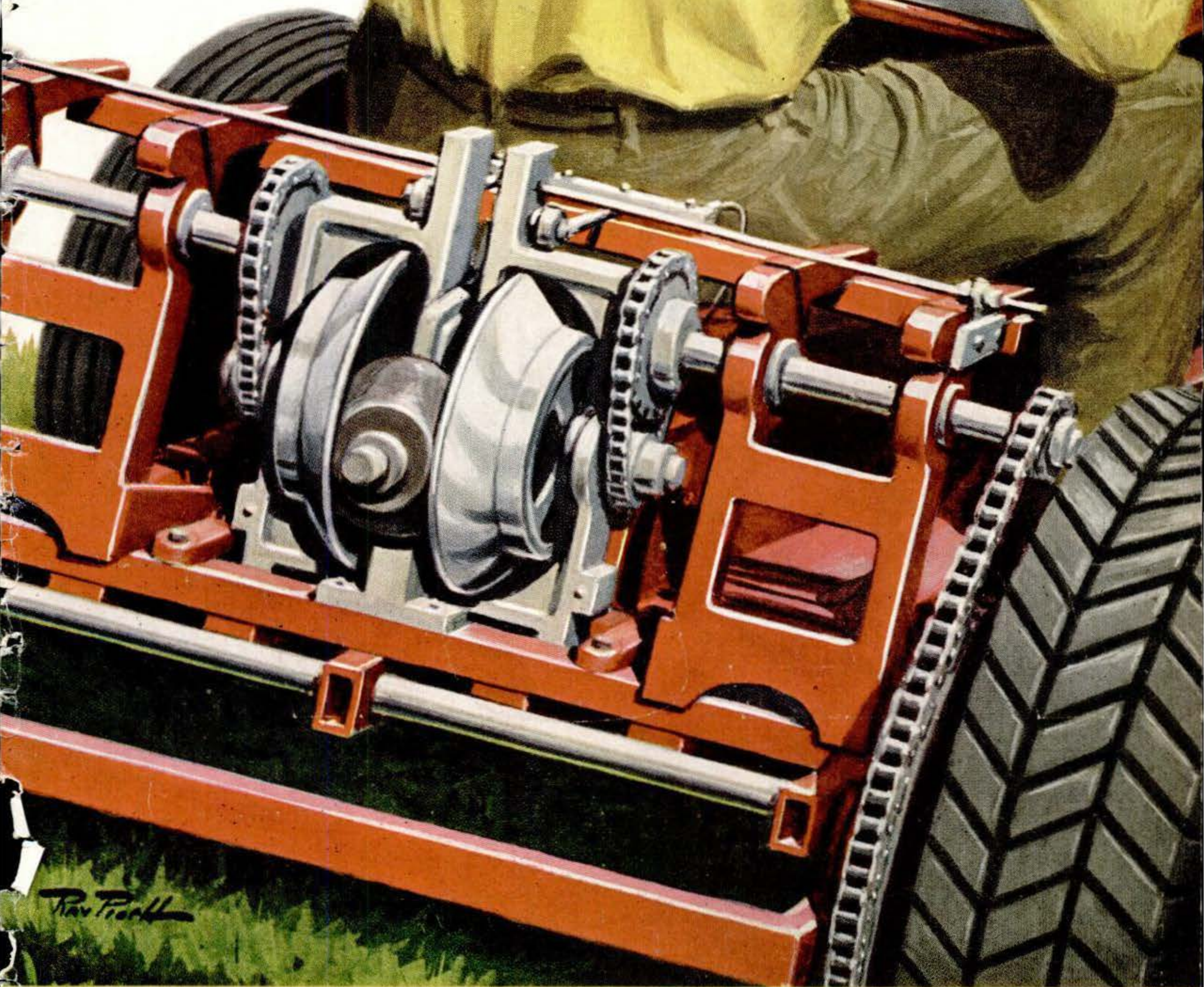


JUNE 1966 35 CENTS

# Popular Science

MONTHLY

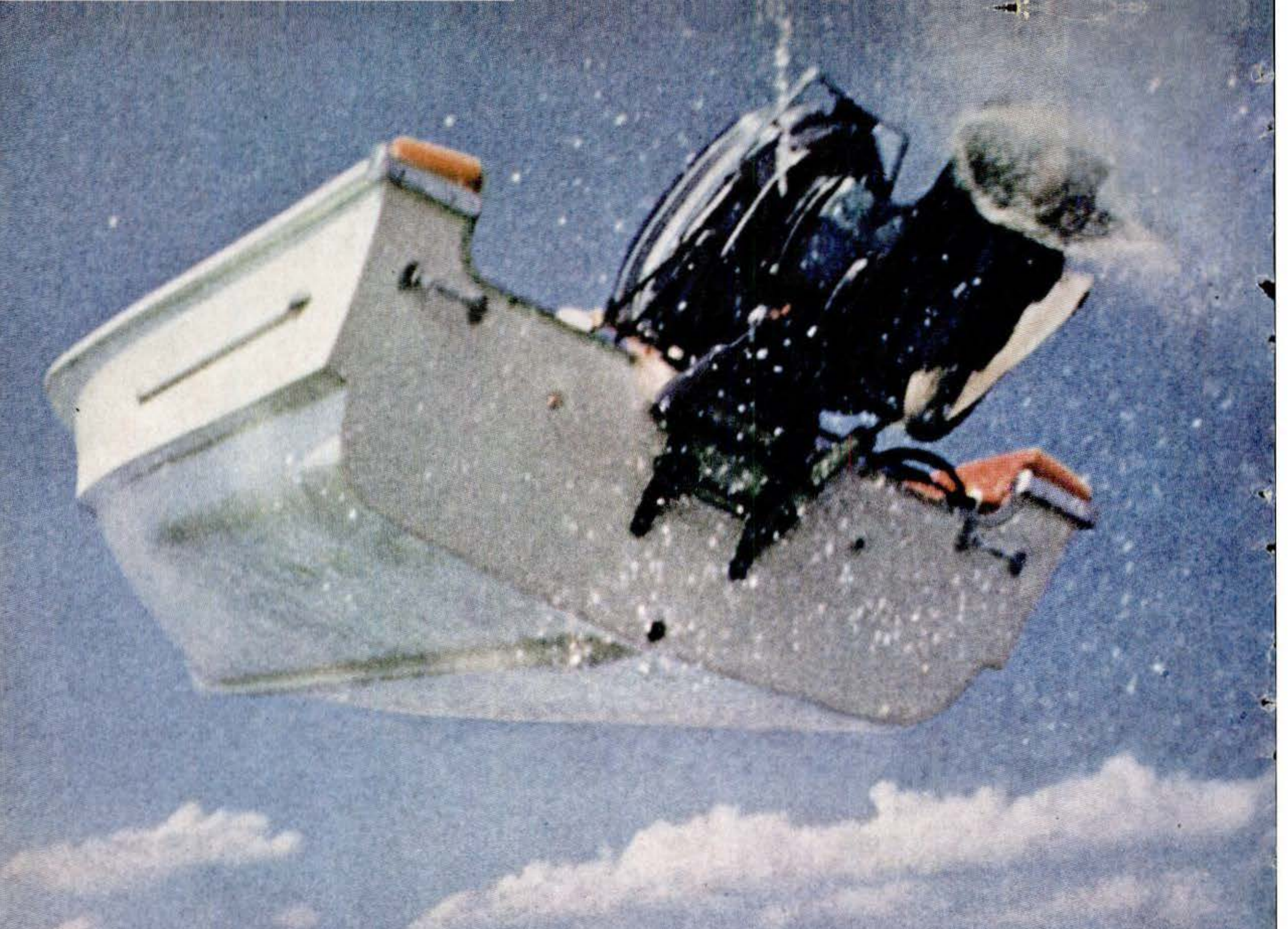
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## **THE FABULOUS MACHINES that recovered our LOST H-BOMB**

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By Vice President Hubert H. Humphrey

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...How Airflow Affects Your Driving



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happens at Mercury's Siesta Key, Florida, proving grounds. Tests are just as rough. Only this time the enemy is salt water, sandbars, oyster beds, rocks. This is how we test marine propulsion at Mercury, testing not only Mercurys, but other brands. This is how we know the score. It's one example of the plus you get with Mercury . . . dependability *plus performance*. See what we mean at your Mercury dealer. 3.9, 6, 9.8, 20, 35, 50, 65, 95 and 110 hp.



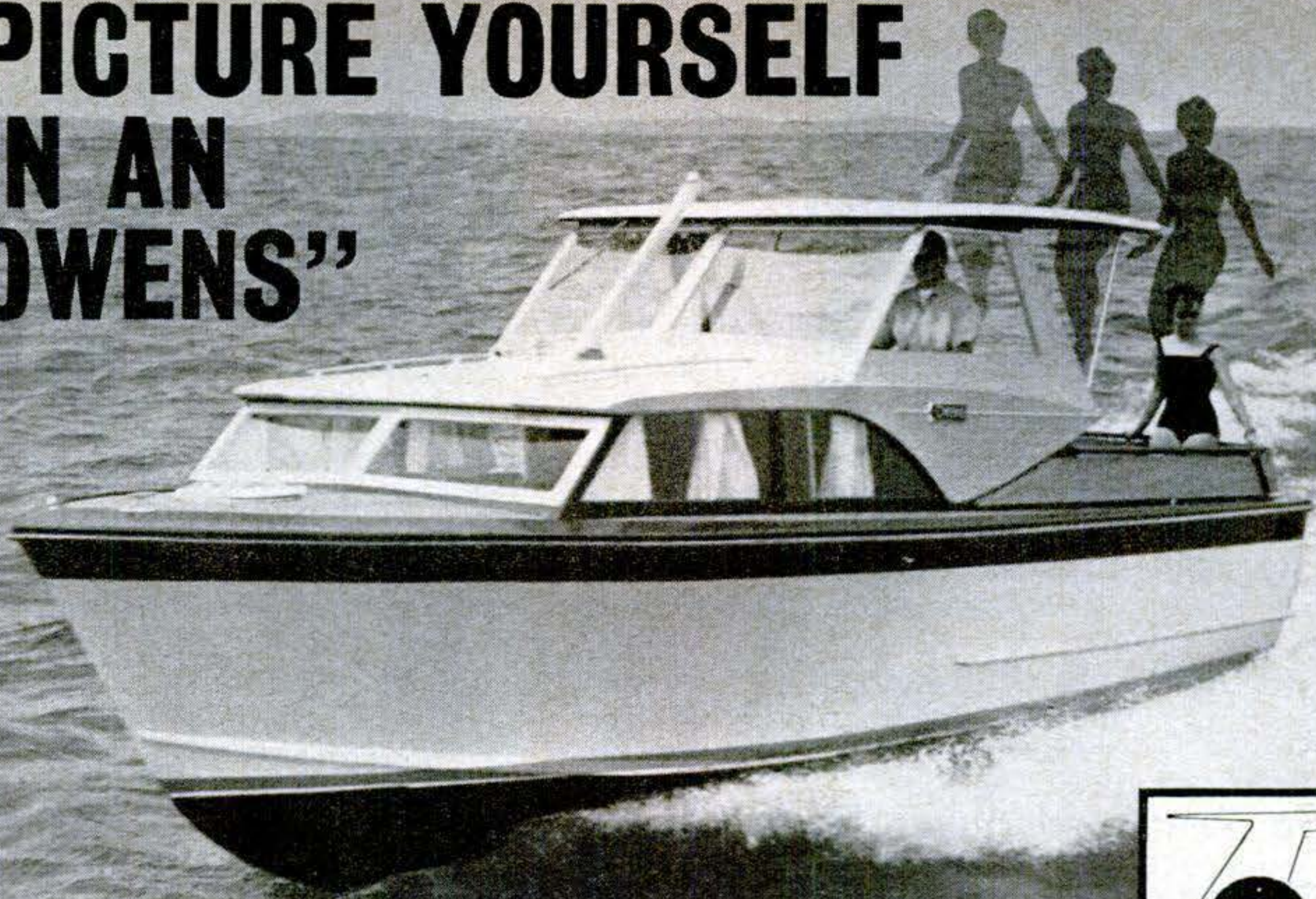
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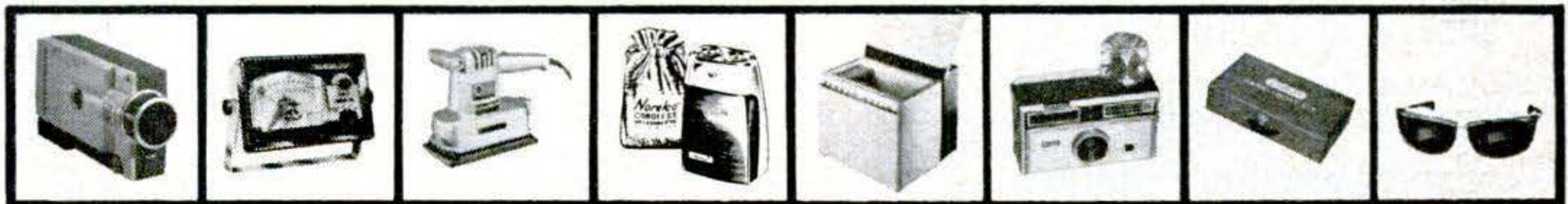


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## HIGHLIGHTS OF THIS ISSUE:

### Amazing New Cone Drive **PAGE 59**

PS Exclusive: This wickedly ingenious drive is a clutch, variable-speed transmission, reverse, and differential rolled into one.

### The Fabulous Machines That Recovered Our H-Bomb **PAGE 86**

These gadgets of the deep reached down 2,500 feet to haul up our lost H-bomb.

### Fastback, Holdback, or Cute Styling? **PAGE 94**

Does fastback design really help a car go faster? Here's the inside story of how auto aerodynamics affects not only speed, but comfort and driving safety.

### We Need Your Inventive Skill!—Hubert H. Humphrey **PAGE 102**

What's our government doing to encourage inventors? The Vice President tells how Inventors' Fairs can help you get your invention off the ground.

### How I Air-Conditioned My Car for \$24.74 **PAGE 126**

Junk parts plus know-how add up to cool summer driving.

COVER PAINTING BY RAY PIOCH

#### CARS AND DRIVING

- 52 What's New for Your Car
- 70 How Hot Can a Six Get?
- 78 Ford Is Back and Ferrari's Quaking
- 94 Fastback, Holdback, or Cute Styling?
- 126 I Air-Conditioned My Car for \$24.75

#### SPECIAL FEATURE

- 102 By Vice President Hubert H. Humphrey: We Need Your Inventive Skill!

#### SCIENCE AND INVENTIONS

- 59 Amazing New Cone Drive
- 67 What Happens When You Get Tired
- 82 By Richard Tregaskis: Keiki the Porpoise—Underwater 'Errand Boy'
- 86 The Fabulous Machines That Recovered Our Lost H-Bomb

#### ELECTRONICS

- 115 What's New in Electronics
- 116 The Box That Calls You to the Phone
- 120 Turn Your Portable into a Clock Radio
- 121 Now: Kit Makes Super Hi-Fi Solid-State Amplifier

#### PHOTOGRAPHY

- 63 Whose Hue? PS Guide to Color Films

#### HOME AND SHOP

- 132 How to Make a Sun-Dial Fire Pit
- 136 Common Pine—18 Ways to Improve Its Beauty
- 140 Restring a Tennis Racket Like a Pro
- 144 Keeping Tools Like New
- 148 A Captive Copter You Can Build in Your Own Back Yard
- 154 They've Thrown Away the Carb on the New Sears Mower
- 157 What's New for the Home
- 158 Amazing World of Silicone Rubber
- 163 Short Cuts for Machinists
- 164 What's New in Tools
- 167 What's New for the Outdoors
- 168 Painting Secrets from a Pro

#### SPACE AND AVIATION

- 76 Coming: Airports Shaped Like Wheels?
- 92 Dr. Wernher von Braun: Photo Spacecraft to Circle Moon

#### BOATS AND BOATING

- 100 Folding Kayak Packs in Two Bags
- 106 How to Bring Yourself Back Alive
- 110 How to "Stretch" Your Boat
- 112 Tips and Tricks When Anchoring

## COMING NEXT MONTH

If you're looking for fireworks, don't miss July Popular Science. You'll—

- Take a dizzying flight in a hot-air balloon.
- Dive to the ocean bottom in a glass-bubble submarine.
- Test-drive the three "hot ones"—Comet Cyclone GT, Chevelle SS 396, Dodge Charger.
- Walk out on the high wire with the daredevil aerialists of the "Big Top."
- Pick up some tricks at Carroll Shelby's fast-driving school.

And you'll get the facts on—

- What's coming in the '67 cars
- Building an electronic treasure finder
- Taking topflight pictures with a Polaroid
- How to buy a fishing rod
- Saving money on your car insurance
- How to finish wood with penetrating resins
- Wheel balancing—what's bunk and what isn't
- Setting up a home print shop
- Those amazing new lawn sprinklers
- Batman's wonderful Batmobile

It's all in July PS—on sale June 28.

## AUTO UPKEEP

- [170 Gus Makes the Best of a Bad Bargain](#)
- [176 Hints from the Model Garage](#)

## PICTURE NEWS

- [66 Three-Decker Bus Is Hotel on Wheels](#)
- [74 Inflatable Moon Shelter for Astronauts](#)
- [123 BMW Gets Rectangular Headlamps](#)
- [131 Traffic Light Ticks Off Seconds](#)

## SHORT CUTS AND TIPS

- [162 Why Carry a Defrosting Tray? Drain It](#)
- [166 Make a Gas Gauge for Your Mower](#)

## EVERY MONTH

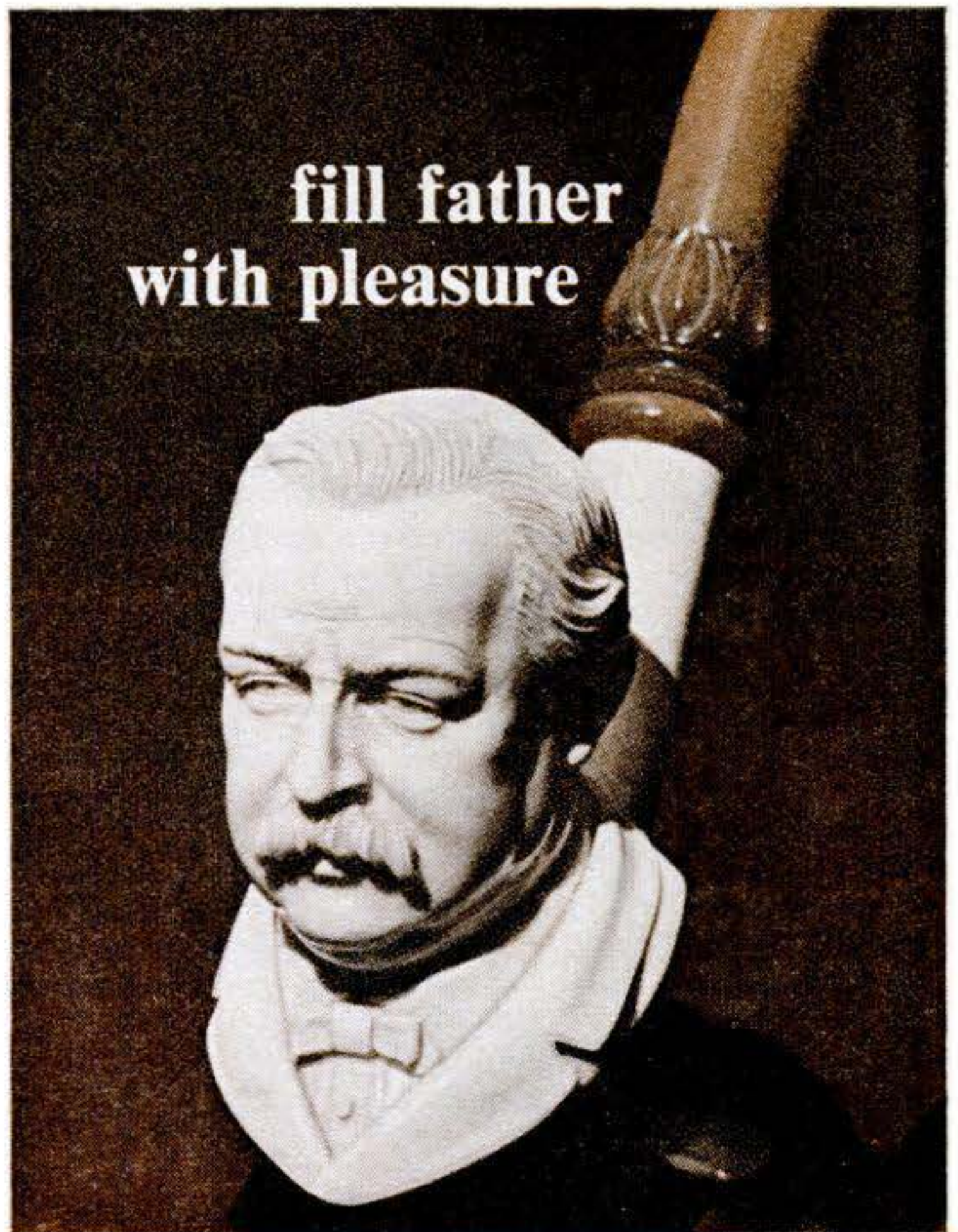
- [6 PS Readers Talk Back](#)
- [12 Wordless Workshop](#)
- [16 "Say, Smokey—"](#)
- [22 Science Newsfront](#)
- [50 Detroit Report](#)
- [99 I'd Like to See Them Make](#)
- [124 New Ideas from the Inventors](#)
- [147 Shop Talk](#)

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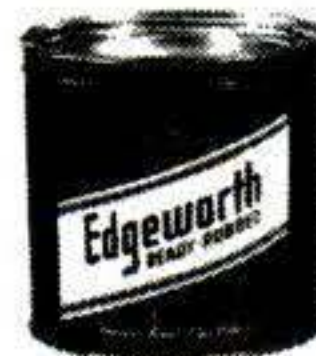


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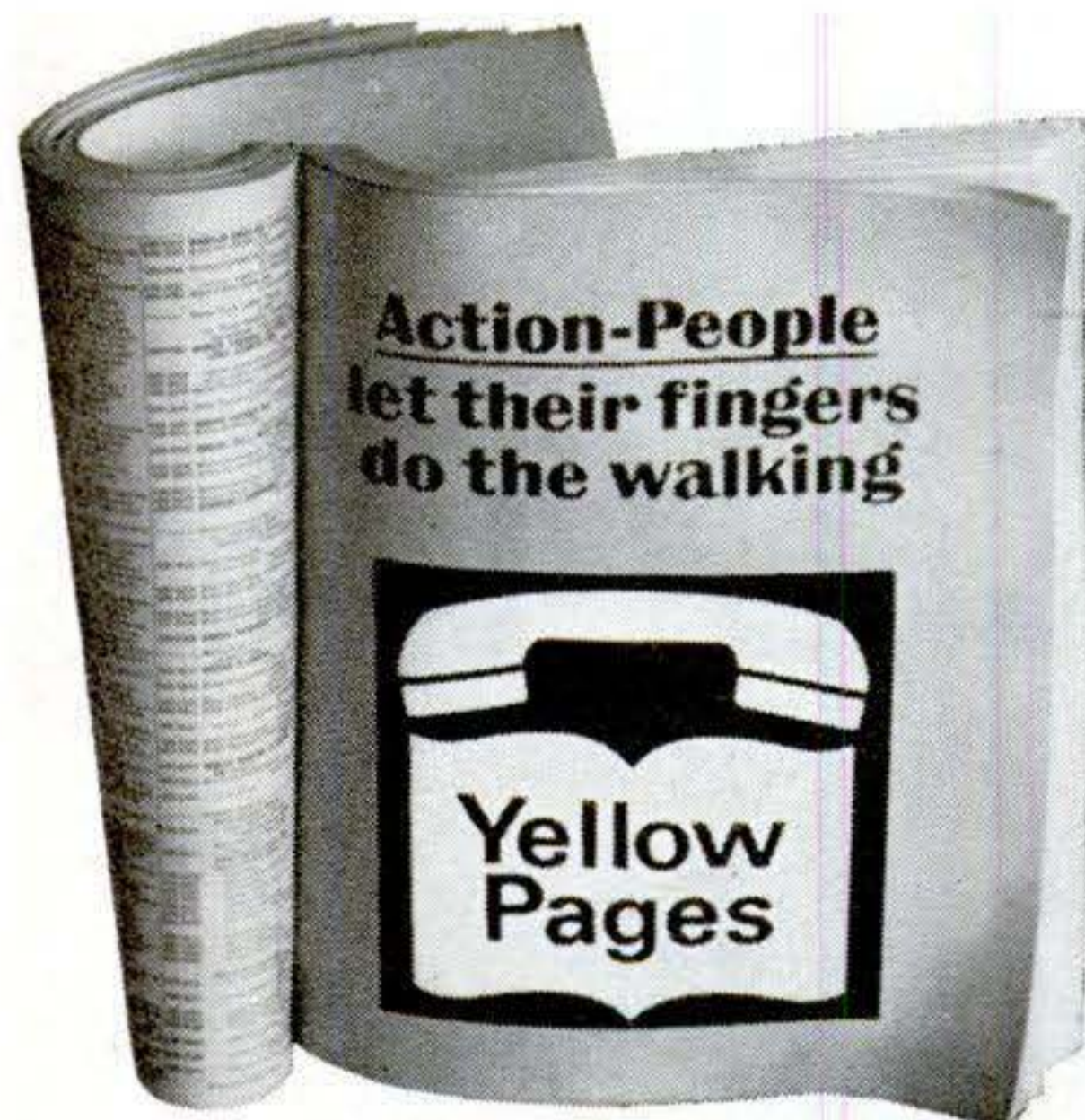
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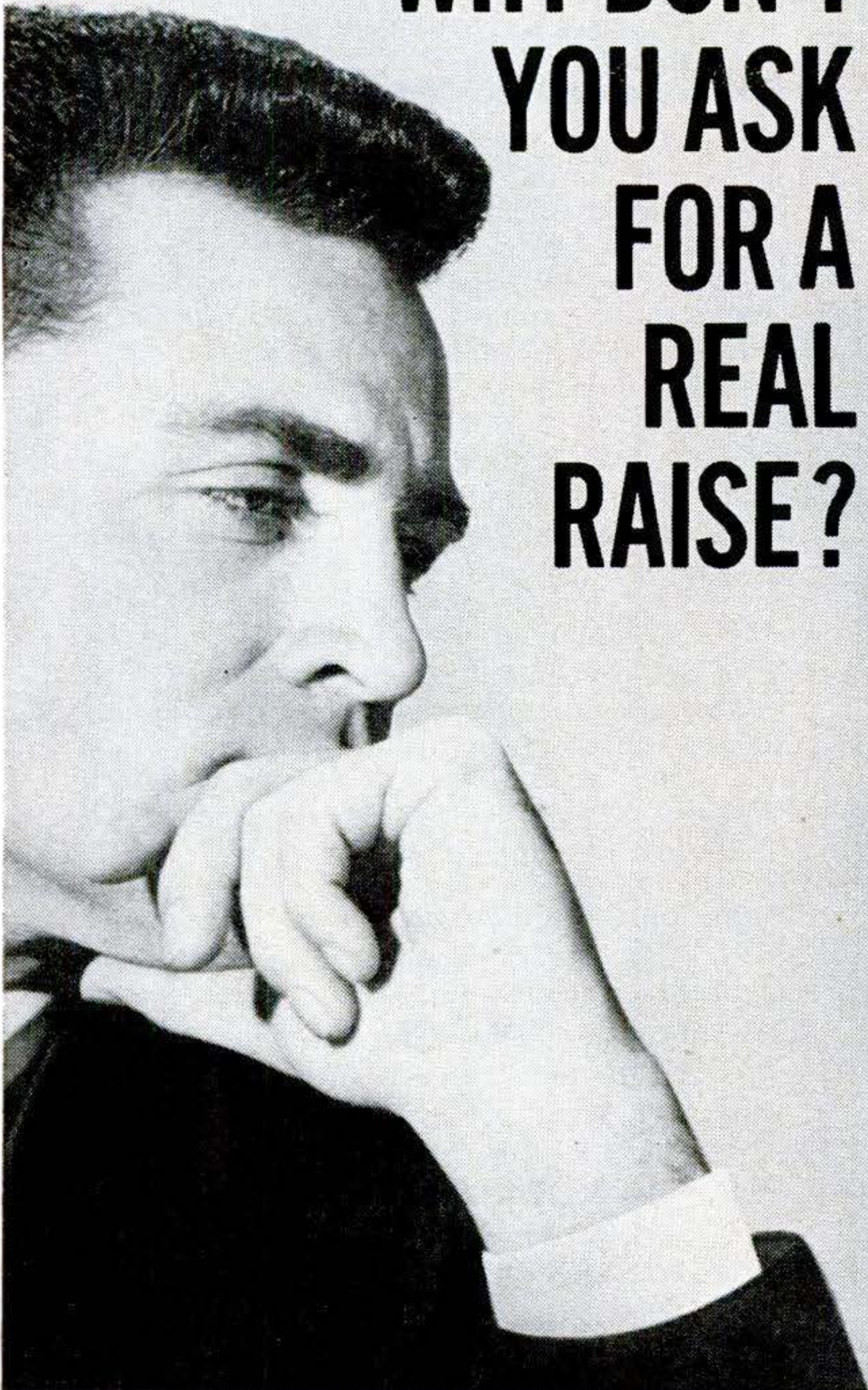
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# Handyman's Handbook



**Need tools, lumber,  
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parts...anything?  
Just let your fingers  
do the walking.  
Action-People do.**



# WHY DON'T YOU ASK FOR A REAL RAISE?

Think you may be turned down? Here's how ambitious men get important promotions without even having to ask.

If it's been a long time since you've celebrated a raise in salary, ask yourself why. Are you really worth more money? If you're not sure, look again at men who have moved ahead...men so clearly marked for promotion that when it came it was just what everyone expected.

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Occupation.....Working Hours.....A.M.....P.M.

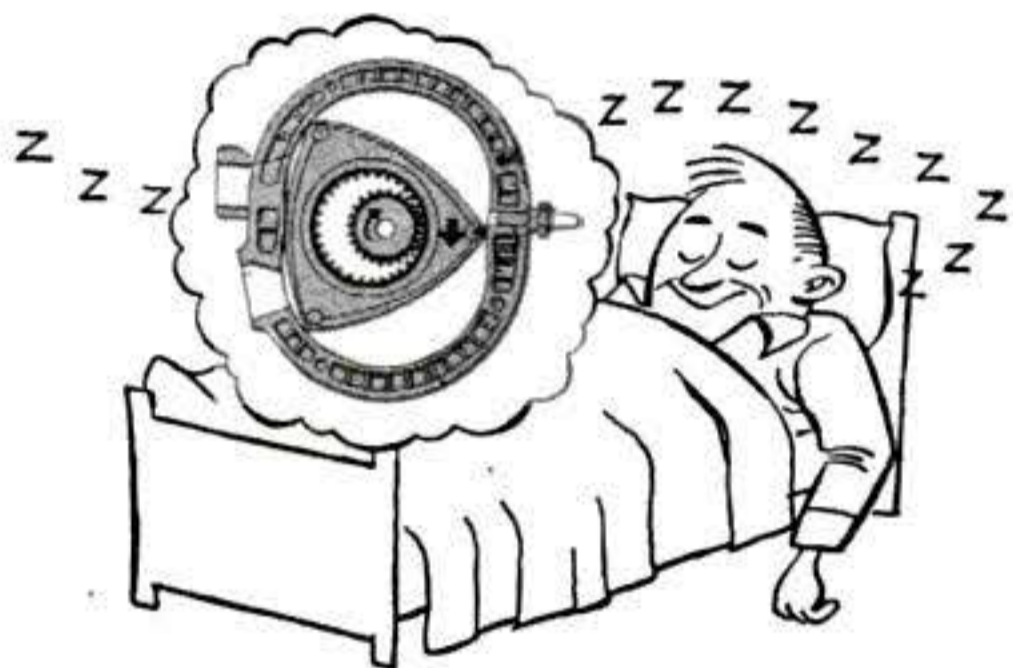
# PS Readers Talk Back

Want to get something off your chest?  
Write "Readers Talk Back," POPULAR SCIENCE,  
355 Lexington Ave., New York, N.Y. 10017.

## Wankel fever hits PS readers

I would like to adapt a Wankel Engine to a motorcycle, and would also like to see how it would work on a gyrocopter. Please tell me how I can get more information about the Wankel.

J. H. MADDEN, Gilroy, Calif.



. . . The RC engine is the engine of my dreams. Where can I find out more about it?  
DENNIS W. FENTER, Portales, N. M.

. . . The article on the Wankel engine aroused my interest and I want to find out more.  
FRED J. WENZ, Brooklyn, N.Y.

. . . The articles by Devon Francis and Jan Norbye on the Curtiss-Wright RC2-60 Wankel engine are outstanding. I would like more information.

CLARENCE W. TROST, Concordia, Kan.

*For further information on the Curtiss-Wright rotating combustion engine, write to the Curtiss-Wright Public Relations Dept., 1 Passaic St., Wood-Ridge, N.J. 07075.*

## A good shop item: safety glasses

I intend to introduce those safety glasses you report on in "Shop Talk" [Mar.] to my patients. Your comment that safety glasses should be included in the home workshop should be stressed more often.

JAMES E. MACVICAR, M.D., Kalamazoo, Mich.

## Gus needs a new scope

I have just finished reading "Gus Gives the Teacher a Passing Grade" [Mar.] in which a statement is made about KVs being too high. At the beginning of the story, you show a picture of a Dumont engine scope which does not have the ability to show KVs. This type of

scope does not show the voltage requirements of the secondary circuit. It does show high resistance value. Several other scopes, including the Sun Scope, show secondary voltage requirements.

WILLIAM C. HERUDEK, Cedar Knolls, N.J.

## Fallout over atomic lights

I read with interest the item in "Science Newsfront" [Apr.] about self-powered atomic lights that last 20 years. I was surprised that all credit was given to Saunders-Roe & Nuclear Enterprises, Ltd., of England and none to the American companies—Luminous Products Corp., Boston; American Atomics Corp., Tucson, Ariz.; U.S. Radium Corp., and Minnesota Mining & Manufacturing Co., St. Paul, Minn. These companies make luminescent devices which use beta radiation produced not only by tritium, but also krypton 85 and promethium 147. The devices have the capability of operating without electrical power and can serve as standby and safety lighting in case of power failure. They are being used in commercial aircraft as exit markers and some railroads are using atomic lights in railway switch lanterns.

JAMES W. HITCH  
Atomic Energy Commission  
Washington, D.C. 20545.

## Sizing up the Mustang's V-8

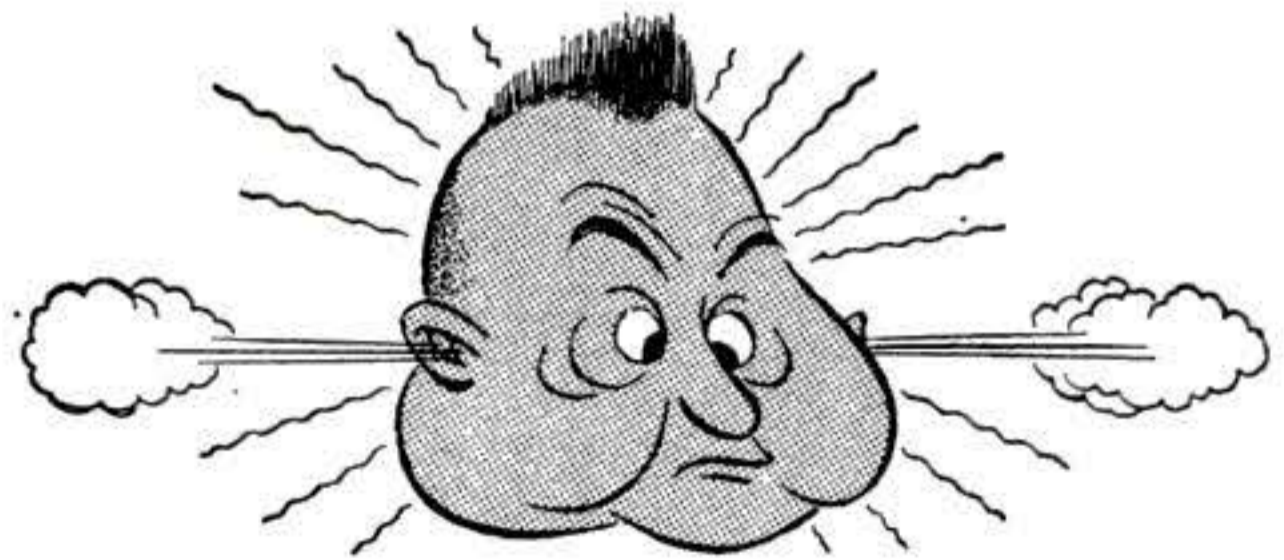
In April's "Detroit Report," you say that the new 285 cu.-in. V-8 might be available in the '67 Mustang. Shouldn't this be 385 cu.-in.?

RICHARD A. COLEMAN, Nashville, Tenn.

*Right you are.*

## What happens when you mix alcohol

The article "What Kind of Mixer Is Alcohol?" [Apr.] reminded me of an experience about 10 years ago. After dynamiting ditches, I drank a cocktail. I immediately turned red as a beet



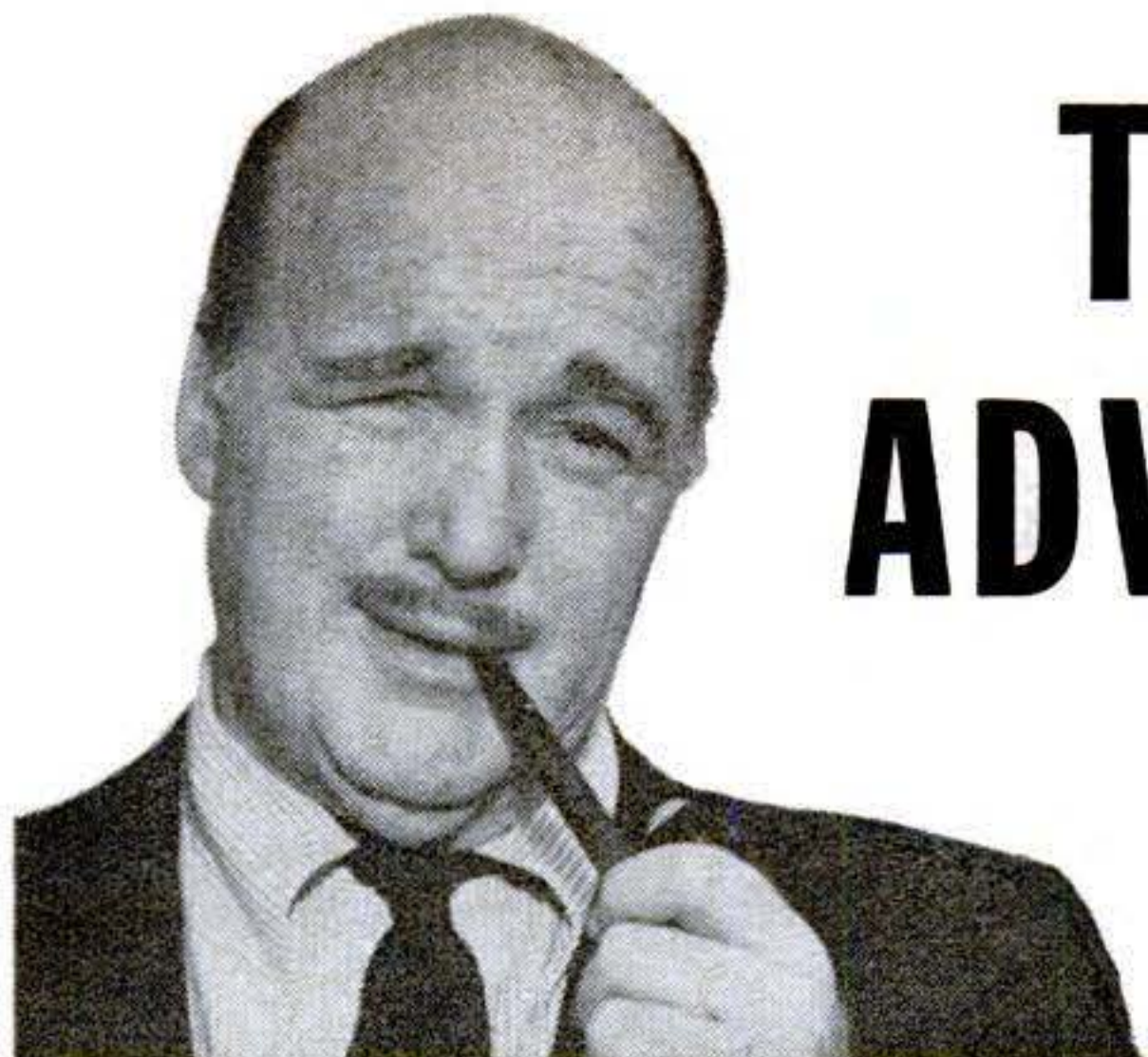
and my head and neck swelled until I thought I would bust. Afterwards the effects subsided, but it is quite evident that the combination of nitrogen derivative in the dynamite and alcohol set me off.

JOHN J. EDMUNDS, Bridgewater, Me.

. . . Everyone should be aware of the problem of alcoholism because it is an ever-mounting factor in our present-day society. I brought this article to our office where it will be used as a reference. By the way, your magazine is excel-

*Continued*





# TOM McCAHILL ADVISES SATURDAY MECHANICS

If you're a Saturday mechanic, my guess is you can fix the screen door, build lawn furniture, overhaul the kid's bike, and rotate your own tires.

It's a different story when that fancy electric coffeemaker stops perking or the push-button automatic washer quits halfway through a cycle. You might spend an afternoon admiring the coffee-maker's innards before giving it a permanent vacation on the top kitchen shelf.

As for the automatic washer, after the Little Lady shouts "Do something!" you'll end up phoning an Appliance Serviceman across town. He shows up in 3 days and has the washer going in one-fourth the time it took you to study the coffeemaker. He also presents you with a ticket for 30 bucks. When you consider he could make twice that selling you a new machine, you got off easy.

Maybe you never realized it, friend, but you have more Appliances around your hacienda today than you did five years ago. If you count power tools, your wife's hair dryer, an air conditioner, plus the standard stuff like vacuum cleaner, toaster, refrigerator, freezer and so forth, you probably have well over a dozen.

These electrical gadgets nowadays represent a pretty good chunk of your hard earned dollars. Did you ever stop to think it could pay you in savings and convenience to know how to fix these things? Also, it could be a great source of extra income if you're inclined to tackle the few thousand broken Appliances right in your own neighborhood.

The Appliance Repair business is easier to learn than you imagine. The National Radio Institute's Appliance Division has a downright interesting, low cost course you can take in your spare time. It covers every type of Appliance you can think of plus air conditioning, refrigeration, house wiring, electric motors—even small gas engines. There's a worthwhile section on farm and commercial appliances too.

NRI starts you with the basic principles of electricity to give you a solid background. Using clear-cut picture diagrams, they show you how various types of Appliances work, separating each into groups. Included with the course is a topnotch, professional Appliance Tester for fast troubleshooting.

Easy to read, bite-size lessons are loaded with photos and cutaway drawings so you see how each Appliance comes apart, and more important—goes back together in working order.

Whether or not you agree that knowing Appliance Repair could help you, I recommend you see for yourself. The little coupon below will get you a free book that fully describes this unique home training. It also brings a free sample lesson. No salesman is going to call.

Do yourself a favor and mail the coupon today.

*Tom McCahill*

TOM McCAHILL

**APPLIANCE DIVISION, NATIONAL RADIO INSTITUTE**  
3939 Wisconsin Avenue, Washington, D. C. 20016

**601-066**

OK—I want to see for myself. Send me the free book on Professional Appliance Servicing and a free sample textbook. No salesman.

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JUNE 1966 | 7

## PS Readers Talk Back

[Continued]



### Don't Growl at Your Service Man—

**It's not his fault the By-Pass Valve in a Full-Flow Filter does NOT Filter Oil!**

Comes time to change your Oil and Filter... the manufacturer recommends you do this at 6,000 miles. What do you do? If you don't insist on a WIX Multi-Cel Oil Filter, chances are 9 to 2 you'll get one engineered for 2,000 to 3,000 miles! You get 2,000 miles of filtration—the pleated paper gets loaded and the by-pass opens. For the next 4,000 miles you might as well have no Filter at all.

#### MULTI-CEL IS AN EXCLUSIVE WIX DEVELOPMENT

The superiority of WIX Multi-Cel depth type filtration went largely unnoticed until a major car manufacturer switched from paper. Then, when recommended oil change intervals rose to 4,000, 5,000 and 6,000 miles, the low-mileage paper Filter proved unequal to the job.

Ask for...demand WIX Multi-Cel Oil Filters! Because it doesn't make sense to pay for 6,000 miles of engine protection and only get half of what you pay for.



**WIX CORPORATION • GASTONIA, N. C.**  
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lent and thoroughly enjoyed each month. There is something in it for everyone.

LOUISE WEBB, Madison County Alcoholism Information and Referral Center, Madison, Wis.

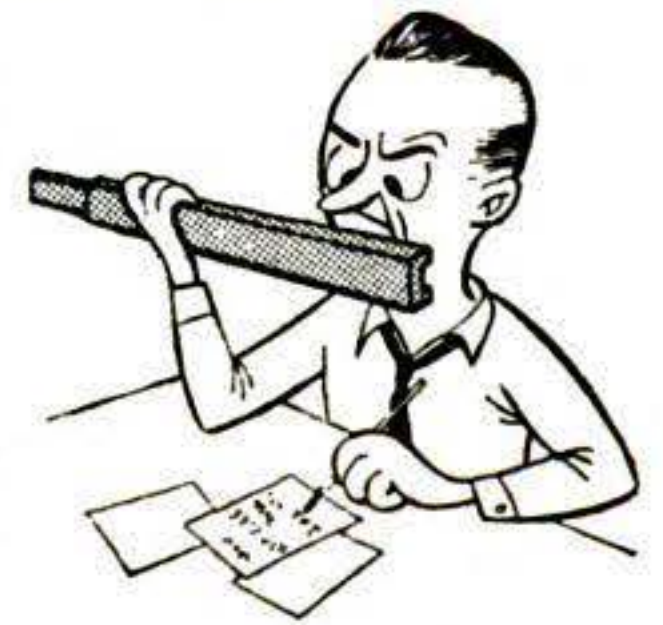
### Decreasing returns on two-ply vs. four-ply

If some experts think two-plys are better than four-plys in a tire ["Are Your Tires Safe Enough?" Mar.], then shouldn't one-ply be even better than two?

ANDREW VENA, Philadelphia.

### A boat for \$12—can it be done?

I have just completed building "A Boat for \$12—You Can Build It" [Mar.], and I am pleased with the finished product. But how can you say it costs \$12? Here's what it cost me:



Plywood .....	\$ 3.41
Pine .....	8.20
Screws .....	2.25
Nails .....	1.55
Glue .....	4.55
<b>Total .....</b>	<b>\$19.96</b>

HARRY H. FROENDHOFF, Cincinnati.

*Costs vary in different parts of the country, of course, but here's what our author spent:*

Plywood .....	\$ 3.50
Pine .....	5.35
Glue .....	2.10
Screws & nails .....	1.00
<b>Total .....</b>	<b>\$11.95</b>

... Utilizing some existing pine boards I had, I built the \$12 boat for \$7.50. I found the plans and instructions easy to follow.

JACK GOODRICH, Livonia, Mich.

### Why not make circular saws for southpaws?

Is there any portable circular saw made for us left-handers? All the portable jobs I've seen have the blade on the right side. This is fine if you hold the saw in your right hand, but puts the blade next to a left-hander's body.

JOHN M. GARLAND, Minneapolis.

*We don't know of anyone making a left-handed circular saw. It's another case where lefties don't get a break.*

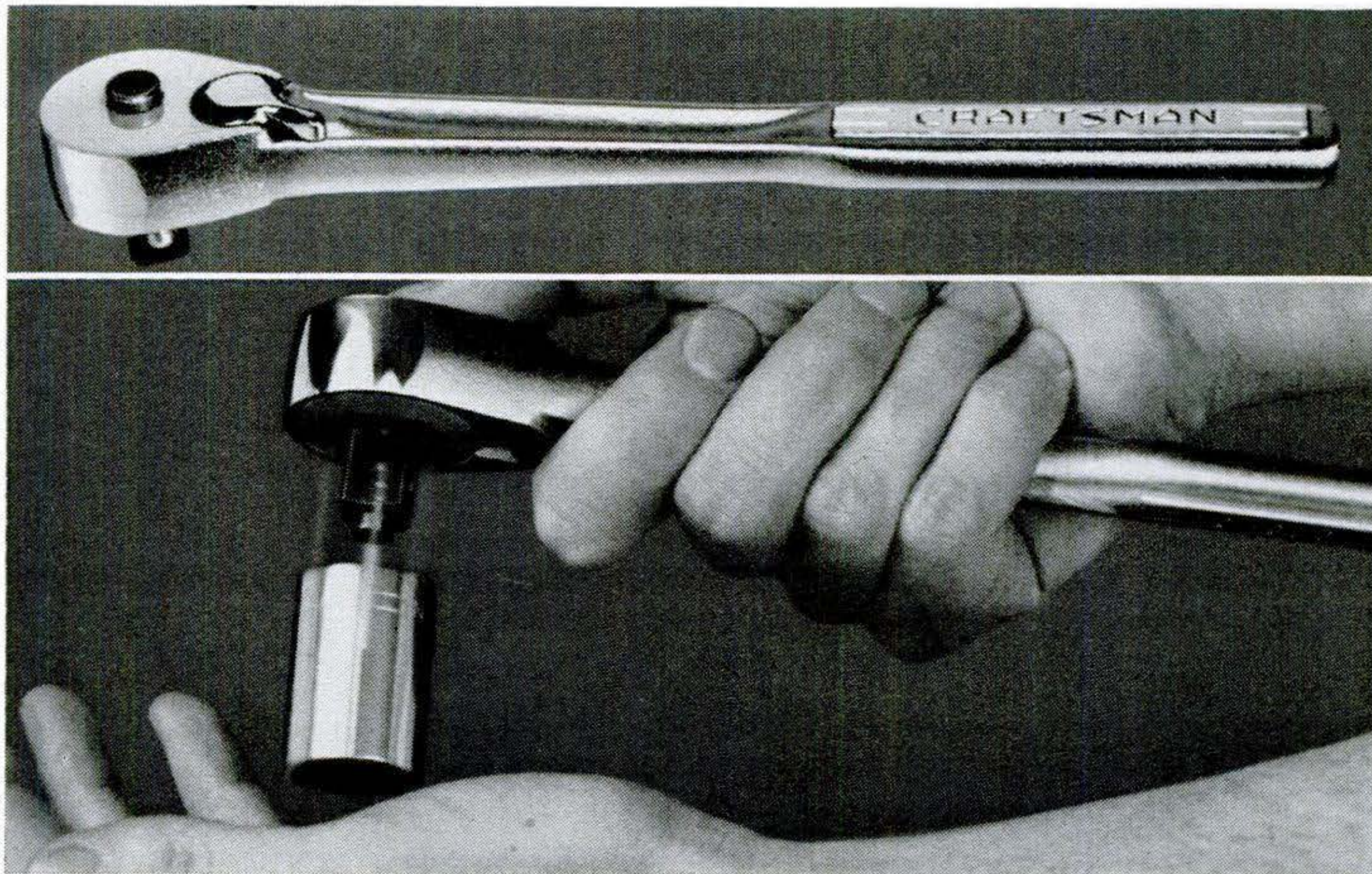
### Doing the wiggle-woggle bit

I have a question about the wiggle-woggle Jan Norbye writes about in "PS Tests the Compact Fastbacks" [Apr.]. I don't see how you can change lanes in time when you're doing 60 m.p.h. and there's only 60 feet of clearance

*Continued*

# Push-button ratchet wrench releases without a fight.

## New and only at **Sears**



**E**VER tried to separate a socket from an ordinary ratchet wrench when your hands were greasy?

Forget it. You just press a button on Sears new Craftsman® wrench. They separate easily—no yanking.

The stroke is smooth and short, great for working in tight spots. Switch lever to reverse the action. The shaft and handle are drop-forged steel for strength without bulk.

In Sears factory tests, the ratchets

were operated over half a million times under full load with no serious wear.

See the newest invention in ratchet wrenches at Sears, Roebuck and Co. Available in  $\frac{3}{8}$ " and  $\frac{1}{2}$ " drive to fit all standard sockets. Prices: about \$5.50 to \$8.00 depending on length and drive.

You get an unconditional guarantee. If this Craftsman wrench fails to give complete satisfaction, return it—Sears will replace it free of charge.

See it now—at Sears.

# the second set of tires is your first real choice!



Now it's just you and all the tires in the world. One of them is the only family-car tire certified safe at 100 mph. The Dunlop Gold Seal.

The same one has Dunlop patented\* Safety-Shoulders. Lean into a corner, and the patent holds you on. Roll up and over a center line or shoulder, and the patent holds you without a lurch.

The same one has what tire men call a low profile. That means a 15% larger footprint area. More of the Gold Seal's wide tread is always on the road for better traction, greater safety, more miles of wear.

And this same one has the Dunlop water-ejecting tread pattern. That speaks for itself in the wet.

Yet the Gold Seal is popularly priced.



Doesn't that sound like a choice tire for a change? You can choose your Dunlop man out of the Yellow Pages.

Every Dunlop tire meets or exceeds every official specification for safe performance.

\*PAT. NO. 3,024,825

**DUNLOP**  . . . means quality in golf, tennis, and tires.  
BUFFALO, NEW YORK

## PS Readers Talk Back

[Continued]

to avoid an accident. The National Safety Council says a car going 60 m.p.h. travels 88 feet in one second. I find it difficult to believe that anybody could check his mirror and side window in less than one second.

JIM MORITZ, Niles, Ill.

*Auto Editor Norbye says it can be done by an alert driver, if the car will respond adequately.*

### Paint removal is easier with sawdust

In "Paint Removal . . . How to Do It Right" [Apr.], the author recommends scraping off chemical removers with a wide-blade knife. I believe the following method is much better:

Have several gallons of sawdust on hand. Apply the paint remover as recommended. When paint is softened, throw plenty of sawdust on and, wearing an old glove, scour the sludge around until the sawdust absorbs all the remover. The sawdust will dig down into uneven spots and curves, without scratching the wood. Surface coloration also remains more even. Best of all is that sawdust absorbs the sludge so effectively that you can use it over



and over. When you're done with the job, just sweep up the sawdust for use the next time.

FRANK H. EMBREY, Bay St. Louis, Miss.

### Every man's flying machine

I think "Is This Every Man's Flying Machine" [Apr.] is a fabulous story. It gave me the flying bug, and I'm sure numerous other bug-ridden hobbyists would like to know where they can get plans or kits.

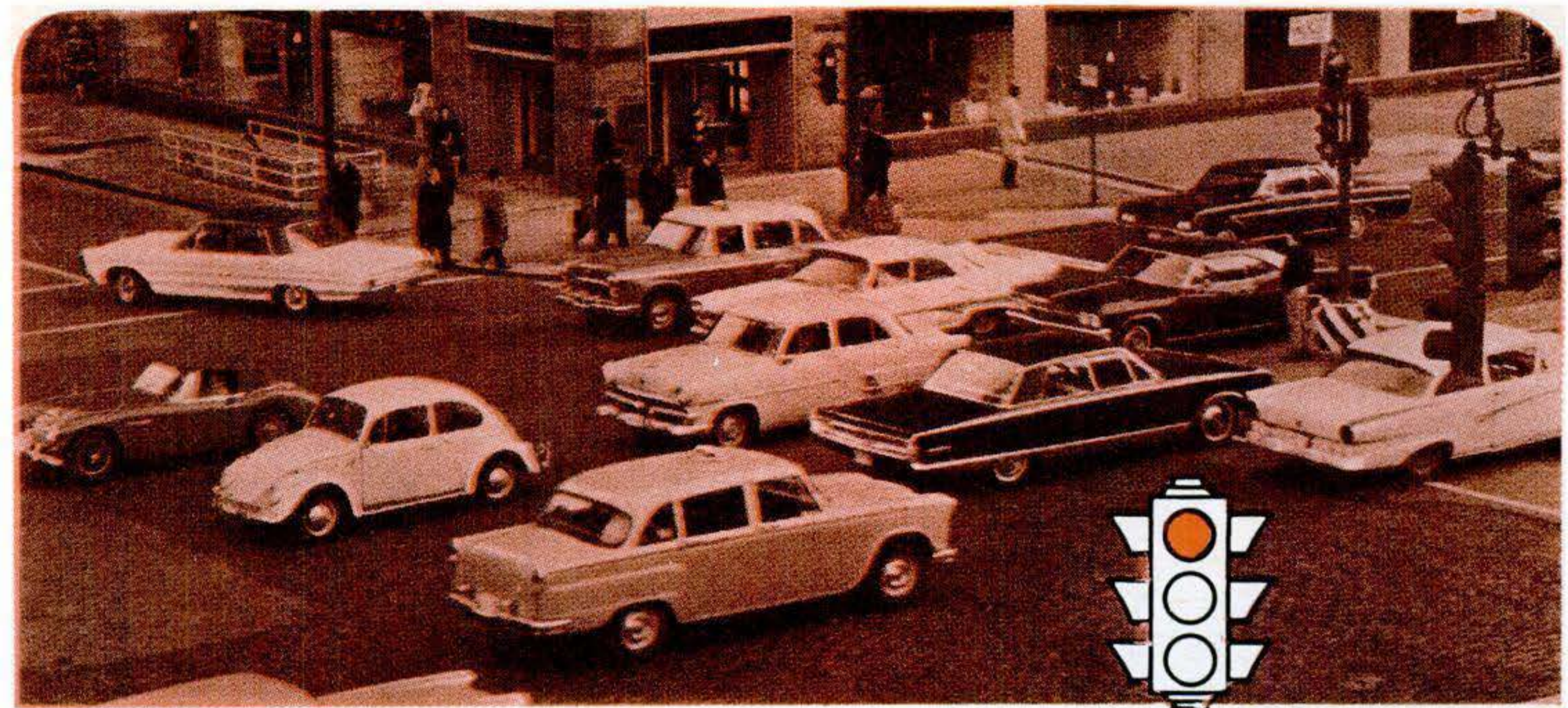
W. GREGG FAWTHROP, Chalfont, Pa.

*For further information on the gyrocopter, write the Bensen Aircraft Corp., Dept. O, P. O. Box 2746, Raleigh, N.C. 27602.*

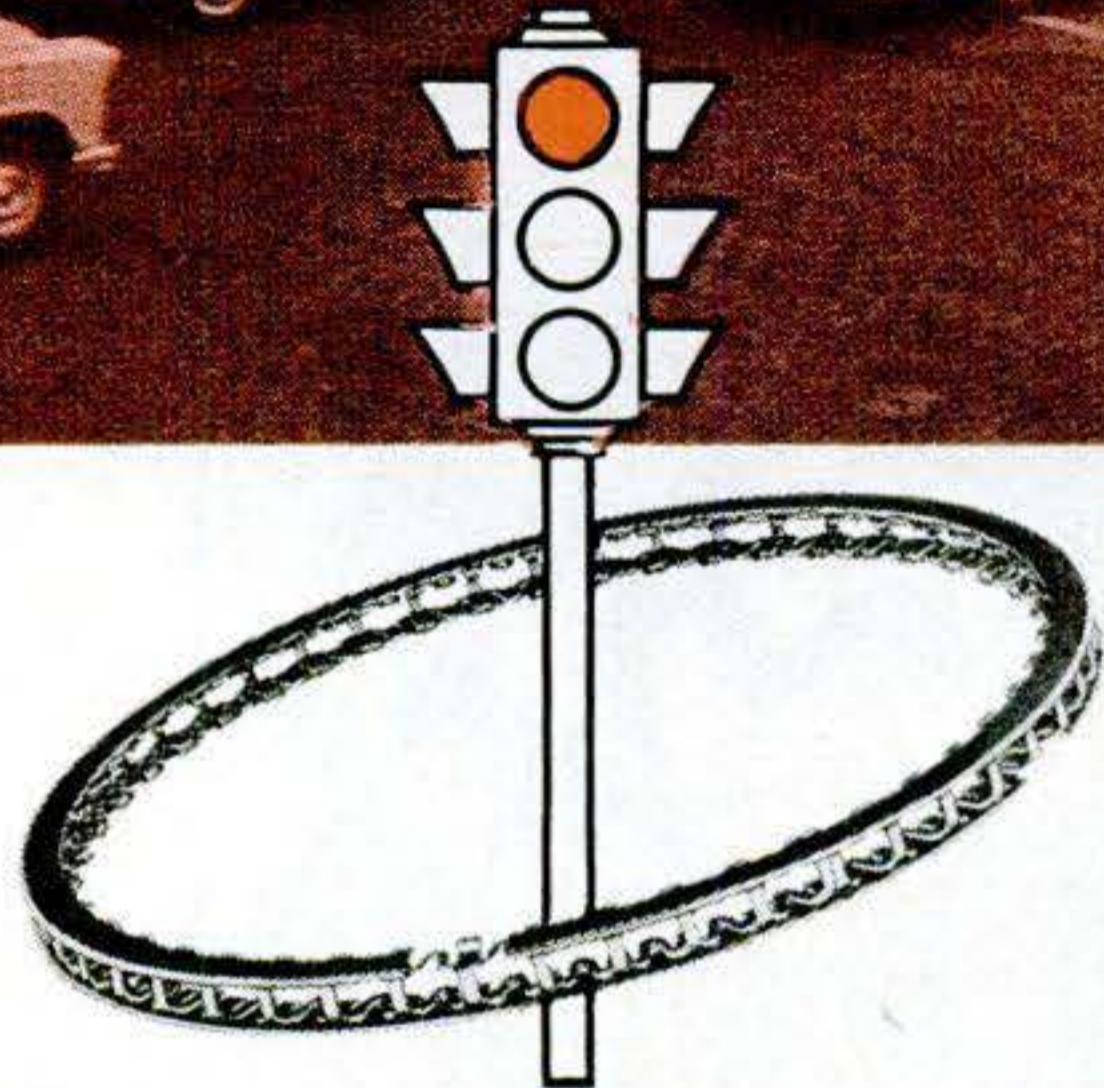
### Request with teeth in it

For years I've been buying blades for my bandsaw (blade 71¾-inches long) that have eight teeth per inch. But my source of supply has now gone out of business and the only blades I can find have six teeth per inch—far too coarse for the kind of work I do. Does anybody know where I can buy blades with eight teeth per inch?

HAROLD C. KIMBALL, Salt Lake City, Utah



**NEW TEFLON\*  
OIL RINGS DRAIN  
160% FASTER,  
WON'T CLOG EVEN IN  
STOP/GO CITY DRIVING**



Bumper to bumper traffic and short trips can make carbon and sludge build up fast in today's high compression engines. But not in engines equipped with new PC Perflon oil rings. Why? Because Perflon rings are coated

with Teflon—a material that's so slick that carbon and sludge build-up is no problem. In addition, Perflon rings have a new wide-span slot design that speeds drainage. Ask for PC Perflon rings next time you re-ring.

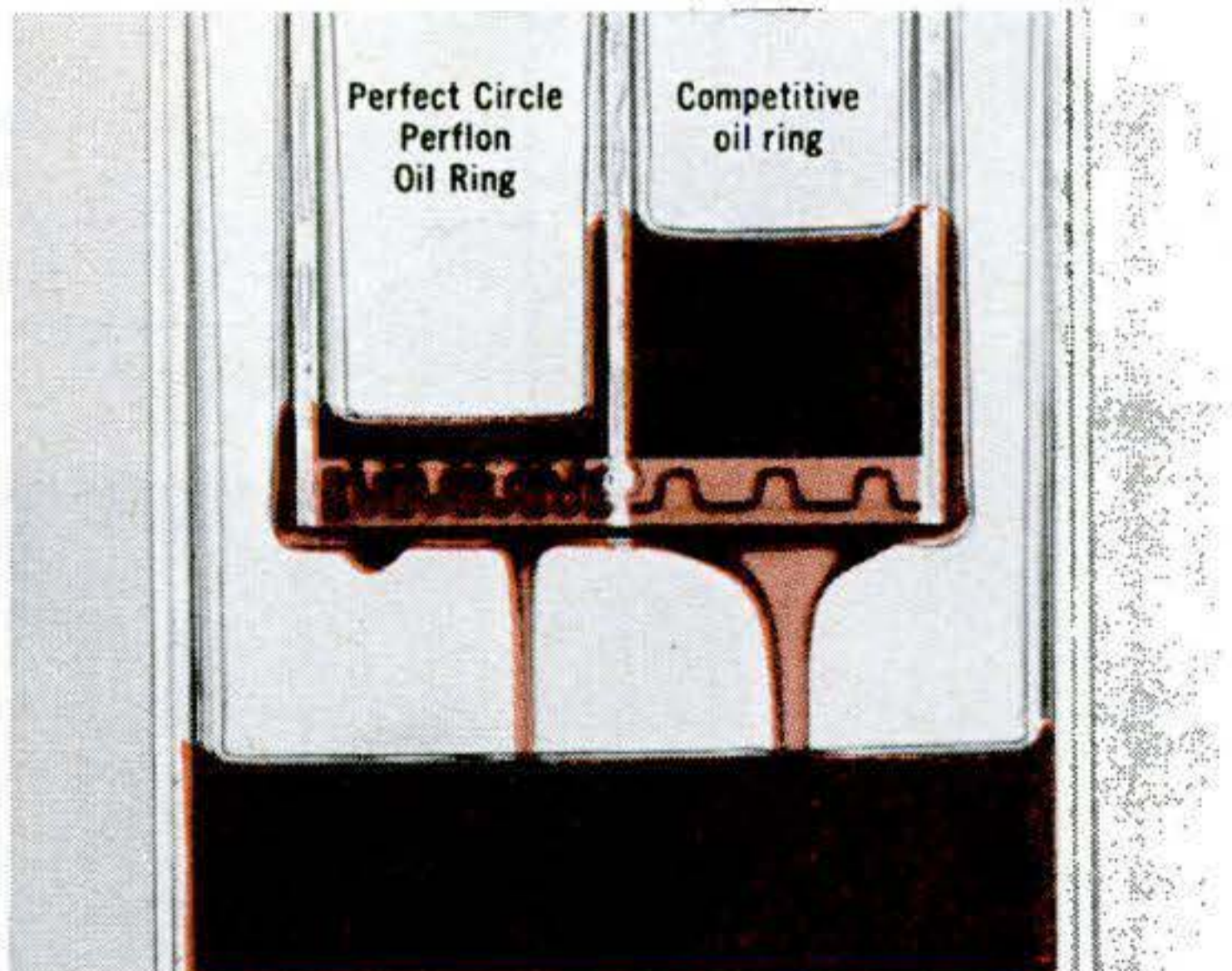
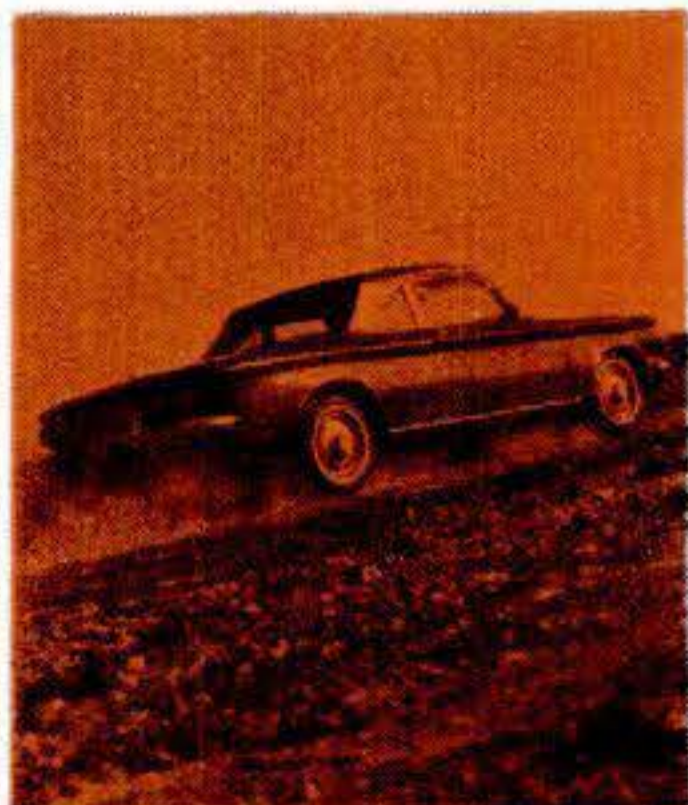
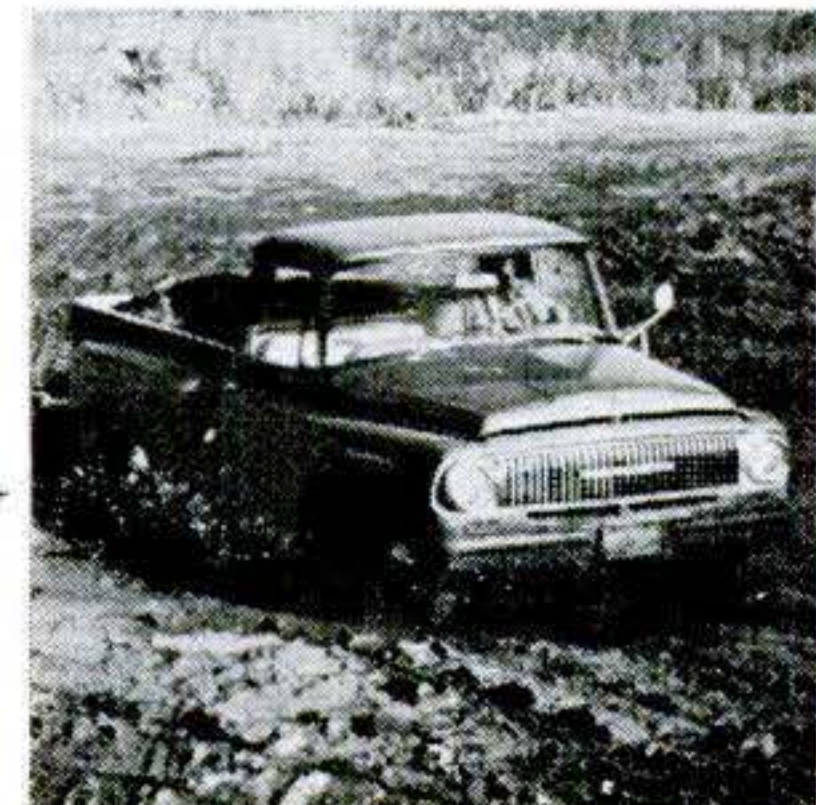
\*Registered trademark for Du Pont fluorocarbon resin finishes.

**PERFECT CIRCLE**

DANA PARTS  
COMPANY



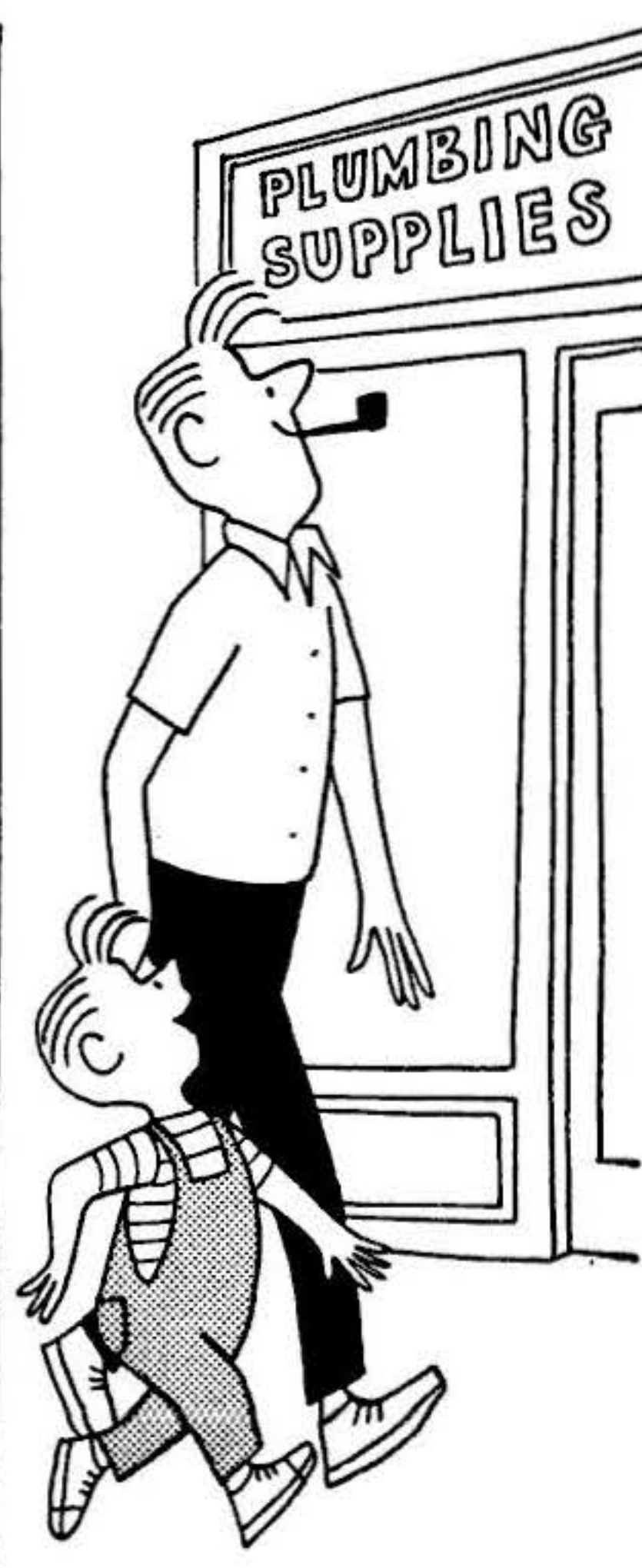
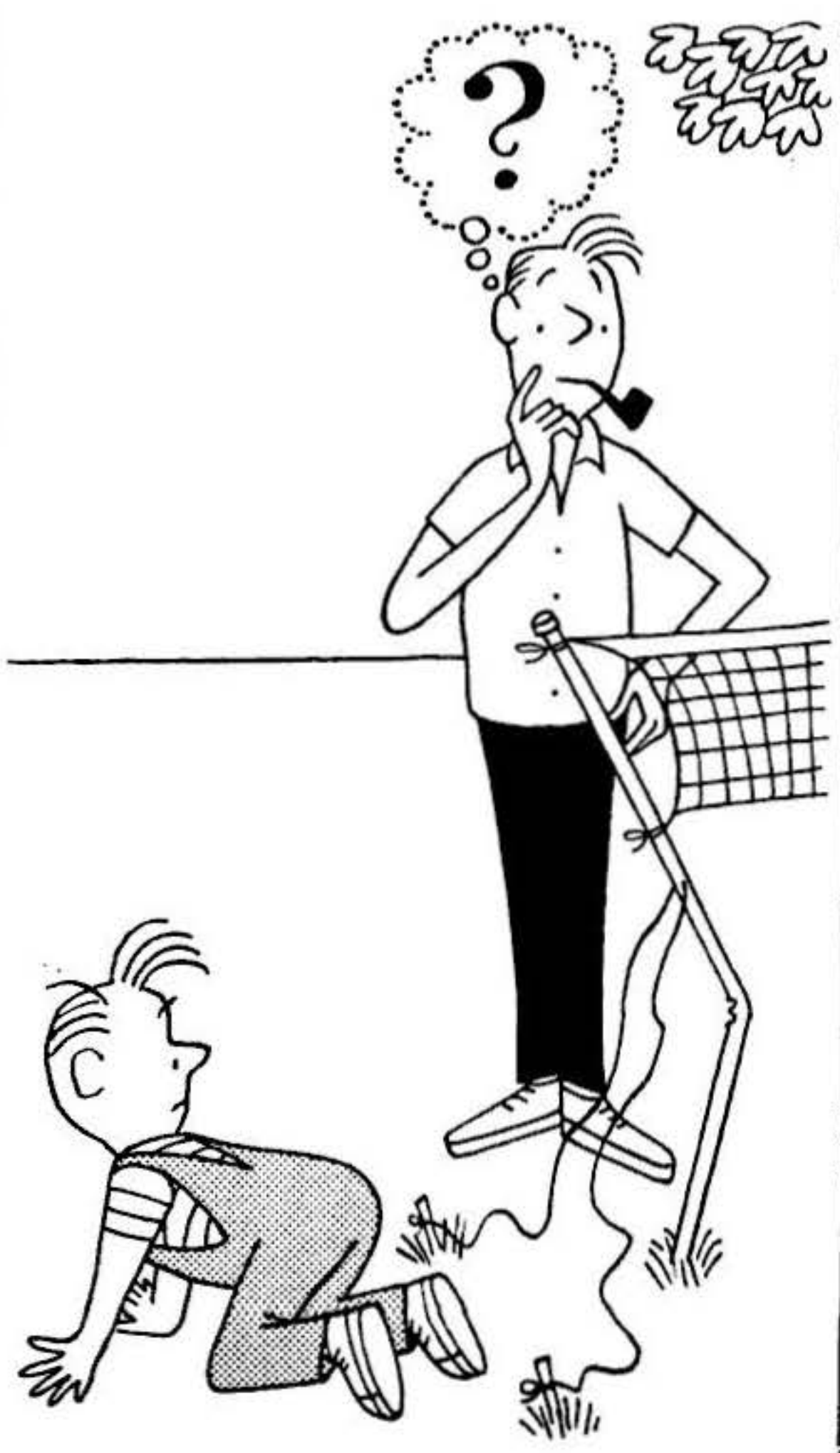
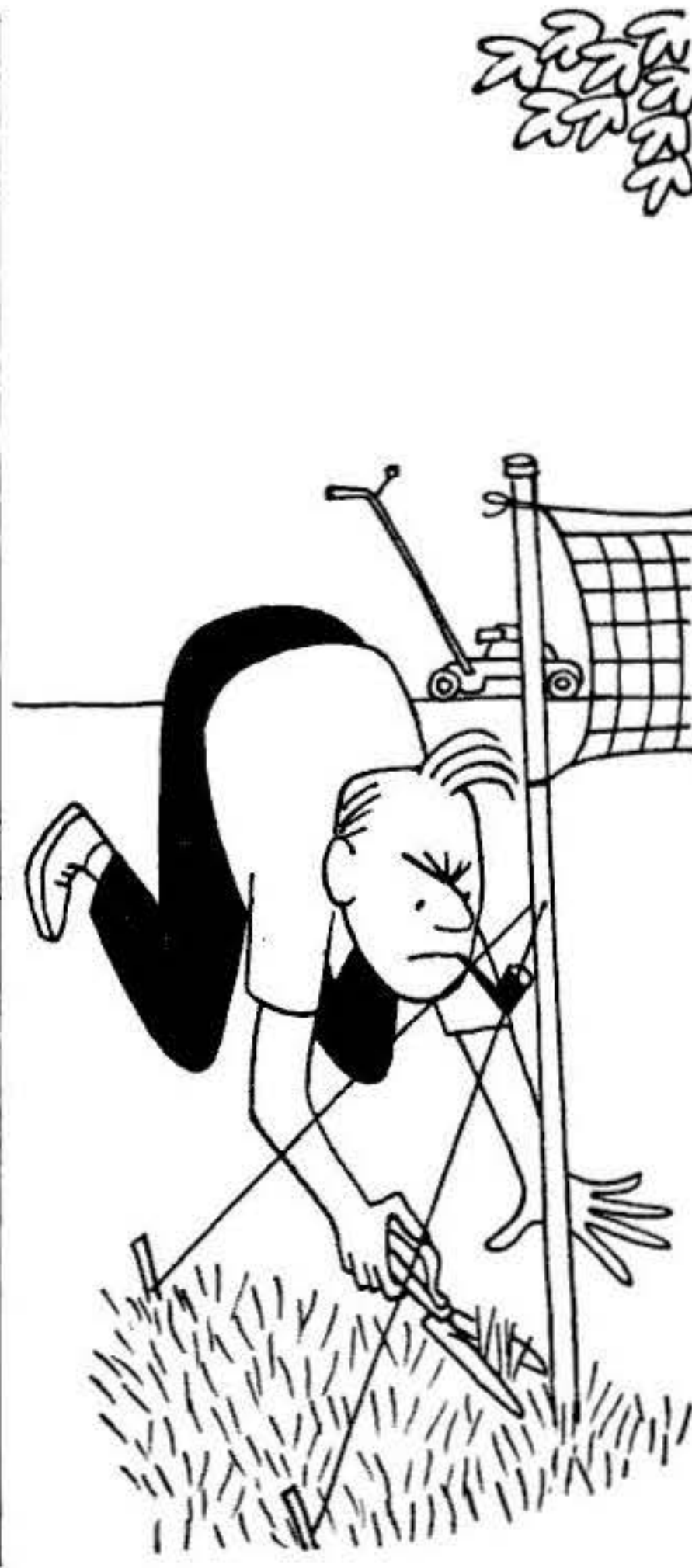
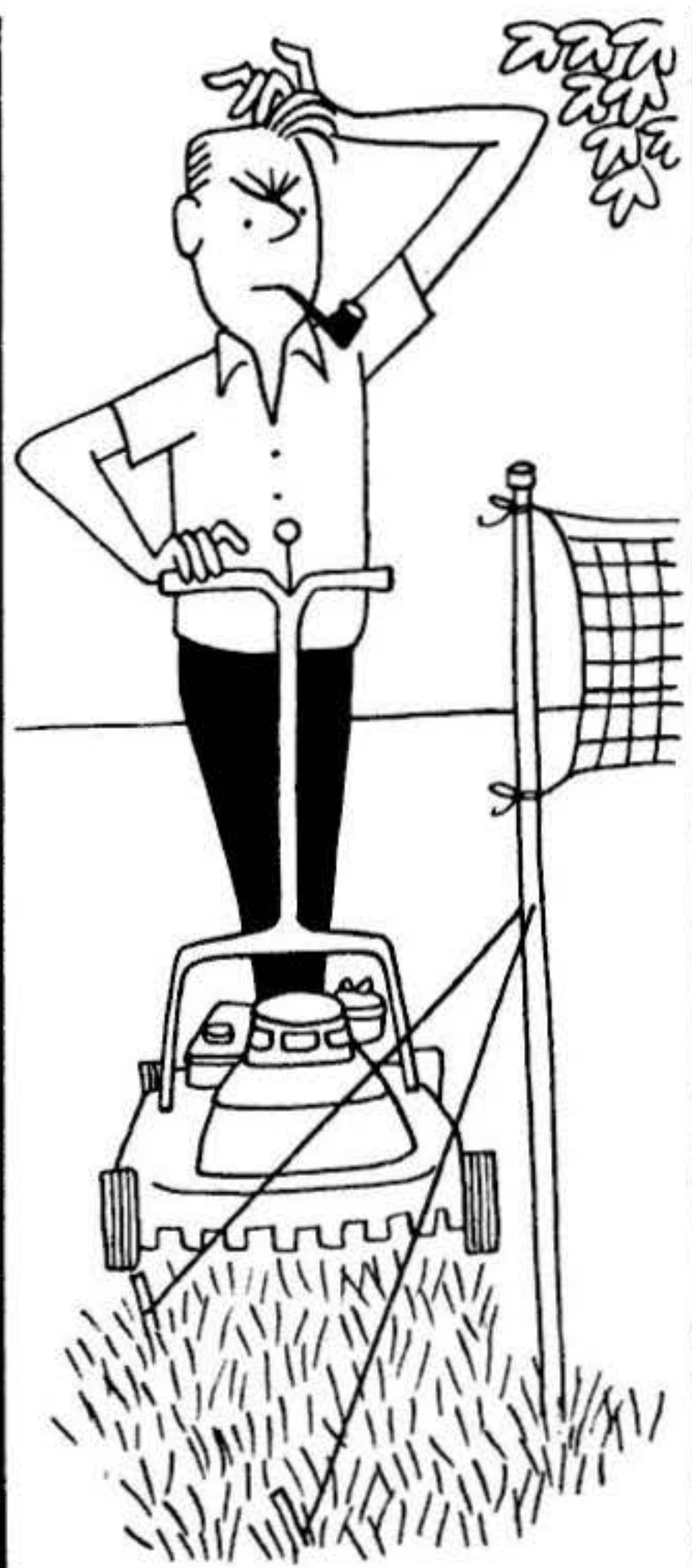
DANA CORPORATION



Un-retouched photo shows how much faster equal amounts of the same weight oil drain through a section of Perflon ring (left) than through a section of a competitive ring (right). Only PC Perflon rings assure this kind of free oil flow and proper lubrication.

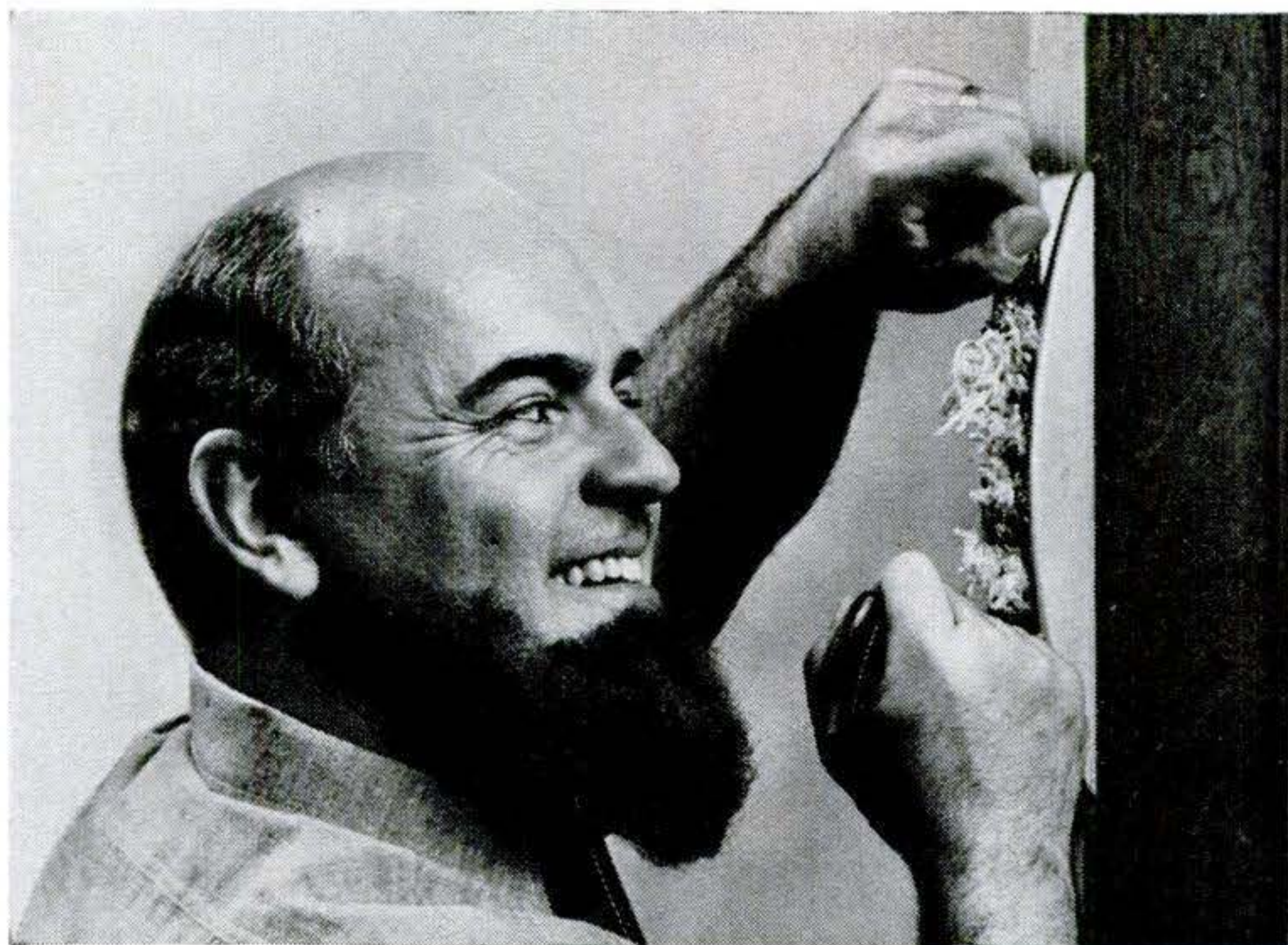
# Wordless Workshop

By ROY DOTY



Continued

# The Stanley Surform<sup>®</sup> shaves everything but your beard.



This could be the most useful tool in your house. It shaves, shapes and smooths practically any surface.

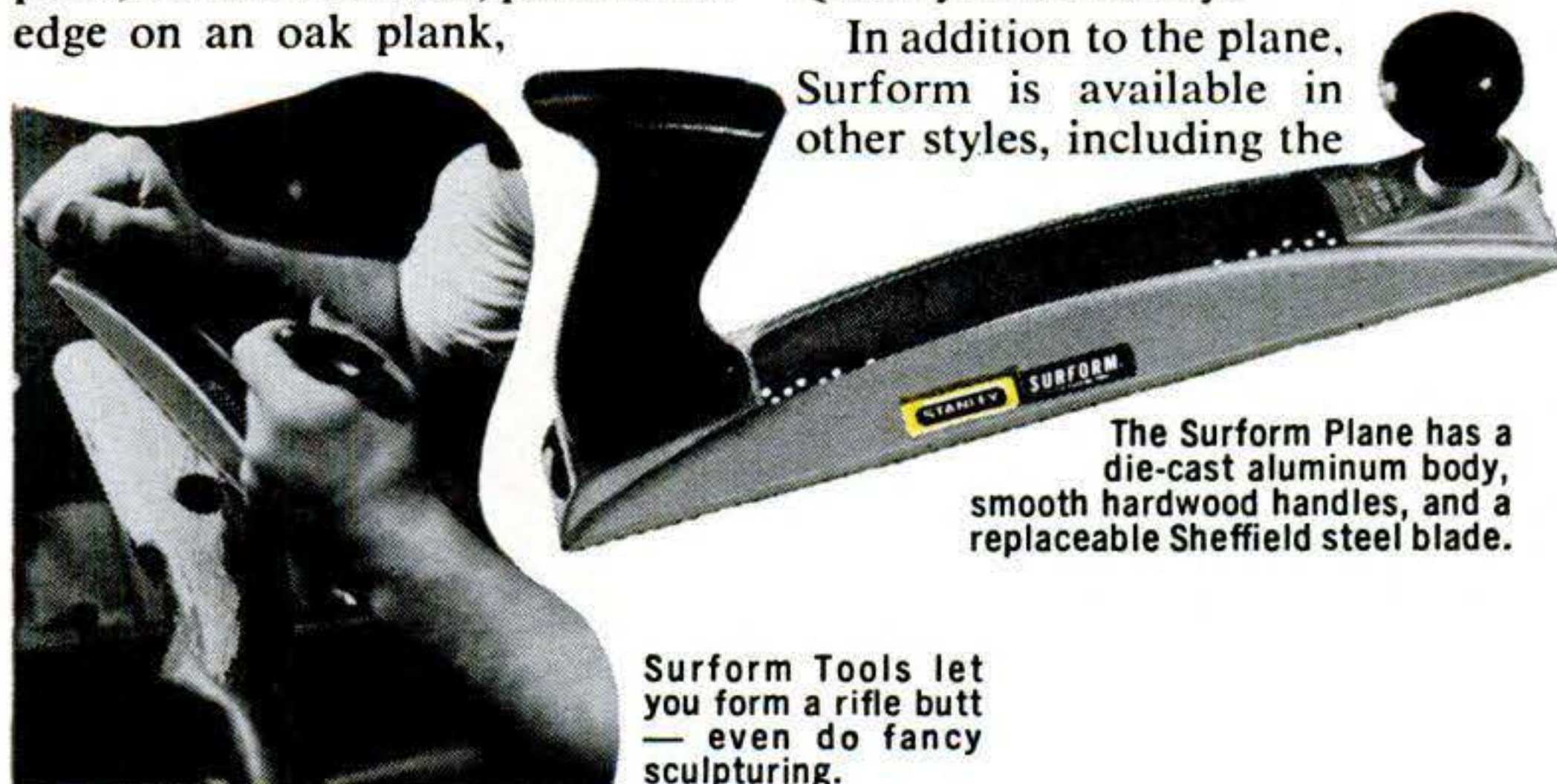
You can trim a door down to size (without removing it from the frame). You can put a good clean edge on a plastic countertop, fix a sticky drawer, make an aluminum storm window fit tight. You can take the bark right off a log, square up the edge of a brass plate, form a rifle butt, put a bevel edge on an oak plank,

even do a little fancy sculpturing.

You can fit a board to an uneven wall, take the barb out of a copper pipe, make an asphalt tile snug, even remove excess filler on auto body jobs. And you can clean up a lot of those other little bothersome household jobs you've been putting off.

In short, Surform tools let you smooth things down, straighten things out, and round things off. Quickly. Effortlessly.

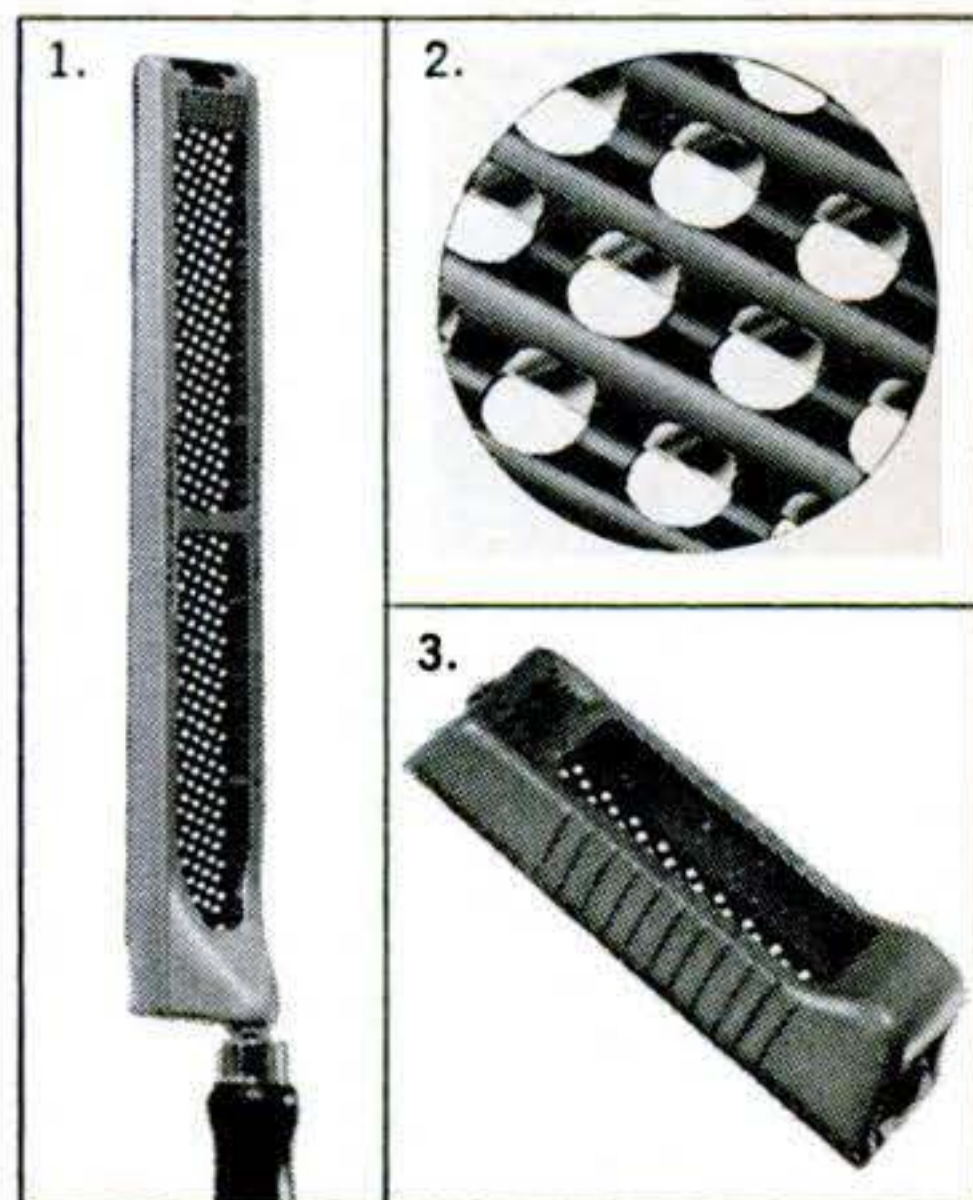
In addition to the plane, Surform is available in other styles, including the



The Surform Plane has a die-cast aluminum body, smooth hardwood handles, and a replaceable Sheffield steel blade.

Surform Tools let you form a rifle butt — even do fancy sculpturing.

file and the handy pocket size. They have replaceable Sheffield steel blades with 450 razor-sharp teeth. And every tooth has its own opening to prevent clogging — the shavings pass right through.

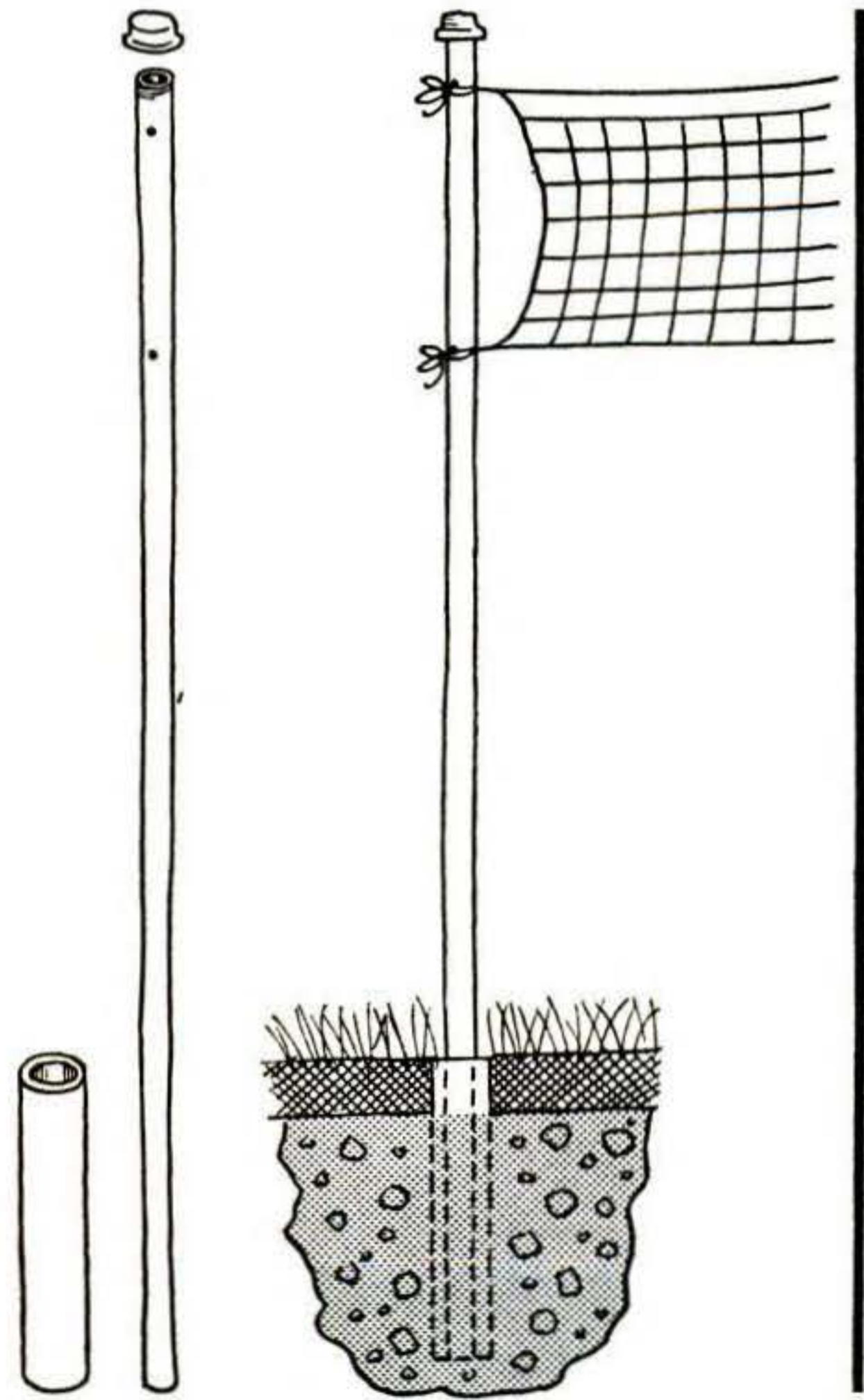


1. The Surform File works faster on wood than a rasp and has a wood handle, an aluminum body, and a 10" blade. 2. Enlarged section of Sheffield steel cutting blade. 3. This pocket-size Surform is only 5 1/2 inches long — couldn't be handier.

Test the Stanley Surform for ten days. If you don't think it's the most versatile tool you've ever used, we'll refund your purchase price. Pick one up this week-end at your local hardware store or lumber yard. Stanley Tools, Division of The Stanley Works, New Britain, Connecticut.

**STANLEY**  
helps you do things right

Wordless Workshop  
[Continued]







# Lucite<sup>®</sup> turns you loose



There's a house paint that'll stand between you and frequent repainting, turn you loose to enjoy life.

Du Pont LUCITE<sup>®</sup> House Paint.

So long as a paint holds its fresh, clean look, you don't have to repaint.

And LUCITE has been proven to resist fading as well as blistering, peeling, cracking, chalking and mildewing far longer than leading oil-base paints.

What's more, LUCITE flows on easily. And it'll dry to a hard, low-sheen finish in less than an hour.

No solvents or thinners or turpentine with Du Pont LUCITE. You wash hands and brushes clean with just soap and water.

Use the house paint that lets you finish sooner, and paint less often, too—this house paint that gives you extra free time to do the things you really want to do.

Let LUCITE turn you loose.



Better Things for Better Living  
... through Chemistry material

# "Say, Smokey—"

## A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please *print* your name and address.



Smokey watches a race with T.A. Toombs, one of his mechanics, and son, Smokey Jr.

*"Since the day I took delivery on my 1965 Olds Delta 88 with a Super Rocket V-8, it has had noisy valve lifters. I change oil every 2,000 miles. The dealer gives me no satisfaction. I would use an oil additive to quiet the lifters, as I did on an older car, but the Olds instruction book forbids that. Your opinion would be appreciated."*

P. E. LOSHBOUGH, Largo, Fla.

Lifter noise is not normal for this car, nor should you have to use an additive in a new engine. If your dealer can't, or won't, solve the problem, write the Oldsmobile Service Department, Lansing 21, Mich., and register a simple description of your problem. You should get action in a hurry, and at no cost, assuming you have followed all of their operating and maintenance procedures.

*"I heard on TV how a lady cooked stews, steaks, hamburgers, etc., wrapped in foil on the exhaust manifold of her car while traveling. I'm just nutty enough to try it if you don't think it would mess up the car."*

PRISCILLA HANZ, New Braunfels, Tex.

It won't mess anything up, but now I've got a question: If you've got one of the newer cars, how are you going to find cooking space under the hood?

*"My 1965 Chrysler Newport sedan sounds like 'riding in a barrel,' even with undercoating and Firestone 'dead-rubber' tires. The Detroit factory service says it's regrettable and refers me back to the regional factory service. This model will drive you nuts on a newly paved road. Any suggestions?"*

H. H. COPENHAVER, Arcadia, Calif.

I'm afraid that on your particular model of Chrysler, strength was more important to the manufacturer than good acoustics. The unit construction is far stronger than the body-and-frame

deal, but it amplifies and resonates noises that exist in all cars. I can only suggest that you turn up your radio good and loud.

*"My 1960 Rambler wagon with automatic had a rebuilt engine installed a year ago. At a light, in gear, it idles roughly unless put into neutral or accelerated slightly. Also, the idle becomes smoother with the windshield wiper on."*

TAISTO SISKI, Malba, N. Y.

Go to a carburetor specialist who uses fuel-analysis equipment and get your engine tested under the same rough-idle condition. This ought to show up a too-rich or too-lean condition. I suspect it's too rich. It's possible also that you have an ignition problem, such as too much advance, or plugs just not right for the rebuilt engine. A scope will indicate which cylinder or cylinders aren't firing properly.

*"My 1965 Mustang with 289-inch engine, 2-by-2 seating, 6.95-by-14 tires, and 'special handling package' performs all right under normal conditions. Not so in the mountains, or on sharp curves or slick roads. The excessively light rear end cries for more traction and stability. How can I correct this?"*

STEWART KEEN JR., Atlanta, Ga.

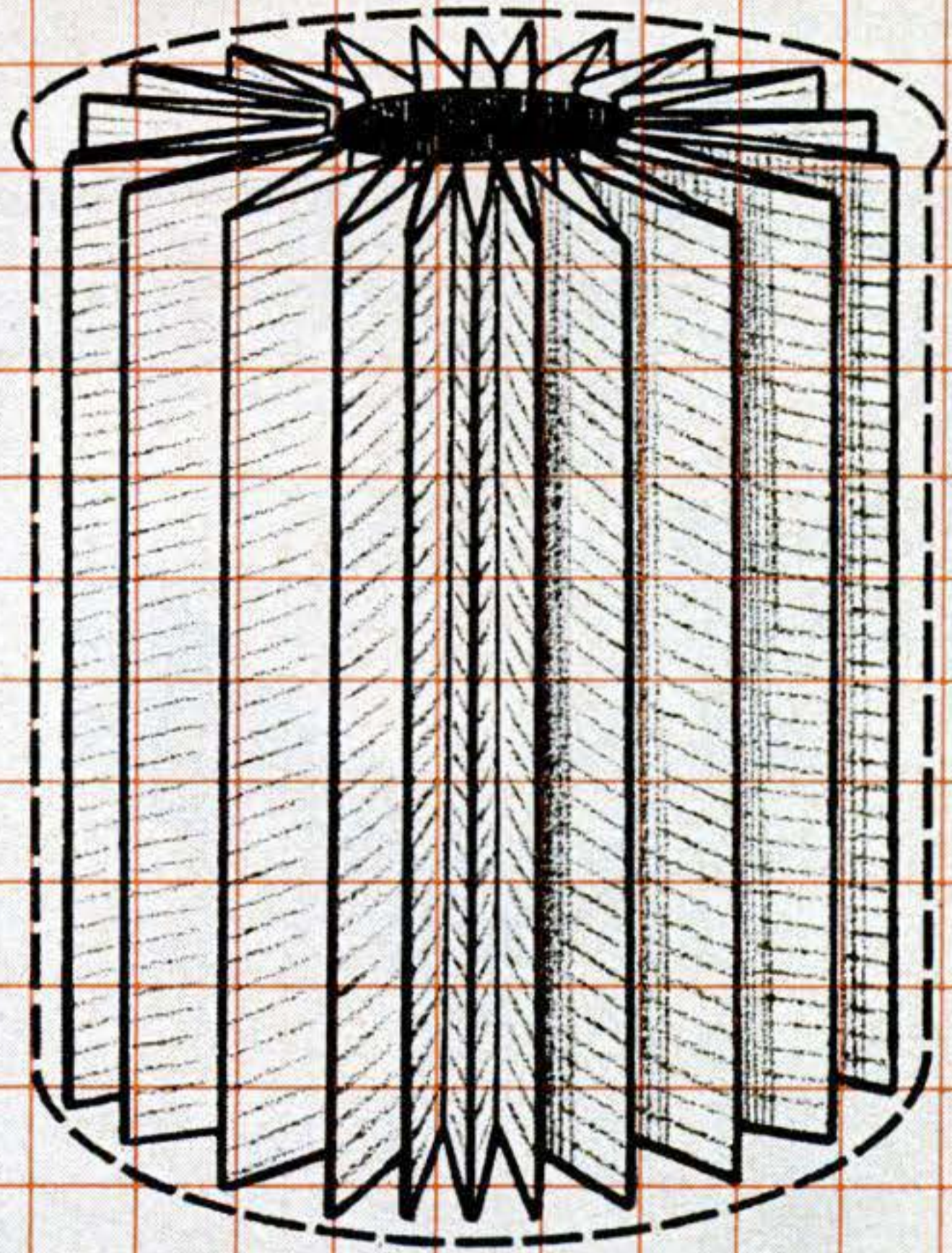
There are two solutions: 1) Install the Shelby handling kit. It's all worked out to correct the situation—but will make the car ride like a bucking bronco. 2) Try the "home" engineering method. Install heavier front springs, or lighter rear ones, and the widest (but not the largest) tires that will fit the rims. Also, add a heavier front sway bar. That'll hold her down, but you won't get the rough ride.

*"The engine in my '47 Cadillac starts promptly when cold, but when it's warm the starter runs until almost its last gasp before the engine catches. The engine has been rebuilt and is in*

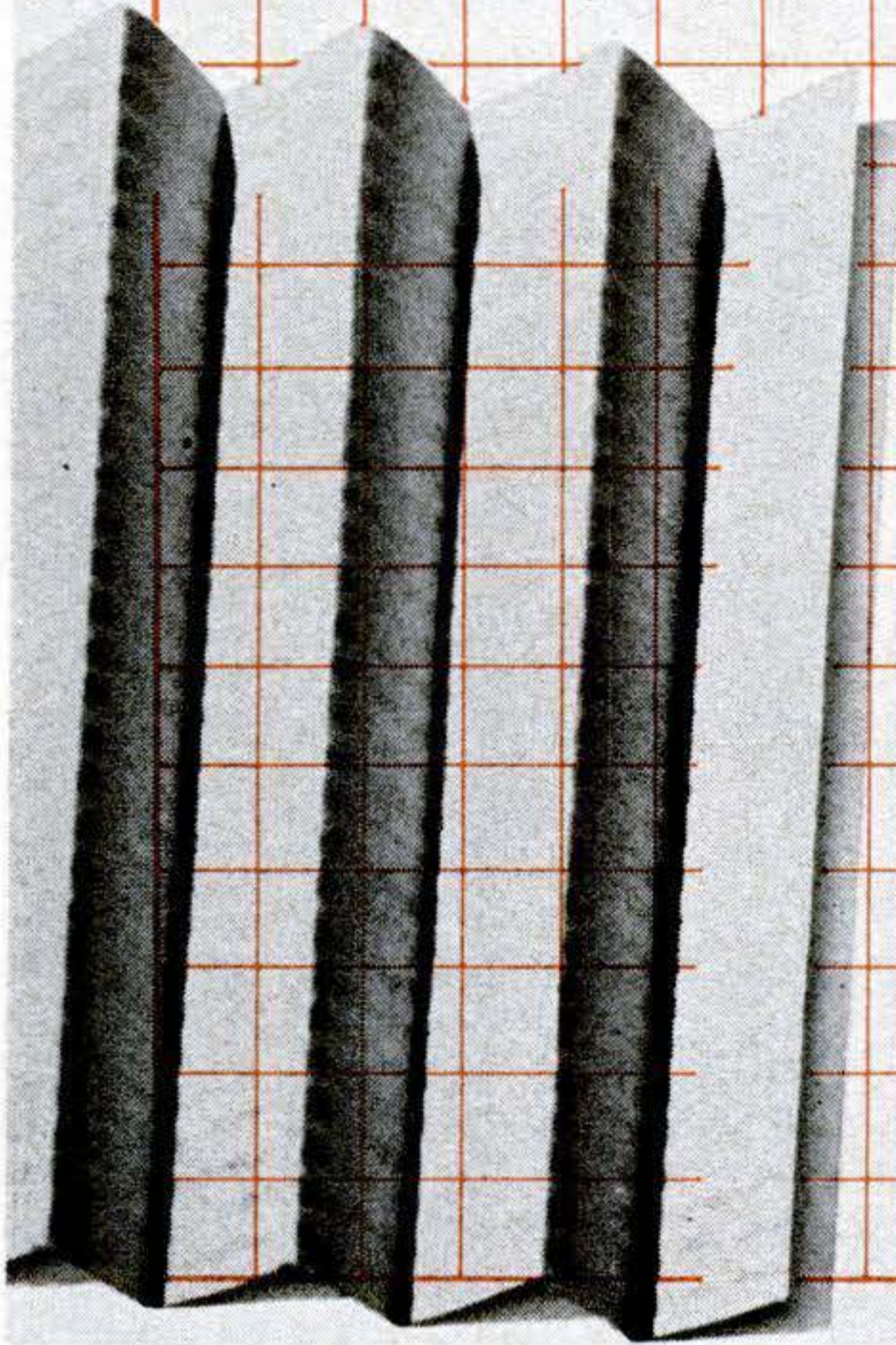
*Continued*

From an AC Engineer's notebook:

*AC's filter material contains millions of "dirt traps"*



*the AC Oil Filter removes dirt particles as small as 1/10th the diameter of a human hair and smaller*



## Every AC Oil Filter has millions of "dirt traps" to help protect the life of your engine

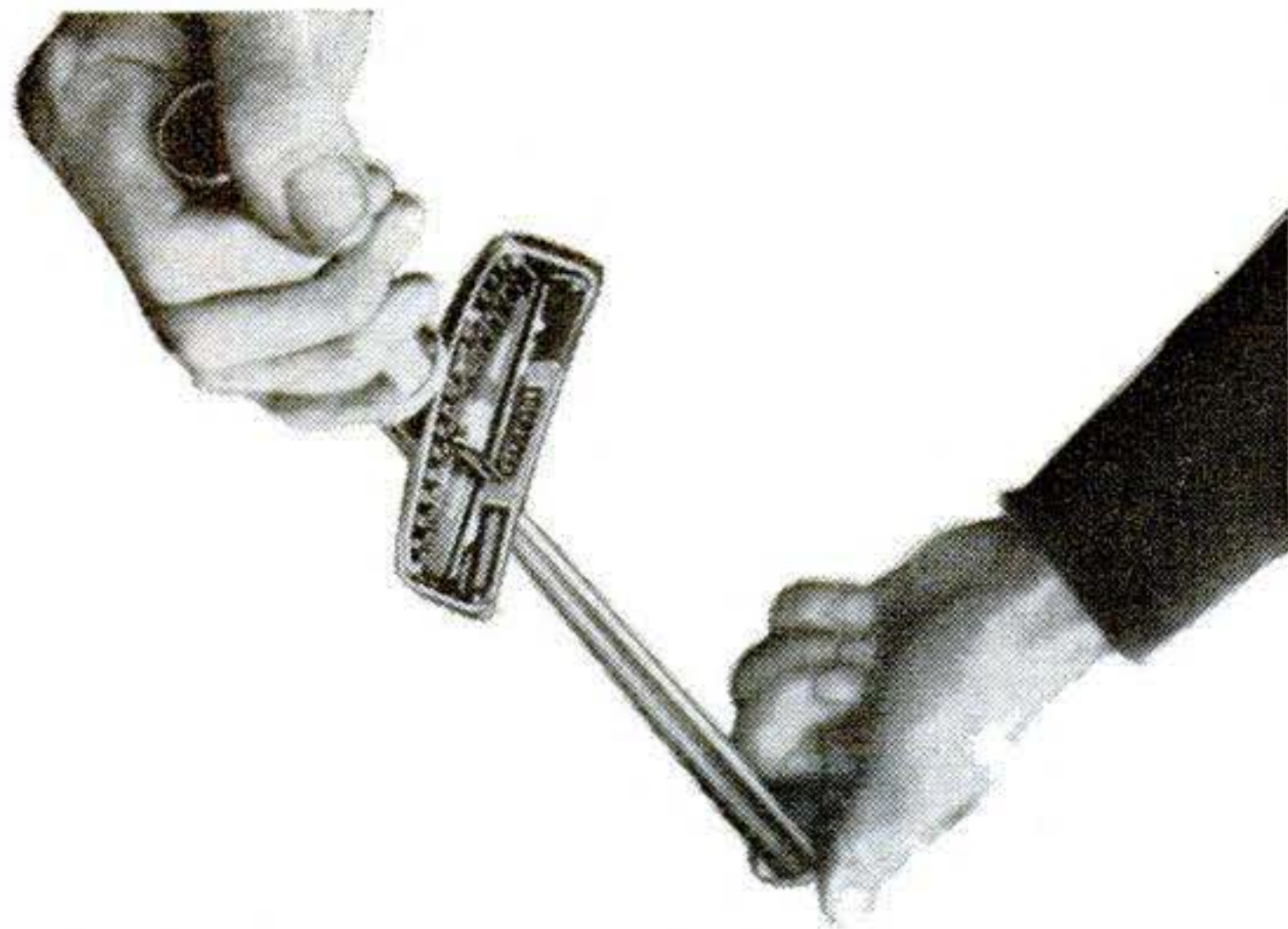
With its millions of "dirt traps," the AC Oil Filter catches and holds abrasive impurities that are as small as 1/10th the diameter of a human hair and smaller. This means it takes over 76,000 of these particles to cover the head of a pin. This unsurpassed filtering efficiency, together with AC's advanced full-flow design, assures you of a continuous flow of freshly-cleaned oil to vital engine parts. This reduces engine wear, increases engine protection. To help your engine run better, last longer, ask for an AC Oil Filter next time you change your oil.

AC SPARK PLUG DIVISION



JUNE 1966 | 17

# Test your automotive I.Q.



The tool in use here is \_\_\_\_\_ ?



What does this symbol stand for?

A torque wrench, which helps a mechanic apply equal pressure to head bolts. The life preserver is the symbol of Quaker State Motor Oil. Quaker State is refined only from 100% Pure Pennsylvania Grade Crude Oil. It keeps your car on the road, out of the repair shop . . . saves you trouble and money. That's why it's the finest engine life preserver you can buy. Quaker State your car—to keep it running young!



Quaker State Oil Refining Corporation  
Oil City, Pennsylvania

## "Say, Smokey—" [Continued]

*good shape. No mechanic can tell me what's wrong."*

GLEN A. GRAYBILL, Barstow, Calif.

Update the carburetor, change over to the 12-volt system, making sure the ignition gets its share of the juice, and she ought to run right. As I recall, all owners of that model have had the same problem of too small a starter.

*"I have trouble shifting from neutral into either low or reverse in my '65 Falcon six with a standard three-speed box. Even after holding the clutch down for 10 to 12 seconds, the gears want to grind. Also, something wants to bind in the linkage. What's the answer?"*

C. H. LANDIN, Altona, Ill.

You probably have clutch trouble. In low and reverse, with the clutch engaged, all gears ought to stop. Check the pressure plate in the clutch for even release, and the disk for grease or oil. The shift adjustment could enter into this problem also, but first get the clutch working as it should.

*"Please settle a long argument about the proper handling of a standard shift when stopped at a traffic light. One argument is that the clutch should be depressed fully, and the gears in first, so when the light changes you can make a fast getaway. The opposing argument is that the transmission should be in neutral with the foot off the clutch, to be pushed in and the gears changed when ready to go."*

LONNIE D. CLAR, Albany, N. Y.

The clutch on standard-shift cars should be used for shifting only—not waiting for the light. The throw-out bearing, which takes the load when the clutch is depressed, is usually the sealed-for-life type. If it is engaged for extended periods—as at traffic lights—the lube is soon used up, and failure of this vital part results.

*"My '63 Dodge V-8 will stall as many as five or six times in damp or rainy weather. The Chrysler people said they replaced the entire carburetor and choke linkage, but I still stall. We could sure use your help."*

RON BROWNING, Overland Park, Kan.

It's pretty hard to pin down the trouble at this distance, but I would start by examining the air cleaner for wetness. If the carb acts normal in dry weather, I doubt the humidity gain there in rainy weather would cause it to act up. Have the ignition system, particularly the coil and high-voltage side, and distributor cap checked closely for leakage due to moisture.

*"The safety-belt buckle on the driver's side of my '65 Chevy has slipped ever since I bought the car new. The dealer claims to have changed*

*Continued*

# FINCO-AXIAL<sup>®</sup>

## COLOR-KIT

VHF • UHF • FM • PASSES AC & DC



### FINCO-AXIAL COLOR-KIT, Model 7512 AB

High performance Indoor and Outdoor Matching Transformers convert old-fashioned and inefficient 300 ohm hook-ups to the new Finco-Axial 75 ohm color reception system.

List price for complete kit . . .  
7512AB . . . . . \$8.95

7512-A Mast mounted matching transformer . . . list \$5.40

7512-B TV Set mounted matching transformer . . . list \$4.15

### FINCO-AXIAL SHIELDED COLOR CABLE, CX Series

Highest quality, 75 ohm swept coaxial cable (RG 59/U) complete with Type F fittings, weather boot ready for installation.

Available in 25, 50, 75 and 100 foot lengths. List price . . . \$5.55, \$8.65, \$11.50 and \$14.20.

the  
complete  
color TV  
reception  
system

### For the best color TV picture

*eliminates color-fade, ghosting and smearing!  
Improves FM and Stereo, too!*

### QUICK, EASY INSTALLATION

ENJOY brilliant "TV-Studio" color reception today by changing over to the new Finco-Axial Color Reception System. NOW, color fade, ghosts and smears are a thing of the past. Finco-Axial shields color sets against signal loss . . . eliminates outside interference and mismatch problems.

*Bubble packaged on beautiful 4 color card*

Write for Color Brochure #20-349

**THE FINNEY COMPANY 34 WEST INTERSTATE STREET, DEPT. PS BEDFORD, OHIO**

## "Say, Smokey—"

[Continued]

*it once, but it still slips and they refuse to replace it again. If I turn my body either way while driving, it loosens. What can I do?"*

CHARLES D. SIBLE, Warren, Mich.

Get a new belt from GM installed right away, no matter who pays for it. I don't believe that buckle can be adjusted. A good belt will not slip. It tends to tighten under pressure. You may want to write Chevy's Customer Relations, General Motors Bldg., Detroit 2, Mich. Make sure you save the old belt to show them.

*"The standard transmission on my '62 Falcon has failed four times in less than 40,000 miles. Each time, the garage tells me that the cause is lock-ring failure. Then they install numerous parts at considerable expense, but the fault remains. There also has been a whine, apparently from the drive shaft, ever since the car was new. Any suggestions?"*

D. L. TALBOT, Ottawa, Canada.

You would be better off to put in a new, updated transmission. I believe the original is short of beef in that model. It may seem like the expensive way out, but the other method—going through all the service bulletins and parts books for heavier replacement parts—could cost plenty, too. Whatever you do, ask for an alignment check of the bell housing and flywheel in

the mounting of your Falcon's transmission.

*"My daughter's '61 Chevy with standard transmission has about 80,000 miles on it. She has never had even a valve job. But she has had at least a half-dozen coils installed, never by the same garage. I've owned Chevies all my life and never installed a new coil. What's up?"*

PAUL FEHER, Lansing, Mich.

Usually coils start failing from wiring, polarity, or too low or high voltage. Look for voltage trouble. Check ignition during starting and normal running, not just at idle.

*"My '61 Plymouth jerks badly under load or during acceleration, though it's hardly noticeable under no load. I replaced a cracked distributor cap, which helped some but didn't end the trouble. Have you got a fix?"*

DON ANDREWS, Scribner, Neb.

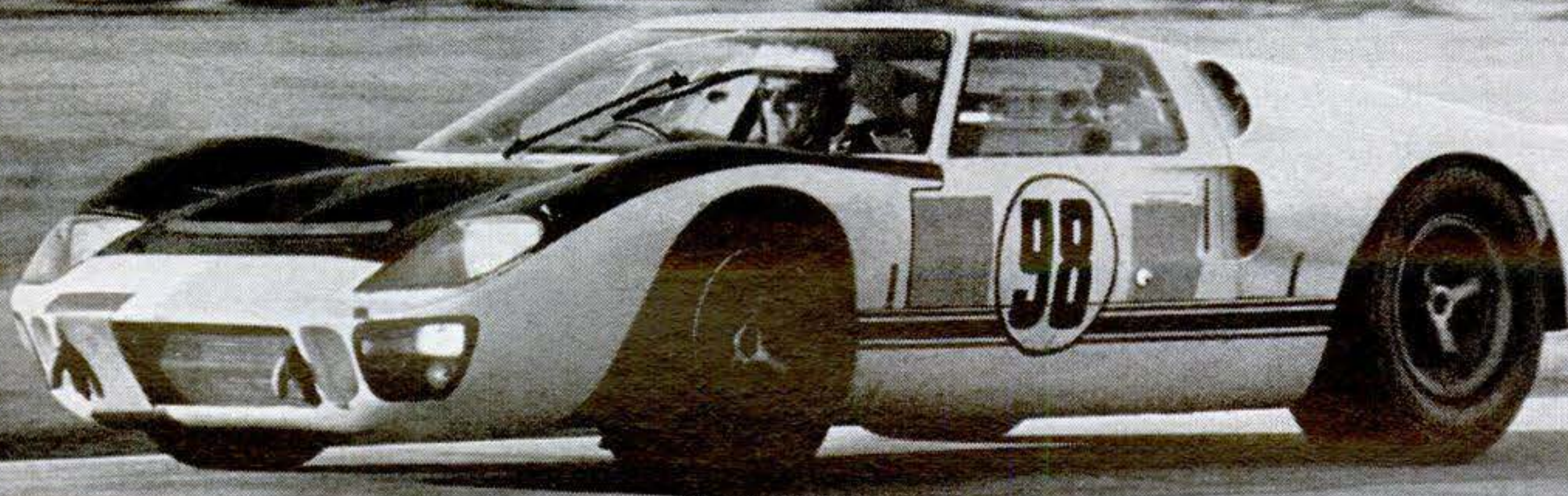
Sounds like one or more cylinders have bad plugs that aren't doing their share under load. A sure fix is to put it under a Sun 'scope and load it a little. You'll get the message.

Got a question on autos? Send it to:

"Say, Smokey—" POPULAR SCIENCE

355 Lexington Ave., New York, N.Y. 10017.

Not every question may be used. Questions cannot be answered by individual letters.



## Look what we've gotten ourselves into!

The Ford GTs that finished 1-2-3 at the 1966 Daytona Continental.

And the Ferrari that won the 1965 Le Mans.

The same 240-A electric fuel pump is available at your local garage, speed shop, or automotive parts store.

Need we say more?



240-A electric fuel pump

**S-W**  
**STEWART-WARNER** 

INSTRUMENT DIVISION

1840 Diversey Parkway, Chicago, Illinois 60614

# Would you believe there's a convertible rear window that won't discolor, resists scratching? Ford Motor Company has it!



A Ford first—convertible rear windows made of pliant, clear glass!

Take a seat in this '66 Ford-built convertible. Look behind you and you'll see one reason why people have come to expect the new ideas from Ford. The rear window in Fairlane, Comet, Ford, Mercury and Lincoln Continental convertibles is clear glass: a Ford *innovation*. Introduced in 1964, all-glass convertible rear windows won't yellow, wrinkle or rip and resist scratching. What's more, you don't have to unzip them to enjoy top-down travel. Made of special tempered glass, they *bend* as you lower the top. And because they're pliant (actually can take a 45° twist) these windows withstand shock and strain that would crack ordinary glass!

Other bright ideas you'll find in many Ford-built convertibles: top raising and lowering gear of exclusive low-friction design to produce long-lasting smooth operation, put less strain on batteries, save 40% of the effort. Special top-bow clips that prevent unsightly ballooning at turnpike speeds. Super-tough 5-ply top fabrics with heat-sealed seams and soil-resistant vinyl topcoating.

Take a look today at the latest fashions and features in convertibles! You'll find them at your Ford and Lincoln-Mercury dealers.



# Science Newsfront

Last-minute news and notes to keep you up-to-date

By W. STEVENSON BACON

## Personal flying belt wins patent

A Buck Rogers flying belt using a turbojet engine has been patented by Bell Aerospace Corp. engineers Wendell F. Moore and John K. Hulbert. Unlike the rocket belt introduced by Bell [see "James Bond's Weird World of Inventions," Jan.], the jet belt is intended for sustained flying over relatively long distances. Its turbojet engine is mounted vertically on a corset-like assembly. Exhaust is channeled equally through two nozzles pointed downward at the operator's shoulder level. The engine uses conventional jet fuel. The patent also covers the throttle mechanism, directional control, pitch-trim control, and fuel-supply warning system.

## Dirty oil for new engines?

Dirty oil with a lot of solid matter may actually be better for breaking in an engine than clean lubricant—at least according to Russian scientist V. A. Lelyuk. In tests with single-cylinder engines in which friction between bore and piston was measured with special equipment, he found that the lubricating qualities of certain oils actually increase with dirtiness under extreme friction conditions. New engines ran cooler with used oil than with clean oil. No difference in surface quality—the microscopic smoothness of piston and bore surfaces—was found between engines broken in with new oils and those broken in with used oils.

## Branding cattle with a cold iron

The red-hot branding iron, a time-honored cowboy tradition, is obsolete: Better results can be obtained by branding animals with superchilled metal brands. In research for the U.S. Department of Agriculture, Dr. R. Keith Farrell has found that cold branding is painless, causes less hide damage, and makes it possible to spot brands from a distance, since there is a growth of white hair and skin over them. Branding is done with a copper brand chilled in a dry-ice-alcohol bath to  $-158$  degrees.

## Beepers for lost H-bombs?

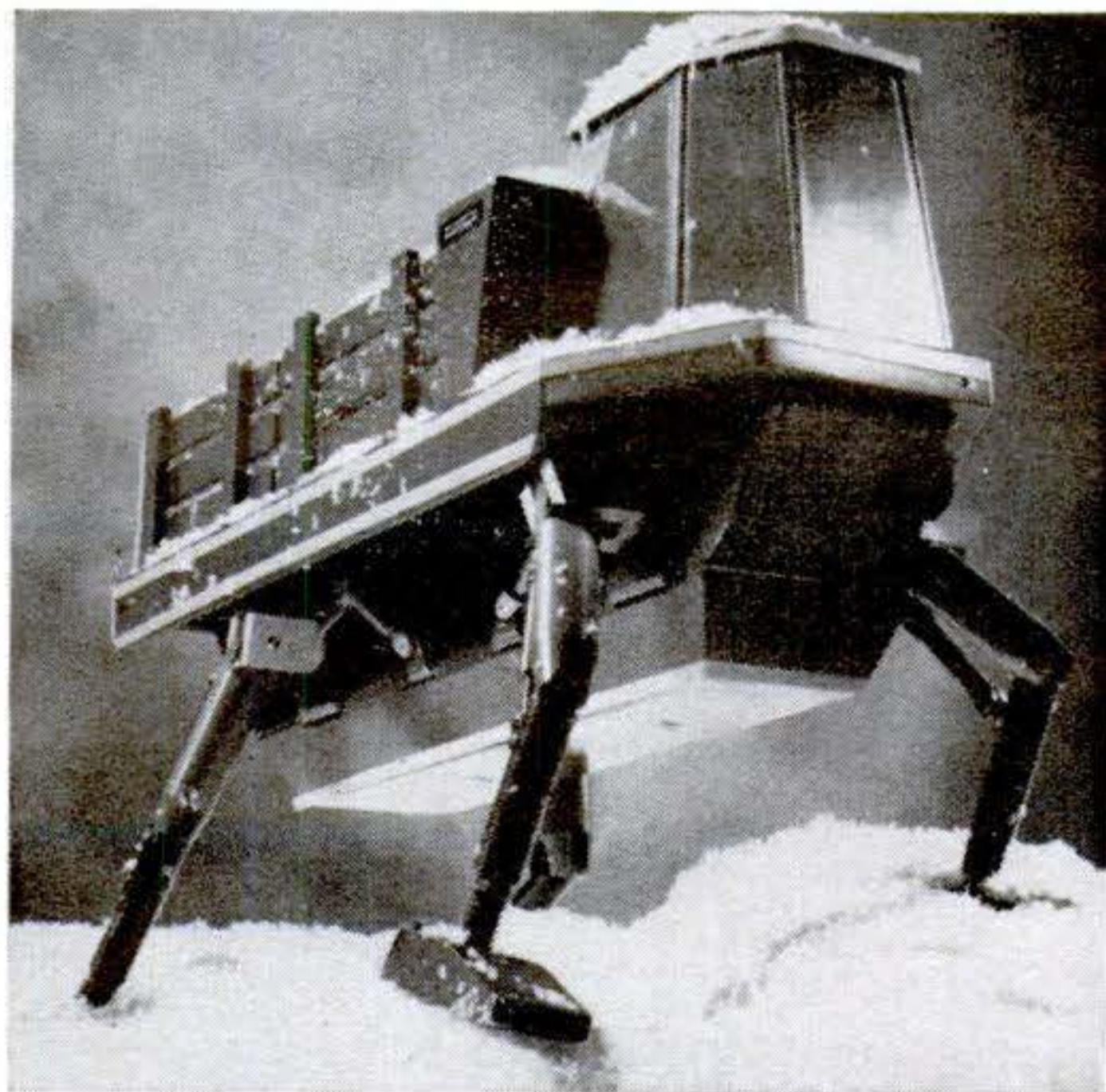
In the wake of the loss and subsequent recovery of four hydrogen bombs over Spain [see page 86], the Air Force is reported to be considering attaching miniature beeper transmitters to the weapons to aid in locating them in the event of an accident. Different kinds of devices might be combined: a homing trans-

mitter of the type now carried by military aircraft to aid search-and-rescue efforts along with an electronic transducer which would emit sonar "pings" for pinpointing a bomb underwater.

## Light dimmers for electric lamps

Simple dimmers for electric lamps that fit right into a standard lamp socket and give stepless control from full bright to dim will be standard home equipment in the near future. The dimmers would use a built-in potentiometer with a switch in place of the simple on-off switch now used. Miniature solid-state electronic circuitry would be built into the socket. Key to the lamp-dimmer device may be a tiny, low-cost (less than \$1) "sensitive-gate Triac" recently announced by RCA. It would be used in a circuit similar to one utilized for controlling tool speed that was published in the November, 1965, issue of PS.

*Continued*



A walking cargo truck that looks like a huge insect is the latest of a series of man-amplification devices under development by GE for the Army. The first such device with four legs, it acts as an extension of the driver, who attaches controls for front "legs" to his arms, controls for rear legs to his own legs. By moving his limbs, he moves the truck over any terrain at five m.p.h. He feels what the machine "feels," can place "feet" on solid ground. The truck is 10 feet tall, 10 long, four wide.



## REDWOOD FINISH FOR ALL WOODS!

Seals and colors  
in one coat

Allows natural  
grain to show

Beautifies interiors  
and exteriors



## REDWOODIZER

*in pints,  
quarts and gallons*

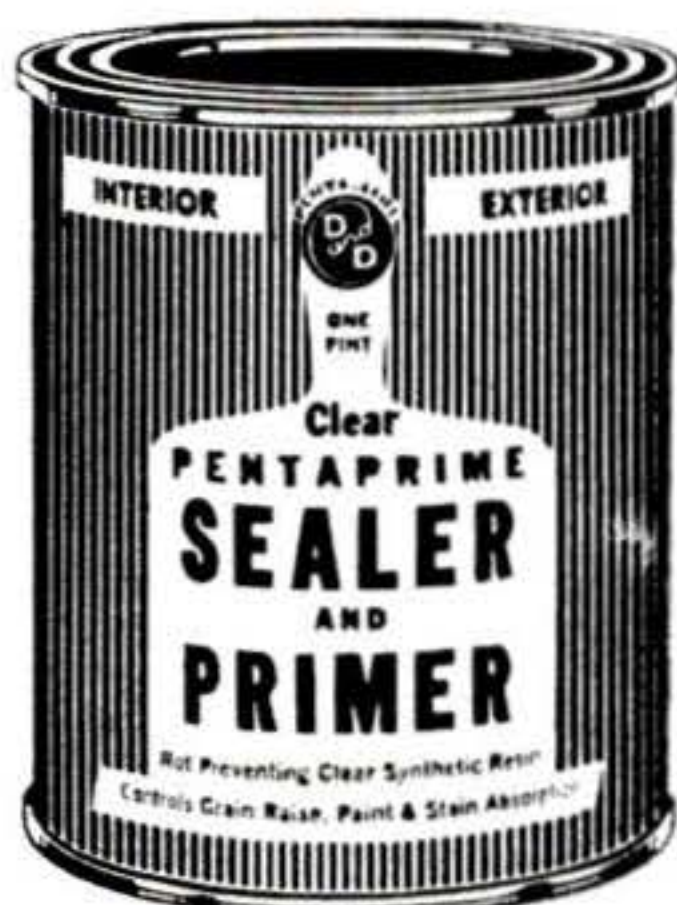
Now—rich redwood glamour on Philippine mahogany, cypress, cedar and other woods! REDWOODIZER even makes redwood handsomer! With Penta protection from rot and insects. Seals out moisture; kills termites and fungus. For new wood or over old finishes.

## PERFECT SEALER FOR PLYWOOD!

Controls "wild grain"

Provides hard coating  
as base for finish

Prevents rot and  
insect damage



## PENTAPRIME

*in pints,  
quarts and gallons*

Seal, prime, protect—in one easy step! PENTAPRIME seals moisture out, primes and equalizes surface porosity for even painting or staining over hard or soft grain areas; controls grain raise. Prevents fungus growth, rot, attack by termites and other wood borers.

## SCUFF-TOUGH FLOOR FINISH!

Gyms, hallways,  
heavy-traffic areas

Flows easily,  
dries fast and hard

Glass-smooth,  
high gloss for all wood



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So then and there Bob made up his mind to get out of the rut he was in. He read an ad for International Correspondence

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Clip this coupon now. Mail it at once. You'll receive 3 valuable booklets—free. They'll prove to you that Bob Jones' success story can be yours!

\*The true story of Robert E. Jones, Houston, Texas. From the success files of I.C.S.

**More than 7,000,000 men and women have already enrolled with I.C.S.**

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- Carpentry & Millwork
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- Reading Arch. Blueprints
- Refrigeration, Air Conditioning

### ART and DESIGN

- Commercial Art
- Interior Decorating
- Sign Painting & Design
- Sketching & Painting

### AUTOMOTIVE

- Auto Mechanic-Technician
- Body Rebuilding, Refinishing
- Electrical Technician
- Engine Tune-Up
- Transmission Specialist

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- Advertising
- Business Administration
- Canadian Business Courses
- Cost Accounting
- Gen'l Accounting
- Industrial Psychology
- Managing a Small Store
- Practical Accounting
- Programming for Digital Computers
- Programming the 1401
- Public Accounting
- Purchasing Agent

- Real Estate Sales
- Retail Business Mgmt.
- Salesmanship
- Sales Management
- Traffic Management

### CHEMICAL

- Analytical Chemistry
- Chem. Engineering
- Gen'l Chemistry
- Chem. Lab. Technician
- Plastics Technician

### CIVIL ENGINEERING

- Civil Engineering
- Construction Eng'n'ng
- Highway Engineering
- Sewage Plant Op'r
- Structural Engineering
- Surveying & Mapping
- Water Works Operator

### DRAFTING

- Architectural
- Drafting Technology

- Electrical and Electronic
- Mechanical
- Structural

### ELECTRICAL

- Appliance Servicing
- Elec. Eng. Technician
- Ind. Elect. Technician
- Motor Repairman
- Practical Electrician
- Practical Lineman
- Reading Electrical Blueprints

### ELECTRONICS

- Electronic Computers
- Electronics Fundamentals
- Electronics Technician
- General Electronics
- Industrial Electronics
- Practical Telephony

### ENGINEERING (Professional)

- Chemical
- Civil

- Electrical
- Mechanical
- Math & Mechanics for Engineering

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- High School Business
- High School (Canadian)
- High School General
- High School Math
- High School Secretarial
- High School Vocational
- College Preparatory

### LANGUAGES

- (Edited by Berlitz)
- French
- German
- Italian
- Spanish

### MECHANICAL and SHOP

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- Industrial Engineering
- Ind. Instrumentation
- Machine Design
- Machine Shop Practice
- Quality Control

- Reading Shop Prints
- Tool Design

### SECRETARIAL

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- Professional Secretary
- Shorthand
- Stenographic
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- Steam Engineering

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Address \_\_\_\_\_

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Auditing  
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Cost Accounting  
C.P.A. Review  
Estate & Trust Accounting  
Executive Accounting  
Federal Tax  
General Accounting  
Industrial Accounting  
Junior Accounting  
Legal Accounting  
Office Accounting  
Personal Income Tax & Social Security  
Practical Accounting  
Public Accounting  
Small Business Accounting  
Starting & Managing a Small Bookkeeping Service

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Architecture  
Building Contractor  
Building Estimator  
Building Inspector  
Building Maintenance  
Carpenter-BUILDER  
Carpentry & Millwork  
House Planning & Interior Design  
Mason  
Painting Contractor  
Reading Arch. Blueprints  
Review in Arch. Design & Practice  
Review of Mech. Systems in Buildings

## ART

Amateur Artist  
Commercial Art  
Commercial Cartooning  
Interior Decorating  
Oil Painting for Pleasure  
Show Card & Sign Prod.  
Show Card Writing  
Sign Painting & Designing  
Sketching & Painting

## AUTOMOTIVE

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Automobile Body Rebuilding & Refinishing  
Automobile Electrical Tech.  
Automobile Engine Tune-Up

Automobile Technician  
Automotive Mechanic  
Diesel-Gas Motor Vehicle Engines

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Business Administration  
Business Management & Marketing  
Business Management & Production  
Canadian Business Courses  
COBOL Programming  
Condensed Business Practice  
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Industrial Psychology  
Magazine & Newspaper Advertising  
Managing a Small Store  
Marketing  
Marketing Research  
Modern Executive Management  
Office Automation  
Office Management  
Programming for Digital Computers  
Programming the IBM 1401 Computer  
Purchasing Agent  
Retail Business Management  
Retail & Local Advertising  
Retail Merchandising  
Retail Selling  
Systems and Procedures Analysis

## CHEMICAL

Analytical Chemistry  
Chemical Engineering  
Chemical Engineering Unit Operations  
Chemical Laboratory Tech.  
Chemical Process Operator  
Elements of Nuclear Energy  
General Chemistry  
Instrumental Laboratory Analysis

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Construction Engineering  
Highway Engineering  
Principles of Surveying  
Reading Highway Blueprints  
Sanitary Engineering  
Sewage Plant Operator

Structural Engineering  
Surveying and Mapping  
Water Works Operator

## DRAFTING

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Design Drafting  
Drafting Technology  
Electrical Drafting  
Electrical Engineering Drafting  
Electronic Drafting  
Introductory Mechanical Drafting  
Mechanical Drafting  
Pressure Vessel and Tank Print Reading  
Sheet Metal Layout for Air Conditioning  
Structural Drafting

## ELECTRICAL

Electric Motor Repairman  
Electrical Appliance Servicing  
Electrical Contractor  
Electrical Engineering (Power option or Electronic option)  
Electrical Engineering Tech.  
Electrical Instrument Tech.  
Industrial Electrical Tech.  
Power Line Design and Construction  
Power Plant Operator (Hydro or Steam Option)  
Practical Electrician  
Practical Lineman  
Reading Electrical Blueprints

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Italian Spanish

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Basic Supervision  
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Industrial Supervision  
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Mathematics and Physics for Engineering  
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Industrial Engineering  
Industrial Instrumentation  
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Mechanical Engineering  
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Safety Engineering Tech.  
Tool Design  
Value Analysis

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Oil Field Technology  
Petroleum Production  
Petroleum Production Engineering  
Petroleum Refinery Oper.  
Pipeline Engineering

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Plastics Technician

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Air Conditioning  
Air Conditioning Maint.  
Domestic Heating with Oil & Gas  
Domestic Refrigeration Heating  
Heating & Air Conditioning with Drawing  
Industrial Air Conditioning

Industrial Heating  
Plumbing

Plumbing & Heating  
Practical Plumbing  
Refrigeration  
Refrigeration & Air Conditioning  
Steam Fitting

## PULP AND PAPER

Paper Machine Operator  
Paper Making  
Pulp Making  
Pulp & Paper Engineering  
Pulp & Paper Making

## SALESMANSHIP

Creative Salesmanship  
Real Estate Salesmanship  
Sales Management  
Salesmanship

## SECRETARIAL

Clerk-Typist  
Commercial  
Legal Secretary  
Medical Secretary  
Professional Secretary  
Shorthand  
Stenographic  
Typewriting

## SHOP PRACTICE

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Foundry Practice  
Industrial Metallurgy  
Lathe Operator  
Machine Shop Inspection  
Machine Shop Practice  
Machine Shop Practice & Toolmaking  
Metallurgical Engineering Technology  
Milling Machine Operator  
Multicraft Maintenance Mechanic  
Practical Millwrighting  
Reading Shop Prints  
Rigging  
Tool Engineering Techn'gy  
Tool Grinder  
Toolmaking  
Turret Lathe Operator  
Welding Engineering Tech.

## STEAM AND DIESEL POWER

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Industrial Building Engineer  
Power Plant Engineering  
Stationary Diesel Engines  
Stationary Fireman  
Stationary Steam Eng.

## TEXTILES

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Loom Fixing Spinning  
Textile Designing  
Textile Technology  
Textile Mill Supervisor  
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## TRAFFIC

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Railway Rate Clerk  
Traffic Management

## TV-RADIO-ELECTRONICS

Communications Techn'gy  
Electronic Fundamentals  
Electronic Fundamentals (Programed)  
Electronic Fundamentals with Electr. Equip. Tr'n'g  
Electronic Instrumentation & Servo Fundamentals  
Electronic Principles for Automation  
Electronics and Applied Calculus  
Electronics Technician  
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Fundamentals of Electronic Computers  
General Electronics  
General Electronics with Electronic Equip. Tr'n'g  
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Industrial Electronics Engineering  
Industrial Electronics Engineering Technician  
Practical Radio-TV Eng'r'g  
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**Full-color 3-D "windows"**

Color pictures that look real enough to step into may decorate your living room as a result of new developments in holography, a system of lensless photography that makes use of coherent (all of one wavelength) laser light to both take pictures and reproduce them. By developing a technique that uses the thickness of the film as well as its surface area to record laser photos, Prof. George Stroke and A. E. Labeyrie of the University of Michigan have created true 3-D pictures that can be viewed with ordinary, noncoherent light, although a laser must be used to make them. By using two laser beams of different colors, the resulting holograms appear in full color.

**Mind over matter**

Why do some persons catch influenza while others never seem to become infected? It's probably due to superior mental resistance to disease, Army research indicates. In tests conducted at the Army Biological Laboratories, Fort Detrick, Md., and reported by the American Medical Association, 96 men out of a group of 480 were found to be "psychologically vulnerable" to illness. Another 78 were termed "intermediates," while 306 of the men were classed as psychologically "nonvulnerable." When an outbreak of Asian flu struck, "vulnerable" men reported illness almost 2½ times as frequently as "nonvulnerables."

**Air bag to carry seven at 35 m.p.h.**

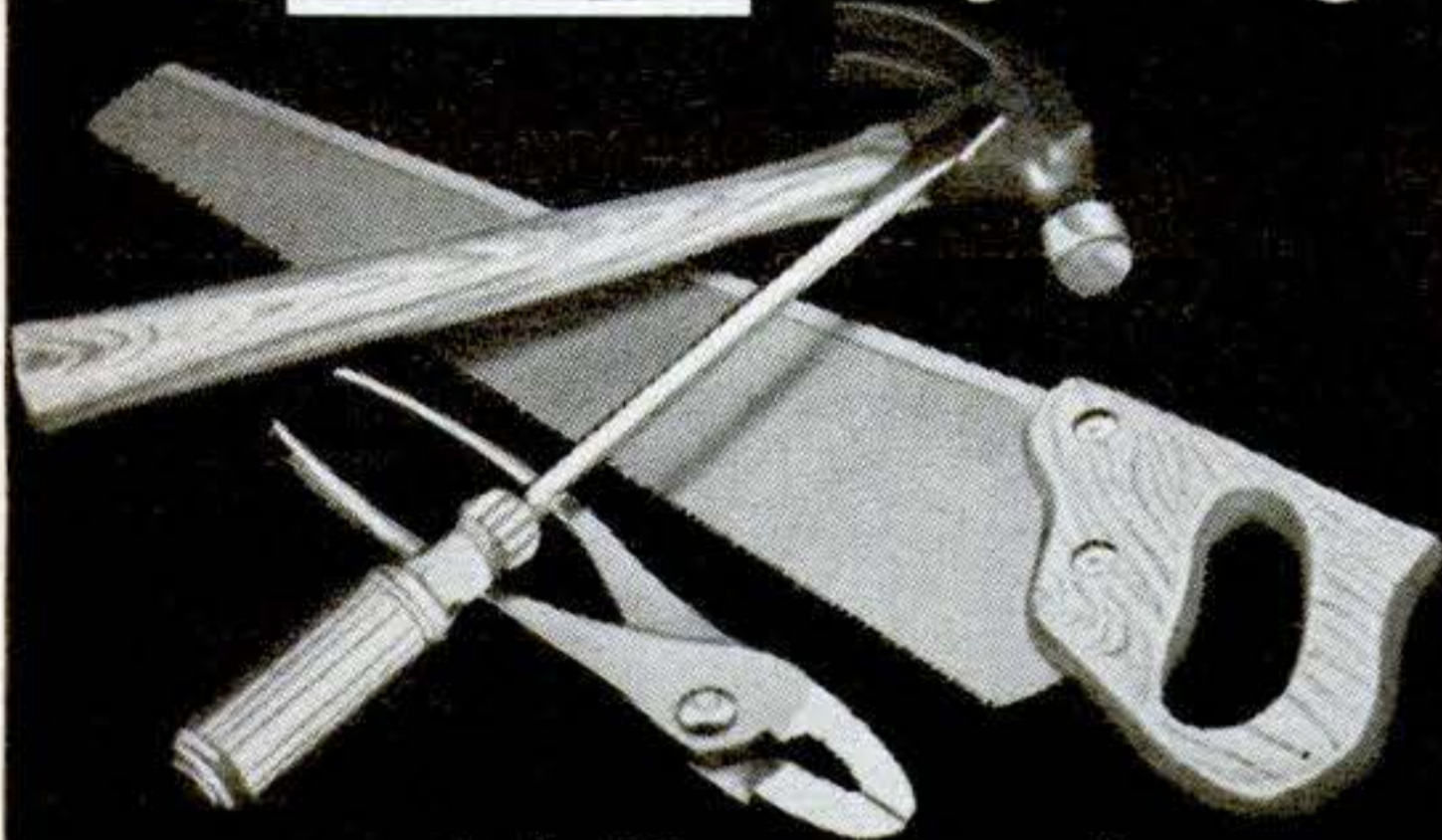
An inflatable hovercraft powered by two small gasoline engines that blow it up like a vacuum-cleaner bag has been demonstrated by Britain's Ministry of Aviation. The lightweight 150-pound vehicle, which can be stored in a car trunk when deflated, is made of two-ply rubberized cotton, a material first developed for skirts for conventional hovercraft. The skirt was so successful that experts decided to give it its own power source. The first test vehicle can be accurately controlled, and has been driven over all types of surfaces including parked cars. It is portable and can be carried or parachuted into jungles, swamps, and other remote areas.

**Ion beam may improve telescopes**

Giant, distortion-free telescopes better than any built to date are expected to result from the accidental discovery that a beam of charged particles can be used to give a telescope mirror a microscopically smooth polish. In tests of a new atomic accelerator at the University of Arizona, a beam of ionized particles was accidentally directed at a piece of polished silica. Later checking showed that the beam had improved the polish of the glass. Drs. A. B. Meinel, S. Bashkin, and A. Loomis, who made

*Continued*

With these you can  
do almost anything



add this and  
do everything

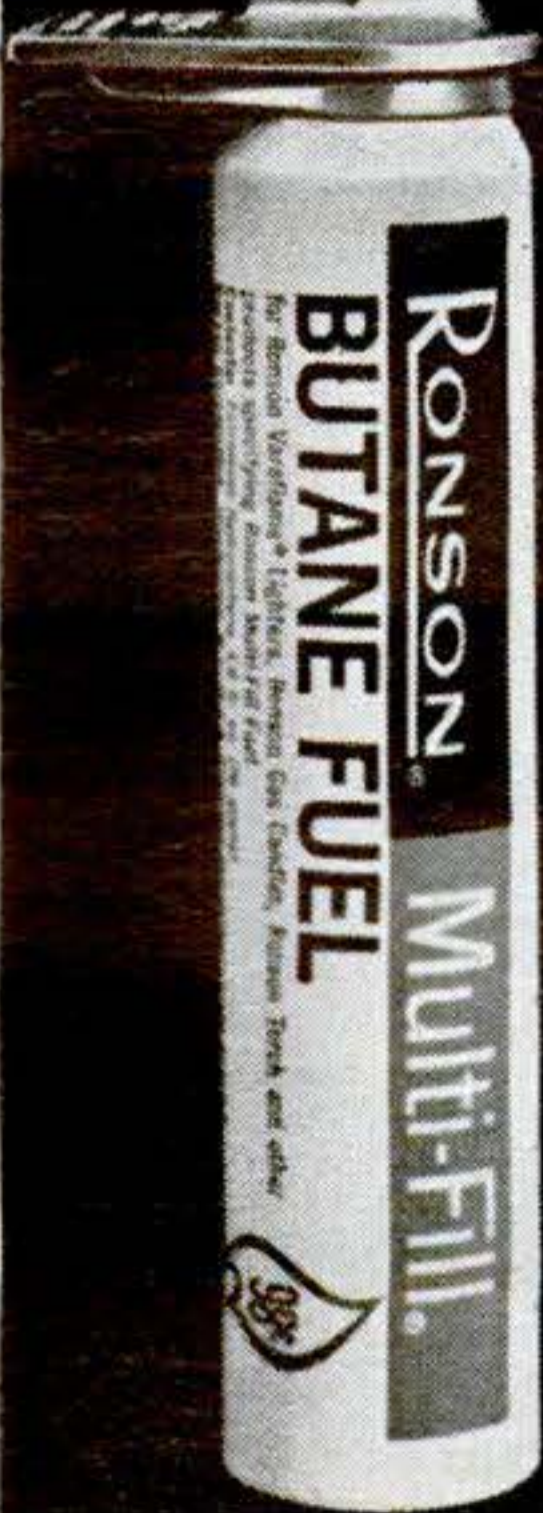
Remove paint . . . Lay floor tiles . . . Soften putty . . . Bend glass tubing . . . Hard or soft-solder metals . . . Sweat pipes . . . Start charcoal fires . . . Perform hundreds of household, hobby, and laboratory jobs.

The new Ronson Varaf flame Torch adjusts from pinpoint to blowtorch flame. Easy to handle. Comes with Multi-Fill® Butane Gas Injector (available everywhere), and big instruction/idea booklet.

**\$4.95\***  
**RONSON**  
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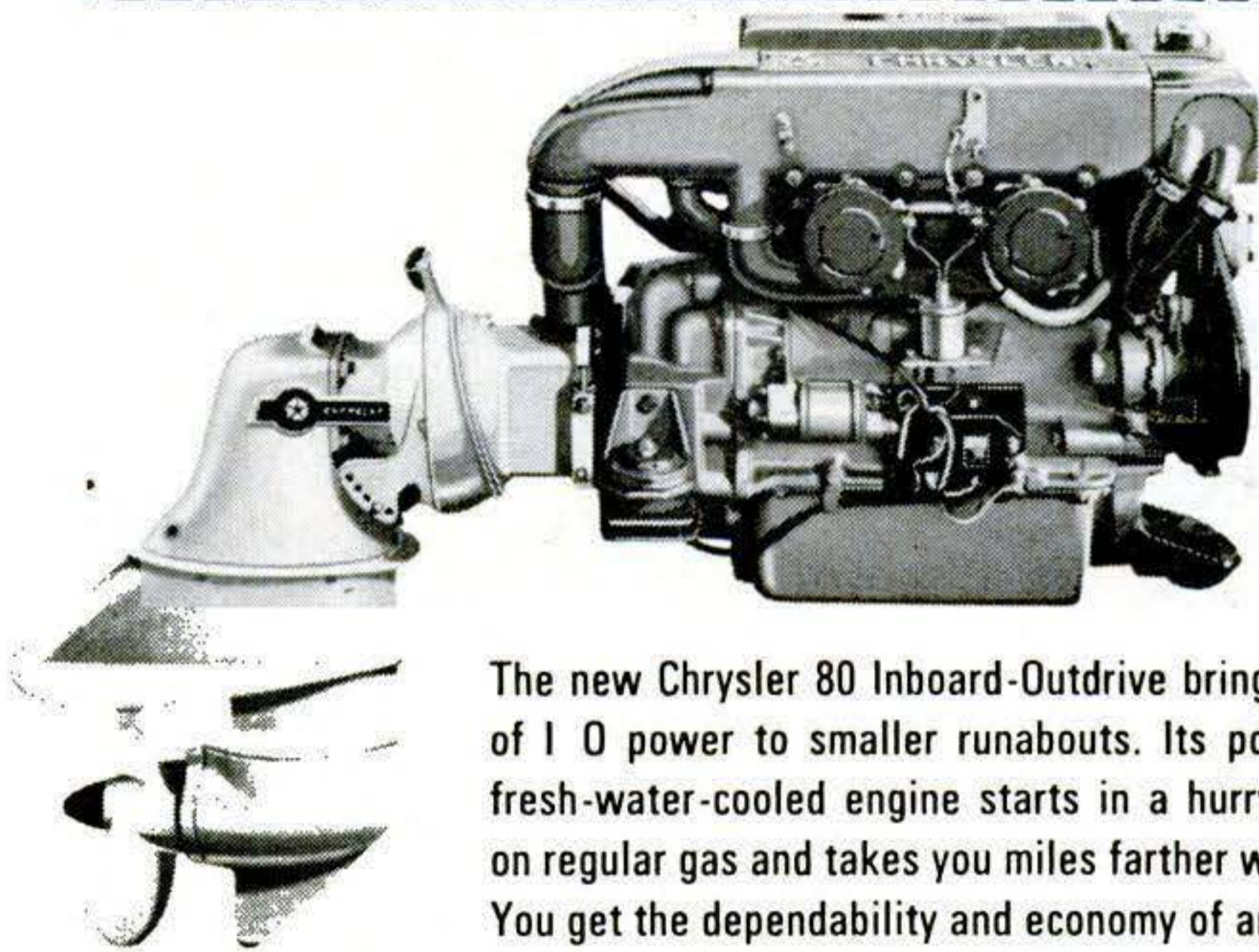
Ronson Corp.  
Woodbridge,  
New Jersey

\* Suggested Retail Price.  
Available in Canada.



**WHAT FITS IN 14, 15, 16-FOOT  
RUNABOUTS, STARTS LIKE "GO",  
RUNS ON REGULAR GAS, HYPOS  
YOUR CRUISING RANGE AND  
GIVES YOU THE FEELING YOU'RE  
CAPTAINING A PT BOAT?**

**ME.**



**CHRYSLER 80 INBOARD-OUT-DRIVE.** 80 hp., 4-cylinder, 4-cycle, fresh-water-cooled engine; 91 cu. in. displ.; 2-1 bbl. carburetors; compr. ratio 8.6:1. Single transom hole mounting. Weight complete : 350 lbs.

The new Chrysler 80 Inboard-Outdrive brings all of the advantages of I O power to smaller runabouts. Its powerful 80 hp., 4-cycle, fresh-water-cooled engine starts in a hurry, purrs like a pussycat on regular gas and takes you miles farther without stopping for fuel. You get the dependability and economy of an inboard combined with the maneuverability, roominess and trailerability of an outboard.

Say good-bye to gas-oil mixes, konk-outs and paddles. When you put a Chrysler 80 in a 14, 15 or 16-foot runabout, you're going first class!

And that's not all! The new Chrysler 80 is just *one* of a great line of Chrysler Inboard-Outdrives (see below). Ask about them at your boat dealer. Order one in your next boat!



Chrysler I'O's come in 11 models, 8 horsepower ratings:



CHRYSLER 80    VOLVO 110 AQUAMATIC    VOLVO 110 COMMANDO    SPACE SAVER 145 DRIVE 90\*    SUPER CROWN 150 DRIVE 90\*    SUPER CROWN 180 COMMANDO-DRIVE    COMMANDO 175 COMMANDO-DRIVE    COMMANDO 175 DRIVE 90\*    COMMANDO 185 DRIVE 90\*    FURY 210 DRIVE 90\*    FURY 235 DRIVE 90\*



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Revelation is for pipe smokers who're tired of sweet, syrupy blends. You get the rich *naturally* mellow flavor of five great tobaccos. It's a taste you can stick with all day long.

## Revelation is for the experienced pipe smoker.



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the discovery, estimate that each ion in the beam removed one atom of glass—a precision heretofore unheard of in mirror polishing.

### Electric motor starts, stops, instantly

A new type of electric motor that can start, stop, and change speed almost instantly has been developed by Dr. David E. Wiegand of Argonne National Laboratory. The motor consists of two stationary core sections, one outside and the other inside, a thin, lightweight aluminum sleeve. The sleeve is the only rotating part, eliminating the heavy rotor used in conventional electric motors. The motor is expected to find use in servomechanisms and other devices such as mechanical "hands" or manipulators.

### New process promises cheap aluminum

Cheap aluminum may replace steel for ship hulls, bridges, and other heavy construction if a recently patented process for making the metal is perfected. Aluminum is expensive to make because it requires great quantities of electrical power—traditionally, low-voltage direct current at high amperage—to separate aluminum from bauxite ore. According to Isaac M. Diller of Westport, Conn., inventor and industrial physicist, the amount of power required can be cut in half by using high-energy discharges of millions of watts at from 1,000 to 5,000 volts. The pulses start a chain reaction in the alumina solution, and the reduction of aluminum continues for many hours afterward.

### Do loud noises bother you?

The teen-ager who turns up the sound of a record player or TV while studying apparently knows what he, or she, is doing. This is the conclusion of University of Southern California researchers who gave 211 high-school students a verbal-reasoning test while blasting recorded playground noises at them at 85 decibels from speakers around the room (85 decibels might be compared to a symphony orchestra during a crescendo). Although the noise level was disturbing to adults, the students did just as well in the test as a control group tested in a quiet room.

### Air Force tests upward bombing

An ejection system that would throw bombs straight up 150 feet or more from an attacking plane is under study by the Air Force. Like previous toss-bombing techniques, upward ejection would permit bombers to attack at extremely low altitudes to avoid radar and still escape the blast of even a nuclear bomb. In tests now under way at Holloman Air Force Base, N.M., dummy bombs are being ejected 150 feet above a rocket sled traveling up to twice the speed of sound.

PS

# Win \$100, enter the Pliobond "Stickup"

Send us the most interesting use of the month for Pliobond® and we'll send you back \$100.

Some hints. Pliobond is a rubber-based adhesive. It can seal and coat. Joins wood to metal to glass to cloth to rubber. Virtually anything to anything.

Forms a tough flexible bond that resists impact, oil, oxygen, water, many solvents and chemicals. Actually grows stronger with age.

Still stuck? Pliobond can mend, waterproof, insulate, or reinforce just about anything around the home, or cars, in workshops.

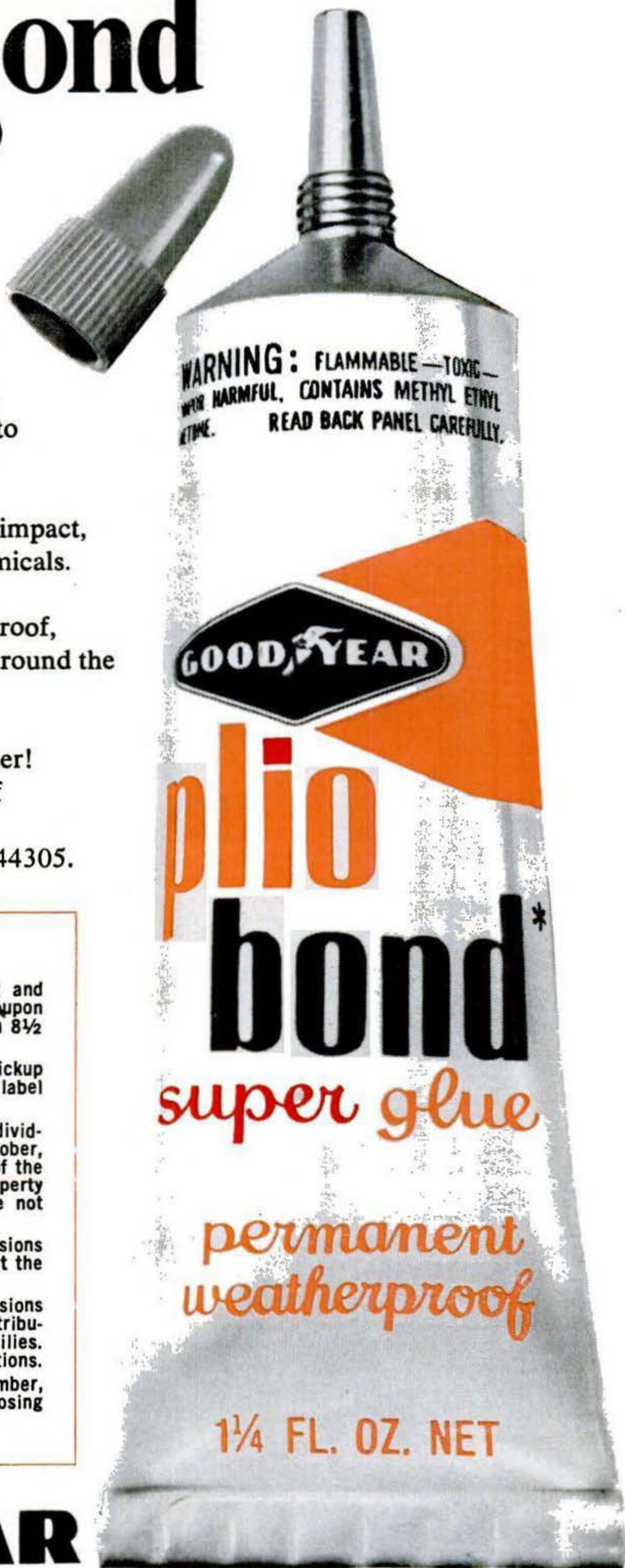
You take it from there. Send us a brief description of your use—it could be a winner!

Top tip received by last day of month of issue wins \$100. Pliobond Stickup Contest, P. O. Box 9115-PS, Akron, Ohio 44305.

## PLIOBOND "STICKUP" CONTEST RULES

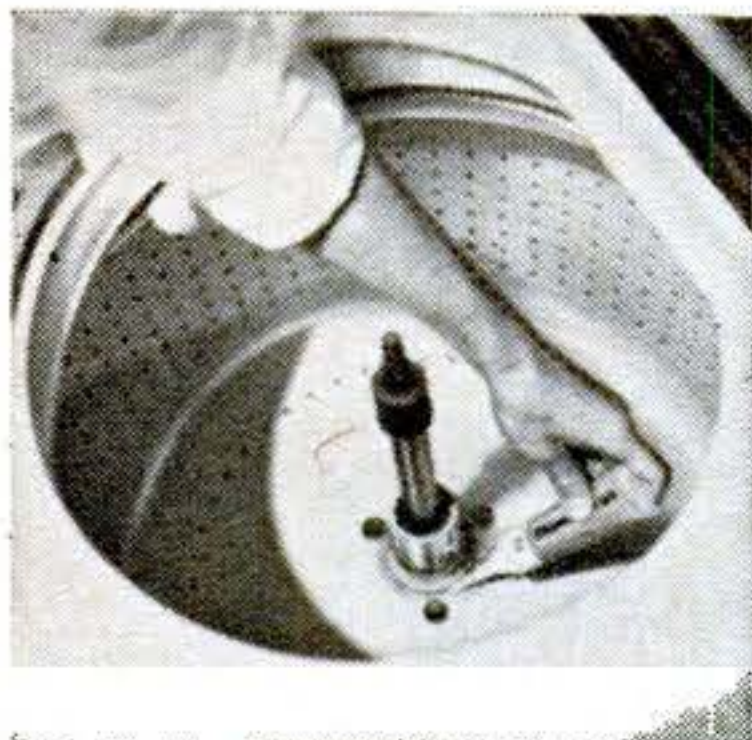
1. Describe in 50 words, or less, an interesting and unique use for Pliobond adhesives. Use an entry coupon from your local store, or plain paper no larger than 8½ x 11 to enter.
2. Send as many entries as you like to Pliobond Stickup Contest, P. O. Box 9115-PS, Akron, Ohio 44305. Send label or other evidence of purchase with each entry.
3. \$100 awards limited to one for each contest. Individual contests run in April, May, June, September, October, 1966. Entries must be postmarked by the last day of the contest in which you enter. All entries become property of The Goodyear Tire & Rubber Company and are not returnable.
4. Entries will be judged by Goodyear and the decisions of Goodyear will be final relating to questions about the contest and winners.
5. Contest open to everyone in the U.S. and possessions and Canada, except employees of Goodyear, the distributors of Pliobond adhesives and their immediate families. Contest subject to Federal and State Local Regulations.
6. All winners will be notified no later than November, 1966. List of winners will be sent on request enclosing self-addressed stamped envelope.

**GOOD YEAR**



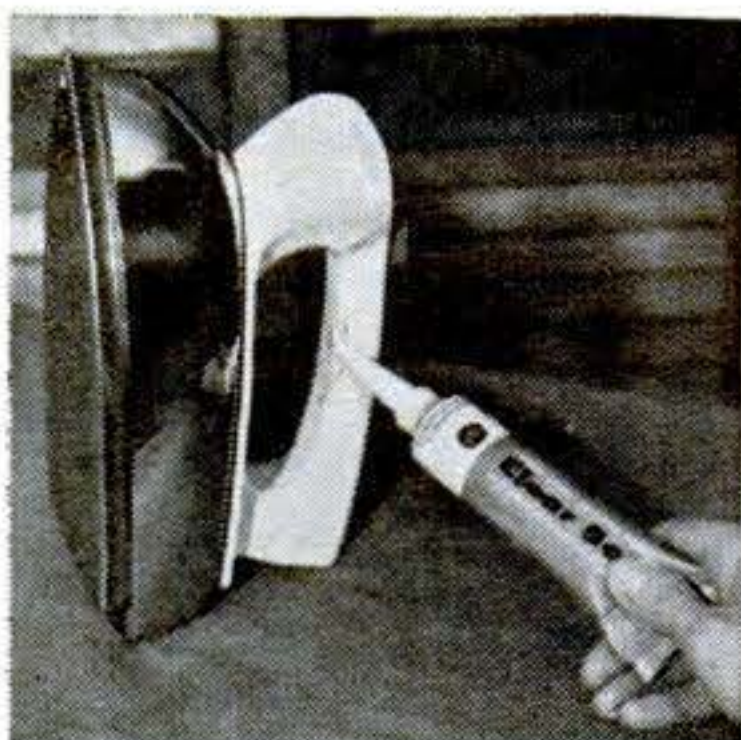


# "Silicone Seal saved me a \$25 repair job..."



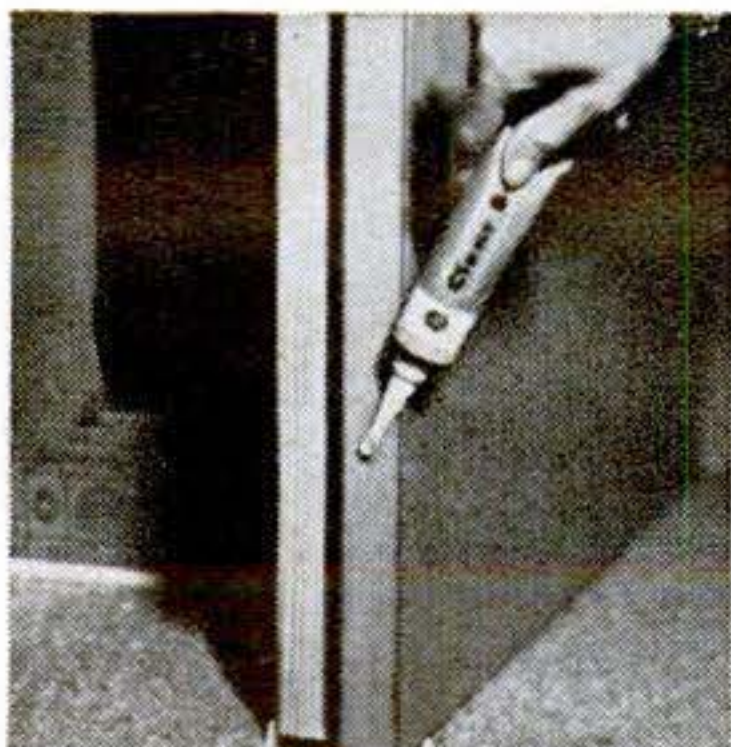
"... Over six months ago, I used it to fix a ripped rubber seal in our washing machine. No leaks since. Saved \$25 replacement cost."

H. C. Bellman  
San Fernando, Cal.



"Repaired a broken iron handle with Clear Silicone Seal. It wears and wears. Also repaired a broken lamp. I wouldn't be without it."

A. Zubuss  
Philadelphia, Pa.



"I used Silicone Seal to cushion the noise of sliding closet doors. Placed dabs near top and bottom to stop bumping and rattling."

B. Crompton  
North Kingstown, R. I.



"After trying every other caulk without success, and replacing tile over the tub four times, we finally solved our caulking problem with Silicone Bathtub Seal."

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**SUPER GLUE!** Silicone Seal bonds to glass, ceramic, wood, metal, fabric, leather and other hard-to-glue materials.

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**"DO-IT-YOURSELF" RUBBER!** Silicone Seal makes flexible door bumpers, protective strips, gaskets, noise and vibration dampeners.

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Tell us about your unusual use for Silicone Seal. If we use it in ads, we'll pay you \$10. All ideas become our property. Write: Section CT-F, Silicone Products Department, General Electric Co., Waterford, N. Y.

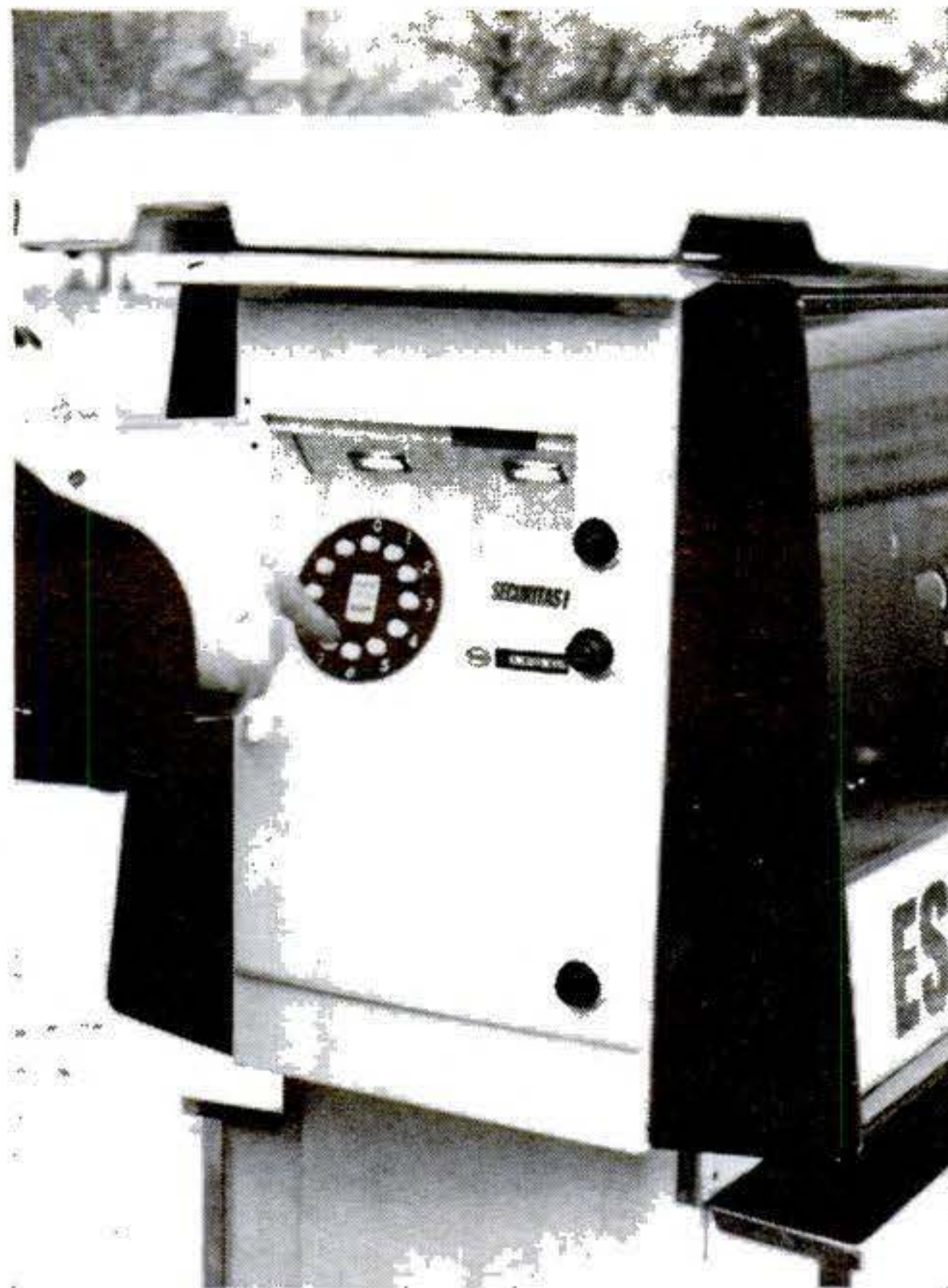


3 oz. and 1 oz. tubes.

**GENERAL  ELECTRIC**

PS

PICTURE NEWS



## Gas pump works on credit card

A motorist in Sweden needs only his credit card to get gas from this self-service, 24-hour-a-day pump. The motorist inserts his card in a slot, records his code number on a ring of pushbuttons, closes the door, and fills up with gas, after which he reopens the door to retrieve his card. He's billed by punched tape in a computer.



## Plywood in racer cuts weight

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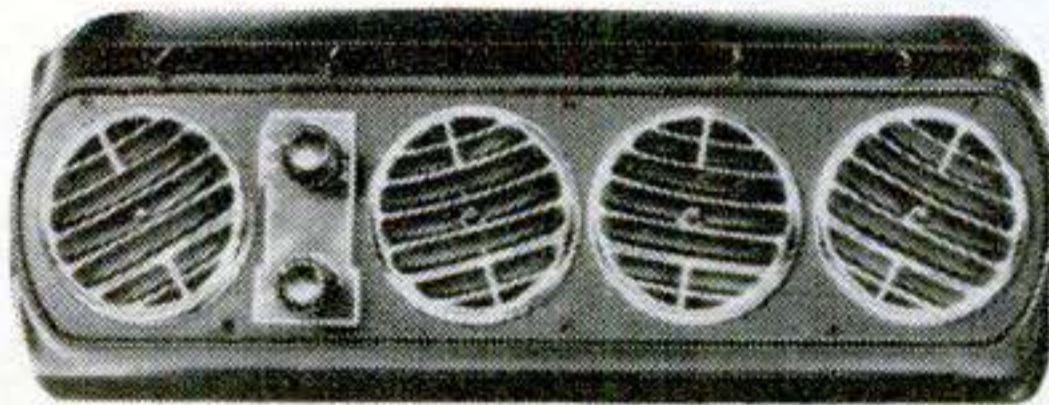
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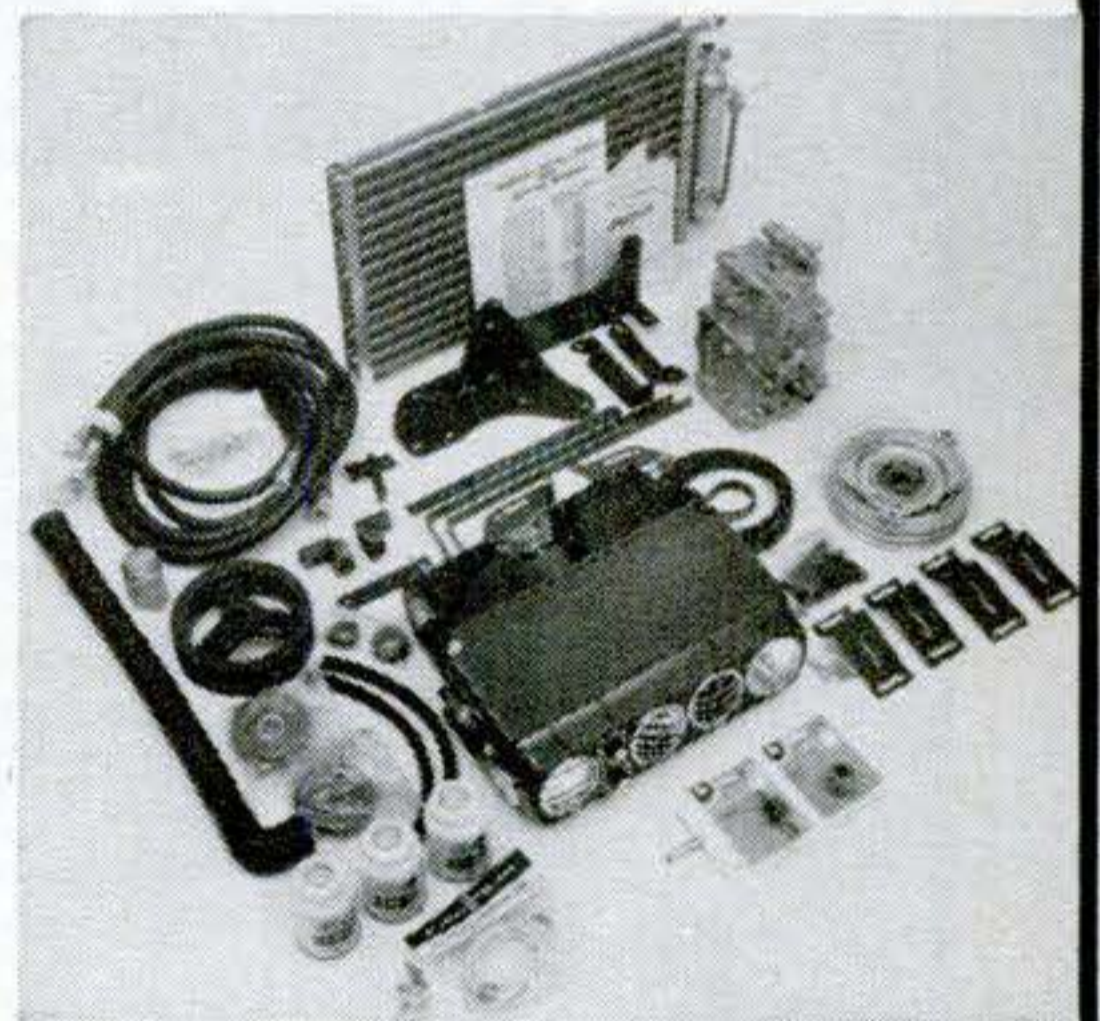
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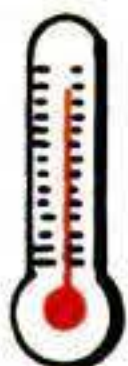
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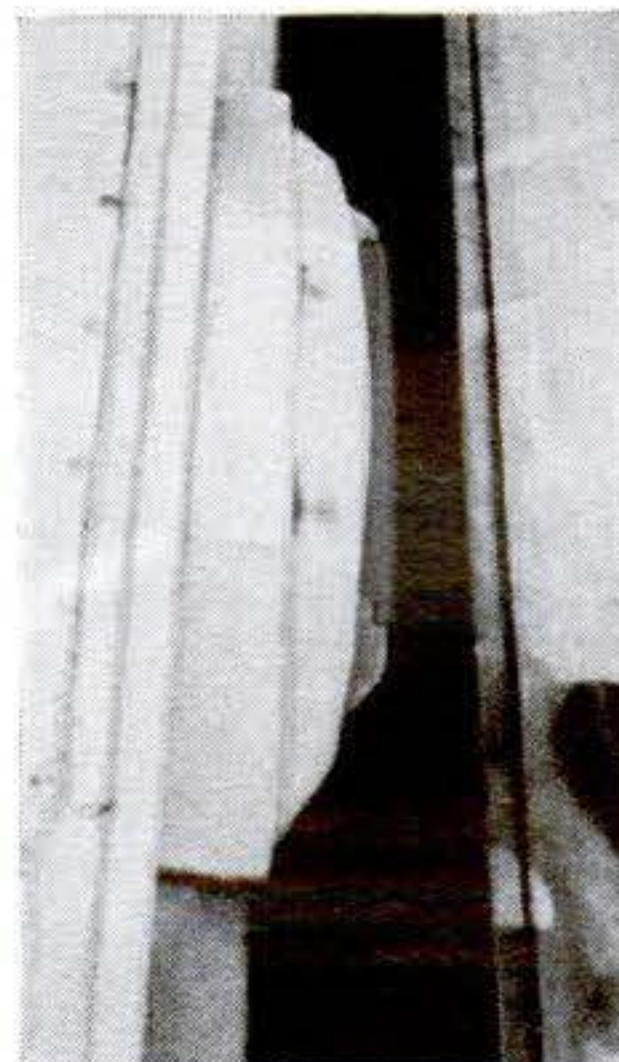
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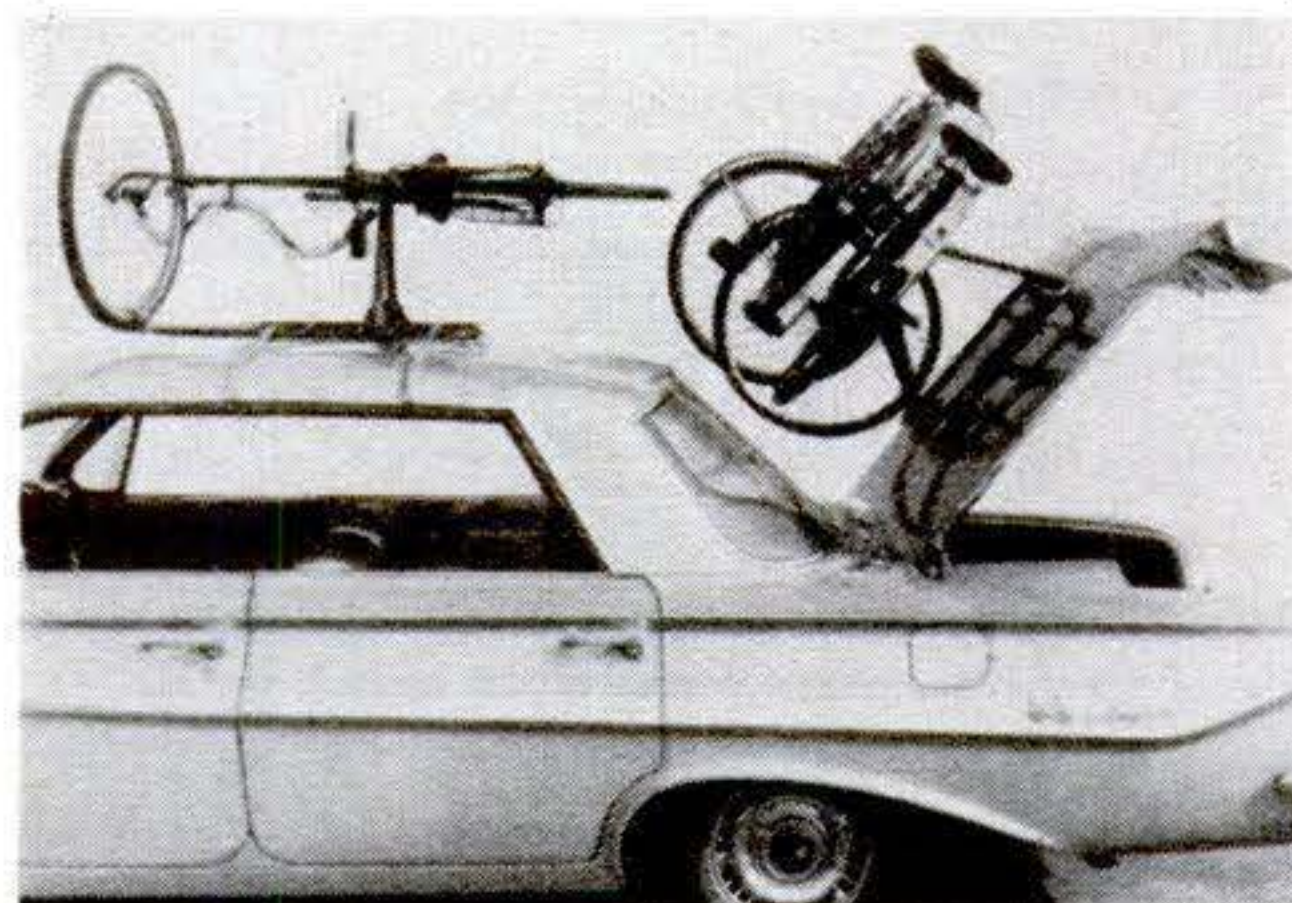
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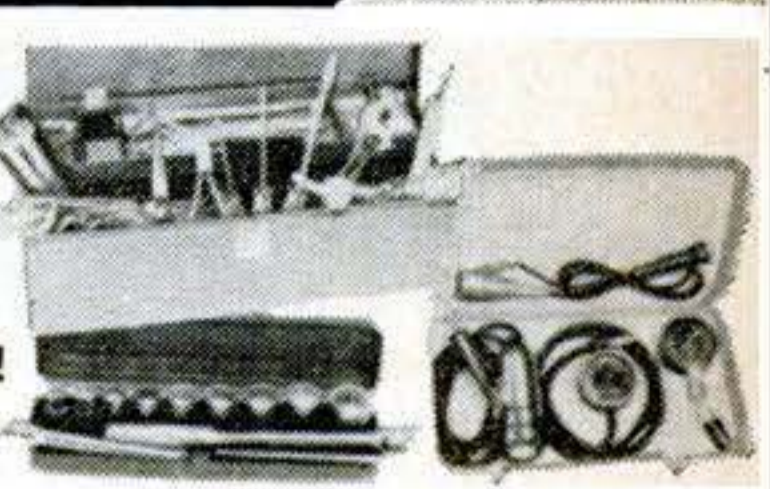
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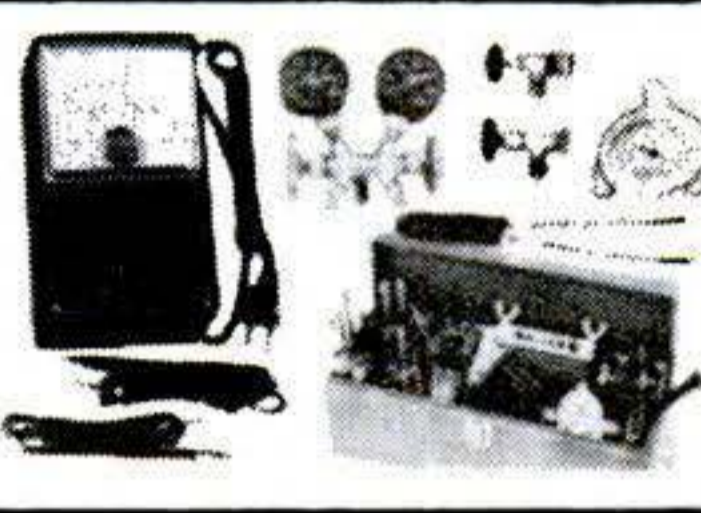
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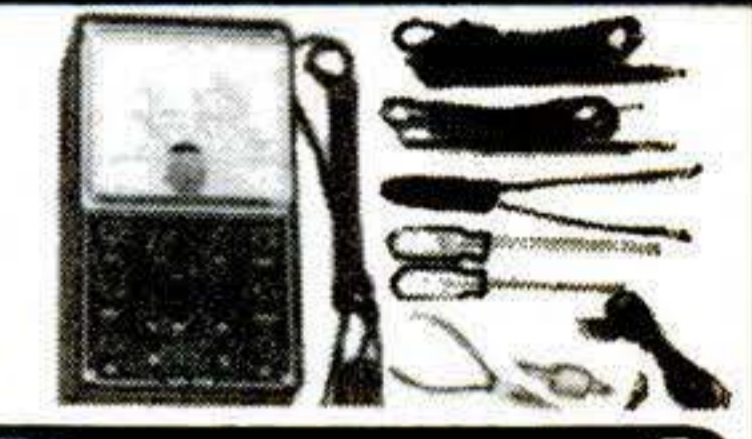
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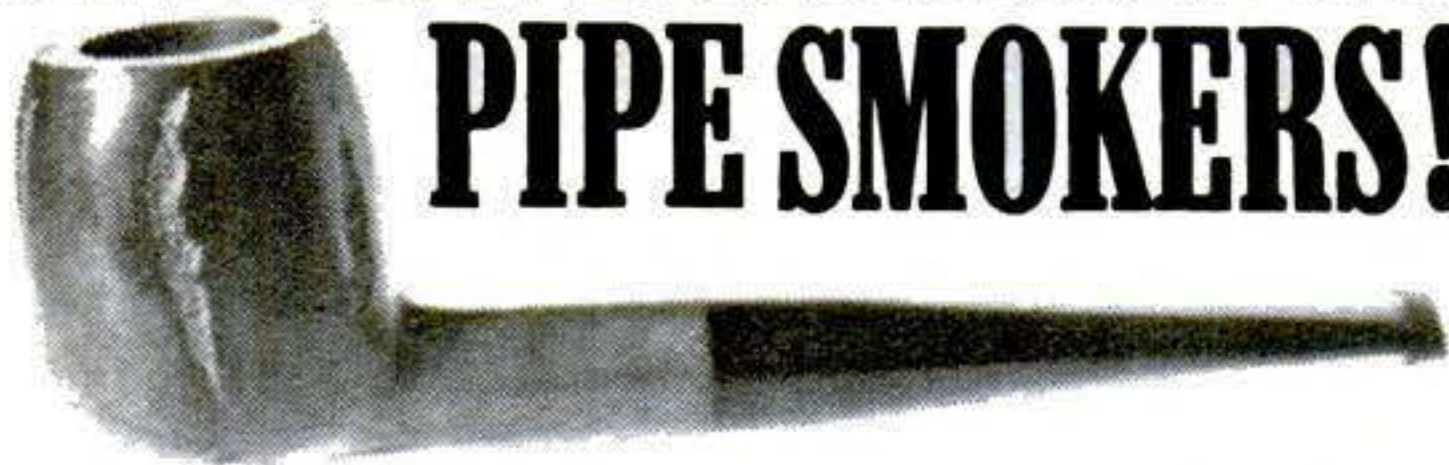
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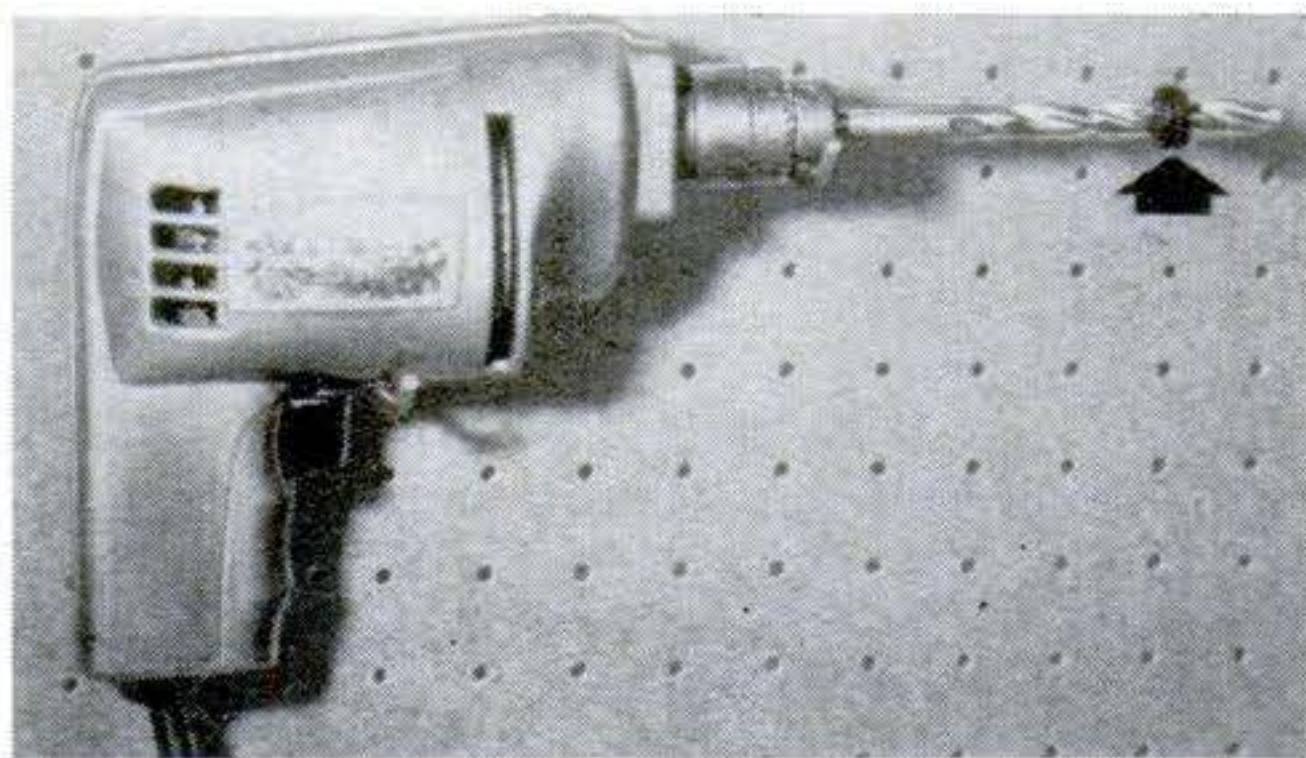
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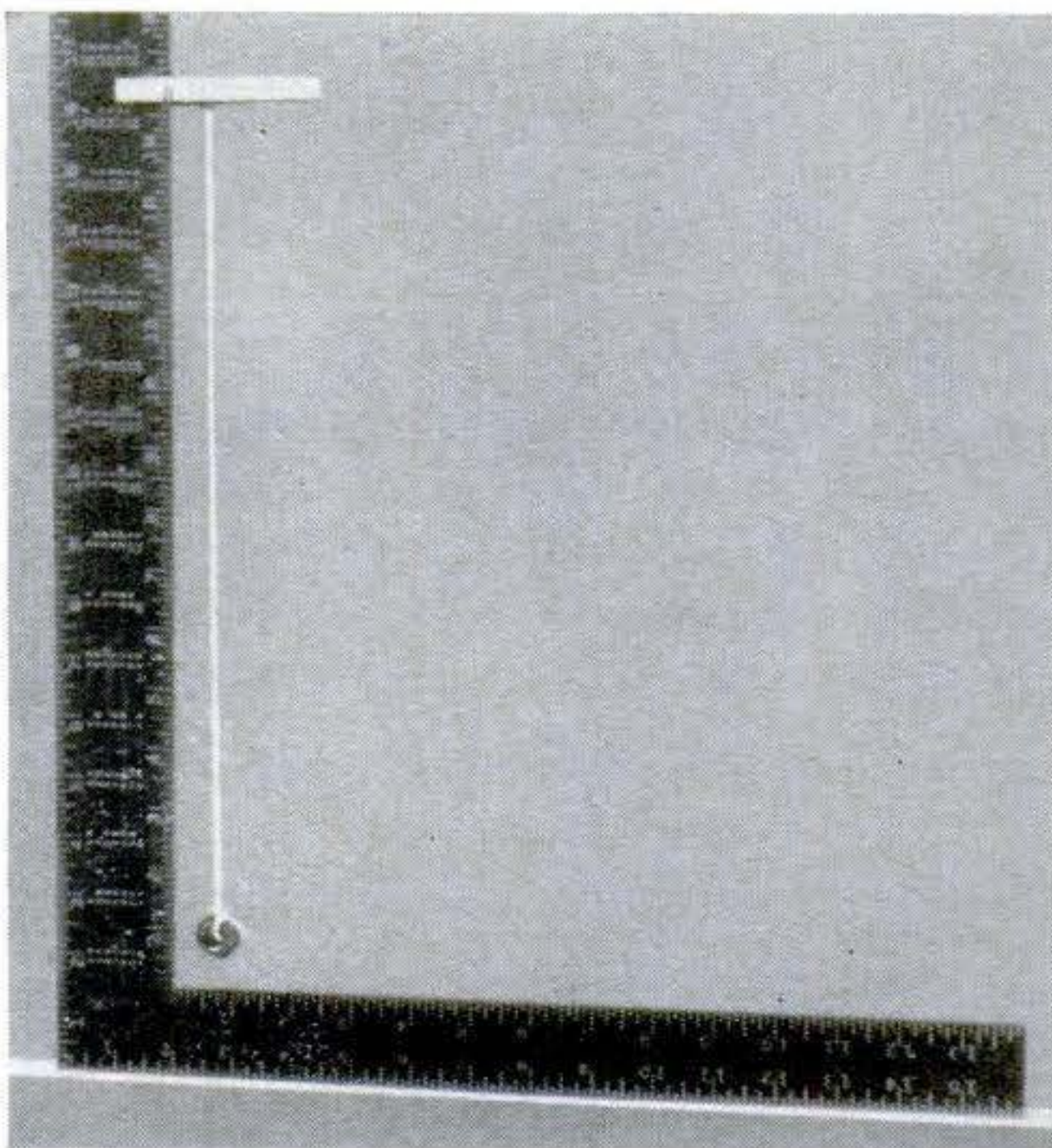
FROM PS READERS



### Grommet serves as depth gauge

Slipped on a drill bit, a rubber grommet can be used to gauge the depth of the hole you drill. It won't throw the drill out of balance, and, in addition, it will protect the cutting edge of the drill when you lay it aside to use another bit.

D. E. ANDERSON, Sunnyvale, Calif.



### Put together your own square level

When you have to level a horizontal piece and don't have a level with you, call on good old Sir Isaac Newton's law of gravity to help you out. You'll need a large carpenter's square, a spring clothespin, a length of string, and a nut or other such weight. Rig them as shown in the photograph above, with the nut about 18" below the clothespin. When the string aligns perfectly with the straight edge of the square, the horizontal piece on which you've placed the square is level. You can use the same system to make vertical pieces plumb.

WILL THOMAS, Buffalo, N.Y.

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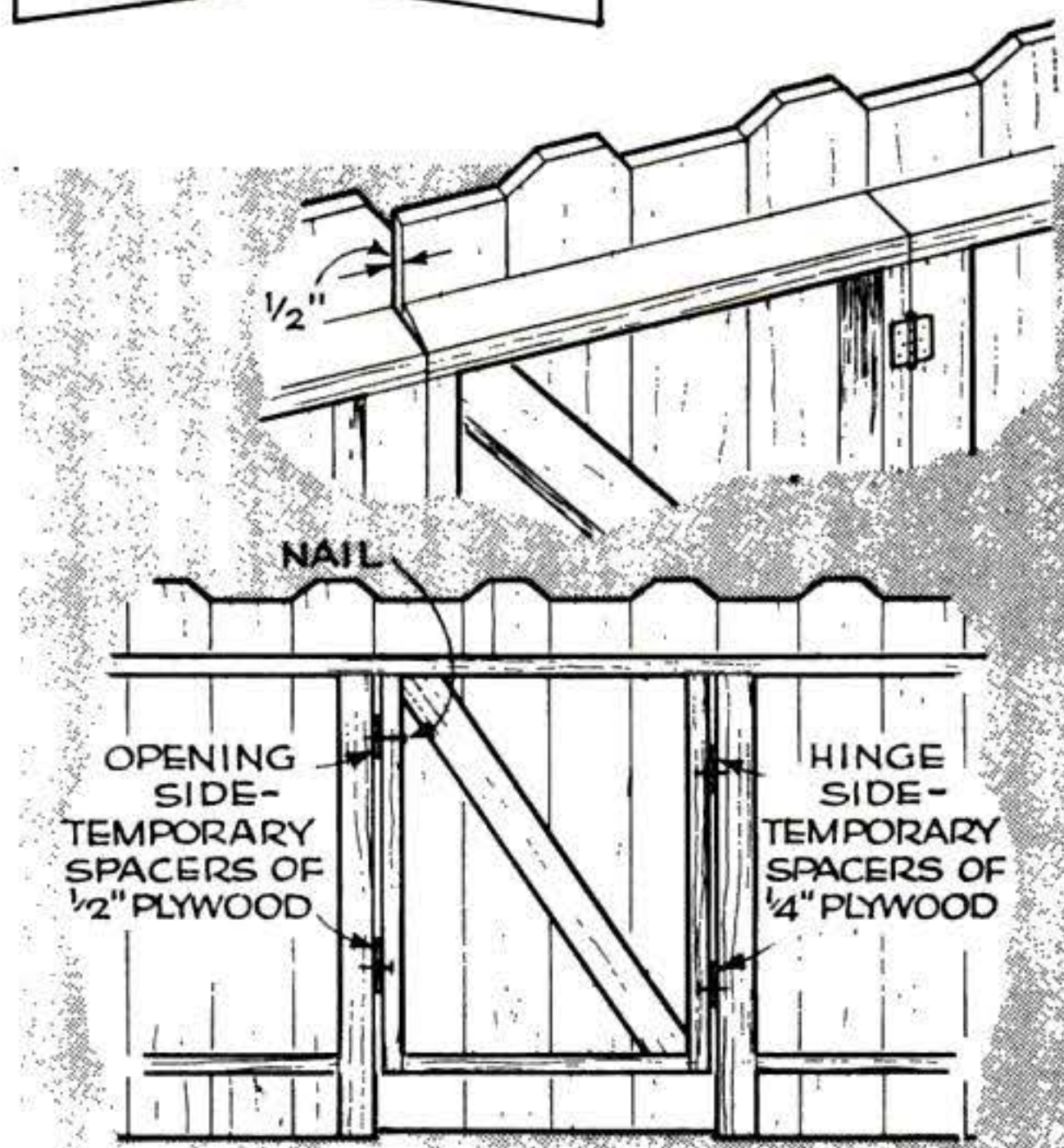
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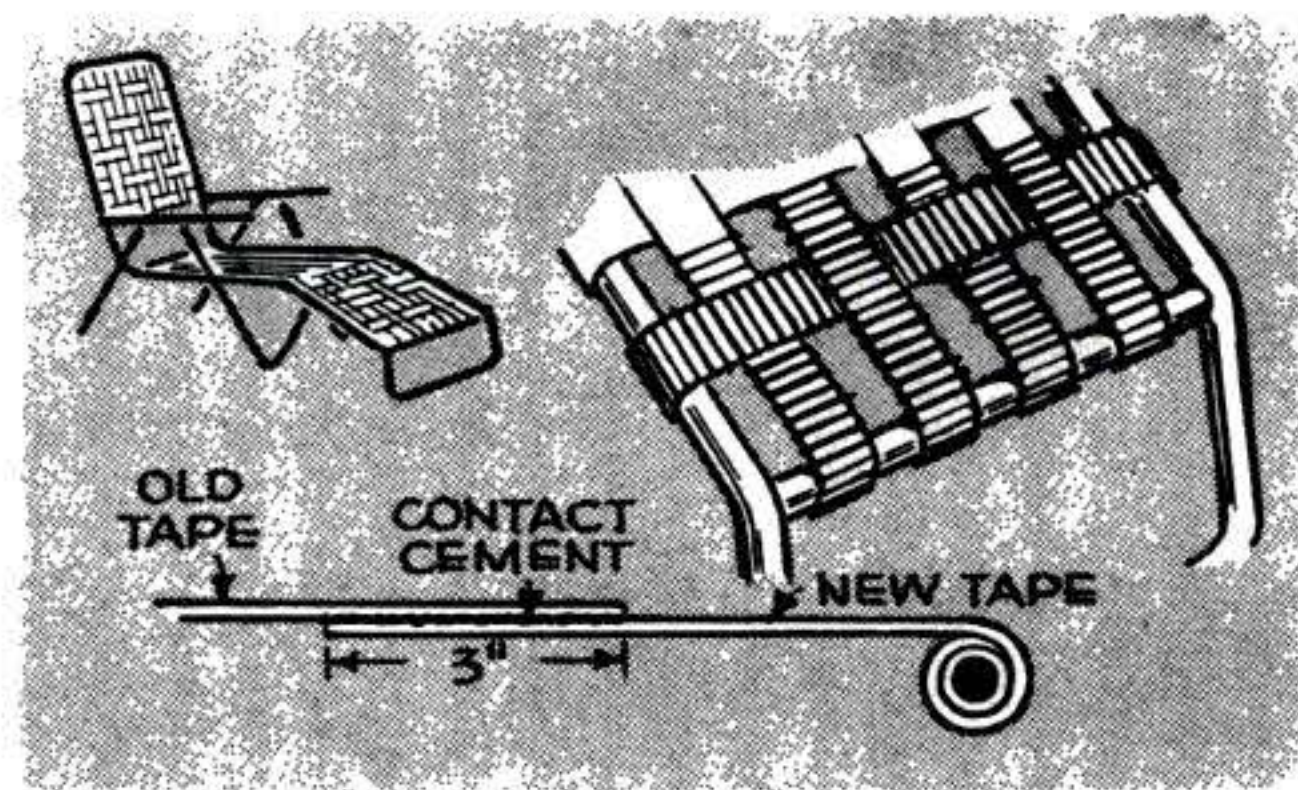
### FROM PS READERS



### You can make a gate in the fence

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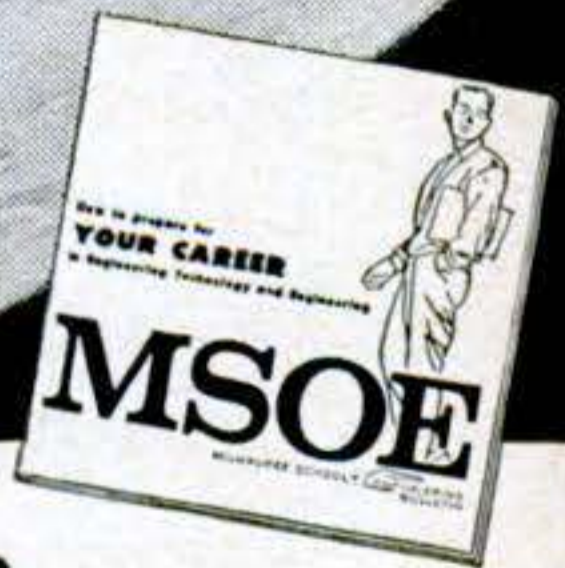
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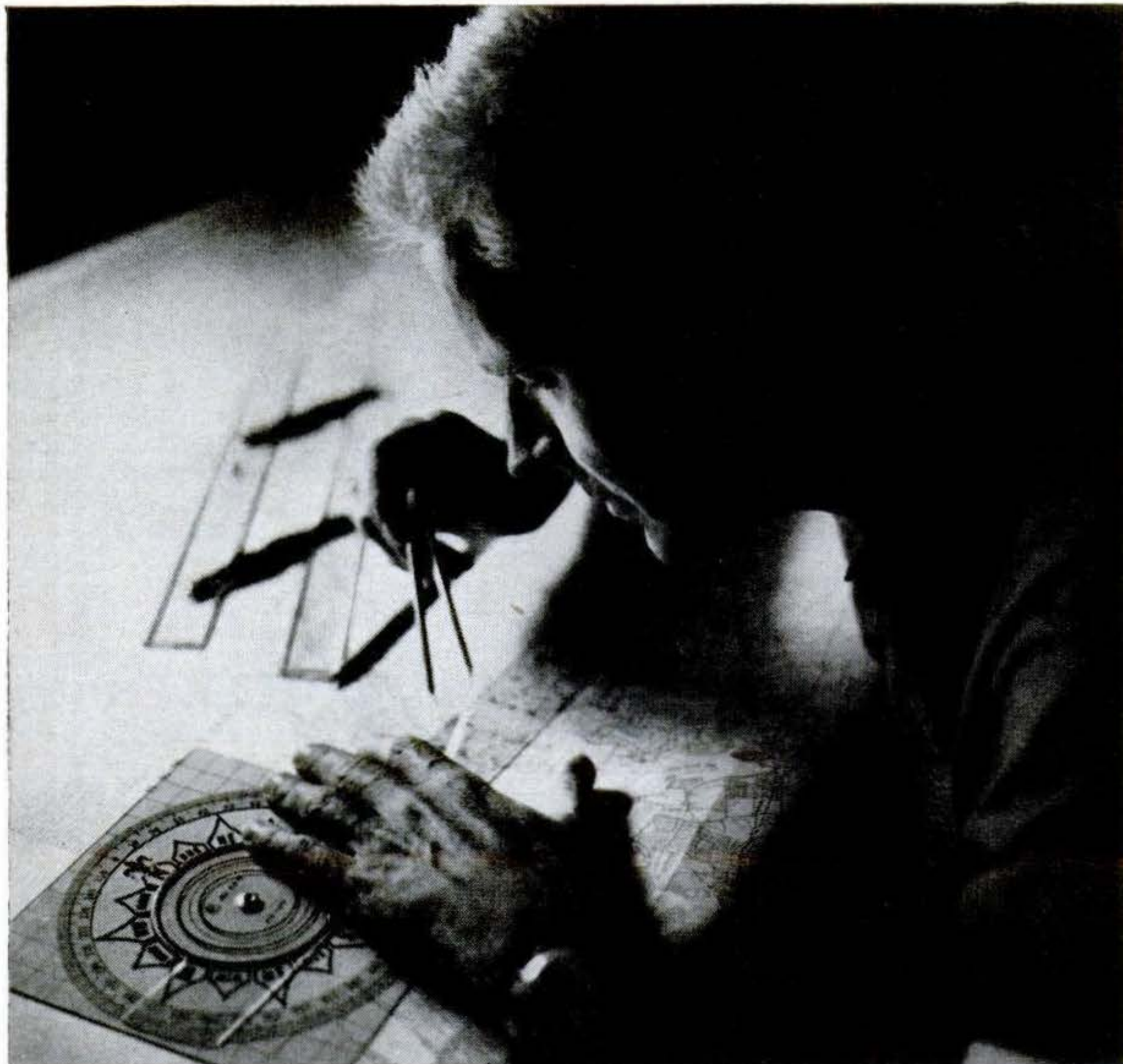
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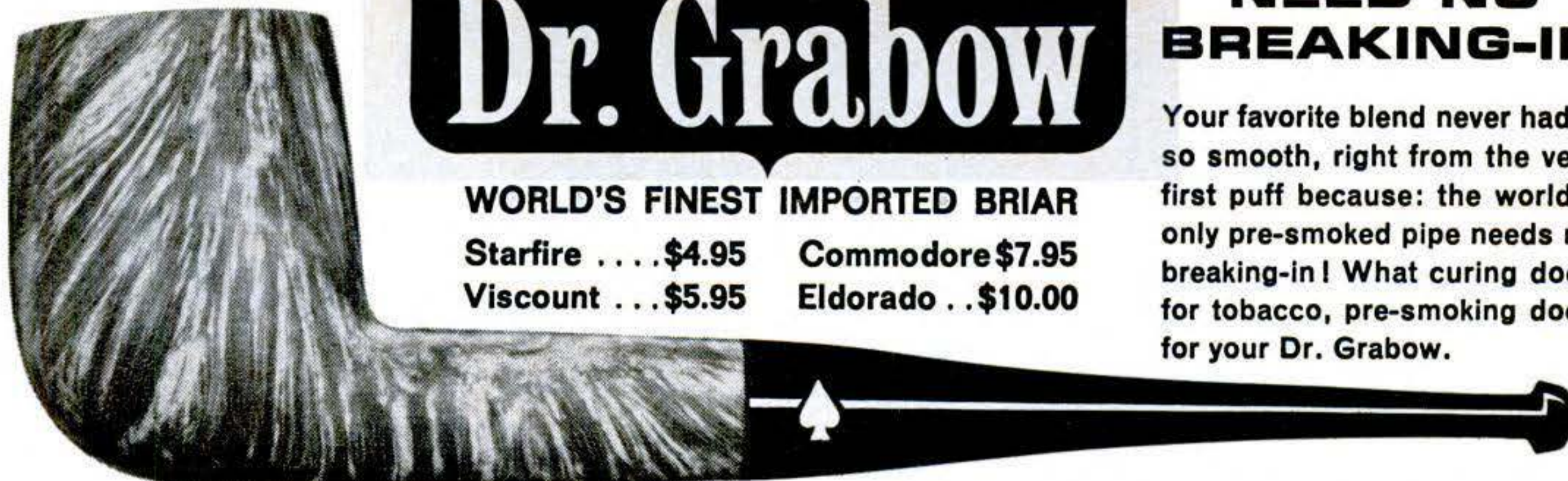
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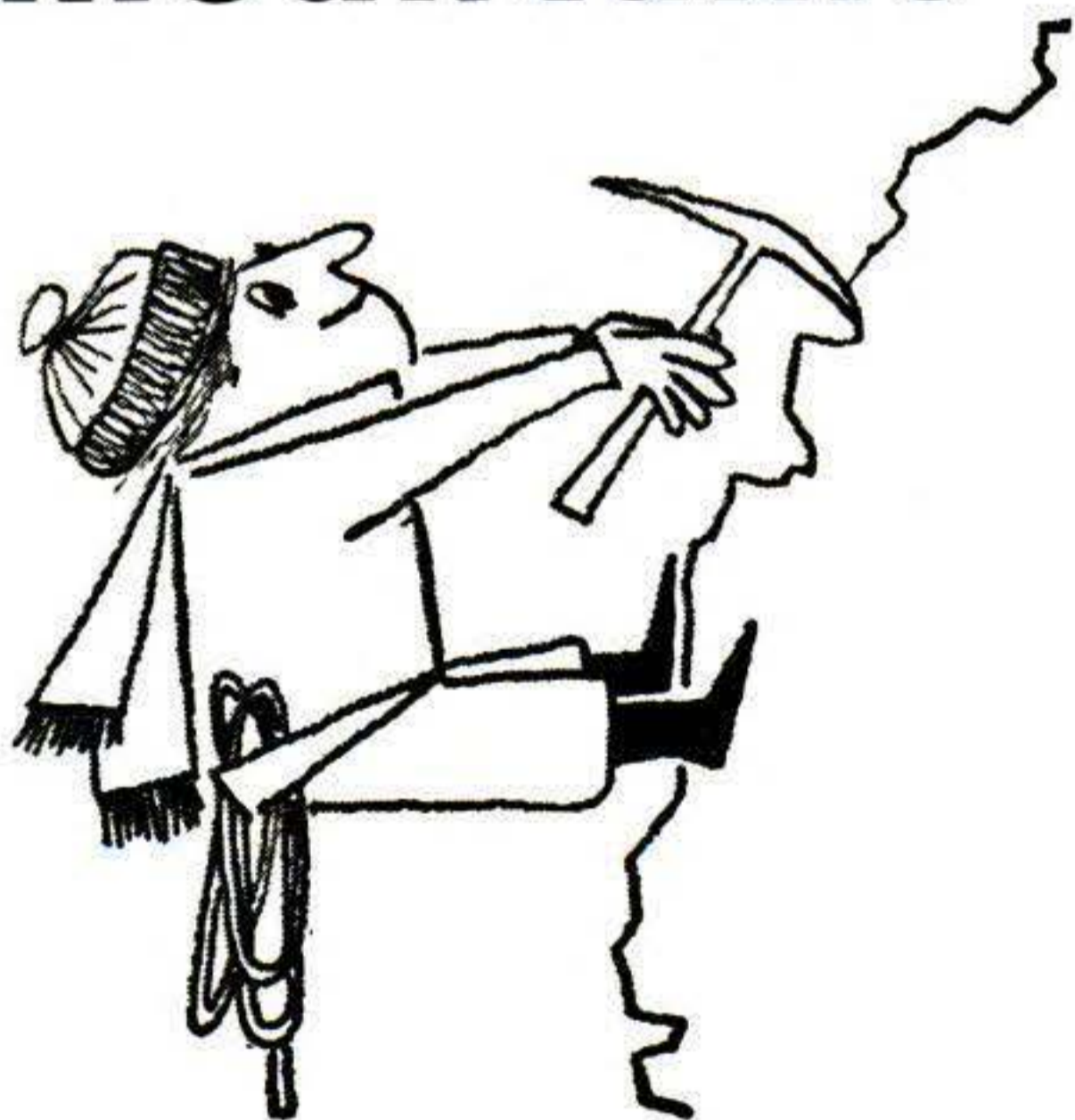


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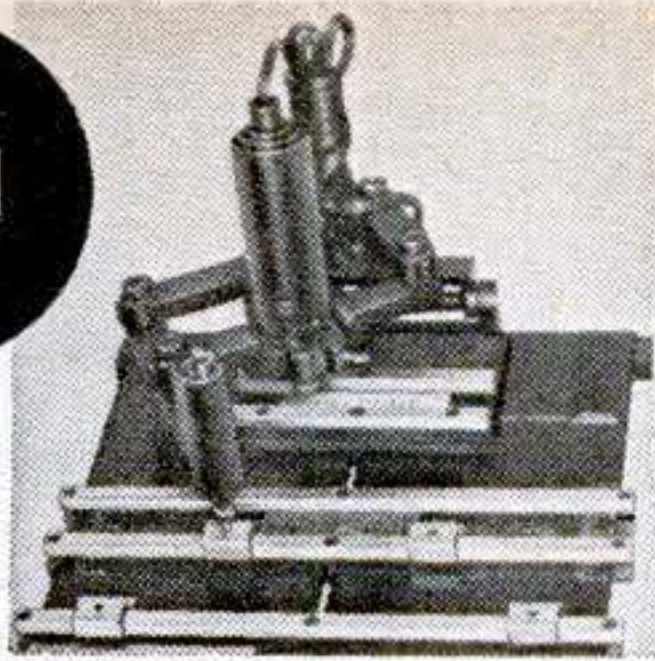
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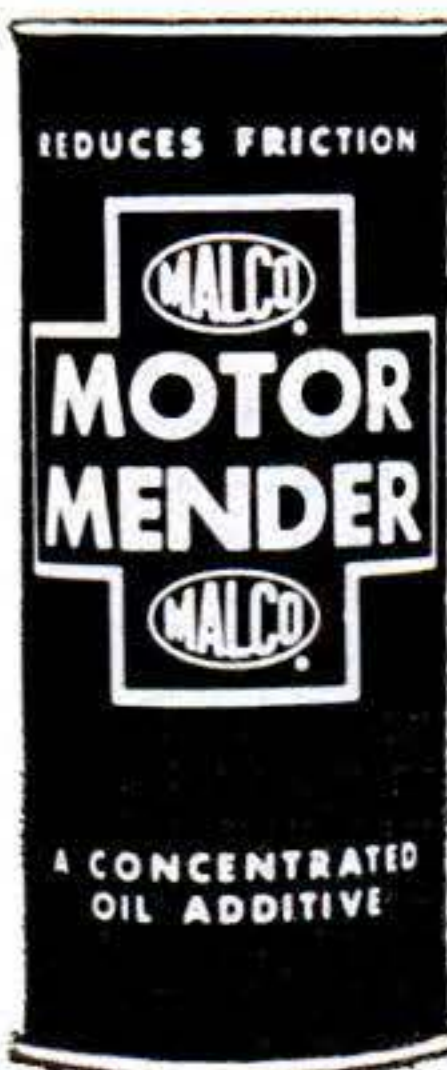
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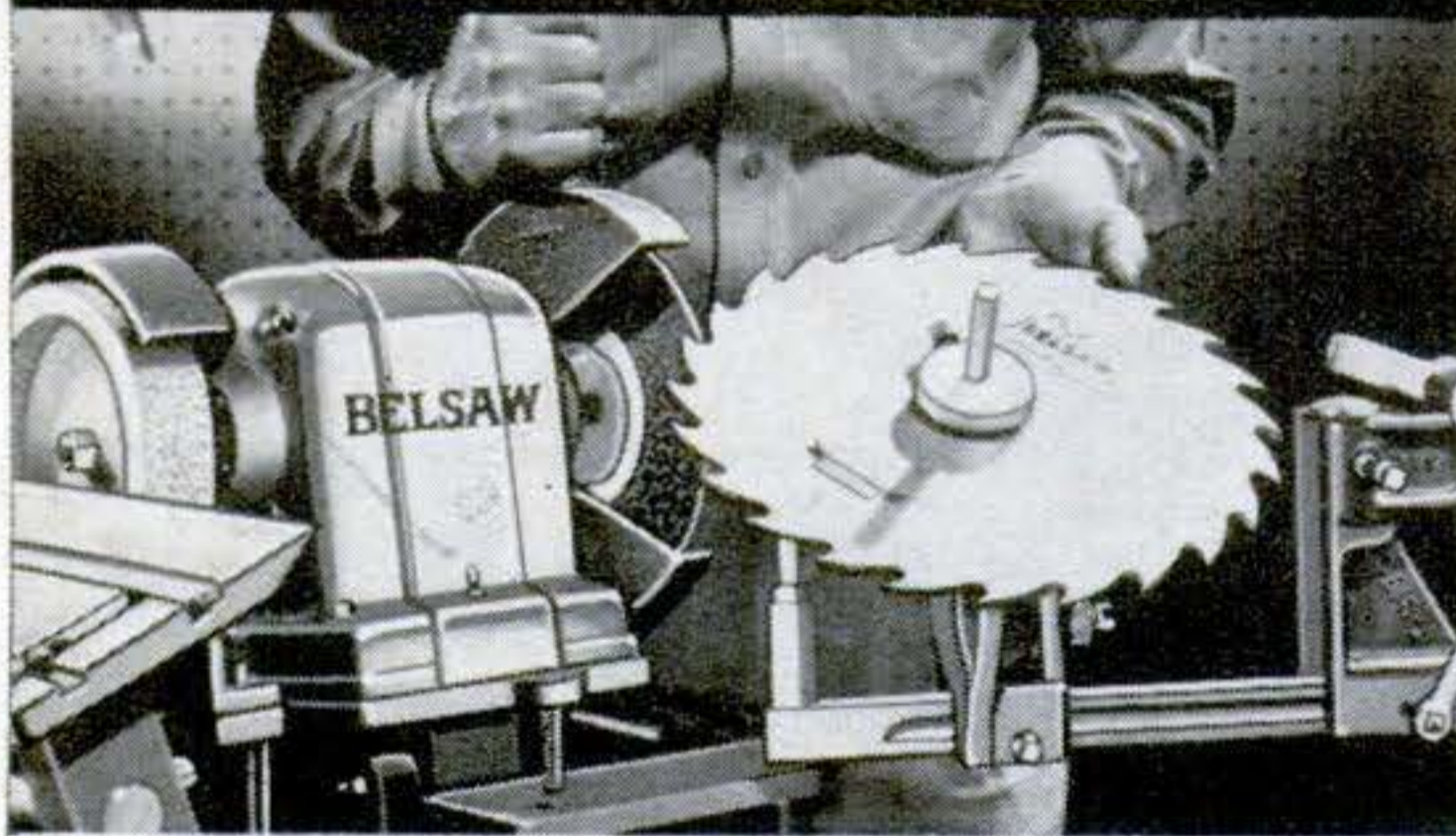
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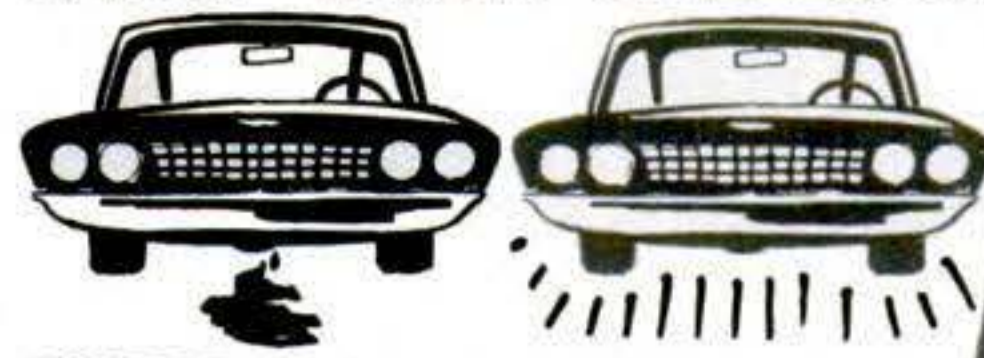
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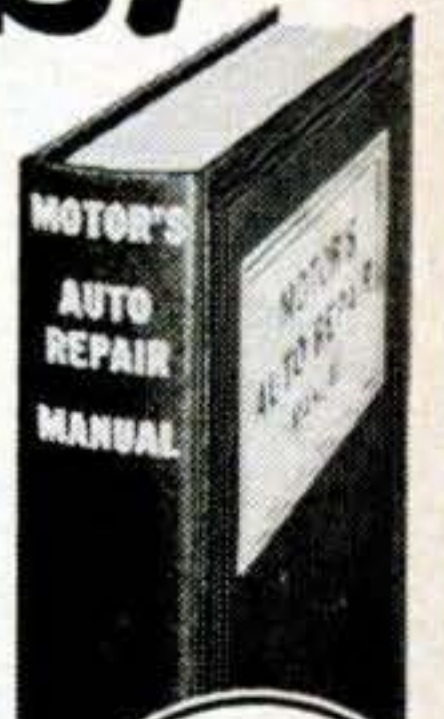
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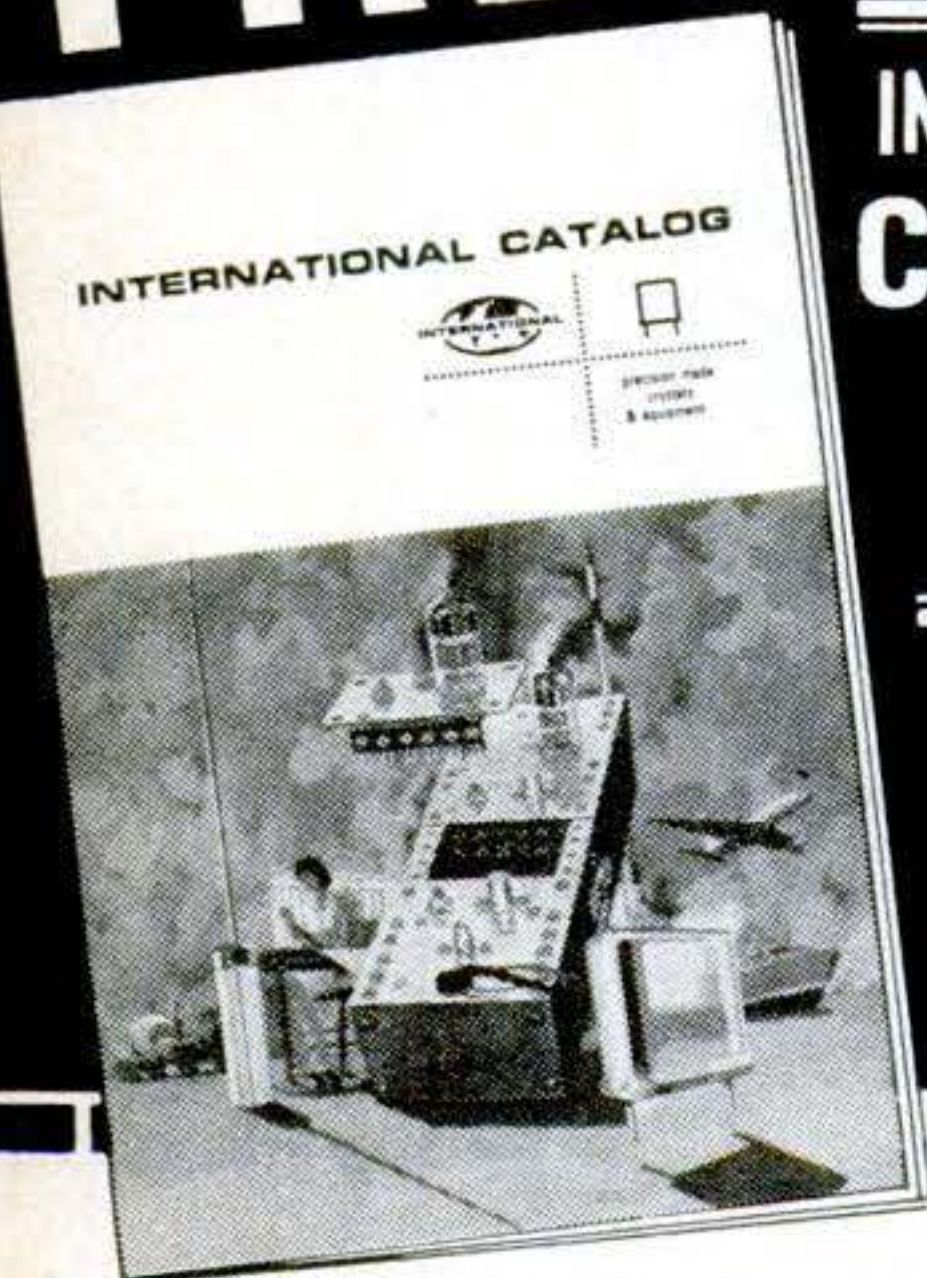


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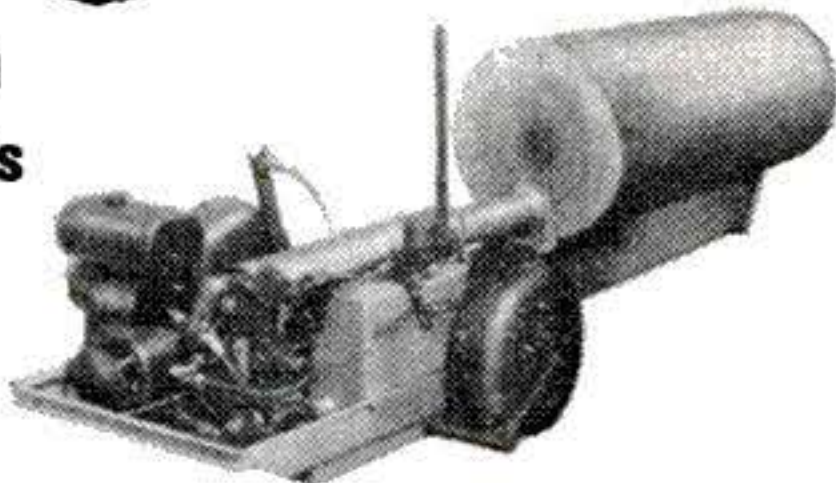
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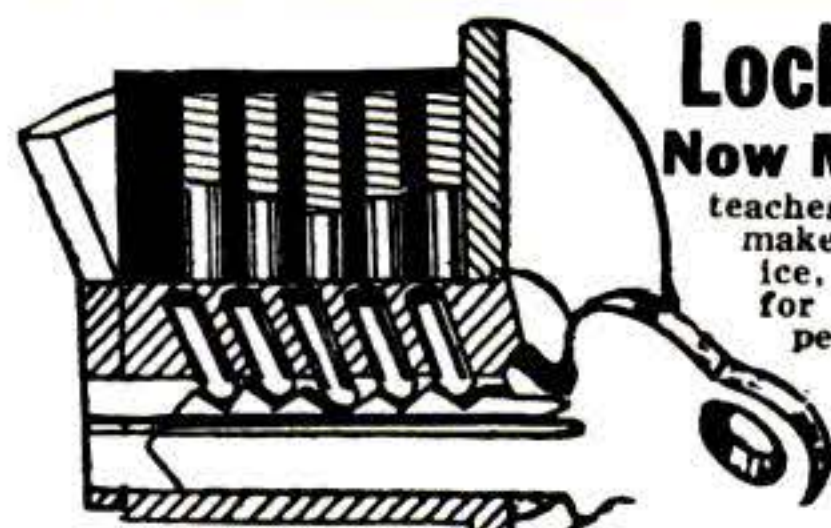
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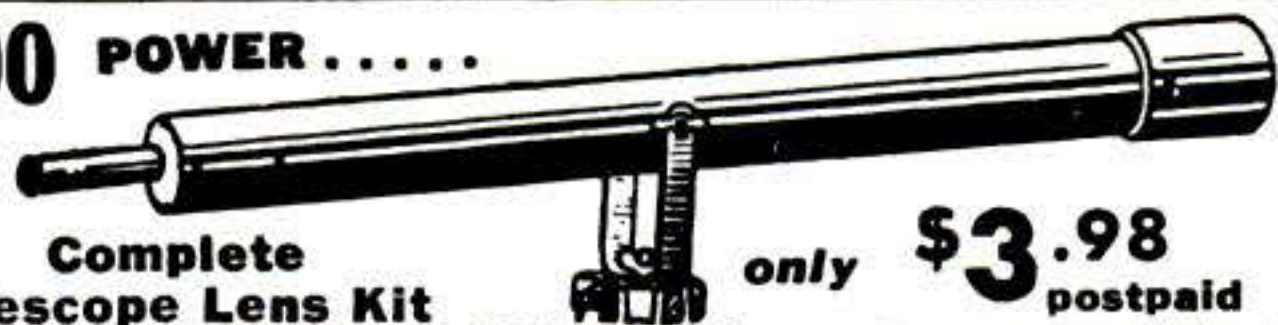
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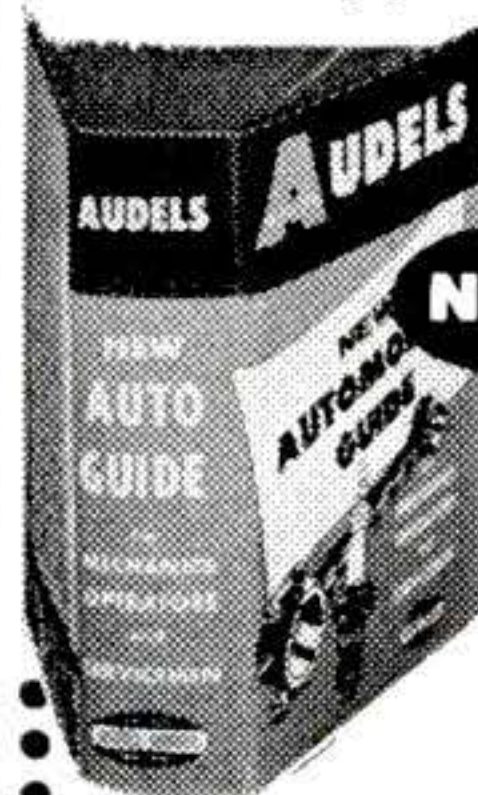


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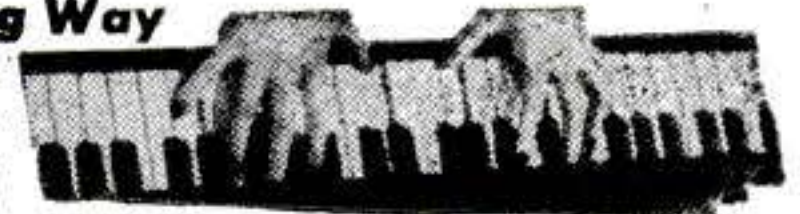
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# Detroit Report...

**BIG NEW V-8 ENGINES ARE COMING** in several lines of 1967 GM cars. The new power plants show design influence from Oldsmobile's pioneering work on lightweight cast iron and Chevrolet's improvements on valve layout and gas flow. Pontiac's 421-cu.-in. engine will be replaced by a 448-cu.-in. V-8, and Buick will replace the 425-cu.-in. unit (Wildcat, Electra, Riviera) with a new 430-cu.-in. engine. Cadillac is also tooling for a new engine, but it won't be in production until '68.

**Rambler's Marlin** will be bigger in '67. Up to now, the Marlin has been built on the Classic wheelbase (112 inches), but the '67 model will be based on the Ambassador. Next year's Ambassador has its wheelbase stretched from 116 to 118 inches, and body width will also expand by two inches. American is planning to get rid of the costly aluminum door frames on the Ambassador and work out frameless door windows, even on body styles with a full pillar. The only cars with this type of construction in '66 use Fisher's "C" body—the Chevrolet, Pontiac, Oldsmobile, and Buick semi-fastback coupes.

**Front drive for the Riviera?** Buick has denied that the Riviera will switch to front drive for '67, and, in fact, next year's Riviera will continue almost without change from '66. But a front-drive Riviera is in the works for '68! It will use a Buick engine, but share the Toronado drive train. There's a rumor, too, that by 1968 Oldsmobile will have a smaller front-drive companion model for the Toronado (with the F-85 V-8 engine).

**Did you know that Oldsmobile** tried front-wheel drive 35 years ago? It was an experimental car with a Viking nameplate, using the same side-valve V-8 engine that was used in the regular rear-drive Vikings that Olds made at the time. It was tried out at the GM proving grounds but was given up because of too much trouble with wheel spin. The engine sat well back in the frame in the 1931 manner, and the front wheels carried only about 45 percent of the weight of the car, against 60 percent in the Toronado.

**Panther's top-of-the-line model** (that's Chevy's answer to a deluxe Mustang) will have concealed headlights. The lamps themselves do not tilt or swing—they stand still on their mounting brackets while sliding doors come in from the curved fender sides to cover them when not in use. Pontiac has also been experimenting with concealed headlights, and at least one '67 Pontiac model will use a system with retractable lamps and folding covers.

**The new Thunderbird** will be built on the big Mercury frame, with Mercury all-coil suspension. Up to now, the T-bird, like the Continental, has been using leaf springs to hold the rear axle. The first four-door T-bird will have its doors hinged Lincoln-fashion, with both door handles next to the central door post. The rear door itself will be half fiberglass and half steel. The metal part blends into the fender line and rear quarter panel. The door windows have no vent panes, as the car will get a new flow-through ventilation system.

**Rambler's experimental AMX** sports coupe can be expected as a '68 model. American Motors is now shopping for tooling sources for this car. There will be only one model—a two-door fastback coupe. The "ramble seat" shown on the experimental car will not appear on the production model. AMX engines will all be V-8s—a small 290-cu.-in. unit and a larger 343-cu.-in. optional engine. The AMX chassis will probably be a platform, using the Classic's steel understructure; the body will be fiberglass.

**The '67 Valiant** will have its wheelbase stretched from 106 to 110 inches. The Barracuda will share the Valiant underbody, and thus promises to be a roomier car than the present Mustang. Dodge's Dart, now built on a 111-inch wheelbase, will be lengthened to 113 inches. Coronet and Belvedere, new for '66, will continue with 117-inch wheelbases.

**Top-secret job at Ford:** It's a completely new car that Ford might rush through in case Mustang sales start to cool off. It would not necessarily replace the Mustang, but could be a further addition to the Ford Division range, which now totals five separate lines: Falcon, Mustang, Fairlane, Ford, and Thunderbird.

Jan P. Norbye  
Automotive Editor

# Who's got everything for your Ford

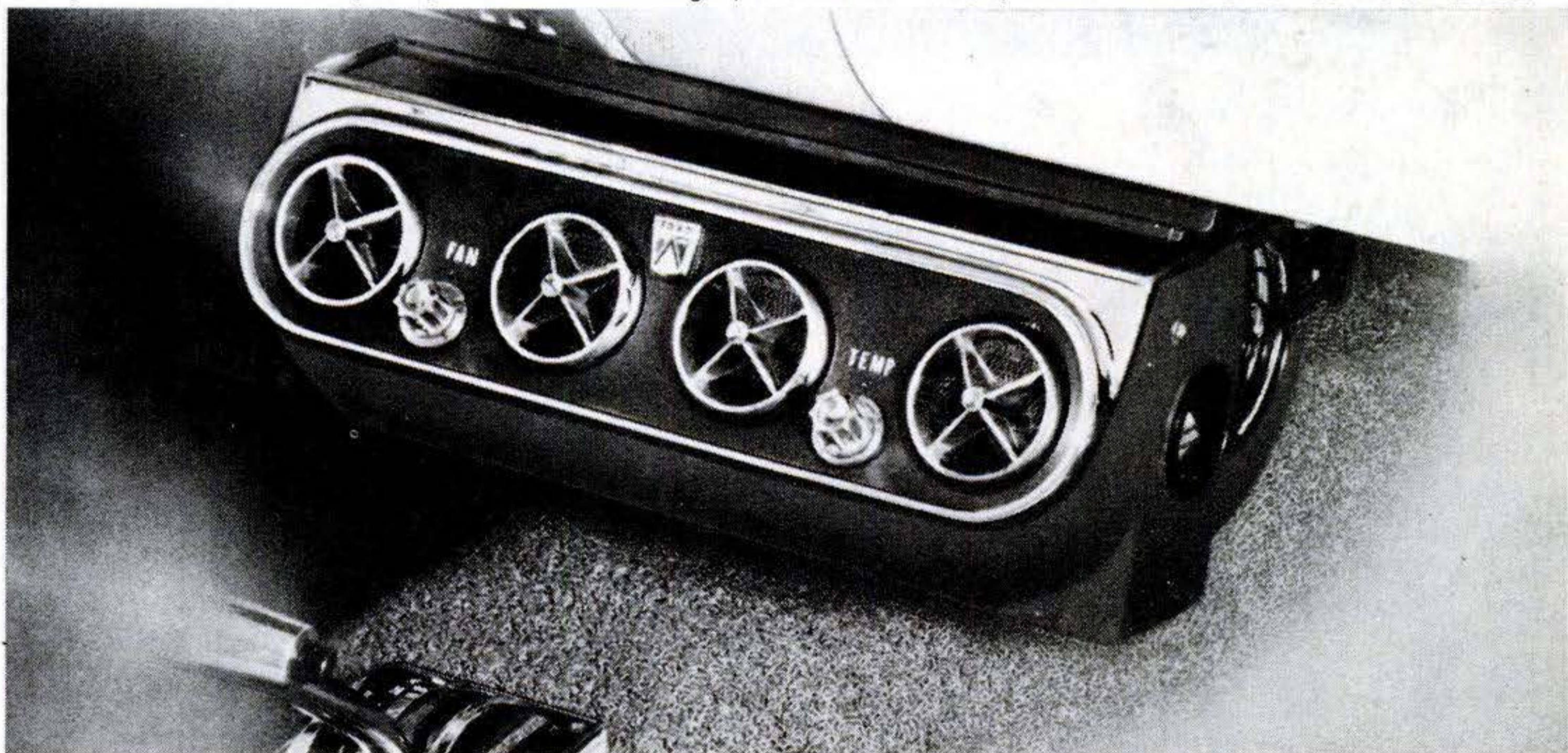


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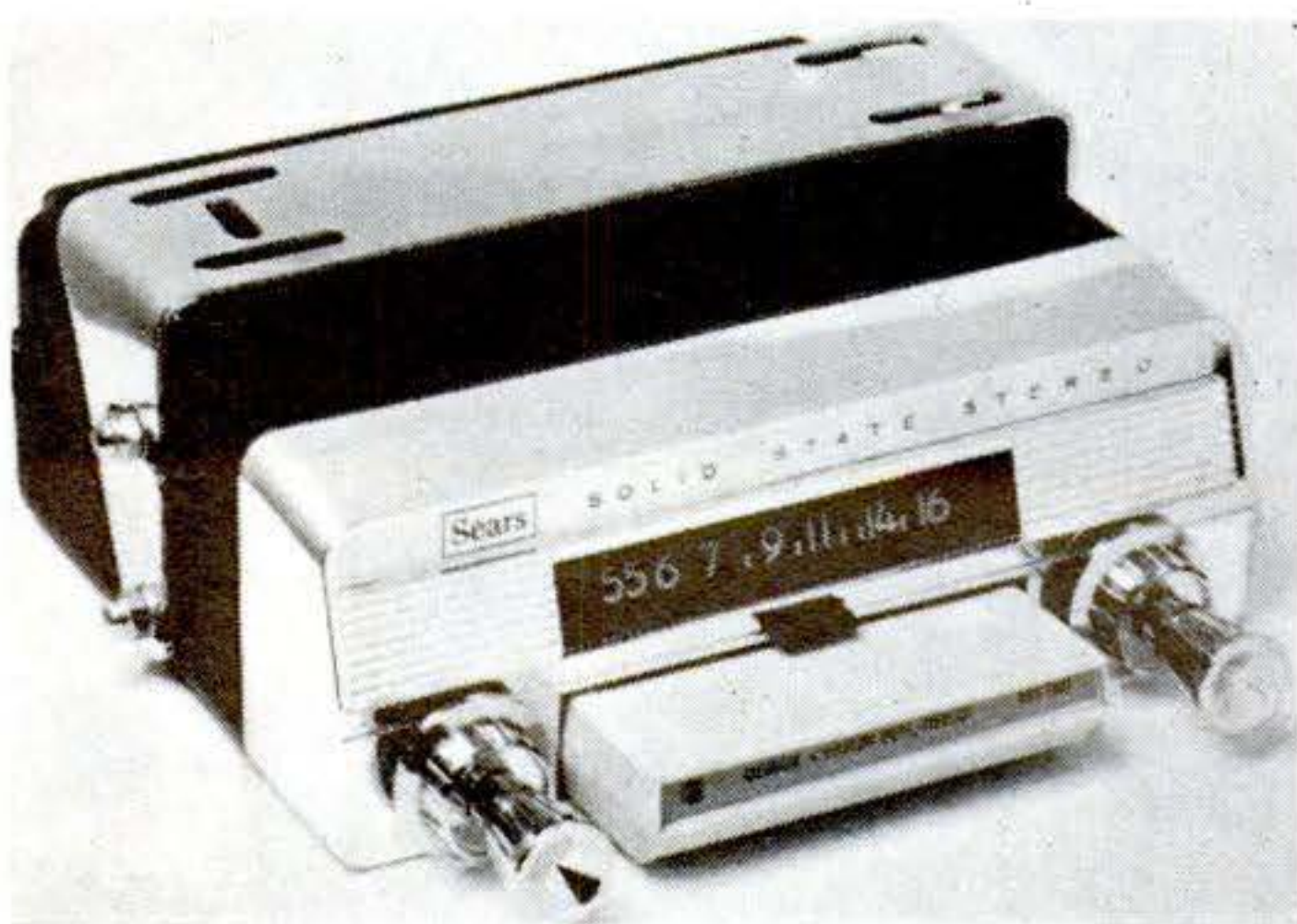
WHAT'S NEW  
FOR YOUR CAR



### Camper sleeps six, fits on pickup, gives six-wheel brakes, costs under \$4,000

The camper shown is designed for the Chevelle El Camino; models are available for other pickups. PS Auto Editor Norbye drove the Car-Tel Chevelle and reports that the car's stock sus-

pension is used, since the outrigger wheels carry the load. Maneuvering is easy, steering light, brakes adequate, cornering stable. Car-Tel Corp., 15511 Kelly Road, Mishawaka, Ind.



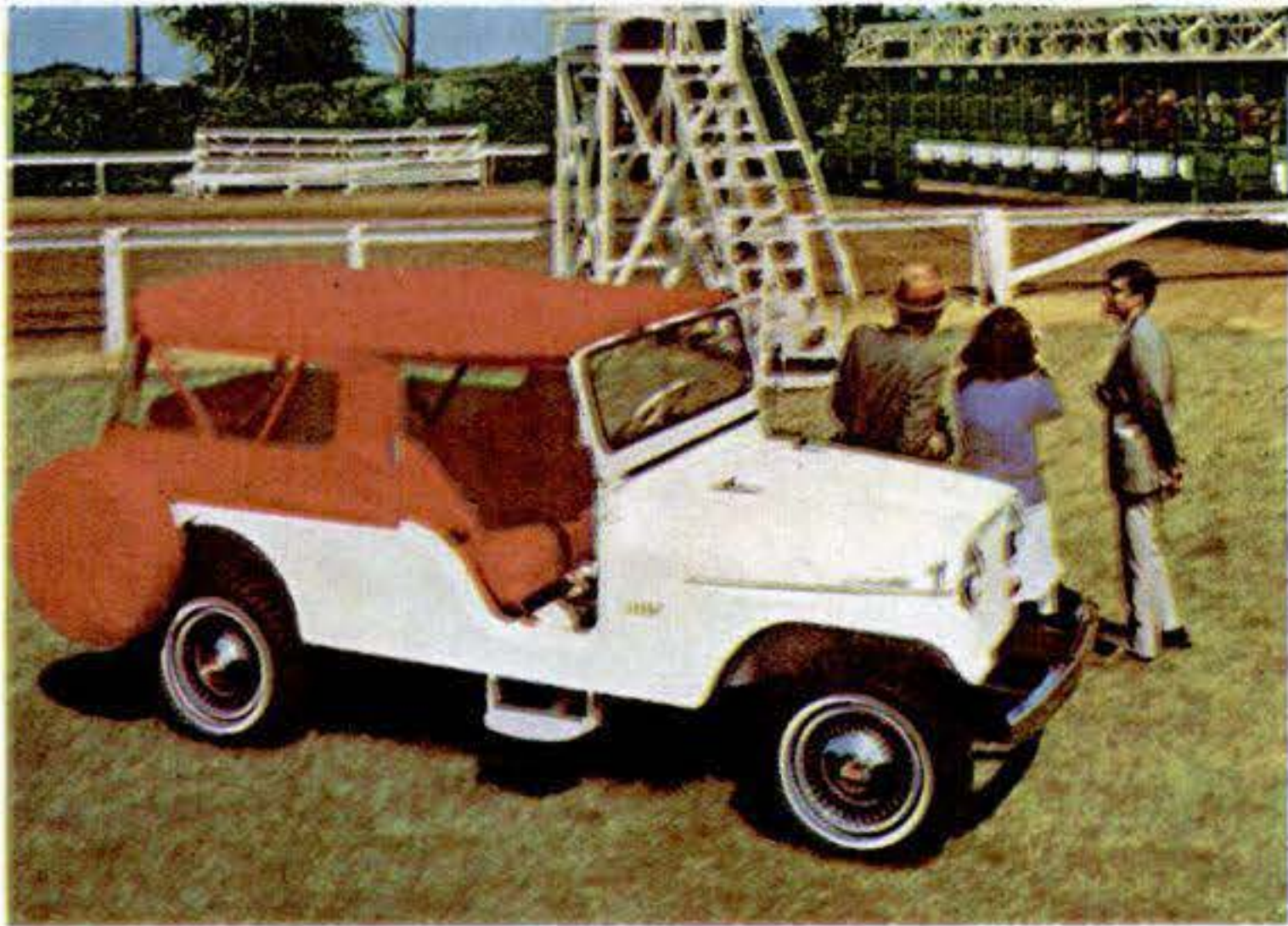
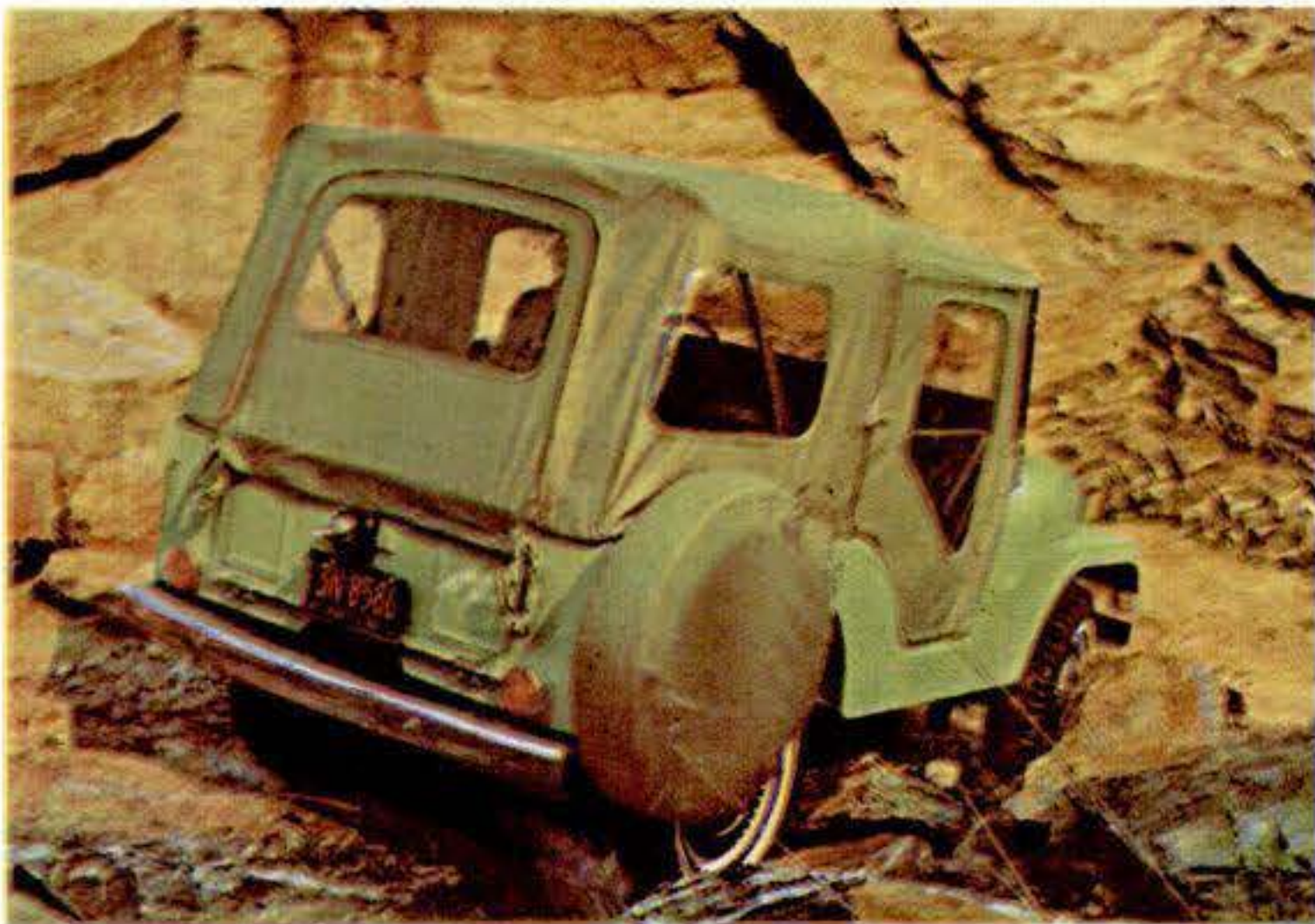
### New eight-track stereo tape/radio combo

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### Luggage carrier for Volkswagen goes aft

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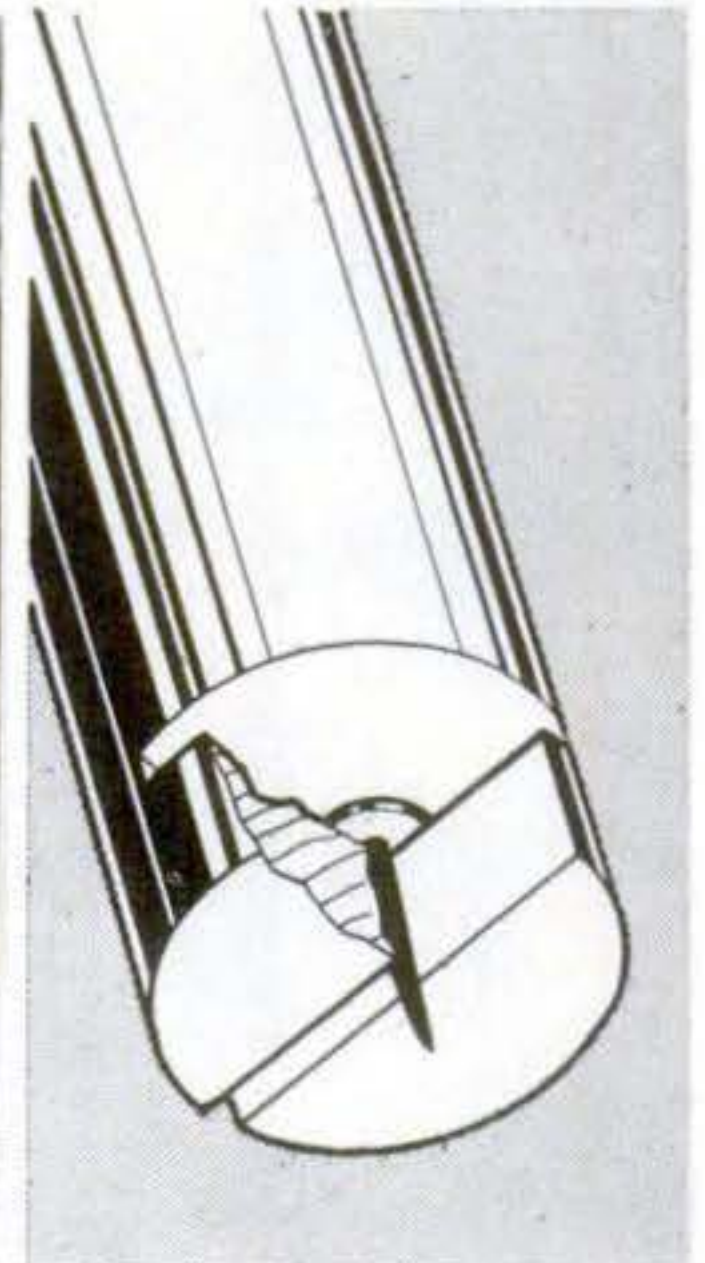
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### SHORT CUTS AND TIPS

FROM PS READERS



### Extender makes tacks easy to start

You can save time, temper, and bruised fingers trying to start short tacks by making this simple tack extender from a section of  $\frac{1}{2}$ " rod. About  $\frac{1}{8}$ " up from the end, hacksaw a slot halfway across. Then slot the end of the rod, bisecting the first cut. You insert the tack in the slot, give it a hammer blow, remove the holder, and drive the tack home. It is especially useful in upholstering work.

W. G. WAGGONER, Sacramento, Calif.



### Door stop protects wood from mars

When nails have to be pulled out of wood, there's always the danger of marring the surface. You can protect against this by slipping a rubber door stopper under the hammer head, as shown above. The wedge shape lets you get closer to the nail.

K. PATTERSON, Regina, Can.



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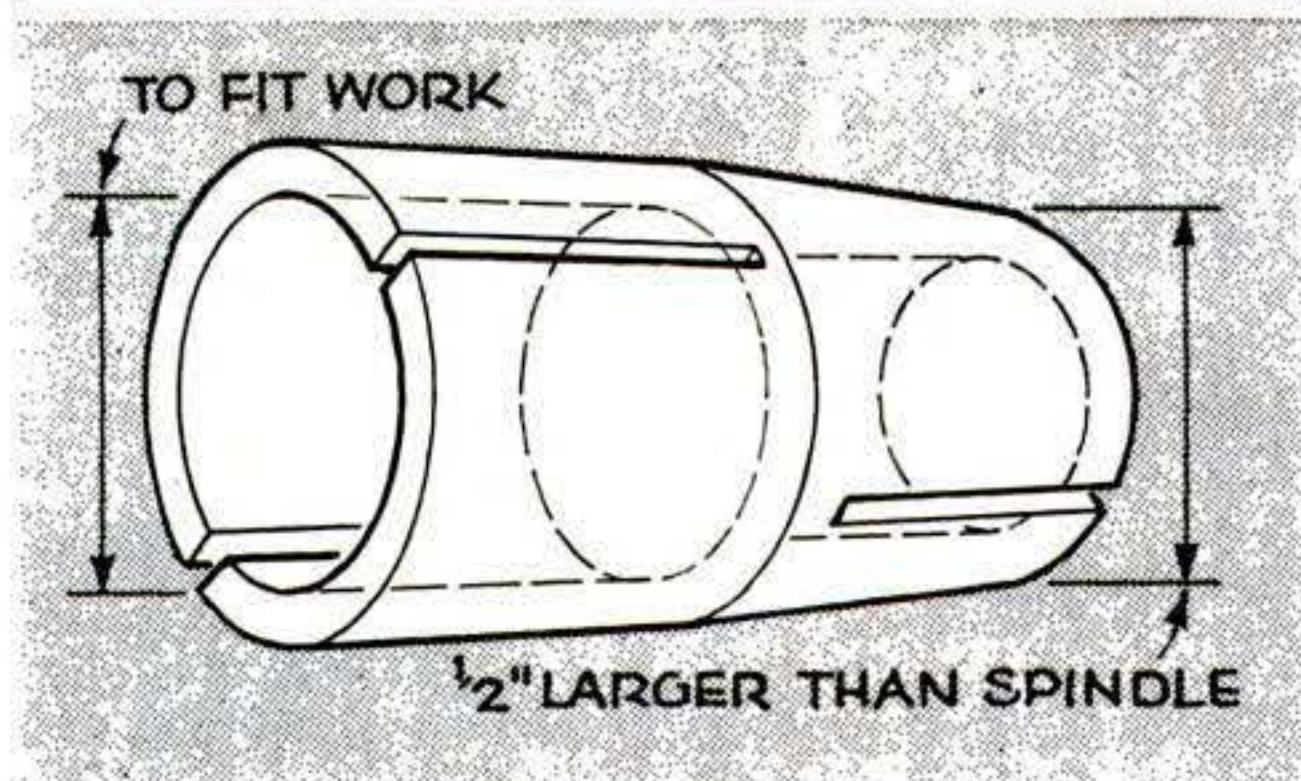
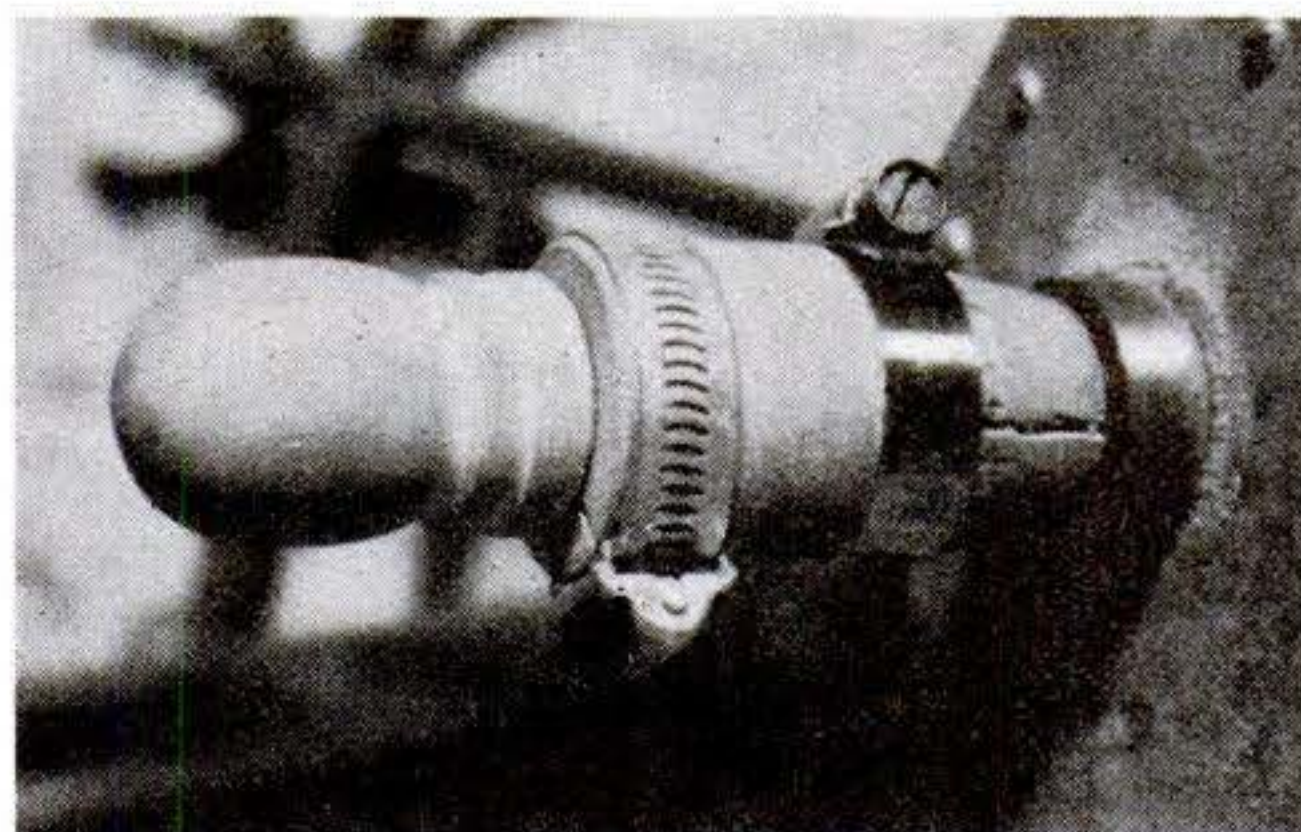


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## SHORT CUTS AND TIPS

FROM PS READERS



### Use your lathe to make a lathe chuck

A wood lathe chuck for turning end pieces, drawer knobs, and the like is a piece of equipment you can make yourself—right on the very lathe you're making it for. Select a hardwood block at least  $1\frac{1}{4}$ " longer than the lathe's spindle and thick enough to be  $\frac{1}{2}$ " greater in diameter at its tapered end than the spindle when finished. Tool it until it is cylindrical, then moderately cone-taper one end of it. Bore that end so that it will fit snugly over the lathe spindle, and then slot the bored length with a saw. It is the slotting that gives the wood cone clamping action. Next, clamp the partially completed chuck to the spindle with a screw-type hose clamp, and bore the free end to hold the work. Slot that bored length, too, and use a second hose clamp to secure your work in the now-completed chuck. Balance the chuck by placing the clamp screws opposite each other. Remember to make lighter cuts when unsupported ends are being turned.

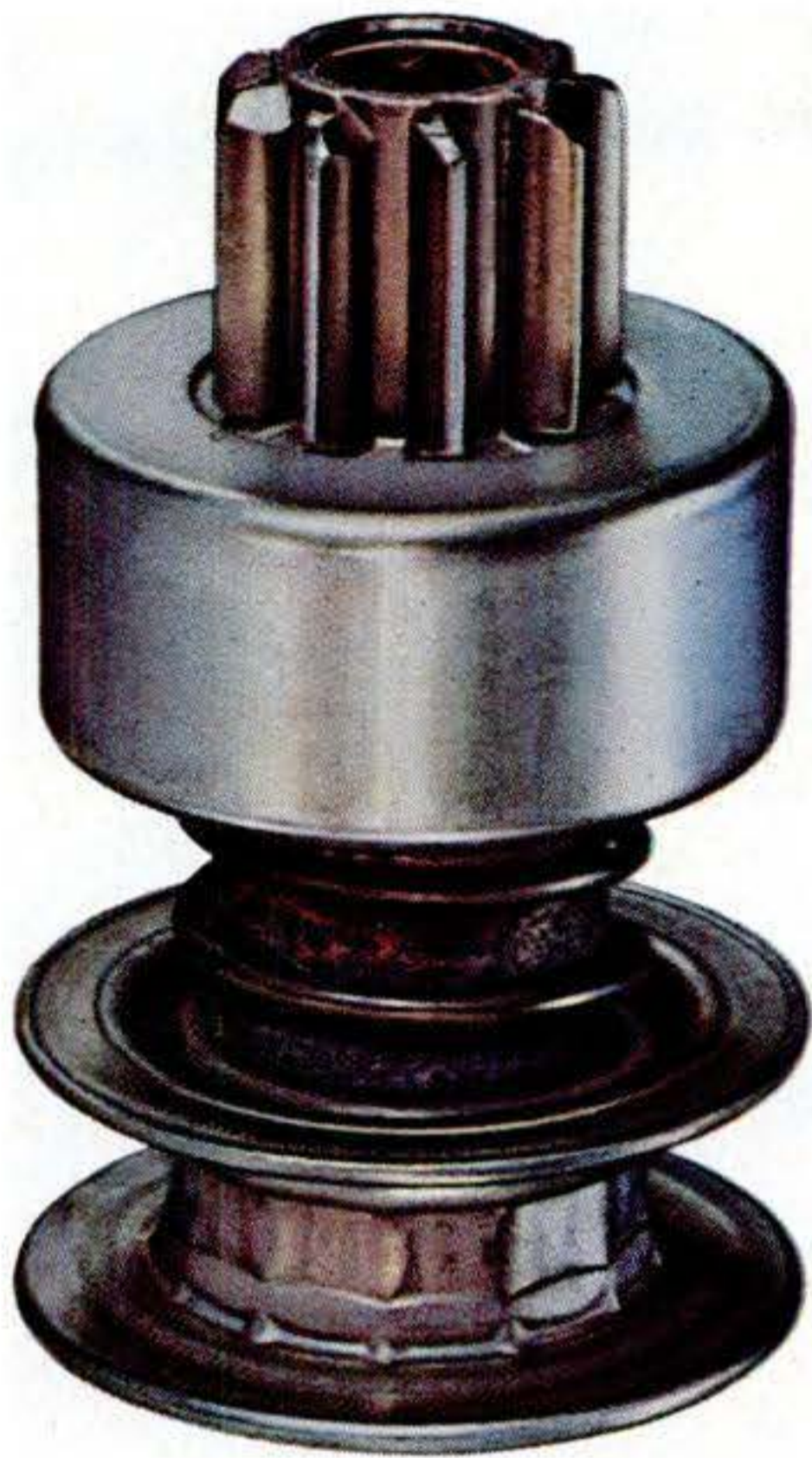
P. LEGON, Malden, Mass.

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A. A. HIEBERT, Clearbrook, Can.





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By **HARRY WALTON** / EXCLUSIVE DRAWINGS BY **RAY PIOCH**

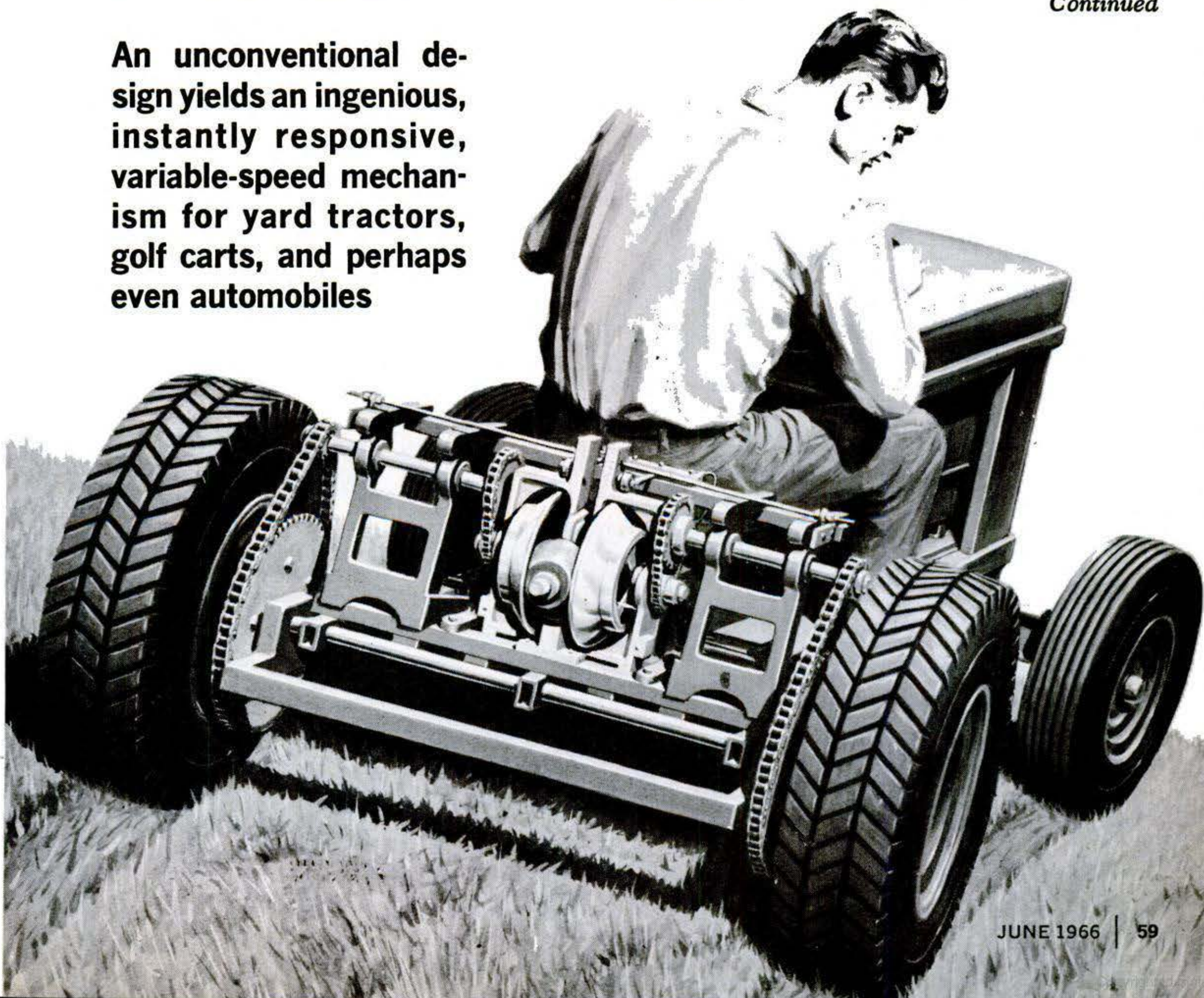
**A** revolutionary drive that its own inventor didn't think would work is making small tractors and golf carts caper around as never before. It can put more push behind snowblowers and garden implements. You could install it in one of these vehicles you plan to build for yourself.

**An unconventional design yields an ingenious, instantly responsive, variable-speed mechanism for yard tractors, golf carts, and perhaps even automobiles**

With just one control, it enables you to start, shift from low to high, slip back into neutral, and go into reverse. You can run as fast backward as forward, with the same choice of ratios.

This way-out mechanism acts as a rugged clutch, a variable-speed transmission, a re-

*Continued*



verse, and a differential, rolled into one. It has no gears, belts, or hydraulic fluid. The invention of Marion H. Davis of Hagerstown, Ind., it's a breakthrough for the friction-drive idea—or traction drive, as engineers prefer to call it. Here are some things it already does:

A six-hp. riding tractor pulls a 42-inch spiker, loaded with 250 pounds of ballast, up and down a hilly lawn. The same machine with a 24-by-42-inch plywood blade plows snow deep enough to spill over the blade's top. A golf cart carries players up grades too steep to walk on. A nine-hp. swamp buggy with 18-inch "fat" tires hauls three men up a flight of stairs.

**Inside the drive.** Cones within cones are the driving elements of this oddball power system.

Coupled to the engine, a driving shaft turns two small cones of hard friction material. They engage and drive two larger surrounding cones, with smooth steel surfaces, which Davis calls "discups." Each outer cone delivers power to one of the vehicle's rear wheels—through a single chain drive, or a

pair of successive ones. It has a rigid rectangular frame of its own, supporting a short shaft, running on ball bearings, to which the cone and a chain-drive sprocket are fixed.

The frame's mounting makes the outer cones execute an extraordinary "wriggling" motion around the inner cones—the secret of the Davis drive's action. Each frame swivels freely on a ball-and-socket joint at one corner. A flexible "torsion rod" extending from the opposite corner to a distant pivot is the frame's only other support, except for a control linked to the frame.

Normally the torsion rod centers the frame, and outer cone, with respect to the inner cones. In this position, both outer cones are out of contact with the inner ones and the drive is in neutral.

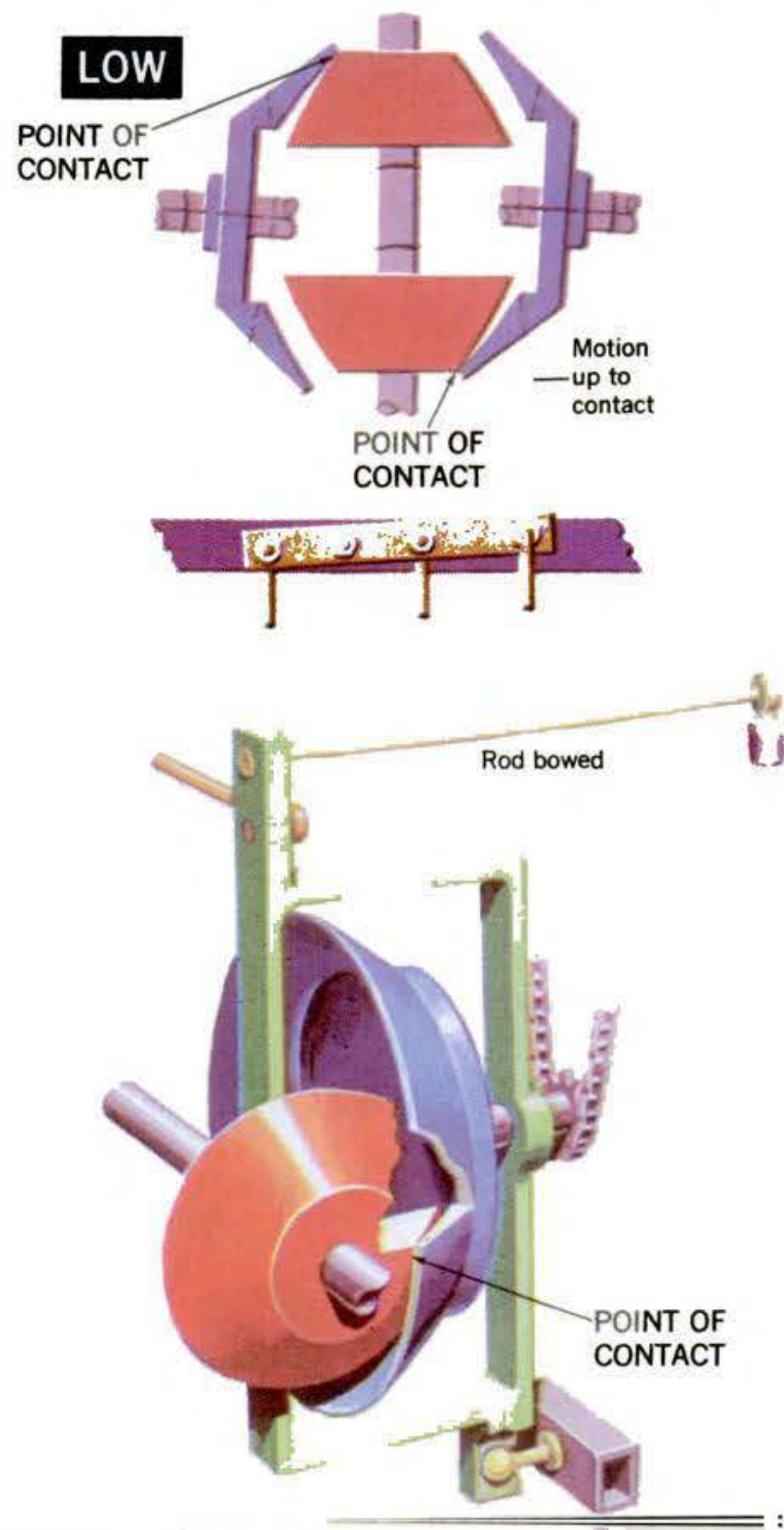
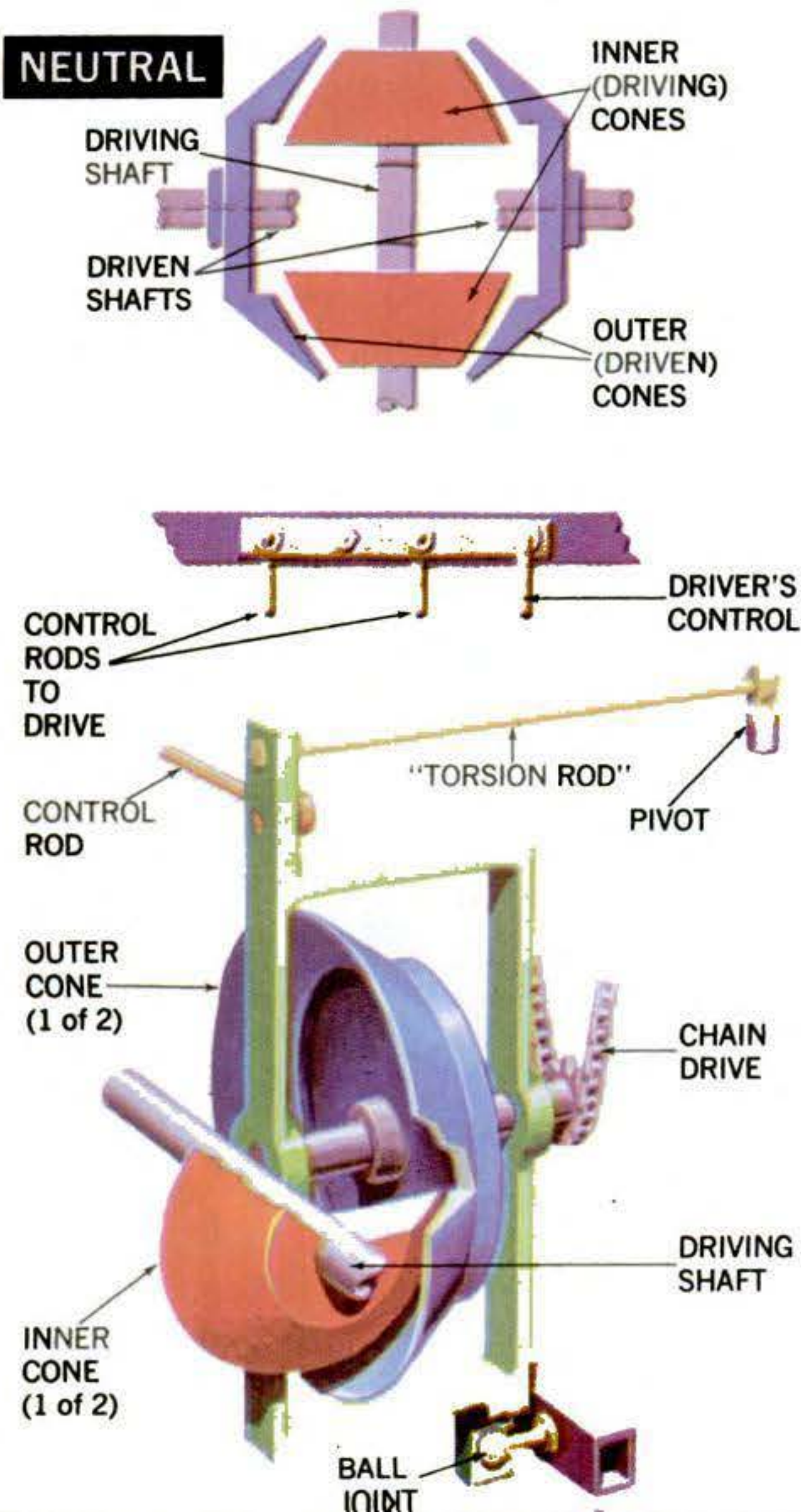
Control linkage can swing each frame, against the slight resistance of the flexible torsion rod. This brings one outer cone into contact with the front driving cone; and the other outer cone into contact with the rear driving cone. Both outer cones now turn in the same direction.

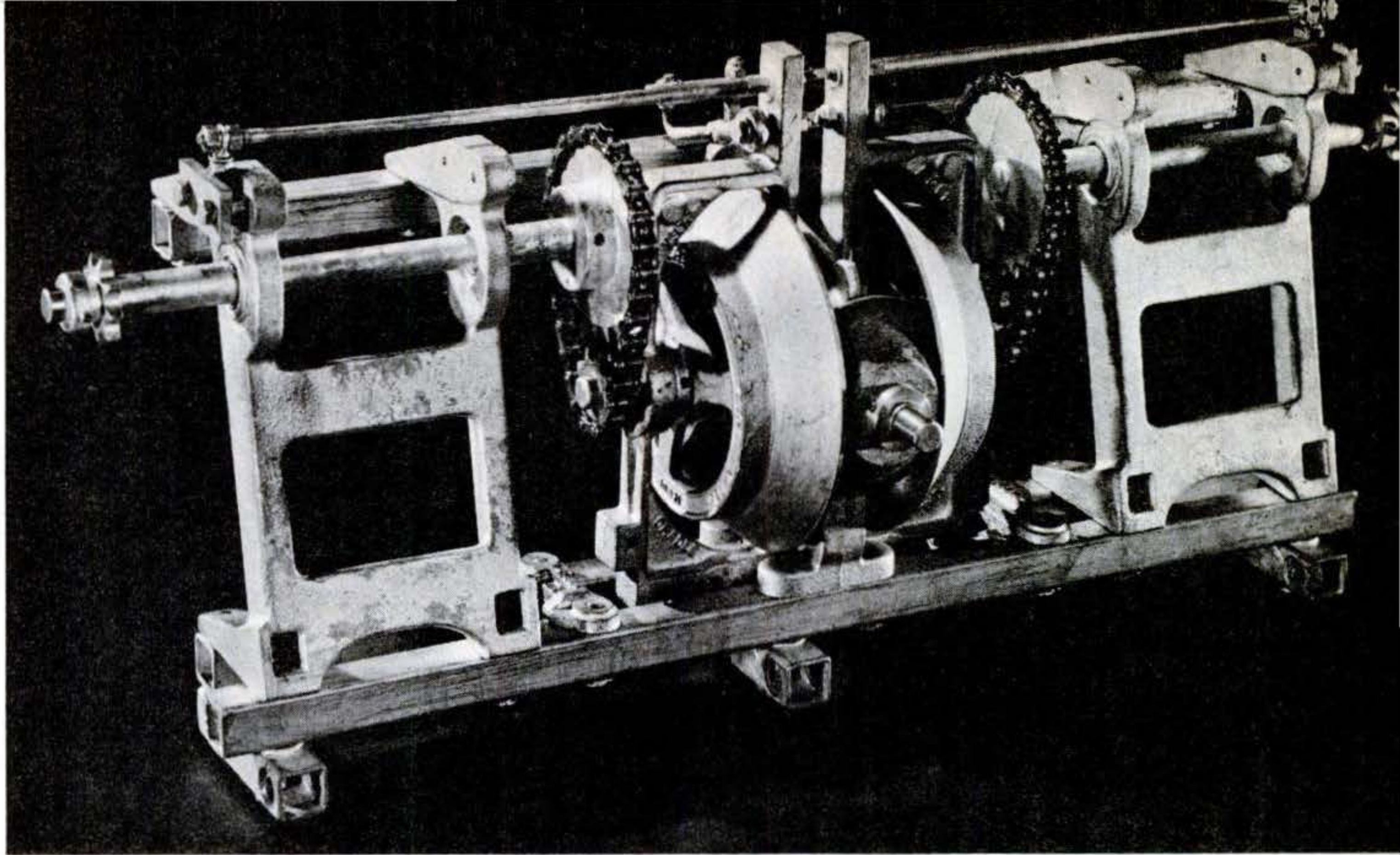
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## How the drive works: What the cones do, control-rod positions to make

**For neutral,** cones are unengaged. In absence of control pressure, self-centering frames of outer cones keep them out of contact with inner cones.

**Drive goes into low** as control pressure, swinging frames, brings cones into contact. Small sides of inner cones engage large sides of outer cones.





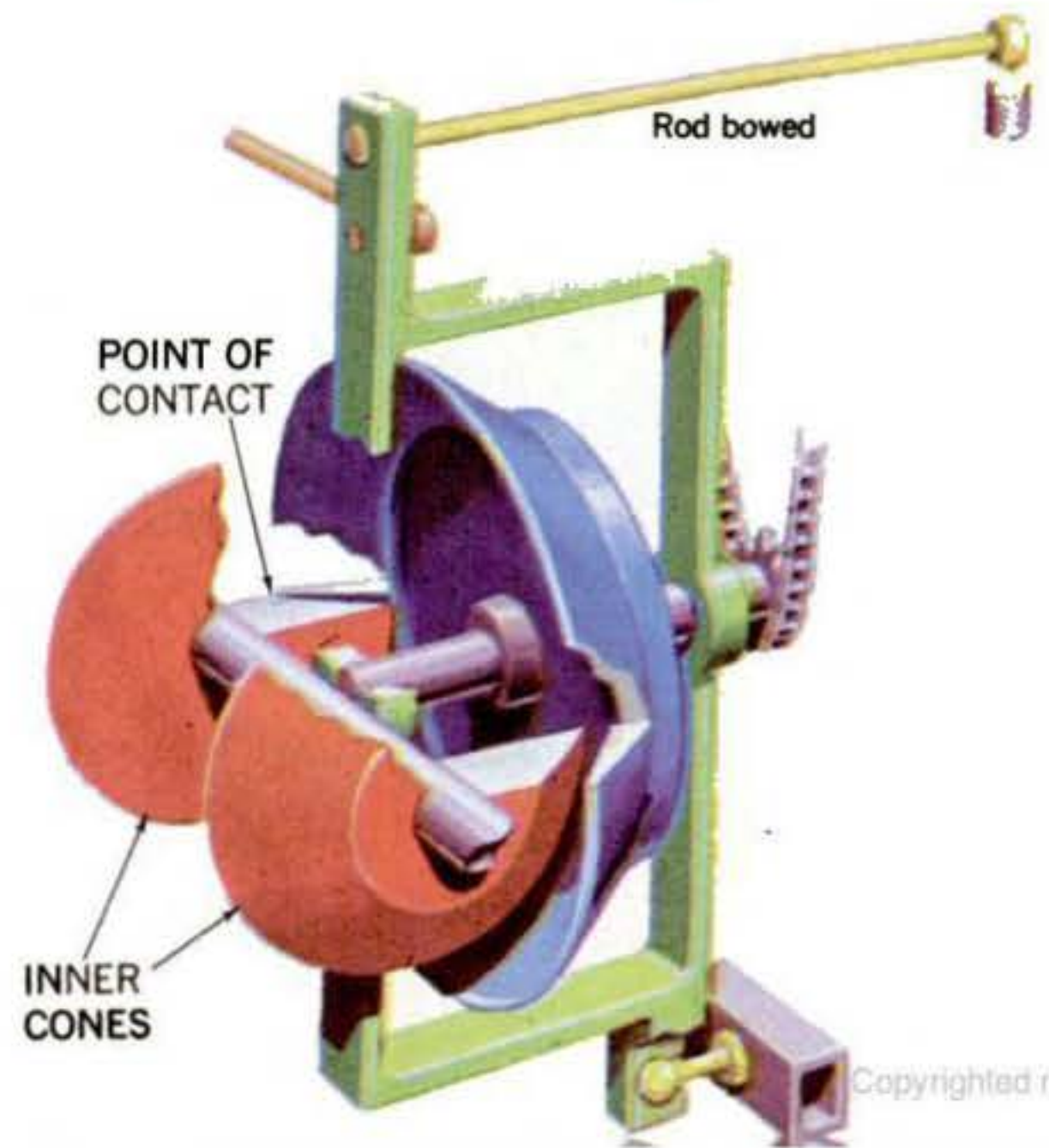
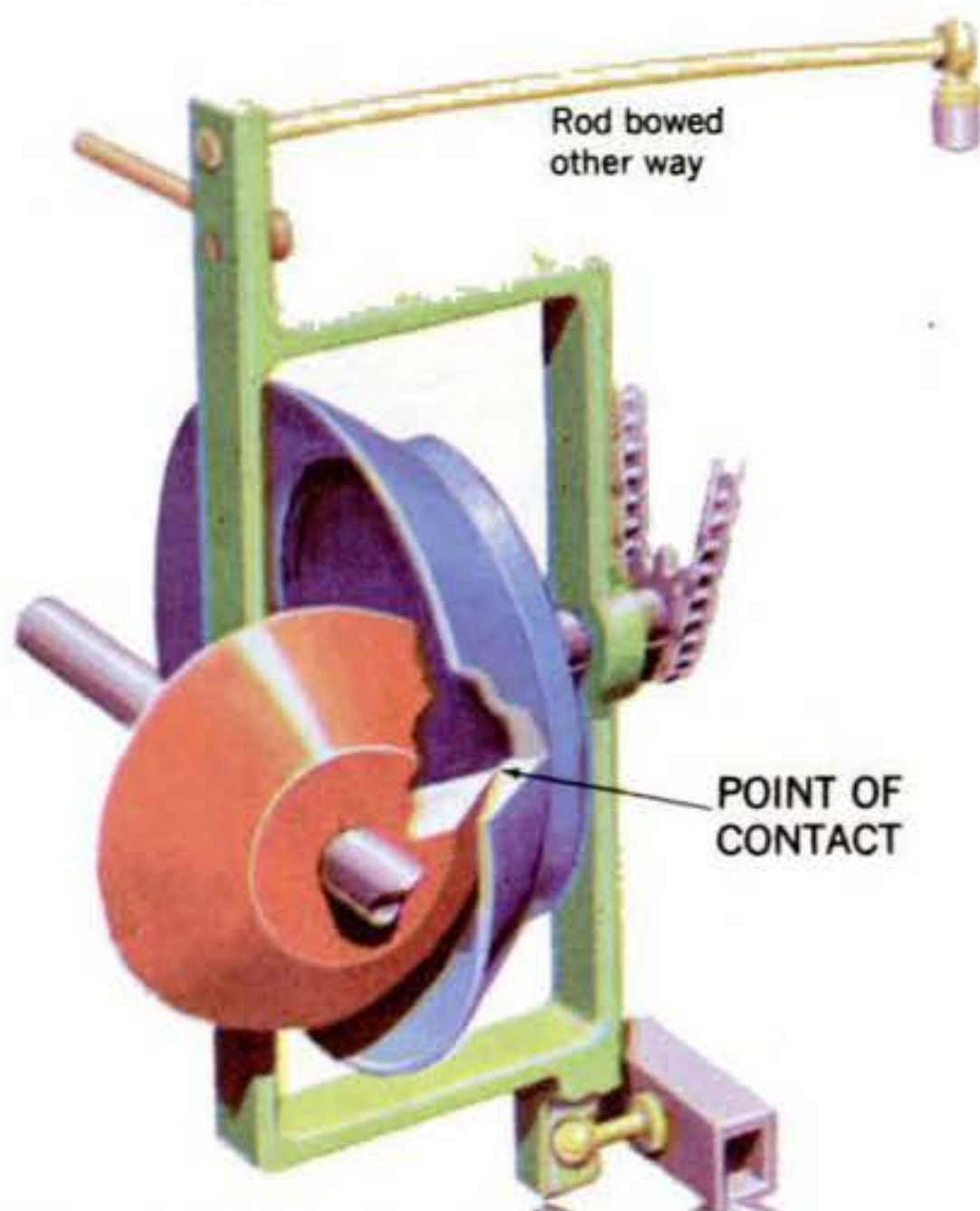
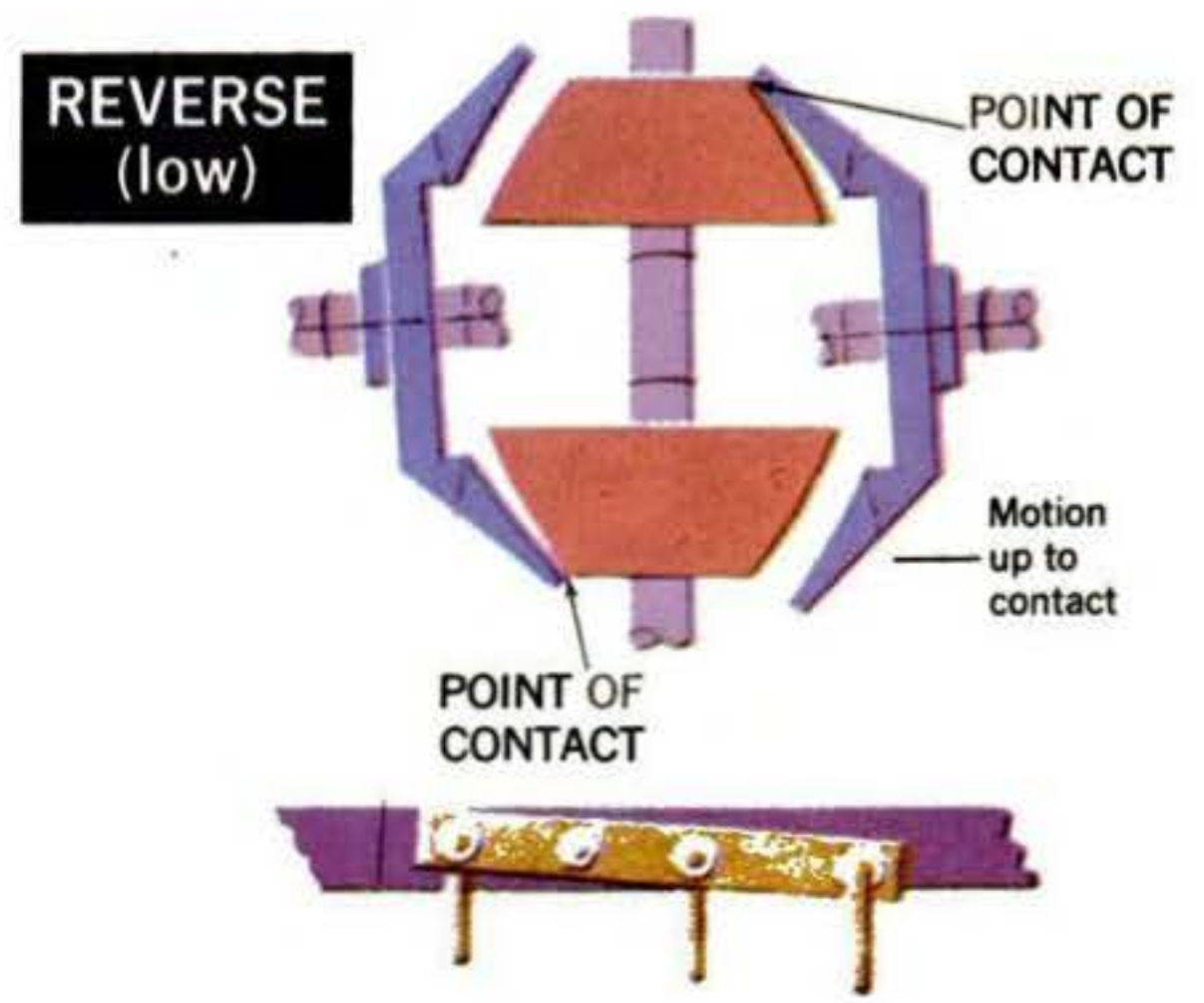
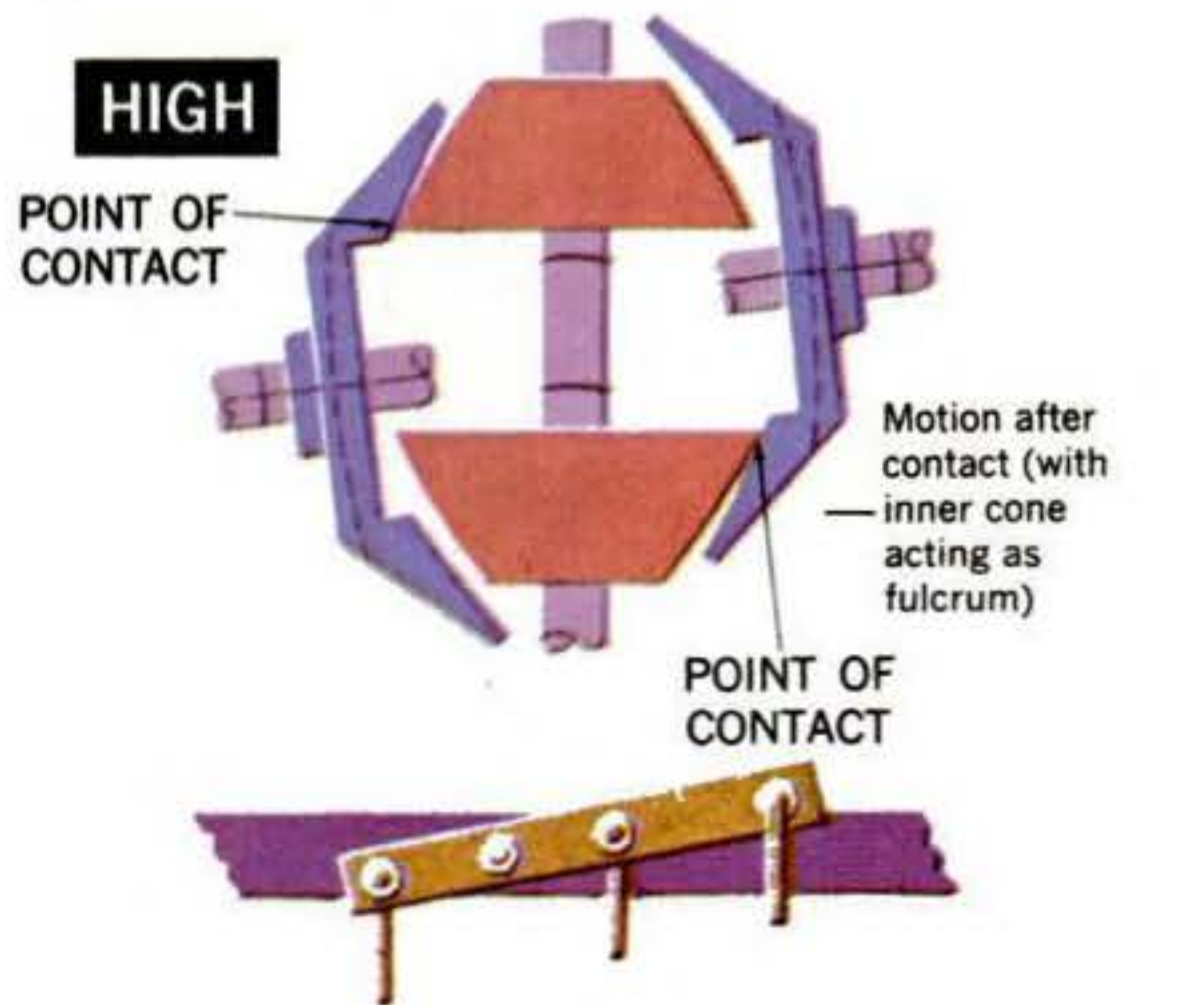
Complete cone drive, viewed from same side as in drawings below, makes this compact package—now available for building your own yard tractor or golf

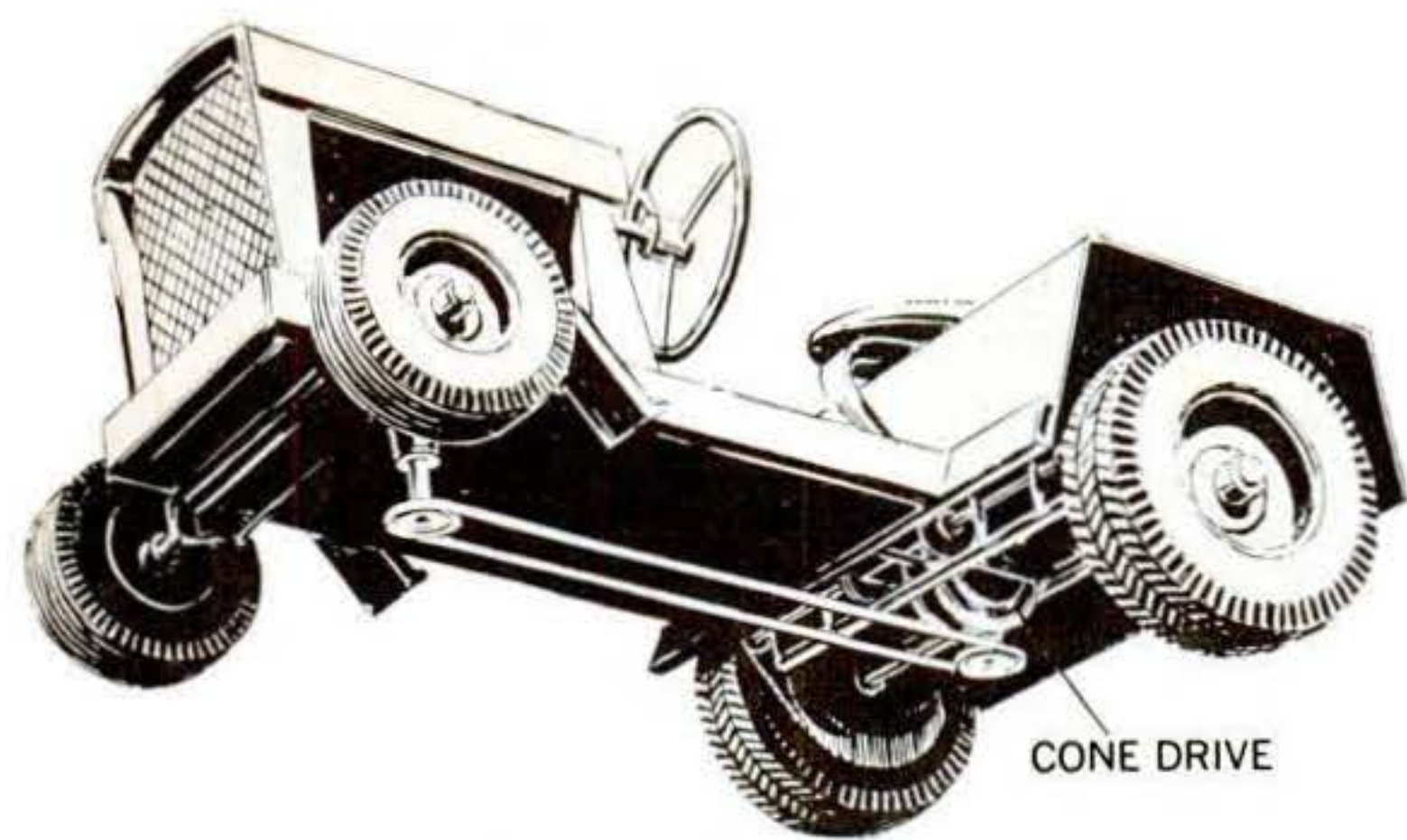
cart. Hitch it to an engine, add chain drives from outer sprockets to wheels, join control linkage (upper rear) to a control lever—and it's in business.

## them do it, and the resulting motions of the drive's mechanism

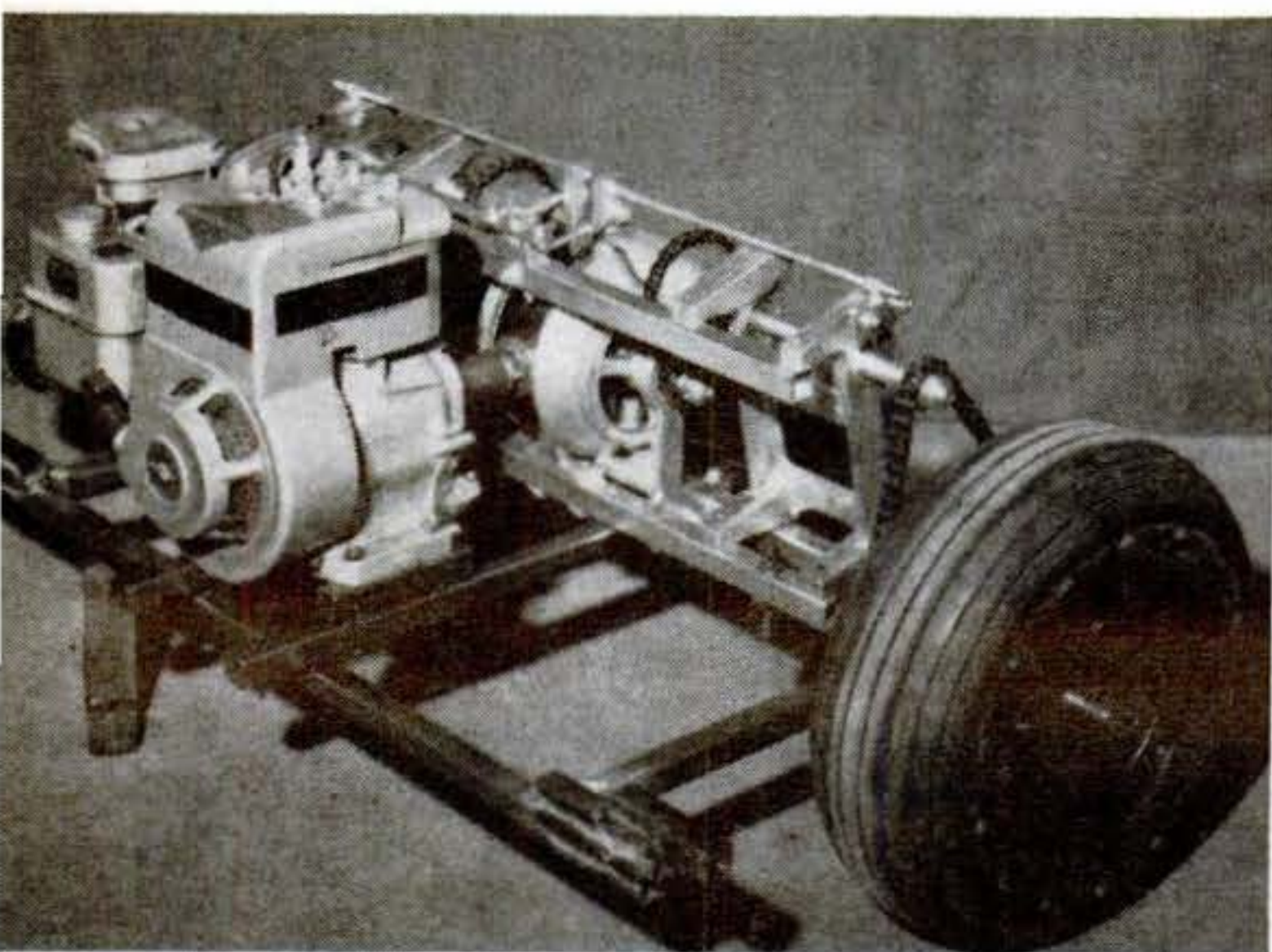
Contact point travels to high, where large sides of inner cones engage small sides of others, with more control pressure and movement of frame.

For reverse, moving control other way engages opposite faces of cones. Otherwise, neutral-low-high action is the same as when going forward.





In belt-drive tractor, above, cone-drive unit is laid on side—providing a vertical driving shaft that drive pulley turns directly. Drive may be installed in any position, to suit design of vehicle.



Golf-cart drive built by Davis, above, mounts cone-drive unit upright and couples it to engine with horizontal drive shaft. Photo also shows how the outer chain drives deliver power to the wheels.

For reverse, the control is simply moved the other way, and each outer cone contacts the other drive cone.

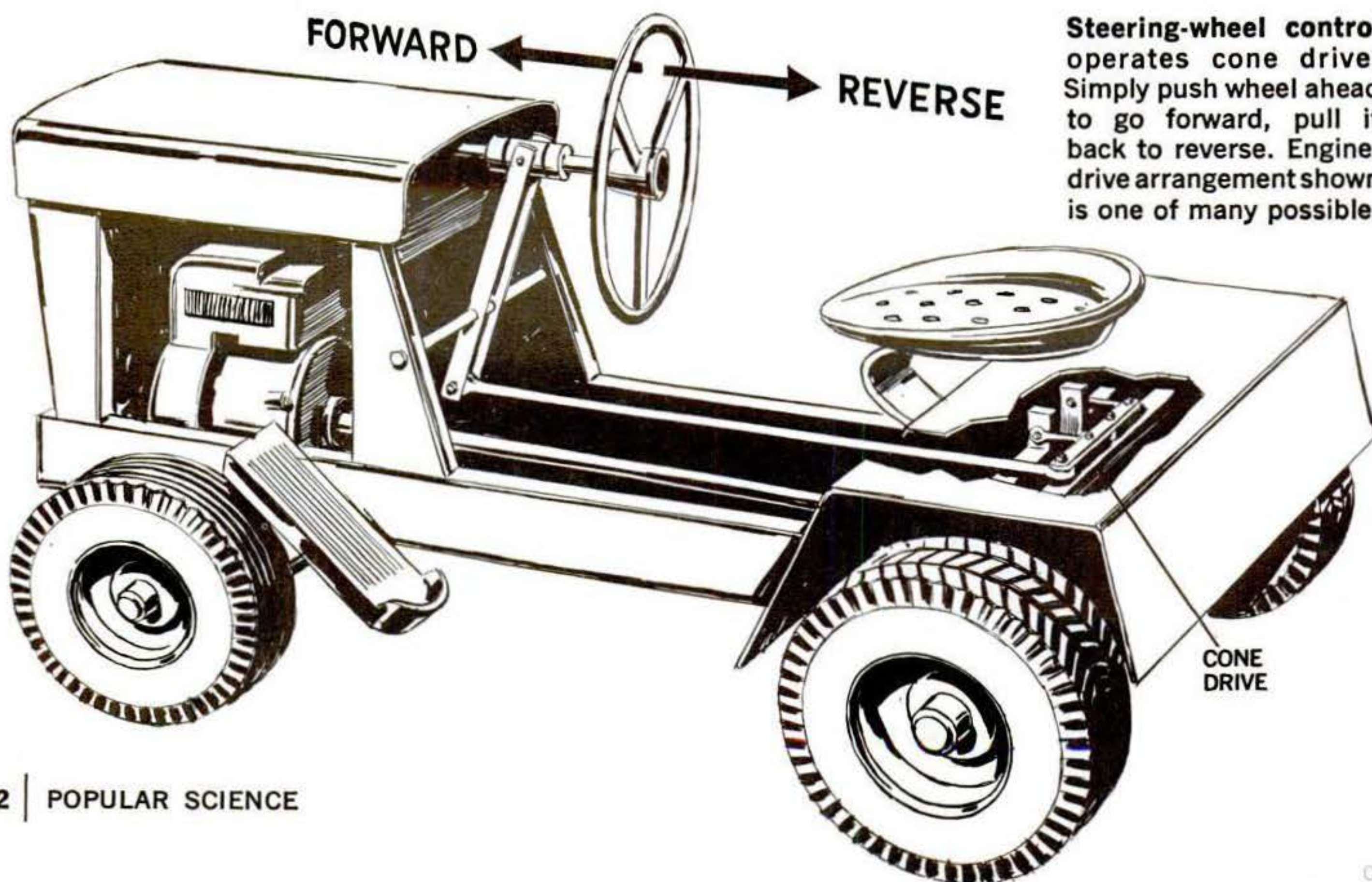
**How it shifts ratios.** At first contact, the small side of an inner cone engages the large side of an outer cone. This gives low, with a ratio of about  $4\frac{1}{2} : 1$ . Moving the control farther makes the outer cone rock upon the inner cone, which has a slightly convex face.

The more steeply angled outer cone is a trifle concave. As the outer cone rocks, the point of contact travels across the faces of the engaged cones. Thus, larger diameters of an inner cone bear progressively on smaller diameters of an outer cone—until at high there is a ratio of about  $1\frac{1}{3} : 1$ . Since the shift is stepless, there is a theoretically infinite number of ratios between low and high.

The outer cones' wriggling action—swinging and then rocking—results from the unconventional motion of their frames. First a frame swings horizontally, on its ball joint, to move from neutral to low. (It tilts from the vertical, too, as its movement proceeds.) Then, in going from low to high, contact with the inner cone provides a fulcrum on which the outer cone and its frame have to rock—in a direction contrary to their initial swing, as is evidenced by reversal of the torsion rod's bowing.

Actually these motions need be only slight to be effective—so slight, in fact, that they must be exaggerated to make them clear in the diagrams. Therefore, just a trifle of slack in the chain drives suffices to allow the outer-

*[Continued on page 182]*



Steering-wheel control operates cone drive. Simply push wheel ahead to go forward, pull it back to reverse. Engine-drive arrangement shown is one of many possible.

# Whose Hue? PS Guide to COLOR FILMS

Roses are red, and  
violets are blue—  
but look what a change  
in color film can do

By PAUL WAHL

PS PHOTOS BY HARRIET ARNOLD



**T**he color film that reproduces all colors exactly hasn't been invented yet, although 30 years have passed since the debut of the original Kodachrome. What the manufacturers have given us are films capable of delivering a color image beautiful enough to satisfy almost everyone and reasonably faithful. It seems more than likely that the honesty of true "natural" color would prove less appealing than the somewhat idealized view pre-

sented to our eyes by today's color films.

You and I see the world around us quite differently because color vision, like other senses, is subjective. And, of course, tastes differ. Some people like their colors bold and bright; others prefer them subtle and soft. Maybe the warmer colors, reds and yellows, are more attractive to you than the cooler blues and greens. On the other hand, if you specialize in landscapes and seascapes, the

For color comparisons of eight leading films, turn the page ►

latter colors will be of greater importance.

Skin tones, regarded most critically by the average viewer of a color slide, usually are rendered attractively, although tonal range on various films goes from an almost transparent pink to a definite tan, with golden shadings between.

All of the current color films make pretty pictures but, like you and me, they "see" differently. Each film has distinct characteristics that give it a personality all its own. Whatever your preferences in color reproduction, you should be able to find *your* color film — the one that sees things your way.

While color rendition ordinarily is the prime factor in choosing a film, also to be considered are such characteristics as contrast, latitude, speed, and grain — all of which affect the end product, your color slide.

**How much contrast?** With high-contrast films you get very light highlights and very dark shadows, and usually lose details in both areas. Low-contrast films are not as bright in their highlights, and shadows are more open; both highlight and shadow details are good in slides made with these films, but the overall effect is flat — the snap contributed by contrast isn't there.

## Some films may be less accurate in color rendition, but please



**Agfachrome CT18 (ASA 50).** Relatively high contrast gives snap to brilliant transparencies in which all colors are quite faithfully rendered, although skin tones may be a bit too deep a tan for some tastes. Overall effect is on the warm side with a tendency for shadow areas to go brownish. Film sizes: 35mm, Rapid, 127, 120.



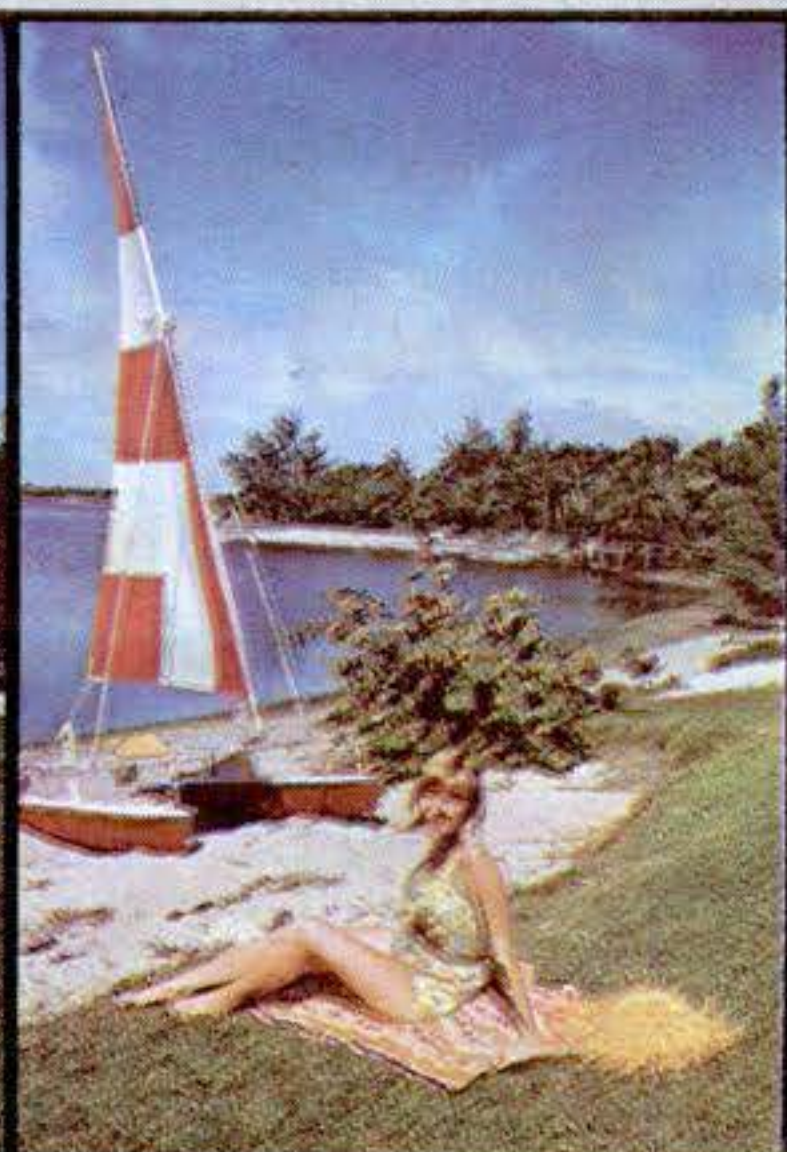
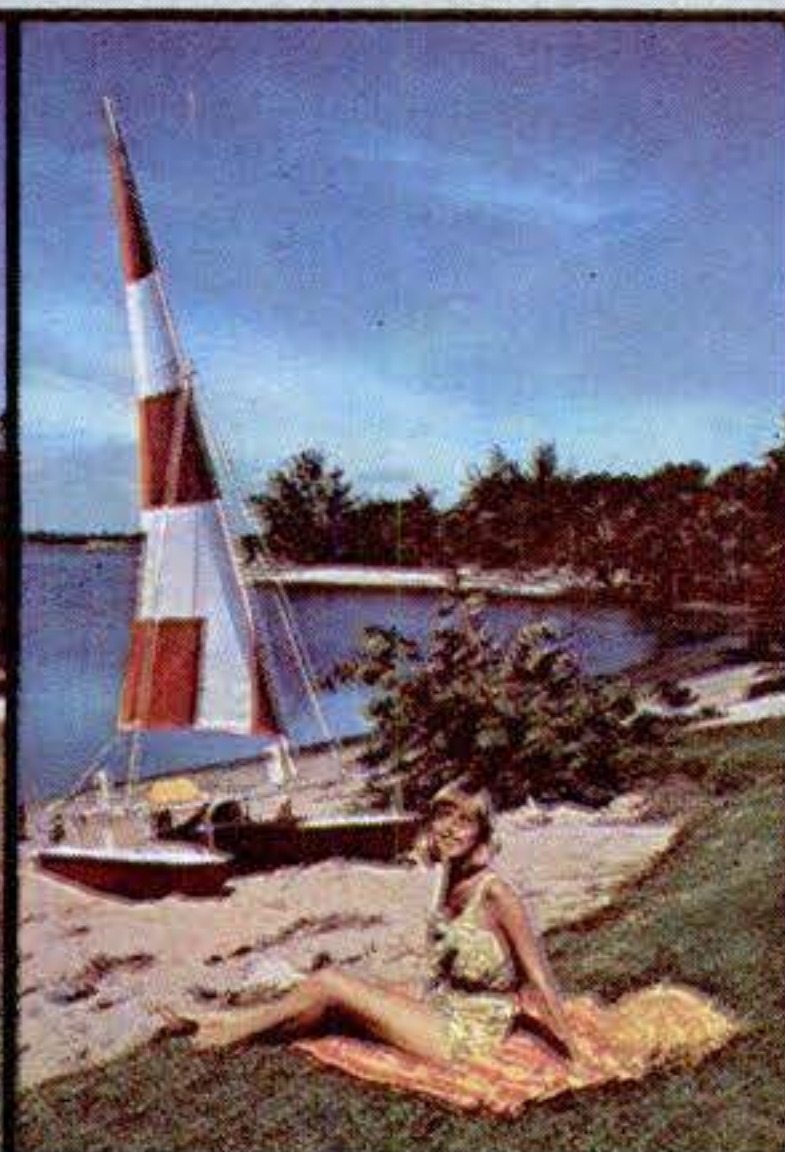
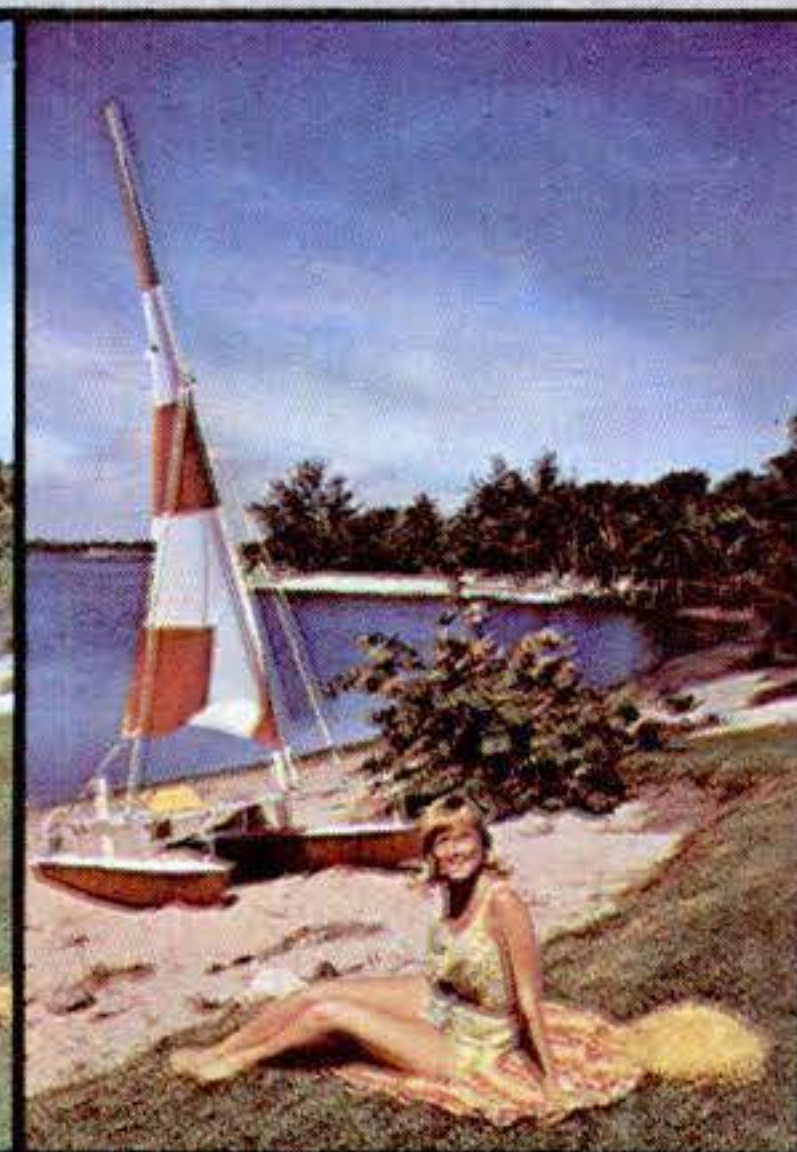
**Anscochrome D/50 (ASA 50).** Colors are muted — soft and warm, but generally accurate. Greens may be slightly dull. Skin tones — and sand — tend to take on a somewhat pinkish tone. Blues are very deep. Film's low contrast provides good detail in open shadows. Film sizes: 35mm, 126 (similar film rated ASA 64), 127, 120, 620.



**Anscochrome D/100 (ASA 100).** Higher contrast makes for a somewhat snappier picture than with Anscochrome D/50. Color rendition is less warm, with colder blues and skin tones that are a more golden tan. D/100 is a very useful film when conditions demand its extra speed: in dim light and for action. Film size: 35mm.



**Dynachrome 25 (ASA 25).** Strikes a happy medium in color brilliance and contrast for a pleasing overall effect. Reds tend to be orangey. Skin tones are a light tan. Shadows are open and neutral. This 3M product is the lowest priced color film on the market, and quality is high. Also sold as Sears Color Film. Film size: 35mm.





For all-around use, you may get better results with an "average" film that strikes a happy medium in contrast; however, there are times when high- and low-contrast films can be real lifesavers. Use the former to brighten up dull days, the latter to tone down too brilliantly lighted scenes where important shadow detail is present.

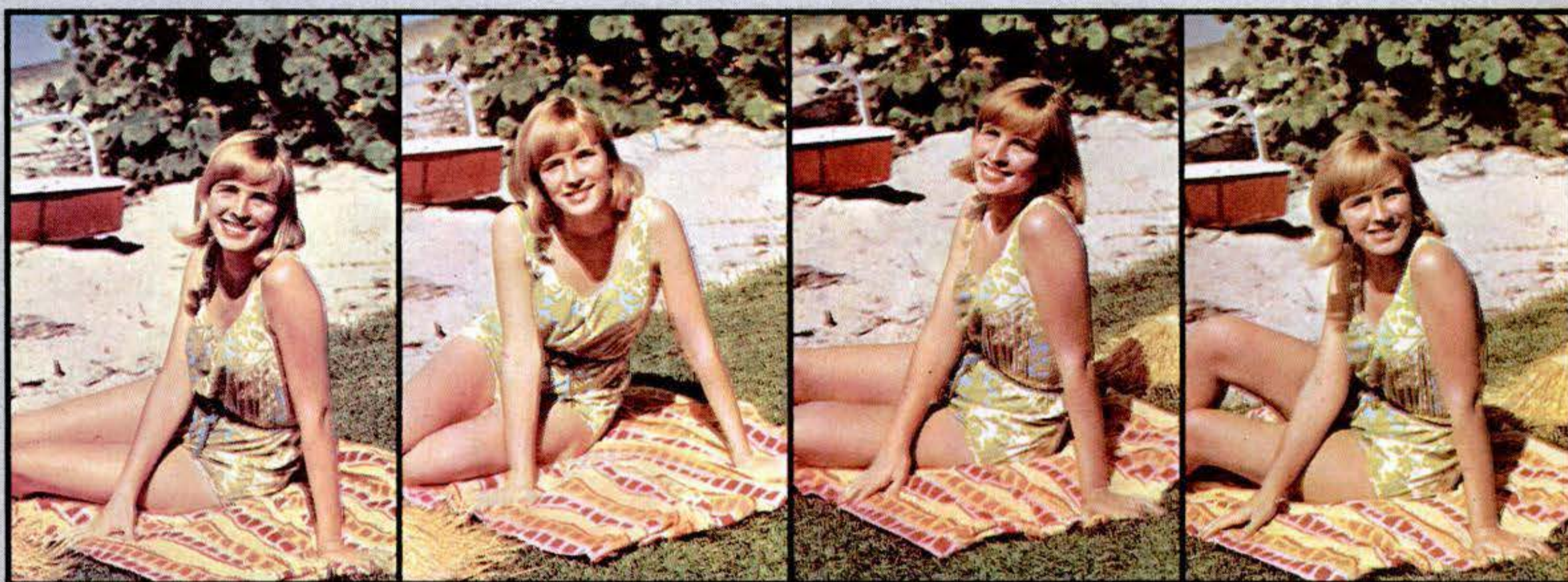
**How tolerant is color film?** Latitude is a film's capacity to forgive mistakes in exposure. While color films are not as forgiving as most black-and-white materials, generally you can count on a tolerance of one *f* stop over- or under-exposure. It's better to err on

the side of underexposure — when projected on the screen, the denser, richer-colored images of underexposed transparencies are frequently more pleasing than those of properly exposed slides.

Today, many photographers tend to rely almost slavishly on the dictates of exposure meters or the decisions made for them by automated cameras. Unfortunately, meters can be fooled — for example, by strong back-lighting. One of the best guides to proper daylight exposure comes free with every roll of color film. It's that leaflet you throw away

*[Continued on page 190]*

**you more. Here's how to decide which one is best for you**



**Dynachrome 64 (ASA 64).** Fairly contrasty — good for dull days. Colors are warm, slightly brownish in cast—especially noticeable in sand and skin tones. Flesh is rendered darker and more golden than in Dynachrome 25. Also sold as Sears Color Film in 126 instant-loading cartridge. Film sizes: 35mm, 126.

**Ektachrome-X (ASA 64).** Comes on strong with vivid colors (that those who like pastels regard as garish) and unmatched brilliance, complemented by medium contrast. Colors are generally quite accurate. Pinkish-tan skin tones are very flattering. Excellent film for all-around use. Film sizes: 35mm, 828, 126, 127, 120, 620.

**Kodachrome II (ASA 25).** Very sharp. Virtually grainless. Colors are bright and generally faithful but there may be a pinkish cast. Natural skin tones. By virtue of low contrast, K-II is especially well adapted to scenes in bright sunshine. Shadows are neutral with good detail. Most popular color film. Film sizes: 35mm, 828.

**Kodachrome-X (ASA 64).** Faster, more contrasty, less sharp than Kodachrome II. In general, color rendition is similar to that of K-II, but less vivid. Skin tones are not as pink, more on the tan side. Higher contrast and greater speed give better results on dull days, and for taking action pictures. Film sizes: 35mm, 828, 126.





### Traffic lights hung at child's-eye level

The town of Wuppertal in West Germany has installed traffic lights at street crossings for children as well as adults. The lights for adults hang as usual at the pole tops, those for children near street level so they don't have to crane their necks to tell whether the red or green shows. They need extra cleaning, though, to remove wheel-splashed dirt.



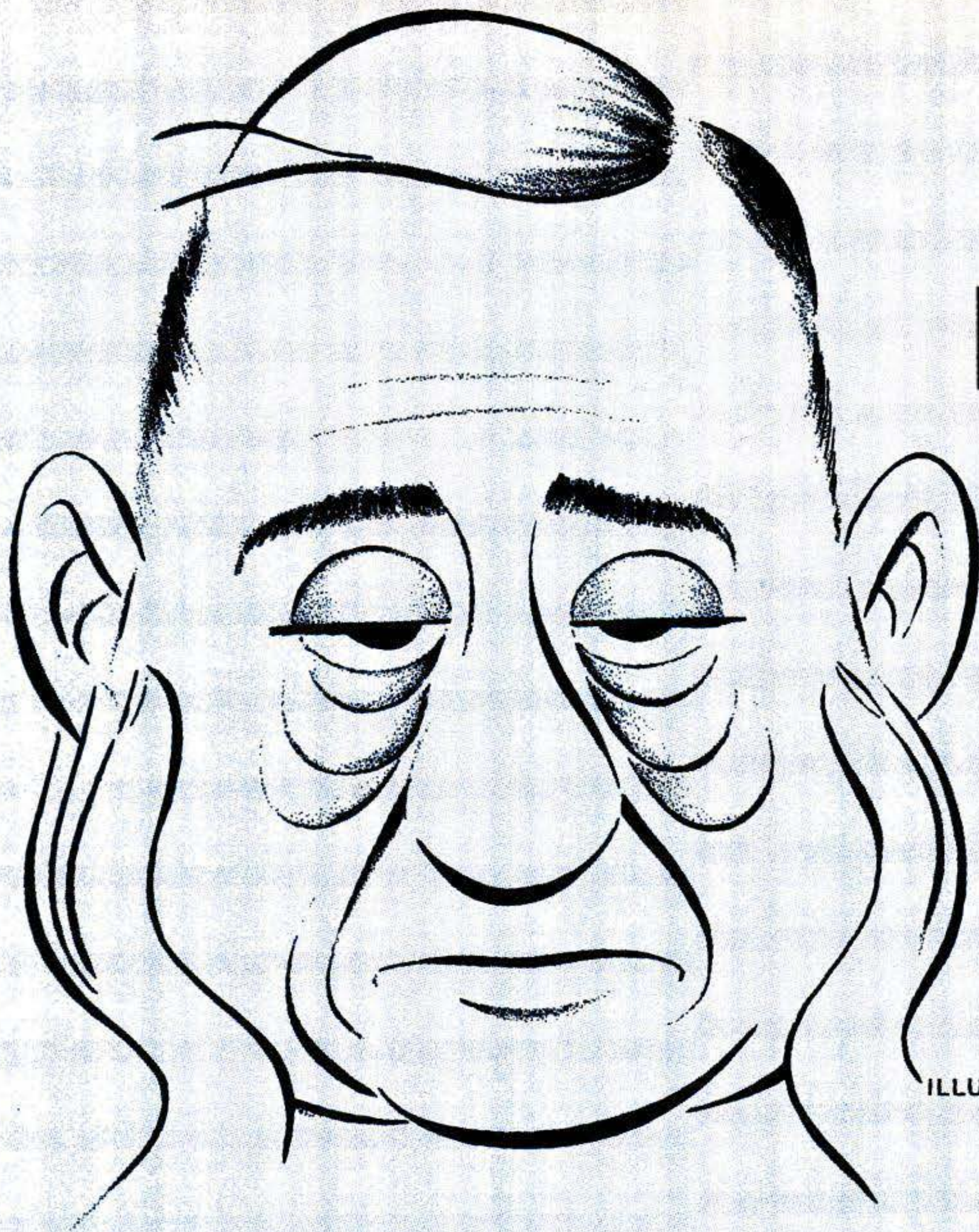
### TV helps astronauts see at night

To orbiting astronauts, night on earth lasts only about 30 minutes, the time it takes the eye to adapt to low light conditions. To help them see the earth at that time, the Navy has developed a low-light television camera and monitor, electronics monitor, and photographic camera recorder. It's shown at left mounted for tests in the cabin of a Navy P2V Neptune plane.



### Three-decker bus is hotel on wheels

You don't have to travel to this hotel; it travels with you. Built in West Germany, the three-decker cruising bus has 24 berths on its upper levels, television in its lounge, built-in showers, shoeshine machines, and a kitchen for meals on the road. Its first tour is scheduled for this summer: New York to Rio de Janeiro, following the Pan American Highway.



# What Happens When You Get Tired?

By LAWRENCE GALTON  
ILLUSTRATIONS BY HERB ANTHONY

**Fatigue can fool you. Maybe it's really boredom, tension, lack of exercise, or the wrong food. Here are the surprising facts on how you can bounce back**

**W**ant to know how to fight fatigue so you can get more things done and enjoy life? *Get tired more often!* Strange as that sounds, investigators are finding that regular physical activity increases your working capacity about 20 percent. In short, the more you do, the more you *can* do.

Much about fatigue has long been mysterious. But little by little scientists are beginning to fit together clues about what happens when we get tired. The results are enough to debunk some long-held theories—for example, that fatigue occurred simply because of accumulation of a waste product in the muscles.

We get our energy from the sun. It's captured and used by plants to combine carbon dioxide from air and minerals from soil into carbohydrates. We eat the plants and change the carbohydrates into glycogen—animal starch. Every time you bend an elbow or raise an eyebrow, the muscles involved are fueled by glycogen. But, along with energy, glycogen yields lactic acid.

**Classic theory.** Accumulate enough acid, so the classic theory went, and you get tired because muscle tissue becomes lethargic in an acid medium. But researchers have found that when you work, so do the

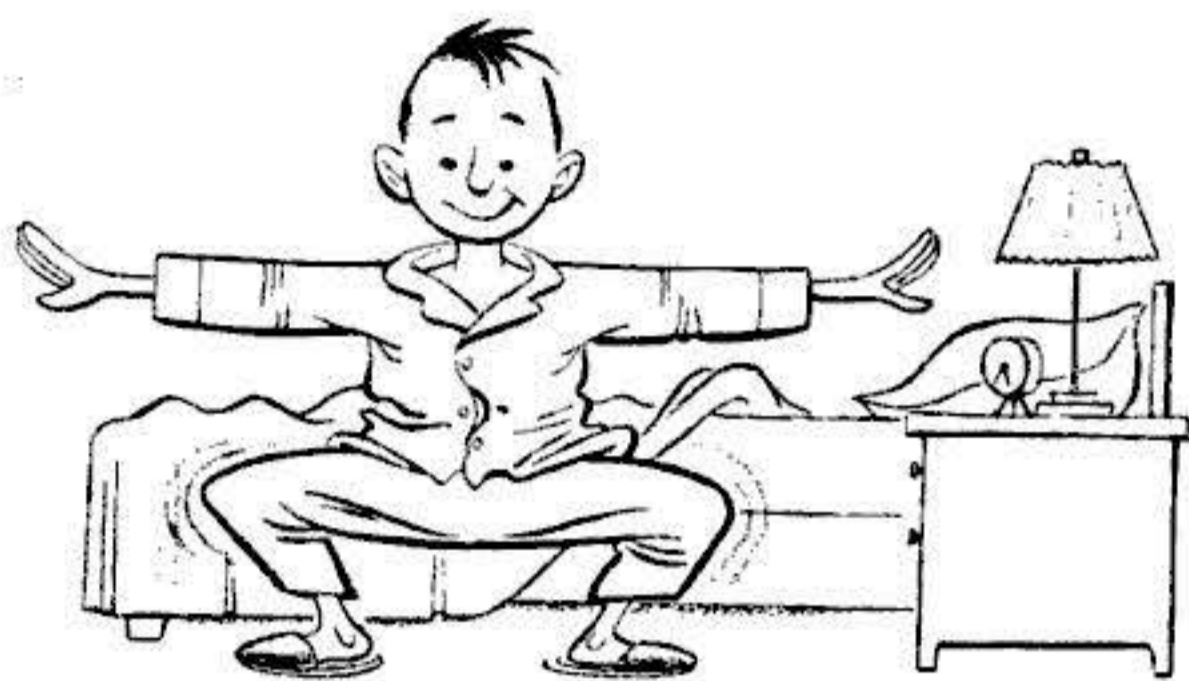
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## Scientific evidence shows that you have about twice as much energy

adrenal glands atop the kidneys. They produce secretions that buffer lactic acid. What little acidity remains stimulates breathing. And as you breathe in more oxygen, it helps dispose of the acid by oxidation.

You may feel tired at the end of a day, but there's little lactic acid to be found.

Actually, muscles, while subject to exhaustion, can bounce back fast—even after a hard workout. Using an ergometer to measure muscular contractions in volunteers lifting weights, investigators found that muscles, after 20 minutes of strenuous activity, may lose half or more of their power—but, after 12 minutes of rest, they re-



**Regular exercise of almost any kind will up your working capacity by 20 percent.**

cover 90 percent or more. With each repetition, of course, exhaustion sets in earlier.

People vary greatly in fatigue resistance. One reason—physical condition. But early this year, University of Toronto investigators at a fairgrounds got 60 passing men, from age 19 to 61, to step up and take a test ride on an ergometer bicycle. All the men were flabby, at least a few pounds overweight. Yet it turned out that those taking regular exercise—anything from calisthenics to swimming—had an average of 20 percent greater working capacity.

**Why exercise?** Regular exercise does more than increase muscle size. At rest, muscles use 60 to 70 milliliters (thousandths of a quart) of oxygen per minute. In exercise, they need 3,000! The heart pumps harder to get more oxygen-carrying blood to the muscles, increasing heart-pumping efficiency. Also, reports Dr. Thomas Cureton of the University of Illinois, tiny blood vessels that penetrate muscles are opened wide, including many otherwise not open at all—and circulation efficiency increases, making for greater strength and endurance.

Some investigators believe exercise is also needed to keep the adrenal glands in shape.

One study, showing that when wild animals are domesticated their adrenals shrink, suggests that our adrenals may have been getting smaller as we have become ever more civilized, giving the glands less and less regular physical stimulation. A major reason for the U.S. swimming team's record-breaking capture of 31 gold medals at the last Olympics is believed to have been the work of scientists on adrenal function.

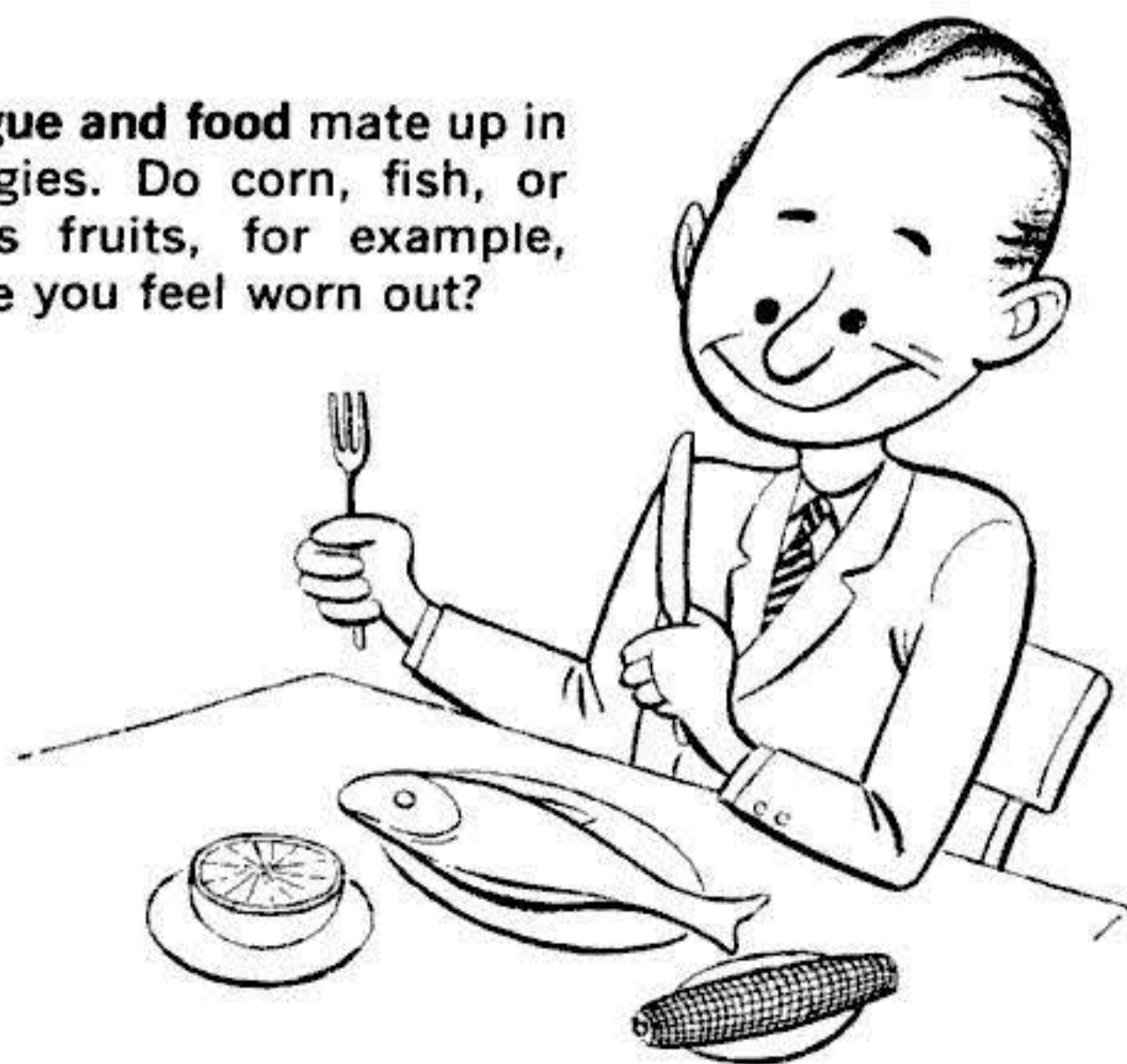
Swimmers training for a 100- or 200-yard race used to do a leisurely mile or so a day. But the 1964 Olympic team used many types of workouts—including short-distance dashes at about 70 percent of all-out speed—to condition the adrenals.

Physical conditioning to better equip all of us to cope with fatigue and other problems of everyday living is now getting increasing stress from medical men. Says a top authority, Dr. Warren Guild of Boston: The man in good shape "can sustain physical and psychological duress longer."

This year, physical-ed instructors, urged on by the American Medical Association, are giving youngsters a "step test" (you might want to try it if your doctor gives you the okay) to get an idea of their fitness. You step up and down a 20-inch-high platform (14 inches for women) 30 times a minute for four minutes. One, two, and three minutes afterward, the pulse rate is taken for 30 seconds at a time—and the sum of the three counts gives a rough indication of fitness.

When pulse counts total: Response is:  
199 or more.....Poor  
171 to 198.....Fair  
150 to 170.....Good  
133 to 149.....Very good  
132 or less.....Excellent

**Fatigue and food mate up in allergies. Do corn, fish, or citrus fruits, for example, make you feel worn out?**



## and stamina as you think you have

To fight fatigue, many drivers turn on the radio—a good habit, researchers say, because emotions make you tired. Listening, you get less angry with other drivers—less tired.



But fatigue isn't only a matter of muscles. The nervous system plays a cardinal role. You've probably had the experience of feeling bushed, yet, motivated by some unexpected pleasure or emergency, being able to summon instant energy and get moving with a speed impossible minutes before.

**Fatigue and monotony.** The sensation of fatigue appears to reside in the thalamus and hypothalamus brain areas. It also appears to be countered by stimulation from the reticular formation. This brain area acts in response to messages coming through the nervous system. It becomes less responsive—apparently the whole nervous system does—when messages are monotonous.

Boredom, experts say, is one of the chief contributors to fatigue suffered by industrial and office workers. As Dr. Peter Karpovich of Springfield College has put it: "It is the nervous system that gets tired first. When work is not interesting, one may tire sooner than with work that is harder but more stimulating. This type of fatigue is really boredom, although you may feel physically tired." In such situations, Dr. Karpovich says, a short break—for coffee, a snack, or a chat—is a big help.

Years ago, Dr. Arthur G. Bills of the University of Cincinnati found that often fatigue results, not from exertion alone, but from emotion piled on top of exertion.

A few months ago, a British psychologist reported an experiment with automobile drivers. He had eight drivers grind repeatedly around a two-mile city circuit—with radio on, then off. Registering devices on accelerator, brake, clutch, and steering wheel recorded a measure of driving efficiency. Results indicate that music from a radio helps reduce impairment in driving stemming from monotony and fatigue.

How come? The psychologist says the extra job of listening to the music lowers "emotional arousal in certain conditions by providing an alternative stimulus." In plain

English: You're likely to get less angry with other drivers—and drive better, longer.

**What's wrong with pep pills?** One indication of nervous-system involvement in fatigue is the ability of such drugs as caffeine in coffee and amphetamine in "pep pills" to boost endurance by stimulating the nervous system. Airmen in World War II used amphetamine for extra stamina and alertness on long, dangerous missions. And when Astronaut Gordon Cooper's automatic controls failed, he was ordered to take amphetamine so his reflexes would be sharp for manual reentry.

But if amphetamine, medically prescribed for special situations, can be valuable, indiscriminate use is dangerous. Abusers, making a crutch of pep pills, have trouble sleeping—and even standing or sitting still—and while they may keep going for hours or days, they may end up collapsing.

Actually, more effective for pepping up than any stimulant drug may be the removal of psychological barriers—apparently most of us have far more strength and energy than we normally use or believe we have. To demonstrate this, Dr. Arthur H. Steinhaus ran a series of experiments at George Williams College in Chicago. He put subjects to work contracting their right arms isometrically, exerting maximal force once a minute for 30 minutes. Instruments measured the force.

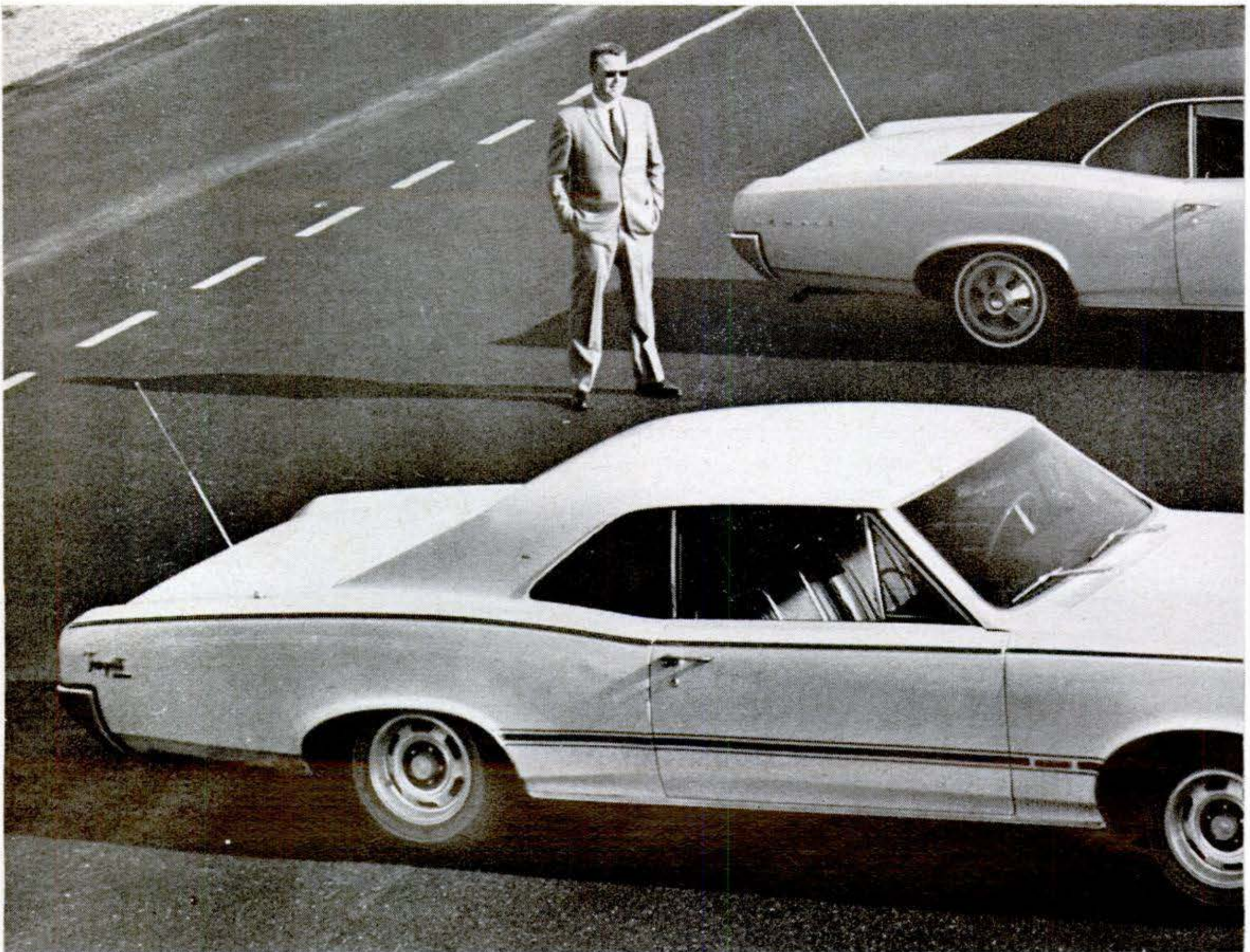
The tests were repeated after amphetamine was given—and again when a .22-caliber starter's gun was fired unexpectedly behind the subjects to startle them into greater effort. Then hypnosis was used; they were told they were getting stronger.

Steinhaus found that amphetamine produced an average increase in force of 9.5 pounds. The gun shot led to a 4.5-pound increase. Best of all by far was simple suggestion under hypnosis; it upped the force by 18.3 pounds.

Not long ago, Dr. Stewart G. Wolf of

[\[Continued on page 188\]](#)

# How Hot



Tempest Custom Sprint sports rally stripes; Le Mans carries dignified black vinyl top. Below, see



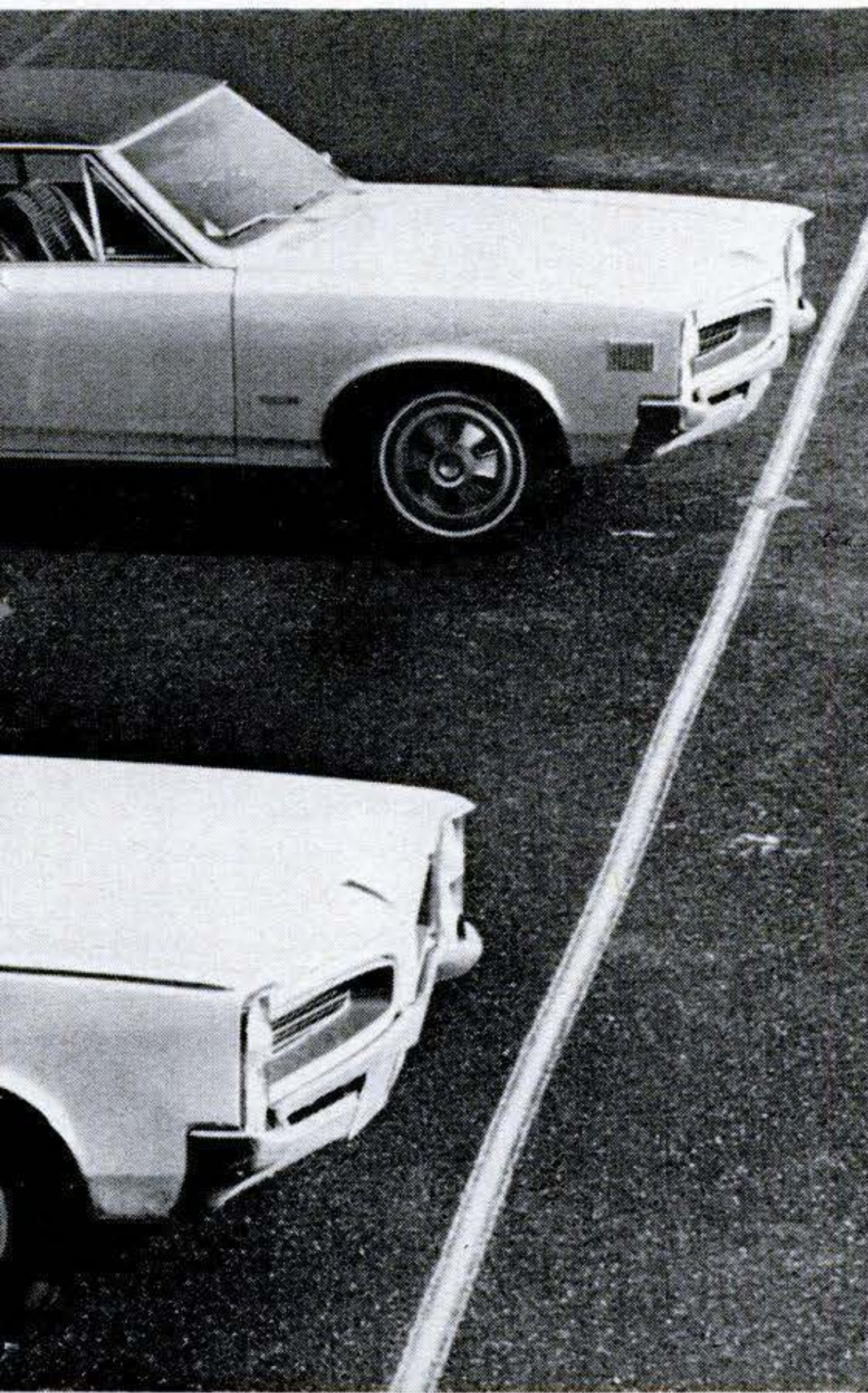
Le Mans enters curve with slight understeer . . . . . remains neutral throughout curve until . . .

Sprint enters curve with firm understeer . . . . .

. . . drifts through with no steering angle until . . .



# Can a Six Get?



how they corner when driven "too fast."



... the tail drifts out under full throttle.

... final breakaway aims car right for next turn.



Pontiac's overhead-cam six gets hotter than some V-8s but is basically a docile and extremely quiet engine. And there are "his" and "her" types of Tempest

By JAN P. NORBYE / PS Automotive Editor  
PHOTOS BY BILL MORRIS

**A**re pushrod sixes on the way out? After 3,000 miles with two Pontiac overhead-cam engines, I say yes. What overhead cams have done for the Jaguar and Mercedes-Benz sixes, they have done for Pontiac's. The result is as sensational as I predicted last August in *POPULAR SCIENCE*—when I hadn't even driven the car.

Look what you get: higher volumetric efficiency, higher r.p.m. range, lower weight (and cost) per horsepower, less engine noise, simpler servicing, and longer life.

I tested both versions of Pontiac's OHC six: the regular 165-hp engine and the high-performance 207-hp. job. The regular engine is very, very quiet, and the hot one is really hot. How hot? It revs to 6,000 with the ease of a turbojet and has enough thrust to hurl the 3,309-pound (curb weight) Custom Sprint from zero to 60 m.p.h. in 9.3 seconds. With that kind of power, even Batman could use an engine swap.

**Testing for torque.** Unlike hot V-8s, this six idles at 500 r.p.m. and has a practically flat torque curve from 1,700 to 5,000 r.p.m. On level ground with two men aboard, the Sprint started from standstill in top gear at idling speed (yes, it has a heavy-duty clutch), and slowly chugged along without a sign of bucking at less than 10 m.p.h. Then I gave it the toughest test for engine torque: As it idled along, I suddenly floored the accelerator and held it down. No fuss. The car just speeded up, without spitting or coughing. At just under 2,000 r.p.m., the torque came in and the Sprint dug in its claws and took off.

The regular OHC six was more sedate. Time from 0 to 60 m.p.h.: 16.2 seconds.

*Continued*



**Le Mans stopped from 65 m.p.h. with severe nose dive and slight pull to right.**

How different are the two types of engine? The hot one came with special main and connecting-rod bearings, transistor ignition, heavy-duty valve springs, high-lift camshaft, split exhaust manifold, and low-restriction exhaust system. There were none of these on the 165-hp. Le Mans.

**The Custom Sprint.** To go with the hot engine, our test car had a fitting selection of chassis options: the heavy-duty springs, shock absorbers, and front stabilizer bar that make up what Pontiac calls its "ride and handling package"; four-speed manual floor shift; Safe-T-Track limited-slip differential with 3.9:1 ratio; metallic brake linings; U.S. Royal red-line tires; and quick manual steering (20:1 steering-gear ratio).

The result is a tough, made-for-men car that could meet any road situation with ease. There wasn't a power-assist device on the thing—and I loved it. Soft ride? No. Easy parking? No. But more important, I felt a close communication between the controls and my own senses—the kind of thing that makes you feel that you and the machine are one.

Women being the obtuse creatures that they are, my wife preferred the Le Mans with the regular OHC six, power steering, power brakes, and automatic transmission. In no time at all, we were referring to the two Pontiacs as "his" and "her" types of Tempest.

**The Sprint vs. Le Mans.** The differences in handling were a matter of degree, not of contrast. The Sprint could take the same turns some 10-12 m.p.h. faster, but within its limit the Le Mans was safe, well-balanced, and controllable. It had adequate power to come out in good shape even if pressed beyond its limit.

With the Sprint, it just wasn't possible to

get into trouble. The car was always under control. It handled like a big, tough, sports car: sensitive and obedient to a determined hand, but one that could easily intimidate a driver who didn't make the effort to properly understand its character.

On rough roads, both cars were relatively rattle-free. The Le Mans could be felt shaking as the frame members bent, with the springs alternately stretching and squatting, and there was some sideways movement in the rear suspension. The Sprint took the jolts as stolidly as Texas takes a new oil well. This lack of reaction in the springs means that road shocks get through to the passengers to a greater extent. But nobody who rode in the car called it downright uncomfortable.

Both cars had great brakes. After the usual warm-up, the Sprint recorded 99-percent efficiency, the Le Mans 96-percent. But while the Sprint was perfectly level at all times and made panic stops without the slightest sign of discomfort, the Le Mans stopped with a stoop and stalled, lost oil pressure and was slow to restart.

The four-speed transmission in the Sprint had a Hurst-Campbell linkage—long a favorite of the dragstrip set. I was able to make very quick shifts with it, but towards the end of my tests, the top-gear synchro mechanism was worn out (the car had over 10,000 miles on it, though).

The gear ratios were not as closely spaced as I'd have preferred, but in view of the engine's torque characteristics, no complaints can really be raised about this power-train combination. First gear was a low 3.11; second, 2.20; third, 1.47; and top, direct drive. With the 3.90 final drive, the overall ratio for bottom gear was 12.20:1, so I had to go easy on the throttle to avoid





**Sprint stopped from 65 m.p.h. without nose dive in an absolutely straight line.**

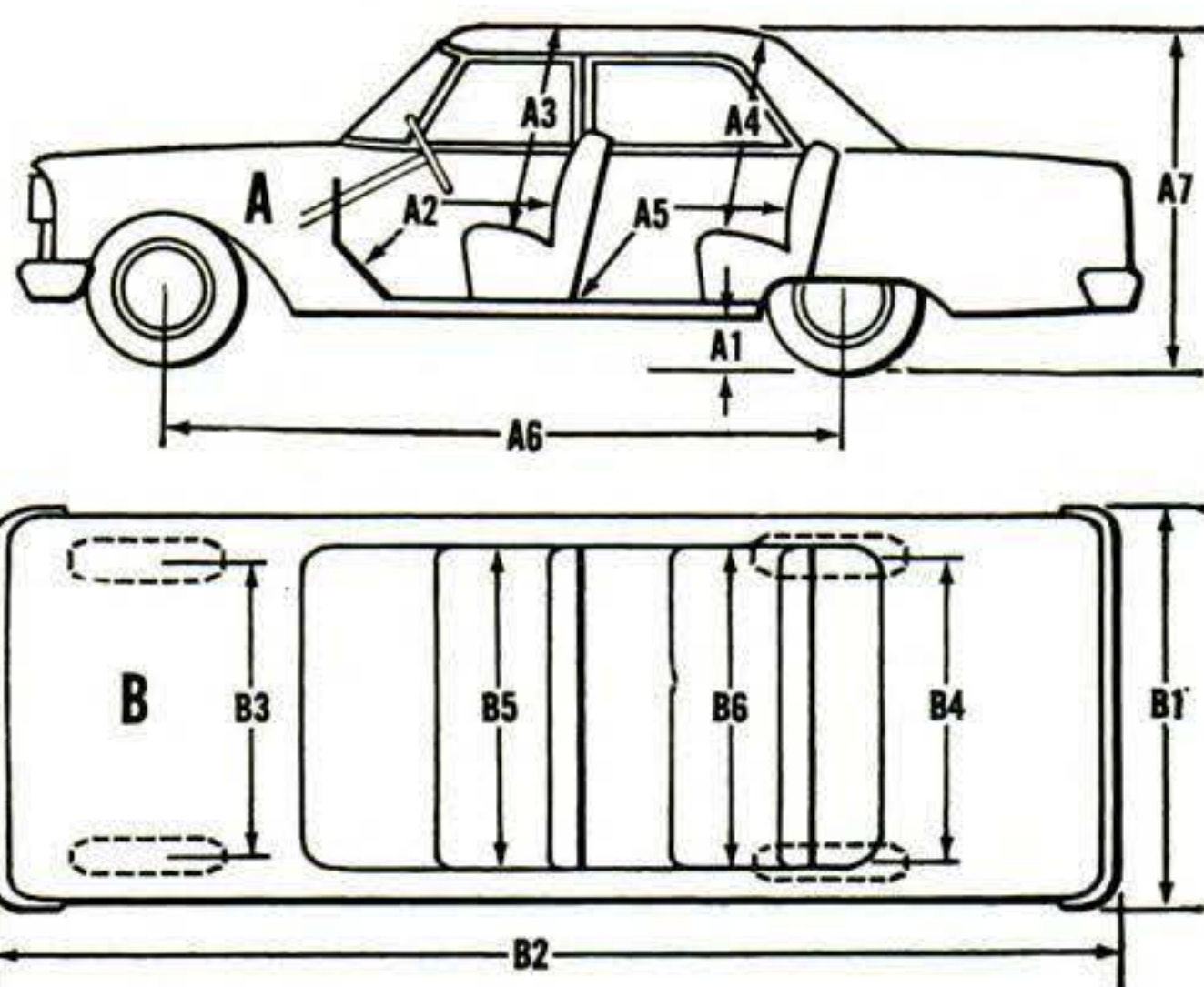
wheelspin when blasting off. When I tried a brutal dragstrip-type start, both rear wheels spun together, thanks to the limited-slip differential. But wheelspin wastes both time and rubber. The best times were clocked with the wheels *just* short of spinning.

**The fixings.** Where the Custom Sprint had gauges, the Le Mans made do with warning lights. The Sprint had a well-placed 7,000-r.p.m. tachometer. In its place, the Le Mans had a large and unusually accurate rally clock. The Sprint had a wood-rim, deep-dish steering wheel with three spokes—it looked a lot sportier than the simple two-spoker on the Le Mans, but had no practical advantage. The standard wheel can be turned just as quickly, and besides, the two spokes carry horn contact strips while the Sprint wheel has only a small horn button on the hub. Neither car is available with any kind of wheel adjustment (tilting or telescoping).

The Le Mans had bucket seats, the Custom Sprint a regular bench seat. But for the seat belt, I could have fallen out of the bench seat, which seems to be softest toward the edges. The backrest was just as wrong, seeming to be softest where firm support is most needed.

The bucket seats in the Le Mans were great, with ridges to give side support, and the right firmness—and softness—where needed. You'll want these buckets in any Tempest, regardless of your choice of power train and chassis options. And the Tempest has a remarkable catalogue of options. Just about the only thing you can't get is an inside mirror that shows much of what's behind you. The way the mirror is mounted, all you get to see is roof liner and trunk lid.

**PS**



**LE MANS      SPRINT**

**DIMENSIONS (inches)**

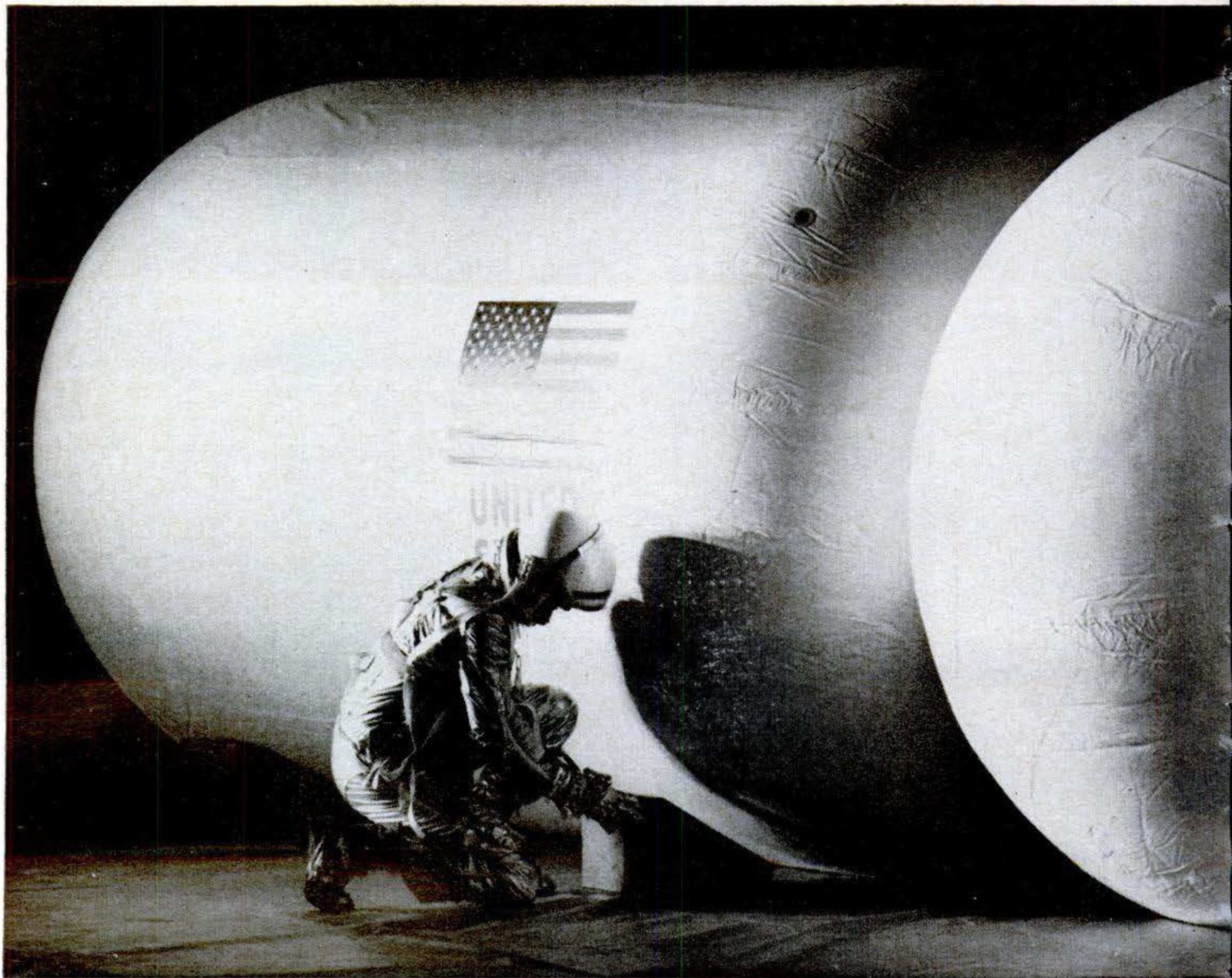
A1	Ground clearance ..	5.0	5.0
A2	Front leg room .....	41.4	41.4
A3	Front head room ....	31.1	31.1
A4	Rear head room ....	37.2	37.2
A5	Rear leg room .....	35.7	35.7
A6	Wheelbase .....	115.0	115.0
A7	Overall height .....	54.0	54.0
B1	Overall width .....	74.4	74.4
B2	Overall length .....	206.4	206.4
B3	Front track .....	58.0	58.0
B4	Rear track .....	59.0	59.0
B5	Front-seat width ....	24.0 (2)	59.6
B6	Rear-seat width ....	59.6	59.6

**SPECIFICATIONS**

Engine type .....	SOHC Six	SOHC Six
Bore & Stroke .....	3.88 x 3.25 in.	3.88x3.25 in.
Displacement .....	230 cu. in.	230 cu. in.
Compression ratio .....	9.0:1	10.5:1
Carburetion .....	Single 1-bbl.	Single 4-bbl.
Power output .....	165 @ 4,700	207 @ 5,200
Torque .....	216 @ 2,600	228 @ 3,800
Transmission .....	Automatic	4-speed
	2-speed and	Hurst
	torque converter	floor shift
Axle ratio .....	2.78:1	3.90:1
Tire size .....	6.95x14	7.35x14
Steering ratio .....	22:1	25:1
Turns, lock to lock .....	4.2	4.75
Turn radius .....	20.5 ft.	20.5 ft.
Brake-swept area .....	269.2 sq. in.	269.2 sq. in.
Curb weight .....	3,412 lb.	3,309 lb.
Price: basic .....	\$2,701.00	\$2,408.00
as tested .....	\$3,263.00	\$3,250.84

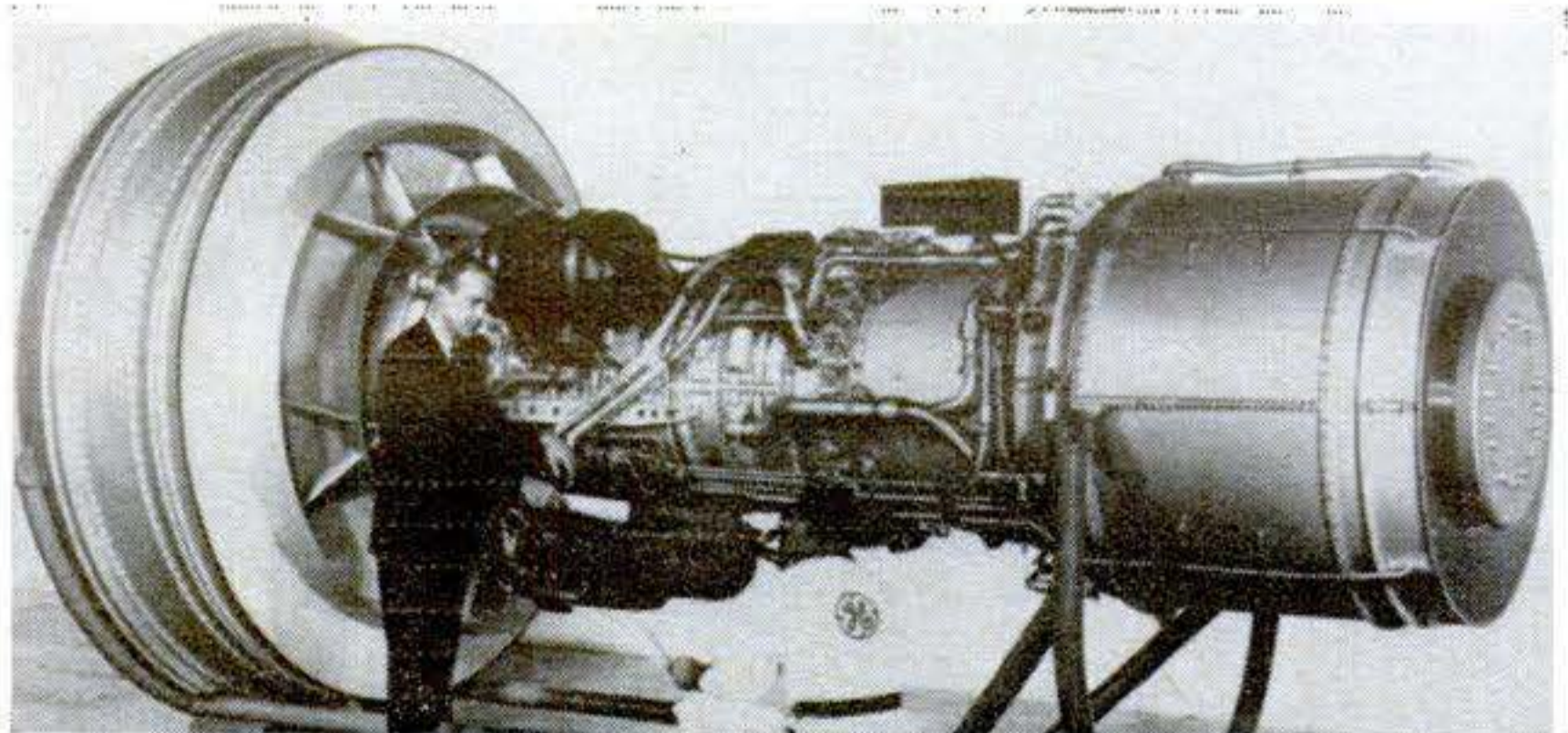
**PERFORMANCE**

0-60 m.p.h. ....	16.2 sec.	9.3 sec.
0-80 m.p.h. ....	29.6 sec.	16.5 sec.
25-70 m.p.h. ....	17.2 sec.	10.6 sec.
40-60 m.p.h. ....	8.2 sec.	4.5 sec.
SS 1/4- mile } Elapsed time	22.1 sec.	16.7 sec.
} Term. speed	70.5 m.p.h.	80.8 m.p.h.
Average fuel mileage	21.08 m.p.g.	17.44 m.p.g.



### Car built of mahogany

Except for steel framework and a conventional metal engine, the car shown at left is solid mahogany. Richard Bucy of Torrance, Calif., who used to own a boat shop, constructed the body, hand-rubbing the finish to produce a mellow patina like that of a fine old piece of furniture and then coating the wood with epoxy resin to prevent scratching in traffic.

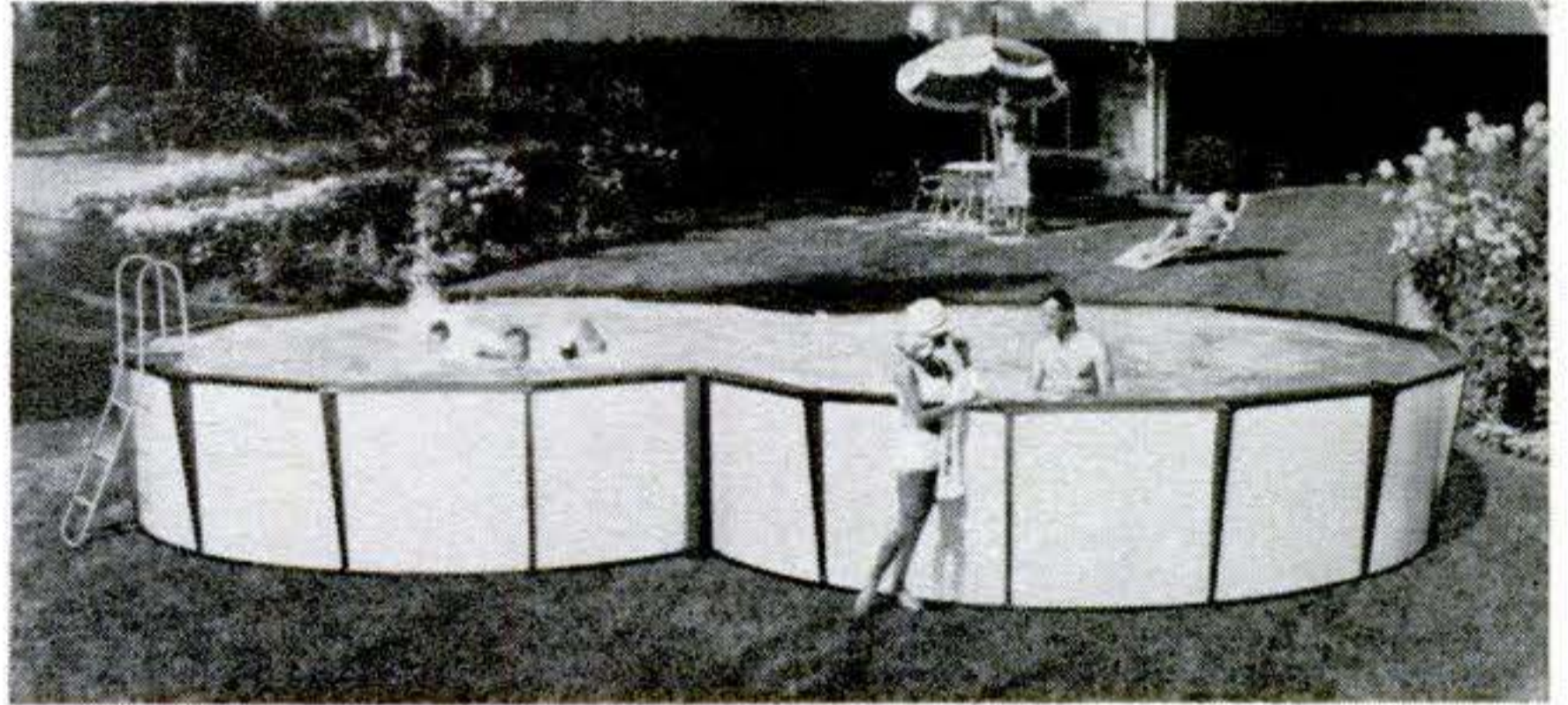


### Big turbofan to power C-5A

More than eight feet in diameter at its front fan, the GE TF39 high-bypass turbofan engine develops 41,000 pounds of thrust. Four of the jets will power the gigantic Lockheed C-5A [PS, Dec. '65], carrying a 265,000-pound payload or 700 troops nonstop at 500 m.p.h. Low fuel consumption gives the turbofan an unrefueled range of approximately 6,500 miles.

## Inflatable moon shelter to keep astronauts alive for periods of up to two weeks

Astronauts exploring the moon could live up to two weeks without space suits in the oxygen mixture with which the lunar shelter at left is inflated. Designed for possible use in a post-Apollo moon mission, the expandable Stay Time Extension Module was built by Goodyear for NASA. The STEM would protect astronauts in extreme lunar temperatures of up to 300-degree heat and down to minus-250-degree cold.



## Double circle lengthens swimming pool

This above-ground swimming pool, in effect two 18-foot-diameter circular pools joined together in the shape of a figure eight, provides end-to-end swimming length of 32 feet. The extra-long Monterey pool, made by Doughboy, is constructed of a galvanized frame supported by I beams. It has a vinyl liner fastened at top, four feet above ground level, by a six-inch plastic coping that serves as a seat.

## Tiny fire engine protects big plants

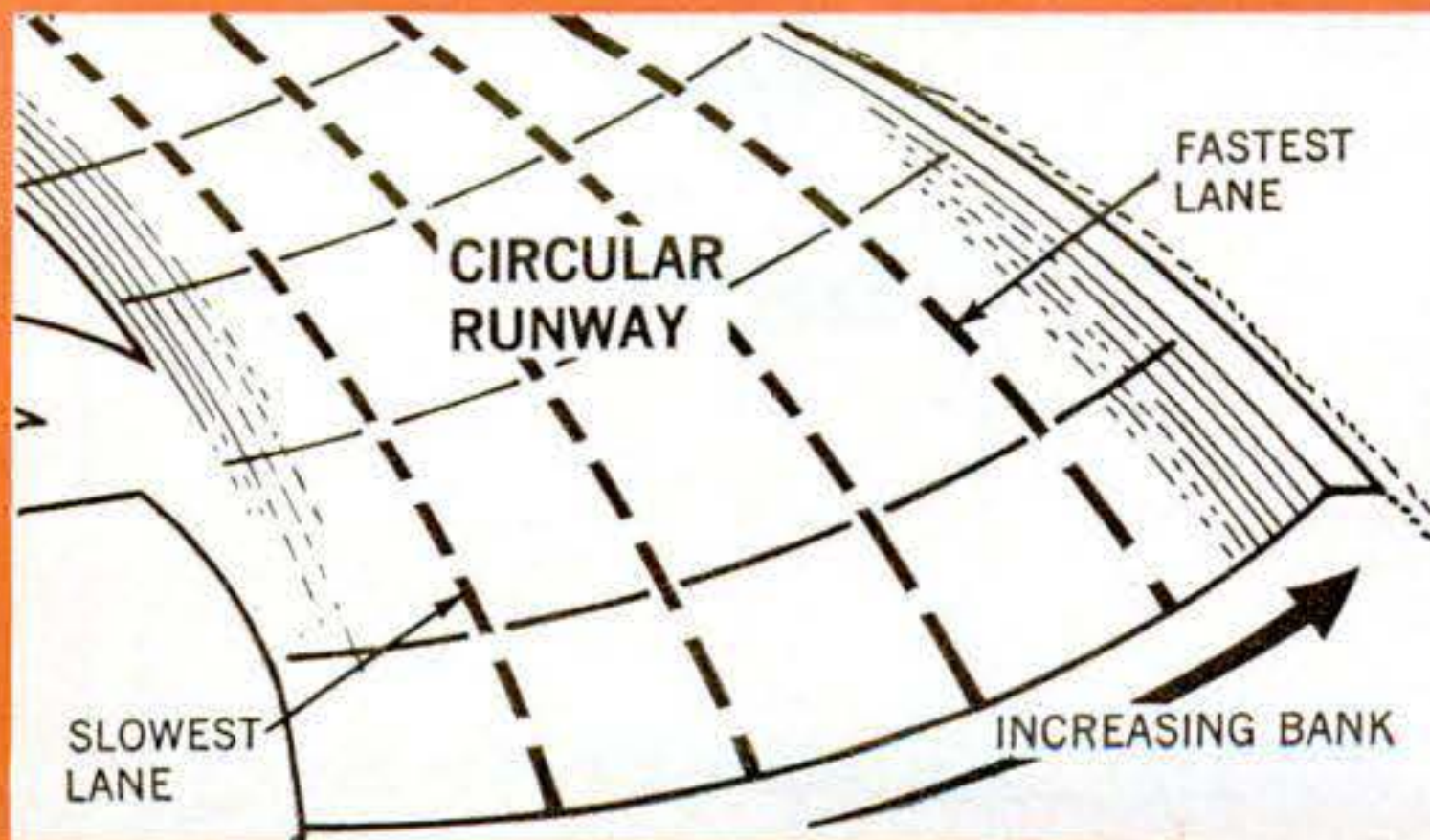
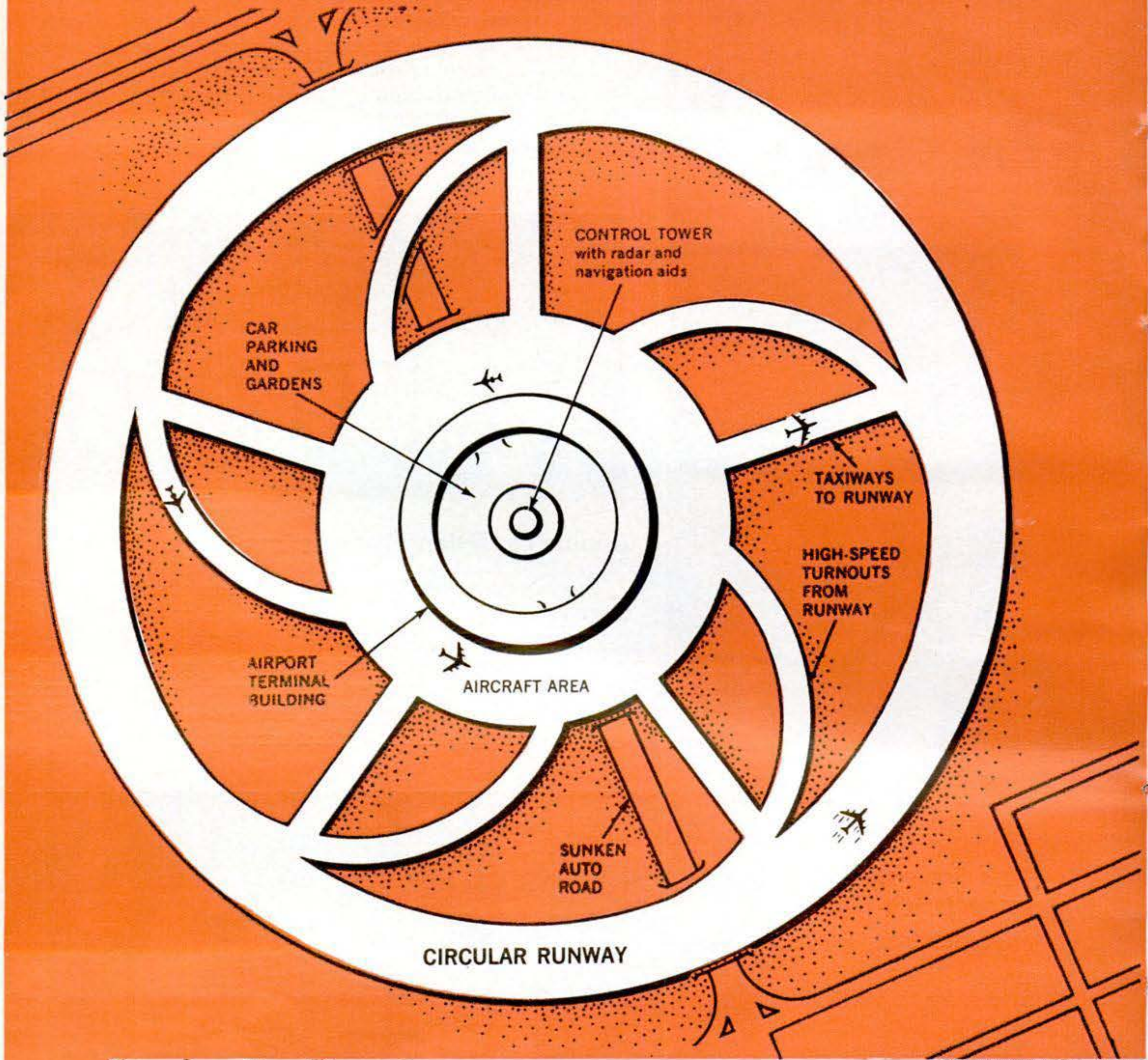
The miniature fire engine at right was designed for in-plant fire fighting. The Cushman three-wheeler is nine feet long, four feet wide, and can make a complete turn in a 15-foot circle.

It has two high-pressure tanks and two hand extinguishers containing 370 pounds of Purple K [PS, Nov. '62], a chemical developed by the Navy for use on gasoline and electrical fires.

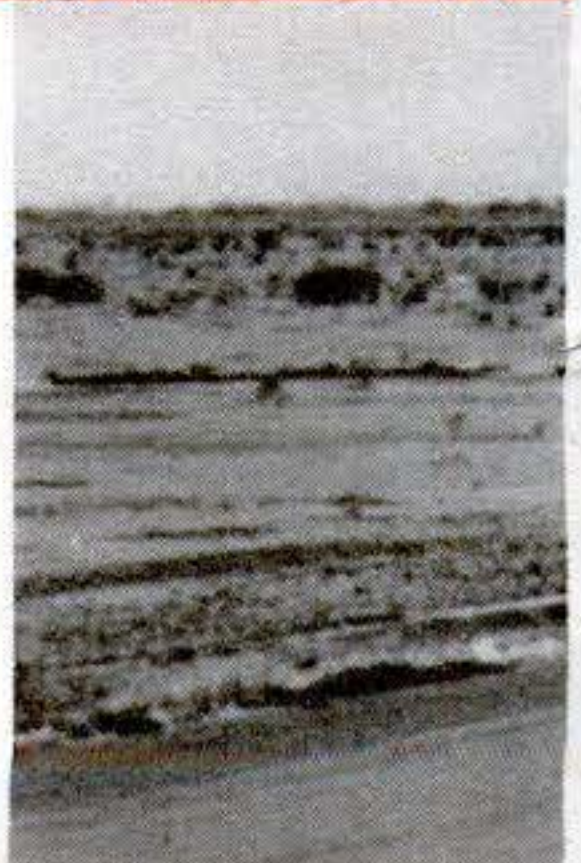


# COMING:

# Airports Shaped Like

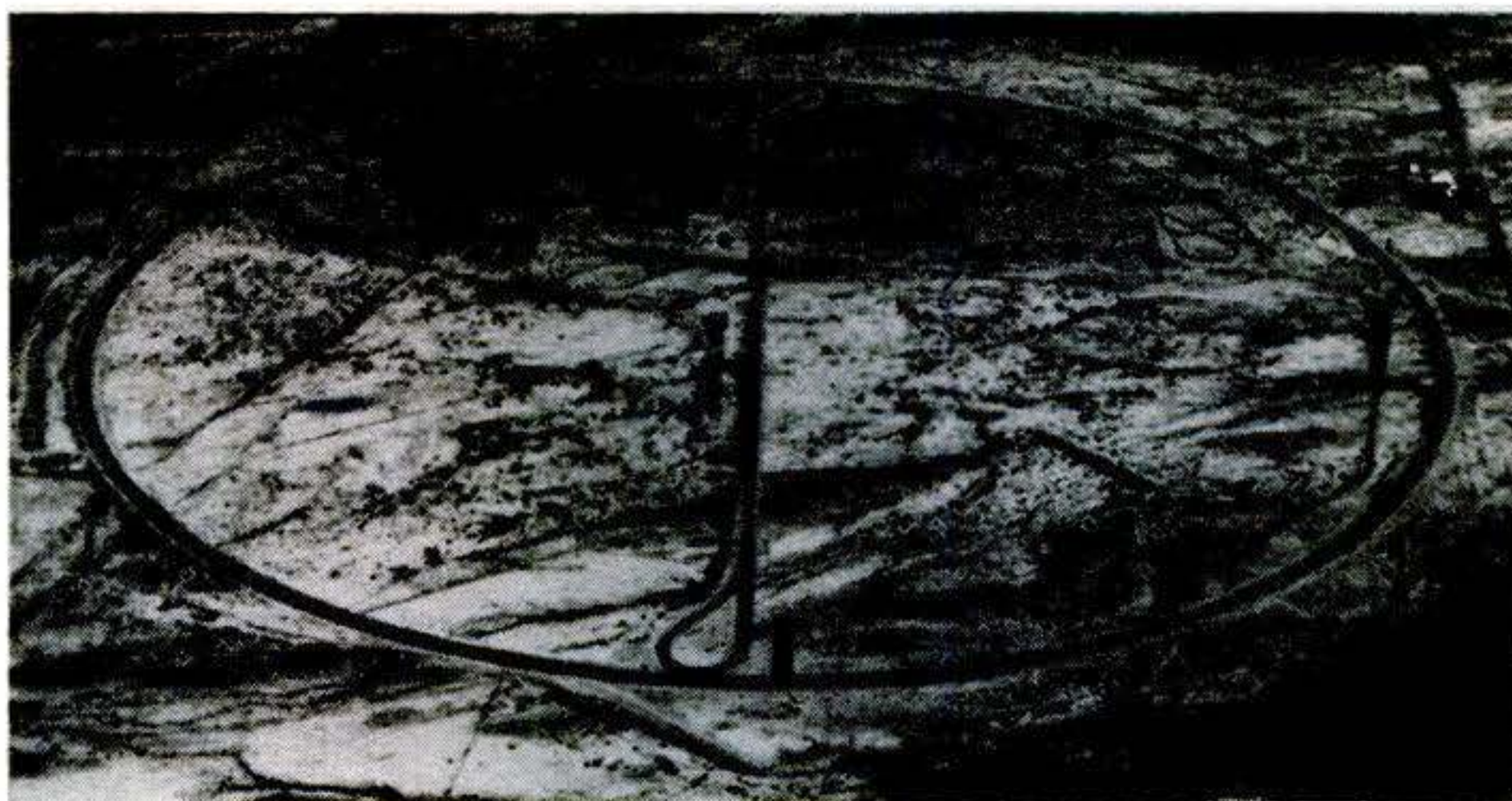


Circular airport would have design pictured above. Endless runway is banked, as at left, and has lanes for craft of different speed, with steepness of banking increasing from slowest (inside) to fastest (outside) lane. Broken lines indicate centers of lanes.



# Wheels?

Ready-made proving ground for Navy trials of circular-airport idea is provided by General Motors test track for cars (right), viewed here from air, at Mesa, Ariz.



## Navy trials prove advantages of a circular runway, unlimited in length, for plane landings and takeoffs

**W**ill the airport of the future be circular, with an endless banked runway that gives a pilot unlimited room to land and take off, and that he can use whichever way the wind is blowing? Trials in 1964 and 1965, using an automobile test track as an experimental airport, have convinced the Navy that circular runways are both feasible and promising.

An endless runway would make for safety by eliminating accidents that occur when a pilot overruns a conventional runway in landing or taking off. The idea of a circular one seems so simple, says a Navy report, that it's hard to believe no one had thought of it before—but it proved original enough to win a U.S. patent, which licensed government use, when the late Lt. Cmdr. James R. Conway put it on paper in 1961. Later, after his death in a plane accident at sea, his scheme was taken up and flight-tested by the U.S. Naval Weapons Evaluation Facility at Kirtland Air Force Base, N. M. A General Motors test track at Mesa,

Ariz., put at the Navy's disposal for the trials, provided a ready-made circular banked runway of 8,400-foot diameter.

At first, Navy pilots reported, landing atilt on the banked track gave them a strange sensation, "like flying into a hole." But they mastered the knack in a trial or two, and became circular-runway enthusiasts. They made successful landings and takeoffs with propeller and jet planes of varied types, ranging in size to a big C-54 whose main landing gear took up all but 18 feet of the track's width.

Suited as well to civilian as military use, the wheel-shaped flying base envisioned by Commander Conway and the Navy would be rimmed by an endless runway 4,000 to 20,000 feet in diameter, the largest serving for an international airport. Spokelike-turn-offs lead to a ring-shaped terminal building at the hub. A central control tower overlooks the whole airport—which would require only two-thirds the area of a conventional one with straight runways.



Navy plane touches down on banked circular track in Arizona, in one of many successful trials with

various craft and approaches. (In airport design on facing page, plane would land counterclockwise.)

## PREVIEW OF LE MANS:

.....

# Ford Is Back and Ferrari's Quaking

After twice failing to unseat the champion of European long-distance racing, Ford goes all-out to capture the world's toughest endurance race this month

By JAN P. NORBYE/PS Automotive Editor

**B**roken transmissions put an end to Ford's hopes for winning at Le Mans in 1964. Ferrari won, as Italy's 12-cylinder projectiles have won every race at Le Mans since 1960. Fresh from a triumphant victory at Indianapolis last year, Ford sent six cars to Le Mans, only to see them all put out of the race by engine failures. To Ford, winning at Le Mans means as much as landing the first men on the moon means to NASA.

Can Ford pull it off? This year, Ford GT Mark IIs have already won the 24-hour race at Daytona and the 12-hour race at Sebring. When the cars line up at Le Mans this month, no less than 13 Fords will meet six "works" Ferraris and a lone Chaparral. These are the top contenders among the 56 cars in the race.

The car that will win at Le Mans must be able to travel some 2,900 miles on public roads (closed for the occasion) in 24 hours. It must have brakes that can haul it down from 200 to 30 m.p.h. every four minutes. The winner is the car that covers the greatest distance between the start, four p.m. Saturday, June 18, and the finish, four p.m. Sunday, June 19. Indy cars are not allowed, but you could enter a stock car. Briggs Cunningham entered a standard Series 62 Cadillac in 1950 and finished tenth. But the race is really for sports cars—both production models and prototypes. There's no maximum limit on engine size, but there is a minimum weight scale based on engine displacement.

**A winning type?** Today there is little disagreement on the *type* of car that will win. All the leading contenders use midships engines, aerodynamically developed bodies, disk brakes on all wheels, and very wide tires.

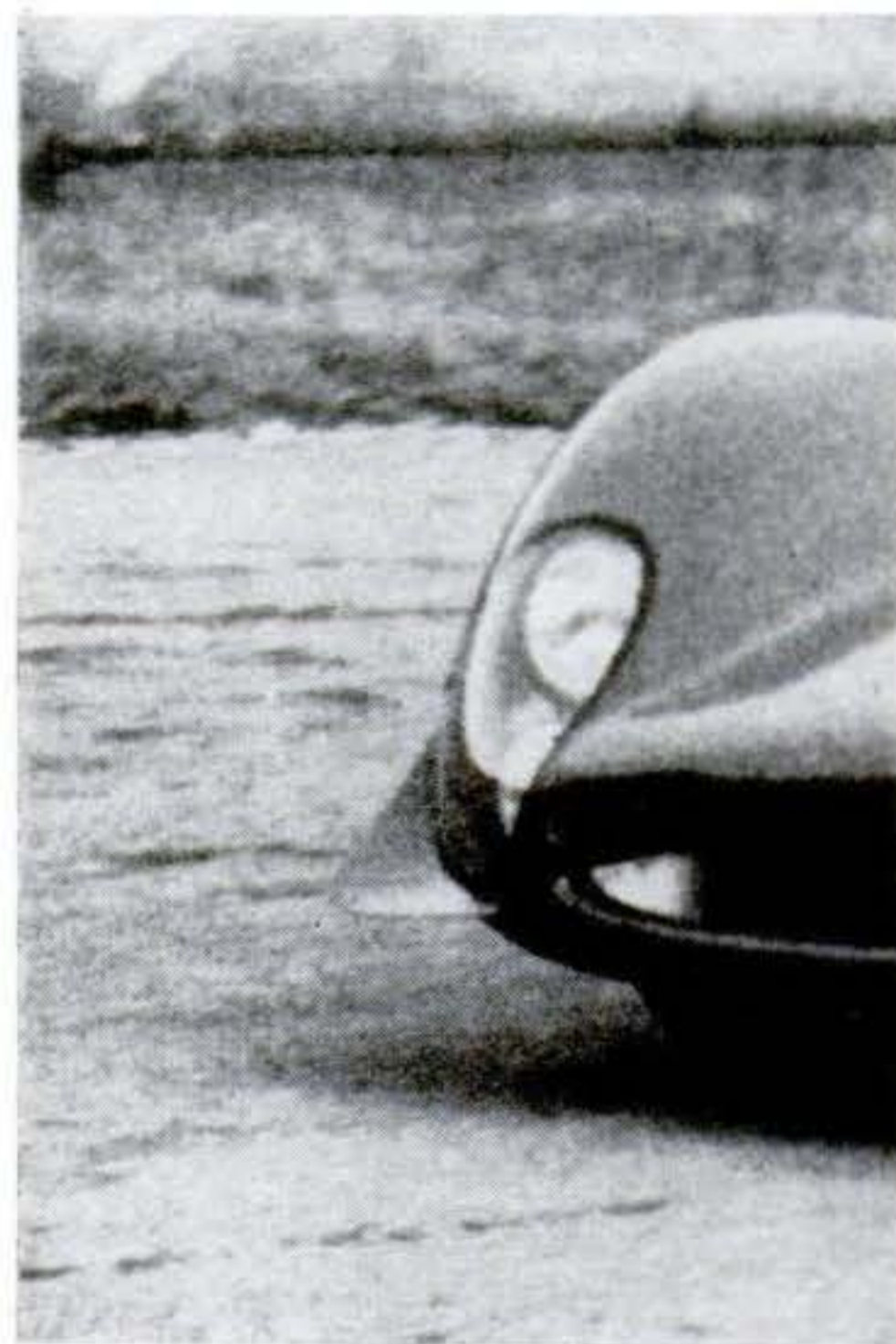
Ever since its birth in 1923, Le Mans has been the world's most grueling race. Some two-thirds of the cars fail to finish, mostly because of mechanical breakdowns. A few are disqualified for breaking the rules, and others are knocked out by accidents.

Drivers hate this race for its long hours of night driving,

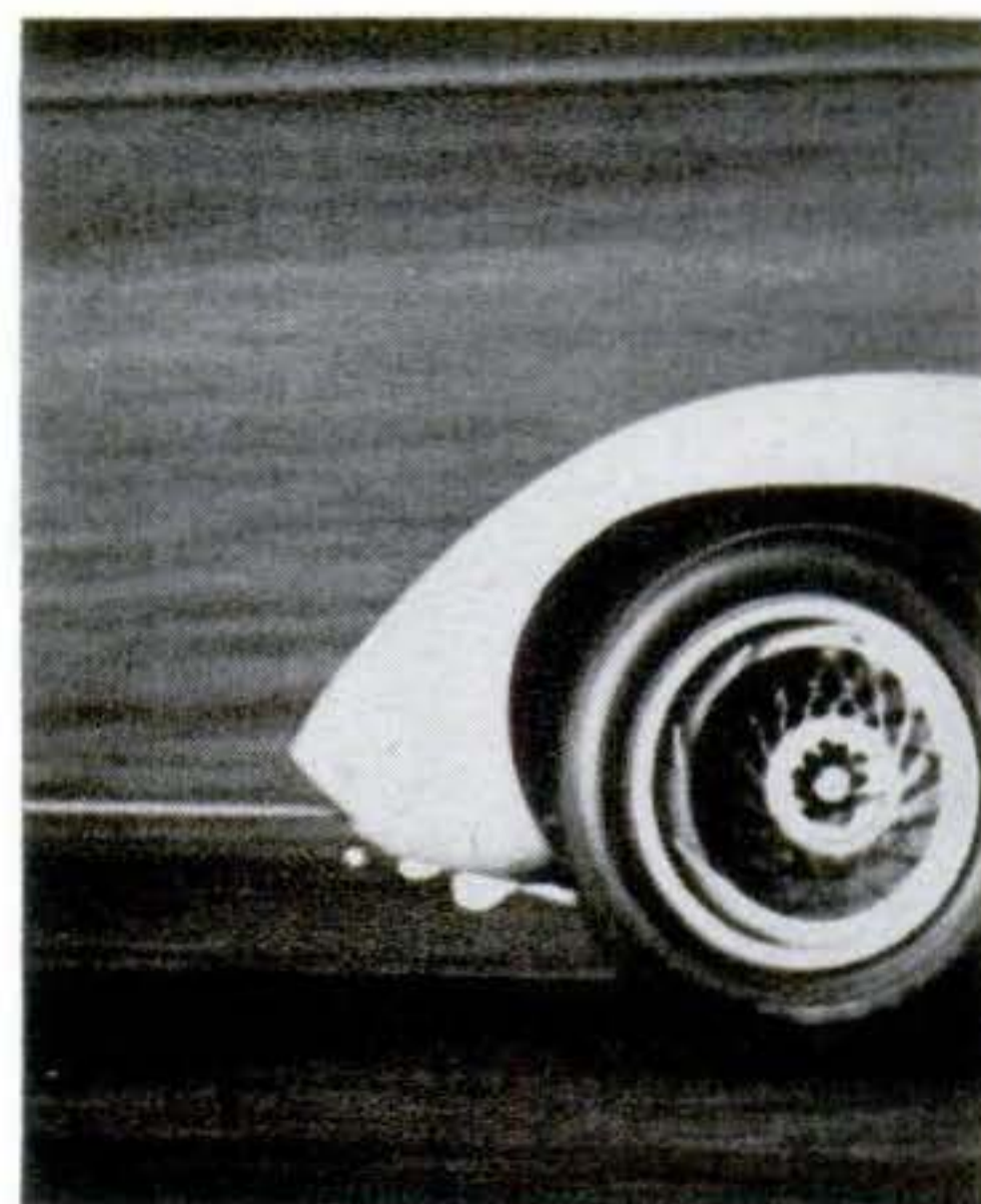
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Ford GT Mark II has all



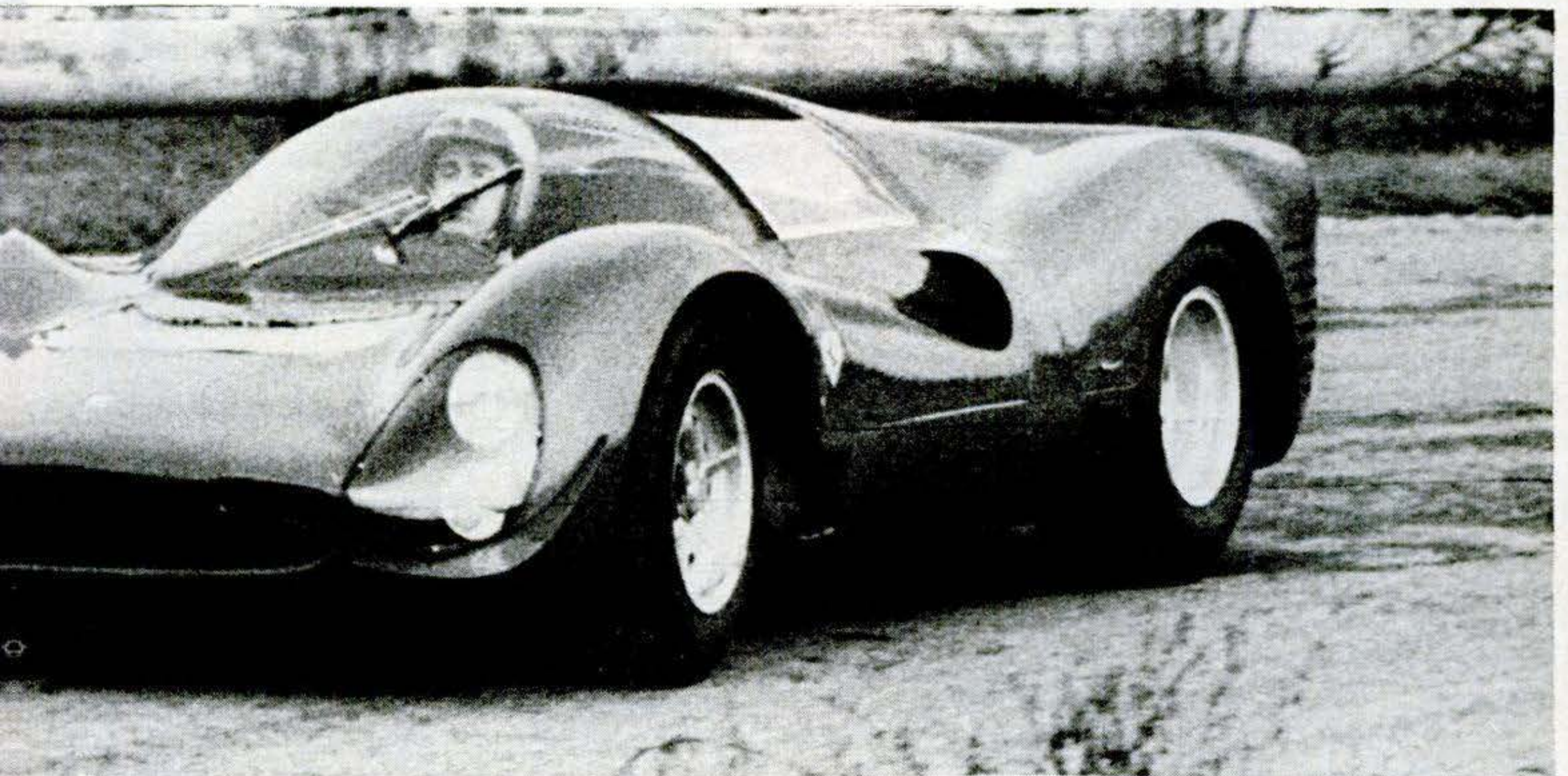
Ferrari 330/P3 has broken



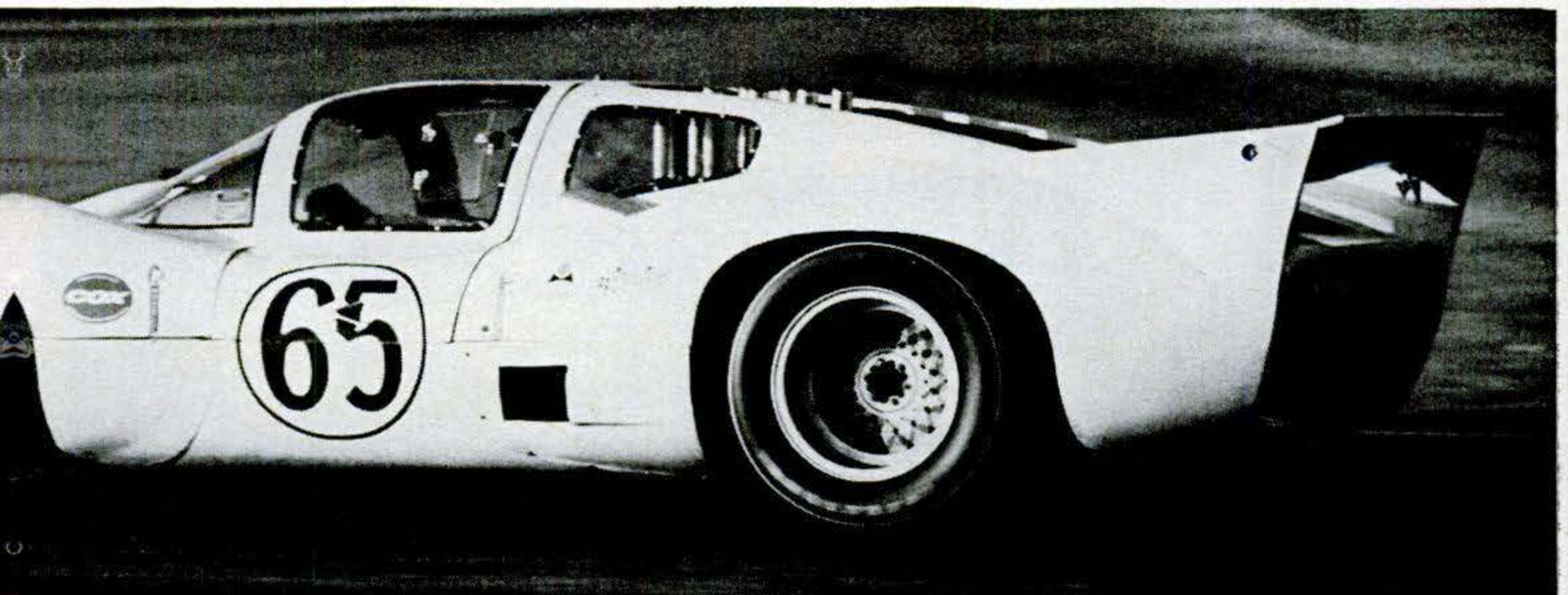
Chaparral has had a poor



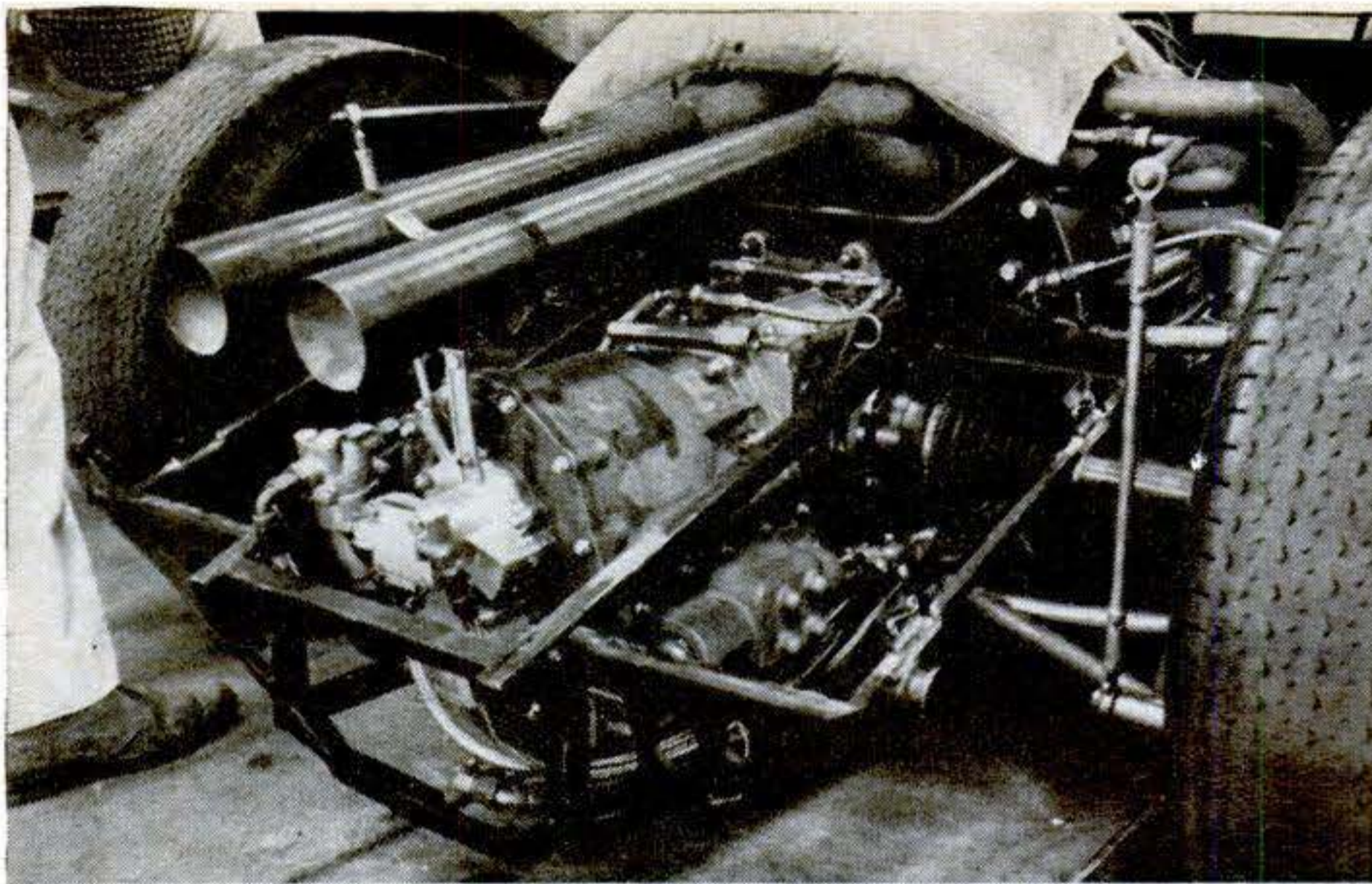
the power and speed it will need for the Le Mans race. Chances are it has the stamina, too.



all records in recent tests. Here driver Bandini puts the car through its paces at Modena, Italy.

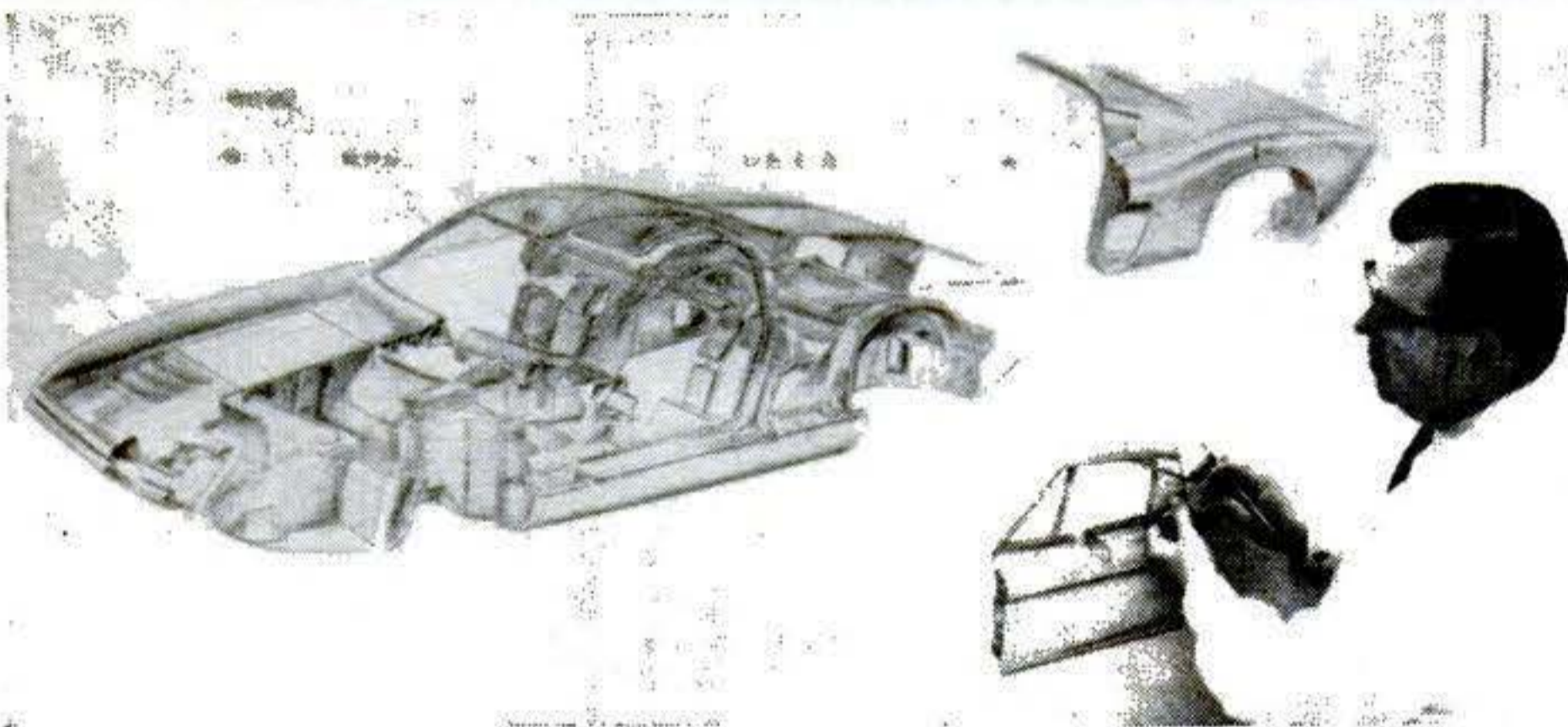


season so far but did a great job last year. For the Le Mans race, it's a real dark horse.



## Ford

Promising challenger: Ford GT-P has 470-hp. V-8 and uses Ford's own four-speed transmission (shown). One Ford may have automatic transmission. GT-40 uses a five-speed ZF transmission. Below, Bob Huzzard checks dimensions on his perspective drawing of the GT-P. The body is fiberglass combined with a sheet-steel platform frame. The car is only 38.5 in. high.



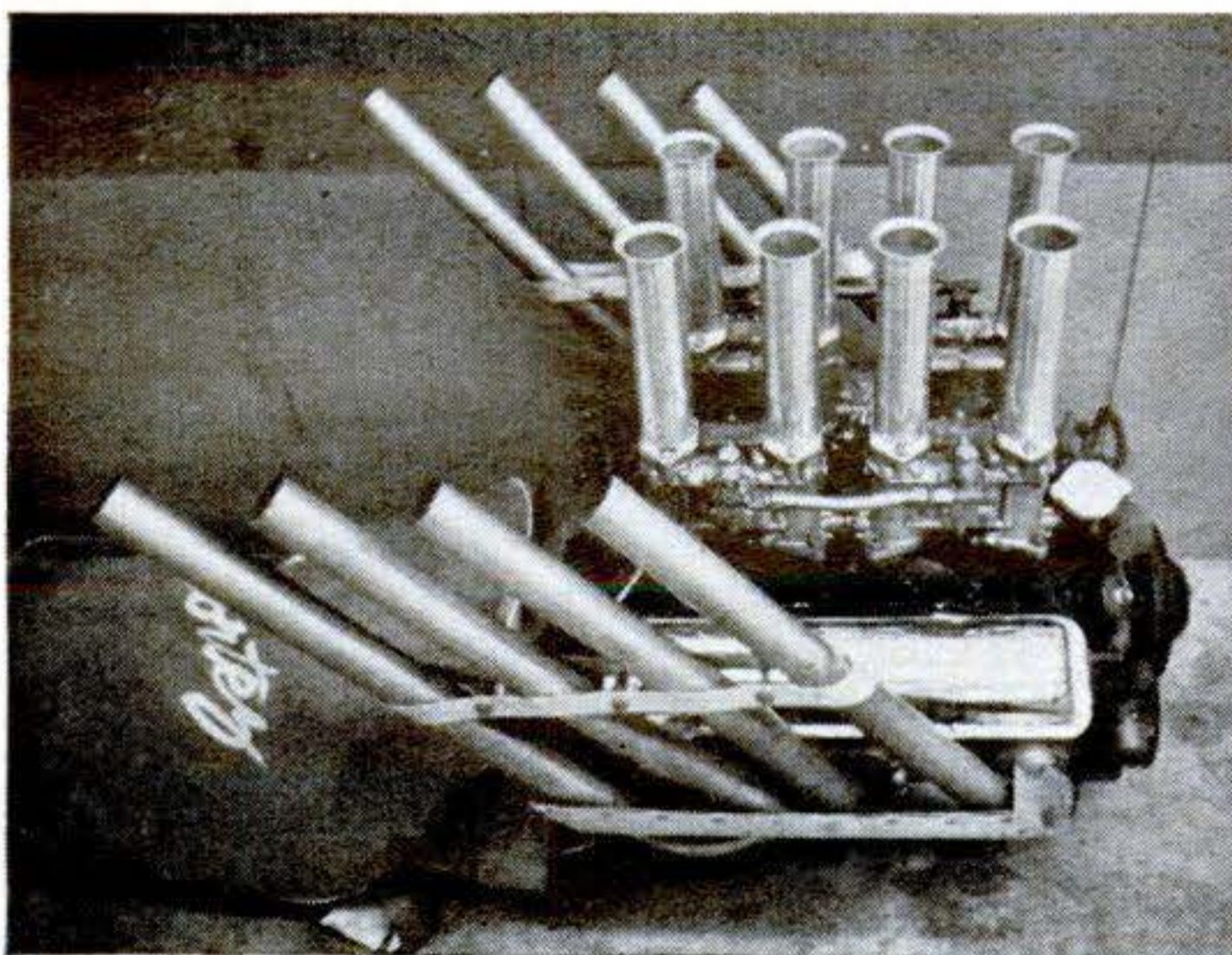
or lower it to aid the brakes in slowing the car from high speeds. He can also raise it on turns to improve adhesion (air pressure will add to the load on the rear wheels).

**The Ford line-up.** Ford has two engine sizes for Le Mans: the 427-cu.-in. V-8 used in stock-car racing and the 289-cu.-in. V-8 developed for Indy in 1963. The "small"

morning fog, endless fatigue, keeping track of tire wear and fuel consumption, listening for strange noises, and watching for signals from the team manager. But it's a supreme test for the cars, and draws some 300,000 spectators to the 8.3-mile circuit.

To keep the cars from flying, the bodies carry spoilers [see page 94] both front and rear. The Chaparral, designed, built, and raced by Jim Hall of Midland, Tex., has an adjustable rear spoiler. The driver can raise

350-hp. engine is used in the GT-40; the big 470-hp. engine powers the other Fords: the GT-P, Mark II, and GTX-1. The GT-P is mechanically a Mark II but has a new body. The GTX-1 is a Mark II with automatic transmission—it first appeared at Nassau last year and may be tried again at Le Mans. The race organizers expect four GT-Ps from Shelby American, three GT-Ps from Holman & Moody, and three GT-40s from Alan Mann Racing Ltd. In addition,



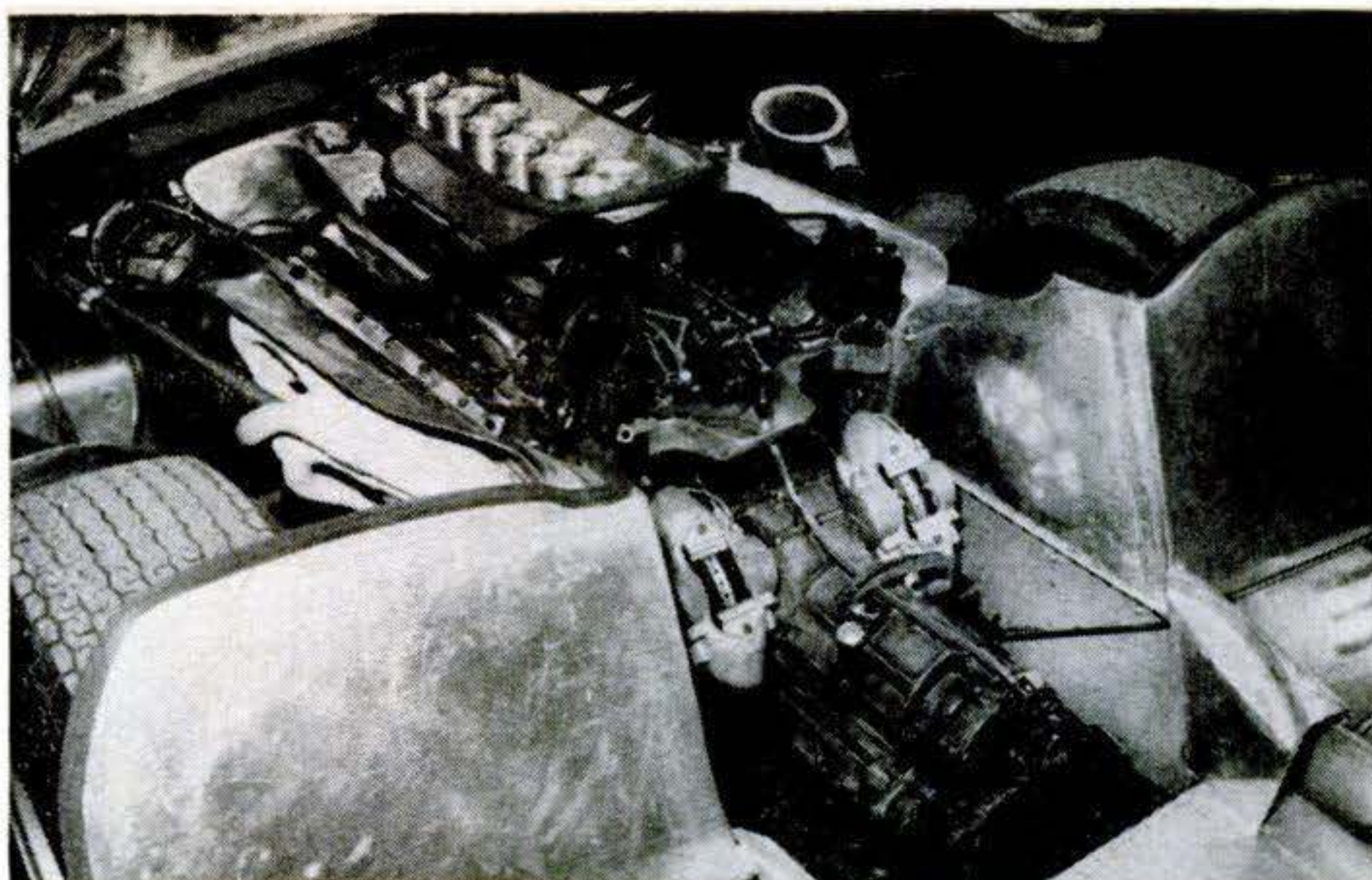
## Chaparral

The super-tuned Chevrolet 425-cu.-in. V-8 used in the Texas-built racer produces some 500 hp. and is mated to an automatic two-speed transmission based on Powerglide parts. Chassis is made entirely of fiberglass-reinforced epoxy. Engine and suspension systems are simply glued in place. This radical principle has proved safe and reliable.



## Ferrari

Defending champion: Smaller and lighter than the Ford, Ferrari's 330/P3 has 420 hp. and a five-speed transmission. Enzo Ferrari will not build bigger engines, as he feels too much power can unbalance a car for road racing. Both V-12 and V-6 Ferraris have four overhead camshafts. The V-6 Dino (below) will compete with Porsche Carrera-6 and Matra-BRM.



Ford of France, the Swiss Scuderia Filipinetti, and the Canadian Comstock Racing Team have each entered one GT-40.

### The 12-cylinder brigade.

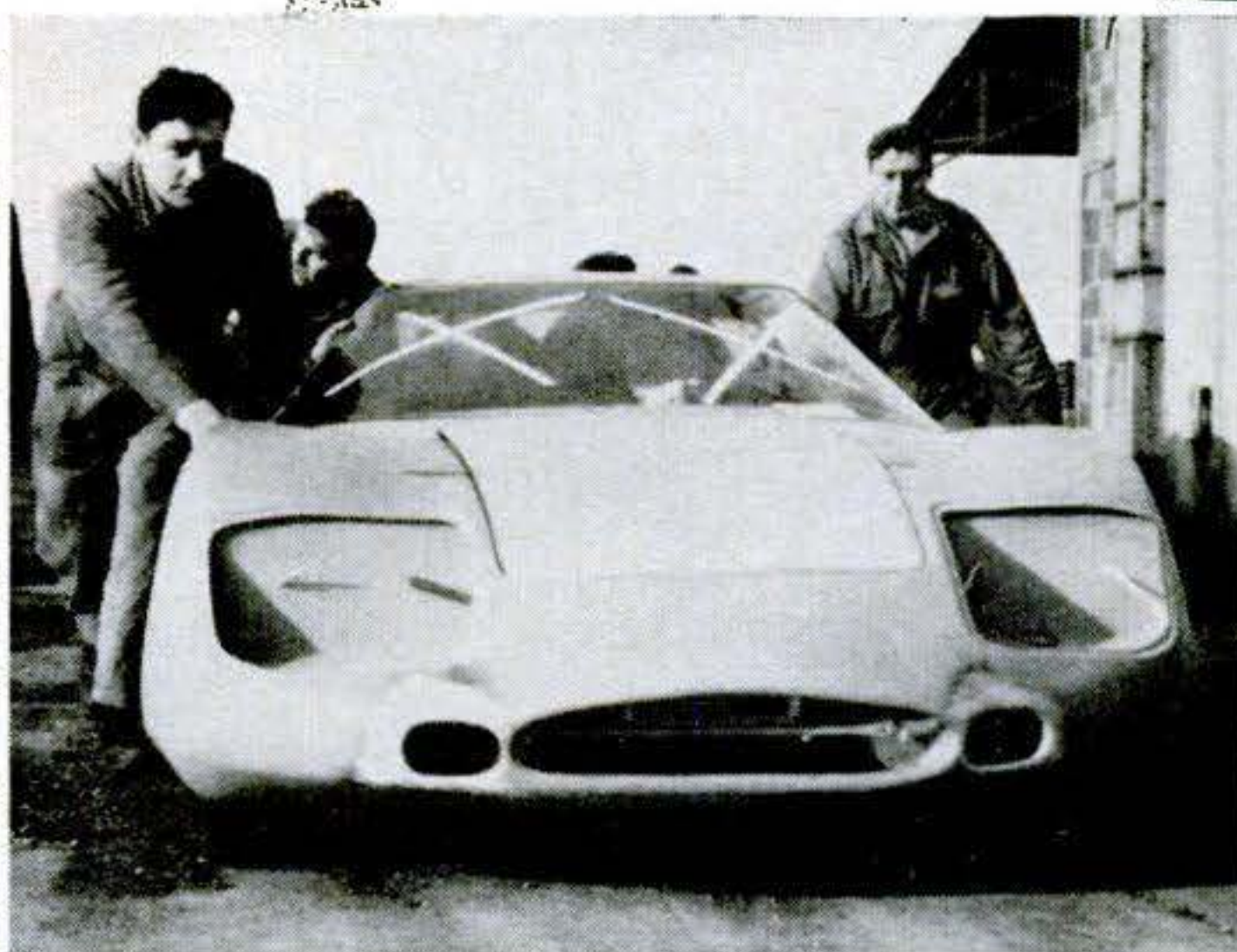
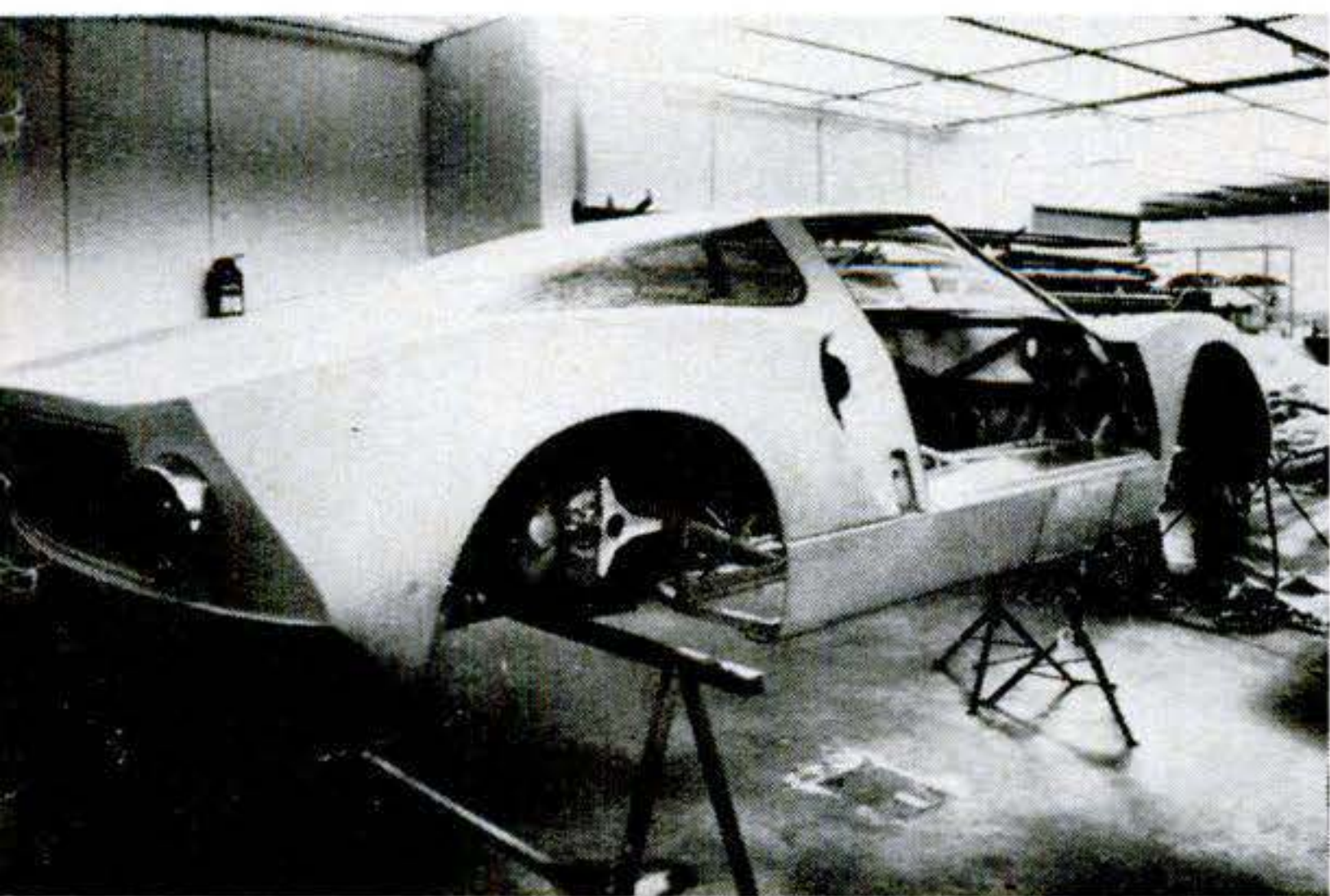
Ferrari hopes to win again with one of its four new 330/P3 cars. Private owners like Colonel Hoare from London, Luigi Chinetti (North American Racing Team, N.Y.), and the Belgian Ecurie Francorchamps, aim to win with single-cam 269-cu.-in. V-12 '65 Ferraris. Two of last year's smaller V-12 275/P2s are also entered—one by Chinetti, the other by Ed Hugus of Pittsburgh, Pa. There are nine V-12 Ferraris in all.

For smaller cars there are special prizes. That's why Ferrari enters two V-6 "Dino's," why Porsche enters four flat-six Carreras, and Matra will race three 120-cu.-in. BRM



V-8-engined cars. These light cars have from 210 to 235 hp. and will reach speeds of 160 m.p.h. Alfa Romeo will race four four-cylinder GTZ coupes, and Charles Deutsch of Paris will enter three front-drive CDs. Jean Rédélé is entering five Renault-engined Alpines.

Is this the year for an American victory? Could be—with American engines powering 16 cars in the race. But I'll still put my money on Ferrari. **PS**



## Matra-BRM

Matra is one of the largest of France's space-age enterprises, with a hand in missiles as well as supersonic manned aircraft. Matra took over René Bonnet's sports-car business last year and now produces Renault-engined cars. For Le Mans, Matra made a deal with BRM (British Racing Motors) to get 235-hp. four-cam V-8s based on last year's GP engine.

A photograph of a large whale breaching the ocean surface, with a diver visible in the water below. The whale's head and back are above the water, while its tail is still submerged. The diver is in the foreground, looking towards the whale. The water is a deep blue color.

# KEIKI

**Friendly and intelligent,  
porpoises like Keiki are being  
trained to carry messages to and from  
divers, locate sunken missile nose cones,  
and aid in scientific research underwater**

# THE PORPOISE...

## our new underwater 'errand boy'

By RICHARD TREGASKIS

Author of "Guadalcanal Diary," "John F. Kennedy and PT-109," etc.

**K**eiki — whose name means "kid" in Hawaiian — is a six-foot, 240-pound captive porpoise. He is the first undersea "errand boy" to be used by science in unlocking the many unsolved scientific mysteries of the oceans.

Keiki was captured in 1963, when he was a mere baby of 120 pounds and only five feet long. Trainers at the Hawaii Oceanic Institute spent months conditioning the animal to respond to an underwater buzzer recall in an attempt to use his amazing skills — porpoises are as high on the tree of intelligence as the chimpanzee — for research work.

Keiki's performances in the aquashow that helps support the institute showed that he had the mental acuity, aptitude, good temper, and loyalty to be of use to scientists in underwater research projects when he was let loose in Kaneohe Bay, east of Honolulu.

But Taylor A. ("Tap") Pryor, head of the institute, feared Keiki would choose to remain free once he was let loose. However, he and his chief marine zoologist, Dr. Kenneth Norris, gambled on the friendly and loyal temperament of their porpoise.

Keiki not only was the first porpoise messenger boy, but became a kind of professor to help instruct trainers at the institute's Sea

*Continued*

Life Park. Mrs. Pryor says, "He learns fast. You don't really have to teach him. He'll watch other porpoises doing tricks, and then do them himself."

The immediate objective was to have Keiki run speed trials in open water to check the legend that porpoises could travel faster than a destroyer at full steam—even hit 60 miles an hour. Keiki was clocked following a speedboat.

When Keiki was finally released, not only did he return to his holding cage, but he ran five weeks of speed trials, coming back each day to captivity. Even when he slipped out of his cage once, he didn't swim out to sea. Instead he swam to the dock where the institute's boat was tied up. When the scientists came to work at sunup, Keiki was there, leaping, grunting, and whistling as exuberant porpoises do.



"Tap" Pryor prepares to release Keiki from his underwater holding cage for messenger duties.

Pointing upwards, biologist tells Keiki to take a message slate to researchers on the surface. Keiki



Slate with a message on it is given to Keiki for delivery. In background is experimental chamber.

became very adept at these duties and willingly returned time and again to carry messages.



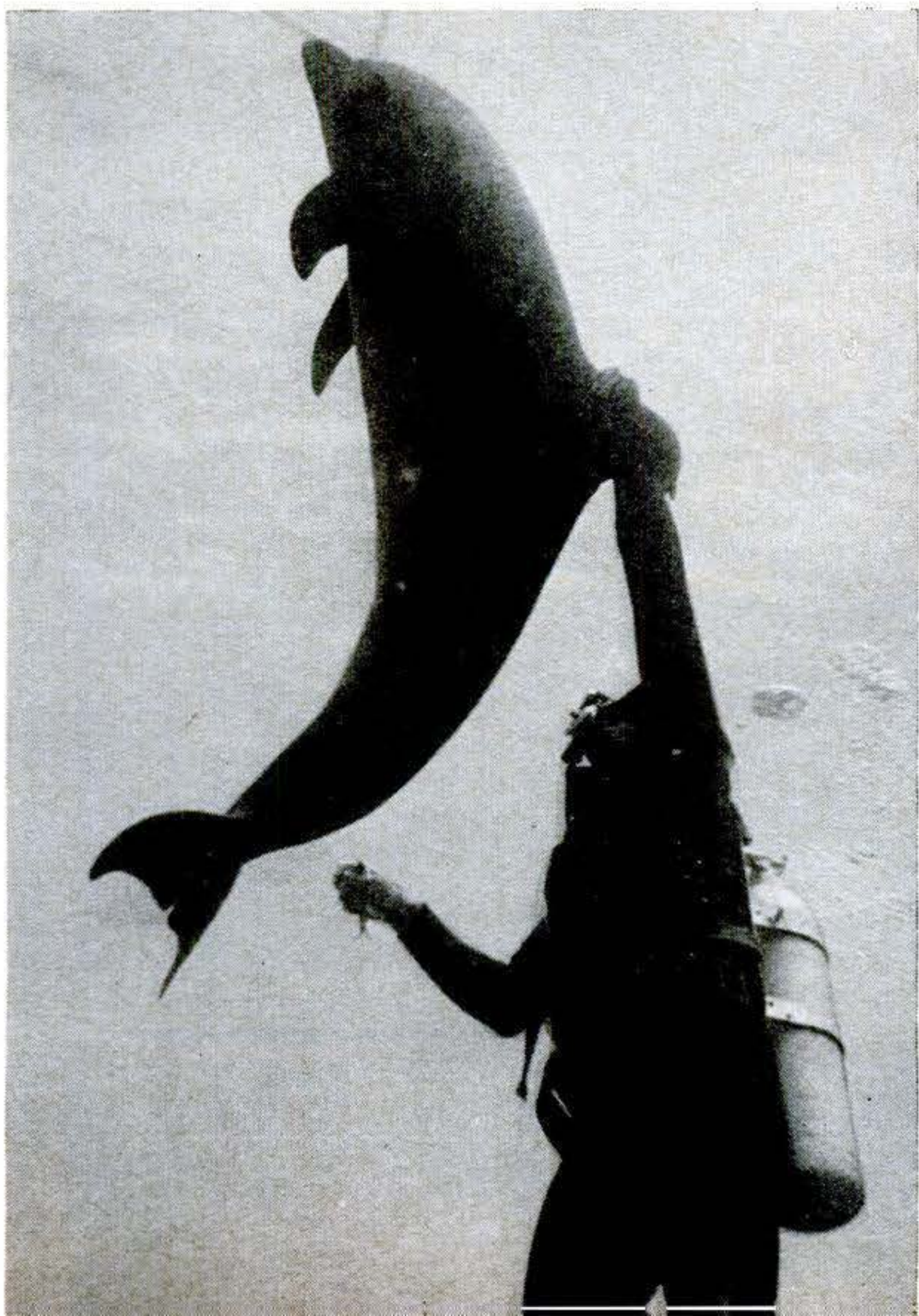
Then, with all the aplomb of Flipper, the TV star, he led the boat across the water to the speed course for more runs.

**Speed: 16.9 m.p.h.** Keiki did his best in the speed trials, but couldn't turn in a faster time than 16.9 miles an hour. The scientists suspected that the plump Pacific bottlenose porpoise might be the wrong species for extremely fast swimming. So they groomed two slimmer porpoises of an-



**Aquanaut Pat Quealy** ties bag with bottom sample to the end of a loop suspended from Keiki's jaw.

**Helpful Keiki** carries a "hitchhiker" along in his trip toward an undersea holding cage.



other variety—Haina and Nuka—to run the course. They swam considerably faster—hitting 24.9 miles an hour.

But the institute is continuing the tests because they hope to find some clue to designing ships for greater speed. One expert, Dr. Max Kramer, says that spongy ducts in the skin of the porpoise open and close in response to wave pressure to give him perfect streamlining. The Navy is finding other uses for porpoises by training them to tell one metal from another. Friendly subs would carry special metal identification patches; an enemy sub would be rammed and destroyed by an explosive-carrying porpoise.

**Earning his keep.** Having failed at his speed trials, Keiki went back to the aquashow. He did his job not wisely, but too well. One of his tricks was to search for and bring back to his trainer a doughnut-size plastic float in return for a fish. Keiki decided he could simplify things by storing up floats in a corner of the tank. One day last summer, Keiki rushed to pick up a floating meal ticket—and swallowed it.

Pandemonium ensued. Keiki flipped and thrashed his tail. An expert prescribed a heavy dose of castor oil, but it didn't work. Something drastic had to be done. Keiki was anesthetized and Pryor slipped his arm down the creature's maw, fumbled around, and came up with the offending object.

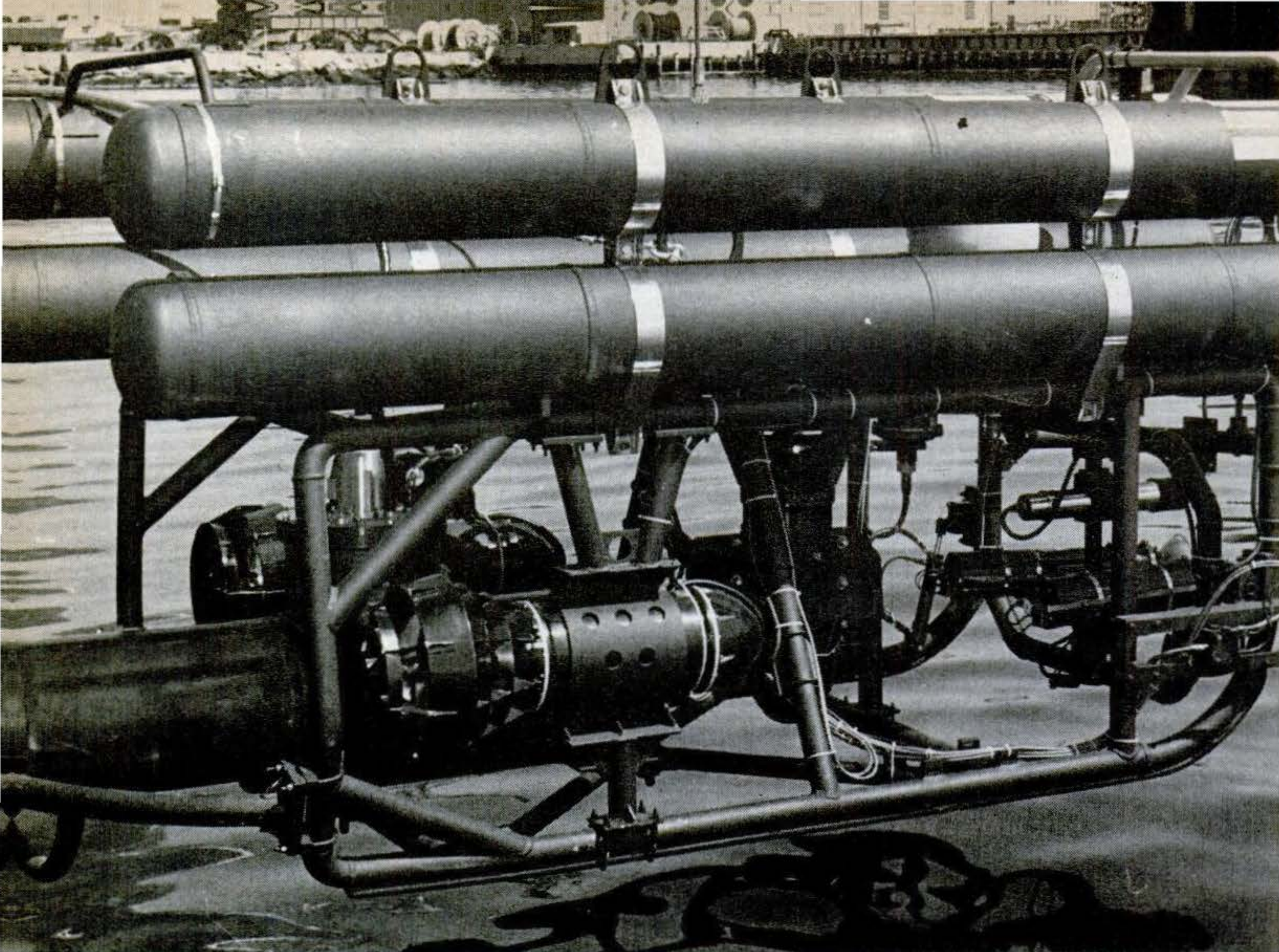
**Running errands.** Keiki was soon groomed for another pioneer research feat. He was taught to run errands for an aqualung diver. Keiki hauled spare compressed-air tanks from the surface to the diver and carried message slates in both directions.

At this time, Pryor and three other marine biologists were planning to live underwater in a submarine capsule off Rabbit Island. Keiki was to be a messenger boy for the aquanauts in their underwater "house." Concurrently, off the coast of California, another porpoise, Tuffy, was being trained to serve as a messenger for the aquanauts in an underwater capsule called Sea Lab II.

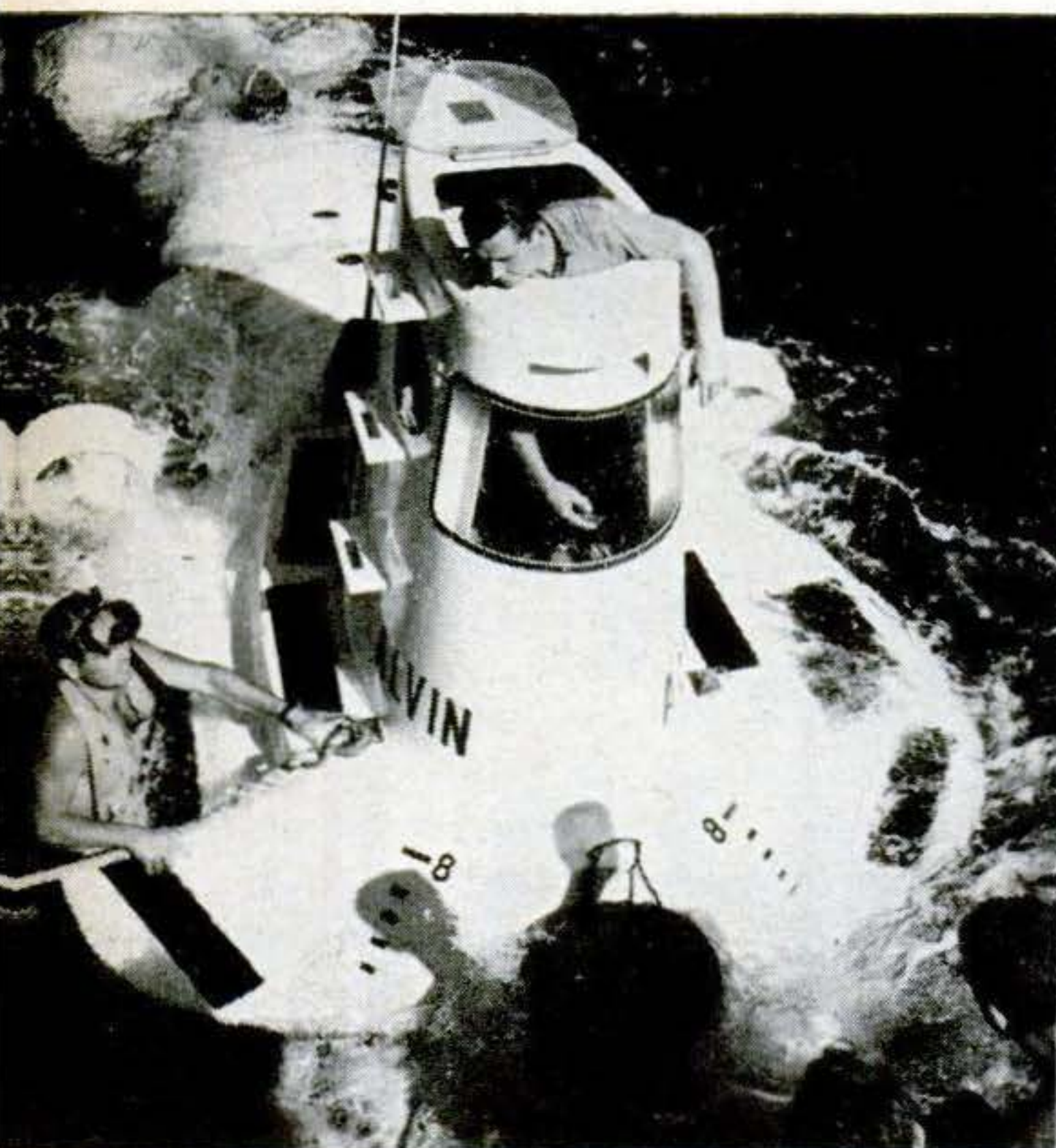
But Keiki started his duties a week before Tuffy went to work for the Sea Lab II crew. Keiki not only ran messages for Pryor, but also carried spare aqualung tanks, bottom samples, and containers.

While he was doing this job, the divers noted a skin disorder on Keiki's left side. Pryor called in a veterinarian who diagnosed the trouble as erysipelas—an inflammation. Keiki was sidelined for medical treatment.

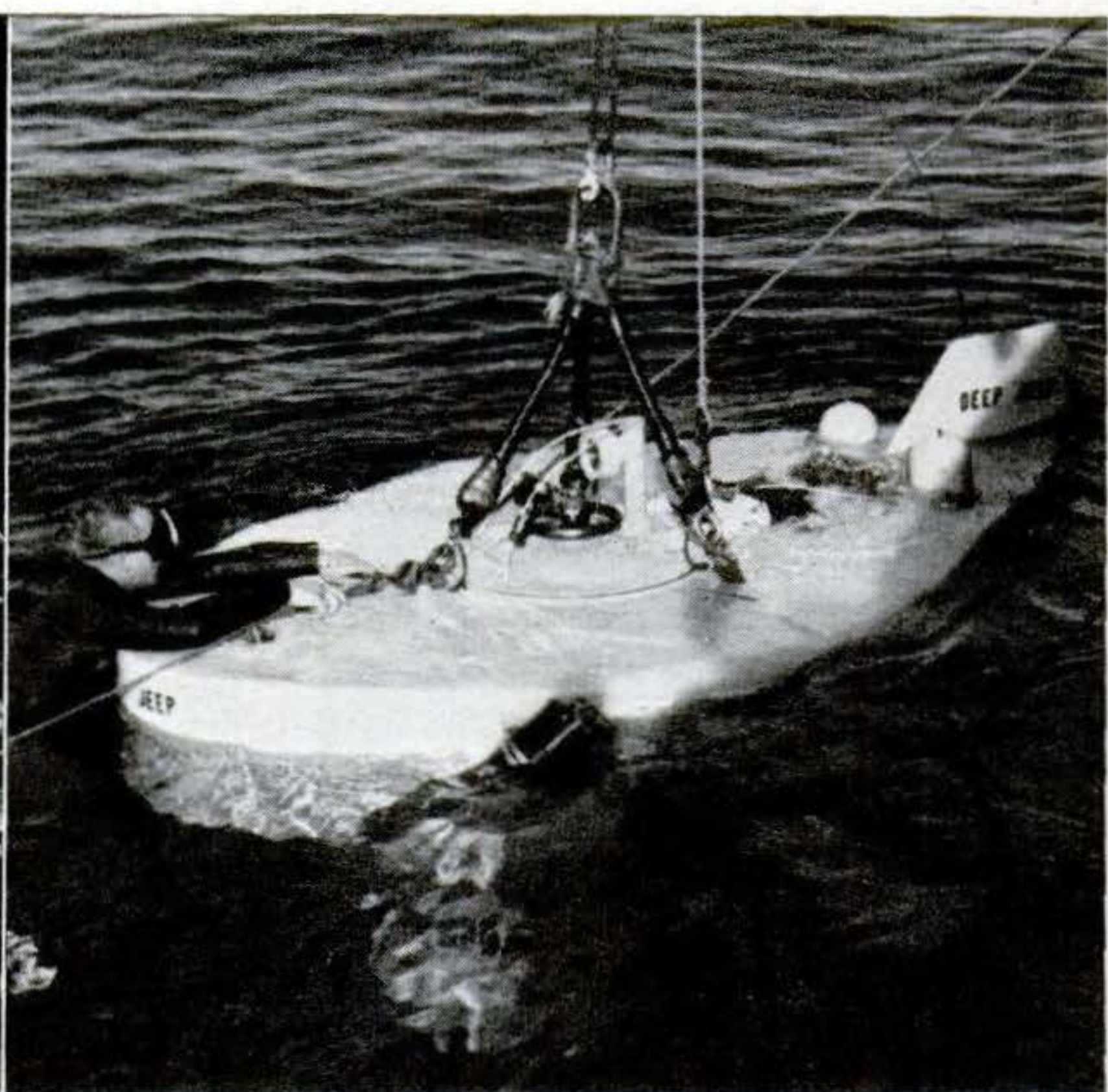
[\[Continued on page 192\]](#)



Remote-controlled CURV, a weird unmanned spacecraft of the deep, succeeded in attaching the



Midget deep-sea sub Alvin found missing H-bomb a half-mile down—and rediscovered it after first raising attempts failed and bomb vanished in mud. Alvin wielded mechanical hand (unseen here) at bow.



Two-man sub Deep Jeep, shown being released from USS Kiowa off Palomares, searched sea bottom down to its 2,000-foot depth limit. Then deeper-diving subs Alvin and Aluminaut took over hunt for H-bomb.

# THE UNTOLD STORY OF THE Fabulous Machines That Recovered Our Lost H-Bomb

It took strange deep-sea submarines to find a nuclear weapon in the Mediterranean, half a mile down—and a new undersea robot to bring it up

By GARDNER SOULE AND  
ALDEN P. ARMAGNAC

It was an incredible ending to a fantastic exploit. In Mediterranean waters off southern Spain, 100 American and foreign newsmen jammed the rail of the U.S. missile cruiser Albany. Past the improvised reviewing stand slowly sailed the sub rescue ship Petrel, proudly displaying on its afterdeck a silvery cigar-shaped U.S.



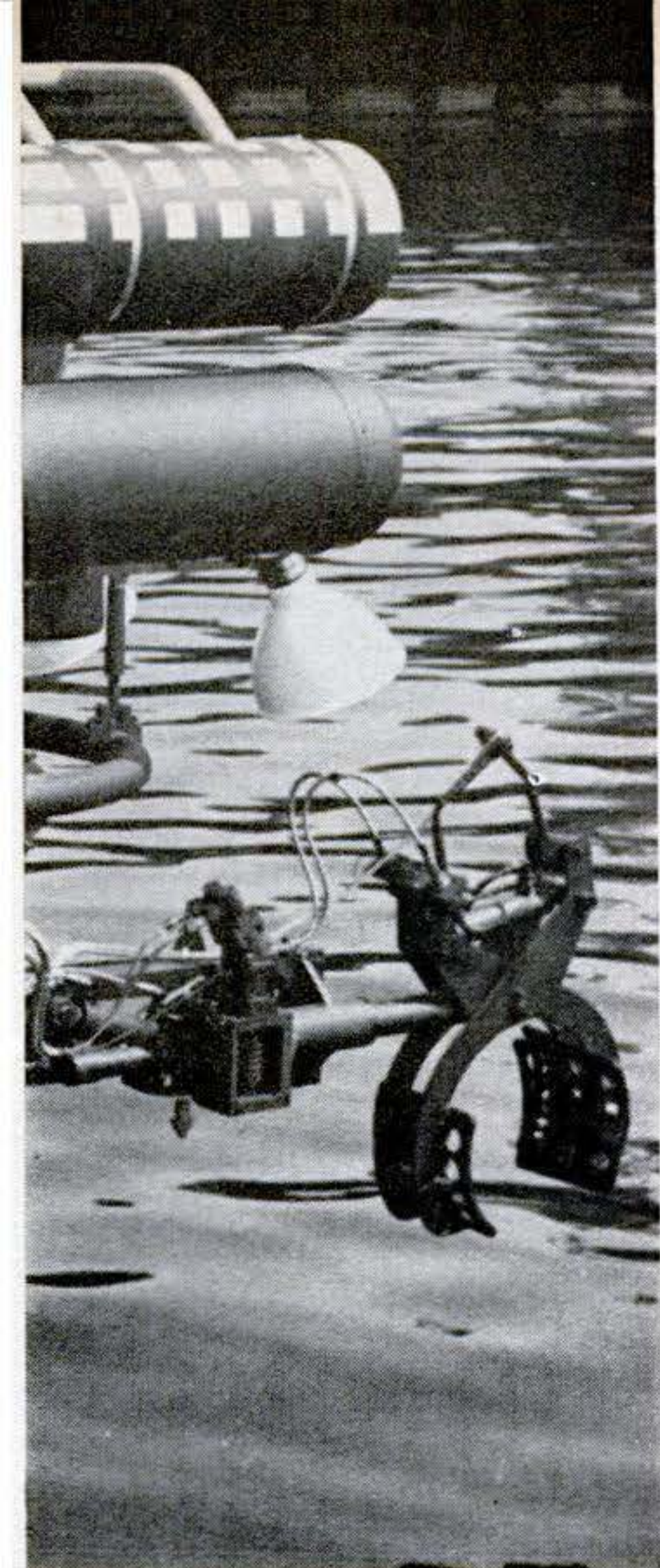
Photo at sea bottom showed bomb and chute.

H-bomb—an object so top secret that the public had never been allowed to glimpse one before. The view of the 12-foot-long, two-foot-thick weapon was near enough for observers to see dents in the bomb casing and a few barnacles clinging to it.

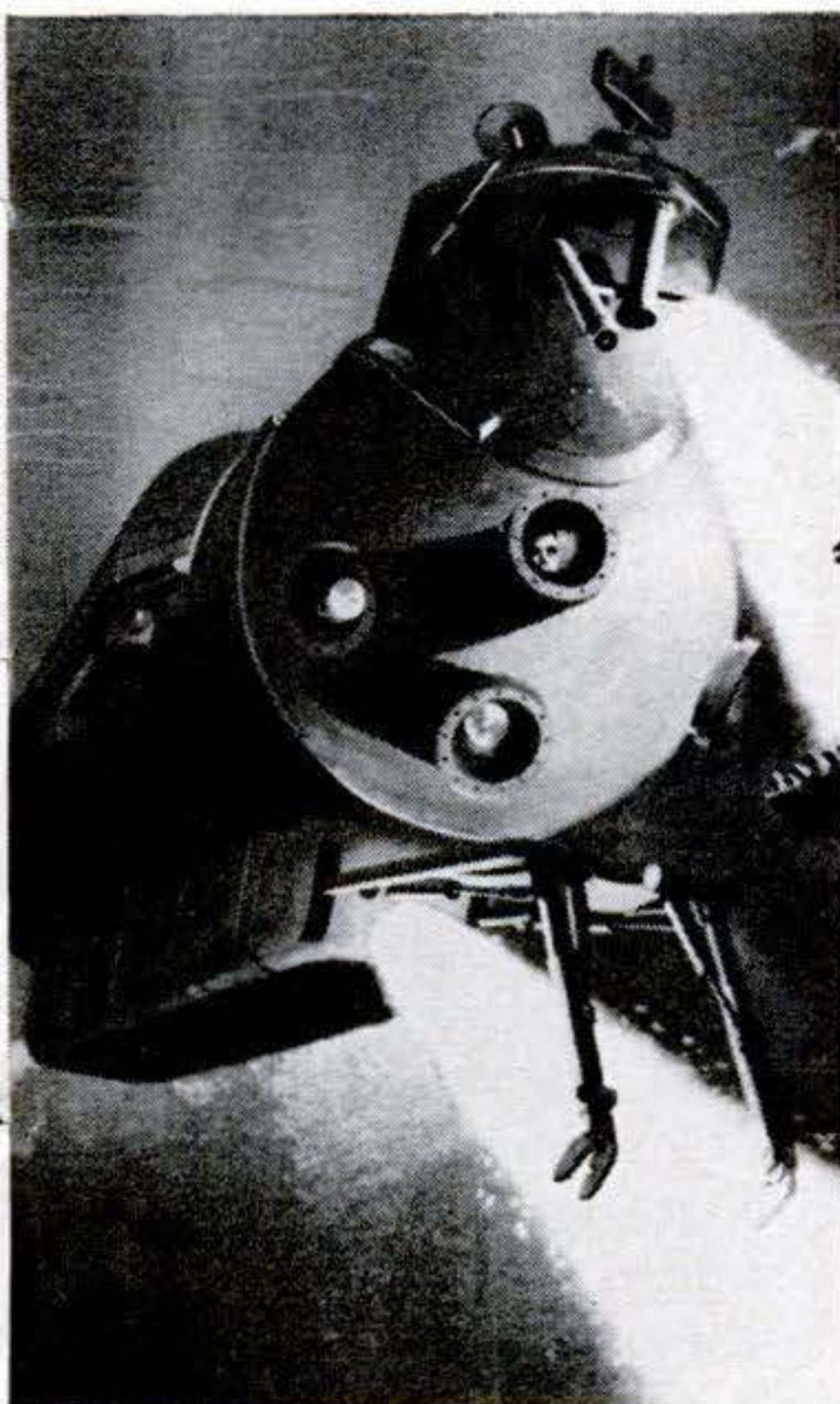
The H-bomb on the Petrel was the world-famous one that was accidentally dropped over Spain, lost for months—and finally found, all but beyond reach, on the Mediterranean bottom half a mile down. It was located and fished up by the most fabulous array of underwater machines ever assembled—including the new deep-sea submarines Alvin and Aluminaut, and an amazing robot called CURV.

This is the untold story of those machines—and the key part they played in an 81-day, multimillion-dollar search-and-recovery effort by 16 Navy ships, 2,500 sailors, 1,000 Air Force men, and 75 civilian helpers including scientists and divers.

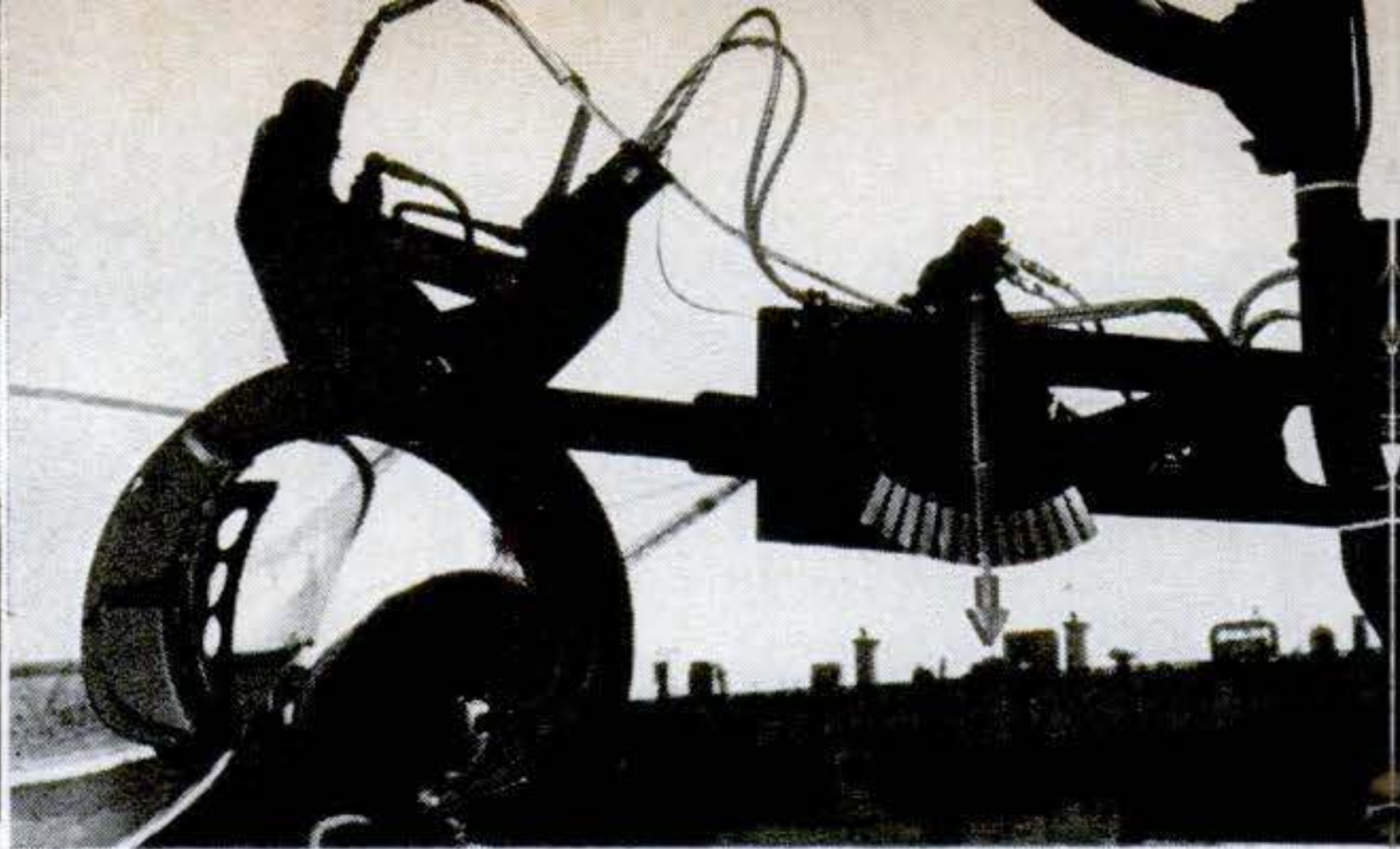
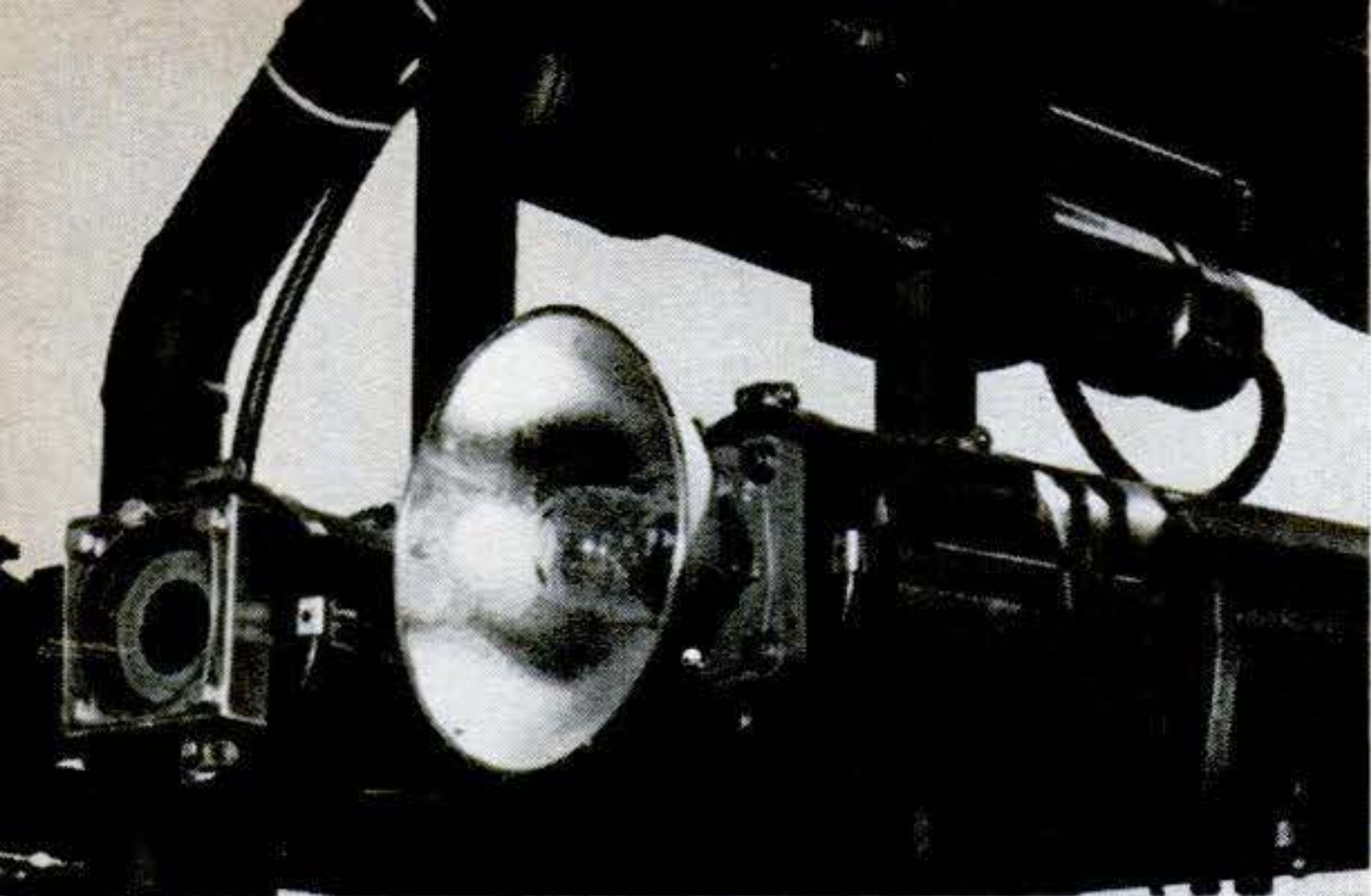
Compelling reasons for urgency spurred the great H-bomb hunt. An unexploded H-bomb in their midst terrified the Spanish people. Infinitesimal as the chances were that it might go off by accident, what would happen if it did was so horrifying that unhappy Spanish authorities pressed the U.S. to find and remove



lines that raised the H-bomb.



Largest of deep-sea craft, Aluminaut had two mechanical hands—and, like the others, windows and undersea lights.



TV camera (top) guided CURV as it neared H-bomb. Below are still camera (left) and its strobe light (right). Succeeding views show other CURV details.

Business end of CURV could seize an object with this claw or other interchangeable implements. It put lines on H-bomb's chute with grappling hooks.

the menace. And danger of another kind, less openly discussed, was something to give U.S. security men nightmares:

About all that could be worse than losing a briefcase full of top-secret H-bomb plans was losing an H-bomb itself. Should Communist agents find it first, and snatch it, the latest-model U.S. hydrogen weapon would be the leading prize in the whole history of espionage. However unlikely such a cloak-and-dagger coup, the bomb had to be regarded as up for grabs until it was safely back in American hands.

The dramatic story began last January 17 at 10:16 a.m. when one of SAC's B-52s, on round-the-clock alert with four H-bombs aboard, collided in midair with a KC-135 refueling plane high above the Mediterranean coastal village of Palomares, Spain.

Seven of the planes' 11 crewmen perished. The four survivors came down on parachutes. So did the four H-bombs.

Unofficial estimates of the bombs' power ranged from one to 20 megatons apiece. Either figure was awesome enough. A one-megaton bomb would suffice, in open air, to create a ball of fire more than a mile in diameter—or, exploding in deep water offshore, would drown the coast with a colossal tidal wave. Lethal blast and radioactivity would claim countless more victims. To guard against an accident of such appalling consequences, mechanical and electrical safety locks keep U.S. H-bombs "unarmed"—incapable of a nuclear blast—up to the moment when one would be dropped in earnest. So the four fallen bombs did not go off.

From joint U.S.-Spanish air bases near Seville and Madrid, U.S. Air Force men rushed to Palomares. Within 24 hours they found three of the H-bombs. One was intact.

Two had been burst open by explosions of part of their TNT detonating charges. Their rupture loosed enough radioactive plutonium over a square mile to require a two-month job of decontamination. The fourth H-bomb was nowhere to be found.

For the first time, one of our nuclear weapons had passed out of U.S. military custody—and vanished.

**In the sea?** By one theory, the bomb might have fallen without its chute and buried itself out of sight, in the soil or the sandy beach. So the land search went on. But most believed it fell in the sea. A Spanish fisherman, Francisco Simo, thought he had seen its chute come down in the water, and pointed out the spot. (Later the bomb was found within a mile and a half of it, and he received a U.S. gold medal for his help.)

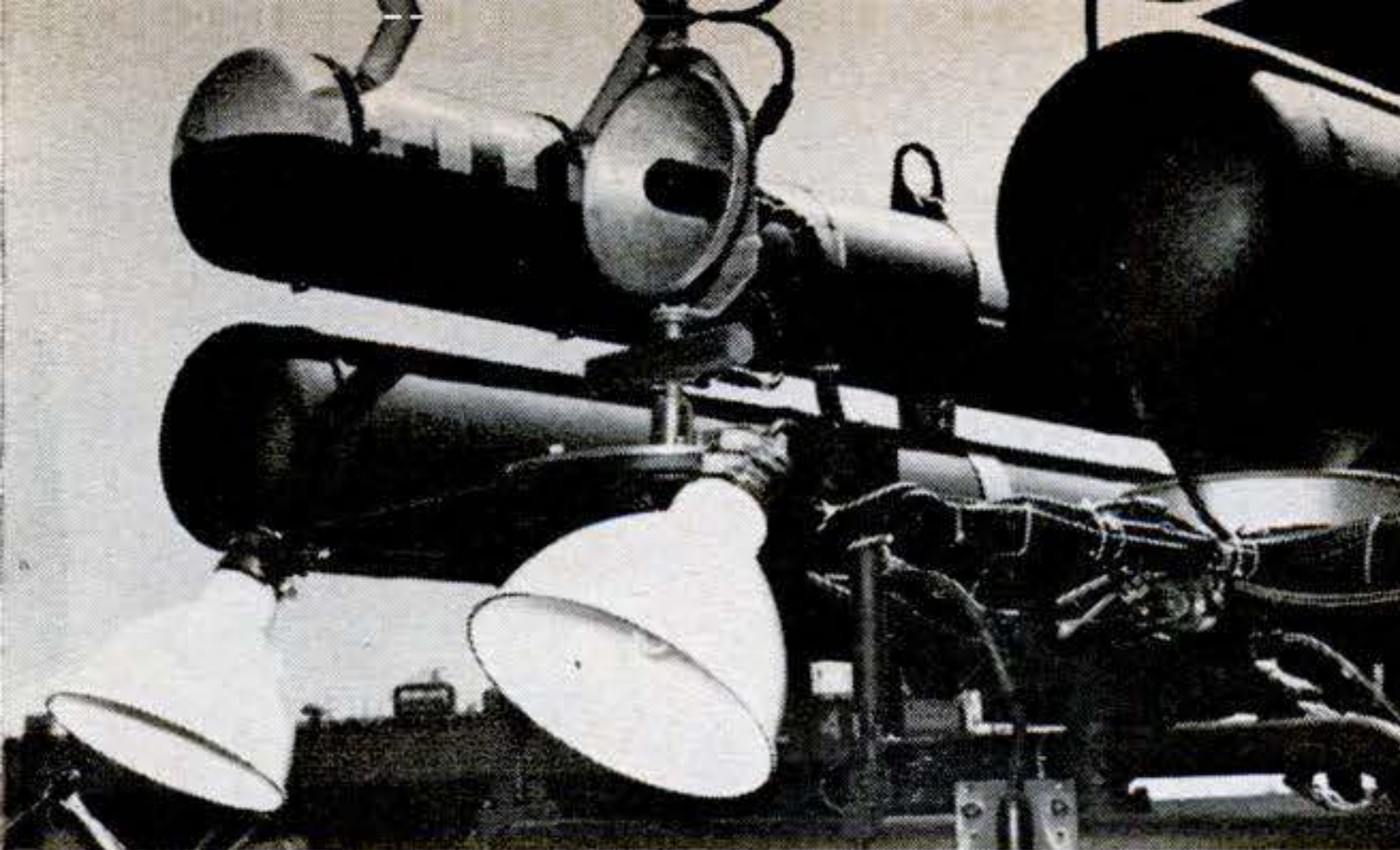
So the main search turned to the sea. As if to discourage anyone else with the same idea, a formidable contingent from the U.S. Sixth Fleet, led by the missile cruiser Boston, appeared off Palomares.

Aquatic bomb hunters worked outward from shore. Frogmen went down 200 feet, their limit. Then came helmeted divers and men in sub rescue diving bells. Plane wreckage was all they found.

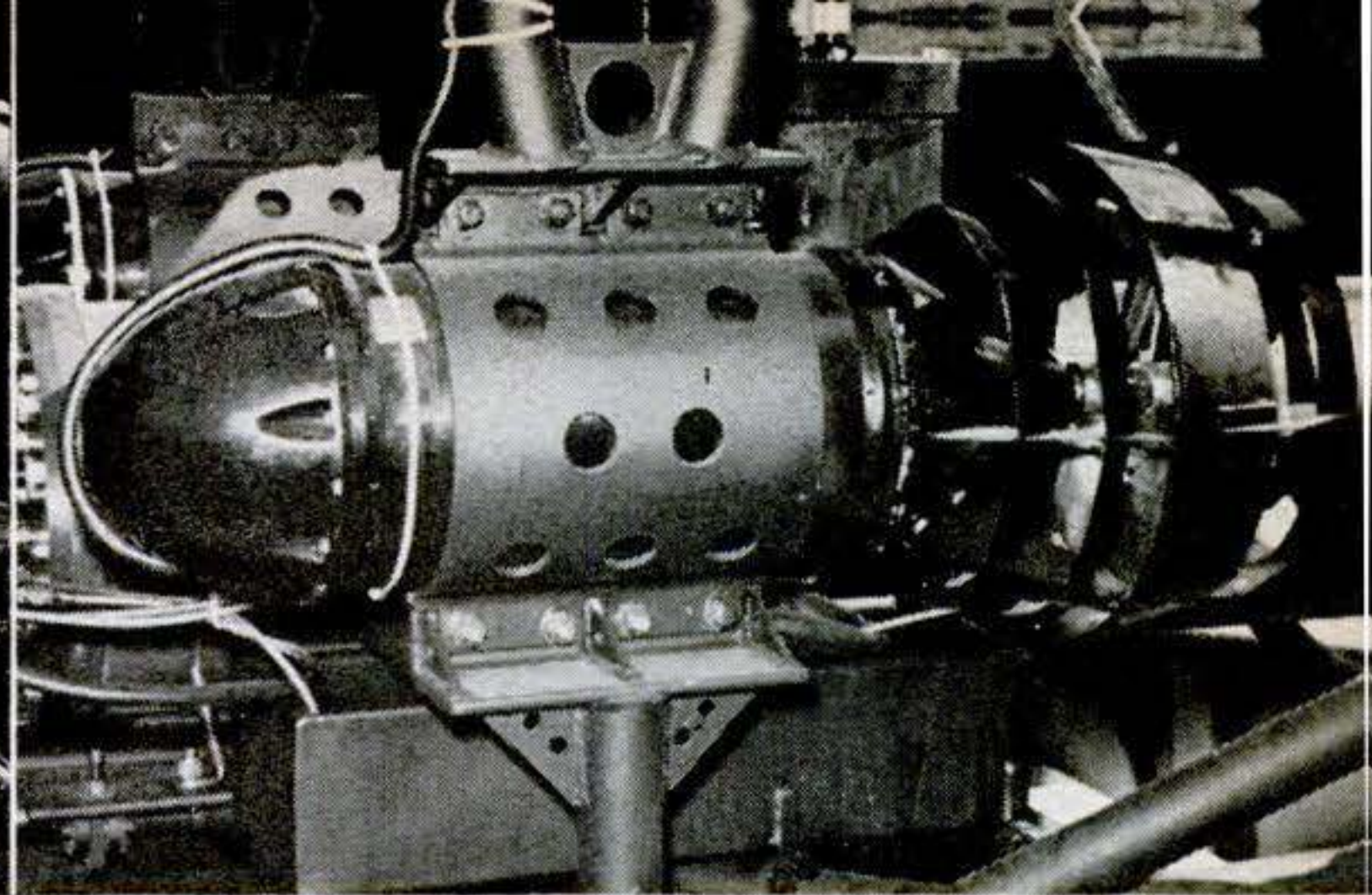
Had this happened only a year or two ago, that would have ended hope of recovering the H-bomb, and it would still be missing. But now the Navy was able to summon to its aid a little fleet of strange new craft—the world's first deep-sea submarines.

By air from the U.S. came the midget submarine Alvin—a white 22-footer with a windowed 1½-inch-thick steel sphere for her two-man crew, liquid-mercury ballast to tilt her for a steep dive, and three swiveling propellers to go ahead or back, up or down





Sonar unit (top center) served to steer CURV until H-bomb came into range of TV camera's two mercury-vapor lamps (at bottom left and center).



To reach bomb, CURV could maneuver in any direction, using two horizontal propellers (one shown) and a vertical one. Each has 10-hp. electric motor.

[see PS, Aug. '64]. Alvin could go 6,000 feet deep. Operated for the Navy by the Woods Hole Oceanographic Institution, she was so new that only three men had learned to run her: William O. Rainnie Jr., Marvin J. McCamis, and Valentine Wilson. They came, too. And an LSD (landing ship, dock) brought the three-man Aluminaut—a 51-foot red, orange, and blue submarine, with a 6½-inch-thick aluminum hull, that could plunge nearly three miles down.

**Subs with "lobster" claws.** Alvin and Aluminaut could survive water pressure that would crush an ordinary sub like an eggshell—1,000 pounds to the square inch, at 2,500 feet. True submarines, battery-powered, they could cruise and explore the bottom with a mobility unattainable by bathyscaphes, the only other manned devices that could dive so far. Their crews could talk with surface ships by acoustic or "sonar" telephone. Both subs had mechanical hands like lobster claws—one on Alvin, two on Aluminaut.

Completing the weird deep-diving fleet, two other new submarines—two-man Deep Jeep and six-man Cubmarine—could descend 2,000 feet and 600 feet, respectively.

Down went the craft, during February and March, to look at 260 objects detected by

Land hunt for lost H-bomb went on at Palomares for 58 days, until bomb was found in sea. Protective

sonar and other means. None was the bomb.

For two weeks a Russian trawler stayed within a few miles of the searchers, watching—and watched. While Russia was not known to have any deep-sea subs, it had been reported as building its first.

**Found—2,500 feet deep.** On March 16, Alvin found the bomb. It made a photo that tentatively, and correctly, identified Object 261 as the weapon. Still attached to its chute, the H-bomb lay on a precipitous slope, five miles offshore and 2,500 feet down. No sunken object so deep ever was raised before.

Alvin and Aluminaut went down to see how the bomb could be hauled up. It looked impossible to attach a line hanging from a bobbing surface ship. So the plan chosen was to lower a nylon cable attached to the anchor line of the oceanographic ship Mizar.

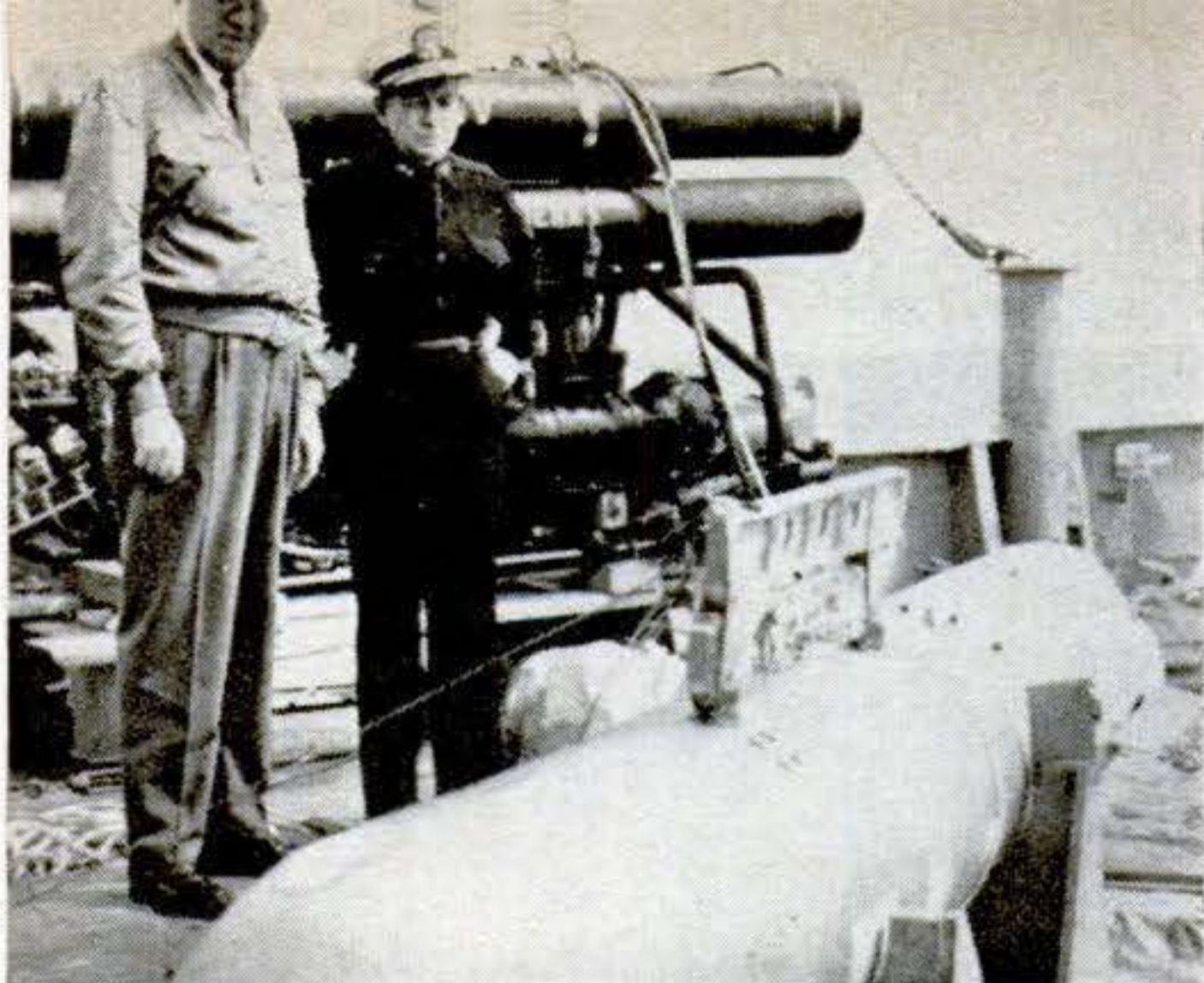
On March 25, Alvin's mechanical hand managed to fasten the cable to the bomb. Hoisting began. The cable snapped.

Twice the attempt was repeated. Each time, the cable parted. After the last try, the bomb slid down the undersea slope and disappeared in mud. It was lost again.

On April 2, at nearly 2,900-foot depth, Alvin's crew spotted what looked like a parachute protruding from the mud. The sub's

*Continued*  
clothing shielded searchers below from radioactivity spilled by two of three bombs already found.





Recovered H-bomb on Petrel poses for photo with Maj. Gen. D. E. Wilson and Adm. W. S. Guest—heads of Air Force and Navy operations at scene—and CURV.

mechanical hand lifted it for a peek beneath. There was the bomb.

**Deep-down perils.** All this time the men in the tiny Alvin, whose small size gave it an advantage in tight places, were facing hair-raising perils. The bottom, as mountainous as the Spanish mainland, was unmapped and dangerous. Piloting a sub among its peaks, when visibility was 30 feet with floodlights and zero without them, was like flying a plane through mountain passes in a fog. Deep-sea currents funneling through the canyons buffeted and tossed the Alvin.

The bomb itself menaced Alvin's crew. Much less remote than the chance of an accidental nuclear blast was the possibility of setting off the TNT charges—as two of the fallen bombs had shown. Such an explosion could disable or sink the Alvin.

What actually came near costing the lives of Alvin's crew, however, was a wholly unanticipated mishap. On one of Alvin's approaches to the rediscovered bomb, its billowing chute snagged the little craft. Trapped half a mile deep, the two men in the sub—McCamis and Wilson—were beyond help if it couldn't free itself. For two minutes or more the sub struggled to escape—reversing, wagging itself with its swiveling screws. Finally it shook itself loose.

**Enter CURV.** Now there came on the scene a strange robot craft—the one, it turned out, that was to bring success. An unmanned spacecraft of the deep, it bore the name of CURV, short for Cable-Controlled Underwater Research Vehicle. Newly developed by the Naval Ordnance Test Station at Pasadena, Calif. (which also designed Deep Jeep), the 13-foot, one-ton CURV had retrieved torpedoes successfully. Before the



Fantastic exploit of retrieving lost H-bomb from half-mile depth was brought off by robot CURV as pictured—after midget sub, Alvin, found the bomb.

H-bomb hunt was 10 weeks old, CURV was flown to Spain to help.

What CURV does resembles a rendezvous-and-docking in space. When its four red ballast tanks admit water, it descends in the sea, linked to its mother ship on the surface by a cable for power and control. Three electric propellers, horizontal and vertical, maneuver it toward a sunken object detected by its sonar. As it nears, its TV camera picks up the object for final guidance. At a control console on the mother ship above, viewing screens show what CURV's sonar and TV camera are seeing—and, with three knobbed hand levers, operators pilot it accordingly.

On reaching the target object, CURV can grasp it, with one of several interchangeable implements. It seizes a torpedo with a hinged claw, from which a buoyed line rises to the surface; then it sheds the claw, and the torpedo is hauled up by the line.

Off Spain, the USS Petrel, with a hoist that could lift the H-bomb, became CURV's mother ship. CURV's claw was replaced with an implement designed especially to snare the bomb's chute, by which it now was hoped to pull up the bomb—a four-pronged grappling hook with spring-latched rods running from the center to each blunt prong.

Now came the feat that covered CURV with glory. Down it went with one of the hooks and, attached to the hook, a nylon cable from the Petrel. CURV poked the hook among the bomb-chute lines, then backed up. The lines, pressing open the springy rods, entered the hook and were caught as the rods snapped shut. Result: one cable attached to the bomb chute. CURV released that hook, surfaced for another, and returned to attach a second hook and cable in the same way.

*[Continued on page 199]*



Unsplined half-shafts and semitrailing arms are combined in Ford Zodiac's unusual rear suspension.

## British Fords feature a V-6

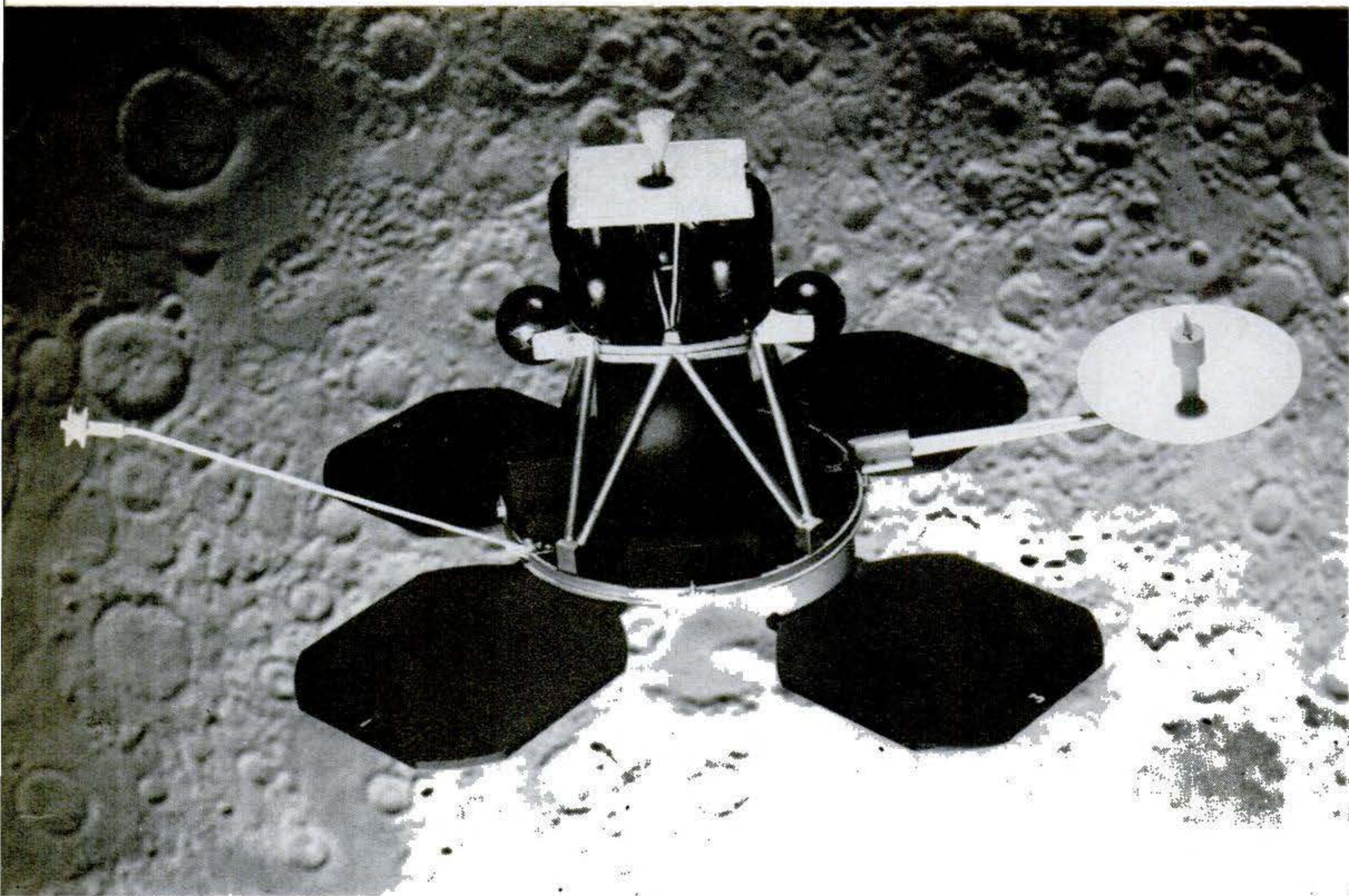
New British Fords tuck the spare wheel in front of a short V-6 engine to leave the 20-cubic-foot trunk unobstructed. They have independent rear suspension and disk brakes all around. Ford's patented rear suspension combines double-jointed unsplined half-shafts with flexibly pivoted semitrailing arms. Evolved from computer calculations, the compound wheel movement improves cornering power and slightly alters wheel camber, toe-in, and toe-out on jounce and rebound. The Zodiac is said to be first with a seven-inch four-headlight system.



## Navy plane sports porch on top

Yep, that's a porch on top of this plane, but it's not for leisurely sunning. It's a walkway for working between flights on a revolving turret housing sensors used in the Navy's Pacific Range

electromagnetic studies. Purpose: to record radio and other electronic radiations emitted by a ballistic missile on reentering the atmosphere. The sensors receive and transmit infrared, visual, and ultraviolet data to recorders, and send a reentry picture to a TV screen.



# Photo Spacecraft to Circle



**From 28 miles away, our Lunar Orbiters' cameras will scan the surface of the satellite to pick out favorable landing sites for our Apollo astronauts**

**By DR. WERNHER VON BRAUN**

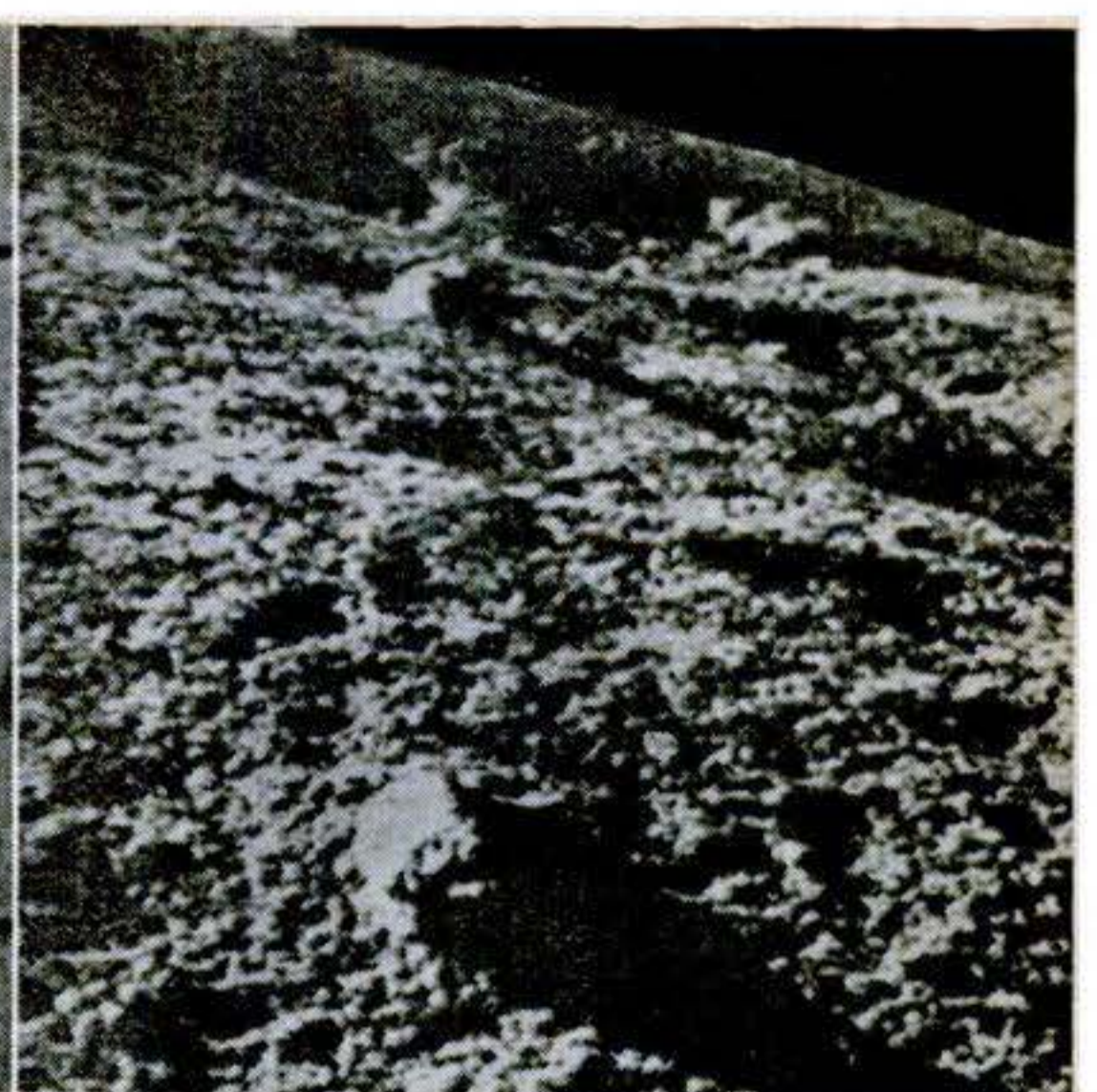
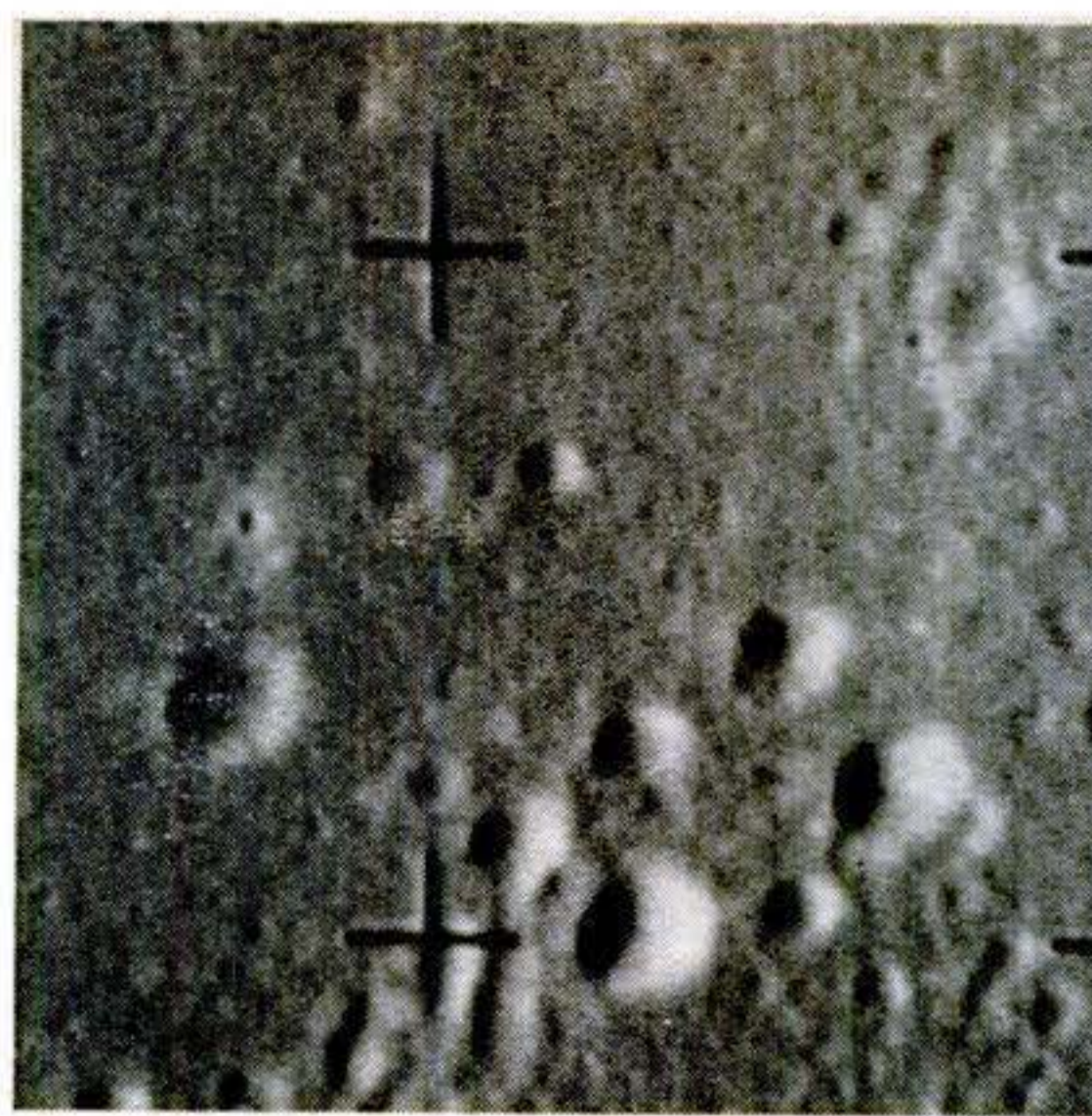
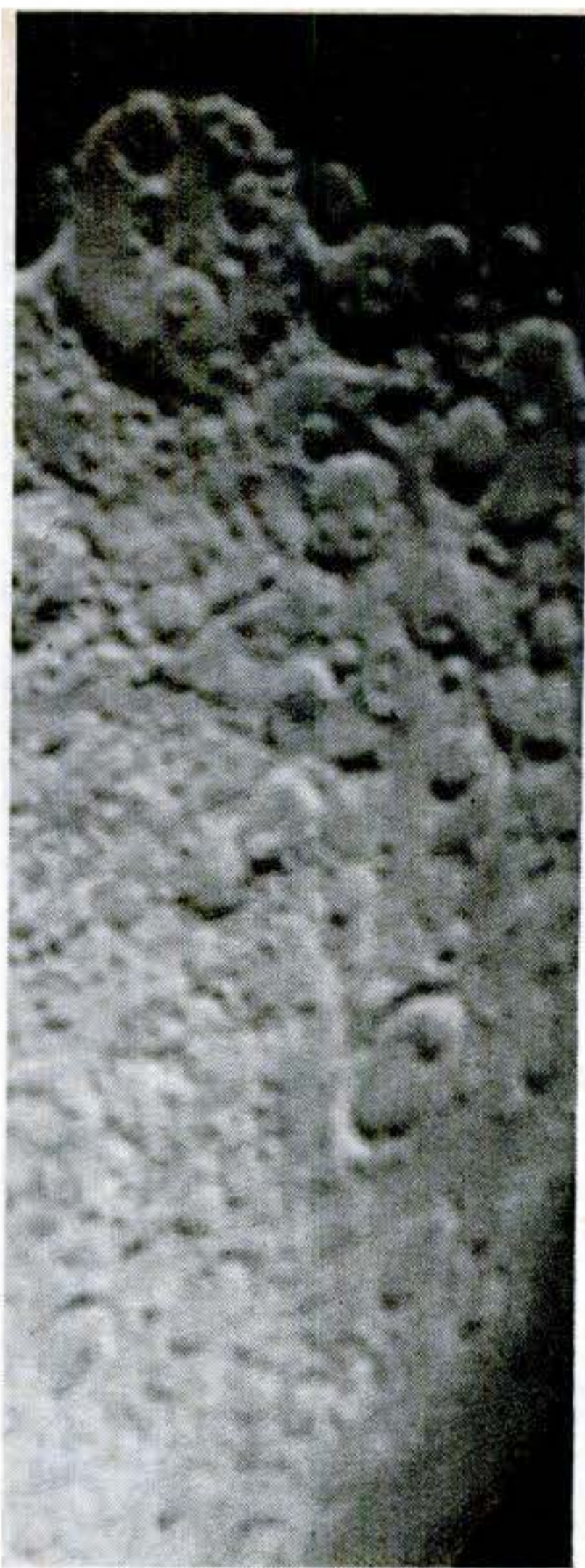
Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.

**T**his summer, the first of a series of five Lunar Orbiter camera spacecraft will be launched. Circling the moon, they will photograph extended belts of lunar terrain from surface-skimming orbits only 28 miles high at nearest approach.

Taking pictures of potential landing sites on the moon for our Apollo astronauts will be the main purpose of these unmanned, 850-pound U.S. space vehicles. A secondary objective is to photograph larger areas of particular interest—on the moon's far side, or in its polar regions—to gather a

wealth of topographical and geological data.

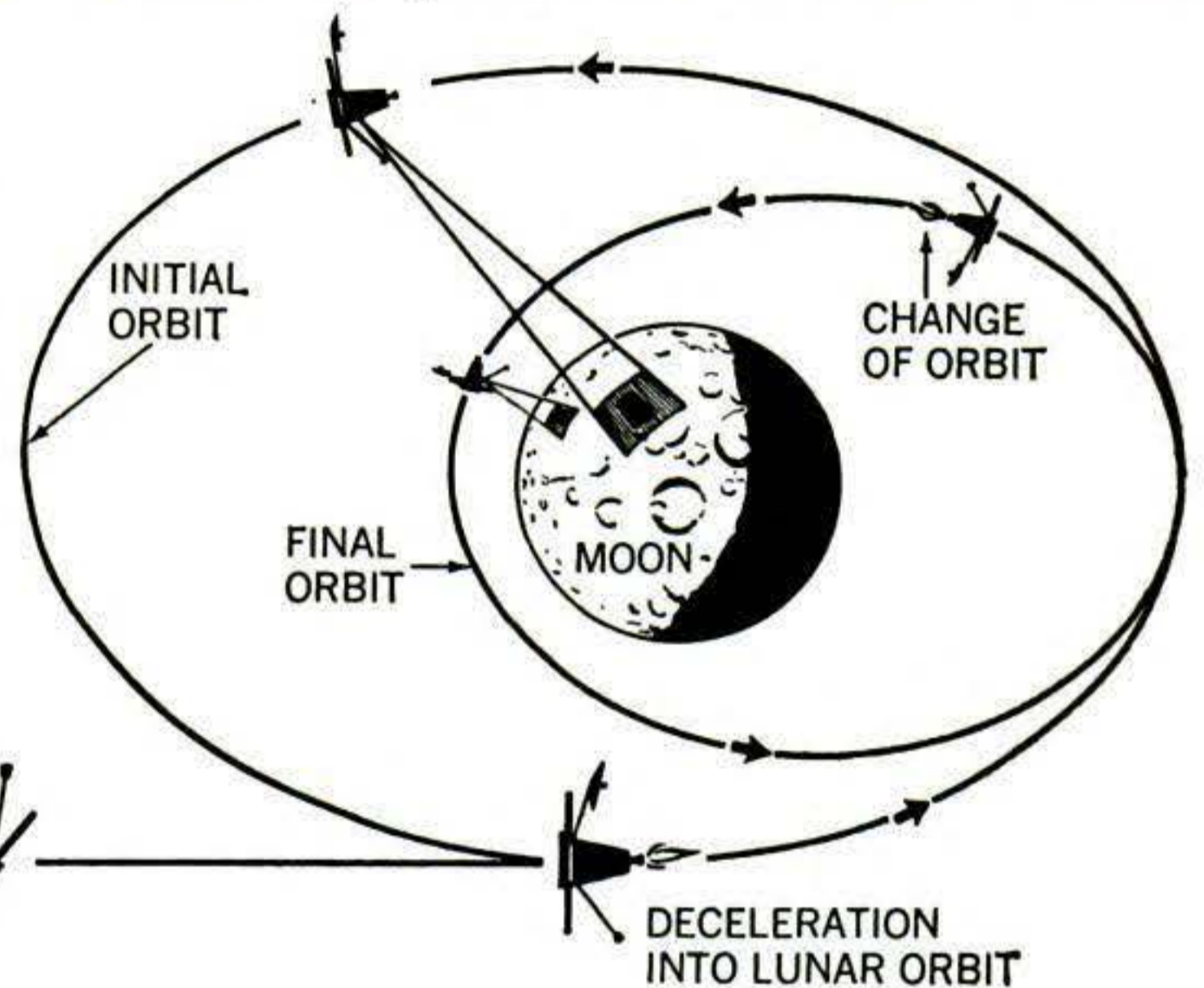
What a Lunar Orbiter will look like may be seen from the model illustrated above. A pumpkin-shaped container at the center houses the photographic equipment. Four black "paddles" are solar panels that generate 266 watts of electric power. The white arms extending from the sides are antennas—a dish-shaped directional one to bundle signals to earth after the spacecraft is properly oriented, and a fishing-reel-shaped antenna for continued radio contact between the craft and the earth during loss



**Closest photos** by Lunar Orbiter will be much sharper than this Ranger view—which, likewise, covers 20 square miles.

**Moon-surface photo** was made by USSR's soft-landed Luna 9—which itself should be spotted if a Lunar Orbiter scans site.

Lunar Orbiter will scan moon as pictured (with model) at left. Globe at craft's center holds camera (lenses are on side toward moon). Diagram, right, shows course as craft approaches and circles moon—at first in high orbit, then in a low, moon-skimming one.



# Moon

or temporary alteration of this attitude. The nozzle atop the spacecraft model, protruding from a white heat shield, is part of the 100-pound-thrust rocket-propulsion system that enables the spacecraft to correct its course and to make changes in its lunar orbit.

**An innovation: photos from orbit.** Up to this writing, the moon has been photographed by spacecraft maneuvered in three different ways: in a curving trajectory past the moon (Russia's Luna 3 and Zond 3), to a crash landing on the moon (our Rangers 7-9), and to a soft lunar landing (Russia's Luna 9). Photos from a moon-orbiting spacecraft will be something new. Though not as

close up as views from impacting or soft-landing spacecraft, they will have the advantage of covering far more lunar territory, at a range still near enough to disclose quite small details.

A Lunar Orbiter's single camera will take pictures alternately with a telephoto lens and a comparatively wide-angle lens. A

[\[Continued on page 200\]](#)

## Moon photographs by spacecraft

*To date:*

1959	USSR	Luna 3	Far side, from about 40,000 miles
1964	USA	Ranger 7	Near side, up to impact (nearest: 1,000 feet)
1965	USSR	Zond 3	Far side, from about 7,000 miles
1965	USA	Ranger 8	Near side, up to impact
1965	USA	Ranger 9	Near side, up to impact
1966	USSR	Luna 9	Near side, on surface (after soft landing)
(USSR's Luna 10, put in lunar orbit April, 1966, did not carry any photographic equipment)			

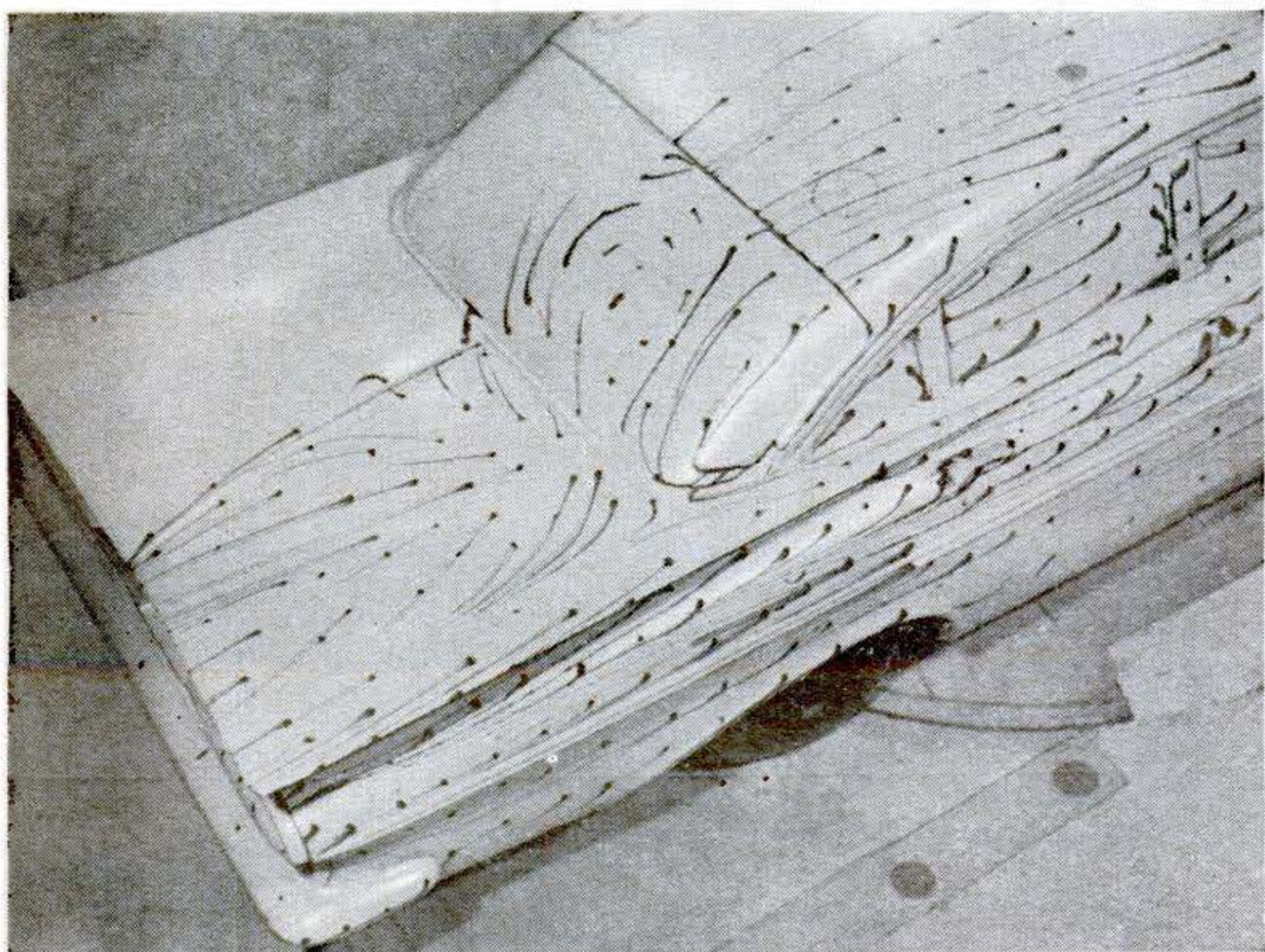
*Coming, 1966-67, U.S.:*

Lunar Orbiter 1 to 5	Near and far sides, from about 28 miles
Surveyor 1 to 10	Near side, on surface (after soft landing)

# Fastback, Holdback, or Cute Styling?

New research is showing better ways to control the unseen forces that affect your driving. Here is the real story of automobile aerodynamics

By JAN P. NORBYE / PS Automotive Editor



**Fastback** (above) coated with fluorescent oil film shows airflow on the body surface. Contrary to what we used to think, smooth lines do not necessarily mean absence of separation outside the boundary layer—the thin layer of air that stays on car's "skin."

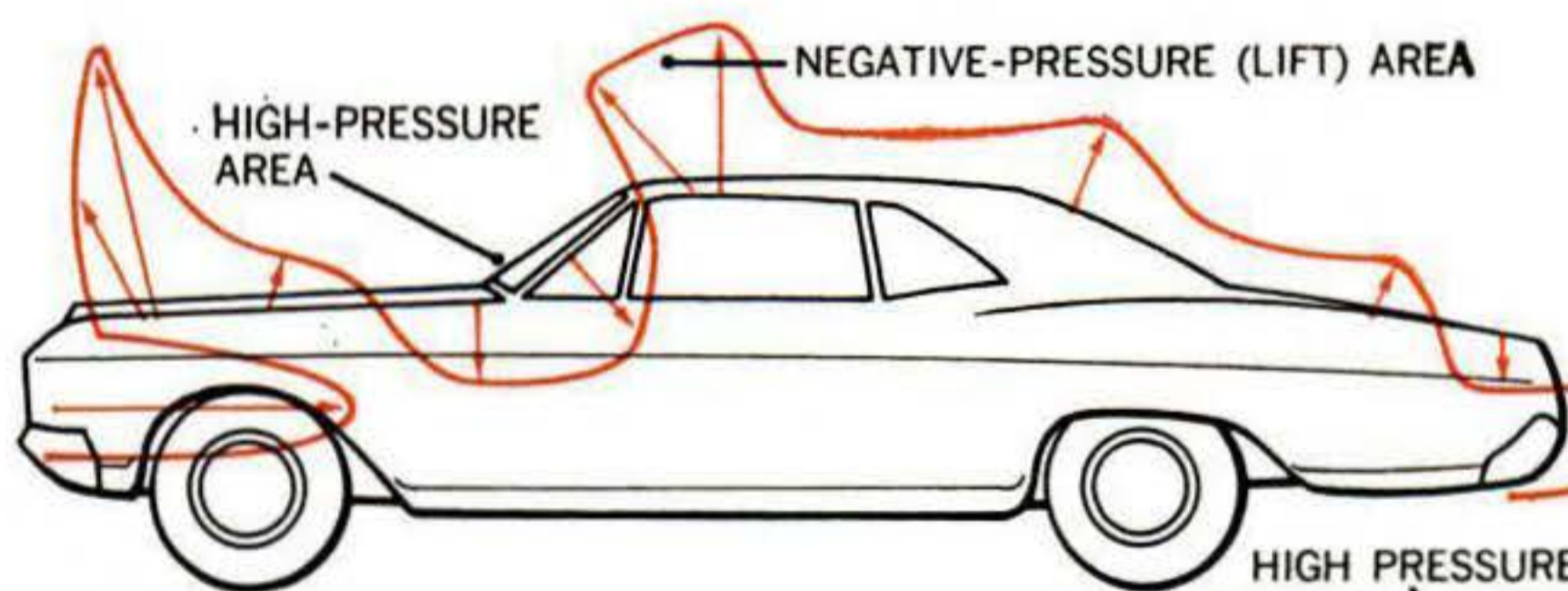
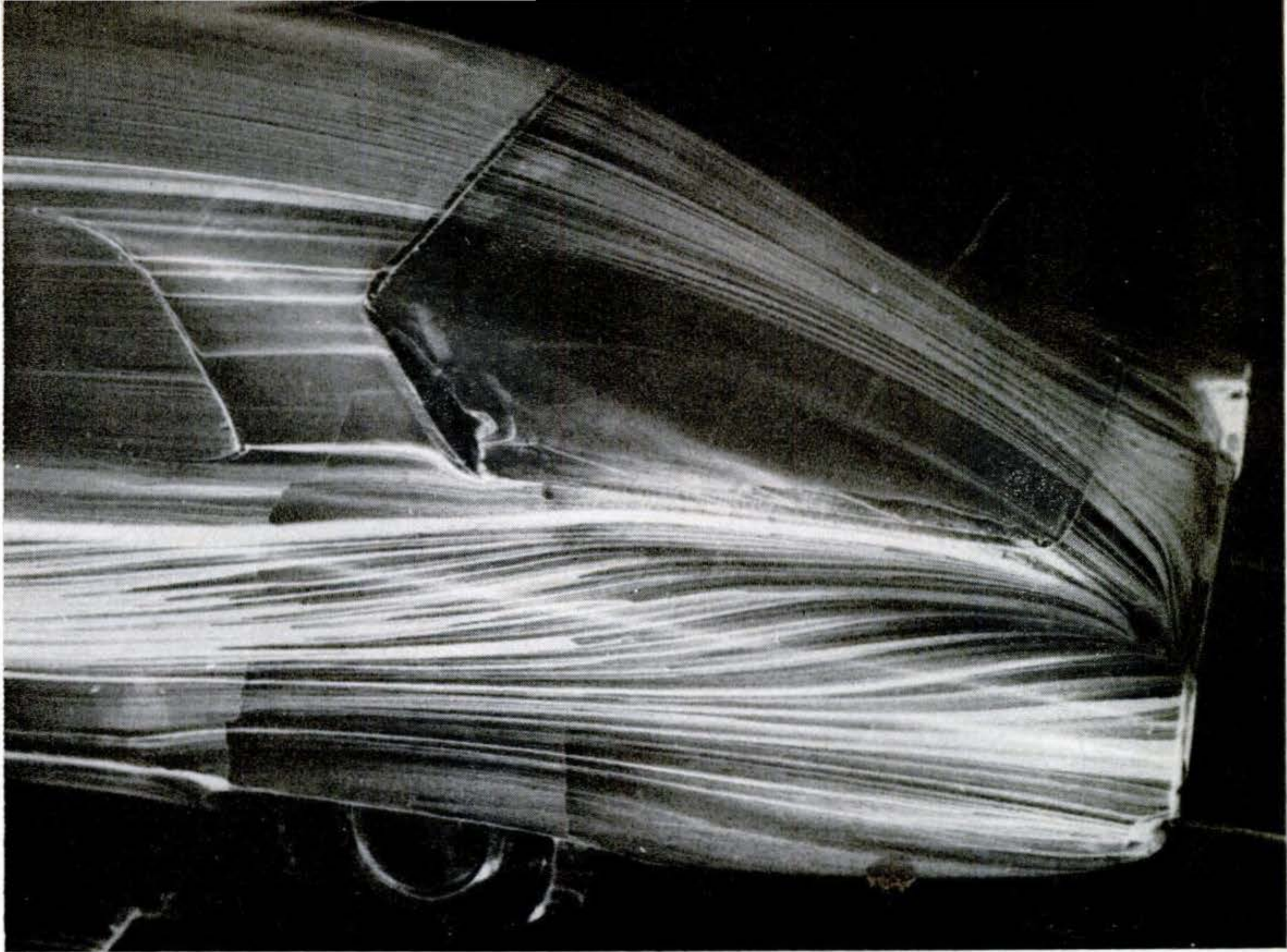
**Notchback-sedan** flow pattern made with kerosene and lampblack (left) shows turbulence at rear window surface. Airflow separation starts at transition between roof line and window, and window is swept by upward and downward streams of air (vortices).

**I**s the fastback faster? Of course—you can tell just by looking at the sloping tail that it will go more smoothly through the air than a notchback.

That's what people have been saying for years. But it isn't any truer today than it was in 1934, when the auto industry "dis-

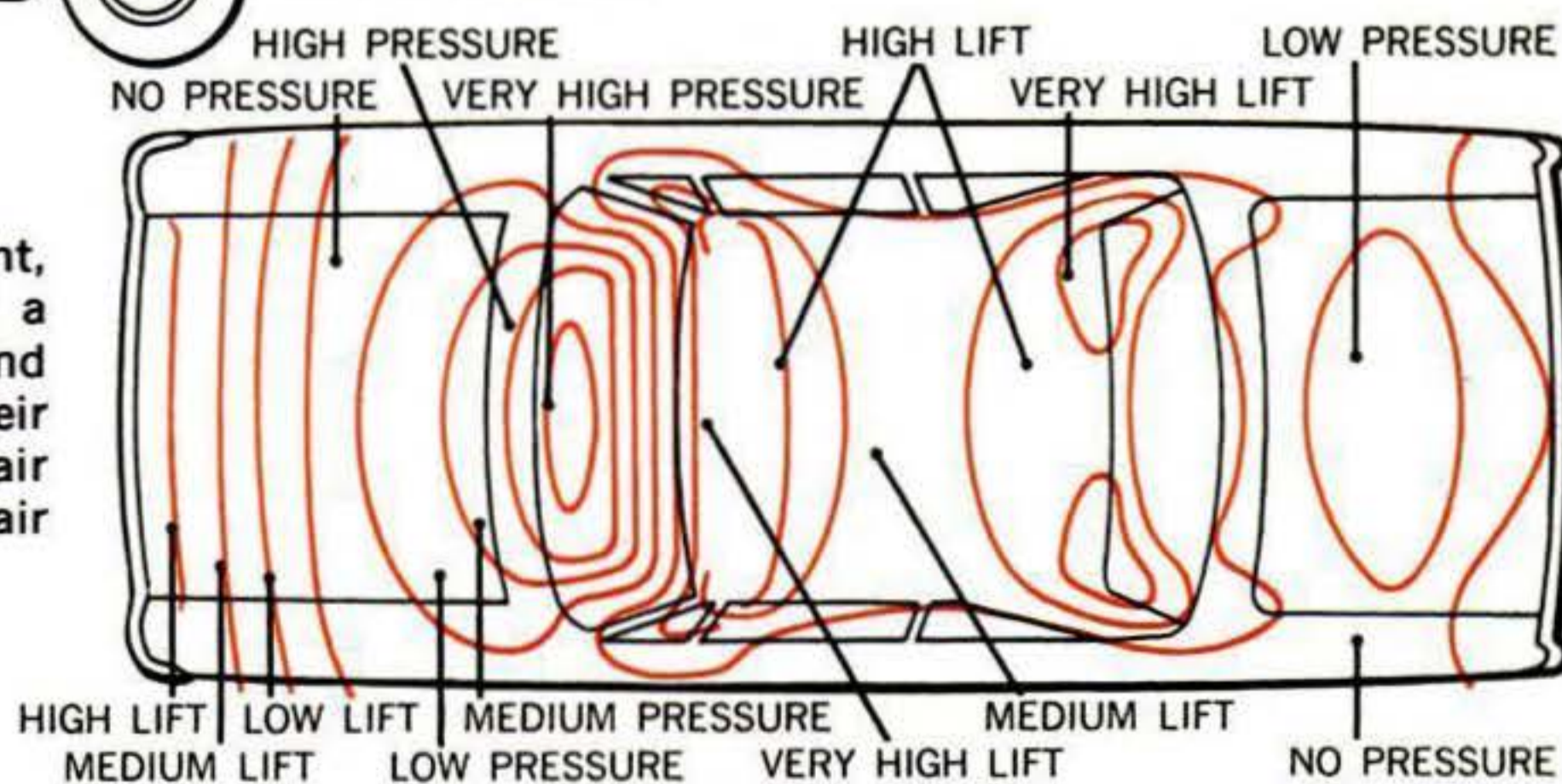
covered" aerodynamics. In this article we'll:

- Explode some of the popular misconceptions about airflow.
- Explain how airflow affects driving safety.
- Tell you how some designers really goofed.



**Air-pressure zones and amount of pressure on a moving car are indicated at left by colored line. The high-pressure zones are the grille and the cowl-and-windshield areas, while there is negative pressure on the front of the hood and all of roof.**

Looking down on the moving car, at right, you can see a pressure-zone map of a body in a head-on wind. A side wind changes the zone shapes, but not their general formation. Designers place air intakes in high-pressure zones, and air outlets in the lift areas.



● Give you the inside story on the shape of the cars in your future.

The truth is that airflow is determined by body shape as a whole—it's not a sloping stern as opposed to a stepped tail that makes the difference. Some fastbacks have lower drag, and are therefore faster than a notch-

back. Other fastbacks have higher drag. Let me explain why.

A car at speed disturbs the air. Air hitting the car head-on splits at a "stagnation" line; below the line, it passes under the car; above, it passes over the car. Upward-de-

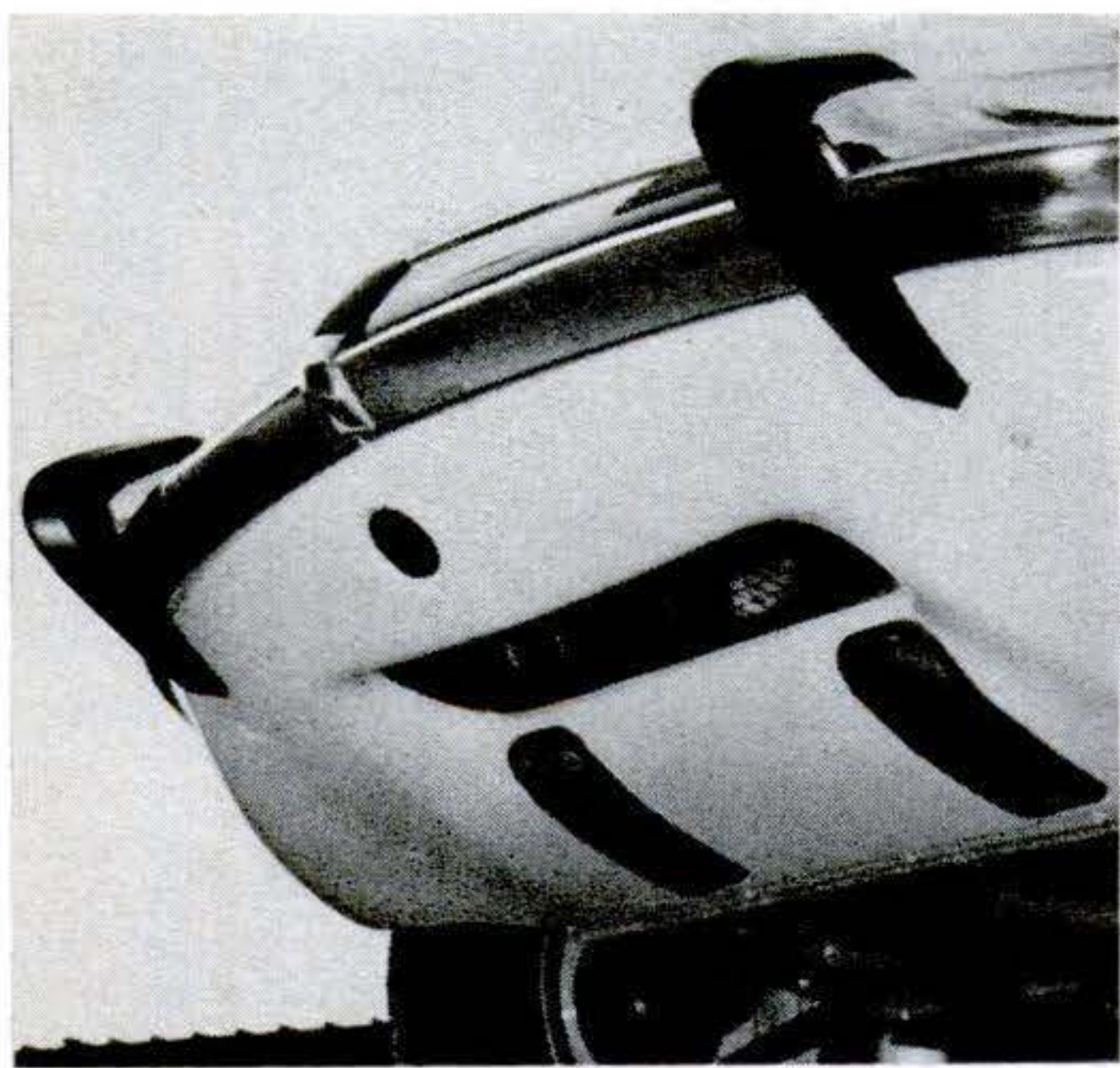
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## If you think airflow affects only performance and economy, you're

flected air is forced to detour above the roof and has to flow faster to keep up with the mass of air around it. When the roof line ends, the high-velocity airflow does not close in on the tail, but separates and forms a wake.

Whether fastback or notchback, airflow separation is bound to occur somewhere between the roof line and the trunk lid. It's pointless to shape a tail section for smooth airflow if separation occurs at the top of the rear window.

How important is drag? GM vice presi-



Air intakes on 1965 Citroën are well placed and admit no more air than is required for breathing and cooling—but Citroën continued its airflow research.



On '66 Citroën, smaller openings admit the same amount of air. There are no conventional air intakes above bumper level, just a sloping hood.

dent Edward N. Cole said in 1951, when he was chief engineer of Cadillac: "Our tests show that until an automobile has attained a speed of more than 60 m.p.h. there is nothing to be gained, from the standpoint of performance or economy, in the aerodynamic characteristics of the car."

But in 1957, Virgil Exner, then styling director of Chrysler Corp., said that it takes "more of the net engine power to overcome aerodynamic losses than all other losses combined at speeds over 50 m.p.h."

Tests have proved that a 10-percent reduction in drag produces a five-percent improvement in gas mileage at 55 m.p.h.

A 25-30-percent drag reduction is possible on most U.S. cars without cutting interior space, reducing visibility, eliminating lights and mirrors, or adding much weight or cost. By and large, American cars are what aerodynamicists call "dirty." The U.S. makers don't design their cars for reduced drag; they design for style.

**The drag coefficient.** The aerodynamic characteristics of a body are indicated by the drag coefficient. Drag is determined by the drag coefficient, frontal area, and speed. The drag coefficient of any body is determined by shape alone—size has no bearing. The rating of 1.00 is assigned to a particular shape—a cylinder seven times as high as its diameter. A square plywood board has a drag coefficient of 1.11.

Wind-tunnel tests have determined the drag coefficients of many cars. That of the Volkswagen is 0.50. U.S. cars range between 0.44 and 0.52. The Citroën, an excellent combination of practical and aerodynamic design, has a rating of 0.33. It has a smooth underside, few protuberances and recesses, small air intakes, and tapered front and tail sections.

But speed and fuel consumption no longer are most important in automotive aerodynamic research. Airflow affects other car functions—many in the driving-safety area.

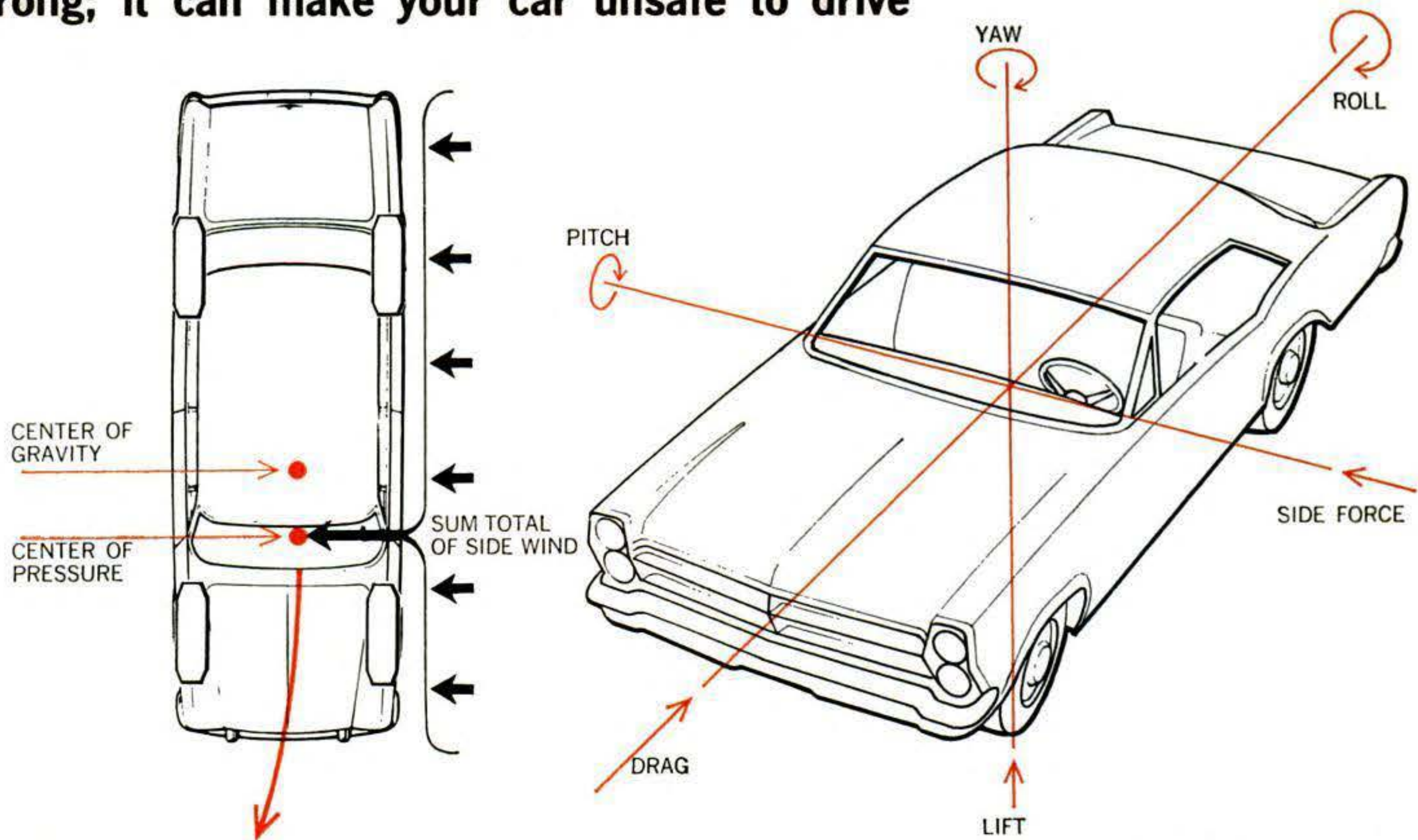
**Handling.** Side winds threaten a car's stability, and aerodynamic lift creates steering, traction, and braking problems.

**Visibility.** Road dirt and rain reduce visibility when they reach windshield and window areas.

**Cooling.** Both radiator and brakes need a flow of fresh air. The common problem is too much air taken in and too little led exactly where it's needed.



**wrong; it can make your car unsafe to drive**



**Aerodynamic side forces** act through the center of pressure. Car will veer off course if side wind acts too far forward on it.

**Axis system of aerodynamic forces** shows the six ways your car can move. All of these movements—singly or in any combination—can be produced by the airflow around the automobile.

*Ventilation.* Air intakes must be placed where they are fed clean air—not somebody else's exhaust. They must be located in high-pressure areas to keep them from becoming air extractors.

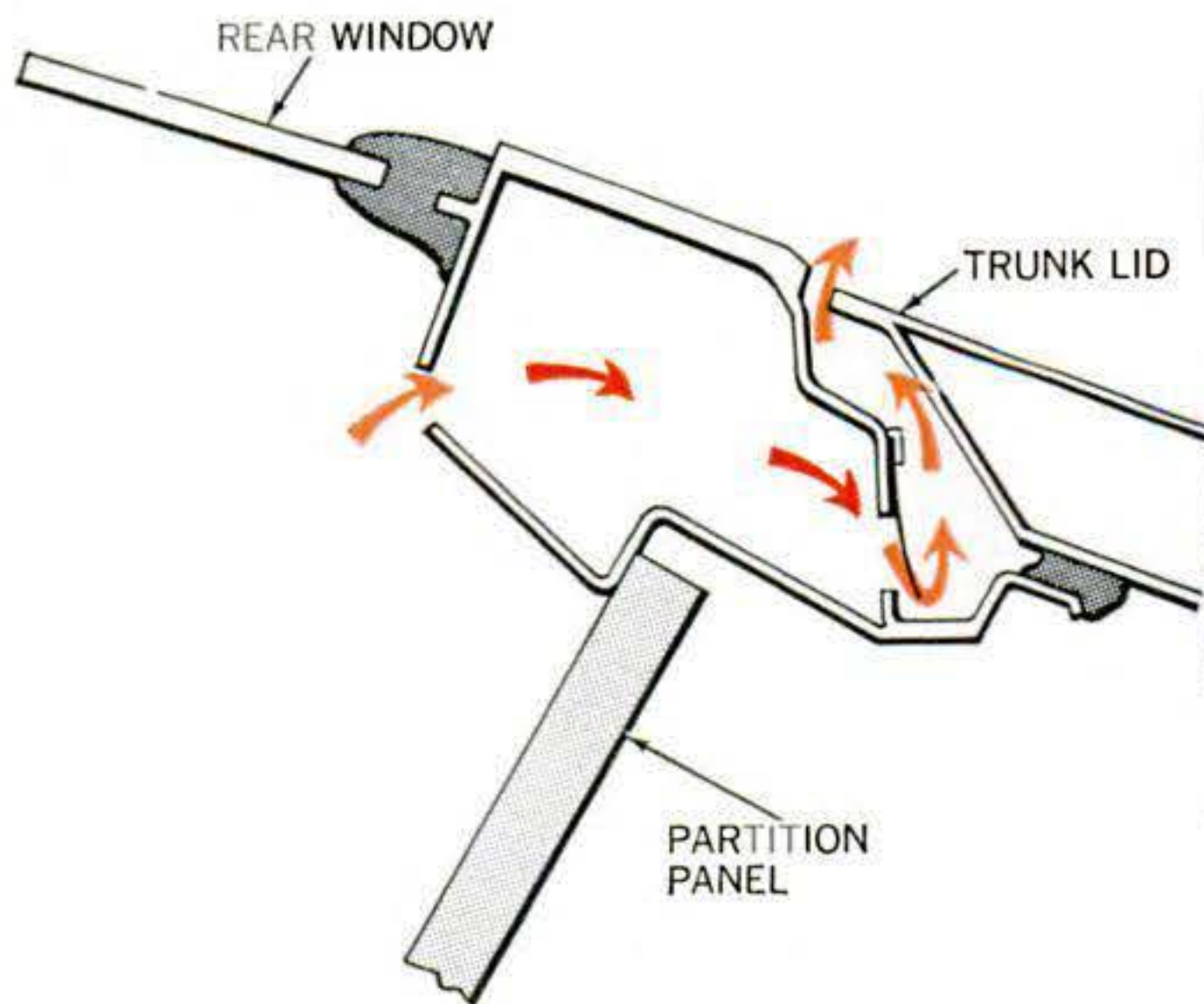
*Noise level.* Wind noise can be directly correlated to the car's drag coefficient. Reduced drag gives you a quieter car.

*Side winds and stability.* Winds do not normally hit a car head-on, but at an angle.

In the same way that centrifugal force acts through a car's center of gravity, side wind acts through a car's center of pressure. It makes no difference whether the pressure angle is straight from the side or just a little off the car's direction of travel.

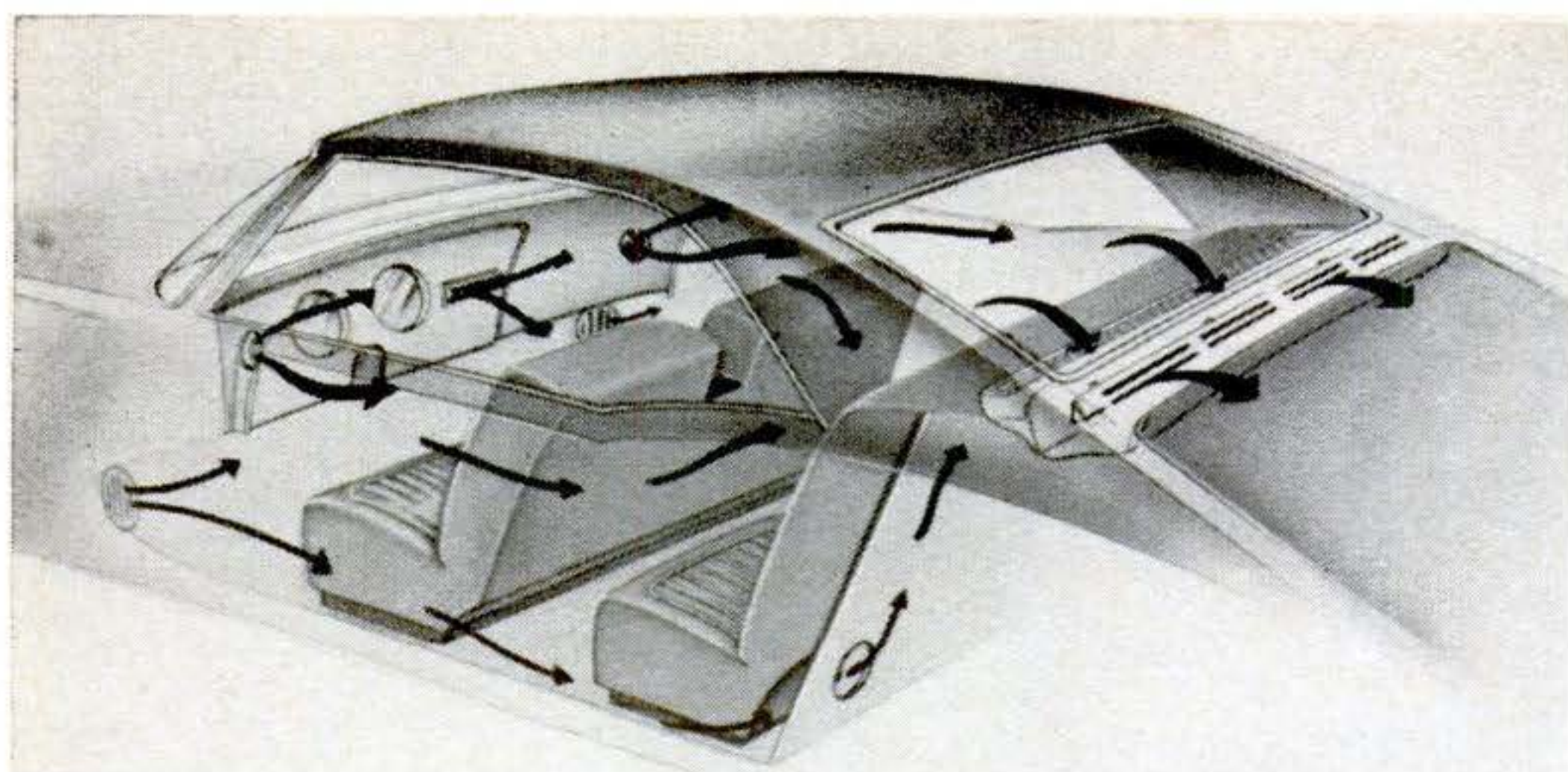
The center of pressure depends on shape alone. It tends to be farther forward on a car with a low drag coefficient. On most cars made in the U.S., the center of pres-

*Continued*



**Outflow of air from body of the Barracuda** is controlled by baffles and rubber flaps (indicated by white arrows) that bar air return. Flow path leads

from the interior to a gap between trunk lid and rear window frame. Because this is a high-lift area, air is drawn out from the trunk.



**Buick Riviera** has well-silenced draftless ventilation system that has eliminated vent panes. Air enters from a cowl intake or from vents in the body sides. It exits via path beginning under rear seat, going through series of baffles, ending at louvered outlets in the negative-pressure area below back window. With a side window opened, air exit is quietly increased.

sure is between the windshield corner posts.

Like aircraft, cars have a neutral steer point—where side pressure will move the car sideways without changing its course. For practical purposes, this point coincides with a car's center of gravity. If the center of pressure is close to the center of gravity, side wind will have little effect on the car's direction; we say the car is directionally stable. If the center of pressure is far ahead of the center of gravity, side winds tend to change the car's direction; it's directionally *unstable*.

To bring the two centers closer, engineers can move the neutral steer point forward by altering weight distribution and suspension design. Stylists can move back the center of pressure by adding area to the rear of the car's profile—usually in the form of tail fins. But tail fins, to be effective, must be very large, like, for instance, those on the land-speed-record machines of Breedlove, Arfons, Campbell, and Summers. The fins popular in the late 50s were for styling effect—not for aerodynamic effect.

**Flying a car?** The high-velocity airflow over a car roof creates a negative-pressure area. You've seen soft tops bulge at speed—they're not blown up like balloons, they're lifted by the outside airflow. A high-pressure area under the car adds to lift force. A typical U.S. sedan has a lift force of some 500 pounds at 100 m.p.h.

Lift aggravates side-wind effects. High-speed racing cars like Ford's GT-40 have experienced yaw situations where the lift was greater than the load on the wheels, and the car was actually *flying*.

Today, all such cars use spoilers, usually at front and rear, to reduce lift. A front spoiler keeps air from getting under the car and building up pressure. A rear spoiler, such as Ferrari's ducktail, creates a high-pressure area on top.

What can you do if your car is unstable in crosswinds? You can improve it. Just as your tires resist centrifugal force on turns, they have to resist aerodynamic side forces.

1) Increase tire pressures all around. This will reduce the heading error caused by side wind and you'll be able to stay on course with smaller steering corrections.

2) Find a good front/rear balance in tire pressures. With front-engined cars it usually pays to raise pressures more in the front than in the rear. This gives small slip angles at front, large ones at rear. When the nose is deflected by side wind, the tail will move sideways, too. (You've actually moved the neutral steer point forward.)

3) Fit tires with greater cornering stiffness, like "belted" radial-ply tires. The effect is the same as raising the pressure in ordinary tires, without the loss in ride comfort overinflation gives.

*[Continued on page 198]*



**EXPERIMENTAL AIRFOIL WIPER BLADE**

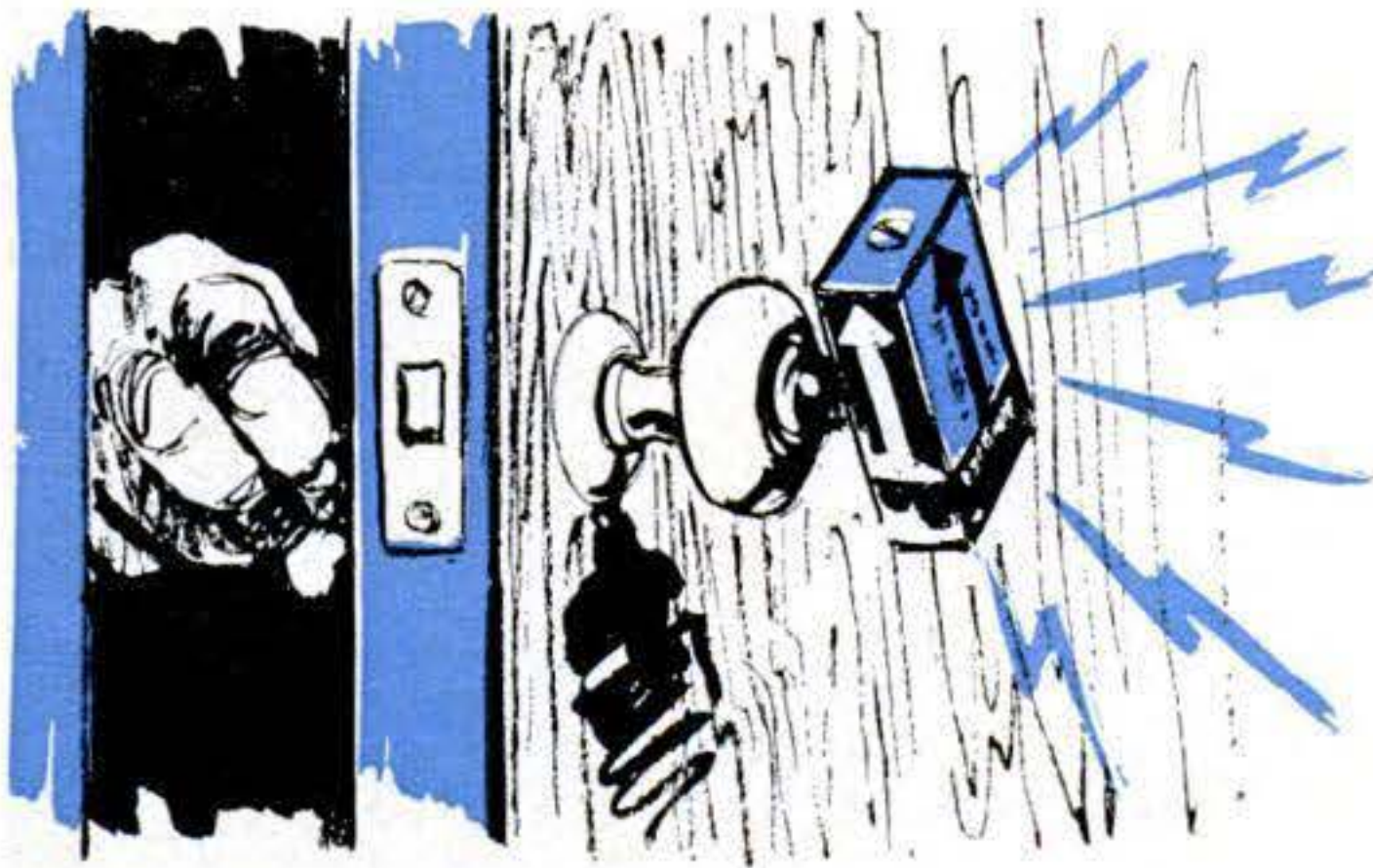
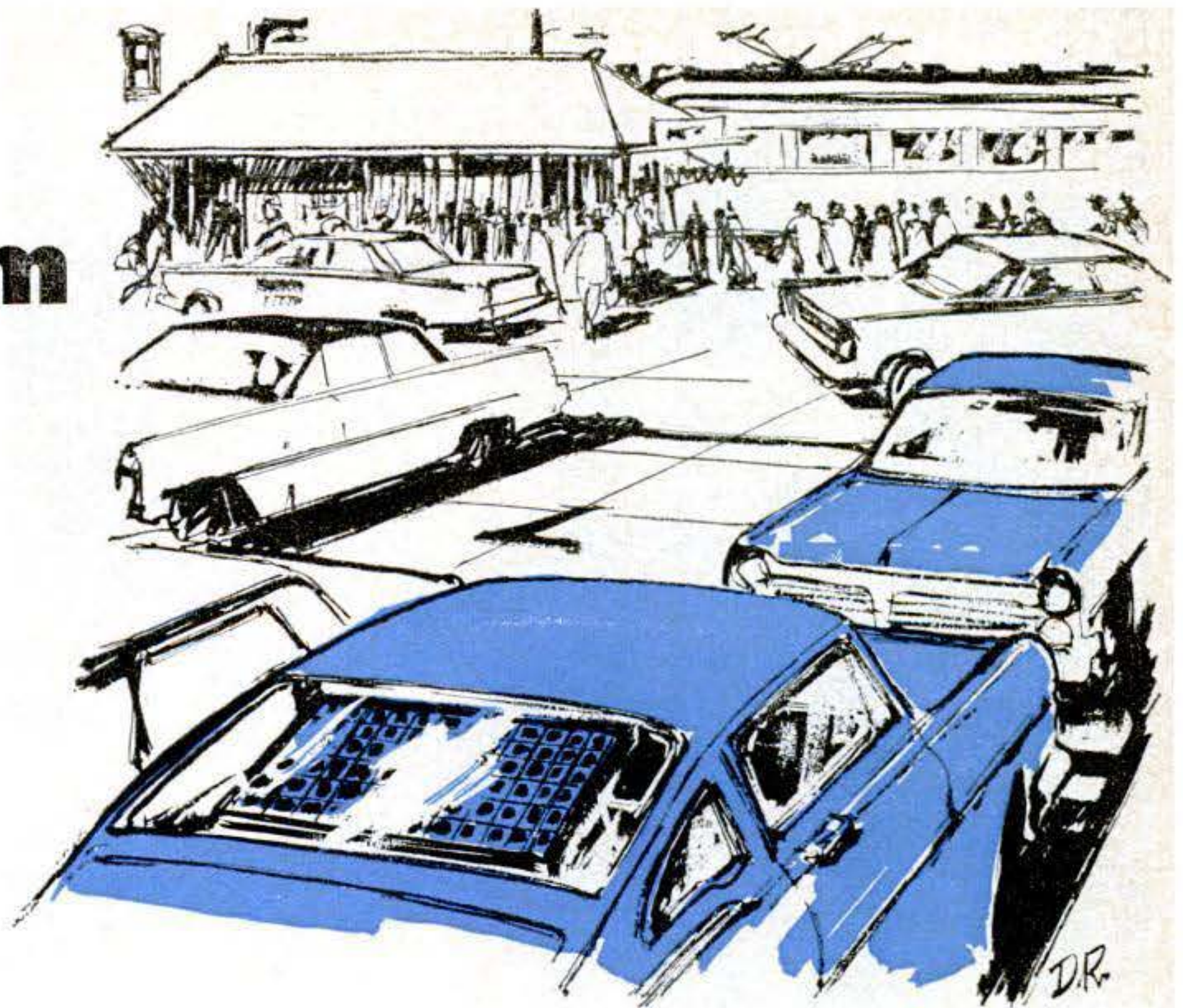


**PRODUCTION AIRFOIL WIPER BLADE**

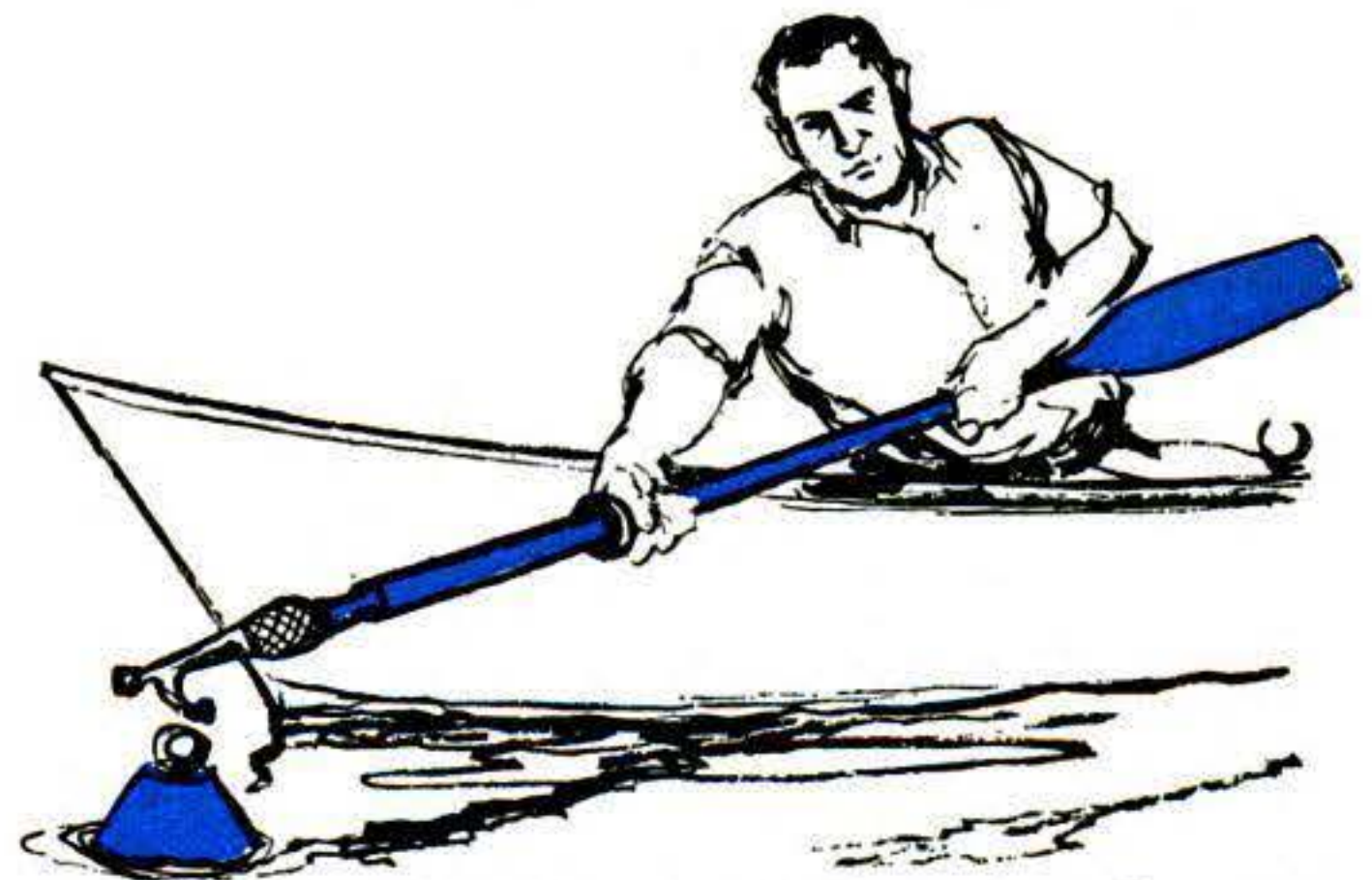
All wind forces acting on a conventional windshield-wiper blade tend to lift the arm off the glass. In 1962, Chrysler developed an airfoil bridge for the wiper arm, using airflow to minimize the lift.

# “I’d like to see them make...”

**A solar-cell charging unit** to supply a trickle charge to the battery of a commuter’s car. These short-haul cars sit all day in the broiling sun.—*C. Dodds, West Palm Beach, Fla.*



**A simple motel-room burglar alarm**—a mercury switch, battery, and buzzer on a suction cup to fit the doorknob. Turning the knob would trip the switch.—*S. Tryzbiak, Newport, R.I.*



**Space-saving boathooks** without handles. Fitted with the old Chinese hold-on that tightens with pull, they’d slip over any standard oar handle.—*D. Rebard, Newport Beach, Calif.*



**Vests with clear-plastic pockets** to hold fishing flies for easy selection. You’d avoid snagged fingers, too.—*D. Riebschleger, Saginaw, Mich.*



**Power mowers with caster-like wheels** so you wouldn’t have to raise the front end to turn the mower around.—*Frank Quale, St. Paul, Minn.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What’s yours? We will pay \$5 for each one published. Please use Government postcards

only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

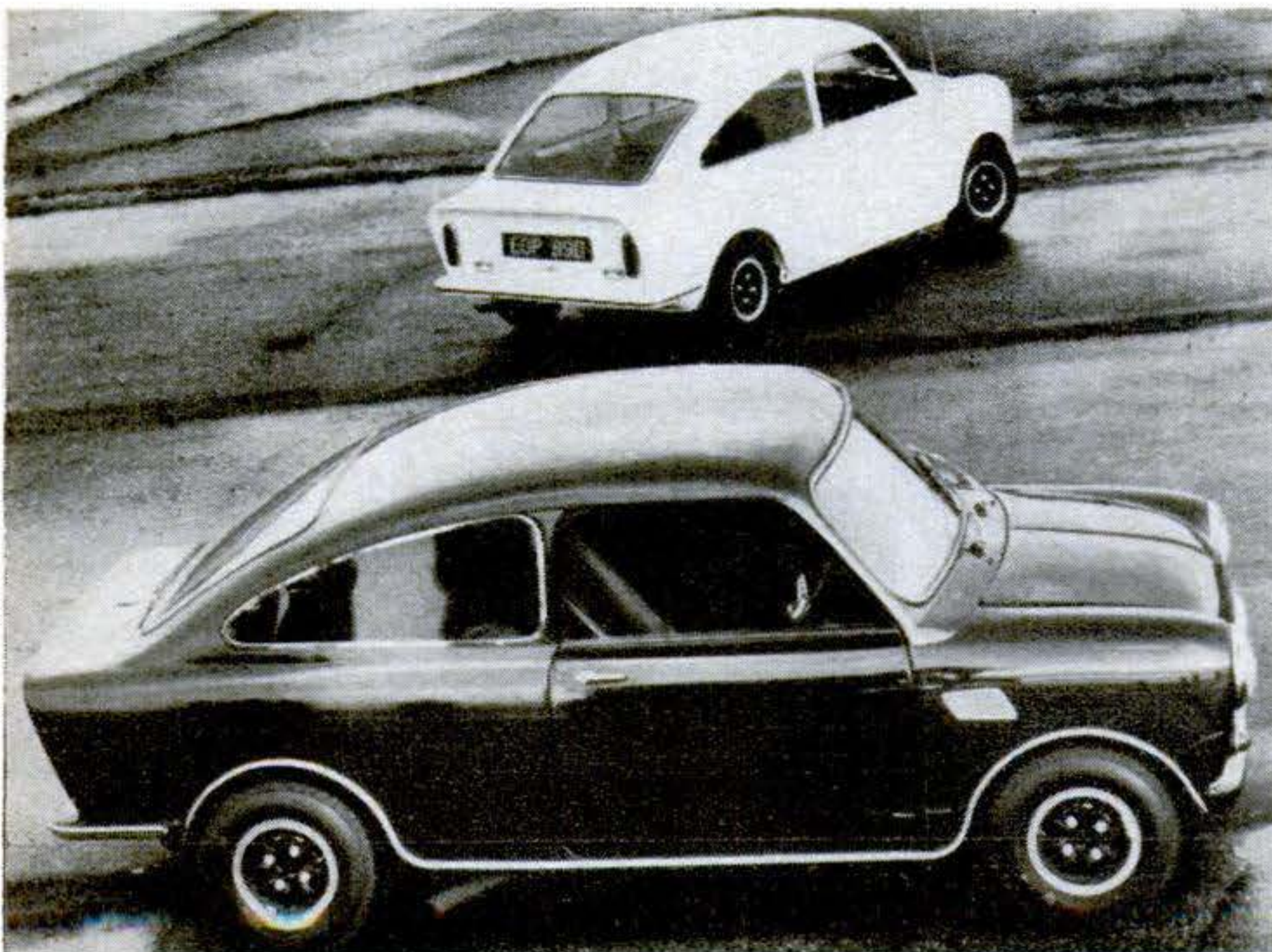


Down to the water with her boat in two bags, this girl unpacks and reassembles the frame, slips on its rubber

## Folding kayak packs for carrying in two canvas bags

Folded on its hinges and packed in two canvas bags, this little kayak can be transported in the trunk or back of a car, or by hand, and after use can be stored in the garage, basement,

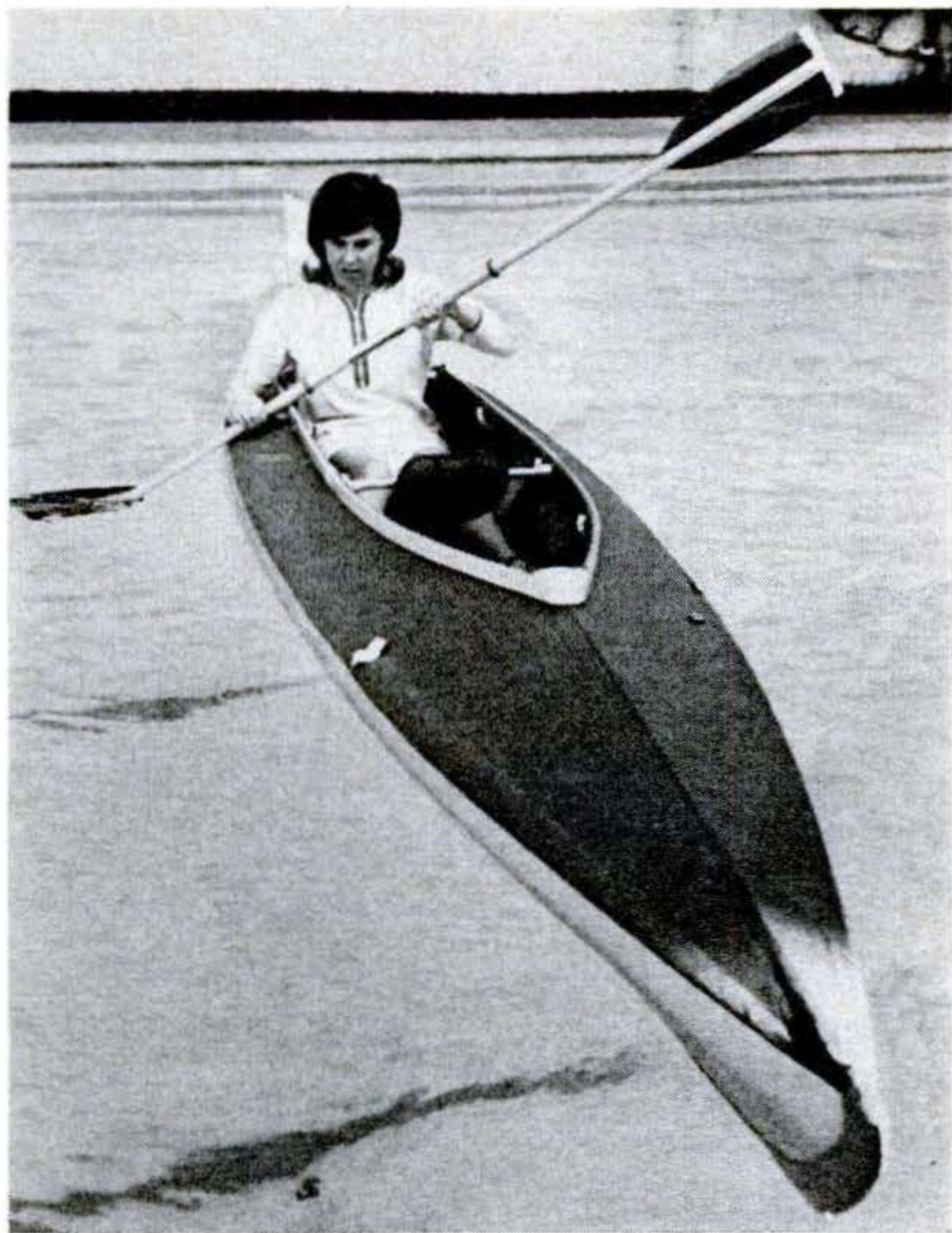
or an attic closet. One bag holds the framework made up of hinged and slotted parts that fit together snugly; the other holds a watertight rubber and plastic skin. At the water's edge, one



## Hot babies go places at fast 140 m.p.h.

Duck-tailed baby fast-backs at left are disguised B.M.C. Minis beefed up to do 140 m.p.h. in racing form.

Marketed by Broadspeed, British speed specialists, the potent GT has fiberglass coachwork, cutting weight to 1,100 pounds. Its front-drive Mini-Cooper engine is upped to 100 hp. Suspension and roof are lowered five inches to drop car height to four feet. Luxury touring versions, laden with accessories, do only 120 m.p.h.



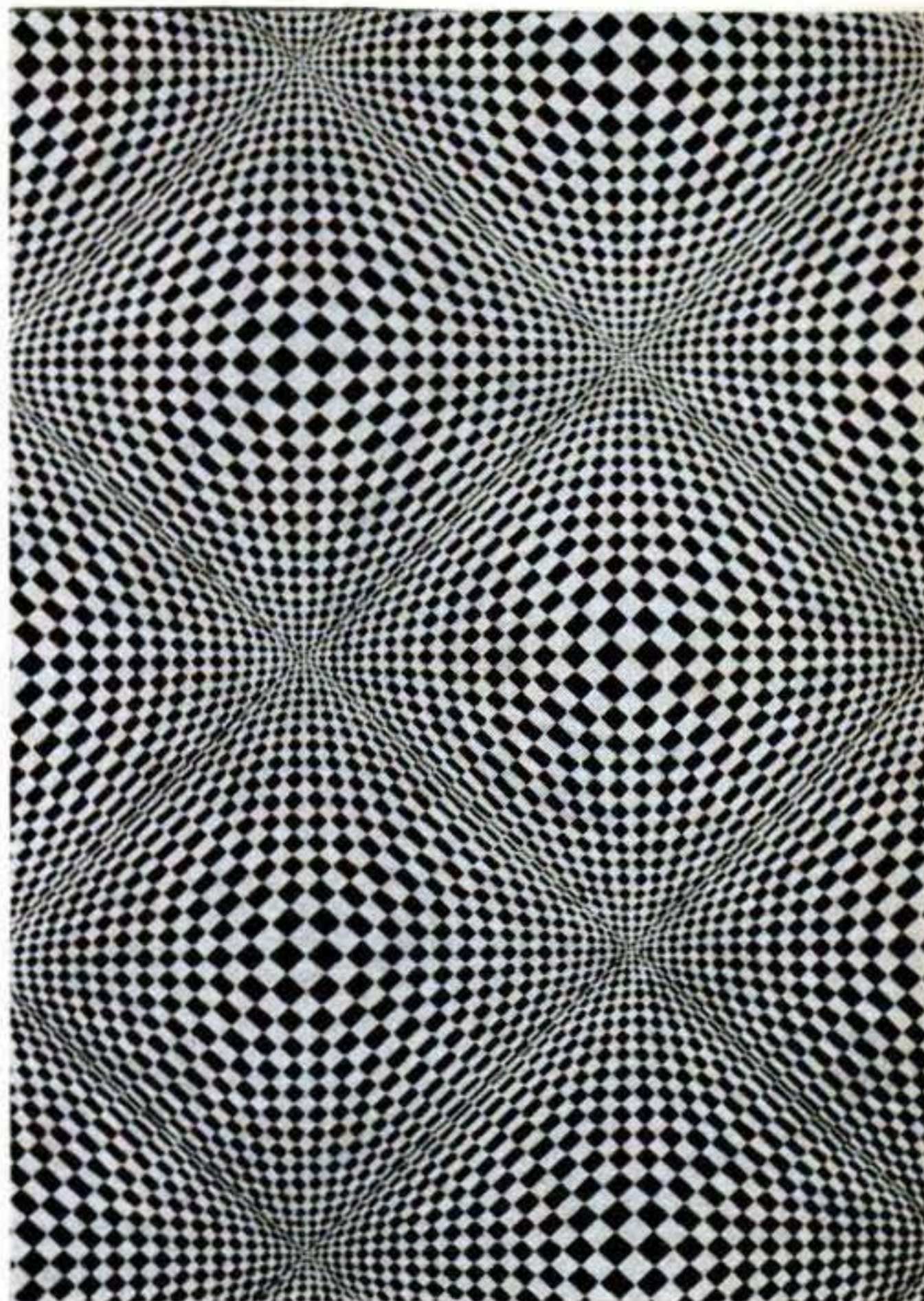
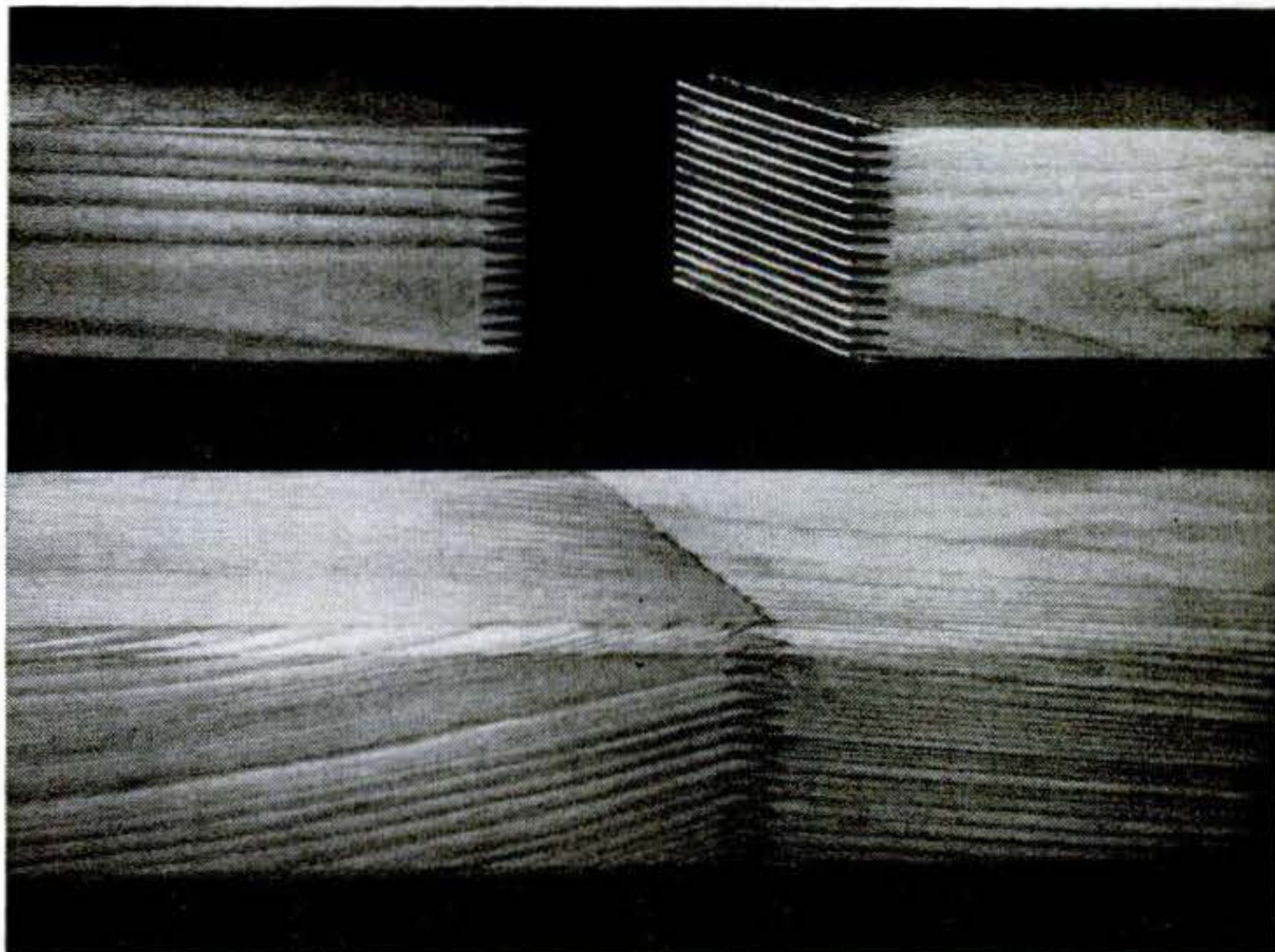
and plastic skin, and paddles away in just 15 minutes.

person can unfold, reassemble, and lock the framework together, slip on the skin, join and lock the two ends of the paddle, and be ready for a day's outing on the water in about 15 minutes. Made by Hans Klepper Corp., 35 Union Square, NYC, the kayak sells for \$369.

### Finger jointing makes wood longer, stronger

A new method of end-gluing lumber at the mill makes roof trusses and the like 32 feet long or longer by finger-joint splicing.

Heated dies form the fingers, glue is applied, and the ends are jammed together in a press. The resulting piece has 80 to 90 percent of the strength of clear lumber. The method, developed with the help of the industry at Washington State University, eliminates the 15 percent waste of a scarf joint.



### Op art gives wallpaper 3-D look

Optical illusion in the Op-art design of the wallpaper shown above has a three-dimensional effect. Done in black and white, the intriguing pattern is one of a series of new designs in a Trimz collection of vinyl-coated and prepasted wallpapers produced by United Wallpaper Co., Chicago, as a departure from conventional designs. All four walls done in it, however, may make you slightly dizzy.

# We Need Your

By VICE PRESIDENT HUBERT H. HUMPHREY

**A**merica's independent inventors now have a significant new resource. It is called the Inventors' Fair or, sometimes, Inventors' Show or Inventors' Congress. Its purpose is to serve as a showcase of new products or processes to interested companies.

Inventors' Fairs are scheduled this year in almost half of the states. The inventions exhibited range from household gadgets to electronic products and spacecraft designs.

An exposition is usually staged at a fair-ground or in a civic auditorium. Exhibitors display, operate, and explain their devices at booths. Cash prizes and ribbons are customarily awarded in various categories. But the real dividend to the inventor is the opportunity to display his wares to those who may help him capitalize upon his work—at a profit to both.

Fairs permit the inventor to achieve one or more of five purposes:

1. Display inventions to potentially interested manufacturers, distributors, investors, and consumers.
2. Determine consumer reaction to inventions by demonstrating them to the viewing public.
3. Attend symposiums covering such sub-

jects as patenting, developing, manufacturing, and marketing new inventions and products.

4. Consult with experts in various fields which are pertinent to the protection, production, and promotion of new inventions.
5. Visit with other inventors and benefit from their experiences in handling their inventions.

Hopefully, company representatives, seeing the inventions, negotiate to obtain them on a license fee or royalty basis.

How often do Fairs achieve this goal? Statistics are not easily available. For understandable reasons, interested companies prefer not to discuss their plans to market new products. Companies which have already worked out contracts with exhibitors usually perform extensive prototype testing and market analysis before they embark on full-scale production.

However, many impressive examples of profitable follow-through indicate that the Fairs do achieve results.

**Who benefits?** Everyone. The public, which gets a new product, process, or service. The inventor, who sees his years of

*Continued*

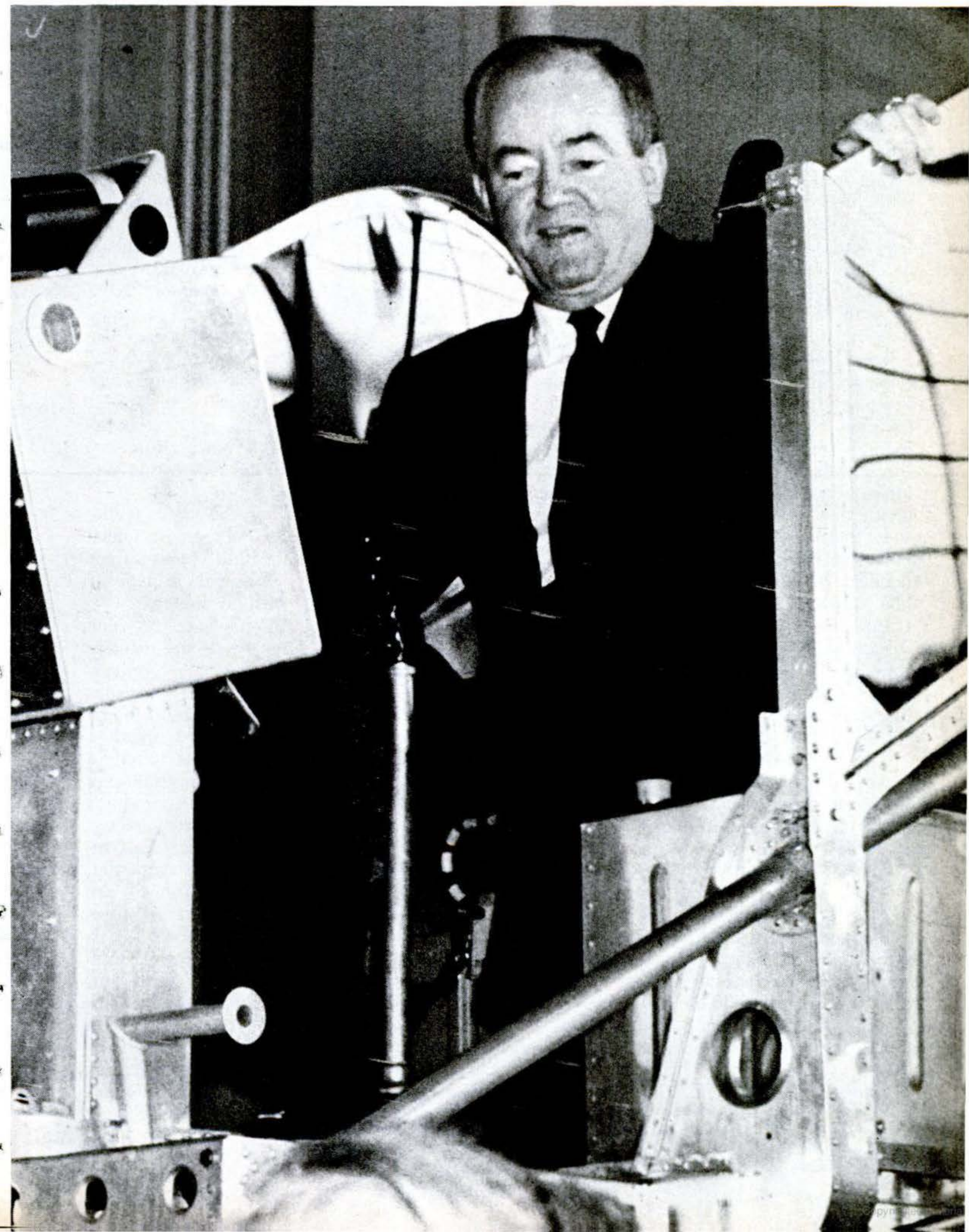
**"Brainpower is one of our greatest treasures,"** says Humphrey. A long-time friend of inventors, and deeply interested in science, he is Space Council chairman. (Photo shows moon-landing vehicle.)

POPULAR SCIENCE is proud to present this article by The Honorable Hubert H. Humphrey, who has been aptly termed "our invention-minded Vice President."

Amazing as it seems, almost 25 percent of all patents issued by the U.S. Patent Office this year—more than 15,000 out of 67,000—will be granted to independent

"amateur" inventors. As the Vice President points out, the genius and skills of the individual are a vital national resource, as essential in today's technological economy as they were in years past. In the article here, he tells you what government is doing on state and federal levels to help make your invention a success.

# Inventive Skill!





## Invention-Minded Vice President

"I am no inventor," says Vice President Hubert H. Humphrey. Even so, inventors credit him with opening for them some of the most pro-

ductive visas in U.S. history. During his 16 years in the Senate, he was a spark plug for "a fair shake for the little guy." As chairman of a Senate small-business subcommittee, he spurred economic growth and new technology. As chairman of a Senate reorganization subcommittee, he pounded many a federal desk and door to get inventors a fair hearing, especially on products of potential use to the armed forces.

Now a member of the executive branch, Vice President Humphrey maintains his in-

labor and investment pay off. A manufacturing or distributing company, which—with luck—earns a profit on the invention. And, in the final analysis, the American free-enterprise system.

That's why Washington, D.C., is interested. Inventors' Fairs are part of a broad program to help keep U.S. business healthy and dynamic.

President Lyndon B. Johnson has repeatedly emphasized: America's economy must keep growing. Our population is expanding. Industries are changing. Automation is wiping out some jobs—largely in the unskilled category. America needs new ideas, new products to expand employment, create new wealth, raise standards of living.

Is there somewhere in the mind of an unknown American a new invention as beneficial and revolutionary as the automobile, airplane, refrigerator, air conditioner? If not, how about inventions which would substantially improve these and other—now commonplace—necessities? And what about the possibility of new products or processes like the mercury battery, xerography, or shrinkproofing of knit goods?

These last three inventions might not occur offhand to many people. But one of the most striking facts about these particular inventions is that they all came from *independent* inventors.

These inventors—the so-called "lone wolves"—are a tremendous national asset.

**Independent inventors** accounted for 40 of 61 important inventions made since 1900. This was the conclusion of a study cited in a classic analysis, *The Sources of Invention*. Without the support of organized laboratories, these independent inventors changed scientific and technical history.

Times have changed. Development of an invention often requires massive team effort and sizable sustained investment.

But the basic idea of an invention—the original concept—and at least its early stages of realization, can still be the province of brilliant lone inventors.

The further they get into the development stage, the more their problems multiply. Unfortunately, few inventors have the wherewithal—the time, skill, patience, money—to bring their brainchildren the long journey to market.

How often have I heard inventors say, "If only I could get corporations to look at my invention." Many a look is taken at Inventors' Fairs—a hard look, but often a very fruitful look, by corporate representatives.

**A national catalyst** for the Fairs is the U.S. Department of Commerce. Its Office of Invention and Innovation, Institute for Applied Technology, National Bureau of Standards, provides constant impetus.

The biggest job must, however, be done at the grassroots. Expositions are usually sponsored jointly by state agencies, universities, and state and local chambers of commerce. There is no uniform program for an invention exposition; each state is urged to develop an agenda which is best suited to its needs and facilities. The exposition may be held alone or coupled with a products show, a procurement show, a technology-utilization symposium, or other activity which increases interest and participation.

Invention expositions in themselves are not new; various states and communities have sponsored them on a sporadic basis over a considerable period of years. However, several years' experience in North and South Dakota, as well as Minnesota, has demonstrated that there is merit in a state exposition as an annual event. This helps assure potential exhibitors that there may be an opportunity to show their new or improved work and encourages them to have it ready in time.



terest in inventors and inventions, in science and technology, as Chairman of the National Aeronautics and Space Council. In travels from Cape Kennedy to Texas and California, he has familiarized himself firsthand with the tremendous technical breakthroughs that have made America's space program possible.

NASA has a very useful Inventions and Contributions Board, the Vice President feels. It stresses not only prompt application of technical innovations in the space program, but spin-offs to civilian-type markets.

"By adapting gadgets which will work on the moon," says Hubert Humphrey, "we can work wonders here on earth."

Wearing another hat, the Vice President is a member of the Board of Regents of the Smithsonian Institution. The Smithsonian is not only custodian of many of the nation's historic advances, but a catalyst for new work.

"Brain power and will power are our greatest national treasures," the Vice President says. "There is no substitute for genius, but hard work helps."—James C. G. Conniff.

The expositions have involved displays ranging in size from 70 to 140 inventions. Public attendance has ranged as high as 86,000 people. Estimates are not available as to the number of manufacturers and distributors in attendance; most prefer to remain anonymous until they find an invention of special interest.

Planning for the Fairs is improving as earlier experience is evaluated. In the future, the Commerce Department informs me, greater emphasis will be put on encouraging educational institutions, research foundations, and technically oriented companies, as well as the creative employees of these organizations, to display their—usually more sophisticated—inventions.

Effort will also be directed toward getting universities to have their engineering students participate in the symposiums usually associated with the expositions. Heretofore, most engineering curriculums have not included teaching in the field of patents and inventions. An early exposure of young people to the accomplishments of inventors and to the facts about patents will stimulate their thinking about careers in creative engineering.

**Almost every phase** of the creative process—from conception to realization—has received some federal attention. For example, an inventor wishing to sell or license his patent may utilize two government publications to announce the fact. For a fee of \$3, the U.S. Patent Office will list the patent and the name and address of the owner under the heading "Patents Available for License or Sale" in the *Official Gazette*, its weekly publication.

The Small Business Administration will publish without charge abstracts and drawings of patented inventions in its monthly *Product List Circular*. Since the inventor's name and address are listed, manufacturers

seeking new products can get in touch with him. To make use of this service, get in touch with one of the many SBA field offices located in large cities throughout the country, or write to the Office of Business Advisory Services, Washington, D.C. 20416.

At one time, an inventor who had an idea of potential interest to the government contacted federal agencies through the National Inventors Council in the Department of Commerce. Now, government agencies have assumed responsibility for the evaluation of submitted ideas. Under current procedures, you may submit your disclosure to the Office of Invention and Innovation, National Bureau of Standards, Washington, D.C. 20234, and it will be referred to an appropriate evaluating agency. You may also obtain a free leaflet, *How to Submit Ideas and Inventions to the U.S. Government*, from the above agency.

**If your invention** is intended for commercial—private-industry—use, an Inventors' Fair can prove invaluable.

Fairs are an old and delightful American tradition. This type of Fair spells "go-go" opportunity. It offers no guarantee of success. The path of the innovator is still hard and often disappointing. Competition is keen; hard economic factors will still dash many a bright hope and attractive prototype.

But we Americans thrive on the chance to prove our mettle.

So, see you at the Fair!

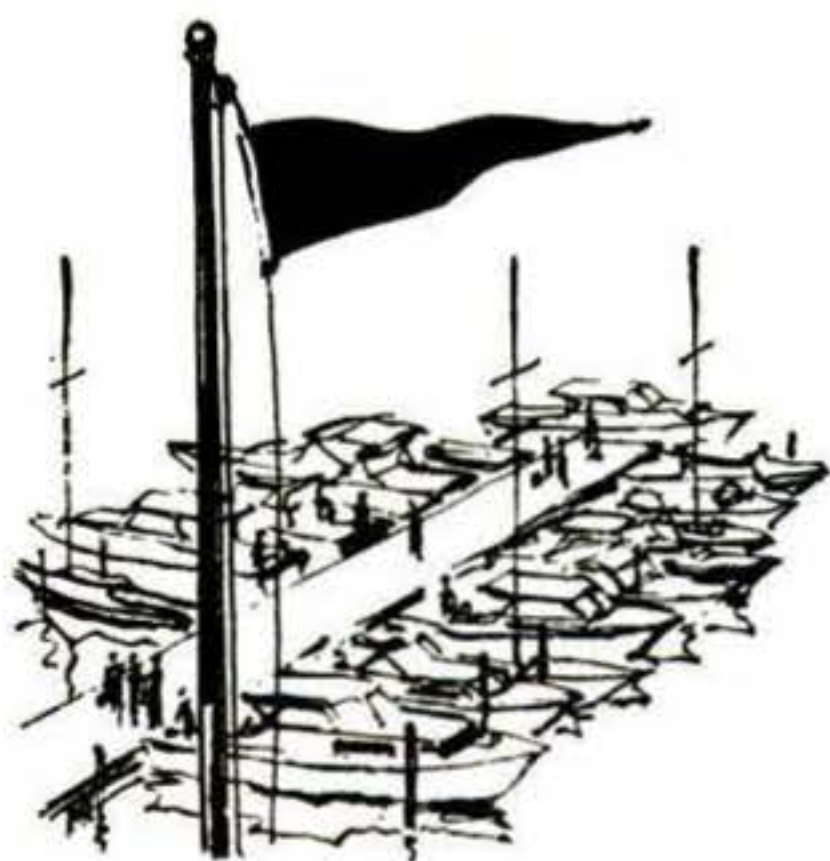
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Calendars of state invention programs are available from the Office of Invention and Innovation, National Bureau of Standards, Washington, D.C. 20234. The calendars, which are updated frequently, tell you how to register and receive information, and provide helpful guidelines on exhibiting and selling your invention.

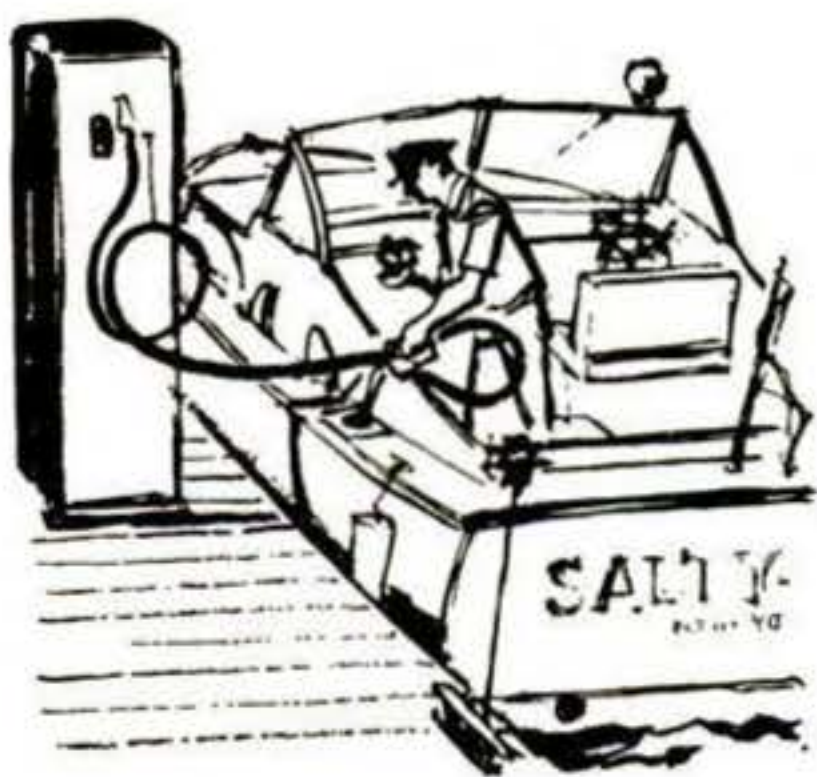
# How to Bring Yourself Back Alive

A veteran Coast Guard search-and-rescue expert tells you how to handle a small boat in heavy weather

By JIM ROE



Mark of a pro is knowing when to stay home. Only a foolish amateur thinks he is tougher than a storm. When storm signals fly, sit tight—keep your boat firmly tied to the dock.



Have full gas tanks. Rough water increases gas consumption, and empty tanks leave you drifting helplessly out of control. Don't start long trips without a reserve.

**T**here are four basic things you should know about handling small boats to survive in big weather:

- When to stay home.
- How to get back before the weather turns too bad.
- How to handle a small boat in rough water.
- What to do when you need to call for help.

The importance of these survival techniques was emphasized in an exclusive **POPULAR SCIENCE** interview with Chief Boatswain's Mate Don Alberts, commander of the Marblehead, Ohio, Coast Guard Station, one of the busiest on the Great Lakes.

Here are the questions I asked and Alberts' answers:

**In your area, do you get a lot of rough-water experience in a big hurry?**

Yes. This area is the busiest in which I've ever served. We have been increasing our search-and-rescue calls by at least 100 a year. We have two 40-foot rescue boats, a 36-foot all-weather motor lifeboat, and a 30-foot rescue boat. We also have two 14-foot multikeel outboards. At least 10 or 15 times last summer, we had every piece of this equipment under way somewhere at the same time.

**How long have you been going to the assistance of pleasure boats, and in what types of water?**

About 15 years. In the Atlantic Ocean off Puerto Rico, the North Atlantic, and now here in Lake Erie.

**I understand you had over 600 calls for assistance last year. What size boat was usually involved?**

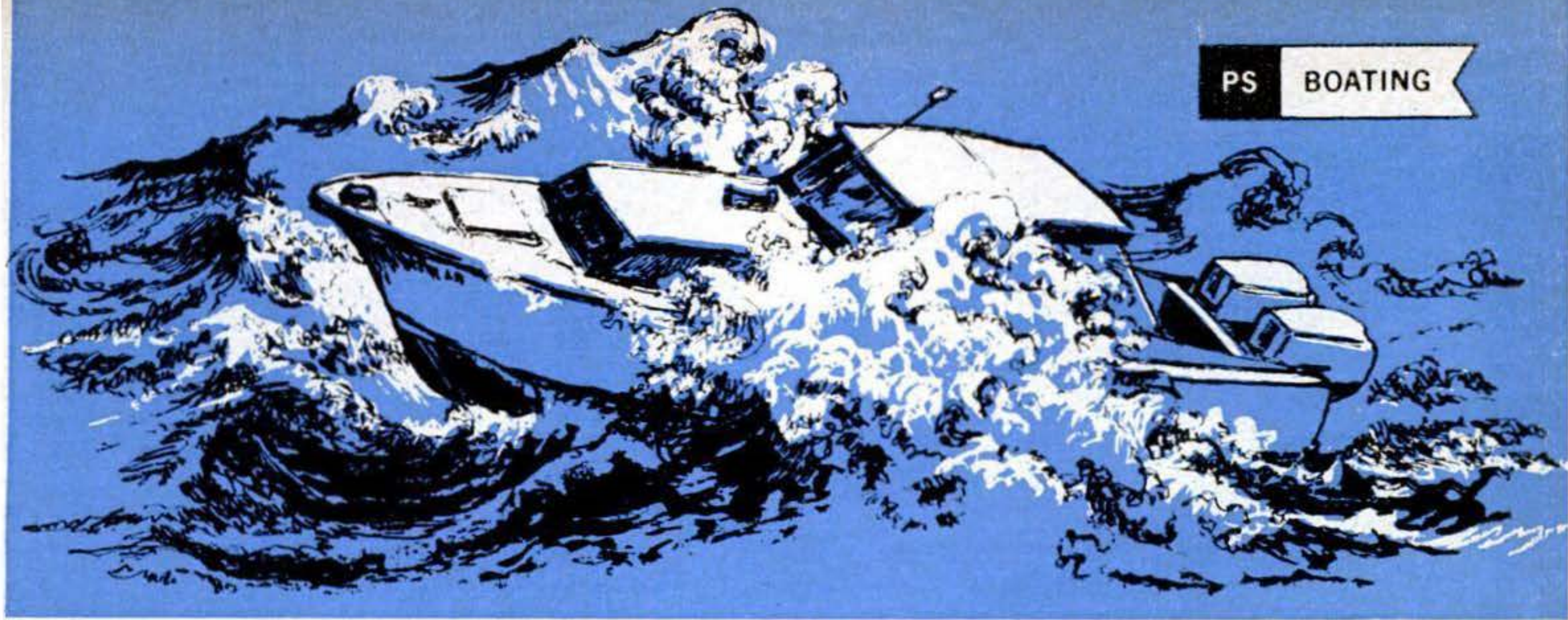
Our most frequent customers were boats 18 to 25 feet long. But some ranged all the way up to 150 feet.

**What are the most frequent reasons for distress calls?**

Poor planning. One of the primary things was running low on fuel. Nearly half were from small boats that had run aground.

**Even 18-footers?**

Right. There are boulders sticking out in the water, and even though they are marked by buoys, a good many boat drivers try to take them on the inside, and run aground.



**Were these mostly beginning boatmen?**

No. I'd say a great number of our calls are from more experienced boatmen, who have owned a boat for two or three years. But the average boatman only gets a chance to operate his boat a limited amount of time each year. So even after two or three years, he might not be experienced for all conditions. It's not so much how many years you've been boating as how many hours you've actually operated a boat. We've found people with big cabin cruisers aground on reefs, tangled in fish nets, and lost in the fog.

**Does any particular type of boat seem more able to take it than others?**

I think fiberglass boats are among the finest. We've found them when they've been out on a reef for an hour or more and never cracked. Some boats would have had a hole right through them. I think a fiberglass boat with a double hull and flotation between the hulls is especially good. Next best, I'd say, is the lapstrake-built boat.

**What safety equipment should a boatman carry aboard?**

The first thing is a life jacket. You should never even venture out past the dock without making sure you have enough jackets aboard for everyone. And they should be right at hand—I've seen cases of drowning where a life jacket was available, but not accessible. People also drown because they can't put on a life jacket under stress conditions. Another important piece of equipment is the anchor—with sufficient line. The line should be at least 10 times the length of your boat. That allows for proper scope. When you break down in heavy sea conditions, you've got to have plenty of line out to allow your boat to ride the sea. In addition to all the equipment required by law, you should make certain you have flares of some sort, or other means, aboard if you need to signal for help.

**One of the first rules of small-boat safety is to know how to keep out of trouble in the first place. How can you know when you should just stay home?**

Keep a close check on the weather by calling the nearest weather bureau or Coast Guard station for advance weather conditions. If the small-craft warning is up, pay attention to it. Even though the weather at that moment might still be fine,



**Check your gear.** Make sure you have life jackets, anchor, line, signaling devices, tools, spare parts, charts showing local navigation hazards, and—if possible—radiotelephone.



**In questionable weather, run parallel to and close to shore. If weather worsens, put into harbor or run up on the beach. Know location of refuges, like peninsulas, islands.**



**Quarter into rough seas. Take 'em a few points off your bow if you can. The safest distance home may be a zigzag pattern to ease strain on your boat. Good sense is best bet.**



**With a following sea, be ready with throttle and wheel to keep your stern from swinging, and broaching to. Set your speed at just a hair faster than the sea's.**

this means that stronger winds are expected. If you must go out, don't venture out too far. Take shoreline courses. And if you do take an extended trip, advise the nearest Coast Guard station of your destinations. You can file a trip report just like a pilot's flight plan.

**What about getting back to the dock in time in case rough weather is developing?**

Just be certain you don't get too far from a safe harbor. Since you don't know what the weather might do, you have to allow extra time to make shore. Know how to plot a course, the speed of your boat, and how rough wind and sea conditions affect its speed. If you plan on taking an hour and a half for a certain run, allow another hour and a half for contingencies. If you find that even this is not enough, hunt for an island or peninsula. If there are any in your area, simply run into the lee of this protection and stay there until the storm subsides. Never pound a boat to pieces trying to make a marina before a storm hits. Running two different courses, reducing speed, and riding the sea in will put you farther ahead than trying to beat your way in at full throttle.

**What do you do if you're caught offshore in rough water?**

Always try to run courses where you're quartering the sea. It's better to go five or 10 miles out of your way and quarter into the sea, than to try to run head-on into it, or have a following sea, or run in a trough. In a following sea, people have a tendency to run fast, trying to outrun the sea instead of working or riding with it. If you do this, you're apt to break off a swell, and pound so hard you'll cut your engine and then get swamped. If you must be under way with a following sea, adjust your speed to ride with the sea. Don't try to outrun it.

**You mean try to go at the same speed as the waves?**

Just a hair faster. In a following sea, your boat has a tendency to lurch forward. Then, as a swell breaks, it has a tendency to drag you back down. If your speed is just a little above the running sea, it should shoot you onto the next crest. I found this true in the ocean, even with a 40-foot Coast Guard boat in 25- or 30-foot seas. Don't work against the sea; let the sea work for you. And time yourself.

**This requires a frequent adjustment of throttles, doesn't it?**

Yes. The seas are not always exactly the same speed, so you need always to be ready to adjust the throttle. It takes timing and experience.

**How can a person get this rough-water experience, except by accident, when he doesn't want it?**

If you're a novice, I'd say 30 minutes to an hour in a good following sea would give you a vast amount of knowledge in how to handle your boat in that kind of sea. When it's rough, put on a life jacket and take your boat out close to shore, where you can get back in if the boat should swamp or capsize. Not too close, of course—you want to be sure you can stay clear of the shore and shoals. And take an experienced seaman with you. You can get a lot of experience just by sampling the action here and there.

If you're in a situation like this, you've got to remember that the person who built the boat took all sea conditions into consideration. Experiment and try steering the boat on different courses and at different speeds, and you'll find which is the best for your boat.

**Should you shift passengers around to attempt a better weight distribution?**

No. Sometimes people will sit aft to raise the bow up in the air more, or they'll try to put passengers up on the bow to hold it down. What you must realize is that when the boat was built, it was designed to carry a certain weight under most sea conditions. If you just sit where the designer has put the seats, you will automatically give the boat its proper trim. Don't shift material and equipment around just for trim on a pleasure cruiser, because you then run into another problem: When you're picking things up and shifting them around, you're taking items that would normally be stationary and moving them around to where they could roll and break loose. Also, if you shift your passengers around, they will tend to get panicky. Just tell them, "This boat can take anything the water can throw at it."

As skipper, maintain command. Always try to calm your passengers and keep your boat operating smoothly. You can have a lot of things going against you. But if you stay calm, you'll have a much better chance of handling them intelligently.

**Suppose you need rescue? What's the best thing to do?**

Here again, you have to think of this before you go out. Do you have a flare? Do you have a flashlight? Or a radio? When you have a breakdown, the first thing to do is to drop your anchor, if you can. This gives you time to think and evaluate the situation. When you're anchored, you'll stay where you are so that the Coast Guard can find you. If you don't have a radio, flash a spotlight, or flashlight, or wave your tee shirt so passing boats will know you want assistance and come to your aid. Even if they can't supply what you need, you can ask them to notify the Coast Guard. The main thing is to report your position and stay there.

If, after calling for help, you are assisted by another boat, or get under way by yourself, be sure to notify the Coast Guard as soon as possible so they don't send a boat out looking for nothing when it needs to be out helping someone else. Of course, every boat should have enough life jackets for all aboard, and at the first hint of danger every person should put one on. Don't wait until the situation deteriorates. And just on the chance that you might someday need a tow, I'd suggest you make certain your boat has strong cleats and a rugged towing eye. In most outboards or small runabouts, the bow eye, which is used for pulling the boat onto the trailer, is fine for this purpose. But a good many boats of this size have cleats so poorly anchored you can practically pull them out by hand. This is something easily checked.

Above all, don't panic. Most boats are built to take more rough water than they ever see. Practice and experiment in how to get the most out of your boat. Then, if you're ever caught in rough water, keep calm and put your experience to work.

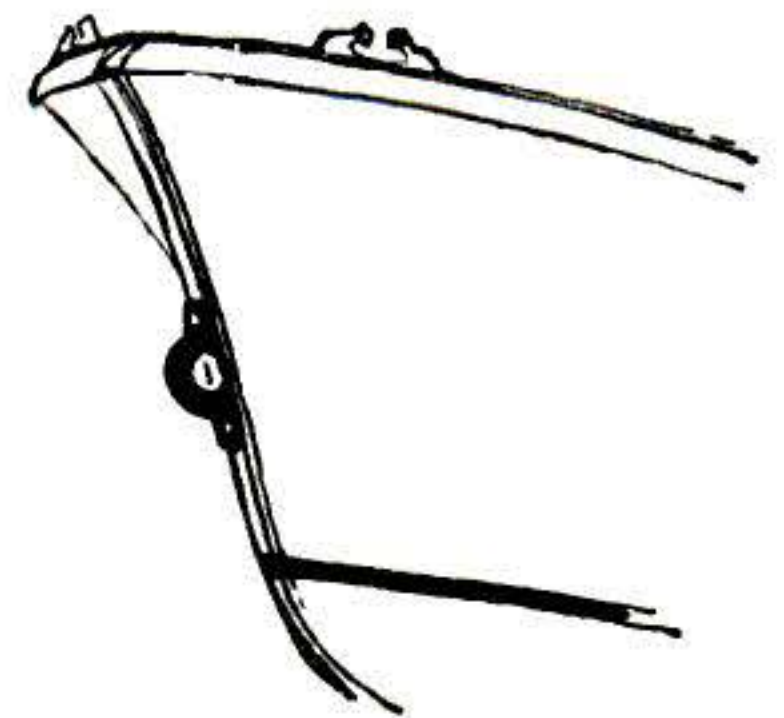
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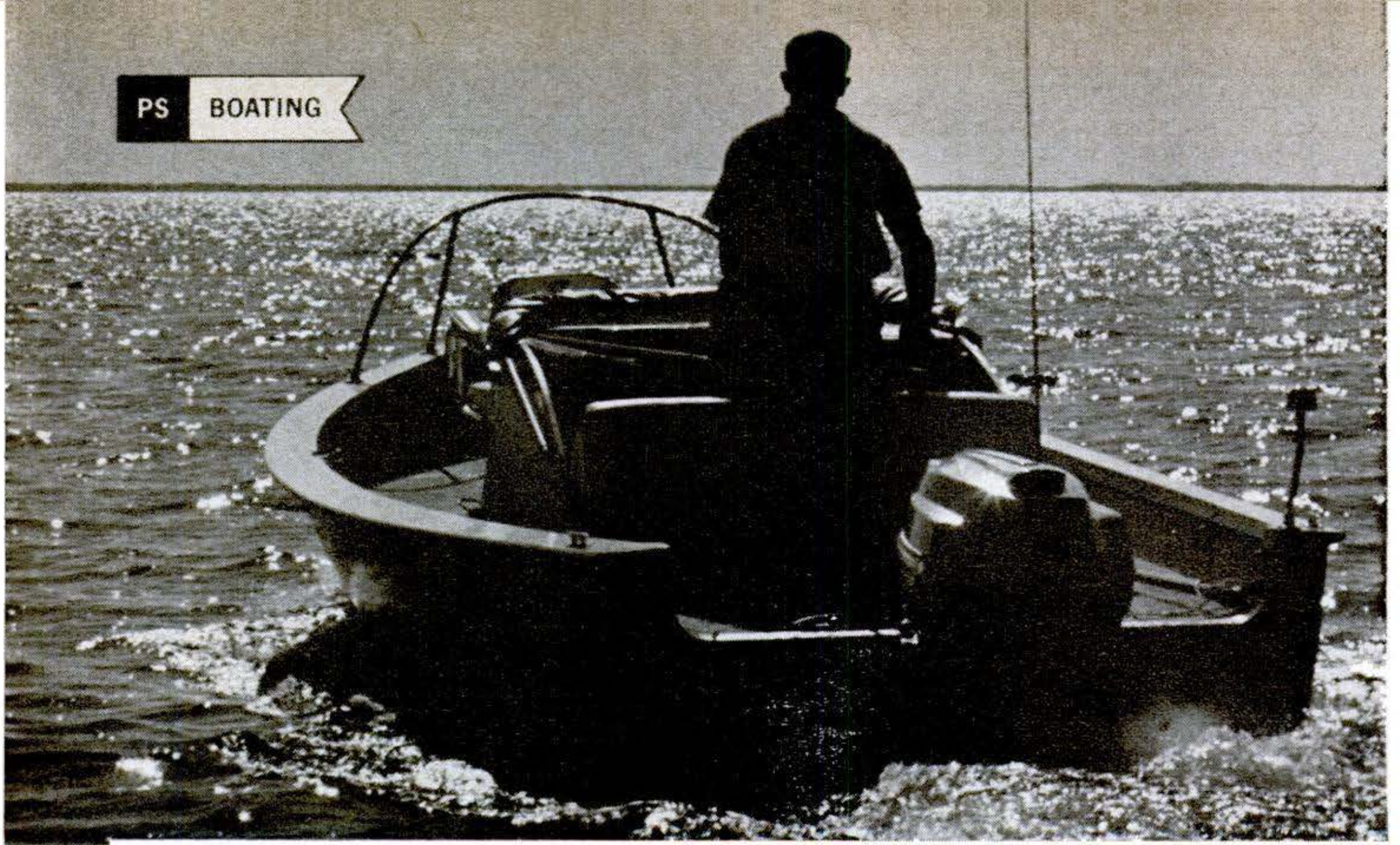
**If you're caught by a storm, find a lee and sit in it till storm passes, and the heavy seas calm down. Notify friends or Coast Guard of your location if you can.**



**Signal for help. It's best to have a radiotelephone. If that's not possible, be sure you have both day and night distress signals in working order. Signal, and stay put.**



**Be able to take a tow. Make sure your boat has strongly anchored towing eye, midway down the stem if possible. Check cleat anchorage, re-fasten more strongly if weak.**



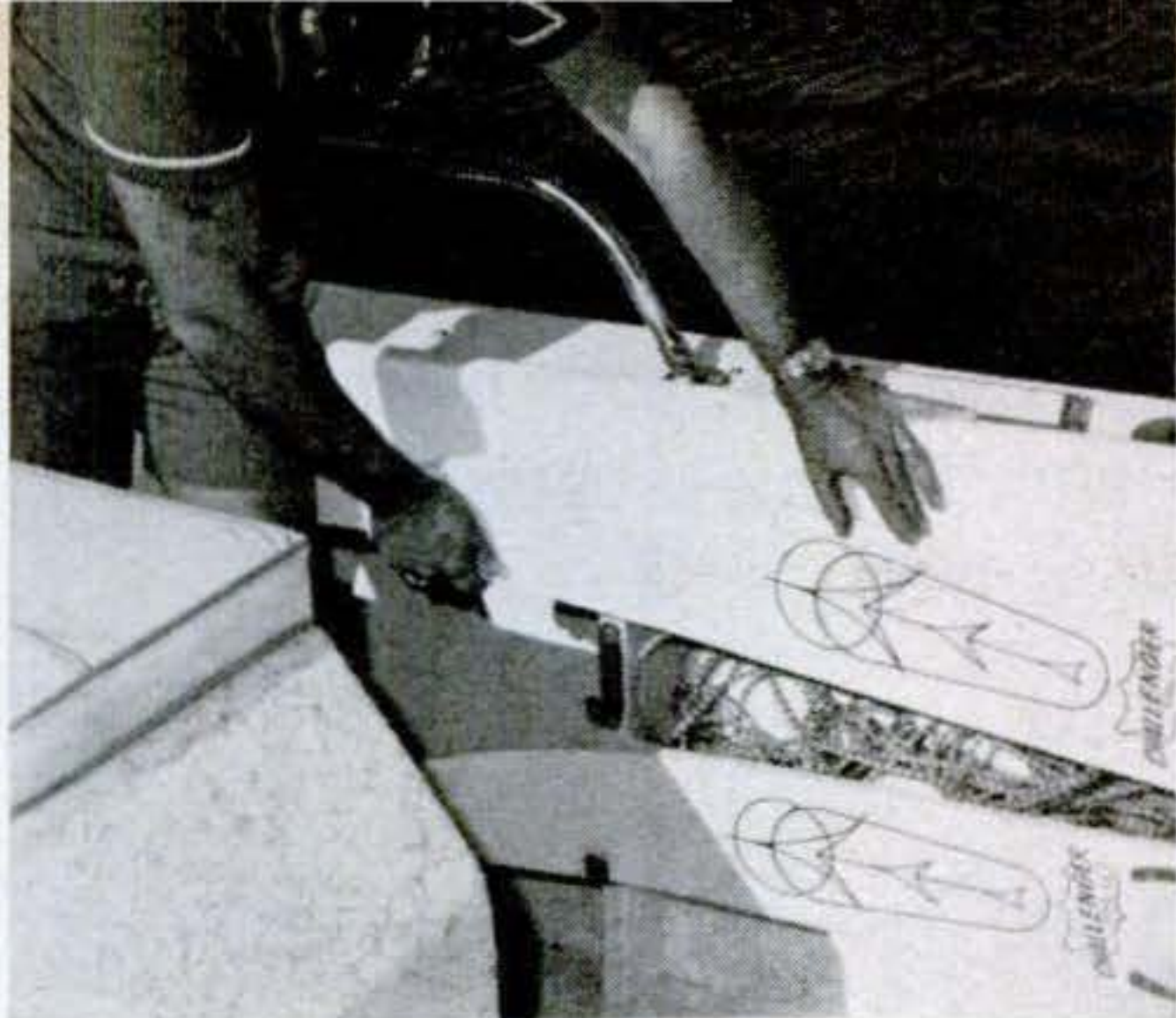
# How to “Stretch” Your Boat

You'll have more room if you keep gear shipshape

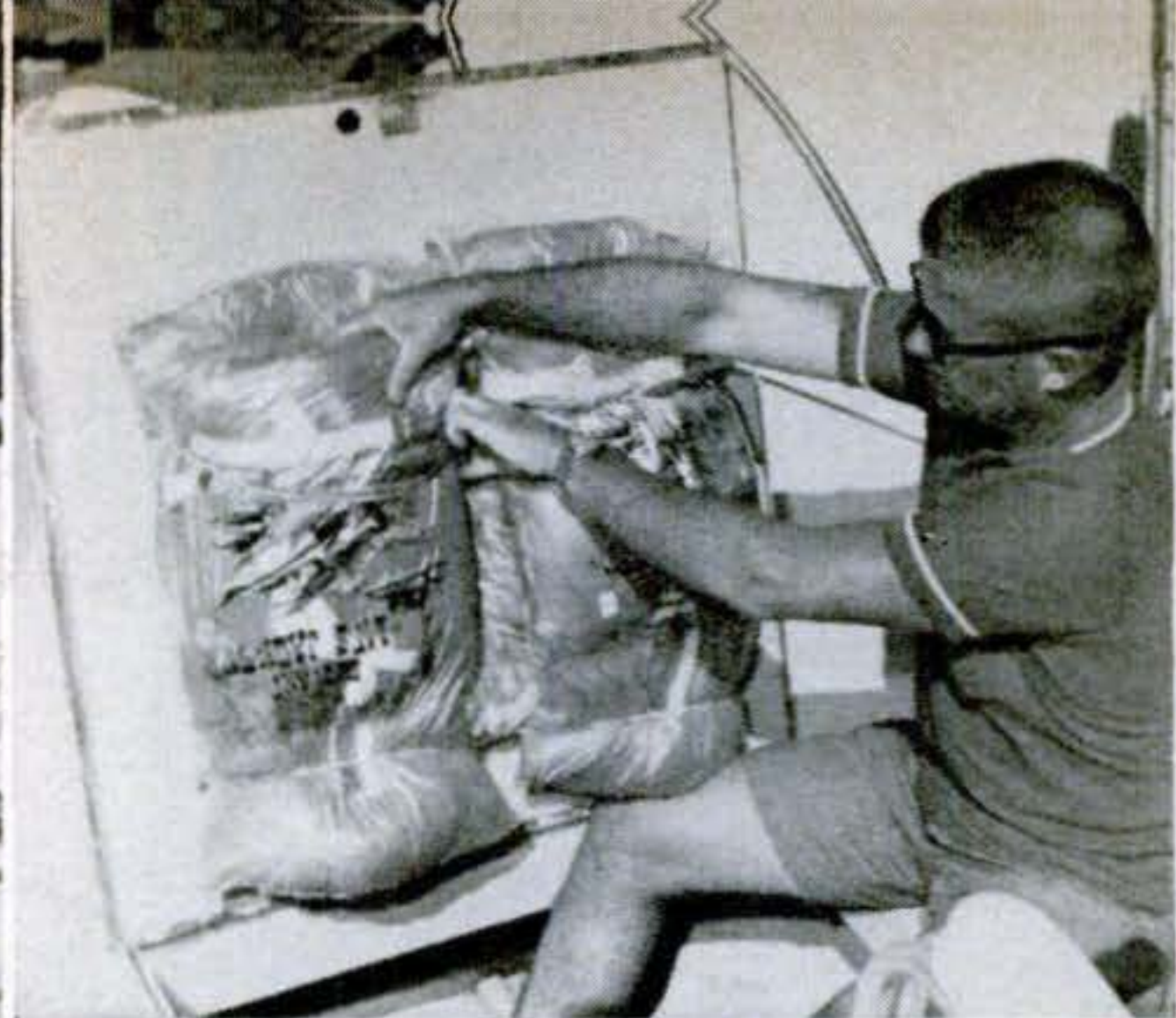
By JIM MARTENHOFF

**T**hat boat that looked so trim and neat on the showroom floor is apt to put to sea with as much space as—and looking like—Fibber McGee's closet. Why? Because it's loaded to the gunnels with hastily stowed gear. You can end such “space-shrinking” with just three materials: 1) Aluminum strap and sheeting from your hardware store; 2) aircraft shock cord (“bungee” cord) sold by marine dealers; 3) little-known items of stock marine hardware—fairleads, pulley blocks, boat-hook hangers, fender hooks and cleats, lashing hooks, and a variety of other small fittings.

Use aluminum to make holders and shelves for everything from fishing rods, gaffs, and nets to barbecue grills, stoves, tents, and sleeping bags. Aircraft shock cord? Use it to rig holders for radios, life jackets, tools, and flashlights. Thread the cord through fairleads or pulley blocks and clamp the cord to itself with ordinary outboard fuel-hose clamps. Some other marine-hardware items are large chromed hooks that can be screwed into place, hooks or cleats for rigging fenders, and boat-hook hangers for both boat hooks and water skis. Start with the ideas at right.



**Boat-hook hangers** keep these water skis neatly stowed, and can be used for fishing tackle and a multitude of other things as well. Aluminum strap is another possibility here.

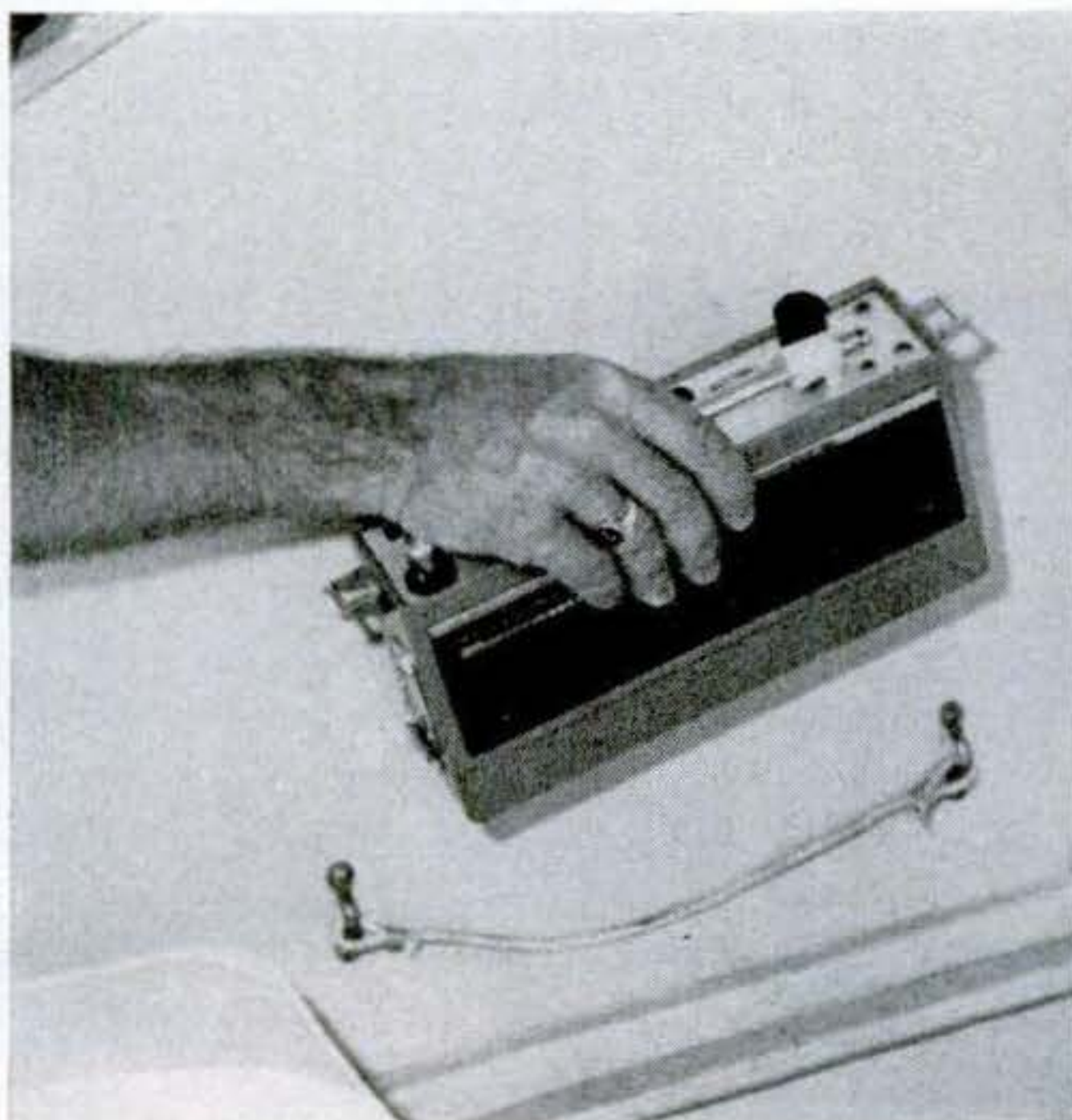


**Shock cord** holds these life vests underneath a deck hatch, out of the way but available in seconds. Similar installations with cord and fairleads can be made beneath bow decks.



**Aluminum straps** hold bait bucket to transom. Fasten the straps with aluminum screws to prevent corrosion from dissimilar metals.

**Small piece of cord**, made fast with outboard-motor fuel-hose clamps, keeps radio secure on small shelf, ready for instant use. Such fittings are both practical and attractive.



**Bend straps** to allow for transom angle so the bucket floats horizontally. Bucket bottom should be an inch above transom bottom.

**Panic corner** includes fire extinguisher in its own bracket, flare kit, "Rescuelite" mounted with shock cord. The plastic bag protects extinguisher from the effects of salt spray.



# TIPS AND TRICKS FOR

When you drop the hook, your boat is supposed to stay put. It won't, unless you do the job right

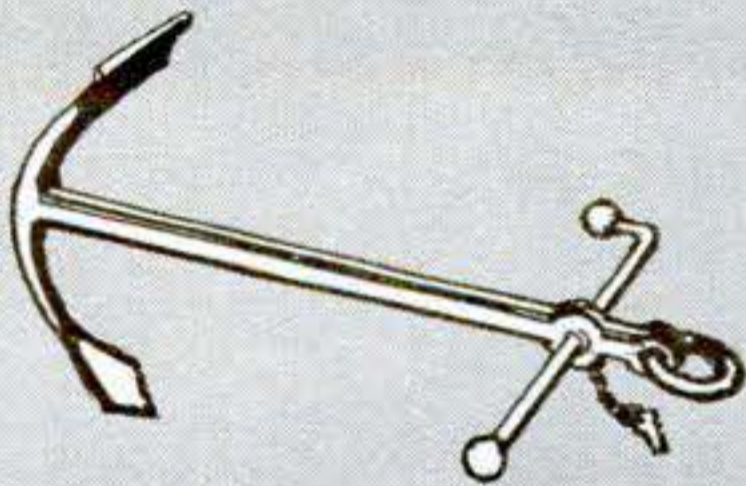
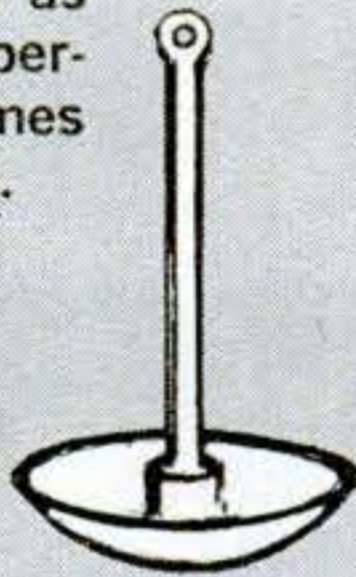
By GEORGE DANIELS

## Guide to anchors



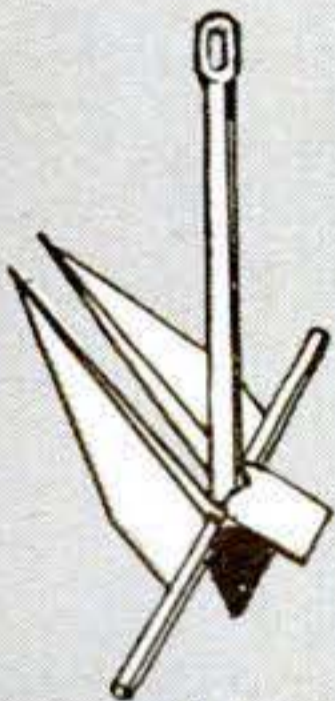
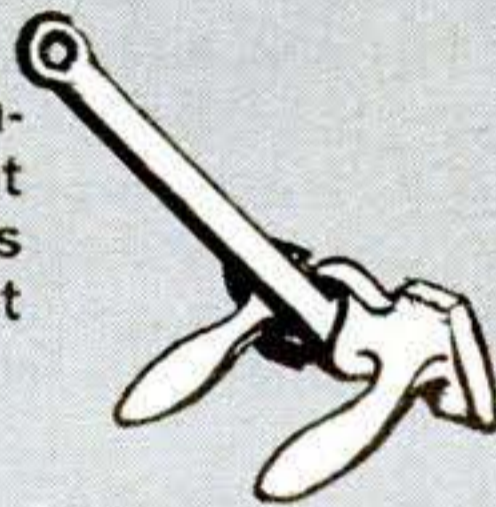
**Fisherman's anchor**—for skiffs, rowboats, and as lunch hook; not for permanent mooring. Comes in 8- to 16-lb. weights.

**Mushroom anchor**—good for permanent moorings, day anchors, and lunch hooks. Comes in 5- to 500-lb. weights.



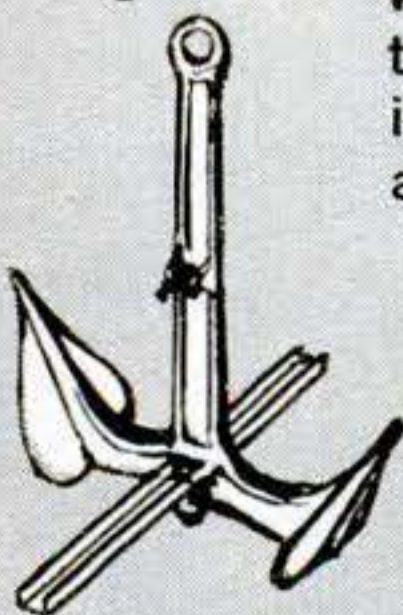
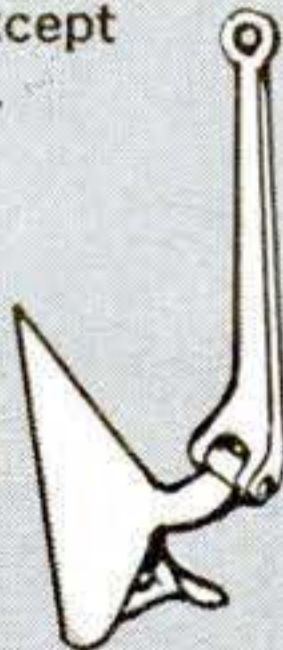
**Yachtsman's kedge**—makes a good day anchor, but is not popular for permanent moorings because attached chains or lines may tangle its flukes.

**Navy anchor**—good for general use and for permanent moorings. The shank tilts forward or backward so that the flukes dig in.



**Danforth anchor**—light-weight; a good cruising anchor; has highest holding power per pound, except on hard, rock bottom.

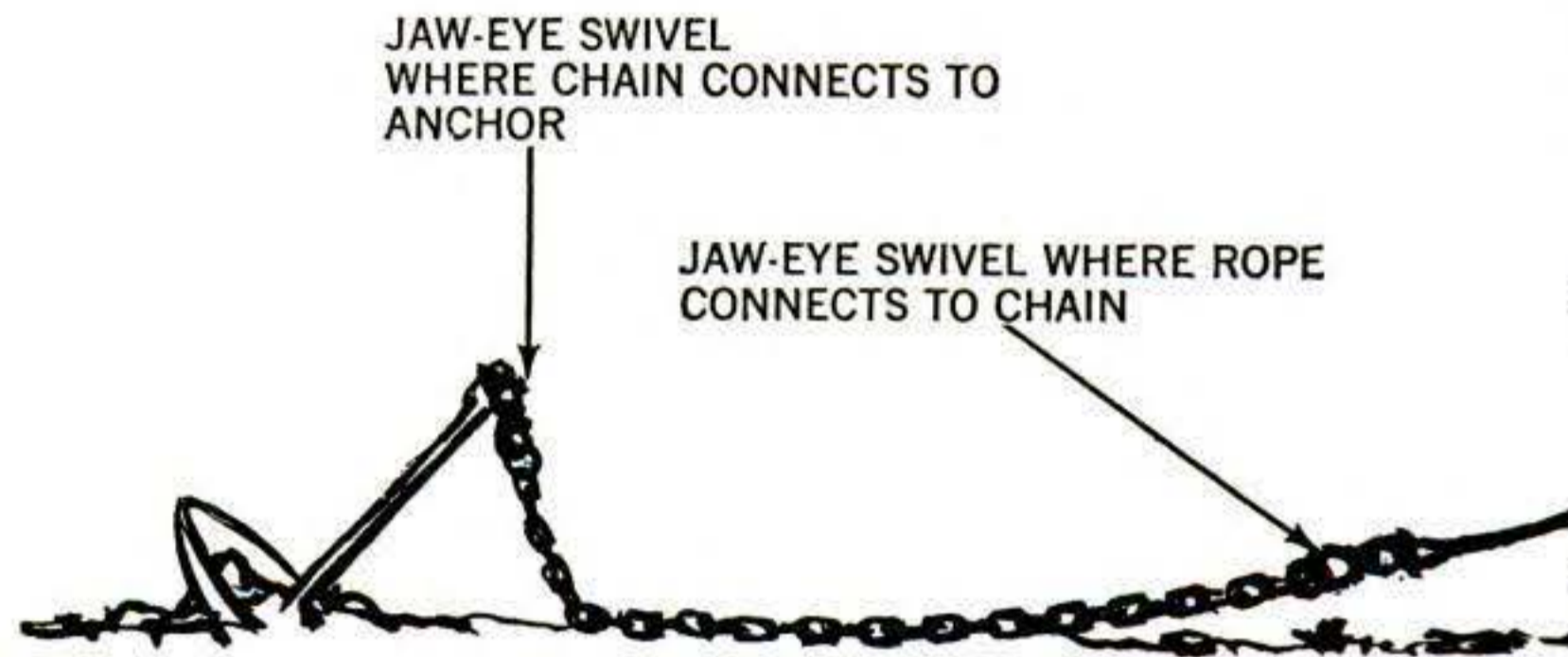
**Plow anchor**—light-weight, deep-digging type with high holding power; good day anchor or lunch hook.



**Northill anchor**—holds by digging in, but doesn't go deep as plow. The crosspiece (stock) can be swung flat for stowing.

JAW-EYE SWIVEL  
WHERE CHAIN CONNECTS TO  
ANCHOR

JAW-EYE SWIVEL WHERE ROPE  
CONNECTS TO CHAIN



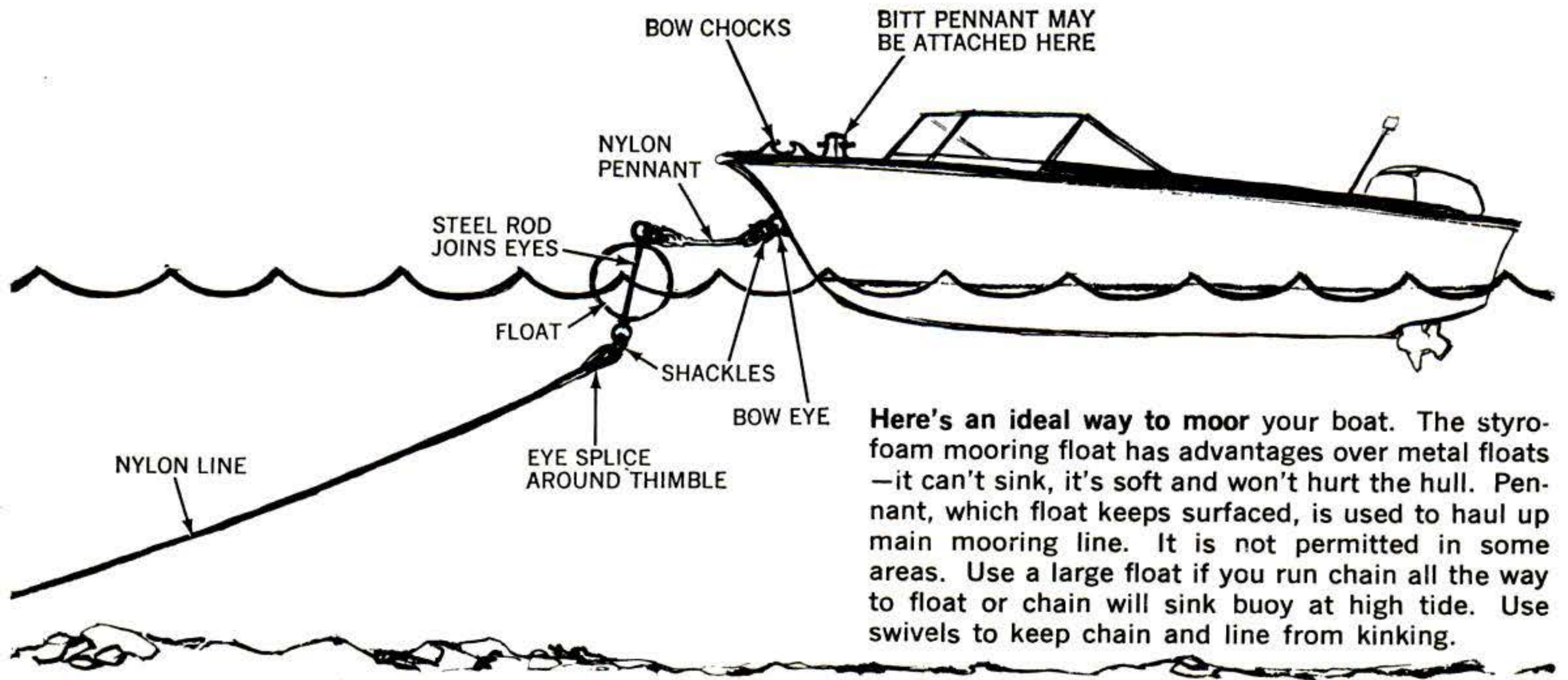
**W**hat's the best way to anchor your boat? Although there are rules for good anchoring, actual experience is the only safe guide to what will work best in any particular area.

If you're new at it, ask questions. It's the only way you can find out whether the bottom where you want to drop anchor is soft mud, hard sand, or a layer of rocks—information that's vital in choosing the anchor you'll need to get adequate holding power. A modern super-anchor with a rated holding power of more than 1¼ tons in hard sand, for example, gets only a 400-pound bite in soft mud, almost none on rock.

**Wind and drag.** As a starting point, estimate the pull your boat will put on an anchor when the wind kicks up. You can get a rough idea with simple arithmetic. Measure the largest cross section of your boat and consider it a flat plate facing into the wind. If you multiply it by .0032 (the flat-plate aerodynamic drag factor), and then by the wind speed squared, you'll have a good idea of the pull on the anchor line. (Most boats have less drag than a flat plate, but the difference puts a safety factor in your figuring.)

For example, let's say your boat has 16 square feet of cross section, and you want to know the drag in a 30-mile wind. Simply multiply 16 by .0032 by 30 by 30 and you get a total drag of 46.08 pounds. For a 60-mile gale, use 60 instead of 30 and you get





Here's an ideal way to moor your boat. The styrofoam mooring float has advantages over metal floats—it can't sink, it's soft and won't hurt the hull. Pennant, which float keeps surfaced, is used to haul up main mooring line. It is not permitted in some areas. Use a large float if you run chain all the way to float or chain will sink buoy at high tide. Use swivels to keep chain and line from kinking.

184.32 pounds. Note that when wind speed doubles, drag force on the anchor quadruples. So if anchor weights listed farther on seem big, you'll know why.

**For permanent mooring.** The mushroom anchor is the most popular for this. Either a mushroom or a navy-type anchor is required in many areas where mooring permits are necessary. The mushroom's holding power usually increases after it's set because it tends to settle into the average bottom and "silt up." One long-trusted guide to size runs like this:

BOAT LENGTH (feet)	ANCHOR WEIGHT (pounds)	CHAIN SIZE (inches)	PENNANT (feet)
Under 16	50	¼	6
16 to 18	100	¼	6
18 to 20	150	⅜	8
20 to 25	200	⅜	8
over 25	10 per ft.	⅜ or ½	10

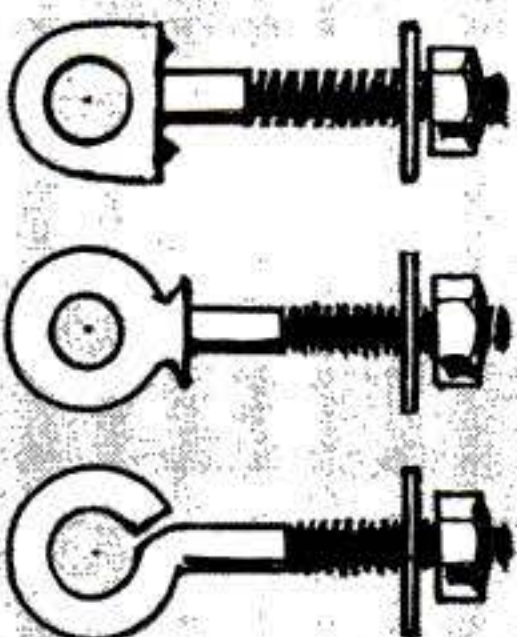
The pennant is the short line that runs from the mooring buoy to the bow of the boat. Keep in mind that the anchor has more holding power than its actual weight. One rule of thumb gives the mushroom a

*Continued*

## The basic hardware you need to moor your boat

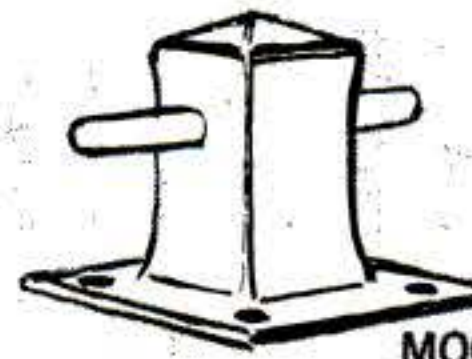
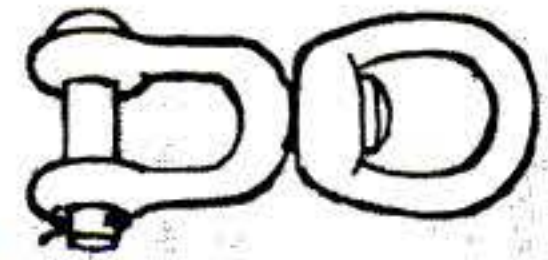


Never tie the anchor line where it joins anything. Any knot halves the strength of the rope. Best bet: Make an eye splice around metal thimble, like this. Thimble can then be shackled to chain. Eye splice cuts rope strength about 10 percent.



**Bow eye (top)** has pins in head to keep it from turning in stem of boat. It makes a very secure attachment fitting for mooring. The forged-shoulder eye bolt (center)—easier to come by—can be substituted for bow eye. Don't use eye bolt with formed eye (bottom). Heavy loads can force it open.

**Jaw-eye swivel** has pin in jaw which is removed to hook it to the chain. The rope is eye-spliced around a thimble through the eye, or linked to eye with a shackle.



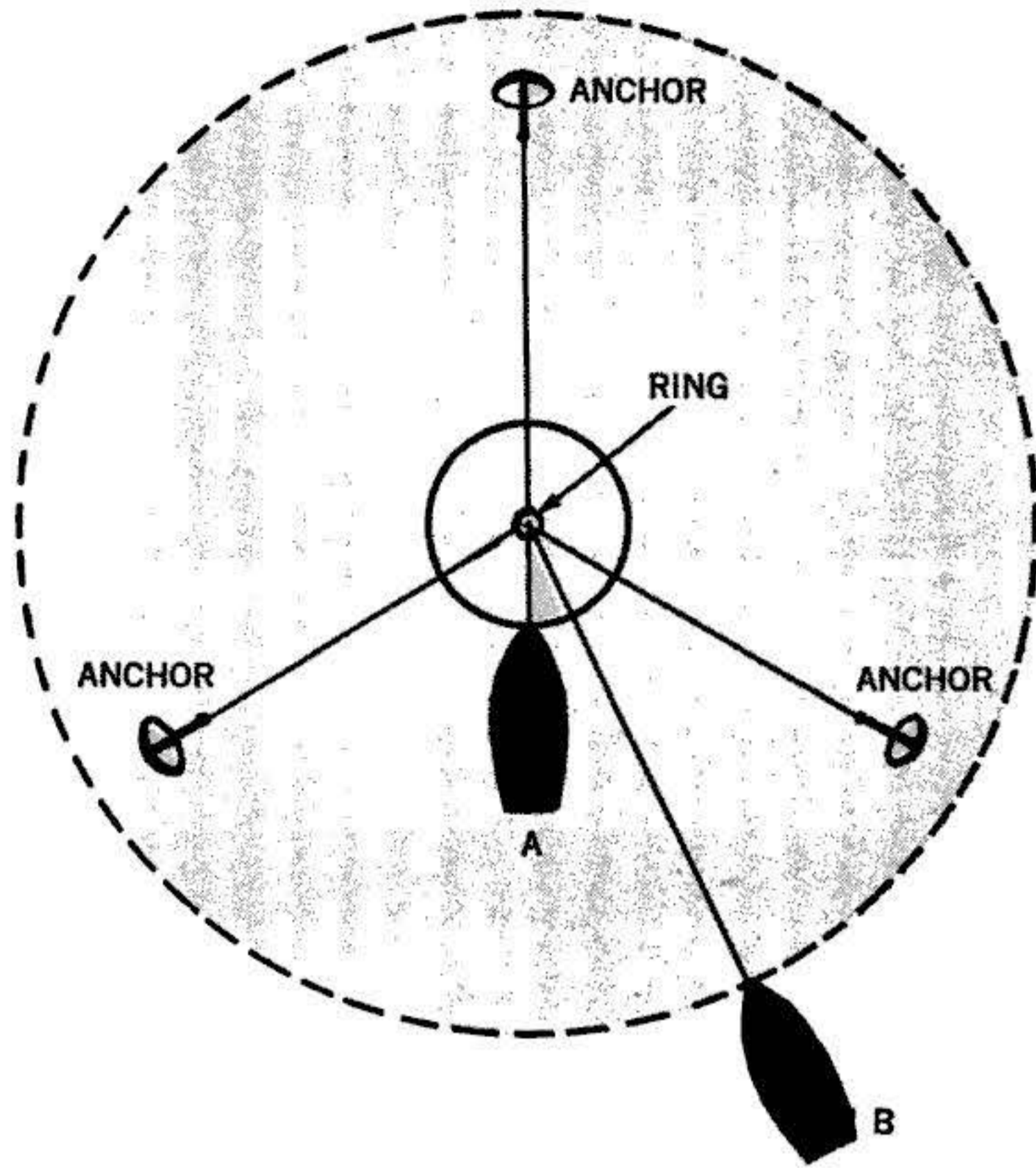
MOORING BITT



CHOCK

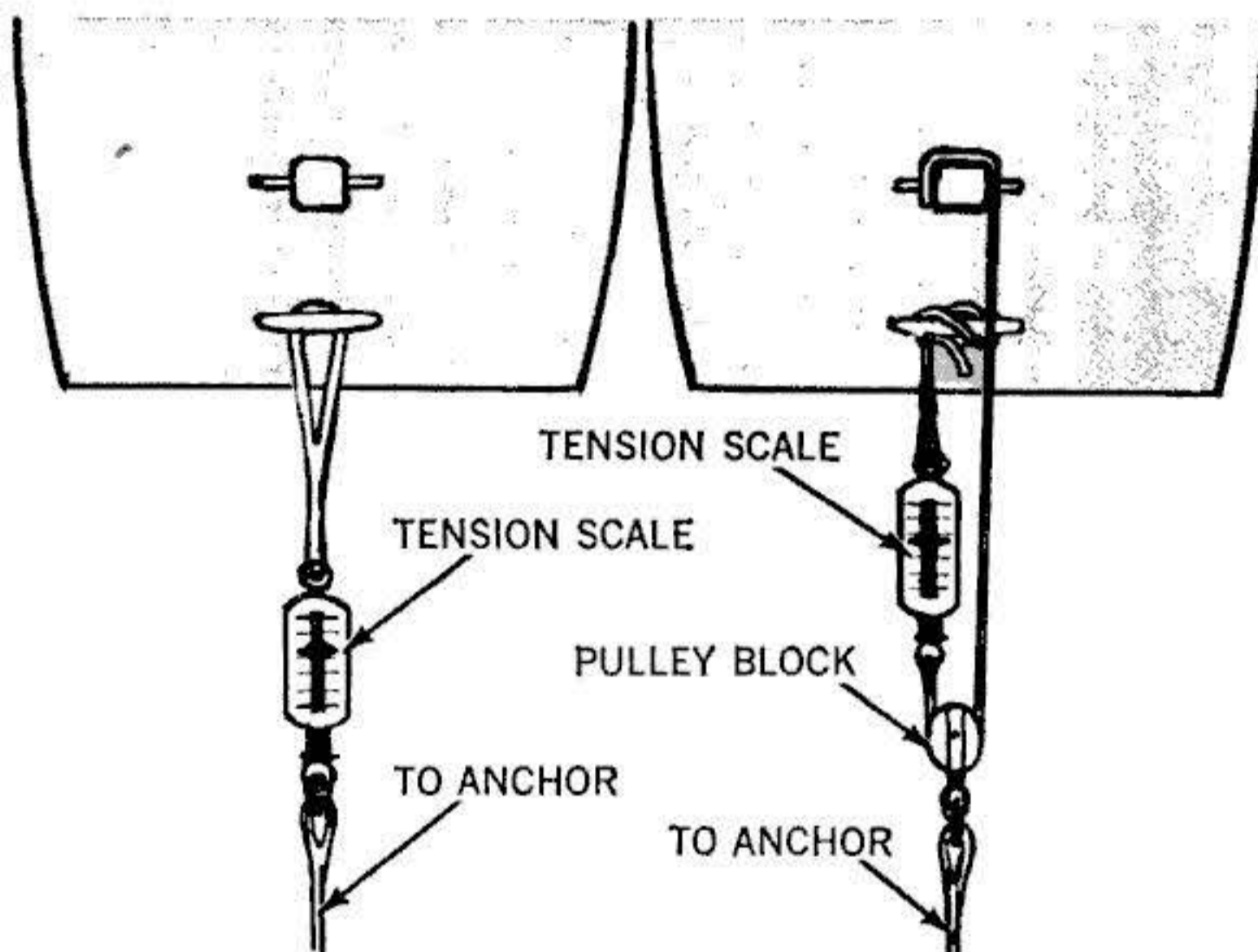
The bitt is through-bolted to the deck. Large eye splice in end of mooring pennant fits around the bitt. The rope runs through the chock to prevent chafing. Place bitt and chocks so rope runs through without kinking.

## Triple-anchor method saves space



Your boat is safer in today's crowded harbors if you use three or more anchors, as above. Join the lines at ring in center. The short line extending from the center ring to Boat A lets the boat swing in a small circle. But if you measure the line from Boat A to the ring, and on to the anchor beyond it, you will find that the total length is the same as that of Boat B—which swings in a much larger circle because it has only one anchor.

## An easy way to test holding power



Attach a tension scale in your boat line. Then provide a stationary reference point by pushing a pole into the bottom alongside your boat, or by using a light anchor on a very short line. Turn on the power while somebody watches the scale. The point at which your boat starts to move past reference mark gives you a reading of the maximum holding power of your mooring in the bottom where it's used. If your scale is too small for the pull you expect, use pulley blocks to reduce the load. In sketch at right, the scale reading will be half the actual pull on the anchor line. If you use double pulley blocks, you get a scale reading of one-fourth of the actual pull.

holding power equal to twice its weight. But if your boat is bulky or the day is windy, it won't hurt to use the next larger size anyway.

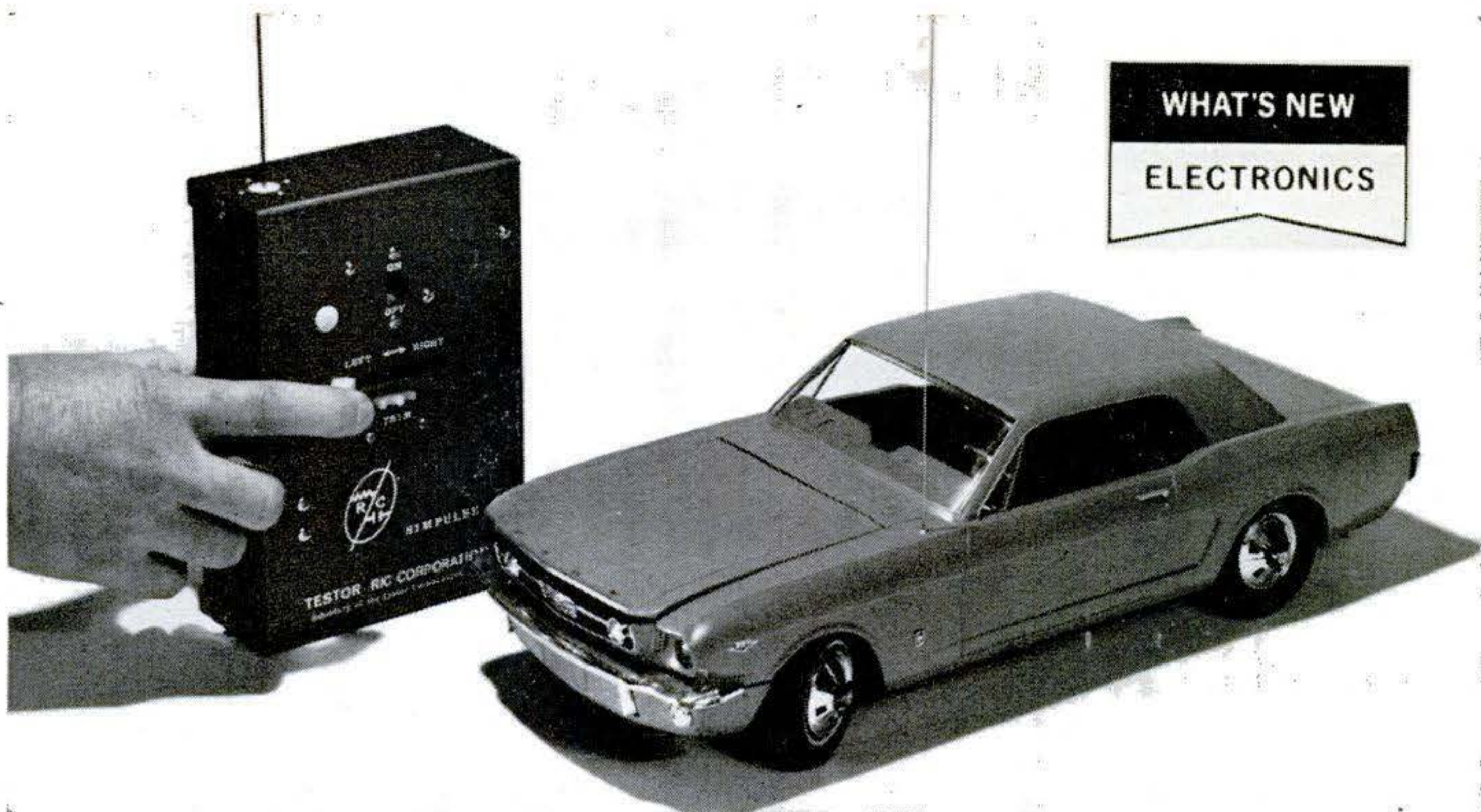
**For a short stop.** The "lunch hook" anchor—dropped while you fish or the kids swim—is often one of the deep-digging lightweight types like the Danforth or the plow anchor. These get their holding power by burrowing down into the bottom when the line is pulled. A five-pound Danforth with a hard-sand grip of 2,700 pounds, for example, will hold most outboards. A 12- or 14-pounder with a peak grip of close to 5,000 pounds will hold most cruisers. They are less effective on a hard, rocky bottom where they can't get a bite and on entangling bottoms studded with such things as stumps and tree roots.

Many skippers pick the yachtman's kedge for a lunch hook. It can get a good hold on almost any bottom, even snag tightly on a chunk of stone. Its holding power is equal to about five times its weight. You can also tie a separate light line to the middle of its crown (business end) to help free it if it gets snared.

Chain, running 10 or 15 feet from anchor to anchor line boosts the grip of any anchor in several ways. Its weight acts as an anchor, itself. It also acts as a shock absorber because any pull on the line must lift the chain off the bottom before it can draw taut and pass the jolt on to the anchor. It's a must for permanent moorings.

**The anchor line.** Choose nylon for this—it's the strongest rope you can buy. It doesn't rot, and has the most "give." Pick a size that can take at least twice the load it's ever likely to get.

The overall run of line, or line and chain, is often called the "rode." Its length divided by water depth is the "scope." If your rode is 50 feet long and the water 10 feet deep, your scope is five, which is popular. But in a storm, the bigger the scope the better. **PS**



### Battery-powered model Mustang steers by radio remote control

You can steer this midget, battery-powered Ford Mustang with the precision of a racing-car driver at Indy, thanks to its proportional radio-control system: The angle of the little car's front wheels is directly proportional to

how hard, and in what direction, you push the "tiller" on the transmitter. The outfit costs \$70, and will be available in toy and hobby shops this fall. It's made by the Testor Co., 600 Buckbee, Rockford, Ill.



### Portable power pack uses palm-size lead-acid storage battery

Here's a miniature 12-volt lead-acid storage battery that's light enough—and safe enough—to tote around in a leather carrying case. The 10-pound, completely sealed and leakproof battery is designed to power transistor TV sets, portable low-voltage power tools, and other DC-powered appliances. They plug into the battery through a built-in automotive-type cigarette-lighter receptacle.

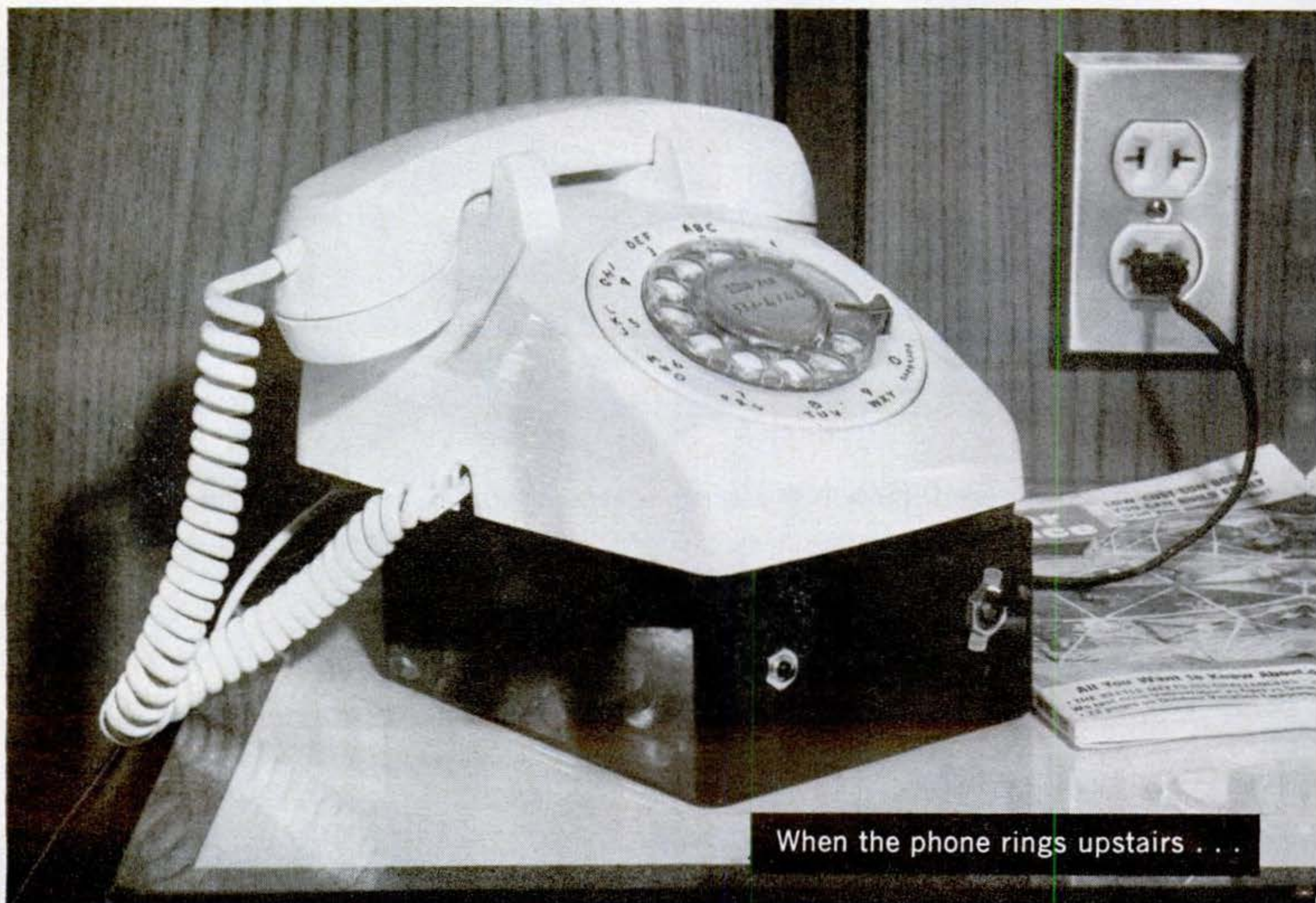
The battery is rated at eight ampere hours'



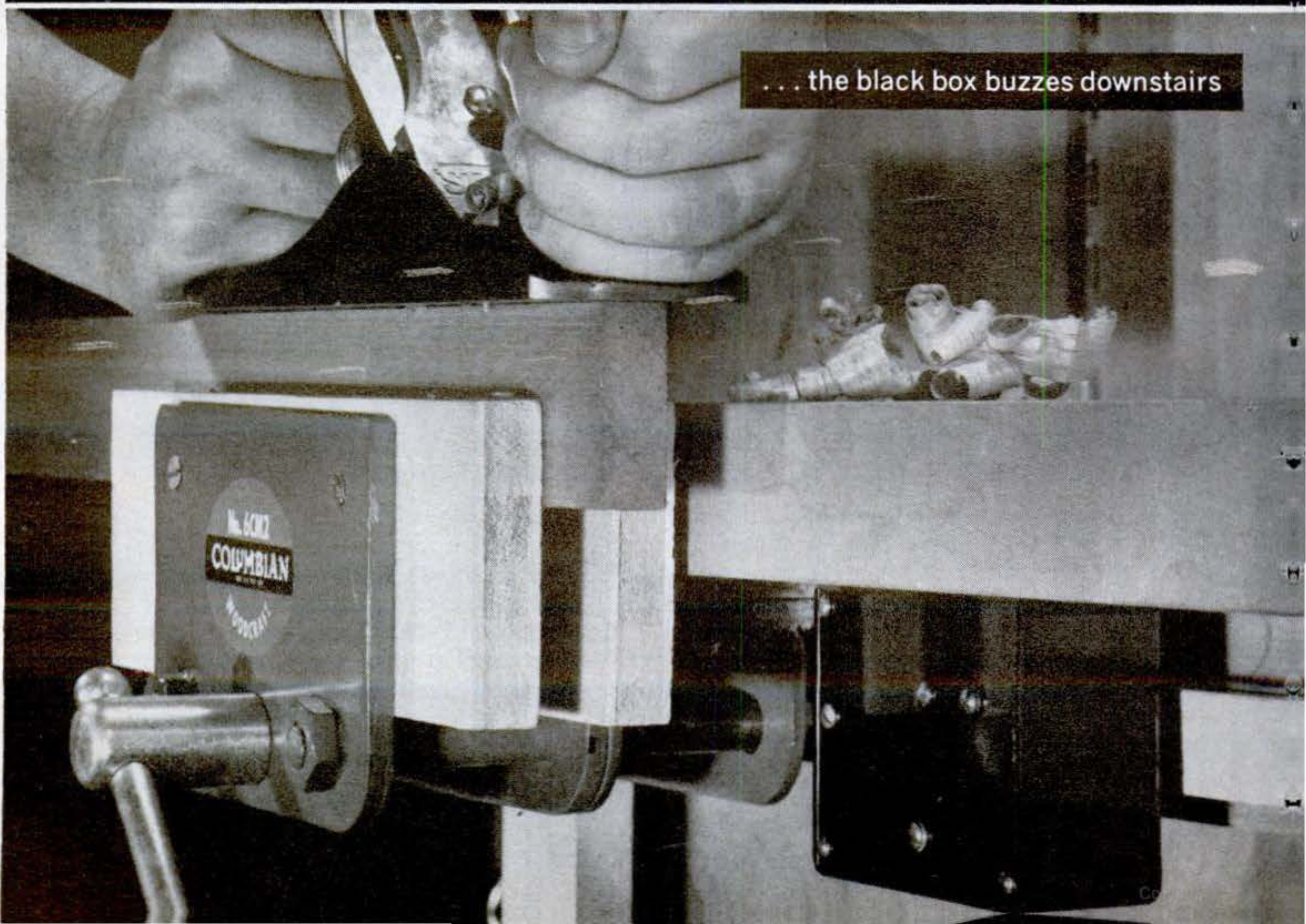
capacity—sufficient to run a portable TV for about six hours—and it can be recharged overnight by the AC-powered charger built into its carrying case. It has a useful operating life of about 1,000 hours—roughly the same as an equivalent-capacity (but more expensive) nickel-cadmium battery.

The complete power pack, including recharger, costs \$40. It's made by the Exide Div., Electric Storage Battery Co., Raleigh, N.C.

*You can build*  
**The Magic Box That**



When the phone rings upstairs . . .



. . . the black box buzzes downstairs

# Calls You to the Telephone

You'll never miss a phone call with this pint-size radio-controlled buzzer that works anyplace in your home

By HOWARD G. McENTEE

**W**here were you the last time your telephone rang? Busy in your workshop? Relaxing in your back yard? Puttering around your attic? Unless you have a house full of telephone bells, you can miss important phone calls simply because you can't hear the telephone ring. Here's the perfect solution: a unique remote-ringing telephone-bell system that works by "wired-wireless" remote control.

Basically, it's a radio-control system similar to the kind used with garage-door openers and to fly model airplanes, with one big difference—the radio-control signals travel between the transmitter and receiver over your home's electric-power lines, not through free space. That's why it's called wired-wireless.

**How it works.** The transmitter unit sits underneath your telephone. There's no direct connection to the phone, so the telephone company won't object to the system. Whenever the phone bell rings, a magnetic pickup coil inside the transmitter cabinet (L1, on schematic diagram) detects the slight magnetic-field variations generated by the ringing bell, and produces a small output voltage. Transistors Q2 and Q3 form an amplifier that boosts L1's output to a level high enough to "turn on" transistor Q4, which acts as an electronic switch. With Q4 "on," the RF (radio-frequency) oscillator circuit (transistor Q5) goes into operation, and sends RF signals (at a frequency of about 100,000 cycles per second) along the power line in step with the phone rings.

The receiver is a marvel of simplicity—it contains only eight components. To use it, you plug it into the nearest AC receptacle. Heart of its circuit is a silicon-controlled rectifier (SCR), Q1, which functions as a combined amplifier, detector, buzzer driver, and power-line rectifier. Coil L2 and capacitor C1 form a tuned circuit that is tuned to the transmitter output frequency, and is connected directly across the power line. When the receiver picks up the transmitted RF signals, an output voltage is generated across coil L3, which triggers the SCR into conduction, and the buzzer then sounds a warning that your telephone is ringing.

Transmitter and receiver draw operating current directly from the power lines. A simple power supply in the transmitter—using an inexpensive "universal" transformer—provides about 25 volts DC, while the receiver circuit works on rectified 120-volt AC. The receiver draws negligible current when it is idling, so no power switch is necessary. *Caution:* Since all receiver components are connected directly to the power line, you must take special care to insure that none of the unit's external screw heads are "hot." Use plastic insulating tubing on all exposed component leads, and position the

components to prevent accidental shorts.

**Building it.** Both the transmitter and receiver are housed in Bakelite cabinets. Wire their circuits on perforated phenolic chassis board (Vectorbord), using push-in terminals (flea clips) as soldering points. Double-check the polarity of the electrolytic capacitors and diodes before you solder them in place.

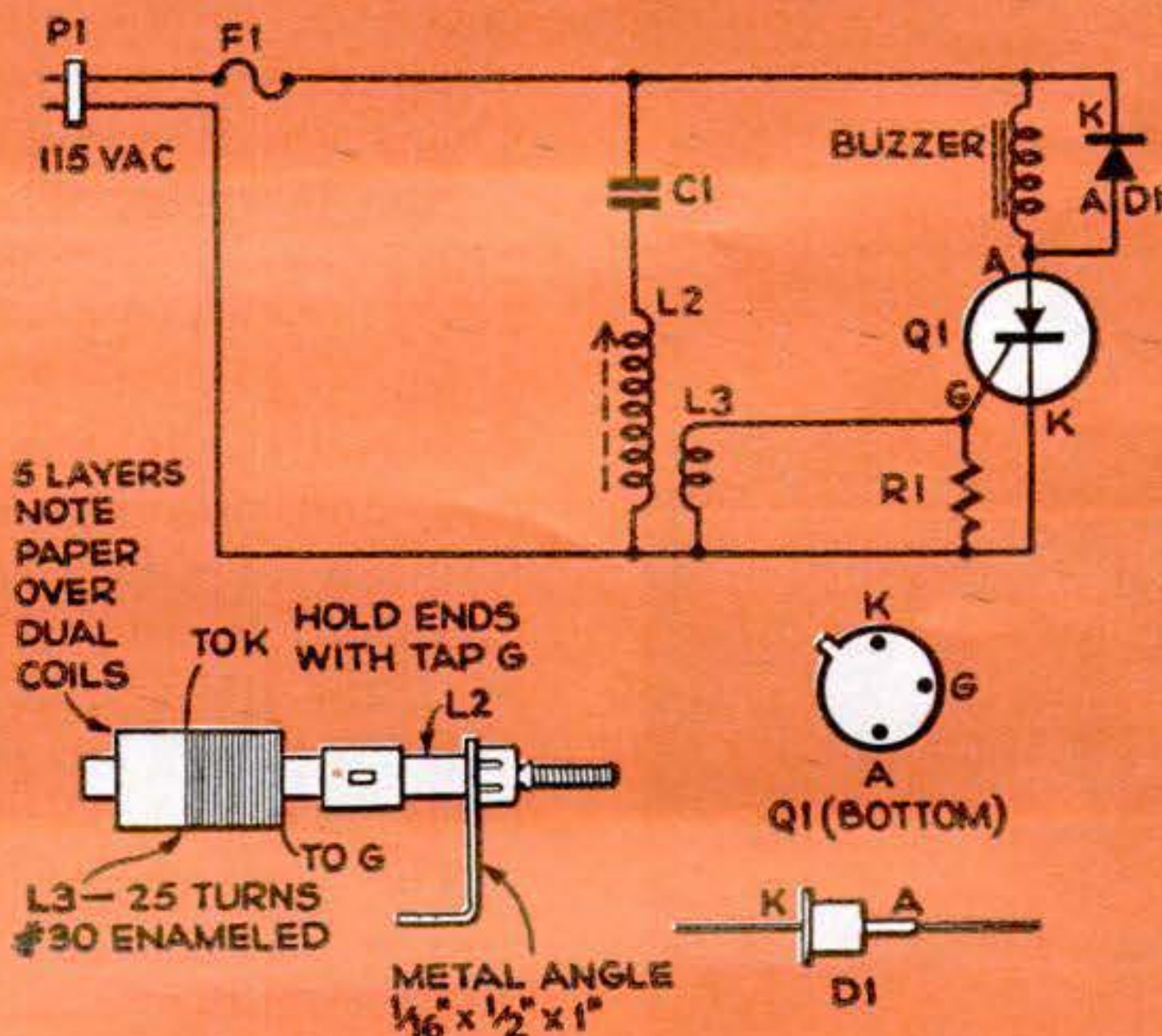
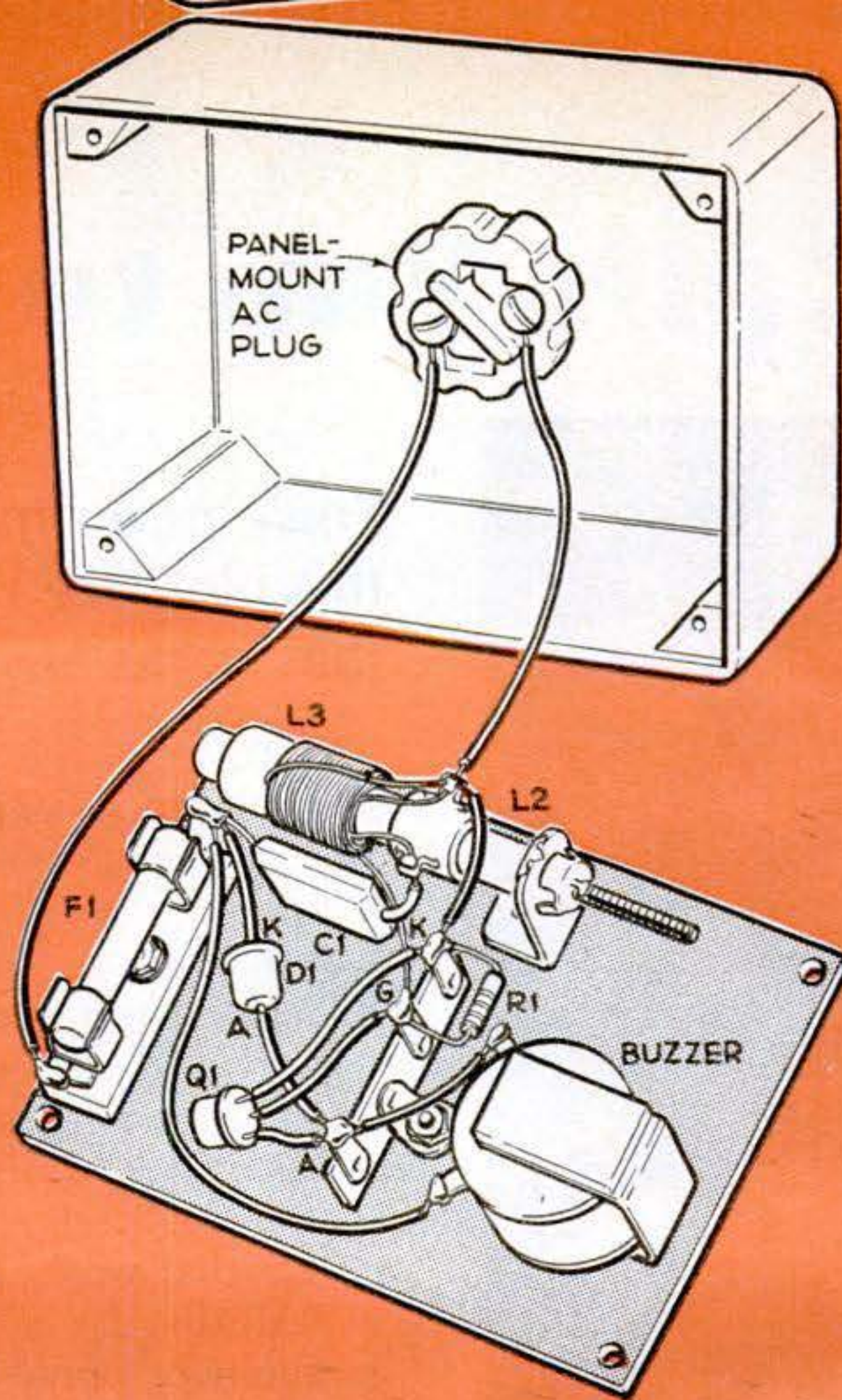
Coil windings L3 and L5 must be wound on top of ready-wound coils L2 and L4, respectively, and in the same direction. Start by wrapping L2 and L4 with five layers of stiff paper strips (brown wrapping paper is fine). Hold the paper in place with a dab of cement. The idea is to bridge the gap between the two adjacent windings on each coil. Then apply L3 and L5 as shown in the diagrams at right. Use No. 30 enamel-coated magnet wire for both windings.

The power transformer, T1, is a universal type, and several of its leads are not used in this circuit. Clip off the leads not indicated in the diagrams. Note: T1 and L1 must be mounted in the relative positions shown in the pictorial diagram to minimize magnetic coupling between the two. Otherwise, the magnetic field surrounding T1 may excite L1 sufficiently to keep the transmitter constantly oscillating. Fashion a simple metal bracket to hold L1 in place.

**Testing and alignment.** Screw the core of L4 into the coil as far as possible, then back it out  $\frac{3}{8}$  inch. With L1 a distance away from T1, clip a 0-50-milliammeter DC meter across pushbutton switch ("test" button) SW2, with its positive terminal connected to the emitter (E) of transistor Q4. With power on, the meter should read between 18 and 25 milliamperes. Then disconnect the milliammeter and measure the DC voltage across capacitor C7 (power-supply voltage). It should be about 30 volts with the oscillator not operating, and about 25 volts when you push test button SW2.

To tune the receiver, plug it into an outlet in another room, and have someone press SW2 on the transmitter while you adjust the core of L2. As you screw the core from its full-out to its full-in position, the buzzer will begin to buzz and then stop. Back out the core until it is in the center of the buzzing region.

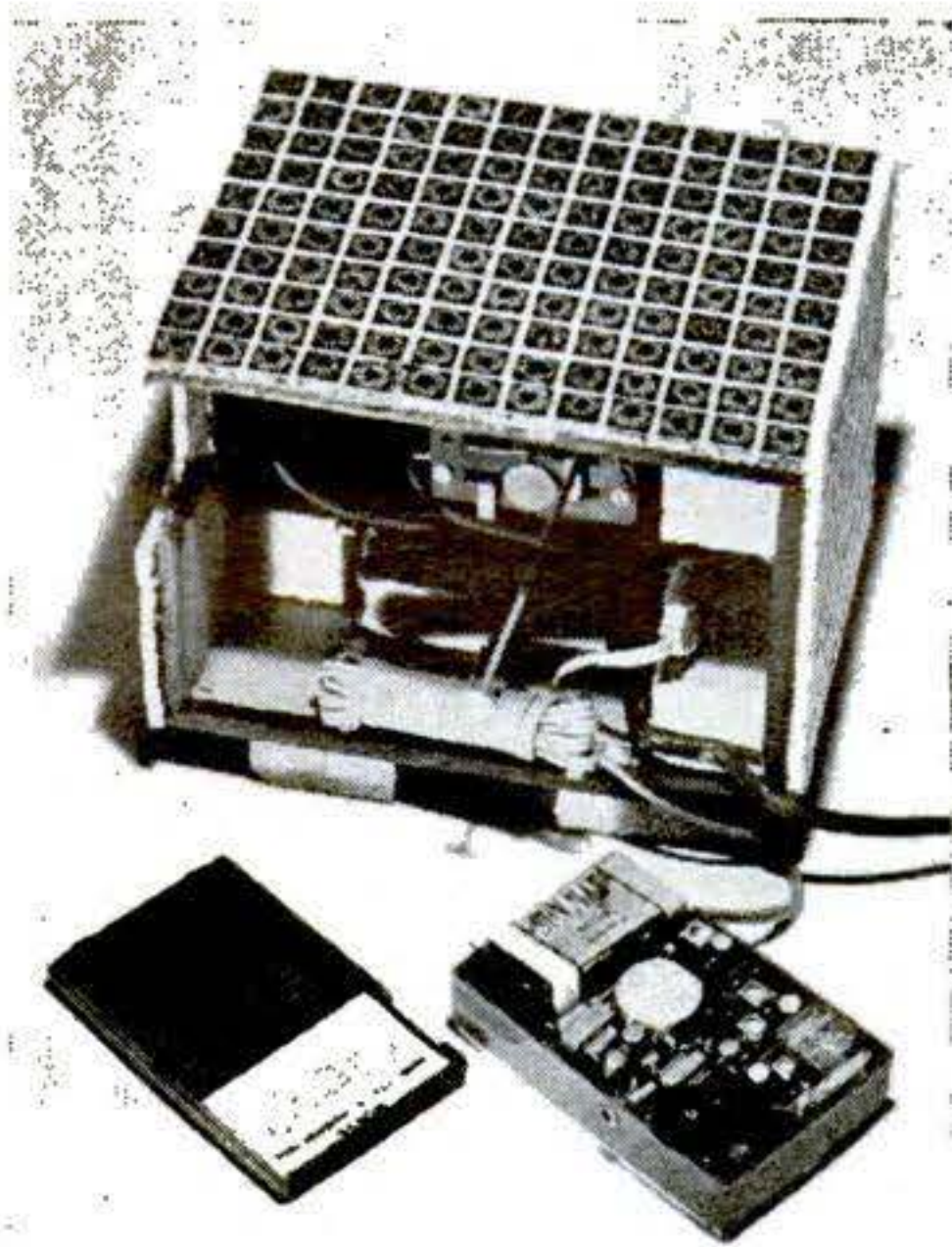
When you fasten the cover on the transmitter case, you may have to shift the posi-



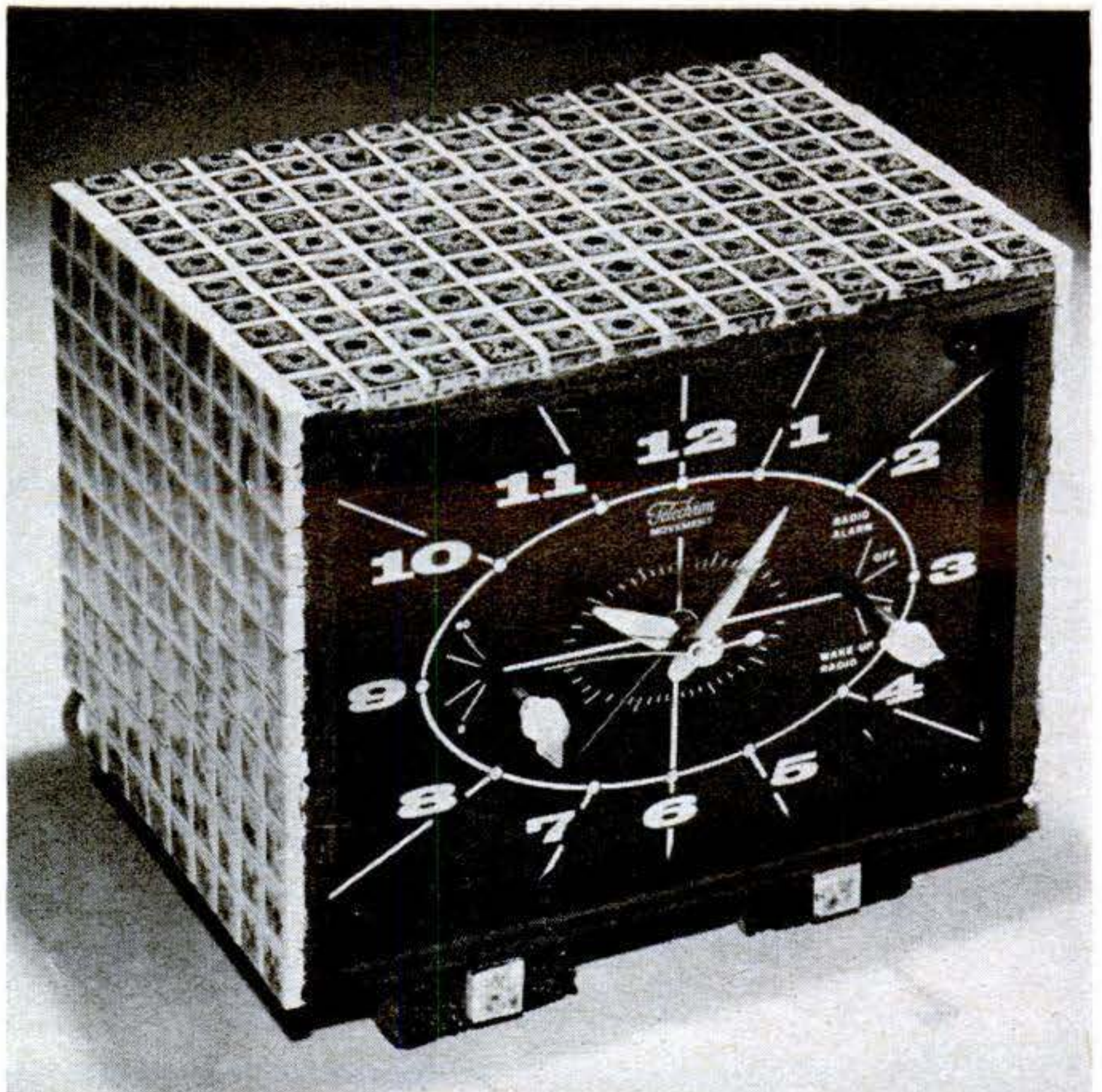
tion of L1 slightly to prevent T1 from triggering the oscillator. Use the receiver as a tester: If the buzzer sounds when SW2 is not pressed, readjust L1's position.

**Setting it up.** Position your telephone on the transmitter so the phone's bell is above the pickup coil. The setting of the bell-damper thumb wheel on the bottom of the phone has no effect on transmitter operation. Thus, you can silence the ringing of the phone itself, yet be alerted to an incoming call at another location.





An inexpensive battery "eliminator" (above, shown installed in the radio) converts your transistor portable to AC-powered operation. The clock-timer switches it on at a preset time, and buzzes.



For a modish-looking clock radio, cover the plywood or hardboard cabinet with ceramic mosaic tile. Two square feet of gauze-backed tile and a few ounces of dry grout will do the job.

## Turn Your Portable into a Clock Radio

By SOLOMON ROTHFELD

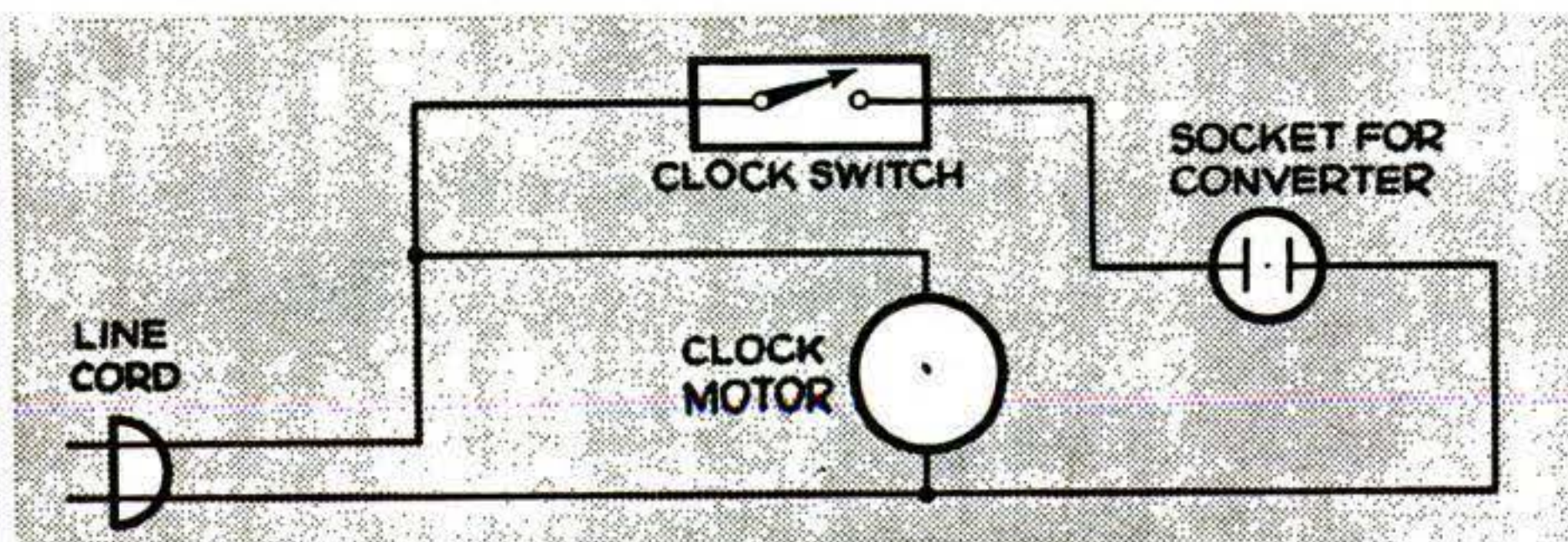
**W**hen your carry-around transistor radio is home from the beach or the ball game, why not turn it into a table-model clock radio? This easy-to-build adaptor does the trick. It consists of an electric clock-timer and an AC-powered battery "eliminator" (or "converter"), wired together as shown below and mounted in a home-built cabinet.

Suitable clock-timers are made by Intermatic and Telechron (GE) in a variety of sizes and shapes. They cost about \$7 or \$8. You can order one from most mail-

order electronic-supply houses (such as Allied Radio Co., Chicago, and Lafayette Radio Co., Syosset, N.Y.). Choose an uncased timer that has a built-in buzzer.

The battery eliminator is an inexpensive gadget sold by most radio and novelty shops. It looks like a conventional nine-volt transistor-radio battery equipped with a power cord, and is designed to snap into your radio in place of the dry-cell battery.

Build the cabinet out of  $\frac{1}{4}$ -inch plywood or  $\frac{3}{16}$ -inch hardboard—its dimensions will depend on the sizes of your radio and the timer. Fashion a simple metal bracket to hold the radio in place. Be sure to provide a cutout in the cabinet so you can reach the radio's tuning and volume controls.



Check the data sheet supplied with your clock-timer for the location of its motor and clock-operated switch terminals. The converter socket is a conventional flush-mount, single-socket, AC receptacle mounted inside the cabinet.



## PERSONAL-USE REPORT:

# Kit Makes Super Hi-Fi Solid-State Amplifier

By RONALD M. BENREY

**T**he Acoustech XI is a kit-built all-transistor amplifier that will outperform most factory-assembled rigs you can buy today. Its frequency response extends well past the upper and lower measuring limits of my test instruments. Distortion, even at the maximum power output of 35 watts per channel, is virtually inaudible.

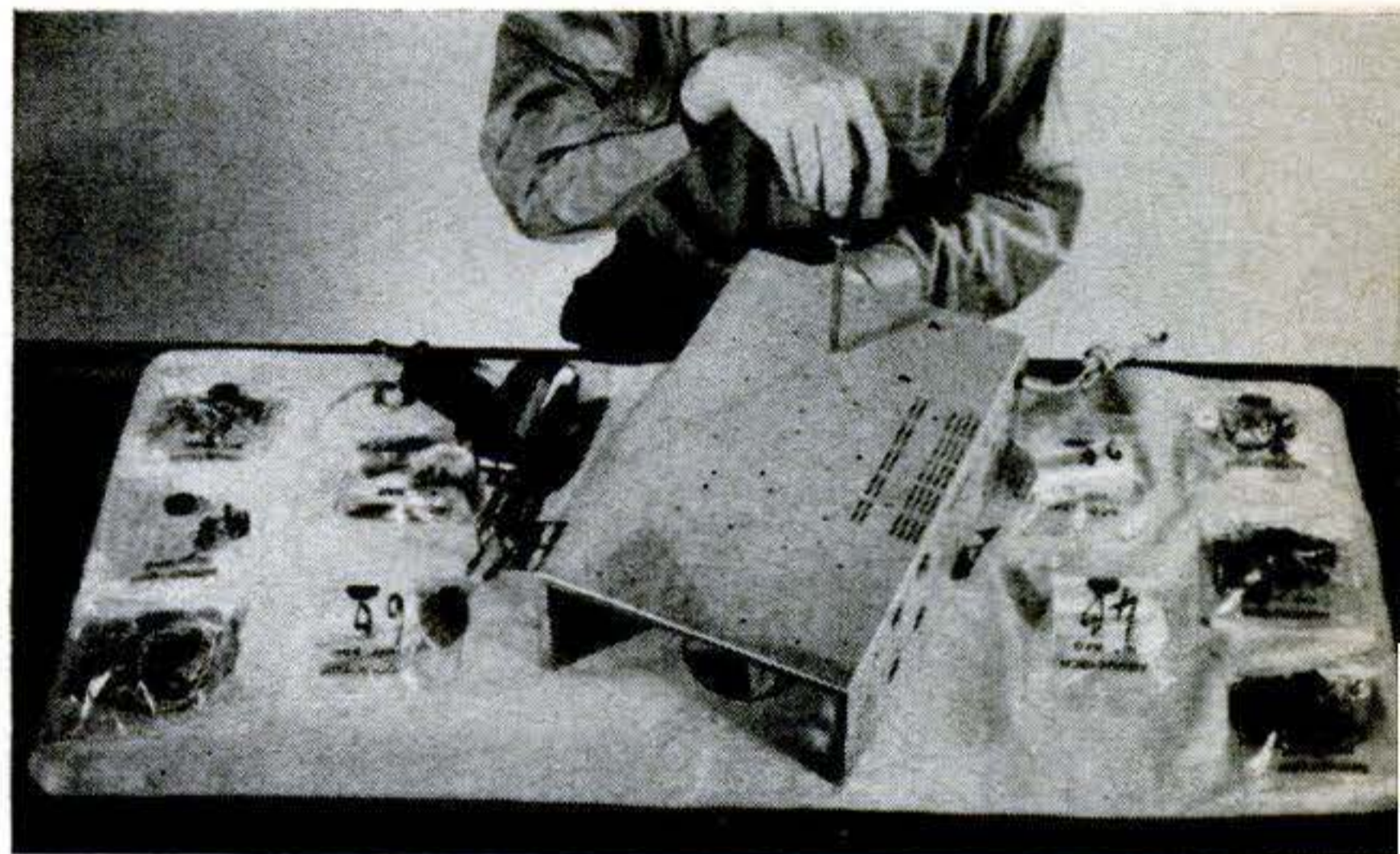
I listened to the amplifier drive both low-efficiency AR-3 acoustic-suspension speakers and high-efficiency Jensen 600-XLs. The sound from both types of speakers was remarkably clear and brilliant, an indication of excellent transient response.

The basic power-amplifier kit costs \$130; the add-on preamp module \$90. They are made by Acoustech, Inc., 139 Main St., Cambridge, Mass.

**Step 1.** Kit is designed so you can stop after wiring the easy-to-assemble power-amplifier stages, if you already own a hi-fi preamplifier. Construction time: about five hours.

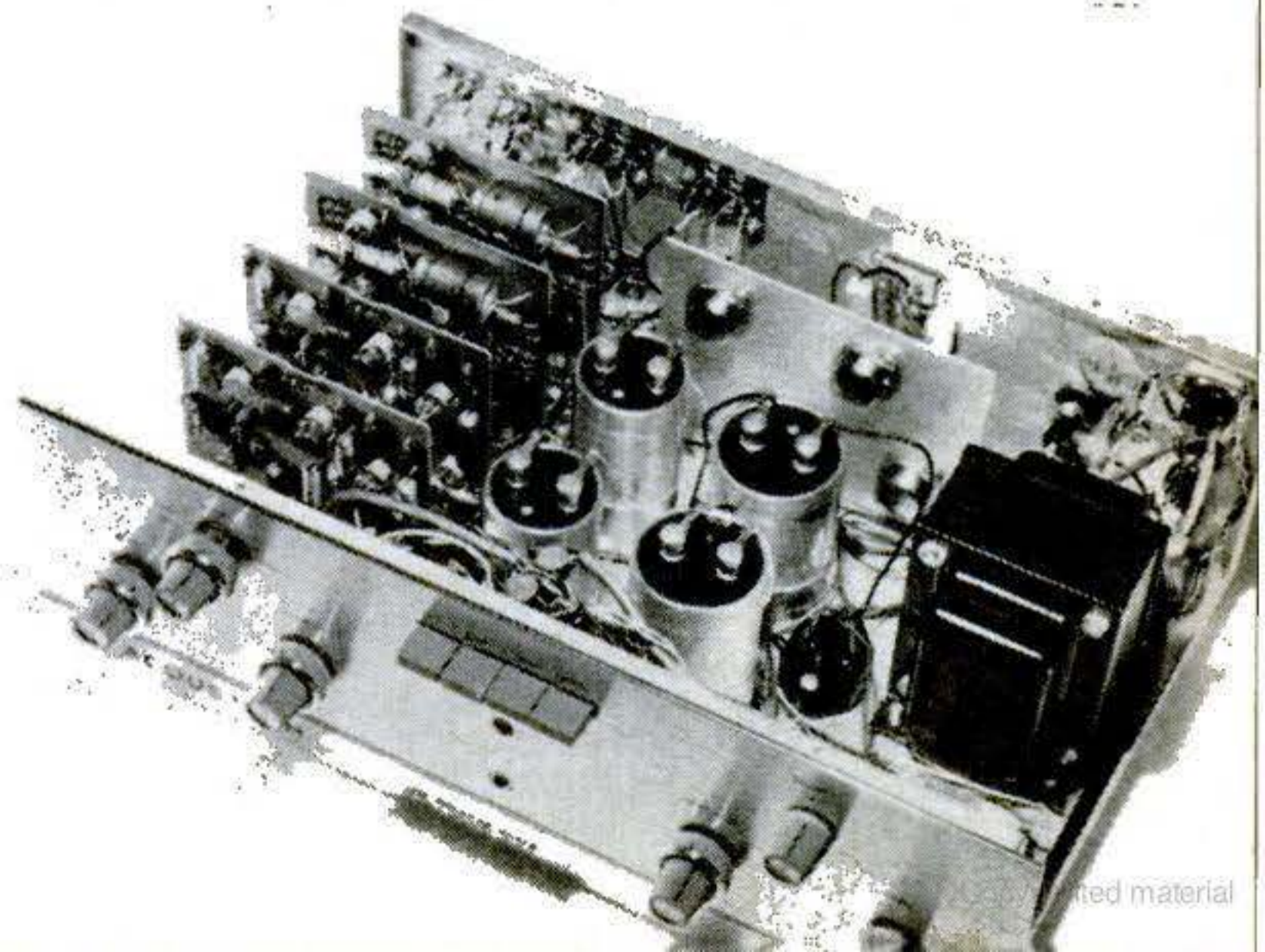
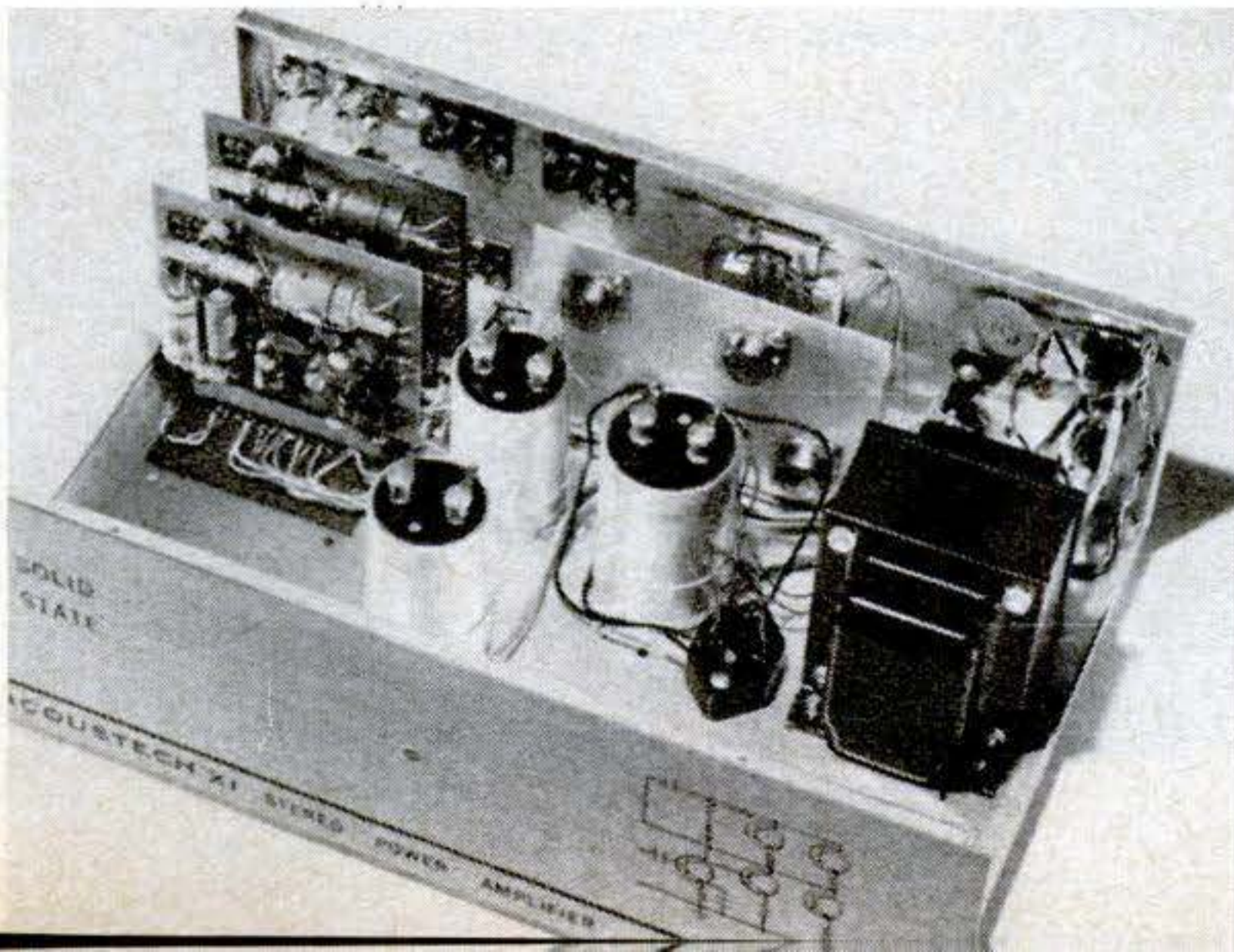


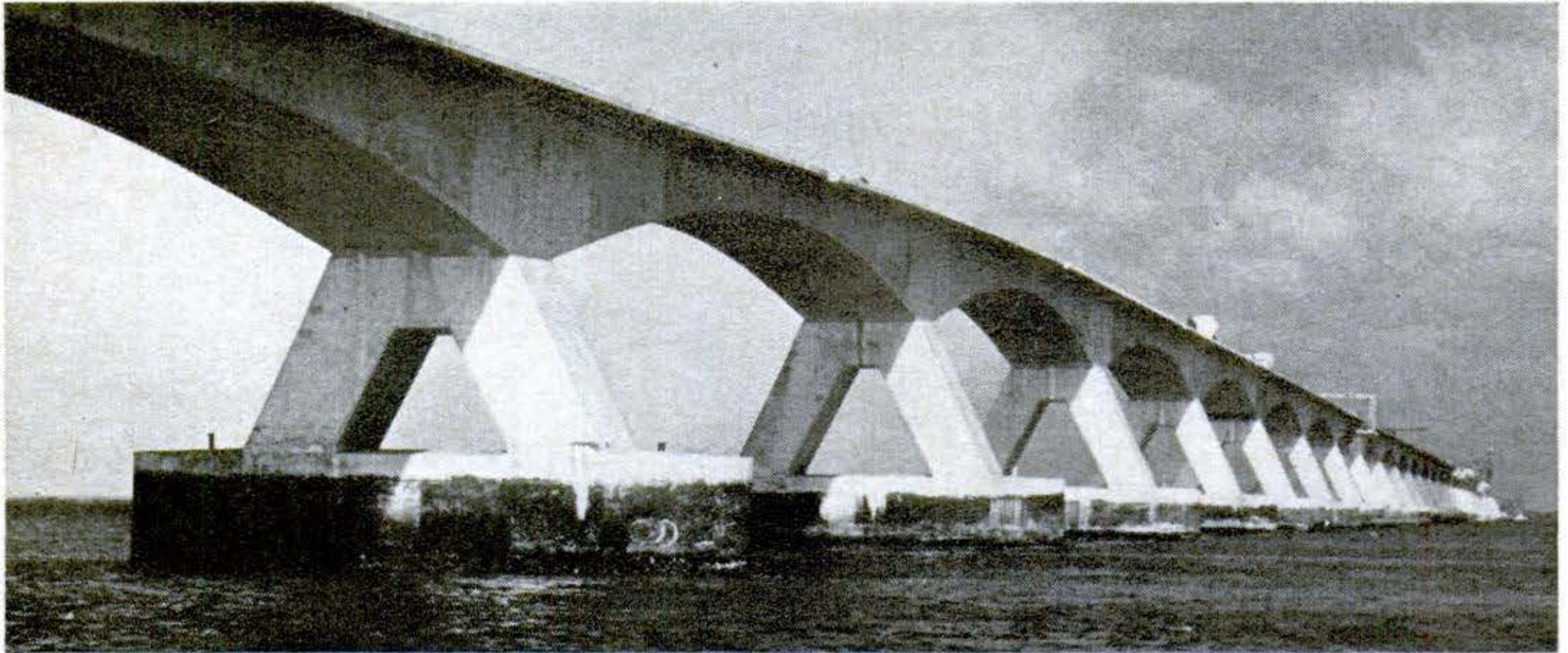
Components and hardware are packaged in numbered plastic bags (like one shown above) that are stapled to a fuzzy-surfaced, solder-resistant cloth. You open one bag at a time to carry out a group of instructions.



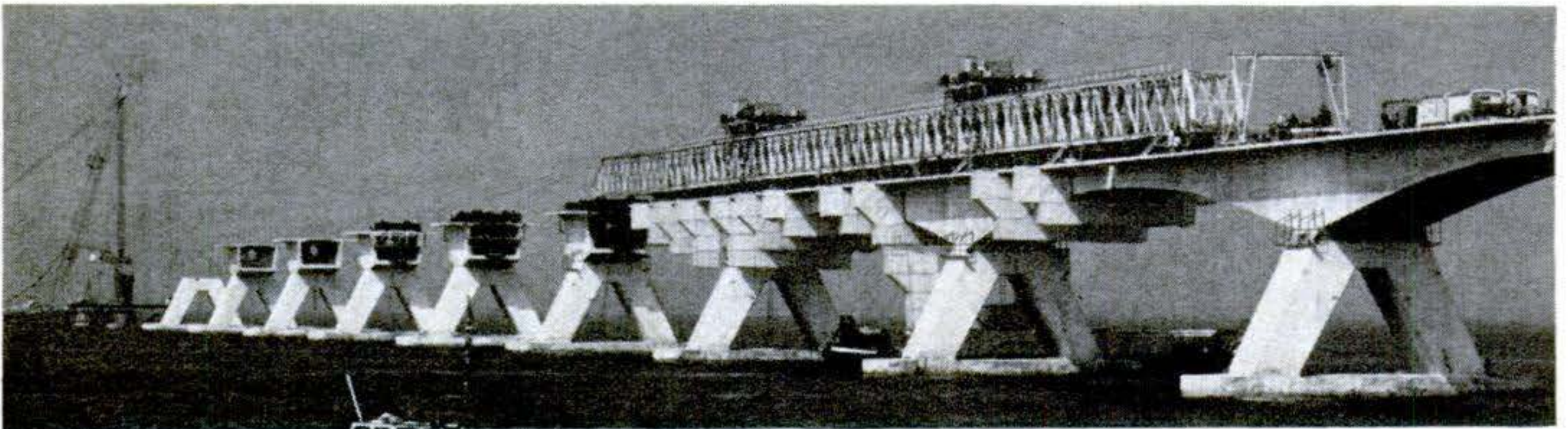
The cloth makes an excellent work surface since small bits of hardware and tiny electronic parts won't roll or slide off it. Tricky-to-wire parts of the circuitry come pre-assembled on plug-in printed-circuit boards.

**Step 2.** You can add on the preamplifier and control circuitry when you build the power amplifier, or do it at a later date. The conversion takes about 12 hours, most of it spent in wiring the complex selector switches.





Resting on A-shaped concrete piers, precast concrete arches stretch across estuary as final link in highway.



Steel tracks for traveling cranes rest on three piers as floating crane (left) drives more piles into place.

## Dutch bridge three-mile estuary, using traveling beam

The three-mile Oosterschelde bridge in Holland, Europe's longest, is being completed this spring from prefabricated concrete sections moved into place by an 800-foot-long moving assembly—like that used to build the 17-mile bridge and tunnel at the mouth of Chesapeake Bay [PS, Mar. '62]. The steel assembly rests on three completed A-shaped piers at a time.

It carries tracks for two traveling cranes that hoist into position the six precast blocks that form each 309-foot arch span between the piers. As each arch is placed, the assembly rig is rolled forward to lift the next concrete unit from a barge. The bridge, started three years ago, is the final link of a new highway connecting the coastal islands of Zeeland south of Rotterdam.

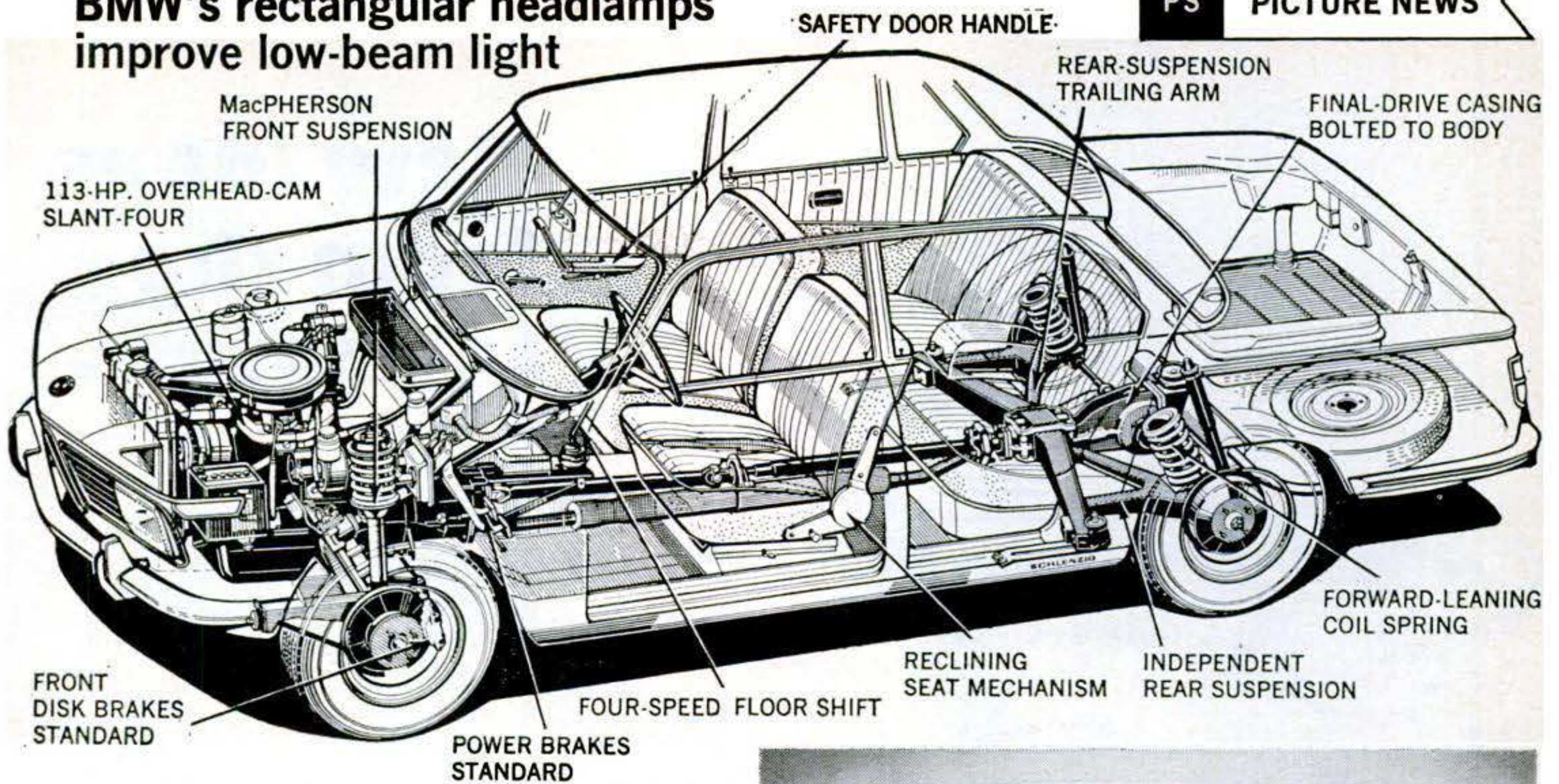


## White House fence reset with home-workshop epoxy

When the historic wrought-iron fence pulled loose from the 130-year-old sandstone wall on which it is mounted around the White House, mechanics came up with a repair using materials common to your home workshop.

Mounting holes in the brittle sandstone coping were filled with epoxy, which was allowed to set firmly and hold the fence posts fast in its grip.

# BMW's rectangular headlamps improve low-beam light



**BMW 2000**, shown in cutaway drawing, is equipped with four-speed floor shift and 113-hp. overhead-cam slant-four engine.

Rectangular headlights on Germany's new BMW 2000 have oval reflectors. They are a new styling theme in Europe that improves low-beam illumination and may spread to Detroit. A roomy four-seater with bucket seats in front, the BMW is good for speeds over 100 m.p.h., is economical on fuel, and is noted for its excellent handling characteristics. It has either four-speed floor shift or optional ZF three-speed automatic.

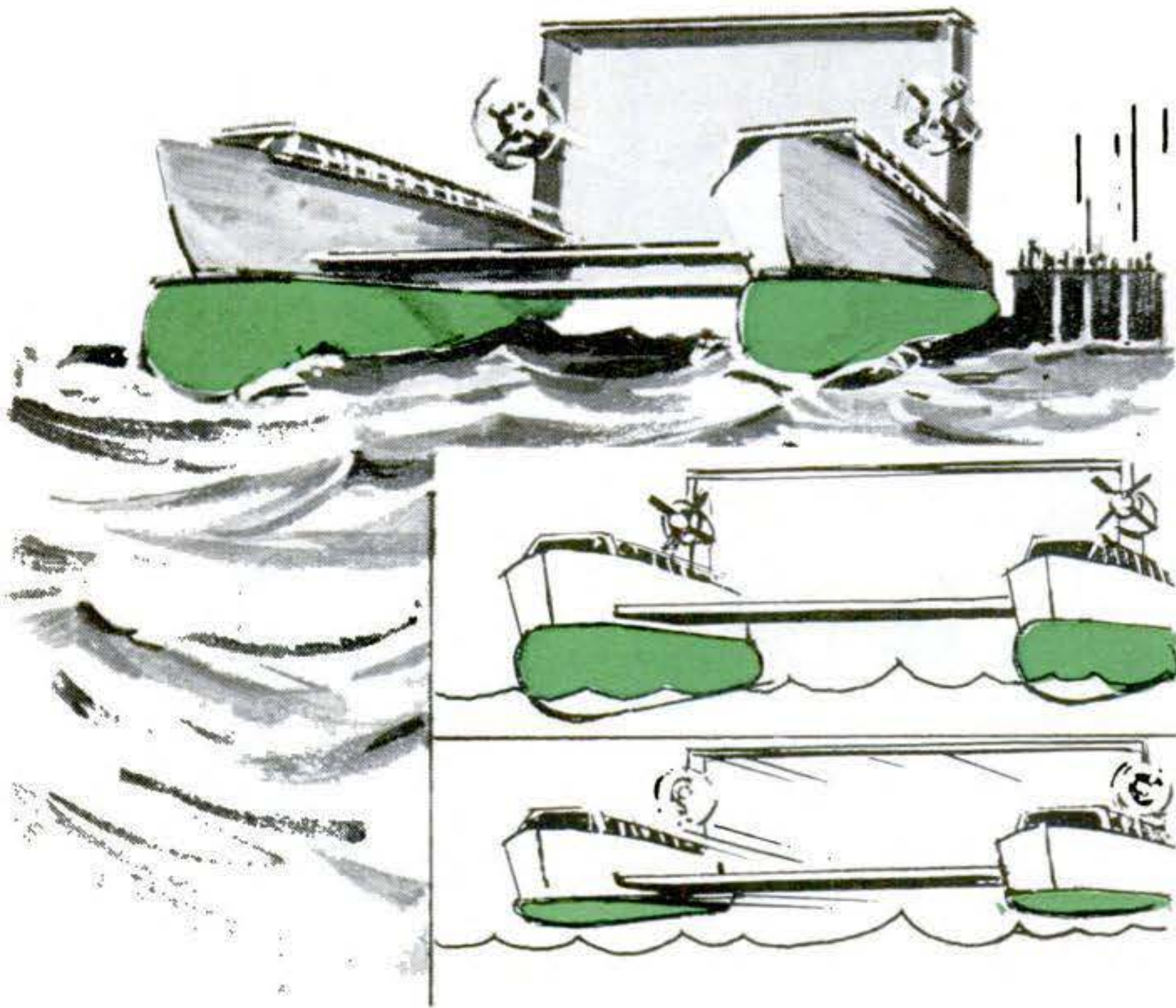


## Low-pressure jets run silent hovercraft

Operating on land or water on low-pressure air jets, this new British hovercraft is said to make virtually no noise. Built by Britten-Nor-

man, Ltd., in England, it's powered by a Rolls-Royce V-8 engine. The version shown carries six to eight passengers. A larger one is planned for use as a ferry to carry cars and passengers across the Solent to the Isle of Wight.

# New Ideas from the Inventors



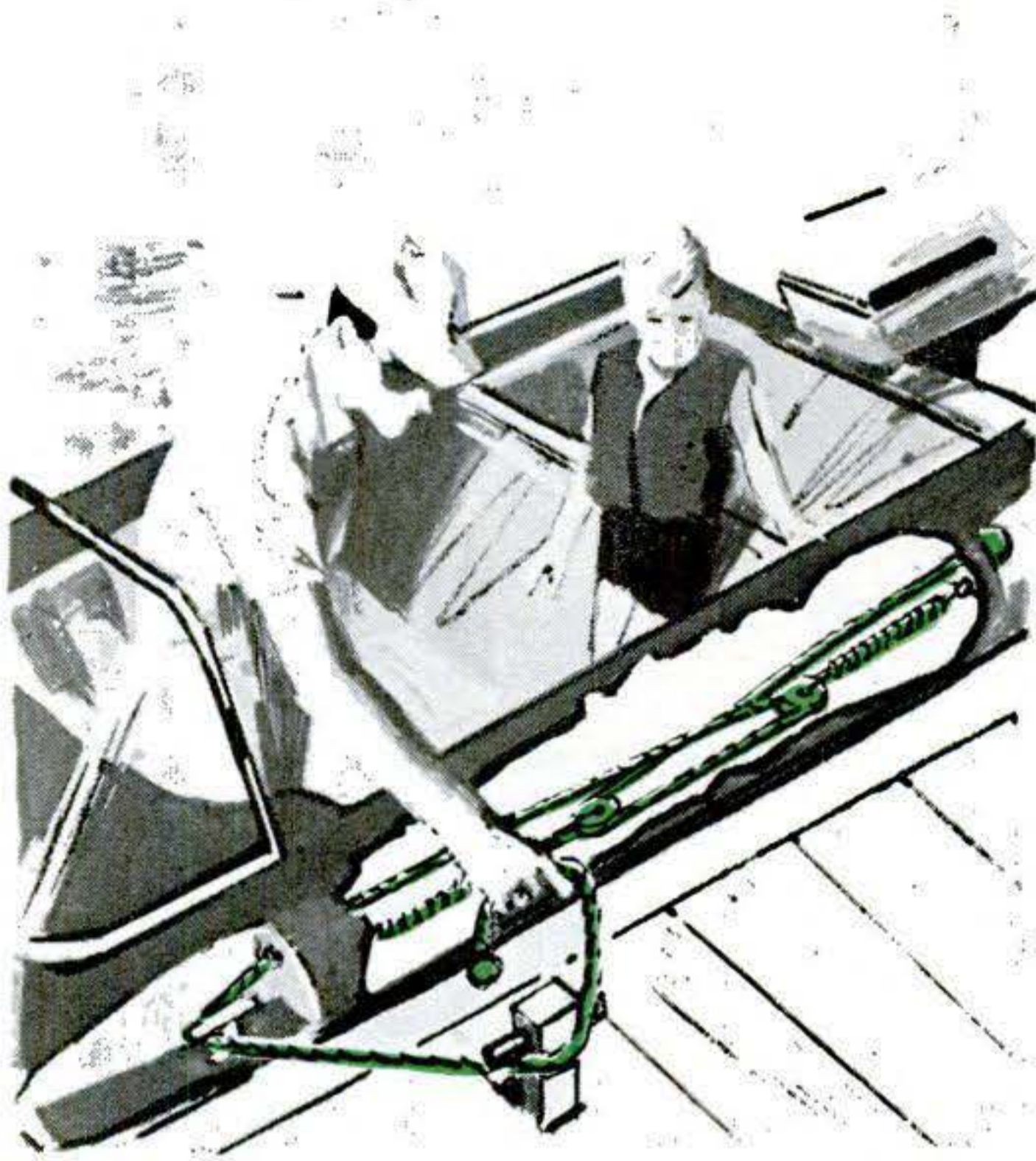
**Hull "tires" lift surface craft.** Pump-up diaphragms under the twin hulls of this recently patented craft would keep the two wings linking the hulls clear of waves and turbulence on take-off and act as shock absorbers during landings. With the hull deflated during flight, the surface-effect craft would skim low over the water, getting maximum dynamic lift from the air cushion between the wings and the surface of the water.



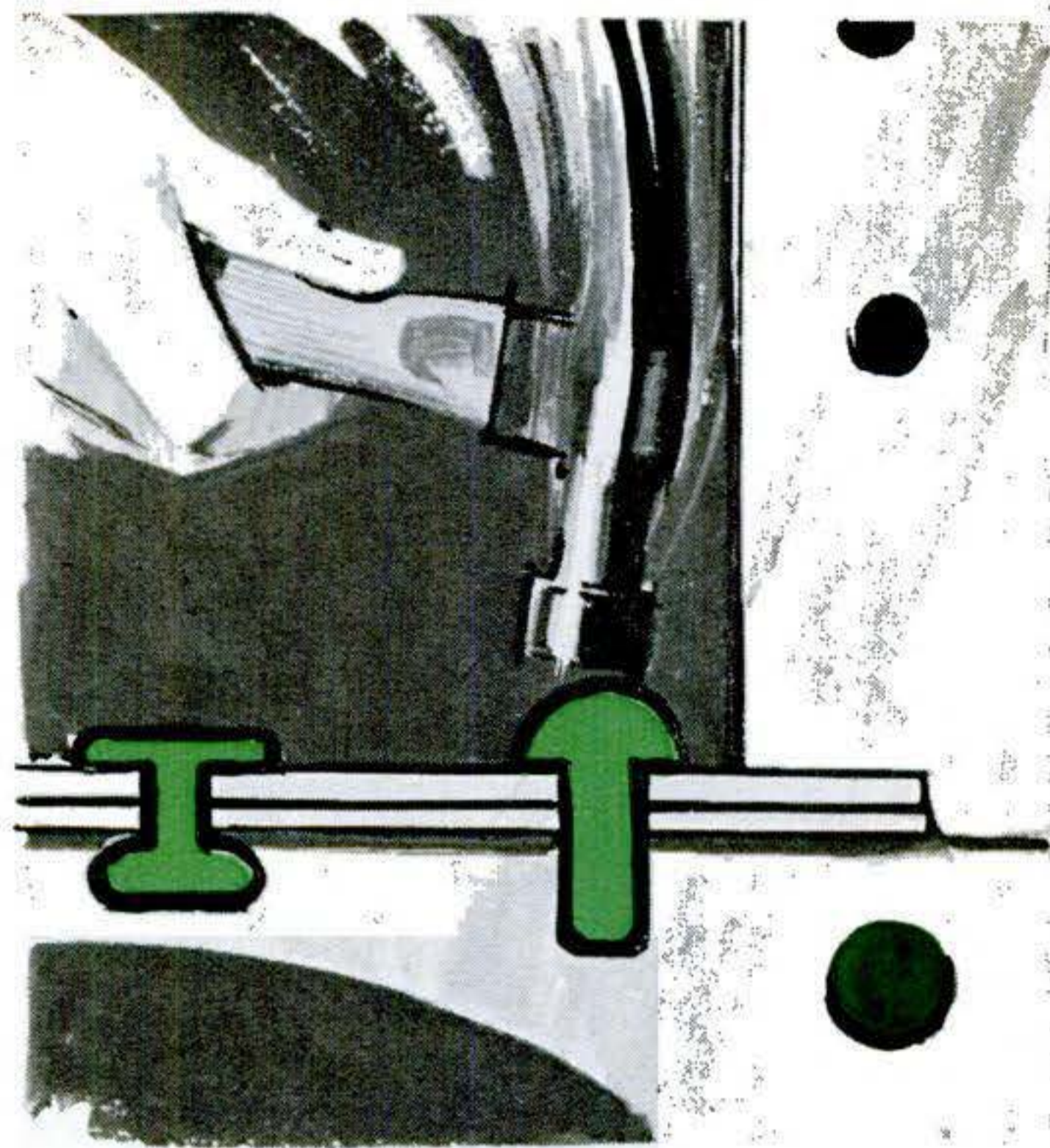
**Can lip forms pouring spout.** Prying up the top seam of this can with an opener would bend out the lip of the can to expose a dripless, V-shaped pouring spout. The body cylinder would be notched at one point, in this American Can Co. patent, before being lapped and sealed to the top. Lifting pressure at this notched, single-thickness point would free the edge and buckle it outward to form the spout.



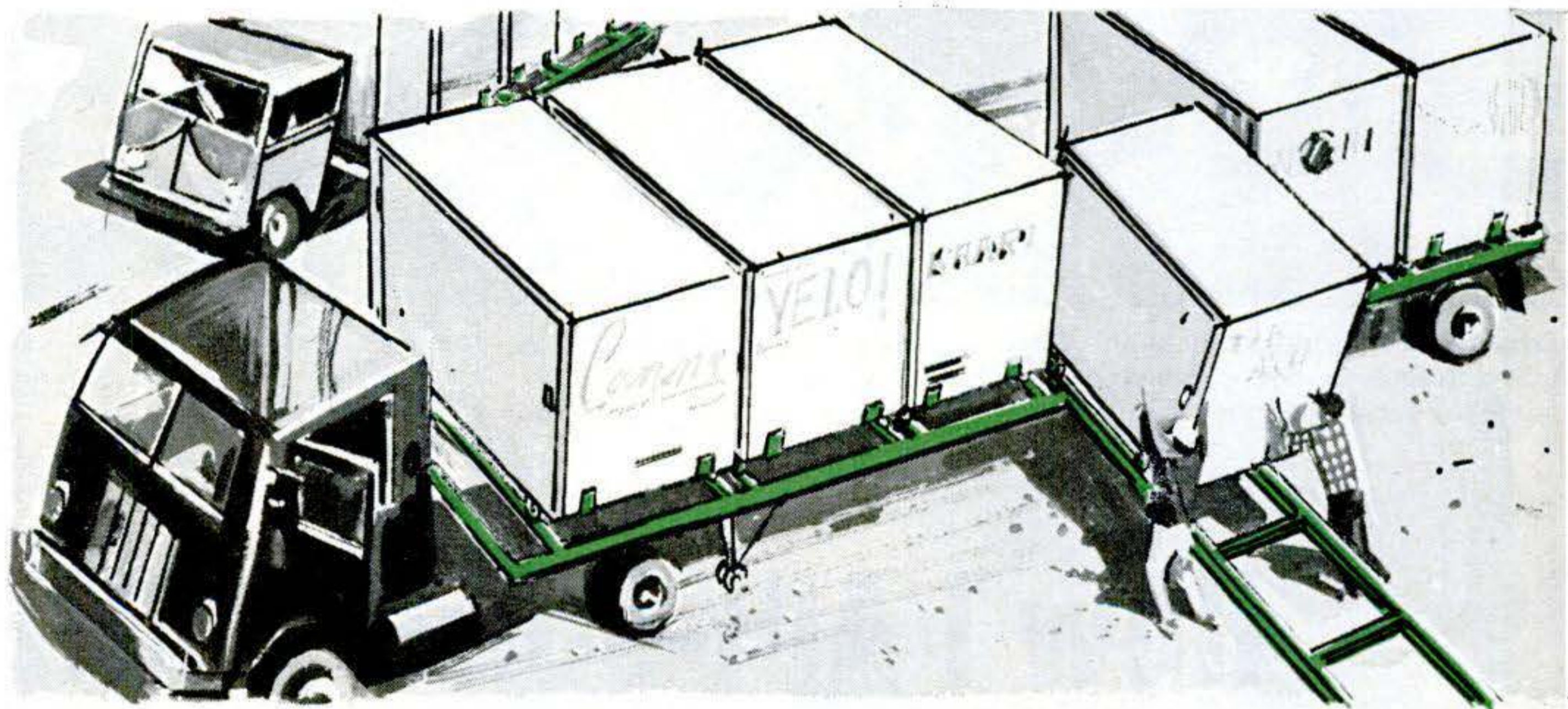
**Air pockets float waders.** Buoyant compartments in the upper part of this waterproof coverall ought to make life safer for a fisherman. They'd keep him upright and afloat if he stepped off a ledge or into a deep hole while fishing a stream, or they'd help him to keep his head above water if he lost his footing while casting in heavy surf. The chest-hugging air cells would restrict movement less than a life jacket.



**Boat stores its mooring line.** A mooring line would always be handy yet never underfoot if it were in a recess in a boat's hull. The ends of this pulleyed line would run out through openings in the covered and vented storage compartment. Springs would retract the line when it wasn't in use, but crimped-on balls would hold the ends where you could get at them easily.



**Fluid pressure locks rivet.** Air or liquid inside this hollow, sealed rivet would cause the shank to flare out when pressure—or a blow—was applied to the head, eliminating need for an anvil. In some forms, the rivet might be inflated by a syringe or air hose, and with certain materials, it could be deflated for easy disassembly of mechanical parts whenever necessary.



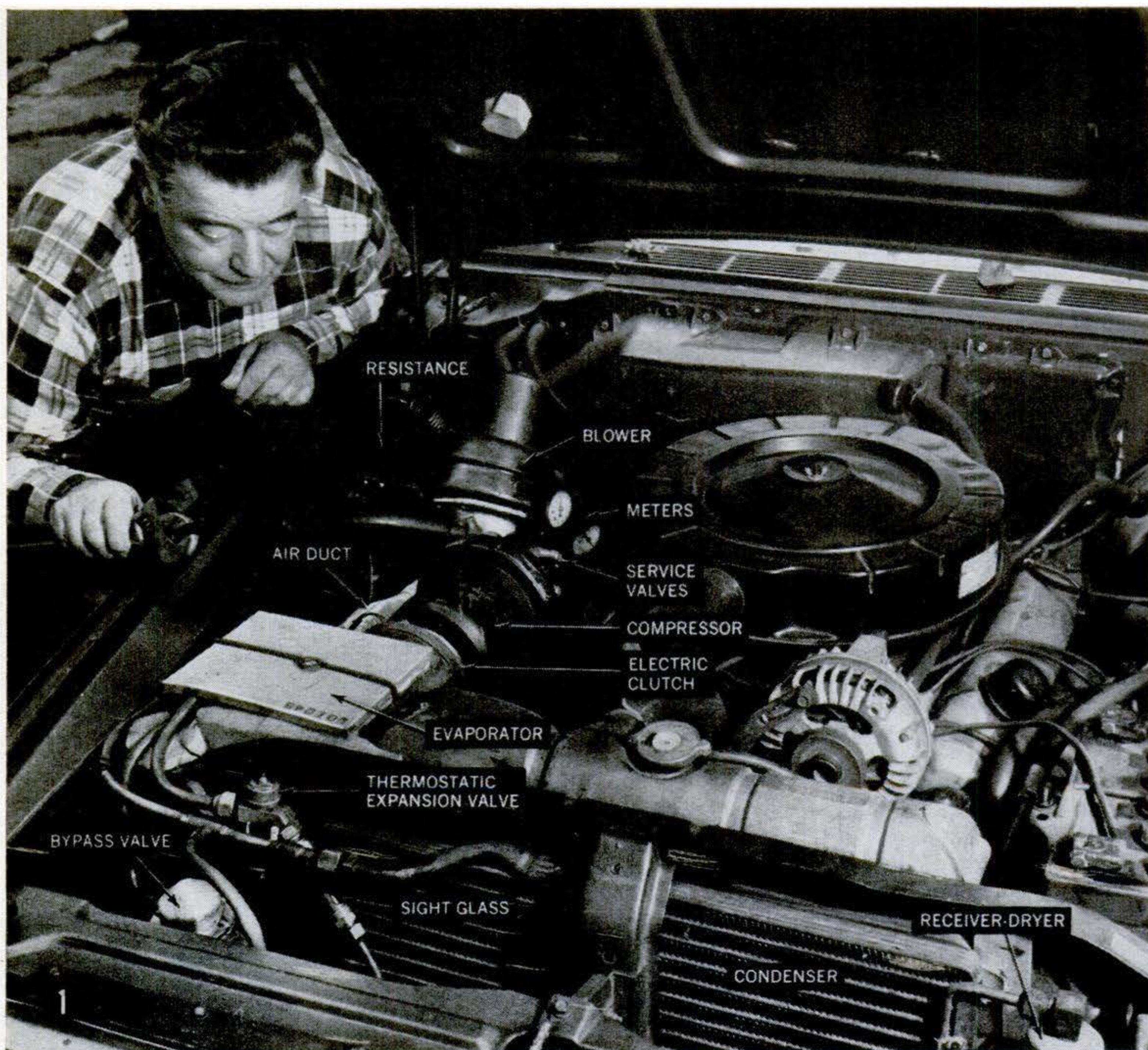
**Truck ramp unloads cargo bins.** A slidable ramp on this trailer for transporting bulk-container freight would give quick and easy access to individual cargo units. Regardless of the order in which the bins were loaded, any bin could be

removed for delivery. Tracks on the trailer bed would receive—and lock—the wheeled bins in a row. The top of the ramp could be moved along the edge rail of the trailer to line it up with whichever bin was to be moved out next.

*The following patents have been issued on these inventions: Hulled craft—No. 3,221,831 to C. W. Weiland, Palos Verdes, Calif.; Can spout—No. 3,169,678 to H. E. Wilkinson, Crystal Lake, Ill.; Waders—No. 3,154,800 to C. A. Anderson, Providence, R.I.; Mooring line—No. 3,129,688 to A. E. Buchholz, Kenosha, Wis.; Fluid fastener—No. 3,213,743 to R. A. Campbell, Oak Park,*

*Ill.; Cargo ramp—No. 3,168,959 to C. N. Chandler, H. W. Bryan Jr., and R. T. Roach, Nashville, Tenn.*

*Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.*



Ernest A. Zadig, mechanical and electrical engineer, takes a look at the completed installation of his home-built car air-conditioning system. A versatile

inventor, he is director of research for The Zadig Patents, South Norwalk, Conn. He has patented devices for radio, automobiles, and toys.

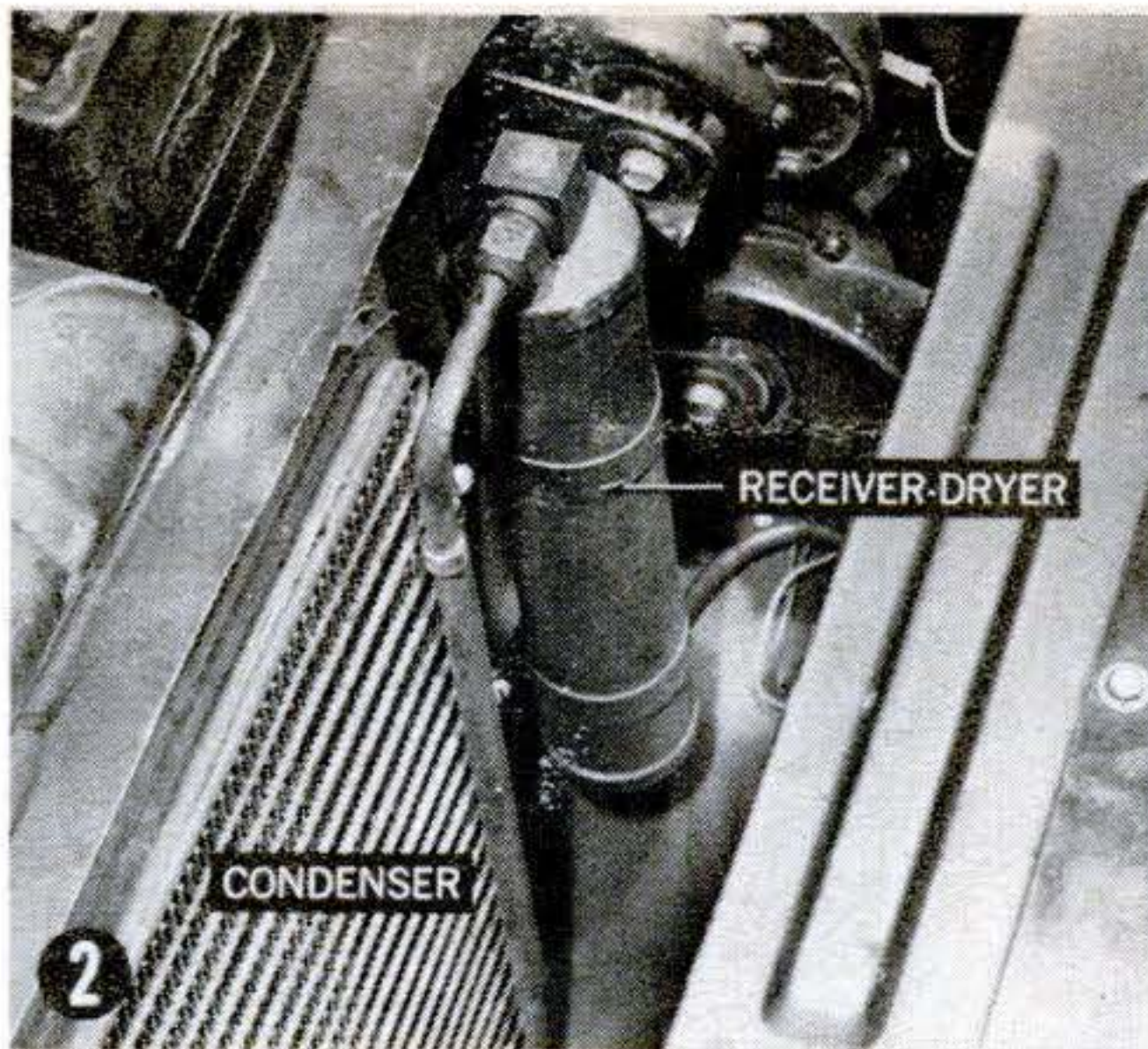
# How I AIR-CONDITIONED

Combine some scrounging in auto junk yards with

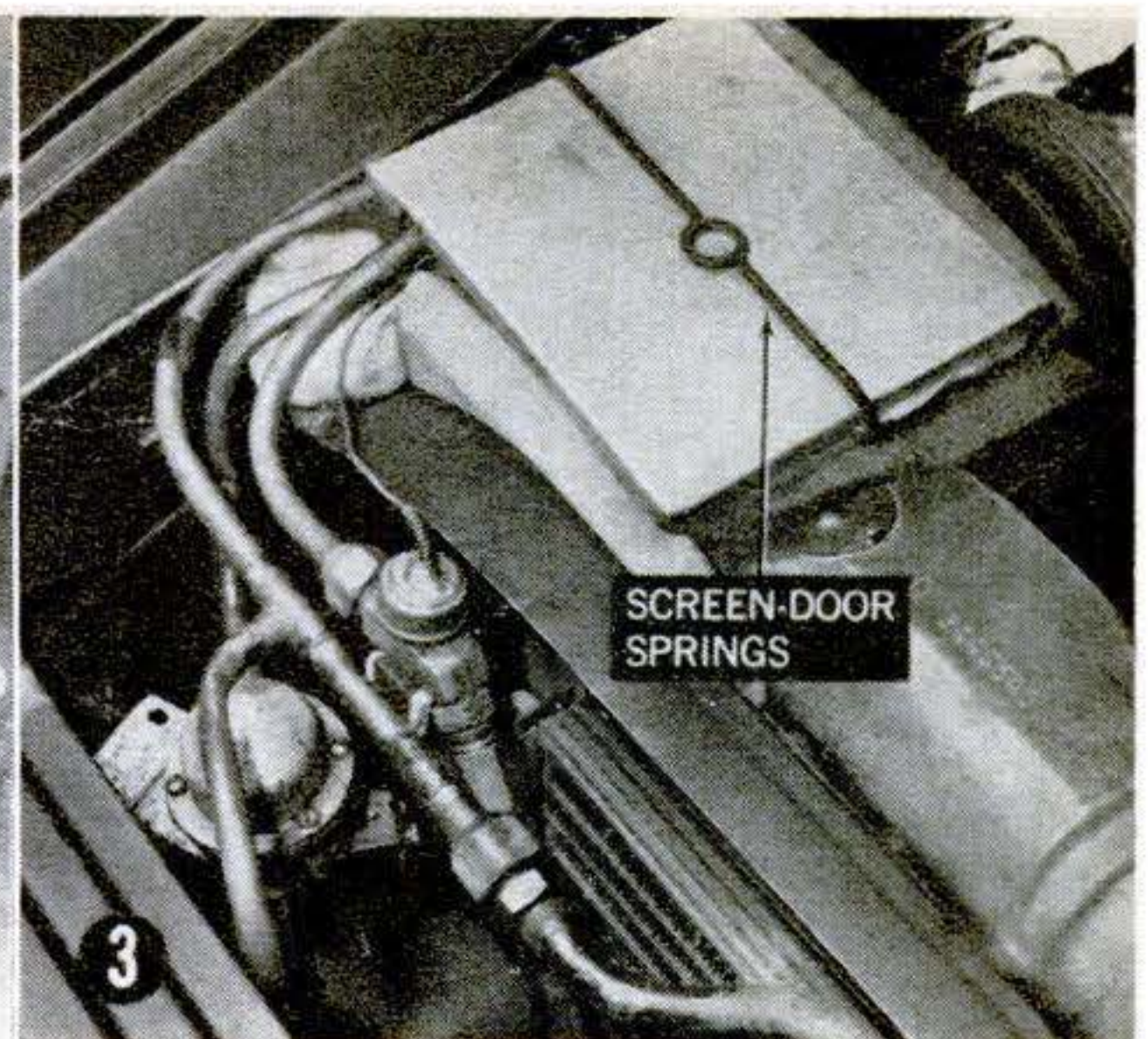
I air-conditioned my car for \$24.74. Now don't turn away, shrug, and say, "Well, maybe *he* could do it." You, too, can do it for just about the same amount of money if you are reasonably handy under the hood. It takes some scrounging around automobile junk yards plus only a smattering of basic air-conditioning knowledge.

For the scrounging, you're on your own, but the explanations that follow should give you the veneer of expertise sufficient for the installation job.

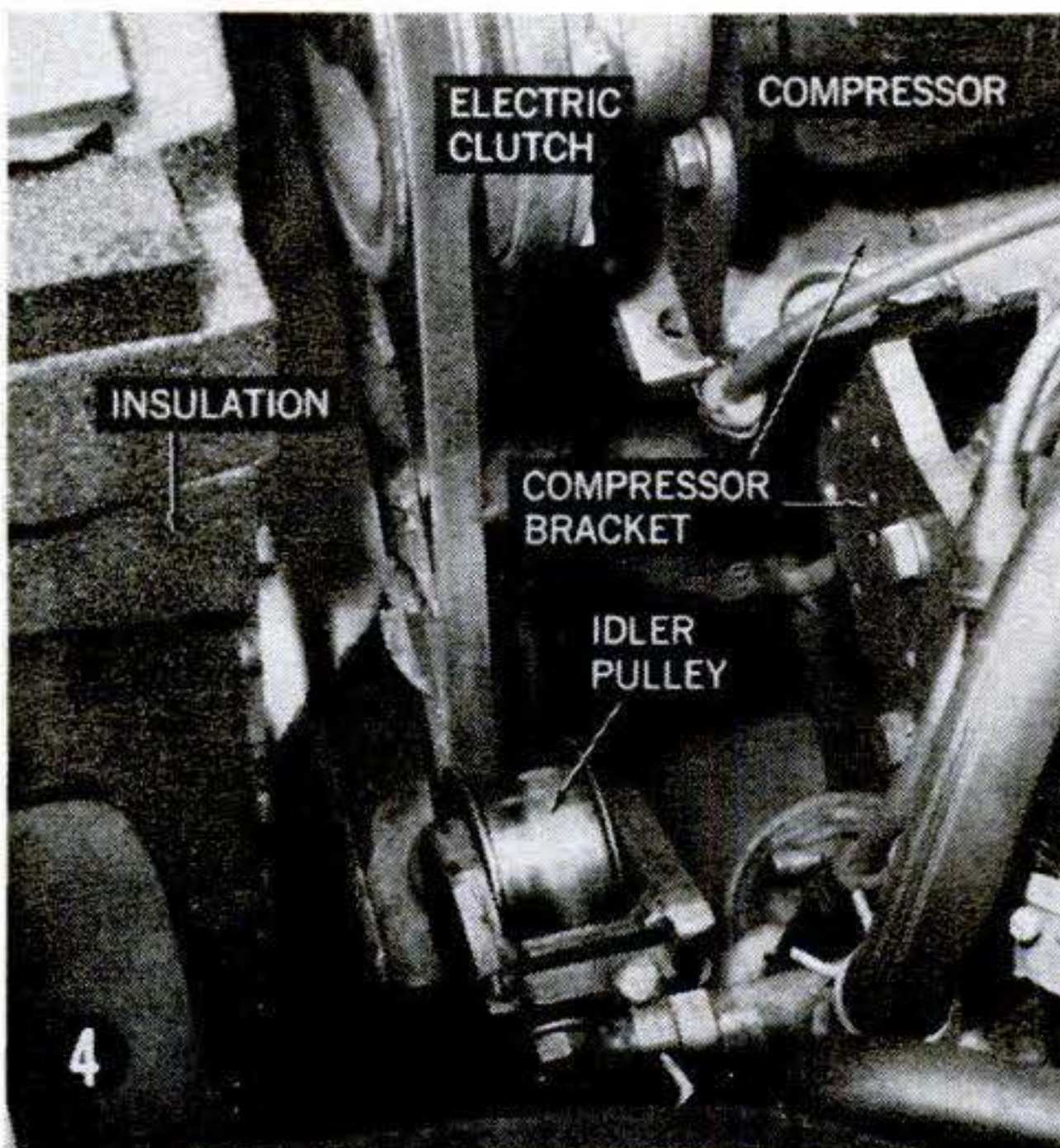
Perhaps the best place to start is with the basics of air conditioning. It is so easy to put heat into a car interior in winter with a simple little hot-water radiator that you



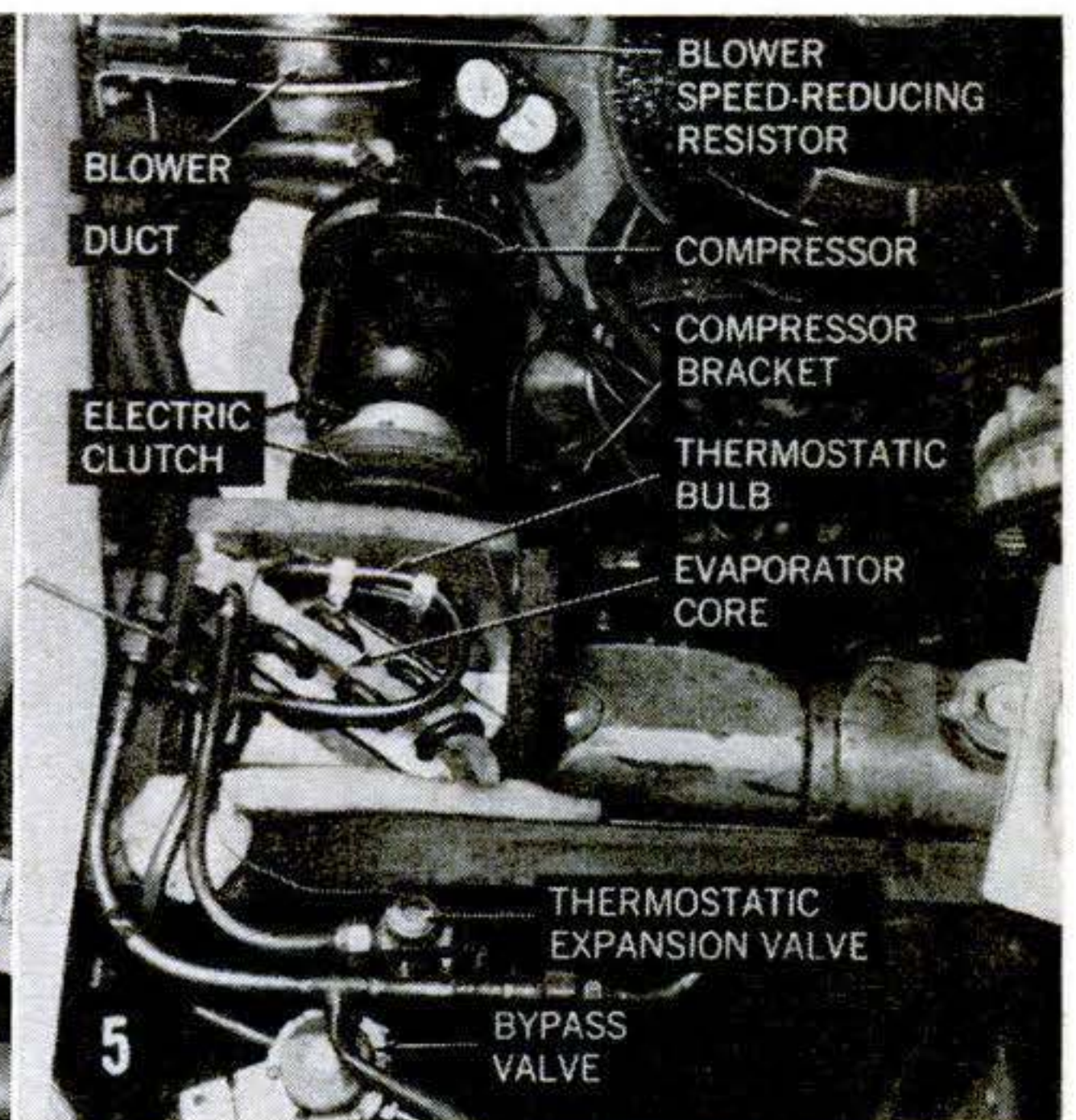
Bellybands fasten receiver-dryer to condenser (above, left). Condenser's top connection is to receiver-dryer, at bottom of which is a tube



to sight glass and expansion valve. Springs (right) hold evaporator cover housing. A tee links bypass valve to condenser output line.



Idler pulley between electric clutch, crankshaft (above, left) maintains belt tension. Insulation is vital. Note tubing connections



between units (right). Evaporator cover is off. Flexible hoses run to compressor. Expansion-valve bulb clamps to evaporator outlet.

# MY CAR for \$24.74

By ERNEST A. ZADIG

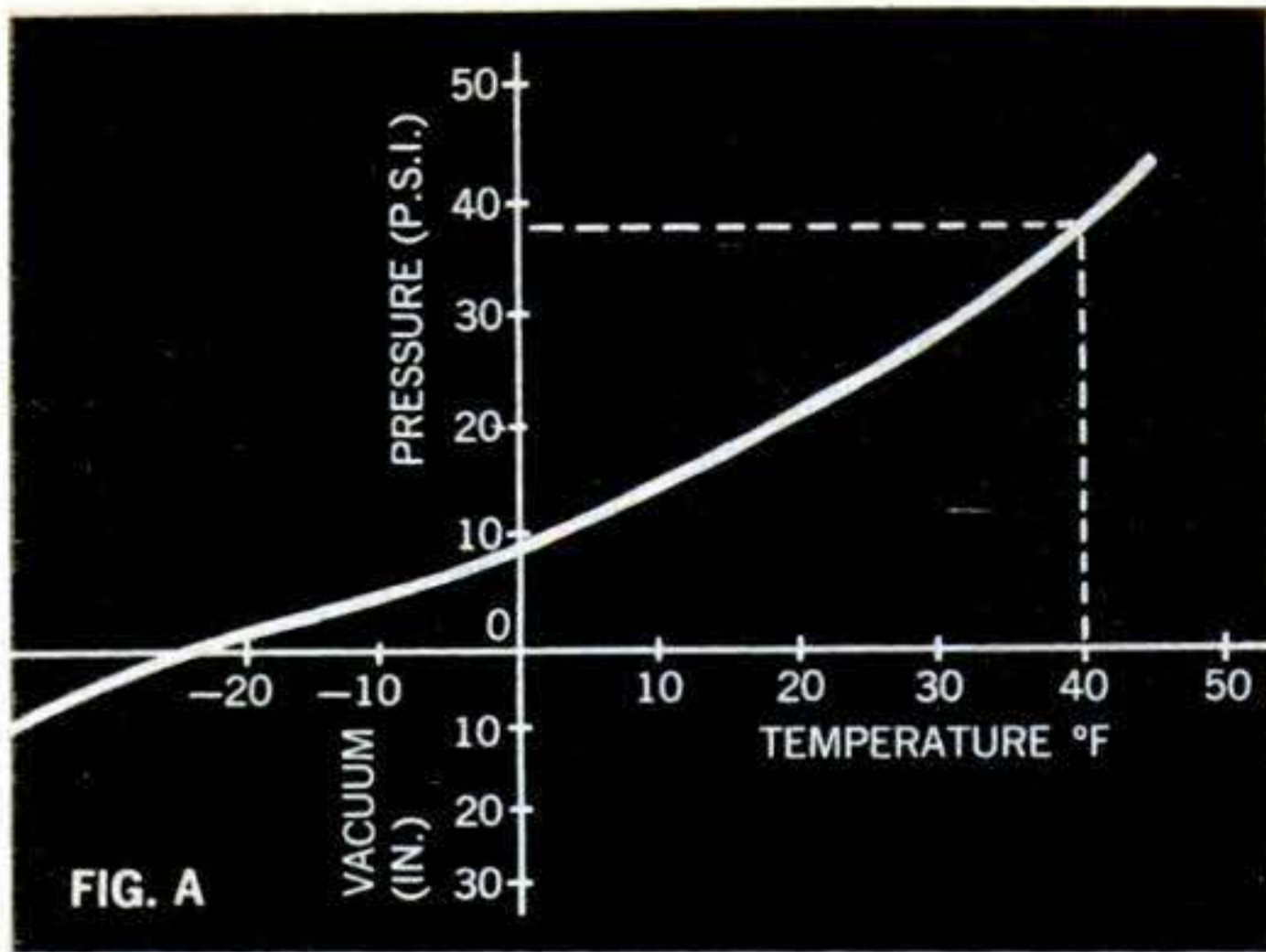
a little know-how, and enjoy summer comfort

may wonder why we can't similarly put in a little cold in the summer.

There's the rub! Cold is not an entity. Cold is the absence of heat. To make something cold we must remove its heat. The refrigerator does not add cold to your bottle of beer. Rather, the beer loses its heat to the refrigerator and thereby becomes cold.

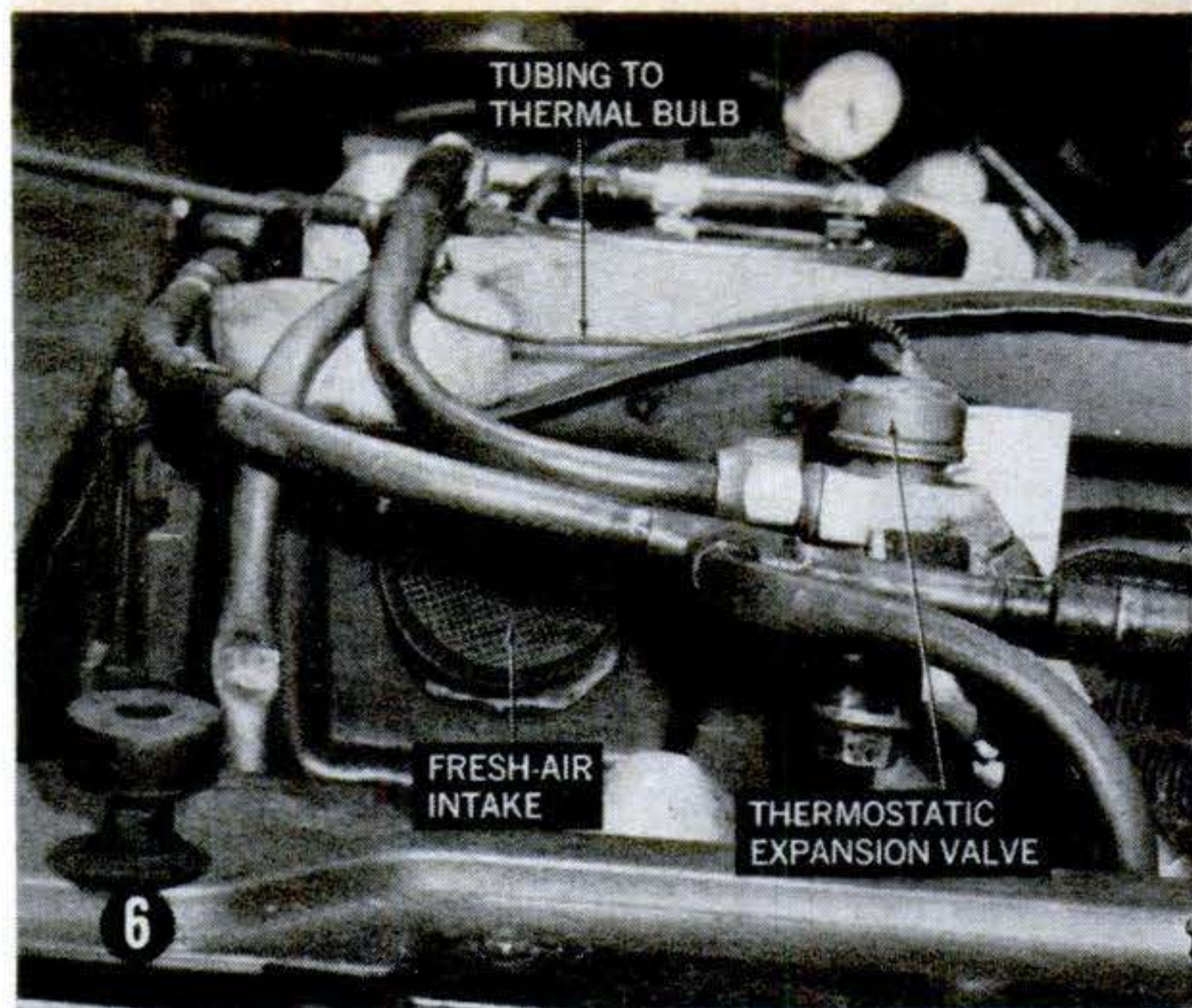
The refrigerator is colder than the beer, and this emphasizes another of nature's laws: Heat can only flow from a warmer to a colder body. With the interior of an air-conditioned car at 70 degrees and the outside air at 85, this law would seem to be violated. We appear to be bucking nature.

*Continued*



But that's where all the machinery comes in. Just as we force water uphill by supplying a pump and energy, so we pump the heat from the inside to the outside with energy taken from the engine. The transfer is made possible by a refrigerant gas called Freon 12 whose boiling point varies greatly with pressure and which can be condensed into a liquid under great compression. From fig. A you will note that it boils at 40 degrees when it is under 37 p.s.i. pressure—and still boils at an unbelievable 22 degrees below zero when the pressure is reduced to 0 p.s.i.

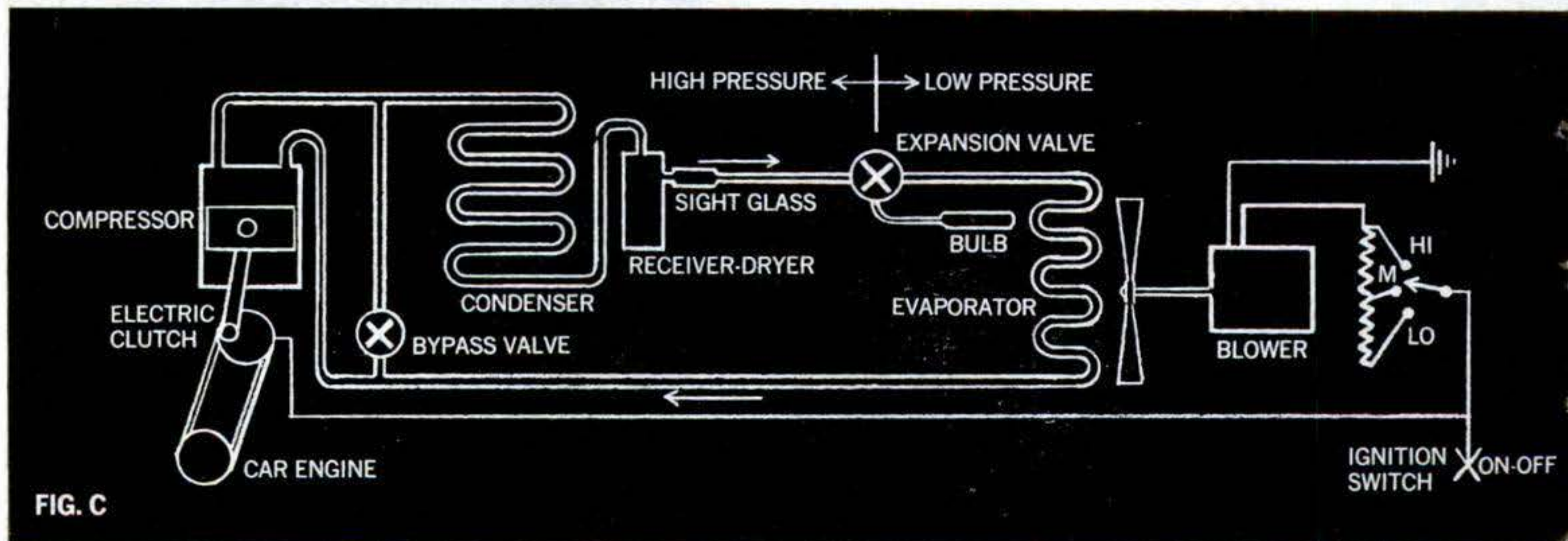
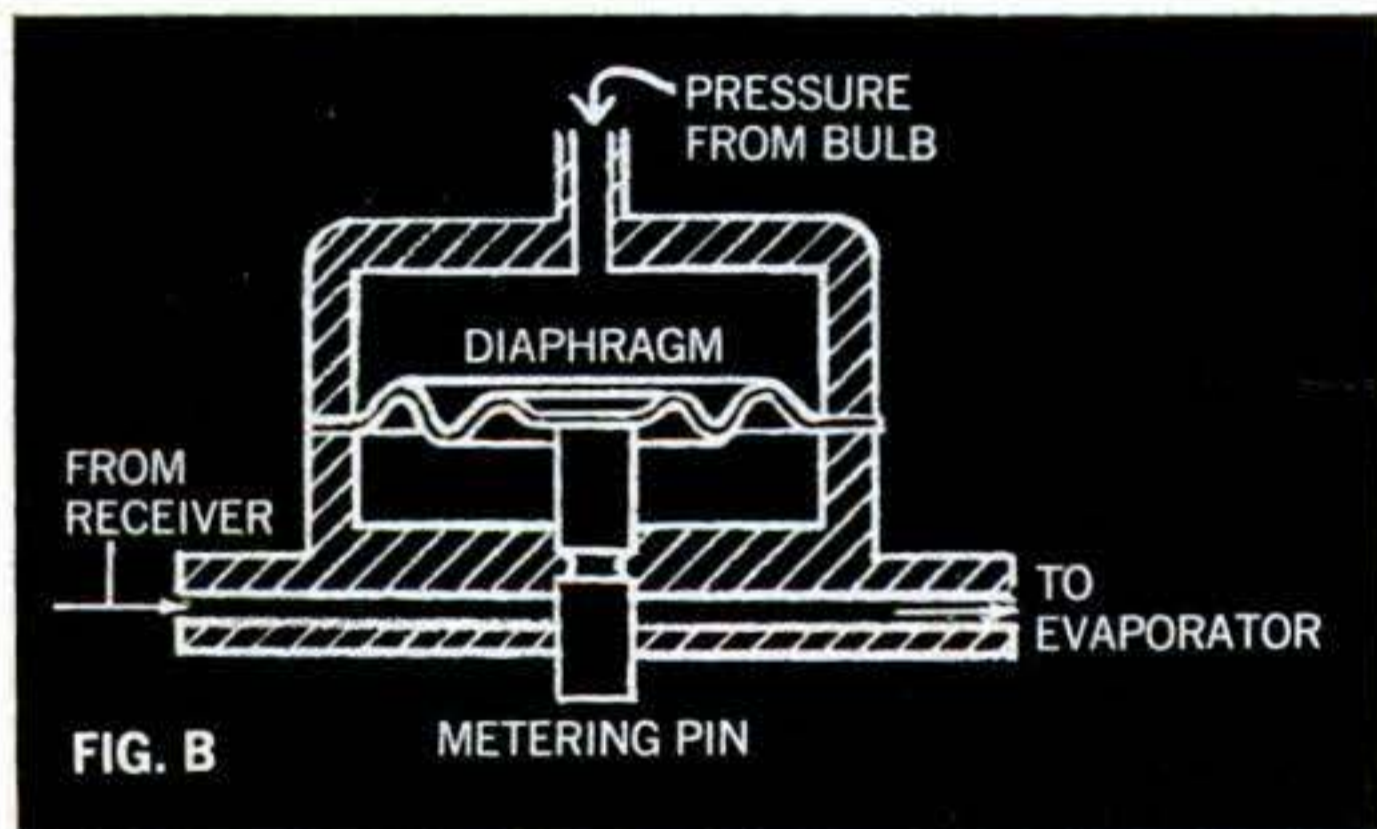
**How to boil Freon.** Just imagine water boiling at different temperatures. In order to boil, the water takes heat—from the gas



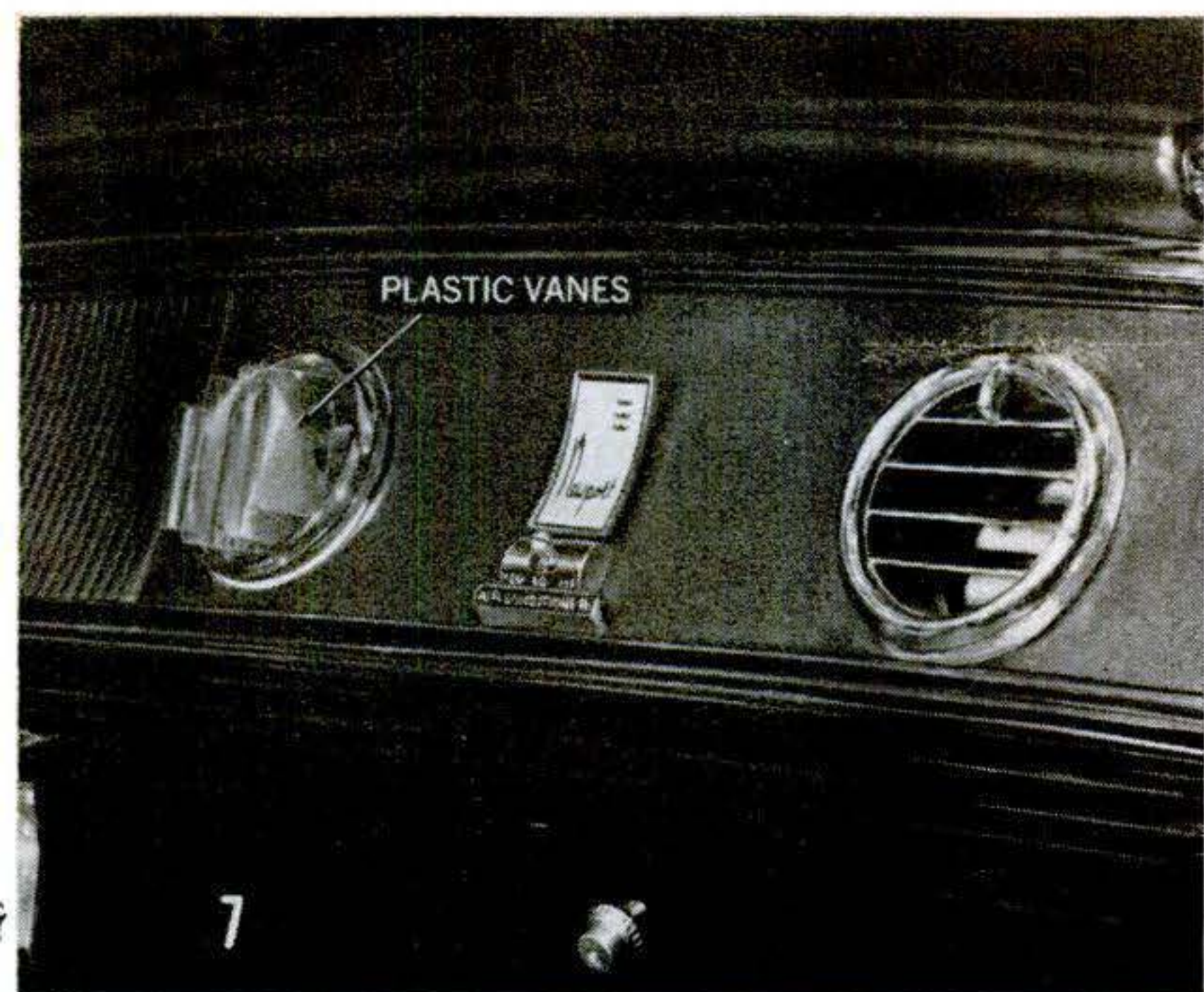
Fresh outside air comes through grille and enters evaporator housing through port shown. Forward motion of car adds ram action. Top from fruit jar covers port in winter to avoid unwelcome drafts.

flame of your kitchen range, say. For the Freon in the evaporator core to boil, it must take heat from the surrounding air in the car interior. The air gets colder and—*presto!*—the car is cooled. The only requirement is to keep the Freon moving under the proper conditions. That's what all the machinery is for.

Let us see why running Freon in an endless race should cool an automobile. The compressor is creating an area of very low pressure on its intake side. The expansion valve (see fig. B) injects a small amount of liquid Freon into this low-pressure zone and the Freon boils—as we know it must by looking at fig. A. To boil, it must have heat, and it takes this from the air. This heat is latent (hidden) in the boiled-off vapor. The vapor is sucked into the compressor and discharged at a very high pressure (and







Additional plastic vanes were epoxy-glued to standard cool-air outlets on left to direct plenty of cool air to driver. Both outlets turn to direct air. Switch at center is for hi-med-lo blower.



Standard flexible cloth tubing connects blower to panel. System's cost was as follows: junk parts, \$13; refrigerant oil, \$.75; Freon, \$4; belt, \$1.40; tubing and fittings, \$4.37; miscellany, \$1.22.

consequently high temperature) into the condenser.

We already know that heat flows from a hotter to a cooler body, and so this hot vapor in the condenser loses its heat to the surrounding air and condenses back to a liquid. The cycle has been completed, and can be repeated continuously. Reduced to its basics, we have pumped heat from the car interior to the hotter air outside by supplying energy.

**Theory into hardware.** Now, how did I do that \$24.74 job? Fig C details what happens and what makes it happen, while photo 1 (at the beginning of this article) depicts the actual installation. The compressor is driven by the car engine through an electric clutch. The condenser is attached in front of the car radiator, with the receiver-dryer (photo 2) next to it. The evaporator core in its housing (photos 3 and 5) is up front where it can get fresh air, with its expansion valve close by. The blower pulls outside air through the evaporator and pushes cooled air into the car.

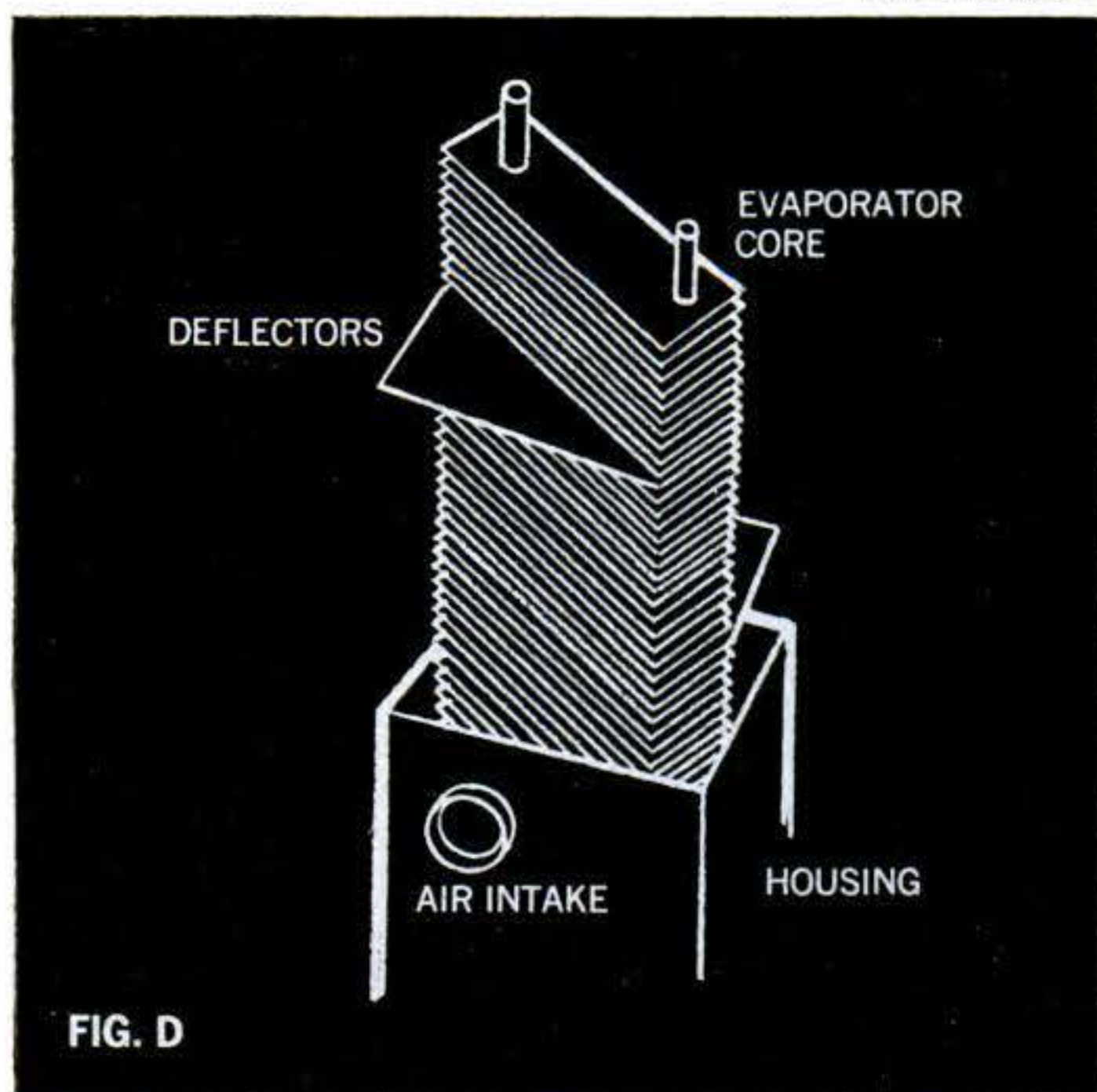
Photos 4 and 5 show pretty clearly how the compressor was installed. The front end of the right engine block had some convenient tapped holes. I welded a bracket from  $\frac{3}{8}$ " cold-rolled steel plate to match these holes and support the compressor. This unit is rigidly mounted; the provision for belt tightening is in the idler pulley, also shown in these pictures.

A word of caution on driving a compres-

sor on an automobile: Under no circumstances use the belt and sheaves that run the power steering. (Cars equipped with power steering are almost impossible to steer without power. A break in this drive caused by compressor load could cause trouble.) In my case, I added a third sheave to the double-sheave pulley on the crankshaft and used this exclusively for air conditioning.

The evaporator can also be seen in these photos and is detailed in fig. D. It is placed way up front against the bulkhead and next to the radiator. The fresh-air intake is shown clearly in photo 6. The proximity of this unit to the heat under the hood neces-

*Continued*



sitates heavy insulation (photo 4). I used one-inch-thick foam cemented to the galvanized-sheet sides, top, and cover.

Of course, there is a bit of heat loss in this arrangement as against one in which the evaporator is inside the car. But in return I get a completely uncluttered car interior. Another bonus is constant fresh cooled air, not recirculated cigarette smoke.

You may wonder why I included the bypass valve. It would seem that the best and fastest way to get air cold is to have the evaporator *real* cold, say down around zero. Here nature again shows up to make things tough: Air contains moisture, and moisture freezes at 32 degrees. If we had the evaporator at zero, it would soon be a mass of frost blocking all air passage.

The bypass valve acts as a monitor over the evaporator. When the evaporator pressure drops to approximately 29 p.s.i. (equivalent to freezing, see fig. A), the bypass valve opens and prevents the expansion valve from feeding more Freon.

**Drying the receiver-dryer.** One problem I found with junk-yard parts you may also encounter: Receiver-dryers off secondhand cars are seldom dry. I solved this by setting the kitchen oven to 350 degrees and baking the unit for several hours.

I added some plastic deflector vanes on one outlet (photo 7), and used standard three-inch flexible cloth tubing (photo 8) to route my cool air into the car.

I got my system into operation myself, but you may elect to have a friendly refrigeration serviceman help you.

Air and Freon don't get along at all and even a tiny drop of water in the expansion valve will kill refrigeration. So the first thing I did was to pump the whole system down to a vacuum. This can be done by using an external vacuum pump, but I used the compressor itself, with the aid of the service valves. I turned the suction service valve all the way out and the discharge

service valve all the way in (see fig. E) and ran the unit for 10 minutes. This forced all the contained air out through the gauge opening in the discharge port.

This gauge opening was closed while the unit was still running by screwing the valve all the way out. A Freon can adapter was then attached to the intake service valve's gauge opening, the valve screwed in slightly, and the adapter valve opened—all with the unit running. As each can was emptied, the valve was closed, the can replaced, and the business repeated. A small sight glass is built into most receivers (I used a separate sight glass for convenience, photo 1), and as you fill you will see the bubbles of refrigerant go by. When the bubbles stop, the system is full. The biggest caution here is to have a complete vacuum before you start filling. Without this you are just wasting Freon.

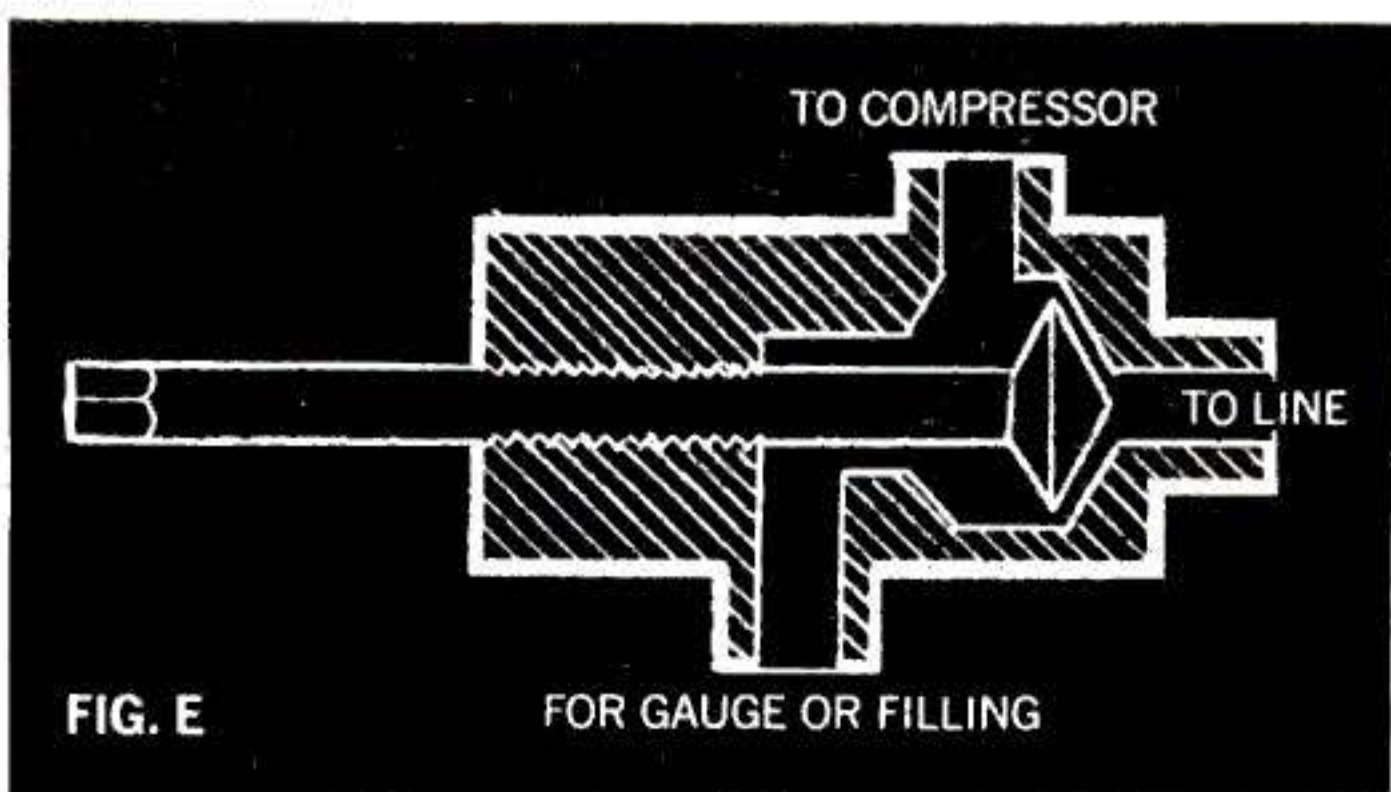
**A caution.** Freon is nonexplosive and nontoxic, but nevertheless handle it with extreme care. This means goggles at all times. Freon vaporizes (boils) at such low temperatures that a drop on the eye will freeze the eyeball, and any spilled on the skin will cause a "burn."

The parts for the air-conditioning system need not all come off the same car: Units from different installations can generally be mixed for a new setup. In any case, the manufacturer's air-conditioning manual for your particular car (available at your dealer) will prove of inestimable help.

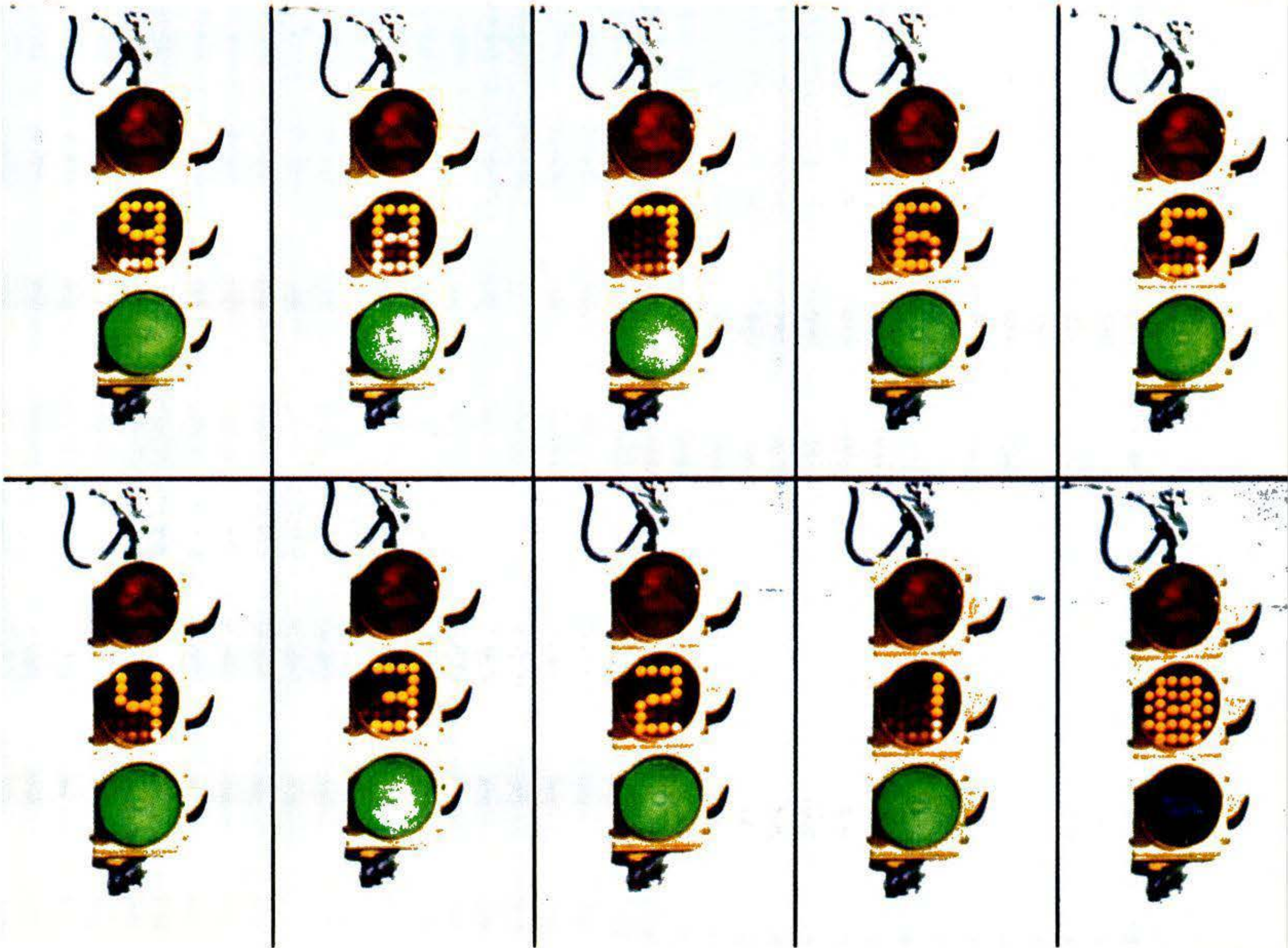
A few final parting words: Use only special refrigerant oil (#300)—never lubricating oil—in the compressor. Make all tube bends with bending springs and all tube flares with a flaring tool. Always smear refrigerant oil on all threads and surfaces before making connections. Have everything tight, and fear leaks more than you fear the devil. I pressured-up the system with air (no Freon), applied soap solution to all connections and looked for bubbles with the fervent hope of finding none.

The secret of good soldering is shining both faces of the joint with emery paper, applying a thin coating of flux to each, and then heating with a propane torch until solder touched to the crevice flows in by capillary action.

When you roll those windows up and drive in cool, silent comfort on a red-hot day, it will all have been worth it, and you will smile smugly when you think of the \$400 saved over a factory installation. **PS**



## Countdown traffic light ticks off seconds



A traffic light that ticks off in visible numbers the last nine seconds before changing from green to amber is in use at a busy street intersection in Abilene, Tex. Computer-like printed circuits operate a bank of 28 tiny, bright bulbs behind the amber lens of the center section, turning them on and off in sequence to number the seconds in the countdown. Built by James L. R. Hines, president of Abilene's Countdown Signal Mfg. Co., it has reduced accidents at the intersection by 48 percent, property damage by 62 percent.





A sun dial on the fire-pit cover tells you the time within a few minutes. The brick fire pit is an attractive setting for back-yard cookouts.



# How to Make a Sun-Dial Fire Pit

By JOHN S. LORR

**A**lmost everyone who likes a cookout has an outdoor fireplace, barbecue pit, or charcoal grill to do the job. But few have one that's as attractive an addition to the backyard as this brick fire pit with sun-dial cover. And you'll enjoy telling time by the sun. If you already have an outdoor fireplace or charcoal grill, you can build the sun dial as a cover for a sandbox or trash-can locker, or as a decoration for your yard or garden.

Build the fire pit as shown in the drawing below, at right. Forms for the concrete ring can be made from  $\frac{1}{8}$ " tempered hardboard or sheet metal bent into a circle and held in place by stakes hammered into the ground. Top the ring with long, slender, Norman-type bricks set in mortar. You can make the pit easy to clean by placing a small-mesh, heavy-duty metal screen over the gravel.

Make the pit cover from  $\frac{3}{16}$ " asbestos board such as Transite. Paint it with colorful outdoor house paint and, using a contrasting color, decorate it as shown farther on.

**Know where you are.** To make the layout for the hour lines of your sun dial, you need to know the latitude of your area. Latitude is how far north or south of the equator you are, measured in degrees of arc. You can find this out from an airport, weather station, or land surveyor near you. (While you're at it, find out the longitude and magnetic declination. You'll need this information, as you'll see later, to make changes in your sun-dial time to get the correct standard time.) Refer to the instructions on "How to lay out the time lines on your sun dial," and draw a diagram like the one shown that corresponds to the latitude of your home.

Transfer your time-line layout to the

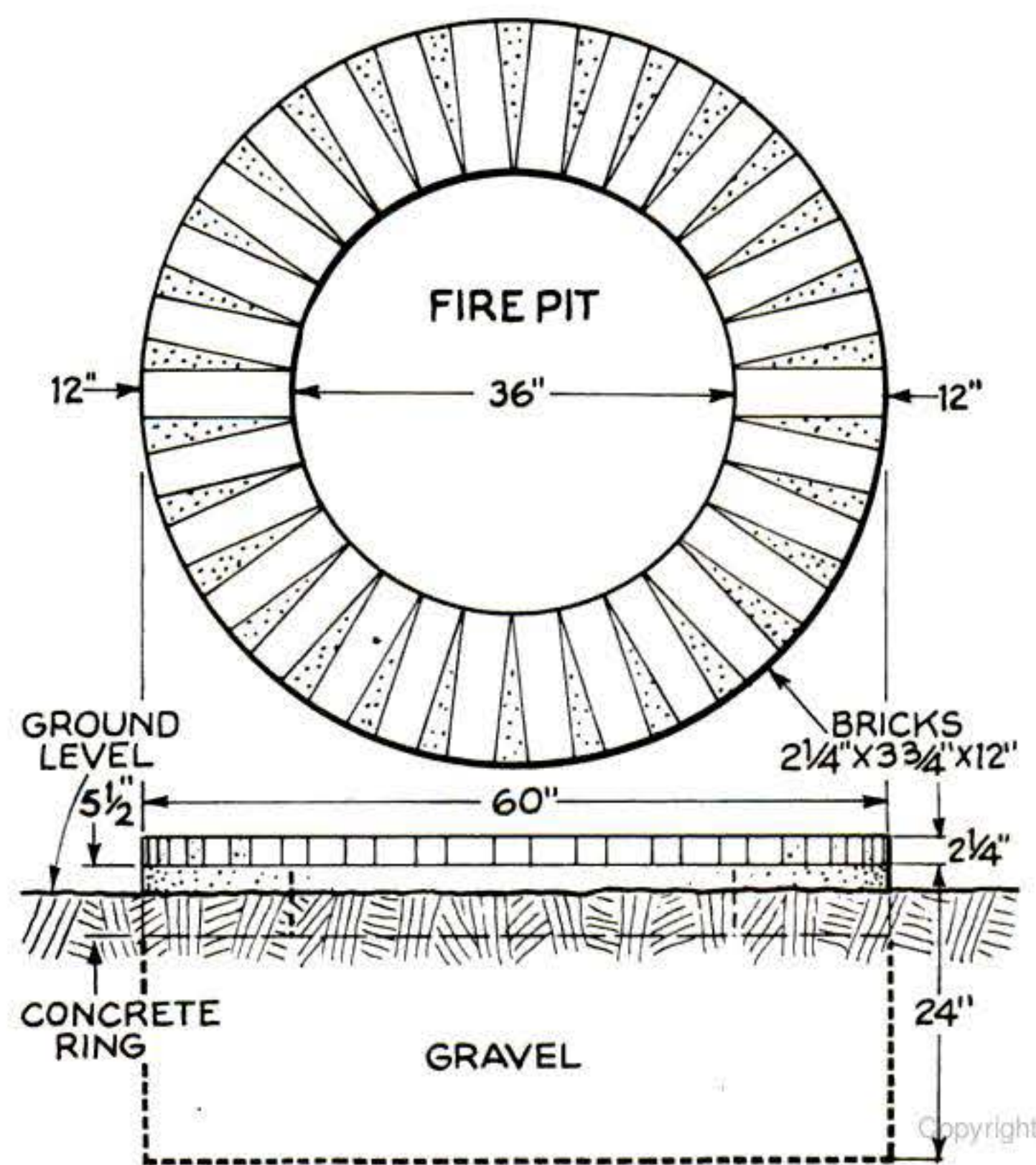
asbestos disk. Do this by fastening the layout paper to the disk with masking tape. Position point X 3" above the center of the disk. A tiny hole punctured in the layout paper at X will let you see that the points coincide. With a sharp pencil, punch small holes at each of the hour and quarter-hour positions, and make a mark on the asbestos.

Remove the layout paper and draw lines radiating from point X to each of the time points. Paint the time lines to contrast with the background color of the disk. If you don't want to draw and paint the numerals on the dial, you can attach metal or plastic house numerals you buy at the hardware store. The upright pointer on the sun dial is called the gnomon, and the shadow it

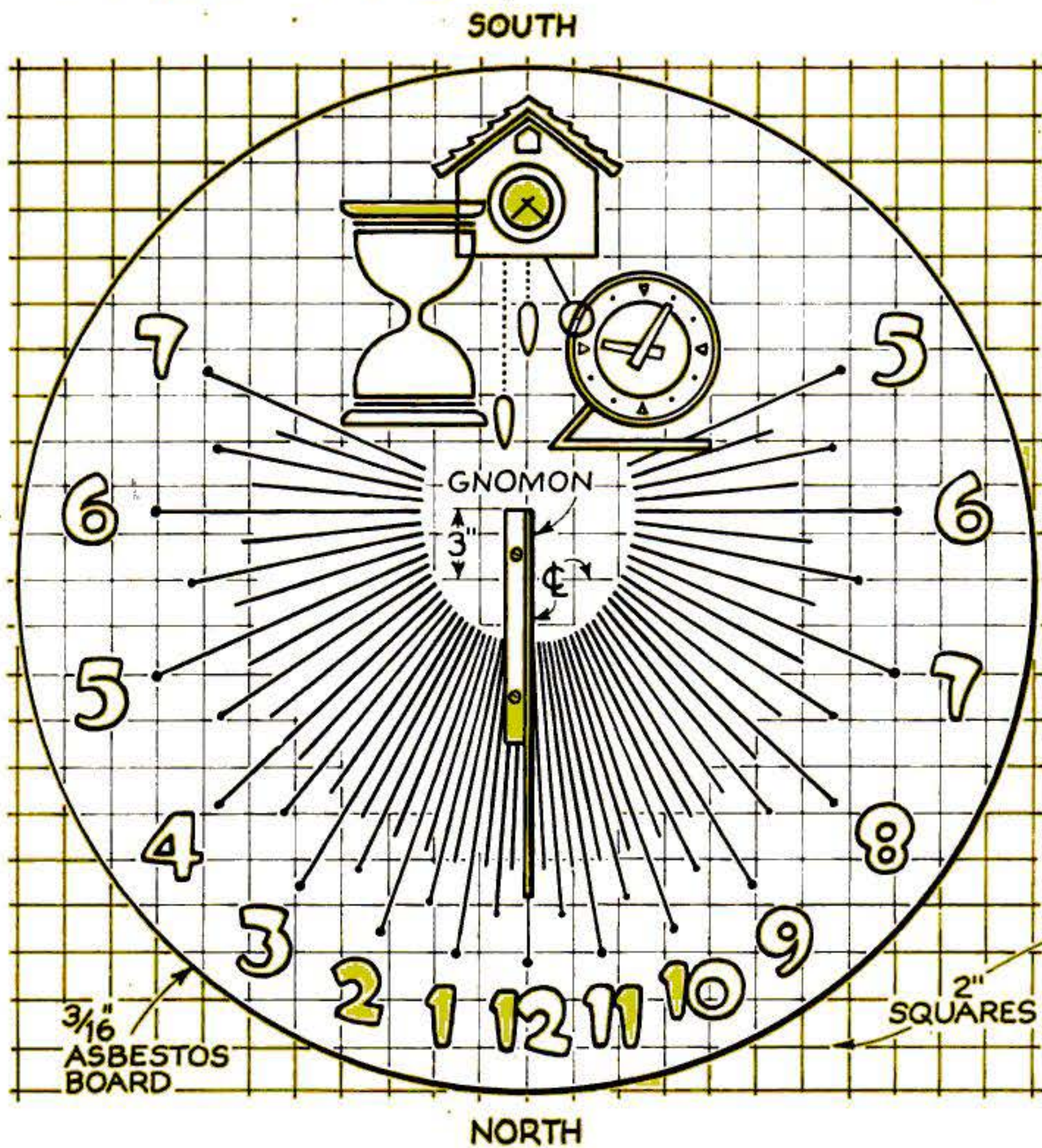
*Continued*

## Here's how to build a circular fire pit

Dig a circular pit 60" in diameter and 2' deep. Fill this with pea-size gravel within 3" of the ground level. Pour the concrete ring, and top it with Norman-type bricks in mortar, as below.

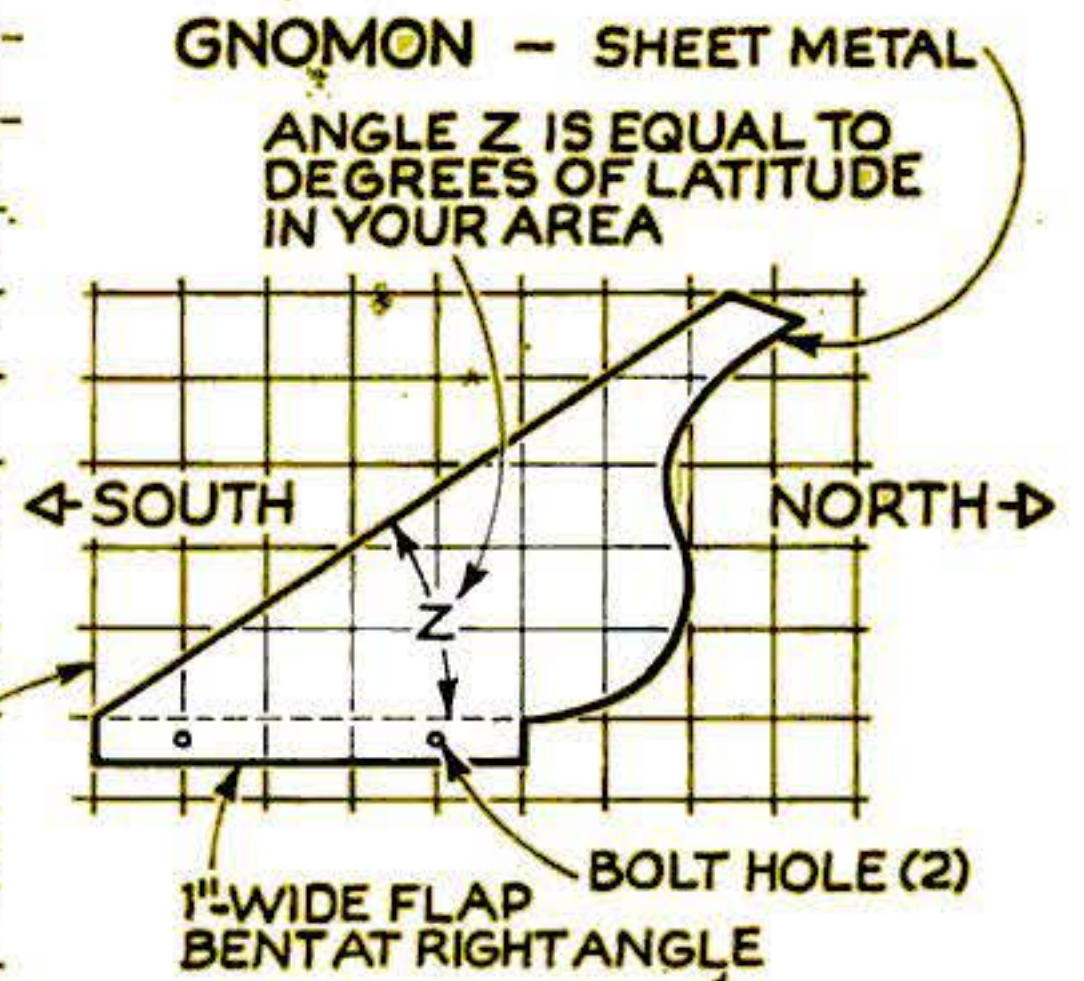






## How to decorate your fire-pit cover

Paint the 4'-square asbestos board with outdoor house paint. Lightly pencil in the 2" squares, then cut out the circle. Transfer your timeline layout to this, and paint on the decorations as at left.



have to make a couple of calculations.

First, you have to add or subtract a few minutes depending on the time of the year. The reason: The sun's speed is a little faster at some times of the year than at others. Averaging it out, we get something called mean solar time. Sun-dial time and mean solar time are the same only on April 15, June 14, September 1, and December 25. On any other date you'll have to make a correction. Use the table showing the difference between mean and apparent solar time to do this. Estimate what the correction should be for the days not listed.

**Making other corrections.** Then you have to make a correction for the longitude of your home. You must add four minutes to your sun-dial time for every degree of longitude you live west of, or subtract four minutes for every degree east of, the center meridian of the time belt in which you live. The center meridians are: Eastern Standard Time, longitude 75°; Central Standard Time, longitude 90°; Mountain Standard Time, longitude 105°; Pacific Standard Time, longitude 120°. For example: San Jose, Calif., where I live, is located on longitude 122¼° (2¼° west of longitude 120°), so I add nine minutes.

And don't forget to add an hour if daylight saving time is in effect.

Don't let all this juggling of time discourage you. With a little practice, you'll be able to tell the correct time within a few minutes. And that's close enough. Anyway, it's just for fun; you're not going to use your sun dial to time the steaks cooking on the fire pit, or to make sure you don't miss the 8:06 train to work. **PS**

## Correct your sun-dial time by this many minutes

*Figures show difference between mean and apparent solar time on the dates listed.*

<b>Jan.</b>	<b>May</b>	<b>Sept.</b>
1 +3.5	1 -3	1 0
10 +7.5	10 -3.7	10 -3
20 +11	20 -3.6	20 -6.5
<b>Feb.</b>	<b>June</b>	<b>Oct.</b>
1 +13.5	1 - 2.5	1 -10
10 +14.5	10 - 0.8	10 -13
20 +14	20 + 1.3	20 -15
<b>March</b>	<b>July</b>	<b>Nov.</b>
1 +12.5	1 + 3.5	1 -16.3
10 +10.5	10 + 5	10 -16
20 + 7.5	20 + 6.2	20 -14.4
<b>April</b>	<b>Aug.</b>	<b>Dec.</b>
1 +4	1 +6.2	1 -11
10 +1.4	10 +5.3	10 -7.2
20 -1	20 +3.4	20 -2.5

## BEST FINISHES FOR WOOD

# COMMON PINE...

## 18 ways to improve its beauty

By JACKSON HAND


**P**eople who think that pine is for shelves and boxes and benches enjoy woodworking more once they make a simple discovery: Pine, treated with respect, is the most useful and versatile material in the woodworking world. Some of today's finest furniture is made of pine. Many antiques in

as if it has no finish at all, but protection is excellent. In time, the wood darkens naturally. (Clear Rez, Firzite, DuPont Penetrating Finish, standard penetrating floor finishes can be used.) Brush it on. Keep the wood wet with additional finish for about half an hour, then wipe it all off. *Do not allow these finishes to dry on the surface.* When woods are absorbent, repeat application after 24 hours.

**2. Satinlac Lightener** is a special lacquer formula that coats the wood without giving it a "wet" or oiled look. The color of the wood barely changes, although it darkens somewhat with time. Some porous wood may need two coats to seal it. The lightener must be overcoated with a regular lacquer, such as Satinlac. Don't put varnish over the whitener unless you don't mind the slight yellowing most varnishes give.

**3. White Firzite** is, in effect, a white stain. You brush it on, wait 20 to 30 minutes for it to penetrate, then wipe off the surplus. Softer grain areas absorb most of the pigment, so the grain is intensified. It is often used without further finish on paneling. For hard-wear areas, it should be topcoated with clearest, palest varnish, such as one of the good new satin-finish polyurethanes.

**4. Old wood**, which is naturally aged pine, looks gray and lifeless, but regains beautiful deep reds and browns under boiled linseed oil. It takes a few months in rain and sun to produce the aging, making this the slowest finish there is. But no other technique pro-



museums are pine. And the warmest, most friendly rooms in your neighborhood are probably sheathed in pine.

Most important, many of the *best* tricks in the wood finisher's bag will work on pine — and only on pine.

Just what can you do with pine? To find out, we bought some ordinary No. 2 pine shelving at about 26 cents a board foot and sawed it up into pieces of equal size. Then we applied a different finish to each piece.

You'll find the results in the color photos on the following pages. Each piece has a different look. Each was finished with a different material or process. Here's the data for each one:

**1. Penetrating resin** intensifies the colors in pine, emphasizes grain. The wood looks



duces this color. Application is the same as for penetrating finishes — which can be substituted for the linseed oil if you need the extra protection. Brush on—keep wet—wipe off all the oil on the surface. The oil finish must be re-oiled periodically or it gradually wears away. An alternative is to use the oil for color—let it dry a week or so, then topcoat it with a semigloss or flat varnish.

**5. Spatter finish** is one you'll see on many pieces of contemporary furniture. It produces the impression of a color since the eye blends the dots with the wood background. Apply it by dipping a brush only an eighth of an inch or so in paint, then flipping the paint on the wood. Practice on newspaper until you find the right dipping-and-flipping combination. Spatter finish is often a solid color applied over a stain of the same color.

**6. Green stain** is a non-wood color produced by using paint, thinned quite a bit, as a stain. Brush it on and wipe it off, with the same technique used for any stain. Most often used colors are blues, greens, and other "cold" hues you can't get in regular stains. Wall paints, thinned, are less sticky to handle than stain made from enamel.

**7. DuPont Fruitwood** is an example of dozens of wood-tone stains made by paint firms. Dealers have color cards showing their effect on various woods. Brush on, wipe off. Normally, you flow the stain on freely, to allow the wood to absorb all it will. In 20 to 30 minutes — or less, depending on depth of color desired — you wipe off all stain. For most finishes, the harder you wipe, the cleaner and clearer the color, since pigment remaining on the surface of the wood tends to cloud it.

[\[Continued on page 180\]](#)



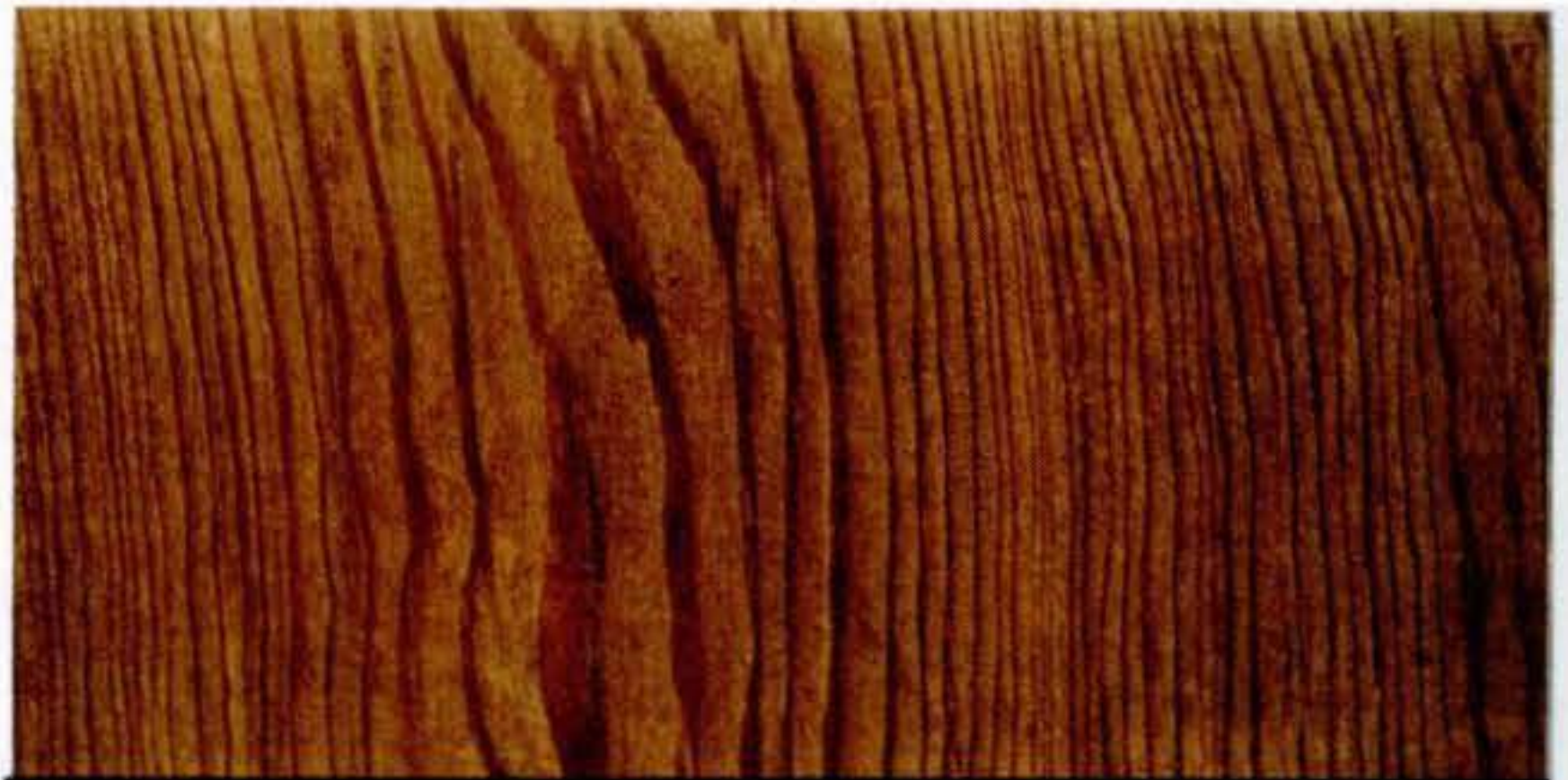
Cheap pine shelving was used for this reproduction of an early Colonial cupboard, stained with Colorizer English oak. To see 18 more pine finishes in full color, turn the page.

# 18 finishes for common pine

Each result that you see here calls for a specific material applied in a certain way. How-to instructions that make them simple begin on preceding pages



3. White Firzite



4. Old Wood



7. DuPont Fruitwood



8. Minwax Early American



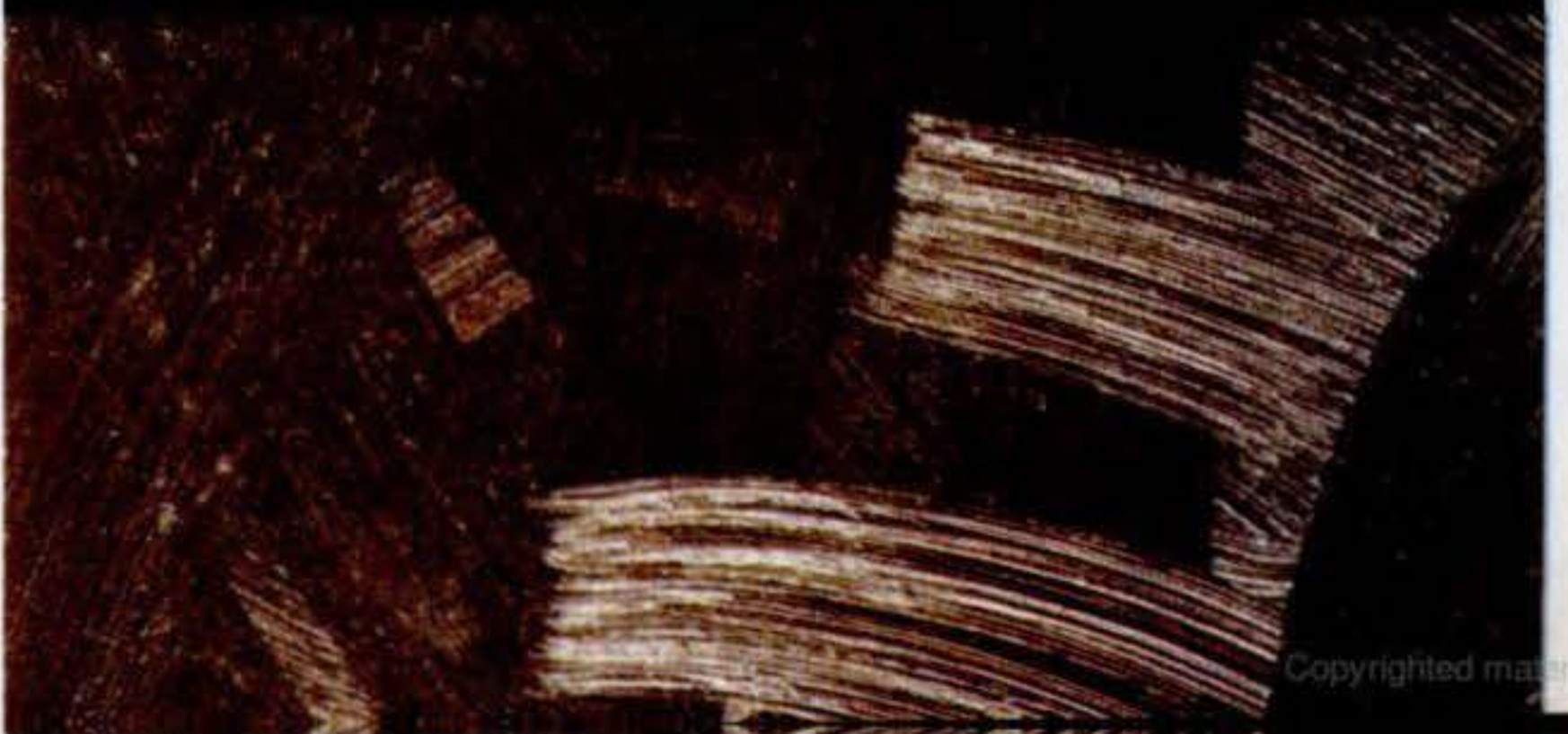
11. Even-Even Windsor Walnut


15. Bronze Stain



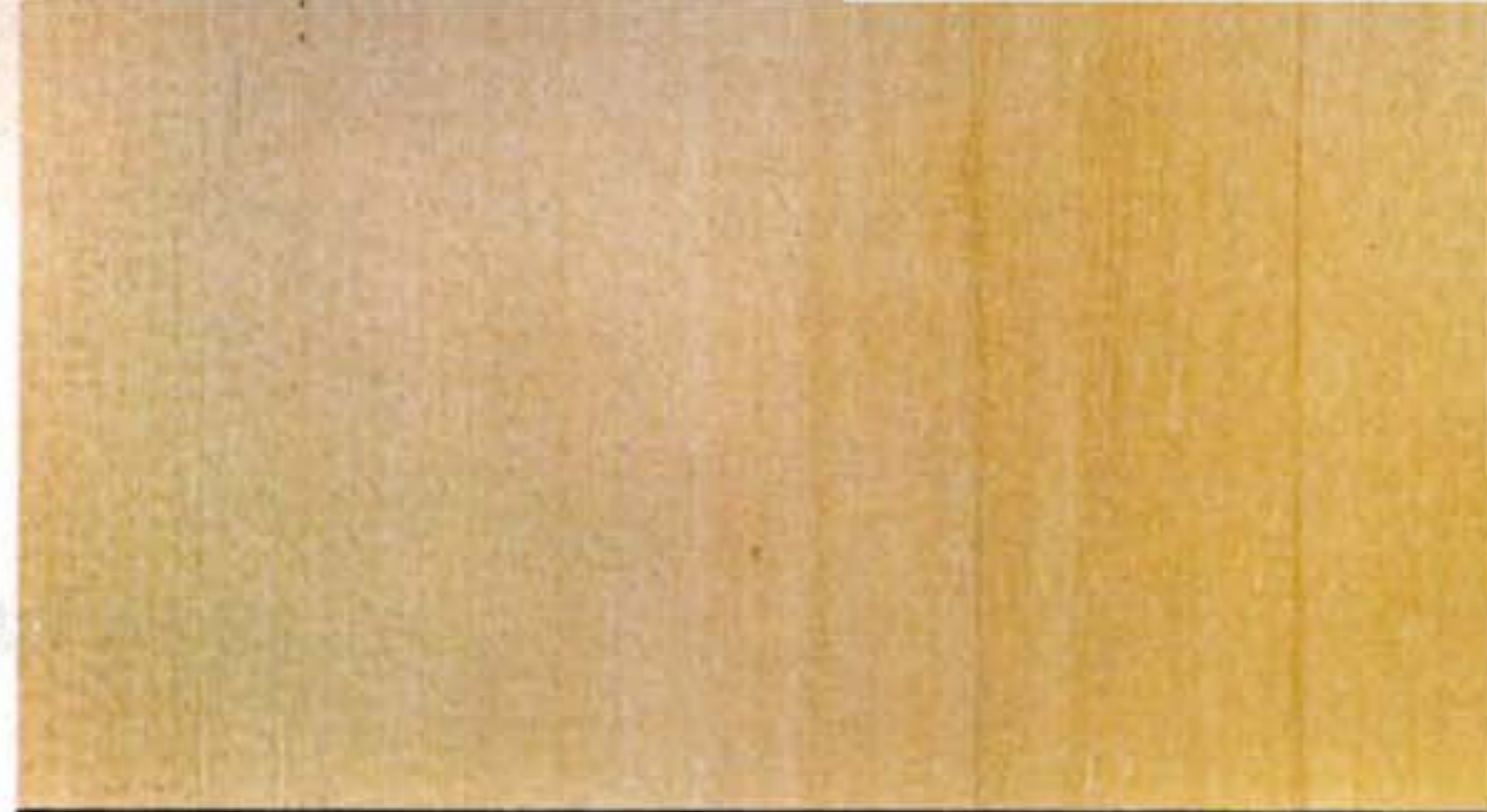
12. Deft Modern Walnut

16. Black Swirl






1. Penetrating Resin




2. Satinlac Lightener




5. Spatter




6. Green Stain



9. Minwax Ipswich Pine




10. Ebony Stain



13. English Oak

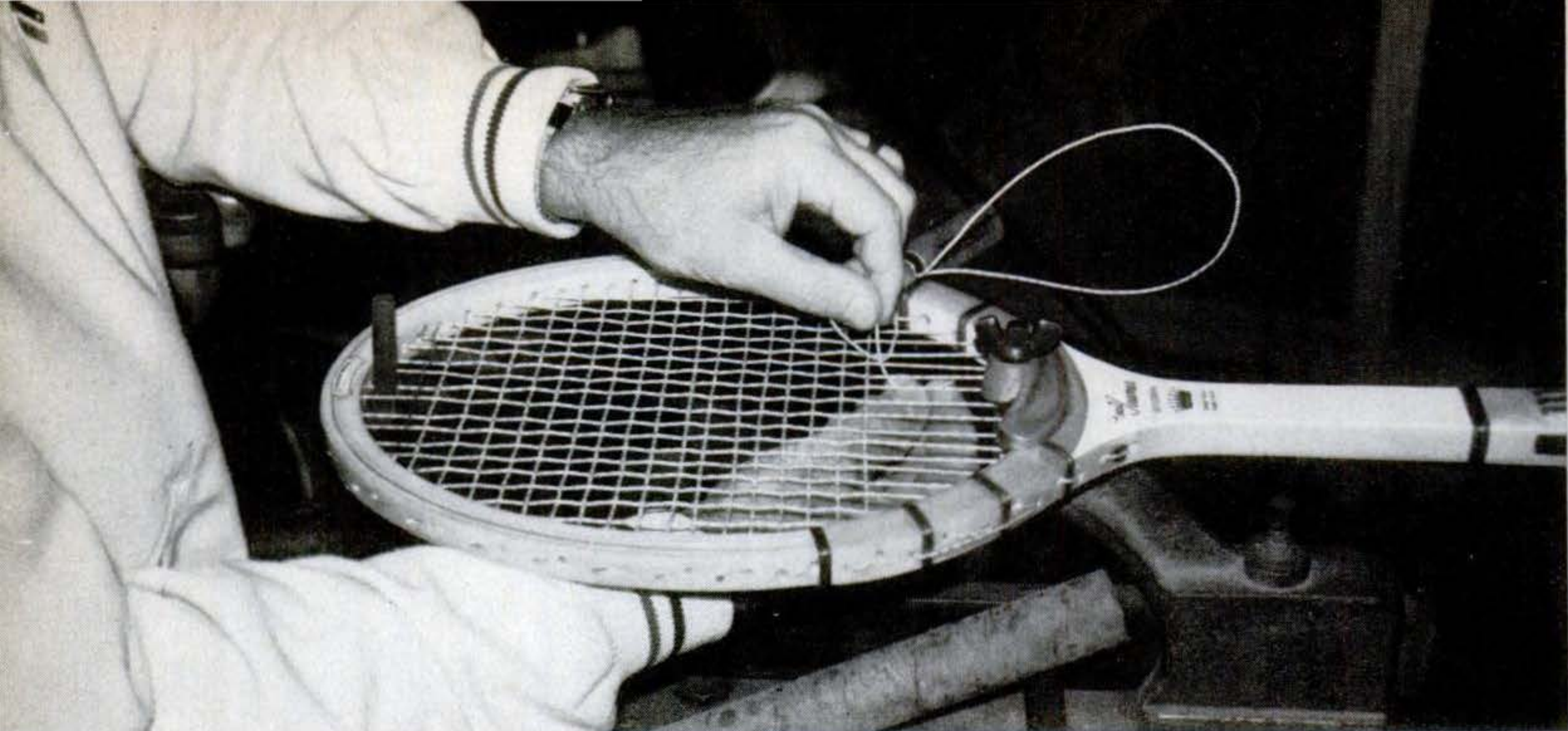
17. Scorched



14. Potassium Permanganate

18. Antiqued





One hand above and one below helps in weaving the cross strings. A shop vise will hold the racket for work. You don't need the two special clamps the pro uses above.

# Restring a Tennis Racket Like a Pro



Dowel, left, is used to pull the string tight. You can cut one from a broomstick. The awl, right, goes into the holes to hold the string after it has been tightened.

**Make a tightening dowel, sharpen four awls, clamp the racket in a shop vise, and you're set to save a bit of change**

By JOHN A. KRAFT JR.

If you're among the millions of Americans who play tennis, here's an extra tennis technique that's worth knowing: how to restring your own racket. You can do it yourself for about half of what a pro charges. Moreover, during the busy months a pro may take several days to get to your racket—lost days of playing.

To string a racket yourself, you use a vise to hold the frame, a dowel to tighten the strings, four awls to hold the strings, and shellac to secure the tie-off knots.

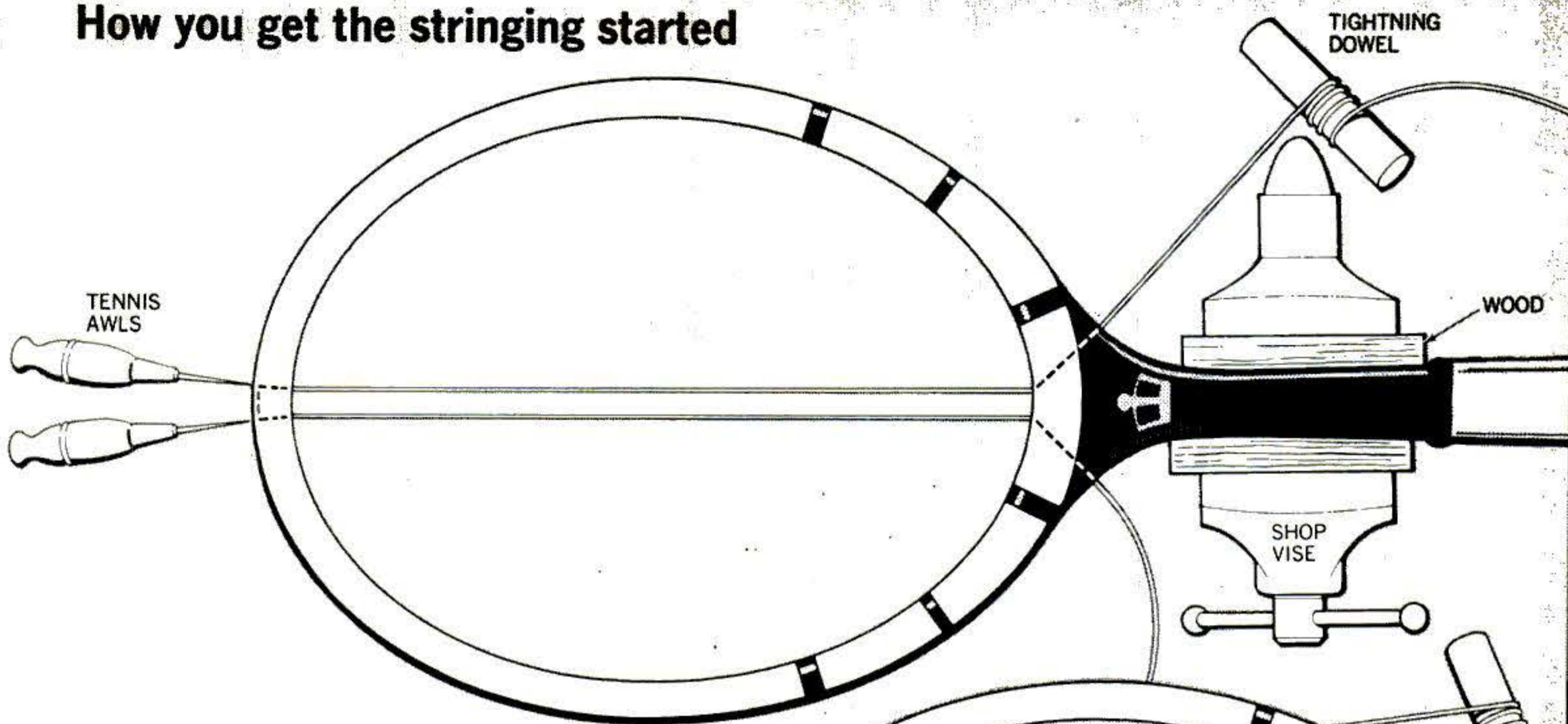
You can cut a dowel 6" to 8" long from a mop or broom handle. Coat it lightly with shellac, and wrap it with a leather grip from an old racket. If no leather is available, the dowel can be used without wrapping.

Tennis awls (needed to keep strings from slipping) have a point tapered finer than an ice pick. The taper makes it possible to insert the awl in a hole, between the wood and string, without cracking the racket frame. An awl costs about \$1.50, but you can make your own by grinding four ice picks to the desired taper.

Vise, dowel, awls handy, you're ready to select the

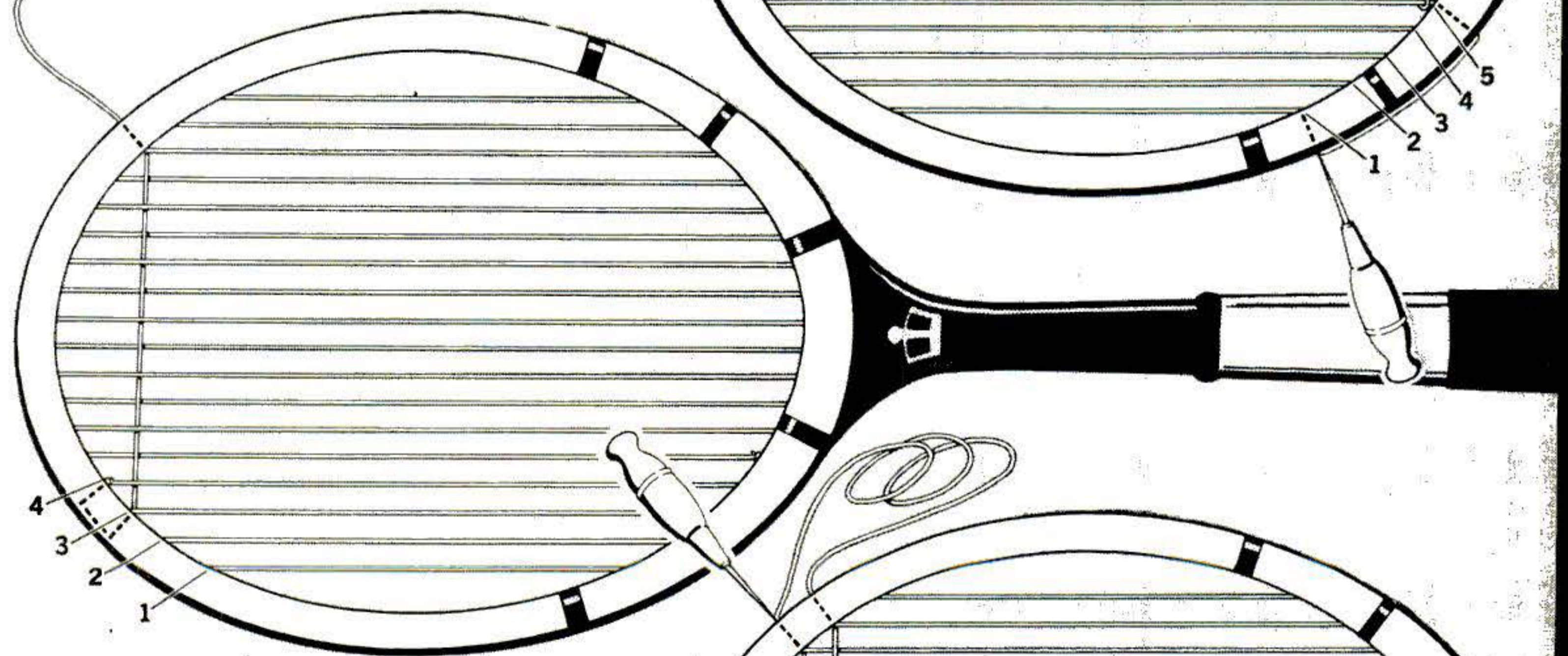
*Continued*

# How you get the stringing started



**1** With the 17'-long vertical string pulled through to even lengths (shoelace-style) and awls inserted at top to hold the string, you begin.

**2** When all the verticals are in, you tie off each side by knotting the 1st outside string around the base of the 5th string, as shown.



**3** In cross-stringing: The 15' length is tied on the 4th vertical and run through the 3rd string's hole. The string fits into grooves on border.

**4** Weave over and under the vertical strings, tightening, and using the awls as before. Hold fingers close to strings to speed it in and out.

strings. There are two types: gut and nylon. Most professionals agree that top-quality gut outperforms nylon. But the better grades of nylon play well, stand up under hard use, and cost a lot less.

Widely used today are "multiply," "pro-fected," and "vantage" nylons. They come in 35' coils. You can buy a coil of multiply from the pro or sports shop for \$2.50, pro-fected for \$3.50, and vantage for \$4.50.

**Which nylon will serve you best?** A lot depends on what you expect in performance. Multiply wears as well as higher-priced nylons, but hasn't the playing quality. If you want performance similar to gut, you have to spend a little more to get it.

Pro-fected can be bought in 15 or 16 gauge. Keep this in mind, because the 15 is a service weight. It stands up better, but it doesn't have the liveliness of 16-gauge nylon. You'll have to decide which is more important to you. A beginner may be satisfied with the service weight. An advanced player should appreciate the lighter string.

Vantage is available only in a tournament gauge; it's not likely you'll need this.

When you've made your choice, remove the old strings from your racket with a sharp blade. Cut down the center, then across the racket face. Push the strings outward so you can get an awl under them.

Be sure that your work area is well lighted. You'll have to see clearly through the openings in the frame to insert the awls without damaging the strings. This is especially true when there are two strings in the same hole, and you have to examine for an opening between the string and frame.

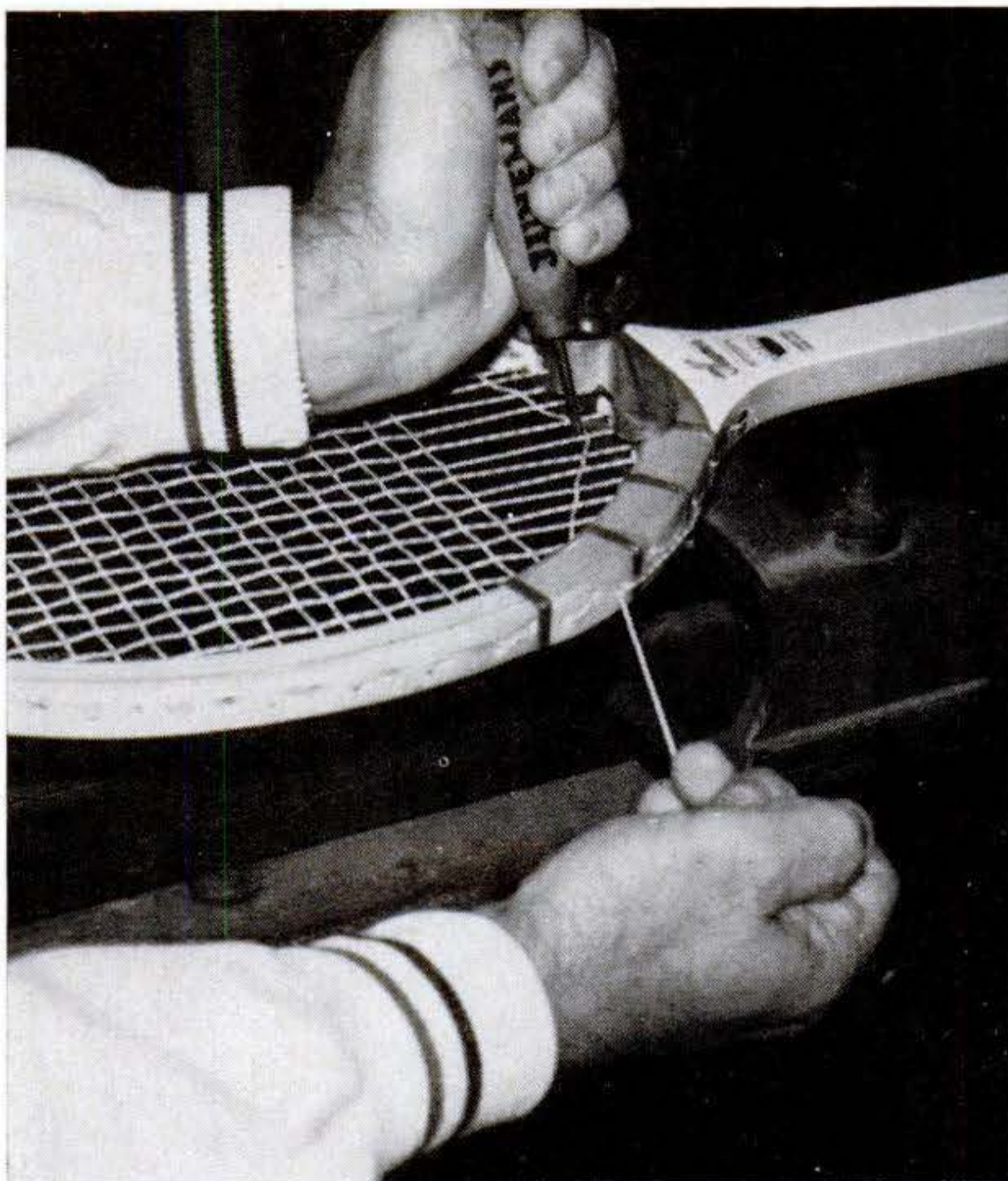
Count on your first restringing job taking a couple of hours. You'll soon pick up speed, however.

How tight should the strings be pulled? Manufacturers of the nylon recommend tension up to 60 pounds. Satisfactory pressure can be obtained by tightening each until a high ping is produced when the string is flicked with the fingertip.

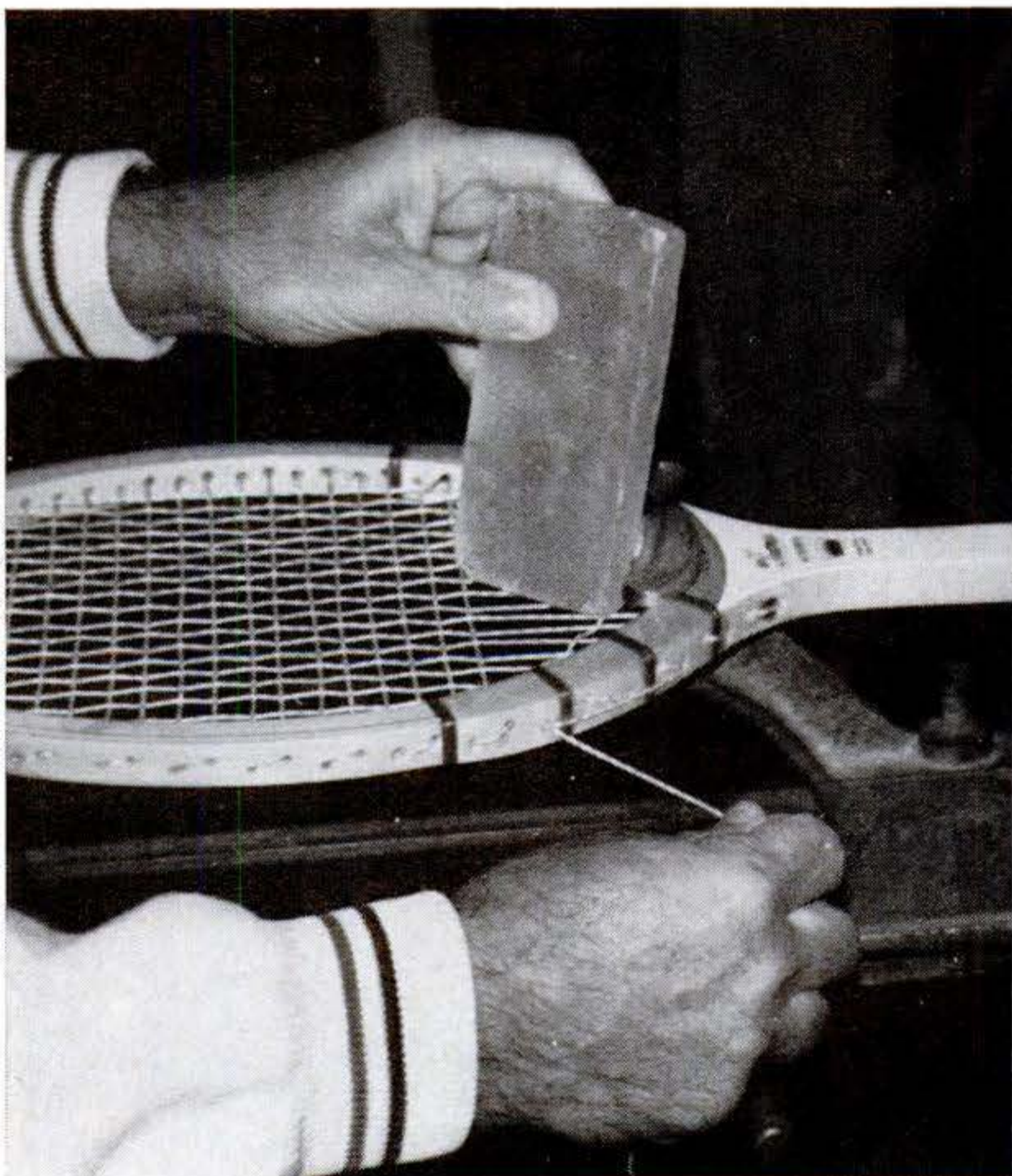
The dowel may be turned with either hand. Place it against the frame, directly in front of the string to be tightened. Use the free hand to determine tension, and slide the awl into position. Insert the awl with an even pressure. Be sure the point extends in a line with the angle of the holes.

After the awl is in place, flick the string again to be sure it hasn't loosened. If it retains the high ping, release the dowel. Tighten all strings the same way. **PS**

## Tricks of the trade: Here's how a

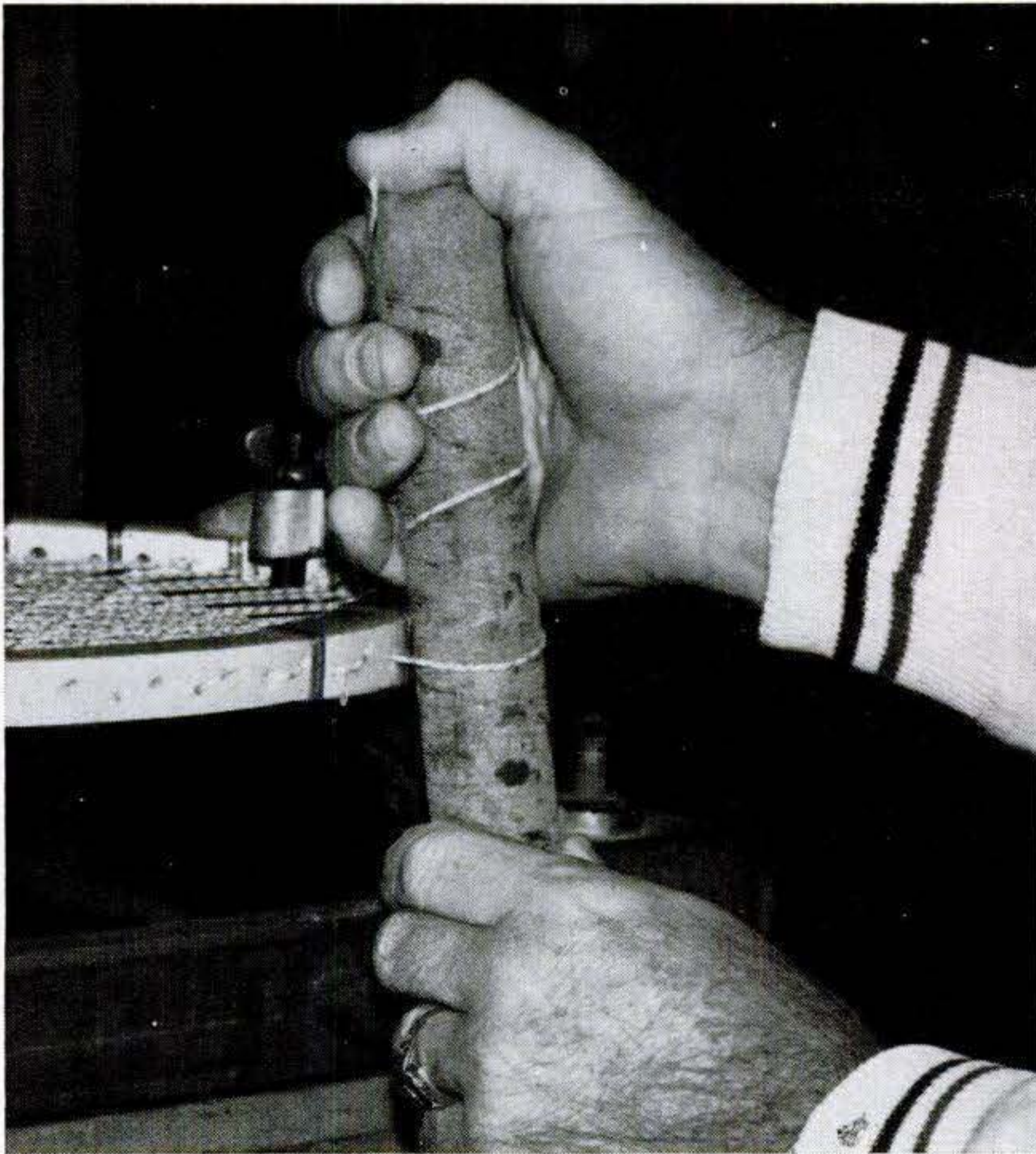


To avoid the friction that occurs when cross strings are pulled through the verticals, the pro uses an awl, as shown above, to pull at an angle.



Another friction tip: Here a light coat of paraffin wax is applied to the vertical strings before the horizontals are pulled over their surface.

## professional stringer winds up the job



The string wound about the dowel is always kept above or below the frame during the tightening process, so that the dowel won't mash string.



When the string is tight enough, the pro examines the hole and inserts the awl point carefully and firmly in back of the string at the correct angle.



The last cross string extends through the hole with the 3rd vertical string and is then tied off with a loop two strings below (on 5th vertical).

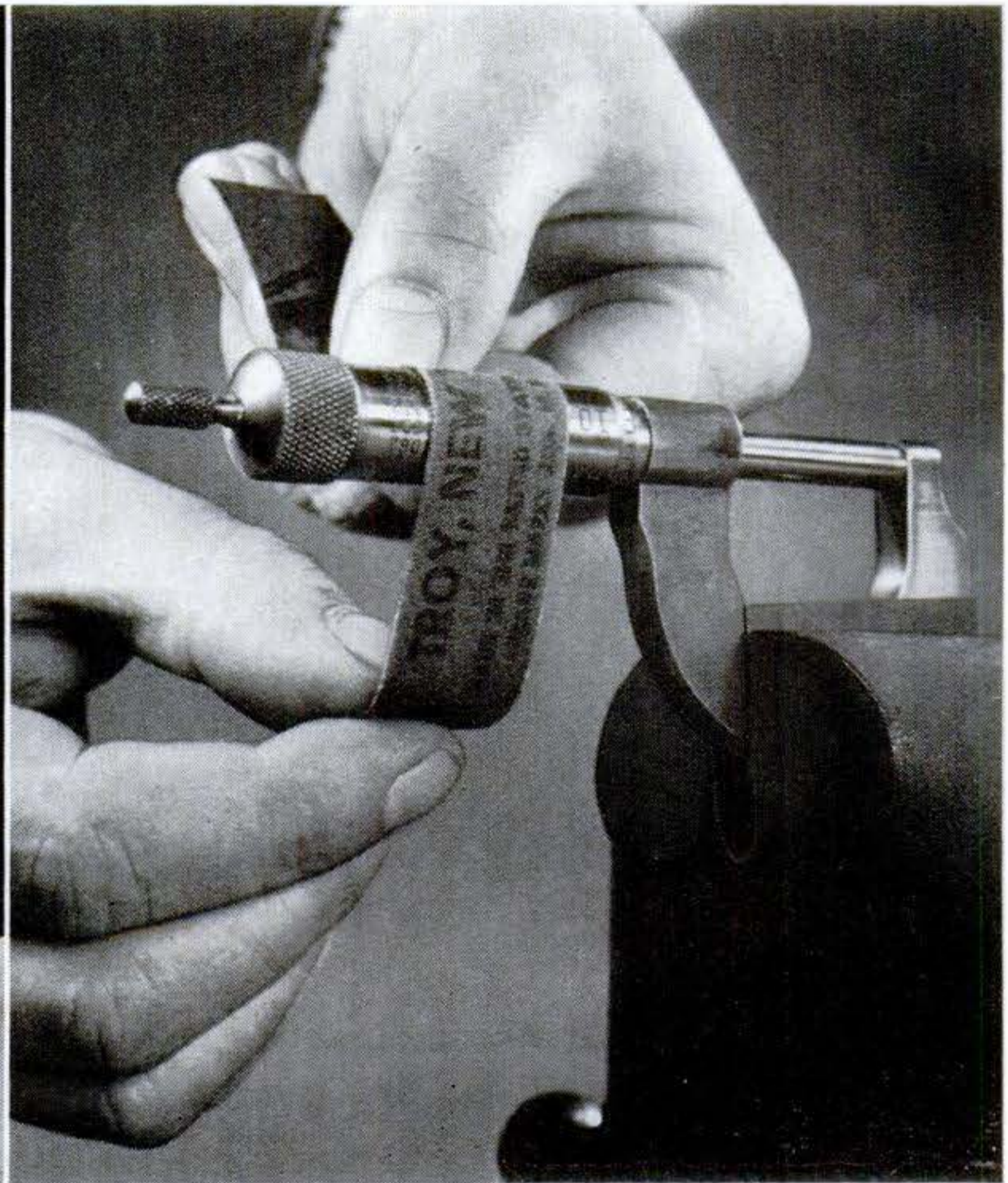


The knot is pulled tight and pressed into place with an awl. A drop of shellac will secure it. All that remains is to straighten strings and play.

# Keeping Tools Like New



**Screwdrivers must fit screw slots** accurately to work well and last. Check with a screw as a gauge when resharpening. Use a fine-grit wheel and grind the end perfectly square. Keep the original shape.



**Precision tools are cleaned of light rust** if polished with crocus cloth, yet the graduation marks remain legible. Clean plated tools with white rouge on a soft, cloth buffing wheel. Lightly does it.



**Hard-to-sharpen cutting tools—like tapered reamers**—should get special care. To avoid nicking the cutting edges, make slow, steady, light cuts; don't wobble the tool; don't back it up to clear chips.



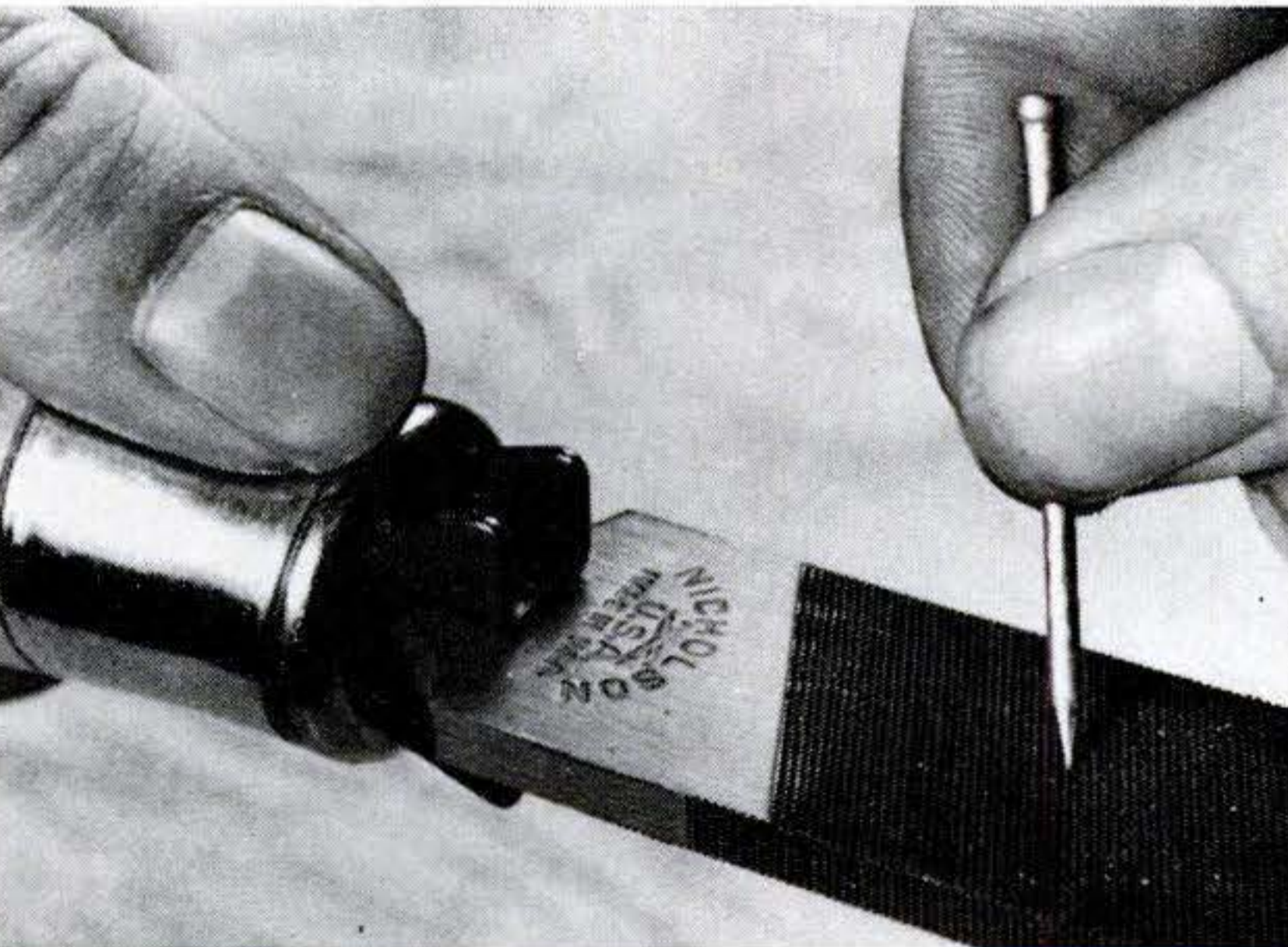
**To clean a paintbrush thoroughly**, wash it in three changes of thinner. This takes a lot of thinner, but it needn't be wasted. Let it settle for a week or so and you can decant the cleared thinner for re-use.



Proud of your shiny new tools? Dismayed by the beat-up ones? Here are some lessons on the art of pampering your tools to keep them looking and working like new



Saw blades that are gummed up can be cleaned without prolonged soaking. You can buy a special solvent that dissolves the burned-on gum. Use the solvent, also, to clean carbide-grit sanding wheels and router or shaper cutters.



To clean a clogged file, sharpen a small nail and scrape along each tooth, then brush with a fine wire brush. Remove oil or grease with chalk. Clean out chips with a file card and wire brush after each use.



Store small tools safely in vinyl pouches or sheaths in which manufacturers package new pliers, files, and cutting tools. Hang the pouches on your toolboard to keep cutting edges safe. *Continued*



Garden spades and shovels can be cleaned, oiled, and stored in a container of oily sand. Mix about a pint of motor oil thoroughly into dry sand. Work shovel up and down to clean it and coat it with oil.



Don't wash a fertilizer spreader with water. Most fertilizers are chemical salts that, when dissolved, are quite corrosive. Wipe down the spreader with a dry rag, then spray the shutter mechanism with oil.



Oilstones last almost forever if cleaned regularly. Use a shallow pan of lacquer thinner. Clean off the gummed oil with a rag. Use lots of oil when whetting; it keeps cuttings from loading the grit.



Tools you whang with a hammer—cold chisels, punches, star drills—gradually mushroom over on the striking end. To keep bits of steel from flying off, chamfer the heads.

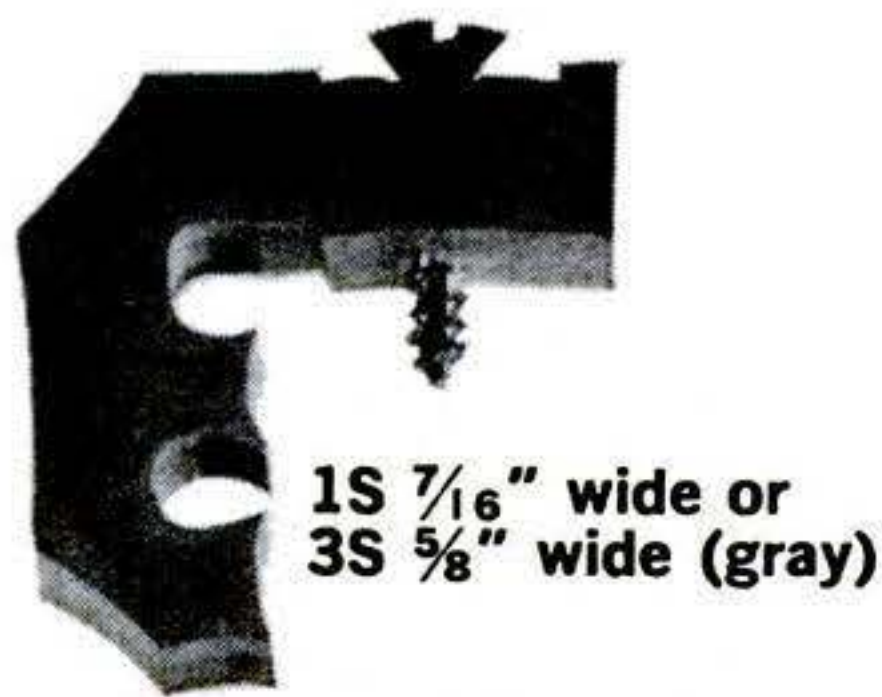


Steel tools used only occasionally should be coated with rust inhibitor. Anti-rust spray you buy at the hardware store displaces moisture and dries to a protective film. Solvent removes the coating. **PS**

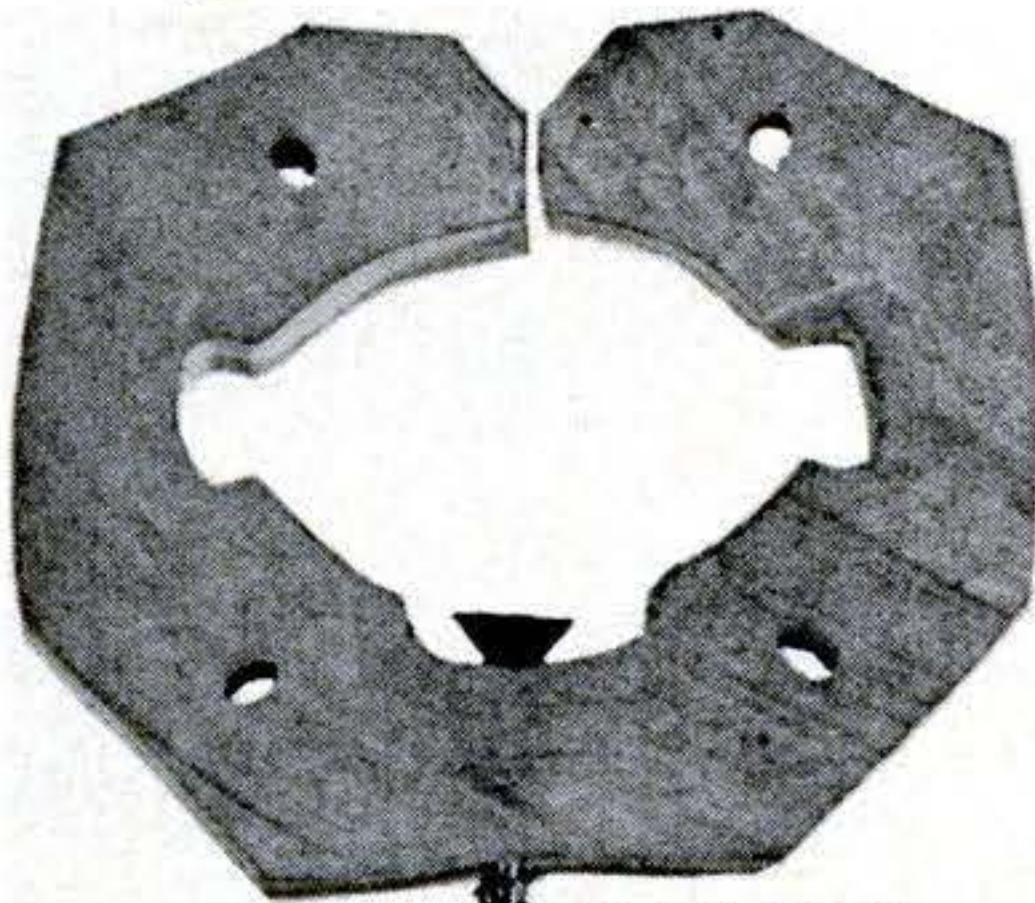


# Shop Talk

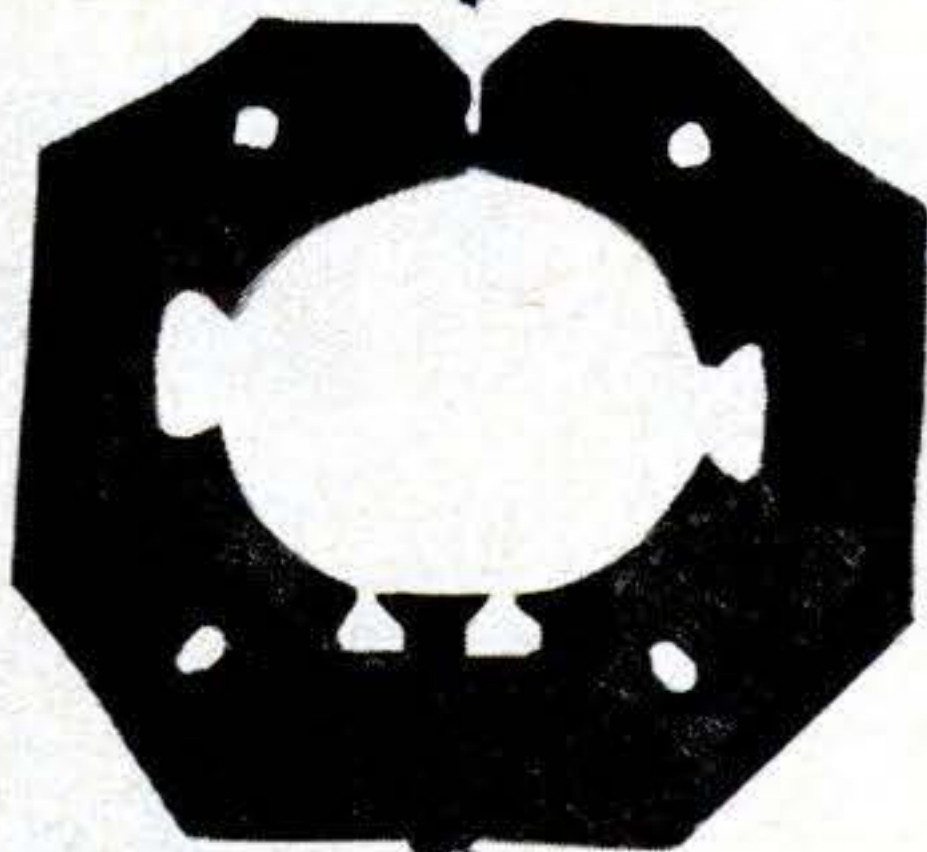
By ROBERT P. STEVENSON



1S  $\frac{7}{16}$ " wide or  
3S  $\frac{5}{8}$ " wide (gray)



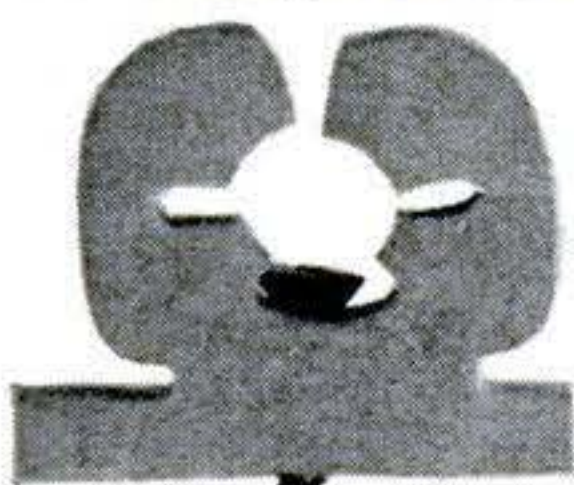
134 (white)



150 (black)



92N (brown)



78S (cream)

## Where to find rubber tool hangers: Chapter II

January PS had been out only a few days when Daniel K. Copell telephoned. He'd seen the suggestion in "Shop Talk" that discarded rubber pipe-holding clips might be picked up from cigar stores for mounting small tools on a home-shop toolboard. He makes the clips that were pictured, and many sizes more, for—as his advertising says—"1001 uses." Our suggestion was good, he thought, but his rubber holders, which are fitted with wood screws, would be easier to mount on a toolboard, whether of perforated hardboard or other material. (In perforated hardboard, you can run in the screws between the holes.) He makes clips in the six sizes shown (actual size) in the sketches at left. The L-shaped ones, 1S and 3S, differ in width as shown. They are straightened out and screwed flat against the mount. The object to be held is then slipped under the free end. To try them out for various jobs, you can get a 72-piece assortment of clips postpaid for \$5. The address: Daniel K. Copell Co., 36 E. 23rd St., New York, N.Y. 10010.

The "Shop Talk" suggestion also brought word from the R. R. McKenzie Co., 1107 Elmwood, Burbank, Calif., of their similar rubber holders, sold in sporting-goods, fishing-tackle, and hardware stores—for everything from fishing rods to workshop tools. Of special interest to fishermen is a pole holder fitted with a neoprene band for tying the holder to boat and pier railings. They'll fill mail orders, too.

## Other good ways to mount tools on a toolboard

You shouldn't forget about the good-looking white Delrin tool-holding fittings for perforated hardboard, around for several years. Some people still haven't discovered that these really hold fast when you install or remove a tool, unlike the common wire fittings that tend to pop out of the holes. They come in a lot of sizes and shapes. All are good. Trouble is, I couldn't find any to provide a secure home for such small items as nail sets and punches—which led to the suggestion of the small rubber pipe-holding clips.

Richard F. Revolinski, Trenton, N.J., writes that the small-size fuse clips (from electronics supply shops, or by mail from Lafayette and Allied catalogues) are also ideal for small tools. And so they are—and inexpensive, too.

You might also like to try an idea from Ferdinand Brigham, Cambridge, Mass. He uses  $1\frac{1}{2}$ " No. 12 flathead wood screws. They are just the right diameter to turn up snugly into the holes of perforated board. Arrange the screws in the holes in patterns to suit different tools.

And if none of these notions suits your fancy, maybe you'd better revert to grandpop's day and store your smaller tools in slots, pockets, and holes in a backboard at the rear of the workbench. That was pretty handy, too.



# CAPTIVE COPTER YOU CAN BUILD ... right in your own back yard

By RICHARD L. BROWN AND HARRY WALTON

**T**hrills no amusement-park ride can beat are your children's every day with this captive copter. With only a 15-second briefing, any youngster can safely take off, hover, climb, whiz around a 28' circle (actual speed, 15 m.p.h.) and touch down to a feather-soft landing.

Spectacular as it is, the copter is quite safe. Its low-slung seat and counterweight make the device inherently stable. Low prop pitch and motor r.p.m. limit forward speed. Centrifugal force keeps the pilot from landing, even with power off, until the boom has almost stopped turning. Even wind has little effect on the copter. As for

space, you can fly it in any clear area 35' or more in diameter.

**Build it or buy it.** Construction calls for fitting and welding steel tube and plate. If you don't have welding facilities, you can take the cut-to-size pieces to a welding shop. Or you can buy finished parts (such as the long boom) and make the simpler parts yourself. You can also get a complete, bolt-together kit that includes a wire-mesh cage for the propeller. Available separately, too, this prop guard is a recommended safety feature.

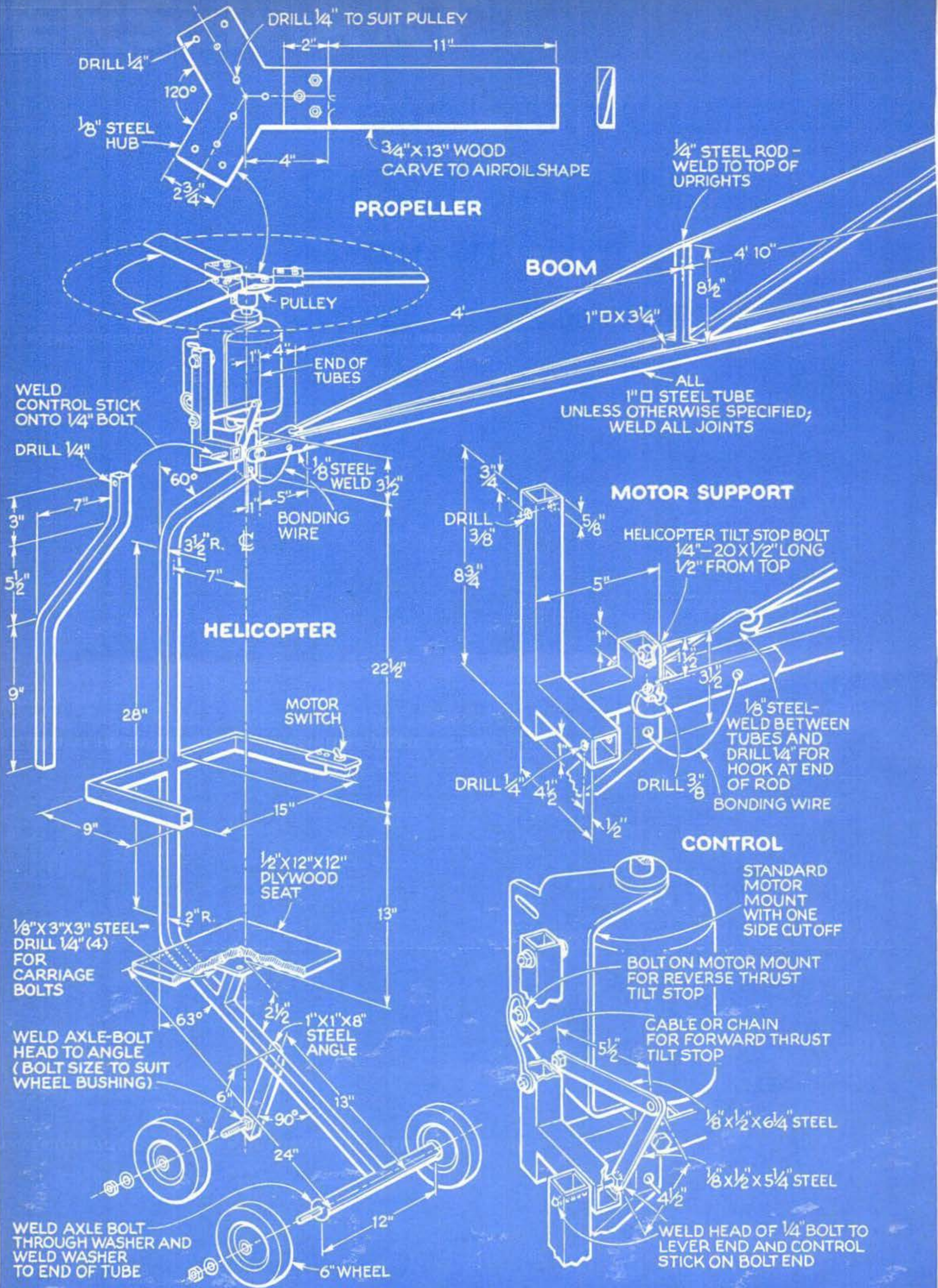
**How it "flies."** A seat hangs on one end of a boom, free to swing in a plane paral-

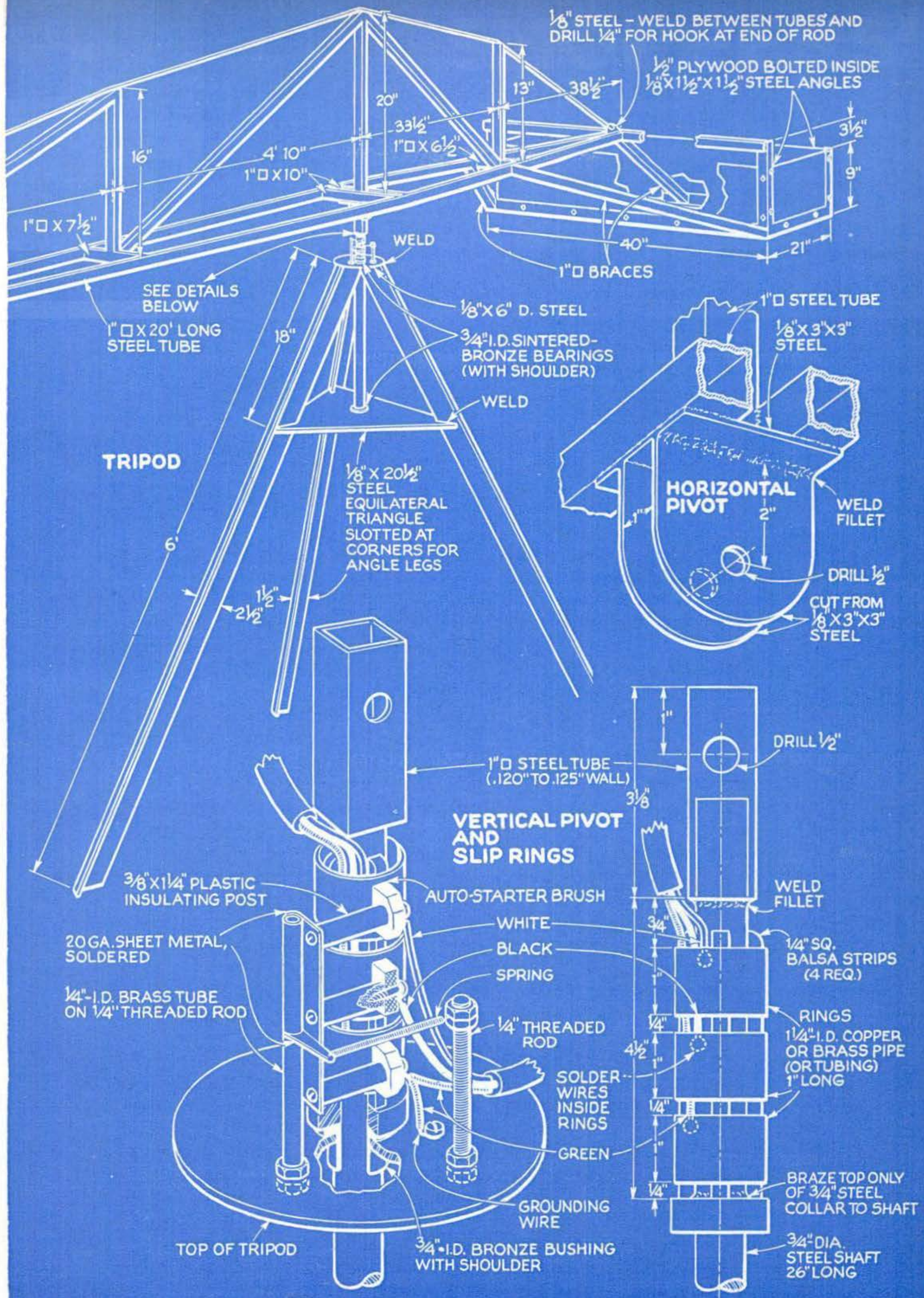
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**Youngsters take to the air at the end of a revolving boom in a modern aerial merry-go-round. On the facing page you see the prototype copter built by Author Brown. Below is one that comes as a kit that**

**you simply bolt together. You can also buy various parts, such as the tapered boom and propeller cage, for a homemade unit. Write Sterling Mfg. Co., 2523 Farnam St., Omaha, Neb. 68131 for the prices.**







lel to the boom, which itself pivots on its mounting post, while the post turns on a vertical axis. On the short end of the boom is a weight box to counterbalance pilots.

A split-phase motor of  $\frac{1}{6}$  to  $\frac{1}{3}$  hp. is pivoted at the top of the copter. With a control stick, the pilot can tilt the motor (and its prop) fore or aft. Straight up, it makes the copter climb. Tilted forward, it holds altitude and flies forward, too. Backward flight results from tilting it back.

**Building the boom.** Lay out the two 20'-long members and weld the two 10" spacers between them. Pull the ends together with  $\frac{1}{8}$ "-thick brace-anchor plates between them and weld top and bottom. Then weld in the remaining spacers, vertical posts, and diagonals, as well as the  $\frac{1}{4}$ " brace rod and two  $\frac{1}{8}$ " plates.

Weld a 3"-square plate of  $\frac{1}{8}$ " steel under the 20" post and the twin spacers. Cut two pivot plates of similar stock, clamp together, and drill the  $\frac{1}{2}$ " pivot holes through both at once. Weld these plates at right angles to the horizontal one, with pivot holes aligned at 90 degrees to the boom centerline and the plates close enough to fit over the 1"-square top of the vertical shaft.

Weld the top of the counterweight box to the short end of the boom. Reinforce it with two diagonal braces from the corners of the box to the first spacer.

Erect the pylon of three 6" lengths of steel angle. Cut the triangle out of  $\frac{1}{8}$ " plate, drill a center hole for the lower shaft bearing, and slot the corners to receive the legs. Weld these to the triangle and to a 6" disk having a center hole for the upper shaft bearing.

Assemble the helicopter on a backbone of 1"-square steel tube, making the motor support of the same material. Drill the  $\frac{3}{8}$ " motor pivot holes at a slant, so that the motor mount will tilt away slightly to leave clearance for the link.

The motor mount is a standard NEMA type cut away on one side. Weld the  $\frac{3}{8}$ " pivot bolt to its base, low enough to let the lower end of the mount swing clear.

Make the prop blades of straight, knotless pine. Check motor rotation before you carve them, to make sure prop thrust will be up. If you carve the prop backwards, you'll have to reverse motor rotation. Use lock washers on the bolts, and check the finished propeller for balance, carving a little off the heavy blade if necessary.

If there isn't enough space for a bolt and nut to attach the control link to the motor mount, file a bolt head thin and (with the link in place) braze or weld its shank inside the mount. To make maneuvering easy, the linkage tilts the prop forward when the stick is pushed forward, back when it's pulled back. Attach the control stick so that it is vertical when the prop is straight up.

**Main shaft and slip rings.** Push the  $\frac{3}{4}$ " shaft well into the square-tube head and weld it with a good fillet all around. Slide on the three rings; then braze the steel collar to the shaft at the top only. Solder the wires inside the rings.

Slide four strips of  $\frac{1}{4}$ " hard balsa under the rings. Spaced 90 degrees apart, they will center the rings. Wrap the assembly with masking tape to a bit above the top ring, and pour in epoxy resin to fill between the rings, balsa strips, and shaft. When the resin has set, remove the tape and polish the rings.

**Wire it safely.** A three-wire circuit eliminates shock hazards. It requires a grounding-type plug, three-wire flexible cord with rubber-covered No. 16 or heavier conductors, a grounding wire to the pylon, and a bonding wire between boom and copter.

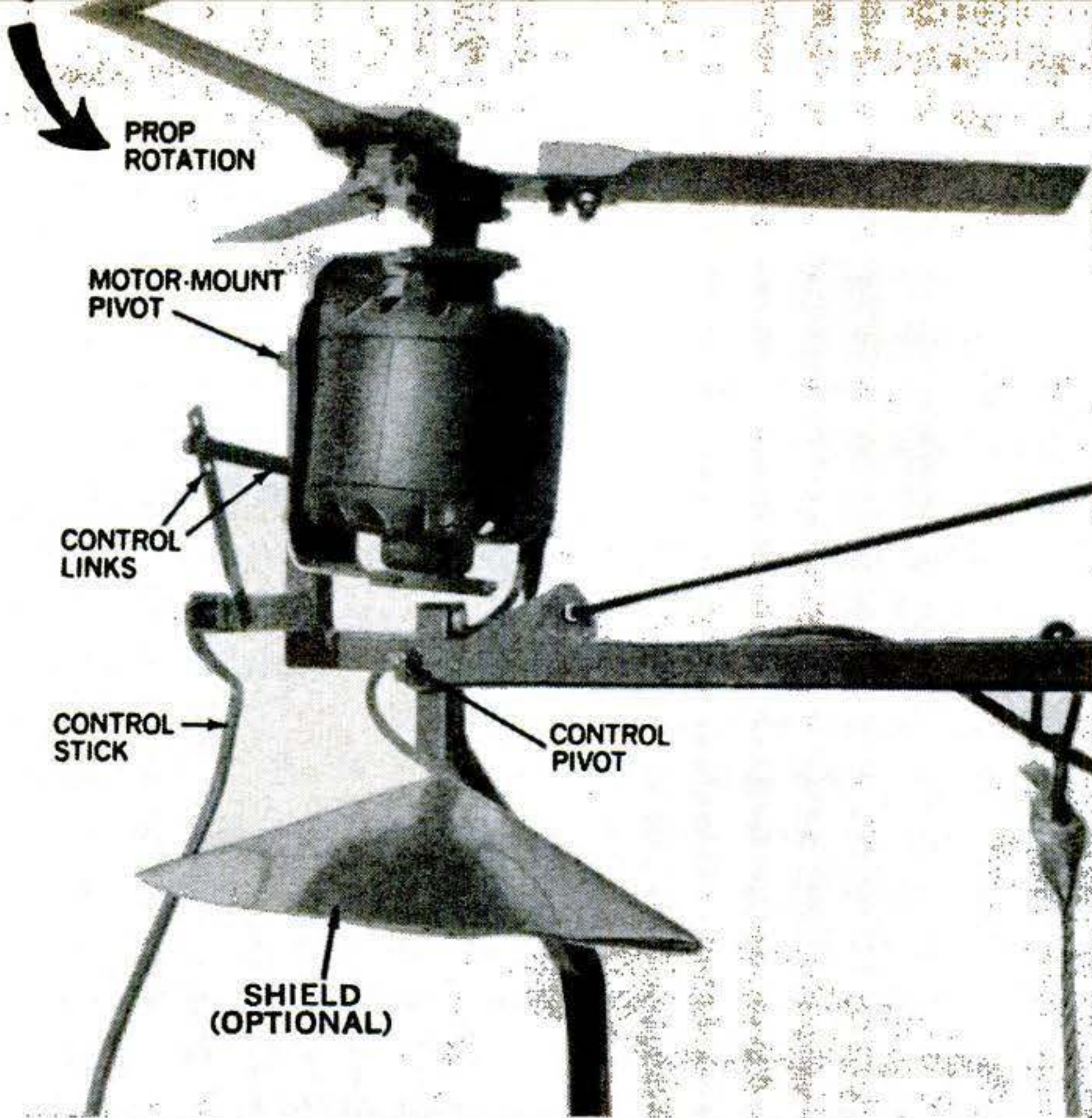
Attach the last with self-tapping screws, using star-type lock washers. Put such washers on the brush terminal screws as well. The control switch is best mounted in a standard fixture box welded to the copter armrest. A three-prong male and female coupling near the end of the boom allows the copter to be detached. Tape the cord to the boom, with generous loops at the copter and pylon to permit full tilt action.

With a meter or continuity tester, make sure there is a continuous circuit from the grounding prong of the power plug to the copter, and also that the black and white wires are completely isolated from the structure. If the control switch isn't enclosed, see that its terminals are well taped and isolated from the frame. Enclose the slip-ring assembly with a one-gallon can.

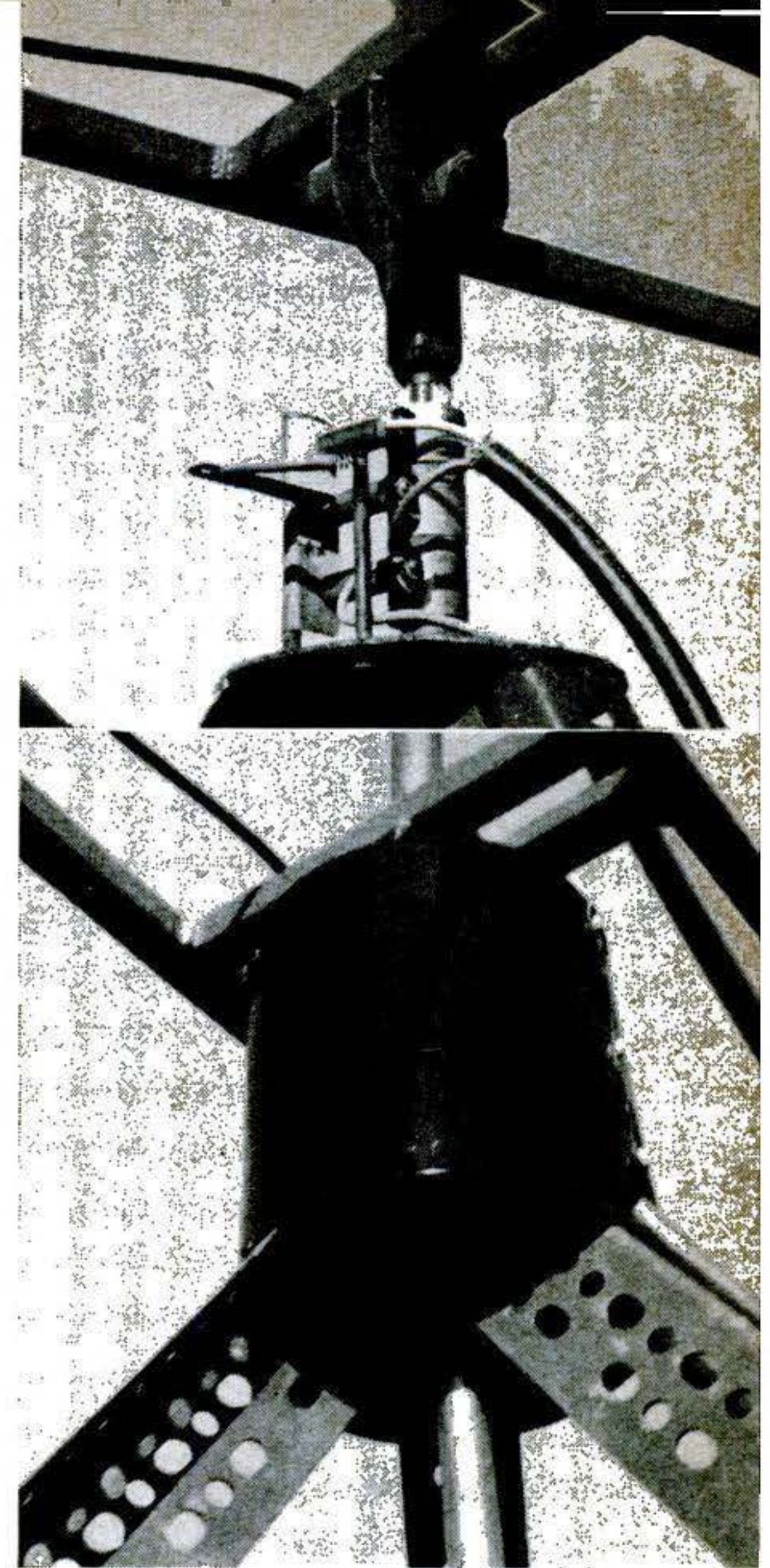
**Assembly and balancing.** Set the vertical shaft in its bearings and the brushes against their rings. Use self-locking nuts on the boom and helicopter pivot bolts. Add washers under the copter tilt-stop bolt until it hits the boom before the prop or its cage strikes the boom brace.

To anchor the copter while a pilot gets on or off, drive a stake or place a sandbag

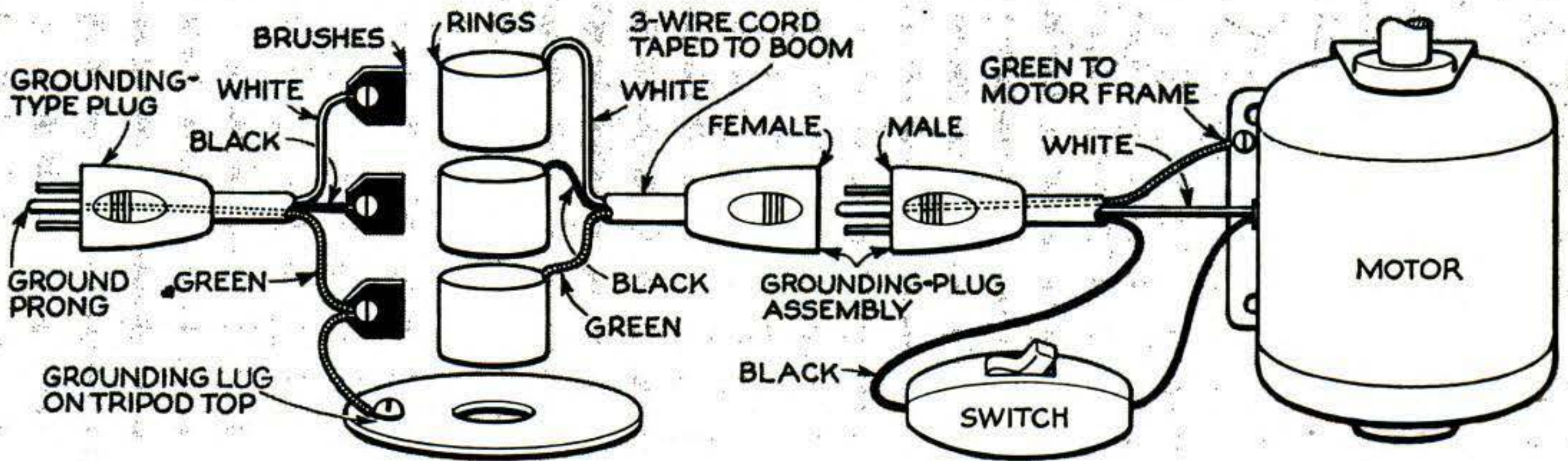




Motor and prop hang from a single bolt, on which they tilt crosswise to the axis of the boom. The control linkage tilts prop the same way stick is moved to make piloting easy. Carve prop to suit motor rotation; high edge of blade must lead.



Three slip rings provide a safe three-wire grounded circuit for the helicopter. This assembly should be enclosed to prevent accidental contact. Gallon can with top and bottom cut out is suitable cover.



just outside the landing circle. Attach a short chain with a hook that can be slipped on the copter seat to hold it.

With your lightest pilot in the copter, set a scale under it. Subtract a pound from the reading, and double the remainder. Make up sandbag weights to this figure; it should leave copter and pilot, at the end of the boom, scaling only a couple of pounds. Raised a couple of feet, the copter should take two or three seconds to settle.

For heavier pilots, add extra weights or make a sliding one that can be clamped anywhere along the short end of the boom.

Test the copter with sandbags in the seat and the control clamped straight up. The boom shouldn't tilt up more than 45 degrees at full climb. Be sure to insert the power plug only in a correctly wired grounding receptacle for safe operation. If an extension cord is used, it too must have three conductors of at least size 16. **PS**

# They've Thrown Away the

Mower is a pusher-type with 20" cut. It costs about \$85. Wheels adjust to vary height of cut.



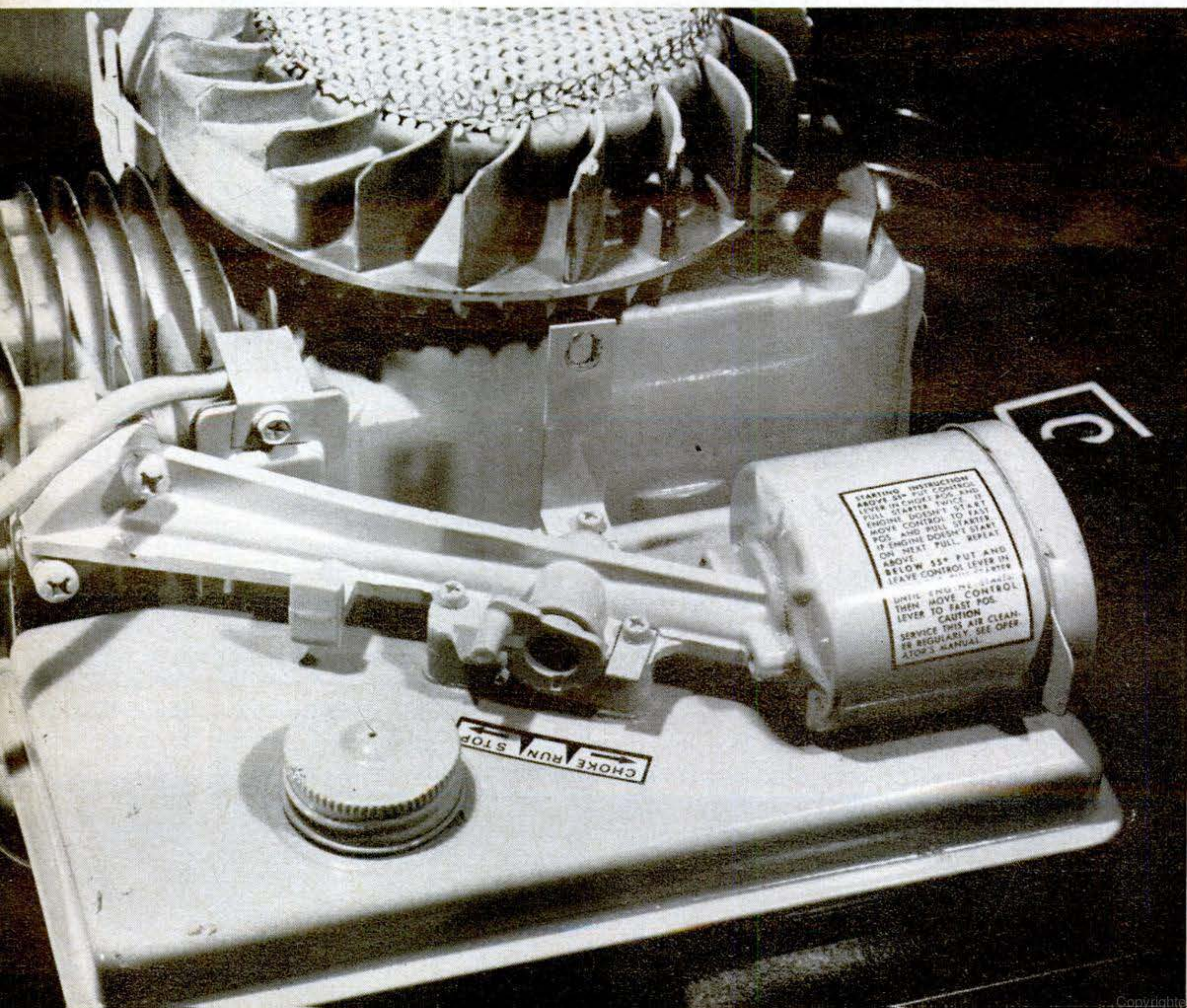
Foolproof fuel system on this rotary ends upkeep problems and gives cooler-running engine

By HARRY WALTON

**Y**ou won't ever twiddle with carburetor settings on a new Sears, Roebuck mower. It has no carburetor to adjust, no float, diaphragm, or needle valve to go wrong. Nor are there any controls on the handle of the 54-pound mower to dis-

Long venturi tube is the secret of the mower's self-governing feature. One rotary valve is set to choke, run, or stop the four-cycle engine. Note decal on the

fuel tank that indicates the three settings. An oil-impregnated air cleaner (at extreme right below) is readily dismantled when it needs cleaning.



# Carb on New Sears Mower

tract you while piloting it over the lawn. It has no throttle, no choke, no shorting switch to stop the four-cycle engine.

There isn't even a governor on it, which means no flyballs, air vanes, spring, or other delicate contraptions to get out of order. Yet speed is under complete automatic control at all times.

Tucked away inside the four-cycle engine is a compression release that eases the load on your cranking muscles as much as 50 percent. You can't see it, fool with it, or forget it. Completely automatic, it works on starting but cuts out the instant the engine catches.

What holds it down, without throttle or governor? One of the cleverest devices to pop up since the Otto engine's first pop.

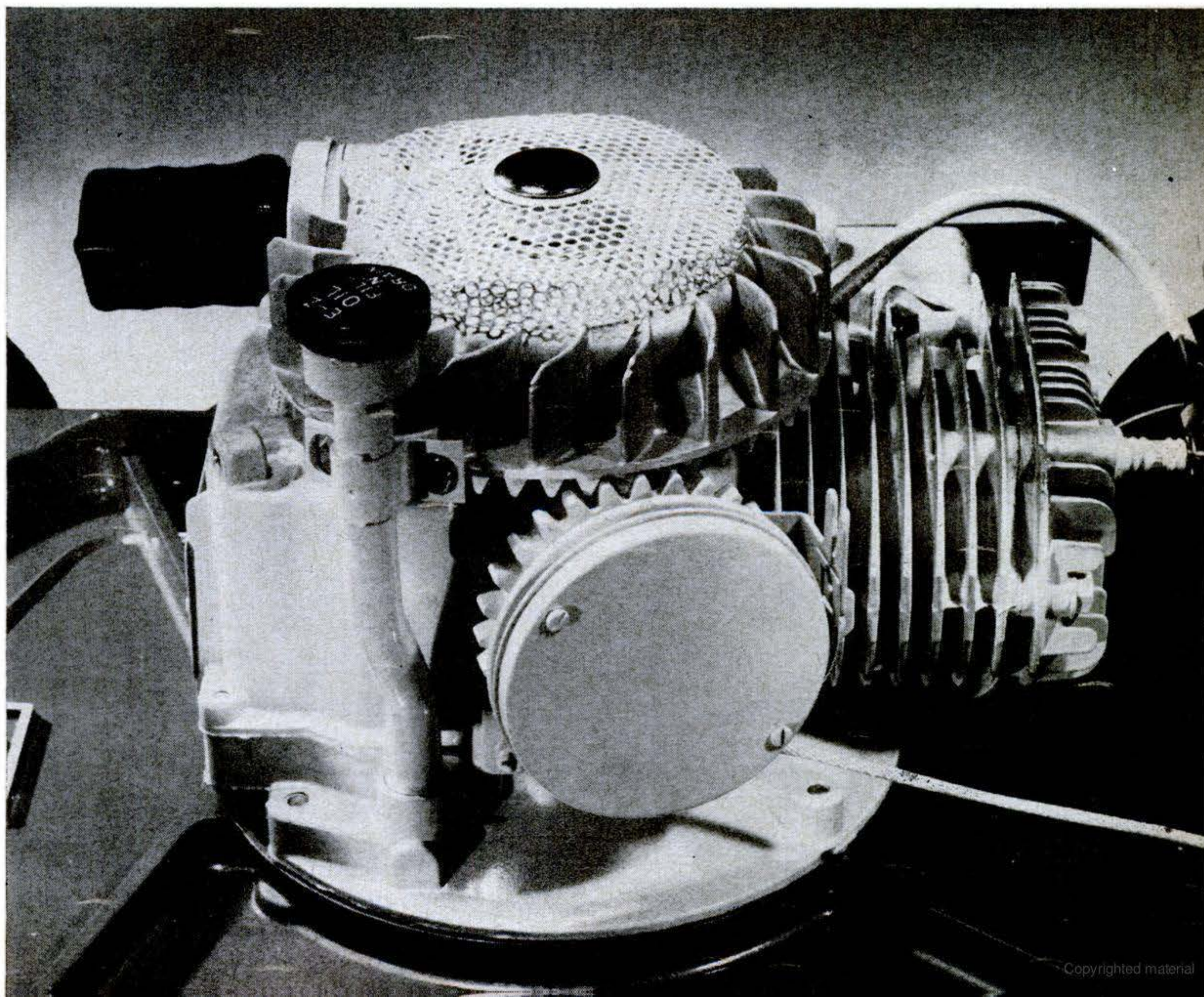
Instead of the usual intake manifold, there's a venturi tube—a long, slightly tapering passage of small diameter. Its open end, or air intake, is fitted with an oil-impregnated air cleaner. At about a third of its length, a fuel pickup tube enters the passage.

This tube has a metering orifice that measures fuel flow, gasoline being lifted from the tank by the air passing above the tube, as in an old-fashioned fly spray. A simple rotary valve in the venturi passage

*Continued*

**High-strength plastic gear on the recoil drum meshes with one under the flywheel for starting, but slides out of mesh as the engine catches. The**

**black oil-filler cap has a dipstick. Crankcase is drained at same place by turning the mower on its side. Engine shroud was removed for these photos.**



just above the fuel pickup can cut off the air (for choking), allow both fuel and air to pass (for running), or cut off both to stop the engine.

**The venturi is the governor.** At "run," the engine revs up to a top speed of about 3,800 r.p.m., the mower blade spinning free. At this clip, air velocity in the passage is so high that there is much friction between the air and the walls. Air pressure in the venturi rises, cutting down the amount of fuel raised from the tank. Though running at its maximum speed, the engine develops low torque and uses a minimum of fuel.

As mowing starts, loading the engine, the engine begins to revolve more slowly. Because of this, air velocity in the venturi falls, skin friction lessens, and more fuel reaches the engine. Consequently, engine torque goes up to match the load. But if speed increases, venturi friction again re-

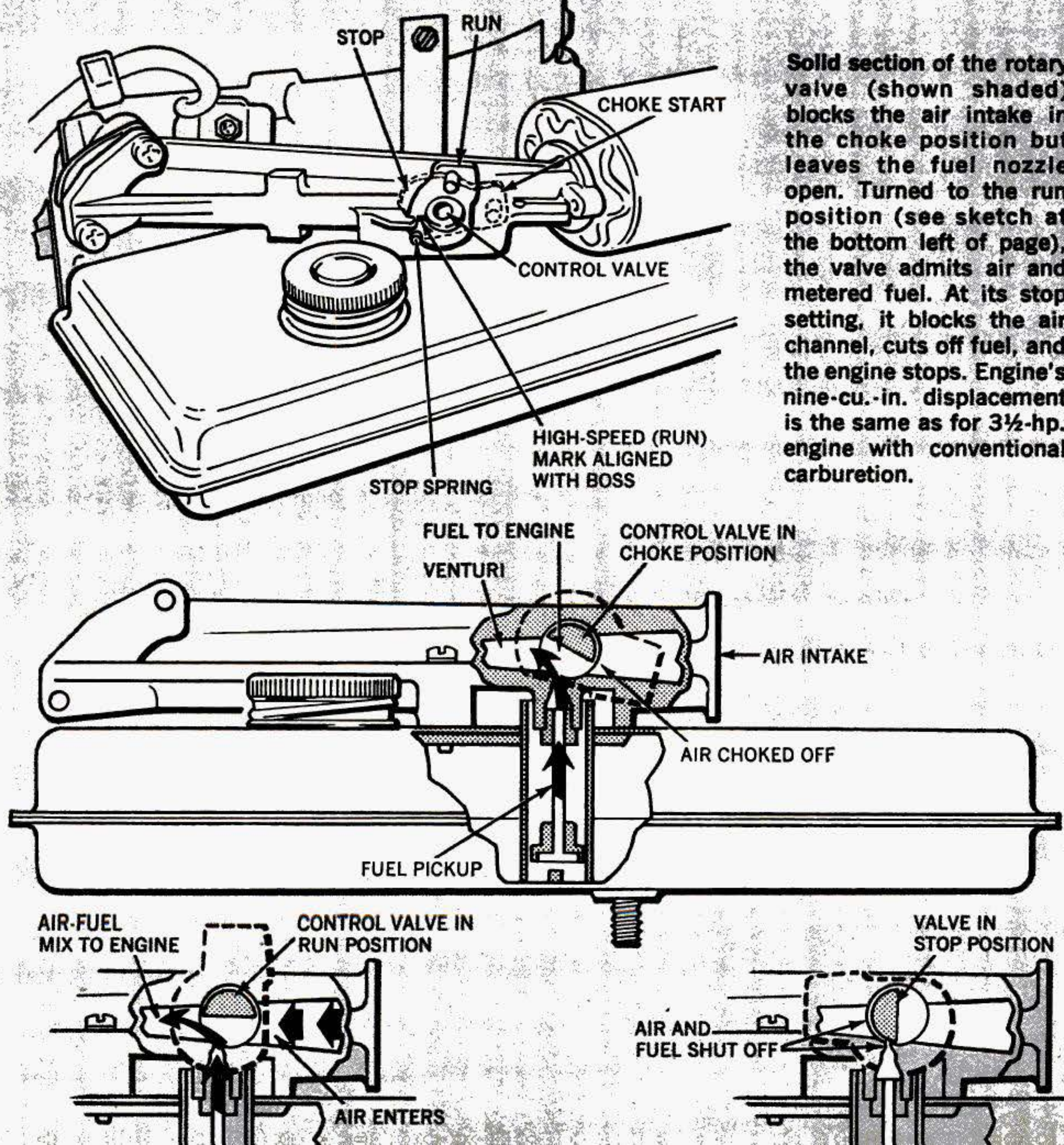
duces the fuel-air volume. No matter how the load changes (in moving from low grass to heavy growth, for example) the instant effect of air velocity and wall friction holds the engine at a set speed.

A partially open setting between the choke and run positions will let the engine idle much like a conventional throttle, but is not used in mowing.

Cranking is easy because you don't have to work against full compression. Pivoted on the face of the camshaft gear is a small curved quadrant. A light spring positions this to keep the intake valve slightly open as you crank. But when the engine runs, centrifugal force flicks the quadrant out of the way, and the valve operates normally for full compression.

The new mower, which went on sale at Sears stores during the spring months, is presently available only as a pusher type at approximately \$85. PS

### How a single rotary valve chokes, runs, and stops the mower

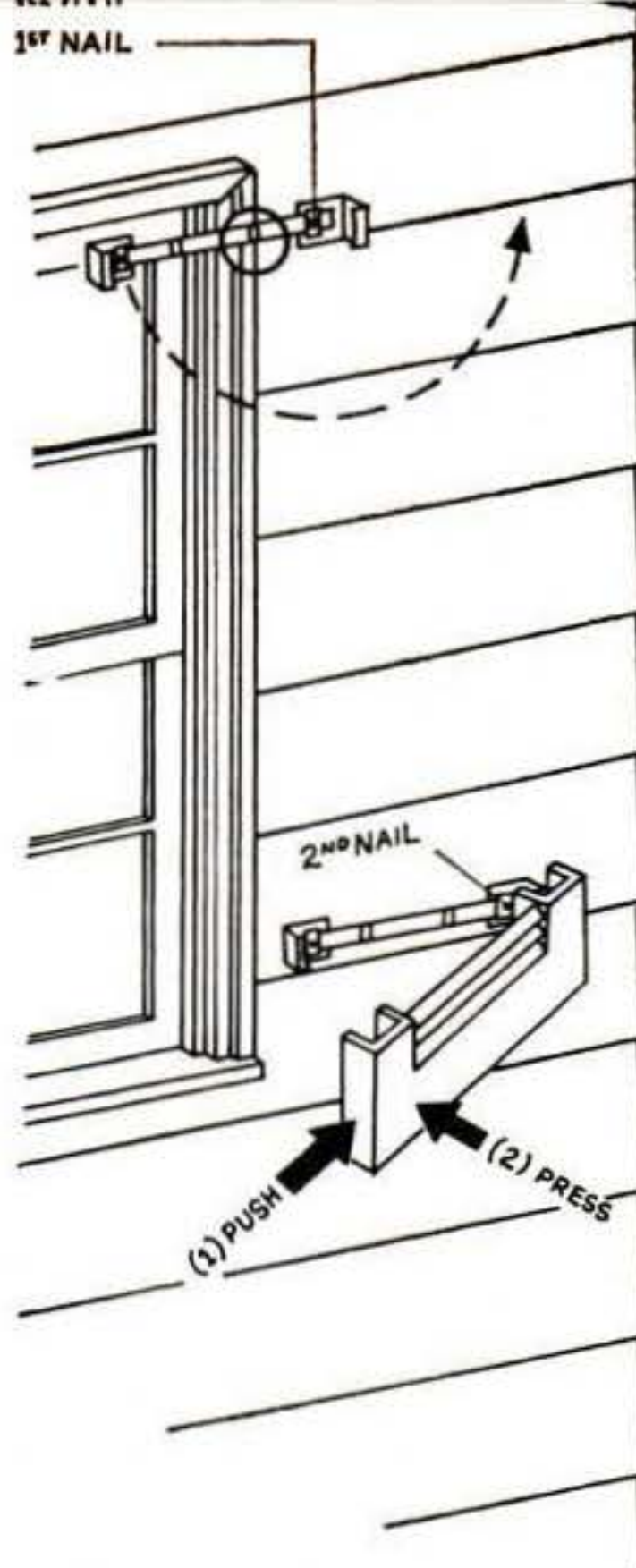


## WHAT'S NEW

### FOR THE HOME

#### Easy-mount nylon shutters in different sizes, colors

You can use these nylon shutters to dress up a new house or replace your present shutters. DuPont makes them in lengths from 35" to 80", in widths from 14" to 18". They come coated in a finish of black, white, or dark green. At right you can see how the shutters are installed. They are hung on spring-steel fastening clips that mount to the wall with nails. When the shutter is snapped into place, the fastening device is hidden.



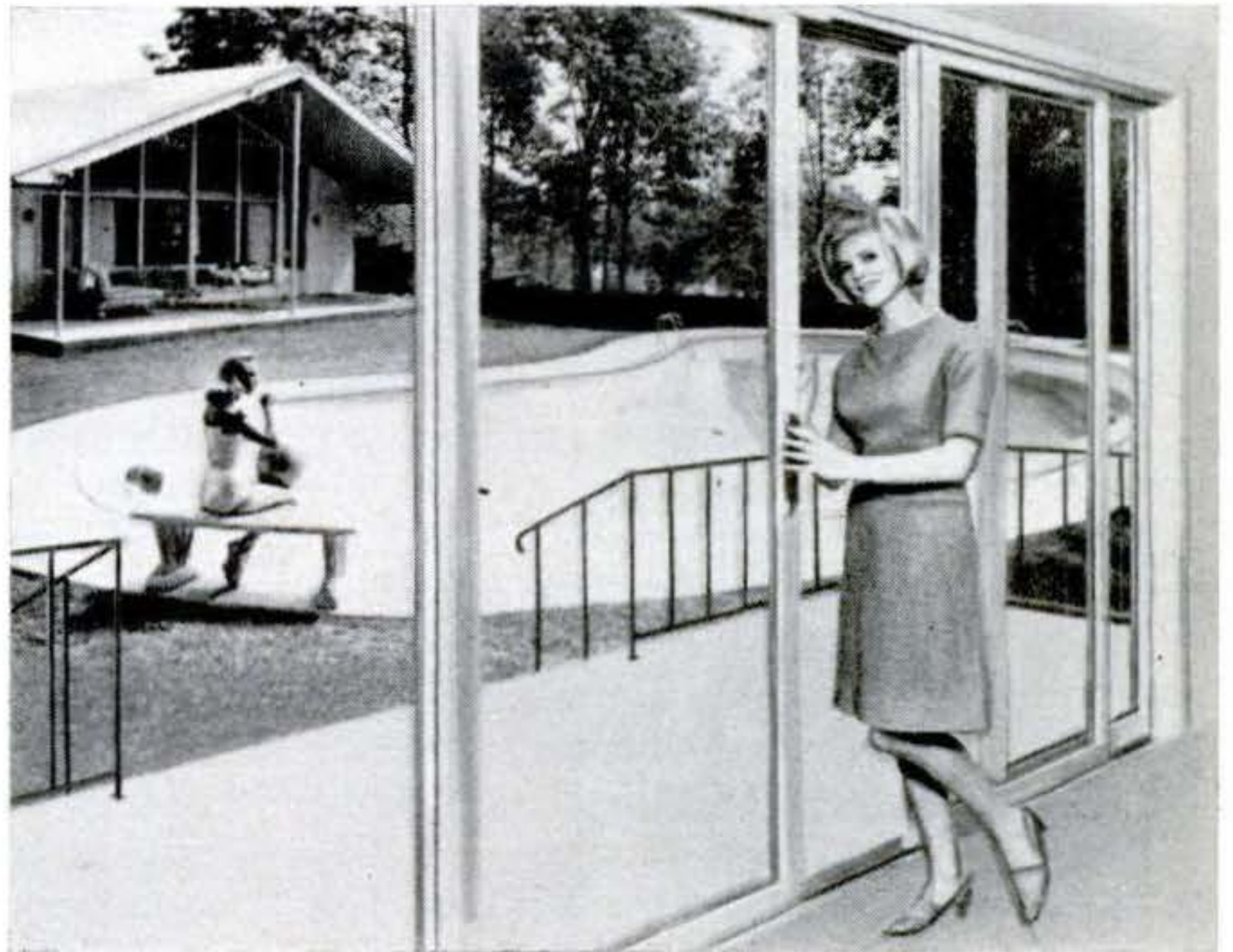
#### Pine plywood comes as siding

With TrendTex plywood siding, you can give the outside of your house the textured look of rough white pine. Choose from six factory-applied stain finishes (gray, brown, red, tan, blue, green) and natural. The siding is treated with a water-repellent preservative, and has a waterproof adhesive. The 4'-by-8' panels come in thicknesses of  $\frac{3}{8}$ ",  $\frac{1}{2}$ ", and  $\frac{5}{8}$ ". Battens are supplied to give the look of vertical siding (see photo). Potlatch Forests, San Francisco.



#### Sliding glass doors give open view, easier access to patio

Add a view of your patio, and get to and from it easier with these sliding glass doors. Framed with ponderosa pine, they come in two-, three-, and four-door units. In the four-door unit, shown at right, both center doors are operative. They ride on twin-wheel roller assemblies in an extruded-aluminum sill track. Head and sill are continuous. There are three glass options:  $\frac{3}{8}$ " insulated,  $\frac{3}{8}$ " tempered,  $\frac{3}{16}$ " crystal sheet. Removable wood screens come milled to match the moving doors. All the units are predrilled for quick assembly. Marvin Millwork Co., Warroad, Minn.

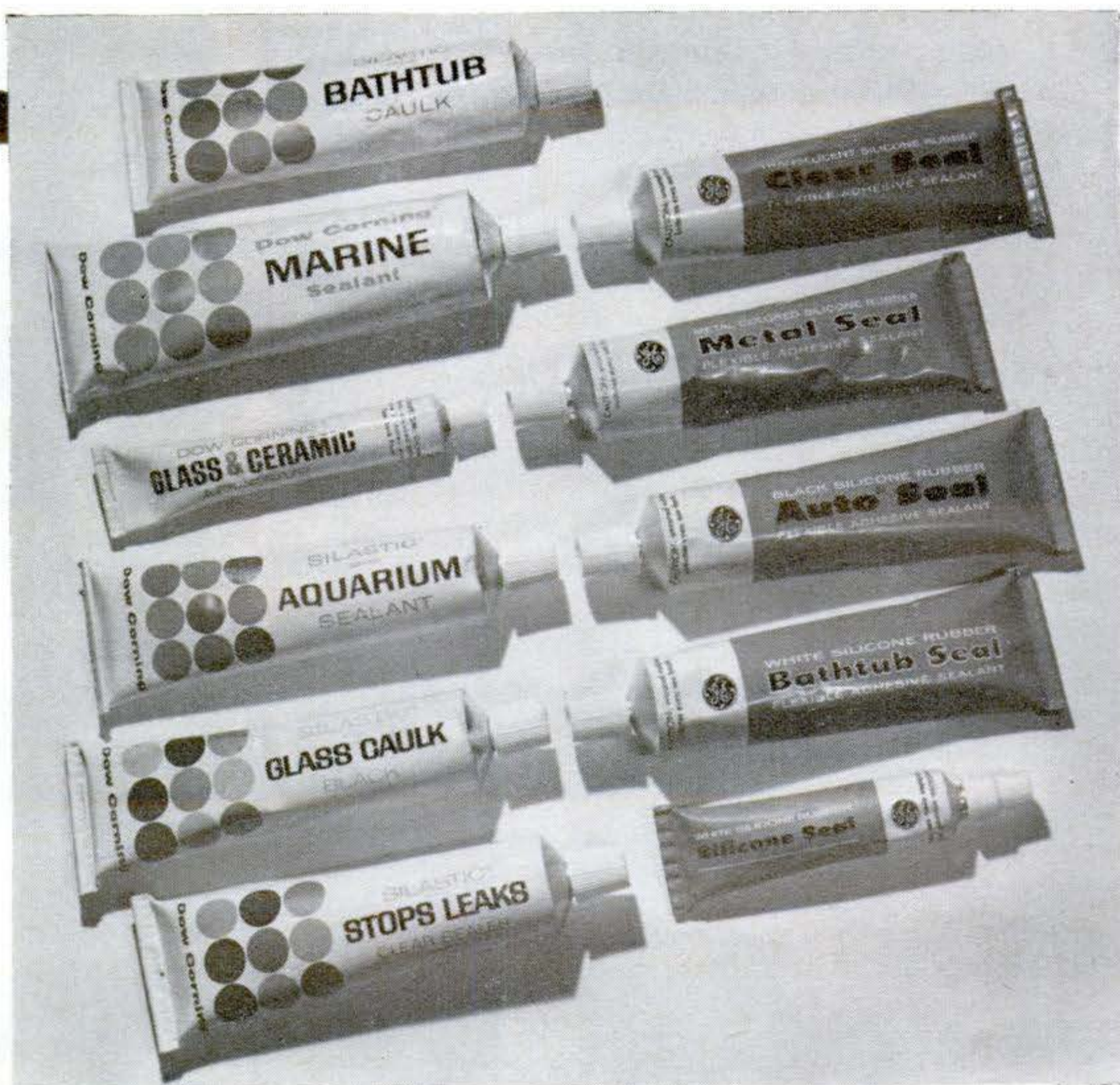


# The Amazing NEW WORLD

Have you discovered it? There's an ever-growing list of interesting and useful products

By JACKSON HAND

Job-specified, these tubes of silicone rubber match color to function—important when the rubber shows. They come in white, gray, black, or clear.



**W**hile most of us haven't been looking, a new material called silicone rubber has been creeping up on us. Now it has surrounded us with a usefulness and versatility that few products can match. It's a sealant, a caulk, an adhesive, and a marine crack filler that sticks to anything clean and has a very insolent attitude toward water, sunlight, ozone, age, and other things that make so many materials shortlived. It will resist all the chemicals found in an ordinary home.

The stuff stays flexible and noncracking in heat up to hundreds of degrees and down to 50 below and worse. It contains no solvents, so it doesn't shrink as it hardens. It's nontoxic. You don't have to mix it before you use it. If you can squeeze toothpaste out of a tube, you already know the basic trick in using silicone rubber.

**What is it?** Chemists call silicone rubber RTV—which takes less time to say than “room-temperature vulcanizing.” Dow Cor-

ning explains that it is a derivative of silica—the stuff that glass comes from. There is a chemical crossover between this ineradicable substance and certain organic compounds that provides extrudability for application and a quick skin-over for clean handling. Normally, applied silicone rubber skins over in 10 minutes, is smearproof in an hour. Give it 24 hours for 90-odd percent of the cure, although it gains strength for perhaps a week or 10 days.

What's the stuff for? At the beginning, it was for caulking bathtubs. Now the lid is off. Few products around will do so many things that couldn't be done at all a few years ago.

Last summer, I put together an extra-length extension cord for electrical yard tools. It had to be waterproof, so I larded a silicone sealant (it acts as an insulator) around all the electrical connections. I figured I had invented something—until I found out they've been “potting” electrical

# OF SILICONE RUBBER



units in silicone substances for years, particularly those they shoot into outer space, where the stuff protects against mechanical shock in heat or cold. I gave up the idea of inventing anything, but since then I have done a lot of interesting chores around the house that were made a whole lot easier by silicone rubber.

**The handyman's friend.** I put a new handle on a heavy spatula. The wood-to-steel adhesion of the silicone sealants is good, and their natural flexibility keeps the wood from popping off if the handle bends a little. Moreover, the silicone I used couldn't care less about the 140-degree heat of detergent water in a dishwasher. It stays put up to 500 degrees. That's why an electric-iron manufacturer uses it to fasten a water-level glass bubble on top of the iron—and it gets pretty hot.

I put together an all-glass aquarium with no metal fabrication units at the corners—just butt joints held with Silastic Aquarium Sealant made by Dow Corning. This was no invention, either. In city after city, across the nation, there are high-rise buildings of curtain-wall construction with glass-to-glass corners held with a silicone sealant.

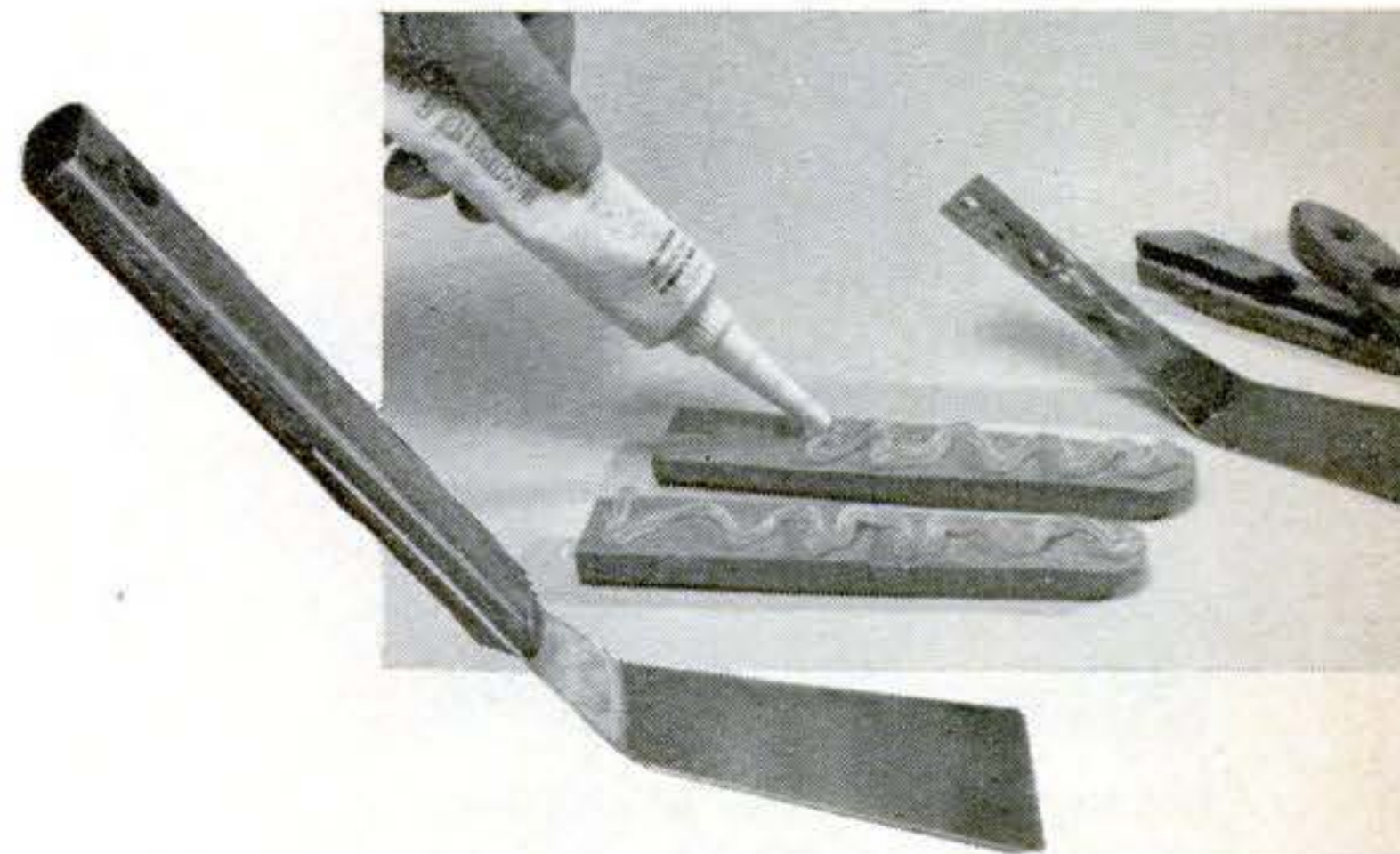
I cemented a ceramic soap dish to our tile shower wall. I glued together—and glued back in place—a broken tail-light cover of red plastic on a friend's sports car. I stuck a plastic container to the inside wall of the freezer, to hold ice cubes. I ran a fillet of the stuff down the edge of a panel at one side of the furnace. Vibration when the burner was on had kept the household awake. The rattle stopped.

I built a redwood planter with GE Clear Seal as the adhesive, then smeared the inside of the planter with more silicone rubber for waterproofing.

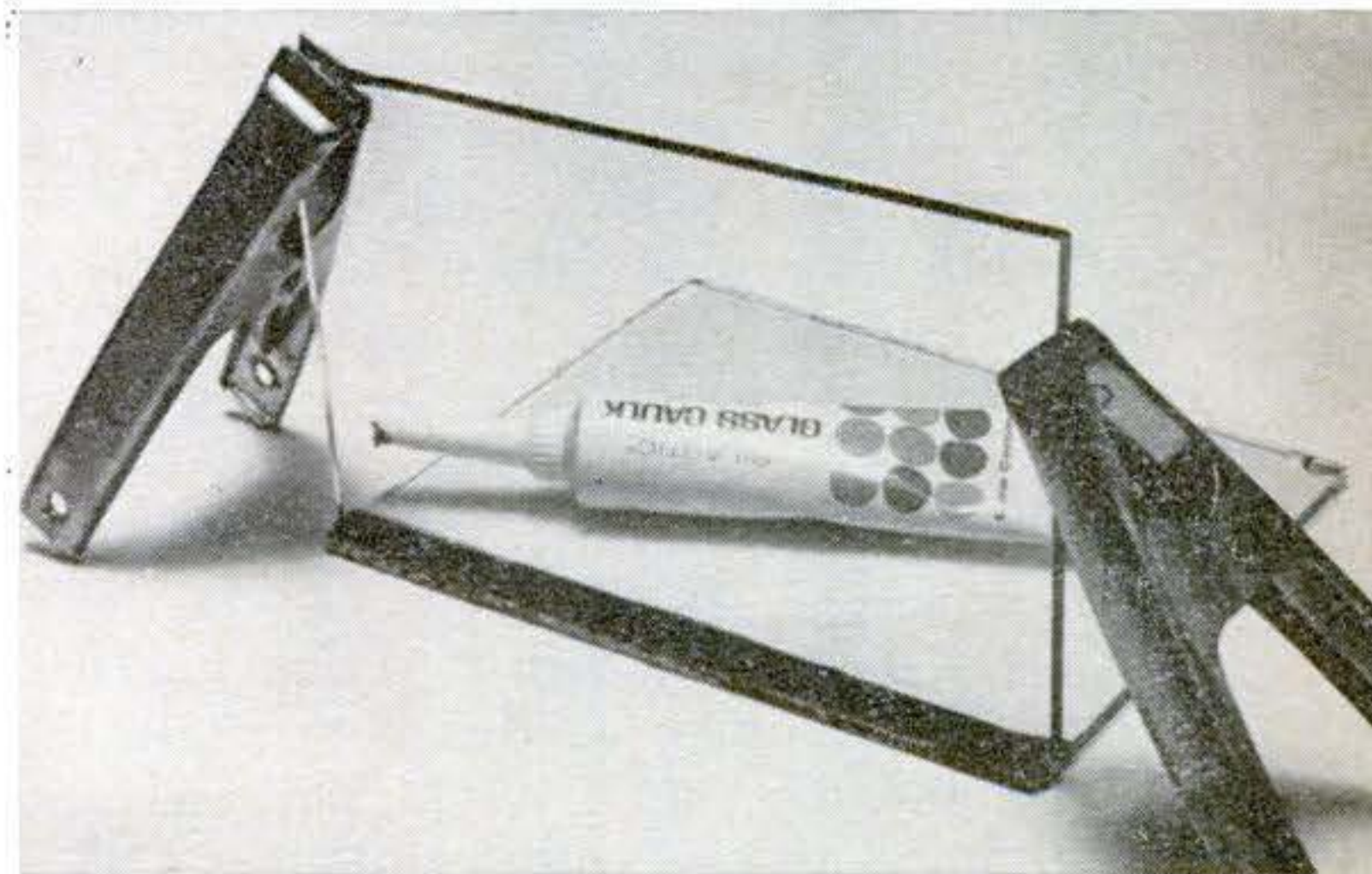
Silicone sealants are a prime material in boat building and maintenance. With them,

*Continued*

## Three examples of home uses for this wonder material

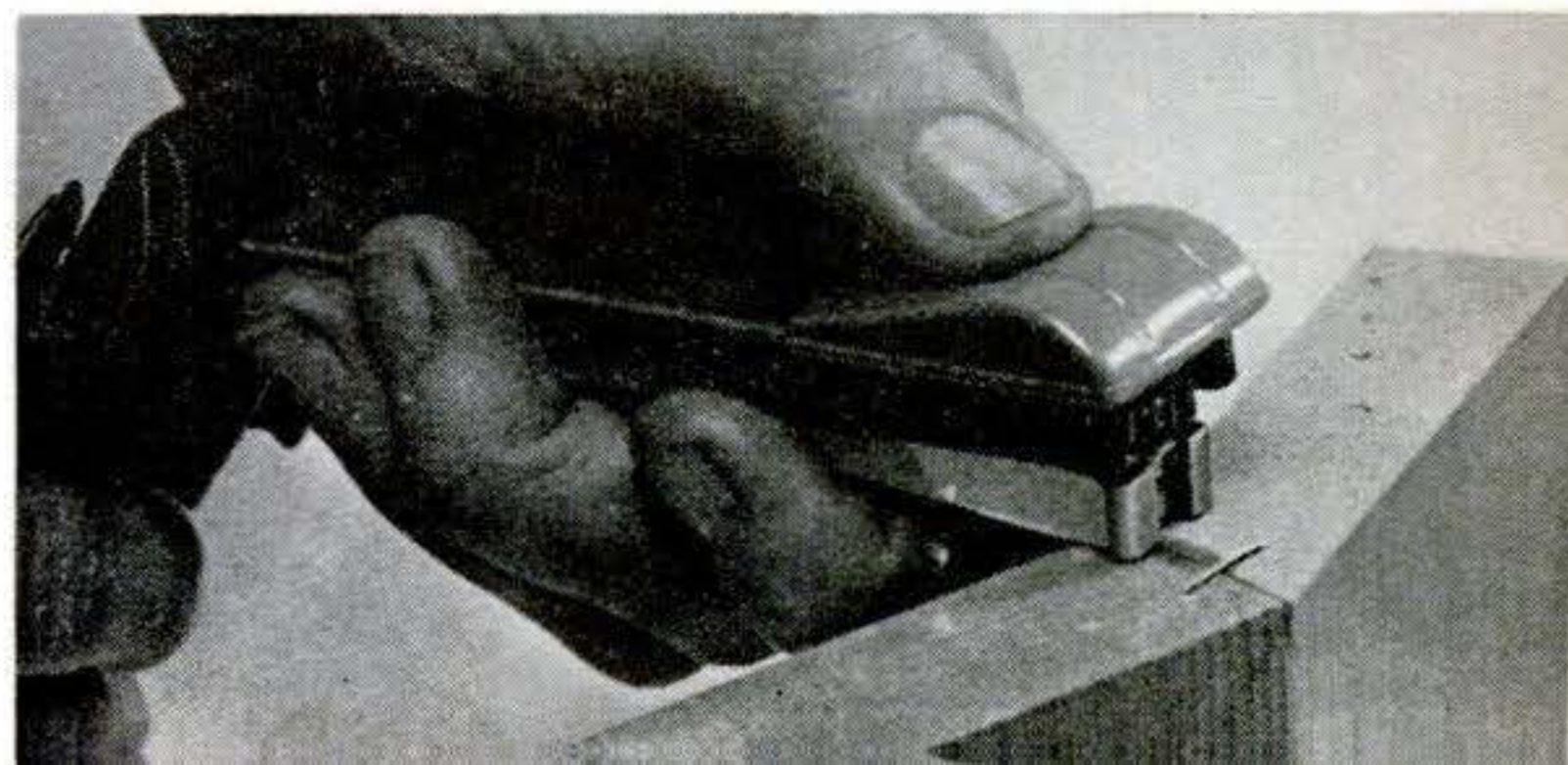


You can glue on new handles—even on spatulas. After cleaning the metal, clamp on the rough-cut new wood for 24 hours, then shape the handle.



For glass-to-glass adhesion, run a bead of sealant along one surface and set the mating piece on it. Use supports, such as clamps, until sealant sets.

Hard-to-clamp parts, like these planter-box segments, can be joined with a silicone sealant. The parts are kept in place overnight with staples.





Repair your driveway or sun deck: GE's Traffic Topping, a silicone material mixed with grit, comes in

red, green, gray, and white. It also gives a "concrete look" to wooden floors and stairs.

you can cement a patch on the inside of a metal or glass hull. Consider the silicone rubber as a sort of gasket—extremely well fitting. Clean the surface—dinged flat. Prime aluminum with a vinyl wash primer. Sand until glass fibers are surfaced. Spread silicone rubber. Apply a supporting patch of aluminum or glass. Use sheet-metal screws or rivets for mechanical hold. With the silicone rubber in this schedule, you'll never leak *there* again—ever.

I used it, too, to repair a leaking seal around the spinner at the bottom of the kitchen blender, and it stopped seeping orange juice all over the counter.

**Johnny get your gun.** Actually, this handy-Andy product has much more serious work to do. Put up in cartridges for your caulking gun, silicone sealants are the easiest to use and, in most ways, the most economical. You need only a ¼-inch fillet of sealant to get a good bond to both sides of a crack you're caulking. Then, a big advantage: The stuff never hardens—at least it has stayed soft 20 years and more under tests. When humidity changes make the crack open and close, the silicone caulk

merely compresses or stretches, as required. The crack doesn't open.

Owing to the way silicone sealants stick to glass, they are perfect for bedding glass in window construction or repairs, and for problem putty situations. I had trouble keeping a small pane of glass in the winter insert of my combination storm door. The slamming of the door plus the air pressure gradually ruined and cracked ordinary putty. With the frame cleaned free of old material, I cemented in the glass with Silastic Aquarium Sealant. No glazier's points—nothing but the sealant. On the outside, I used regular glazing compound to form the bevel—but its only function was to provide shape for painting.

The glass-to-glass adhesion of silicone sealants was demonstrated interestingly a few years ago in a building that included wide exterior wall sections made of large glass tubes placed side by side, caulked inside and out. The architect's idea was that the tubes would give tremendous translucence and excellent insulation, owing to the air in the tubes. He was right. But the caulking fell out. The long tubes, expand-



ing in length under heat and shrinking in cold, cracked the caulking to powder. Silicone rubber replaced it—and was able to stand the gaff.

Commercial sealant organizations are using more and more silicone caulking materials; they cost more than ordinary caulk and putty, but smaller quantities are needed. In most cases, the professionals have found that they can back up the silicones with some inexpensive material, which serves merely to occupy space (such as plastic foams) while the silicone provides the sealing and weatherproofing.

**All around the house.** Silicones make the home owner handier than he ever thought he was. Consider the range of jobs they'll do:

- Patch gutters and downspouts that drip—you can even use silicones to fasten lengths of gutter together, and to bridge the gap between metal and wood if you have wooden gutters.

- Bed a kitchen or bathroom sink so snugly and watertight that rot can't find a place to start—nor can household germs.

- Run a fillet of silicone around the upper-to-sole joint in workshoes or shoes you wear for sports.

- Patch a tent—or any other fabric. Cement down loosened leather or plastic on luggage.

- Cement license numbers on a boat, house numbers on a mailbox, your initials on the door of your car.

- Patch darkroom tanks and trays, or use it to make new ones.

- Repair gaskets around doors of washers, dryers, and refrigerators.

- Anchor loose floor tile—or wall tile—

including slate, rubber, asbestos, vinyl.

- Fill cracks in masonry and, most particularly, cracks between masonry and nonmasonry materials.

- Caulk around bathtubs and other fixtures when the original mastic or grout has cracked away.

- Seal up flashing against the weather and, at the same time, cement it down. (You must provide a temporary way of maintaining contact for the hour or so the silicones need to set.)

- Glue down a glass table top that skids. Squeeze small dabs of clear silicone sealant at the corners.

- Seal windshield or other window parts of your car, fasten loose gaskets—apply new ones if they're needed.

- Seal leaking skylights, and air-conditioning installations that leak air.

- Fill the holes for TV antenna leads.

- Caulk up enclosed shower stalls.

- Fasten reflector buttons on posts.

- Repair cracked, crumbling driveways.

Driveways? Yes, with one of the newest of the silicones, a rubber mixed with a sand-like grit. The result—GE's Traffic Topper—is a substance that looks exactly like troweled concrete, and wears like it, too. Usually, the cracks it covers in concrete do not return, owing to the elastic nature of the rubber.

The breakthrough that made the silicone rubbers so great for around-the-house uses was the chemistry that eliminated the need for a catalyst, or hardening agent. Most materials that come as close to "miracle products" as this stuff are double-compound,

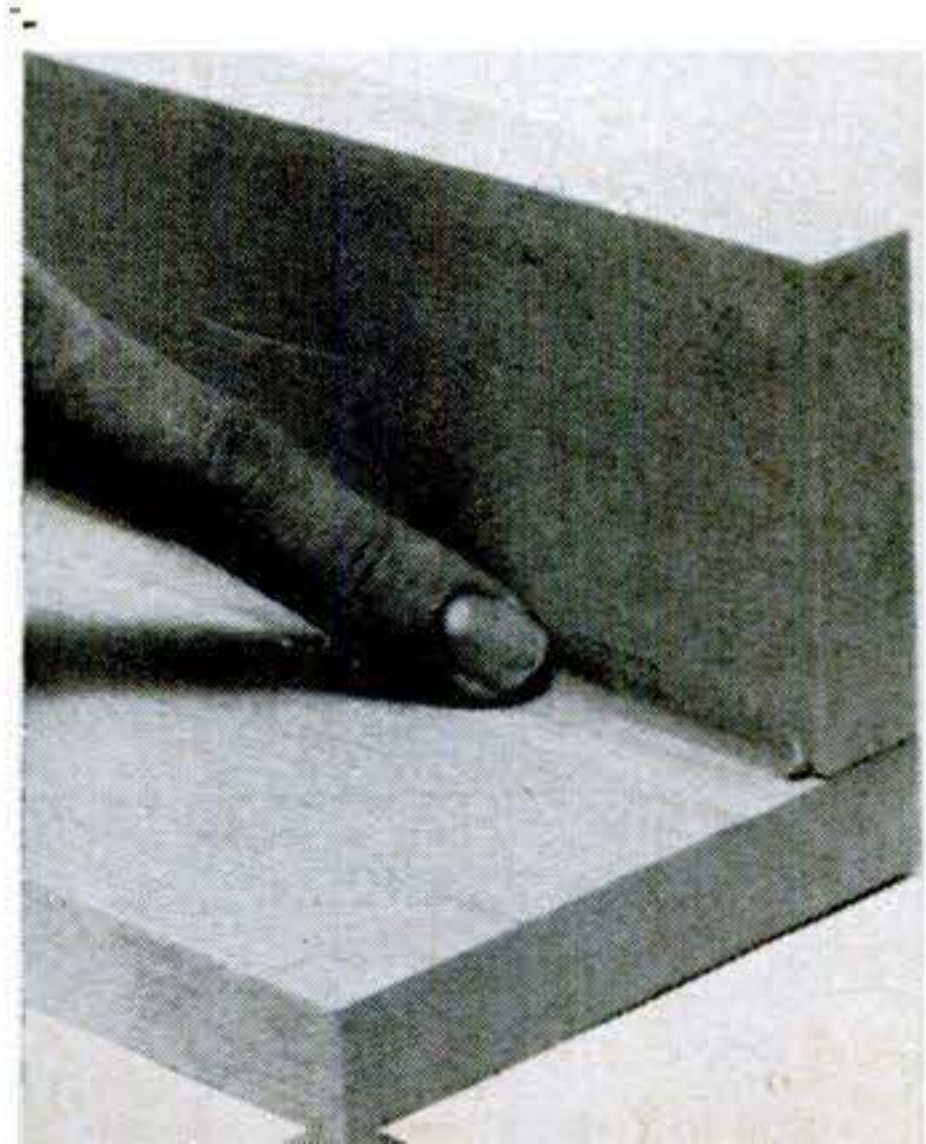
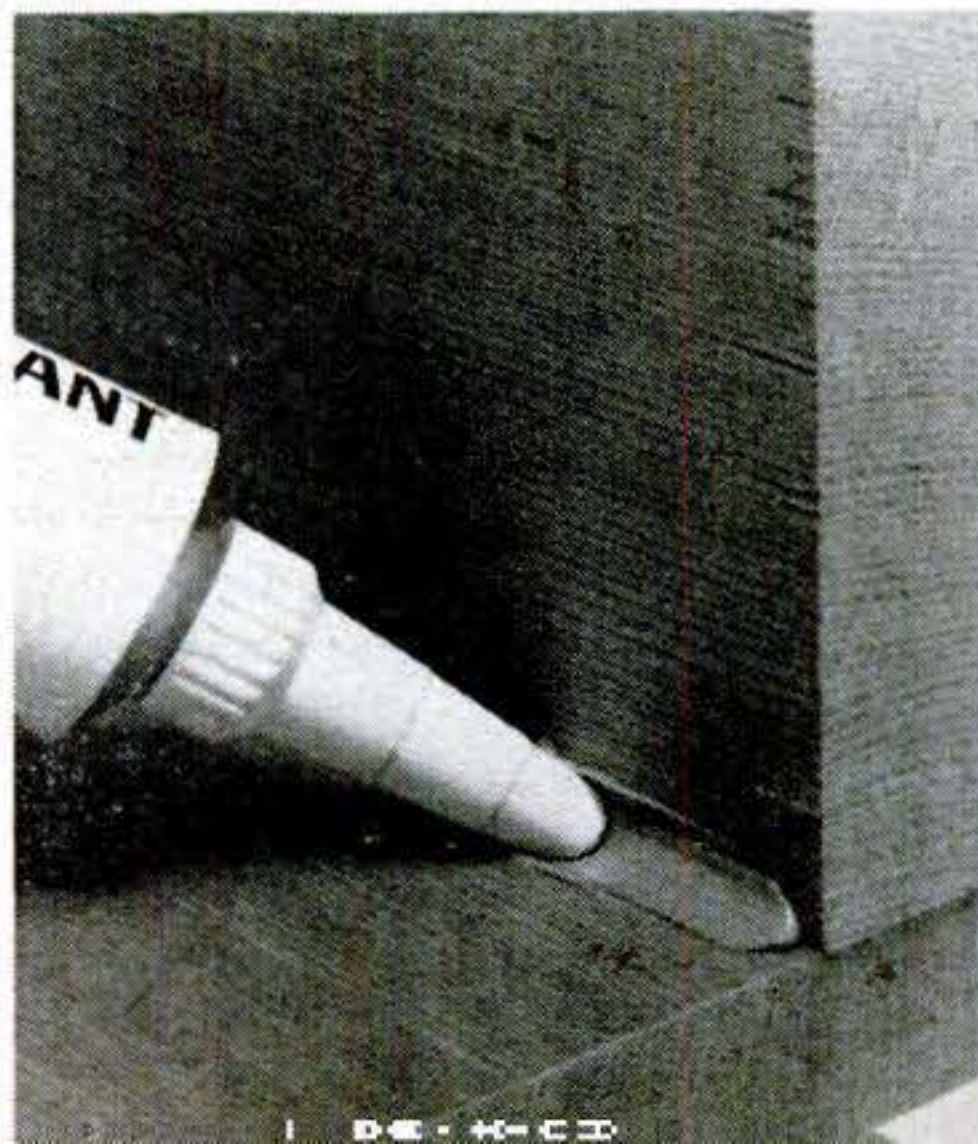
*[Continued on page 197]*

## Silicone sealer makes jointing easy and gives remarkable adhesion

Cut the tapered plastic nozzle to get the size bead you need. When the nozzle is cut at an angle, as shown, you can see your work as you pull the nozzle along the joint.

How fast you move the tube along, coupled with the squeeze you give it, determines the fillet you produce. Any overflow can be cut away later with a razor blade or chisel.

A virtually edgeless joint can be made by smoothing the rubber with your finger right after it is ejected. Waiting more than a few seconds will cause roughening.



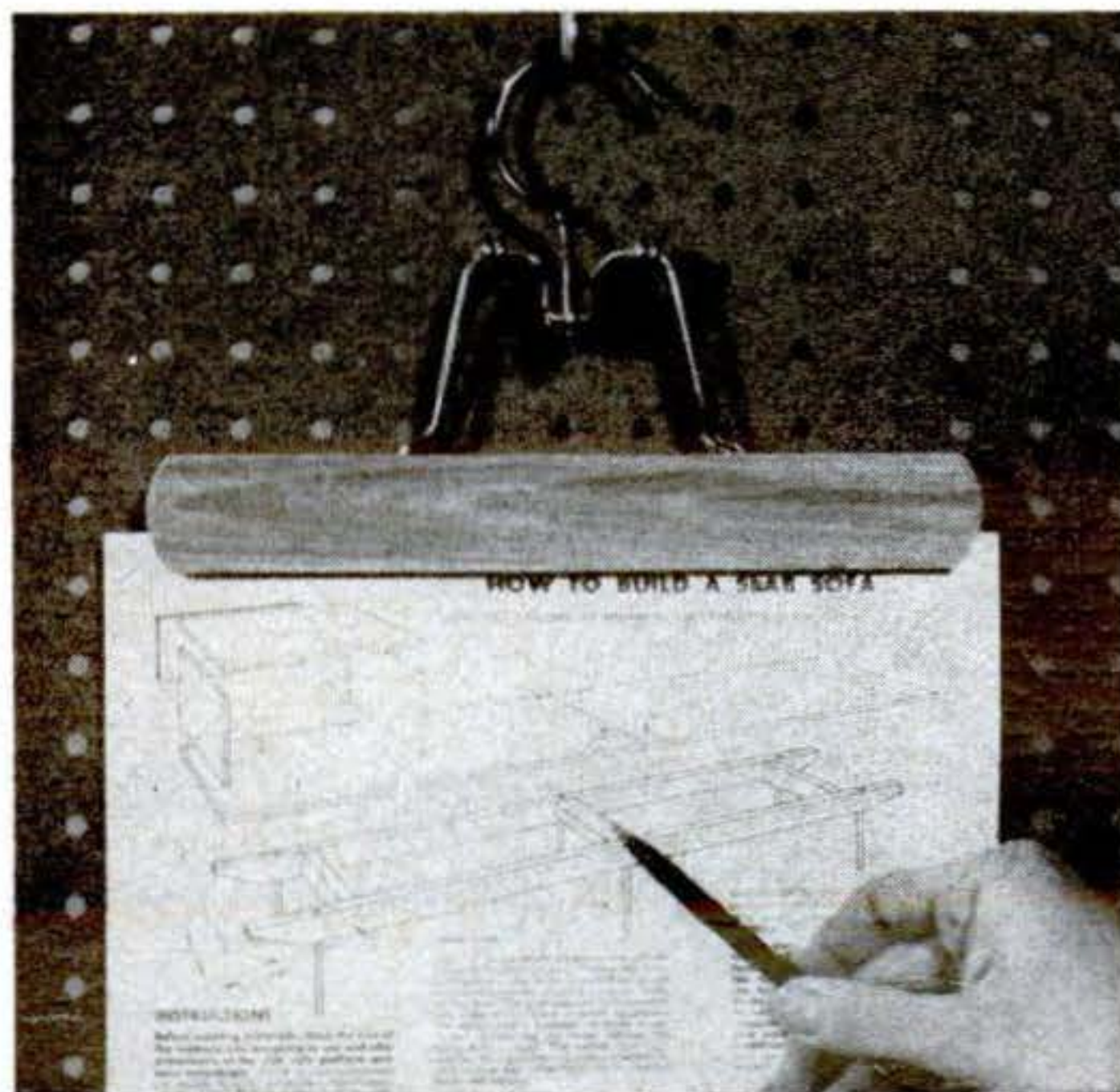
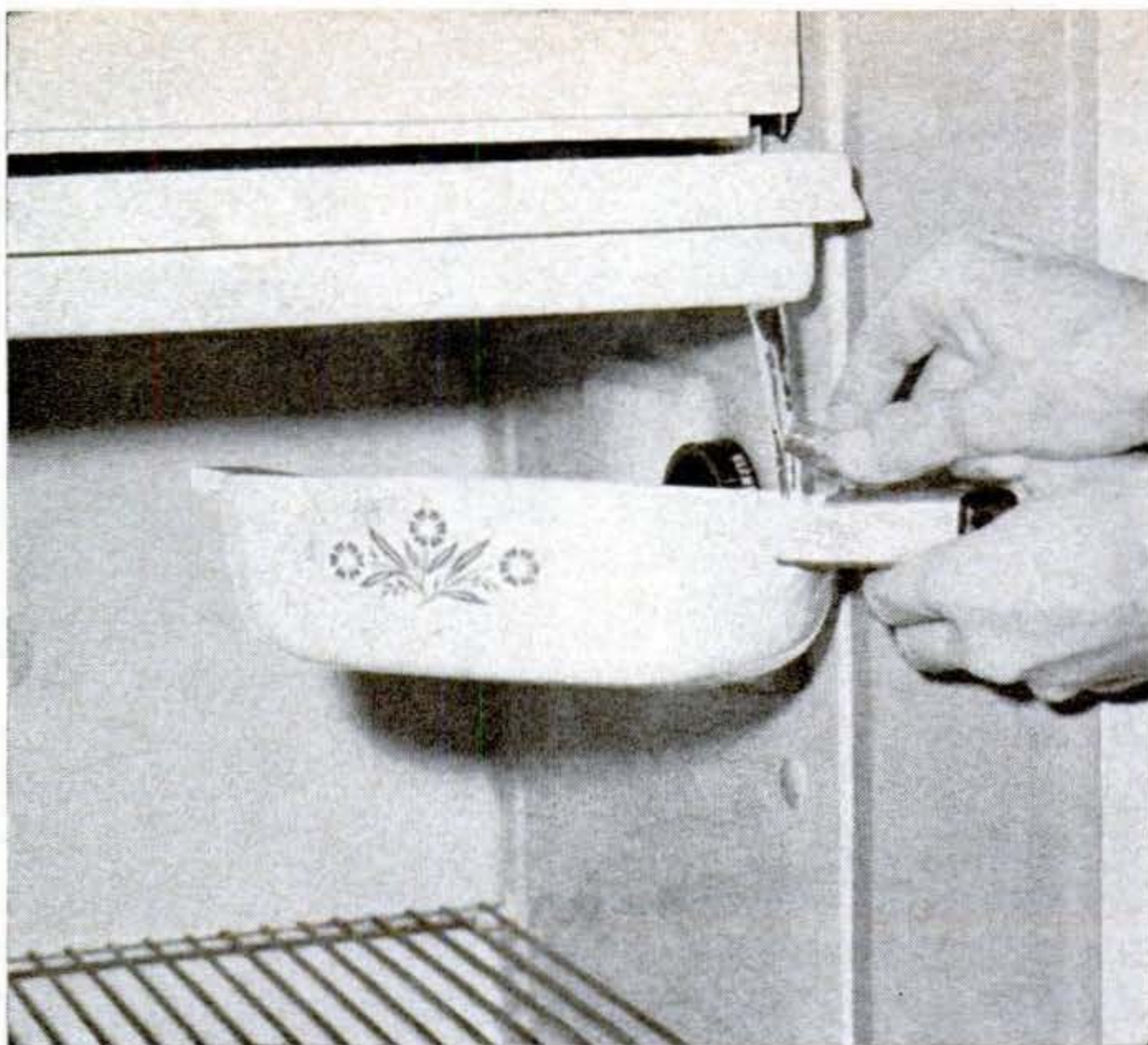
## SHORT CUTS AND TIPS

### FROM PS READERS

#### Why carry that defrosting tray? You can drain it

Your freezer compartment often defrosts more than the tray can hold. Removing the tray for emptying is a messy job, and during this time more water drips through the refrigerator. You can circumvent this by making a hole in one of the front corners of the tray and inserting a cork at the bottom. Drainage is then easy, as shown at the right.

W. S. GOHL,  
Bohemia, N.Y.



#### Trouser hanger will hold your plans

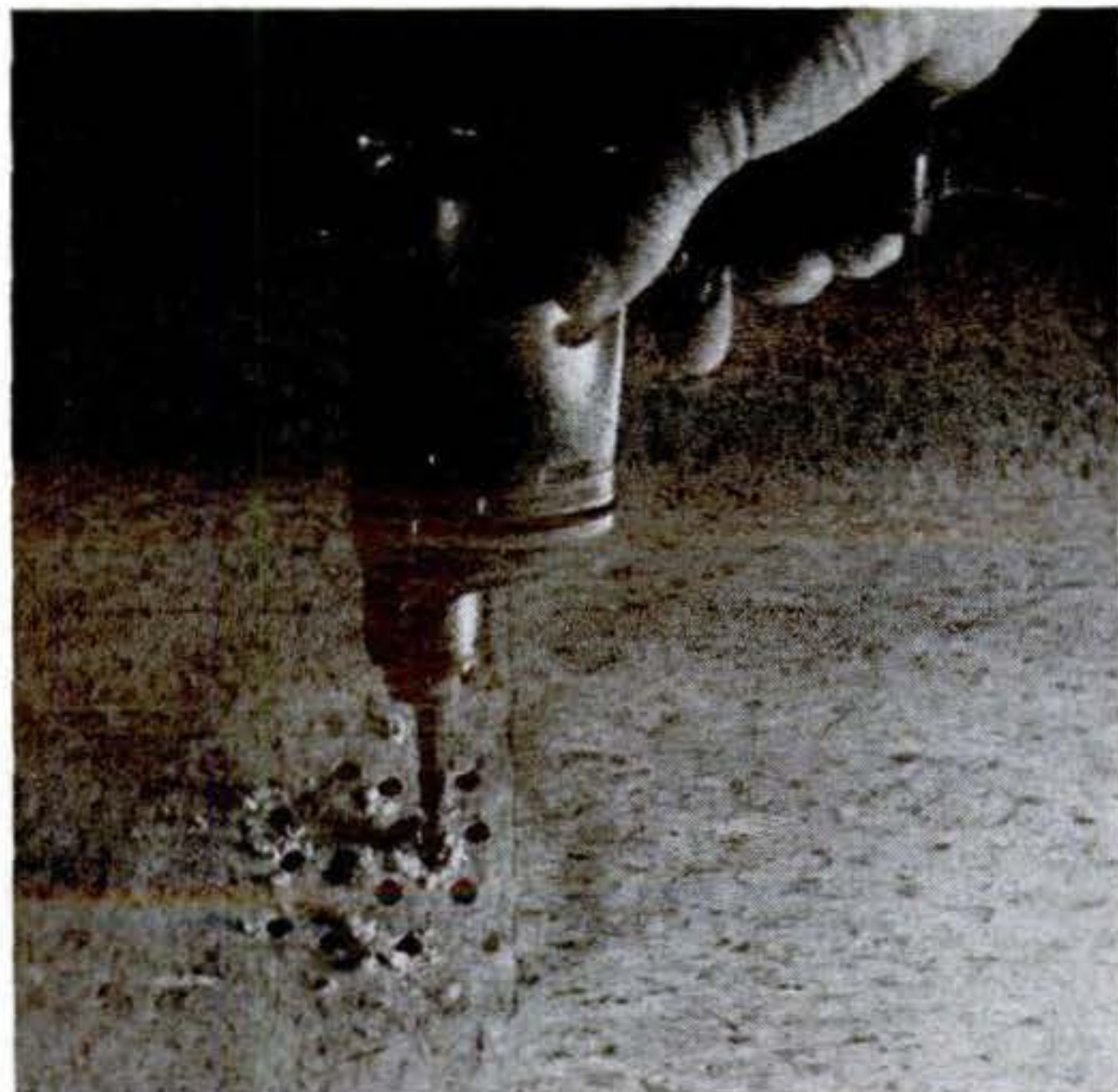
A workshop project always goes better if you can keep the plans close by for easy reference. I find a trouser hanger ideal for holding a single sheet or a whole magazine because it can be easily hung, and right at eye level, in a convenient location near the workbench.

KEN PATTERSON, Regina, Sask., Can.

#### Caulking gun speeds cementing job

Next time you have to tuckpoint masonry or fill cracks in concrete, fill a caulking gun with a small batch of mortar or concrete, insert the nozzle tip at seams, and inject the mix. This method speeds the job and reduces mess. Wash the gun out before the mix sets.

J. H. MATTHEWS, St. Louis, Mo.



#### You can tile right over that drain

Planning to put down a resilient-tile floor in your basement or utility area? Here's a tip to make cutting around the drain opening unnecessary. A series of  $\frac{1}{4}$ " holes drilled through the tile to the drain (as shown above) will provide drainage and look a lot better, too.

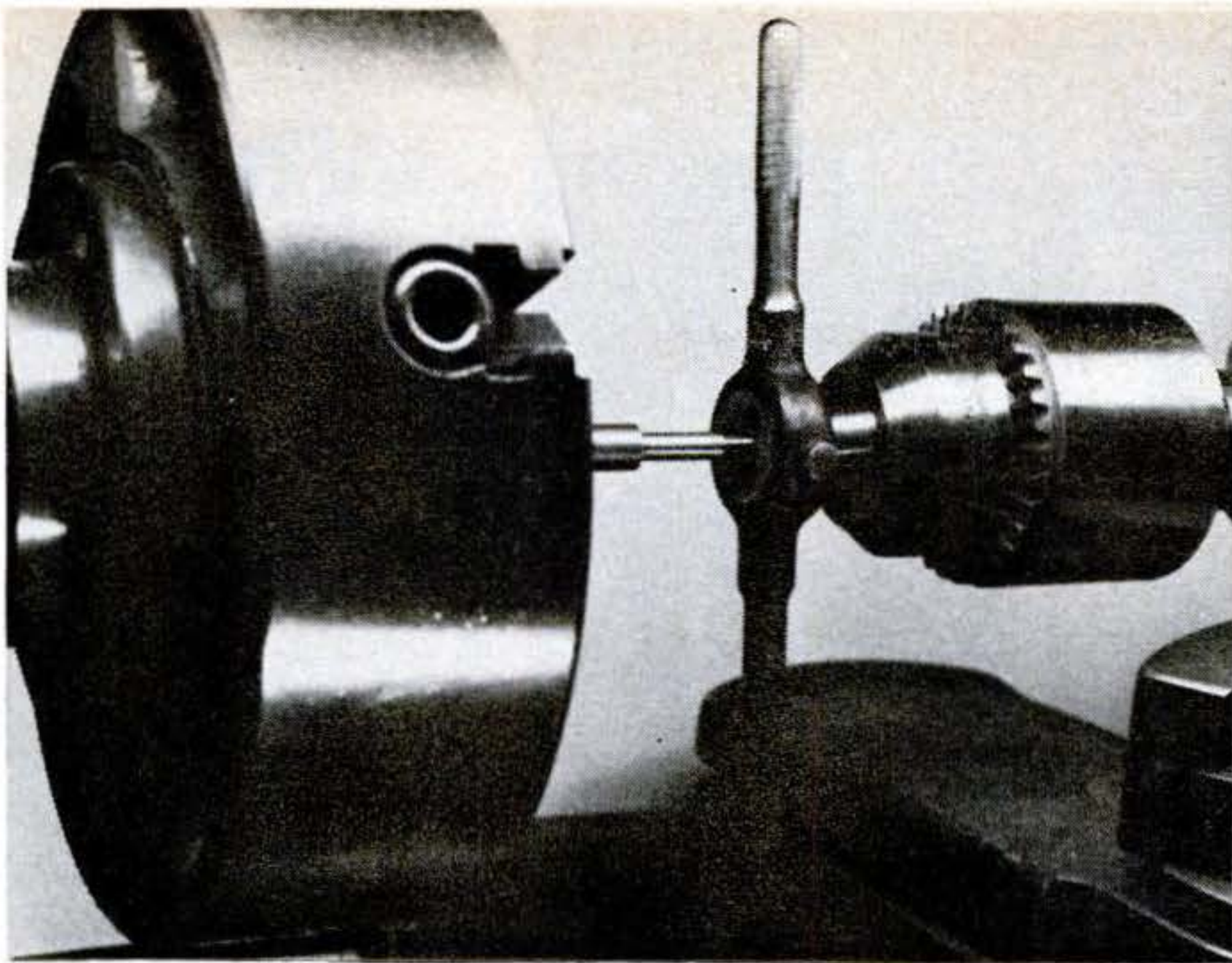
F. L. GREENWALD, Western Springs, Ill.

#### Make those punched holes neater

You can punch cleaner holes by remembering these backing tips: When driving through light metal, gasket material, or leather, sink your solid or hollow punch into the end grain of the wood back-up block. For difficult-to-make holes in metal, use a lead back-up.

M. L. NUTTING, Burlingame, Calif.

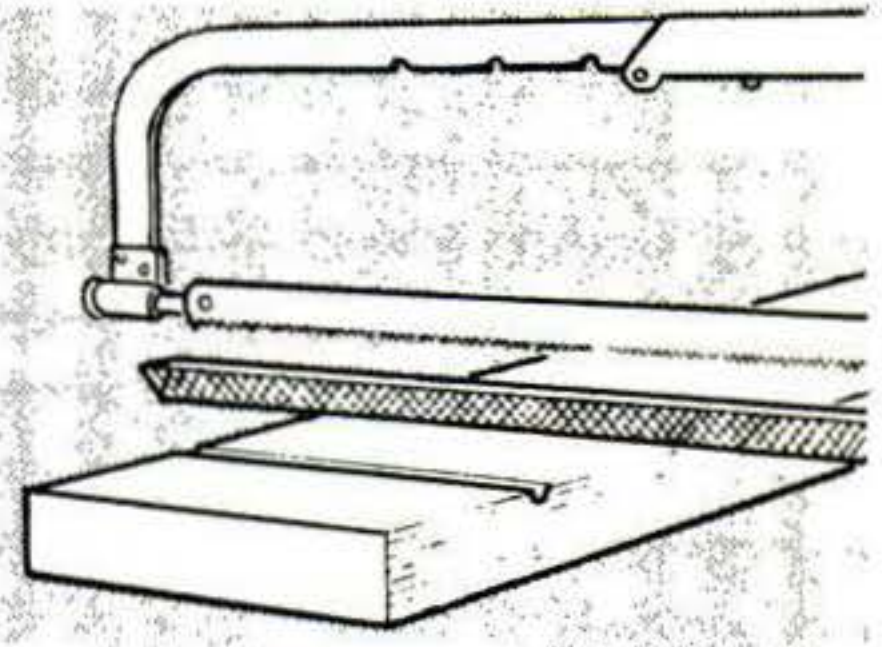
# Short Cuts for Machinists



## Headless bolt gives die a straight start

When you thread small-diameter rods, you won't get chewed-up or lopsided threads if you use this trick to start the die. Chuck the rod, and clamp a headless bolt in the tailstock chuck. Thread the die on the bolt, then press the end of the bolt to the rod. Lock the headstock and run the die onto the rod. The bolt threads will guide it.

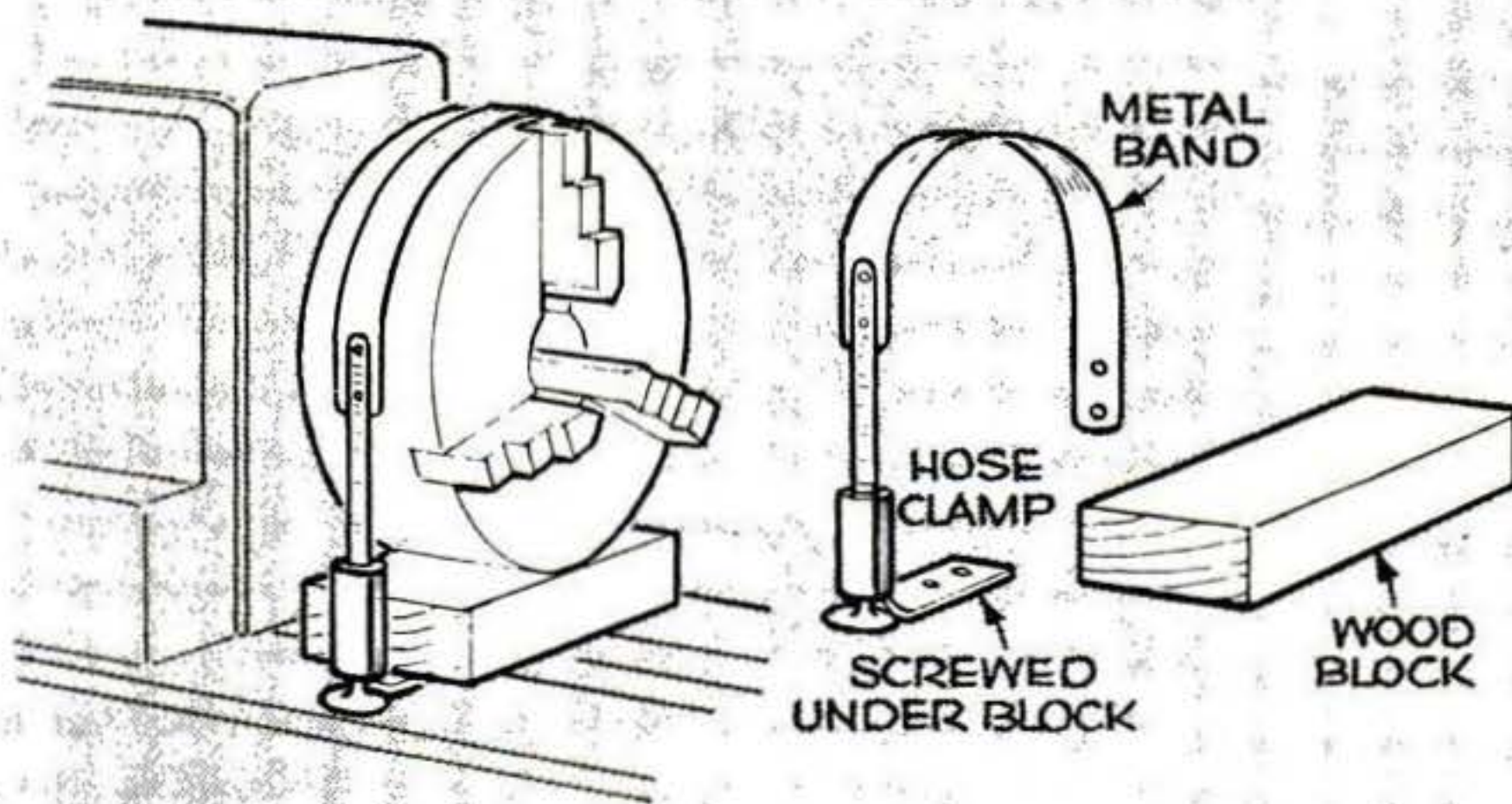
CONRAD SKLADAL, Sunnyvale, Calif.



## Sure way to get a straight start with a hacksaw

Deepen the scribe mark with a small triangular file, and you'll get a groove to guide the hacksaw teeth. It will help you make a straight cut, and it will prevent the saw from slipping and nicking the stock.

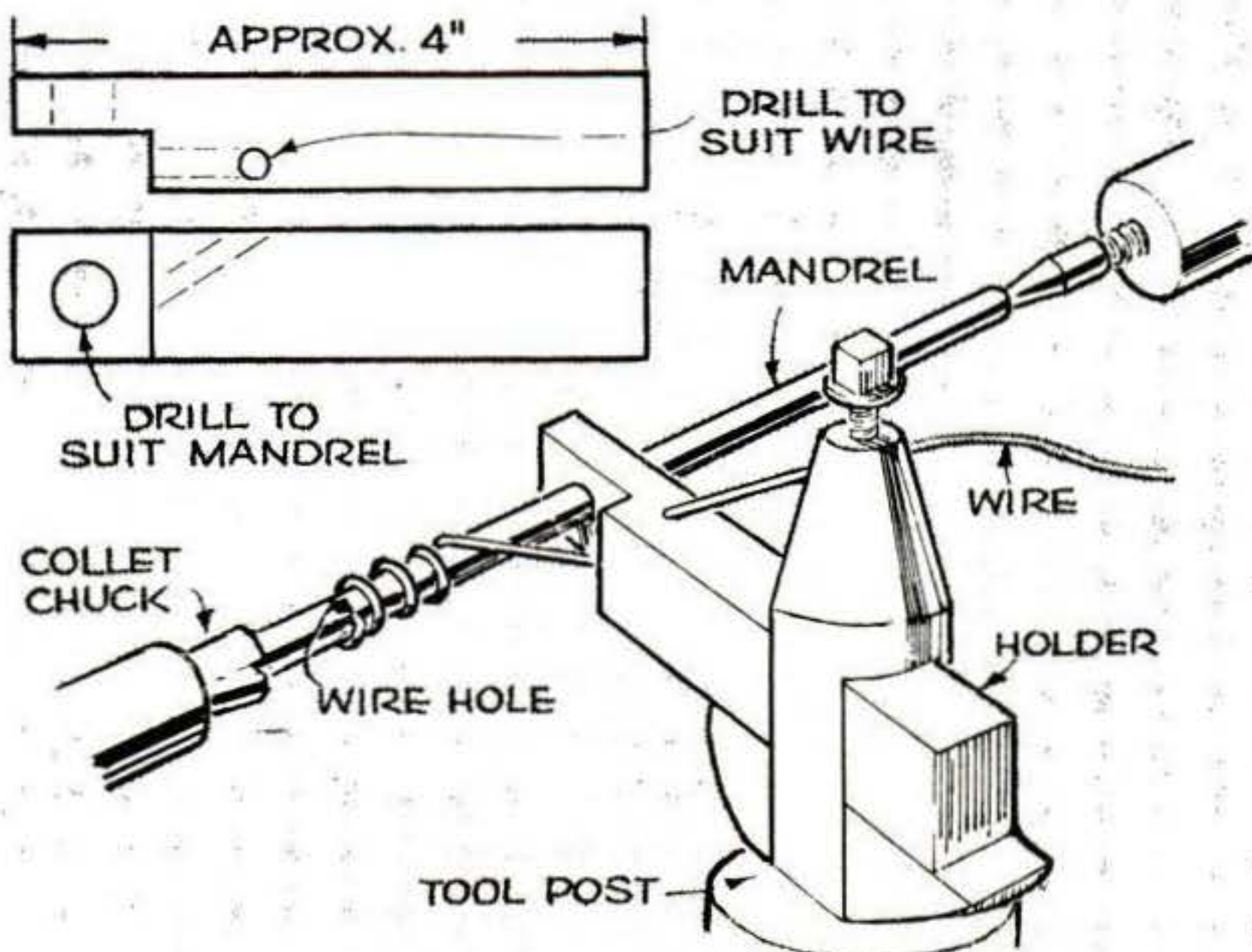
DANIEL BOUSHA  
Jackson, Mich.



## Chuck-removing clamp

A heavy chuck comes off the lathe without banging the ways—or your fingers—if you clamp it to a support block as shown at left. Use a wood block the width of the lathe and fit it snugly under the chuck. A metal hose clamp screwed to the block holds the chuck. To remove the chuck, turn the spindle by hand or run the lathe backwards in low gear.

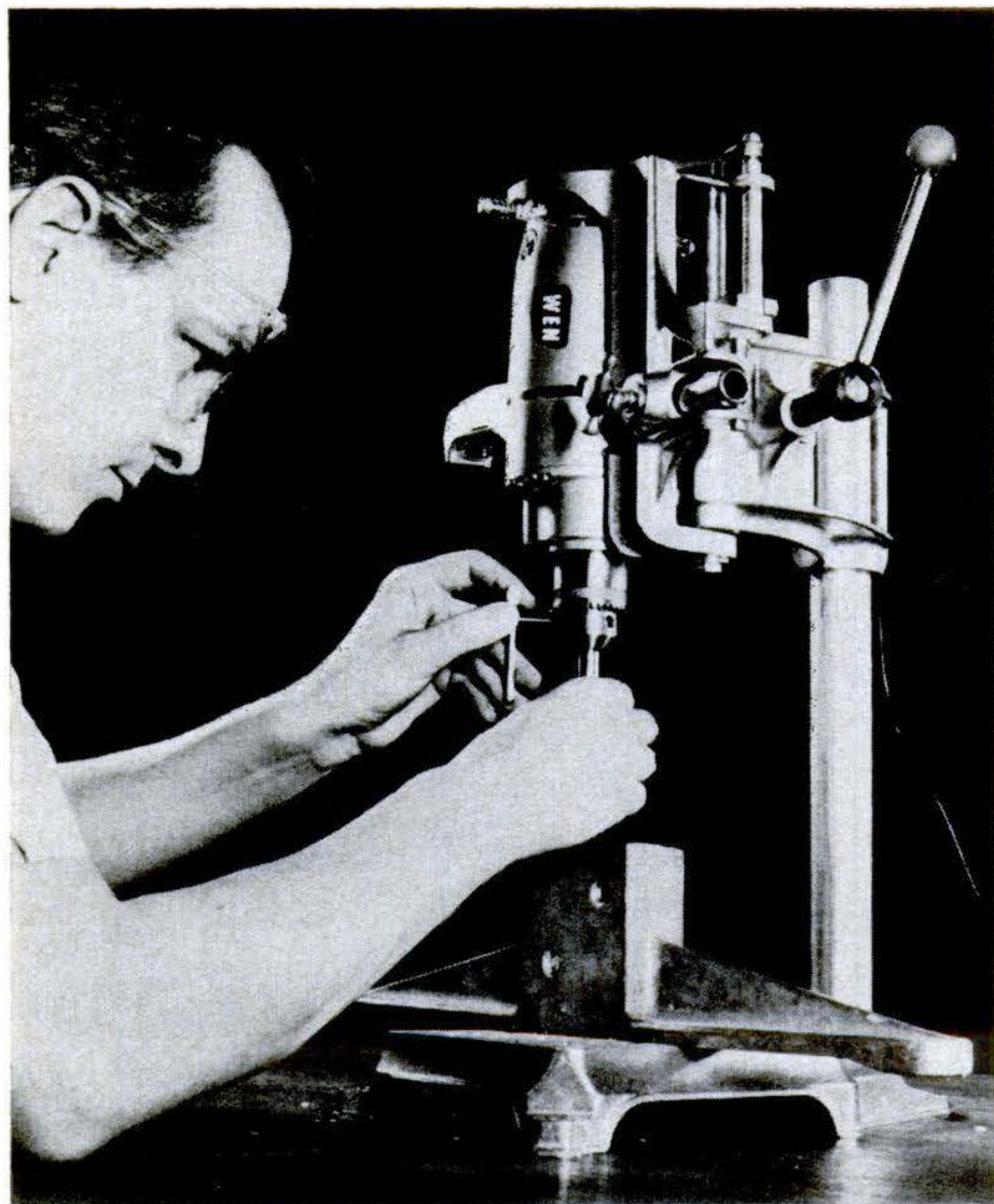
PETER LEGON, Malden, Mass.



## Device lets you turn out springs on your lathe

Mount this holder in the tool post on your lathe and you can turn out springs in a jiffy. Make the holder out of bar stock (hardwood will do if you have only a couple of springs to make). Mandrel size determines the i.d. of the spring. The end of the wire goes in the hole in the mandrel. Use threading gears to get the spiral you want and keep the wire tensioned.

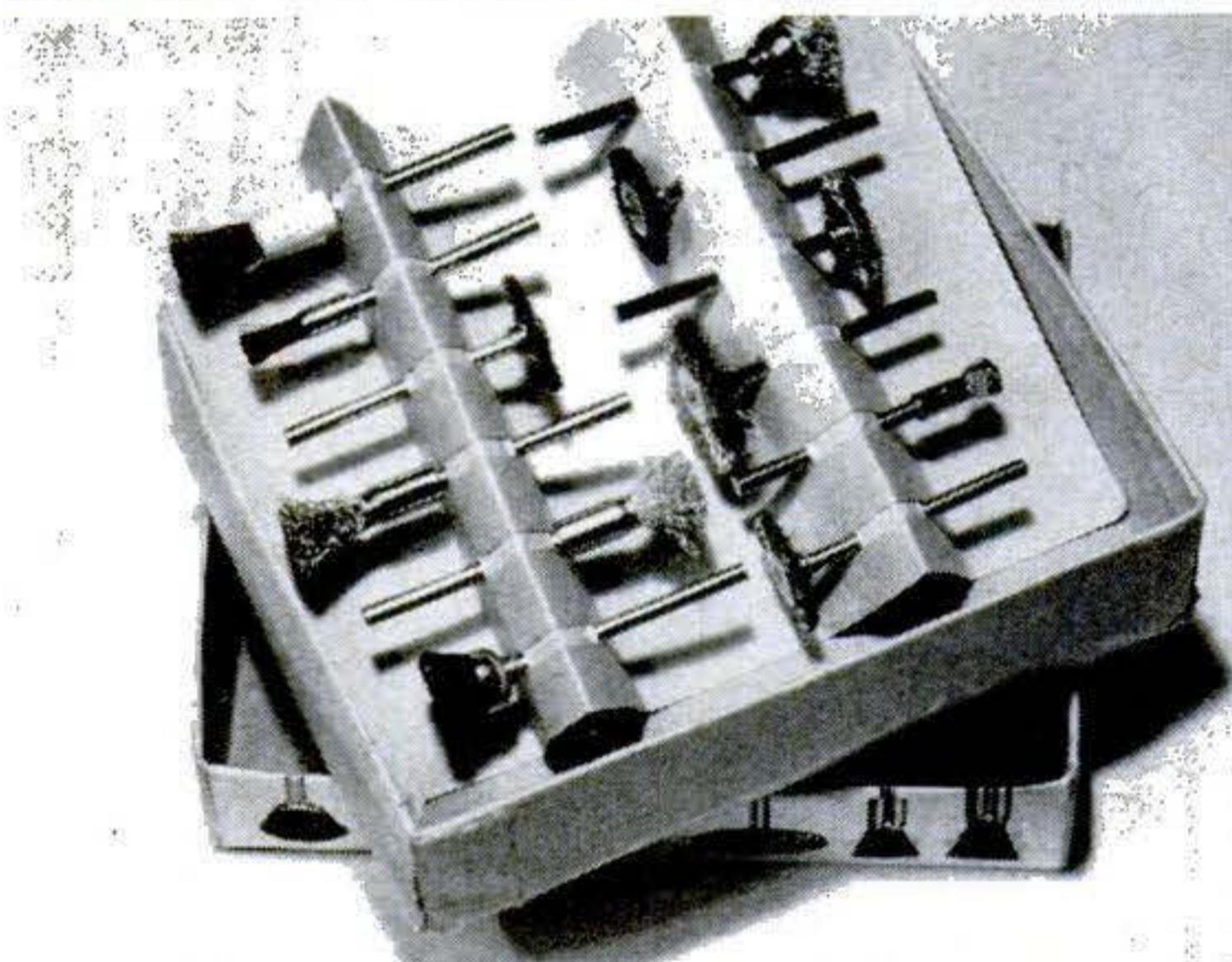
O. A. OLSEN, Bridgewater, N.Y.



# What's New in Tools

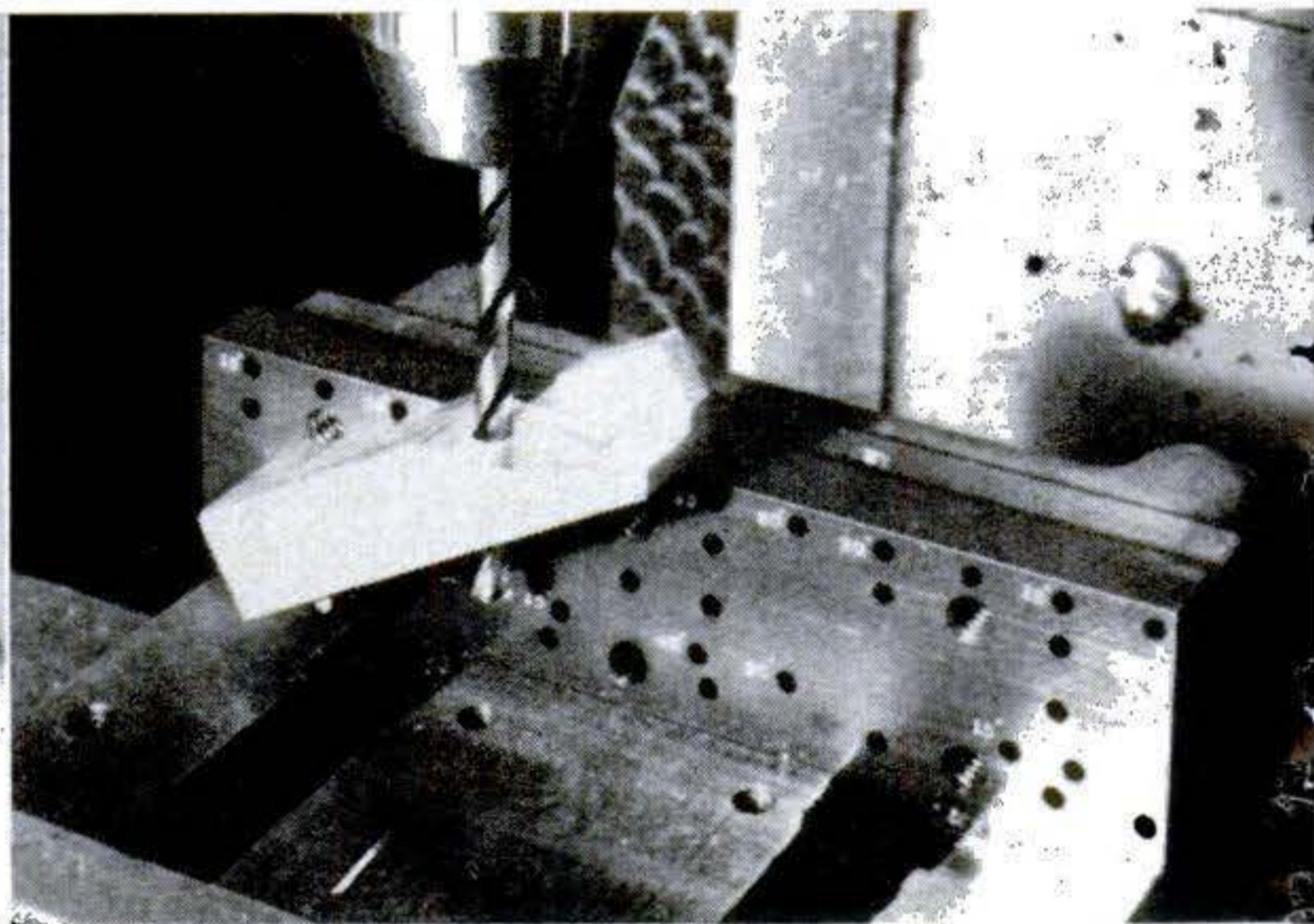
## Handy new combination

Need a drill-press unit? Here's a good one—Wen's four-speed reversible  $\frac{1}{2}$ " All-Drill coupled with Wen's new drill-press stand. One knob clamps the drill in place; three bolts give alignment. A calibrated (to  $2\frac{3}{4}$ " ) depth gauge and locking nuts give you easy control of hole depth. There are no pulleys or belts. Column height is 19", overall height,  $20\frac{1}{4}$ ". Price of the two is \$80.90; the stand alone costs \$35.95.



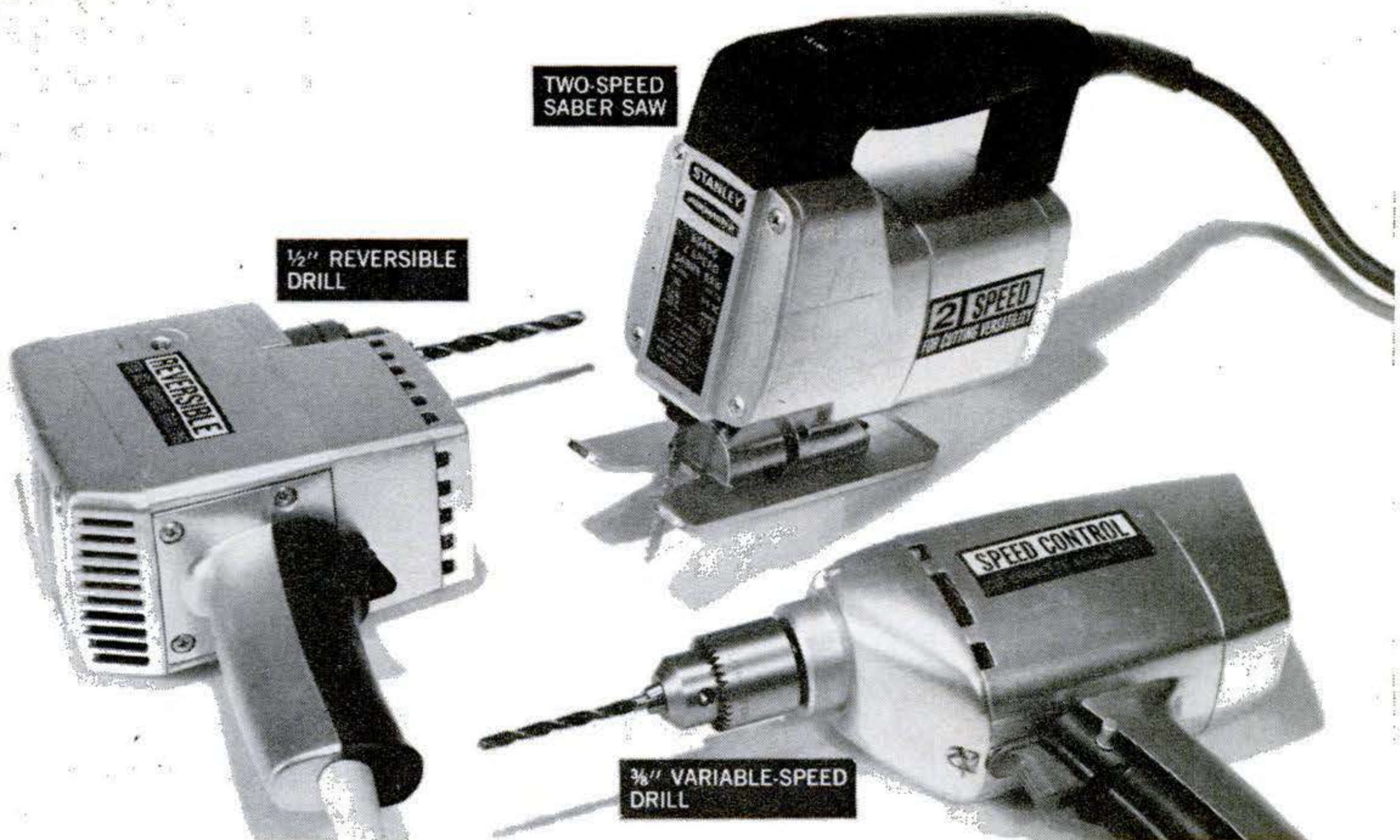
## You'll find 1001 uses for these brushes

Designed to aid do-it-yourselfers and hobbyists, these 12 miniature brushes have a  $\frac{1}{8}$ " stem diameter to fit your power drill or special brushing tools. Use them for modelmaking or metalworking—removing corrosion and surface film, deburring, edge-blending, cleaning, and finishing. They'll work on plastics and rubber, as well as wood and metal. Weiler Brush Co., Cresco, Pa. 18326, is the manufacturer.



## Hole-pattern jaw sets angles on machine vise

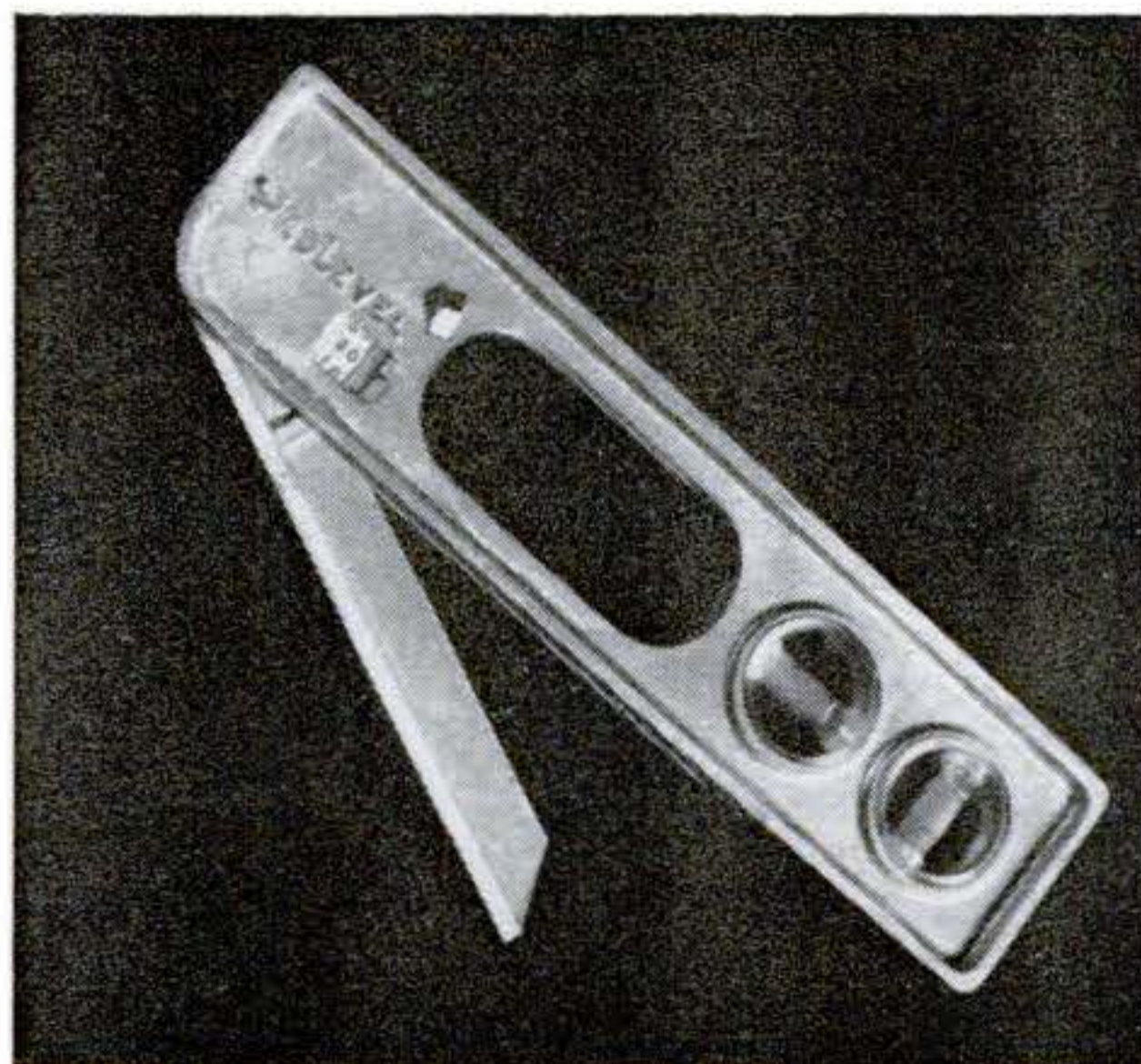
The Easy-Angle lets you set angles from zero to 90 degrees on work in a machine vise. It's a hardened-steel vise jaw with a calculated hole pattern. By inserting two pins in the proper holes (indicated by a chart) angles to an accuracy of  $\frac{1}{4}$  degree are obtained. You can bank the holed unit against the vise jaws or replace the fixed jaw with it. Karl A. Neise, Inc., 56-02 Roosevelt Ave., Woodside, N.Y. 11377.



### Three new members join the growing Job Master family

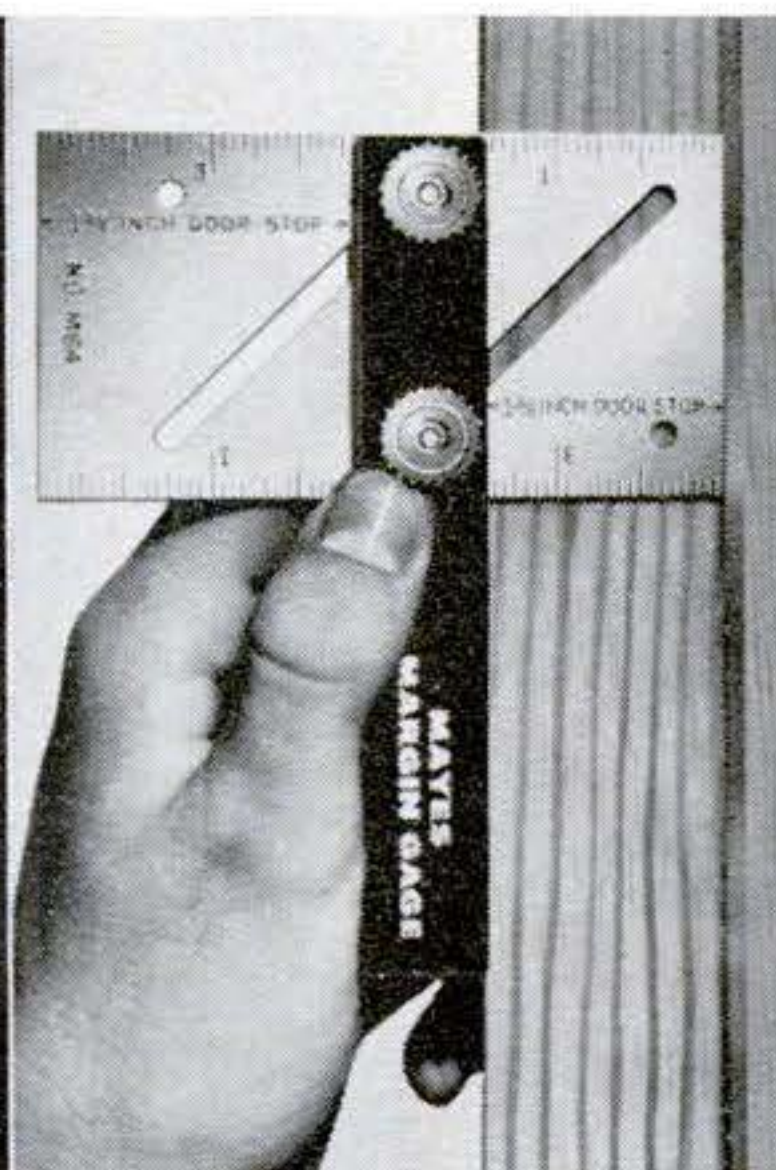
Big news in Stanley's newest line of tools is the 1/2-hp. variable-speed drill (above, right). You can control speeds from 0 to 1,000 r.p.m. by varying the pressure on the trigger switch. Fit a driver bit to the chuck and you've got a powered screwdriver. You start the screw into the work slowly, gradually increase the speed, and

decrease to set the screw tight. The 3/8" drill weighs 3 3/4 pounds. Price: \$36.95. The saber saw at top (\$39.98) can rip 2" lumber and slice a 1/2" steel bar. The base tilts for angle cuts. The 1/2" all-purpose, reversible drill, at left, comes with a second handle to fit in the side of the housing. It sells for \$59.88.



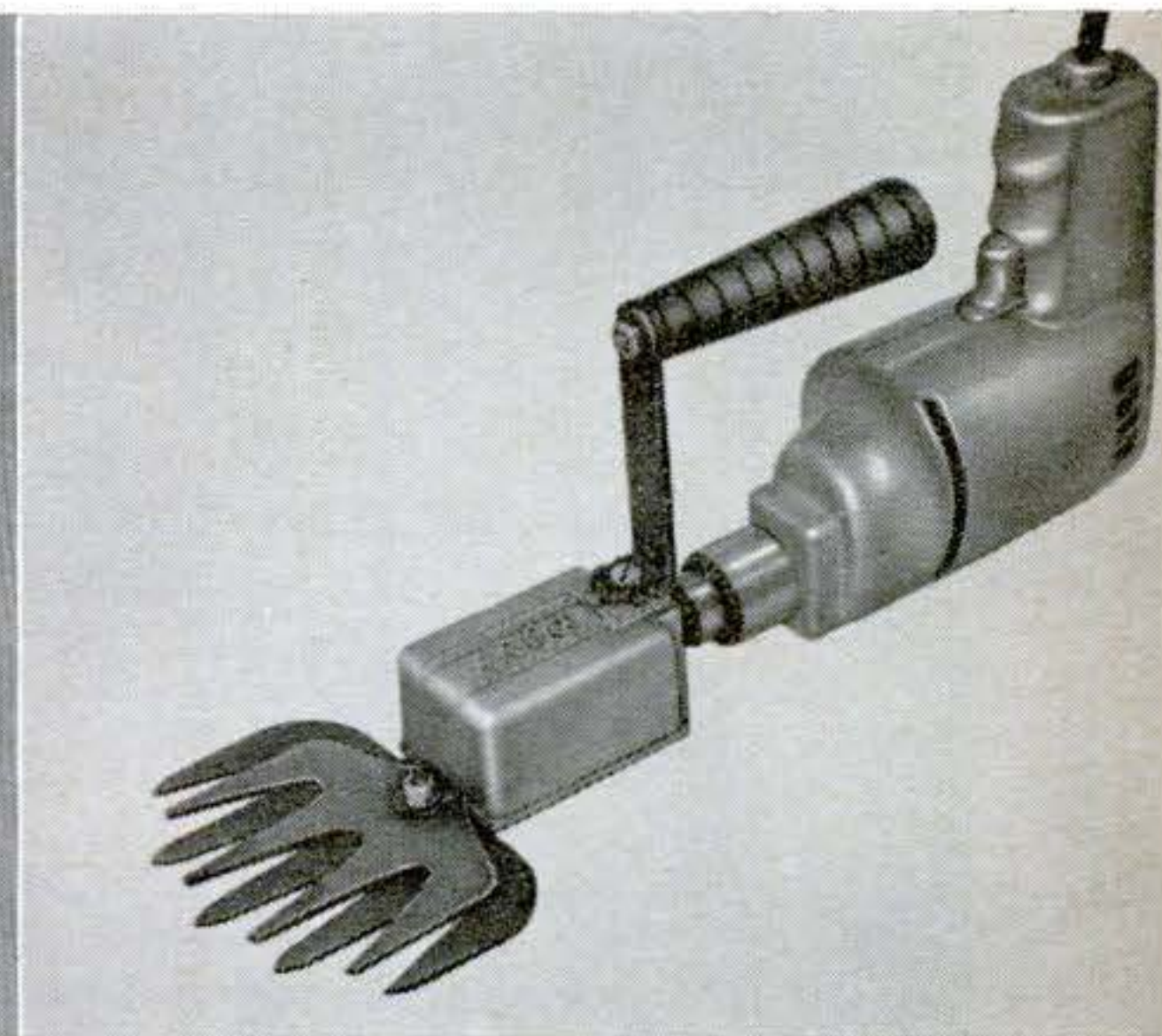
### Protractor-level-square in one

Three tools useful around a home shop are combined in the Pro-Level, made by Held Industries (Box 353, St. Clairsville, Ohio 43950). With it, you can check true plumb, dead level, and any angle in between. The squaring arm retracts like a knife blade. Cost: \$3.97.



### Pocket-size margin gauge

This gauge and scribe is also a combination square. Set the steel blade in different positions, and you can locate butt-hinge recesses, mark 45-degree cuts, square two-by-fours, and do other jobs. Mayes Bros. Tool Mfg. Co., Johnson City, Tenn., 98¢.



### Shrub trimmer attaches to drill

If you own a portable drill, here's a lightweight trimmer you can chuck in it to cut and shape your shrubs electrically. The hardened tool-steel blade holds a keen edge and the handle locks at 10 angles for comfortable reach. \$6.95 from Arco Tools, 421 W. 203 St., NYC 10034.

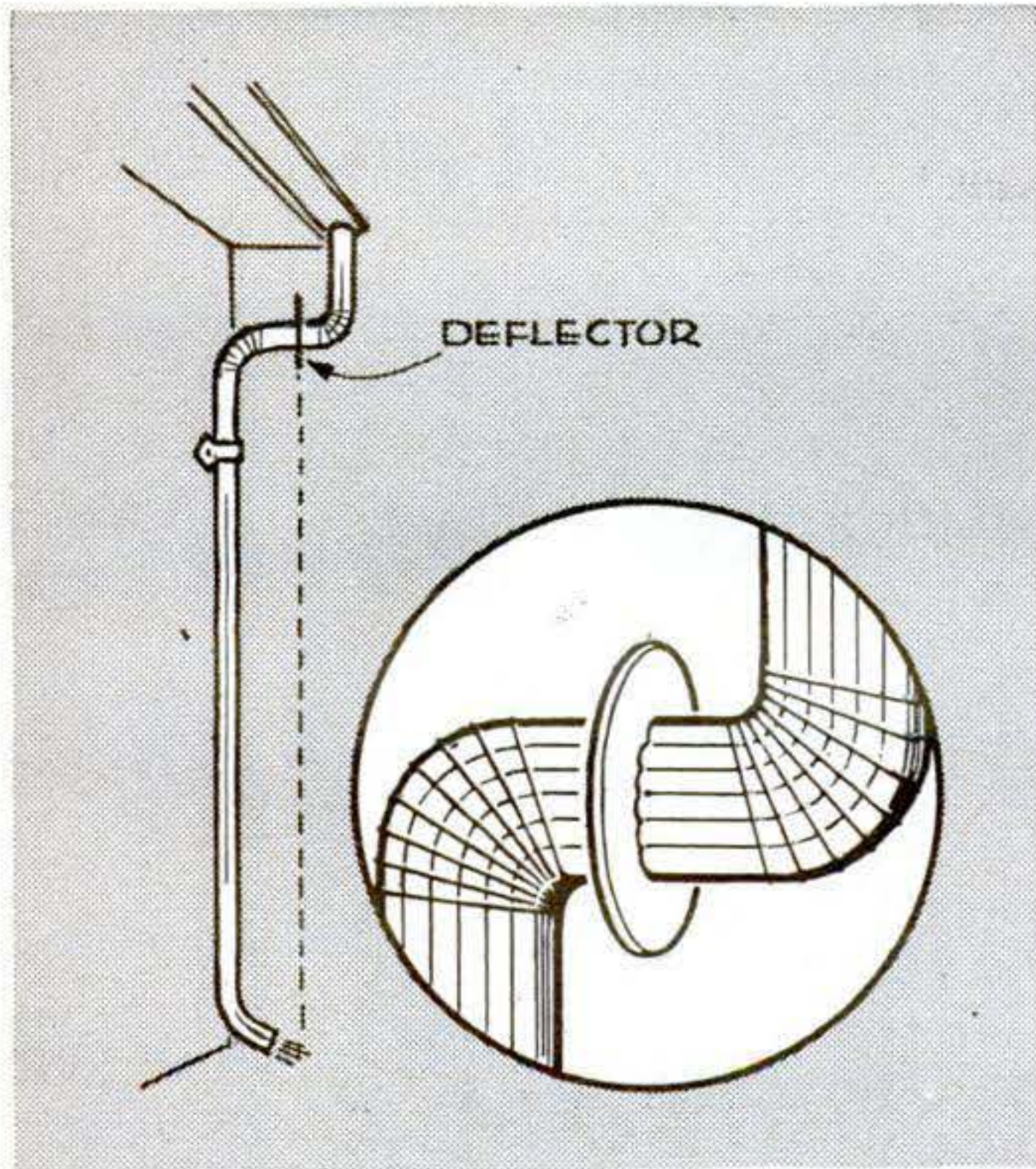
## SHORT CUTS AND TIPS

### FROM PS READERS

#### Use your old credit cards as identification plates

Don't throw away your outdated credit cards. They make fine identification plates for luggage, notebooks, or key tags. Just cut out your name and address as shown at right and attach the label at the desired spot with a coating of good household cement.

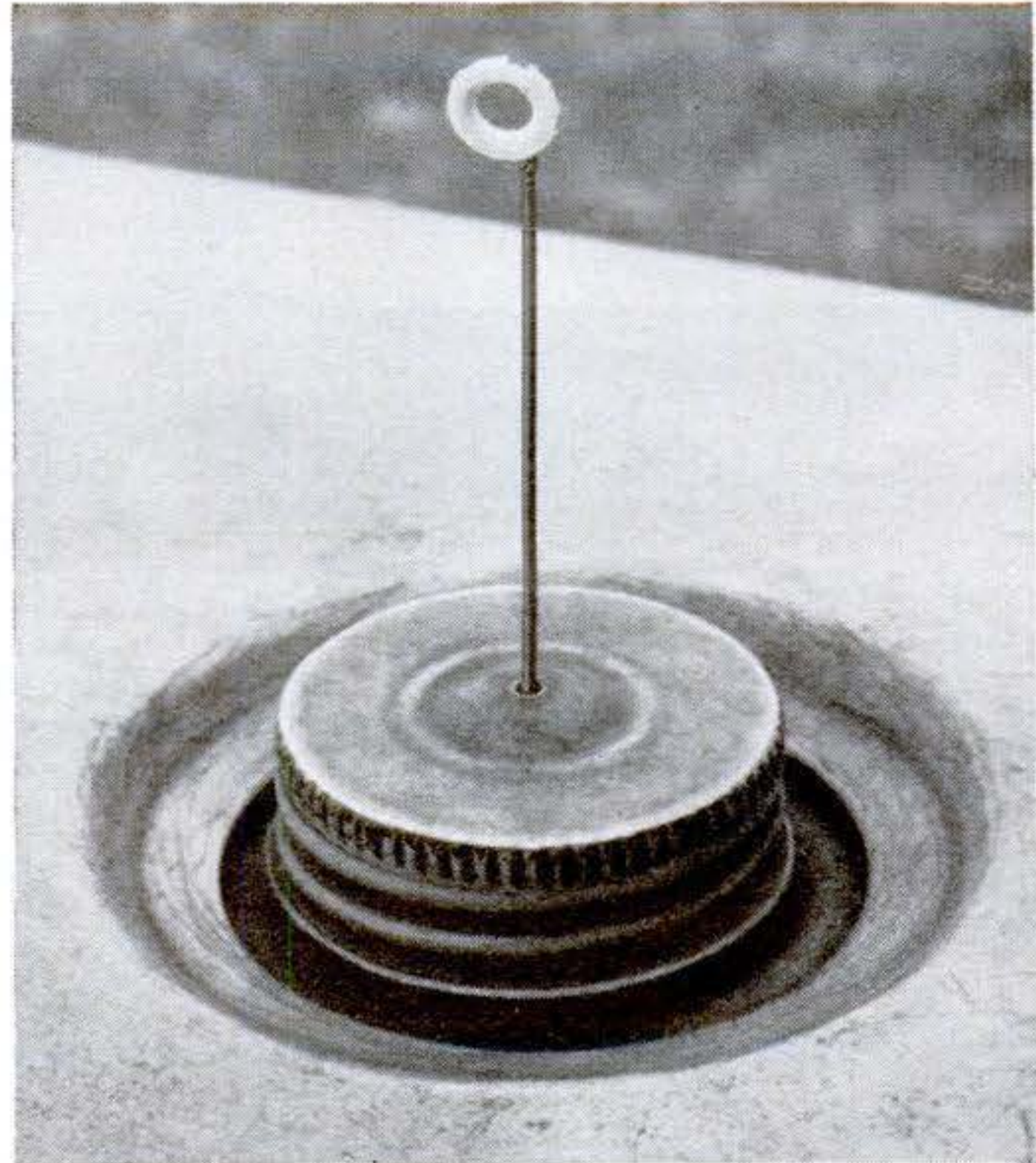
WILBUR H. FULKER  
Colorado Springs, Colo.



#### Downspout collars protect house paint

If your house paint is peeling around the downspouts, this simple tin deflector is a cure. It keeps gutter overflow from using the downspout as a paint-eroding path to the ground. Just cut a sheet-metal disk several inches larger than the elbows that connect to the gutter outlet. To get a tight fit, use the end of the elbow as a pattern for the cutout.

CLARENCE BREITENFELDT, Marathon, Wis.



#### Make a gas gauge for your mower

Has your mower ever run out of gas at the far end of your property because you don't have a fuel indicator? To take care of that I inserted a tightly coiled wire about  $\frac{1}{16}$ " in diameter into a cork and then thrust the end of the wire up through a hole drilled in the gas-tank cap. So I'd be able to see the top of the wire easily, I attached a white-painted grommet to it.

KARL J. KRAUSSE, Rockville, Md.

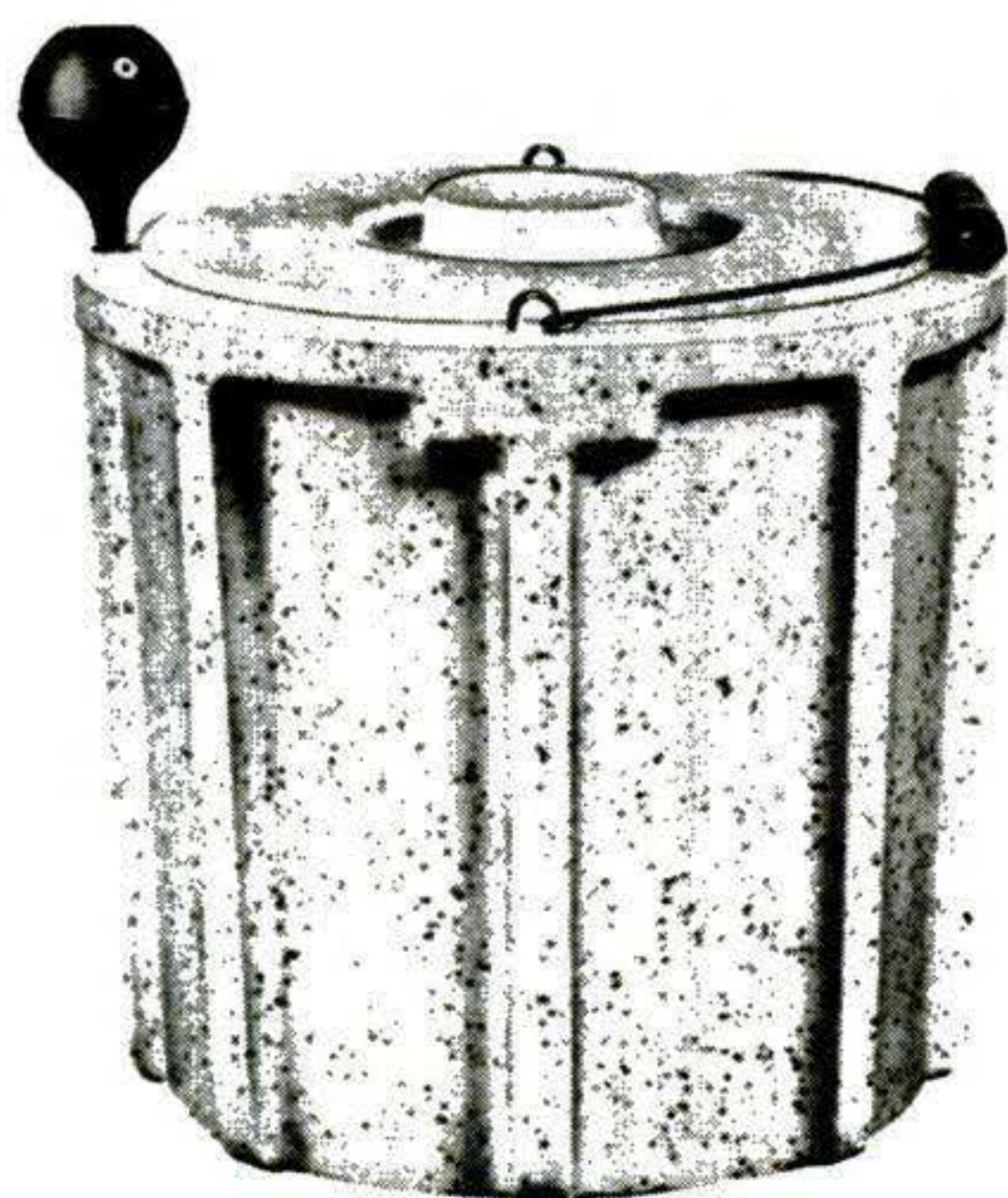


WHAT'S NEW

FOR THE OUTDOORS

### Big paddleboard supports 400 pounds, won't sink

The resilient Go-Buoy paddleboard weighs 26 pounds, is 11' by 24". Formex Corp., Elkhart, Ind., makes it of one-piece polystyrene with reinforcing aluminum tubes. A double-ended paddle comes with it.

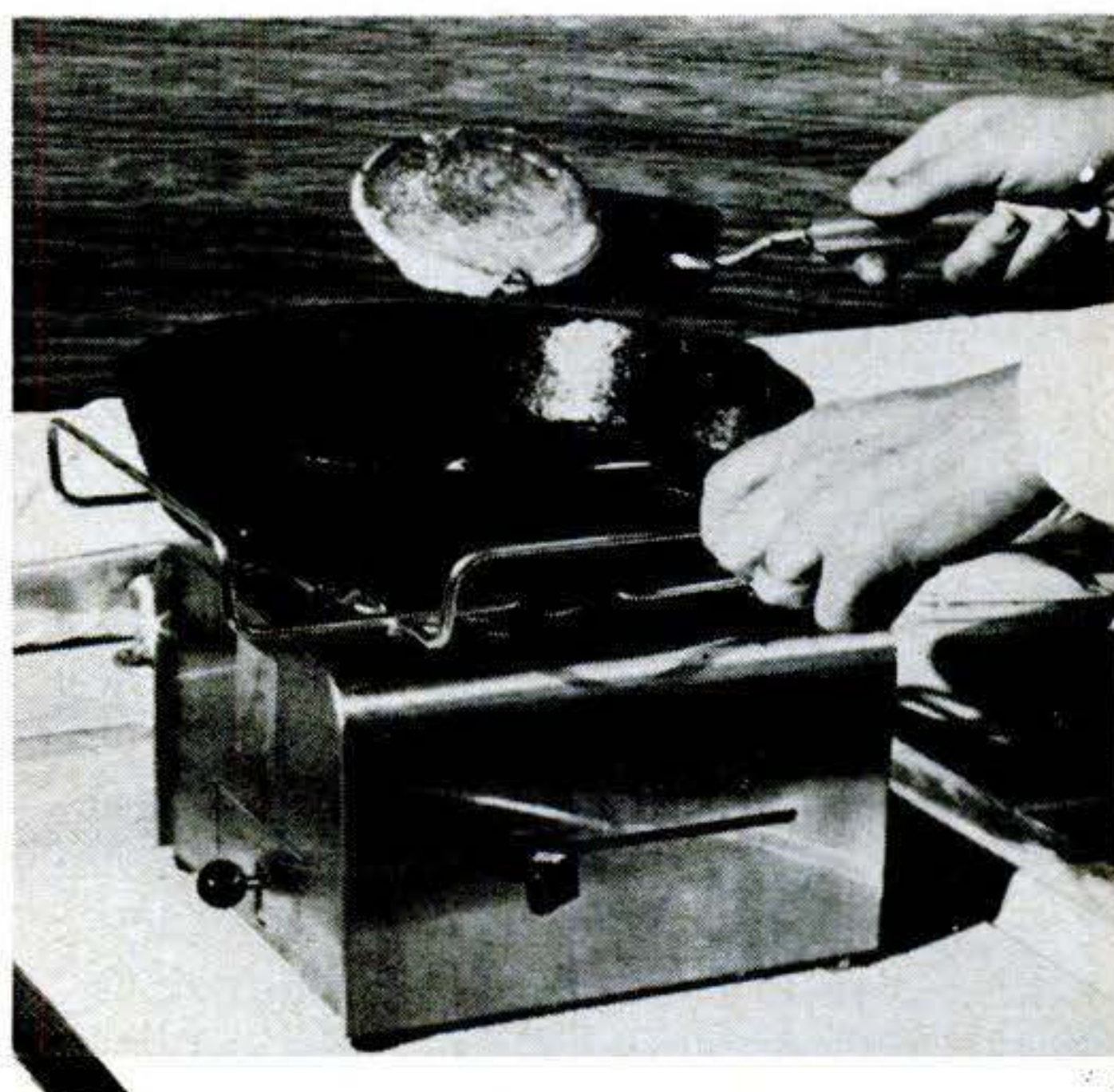
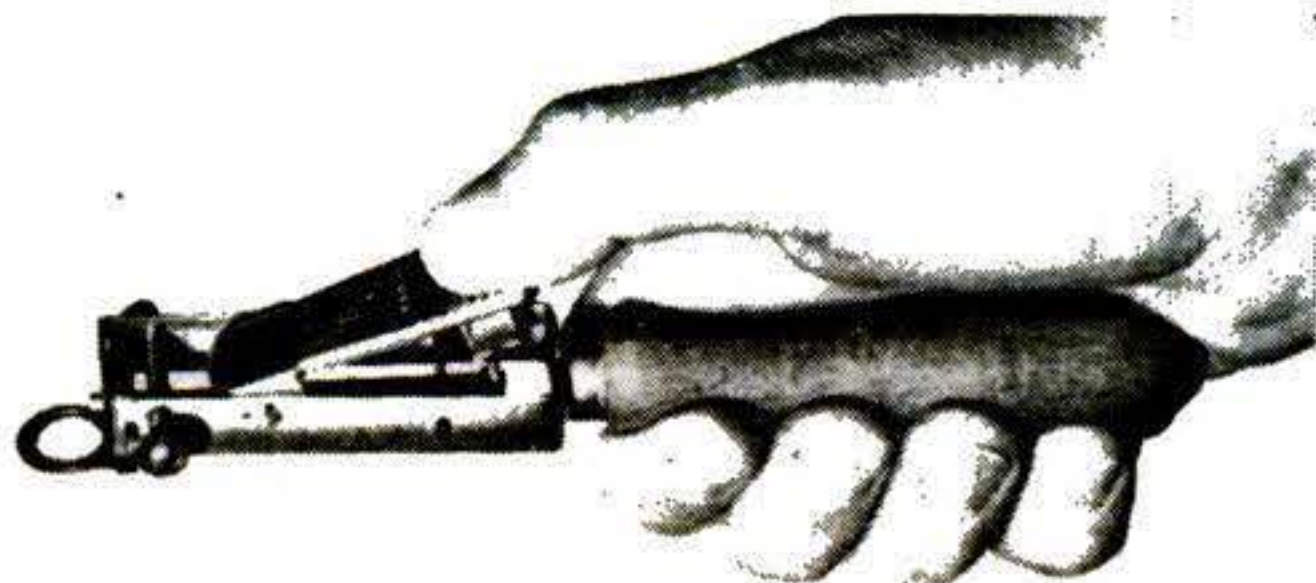


### Bucket feeds air to keep minnows alive

Squeeze a rubber bulb on the top of the Aer-A-Bucket, and you supply oxygen to minnows during long trips or in hot weather. The action aerates the water through holes at the bottom of the inner shell. The polystyrene bucket holds 2½ gallons. From Fin Bais, 100 Fairview, Hamilton, Ohio, it costs \$4.95.

### New device lights stoves, torches

Press the thumb lever on the Champion Spark Stovelighter, and a spring-activated flint wheel rubs against metal, creating sparks. The 6¾" unit has a wood handle and an eyelet for hanging. It's \$1, postpaid, from I. Goldberg and Co., 429 Market St., Philadelphia.



### Galley stove burns safety fuel

Raise the flame on that stove cooking flapjacks above, and a quart of cold water in an open pot boils in 12 minutes. Flame Boy Products, E. Berlin, Conn., makes it in stainless steel or aluminum, with one or two burners. They also make Sa Fuel—a solid-gasoline fuel said not to create explosive conditions.

### Sonic lure whistles up fish

Hep fishermen say you can attract fish with bubbles heard through their nerve endings. The flow of water through this concave spoonfish makes "whistling" bubbles. Tiki Lures, Inc., Detroit, offers four sizes (2", 3", 4", 5"), nickel- or brass-plated, with treble hooks.



# Painting Secrets from a Pro

Know-how makes painting a room faster and easier—and gives you a better job, too

By TOM PHILBIN JR.

**N**othing is more important in turning out a top-notch interior paint job than the use of quality paint and tools. They're intrinsic to the job's success.

Price is a good test of paint quality. On the average job, enamel, flat, and ceiling paint (also flat) are used. If the enamel costs less than \$6 a gallon, the flat \$5, or the ceiling paint \$3.50, stay away from it.

Quality brushes cost more, too, but you'll be able to use them on future jobs, and they won't shed hair as you paint. Price is again a good basis for judging. Brushes should cost between \$4 and \$7, roller sleeves at least a dollar each.

Use ready-mixed paints. You'll save mixing time and won't have to match if you run out during the job.

All paint, ready-mixed or not, *must* be mixed well. To do this quickly and completely, "boxing"—pouring back and forth between cans—is the trick. Big buckets are needed for boxing, so buy five or six paper or plastic mixing buckets, five-quart size or larger. Make sure that the paint is fresh, so it'll be at full strength. Then you'll need only a small amount of thinner (say two-three ounces) to get a paint that has substance but isn't too thick.

Paint in daylight if possible. Artificial light is false, and what you swear you're covering at night turns out to be a "holiday" (missed spot) in cold daylight. Then you're in trouble, because most paints can't be touched up without spots showing.

**Start early.** The morning is a wonderful

**One trick in painting** is to get a good amount of paint over a maximum area and then brush it out. The brush is held lightly, at a 75-degree angle to the surface, so the front bristles get maximum use. Brushwork goes from the dry into the wet. Apply the new paint about a foot away from the last wet area and brush towards it.

time to paint. And quit early, or you may get tired and start making mistakes.

Get started right. First step in a paint job is setting up the room properly. Move all furniture out of the room, or combine it in a close group at room center.

Canvas drop cloths (about \$4.50 each) are best for covering, but you can fabricate good coverings for furniture by first laying inexpensive polyethylene-film drops on it, then covering with old sheets or blankets.

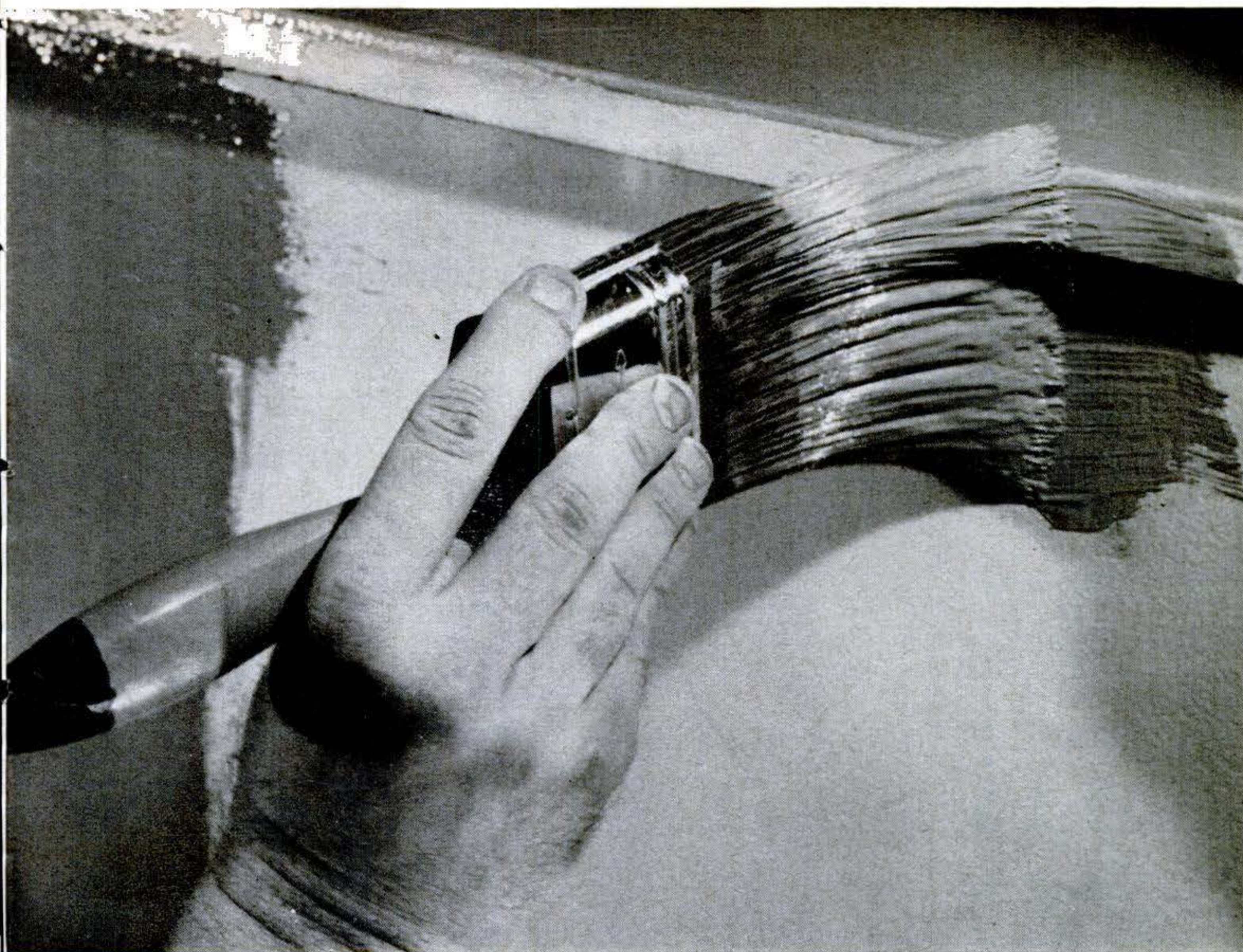
Drops, newspapers, or building paper are all good for floors. You can keep paper coverings from shifting around by overlapping them, then taping them down.

Paint usually sneaks onto floors other than the one you're painting. Shoes pick it up from drops and track it into other rooms. To avoid this, make paper paths wherever you expect to walk.

Another setting-up trick: Take off light-fixture plates. This way you don't have to cut in carefully around them.

**Preparing the surfaces.** This is extremely important. No paint can compensate for a wall that isn't ready. Just as important is





following step-by-step procedure in preparation and painting. I've saved hours in waiting time on many a job by scheduling the work properly.

Suppose, for example, I'm painting an average living room.

First thing I do is mix all the paint for the room: ceiling, walls, and woodwork. The empties facilitate this. Also on hand are two roller sets (so I won't have to stop and clean the ceiling set for use on the walls), two 3" brushes for cutting in walls and ceilings, and three more brushes for woodwork.

Next, I dig out hairline cracks in the ceiling, wet them down (for better adhesion), and plaster. While these are drying completely (15 minutes), I dust down the walls (or wash with mild detergent), and then dig out any plaster cracks there.

Then it's back to the ceiling patches for a little sanding with medium paper and priming with a light coat of ceiling paint.

**Priming.** Because prime must be allowed to dry *completely* (if it's not to bleed

through) before the finish coat can be put on, I go back to the walls and prime those patches with a light coat of wall paint.

By the time I finish priming the walls, the ceiling is ready for paint. After this, I finish the walls and, last, the woodwork. Ideally, I have been working steadily.

For two coats on the walls, the procedure is the same. But first-coat wall prime must dry completely here, also, so I paint the windows while it's drying.

Different colors of finish coats are primed differently. For light colors (pinks, yellows, beiges, etc.), prime with a slightly thinned finish coat. For dark colors (greens, reds, deep beiges, etc.), use a primer-sealer tinted slightly lighter than the finish coat. For patches under a dark finish use a primer-sealer. Walls with dark finishes bleed unless you do.

Surfaces painted with enamel are primed with shellac (three-pound cut) rather than paint. Use a separate brush to put it on patches and "alligator skin." Make sure that all grease is off the surfaces.

*[Continued on page 194]*

# Gus Makes the Best

When two men decide they'll swap cars and both cars turn out to be lemons, the whole deal can go sour pretty fast

By MARTIN BUNN

**B**efore an audience of two small boys, Gus was hoisting a compact up behind his tow truck in a parking lot. The ratchet clicked as the car inched higher, the children's eyes following it as if magnetized.

From the corners of his own eyes, Gus saw a taller shadow join theirs. He looked up at a young, bareheaded man wearing dark-rimmed glasses.

"Tim Shannon!" said Gus with real pleasure. "I heard you'd come back to town."

Shannon offered his hand.

"Good to see a friendly face, Gus."

"Oh, I'm still sore about the time you squirted grease all over my new lube rack," returned Gus with a smile. "You weren't a very good grease monkey, but now I hear you're a hot production engineer. Top man at United Plastics, the paper said."

Shannon's long face twisted briefly.

"I'm quitting there. Going to take my family on a trip and look into a job at the same time. These are my kids." Shannon's eyes suddenly lighted. "Say, maybe *you* could pep up that tired car of mine. Nobody else has been able to."

"Any time," returned Gus cordially.

**Two hours later**, Shannon drove a '64 two-door with a starred right-rear window up the ramp of the Model Garage.

"I'll leave it and catch a ride with some friends back to the plant, Gus," he said. "Got to tie up some loose ends."

"Tell me about the car first," said Gus.

"It's got no pep. It accelerates okay in traffic, and seems to keep hitting on all eight at higher speeds. Only it won't go over 55, even with the gas to the floor. I've had it to the agency, and in a service station near the plant. Between Brant and me, it's had a new coil, a new carburetor float, new points—even a new muffler, on the theory the old one was

creating back pressure. Nothing's made any difference. No wonder Brant wanted a car with more sass."

"You mean Sam Brant, your boss at United?" asked Gus. "Was this his car?"

"I wish it still were!" snapped the young man. "That lousy car swap we made started the whole trouble." He looked at Gus tensely. "I'm not leaving because I want to, or for a better offer. I just can't stick it any more."

Gus turned away. "Come have a cup of coffee and tell me about it."

**Shannon sat down** in the office, sipped Gus's dark brew, and smiled crookedly.

"I guess I have to tell somebody. My wife thinks I'm crazy to leave United. But Brant wants me to go. He thinks I cheated, trading him a car I knew was an oil hog."

"Is it?" asked Gus.

"Afraid so. When I came here, I traded my old jalopy on an almost new '65 wagon. It seemed a good buy. The exhaust smoked, but the dealer said that was because some valves were sticking, and they'd run top oil through the carb. He swore the valves were okay, but I should keep using top oil. I did, and the exhaust kept making blue smoke, but the car ran fine. The plugs fouled twice, but I had them cleaned and forgot about it. Anyway, my wife was the one who used the car most. I didn't know she was putting in oil every time she got gas."

Gus stoked up his pipe. "How'd you come to swap cars with your boss?" he asked Shannon.

"He had my wife and me for dinner. She mentioned that the kids gave her a hard time in the wagon—they'd open the back doors before she'd stopped. So I said I wished we'd bought a two-door, and Brant admitted he'd like a station wagon to carry samples—he makes sales trips—and that his car was an old

*Continued*

**of a Bad**

**Bargain**

Gus stoked up his pipe.  
"How'd you come to swap  
cars with your boss?" he  
asked Shannon.



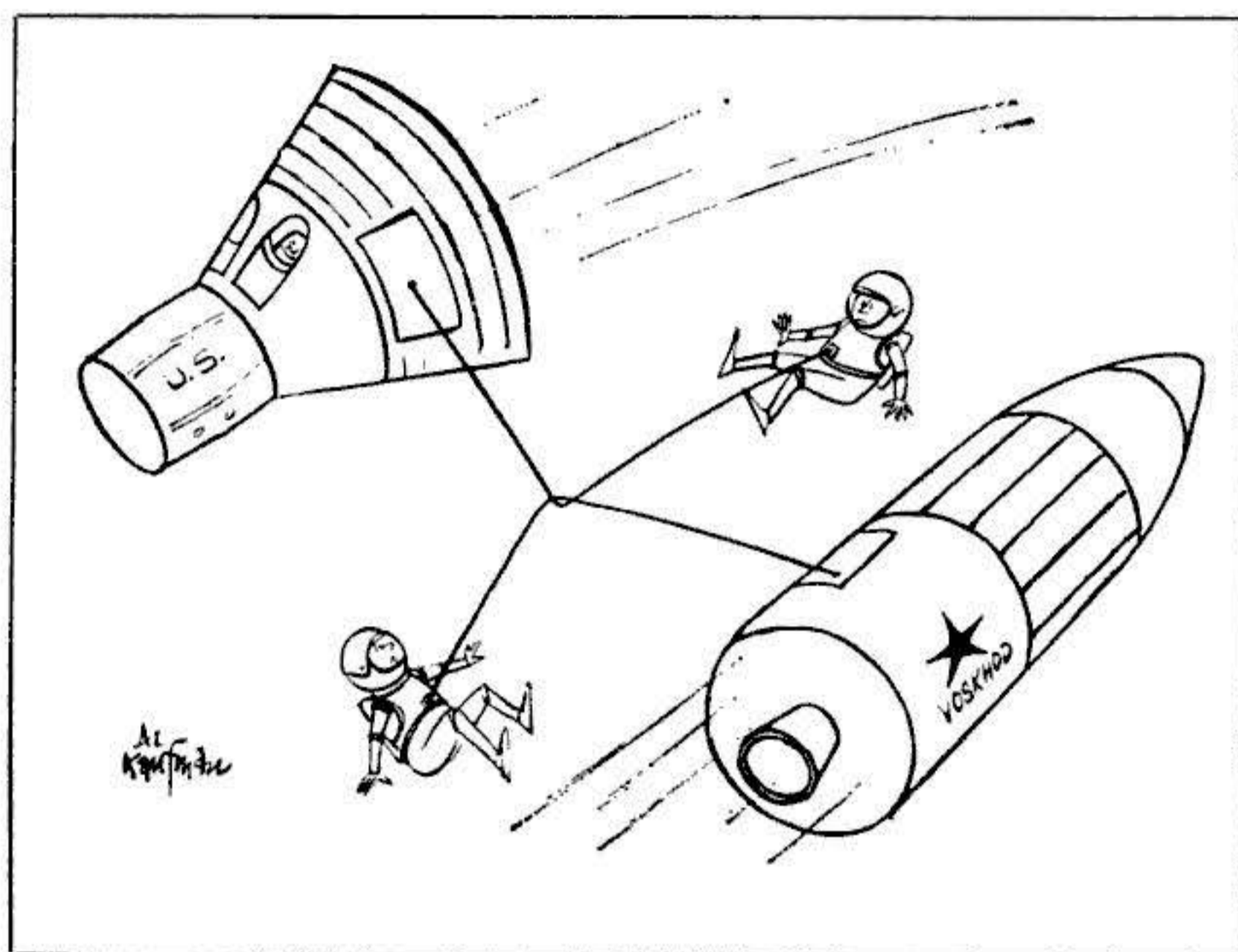
*RAY DULANEY*

lady's crate without enough go for long-distance driving.

"Well, we made the swap, with some money to boot for me—the wagon was a year newer and a more expensive model. The cash came in handy; we bought a dishwasher and paid off what I still owed on the wagon. Brant seemed satisfied, too.

"That was a month ago. After he came back from his first trip, he said, 'You should have told me your car burns oil like a furnace.' I was flabbergasted. When I asked him what he meant, he shrugged me off as if I knew, all right. Since then, nothing I do at the plant seems to suit him."

Gus drew on his pipe. "You think about



offering to trade your cars back again?"

Shannon snorted. "Sure have. Yesterday I saw the wagon in the service station. The mechanic told me the plugs had fouled again, and he'd recommended a ring job. So last night I asked Brant to swap back, and give me time to return the extra cash he'd paid. He snapped back that he wasn't in the installment business. We had some words, and I resigned as of tomorrow."

"Then you're only going back there to empty your desk?" asked Gus.

"We've just set up some new injection presses. I want to check them out."

"Uh-huh. Well, you can come for your car about five," said Gus.

**After Shannon left,** Gus put the two-door on a body lift. There was no sign of brake drag, tight wheel bearings, a misaligned drive train, or a kinked tailpipe. Gus lowered the car to the floor.

The engine turned freely, without ex-

cessive friction. A timing light showed timing right on the nose, centrifugal and vacuum advances working normally. The air cleaner wasn't dirty, and the automatic choke had opened while the engine was running. Gus thought of other possibilities—a clutch that slipped at high speed, or ignition points that bounced because of a weak spring, limiting engine revs.

As if thinking for itself, his hand pulled the throttle rod wide open. With a drop light, Gus looked down the air horn. The throttle plate was not quite vertical, but at a visible angle. It still blocked part of the carburetor throat.

Whistling softly, Gus loosened the throttle linkage and readjusted a clevis. When he was done, the throttle plate stood on end, a thin edge that would pass maximum fuel-air volume to the engine.

He closed the hood, told his assistant, Stan Hicks, that he was leaving, and in five minutes was on the high-speed turnpike, flooring the car's throttle. Speed climbed at once—to 50, 55, 60. At 70, Gus eased off to drive out at an exit. Swinging around, he headed up the opposite ramp back to town.

Just before he merged into the traffic flow, a wagon passed him. Gus stayed behind it briefly at 65, then speeded up. The speedometer was nudging 74, and Gus never

saw the amazed double-take of the wagon's driver as the sedan roared past.

**Shortly after five,** a '65 station wagon trailing blue smoke pulled into the shop. From it stepped Tim Shannon, defiant and embarrassed. Gus promptly guessed the identity of the other man, behind the wheel. Older than Shannon, he had appraising blue eyes in a face like a knobby potato.

"This is Mr. Brant, Gus. He brought me over to get my car and talk about his."

"Only heard about you when Tim told me," put in Brant. "But I thought the man who made that crate of his perform like it does might straighten mine out, too."

"How'd you know about Tim's car?" asked Gus. "I haven't told him yet."

"You passed me on the pike," explained Brant. "I recognized the car by that busted window, so I asked Tim who was driving. Say, just what was wrong with that car?"

"The throttle linkage," said Gus. "It

*Continued*



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didn't open all the way. The engine couldn't get enough gas for full power."

Brant grunted in surprise. "The dough I spent on tune-ups—and nobody else spotted that! Would you be willing to see what you can do to stop this car from gulping oil, short of a ring job?"

"Glad to. Bring it in tomorrow."

**The first thing** Gus looked for on the station wagon's V-8 next morning was some trace of an external oil leak. There was none. Checking cylinder compression, he found it good enough to rule out worn pistons, cylinders, or rings. Engine oil pressure, checked with a gauge, was within specifications. A punctured vacuum-booster diaphragm, Gus thought, would suck oil into the intake manifold. But this car had electric wipers, and no booster pump.

Gus removed the rocker-arm covers. There was no sludge on the rocker assemblies; the oil-return holes below were open and unclogged. So much for the guess that pressure-trapped oil was being forced past valve stems into the cylinders.

"Still stumped by that oil burner, Gus?" asked Stan, passing by.

"Yeah," grunted Gus. "Not a clue yet."

"Maybe somebody bored holes in the cylinder heads," quipped Stan.

He strode off, grinning. But his words jogged Gus's memory of a service bulletin seen months ago. Gus got busy removing one of the rocker-arm assemblies. When it was off, he lifted the air cleaner from the carburetor and blocked the choke and throttle open. Then he applied the air hose to one of the holes from which he had unscrewed a rocker-arm support bolt.

Air whistled in the carburetor throat.

The wagon's engine was buttoned up again when Sam Brant came in.

"What's the bad news?" he asked. "Has it got to be a ring job?"

"No ring job," declared Gus. "And you will get much better oil mileage."

"That sure is good news," Brant said. "What was it?"

"A factory blooper. This engine burned oil from the day it was made. The holes for the bolts that hold on the rocker-shaft supports were drilled too far—right through to the intake ports. Those bolts pass through the hollow rocker shafts, which carry oil under full pressure. So oil was forced past the bolt threads into the intake ports, drawn into the cylinders, partly burned there, and partly blown out the exhaust."

Brant shook his head. "Sounds like Detroit needs some good production engineers, too. Did you put on new heads?"

"No. You know that most bolts are a bit undersized. Their threads don't actually bottom in the female threads—75 percent engagement is usual. So instead of the old bolts, I screwed in some special studs the manufacturer put out for this job, with nuts to hold on the supports. The stud threads are designed for maximum engagement and sealing. They fit the holes so closely oil can't get past them."

"But the dealer who sold Tim Shannon the car," added Gus, "didn't know about this fix—or couldn't be bothered. By recommending top oil, he hid the fact that the car was burning oil. And Tim didn't drive it enough to find it out, as you did."

Brant looked at Gus steadily. "I gather that I've made a blooper myself," he said. "I'd better get back to the plant and see if I can straighten it out."

"I don't think it'll be too hard."

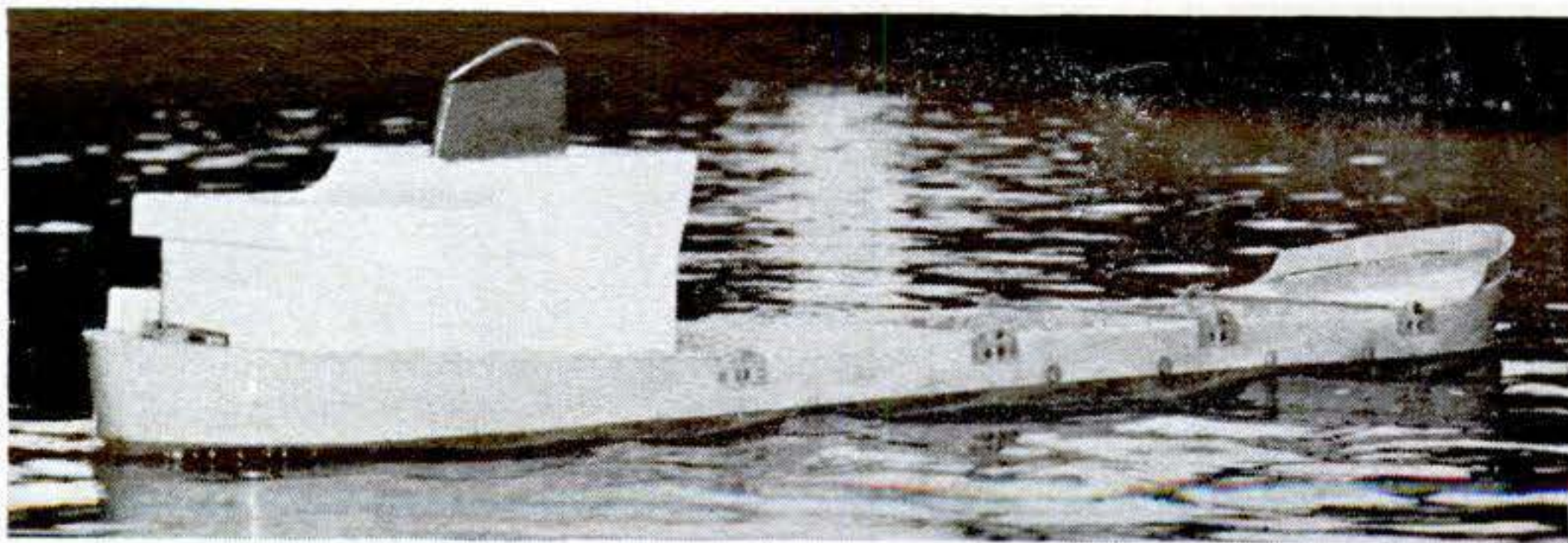
"You don't?" asked Brant. "Why not?"

"The way I figure," said Gus, "there'll be two of you trying." P.S.

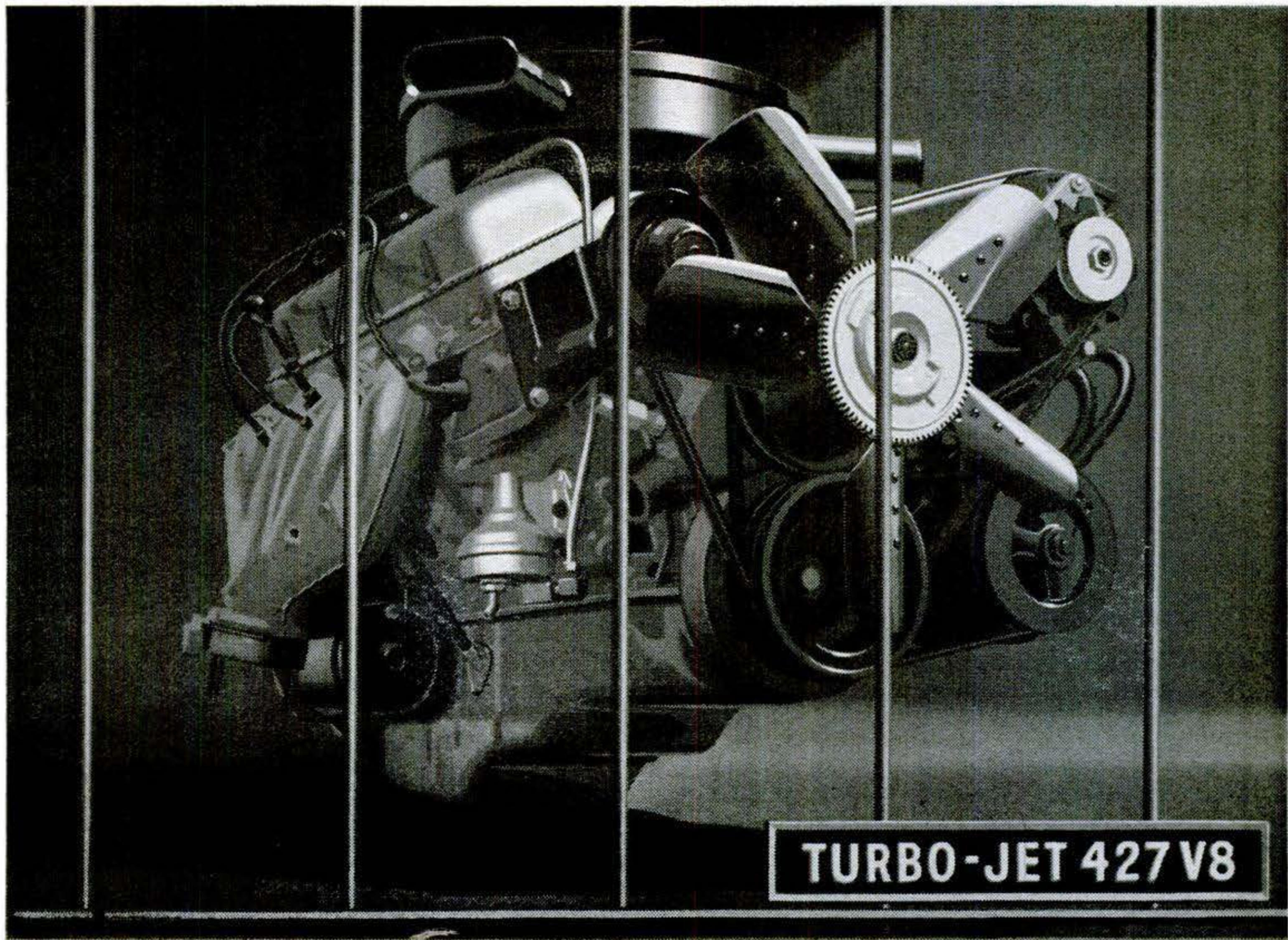
## Jointed ship cuts costs, speeds cargo

This come-apart ship has a detachable stern unit that couples to different cargo sections to increase use of aft propulsion machinery, controls, and crew quarters

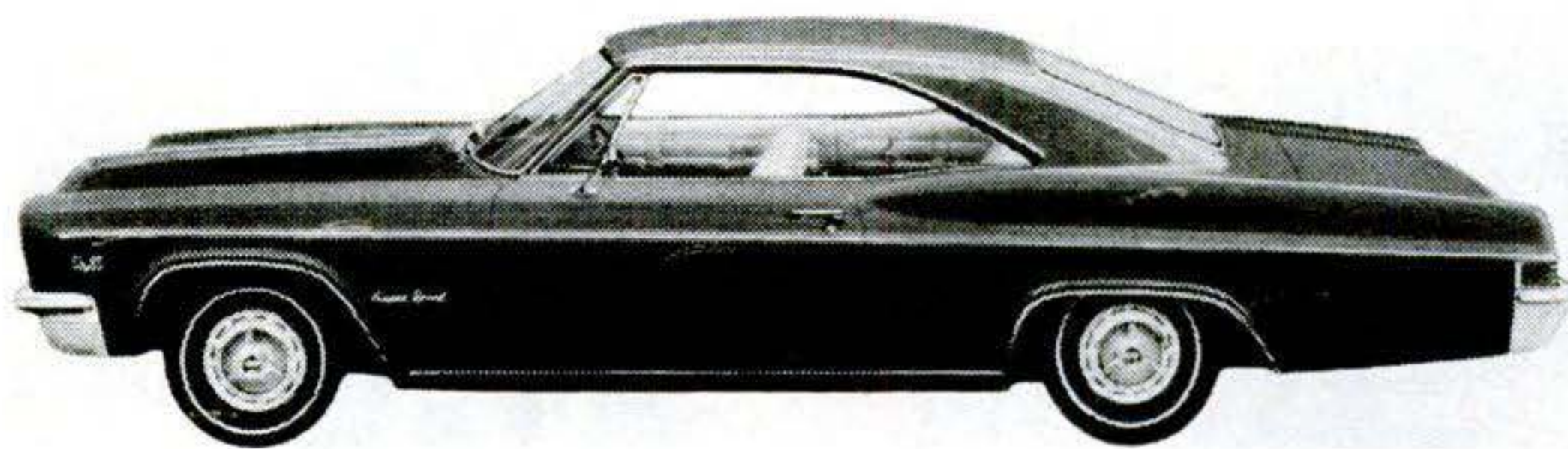
—two-thirds of a freighter's initial cost. A model of a British National Research Development design for a 205-foot freighter, it would permit in-



dependent loading and unloading of cargo sections while the propulsion unit spent most of its time at sea.



## do not tease



*'66 Chevrolet Impala SS Coupe—new standard safety package includes outside rearview mirror. Always check it before passing.*

Poke the gas pedal of this new Chevrolet Turbo-Jet V8 and you get action. A full 427 cubic inches of it.

Its advanced design, with tilted valves and deep-breathing ports, sees to that.

Say you choose to cage it in that bucket-seated Impala SS above (it's available in 18 other Chevrolets, too). You can order it with hydraulic lifters and an output of 390 hp. Or you can order a version with

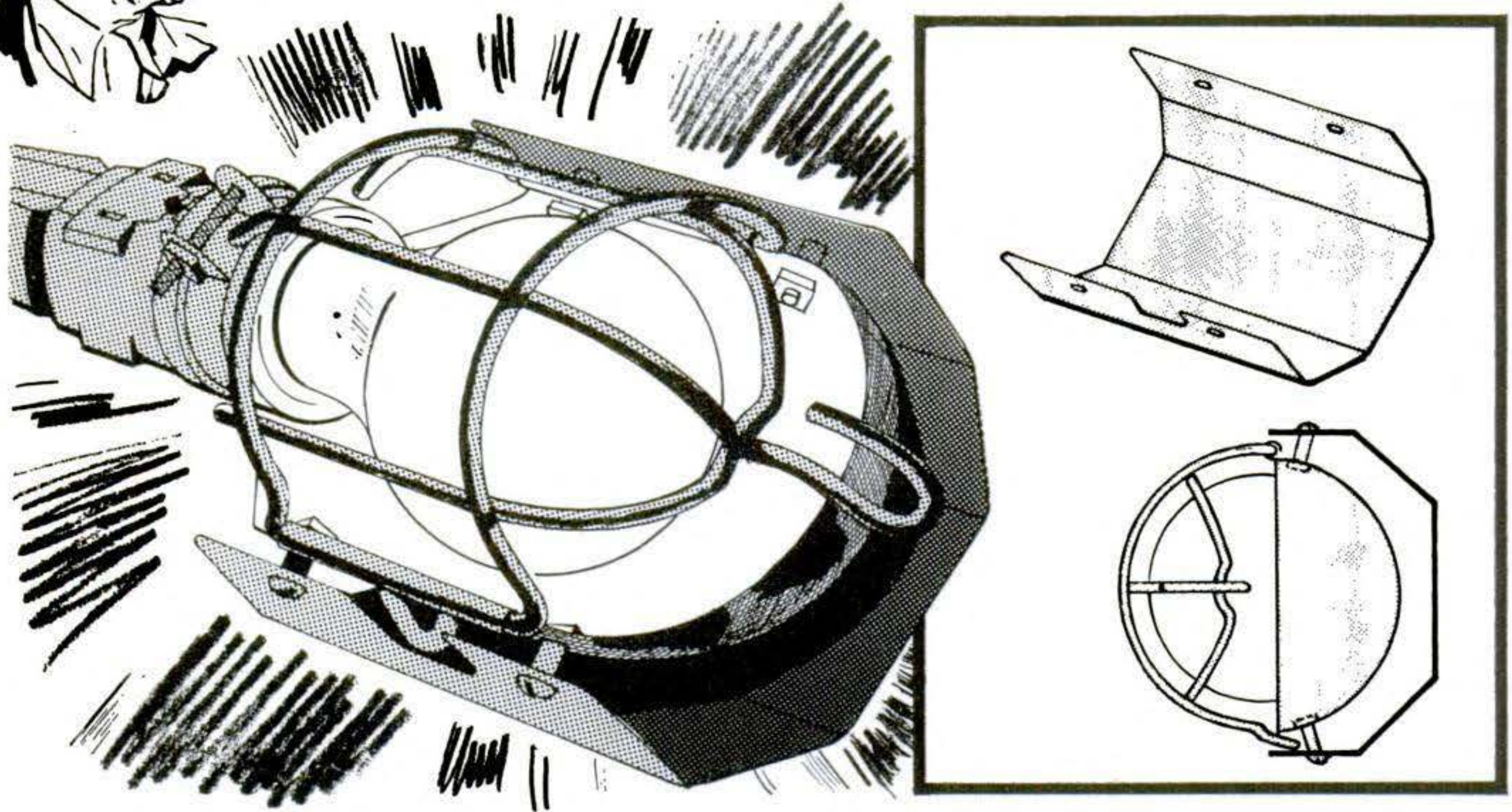
special-performance camshaft, solid lifters—and 425 hp. Either way, you get higher rate front and rear springs, heavy-duty shocks all around and 8.25 x 14 tires as part of the Turbo-Jet 427 package.

Sound like a lot of machine to you? As any road will show you, it's the most.



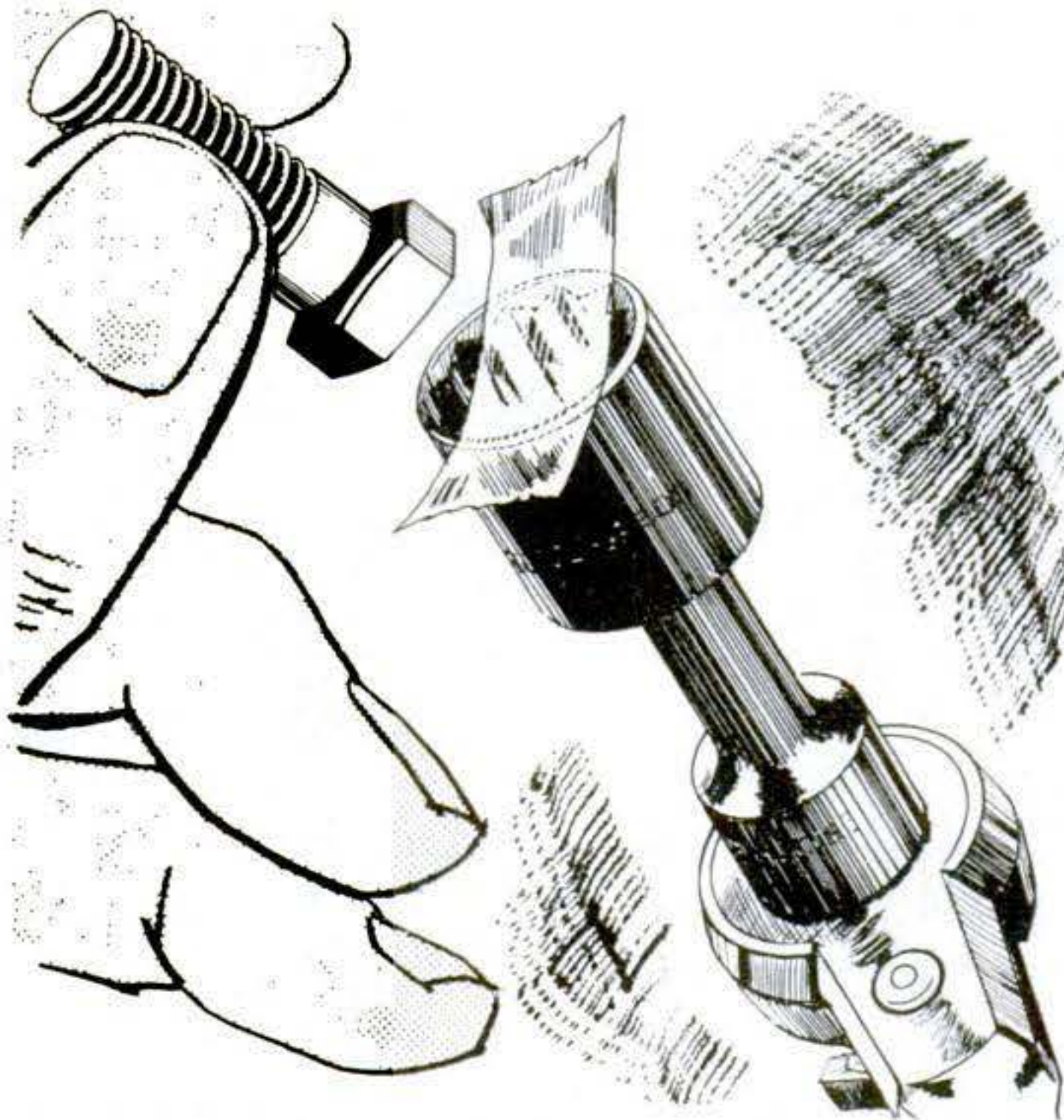


# Hints from the Model Garage



**A droplight won't shine in your eyes** when you need both hands to work if you make a five-sided shield that fits around the reflector. This will keep the light from rolling over. Start with a small piece of sheet metal and form the four angles by bending it over a sharp-edged piece

of wood. The shield can be bolted or riveted to the reflector. Allow ample air space between the two—it will keep the shield cooler. If you're worried about getting your hands burned on the shield, slip a piece of fiberglass insulation into the open space.



**Getting a bolt started** in a tight place only accessible with a socket wrench is easy if you tape bolt to socket with double-coated plastic tape. This tape, sticky on both sides, has a million uses around the garage—picking up small parts, holding gaskets, and so on.



**If the carbon piece** on top of the distributor shaft breaks, and you don't have a spare, you can improvise one. Take the valve out of the spare tire and use the valve spring in place of the carbon. When you get to a garage for new carbon, put back the valve—and inflate the tire.



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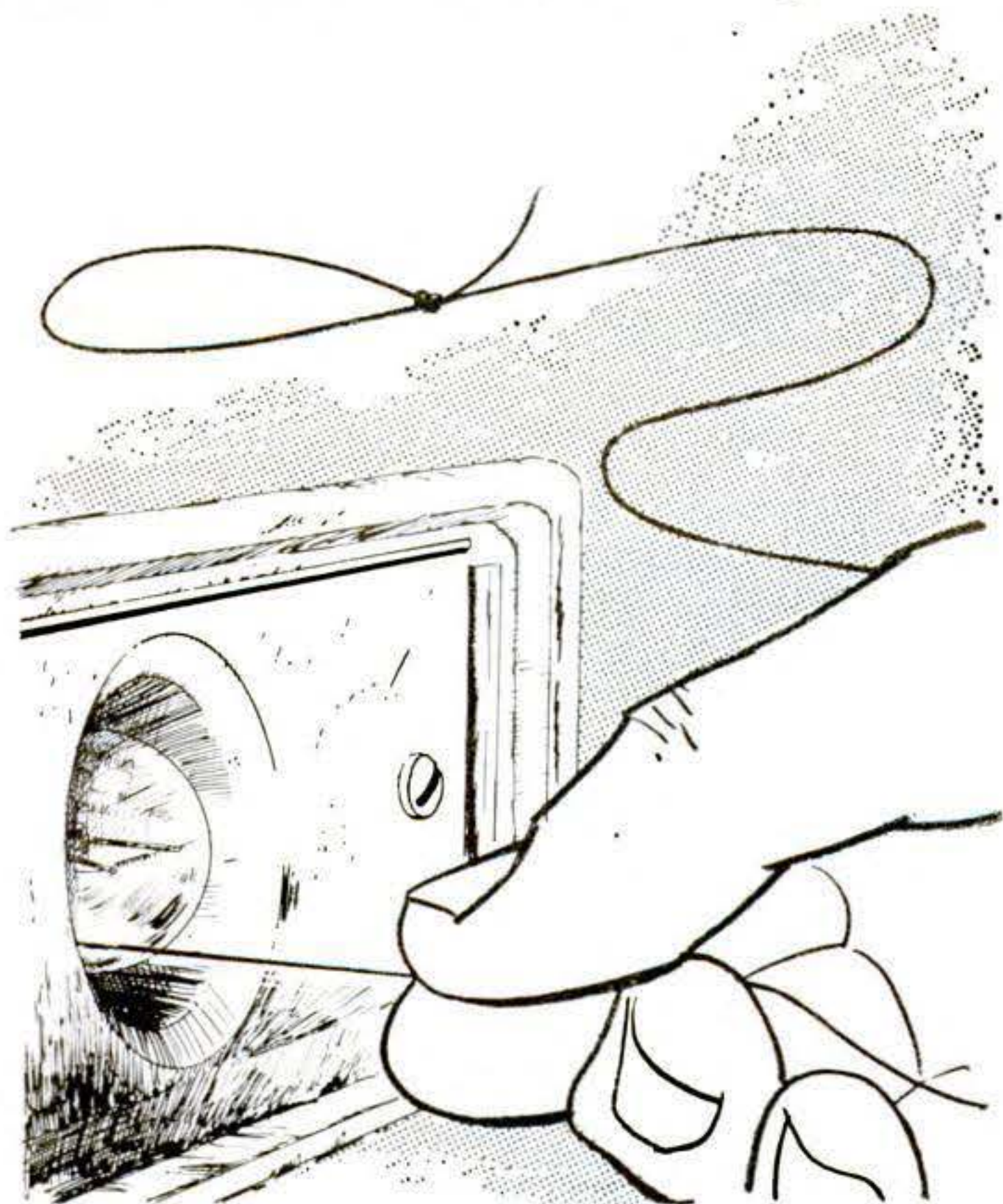
The most versatile pliers ever made...and the pliers most prized by hundreds of thousands of tool users. Be sure when you buy that it's a *genuine* CHANNELLOCK... look for the trade mark on the handle.



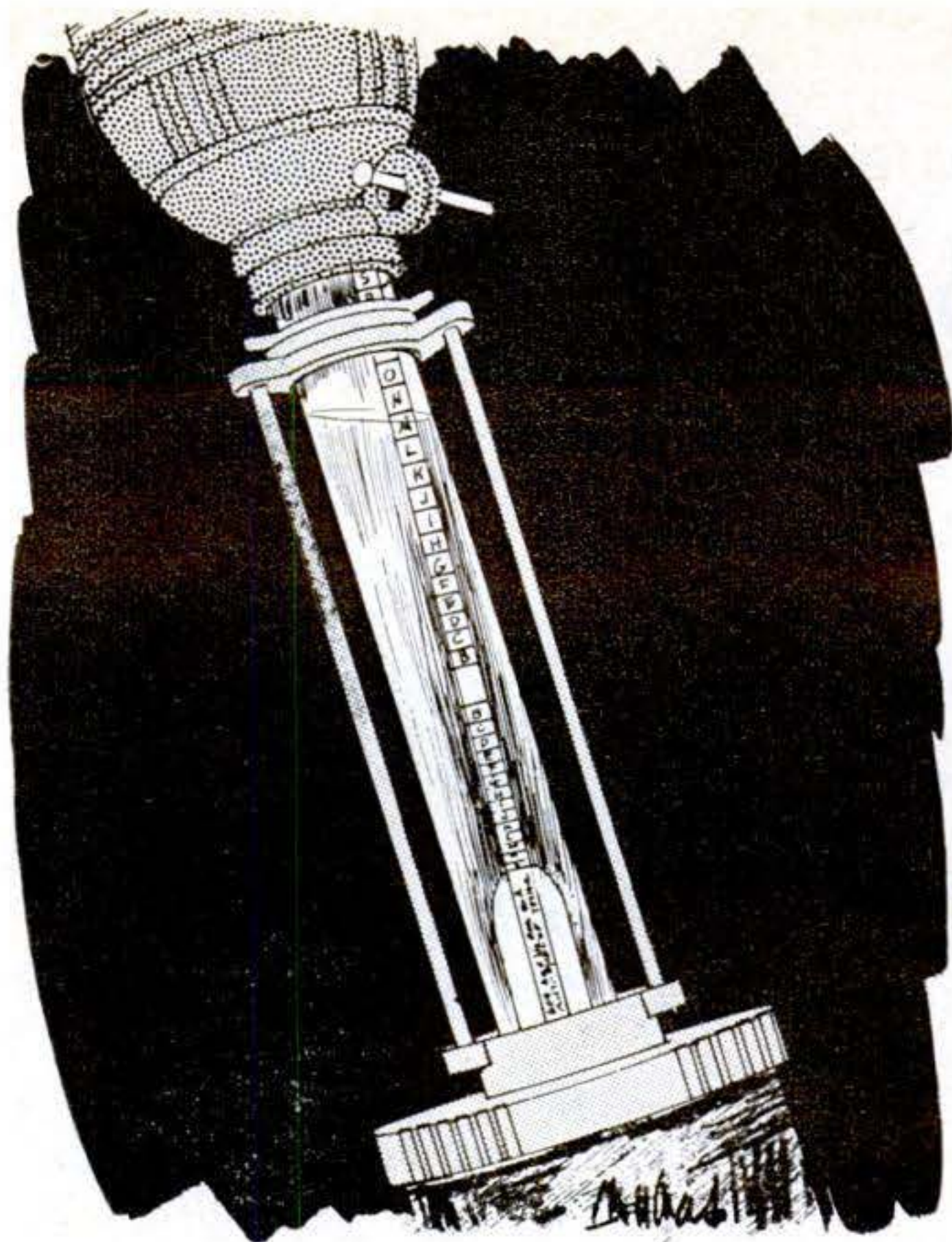
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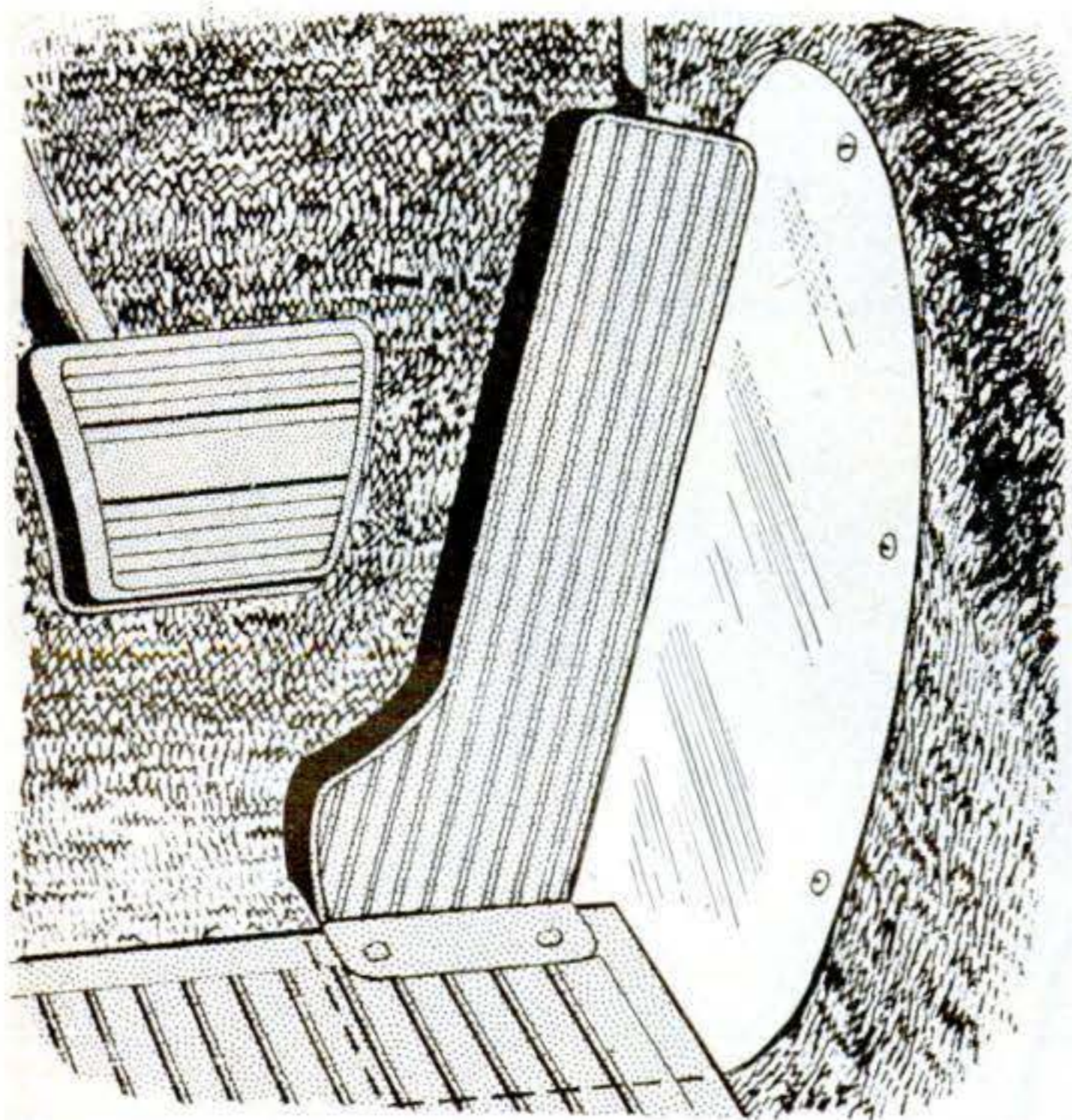
## More Hints from the Model Garage



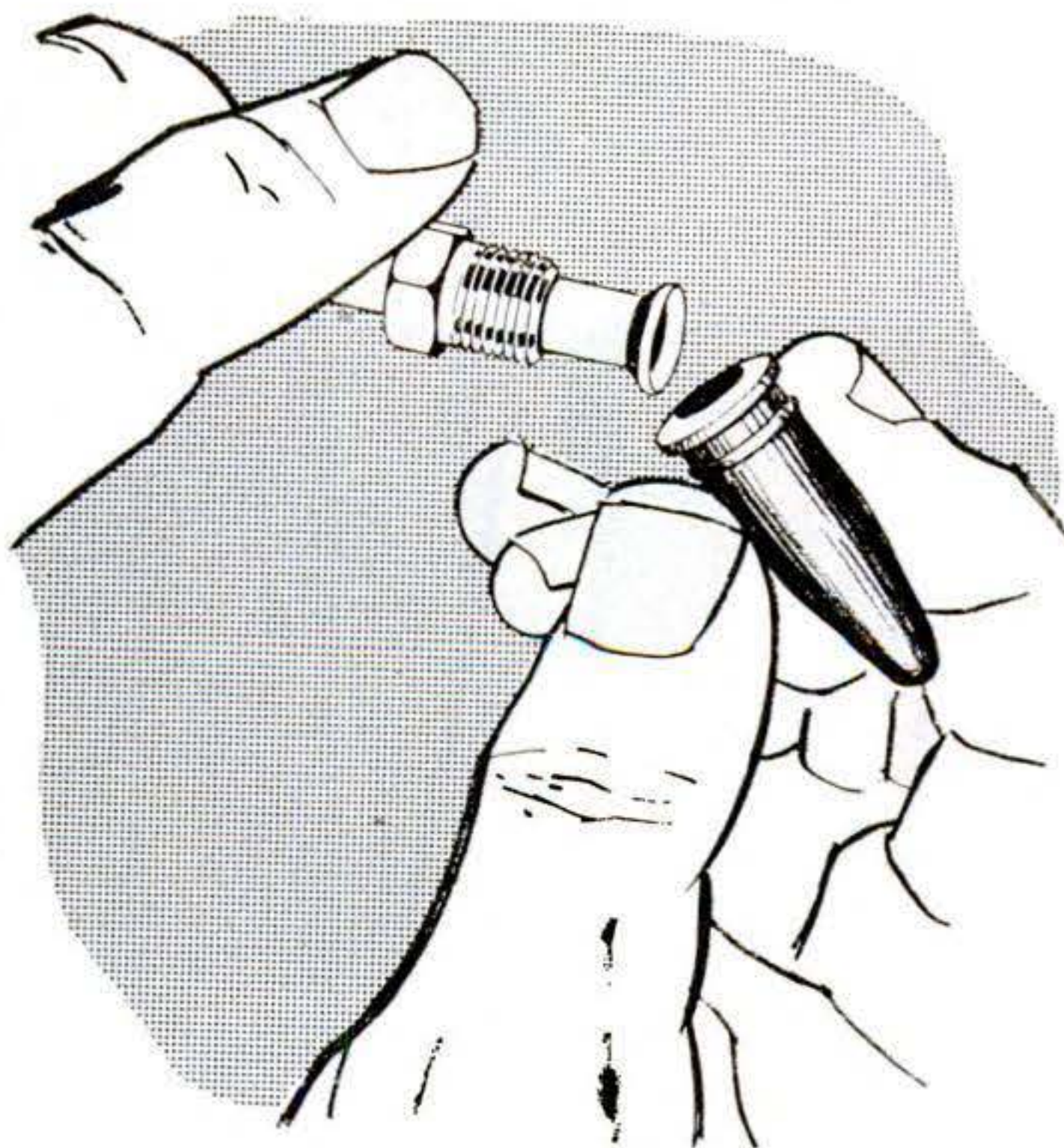
**Removing light bulbs from recessed sockets** can be a cinch. Before you push on the bulb and twist your finger to free it, make a loop with a piece of thread and place it around the bulb. When the loop is tight on the neck of the bulb, free the bulb and pull the string.



**The floats in battery hydrometers** and radiator testers are often broken if banged against the side of the tube. To prevent this, keep the instruments filled with water when not in use. Water cushions shock, and your hydrometer or radiator tester will be more safely stored.



**To avoid damage to the carpet** around the accelerator, use a small Plexiglas guard. Make a paper pattern, cut the Plexiglas, and sand the edges. Heat the Plexiglas in the oven until it's pliable, form and install it. Extend the guard under the carpet where the heel rests.




**Replacing or overhauling a fuel pump** calls for an easy way to stop the fuel flow from the line. The rubber tip from a medicine dropper fits neatly on the end of the fuel line and makes sure no gas is lost. For carburetor repairs, use the rubber tip to keep dirt out of the fuel line.



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TRADEMARK

## Common Pine . . . 18 Ways to Improve Its Beauty

[Continued from page 137]

This technique is used for all the various "wiping stains."

**8. Minwax Early American**, another wiping stain, is one of the best darker brown colors available. Like most other Minwax stains, it's a combination of dissolved colorant plus fine-ground pigments you stir into suspension. The result on wood is a combination of color that dyes the fibers, and pigment that wipes into and emphasizes the pores. Some of the lighter colors have little solid pigment, making stirring critical.

**9. Minwax Ipswich Pine** is lighter than Early American, and a companion of Puritan Pine, which is still lighter. The wiping stains with thin resin-formulated vehicles provide enough protection for small-abuse areas such as paneling, although many users topcoat them with a clear finish. On hardware areas like table tops, it is best to follow with a two-coat varnish schedule.

**10. Ebony stain** makes pine black. If the wood is flat-grain-sawed, some of the annual rings hold a golden color. Then pine leaps out of the ordinary and becomes a luxury material. Small furniture pieces, a jewel box, a wall bracket, free-standing shelves done in black-stained pine take on the look of ebony and onyx. They look best topcoated with a semigloss or flat varnish to remove any shine.

**11. Even-Even Windsor Walnut** is great on pine, despite its name. This stain comes in a tube, a toothpaste-like material that you smear on with a cloth. As long as you leave no stain film on the surface, uniformity of application is almost automatic. Take pains, however, to cover entirely, leaving no unwet spots, for the stain has no "creep," as oil-based ones do. There is little or no protection in the water-emulsion stains, so they must be topcoated. Shellac, lacquer, varnish are all compatible.

**12. Deft Modern Walnut** shows by its contrast with Windsor how little names mean when you buy color. It is one of the new water-emulsion wood stains that you apply with a damp rag. These stains are nonflammable. Their colors approach those available with the best watercolor stains used in industrial wood-finishing techniques. Generally, the color seems flat, dull, and dusty when the stains are dry. The topcoating brings out the true color.

**13. English Oak** is a custom-mixed stain from the Colorizer line. The nearly black

color, with golden brown showing through, is excellent for Early American pieces. Well-stocked paint stores now carry stains as well as paints and enamels, so you can mix or intermix any stain color you want.

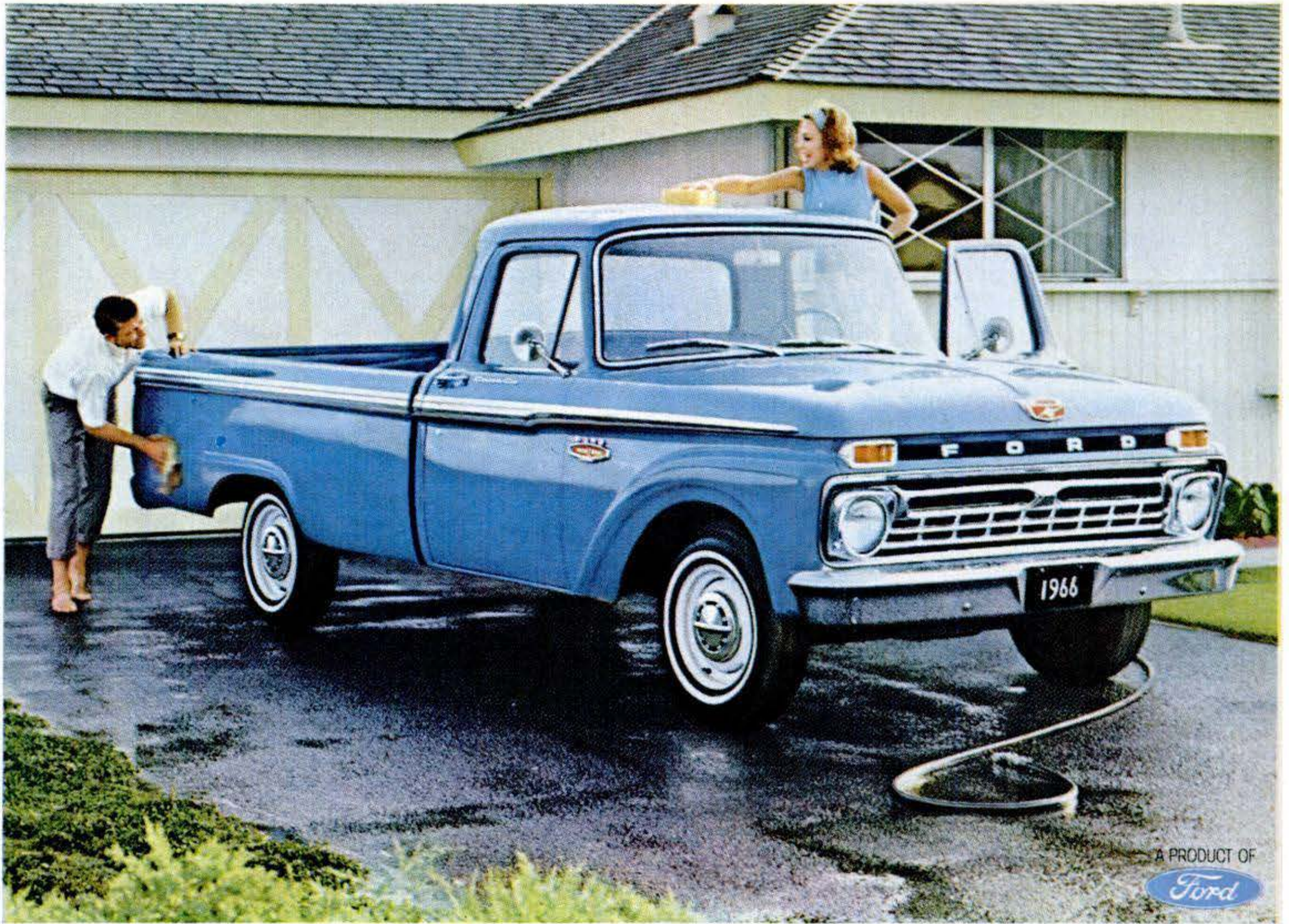
**14. Potassium permanganate** (poison), which you can buy at photo shops or drug stores, is a chemical oxidant that turns pine brown—a shade you can't get any other way. The permanganate is red-purple in solution in water and is a potent stain. A standard way to use it is to mix up a saturated solution of the crystals in water. You take a relatively small quantity of this stock solution and dilute it with the amount of water you need for the stain job. If it is too light, repeat applications are cumulative. Flood the surface quickly and uniformly, to avoid mottling. Topcoat with shellac, varnish, or lacquer.

**15. Bronze stain** is an interesting color for small pine pieces. It is nothing more than a bronzing solution, which you mix yourself. Stir powdered bronze into a penetrating resin such as clear Firzite or Rez. Keep it in suspension by frequent stirring, and brush it on, wipe it off.

**16. Black swirl** utilizes the economy and workability of pine as the base for a built-up finish sometimes called "gesso." To apply the finish as illustrated here, you smear plaster-of-paris smoothly over the surface, then texture it with a fairly stiff, dry brush. Any sort of texturing—random or deliberate—is possible. When the plaster-of-paris is hard, apply enamel. Try to cover in one coat, if you want to maintain sharp textures; go to two or three if you want to round off the edges. Some paint stores sell special gesso formulas.

**17. Scorched finish** is another novelty texture good for small work. Use a propane torch or other flame to scorch the wood just enough to blacken the surface. Because of varying hardness in the grain, the depth of the burning varies. Then a wire brush takes away the charcoal, leaving color and texture, ready for varnish or lacquer.

**18. Antiqued finish**, a form of the standard finishing trick known as "glazing" [see PS, Mar. '66], is currently a high favorite. Since it is composed of a base coat and an overglaze, endless color combinations are possible. Antiquing kits are made by most major paint manufacturers. PS



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IN A FORD  
ALL THE WAY**

**FORD/66**

## Amazing New Cone Drive

[Continued from page 62]

cone frames to swing and tilt—which they could not do if there were no slack at all. The slight twisting of a chain by a frame's motions is amply allowed for, by making the driven sprocket narrower than the driving sprocket.

**How you operate it.** Connect the cone drive's control linkage to a pivoted steering post, and the steering wheel itself becomes the driver's control. Simply push the wheel ahead, and you go forward. Pull the wheel toward you, and you back up. Since control pressure is gentle and effortless, Davis says, he prefers to operate the control continuously. But detents may be used, if wanted, to hold the control setting at a desired ratio. A separately controlled brake, also optional, can be provided by friction pads bearing upon the large cones' outside surfaces.

**The differential action.** Both wheels pull with full power—but, on turns, there's differential action so good that the inside wheel can swing on an 18-inch radius.

That the drive acts as a differential was a surprise discovery—and remains a bit of a puzzler. There is no doubt that it does. On a turn, the inner-wheel discup can be seen to shift to a lower speed by rocking back on its driving cone. The outer-wheel discup simultaneously tends to rock toward a high speed on its driving cone. Only by locking the control in high can this differential action be overridden.

Apparently there must be enough give in the drive—whether in the frames' springy mounting, in control-rod play, or elsewhere—to allow the twin discups this much independent action, despite the control linkage connecting them. But what makes them do it?

Three engineers of a major transmission-manufacturing company studied the drive and came up with three explanations—all different, Davis reports. But his own patent papers suggest what may be at least part of the answer, if not the whole one:

Suppose the vehicle makes a left turn. Ground friction slows the left wheel, making it harder to turn. The extra torque tightens the wheel's drive chain. And this exerts a force tending to move the outer-cone frame toward a lower ratio. Conversely, the freer-running right wheel tends to move its outer-cone frame toward a higher ratio. The opposite happens in a right turn.

**Brake-lining cones.** Davis makes the driving cones of brake-lining material used in logging trucks. In that tough service it must hold without fading, glazing, or overheating. For the drive cones, it is ground to a smooth precision surface. In use it compacts and polishes like cast iron. To date, such drive cones have run 500 hours without showing any measurable wear.

Other traction drives, chiefly for industrial use, have been under investigation for 10 years. Most are enclosed, with all-metal disks, cones, or rollers running in oil. Traction results as the hard surfaces deflect, under contact pressure so high—more than 120,000 pounds to the square inch—that they do not slip.

The Davis drive differs in important respects. It runs dry instead of in oil. It needs no cooling. Its traction elements, not being in constant contact, can serve as a clutch. Slipping does them no harm. Contact pressure, and therefore bearing load, are moderate. The differential action is another advantage.

**The story behind the drive.** When Davis was five years old, his father bought the community's first tractor. Davis has been thinking about power transmission ever since. At the age of 16, he realized his ambition to build his own tractor, which helped pay his way through college. During World War II he designed naval-gun drives. Since then he has devised manual and automatic V-belt clutches, sprocket-driven clutches, and variable-speed belt drives, which are made and sold by his firm, the V-Plex Clutch Corp., Hagerstown, Ind.

Meanwhile, he saw the need for a "packaged power platform" to which you could hook an engine and wheels, to make a practical vehicle of any kind you wanted. In 1958 the cone-and-discup idea came to him.

Handbook-and-slide-rule theory said it wouldn't work. But the cone-drive notion bugged him. To get it out of his mind, Davis decided to build the drive, try it, and toss it out when it failed.

Davis asked Ted Sedgewick, once his high-school shop teacher and now a V-Plex toolmaker, to machine the parts—without telling him what they were for. Sedgewick accidentally found out, and lectured Davis as if they were back in the classroom. The thing wouldn't work; it was obviously a waste of time. But the parts were already

*Continued*

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**Amazing New Cone Drive**  
 made and, at Davis' insistence, were assembled for trial.

"We expected to see it flop, and forget it," Davis says, "but it fooled us. It did more than we asked, or even dreamed."

Of 25 units operated to date, none has yet quit. The original drive cones are still running. Skeptics have been invited to try abusing the drive—by overloading, quick shifting at any speed, ramming into loads, pushing against stumps until the drive wheels spin. Such shenanigans have wrecked engines—but not the drive.

**A dual-control drive, too.** Besides the single-control cone drive, Davis now is developing a dual-control version, with independent control of the two output shafts. With dual controls, you can turn with the inside wheel standing still or even going backwards—literally on a dime.

Using a dual-control Davis drive, a vehicle with swivel (caster) wheels in front can be steered by power alone with fantastic accuracy. You can thread obstacle courses, says Davis, or pirouette the machine like a robot ballet dancer. Dual controls would do the same for tracks, just as in big Cats—making the drive a natural for small tracked dozers or snowmobiles as well as for tractors.

For a dual-control version, the driver's control is a pair of hand levers—joined at their tops, for one-hand operation, by a flexible hand grip. With it, you can move the two levers the same way or—by a twist of the wrist—in opposite directions.

Two cone-drive units might be used for a four-wheel drive, but will call for some kind of synchronizing control.

Half the drive (one discup) provides variable speeds of 800 to 1,200 r.p.m. on a drill press in the V-Plex shop.

Still untried, and challenging, is the drive's performance in midget racers. No one yet, either, has tried the drive in a small car—but it's a possibility.

The basic production model\*, suitable for vertical- or horizontal-shaft engines up to nine hp., can be adapted to vehicles with 30- to 48-inch tread. Priced at \$75, it comes with single control and includes separate output shafts, though not the wheel axle. Drawings for a garden tractor are offered free with the drive unit. PS

\*V-Plex Clutch Corp., 550 West Main St., Hagerstown, Ind.





## If you've never driven this pickup...

You'll quickly notice that the engine works smoothly, powerfully—whether it's our famous 6, V-8 or 4. And you can believe what our man says about economy.

It's quieter than ever because there's a new acoustical headliner in the cab. A balanced drive line reduces vibration. Improved clutch linkage lessens pedal effort.

The ride on the highway is so gentle you may wonder how it behaves when the going gets rough. No worry. INTERNATIONAL® knows how to build the frame,

springs and shocks to take almost anything.

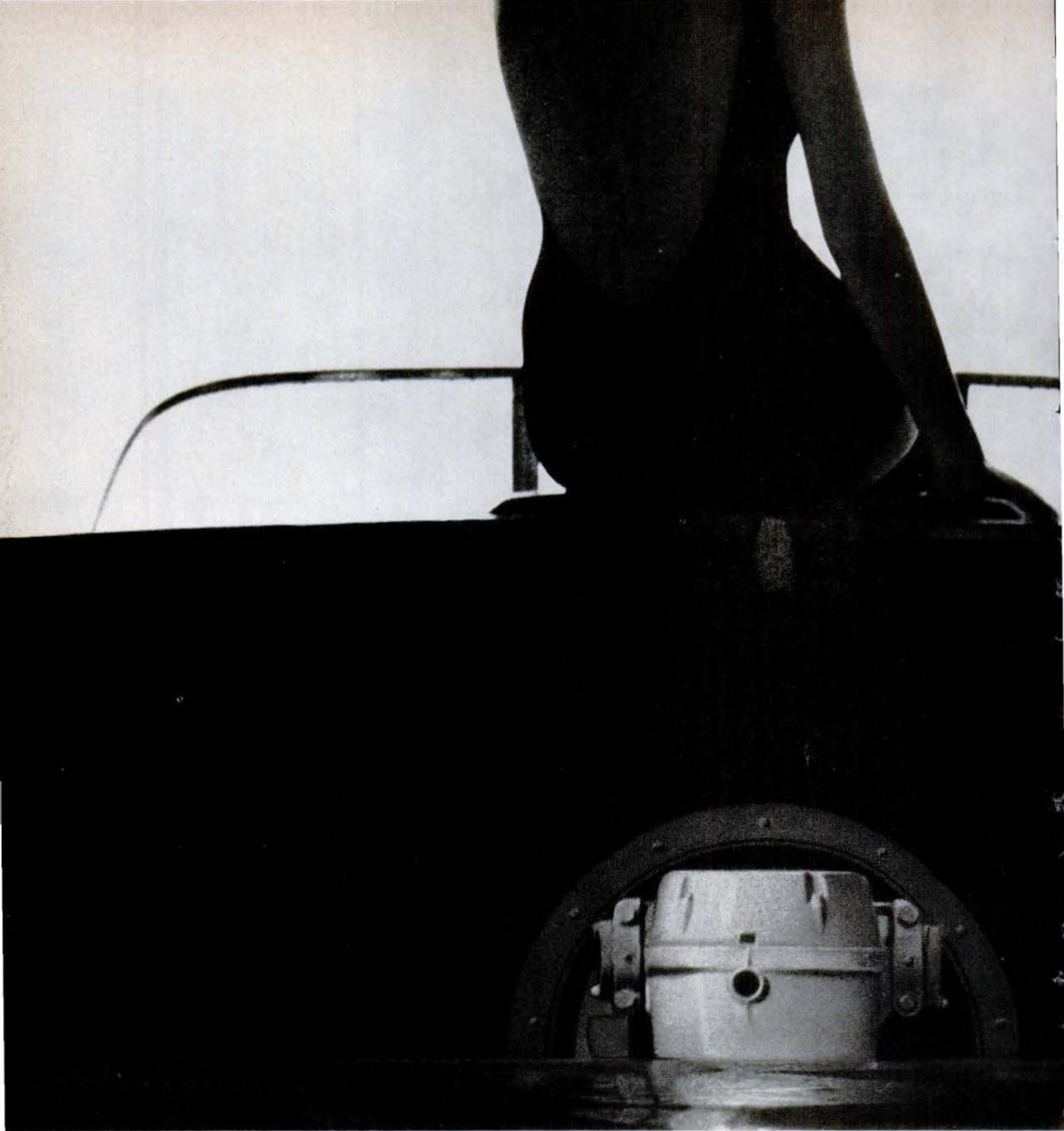
For the ultimate in pickup luxury, ask about the plush cab interiors we offer. Extras like padded dash and door panels, nylon carpet on the floor, colorful seat upholstery—a lot of things that'll make you want our pickup for a second car.

See your INTERNATIONAL Dealer soon. He can add much more to this story. And it'll have a surprise ending—prices are less than you'd think.

**INTERNATIONAL HARVESTER CO.**  
CHICAGO, ILLINOIS



## ...your International dealer can show you what you're missing

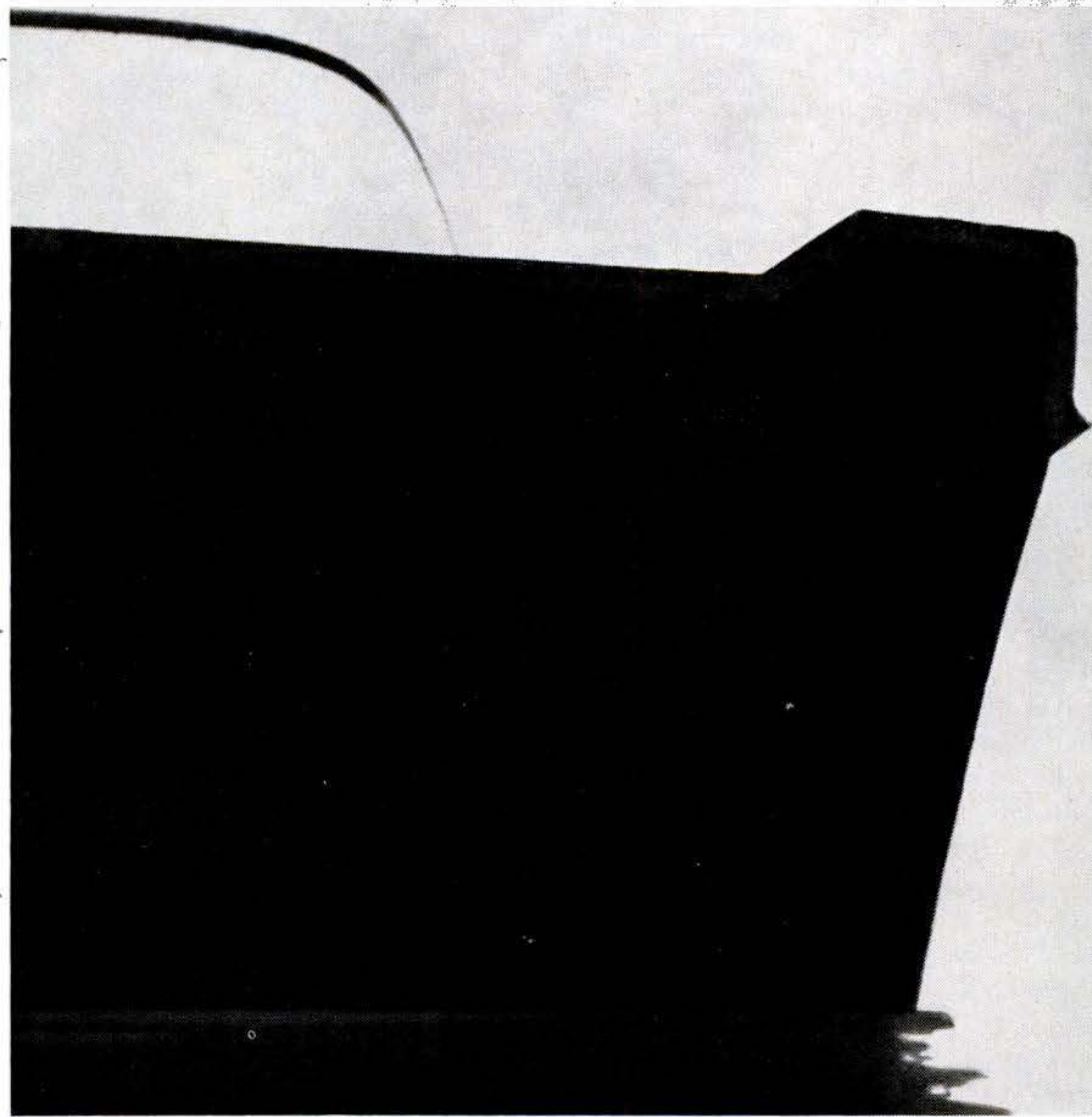


*For 24 months after purchase, OMC Stern Drive will replace to the original purchaser of an OMC Stern Drive any part of its manufacture, which upon inspection proves to have failed in normal use due to faulty material or workmanship.*



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# How can something so compact be such a powerhouse?



200 horsepower and still your transom looks trim! That's the new FASTBACK OMC Stern Drive for you . . . the newest concept in marine power. Propels everything from a runabout to a cabin cruiser. What's even better . . . OMC FASTBACK is the only stern drive available with two superb mounting systems . . . OMC's unique, new floor mounting system and the popular OMC transom mount. Both feature exclusive rubber mounts to reduce annoying vibration, cut hull strain.

OMC FASTBACK turns tighter than other stern drives, too . . . a full 90° port to starboard. Picture yourself in a crowded harbor . . . where those extra degrees at your control can turn a bad situation into no-sweat.

About that power we spoke of: OMC FASTBACK models are available from a sizzling 90 to a thundering 200 hp. Lets you whisk skiers around the lake with power to spare . . . slows to a crawl when you're trolling for the big ones. And incidentally, OMC FASTBACK includes full 75° power tilt and exclusive electric power shift as standard equipment. Also a 2-year warranty\*.

Test drive OMC FASTBACK in the boat of your choice . . . or send for the FASTBACK Fact Book: OMC Stern Drive, 22 Arbor Ave., Galesburg, Illinois. Then specify OMC FASTBACK . . . the best looking power on the water today.

## What Happens When You Get Tired?

[Continued from page 69]

the University of Oklahoma reported that most people "unconsciously and automatically limit exertional effort to somewhere in the neighborhood of 50 percent of their capacity." He told of a study in which subjects were asked to hold weights in their extended arms as long as they could. After a rest period, they were given dummy pills, which they thought contained a powerful antifatigue medication. "This," said Wolf, "resulted in nearly doubling endurance."

**The stuff of dreams.** Some scientists believe a whole new area for fatigue research has opened. It has long been thought that dreams simply fill psychological needs. What of physical ones?

When you dream, rapid eye movements also occur. Investigators stopped subjects from dreaming by waking them every time the eye movements appeared. Deprived of dreams one night, the dreamers made up for lost time the next night. But when deprived for as long as two weeks, they showed signs of severe mental illness.

According to Dr. William Dement of Stanford University, some still unidentified toxin, or poisonous waste, produced in the nervous system during its work each day is used up during dreaming.

Could such a toxin cause fatigue? At this point, nobody knows. But Dr. E. L. Hartman has suggested that morning dullness might be due to a deficiency in dreaming. Since "refreshing sleep is everyone's nurse," research to find a medication to either induce or substitute for dreaming might be very much in order.

**The "I'm-tired syndrome."** Many physical disturbances can cause abnormal chronic fatigue. If the thyroid, that little gland in the throat that paces energy-conversion processes, works under par, you'll tire easily. And this problem, readily correctable with thyroid medication, may be more common than supposed, doctors believe.

Diabetics not taking enough insulin suffer fatigue because certain wastes pile up; if they take too much, they tire because excess insulin removes too much sugar.

A heart defect that impairs circulation can cause chronic fatigue—and the fatigue may be the first sign of the heart problem.

The "lethargy of allergy," as Dr. W. B. Herter of California calls it, may explain what bothers quite a few people. In Herter's experience, if a medical exam

shows no obvious cause for chronic fatigue, a wise doctor ought to find out what a patient eats. If the list includes corn, chocolate, sea food, citrus fruits—common trouble makers—a diet without such items may produce dramatic results.

**"Tired blood."** Much talked about, this is supposed to be the result of lack of iron and vitamins. Recently, the Federal Trade Commission declared officially that "the number of people in the total population who are tired because of iron or vitamin deficiency is infinitesimally small." They hold that the commonest causes of abnormal tiredness are in the mind.

One common mental cause of abnormal fatigue is depression—drawn-out "blues," not ordinary ups and downs of mood. Says Dr. Nathan S. Kline, Lasker Award winner for his mental-health research, "More human suffering has resulted from depression than from any other single disease."

In a four-year study, doctors at Massachusetts General Hospital, Boston, found fatigue to be the single most frequent symptom of depression. Effective drugs are available to treat depression.

**Tension—taut and tiring.** All of us are subject to tension. There are "tranquilizers," of course, but many top physicians use them only in extreme cases. Says Dr. Harry J. Johnson, President of Life Extension Foundation: "Relaxation in small and large doses is the antidote to excessive tension. This does not mean rest—it means a change of activity. The best cure for tension fatigue is exercise."

Out of all the work on fatigue comes a simple set of guidelines you can use if you have less energy than you should.

1) Have a complete physical exam. Odds are heavy there'll be no disorder.

2) If you're an otherwise healthy specimen, get yourself into shape—a good doctor will advise you—with regular daily exercise.

3) If your job has much routine, take short breaks; just five minutes will help.

4) Plan your evenings in advance. Having something to look forward to can do a lot to stave off fatigue from boredom.

5) Take a good look at your mental attitudes. How much you can do depends considerably upon how much you think you can do—it's a scientific fact that most of us have about twice the energy and stamina we think we have or try to use. **PS**

# Now

**the only four-wheel drive  
in its class with**

# V-8 power... Bronco!



**Want even greater action** than Bronco's spunky Six? Give the new V-8 a go. 200-hp to drive all four wheels. That's power for the big jobs, and the big jaunts... to where the fun is and the roads aren't. A 34-ft. turning circle—smallest of any 4-wheeler—gives Bronco quicksilver handling. Bronco's tough, too—far tougher than its car-like ride lets on. A rugged frame is one reason. Heavy Mono-Beam suspension is another. Wagon, Roadster or Sports Utility, Bronco is a combination of features no competitor can match. Think it over. Chances are you and Bronco make a great combination, too.

## **Bronco wins at Riverside!**

In the brutal Four Wheel Drive Grand Prix at Riverside, California, March 4-6, Bronco won top honors against all comers! Bronco 289-cu. in. stock V-8 won first in its class, while Bronco with a standard Six took Top Eliminator prize.

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fun one  
from **Ford**



**Get more  
POWER with  
a big (MAN'S)  
motorcycle!**

## **BSA LIGHTNING**

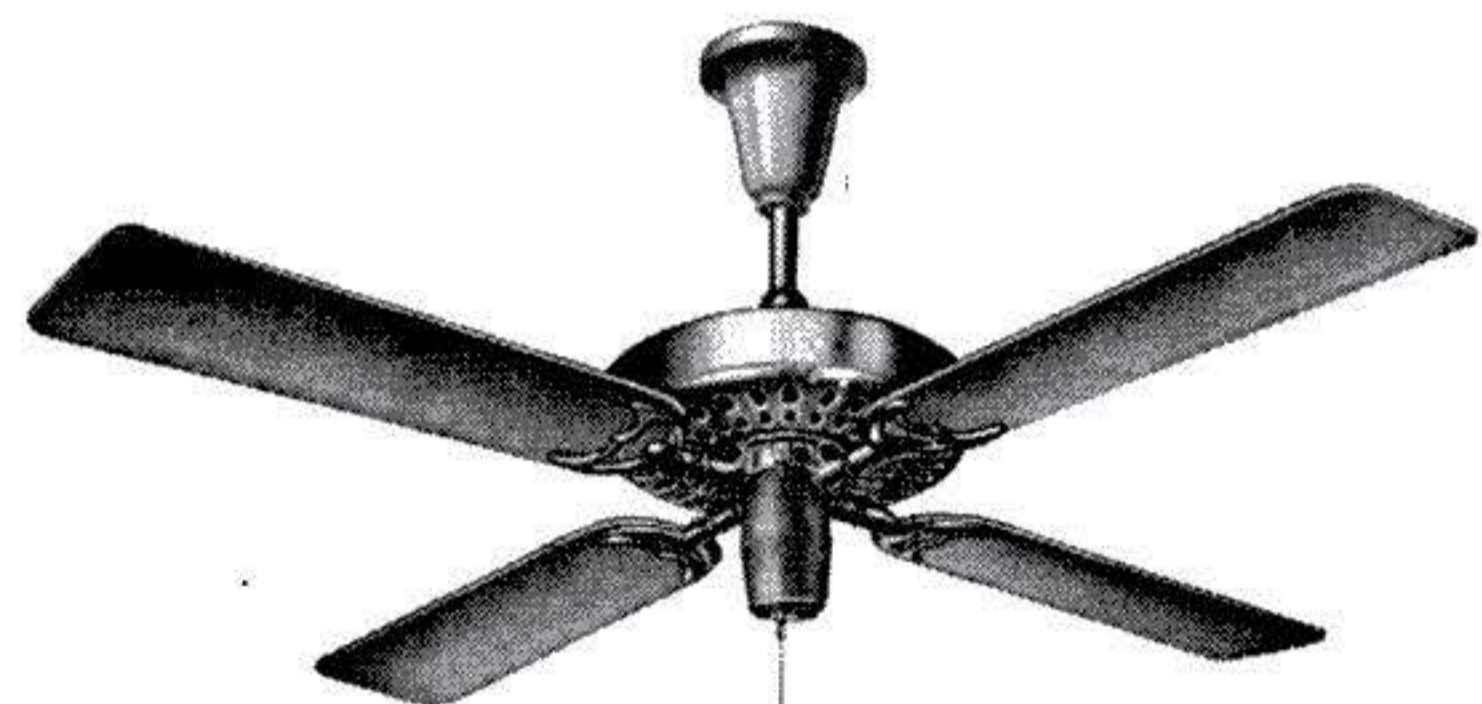
Excitingly fast BSA 40 cubic inch twin! Rocket-like acceleration without constant gear shifting. Big, muscular power and confident handling. See the LIGHTNING at your BSA dealer!

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2697 Frisco Ave., Memphis, Tenn.—38114

## **Whose Hue? PS Guide to Color Films**

*[Continued from page 65]*

with the box. If you carefully follow the film manufacturer's exposure recommendations, you'll get good results — without a meter. Incidentally, question your meter's judgment if it indicates an exposure that differs with the table by more than a stop.

For picture insurance, bracket your exposures whenever possible: Shoot first at the indicated lens opening and shutter speed, then take two more pictures (without changing shutter speed) at the next larger and smaller *f* stops. At least one of the three exposures should be good.

**Slow or fast film?** The most popular 35mm color films — Agfachrome CT-18, Anscochrome D/50, Dynachrome 25, Dynachrome 64, Ektachrome-X, Kodachrome II, and Kodachrome-X — are daylight transparency (reversal-type) materials in the ASA 25 to 64 exposure-index range.

These films are amply fast for general use — basic exposures for average subjects in bright sunlight are *f*/8 for ASA 25 and *f*/11 for ASA 64 films, with shutter at 1/125 second. Reserve the faster films for those dim-light situations where sensitivity is really needed — you pay for speed in image quality.

**Is grain a problem?** Graininess used to be a factor in the selection of a reversal-type color film. Improvements in films have made its consideration more academic than practical for the average photographer. The faster films tend to be grainier, but few viewers will notice any marked difference in projected images, even when blown up to fill a 60-by-60-inch screen.

While there are some excellent independent color-film processors, if you're in doubt about where to have your film processed, send it to the manufacturer's laboratories. Prices of Agfachrome and Dynachrome 35mm films include processing. Anscochrome may be bought with or without processing. Kodak offers separate prepaid processing mailers.

The photos near the beginning of this article show how eight different color films "see" the same subject under the same conditions. Pick out the pictures you like best. Then try two or more films. Compare your results by slide projection — viewing transparencies by direct or reflected light is deceptive. Once you've decided on a film, stay with it and learn to use it effectively under various conditions. Your color slides will be better than ever.

**PS**

**If you're curious why a GMC pickup is priced \$49\* more than others, there's an easy way to find out.**

**Drive one.**



The three letters on the grille lead to the reason why this truck is worth more. GMC. They stand for "built, sold and serviced by truck people." People who know how to give you a lot more truck.

\*Based on manufacturers' suggested retail prices, the GMC V-6 model pictured above is never priced more than \$49 over comparable competitive base models. Often the difference is less.



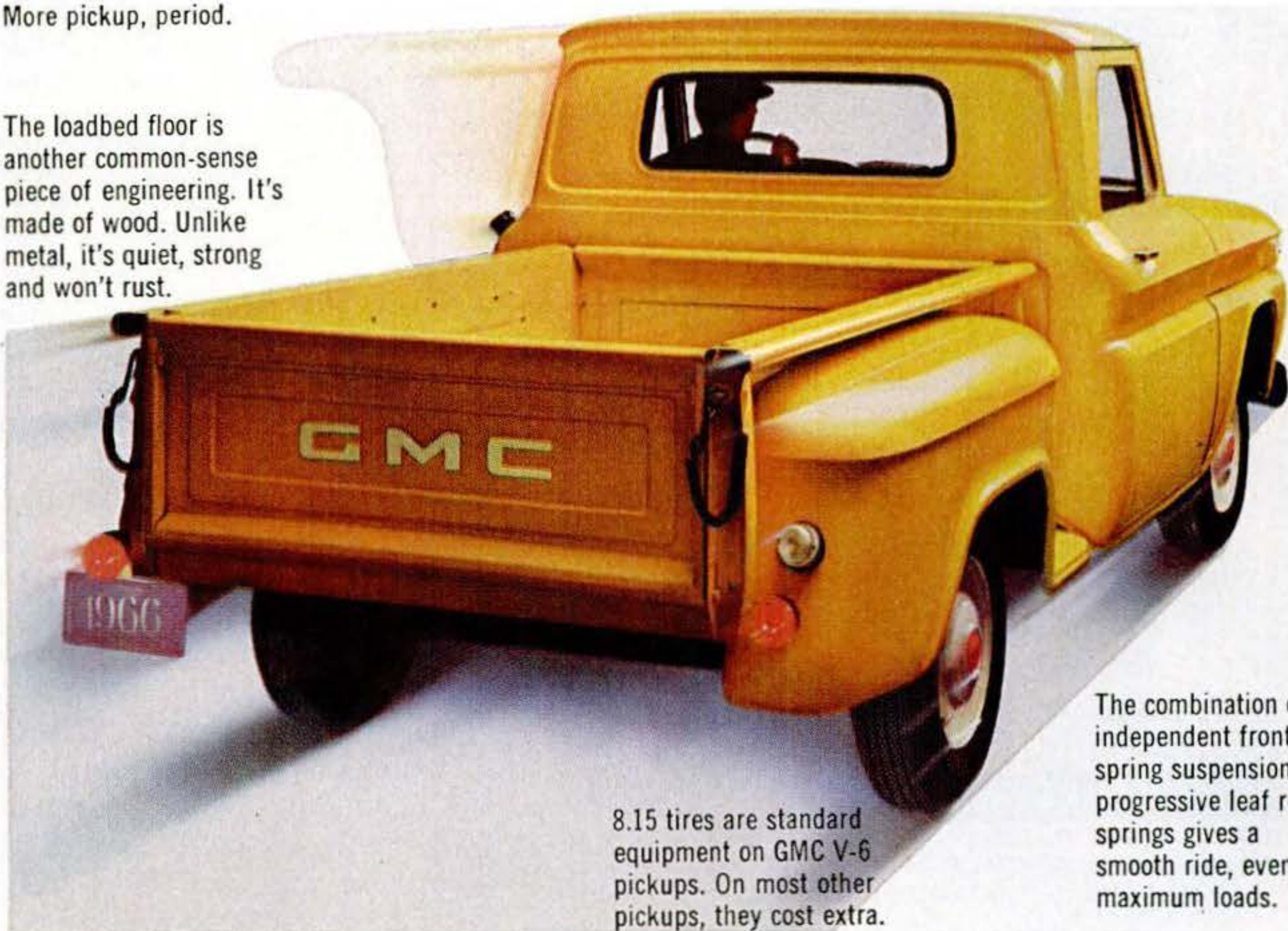
The cab has two walls of steel and a thick pad of insulation. More security. More comfort. More maintenance-free miles. Let's face it. More pickup, period.

Seats are foam-padded. Backs are fully adjustable. Also available is a new custom sports interior. Bucket seats. Padded dash. Carpeting. Padded door trim. Like your family car.

The 170-h.p. V-6 powerplant is still the most modern truck engine on the road today. It's the engine that has been known to go up to 150,000 miles before major repairs. If you want to specify even more power, GMC has produced a V-6, a 351 cu. in. brute with 220 h.p.

Four headlights. Not two like most other pickups.

The loadbed floor is another common-sense piece of engineering. It's made of wood. Unlike metal, it's quiet, strong and won't rust.



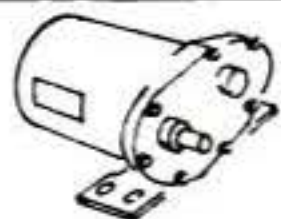
8.15 tires are standard equipment on GMC V-6 pickups. On most other pickups, they cost extra.

The combination of independent front coil spring suspension and progressive leaf rear springs gives a smooth ride, even with maximum loads.

**GOVT. SURPLUS AND OTHER BARGAINS SAVE UP TO 90%**

**HEAVY DUTY AC GEAR MOTOR**

Rated 1/4 HP @ 1725 RPM's. Runs on 115 V. AC, 60 cycle, single phase. Continuous duty. Reversible. 3/4" keyed output shaft 120 RPM. All metal gear case construction. Exc. for conveyor belts, garage door openers, any heavy duty-low speed use. 11 3/4" L x 7 3/4" W x 6" H. Shpg. wt. 24 lbs. NEW. Special purchase. Specify model VW120. A \$52 value. Now \$24.50.



**1500-1 GEAR HEAD MOTOR** Speed 6 RPM @ 24 V.D.C. Reversible. 5 AMPS. Also runs well on 12 V.D.C. on reduced power. Excellent for small drive unit for winches, kids cars, powered displays, capstan, etc. Has 5/8" drive shaft. Shpg. Wt. 7 lbs. Like new. Tested prior to shipment. 9" L x 5" H x 3 1/2" W. Approx. GOV'T COST \$97.50. Just \$12.95

**DC JET GENERATOR ARC WELDING KIT** complete with GE Type CM Gen (30 V. D.C., 400 AMP, 3000 RPM: ampere rating is for continuous duty, intermittent amperage is 500 to 600 amps). Also 2 rheostats, 1 voltage reg., 1 voltmeter, 1 electrode holder, 1 welder's mask, 1 toggle switch, 10 lb. vacuum packed 1/8 in. welding rods, pair welder's gloves & spline coupling. All units guaranteed pre-tested. Wt. 110 lbs. Approx. GOV'T COST \$700. All items \$64.50



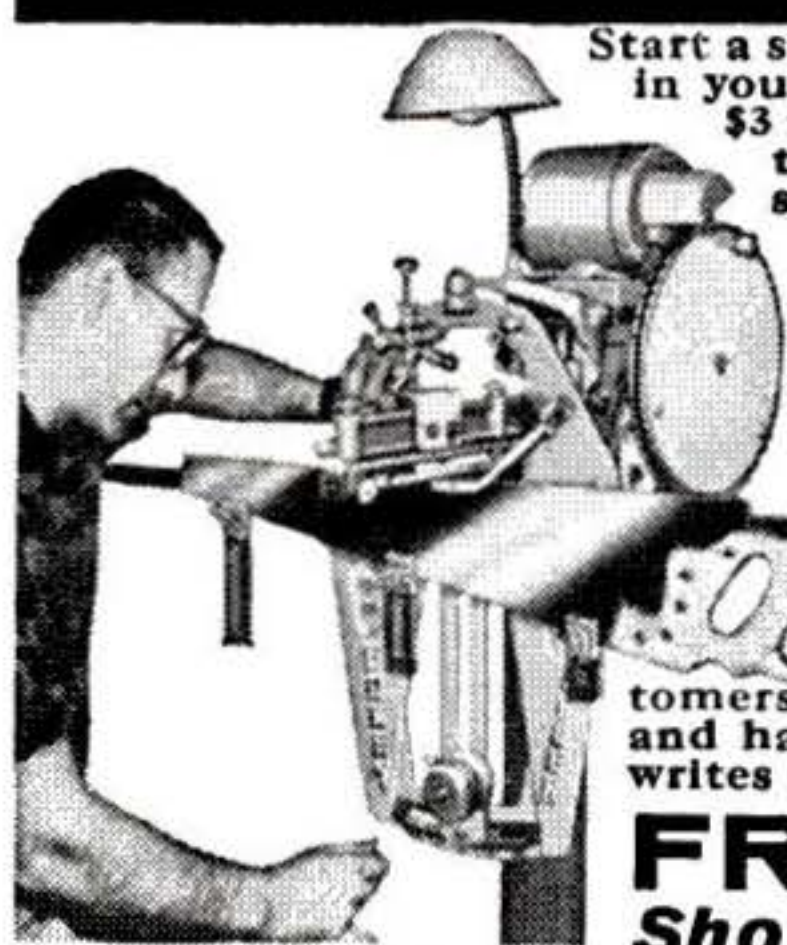
**HEAVY DUTY MAGNET** Fantastic power, will pull 125 lbs. on steel block. Excellent as underwater retriever. Picks up all ferrous metals. 4 1/8" L x 1 5/8" W x 4" H. Shpg. Wt. 3 lbs. \$7.95

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Start a steady repeat CASH business in your basement or garage. Earn \$3 to \$6 an hour in your spare-time! Excellent profits in saw sharpening business! Automatic Foley Saw Filer, easy to operate, files combination saws, hand, band, and circular saws. No experience needed. H. C. Delbert wrote us: "Since I got my Foley Filer 5 years ago, I have averaged 4 1/2 saws each day since I started."

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**Keiki the Porpoise . . . New "Errand Boy"**  
[Continued from page 85]

Meanwhile his rival, Tuffy, was getting all kinds of publicity for his work in the Sea Lab experiment. And Tuffy earned it.

Later, at the Point Mugu, Calif., missile station, a bright space scientist conceived the idea that the \$4,000 launching booster, which fell into the ocean when each ICBM was blasted off, could be recovered by some underwater detective work by Tuffy.

The plan was to add a \$1.98 buzzer mechanism to each rocket, so the booster could be located on the bottom of the sea by the porpoise's acute sound perceptions.

The plan worked perfectly. Tuffy homed in on the buzzer as if he had been doing it all his life. And he continued at this job.

**Training humans.** Keiki recovered from his bout with skin disease, and was helping his masters as the principal instructor of human porpoise trainers being introduced to their job. He seemed tolerant and understanding of human slowness in the intelligence department. But Mrs. Pryor, head of the training endeavor, said that Keiki sometimes liked to play practical jokes.

One of his favorite pranks originated when he observed a photographer lining up to make a picture outside the glass tank. From then on, Keiki would watch and wait until the photographer was in a vulnerable position, and swoosh! With an expert flip of his tail, he'd drench the lensman.

The latest of Keiki's tricks is to play tic-tac-toe on an underwater blackboard with a trainer. But life isn't all play for porpoises that work for science. There is much research to be done on the phenomenal sound perception of porpoises. Understanding this might lead to a submarine radar. At present, our undersea ships are still nearly blind when submerged.

The most ambitious experiments now are efforts to communicate with porpoises. Neurophysiologist John C. Lilly has conducted NASA-subsidized experiments that attempted to establish communication between porpoises and man.

So far, scientists have not succeeded in understanding the whistles and rusty-hinge noises that make up the amazing vocabulary of porpoise sounds. If the tones can be analyzed, and men can learn porpoise talk, the animals may be the most effective underwater intelligence agents ever known, and useful for all kinds of underwater scientific research.



# tops



## for outdoor fun! '66 PICKUP-CAMPER

Enjoy the outdoors on a budget with this sensational, new DATSUN Pickup-Camper combination. A custom built Camper for the new Datsun Pickup (available thru local Dealers) will transfer this rugged work-horse into a perfect vacation vehicle. New Datsun Pickup features a powerful, new 1300cc engine, 4-speed stick shift, WSW Tires, heater, 250 Watt Alternator, torsion-bar suspension, more cab and load room and many more extras. In a class-by-Itself—Test it! \$1655 del., (Pickup Only) plus tax, lic. D&H and local freight if any.



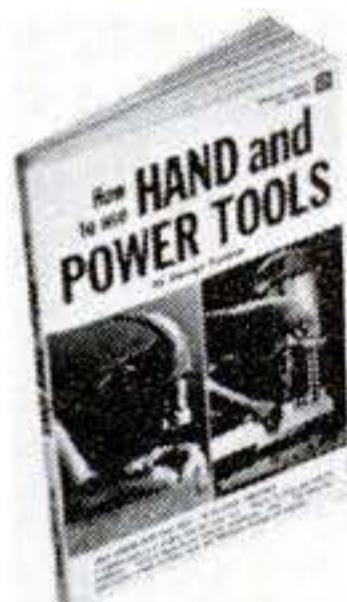
FOR DEALER NAME WRITE—DATSUN, P.O. BOX 191, GARDENA, CALIF.

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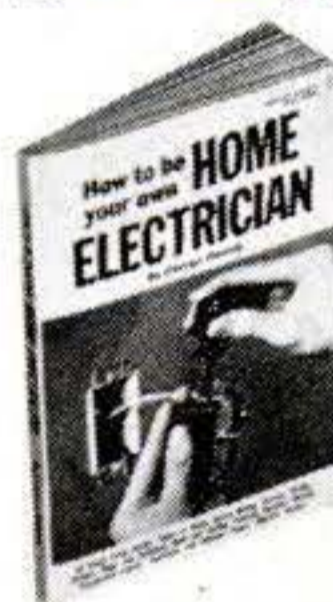
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PS-666

**MONEY-BACK GUARANTEE**

## Painting Secrets from a Pro

[Continued from page 169]

**Plastering.** The secret of smooth and quick plastering is using a scraper with a flexible blade. A rigid blade can't do the smooth job that cuts sanding time. A 3½" blade (about \$1.65) is excellent.

Pure plaster dries too quickly to keep you abreast of your work schedule. Mix the plaster 4 to 1 with spackle so it stays workable.

If you have a hole to fill, stuff it first with steel wool, and use plaster only to finish it off. On some larger holes the filler may crack as it dries. Avoid this by wetting it down with water immediately after patching, and if it starts to go later, wet it again.

**Plenty of paint.** The trick of painting with almost magical results in terms of ease, quality, and speed is to use plenty of paint—no matter what you're painting. Let the paint do the work. Good brushes and rollers are important here. They hold, and bring, more paint to the surface.

For walls and ceilings, 9" rollers are best. They use half again as much paint as brushes, but are faster and the missed-spot hazard is lessened.

**Ceilings.** Paint your way *to the light source*—windows, say—working from one side of the ceiling to the other and then back again. First, use a 3" brush to cut in where the roller can't go. (If you have molding, wipe it clear of dust so it won't foul the brush.)

After cutting in, run your dry roller back and forth into the pan until it's full. Then roll it softly over the grated part of the pan to remove excess.

Paint one small section at a time: only what can be easily seen and easily reached (say 3' by 3'). Go into the maximum dry area on every stroke and make your first strokes cut across the light source. Now crisscross in line with the light to flatten and finish the paint.

If you're using enough paint, your roller should still be wet after each 3'-by-3' section. Never try to stretch the paint by rolling into a new area. That's when missed spots multiply like rabbits.

As you get down from the ladder after finishing each section, look up—from a fresh vantage point—and check for missed spots and unflattened strokes. Touch up right away.

When one strip of ceiling is finished, continue to paint, section by section, back the other way. Since plenty of paint is used, the first section you painted will still be wet when you get to it, and lap marks will be avoided.

Never stop painting in the middle of a ceiling or a wall.

**Walls.** As with the ceiling, use a 3" brush to cut in before you roll. (On this, and any brushwork, dip the brush about 2" into the paint, tap it lightly on the inside of the can, and go right to the surface. Don't wipe it on the rim.)

If the walls have molding or panels, cut them in with the wide part of the brush. If you have to cut the wall in at the ceiling, cut in with the brush held flat in one bold continuous line. Any paint that gets on the ceiling can be wiped off easily with a rag.

Walls themselves are also painted in small sections with a 9" roller going from top to bottom in 3' or 4' strips. Use plenty of paint but not so much that it runs. You can see big drips, but after each section is finished, check for the subtle kind that looks like the scales of a fish. That means you're using too much paint.

Until you get the feel of how much paint to use, you'll probably get some drips. Just make sure they're rolled out.

**Baseboards.** If the baseboards are going to have flat paint, do them as you finish the wall section. If baseboards are enamel, paint them after the walls are finished.

To avoid getting paint on the floor, baseboards are "dry-brushed." Paint the top of the baseboard with a full brush; when the brush is practically empty, come back and cut in near the floor.


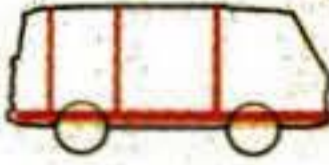



**Enamels.** Painters gave a sigh of relief when the 7" mohair roller for enamel came along, because it makes pumpkin pie out of painting kitchens and bathrooms.

Enamel is much harder to work with than flat. With a mohair roller, though, the finish is a film of very tiny bubbles, somewhat like the skin of an orange. If this type of finish is not desired, use a 4" brush. There's no need to paint in one direction. Put the enamel on any old way, then smooth it out in one direction.

**Cleanup.** For just overnight, wrap the brushes and rollers (with paint still in them) in Saran wrap. To keep paint overnight, pour a thin film of the thinner you're using over it, and put lids on snugly.

When you work, a hat and long-sleeve shirt are musts. You can't avoid getting some paint on hands and face. To get this off, buy a waterless cleanser. You put it on—wipe it off with toweling. S

# Chevy-Van's low price

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a tough body that's reinforced  all welded and  
specially protected against rust  also  
big wide doors  flat floor and  
the dollar-saving power of a famous Chevy 6 



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of General Motors, Detroit, Michigan.)*



# Want a fishing engine that's little, light, lively and loaded with big motor features? Answer: the new Sea-Horse 6

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## The Amazing World of Silicone Rubber

[Continued from page 161]

and when the two are mixed together, the pot life is limited. The silicone rubbers, on the other hand, have all the ingredients for setting and curing except contact with the air. In an action that is entirely in contrast to materials that give off a solvent or plasticizer into the air, leaving a solid, the silicone rubbers take up from the air the ingredient required to turn the extrudable paste into a firm, rubberlike mass. What ingredient? A tiny quantity of moisture vapor.

**It sticks to the job.** Silicone rubber, an adhesive for virtually any substance or combination of substances, requires only clean surfaces to stick to. Really clean is best. Use a high-solvency cleaner such as Cleanwoode or Liquid Sandpaper, or wash waterproof materials in a good detergent, rinse well, and dry carefully.

Some porous substances—like masonry—give you a better bond with a primer, which serves fundamentally to prevent absorption of the silicone material. It helps, also, to scarify metals if they have a polished surface, with aluminum oxide paper or a pass over a grinding wheel.

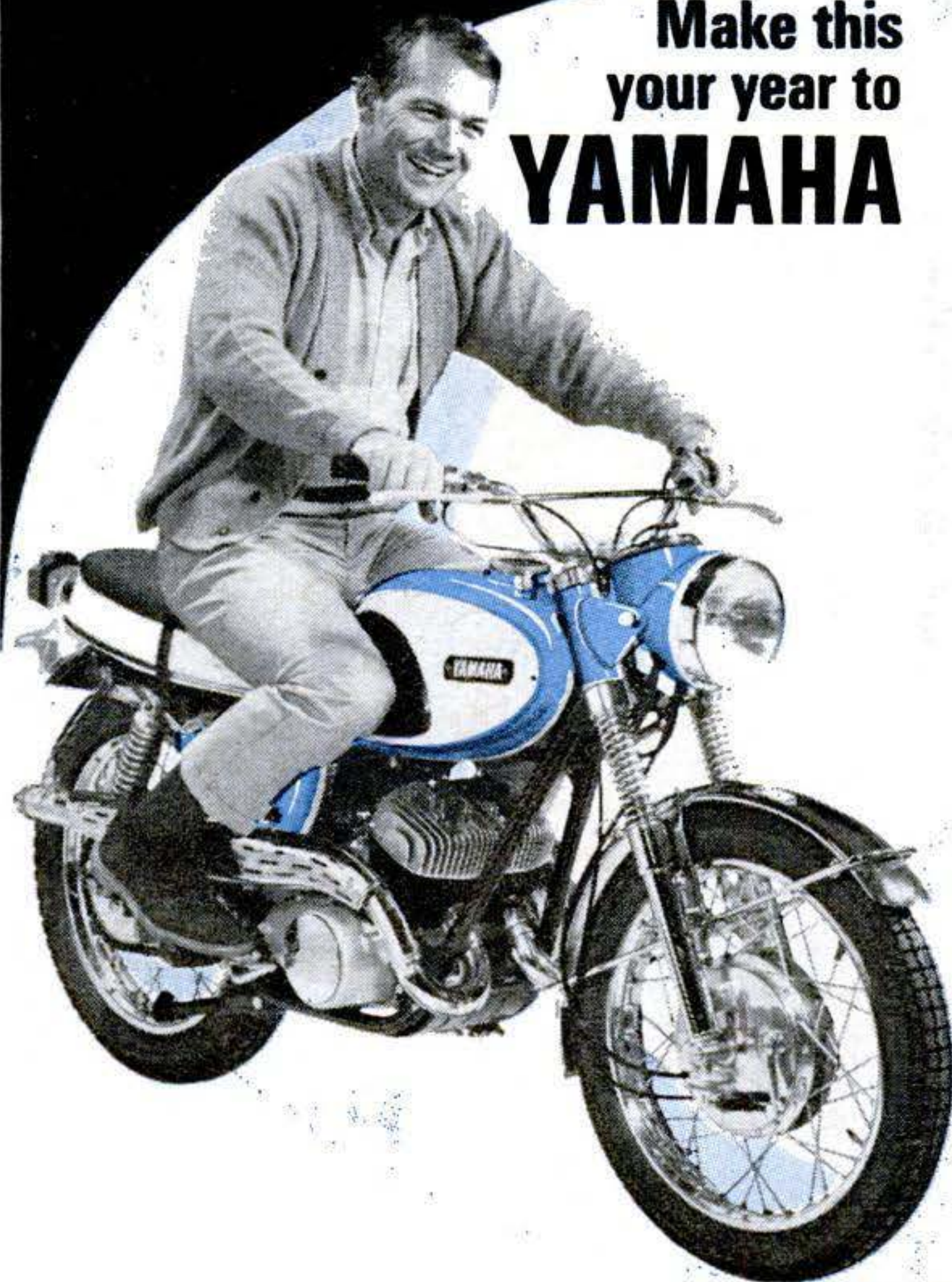
You can buy silicone rubber in several

ways, under the General Electric and the Dow Corning labels—and you can also buy caulking-gun cartridges of formulas intended basically for caulk and putty uses. Among those you see in retail stores, however, there is little difference except for color, and perhaps initial viscosity.

The reason for the colors is, simply, that white looks best in baths, the black is right around automobile windshields and in aquarium work, the gray looks great against aluminum window frames. These three—plus the clears—give you a choice so you can pick the one that looks best when the silicone rubber will show. The reason:

Nothing is perfect. You can't paint silicone rubber with any confident degree of success. Although it will stick—in its right-from-the-tube form—to almost anything, *almost nothing will stick to it, once it has cured.* Considering that the chemist fellows who got the thing started were shooting for a *parting medium*, it would seem fair enough to give them credit for our share of the victory—a product that will stick the unstickable, caulk the uncaulkable, seal the unsealable, and patch the unpatchable. **PS**

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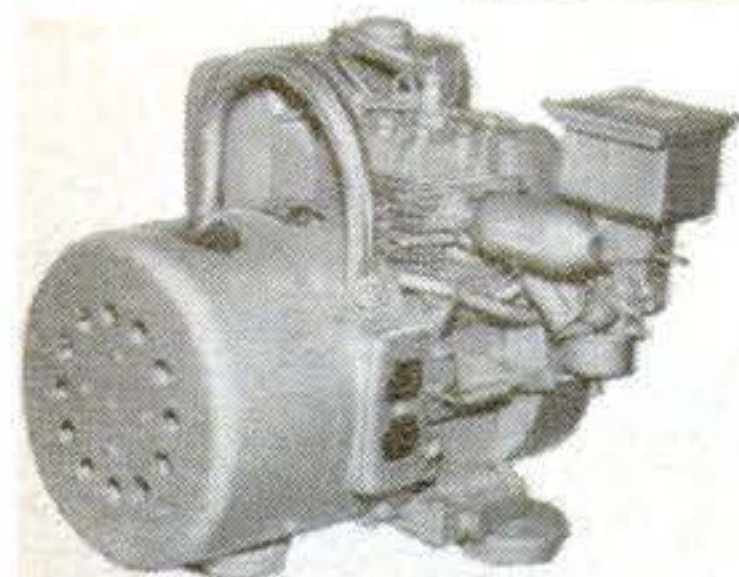
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## Fastback, Holdback, or Cute Styling?

[Continued from page 98]

**Where did they go wrong?** Some auto makers do not put their cars through any kind of aerodynamic testing. How wrong they can guess on airflow was demonstrated by Dr. J. J. Cornish, now associate director of research with Lockheed-Georgia, when he wind-tunnel-tested a British sports car, the MG-A, at Mississippi State University some years ago.

The car had two vents on the hood to evacuate hot air from the engine compartment. Actually, Dr. Cornish found, they became air intakes, and the engine air went *forward* under the hood and out through the radiator.

Now consider the final exhaust outlet on station wagons. On some of these, the tail-pipe leads burned gases into the wake that chases the wagon—and when the wagon stops, the gases enter the open tailgate window (which, at steady speed, works as an outlet).

**Looking ahead.** Today, Detroit is very wind-noise-conscious. Vent panes are disappearing. Side windows will become flush instead of recessed. You'll see more retractable headlights, sleek fairings on outside mirrors and radio antennas, and fewer disturbing ornaments and moldings. Your future car will have "acoustic padding."

Air intakes will be smaller. In developing the Toronado, Olds engineers found that increasing grille size beyond a certain point led to reduced air admission. It's possible to place small air intakes so they provide an escape route for the air that rams into the nose of the car while causing minimal disturbance to the air that's routed over the roof (see the Citroën pictures). Air evacuation under the hood can be combined with exhaust extractors. This will improve efficiency and reduce air noise (and drag) by providing a muffler effect.

Tail fins are not coming back. Stability in crosswinds will be built into your future car by a combination of weight distribution, suspension design, and aerodynamics. Some possibilities here: venting across the front of the car (stability tubes), sideways airflow spoilers, and increased use of front-wheel drive, which allows the center of gravity to be moved forward.

But the shape of your car won't change much. Not until those 120-m.p.h. super-highways are built.

PS

# The Fabulous Machines That Recovered Our Lost H-Bomb

[Continued from page 90]

**Crisis.** There was to be a third cable, for a safety margin of strength. Events ruled otherwise. CURV itself was caught by the chute. And Alvin, looking on, reported a crisis—the bomb was shifting and in imminent danger of plunging into a 4,200-foot abyss, where it might be lost forever. What to do? The agonizing decision was up to the task force's commander, Adm. William S. Guest. "We have to take the weapon," he snapped. Petrel's winches started turning.

Up came the chute and the bomb. Along the way, CURV became disentangled. The two cables held. When the bomb was within 100 feet of the surface, hoisting paused while frogmen went down to it and attached another cable by placing a band around the bomb itself. Its weight of several tons on the hoisting cables would increase substantially

as it came out of the water. Then the lift slowly resumed.

Just 1¼ hours after hoisting began, the H-bomb was safely on the Petrel's deck. Though battered, it was intact.

To prove to the world that it was recovered, it was publicly displayed next day. Then the fearsome weapon came home by sea—crated and packed in sand like a priceless historic relic, which in fact it was.

For its triumphant recovery had done even more than allay Spanish fears of its menace, and preserve intact the top secrets of U.S. weaponry. It had dramatized the newly achieved ability of the U.S. Navy, with fantastic manned and unmanned craft that are forerunners of more to come, to sail and explore and, if need be, to rule, the inner space of the seas half a mile and more down. **PS**



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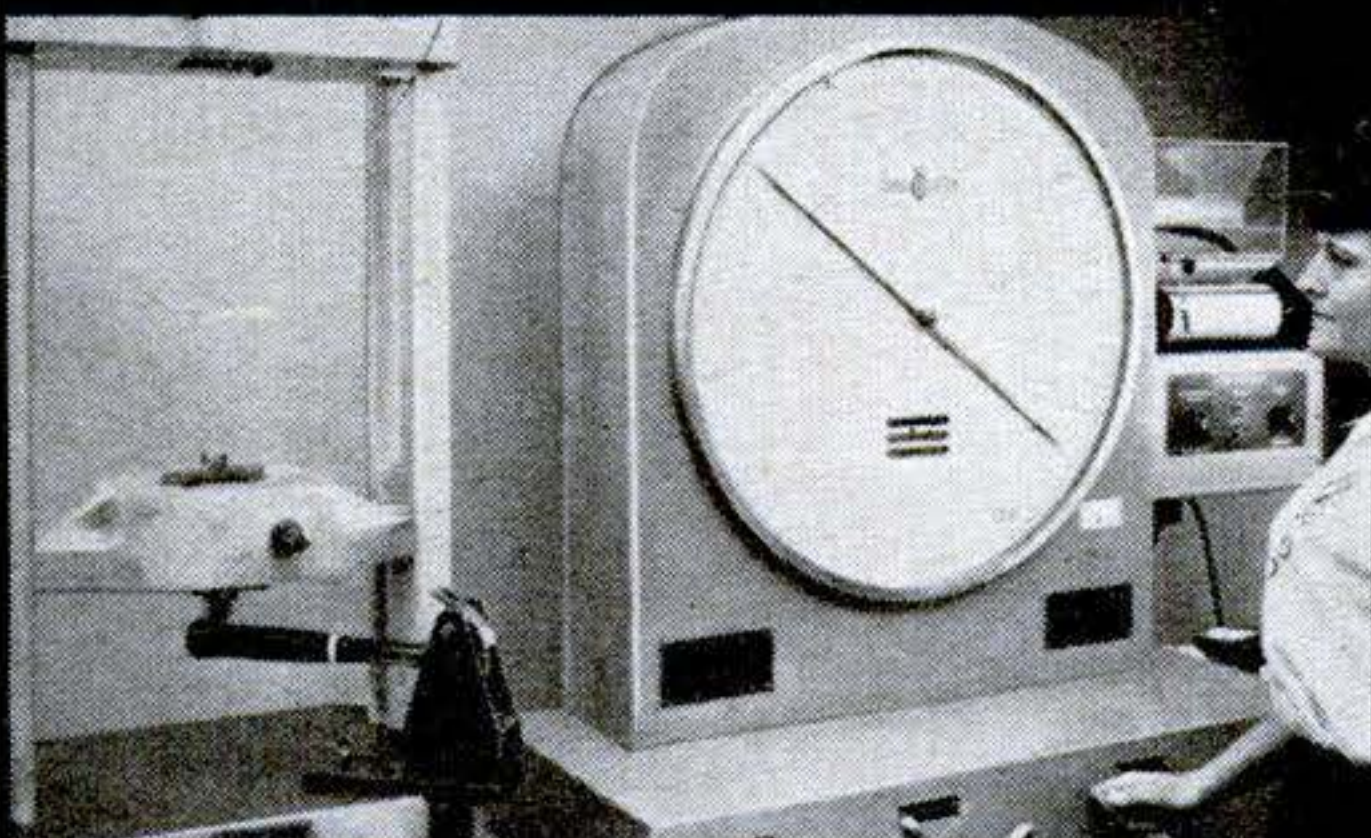
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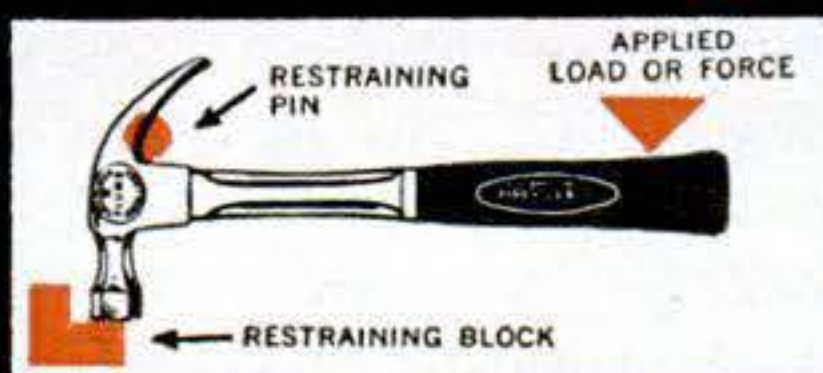
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## Photo Spacecraft to Circle Moon

[Continued from page 93]

frame made with the telephoto lens will be able to register a 20-square-mile area so sharply that it will be possible to distinguish an object as small as a card table. The wide-angle lens will photograph about 350 square miles with high enough resolution to reveal a feature of the lunar surface no larger than a boxing ring.

Successive wide-angle frames will overlap. A pair of the frames, like adjacent aerial photos of the earth, can be placed in a stereo viewer and seen in three dimensions—extremely helpful in relief, or contour, mapping. The ability to do this is another of the advantages of photographs from lunar orbit.

The film in a Lunar Orbiter's camera will be a long, 70-millimeter-wide strip. After exposure it will pass through a processor in which it will be developed and dried, yielding a high-quality film negative.

To transmit the pictures to earth, the TV-like technique will be basically the same as the one successfully used in our Ranger spacecraft. A moving light beam will scan the negative and fall upon a photomultiplier, which converts variations in lightness and darkness into corresponding fluctuations of electric current. This "electrical equivalent" is radioed to earth, where the process is reversed and a photographic image is reconstructed. The Lunar Orbiter photos are expected to excel the Ranger views by far in quality of resolution, with the help of the much more powerful optical system to be used.

**Lunar Orbiter's flight plan.** A typical flight will follow this program: An Atlas/Agena launch vehicle hurls the Lunar Orbiter from its pad at Cape Kennedy, Fla. The Agena, during its first burn after separating from the Atlas booster, puts the spacecraft into a parking orbit about 100 miles above the earth.

Then, at an instant determined by the moon's own orbital motion around the earth, the Agena restarts for its second burn. It pushes the spacecraft out of the parking orbit and into a moon-bound course. On reaching a speed of about seven miles per second, the Agena shuts down, and the spacecraft separates from it—for a three-day unpowered coast to the moon.

During the journey, as well as afterward, nitrogen-gas jets control the attitude of the spacecraft so as to keep the directional an-

tenna aimed toward the earth, and the solar panels toward the sun. For this purpose, the jets are activated by a pair of sensors. A "sun sensor" keeps itself, and the lengthwise axis of the spacecraft, trained on the sun—the brightest object in the sky. Meanwhile a "Canopus star tracker," looking sideward, locks itself upon the brilliant star Canopus—thus checking rolling, and completing the steadying of the craft in space.

When either the sun or Canopus is not visible, a gyroscopic "inertial reference unit" takes over attitude control of the spacecraft. During short passages through the shadow of the earth or moon, when the solar panels are inoperative, nickel-cadmium batteries provide electricity.

After a last correction of the spacecraft's course as it nears the moon, it brakes itself with its own rocket. This enables the tug of the moon's gravity to whirl it into a lunar orbit—initially, at a high altitude. (For awhile its course will be closely watched for "wobbling," due to any irregularities or departures from symmetry in the moon's gravitational pull, to make sure it can safely be brought as near the surface as intended.) Then, by firing its rocket once more, the spacecraft changes its orbit to a low one that provides the best photographs.

**Other data, too.** After exposing all their film, the Lunar Orbiters are to transmit information for several months on the abundance of micrometeoroids and the level of radiation encountered in orbit around the moon. Gradual changes in the unpowered orbits will give scientists greatly improved data, also, on the moon's gravitational field and the lunar tidal effects produced by the earth's gravity. All this information is of vital interest to our forthcoming manned Apollo-Saturn flights to the moon.

Systems management of the Lunar Orbiter program is handled by NASA's Langley Research Center. The program's overall direction, on the Washington level, rests with NASA's Office of Space Science and Applications. Prime contractor is the Boeing Company, with Eastman Kodak and RCA the respective subcontractors for photographic and electronic subsystems. Evaluation of results is being coordinated by NASA-Langley, Jet Propulsion Lab, NASA-Houston, U.S. Geological Survey, Air Force Aeronautical Chart and Information Center, and the Army Map Service. PS



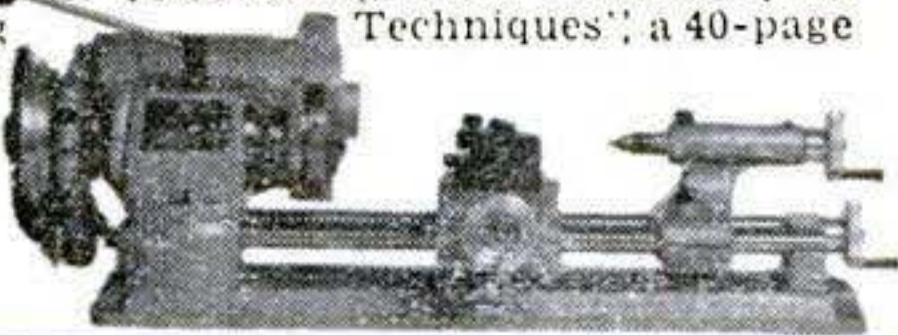
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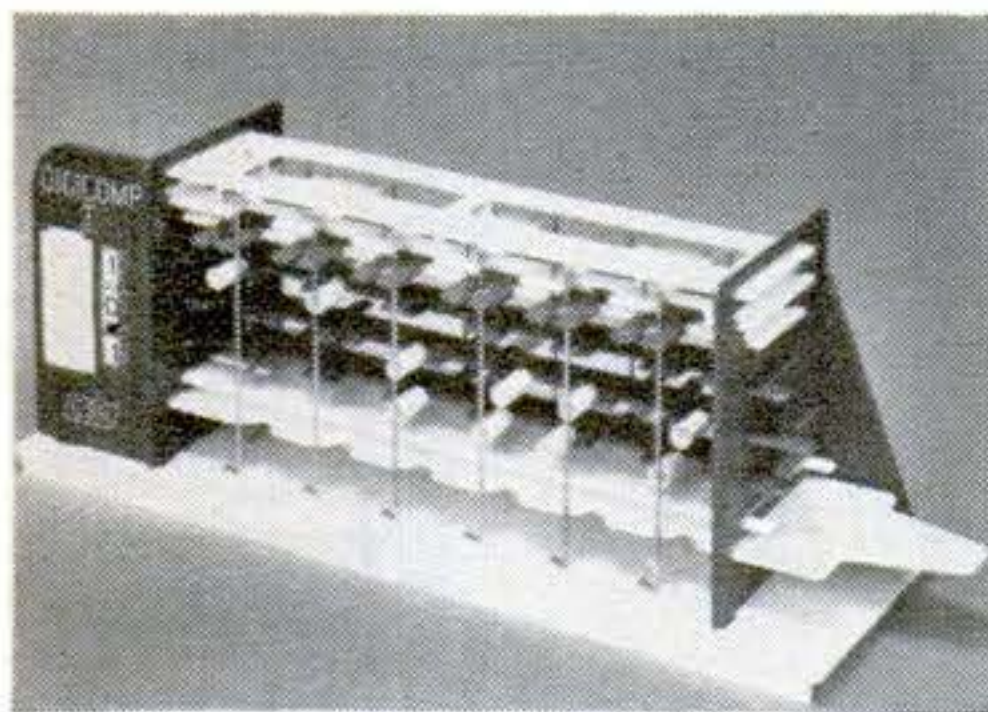
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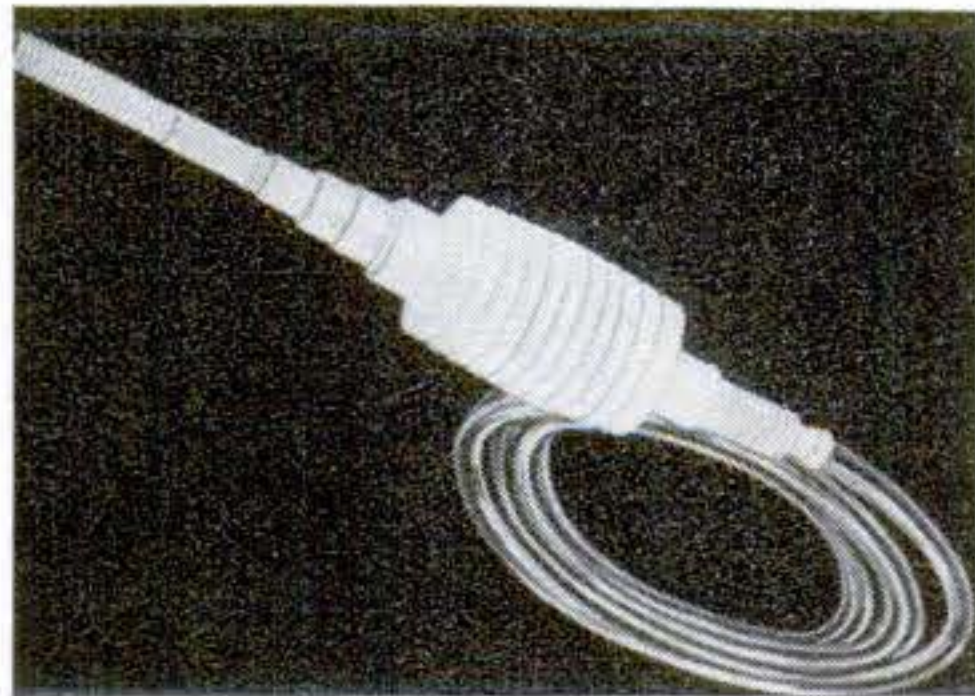
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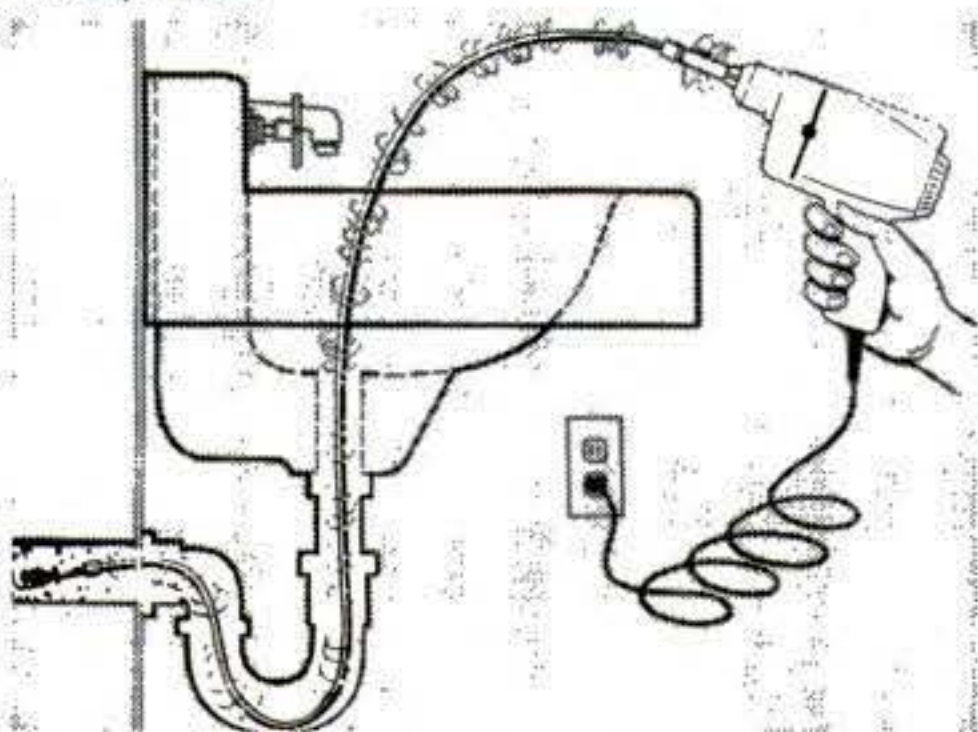
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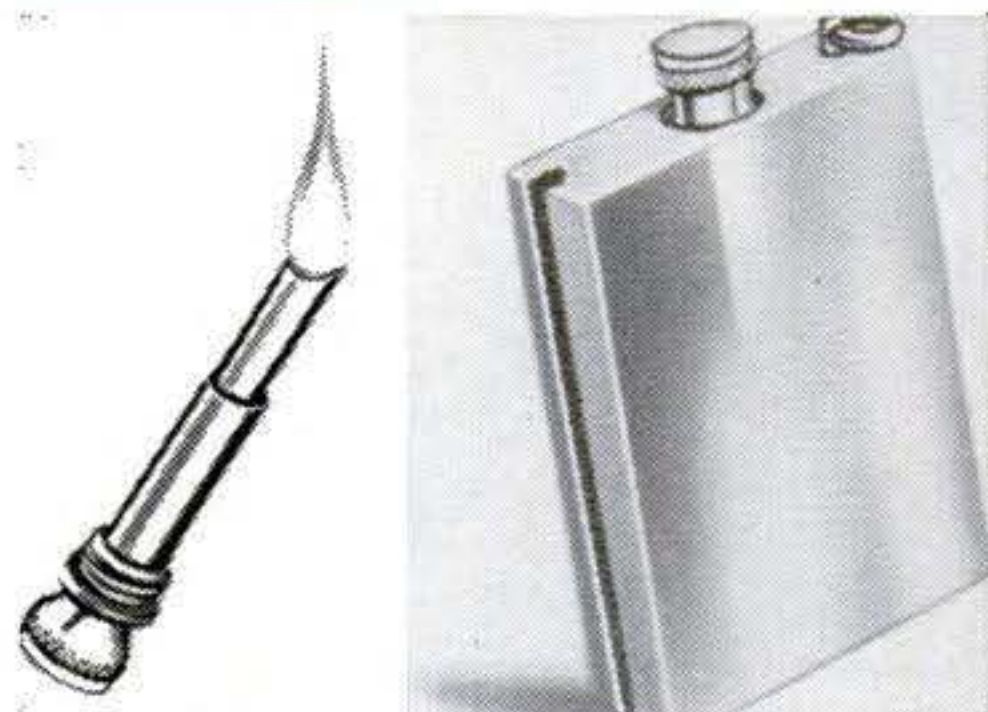
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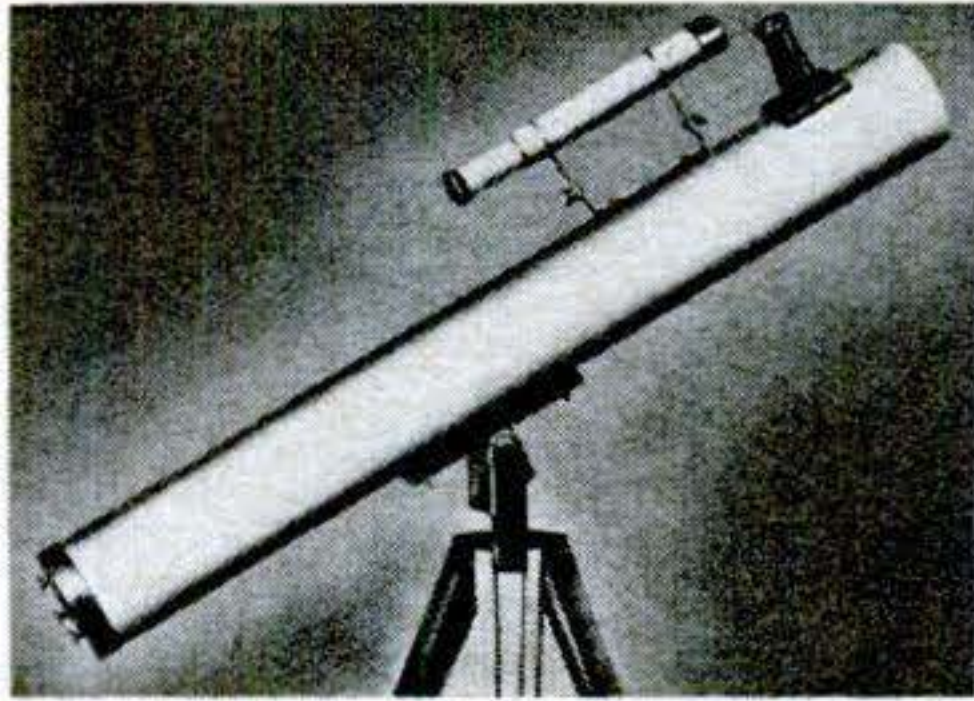
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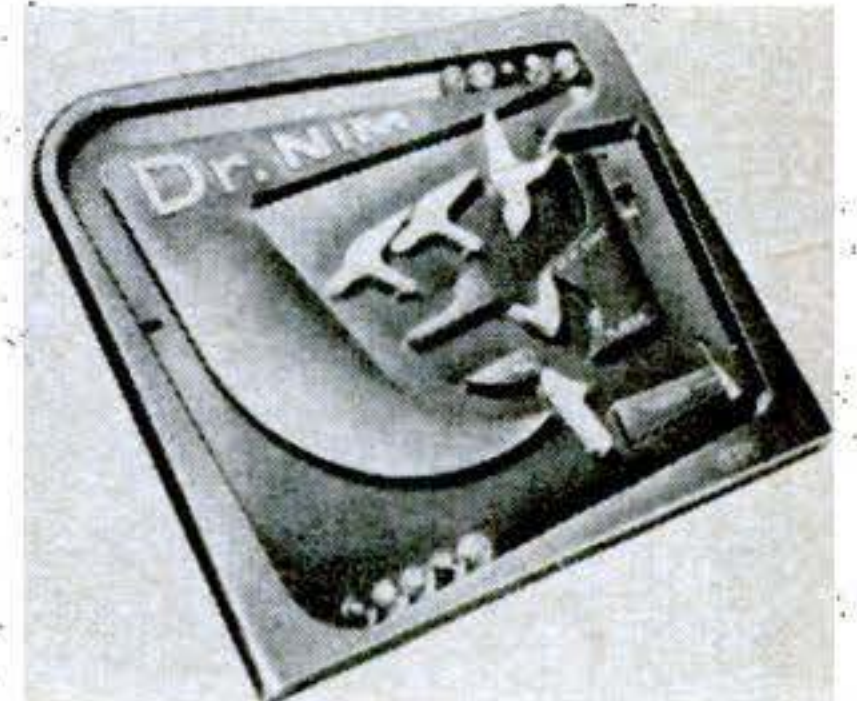
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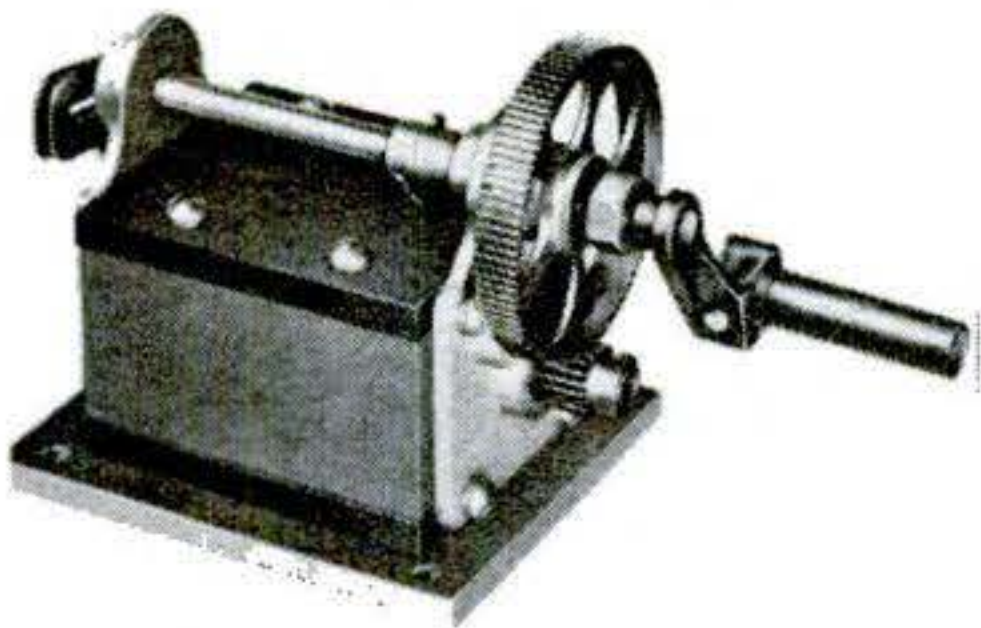
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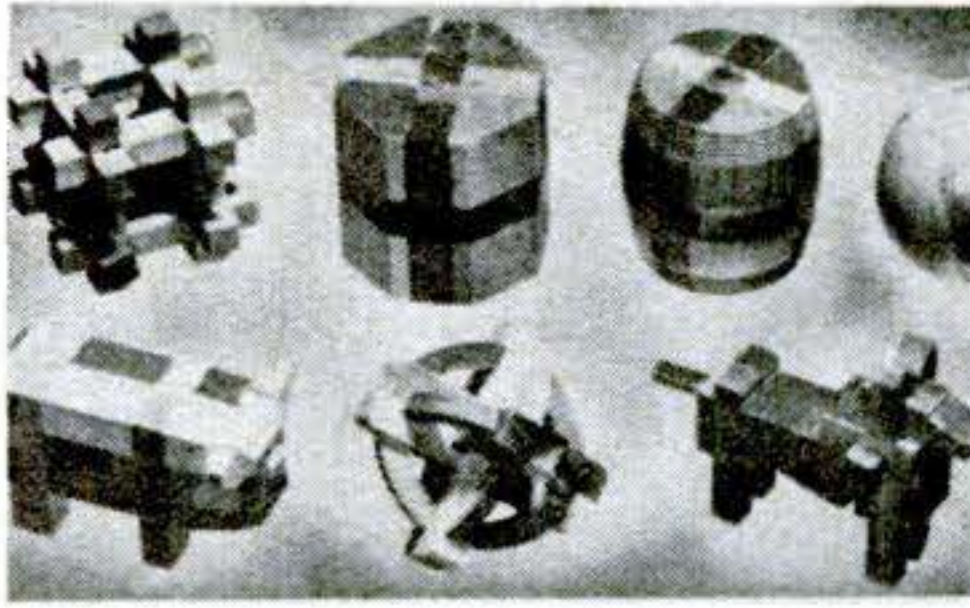
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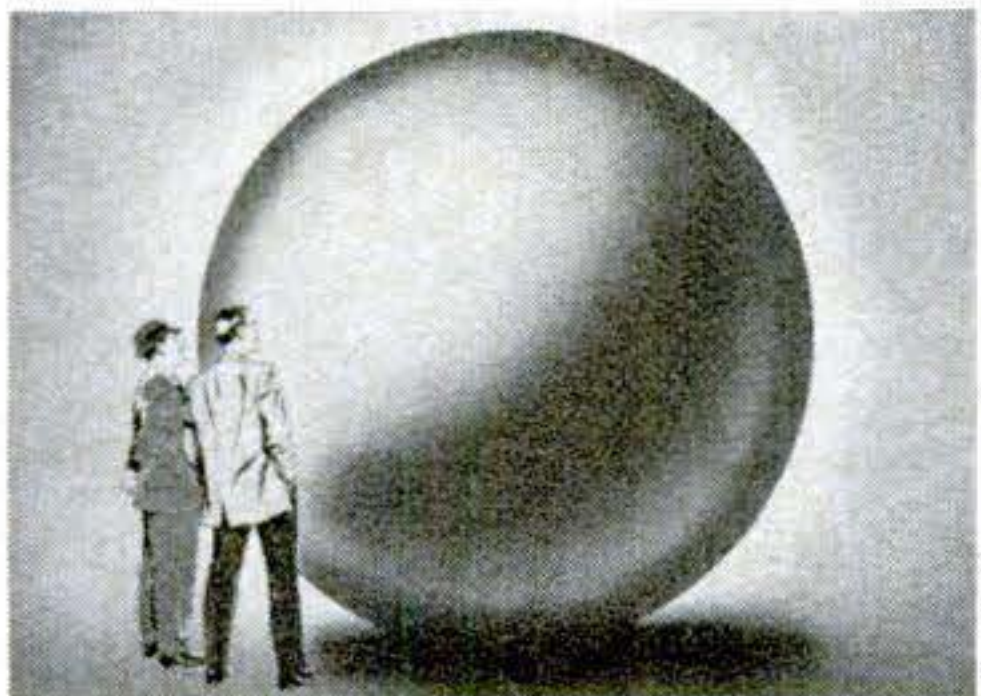
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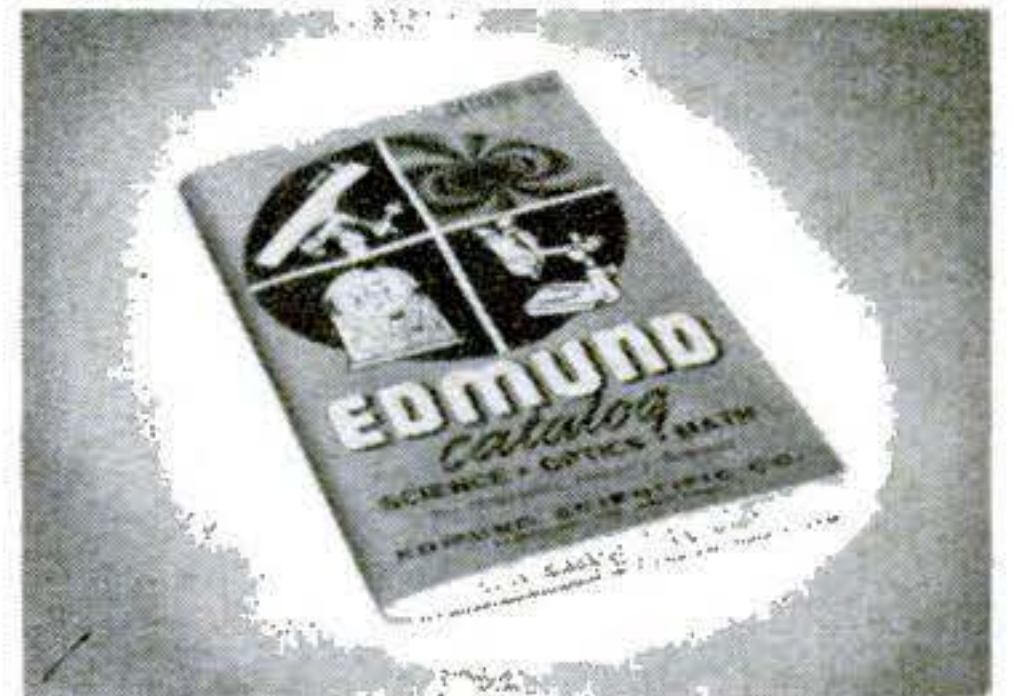
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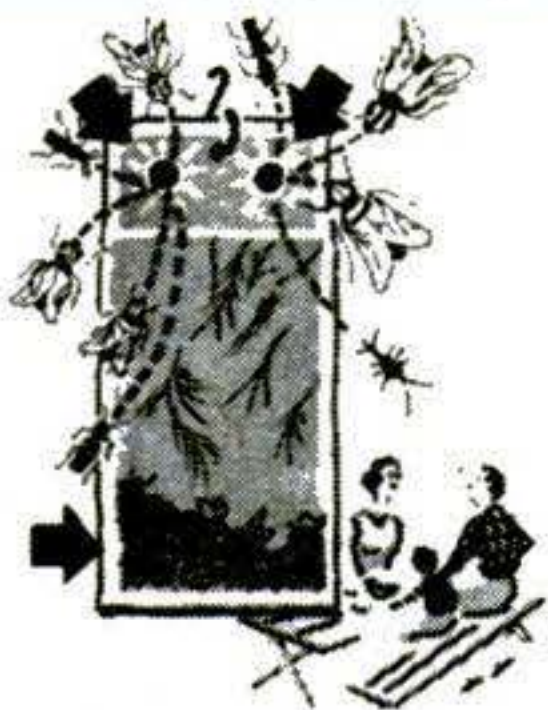
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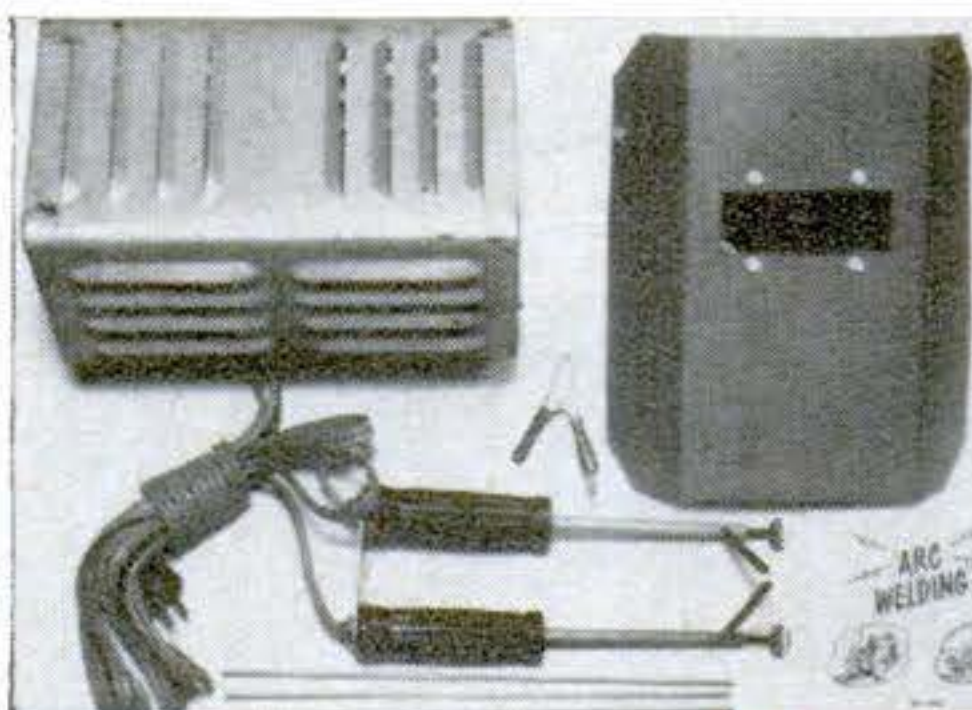
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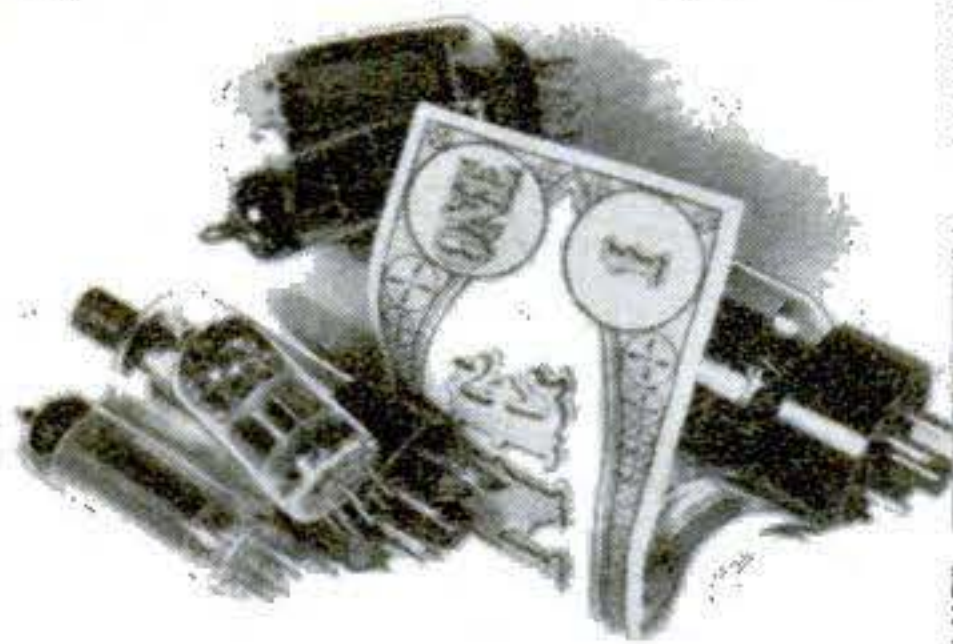
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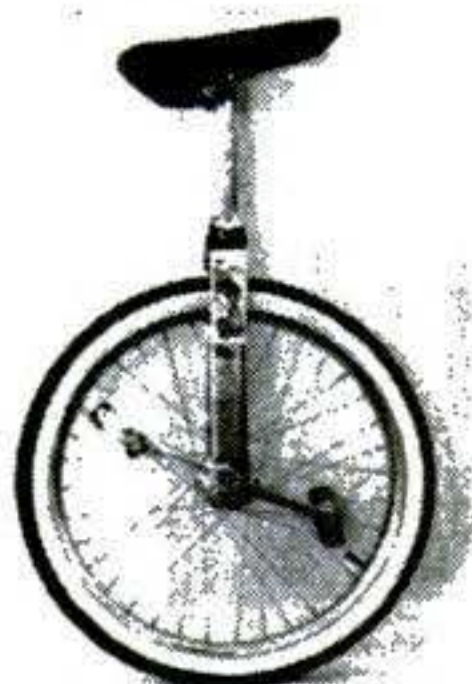
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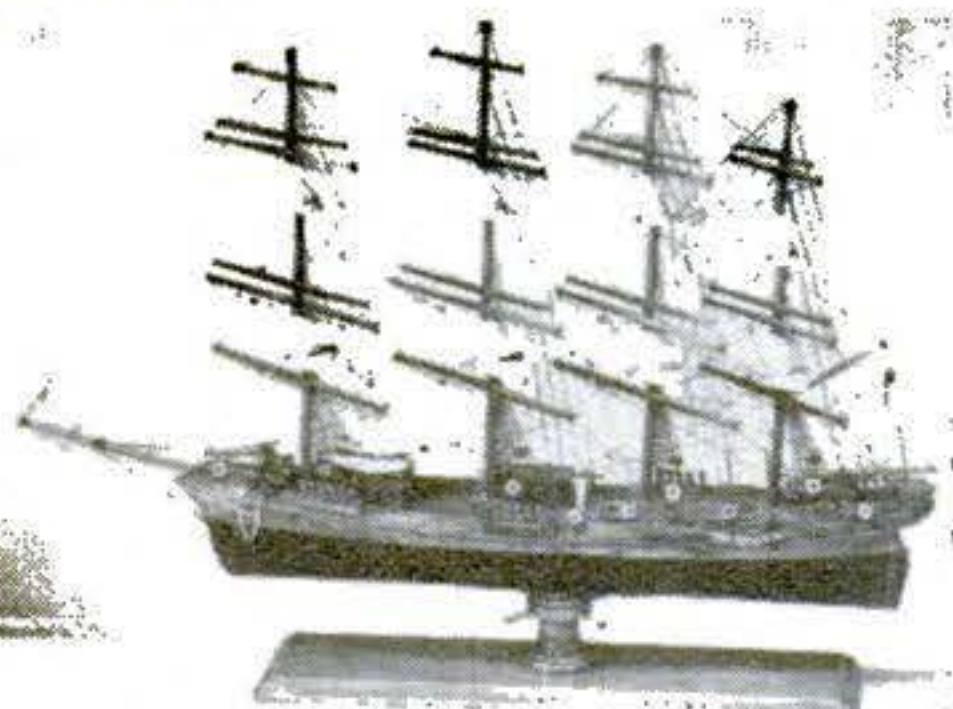
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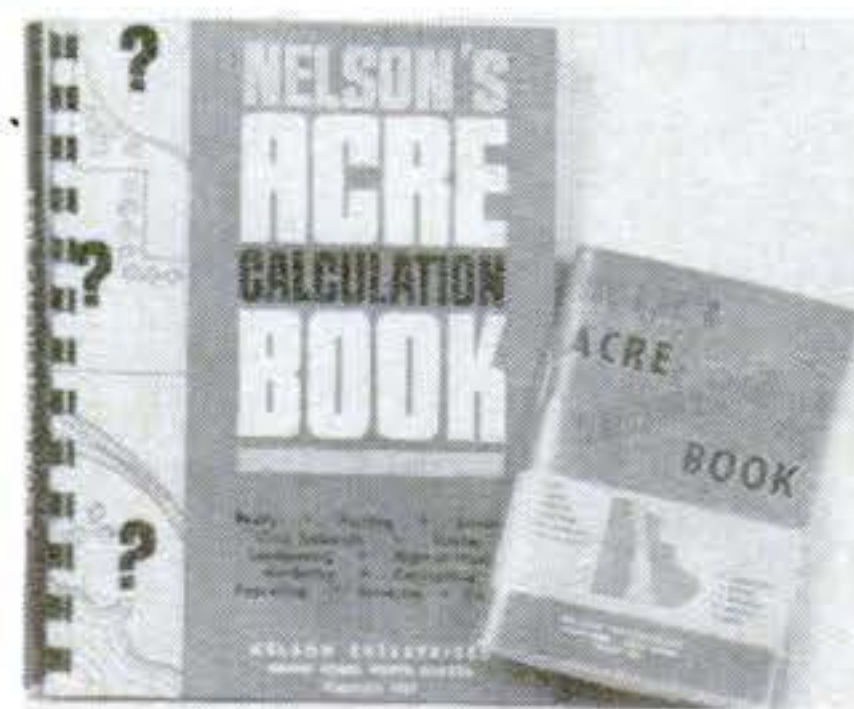
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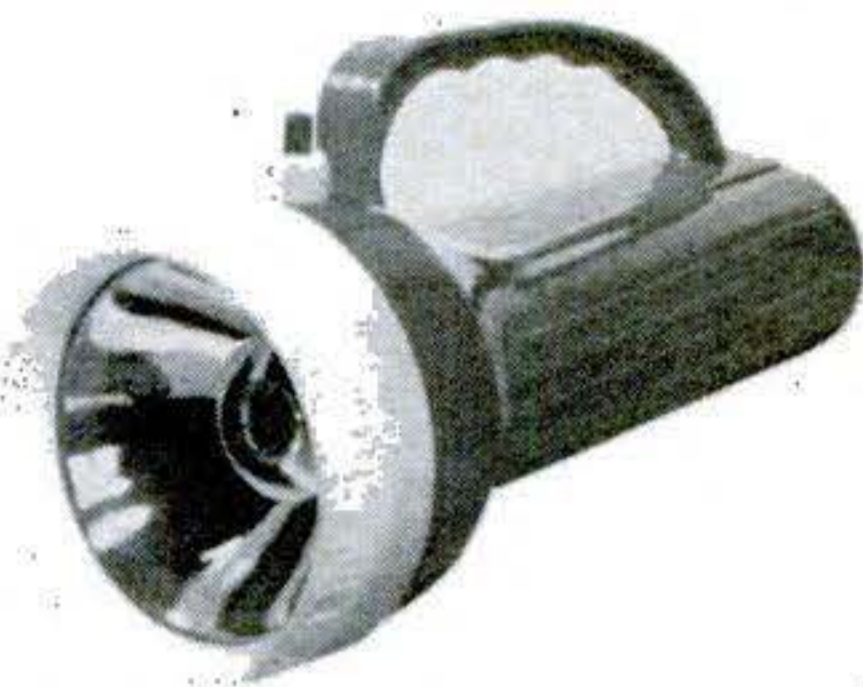
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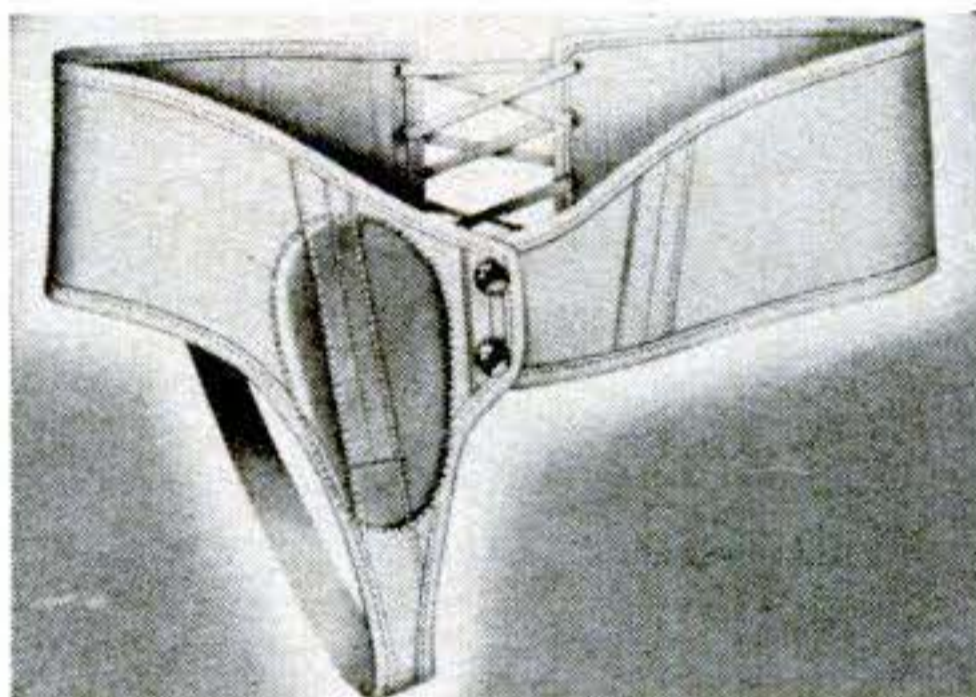
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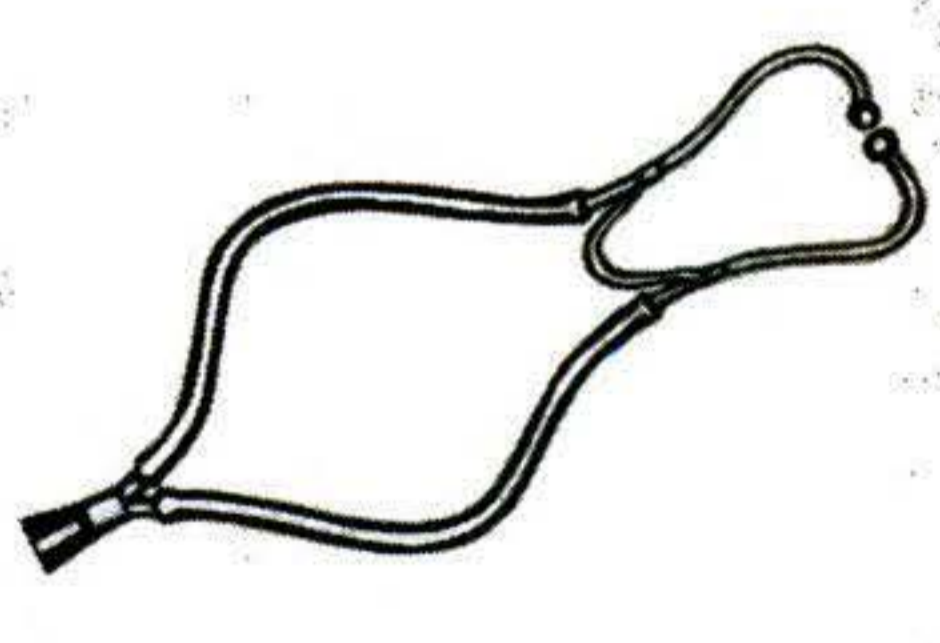
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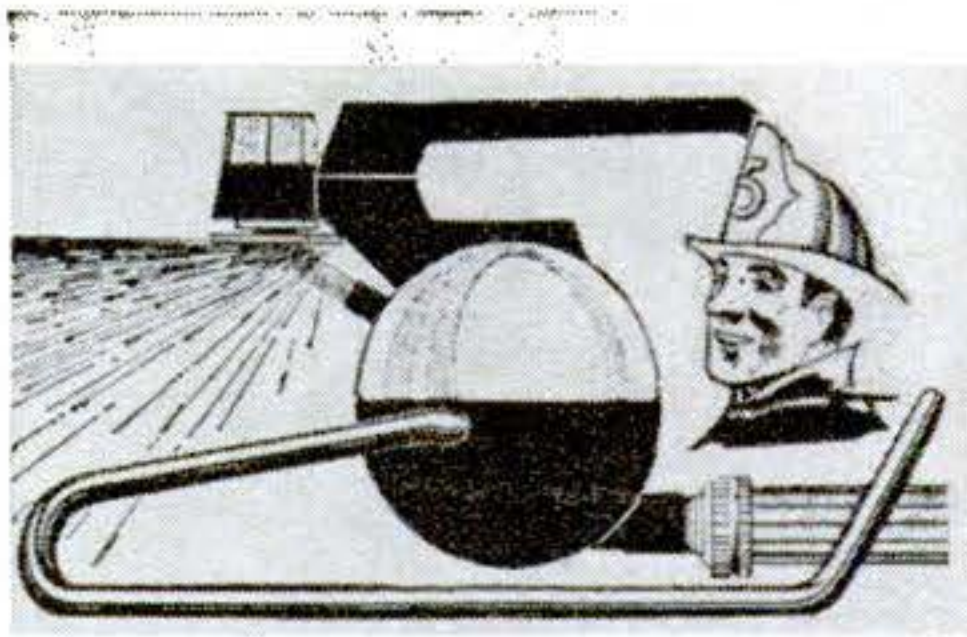
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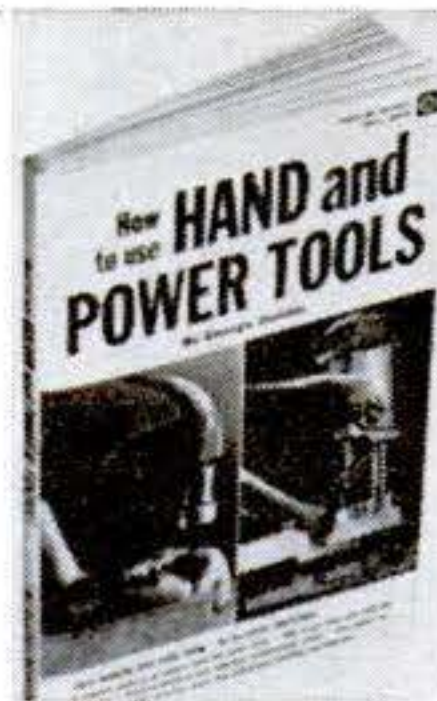
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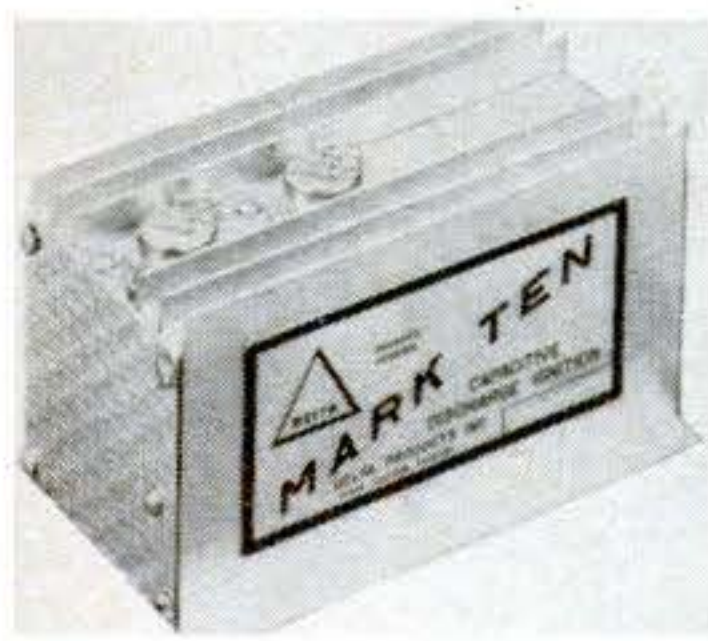
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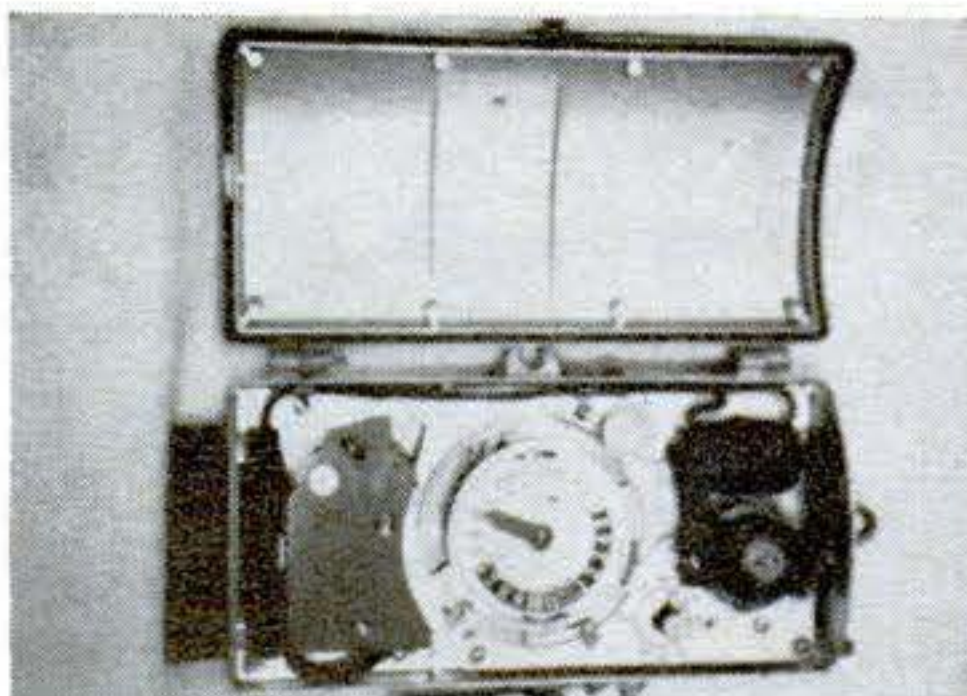
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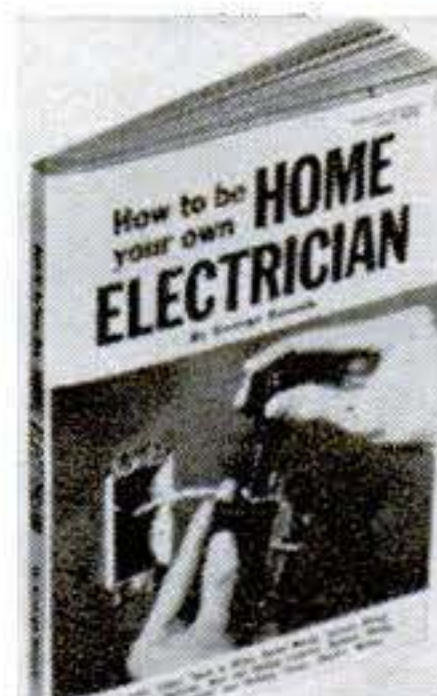
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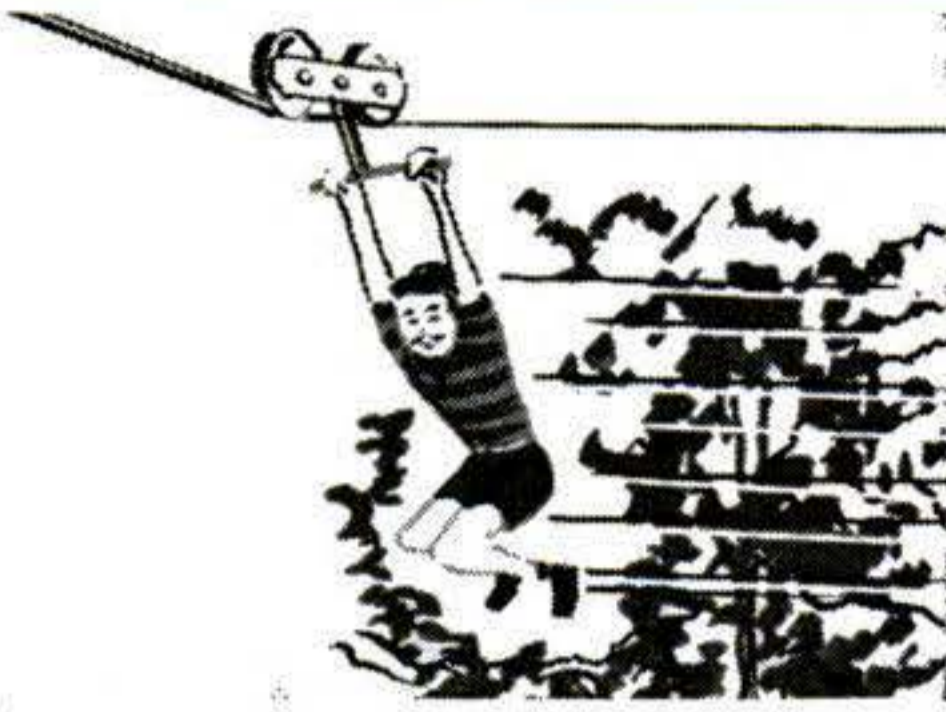
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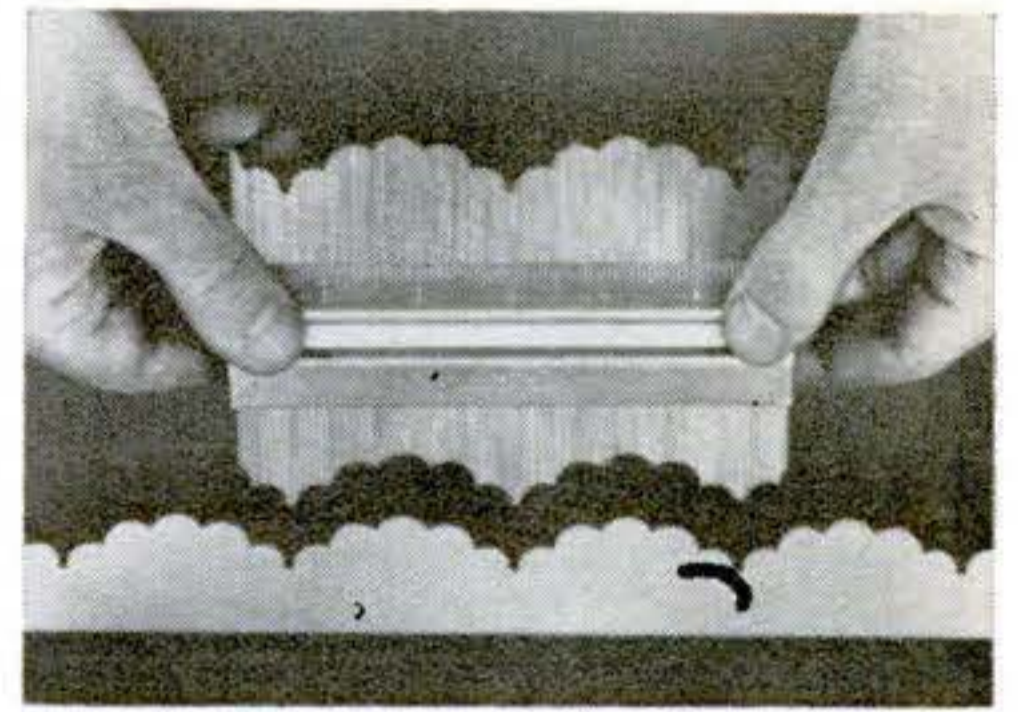
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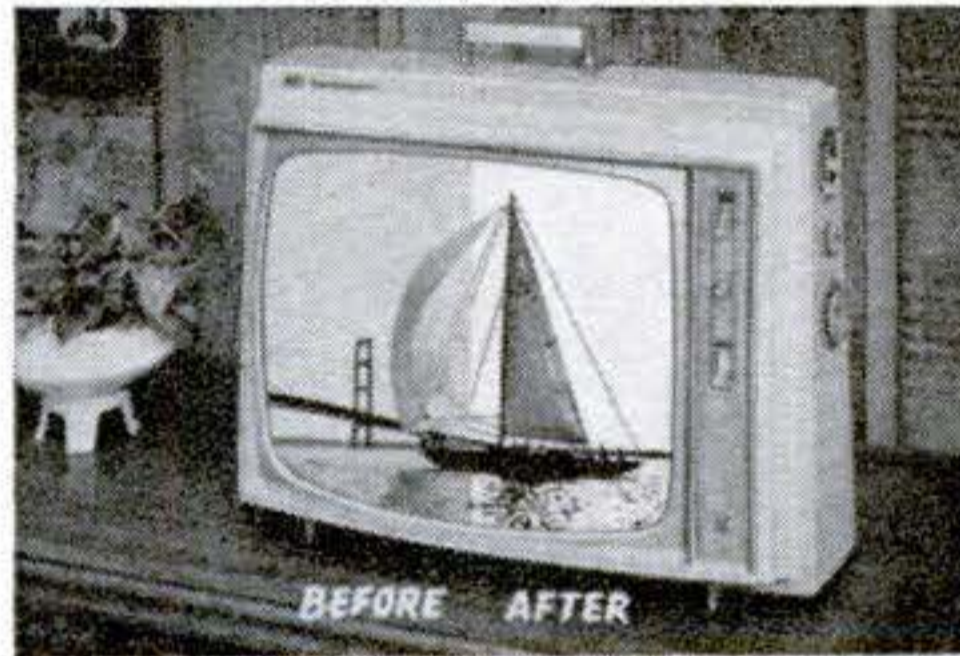
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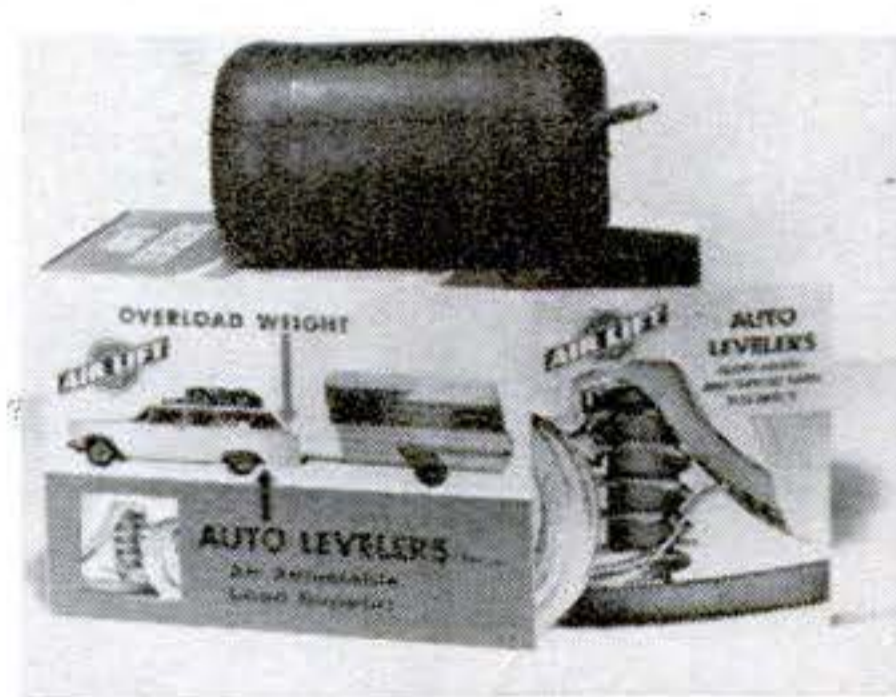
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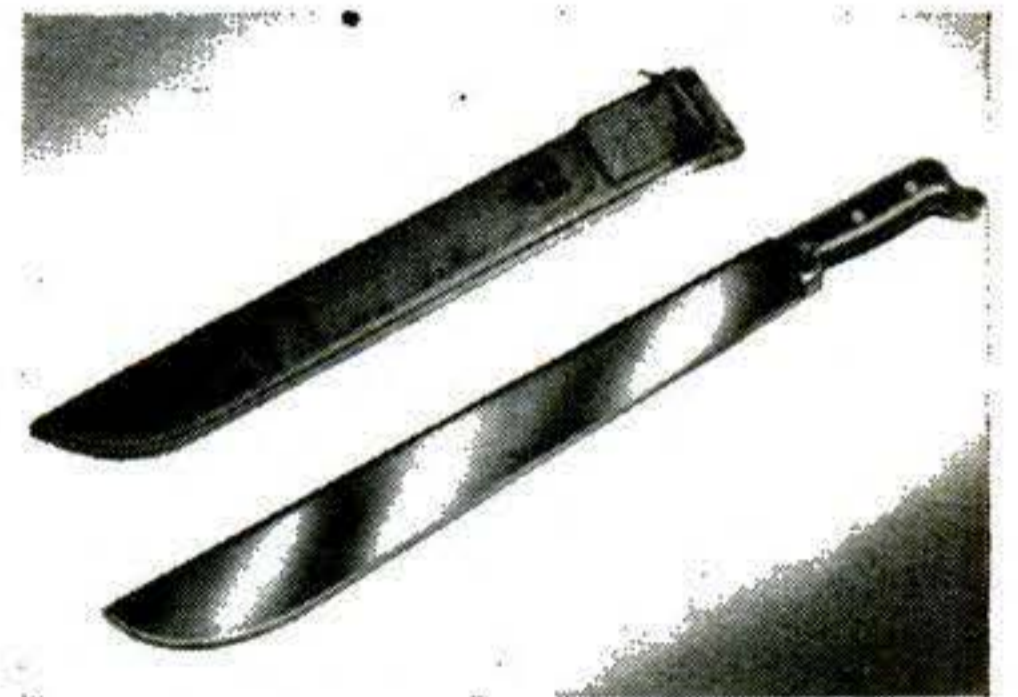
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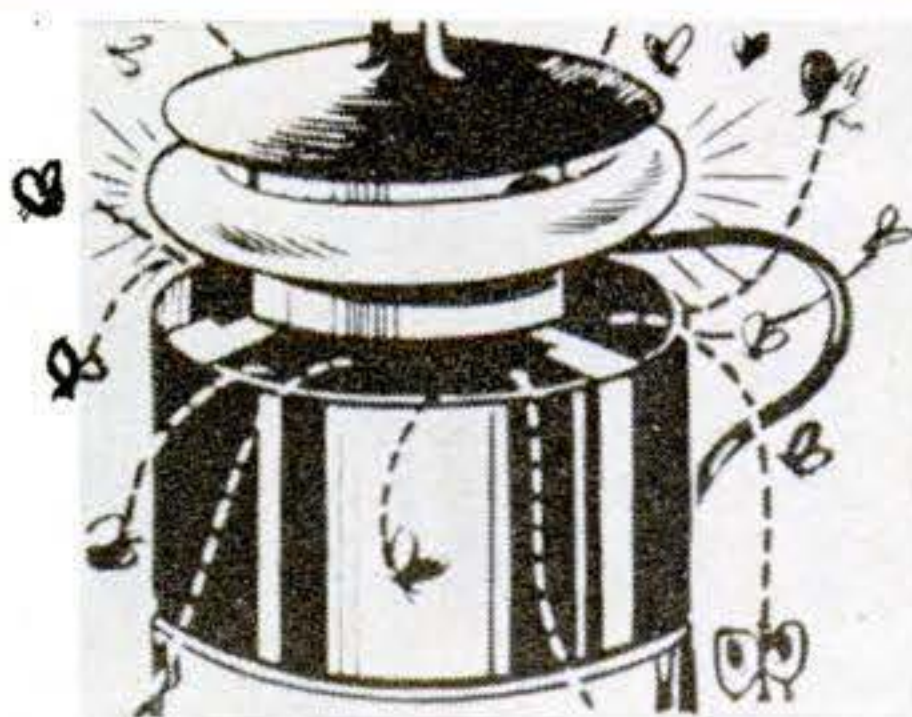
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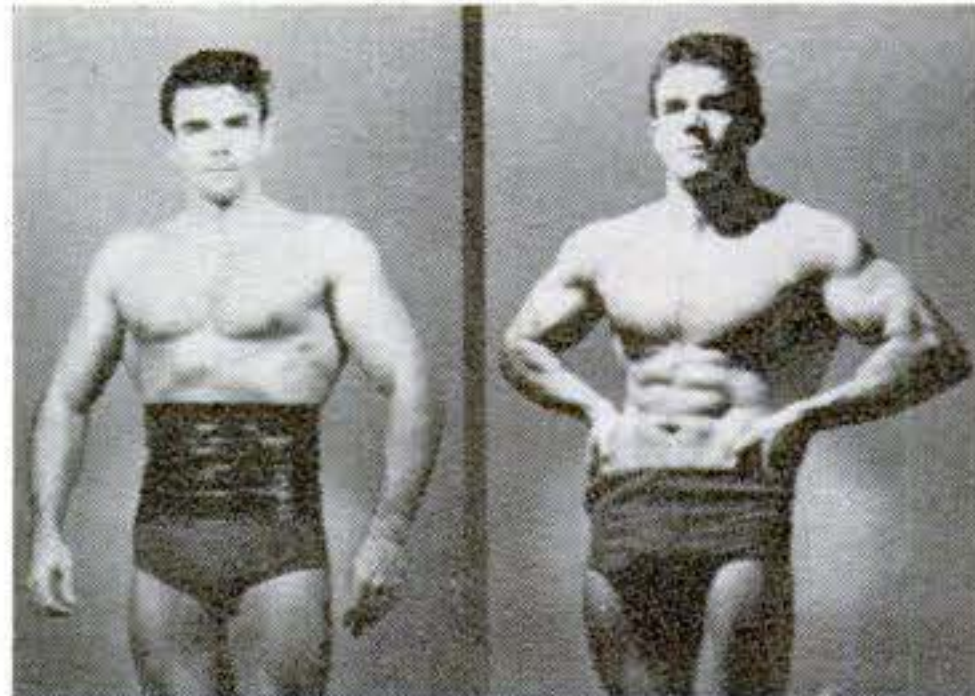
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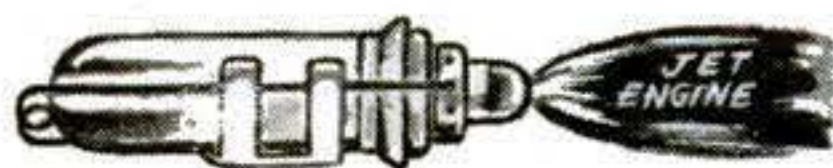
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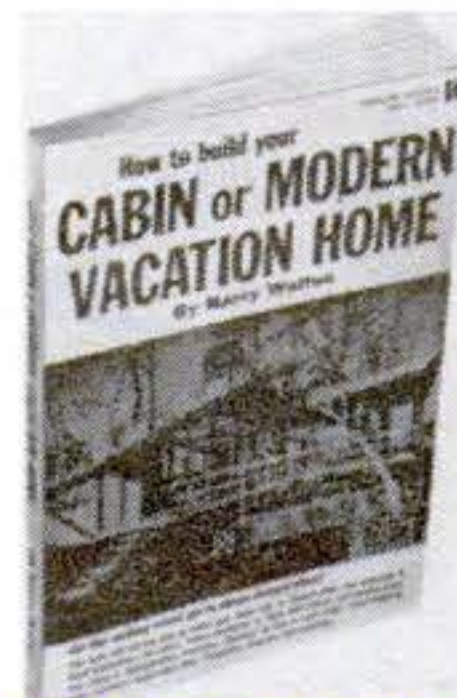
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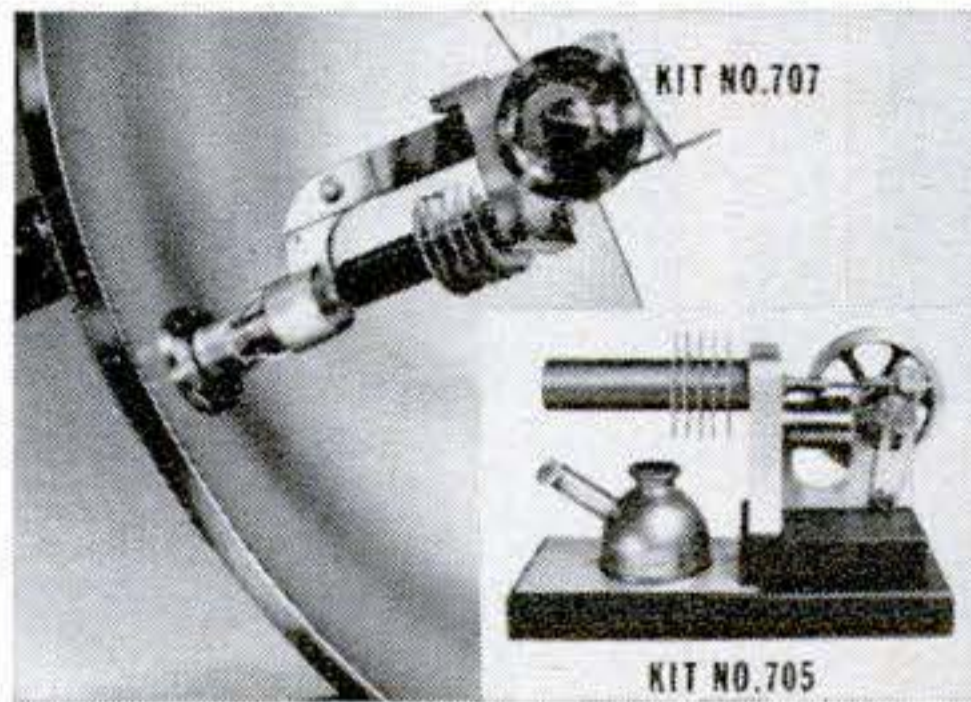
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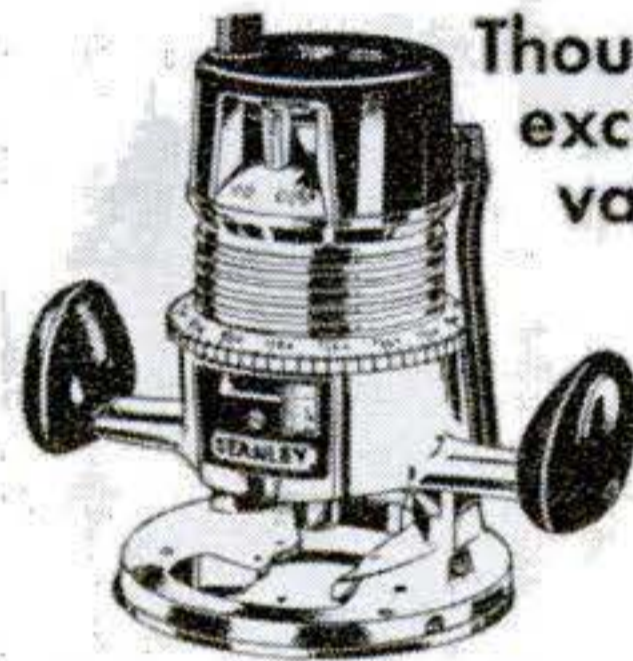
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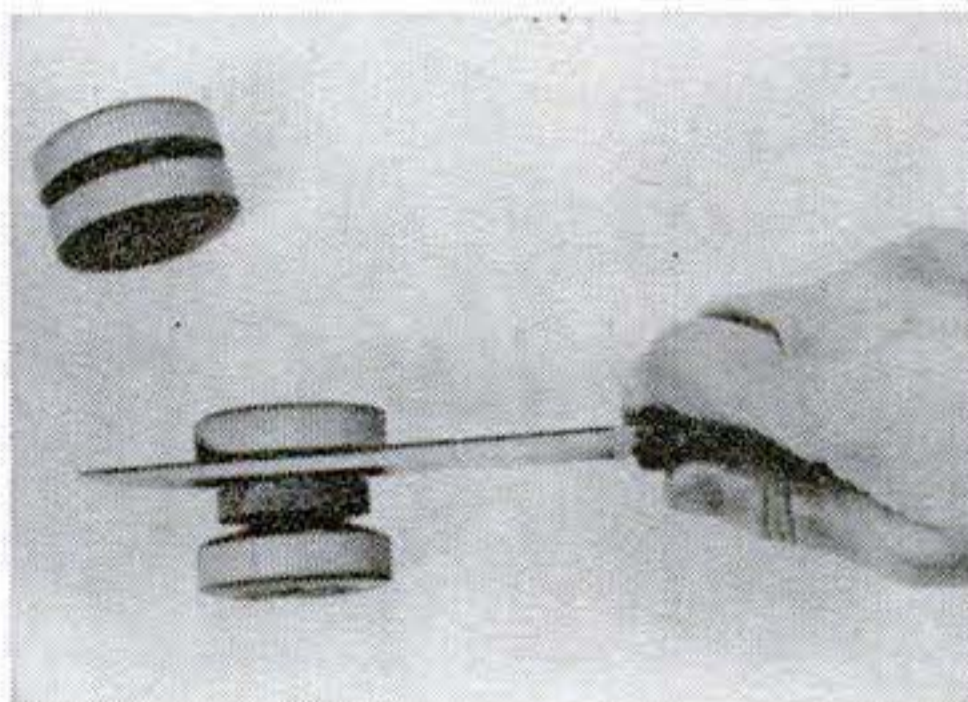
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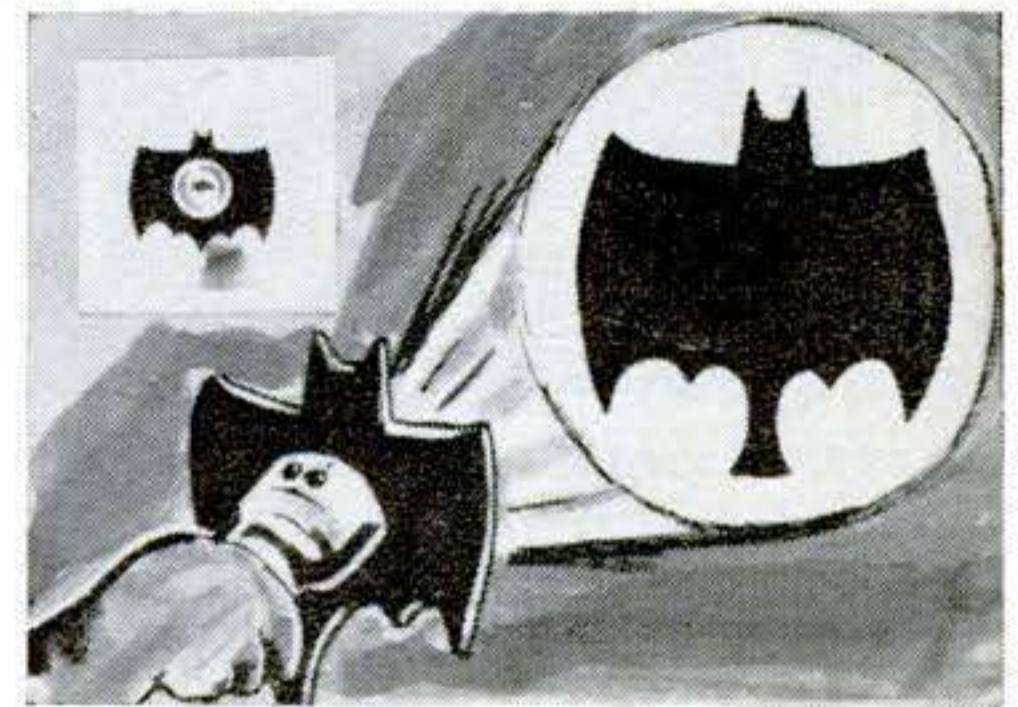
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## USE THIS HANDY INDEX TO FIND WHAT YOU WANT

Advertising, Agencies for Advertisers...	53
Agents Wanted .....	43
Antiques, Relics & Indian Goods.....	29
Aptitude Tests .....	45A
Art Instruction, Cartooning, Sign Painting .....	54
Astronautics .....	5A
Authors Service .....	52
Auto Supplies & Equipment.....	2
Auto Trailers .....	3
Automobiles & Midget Cars.....	1
Aviation .....	5
Batteries, Generators, Etc. ....	6
Boats, Inboard & Outboard Motors.....	11
Body-Building Courses, Jiu Jitsu, Etc. .	12
Books & Magazines.....	23
Business Opportunities .....	37
Business Service, Information, Name Lists .....	50
Buy It Wholesale.....	38A
Cameras, Photo Supplies.....	34
Camping Equipment & Tents.....	16
Coins & Currency.....	26
Contests .....	46
Detectives .....	47
Do-It-Yourself .....	66
Dogs, Birds, Hamsters & Pets.....	17
Earthworms, Crickets, Frogs.....	18
Educational & Instruction.....	45
Electric Trains .....	64B
Electrical Supplies & Equipment.....	7
Employment Information .....	42
Engines, Motors, Etc. ....	10
Farms, Other Real Estate.....	19
Field Glasses, Telescopes.....	14
For Inventors .....	60
For Sale Miscellaneous.....	71
For the Home.....	69
Formulas, Plans, Etc. ....	39
Garden Supplies & Equipment.....	10C
Government Surplus .....	11A
High-grade Salesmen .....	44
Hobbies, Collections .....	31
Home Craftsman .....	65
Import-Export .....	38B
Inventions Wanted .....	61
Jokes, Games, Novelties, Etc. ....	24
Loans By Mail.....	80B
Machinery, Tool Supplies, Etc. ....	9
Magic Tricks, Puzzles, Etc. ....	25
Minerals & Precious Stones.....	30
Miscellaneous .....	79
Models, Model Supplies.....	64
Money-making Opportunities .....	38
Motion Pictures & Color Slides.....	33
Motorcycles, Bicycles & Supplies.....	4
Musical Instruments and Song Writers..	35
Of Interest To Women.....	70
Old Gold, Jewelry, Watches.....	67
Personal .....	80
Phonograph Records .....	35A
Plastics .....	40
Printing, Multigraphing, Etc. ....	57
Printing Outfits, Supplies.....	58
Profitable Occupations .....	22
Radio, TV, Electronics, Hi-Fi.....	36
Razor Blades, Shavers .....	74
Remailing Service .....	80A
Rubber Stamps & Office Supplies.....	56
Science & Chemistry.....	41
Special Services .....	51
Sporting Goods, Guns, Fishing Tackle, Etc. ....	15
Stamp Collecting .....	28
Treasure Finders & Geiger Counters....	77
Wanted to Buy.....	72
Watch Repairing .....	78
Welding, Soldering .....	8

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