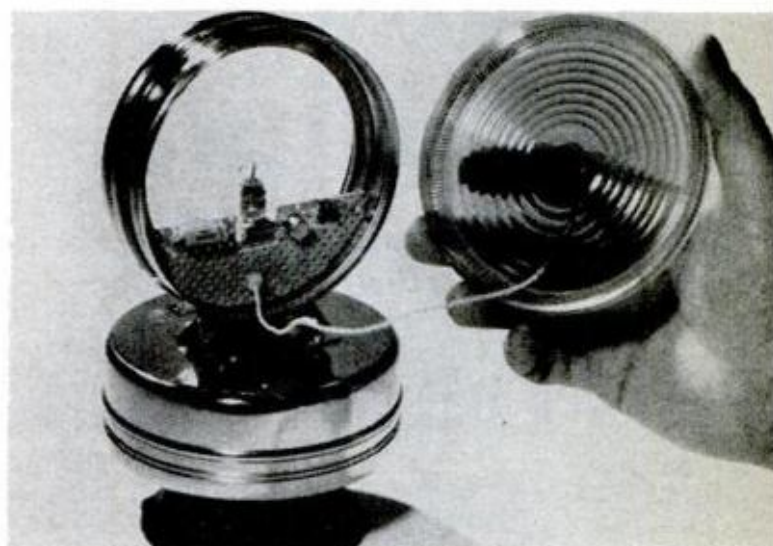
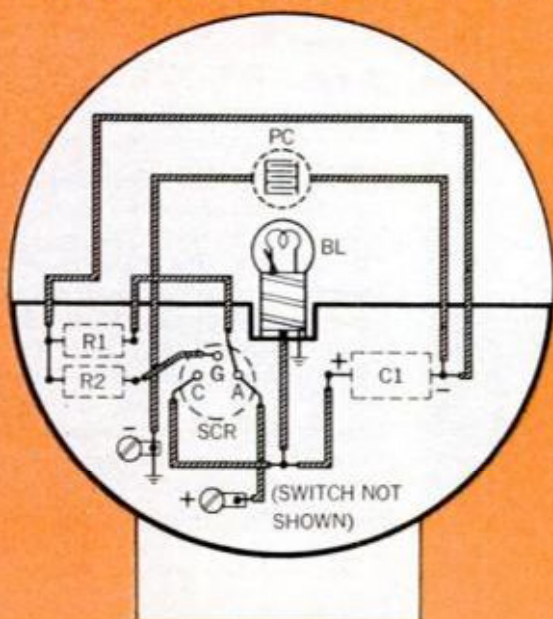
Most lamps of the type used here have an amber lens on one side and a red one

on the other. Mount the photocell on the inside of the amber lens so it faces outward. Don't use the red lens or the cell will be fooled into thinking it's dark outside and will turn the lamp on too early. In attaching the cell, use a thick layer of clear silicone sealant (such as Dow Corning Silastic) between it and the lens. Although the cell points away from the blinker bulb, the sealant will reflect enough light around the edges and into it for the circuit to operate properly.

The parts are all simple and readily available from local electronics stores or mail-order houses like Allied Radio in Chicago, Lafayette Radio in Syosset, N. Y., Olson Electronics in Akron, Ohio, and Radio Shack in Boston. The SCR can be any low-cost, low-voltage type with a 1-amp rating, such as Radio Shack No. 276-1057. The photocell is a CdS type, such as Lafayette No. 19T2101 or Olson No. TR-91. R1 and R2 are both ½-watt resistors, one 47K and one 2.7K. C1 is a 50-mfd, 15-volt electrolytic capacitor. ★★★



**SIMPLE CONTROL CIRCUIT** requires only two connections to existing lamp wiring at the bulb socket. Just be sure that positive and negative leads are wired as shown for proper polarity



**TINY CIRCUIT BOARD** is cut to fit inside lamp housing just below blinker bulb. The light-sensing photocell is cemented to the center of the amber lens on the inside so it faces outward. Batteries are housed in circular lamp base, as shown below







# How to Choose The Right Film for The Best Picture

Today's superfast glamor films are stealing the show, but they aren't always the best choice. Often a slow or medium speed will give better results. Here's a guide to current films and when to use each one

By PHIL GERACI

**D**ECIDING WHAT FILM TO BUY used to be a simple matter of going down to the drugstore and choosing from two or three types, usually depending on whether you wanted color or black-and-white. Not any more. Today, shelves are piled high with dozens of different kinds, each designed for a particular use. There are definite reasons for picking one film over another, and the selection becomes easier if you understand the characteristics and limitations of each kind.

The accompanying chart lists commonly available films in a wide variety of types and brands. You won't find them all at any one store, but the tables can be helpful in making comparisons and in selecting suitable substitutes for films you may not be able to locate in your area.

In black-and-white films, the basic choice is between high speed and good grain structure—you can't have one without sacrificing some of the other. A film's ASA speed rating is an indication of the amount of light needed to produce a picture—the higher the number, the "faster" the film and the less light required. Speeds have been soaring so rapidly lately that a film like Kodak's Tri-X, once considered fast at 400 ASA, is now actually a medium-speed film compared to emulsions that go on up to 1600 and 2000 ASA.

High-speed films enable you to shoot in dim light, but they aren't the answer for all occa-



**CHOICE OF FILM** here depends on type of effect you want. At far left, a fast film permits shooting in dim light near a window or table lamp. Result can be pleasing as an informal snapshot, but picture is grainy, lacks contrast and puts face in shadow. Use of slow, fine-grain film at near left requires considerably more light, but produces a technically better picture with crisp detail, good contrast and delicate modeling without shadows



# Handy Tear-Out Film-Selection Guide

Films listed are those which are commonly available at many drugstores and at most photographic dealers

## POSITIVE COLOR (for making transparencies)

Type	Speed (ASA)	Home Processed?	Main Light Balance*	Available Sizes
Agfachrome CT 18	50	No	Daylight/blue flash	35mm, 120, 127, Rapid
Ansochrome 64	64	Yes	Daylight/blue flash	35mm, 120, 126
Ansochrome 50	50	Yes	Daylight/blue flash	35mm, 127, 120, 620
Ansochrome 100	100	Yes	Daylight/blue flash	35mm
Ansochrome T/100	100	Yes	Photofloods (3200°)	35mm
Ansochrome 200	200	Yes	Daylight/blue flash	35mm
Ansochrome 500	500	Yes	Daylight/blue flash	35mm
Dynachrome 25	25	No	Daylight/blue flash	35mm
Dynachrome 64	64	No	Daylight/blue flash	35mm, 126
Kodachrome II	25	No	Daylight/blue flash	35mm, 828
Kodachrome II Prof. Type A	40	No	Photofloods (3400°)	35mm
Kodachrome X	64	No	Daylight/blue flash	35mm, 126
Ektachrome X	64	Yes	Daylight/blue flash	35mm, 126, 127, 120, 620, 828
High-Speed Ektachrome	160	Yes	Daylight/blue flash	35mm, 120, 126, 620
High-Speed Ektachrome Type B	125	Yes	Photofloods (3200°)	35mm, 120

\*Films balanced for daylight or blue flash may be exposed by the light of a 3400° photoflood by using an 80B filter; by 3200° floods (professional types) by using 80B plus 82A filter. Films designed for exposure by 3200° photofloods may be exposed in daylight by using 85B filter (also, by blue flashbulbs). Films designed for 3400° photofloods may be exposed in daylight with 85 filter.

## NEGATIVE COLOR (for making prints)

Type	Speed (ASA)	Home Processed?	Main Light Balance*	Available Sizes
Dynachrome for Color Prints	64	Yes	Daylight/blue flash	35mm, 126, 127, 120, 620
Agfacolor CNS Rapid	80	Yes	Daylight/blue flash	Rapid
Agfacolor CN 17	40	Yes	Daylight/blue flash	35mm, Rapid, 120
Kodacolor X	80	Yes	Daylight/blue flash	35mm, 828, 127, 126, 616, 116, 120, 620
Ektacolor Professional, Type S	100	Yes	Daylight/blue flash	120, 220, 620

\*Negative color films can, theoretically, be exposed by light of any color. However, most labs recommend using 80A filter when film is exposed by light of 3200° photofloods, 80B filter when exposed by 3400° photofloods.



**ACTION SHOTS** require good film speed so you can stop motion. At far left, slow film forces use of a slow shutter speed, causing players to appear blurred. At near left, medium-speed Tri-X at ASA 400 freezes players, producing a dramatic, caught-in-midair result. With a film like this, well-lighted indoor scenes can often be taken at 1/125th of a second and f/8, a combination that both arrests movement and provides a good depth of field



## BLACK-AND-WHITE FILMS

### ASA 0-50

Use: Scenics, landscapes, portraits. Very fine grain structure means extreme enlargements are possible. Fine-grain developers are recommended.

TYPE	SPEED (ASA)	AVAILABLE SIZES
Adox KB-14	20	35mm
Agfa Isopan IFF	25	35mm, 120
Ilford Pan-F	32	35mm
Kodak Panatomic X	32	35mm, 120
Agfa Isopan IF	40	35mm, 127, 120, 620

### ASA 50-200

Use: Average subjects under average lighting conditions. Simple, nonadjustable cameras. Combine relatively fine grain with medium speed. Fine-grain developers may be used.

Adox KB-17	64	35mm
Adox KB-21	80	35mm
Anso Versapan	100	35mm, 120
Agfa Isopan ISS	100	35mm, 127, 120, 620
Ilford FP-3	125	35mm, 120
Kodak Plus-X	125	35mm, 120
Kodak Verichrome Pan	125	Most roll sizes

### ASA 200-800

Use: Average to poorly lighted subjects. Film speeds permit photographs in bright or dim surroundings with adjustable cameras. Not for general use in nonadjustable cameras.

Kodak Tri-X	400	35mm, 127, 120, 620
Agfa Isopan ISU	400	35mm, 127, 120
Ilford HP-3	400	35mm, 120
Anso Super Hypan	400	35mm, 120
Ilford HP-4	500	35mm, 120
Ilford HPS	800	35mm, 120

### ASA 800-plus

Use: Extremely poor lighting conditions. Not for normal use in daylight. Not for flash. Special developers recommended.

Agfa 1000 ASA	1000-2000	35mm, 120
Agfa Isopan Record	1200	35mm, 120
Kodak Royal-X Pan	1250	120
Kodak 2475	1000-1600	35mm



**PORTRAIT SHOOTING** is good example of situation in which high-speed film offers no advantage. Close-up at far left, made with superfast ASA 1600 film, is flat and grainy with overall tone of drab grayness. At near left, slow film gives fine grain, good contrast and sparkling highlights. Background has gone out of focus because of wide lens opening needed, but this is actually an advantage, eliminating distracting detail behind the model's head





**SUBTLE DIFFERENCES** are sometimes not immediately apparent. Shot at far left looks sharper at quick glance because fast film permits greater depth of field. But film's grain obscures subject in background—actually the picture's important part. Same scene at near left, shot with slow film, is sharper at subject area even though the foreground is out of focus

sions or for all cameras. They should be used carefully. The problem is that, as speed goes up, grain in the film becomes more prominent. Coarse grain robs a picture of sharpness and detail, kills highlights and produces a generally drab and fuzzy result. For this reason, today's superfast films—800 ASA on up—should be used only where pictures would otherwise be impossible. They can be useful in situations where flash is not practical or not permitted, such as at night sporting events or in churches and museums.

Medium-fast films rated at 400 to 500 ASA, like Tri-X, Ansco Super Hypan and Ilford's HP-3 and HP-4, are a good compromise for general shooting because they offer reasonably high speed without excessive grain. In adjustable cameras, they can be used in a wide range of picture-taking situations from bright beach scenes to dim interiors. Their speed not only permits shooting in poor light, but it enables you to use fast shutter speeds to freeze motion and small lens openings for maximum sharpness.

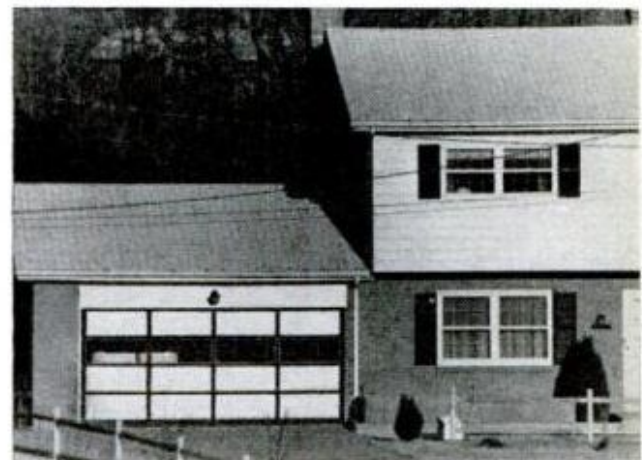
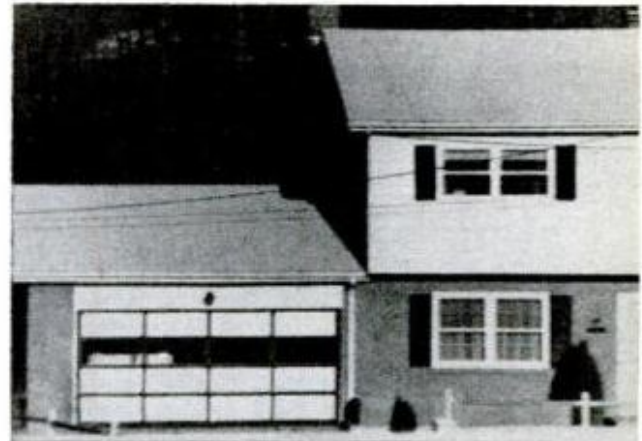
Fast films are not suitable, however, for nonadjustable cameras that usually have a fixed shutter speed of 1/30th to 1/50th of a second and a lens opening of about f/16. At these settings, a high-speed film would be way overexposed in bright light. By the same token, very slow films—those ranging from 20 to 32 ASA—aren't suitable, either. In this case, the lens opening is too small for good exposure, and the result would be severe underexposure. The best films for simple cameras are those rated at 64 to 125 ASA.

For adjustable cameras, slow and medium-speed films are preferable where the light is bright or you can control the lighting yourself, such as with flash or floodlights. Films with ratings up to 125 ASA, such as Kodak's Panatomic-X, Ansco

Versapan, Agfa Isopan ISS and Kodak's Plus-X, offer fine grain, sparkling highlights and superb detail. They're ideal for portraits and still lifes where motion is not a problem and for big enlargements that must be sharp and free from grain.

As a general rule, use the slowest film that will give you a good exposure for the conditions you're shooting under. If you have to stop motion, it's best not to shoot slower than 125th of a second—and 1/250th or 1/500th is better still. If good

*(Please turn to page 196)*



**TELEPHOTO SHOTS** need high-speed film to permit as short an exposure as possible. At top, house is blurred by camera shake in long exposure. At bottom, fast film gives a sharp picture



# How to Fix Your Automatic Transmission

You can't do everything, but you can troubleshoot your gearbox and actually repair more things than you thought you could

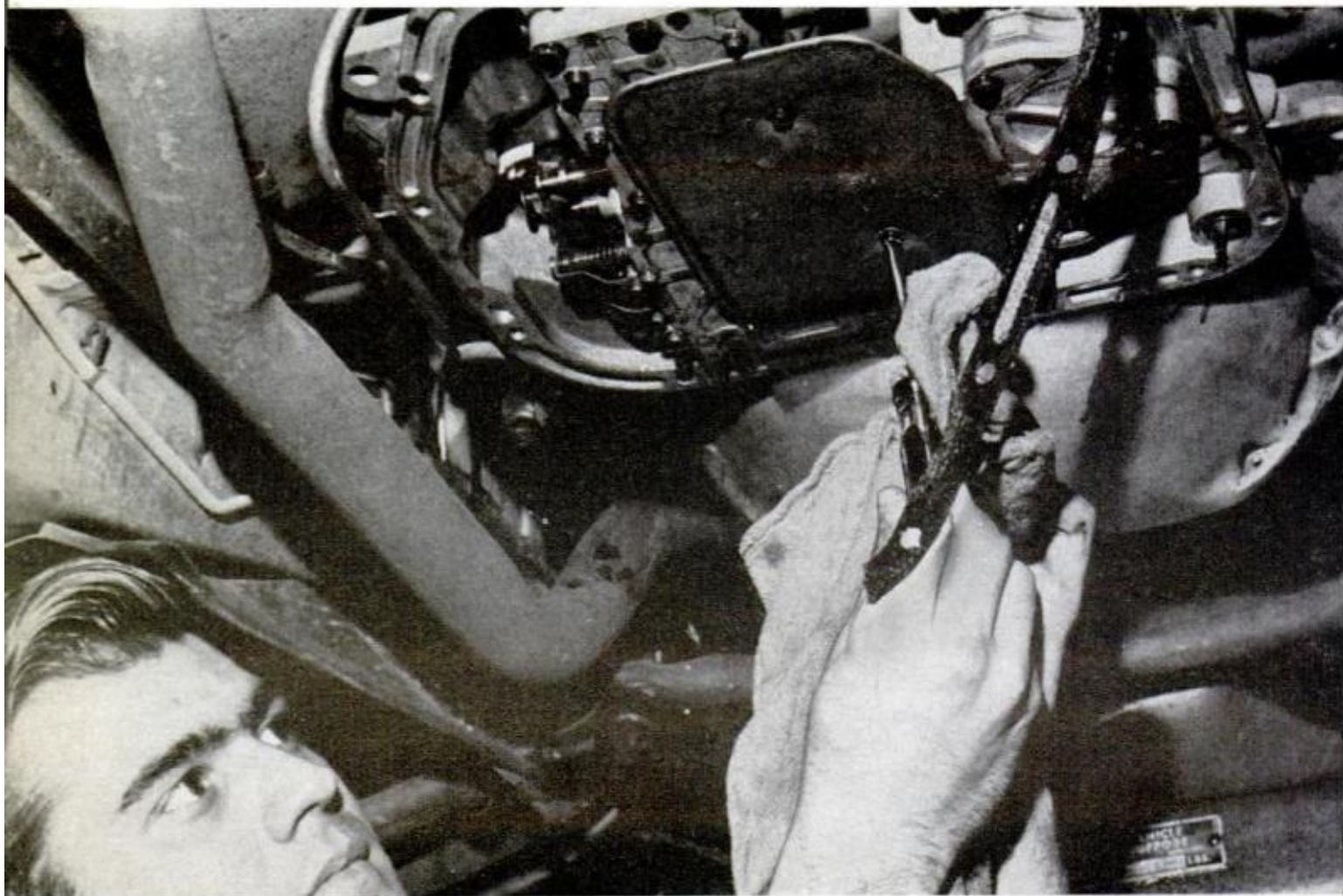
By MORT SCHULTZ

**I**F YOU THINK you have automatic transmission trouble, first make sure you do. Maybe you don't. Imagination or misinterpretation of symptoms can cost you money.

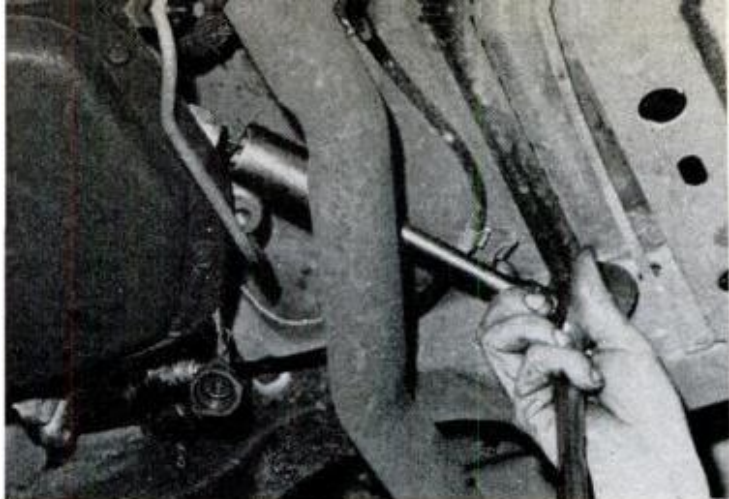
Car owners have been known to pay to have gearboxes "fixed" because they don't upshift at 15 mph, 20 mph, 35 mph or

some other exact specification. What a waste. A driver can unconsciously vary his car's shift pattern by 25 mph from one shift to another if he varies the pressure he puts on the accelerator. Furthermore, no one is smart enough to tell you at what exact speed a transmission will shift because of other variables. Two cars which

**REPLACE FILTER** before changing transmission fluid. Pan gasket must be replaced if any part is removed







**NEUTRAL SAFETY SWITCH CONTACT** must be tight on the switch. If that's not the problem, replace switch

have the same transmissions may have different tire sizes and rear-axle ratios which cause shifting to occur at different speeds.

Yet there is a way to determine if an abnormal delay in shifting exists. Operate the car under typical city-driving conditions. A transmission that doesn't upshift to direct drive within the normal city speed limit of 25 mph is not acting right. A slipping transmission is a candidate for repair. Slipping becomes apparent when engine speed runs away before the transmission upshifts.

Transmission whine is one of the most misleading symptoms of all and has caused many drivers to pay for needless service. A certain amount of whine is normal.

Gears in an automatic transmission are in constant mesh. In first gear and reverse, a whine produced by gear rotation increases as car speed increases. An objectionably shrill sound spells trouble, as does a whine in high gear when gears are not rotating.

Grinding, knocking, scraping and clicking sounds coming from the gearbox, no matter under what conditions, indicate a sick transmission. Another problem is a drop of transmission fluid that appears somewhere on the case. This leak requires repair. An oily film at a bolt or gasket joint is normal seepage, so leave it alone.

A sure sign that an automatic transmission needs attention is when it's in gear and the car won't move. Not so obvious is a car that won't start with the transmission selector in Neutral or Park, or one that starts with the selector lever in any position. Both problems are caused by a neutral safety switch contact that's worked loose or by a damaged switch. This part

JULY 1970

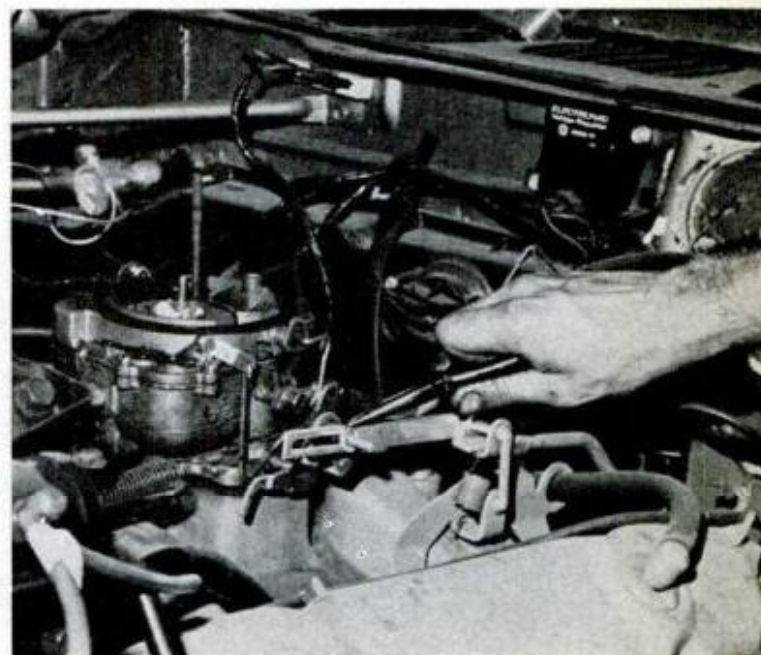


**TRANSMISSION FLUID LEVEL** is first thing to check. Read dipstick with unit at operating temperature



**USE ONLY FLUID SPECIFIED** by the manufacturer. Don't try to save pennies with the "cheap stuff"

**DISCONNECT KICKDOWN VALVE LINKAGE** at carburetor, road-test car to see if valve is problem







**DRAIN PLUG** should be used, if possible, when draining transmission fluid to keep your garage neat

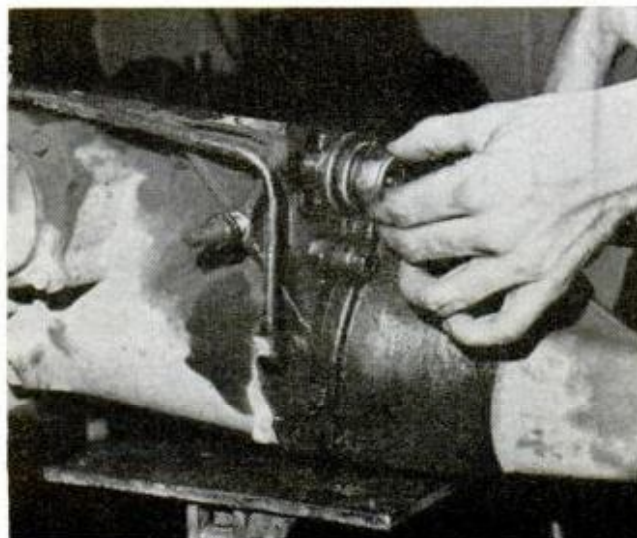
is found on the side of most transmissions. One thing you should have to pinpoint it is the car's service manual or other manual such as Motor's Auto Repair Manual.

For all problems except a leak and neutral safety-switch trouble, inspect the fluid level, while the transmission is at operating temperature. This requires that the car be driven about five miles. If the fluid shows "overfilled" on the dipstick, drain excess. An overfilled transmission causes fluid to aerate, which lowers pressure and leads to slipping and erratic shifting.

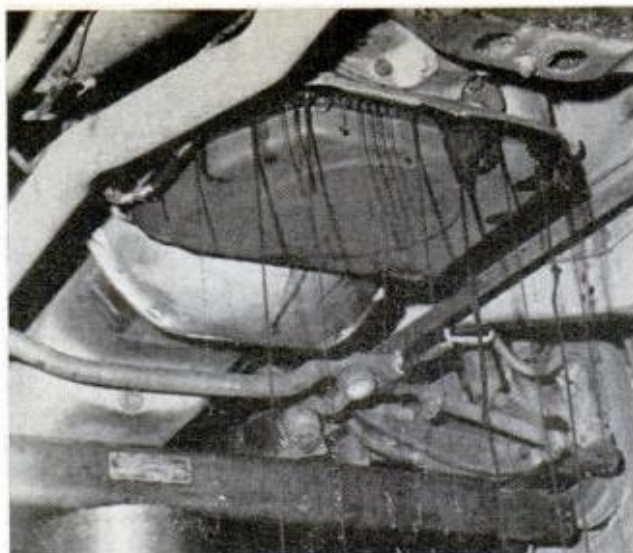
If the transmission fluid level is below the "full" mark on the dipstick, harshness, shifting delays and noise could result. Add fluid—always the type specified by the maker of your car. If transmission fluid is very low or has been lost, the car won't move with the transmission in gear.

Now, suppose fluid level is okay and

**FAULTY VACUUM CONTROL** (modulator) causes many transmission problems. Replacing it may solve yours



138



**IF DRAIN PLUG ISN'T AVAILABLE**, remove pan bolts, pry pan loose and stand back from the downpour

your problem is harsh, slipping, delayed or erratic shifting. Some transmissions have an electric kickdown switch which should be disconnected while you run a road test. If the problem no longer exists, this switch is at fault and should be replaced.

Other transmissions have a manual kicking valve controlled by a pressure linkage on the carburetor. Take this valve out of the system by disconnecting the linkage. If the valve is causing the problem, the transmission will now perform normally during a road test. With this out of the way, you should now drain and drop the transmission oil pan. Some transmissions have drain plugs. Most don't.

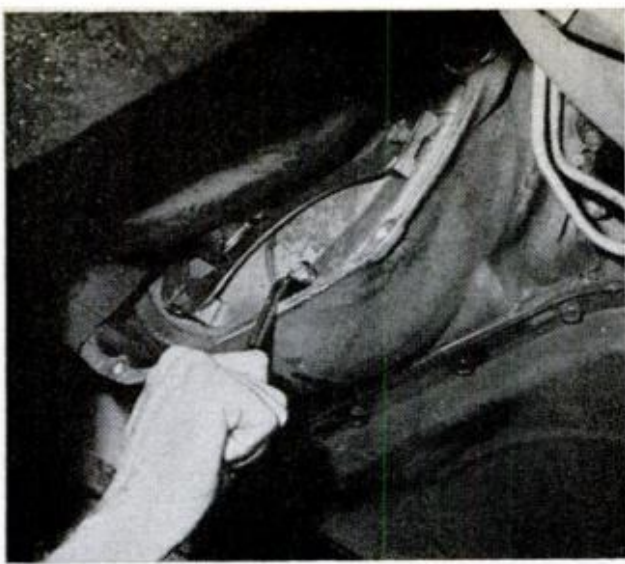
To drain fluid when no plug is provided, remove all bolts except two opposing ones, which should be loosened. Now pop the pan loose with a puttyknife or screw-

**CRACKED CONVERTER DRIVE PLATE** was discovered to be the cause of clicking sounds in this transmission



POPULAR MECHANICS





**CONVERTER**, as well as gearbox, should be drained to be sure all the old transmission fluid is removed

driver, but get back fast so you aren't spattered by fluid.

The converter should also be drained. Most cars have one drain plug, but some (Ford, for example) have two. Remove both to get all fluid out of the converter.

Examine the pan and fluid for debris warning of part failure. Also check fluid for color (it should be red—not black or orange) and odor (it should not smell like varnish). If any of these conditions exist, transmission parts have failed.

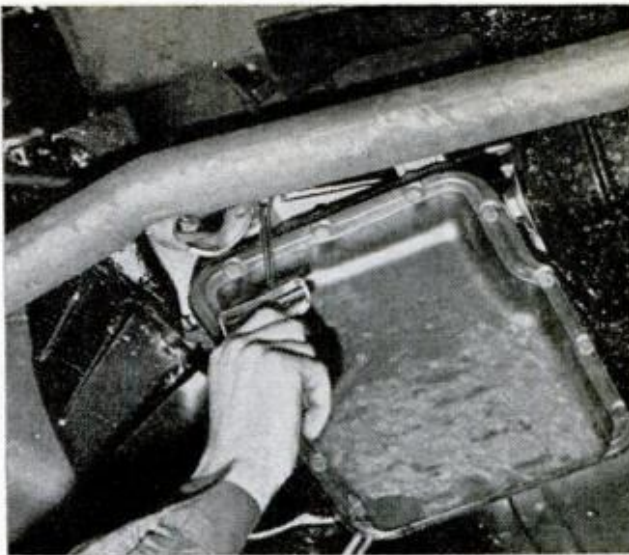
A major overhaul is probably needed, although you may avoid it if damage hasn't gone too far, by tuning the transmission. Tune-up involves adjusting the transmission bands and linkage, cleaning parts, replacing the transmission oil filter, and installing fresh fluid of manufacturer's specification. You'll need a torque wrench

*(Please turn to page 197)*

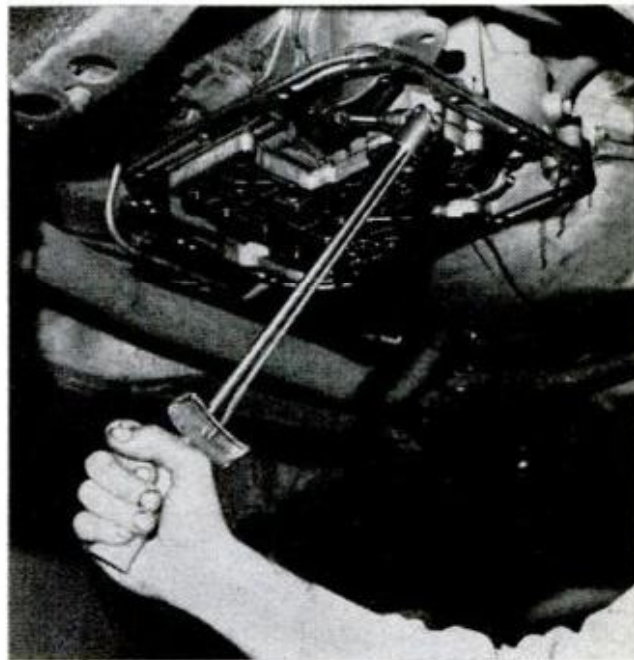
**BAD SPEEDOMETER ADAPTER** O-ring may cause leak. Remove speedometer gear housing from gearbox



JULY 1970

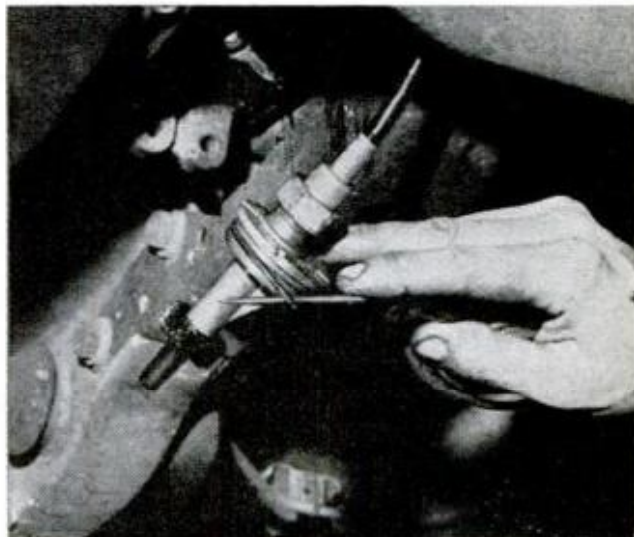


**MOST FRONT BANDS** can be adjusted without removing pan. Torque to manufacturer's specifications



**ADJUSTING REAR BANDS** is not as easy. Pan must be removed to make them accessible for adjustment

**REMOVE DAMAGED** speedometer adapter O-ring by prying it loose, then slip new one into position





# EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



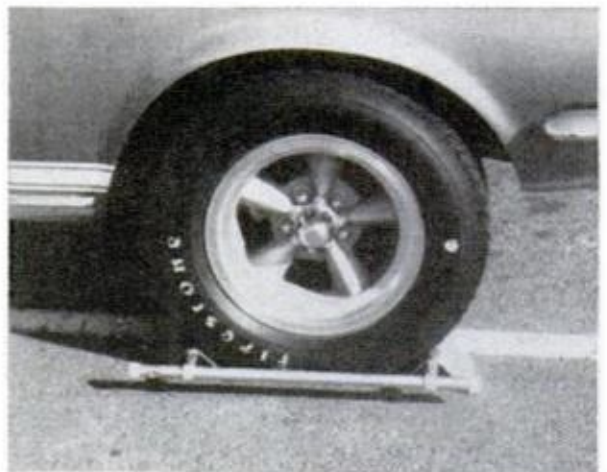
**KEEP YOUR GARDEN BEAUTIFUL** and bug-free with the Spray and Dust Bug House. Contained in its own "bughouse," the kit comes complete with a No. 609 Favorite compression sprayer, No. 6419 Hydra-Gun Sprayer, No. 6766 Admiral Duster and five packages of Pop-In pesticides. It is sold for \$33.99 by the H. D. Hudson Mfg. Co., 154 E. Erie St., Chicago, Ill. 60611.



**YOU'RE COOKING IN STYLE** with this attractive butane cooking unit called the Table Chef. Fueled with a Ronson "Multi-Fill" butane injector, it will operate up to 13 hours on low flame. Burner, deluxe stand and a 250-gram Multi-Fill sell for \$29.95 from the Ronson Corp., 1 Ronson Rd., Woodbridge, N.J. 07095.

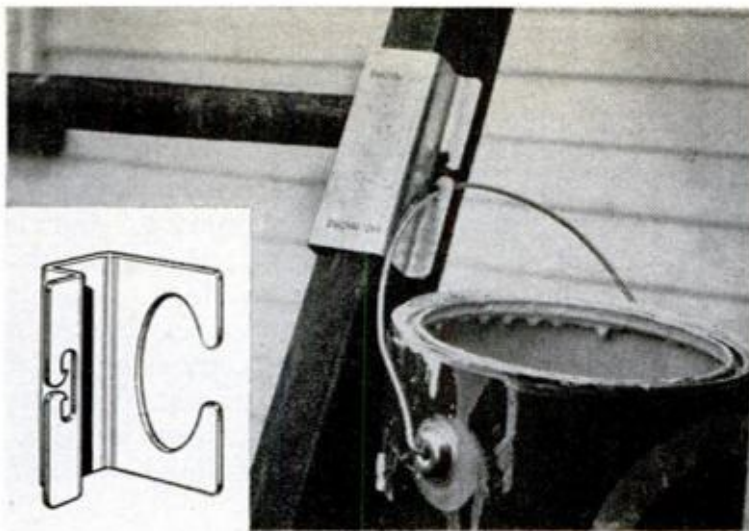


**ENJOY THE TASTE** of smoked fish, meat or fowl in minutes with the Li'l Smoker. It's portable and compact, making it ideal to take along on your hunting, fishing, picnicking or camping trips. It can also cook hot dogs, bacon and sausage, and, in addition, will serve as a hot-plate. Available for \$9.95 plus 75 cents postage from Doutt Enterprises, c/o Doutt's Li'l Smoker, Box 758, Silverdale, Wash. 98645.



**WHEN CHANGING A TIRE** or making emergency repairs you can avoid personal injury and/or property damage by using the Saf-T-Stop wheel block. Placed under a tire, the unit securely holds the wheel in position, prevents the vehicle from moving in either direction. It's priced at \$4.95 by the L & L Manufacturing Co., 1769 Pleasant Valley Ave., Oakland, Calif.





**SOLVE THE PROBLEM** of how and where to hang a paint bucket on a ladder with the Reversible Paint Can Hook. The hook is simply placed over a rung of your ladder and positioned on the side rail to hold the bucket firmly against the side of the ladder. In place, the bucket is out of the way, easy to reach and cannot fall. It fits all extension ladders and can be used on either the right or left side rail. It's also great when window washing or for holding a tool caddy. Priced at \$1.75 and manufactured by the J & F Distributing Co., Dept. PM, 25 Surrey Rd., Aurora, Ill. 60538.



**YOU CAN BUILD A WATERFALL**, water fountain or fountain ring from this kit. Any one is easy to install—just dig a 12-in.-deep hole, place plastic pool liner in the hole, fill with water and submerge the pump. No permits, plumbing or drains are needed. Complete kits are available, starting at \$19.95, from the Little Giant Pump Co., Box 12010, Oklahoma City, Okla. 73112.

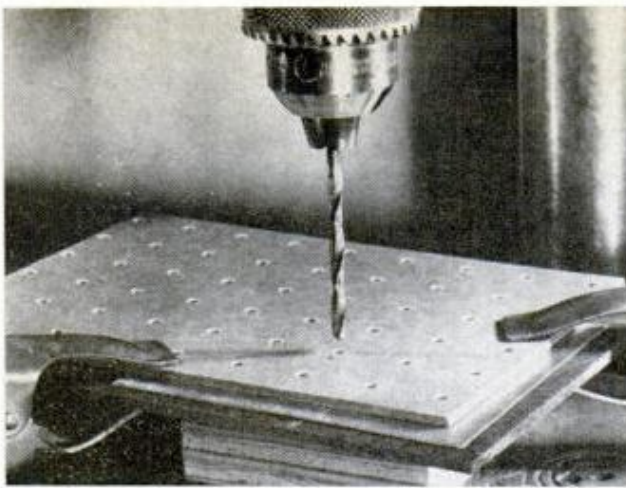


**ALL-PURPOSE GARDEN GUN** for controlling insects and fungus disease, and spot spraying of weed killers, does the job of two different sprayers. At the turn of a dial, it delivers 6 gal. for treatment of flowers and shrubs or 15 gal. for lawns and trees. Attached to any garden hose, it offers a multiple spray-pattern choice. Sells for \$6.49 from Melnor Industries, Moonachie, N.J. 07074.

**GET YOUR BARBECUE FIRE** going in minutes with the Quick Start Propane Charcoal Lighter. It's odorless, safe and economical. A small gas flame is first used to ignite the charcoal, after which a jet of air spreads the fire to the entire pile. Lighter uses a standard 14-oz. throwaway propane cylinder, is made by the Donnell Co., 332 Maplewood St., Bridgman, Mich. 49106, and sells for under \$9.



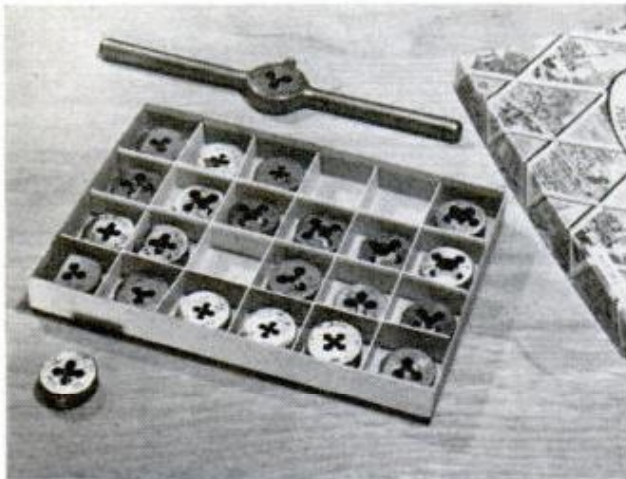




# HINTS FROM READERS

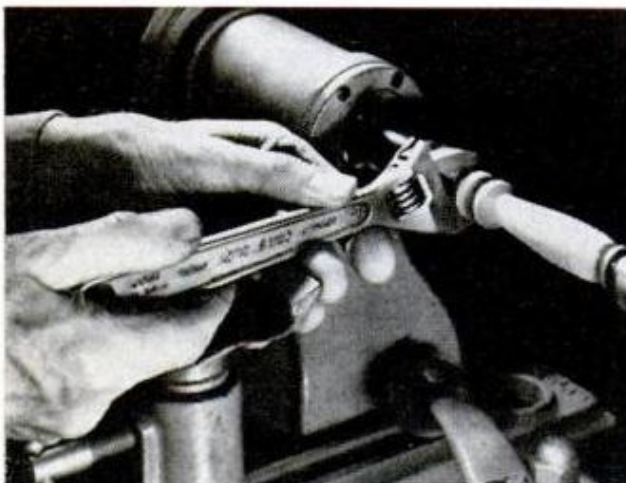
## Perforated hardboard spots bit

To prevent excessive burring when drilling thin metal, it is customary to sandwich and clamp it between two blocks of wood, which makes it impossible to spot the bit. If you use perforated hardboard for the top block, you can center the bit directly over the punch mark. This stunt works particularly well when bit size is near perforation size.—*Walter E. Burton*



## Candy box holds dies

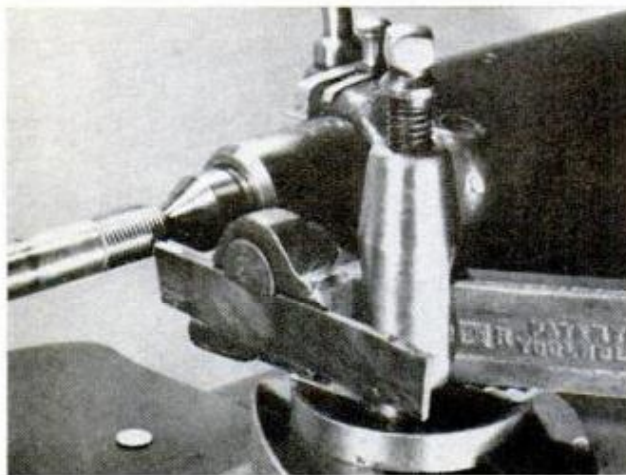
After two dozen pieces of maple candy had been consumed, their compartmented box came in handy for orderly storing of a reserve assortment of button dies. It's best to anchor the cardboard dividing strips, at bottoms and ends, with dabs of white glue. For prolonged storage, the dies should be coated with a rust-resisting preparation.—*Burt Edwards*



## Wrench "caliper" burnishes turning

A sure way to be right on the mark when turning a dowel or tenon on a wood lathe is to cut the dowel a few thousandths of an inch larger than required. Then, clamp a smooth-jawed adjustable wrench on the work to polish and bring the dowel to the desired size. Photo shows wrench finishing dowel-like tenon.

—*Allen Joe Park*



## Grounding home appliances

I recently purchased a portable dishwasher which must be grounded. To avoid this nuisance every time the machine is used, I soldered a small alligator clip to one end of a short piece of insulated wire and a terminal to the other. With the terminal attached to a screw at the receptacle, now all I have to do is connect the alligator clip to the ground on the washer. One of these could be provided at every receptacle.—*Robert H. Dukas*

## Cutoff tool cuts threads

In a pinch the thin blade of a cutoff tool can be made to serve as a thread-cutting tool by grinding the blade to a 60° point. Front clearance should be 5°, the sides of the blade already have sufficient taper to provide side clearance.

—*C. W. Woodson*





# Build This **TURTLE BOAT**

## For the Fun of It!

Its paddle wheels are propelled by hand cranks, and it's as safe a kids' boat as you'll ever find for ponds and streams

By HAL KELLY

**T**HERE'S A SUMMER OF FUN AHEAD for young skippers who step aboard this exciting paddle-wheel boat. Propulsion is by hand cranks and the rudderless craft is steered by its two paddle wheels. To turn around, one crank is turned forward, the other backwards.

The flat-bottom 4x11-ft. hull is light enough for even a six-year-old skipper to outdistance dad in a rowboat. The turtle shells over the paddle wheels keep water from splashing into the boat.

No jig is needed to build it. The sides and center section are all clamped together



and cut and planed at one time. They must match exactly and the edges must be square to the sides so the bottom will lie flush on all three. Notice that there must be a cutout at the bottom for the 1/2-in.-thick plywood bottom. Next, dado the sidepieces at each end. Since the center section is 1 in. shorter than the sides it is not dadoed. This piece slips into a 1/2-in.-deep dado on the front and backpieces. Beef up the center section with 1/4-in. plywood glued and nailed to each side where the cranks are fastened. You can cut out the section for the cockpit area immediately, but leave the seat section for later.

The 1/2-in.-thick bottom section is glued and nailed in place with the 1 1/2-in. No. 13 boat nails. Place the setup on a pair of sawhorses and fasten the endpieces in place. Now flip it over and, with glue and 3/4-in. No. 16 nails, fasten the 1/4-in. plywood bottom. To make bending easier,

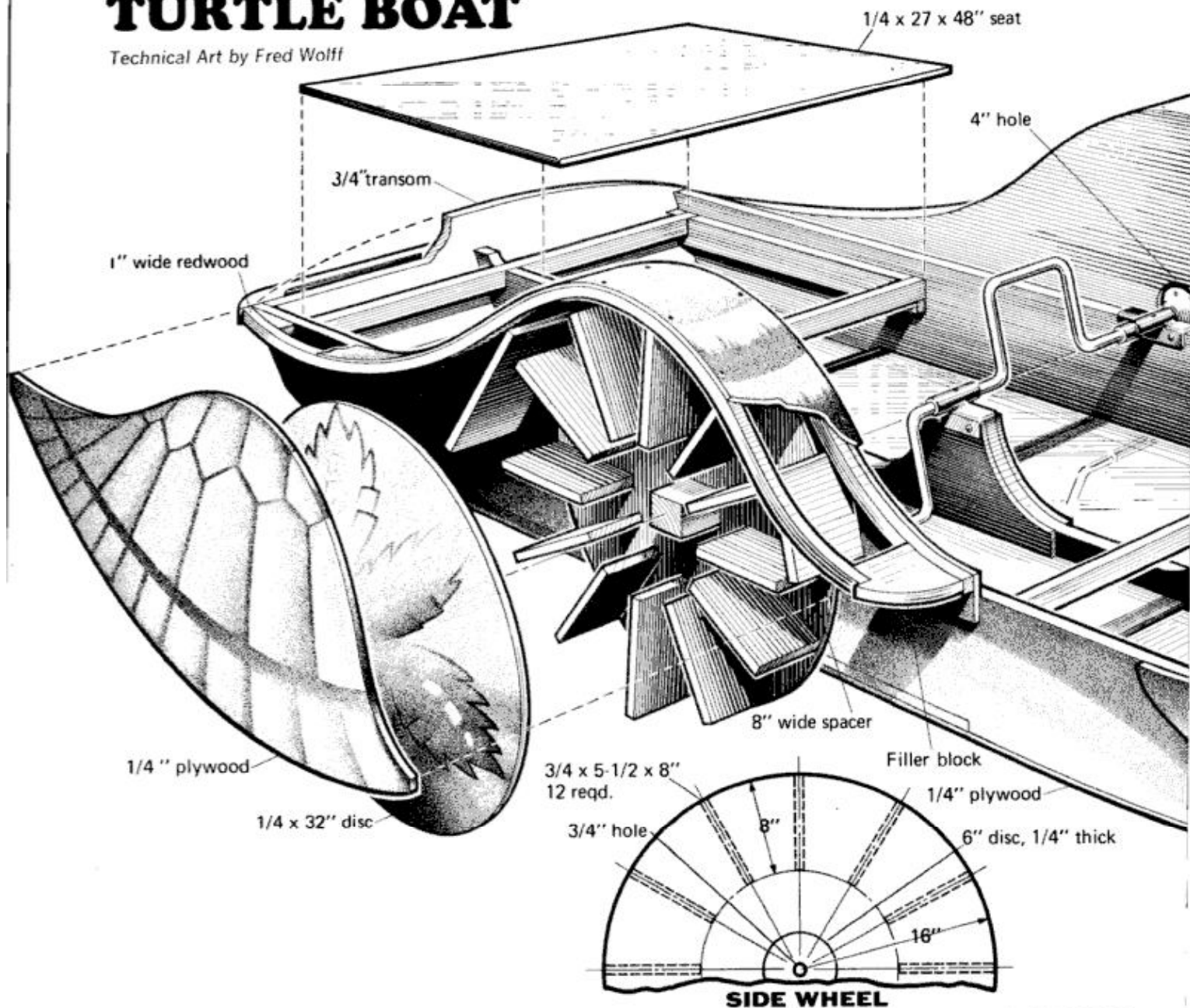
soak the ends of the plywood with hot water. Flip again and trim the center section to correct depth for the seats.

The inside of the paddle-wheel housing is of 1/4-in. plywood glued and nailed to the outside of the boat. Next, cut scraps of 1-in.-wide redwood for the top edges of both inside and outside of the housing. Glue and nail the plywood sides to these pieces. The insides are glued and nailed to two pieces of wood 8-in. wide; the outside, in turn, is fastened to them. Since the outside piece is attached to the side of the boat at the transom, the housings almost come to a point at the back. It is an easy bend. At the front the sides are brought in to approximately 7 in. of the sides where a filler block is used. A Stanley Surform works fine for fairing the top of the paddle housings. I used 1/8-in. plywood for the top; if this is not readily

*(Please turn to page 198)*

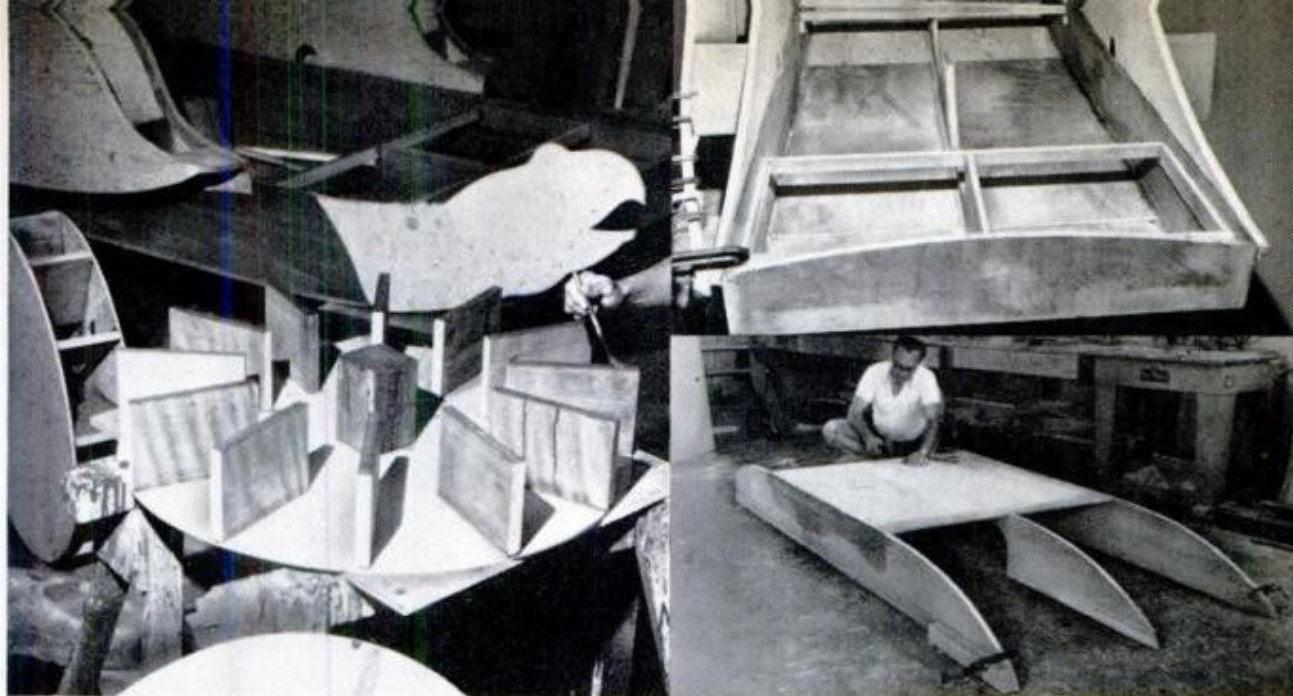
## TURTLE BOAT

Technical Art by Fred Wolff

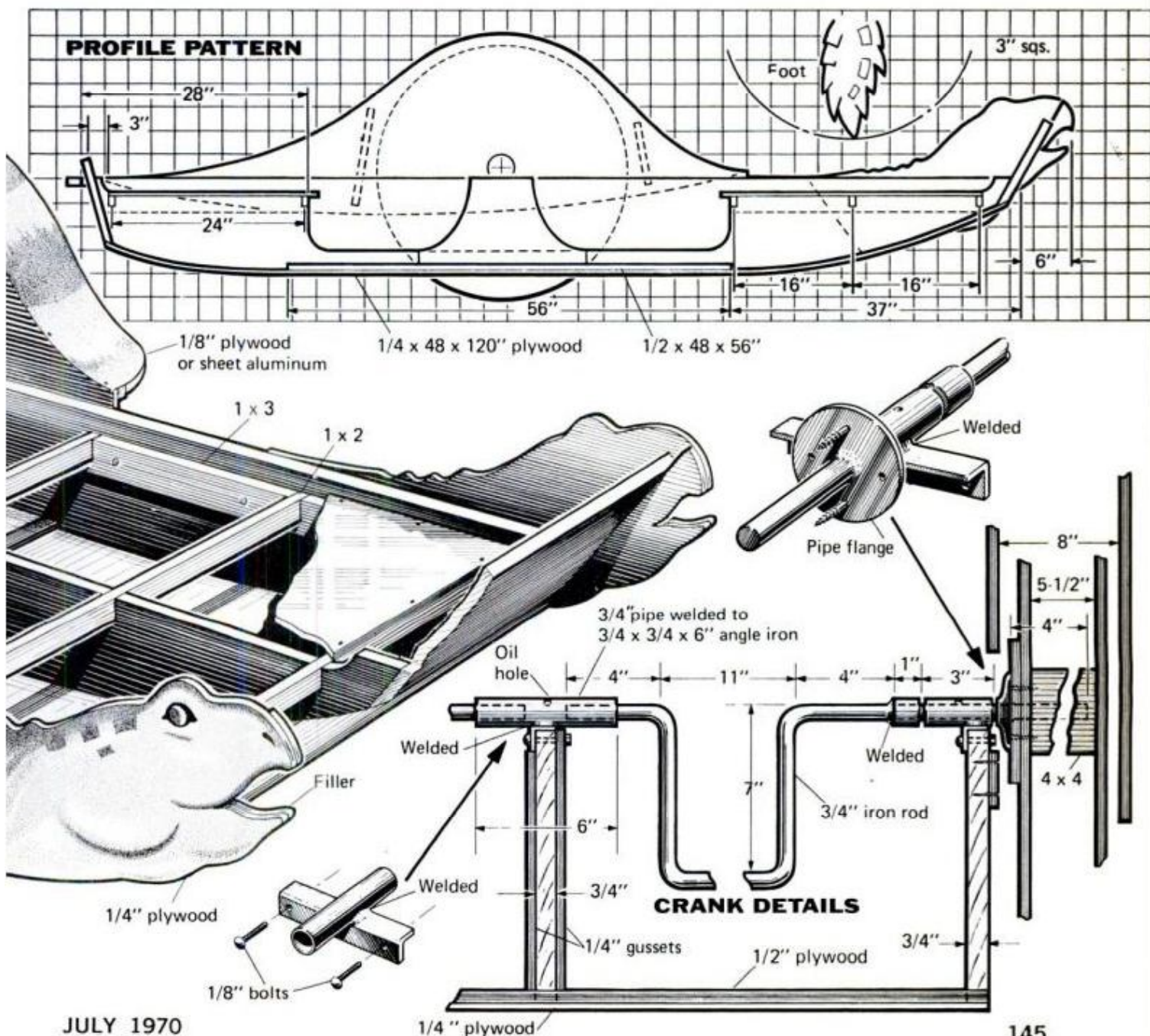


**SIDE WHEEL**





**WATERPROOF GLUE** and marine nails are used throughout to assemble the Turtle Boat. Photo at left shows finished paddle wheels and cranks ready for assembly. In picture at top right, paddle-wheel assemblies are ready to receive the tops of the wheel housings. Below: Bottom is fastened to keelson and gunwales









# Build This Early American Bedroom Set

## PART 1: NIGHT STAND AND BED

By M. J. JOHNSON

*Technical Art by Fred Wolff*

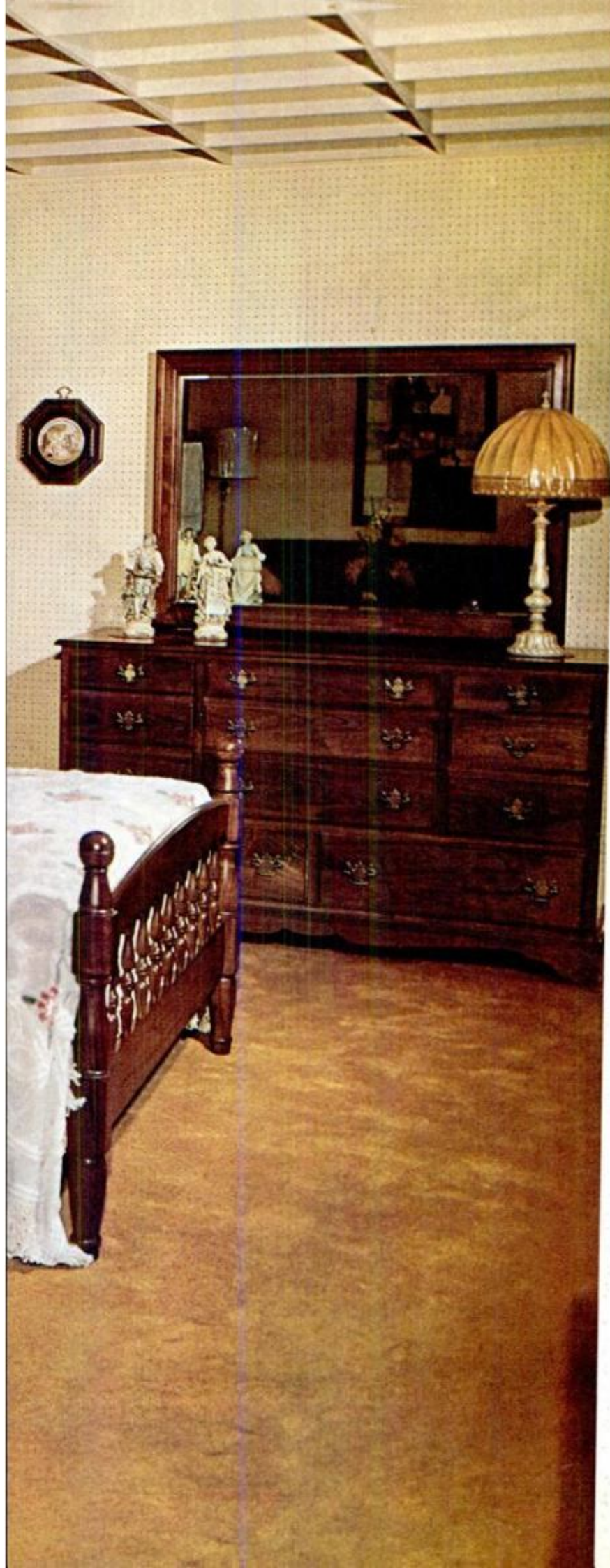
**C**OULD YOUR BEDROOM stand some new furniture? How about this charming four-piece Early American? You can build it yourself and be proud of it for years.

The set you see here was made from native walnut, but pick any wood you want. Solid cherry would make a beautiful set.

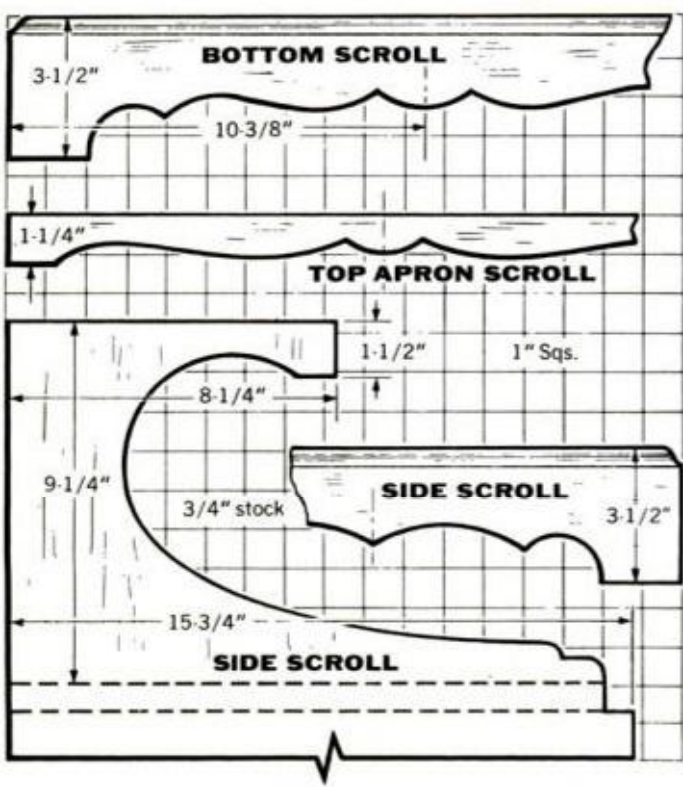
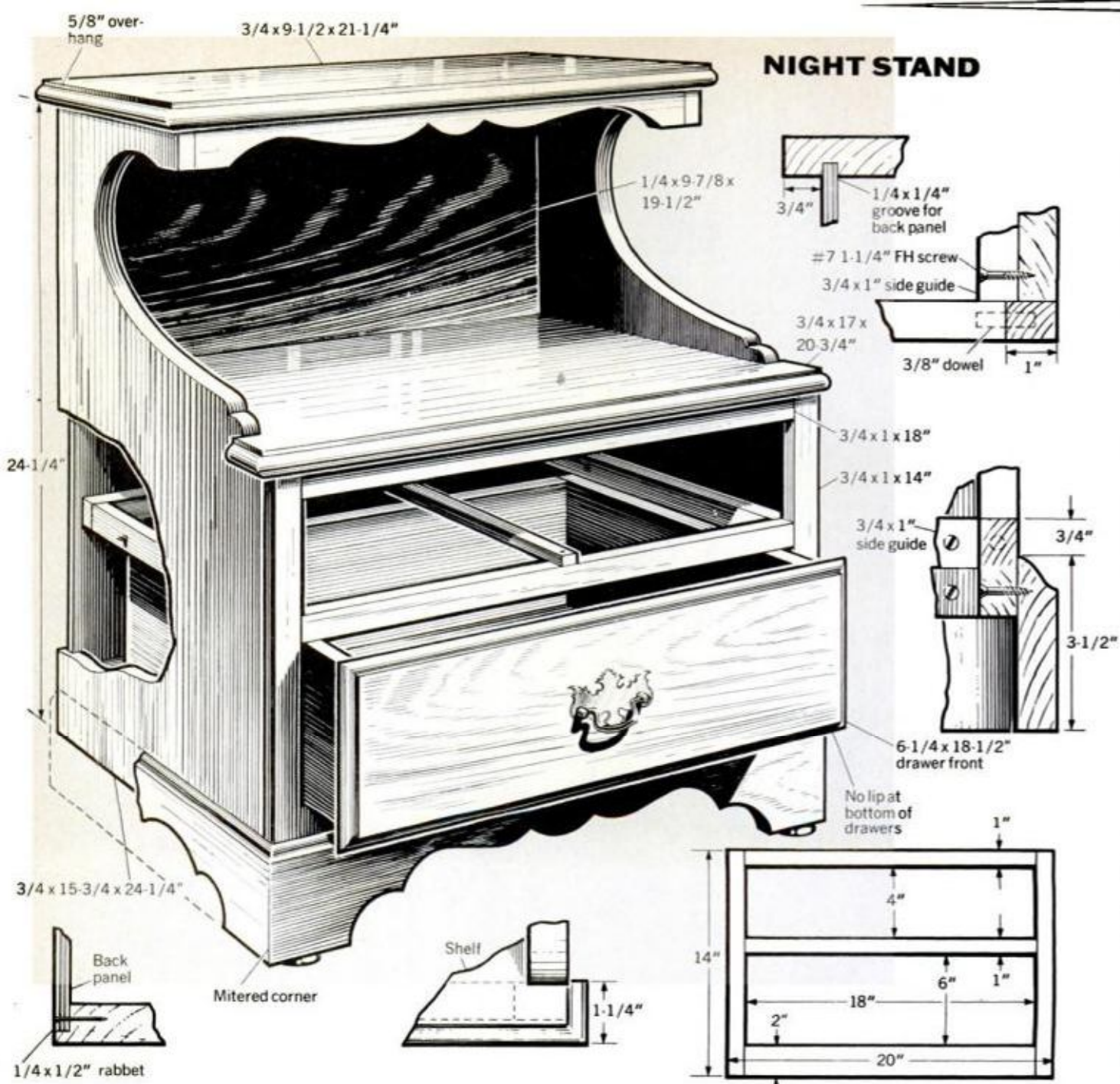
Part 1 details the night stand and the four-poster bed. Part 2 (next month) will detail the triple dresser, mirror and chest on chest.

Start the night stand by making the front drawer frame first from  $\frac{3}{4}$ -in. stock. Glue and dowel it together so it measures 14 x 20 in. Next make a pattern for the scroll-cut side members by ruling 1-in. squares on wrapping paper and following the grid drawing given. The side members require stock  $15\frac{3}{4}$  in. wide so you'll have to edge-glue several boards to gain such a width. Bandsaw both side members at the same time, picking the best side of each for the outside, then run a  $\frac{1}{4}$  x  $\frac{1}{2}$ -in. rabbet along the back edge for the  $\frac{1}{4}$ -in. back panel.

Now glue and clamp the drawer





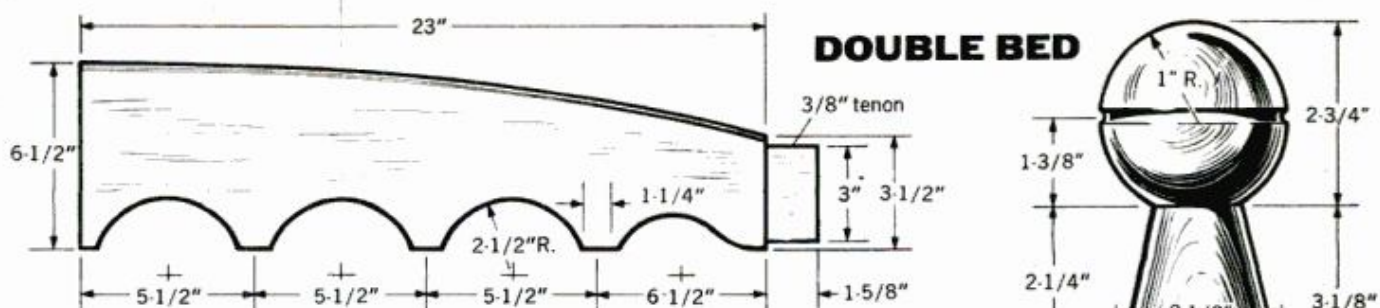


frame to the front edges of the side members and use the back panel to keep the assembly square. The 17-in.-wide shelf is cut and installed next. This has to be built up for width, too, and is notched at the front corners for a distance of 1 1/4 in. It's shaped across the front and ends with a suitable router cutter and is supported by 3/4 x 1-in. cleats screwed to the side members. The shelf is fastened to these cleats with glue and screws driven up from below. Drawer guides are fastened to the side members in the same way and kept even with the drawer crossrails. Similar cleats are added across the back to support the center drawer guides.

At this time the back can be added

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**HALF PATTERN OF HEADBOARD RAIL**

permanently. Notice that it's in two pieces, the upper piece being  $9\frac{7}{8}$  in. and of good stock, the bottom piece being  $14\frac{5}{8}$  in. and of common fir or hardboard. Notice too that the  $9\frac{7}{8}$ -in. piece projects  $\frac{1}{4}$  in. at the top to enter a blind groove cut in the underside of the top shelf.

This leaves the  $3\frac{1}{2}$ -in. scroll-cut base to be added to three sides. It's mitered at the corners and laps the sides  $1\frac{1}{4}$  in. Screws inside hold it.

Standard drawer construction is followed to make the 4 and the 6-in. drawers. Lipped fronts lap the openings  $\frac{1}{4}$  in. on three sides but not at the bottom. The drawers are guided by a grooved runner glued to the bottom and centered to ride the center rail.

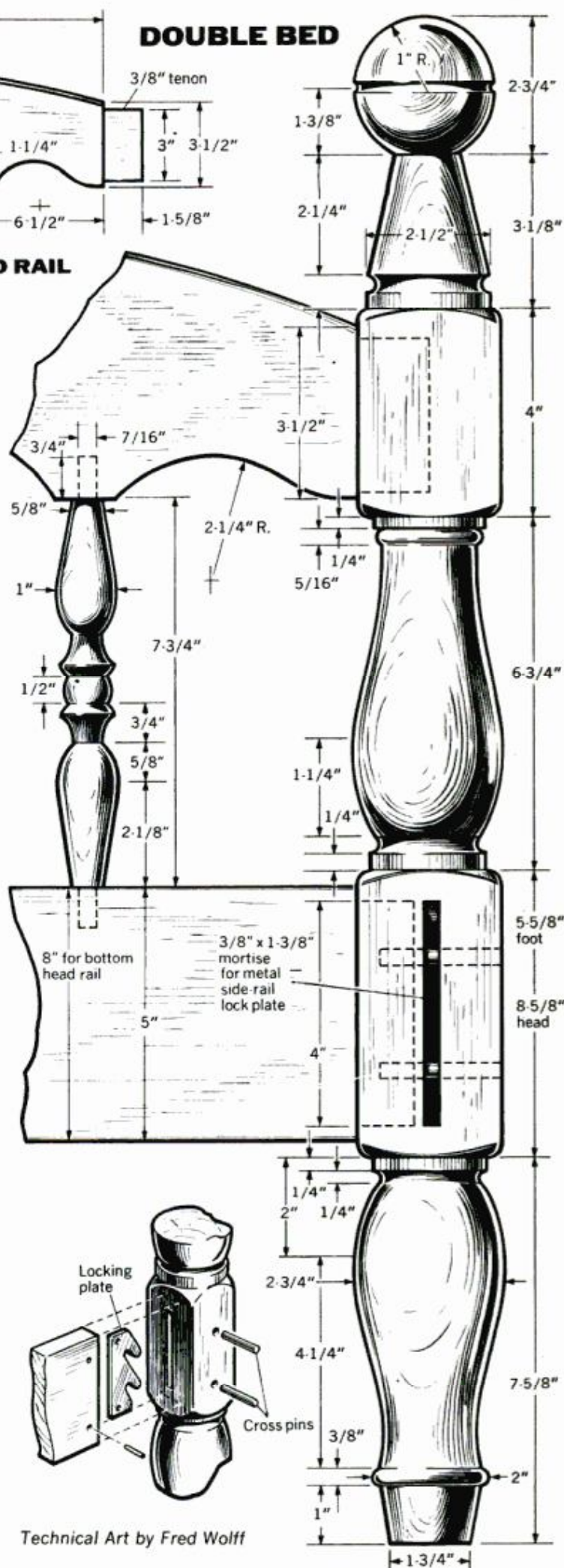
### Making the bed

The four legs for the bed are turned alike, the only difference being their lengths. The two for the headboard are 3 in. longer than the footboard legs and this difference is made up in the length of the lower square sections as the drawing at right indicates. Each leg is lathe-turned from a  $2\frac{3}{4}$ -in. turning square, then facing surfaces are mortised for  $\frac{3}{8}$  x  $1\frac{5}{8}$ -in. tenons which join top and bottom crossrails to each pair of matching legs.

Overall length of the crossrails is  $49\frac{1}{4}$  in. Layout both scroll-cut top rails on  $6\frac{1}{2}$ -in. stock, following the pattern above, and carefully saw them out. Round off the top edges only with a plane and sanding block.

You'll need a total of 18 turned spindles with  $\frac{3}{4}$ -in. tenons turned at the ends to fit  $\frac{7}{16}$ -in. holes bored in the crossrails. Once you have the spindles glued in place you can glue the rails to the posts. The lower foot and head rails are 5 and 8 in. wide respectively. ★ ★ ★

(Continued next month)



Technical Art by Fred Wolff



# Make This Handsome Banjo Barometer

You make the case, buy the instruments and wind up with a handsome weather station.

By W. CLYDE LAMMEY

**I**N EARLIER DAYS householders relied on barometers for daily weather "reports." These instruments were generally of the "banjo" type and many were made both large and ornate. By using less complicated and relatively inexpensive instrumentation, you can make a banjo barometer which is an ornamental and useful replica of the older types.

The barometer illustrated has all the fittings of the old ones except the level, which is unnecessary when an aneroid-type instrument is used.

The frame, cap and pediment are of mahogany. Select a choice piece with attractive grain for the frame, enlarge and trace the pattern on it and then saw just outside the pattern lines so that you have a little stock left for sanding to profile.

Before you bore or saw the openings for the barometer and hygrometer, have the instruments at hand and determine from them the size of the openings. Allow a little extra for clearance, about 1/8 in. all around.

Be sure also that the holes are located on the center line of the frame. The same will be true of the boxed thermometer, the oval-shaped "shell" inlay and the mirror. Overall dimensions given for the oval-shaped inlay are only approximations; they may vary so have the inlay at hand to lay out the recess.

Screws will be furnished for attaching the mirror, the barometer and the hygrometer but not

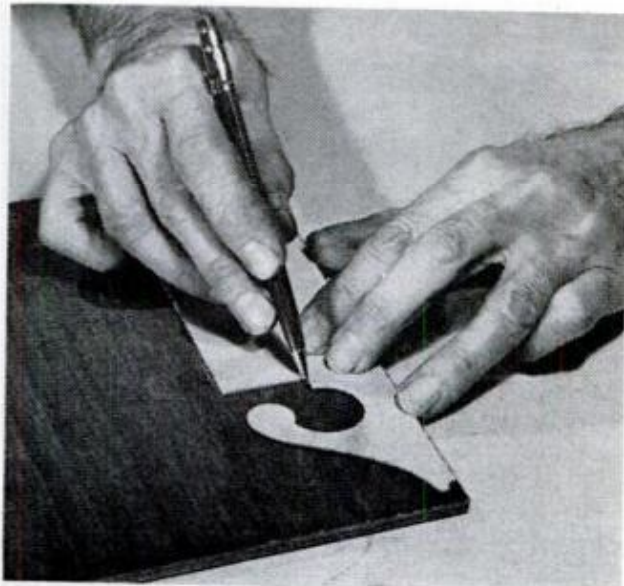




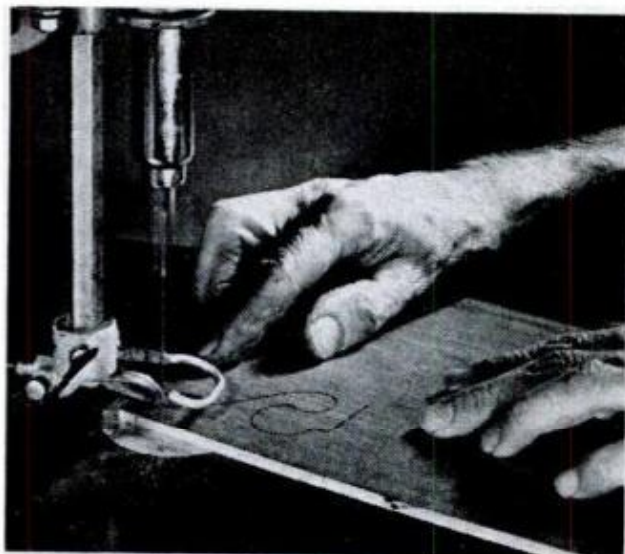
always for the thermometer. Use No. 0 1/2-in. roundhead screws to attach the latter. Don't take the inside dimensions of the thermometer box literally. Check the size of the thermometer before you make the box, just to be sure there are no variations.

Don't hurry the sanding of the frame, particularly the bandsawed edges. Here you'll want to remove every saw mark by careful and thorough sanding to assure a flawless finish. The corners will require sanding with the paper wrapped around a dowel. Work with progressively finer grades, finishing up with 180-grit garnet paper. A cabinet scraper will help remove saw marks fast. (See *Cabinetmaker Scrapers*, page 180, May PM.)

The finish can be anything you like on

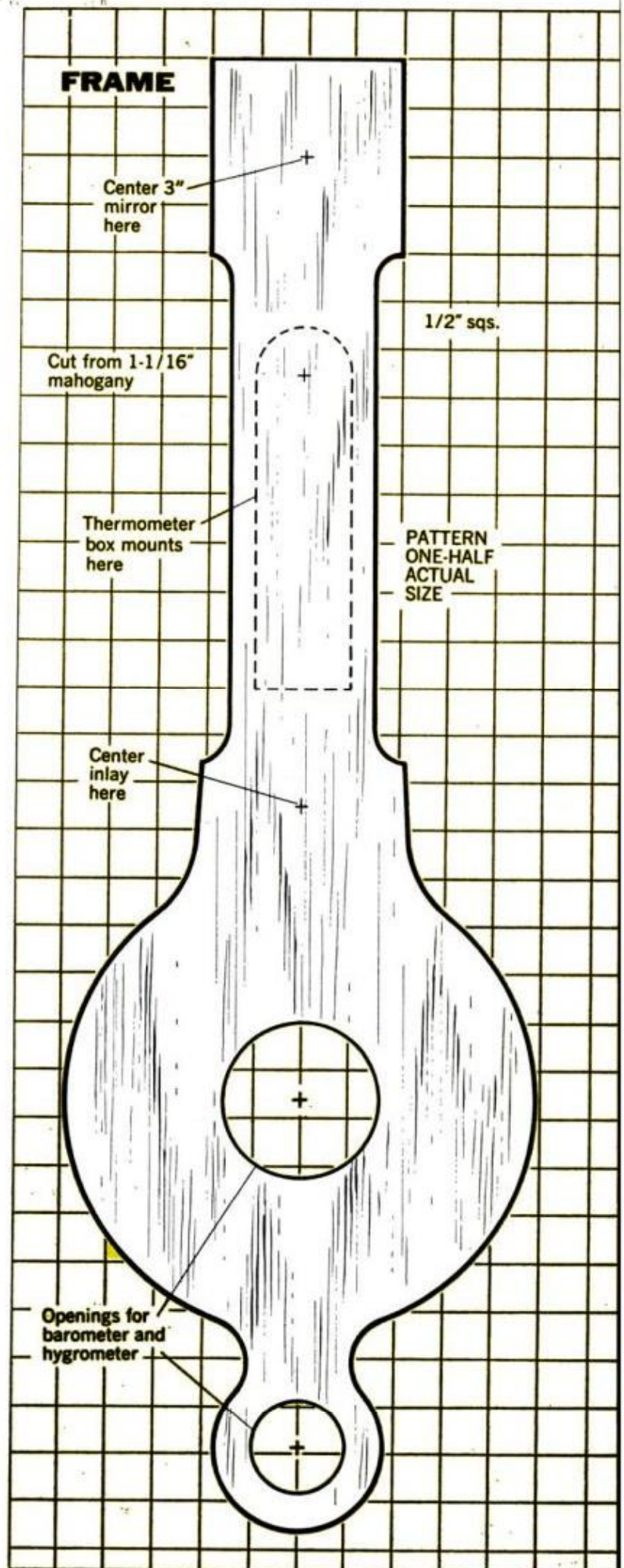


**PEDIMENT PATTERN** is traced on 1/4-in.-thick mahogany plywood. Place it so grain runs horizontally



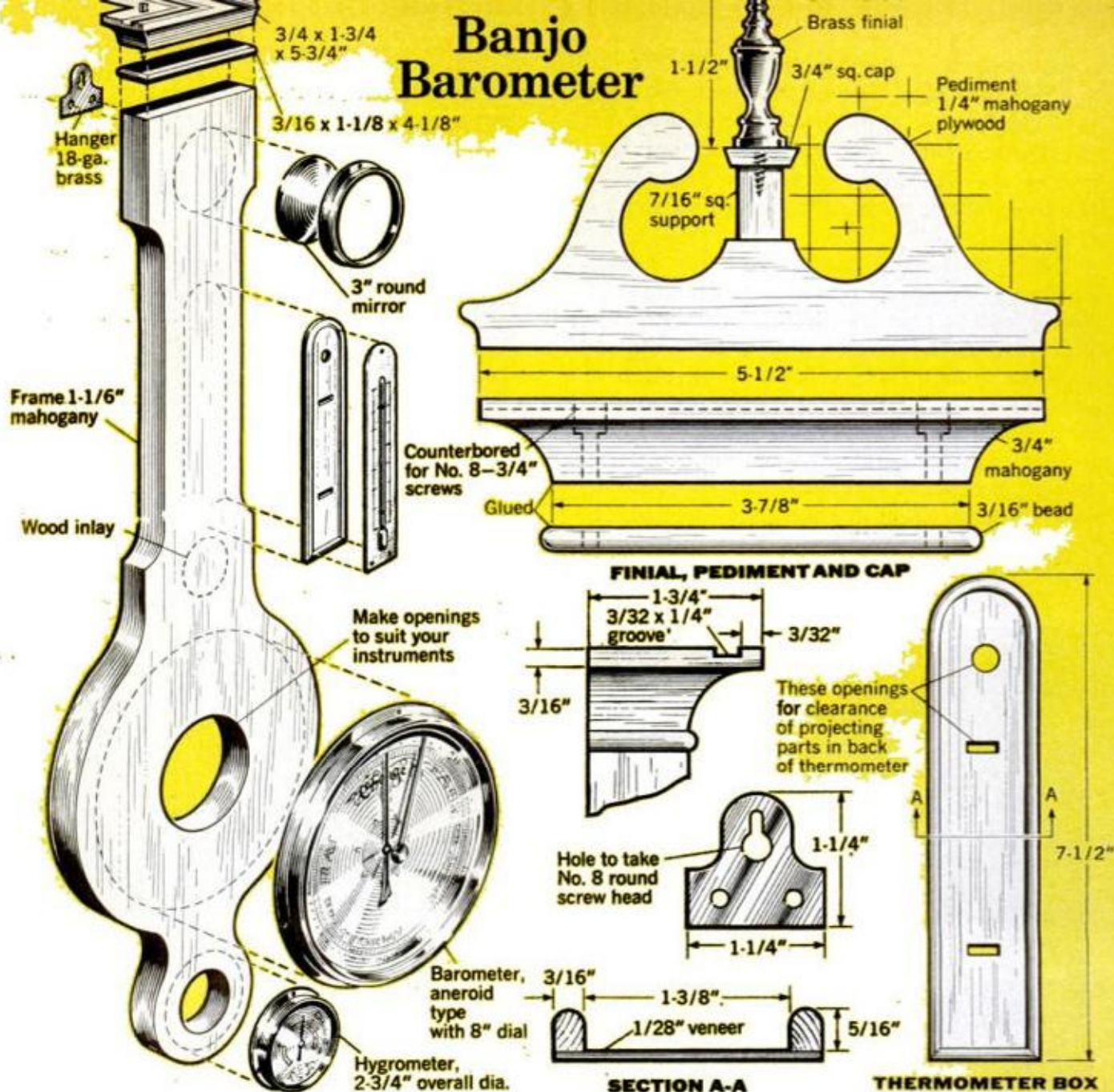
**JIGSAW DOES THE BEST JOB** of sawing out the pediment. Use a fine blade and follow the line carefully

JULY 1970





# Banjo Barometer



mahogany, from natural color to a dark reddish brown, the latter being achieved by staining. Use a wiping stain so you can control more closely the depth of color. Then apply paste wood filler, wipe off, following directions on the can, and apply sealer when dry. Follow by at least two coats of semigloss finish. Carefully rub down the last coat with very fine (No. 4-0) steel wool until you have a beautiful satiny gloss.

All the fittings (the barometer, hygrometer, thermometer and mirror) with matching silvered dials, plus the brass finial, are available in a kit from Mason & Sullivan Co., 39 Blossom Ave., Oosterville, Mass. 02655. While an oval "shell" inlay was used in the original barometer, the kit includes a round inlay as shown in the photo at the right. ★★★



**THE KIT INCLUDES** all the instruments, mirror, finial and round "shell" inlay. It sells for \$22 postpaid

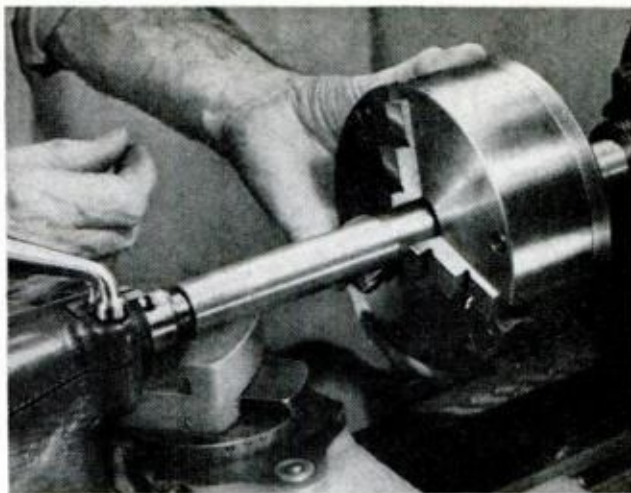


# HINTS FROM READERS

## Safe way to handle chucks

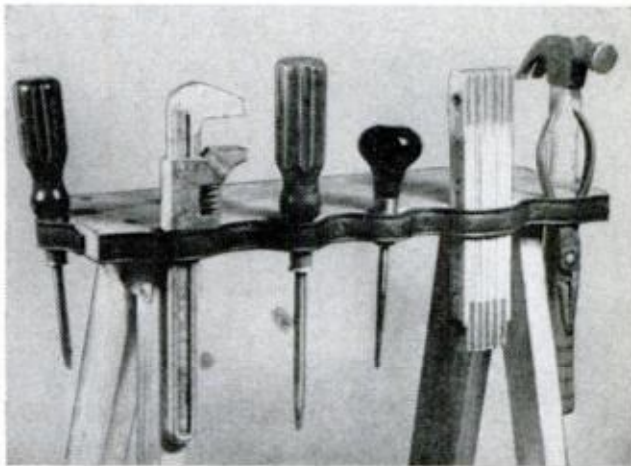
Since removing a heavy lathe chuck from the threaded spindle can be a clumsy task, there is always a chance of it slipping and falling on the ways. A safe way to handle it is to use a thick-wall pipe as shown. Push one end into the spindle hole about 2 in. and fix the other end over the tailstock center. Chuck stays on the pipe rest until it can be grasped for removal.

—Robert J. D. Hill



## Stepladder tool caddy

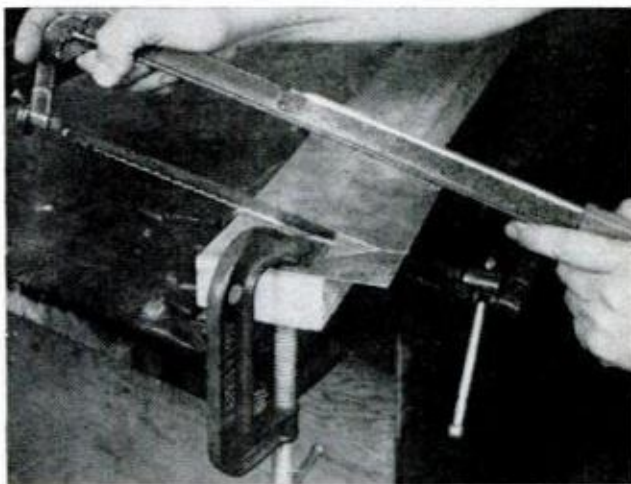
A stepladder top proved a poor spot for parking hand tools so I devised a drop-proof method to keep the tools close at hand. Simply screw-fasten a length of leather strap around the top, forming loops as you go. Custom-shape loops to fit tools usually used.—William Swallow



## Chatterless hacksawing

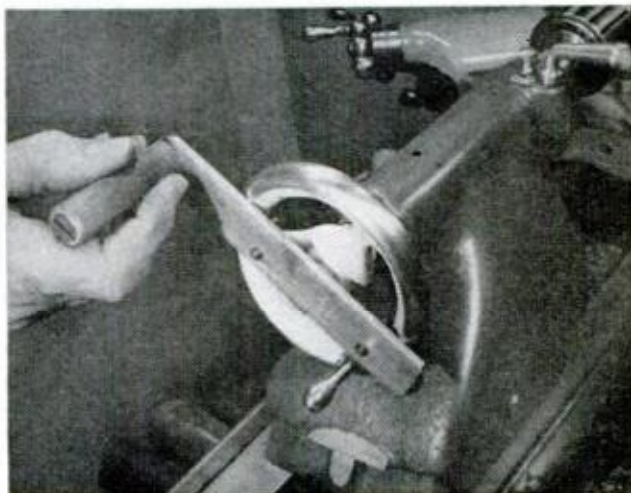
You can eliminate chatter, and marred work that results when your hacksaw skips while cutting thin materials. Simply C-clamp the workpiece to a length of 2x4 held in a vise. Loosen the clamp and shift the metal when the saw's teeth reach the wood—too deep a bite will clog the fine teeth and make the cutting tougher.

—Anton M. Barkey



## Chasing threads close to shoulder

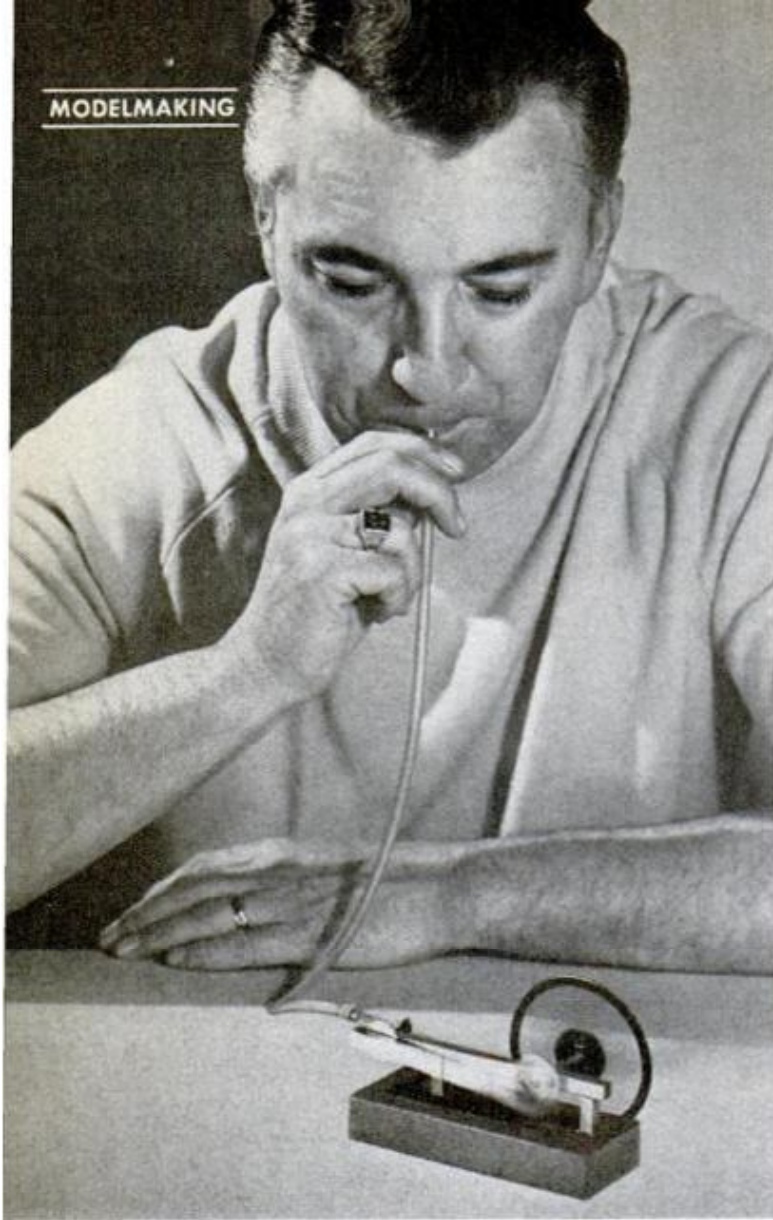
If you set your lathe compound at the same angle as for a right-hand thread and turn the toolbit upside down, you can run the cut up close to a shoulder. Set the spindle to run in reverse, as for cutting a right-hand thread, run the cut and back off. A clearance groove is not necessary; it may actually weaken the threaded part. If your toolholder won't permit this trick, you may have to use the bit alone with shims to center it.—Tom Johnson



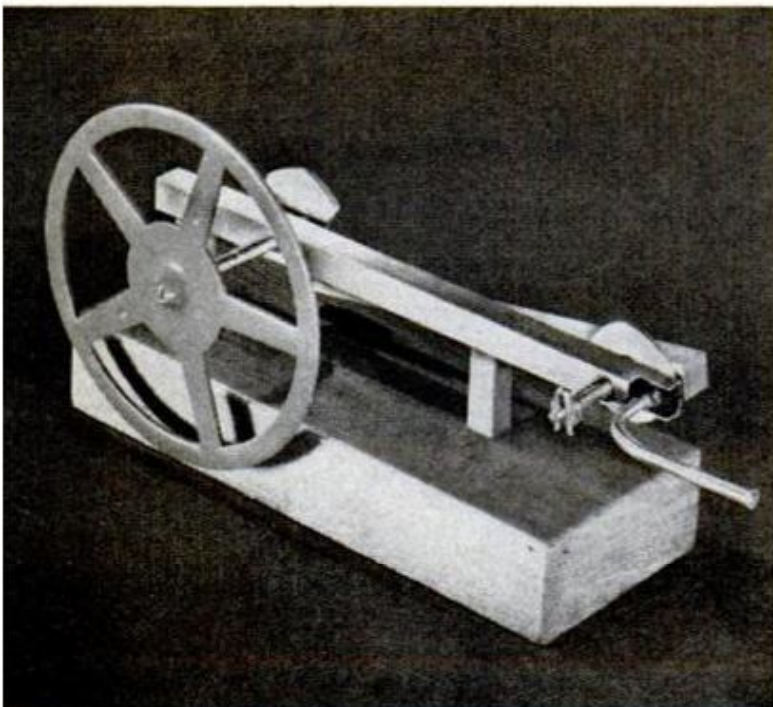
## Crank saves lathe time

Turning the tailstock handwheel to advance a large drill can be tiresome if a lot of holes have to be machined. I attach a right-angle crank to the feed wheel when drilling by lathe. Pins in the crank are arranged and bent to suit the tailstock wheel. Here, crank is fitted to three-spoke wheel and slightly offcenter; performance is still satisfactory.—Robert J. D. Hill





**MINI-ENGINE** operates by blowing through tube or by connection to "teakettle" boiler on kitchen stove



**CRANKSHAFT TUBE** is soldered to horizontal member, leaving  $\frac{1}{16}$  in. protrusion for mounting the crank

# Mini 'Steam' Engine Made With Simple Hand Tools

Actual working model requires no lathe, castings, or nuts and bolts.

By **ANDY SPRAGUE**

*Technical Art by Fred Wolff*

**I**F YOU HAVE BEEN WAITING for a model engine that doesn't require a shop full of tools to make it, here's one which is about as simple to build as you could hope for. You can make it with hardly more than a soldering iron, hand drill, file and hacksaw. And it really runs!

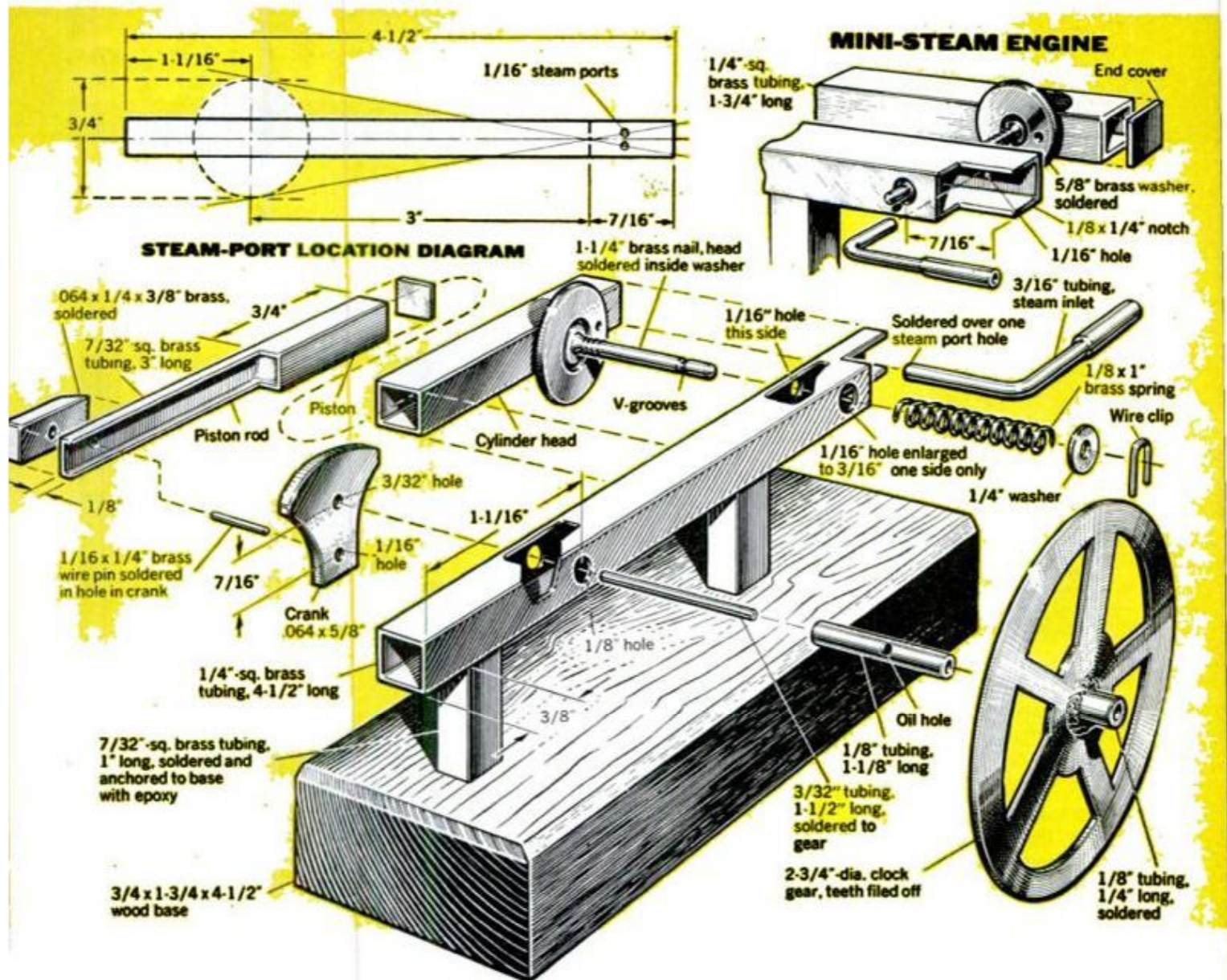
It's made entirely of common hobby-shop materials,  $\frac{1}{4}$ -in.-sq. brass tubing for the most part, a washer, a brass nail and a spring from a motor brush. The flywheel is a clock gear with its teeth filed off. (See parts list at end of article).

Begin by cutting a  $4\frac{1}{2}$ -in. length of  $\frac{1}{4}$ -in.-sq. tubing for the horizontal member to which all other parts are connected. Then drill the  $\frac{1}{8}$ -in. hole through the tubing on the center line for the crankshaft tube. Drill the  $\frac{1}{16}$ -in. hole  $\frac{7}{16}$  in. from the opposite end and parallel to the crankshaft hole. And, finally, drill a  $\frac{3}{16}$ -in. hole through one side of the tube only. Use the previously drilled hole as a guide.

The cylinder is of  $\frac{1}{4}$ -in.-sq. tubing  $1\frac{3}{4}$  in. long. Solder a  $\frac{5}{8}$ -in. brass washer flat to the cylinder so that the washer's center line is  $\frac{7}{16}$  in. from the end of the cylinder. Using a  $1\frac{1}{4}$ -in. brass nail, solder its head exactly in the center of the washer hole.

To make the cylinder head, saw off a  $\frac{1}{4}$ -in. square from the  $\frac{1}{4}$ -in. stock and tin one side. Then place it against the cylin-



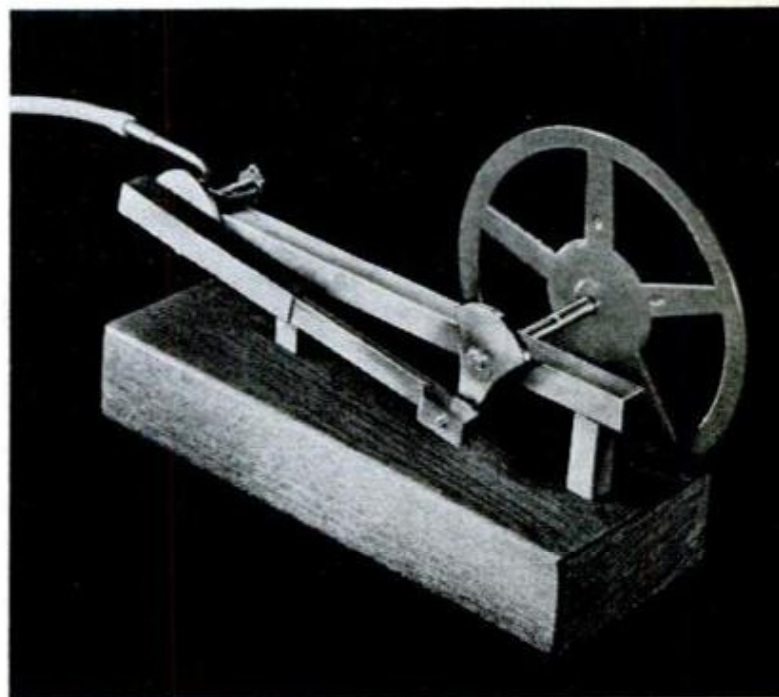


der head and sweat-solder it in position. Saw off the nail point and file two vee grooves on both sides of the nail about 1/8 in. from the end and vertical to the cylinder. These are for the wire clip that will hold the cylinder tension spring in place.

Cut a 1/4-in. section of 1/8-in. tubing and solder it to the center hole of the clock-gear flywheel. Insert the crankshaft through the tube in the horizontal member and solder the flywheel to the crankshaft. The flywheel should spin easily.

Next, calculate placement of steam ports by placing the horizontal member with crankshaft side up, and rotate flywheel so as to place the crank pin at a 90° angle to the horizontal member. With a straight-edge, then line up the crank pin with the cylinder hole and mark the point at which it will line up with the center of the outer ring of the cylinder washer when assembled. Reverse this procedure to deter-

*(Please turn to page 192)*

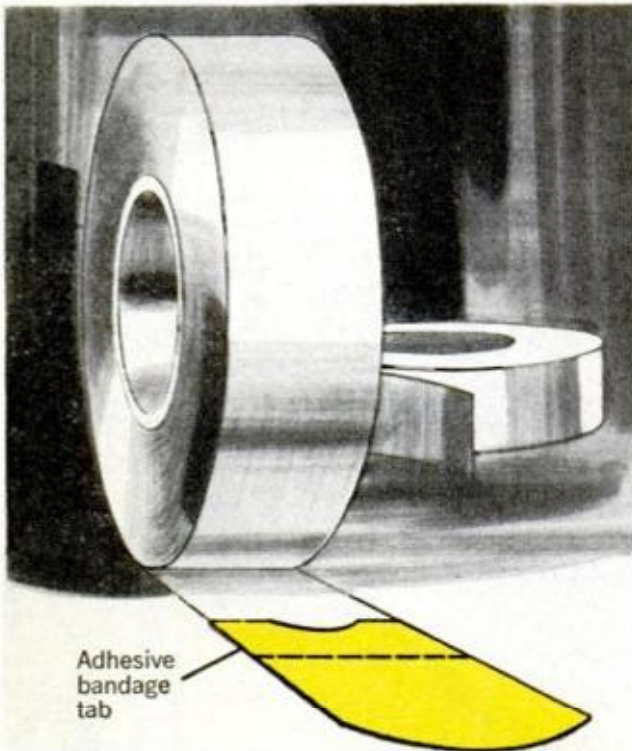


**PISTON AND PISTON ROD** are one piece, made by sawing a 3-in. section of the 7/32-in. square tube

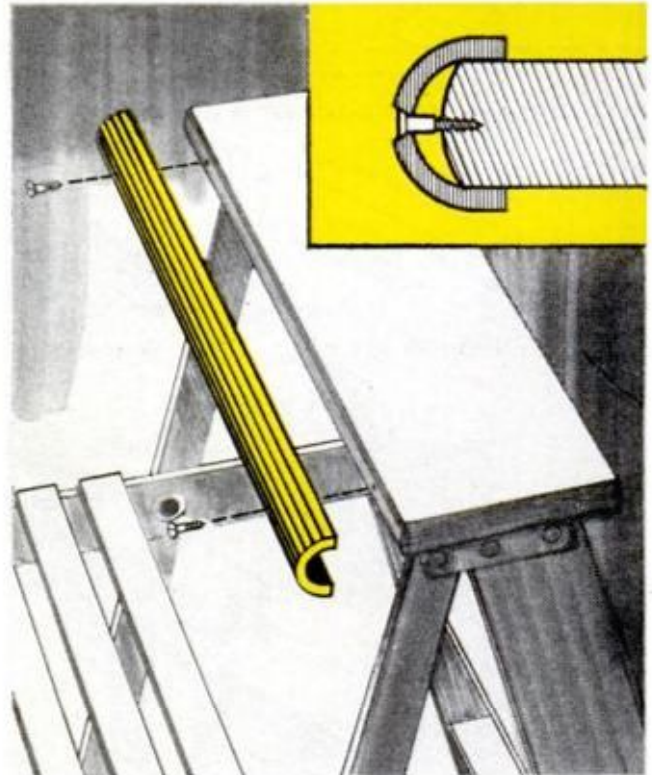




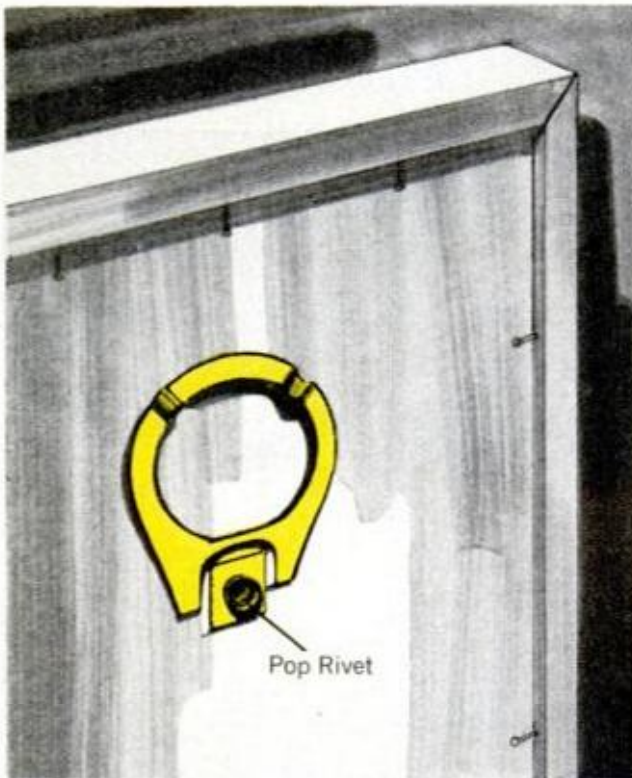
# SOLVING



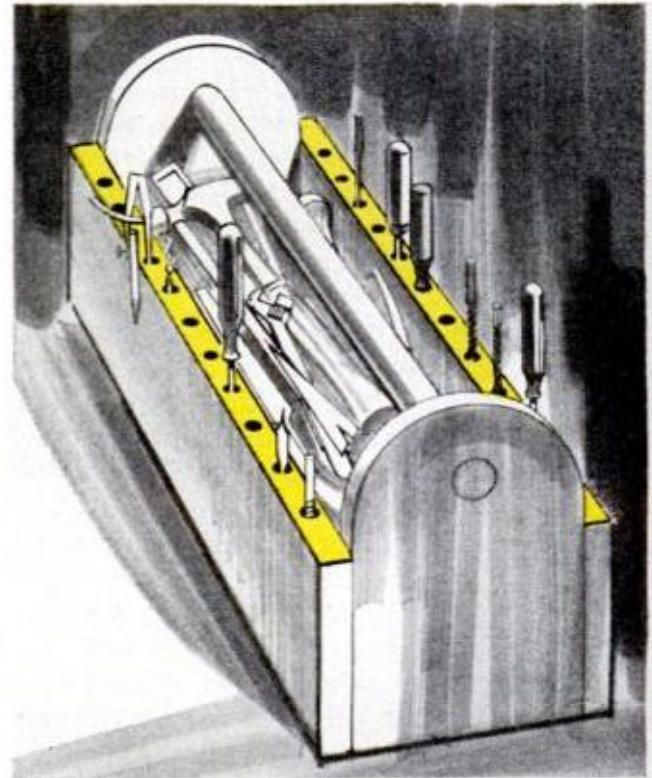
**YOU CAN QUICKLY FIND** the end of cellophane tape every time if you stick a plastic or paper tab from an adhesive bandage to the end of the tape. Replace the tab each time you cut tape.—*Joseph Braunstein*



**STEPLADDER LEANED AGAINST A WALL** is sure to cause marks and possible gouges. You can prevent this from occurring by fastening a length of slit garden hose along rear edge of top step.—*Wilfred Beaver*



**READY-MADE HANGERS** for pictures are available from pull tabs on soft-drink cans. Simply drill a hole through the tab and fasten the tab to a picture's cardboard backing with a Pop Rivet.—*James D. Johnson*

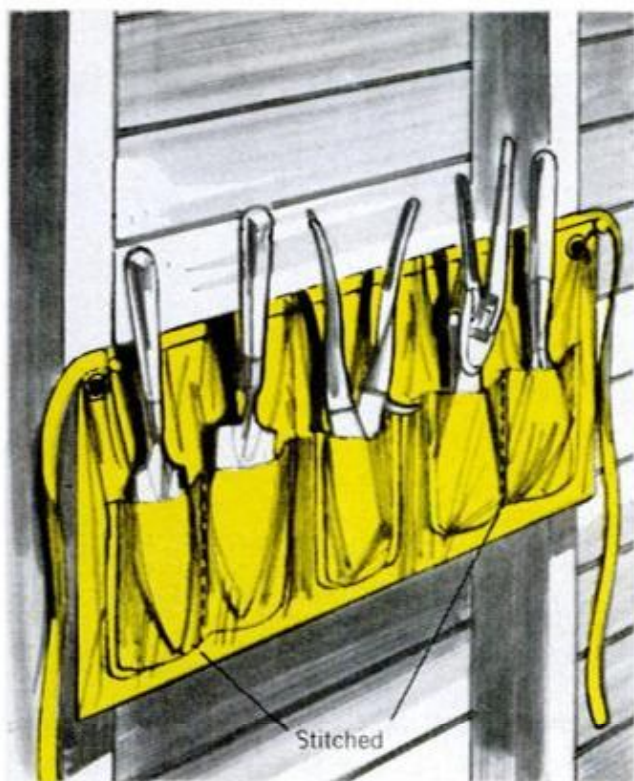


**KEEP SMALL TOOLS FROM GETTING LOST** among the larger tools in your toolbox by drilling holes along the top edges of the box sides. They provide handy storage for drill bits and the like.—*Harry J. Miller*

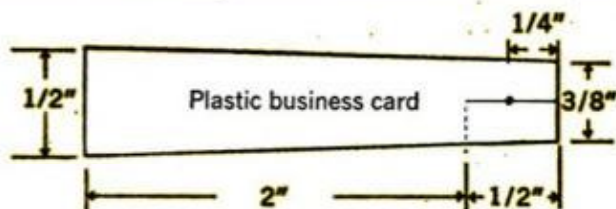
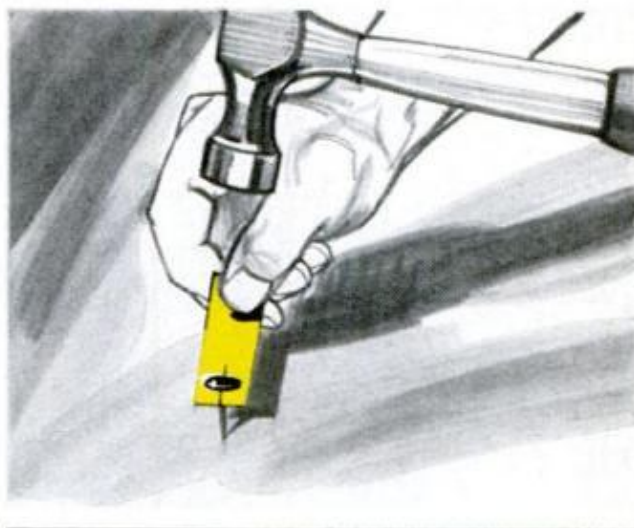


# HOME PROBLEMS

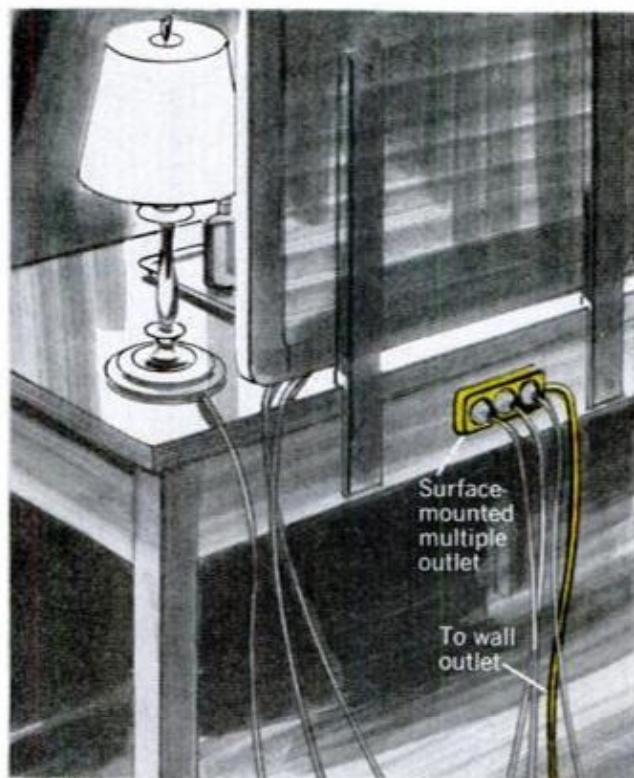
Illustrations by Adolph Brotman, Worman Associates



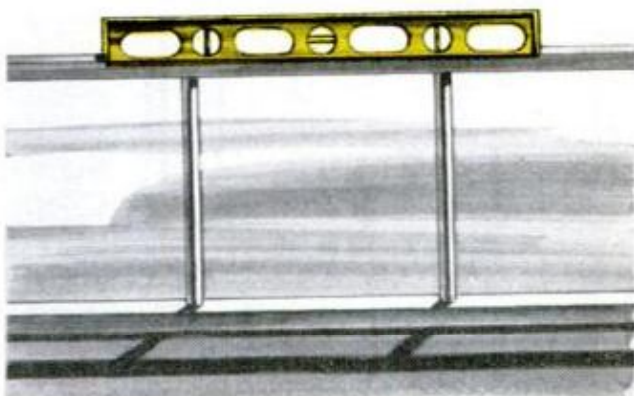
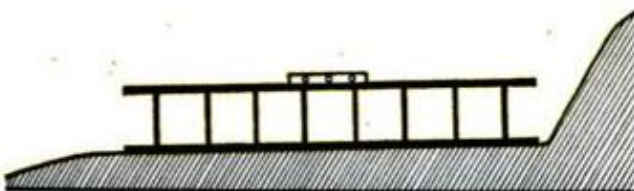
**PUT YOUR CARPENTER'S APRON** to use full time by hanging it from a pair of nails in the garage wall. Pockets make an ideal spot for parking small garden tools such as snips and trowels.—Victor H. Lamoy



**TO MAKE A DANDY TACKHOLDER**, just slot and drill the end of a small plastic business card. After the tack is started, you simply pull the card away. It will spring back to original shape.—Walter Fehlberg



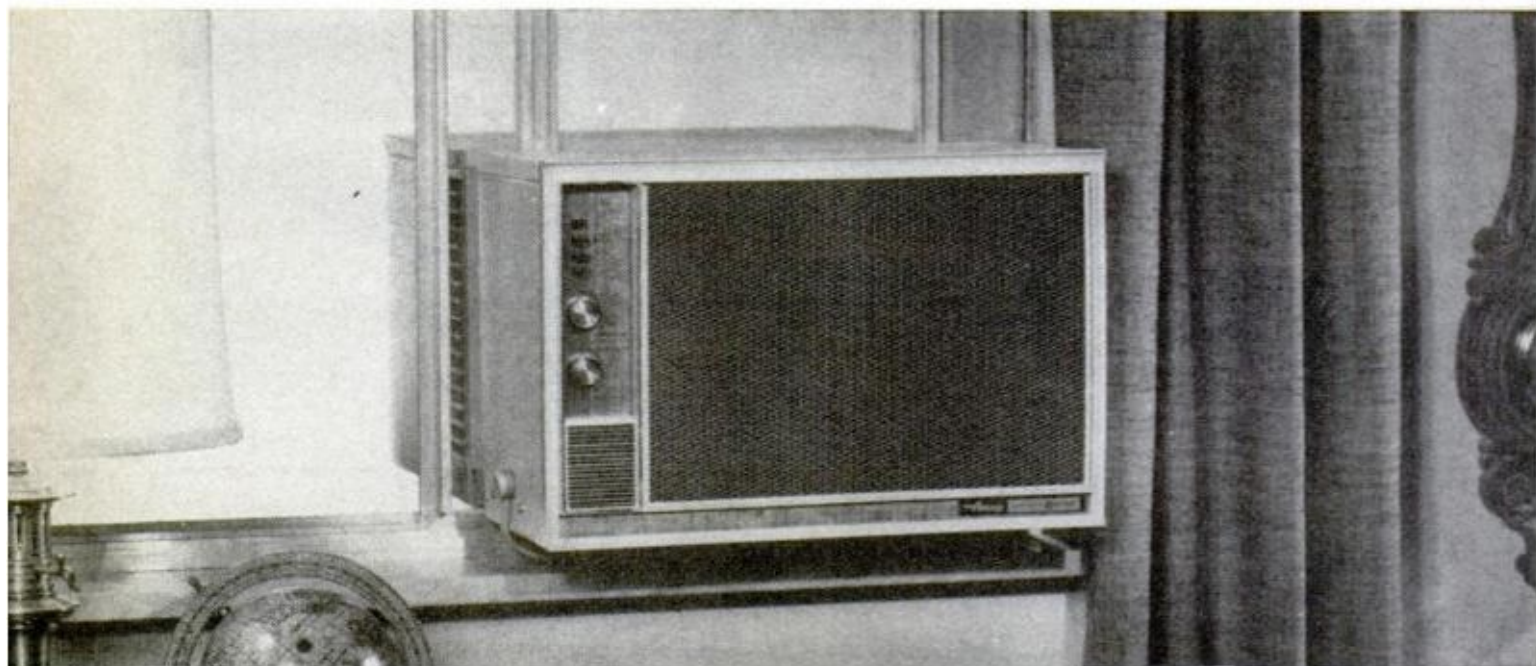
**TANGLED WIRES** on a vanity can be eliminated by mounting a surface-type multiple outlet on the back out of sight. Run all lines to this outlet, then plug the single feed into wall receptacle.—Victor H. Lamoy



**WHEN YOU NEED A LONG STRAIGHTEDGE**, consider using a section of your aluminum ladder. Lay the section on one side (shim it if it has a taper) and place your level along the ladder's top rail.—Ralph O. Fritts



# Two New Airconditioners for

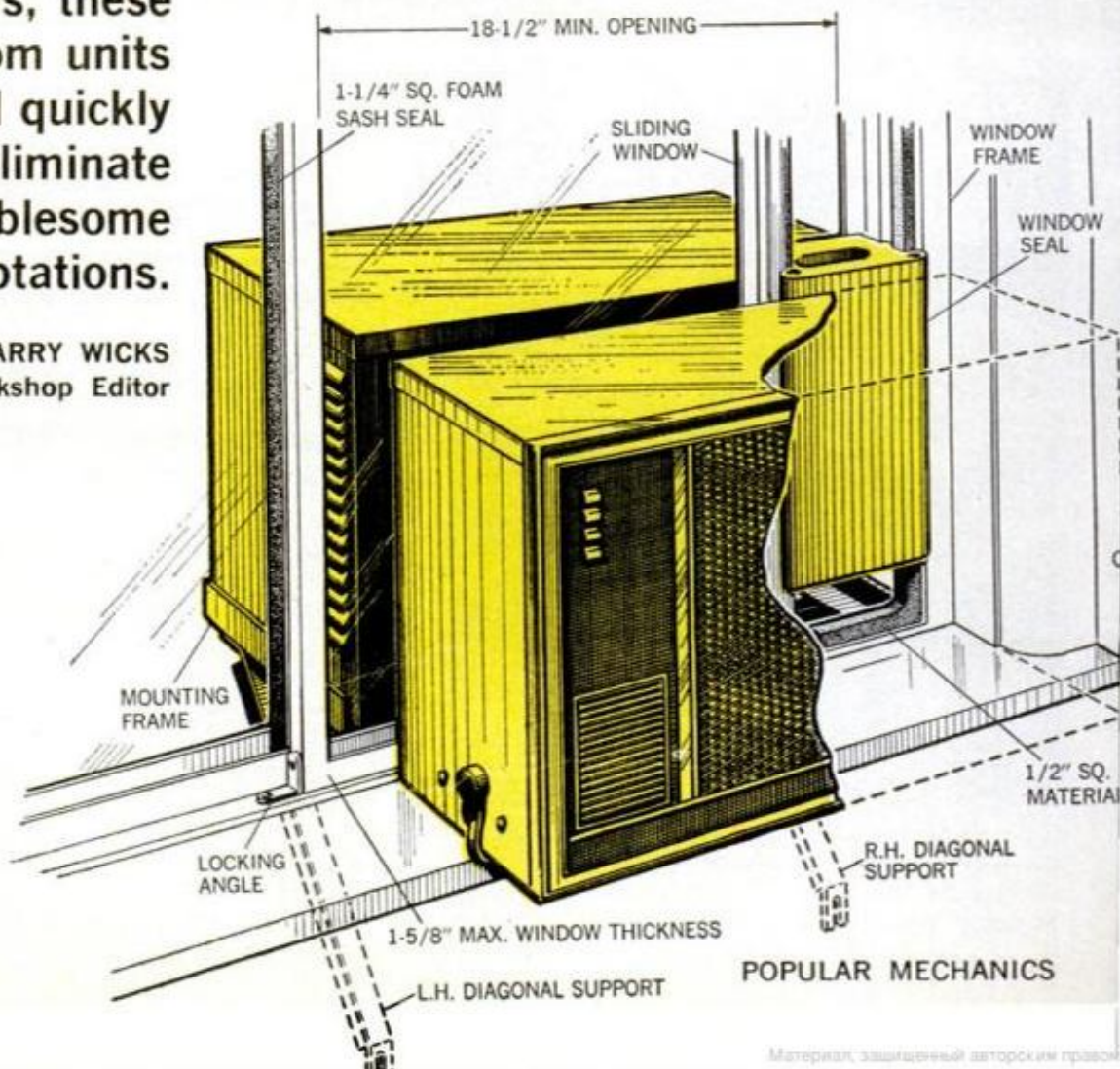


Designed specially for casements and sliders, these room units install quickly and eliminate troublesome adaptations.

By HARRY WICKS  
Workshop Editor

HORIZONTAL SLIDERS accept this unit without alterations; the window can be closed to within three inches of right-hand frame

## Sliding-Window Airconditioner





# Problem Windows

**CASEMENT VERSION** permits you to lock window in winter. Both units shown operate on 115-v. circuits

**I**F YOUR HOME is equipped with casement or sliding windows, you've got friends at the Airtemp Div. of Chrysler Corp. They've just announced an industry first: a room airconditioner designed especially for casement windows. They're also offering an improved model designed for horizontal sliding windows.

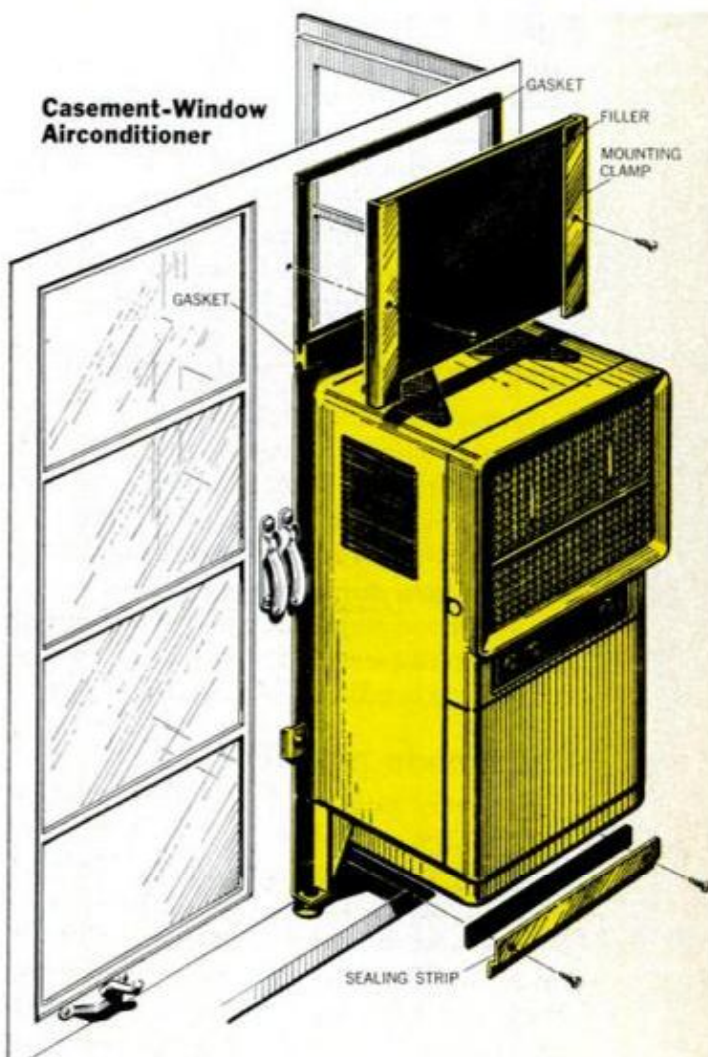
Labeled the Casement and Freeway (for sliders), the units are engineered to permit window installation without breaking a pane or altering the frame (see drawings). Once they're in place, foam-rubber sealers are installed in the same way as for conventional units to keep out dirt, noise, dust and weather. Each of the new conditioners is available in two cooling capacities: 5600 and 7500 B.T.U. for the Casement models; 5800 and 9000 B.T.U. for the Freeway.

To install the Casement you simply remove the screen from the inside of the window frame and mount the airconditioner in its place, using the same four holes that held the screen. A good design feature is that the entire unit is mounted within the room. Thus, when it is not necessary to operate the unit, the window can be completely closed and locked in the usual manner. And if you have four-light casements, a steel filler piece (see drawing, lower right) is available at a slight additional charge.

Equally easy to install, the Freeway features a split-chassis design; the indoor and outdoor sections are separated by the window that slides between. The window closes to within 3 in. of the right-hand frame, and a 2-in.-thick sponge-rubber sealer is provided to fill the void above the unit.

Suggested retail prices are \$255 and \$275 for the Casement models; \$210 and \$265 for the Freeway units.

For locations of Chrysler-Airtemp dealers in your area, write to the Chrysler Corp., Airtemp Div., 1600 Webster St., Dayton, Ohio 45404. ★★★

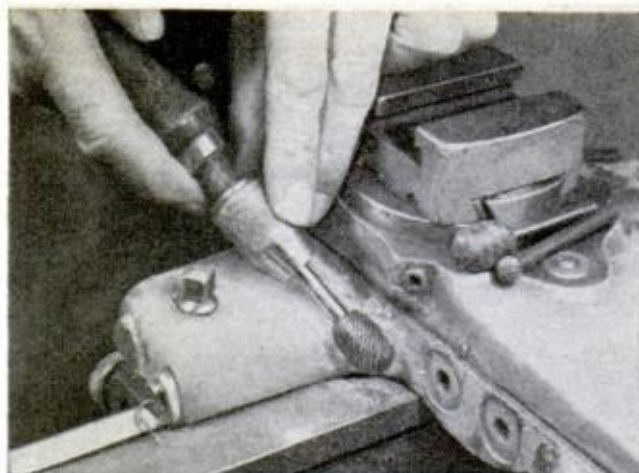




# HINTS FROM READERS

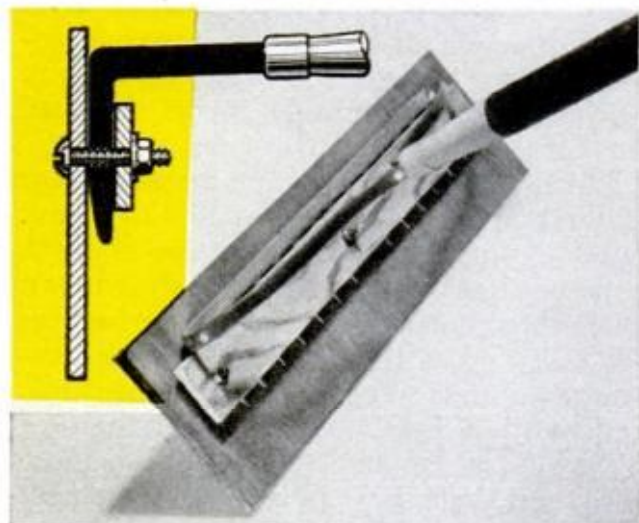
## Hand filing with a rotary file

Since rotary files come in many shapes, some can be used like hand files for smoothing hard-to-reach areas such as inside curves and fillets. Simply clamp the file in a pin vise for handling. The direction to move the tool depends upon the teeth arrangement. A "melon-shaped" file is shown being used as a nonrotating tool to smooth epoxy.



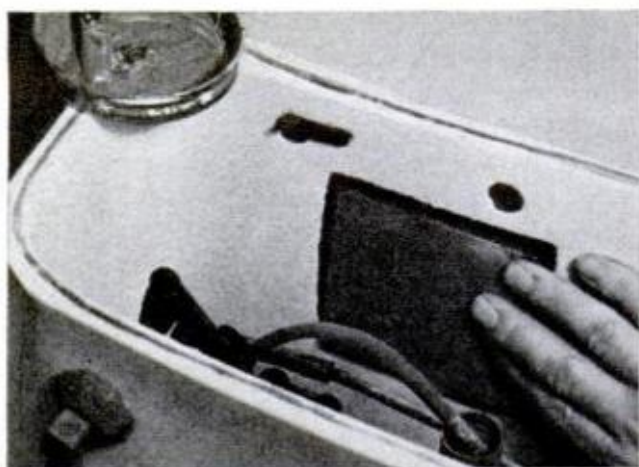
## Using a rake for grading

Recently while doing some grading and leveling in my back yard, I found that a 5x20-in. piece of plywood added to the tines speeded the job. By using a second, narrow strip of wood, plus a couple of nuts, bolts and washers, the leveler can be quickly removed and hung in the garage until needed.—*J. P. Thomson*



## Keeping disposers healthy

On the several occasions when our sink disposer failed, I've noticed that all a repairman does is work the innards with a stick, then run the hot water a while to get grease moving. To eliminate service calls, I periodically flush Ajax or Comet down the drain with hot water. Since we've started this preventive maintenance program there have been no failures due to grease buildup.—*Frank Curtis*

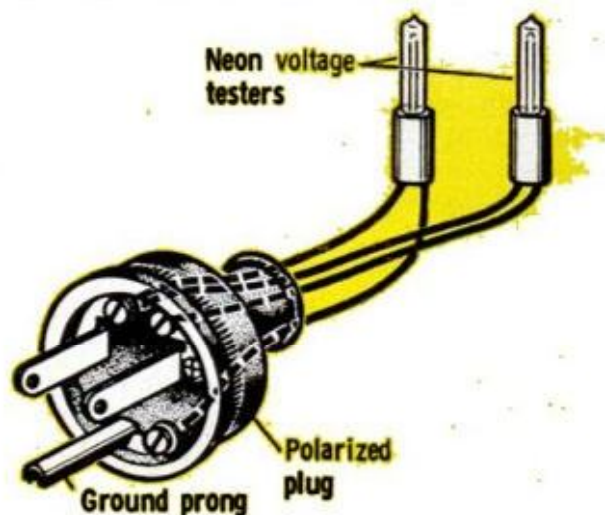


## Cure for cracked water closet

A cracked china toilet tank can be permanently repaired with a metal patch cut from  $\frac{1}{10}$ -in.-thick sheet aluminum and cemented over the crack with filled epoxy cement. First empty the tank, let it dry and prepare surface by rubbing with silicone-carbon paper. Make patch big enough to cover the crack's lower end to prevent it from extending.—*John Burroughs*

## Shop-made polarity tester

Properly polarized and grounded receptacles are quickly and *simultaneously* checked with this little tester. To make it, you need two small-voltage neon test lamps and a polarized plug. Both bulbs must light when prongs are inserted. If they don't, something is wrong with the receptacle. Be sure to follow wiring hookup exactly as shown.—*Henry R. Rosenblatt*





# New tools you should know about



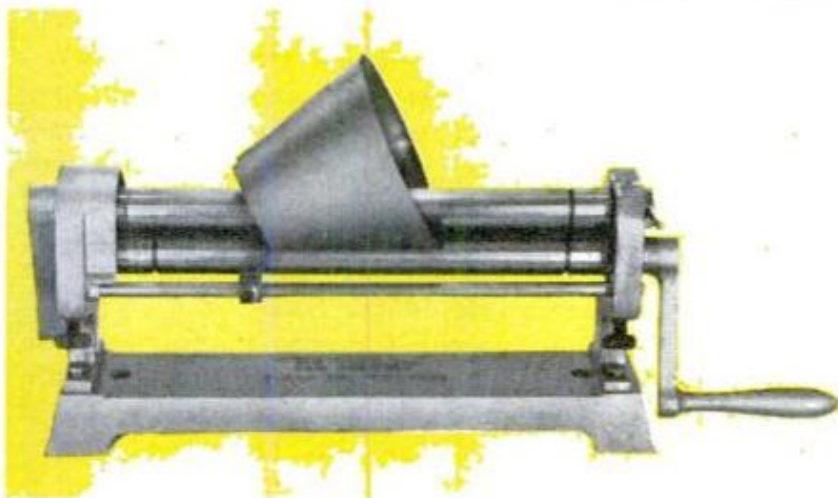
## Color-coded micrometers

Standard-size laboratory micrometer comes in satin gold, silver or black finish. Colors are claimed to increase readability and simplify identity. With holster-case, \$16. Brown & Sharpe, Industrial Products Div., Precision Park, North Kingstown, R. I.



## Gasoline-powered hedge trimmer

Lightweight 10-lb. trimmer offered by Orlene Products, 3340 Emery St., Los Angeles, Calif. 90023, lets you use power on hedges far from an electric source. It can be operated in any position without fear of fuel spillage and, since it has no electric cord, used safely on wet hedges. Powered by an O & R Industrial engine, Model 249 will run five hours on a gallon of gas. High-carbon-steel blades boast chromed cutting edges.

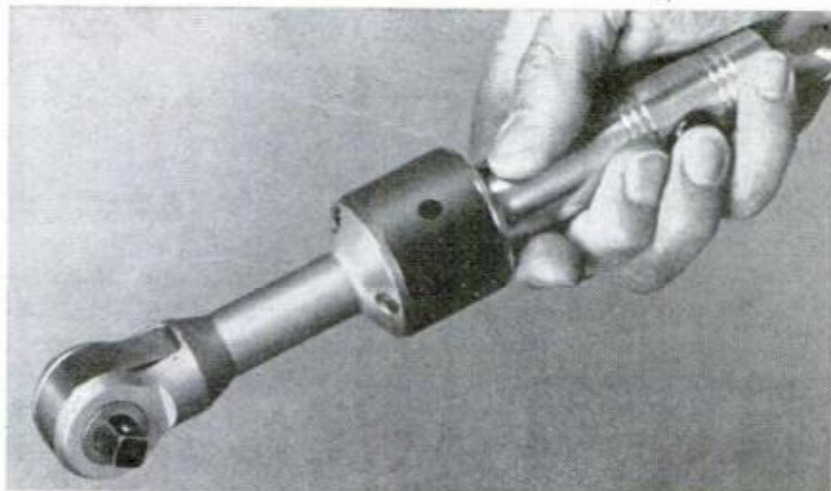


## Sheet-metal roller

Precision-machined sheet-metal roller is said to be the only model available with an automatic cone-rolling attachment. The tool has automatic lift-up for part removal and can roll wire as well as sheet metal. In three sizes—12, 18 and 24 in.—rollers are priced at \$100, \$130 and \$150 respectively (f.o.b. factory). Minimum cone i.d. is 1½ in. Neo Products, 732 S. San Pedro St., Los Angeles, Calif. 90014.

## Pneumatic ratchet

Reversible pneumatic ratchet introduced by Datco, Inc., Route 1, Box 982A, Dallas, Tex. 75216, eliminates time-consuming use of hand ratchets in small areas. If more torque is desired, the tool is simply operated as a hand wrench. Designed for standard ¾-in. sockets, the Model 375-C wrench's double-pawl drive offers positive ratcheting action without danger of thread damage from overtightening.







# PUT YOUR PATIO UNDER COVER

Use translucent, colorful panels and you'll let light in while keeping rain and solar heat out

By HARRY WICKS, Workshop Editor

**I**F YOU HAVE A PATIO attached to your house, it's evident that you and your family enjoy all the advantages of warm-weather outdoor living. Cover it with a roof and you'll increase that pleasure several times over. That's a pretty positive statement, but it's indisputable that with a roof shielding out solar heat and rain, you'll be able to "set a spell" any time of the day no matter what the weather is doing. And, happily, a roof is not difficult to install.

A patio covering currently popular with do-it-yourself homeowners is plastic translucent paneling. The material gives the two advantages already mentioned and it lets light filter through to maintain the airy, cheerful feeling that is synonymous with outdoor living.

The major buyer-resistance that plastic panels met when first introduced was the limited choice of colors. It was difficult to achieve color harmony. Filon Co. has overcome that problem by determining the 12 most widely used house colors. Then, Lloyd Faulkner, A.I.D., was commissioned to create a dozen compatible styles. They're offered in three series—Filon-

Stripes, Sunguard and 410 (the latest)—the first two priced at about 50 cents per sq. ft., the 410 about 35 cents per sq. ft.

The material is easy to work with and requires no special tools or equipment. Panels can be cut with a fine-tooth hand-saw or your circular saw equipped with abrasive-disc blade.

● *Building the framework.* You can use ornamental metal posts secured to the concrete floor with lead shields. Or, if you prefer wood, use 4x4 stock and either method shown to anchor them.

● *Beam.* Recommended are 4x4s for spans (post to post) up to 10 ft. long and 4x6s for 10 to 14-ft. spans. To insure patio ventilation, make certain that bottom of the beam is a minimum of 7½ ft. from the deck.

● *Ledger strip.* Attach a 2x6 to the house with lagscrews (into studs) to serve as the ledger strip. Make doubly sure that top of the ledger is at higher elevation than top of the beam to direct water runoff away from the house.

● *Rafters.* Here, again, size is determined by span (ledger to beam). Use 2x4s for runs up to 8 ft., 2x6s for 8 to 14 ft. and





**CORNER POST** is bolted to bracket planted in concrete. To avoid rust stains, use galvanized hardware



**T-SHAPED BRACKET** used to fasten beam to post is fast method, provides rigid, strong construction



**CROSS BRACE** is installed flush with top of rafter. Diagonal brace (below) keeps the structure square

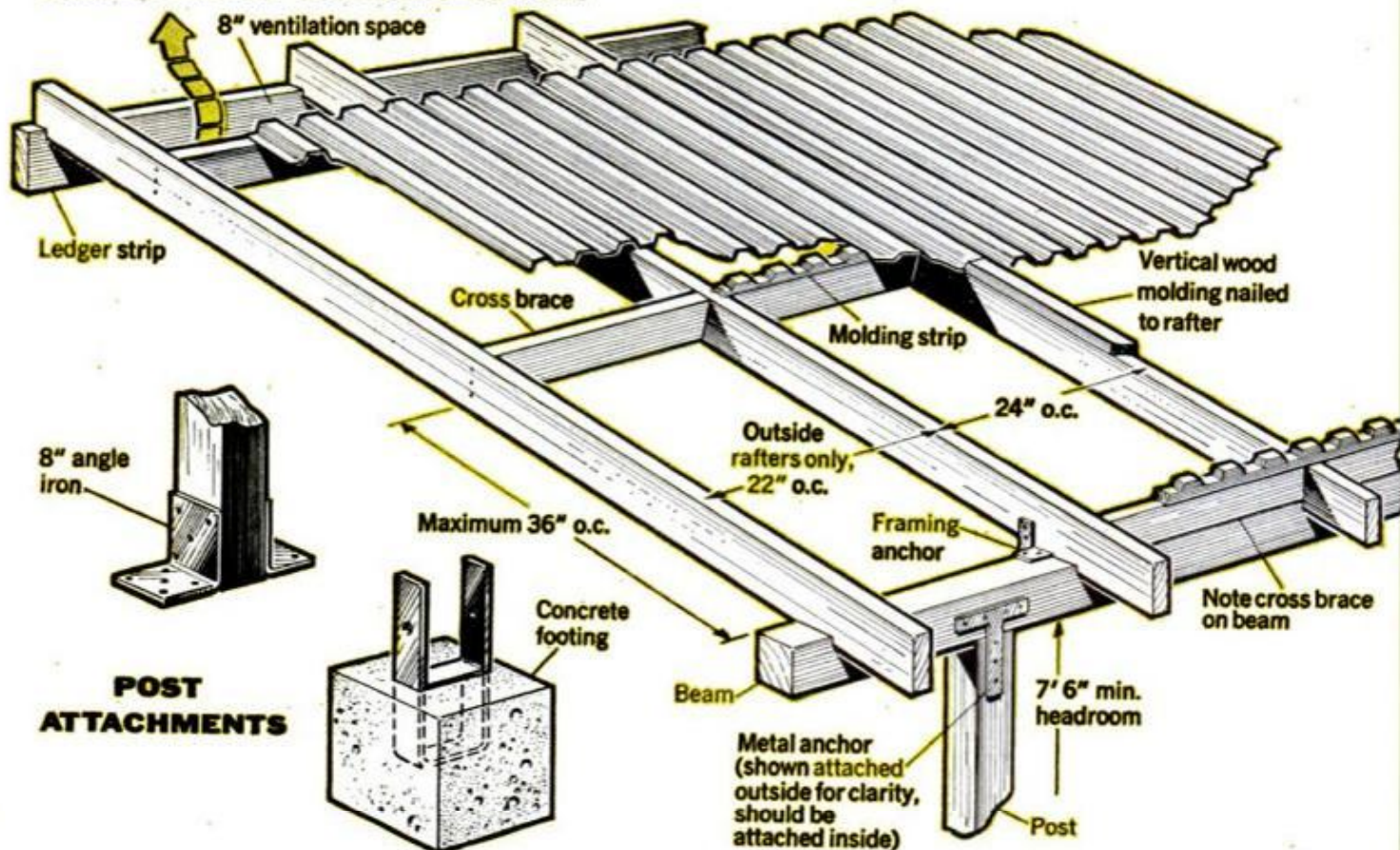


**CONFIGURED FILLER STRIPS** are nailed atop cross braces, provide solid nailing (below) for panels





## PATIO ROOF INSTALLATION



### POST ATTACHMENTS



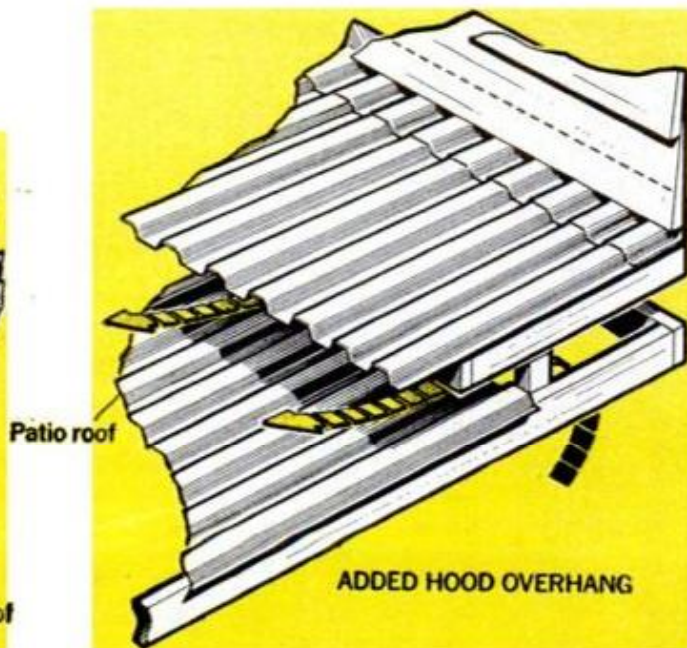
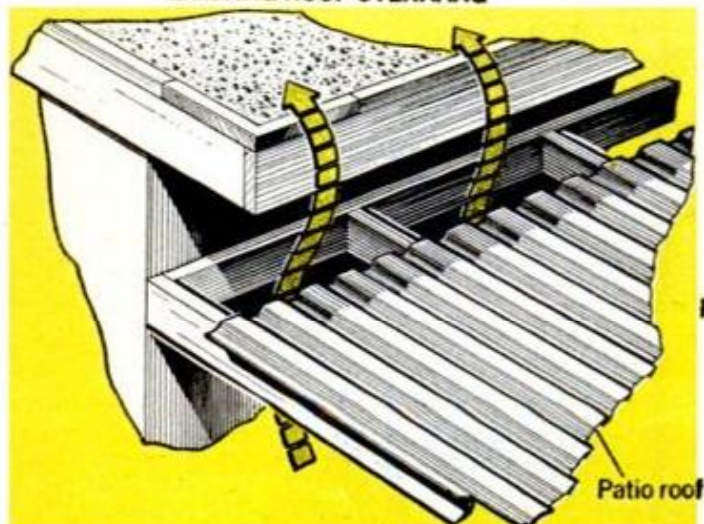
2x8s for spans of from 14 to 20 ft. If your layout varies from these dimensions, check sizes to use with your local building department. For full bearing, notch rafters at both ends, then nail them or use metal anchors.

Before installing the panels, cross braces must be placed between panels and configured wood filler strips fastened atop both to provide solid nailing. Sealant is

applied at panel overlaps and aluminum weatherproof nails with Neoprene washers are used for fastening. Complete panel installation instructions are in a Filon booklet entitled *Patio Planning Kit*. It's free at your local dealer's, or you can obtain it by enclosing 25 cents with your order directed to Consumer Services Dept., Filon Div., 12333 S. Van Ness Ave., Hawthorne, Calif. 90250. ★ ★ ★

## METHODS OF VENTING

EXISTING ROOF OVERHANG





# HINTS FROM READERS

## Replacing cover without splatter

I've tried about all suggested ways to avoid the shower of paint that occurs when the cover is seated in the rim of a partially used can of paint. But somehow a little paint always manages to reach hammer, shoe or surrounding area. Now, I cover the can with a cloth and tap the top in place without fear of splatter.

—Walter E. Burton

## Making cutout in sheet metal

Here's an easy method for making square and rectangular cutouts in a small piece of sheet metal when a nibbler or similar tool is not at hand. Simply mark the cutout, roll the metal around a wood form, and clamp in a vise. After making the first two cuts, rotate the metal 90° on the form, roll and reclamp for the final two cuts.

—Frank L. Rush

## Replacing an ax handle

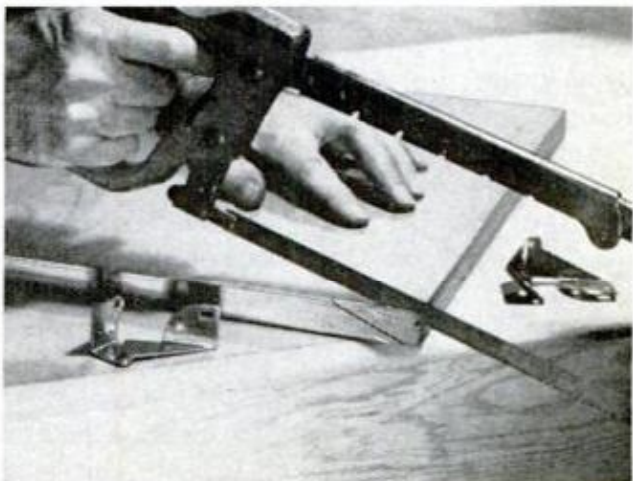
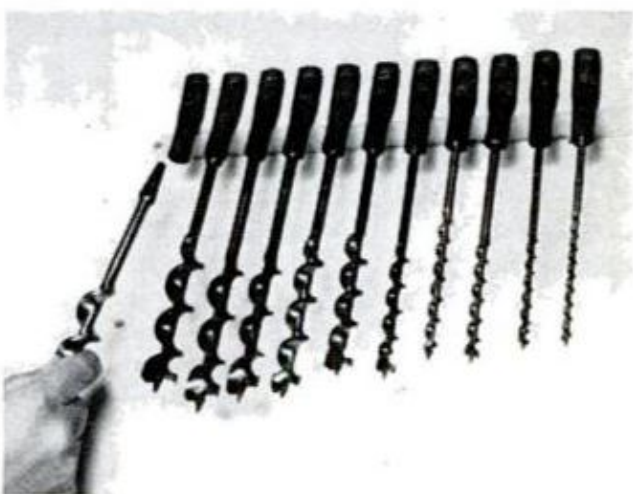
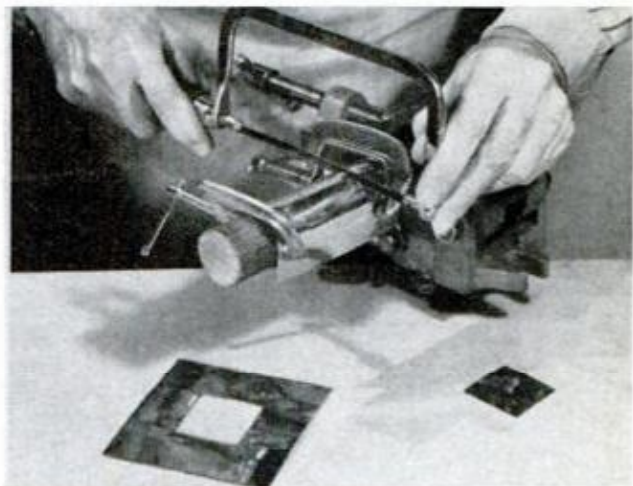
Next time you have to replace an ax handle, instead of whittling the hardwood to size, try this lumberjack's trick. Submerge the ax head in water and drive the new handle in with a hand sledge. As the handle enters the ax head excess wood peels away. With head driven home, remove ax from water and trim off the 'peelings'.—Forrest E. Sehlin

## Holder for auger bits

Though there are several ways to store auger bits neatly, I've found this method works best: Cut a short length of 3/8-in. vinyl hose for each bit, tack the lengths to a strip of wood and attach the rack to your toolboard. Bits stay snugly in their individual holders, yet a slight tug releases them as needed.—Arthur L. Ramos

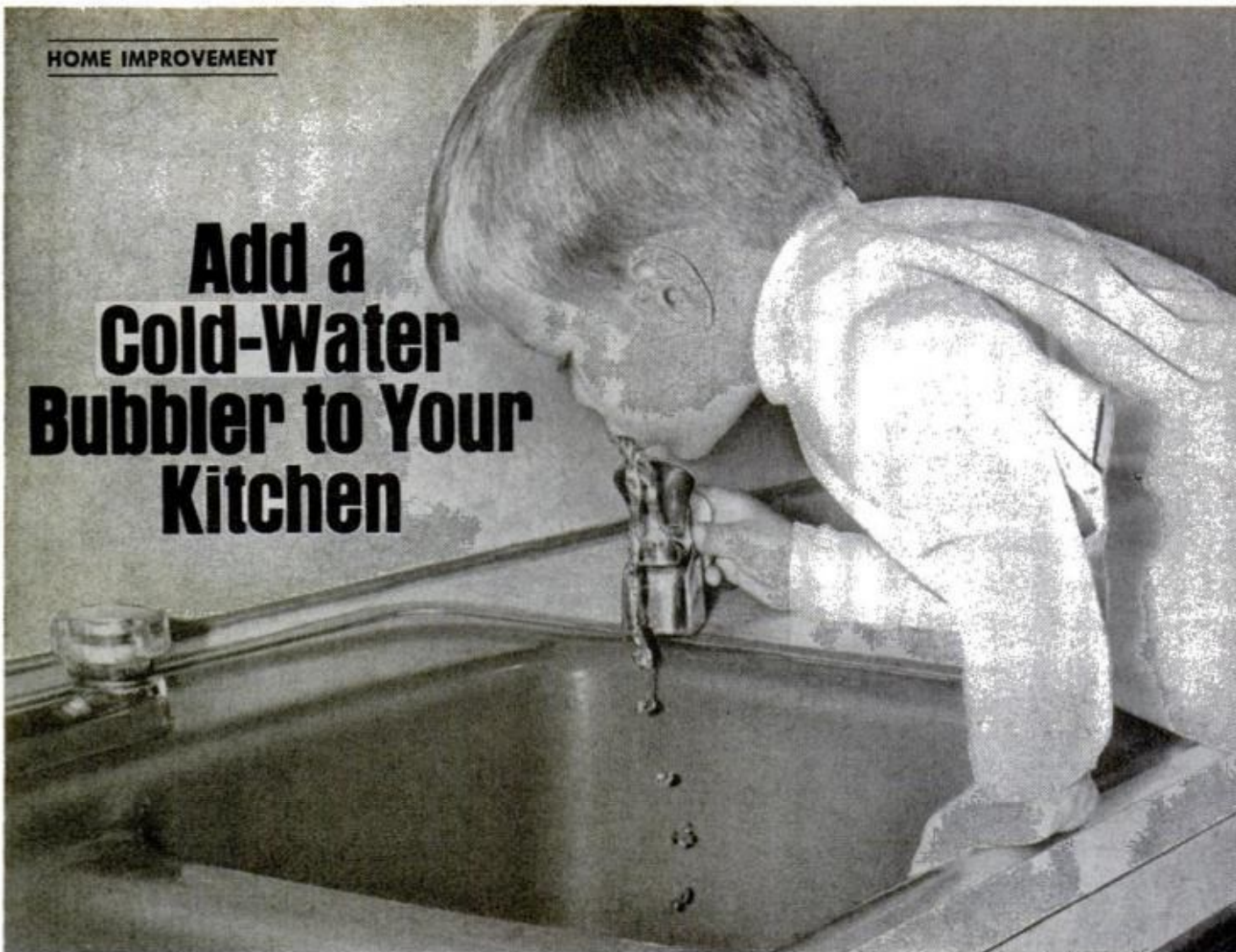
## Mortising a pivot hinge

If you don't have a backsaw handy when you have to cut mortises for pivot-type cabinet hinges, use a hacksaw. The fine teeth of the metalcutting blade cut the 1/8-in.-deep mortise easily without slipping off the edge of the door and causing damage. A block of wood held against the blade as it starts adds insurance against slipping.—Victor H. Lamoy





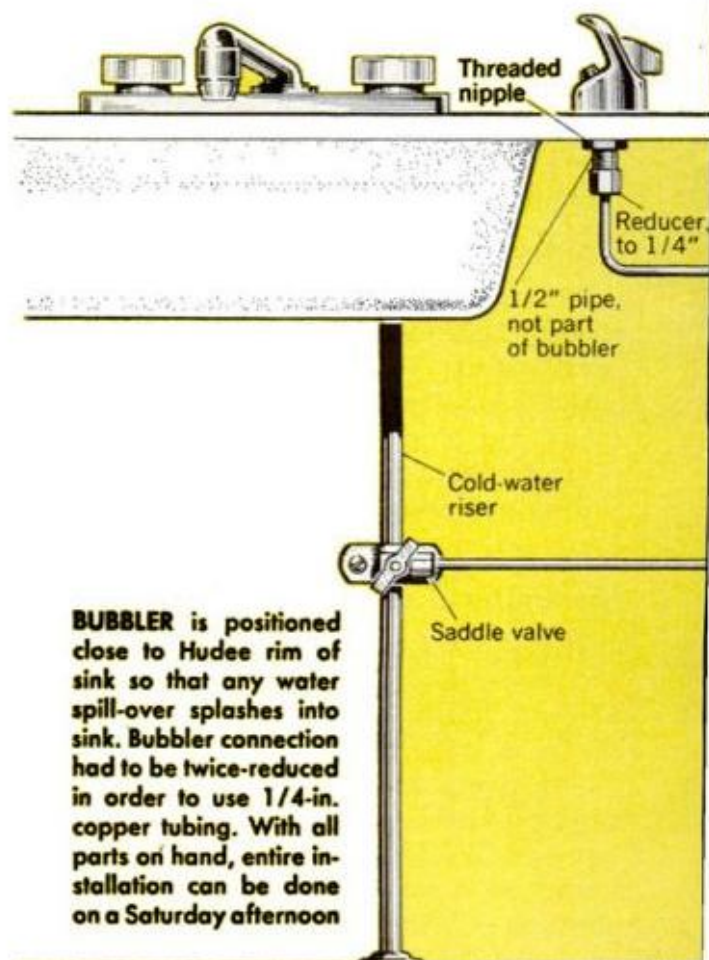
# Add a Cold-Water Bubbler to Your Kitchen



**I**F YOU STOP TO THINK about it, on a hot summer day no liquid really satisfies or quenches a thirst like a glass of ice-cold water. You can, of course, keep a supply on hand by storing a water jug in the refrigerator but, if you have several youngsters, that means that the refrigerator door will be open more than it's closed. And that produces excessive moisture and keeps the motor humming almost constantly.

Wanting an ice-cold water supply in his kitchen, DeRay Pugh of Bountiful, Utah checked out the commercial coolers. Not surprisingly, he found that they retailed at \$150 and up. Since the price tag nixed buying one, he installed his own version. Total cost ran about \$26. His system, which uses a 30-in. length of 2-in. galvanized pipe for water storage, holds 1¼ qts. He used an Oasis bubbler (shown), purchased from a commercial distributor. You should be able to obtain a bubbler at your local retail plumbing supply house.

In addition, you will also need a length of ¼-in. copper tubing to suit the run



**BUBBLER** is positioned close to Hudee rim of sink so that any water spill-over splashes into sink. Bubbler connection had to be twice-reduced in order to use ¼-in. copper tubing. With all parts on hand, entire installation can be done on a Saturday afternoon



from your sink to refrigerator and back, plus an assortment of fittings and end caps required for the storage tank (shown below).

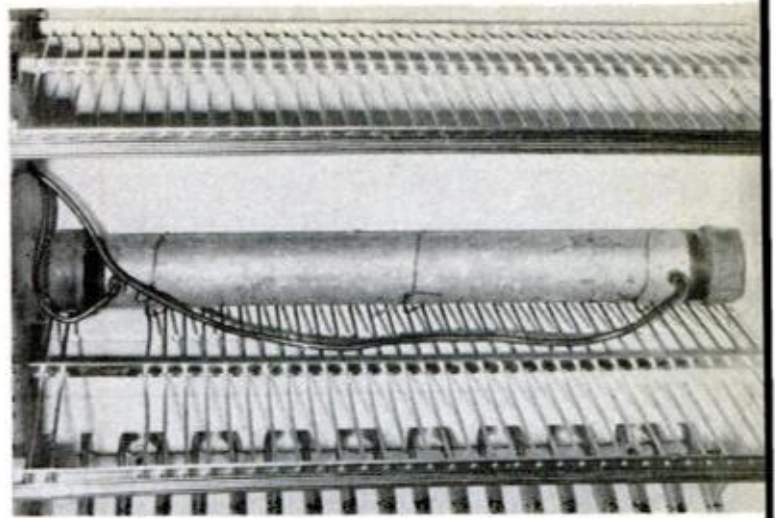
Since the rear portion of the bottom shelf in a refrigerator is usually wasted space, locate the tank there. Drill the holes through the refrigerator side carefully to insure a snug fit for the tubing. A piece of masking tape over the spot you want to drill will keep the bit from drifting as you start the drill.

Before drilling the hole in the countertop to mount the bubbler, mark the desired location. Then use your ruler on the underside of the countertop to make certain that you will clear the sink's flange, mounting lugs and anything in the cabinet drawer below.

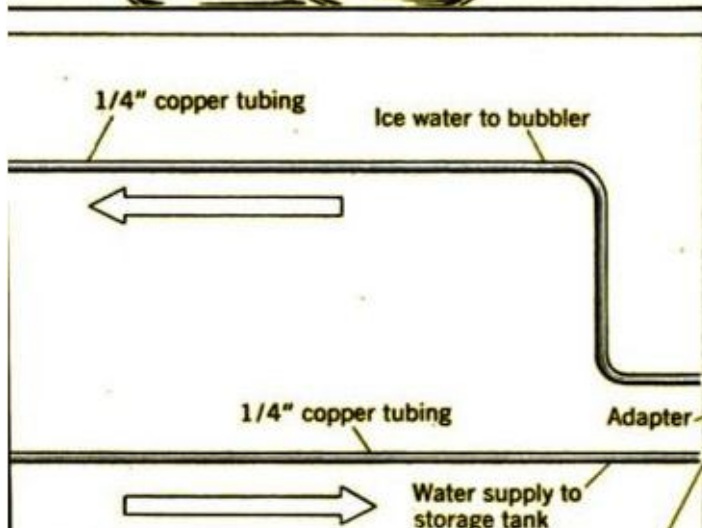
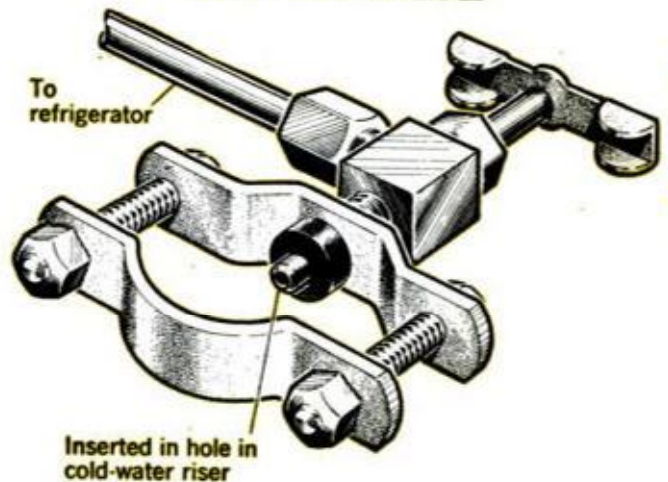
Run a bead of caulking between bubbler and countertop to prevent leaks.

Be sure to place the tubing well back in the cabinet to avoid damage or, as an alternative, run tubing through the floor, along the underside of joists and up to the sink.—*Bill Halley* ★★★

**STORAGE TANK** (top photo) is simply wired to bottom shelf, is completely out of the way. Saddle valve (right) goes in quickly and is the simplest method of tying into an existing cold-water riser

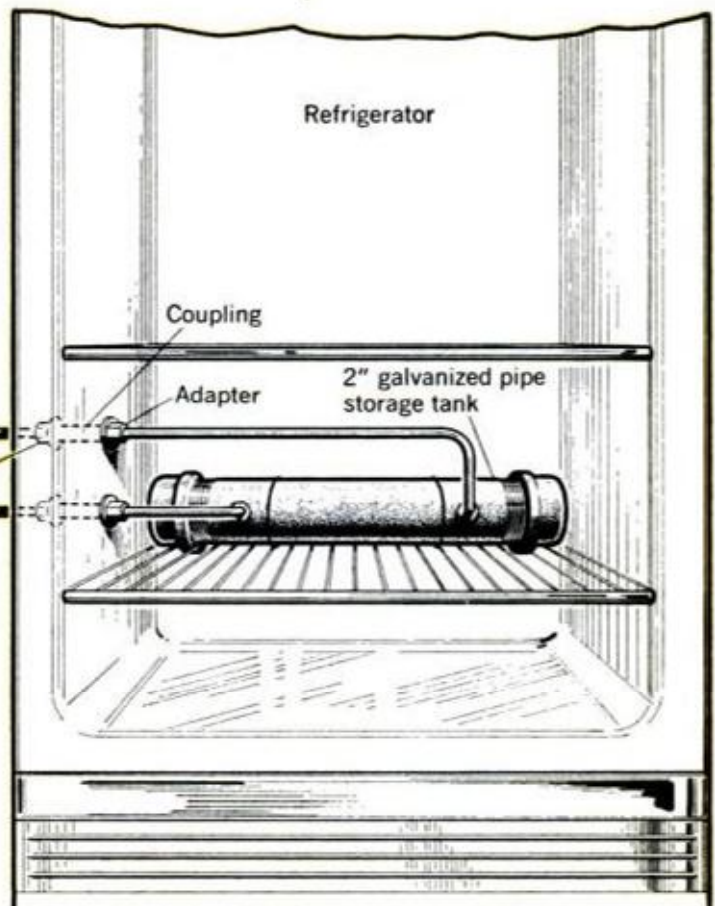


### SADDLE VALVE



**HOLE THROUGH REFRIGERATOR** side should be carefully drilled to provide neat, perfect fit. If hole is sloppy and space exists around fitting, pack in loose insulation. Since copper tubing is extremely soft, any runs through cabinets should be protected from possible damage. The saddle valve, used for connection to the cold-water riser, can be bought at plumber's supply house or by mail order from Sears, Roebuck

Pack hole with loose insulation

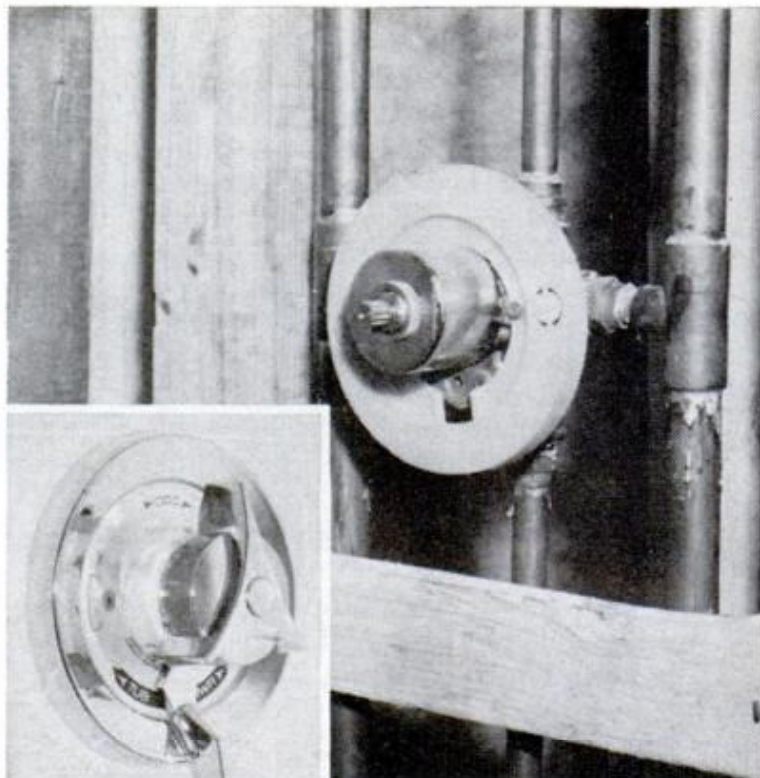




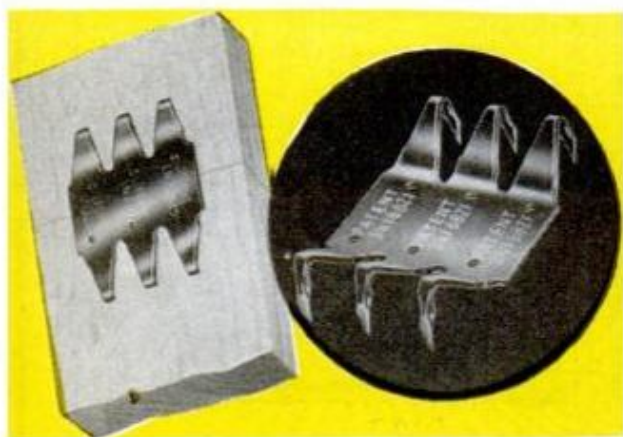
# New Building Products



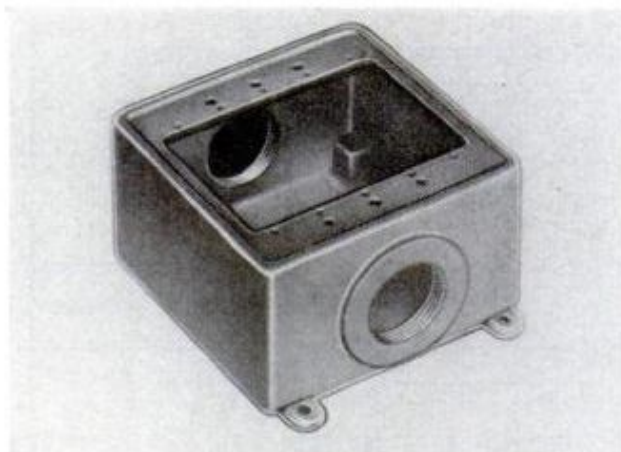
**MESSAGE CENTER** and clock timer are features of a new music intercom system. The cassette tape in the solid-state cassette/radio/intercom system serves as a family message center. An alert light indicates a message is waiting on the tape. Finished in walnut wood grain, Communicator Model 2542 sells for \$330. Made by Nutone, Div. of Scovill, Madison and Red Bank Rds., Cincinnati, Ohio 45227.



**PRESSURE-ACTUATED SHOWER VALVE** saves you from burns and costs no more than conventional mixing valves, claims Symtrol Valve Co., 445 C St., Boston, Mass. 02210, the maker. Labeled Temptrol '76, it holds desired water temperature within 2°, even when supply varies up to 85°. Front view of rough-in (above) shows plastic shield which stays on until wall is finished. Area around valve is then grouted or plastered.



**CLINCH-ACTION FASTENER** eliminates toenailing, draws opposing wood members together as integral nails are hammered in. Made by Wood Connector Products, 340 W. Colfax St., Palatine, Ill. 60067, Strap-nail is used for mitered corners, T-connections, flush butt-joints, furniture repairs. Fasteners have three widths; two, four or six integral nails.



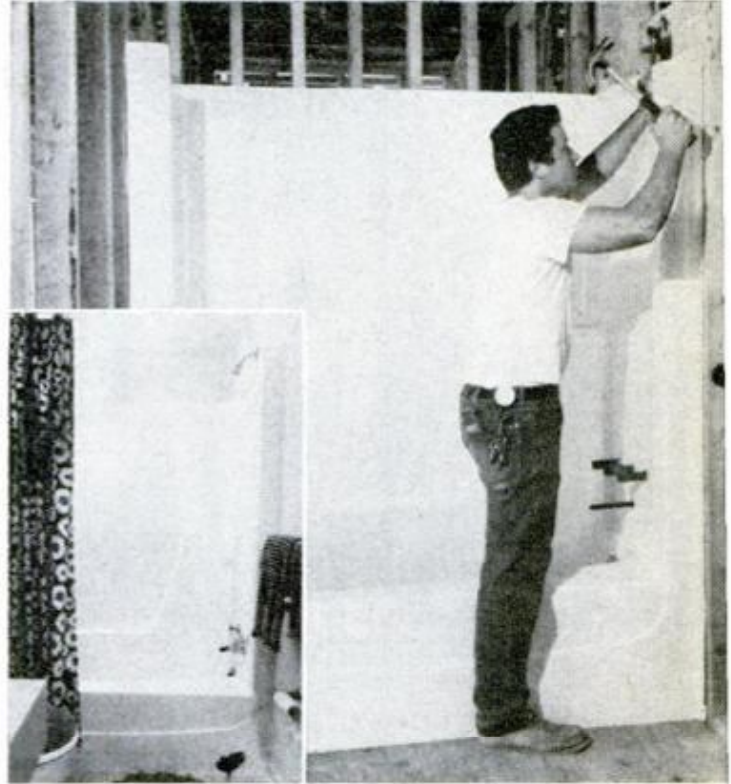
**WEATHERPROOF POWER OUTLET** features deep-design box suitable for high-amperage industrial use. Of cast aluminum, box is offered with one or two threaded hubs in either 1 or 1¼-in. outlets. Overall size, 3 in. deep by 5½ in. square, provides ample room for 60-amp., four-wire receptacles. Bell Electric Co., 2600 W. 50th St., Chicago, Ill. 60632.



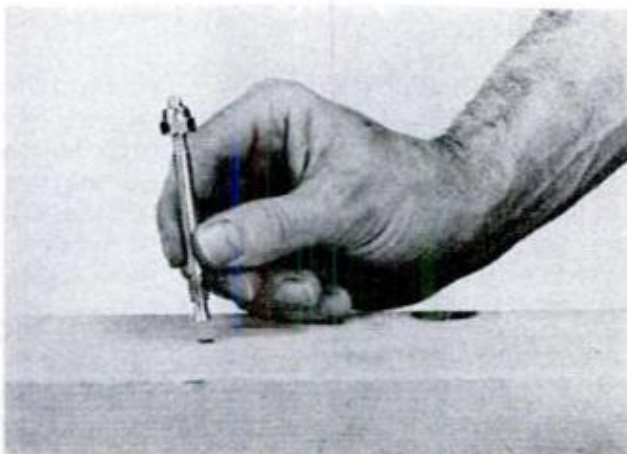
# You Should Know About



**TOUGHER STORM DOORS** built with  $\frac{1}{8}$ -in.-thick Herculite K tempered safety glass are claimed four to five times stronger than ordinary glass. Unlike conventional glass which leaves jagged edges when shattered, the safety glass crumbles into small particles under impact (inset) to reduce the chance of injury. A  $\frac{3}{16}$ -in. thickness is available for sliding doors. For information, write PPG Industries, Inc., 1 Gateway Center, Pittsburgh, Pa. 15222.

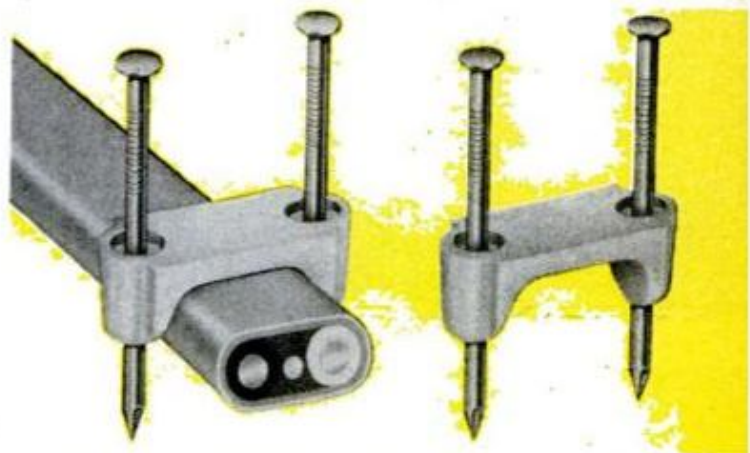


**PRACTICALLY NO MAINTENANCE** is the boast made for this fiberglass-reinforced plastic bathroom unit. Built with three walls and a tub as an integral unit, it's simply nailed to the studs with no seams to caulk. Other features include sculptured shelves for books or toys, a canted design for more tub space and a bottom said to be less slippery than that in standard tubs. Owens-Corning Fiberglas Corp., Box 901, Toledo, Ohio 43601, is the maker.



**HIGH-STRENGTH MASONRY ANCHOR** eliminates changing bits—you simply drill one hole through piece to be fastened and drop in  $1\frac{1}{4}$ -in.-dia. anchor. When bolt is tapped into hole, clip bears against hole surfaces to hold anchor in place. Parabolite comes in two lengths:  $1\frac{3}{4}$ -in. (four for 98 cents) and  $3\frac{1}{4}$ -in. (four for \$2). USM Corp., Reading, Pa.

JULY 1970

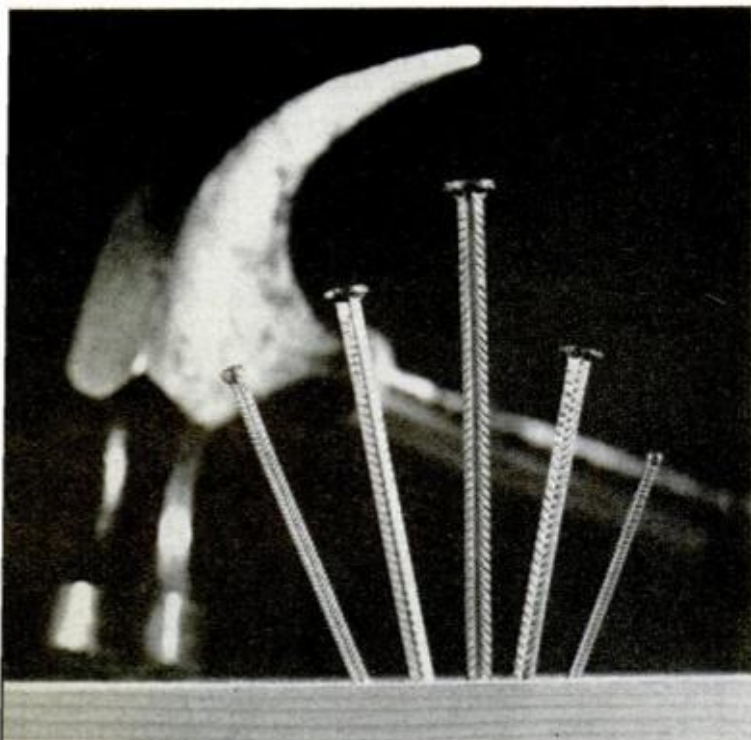


**COMBINATION STAPLE AND STRAP** consists of injection molded plastic strap with two zinc-plated nails. Claimed to provide insulation with high dielectric strength, it is not affected by heat or cold, will not rust or rot. In  $\frac{1}{2}$  and  $\frac{3}{4}$ -in. sizes, it fits new or old type Nos. 10, 12 and 14 Romex, UF and BX cables. Holub Industries, Inc., Sycamore, Ill. 60178.

169



## New Building Products



**NEW-TYPE NAILS** have angled serrations along their square shanks. Called Scotch nails, they weigh less and provide more nails per pound, reduce wood splitting and resist tendency to work loose. Available at building supply dealers in many sizes, they're made by Bethlehem Steel Corp., Sparrows Point, Md.



**PREPACKAGED STEEL DOOR** comes complete, ready to install into standard framing. Made of corrosion-proof galvanized steel, Benchmark doors are shaped from two panels with interlocking edges for extra rigidity. Six models, 30 and 36 in. wide, are polyurethane-insulated for draft-free comfort. General Products Co., Box 887, Fredericksburg, Va.

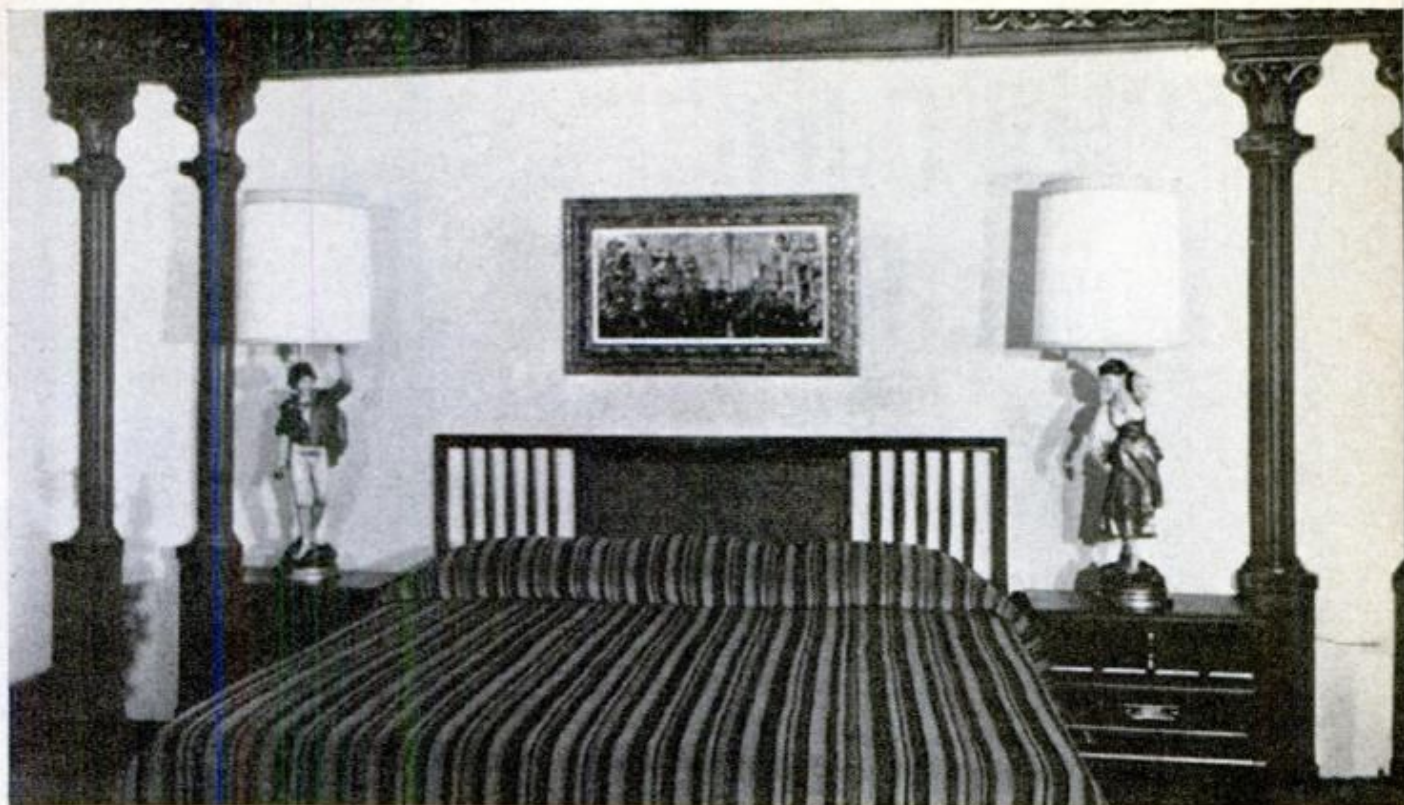


**FREESTANDING FIREPLACE**, available in nine decorator colors, comes with attractively stippled semi-gloss finish. Manchester-Pierce unit is built of heavy-gauge sheet steel, has double-wall construction with full insulation, can be located almost anywhere in a home. Condon-King Co., 5611-208th Ave. S.W., Lynnwood, Wash. 98036, makes it.



**BLACKTOP SEALER** can be rolled on, is said to have unusual load-bearing stability and strength. The maker claims one gallon of Formula B Sealer will cover up to 250 sq. ft. and restore the "new" look to asphalt while sealing and protecting the surface. Sold through lumberyards and hardware stores, it's made by Sakrete, Inc., Cincinnati.



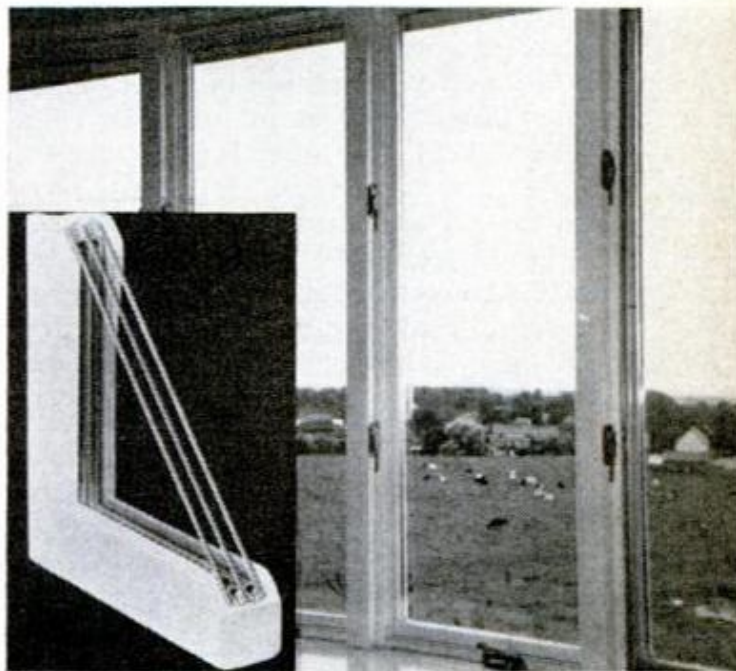


**INSTANT ARCHES** give elegance to walls, entries or can be used as room dividers. Called Arch Eminence by Kirsch Co., Sturgis, Mich. 49091, they are made in modules which adjust horizontally and vertically to fill widths of 40 in. to 20 ft. Four fiberglass designs are offered: plain, Mediterranean, traditional and Corinthian-Classic in light walnut or antique white.



**PUSHBUTTON-CONTROLLED**, wall-mounted fireplace has two gas logs rated at 14,000 B.T.U. Constructed of molded fiberglass with an old-brick appearance, it is topped by a black metal hood. Installation does away with hearth, footing or noncombustible backwall. Unit can be vented up through studs or exterior wall. Approved for zero-clearance mounting, the fireplace takes less than an hour to install. About \$220 at Sears stores or through the company's catalog.

JULY 1970



**TRIPLE-GLAZED WOOD WINDOWS** feature three sheets of insulating glass, with air space between, that keep out heat and cold. They eliminate seasonal chore of putting up storms and screens, are designed to eliminate condensation, even in high-humidity areas. Ponderosa Pine Woodwork, 30 S. LaSalle St., Chicago, Ill. 60603, claims that heating-cost studies in six regional areas showed windows paid for themselves in heat savings in periods of 2.8 to 4.6 years.

171



# A 'Well-Oiled' Home Runs Smoother

The right lube in the right place can spare you costly repairs

By STEVEN J. HOWARD

**B**Y SPENDING a few minutes twice a year lubricating things around your house that swing, slide and turn, you can save yourself both money and aggravation. Experts in home maintenance claim that for every billion dollars that Americans spend annually for home appliances, an additional \$200 million is spent on repairs required because of inadequate lubrication. That's a staggering amount for fixing things that would not need fixing if a little oil and grease were applied at the right time.

But appliances aren't the only household items that require lubrication. Just about everything around your home that moves will perform better and last longer if it's properly lubricated regularly.



**USE GRAPHITE OIL** to keep door locks in good working order. Rule of thumb: A little dab will do it

172



**KEEP METAL PARTS**, such as the rod in a door closer, lubricated with general-purpose white lubricant

For example, let's look at the number of objects in a supposedly *nonhardware* room (living room) which require periodic attention. Door jambs should get an occasional spray of silicone grease, hinge pins a dab of general-purpose white grease to eliminate squeaks. And windows need care; a small amount of silicone applied to double-hung sash channels assures freer and easier up-and-down sliding. And, while at the window, put a drop or two of white grease on the sash lock. If you have casement windows, a dose of household oil in the cranking device keeps the mechanism from failing.

Don't neglect drapery traverse rods. They'll operate better and won't bind if kept lubricated. Check rolling furniture,



**GET RID OF SQUEAKS** that annoy you every time a door swings. Put a couple of drops of oil on pins

POPULAR MECHANICS



such as serving carts, regularly and keep them operating smoothly by oiling the wheel hubs. Even zippers on seat covers (especially the machine-washable type) will open and close more readily if you coat them periodically with silicone. All in all, this is quite a list for a nonhardware room.

Since many items around the home need lube maintenance, a helter-skelter, disorganized approach to lubricating will not give satisfactory results. Your best bet is to draw up a plan—a master lubrication chart. The chart should list what needs to be lubricated, how often, and with what.

To insure a good plan, follow several general rules:

● *Never overlubricate.* It's wrong to think that because a little lubricant is good, a lot of it is better. Overlubrication—like underlubrication—can ruin a piece of equipment. For items that require a liquid lubricant, one to three drops is usually all that's needed. When using a silicone, apply light film.

● *Follow directions.* Always add a manufacturer's lubricating instructions to your master plan. If you've misplaced the maintenance manual for any part of your equipment, write the manufacturer for a replacement copy.

● *Use the right lube.* Until a few years ago, a lightweight all-purpose household oil was used for just about all home-lube tasks. It's still important but, for certain chores there are other agents that do a better job. The chart on page 174 will serve as an aid here.

● *Practice preventive maintenance.* Lubrication before the fact can prevent squeaks, rattles, binds and failures. Thus,

if a part calls for lubricating twice a year, *do it twice a year*, although everything appears to be running smoothly.

● *Always clean before lubricating.* Alcohol, kerosene and plain detergent and water all make good cleaners, depending upon the part being washed. Use them whenever possible, but always make sure the surface is dry before applying the lubrication.

Basically, there are five household lubricants you should have on hand. Each is available in hardware stores in some type of handy-to-use applicator such as a puff-type dispenser, squeeze-type tube or can, or an aerosol spray can. The lubes to stock are:

1. Lightweight household oil for light machinery such as small electric fans, blenders and automatic can openers.

2. Heavy household oil (SAE 20) for larger machinery—sump pumps, large ventilation fans, oil burners, warm-air furnace blowers and dishwashers.

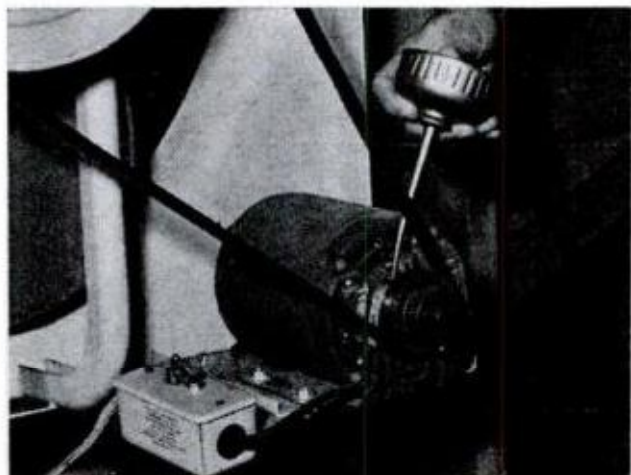
3. Silicone lubricant in stick or spray form for use on all metal and wooden sliding surfaces.

4. General-purpose white lubricant for all metal parts that move against other metal parts—hinges and latches in the house, on cabinets and appliances.

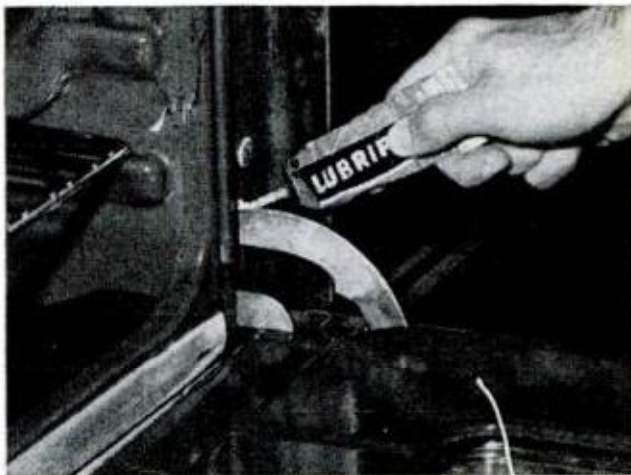
5. Weather-resistant combination graphite-and-oil lubricant for exterior locks and equipment.

The chart on the next page lists a variety of household items that need lubrication; it can serve as the basis for your household lubrication plan. To the list, add equipment, appliances and the like whose lubrication is dictated by manufacturer's instructions.

Be observant as you go from room to



**BUY HEAVY OIL (SAE 20)** to keep your large equipment, such as attic fan motor, running noiselessly



**OVEN DOORS WILL SWING EASIER** if you coat them semiannually with a general-purpose white lubricant



room in search of equipment that requires lubrication. In the kitchen, in addition to appliances, kitchen-cabinet hardware needs lubrication. Swing faucets and water taps could do with an occasional shot of graphite-oil. In bathrooms, lubricate sliding shower doors, medicine cabinets and sink and toilet hardware. This will give you an idea of what to look for in each room. As you come across additional items, add them to your master lube chart. ★★★

**DON'T OVERLOOK** nonmetal surfaces such as sliding-door track in furniture. Here, use a silicone spray



## MASTER HOME LUBRICATION CHART

ITEM	LUBRICANT	WHERE TO APPLY	WHEN	AMOUNT
Window cranks	Lightweight household oil	At handle spindle	Semiannually	One drop
Casement and jalousie channels	General-purpose white lubricant	Along channels	Semiannually	Light covering film. Work window to spread lubricant
Overhead-type garage door	Graphite-oil	Along tracks, at pulleys and locks	Semiannually	One to three drops, then activate parts
Storm-door snubber	General-purpose white lubricant and lightweight household oil	On sliding surface and in snubber	Semiannually	One drop grease on sliding surface; two drops oil in snubber
Furnace blowers	Heavy household oil	In lube cups. Prepacked types need no lube	Twice during season	As per maker, usually two to three drops
Plumbing fixtures	Graphite-oil	At moving surface	Semiannually	One drop
Sliding shower and medicine cabinet doors	General-purpose white lubricant	In channels	Semiannually	One to two drops. Slide door to spread lube
Light machinery (including small appliances)	Lightweight household oil	Per manufacturer's instructions	Semiannually	Per maker, usually one to three drops
Heavy machinery (including large appliances)	Heavy household oil	Per manufacturer's instructions	Semiannually	Per maker, usually one to three drops
Locks	Graphite-oil	Open latch and apply lubricant through keyhole	Semiannually	Two drops. Work into crevices by inserting key
Drawers and sliding furniture doors	Silicone	On tracks, drawer or door rails	Semiannually	Light covering coat
Sliding closet doors	Silicone	In channels	Semiannually	Light covering coat
Hinges	Light household oil or general-purpose white lubricant	On hinge pins	Semiannually	One drop. Remove pin, clean, apply oil and work back and forth in hinge
Double-hung windows; combination storms and screens	Silicone	Along channels on both sides	Semiannually	Light covering coat
Sash locks	Light household oil or general-purpose white lubricant	At joint	Semiannually	One drop

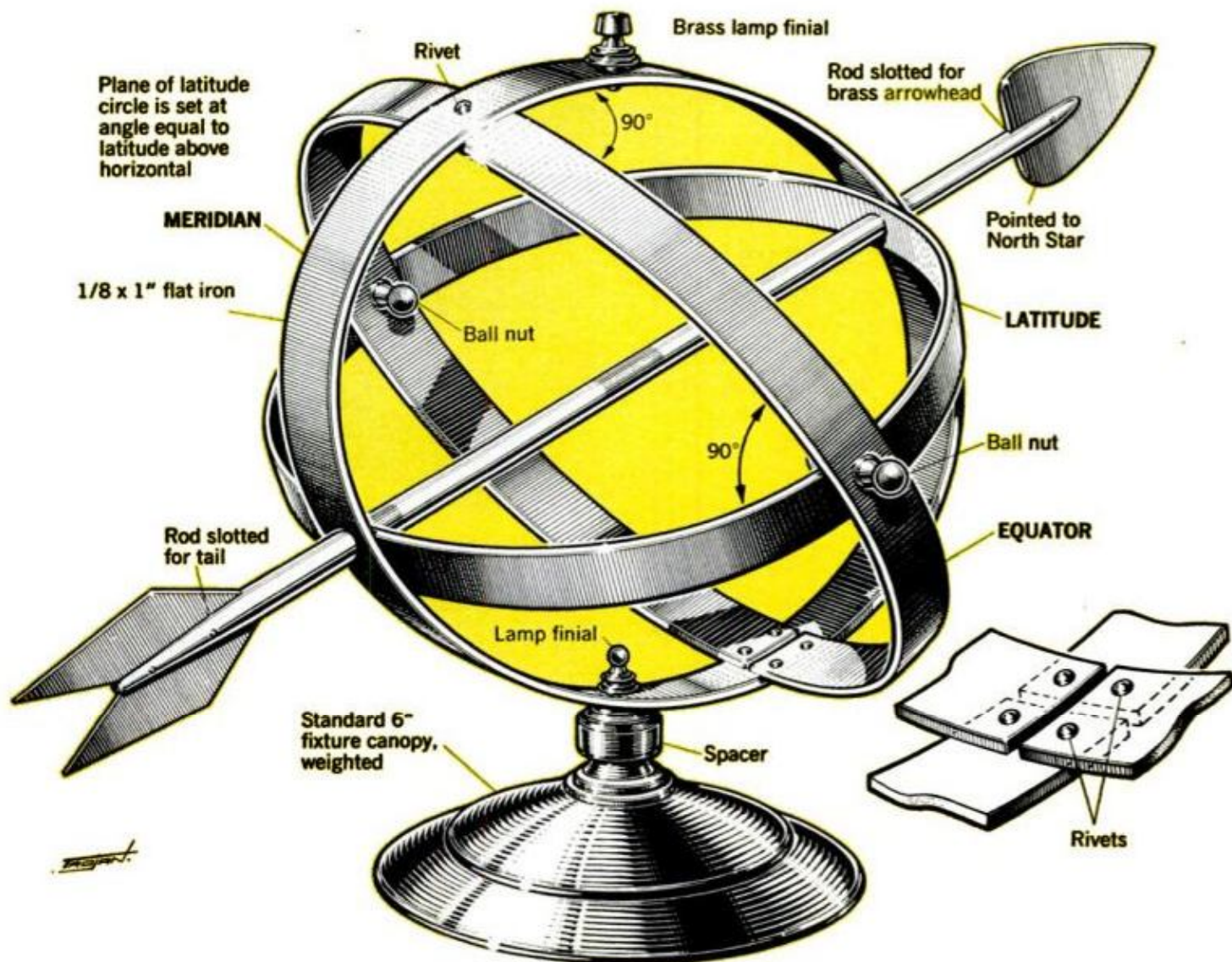


# Make This Decorative Yard Ornament

PLACED IN YOUR BACK YARD, an armillary sphere is sure to stimulate conversation. And, if you position it carefully, you'll be able to tell the time of day without budging from the patio. The skeleton-like sphere is an ancient astrological instrument consisting of rings that represent the important circles on the celestial sphere. This simple version uses sheet-metal rings and lamp parts.

Roll the rings into 10-in.-dia. circles and assemble them at a  $90^\circ$  angle to each other. The arrow shaft, which represents the polar axis of the sphere, passes through the intersections of the meridian and latitude circles. The hole for fastening the sphere to the base is drilled after the sphere is assembled. To locate the hole, block the arrow shaft at an angle equal to your geographic latitude and drop a perpendicular from the center of the sphere.

If carefully constructed and properly calibrated, the sphere can serve as a sundial: The shadow cast by the arrow shaft on the equator circle indicates the hour.—*John Dougherty*

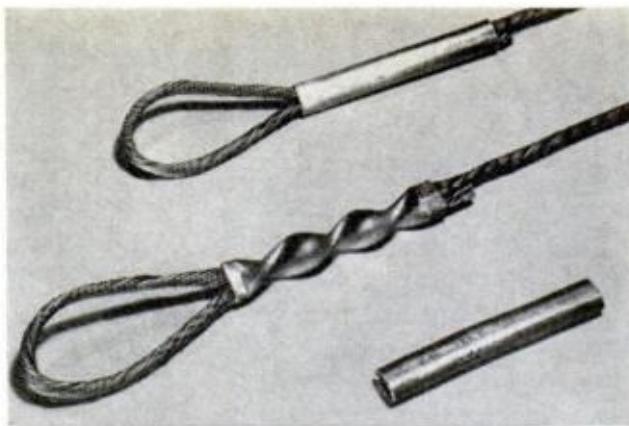




# HINTS FROM READERS

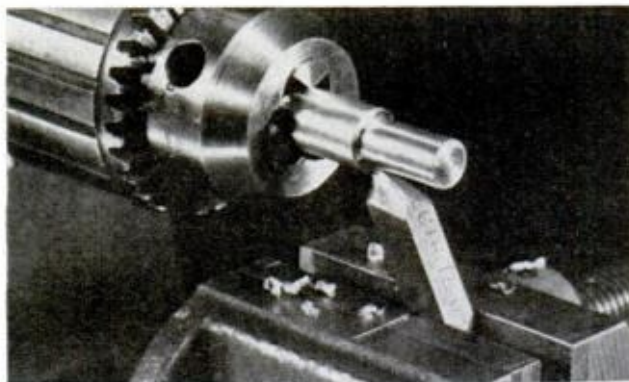
## Splicing wire rope

Here's a fast way to provide strong splices in wire rope. Simply cut a length of copper tubing, insert the wire rope as shown and anneal the copper. Heat it to a bright redness, quench in water and clamp the tubing in a vise. Next, grip the other end with pliers and twist it. The splice is so strong that the wire will break before splice opens.—*Joseph Giannelli*



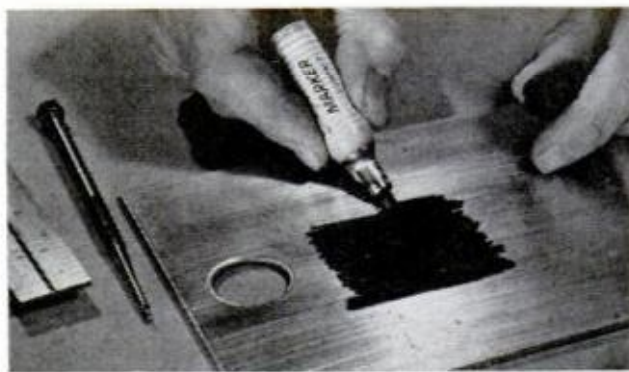
## Milling machine used as lathe

There are times when your lathe is tied up that you need a certain size of bushing or small pin. By chucking the stock in a collet and using a vise as a toolholder, you can do the job on a milling machine. The machine shown is a horizontal type, but the stunt works equally well on a vertical machine or a drill press having a milling table.—*George Durham Jr.*



## Substitute layout fluid

If your shop lacks layout fluid when the need arises, try using a permanent-type, felt-tip marking pen. I've found that on small workpieces the pen is handier to use than a brush or spray applicator. When the job is finished, the marking can be quickly removed with lacquer thinner or acetone.—*Edward E. Smith*



## Erase damage to micrometers

Here's a trick I've learned that has kept my mikes in good shape ever since I started using the idea. Put a rubber slip-on pencil eraser over the stem of your micrometer to prevent nicks during storage in the toolbox. This works well and on 1-in. mikes, the tool can be closed down loosely to protect anvil.—*Ernie Wiczorel*



## Checking for shorts

Using an ordinary double-outlet utility box, a screw-in bulb adapter and a 5-amp. plug-type circuit breaker, you can make a handy tester for dubious leads. Simply break the connecting link on one side and attach a 120-v. a.c. line to the screws. Leave the opposite connecting link intact. When an appliance is plugged into the box, the circuit breaker is in series.

—*Benjamin Borsody, P.E.*



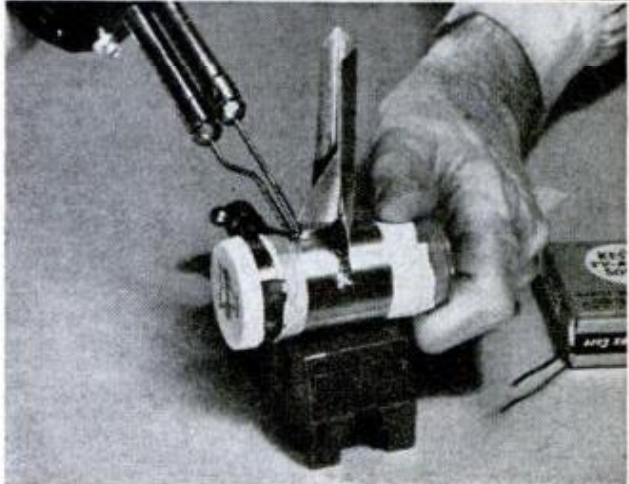
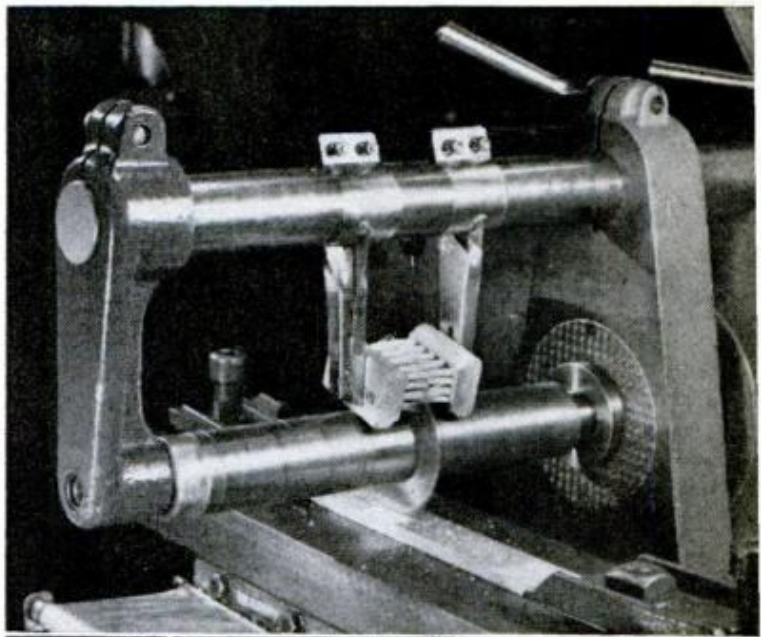


# 'Toothbrushes' Keep Cutters Clean

WHEN YOU MILL materials such as soft aluminum, especially with narrow, saw-type cutters, chips carried around by the teeth can cause a cutter to jam. Though some operators hold a wire-bristle brush against a cutter to lessen the chance of this happening, hand-holding a brush can be tedious. The "toothbrush" attachment shown applies bristles simultaneously to both sides of the cutter. The brush-unit parts are of easy-to-cut tin-can material and are assembled by soft soldering. With suitable design, plus proper bending and bracing, this attachment can be made safe and rigid enough for the work it is intended to do.

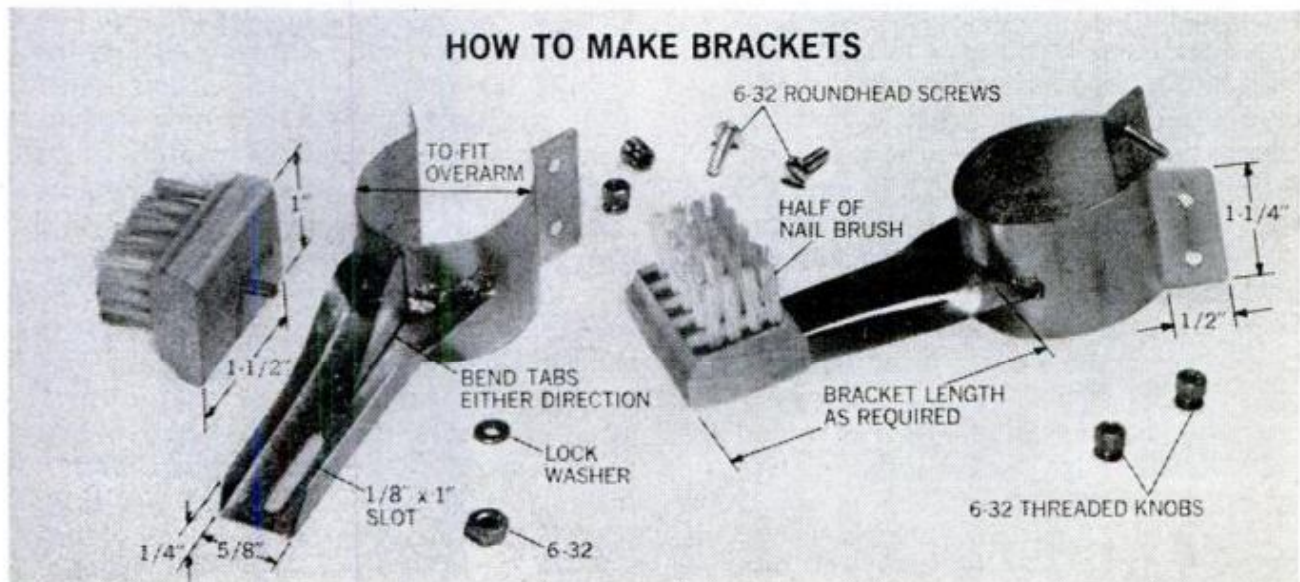
Though a small nail brush was used here, a brass-bristled suede-shoe or kitchen fiber brush would also be satisfactory. After cutting the brush in half, screw a 6-32 bolt in the center of each segment and cut off the bolt head to leave a  $\frac{1}{4}$ -in. projection. This stud fits a slot in the lower portion of the bracket extending down from the machine overarm. A hex nut and lock washer on the stud hold the brush in position, and the slots permit vertical adjustment.

The upper end of the bracket is soldered to a strip of tinfoil wrapped around the overarm. The plate is secured with two 6-32 bolts and knurled nuts. To add stiffness, solder a triangular brace between bracket and overarm.—Walter E. Burton



**SOLDER BRACKET** to band that encircles machine overarm, with band held in position it will occupy

**DISASSEMBLED PARTS** for one brush unit. Triangular brace (not shown) is added later to stiffen bracket





# 12 GREAT LATHE TRICKS



Part of the fun of working on a lathe is that there seems to be no end to the innovations that you can try. Here are an even dozen

By WALTER E. BURTON

**A**FASCINATING ASPECT of lathe work is that it involves so many ways of doing so many things. There are countless shortcuts, tricks, improvisations and interesting accessories you can devise to save time, make the work easier, or do "impossible" jobs. Here are a few:

● *Banjo chuck wrench.* A handy friend with a lot of muscle, this wrench is jigsawed from ½-in. plywood. Radiating slots in the head, which is about the same diameter as the chuck body, are positioned to slip over the chuck jaws (photo, opposite page). When you apply torque with the wrench, the spindle is restrained by belt drag, by engagement of back gears, or by other braking action. The wrench shown is for a 5-in. chuck on a 9-in. lathe; it has a head diameter of 5 in. and a 1½ x 8-in.

handle. The slots come within ½ in. of the head edge.

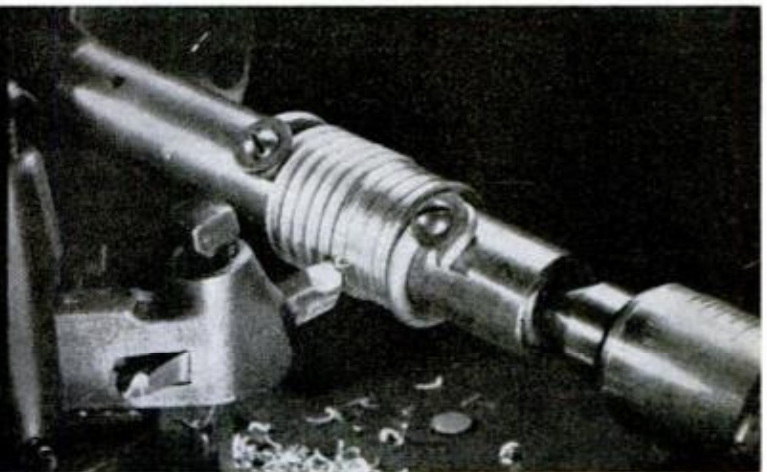
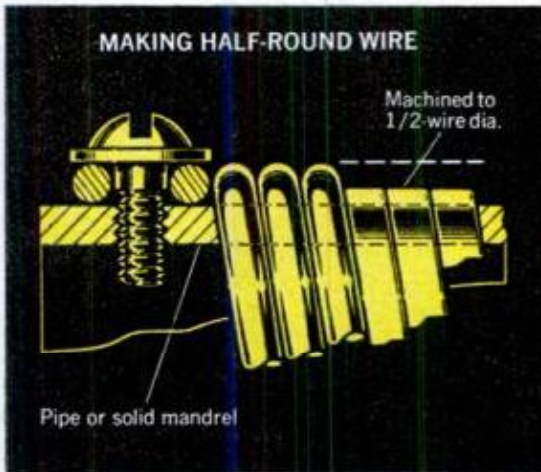
● *Cleaning lead-screw threads.* Dirt accumulations can be removed with a wood scraper clamped to the carriage apron. Trim the tip to fit thread grooves snugly, attach it to the carriage in whatever manner is convenient. Adjust the tip to ride smoothly in thread grooves with slight dragging action. The lathe is set as if cutting the same number of threads the lead screw has; in this case, the "cutter" is the thread-cleaning scraper. Carriage may move either toward or away from headstock, but it seems desirable to position the scraper so it trails the apron. This reduces the likelihood of a split nut in the apron accumulating a load of loosened dirt. After a portion of screw has been



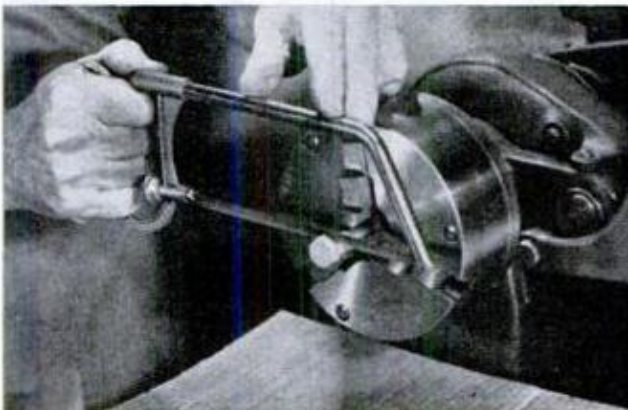


**DIRT ACCUMULATIONS** in lead-screw threads can be removed with bamboo or wooden scraper clamped to apron

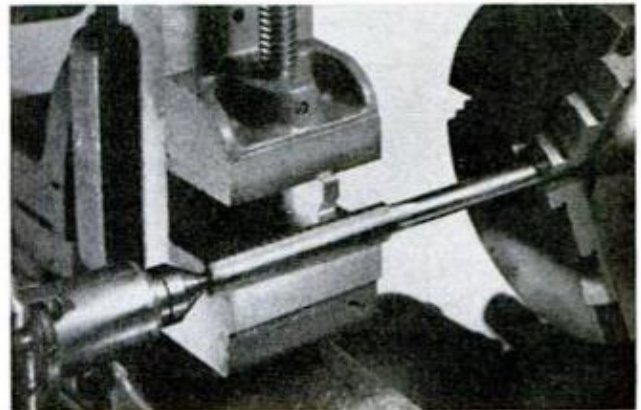
**BANJO-SHAPED WRENCH** is a handy persuader when chuck is stubborn, refuses to loosen from headstock spindle



**DECORATIVE WORK** sometimes requires half-round wire. Make your own by machining to half diameter



**PROTECTIVE CARDBOARD COVER** on lathe bed makes cleanup easier and keeps gritty chips from the ways



**STANDARD TAP**, chucked in lathe with outer end held by tailstock center, can serve as milling cutter

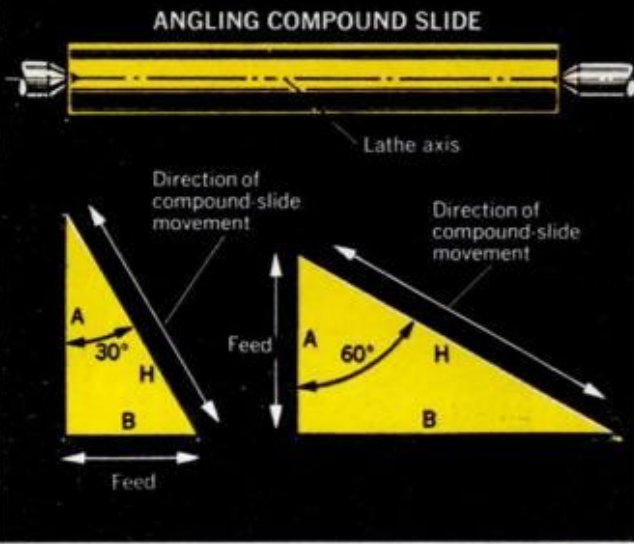
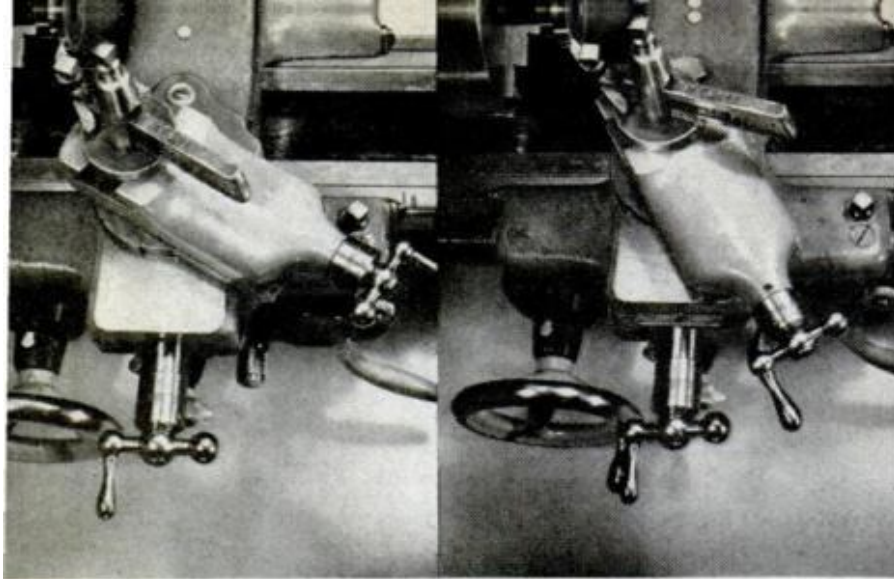
plowed, use a stiff brush, cloth and solvent to remove loosened dirt from threads and longitudinal keyway. After cleaning, it should be oiled.

● *Making half-round wire or rod.* If you need some half-round or nearly half-round wire, you can make it on the lathe from standard round stock. Simply wrap a length of wire around a mandrel and machine the outer portion until the desired thickness remains. Unwind the wire, straighten it, and clip off the ends where

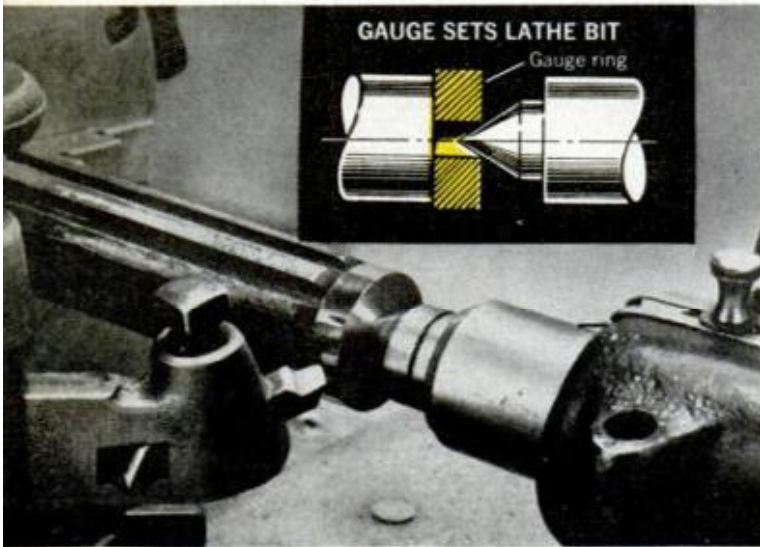
it was clamped to the mandrel. The mandrel can be solid bar, or, as in the setup shown, a scrap length of ordinary pipe plugged at the end (or ends for between-center mounting) so the center hole can be drilled. Two short bolts, fitted with washers, clamp looped wire ends to the mandrel.

You many find it convenient to provide several bolt holes so you can machine only as much wire as required at a time. For accuracy, you should true the man-





**FINER FEED** is possible by swinging compound slide to desired angle and using it to control movement



**MICROMETER TEST GAUGE** provides indirect way of turning work between centers to a definite diameter

drel before you wind the wire by taking a light cut.

● **Angling compound slide for finer feed.** Lathes using the English system of measurement have cross-feed and compound-slide micrometer collars calibrated in thousandths of an inch. When the graduations are close together, it is difficult to control the feed to the precise thousandth. A trick worth knowing is to swing the compound slide to an angle of  $30^\circ$  or  $60^\circ$  with respect to the cross slide, and use the compound screw to control tool movement. Then, an .001-in. movement of the slide means a tool movement parallel to or at a right angle to the lathe axis of half the distance, or .0005-in.; thus, to get an effective tool movement of .001 in., the slide must be moved .002 in. Here's how to do it:

For controlling tool movement *parallel* to the lathe axis (lengthwise on the bed), as in adjusting depth of a facing cut, swing

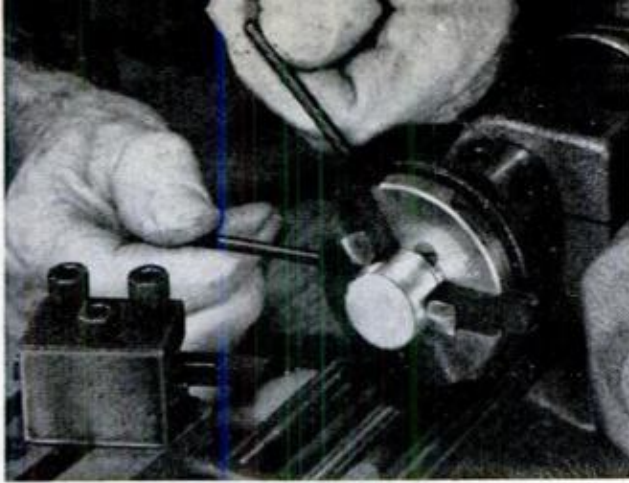


**NUT MANDREL** can be made of a short length of steel rod with threaded stud at one end to hold nut

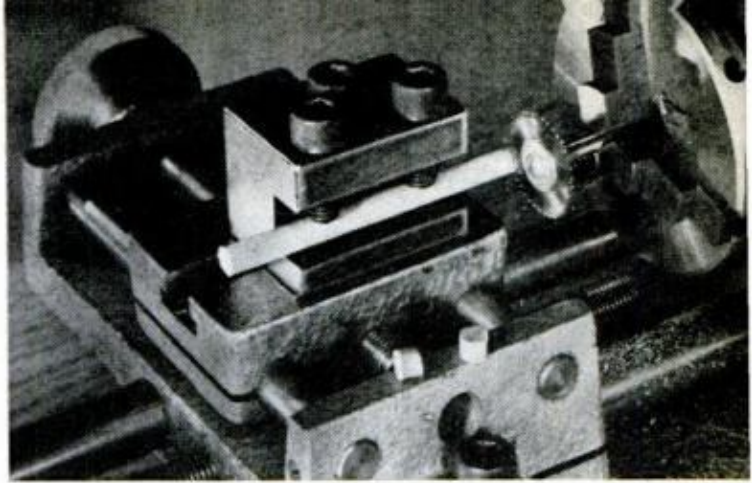
the compound slide to  $30^\circ$  from the cross slide. Then, when the slide is moved .002 in., the tool will move in a direction parallel to the lathe axis just half that distance. To control feed at a *right angle* to the lathe axis, set the compound slide  $60^\circ$  from the cross slide. Then each .002-in. movement of the compound slide changes the tool feed by .001 in. in a direction perpendicular to lathe axis. To turn a shaft using the *cross-feed* screw to control tool movement, you move the screw so that the micrometer scale will indicate one half the desired reduction in workpiece *diameter*.

For instance, to reduce the diameter by .006 in. in the next cut, you would turn

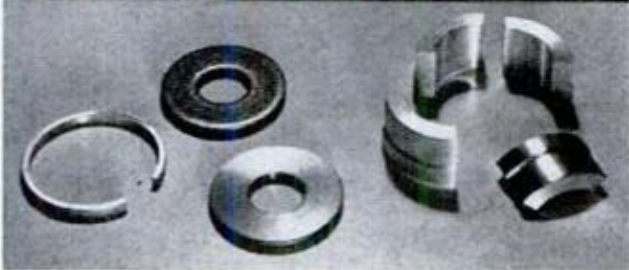
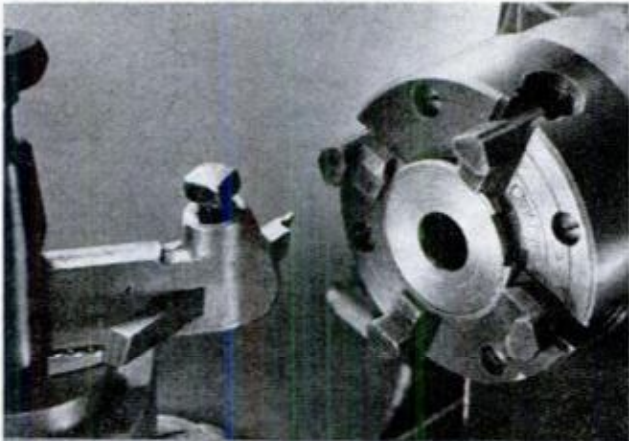




**THINWALL TUBING** can be chucked if you plug it with soft pine before clamping it in the lathe chuck



**ASSORTMENT** of brushes, pads and the like that come with a hand grinder expands small-lathe abilities

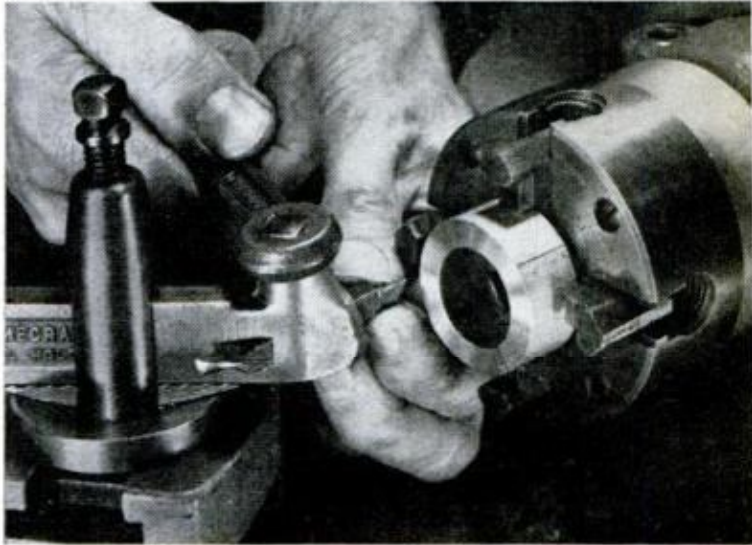


**WASHERS ARE FACED** in the top photo. Break-away rings (bottom), are machined by making the cuts first

the screw until its scale indicated a movement inward of .003 in. But with the compound slide set at  $60^\circ$  and used to control the tool feed, you would change the scale reading .001 in. for every .001-in. reduction in workpiece diameter. This is because the tool is moving only .0005 in. for every .001 in. of scale change, and is reducing the workpiece radius by a half-thousandth.

● *Nut mandrel for collet chuck.* A useful adjunct to a set of collets is an assortment of mandrels on which to machine nuts. Each mandrel can be a 2-in. length of steel rod that will fit the largest collet, and having at its end a threaded stud to hold the nut (such as  $\frac{1}{4}$ -20).

● *Gauge sets lathe bit.* An indirect way of turning a piece of work between centers to a definite diameter is to set the



**ALUMINUM RING** consists of four segments epoxy-glued together before machining to the finished size

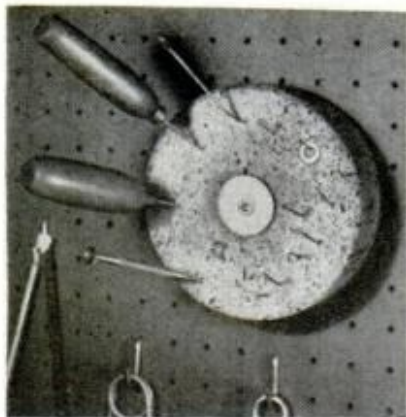
tool with the aid of a disc (or ring) of known diameter that has a concentric hole—such as a micrometer test gauge. The stunt can be used to achieve a fairly accurate final diameter when you machine work, such as a shaft with an odd number of flutes that is difficult to make directly. Or it can be used when no micrometer is available. The test disc is positioned on the tailstock center, and the squared end of a chucked bar or tube brought against it to hold it in place. The tool tip is brought into contact with the test-disc edge, and the reading of the micrometer collar is noted. From that point, settings for other diameters can be calculated. Thus, using a 1-in. gauge disc like that shown, the tool bit is fed inward from the gauge-edge position a total of .125 in. to produce a turned diameter of .750 in. Because of possible variables, this system is less likely to produce micrometer accuracy.

● *Tap used as milling cutter.* A conventional tap chucked in a lathe, with its outer

*(Please turn to page 200)*



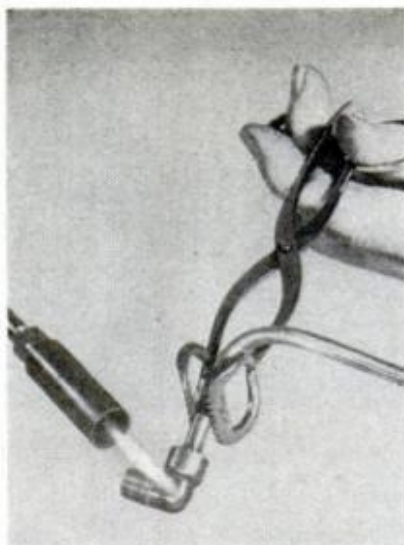
# HINTS FROM READERS



## Cork float tends tools

You can keep pointed tools handy without pricking yourself by parking them in a fishnet float. Fasten it to the bench with a screw through the center-hole and a washer large enough to cover the hole.

—Walter E. Burton



## Kitchen tool in shop

Next time you have to hold a small item to be soldered, try using a pair of kitchen tongs. They're inexpensive (about 50 cents) and easy to clean. Solder splashes won't stick to the polished surface.

—Herbert Y. Moon



## Supporting long boards

If you mount a frame on a joist above and one side of your table saw, you'll have excellent support when you have to crosscut a long board. Use storm-window hardware to attach the frame so it's removable.—H. Muller

## Trick for glazing windows

Usually, when you draw a putty knife across a bead of putty, the stuff pulls out. By dipping the blade in a gasoline-oil mixture I get a smooth bead without aggravation.—Lance Shay

## Radial-saw glue press

When you have a stack of blocks to glue together and no clamps, use your radial saw. Remove the blade, place work under the motor and lower arm so motor bears down on the wood.—Robert G. Lanzit

## NEXT MONTH IN SHOP AND CRAFTS

**NESTING PARTY TABLES.** This all-time-great project, which originally made a hit with readers in 1937, is presented in an updated version for 1970 craftsmen to copy. Perfect today for TV snacks, four individual tables pull out from a parent table to make serving extra handy. These gaily finished tables will be right at home in your family room. See the August *PM* for complete plans.

**HANGING MINI-BAR.** Both decorative and useful, this smart wall bar is ideal for den or home office. Its picture front swings down to form a handy serving counter. There's storage space for glasses, stirrers and four bottles of your favorite brands. Watch for it in the August issue of *PM*.

**PRIVACY SCREENS THAT GET ADMIRING GLANCES.** Back-yard and patio fun is more enjoyable if you and your guests can have privacy outdoors. Here are two fences as easy to build and as attractive as any you've seen. They're in *PM* next month.

**BUILD THIS WOOD PLANER FOR \$100.** As your woodworking experience increases, you suddenly realize that just about all lumber is project-usable—once it is dressed. Here's a thickness planer you can build in your shop that will save the time and expense of having a lumberyard do that dressing. See next month's *PM* for complete plans.

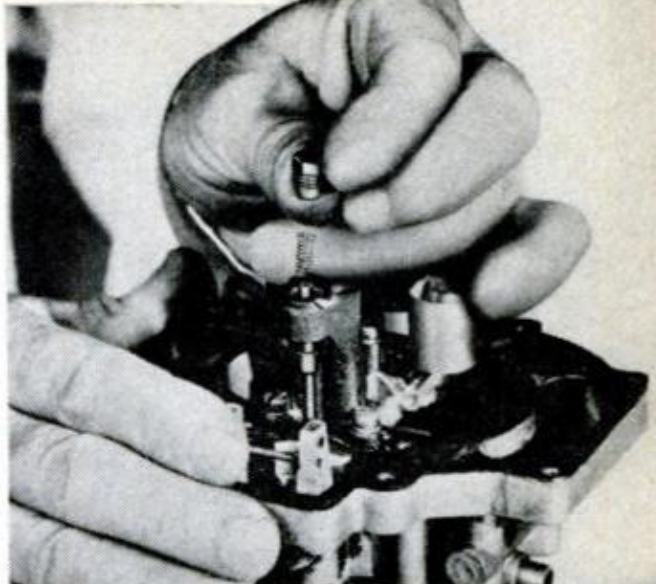
**PLUS:** Take the "Sweat" Out of Condensation Problems, Galley for Small Boats, Lathe-Carriage Limit Switch and much, much more.



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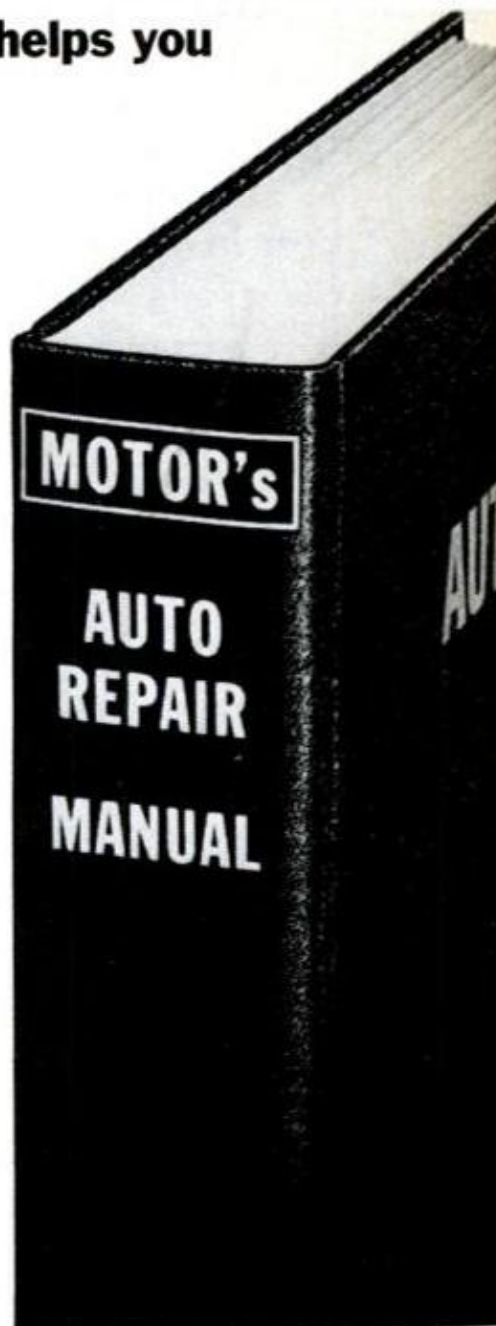
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IMPERIAL	BUICK	FRONT DRIVE
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## MATCH TRAILER TO YOUR CAR

(Continued from page 72)

gross-trailer-weight limits from the car-makers:

- Whenever possible, the gross trailer weight should not exceed the weight of the towing vehicle. (A 4000-pound car, for example, should tow, at most, a 4000-pound travel trailer.)

- On compact cars, restrict gross trailer weight to about two-thirds of the car's own weight to avoid warranty problems.

Here are some currently recommended options:

- All American manufacturers now recommend an *automatic* transmission if you plan to tow a trailer. It lets the engine shift at most efficient speeds, allows even an inexperienced driver to tow smoothly.

- Get a V8. To tow heavy loads you need extra horsepower. (Forget that old talk about "Sixes outpull Eights on hills!")

There is confusion about towing hitches. Here are some things to remember:

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**. . . the more frame attachment points, the stronger the hitch.**

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- Never use a *bumper-clamp* hitch for any trailer weighing over 500 pounds. It localizes the strain on a tiny spot, which may bend or break the bumper. (Those big wide hitches used by rental yards spread the strain somewhat better.)

- Always attach a towing hitch to the side frame rails in at least two places (four or five are better). Imagine an "H" bolted under your car so that the crossbar is doing the towing—that is a four-point frame hitch. If it were also attached or reinforced at the rear cross member, it would be called a five-point hitch. Remember: the more frame attachment points, the stronger the hitch.

- Ordinary frame-mounted hitches will safely handle trailer loads up to 3500 pounds.

- Use a load-equalizer hitch when trailer tongue loads exceed 200 pounds.

- *Do not use an axle-mounted load-equalizer hitch.* Many manufacturers now expressly forbid their use.

Nearly every American carmaker now recommends load-equalizer hitches for tongue loads exceeding about 250 pounds. With it, a scientific arrangement of steel spring bars—actually "levers"—shifts about a third of the tongue weight forward and about a third back to the trailer axle. A 1000-pound tongue load can there-

fore be reduced to about 350 to 400 pounds on the car's rear suspension.

The "weight limits" in our charts require a bit of explaining. There is no such thing as an absolute and unbreakable rule. The figures we used are predicated on general policy of each carmaker. They often state that "gross trailer weight should not exceed gross weight of the towing vehicle." Yet you will find plenty of evidence, in the charts, to show that 4000-pound cars can tow 5000-pound trailers. (See Ford and Chevrolet, for example.)

Why should you pay any attention to these load limits? After all, many passenger cars have towed 7000-pound trailers over steep mountains. Why impose any limits? Because there is often a wide gap between what is *possible* and what is *practical*. The automakers have set modest limits to protect your new-car warranty. If you fit your new car with recommended equipment and observe load limits, you tow with full factory backing.

Most automakers have set 2000 pounds gross trailer weight as the maximum without heavy-duty equipment. If your trailer does not exceed that figure, your car probably doesn't require special towing gear. (See your dealer for that information.) If gross trailer weight is 2000 to 3500 pounds, *some* heavy-duty equipment is required. It's spelled out in precise detail in the new-car literature. When this weight is 3500 to 5000 pounds the factory calls this *heavy-duty service* and recommends the full towing package.

Hundreds of trailer-towing tests have convinced us that heavy-duty components are worthwhile for *any* type of vacation duty. Such equipment not only protects your warranty but also increases longevity of many parts, provides an excellent safety margin and improves handling. Consider this, too: A large engine *loafing* may be more economical than a small engine *straining* under full-load conditions.

If you plan to tow a heavy trailer don't select a middle-sized car. It's false economy. Bigger cars have stronger components. These practical limits for cars aimed at trailer towing are recommended:

*Compact Cars.* Select a trailer under 2000 pounds gross weight.

*Intermediates.* Trailers under 3500 pounds should be no problem.

*Full-sized cars.* Trailers up to 6000 pounds are allowed with full warranty.

When trailer weight will exceed 6000 pounds by a substantial margin, consider a commercial-duty station wagon or pickup truck. The Travelall is one example. Chevrolet and GMC Suburban are others. Our charts were necessarily restricted to conventional cars for this report. ★★



## TRANS-AM: COMPETITION

(Continued from page 77)

put in a lot of figures about the car—weight distribution, stresses and so on—and came up with what we feel is the most efficient structure per pound yet built.

Wherever possible we used aluminum parts to keep the weight down. The target weight of our Trans-Am Barracuda is 3200 pounds with 22 gallons of fuel on board—minimum weight under the rules.

In the engine field, AAR's engine research and development department has developed and is continuing to develop improved versions of the 305-CID (destroyed, 340-inch) Plymouth engine. All American Racers and Keith Black Engineering are working together on the engines. The stock block and many parts were delivered directly from Chrysler in Detroit. The engine has been destroyed from the standard 3.31 to 2.960 to meet the SCCA 305-cu.-in. requirements for the Championship. Bore is 4.040. The one four-

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### **Spectators see their cars in competition—cars they drove to the track.**

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barrel carburetor is on top of the engine which shares basic cylinder-head design and rocker gear with the production version. Pistons and the oil pump are built to AAR specifications. When building the Trans-Am engine, we profited from our experience preparing stock-block engines for USAC and Can-Am racing.

The job of building two completely new Trans-Am cars and the necessary number of engines plus the whole organization of the program requires a strong team. Manager of our program is Robert L. Tarozzi, 32, who joined us last November. A former Chrysler engineer, he managed last year's NASCAR Grand Touring version of AMC's Javelin. He is responsible for overall operational management.

Phil Remington, 49, and very well known in the world of automobile racing, is director of fabrication and construction. He is an expert at metal forming and shaping and has made very valuable contributions to the Barracuda team. John Miller, 37, is head of AAR's engine department, specializing in engine research and development. The man responsible for the team's logistics is E. Forbes Robinson, 59, a veteran of 20 years in the racing business. The general management of it all lies in the hands of AAR's vice-president, Max Muhleman, 33. The Chry-

ler factory executive behind the Trans-Am program is Peter L. V. Hutchinson, 29, who last was in charge of the Plymouth Indy entry. He is responsible for coordination between the Chrysler Corp. and the Plymouth and Dodge racing teams.

Looking down the road a bit, I think there are several reasons why the Trans-Am Series is bound to become even bigger in the years to come. As in other sports, auto racing lives largely by the number of spectators it draws, and here Trans-Am racing has a big advantage over most other kinds of racing. Spectators see *their* cars in competition—Barracudas, Challengers, Camaros, Mustangs, Firebirds, Javelins—cars they drove to the track.

Manufacturers feel that winning races helps sell cars. As the trend in car design has started to turn from the big family car to the sporty looking and performing automobile, the performance of any particular make will become more significant. Actually, Trans-Am racing will improve the breed of cars. No matter how scientifically the test runs on factory tracks are carried out, they are still not the same as racing. Technical achievements and innovations in car and engine design are neither produced nor revealed as fast as in racing, where in a warlike situation, results have to be achieved under pressure. I think that many ideas which the different racing teams use to improve their Trans-Am cars will later on be applied to the road cars. Customers will benefit from our racing experience.

A racer likes to be in the kind of racing that gives him the most satisfaction. The more difficult it is, the more rewarding. This is one thing that makes Grand Prix racing great: the quality of competition, plus the tradition and the prestige.

To answer why I am racing the Trans-Am Series involves another question I am asked very often: "What is the most difficult kind of racing? Stock-car? Indy-car? Can-Am?" I feel it is basically wrong to say that one is more *difficult* than the other. The difficulty is not determined by a particular kind of racing, but by your opposition. In other words, it's equally difficult to beat a Jackie Stewart or a Mario Andretti—talking about road racing—whether they are behind the wheels of Trans-Am cars or Grand Prix cars. Top drivers just drive any car a little closer to the limit than the average racer. Just make it to a Trans-Am event to see what I mean! Remaining events are at Brainerd, Minn., July 5; Elkhart Lake, Wis., July 19; St. Jovite, Que., Aug. 2; Watkins Glen, N.Y., Aug. 16; Riverside, Calif., Oct. 4; and Kent, Wash., Oct. 11. ★★ ★



## FACE IN THE MUSTANG WINDOW

(Continued from page 94)

her feet. She wished for a flashlight but knew there was none, then realized it would be wet and useless anyway.

Another minute passed. She began to wonder, "Will anyone come? Will Mark come back? . . . Mr. Smith and his friend on the Pocahontas saw us. . . . They'll surely get help. . . . I've got to make this little bit of air last." Then an awful thought struck her: "Maybe Mark has drowned."

There is only one big window on the side of a Mach I. She found the crank and decided to roll it down. Afraid of the inrush of water, she changed her mind.

This is the time at which trapped victims go wild. They beat frantically at the car. "We find them with fingernails torn off," Chief Kenney told me later. They use up what little air they have. Nancy kept her cool. Again, she began to think and plan: "If I get excited I'll use up the oxy-

der, "How many hours have passed?" The bubble, diminished by small leaks and compressed by water pressure, was shrinking. Once she felt the car rock. Water came in faster. She could hear it.

"Something happened. It's *gulching* in," she thought. She huddled far back under the rear window, looking for the legs to reappear.

She warned herself. "Stay awake, Nancy. You can't surrender. If the water comes over your nose you mustn't breathe it in."

There was very little air left, and she was rebreathing it. Water was up to her chin. There is very little room under a fastback window; she lay flat with head tilted back to raise her nose into the air pocket.

When the water "gulched" in, something indeed had happened. The Australian had come down, found the car and tied the rope to it. His weight may have shifted it temporarily into a more upright position,



**FIVE FIREMEN** who had major roles in the heroic rescue of Nancy Burns are honored at annual awards ceremony of the Officers Assn. of Miami Fire Dept. From left are Bob Lane, Dan Green, Drew Upright (of Miami Daily News, who made the presentation), Sam Givens, D. A. Hewson (association president), Paul Dammann, Miss Burns and Larry Norton

gen. . . . But I've got to beat on the window to let them know I'm alive. Otherwise, they'll give up and leave me. . . . Mark has to know I'm breathing."

She began to rap on the rear window. After a few moments she lay quiet, looking up. "Those are mud clouds," she thought. "They're rising all around me." And then, for an instant, the clouds took form. She saw two dark legs. Mark had come back!

She rapped the glass hard, using a friend's gold wedding ring that she was wearing for safekeeping. "He'll hear! He'll see me!" she thought. But after a few seconds the legs went away. Mark, in the blinding mud, had been unable to find the car. Breathing now came harder. She began to feel a terrible urgency to hurry. "Keep cool," she reminded herself. "Save the air."

For the first time she began to feel lonesome. She had been under water perhaps five minutes when she began to won-

allowing the right door to open slightly. Soon afterward, however, the "gulching" stopped. Perhaps when the rope broke, the car had toppled once more on its right side, squeezing the door closed again.

But something else also had happened: The firemen had arrived. Even now they were diving, trying to open the driver's door, pressing their eyes to the window, trying to see if Nancy were still inside and alive.

Of all this Nancy was unaware. She heard no sound, felt no movement. And the air in the bubble was slowly turning to carbon dioxide.

Not until she sensed the end was near did she think of praying. "God, I know I haven't been as faithful to You as I should." She heard herself talking out loud. "But I can't do anything more. It's all up to You now if You want me to die or live." The air bubble was nearly gone. Her last thought was, "Well, I'm seeing the last of anything I will ever see, and



it's dirty water." She began slapping her face with her left hand, saying, "Stay awake, Nancy. Stay awake." Then she blacked out.

**L**ATER INVESTIGATION indicated that Nancy now had been in the water about ten minutes, in the bubble for nine. She did not know that a fireman was at this moment outside trying to peer in. It was Larry Norton in uniform, minus only his shoes.

On his first trip down, Norton, like the others, tried the driver's door. But, although the others had reported *standing* on it, he found himself floating beside it. The car, then, had shifted with the tide, or possibly with the weight of the rescuers. It now lay tipped at 45°, about 15 feet off the wall. He pressed his face to the rear window but could not see inside.

On his first dives Norton could hold his breath for 60 seconds. But now it was shortening. On his fourth dive he tapped on the window, then pressed his ear to the car and listened. He heard nothing. "Whoever is in there is dead," he thought. He came up for air and dove again. He thought: "The rope keeps this car from being rolled away."

On this ascent he saw the wrecker. He shouted, "Let's hook the cable real good. Anything to drag the car out of the water." Then he thought, "I'm getting excited. Cool it." On his next dive he couldn't find the car. He had to come up after 15 seconds, exhausted.

He gulped air for a few seconds, then did two more quick dives. He kept finding only the unopenable driver's door. "There's got to be another door," he thought. Presently, he realized he could make only one more 15-second dive—his eighth. He took a close look at the direction of the rope, then surface-dove without touching it. He knew he had to work fast. It took three seconds to find the driver's door. He struggled briefly with the rope, trying in vain to untie it. Next he tried to slide the window down. Then he beat on the glass to give encouragement if Nancy were alive.

Eight seconds gone, he swam over the hood, found himself *under* the passenger side: If the car rolled now it would crush him. Carefully, he felt for the door: *it was open the width of two hands*. He tugged cautiously. It opened two feet more, digging into the mud, sending a swirl of slime inside.

In the murk he saw nothing. Then he started to enter the car.

But he had been down 13 seconds and desperately needed to refill his lungs. He began letting out air, a little at a time. Al-

ready he could feel the lung-cramp that sets in, and his throat began to tighten. He had no energy. *But should he go up now? Should he leave the girl when she was so close within reach?*

"Go up, get air, then come down," he told himself. "You can't stand this. You'll drown, too." Then he argued back: "If she's still in there, she's either dead or dying. If she's dying, the next seconds count. I'll stay."

Once Norton had saved three children in a pool. He learned then that a diver sometimes can "double-extend" his time down. Older divers had told him that pockets of air sometimes remain unused in the lungs. He began working his chest muscles, to squeeze any such remnants into use. It may have worked, for suddenly he was able to thrust his head and shoulders up inside the tilted car. Next, he was inside up to his waist. But he was blind in the muddy water. Holding the door post with his left hand, he groped with the right, found the steering wheel,

---

**Norton realized he could  
make only one more dive  
—his eighth.**

---

then the driver's seat. His hand traveled up the seatback to the headrest, and as it did so, high against the ceiling he touched an object: a cold, small, sandaled foot.

Twenty seconds had passed.

Norton is a husky man, 5-foot-11, 190 pounds. His top physical condition, from daily swimming, was beginning to help. Fighting exhaustion, he worked with furious speed. He decided the girl must be lying face up under the left rear ceiling. He found a firm grip on one ankle, her right, and pulled. If she were alive, he knew she might try to breathe under water and drown in his grasp.

But the attempt had to be made. He thought: "She's floating, banging along the ceiling." The girl came down floating into the front seat, left leg doubled under her. She was facing away from him, back to the door. He circled her waist with his right arm. And suddenly he knew his lungs could take no more.

He hesitated. And in that moment he felt a hand ever so slowly wrapping itself around his right arm.

The touch of life electrified him. As the fingers tightened on his forearm near the wrist, he thought: "*She's alive! Thank God, she's still alive.*" New energy surged through him. By later fire department cal-

*(Please turn to page 190)*



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## FACE IN THE MUSTANG WINDOW

(Continued from page 189)

culations Nancy had been in the submerged car for close to 15 minutes.

What worried Norton now was that victims under water rise too slowly unless *boosted*. Often they drown in the last seconds. Not knowing whether Nancy was conscious or if she had inhaled water, he fought for a firm footing. He needed to kick off sharply and push her to the surface. But his groping feet found only soft, clutching slime.

Then he remembered that half-opened door. Suddenly his feet found the hard steel. He kicked off hard, and gave the girl a powerful shove. She shot upward. A second or two later she surfaced, her blonde hair streaming on the water. A moment later Norton shot up beside her. He swam with an arm under her shoulders, pulling her backward toward the seawall. Her face was gray, her eyes closed and lifeless. Was he too late? At that moment the girl threw back her head in a long, shuddering gasp for air. "Help me!" she cried.

**N**ANCY BURNS does not remember being pulled from the car. She does remember crying out, and being dragged by strong hands across the marina lawn, still wet from Mark's hose. She heard Mark shout: "*Handle her easy!*" But the men of Rescue Two knew that seconds still counted. They dragged her, hips up, face down, to drain all the water she might have swallowed. *But only drops came out.*

Even while unconscious, Nancy Burns had refused to surrender. She had refused to inhale water.

Nor had Fireman Norton surrendered. On his eighth dive he had "double-extended" his time to 40, perhaps even 45 seconds—to Red Cross experts a marvel of endurance.

Nancy's next awareness was the rich, warm smell of green grass, the smell of life. "What a wonderful smell," she thought. Eyes closed, she couldn't get enough, and she gulped deep, sweet breaths. Then she felt herself lowered gently to a blanket and two rescue squad men—Joe Ward and Walt Martin—were placing an oxygen cone over her mouth.

She heard Mark's worried voice: "Her eyes won't open." And she realized, "I'm afraid to open them. I'm afraid all this is the dream. If I look now, I'll still be under water." And then she was in the ambulance, and getting more oxygen, and a fireman's hand was ever so gently parting her eyelids. Nancy Burns was seeing life again. ★ ★ ★



## LIGHTNING STRIKE YOUR BOAT?

(Continued from page 103)

for flying private colors. If high enough, you can install a pointed rod at the tip and run a copper strap or No. 8 AWG wire down to an ultimate ground.

Regardless of your protective mast, all large metallic masses aboard should be interconnected with short jumper cables to the common system. This would include engines and such objects as spotlights, fuel and water tanks, metal ventilators protruding through cabin tops, stacks, metal handrails and the like. The purpose is to prevent side flashes which pose the greatest hazard to personnel.

The smaller the boat, the less chance it will be struck by lightning. But take a good look at your craft: Many modern outboard runabouts are outfitted with Citizens Band radio with a metal antenna, or fiberglass whip, that should be grounded. So should fishing outriggers if they can't be lowered. It's always possible to create a protective cone with a temporary mast fitted with a sharp-pointed rod at the tip, No. 8 wire and a submerged ground. Again, it should be stressed that a temporary protective device should not be rigged at the last minute. It could be dangerous.

On small, open boats with no mast or antenna, the odds of being struck are so low that a temporary conductor is probably more trouble than it's worth. However, do *not* continue to fish from such a boat during a storm! Lay your rod down in the boat and wait it out. Holding an upright fishing rod invites disaster.

On any size boat, don't "bridge" metallic items with your hands during a storm. For instance, never have one hand on the gear shift and the other on a spotlight control at the same time.

If the boat has a cabin or cuddy, you are better off inside—and would normally be there anyway during heavy, wet weather.

Stay out of the water during an electrical storm! This basic rule has been known to men for many centuries.

If your boat is struck by lightning and, even more rare, someone aboard appears to have been killed by the flash, give artificial respiration immediately. Mouth-to-mouth resuscitation has been credited with saving numerous lives that might otherwise have been lost to lightning. Get the victim to a doctor immediately. It's knowledge worth having, even though the odds of a fatality are infinitesimal.

Proper protection prevents heavy damage—to yourself as well as to your favorite boat. ★★★

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## DETROIT'S MINIS

*(Continued from page 87)*

point the way to a new form of power to supplement the piston engine.

The most promising replacements for the piston engine are electric cars (or a piston-electric hybrid) and turbines. Turbines are ready now, or virtually so. But they would have to be installed in luxury cars and sell at a stiff price; at least \$10,000, maybe \$12,000 to \$15,000. The electric is more promising from a cost standpoint. Not that electrics are cheap. The power unit—rechargeable batteries—in its present form is even more expensive than the turbine. But as the electric car is presently envisioned by industry engineers it lends itself to small, two or three-seat personal cars. However, Detroit would be reluctant to bring out small, electric-powered cars even if it could solve the problems of costs, weight of the power unit and the nuisance of recharging batteries after a run of 150 miles or so.

"It's an old rule in this business," says an engineer assigned to an electric-car project, "that you make evolutionary changes; not revolutionary changes. A new form of power—electricity or whatever—coupled with a new size of automobile—extremely small cars—would be asking the customer to accept too much 'differentness' at one whack. But if the mini cars really take hold, that would solve half the problem. It would precondition people to the idea of smaller cars."

But that's long-range, if-and-maybe. The minis will have a more immediate influence on the type of car you drive and on car prices.

An itch that has both Detroit and overseas automakers scratching nervously is what the minis will do to used cars. The premise is that used-car prices will take a beating. Why buy a used car, the theory goes, if you can drive a new small car for about the same price, possibly a few dollars less? And if used-car prices go down, how will owners of standard-size cars react when they find their trade-in equity withered away? Will they switch to something smaller, something more mainstream, in the hope of minimizing depreciation on the next trade-in?

The minis also pose a "threat" to the oil companies and the service industry. As Roy Chapin points out, the small cars will use less gas. The auto companies are talking about 23 to 30 miles to the gallon for their condensed cars.

All scaled-down cars will offer easy-service features and stress do-it-yourself maintenance. This should cut the size of your repair bills. But that doesn't exactly

gladden the heart of the corner mechanic.

Finally, the coming of the cub cars will give American motorists the most varied menu of vehicles ever offered—domestic cars, mite-size cars and imports, too.

If Detroit can move down into the market dominated by imports, foreign-car firms figure it's only fair that they move up into the medium and luxury-car classes where U.S. makes shine. VW has already responded to the challenge by bringing in the Audi sedan and a new (to the U.S.) Porsche sports car. This gives VW a price spread—from the Bug at \$1839 to Porsche at \$9450—unmatched by any American car manufacturer.

And there's more to come. VW is talking about bringing in the five passenger 411 ticketed at around \$3000. Toyota and Datsun are combing their catalogs to see what they can come up with to counter VW and the Gremlinites.

It's more than a new ball game. It's more like a brand new league. ★★★

## MINI 'STEAM' ENGINE

*(Continued from page 155)*

mine the location of the second port, then drill the  $\frac{1}{16}$ -in. holes.

With the piston and cylinder in place you will need a  $\frac{1}{8}$  x 1-in. light coil spring to hold the unit together. The one I used is an electric-motor brush spring that can be obtained at an appliance repair shop. Secure the spring in place with a small brass washer and U-clip made from brass wire or rod.

To calculate the position of the cylinder port, revolve the flywheel crank to a position  $90^\circ$  to the horizontal member. Looking through one of the two holes, mark the point at which it hits the cylinder washer. Disassemble the engine and drill a  $\frac{1}{16}$ -in. hole through the washer and cylinder at the point marked. Reassemble; when the flywheel is revolved, the cylinder port should hit both intake and exhaust ports respectively.

Again disassemble and, using a section of  $\frac{3}{16}$ -in. tubing, solder the steam pipe to one of the two holes, depending which way you want the engine to revolve. If excess solder has filled the holes, redrill the intake pipe and exhaust port.

The brass stock used to build the engine is available at most hobby shops and is generally displayed in its own carton. If not, parts required are: square tubing (one each)  $\frac{1}{4}$  and  $\frac{3}{32}$  in.; round tubing (one each)  $\frac{1}{8}$  and  $\frac{3}{32}$  in.; one .064 x  $\frac{3}{4}$ -in. strip, one length of  $\frac{1}{16}$ -in. wire rod, one  $1\frac{1}{4}$ -in. nail, one  $2\frac{3}{4}$ -in. clock gear and one  $\frac{1}{8}$  x 1-in. spring. ★★★



## COUGAR OWNERS REPORT

(Continued from page 109)

wouldn't engage properly. *Repairs okay?* Yes, they replaced starter. Mercury had advised dealer that this is a recurring problem. *Dealer?* Okay. Most dealers are the same. If you're reasonable, so are they. *Why Cougar?* I get a new car every year. Had an XR-7 in 1967 and think they're the best on the road. *Workmanship?* Best I've seen in a new car. *Comfort?* Front has all the room it needs, but back is uncomfortable. *Complaints?* Paint wearing off console, snow blows in at windshield header, too little room under hood for servicing. *Praises?* Surprisingly good gas mileage for so big an engine (428 V8 gets 10-16 mpg), good ride, beautiful sound from stereo system.

An Ohio medical secretary: *Mechanical troubles?* Carburetor not adjusted properly when purchased. Fuel line froze. *Repairs okay?* No further problem after dealer adjusted carb. Car had to be towed with frozen fuel line, but that was repaired okay, too. *Dealer?* He gave me the red-carpet treatment. There were no extra I-forgot-to-tell-you charges added after terms were settled. My dealer has been reasonable all the way around. *Why Cougar?* I owned a 1967 Cougar. It was more than a nice car, so I bought this 1970 model. I like the looks, the handling and ride. *Workmanship?* Better than others in this class. Most everything fits, opens and closes, no rattles or squeaks. *Comfortable?* More than comfortable. It's a luxurious ride. *Complaints?* They made it a bigger car. I like the larger engine but would prefer the smaller, sportier look of my '67. Ill-fitting door on passenger's side closes only when slammed hard. Same problem on my '67. *Praises?* Tremendous road control and handling, especially on ice. Very comfortable ride. Good mileage.

Several owners disagreed with the comment about handling on ice. While nearly all praised the car's smooth, quiet ride, some felt the rear end was overly light.

Other minor complaints centered on seatbelt accessibility, small glovebox, placement of evaporation-control plumbing in trunk, large corner posts restricting rear vision, leakage around the zippered convertible rear window, poorly sewn upholstery, sloppy glue-work at the headliner, lack of front vent panes. But as mentioned, these lapses weren't condemnations of the car—owners merely saw them as possible areas for improvement.

The parting shot comes from a 16-year-old son: "Dad doesn't get to use the Cougar enough to complete these forms. Too many others in family like the car." ★★



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## DODGE POLARA OWNERS REPORT

(Continued from page 119)

easily." Again, a clergyman from Illinois says, "Weak rear springs meant I had to put on heavier leaves and I added air shocks. Car used to bottom with people in back seat. Dealer had the same problem with his Polara."

No one complained about the Polara's styling per se, nor did many rave about it. Some griped about styling indirectly. Like, "Hidden windshield wipers leave blades frozen solid after sleet storm." And, "Concave rear window on four-door hardtop makes it very hard to clean in winter." I'd like to see less tuck in the body sides so dirt and salt don't spurt up from wheels." "I think Dodge should improve exterior design to eliminate wind noise." "Bring back front vent panes."

On the interior, styling again came in for censure, owners suggesting practical design instead of "beauty." "Much of dashboard," says a Maryland druggist, "especially high-beam indicator, masked by steering wheel." Another critic: "Change dashboard illumination so it doesn't reflect in windshield at night." Or how about this strange complaint: "Too much legroom. Front seat will not adjust far enough forward for wife, and she is normal height."

Nearly 10 percent of Polara owners bought station wagons. Generally, they were well pleased. "We find ours very comfortable, both in the front and in the two rear seats," says a New York housewife. Another repeats, "This is a very comfortable station wagon, front and back. We have taken several long rides and have changed seats, and everyone was comfortable." To the contrary, a New Jersey factory worker writes, "Being a three-seat wagon, it has more rattles than sedans. A rattle in the center seat is unbearable, but the service manager ignores it. Neither front door closes tightly." An Indiana salesman suggests, "Exhaust outlet should be changed so it doesn't let fumes in rear window."

PM always includes the question, "What would you like to see changed on your car?" Here are some of the more common suggestions. "Needs light for ignition key." "Larger glove compartment." "Change dash design so there's no glare on windshield." "Would like automatic transmission to have the ability to start in second gear for winter driving." "Change gas filler—impossible to fill tank when pulling trailer." "For \$4500, a car should come with radial tires standard." "Would like to see better inspection at the factory."

Which brings us full circle. ★★★



## LAB HOPS ON 'HAPPENINGS'

(Continued from page 99)

thorns" starfish in the Pacific. This many-armed organism is a threat to coral reefs because it feeds on the polyps that deposit material that forms the reefs.

An expedition sponsored by the Westinghouse Ocean Research Laboratory reported that mass extermination of the starfish was impossible, that chemical injection of individual starfish was the only sure means of killing them.

The scientists noted that a natural predator of adult starfish—a large conch called triton—was seen only in small numbers. It was possible that avid shell collectors were cutting down the triton population.

Early in 1970 the Center issued a report on an Australian biological phenomenon. Titled *Victorian Mouse Plague*, the report read in part: "A great plague of mice is moving through northwestern Victoria with millions more of the rodents stretching as far north as Dubbo . . . Patients in hospitals are being protected by cans being placed around the legs of their beds . . . (Mice) in some places cover the road to the extent that driving in excess of 20 mph is dangerous due to the skidding hazard . . . There is hope that the plague will subside . . ."

The discovery of a "stone age" tribe, the Akuri, in Surinam, South America, rated the Center's attention. It was listed as an "urgent anthropological event" because, it was thought, contact between the Akuri and their discoverers would cause changes within the tribe.

The Center always goes on alert during the Apollo moon shots, when over 200 astronomical observers in 30 countries keep the moon under constant watch. During Apollos 10, 11 and 12 the Center received 169 reports from ground-based observers. During Apollo 11 observers reported seeing "illuminations" in the crater Aristarchus. At the same time, the Apollo astronauts reported seeing similar phenomena. These simultaneous observations are a "first" in astronomy.

Though the Center for Short-Lived Phenomena is geared to move fast, sometimes it just isn't fast enough. About a year ago, two U.S. ships reported sighting a "floating island" between Haiti and Cuba. It was thought the island was a land mass that had washed out of the Amazon during heavy rains.

As Smithsonian scientists prepared to fly to the Caribbean, a Navy report came in: "Intensive 6-hour aerial search negative . . . We presume floating island has sunk."

The flight was cancelled. ★★★

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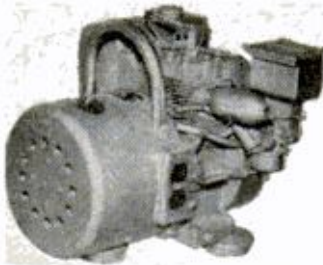
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**CHOOSING THE RIGHT FILM***(Continued from page 135)*

depth and sharpness are critical, try to stay down at f/8 or smaller. With these basic requirements in mind, figure out what film speed you'll need to give you the desired exposure under the existing light conditions. Where you can't measure the light precisely, use the exposure guide supplied with each roll of film to help you estimate the conditions. If one film won't satisfy your needs, go to the next higher speed rating until you find a type that will.

The same basic principles apply to color films except that there are some additional considerations. Grain is not so much of a question as good color rendering. In general, slower films give you truer, richer colors. For action shots and indoor scenes, however, you're pretty much forced to go to faster films like Kodak's High-Speed Ektachrome at 160 ASA and Anscochrome 200 at 200 ASA. Anscochrome's still-faster 500 ASA type can be helpful in shooting night scenes in color, stage shows, indoor sports events, church and museum interiors and so forth.

In addition to speed, color films must be chosen according to the results you want—slides or prints. Positive color produces slides for projection. While prints can be made from them, the process is expensive in quantity. Negative color, on the other hand, is designed mainly for color prints, although it can produce slides and even black-and-white prints. This is handy if you aren't sure what you will need or if you will want a mixture of slides and prints. On the minus side, negative films aren't as fast as positive types.

The kind of light you're shooting under is another important factor in choosing a color film because daylight tends to be bluer than incandescent light. Outdoor film is designed to compensate for this, but, if used indoors, will appear much too red. Indoor films used outdoors will go too blue. You can compensate for both conditions with filters, but this is rarely practical except in an emergency because a filter cuts speed drastically. Such filters are listed in the accompanying charts.

Positive color films are made in both indoor and outdoor types. Outdoor emulsions are usually labeled "Daylight" and indoor types "Tungsten" or "Type B." By contrast, negative color films come in only one type and can be used indoors or out without worrying about the kind of light present. This can be an advantage when you're shooting in a variety of locations, both in and out, at the same time, such as on a sightseeing trip. ★★★



## AUTOMATIC TRANSMISSION

(Continued from page 139)

calibrated in inch-pounds for the band adjustment. If the transmission pan inspection indicates no internal problem, adjust the front and rear bands.

Most transmissions (Chrysler products are exceptions) have a vacuum control unit. It would pay to spend a few cents to replace this part. When it fails, it causes a multitude of problems and may be at the root of yours. Transmissions having no vacuum control units use fluid pressure. Make sure the fluid line is not leaking.

After work is performed, road-test the car. If the harsh, slipping, delayed or erratic shifting problems haven't cleared up, the gearbox and converter will have to be removed and disassembled, parts inspected, and new parts, seals, rings and gaskets installed.

What about noise? A grinding gear noise necessitates tear-down of the transmission. If there's a knock, click or scrape, inspect the torque converter. Chances are it's loose or has a cracked drive plate.

The noise easiest to correct is a whine or buzz. Try to determine if it is coming from the gearbox or converter by putting the car in gear while on a rack or jacks and placing your ear near each part.

If the noise comes from the converter, that part will probably have to be replaced. If it's from the gearbox, drop the pan and inspect for debris. If no part failure is indicated, the noise is probably a faulty vacuum control unit.

You can repair many fluid leaks yourself. Depending on your kind of transmission, leaks from the following areas can usually be fixed without dropping the transmission: lever-shaft oil seal, kick-down wire-terminal plug seal, pressure-gauge plug, vacuum-control unit seal, oil-cooler fittings, and speedometer adapter O-ring. Replacing the rear oil seal is also within your province, although the prop shaft has to be dropped and you'll need a rear oil-seal removal tool (about \$5).

If abnormal noise is present from a transmission that leaves the car at a standstill when in gear, shut off the engine at once. The transmission and converter must be dropped and overhauled.

If no noise is present and the car doesn't move, position the selector lever in Drive with the car on a rack or jacks and watch the propeller shaft. If it turns but the rear wheels don't, blame the rear axle.

However, if the prop shaft doesn't turn, check the transmission linkage along the line to make sure it hasn't become disconnected. If it hasn't, you must drop the transmission for overhaul. ★★★

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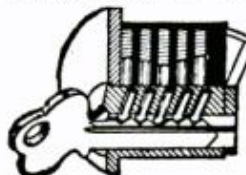


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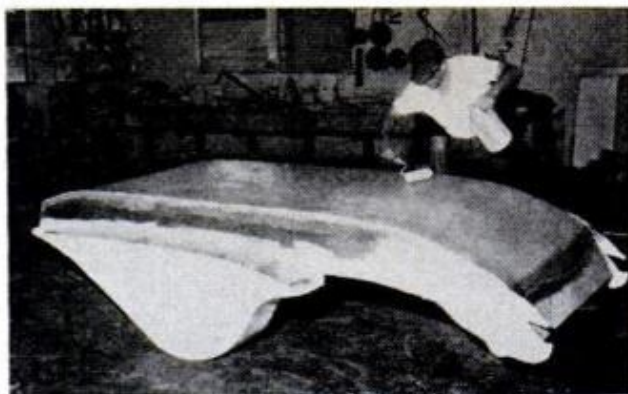
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## BUILD THIS TURTLE BOAT

*(Continued from page 144)*

available, you can substitute sheet aluminum.

The paddle-wheel sides require one 4x10 sheet of 1/4-in. plywood. Rough-cut the sides initially and temporarily fasten the four sides together. With a simple jig, all four sides can be cut perfectly round on a bandsaw. To do it, set up a pivot point (nail) at right angle to the blade's cutting edge 16 in. from the blade. Drill a small hole in the center of the four pieces of plywood and set them on this pivot. With the bandsaw running slowly, turn the plywood until you complete the circle.

Twelve 5 1/2 x 8-in. scuppers are used in each wheel. The centerpiece is 4 x 4 x 5 1/2 in. Glue and nail the sides to the scuppers and the centerpiece. On the inside of the wheels, I glued and nailed a 6-in. round piece of 1/4-in. plywood to which the cranks are attached by screws. It also holds the paddles a bit farther from the hull. Don't forget to drill the 3/4-in. diameter hole in each paddle for your crank.

For protection when beaching the craft, you're well advised to fiberglass the bottom. You'll need a 50-in. wide cloth about 10 1/2 ft. long and three quarts of resin. I used Boat-Armor resin (Glass Plastics Div., Valspar Corp., 200 Sayre St., Rockford, Ill. 61101) and Blu-Sheen fiberglass marine cloth on the craft shown.

The best approach to building the cranks is to have your local metal shop make them. It will usually have scraps of angle iron, steel rod and small pieces of pipe on hand which can be welded together. Simply supply the drawing to follow.

Painting is simple. Your best bet is to consult your marine supplier. Ask him to recommend a high-grade marine paint that is water soluble. Some are available in white only, but colors can be added for tint.

★★★



## HOW THE JETS CUT SMOKING

(Continued from page 105)

ets too much, raising starting problems."

Distance of the air scoop from the body is controlled to a tolerance of plus or minus .017 inch and the tube diameter must not vary by more than .010 inch—that's how critical they are.

A major problem was to be sure that the new burner cans wouldn't hamper re-lighting operations if a flameout occurred. The pockets of rich fuel, which actually facilitate relighting, would no longer be available. Helping to overcome this potential problem was modification of the fuel injector nozzle. This part squirts fuel into the burners.

Such a nozzle used by an unmodified JT8D has a series of axial, or zero-degree, holes running around the nozzle nut that injects air to aid in atomizing fuel as it sprays from the nozzle center.

By angling holes 35° and increasing their size, engineers changed the fuel-spray angle to make a much wider cone, providing better atomization to facilitate relighting the fuel in flight. This reduced the fuel-air ratio of the fuel pockets at takeoff to .081, compared to .108 for an unmodified JT8D. Knowing that smoke reduction was a coming trend, engineers designed the JT9D engine for the new giant Boeing 747 with this in mind. It's as smokeless as the new JT8D.

The JT8D smoke-reduction program isn't out of the woods yet. Airline service evaluation of the new combustion cans shows that metal distress occurs after about 3000 hours of operation, a result of higher temperatures created in parts of the chamber. (Unmodified JT8D burner cans last 10,000 hours.)

Metal deterioration is sufficient to require that the engine be torn down and the burner cans replaced. Ways to prevent this distress and increase the life of the modified burners to what it was originally are under study.

Eight airlines—United, American, Eastern, Pacific Southwest, TWA, Finnair, Lufthansa and Swissair—have been flying the modified planes since July 1968. The engines have accumulated more than 100,000 hours of flying time.

The airlines would prefer to equip aircraft with the new cans as old burners wear out. They point out that since the modification cost is about \$4000 an engine, a crash program might increase air fares. But nine major airlines have already agreed—rather than contest a suit by the State of New Jersey—to install retrofit kits on all their JT8D engines by the end of 1972. ★ ★ ★

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## 12 GREAT LATHE TRICKS

(Continued from page 181)

end supported by the tailstock center, can be used as an emergency milling cutter. In the photos, a 1/2-in. tap is forming a semicircular notch (having a 1/4-in. radius) in a bar of 1/4-in. aluminum held in a milling-attachment vise. The feed can be all toward the axis, or each cut can be started at the tip of the tap, and the carriage moved toward the headstock until full tap diameter is effective.

● **Chucking thinwall tubing.** An often overlooked stunt is to plug thinwall tubing before clamping it in a lathe chuck. Plugging prevents chuck jaws from bending the tubing wall inward too far, and the plug is easily knocked out when the work is done.

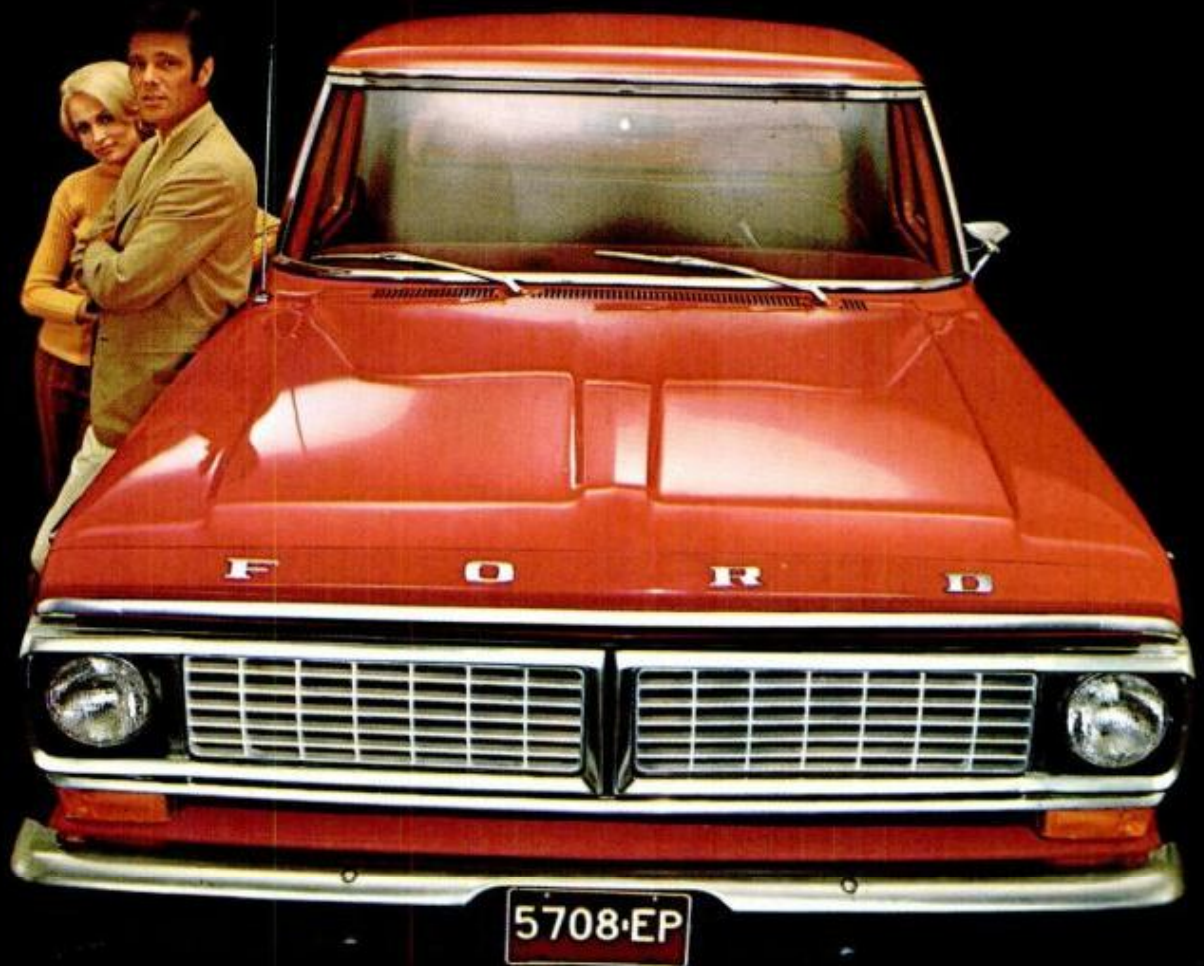
● **Small lathe uses hand-grinder accessories.** The assortment of cutters, brushes and the like that comes with a "motor tool" expands the capabilities of a small lathe. The tool shank generally is clamped in the headstock chuck, and the work fed to it by hand or with the aid of carriage and toolholder block.

● **Ferrules soldered on lathe.** When making a ferrule by wrapping wire tightly around a wooden handle mounted in a lathe (photo, page 108), you can anchor the turns by applying solder to the wire while it's still under winding tension. This should result in a tight ferrule. The starting end of the wire is inserted into a hole drilled in the handle; the other end is trimmed off and remaining sharp points are removed.

● **Holding washers for facing.** To hold a washer in a lathe while its face is machined, encircle it with a split ring cut from another washer of the same size. The ring provides an area between washer and chuck jaws in which the lathe tool can operate without striking jaws. Split the ring with a saw cut, and expand it until it can be pushed snugly over the edge of the washer to be machined. Place this combination in the chuck so that none of the jaws come at the split, and seat the washer firmly against the jaw faces or the chuck body.

● **Machining break-away rings.** If you want to make two half-rings that fit together to form a reasonably perfect ring, you can make the cuts before doing the machining. Assemble the required number of individual, close-fitting parts into a blank that can be machined and then broken down into its original number of segments. Use an epoxy glue to fasten the parts together; to separate joints, apply force in a way that will not cause marring or other damage. ★★★





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