

APRIL 1966

35 CENTS

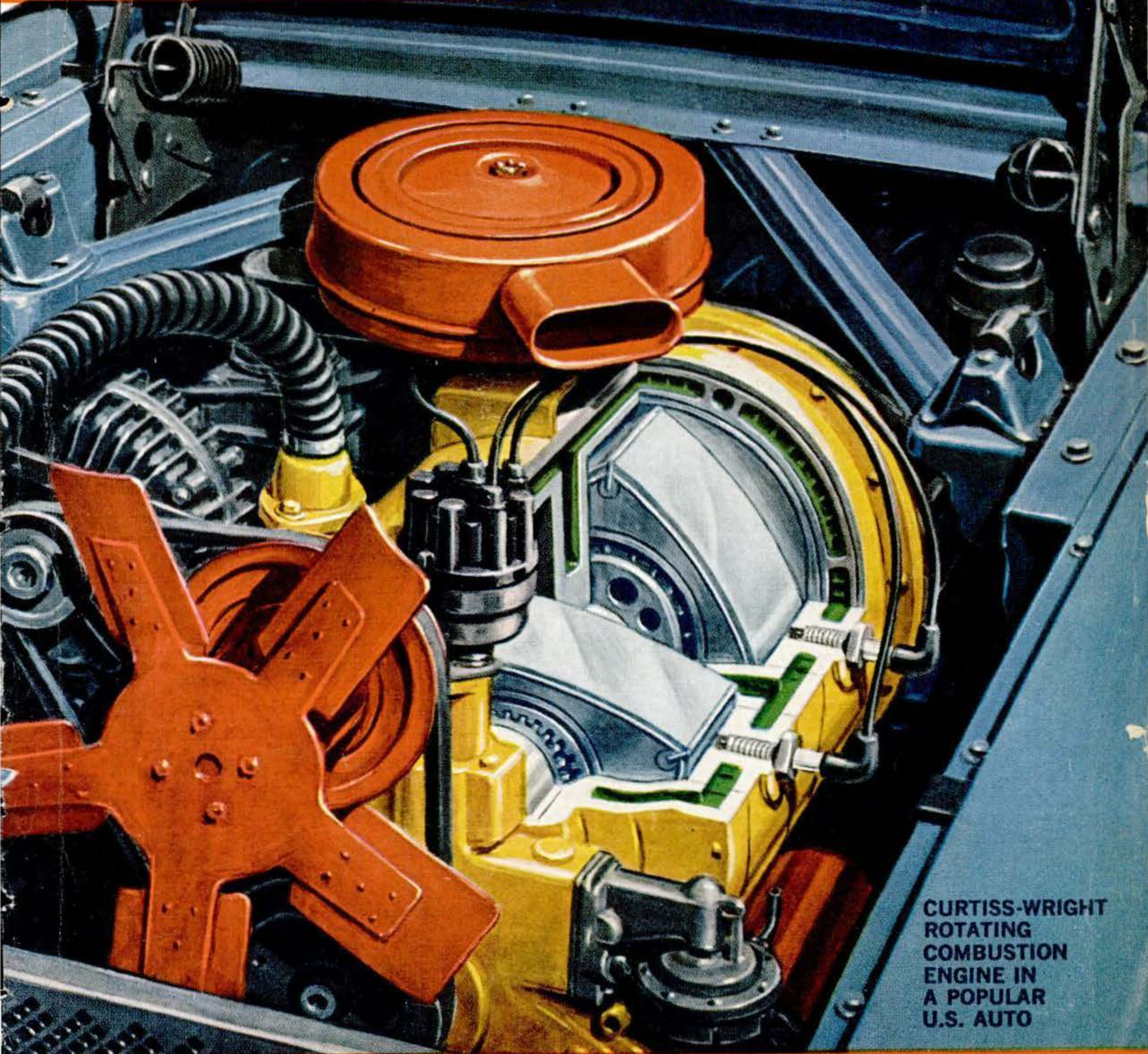
Popular Science

MONTHLY

PS EXCLUSIVE!

**We Test-Drive
U.S. Car with
Rotary Engine**

"WANKEL FEVER" HITS DETROIT



**CURTISS-WRIGHT
ROTATING
COMBUSTION
ENGINE IN
A POPULAR
U.S. AUTO**

10 PAGES OF IDEAS TO IMPROVE YOUR HOME

What It Takes to Win at Indy
by '65 winner **JIM CLARK**

**New! What Happens If You Mix
Alcohol, Food, and Drugs**

More and More People Prefer

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HIGHLIGHTS OF THIS ISSUE:

What Kind of Mixer Is Alcohol? PAGE 95

Death can result from mixing ordinary drugs and food with a couple of drinks.

U.S. Car with a Rotating Combustion Engine PAGE 102

How does a Wankel-type engine perform in an American car? Here's PS's exclusive test-drive report . . . Plus: "The Engine That's Giving Detroit 'Wankel Fever' "—Page 98.

What It Takes to Win at Indy PAGE 122

World champion Jim Clark, '65 winner of the Indianapolis 500, tells the inside story.

Improve Your Home: 40 Pages of New Ideas PAGE 131

Big special section: new products, techniques, projects, ideas for your home and workshop.

You Can Build a Tape Player for Your Car PAGE 186

Want highway hi-fi? Just add an amplifier to a preassembled tape transport.

COVER PAINTING BY RAY PIOCH

CARS AND DRIVING

- 80 What's New for Your Car
- 98 The Engine That's Giving Detroit "Wankel Fever"
- 102 Test Drive of U.S. Car with a Rotating Combustion Engine
- 112 Testing the Compact Fastbacks
- 122 What It Takes to Win at Indianapolis
- 200 Does Your New Car Have the Power to Stop?

SPECIAL REPORT

- 108 Saving a City from a Cloud of Death

SCIENCE AND INVENTIONS

- 95 What Kind of Mixer Is Alcohol?
- 117 Talking Books Tell Stories by Record on Finger-Powered Phonograph
- 128 Ships Float Uphill and Down

PHOTOGRAPHY

- 184 Big News in Small Cameras: Electronic Shutters

SPACE AND AVIATION

- 88 Helicopter Controls Head-On Crash
- 91 Is This Every Man's Flying Machine?
- 118 Dr. von Braun: Beating the Perils of Manned Space Flight

**IMPROVE YOUR HOME
Special 40-Page Section**

- 132 Rough Stuff: The Big News in Wall Paneling
- 137 Extend Your Living Space with a Deck
- 142 Colorful Products for Your Home
- 143 Gang Nails: Good for Home Jobs
- 144 Store It Where You Want It
- 149 The PS Concrete Calculator
- 150 Paint Removal . . . How to Do It Right
- 154 New Garage Door or Carport—Fast
- 156 Facelift for Your Front Door
- 165 Beams Make News in Suspended Ceilings
- 166 New Products for Improving Your Home
- 168 What You Gain from Sliding Glass Doors

FOR THE SHOP

- 196 Now Everyone Can Afford a Router

AUTO UPKEEP

- 204 Gus Settles a Case out of Court
- 210 Hints from the Model Garage

ELECTRONICS

- 186 Build a Tape Player for Your Car
- 191 What's New in Electronics
- 192 The PS 9-in-1 Troubleshooter

COMING NEXT MONTH

An exciting variety of features on everything from cars and driving to camping, boat testing, color TV, CB radio, space and aviation, home-shop techniques—and a surprising way to stretch the carefree fun of the summer season. Here's a partial list:

- What's Coming at Indy in '66
- Volkswagen vs. Simca and Opel
- Amazing Sun Dome You Can Build
- 20-Page Section on Camping:
 - Which Camping Vehicle Should You Buy?
 - All About Trail Bikes
 - New Shapes Make News in Tents
 - Ford's New Super-Van
 - The Go-Anywhere Jiger
- All the News About Air Conditioners
- New Designs in Boat Trailers
- Repair It—Before You Apply Wood Finish
- Flash for Better Color Photos
- Professor's Tricks Make Physics Fun

Plus: Many other useful, entertaining articles and all the regular PS departments.

BOATS AND BOATING

- [176 The New Johnson Surfer](#)
- [179 Will Your Boat Pass the Coast Guard's Ventilation Inspection?](#)
- [180 How to Install a Fuel Tank in Your Boat](#)
- [183 What's New in Boating](#)

PICTURE NEWS

- [83 Roll-Up Mast Extends 40 Feet](#)
- [84 Arabesque Decorates Hard Hat](#)
- [107 Truck "Walks" on Its Wheels](#)
- [121 School to Rise Over River Pier](#)
- [127 Take-Apart Bike Stows in Car Trunk](#)

EVERY MONTH

- [6 PS Readers Talk Back](#)
- [18 "Say, Smokey—"](#)
- [29 Science Newsfront](#)
- [64 Detroit Report](#)
- [173 Shop Talk](#)
- [174 New Ideas from the Inventors](#)
- [195 I'd Like to See Them Make](#)
- [244 Wordless Workshop](#)

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Courtesy Valentine Museum



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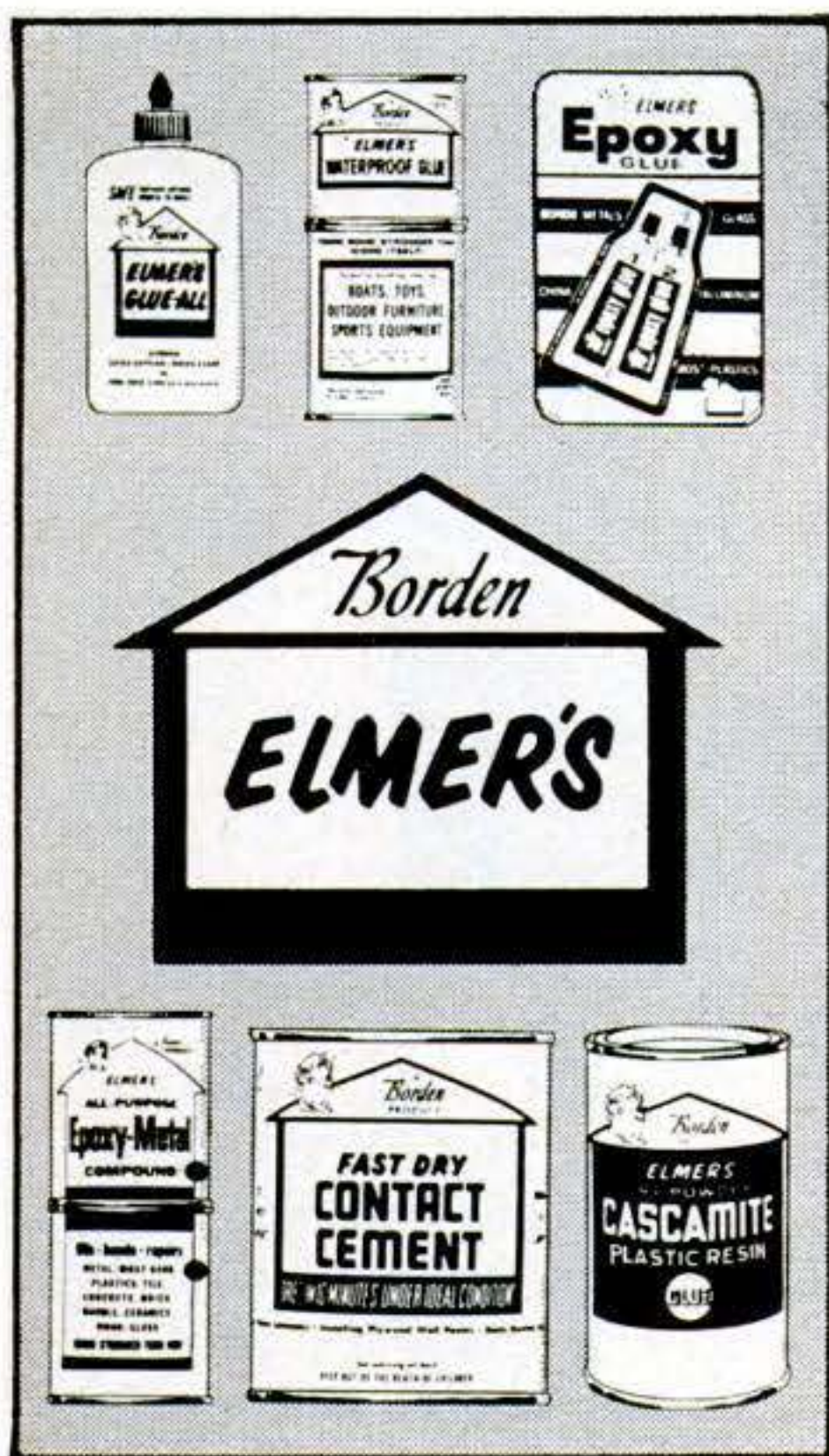
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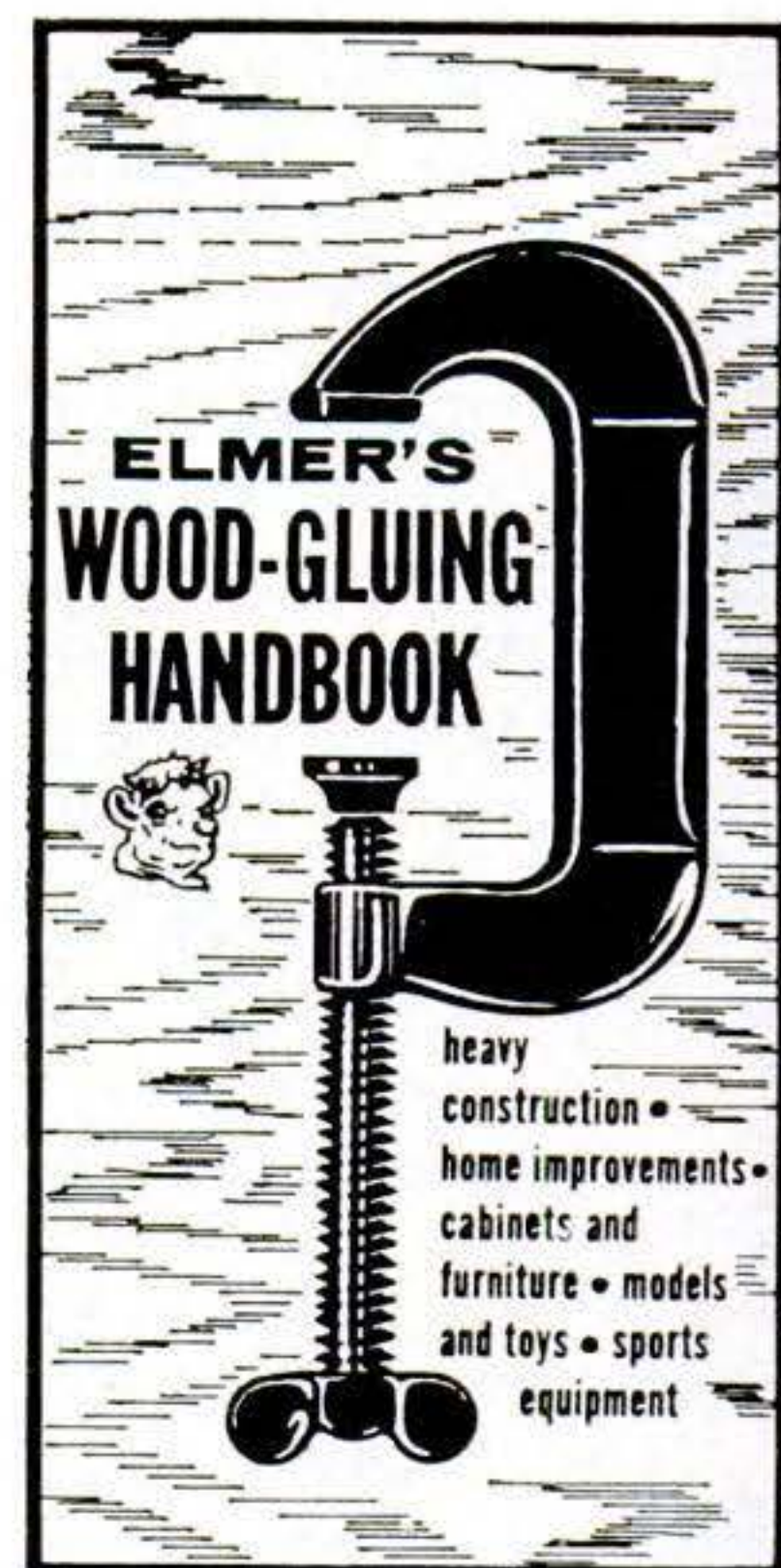
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FREE BOOKLET

It tells you how to match the right glue to the type of job and the kind of material...so that you get a perfect bond every time. It gives you scores of tips to make gluing faster and easier. It's yours if you'll just send a stamped, self-addressed envelope to: The Borden Chemical Company, Dept. S-1, 350 Madison Avenue, New York, N.Y. 10017.



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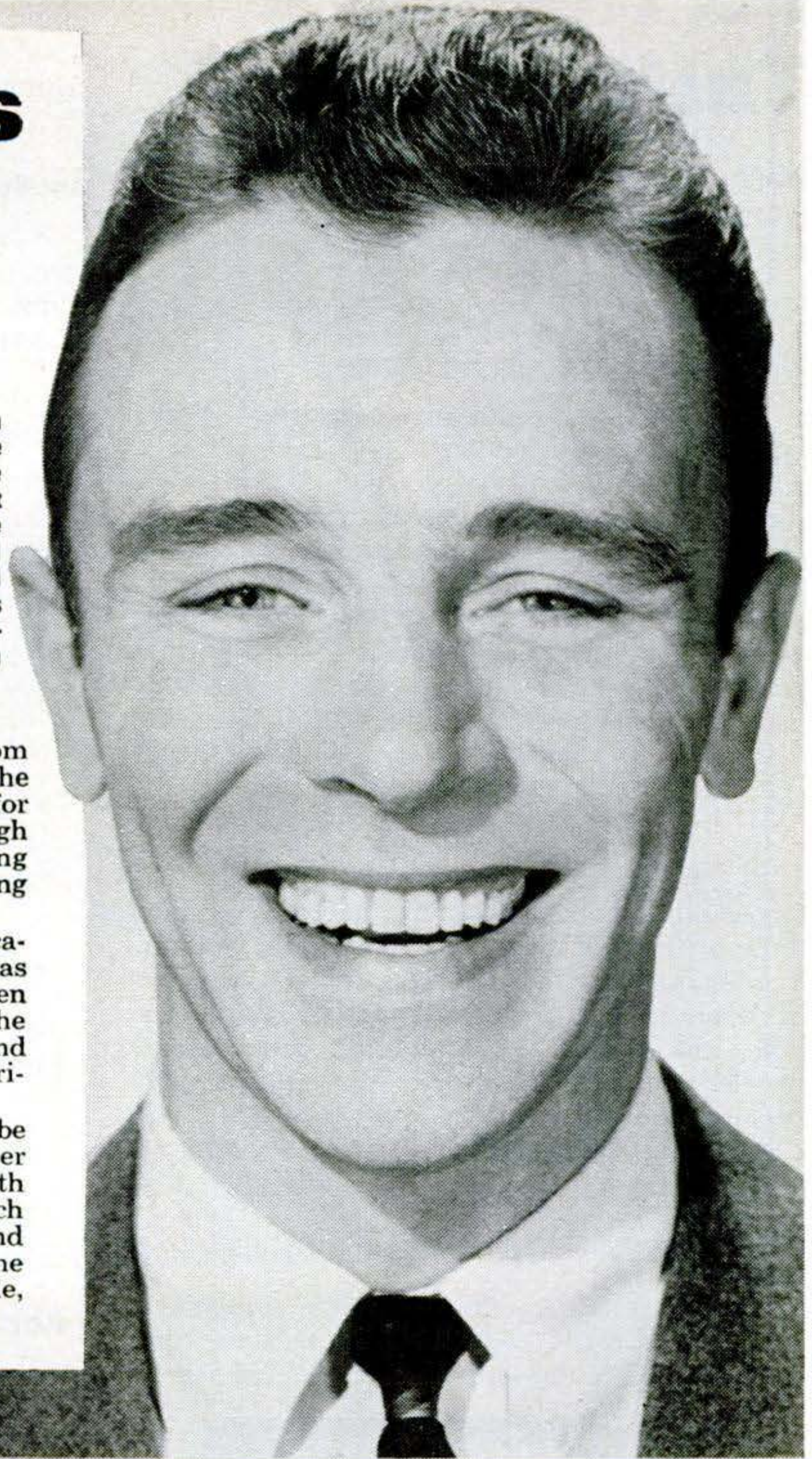
“Look who’s smiling now!”

“The department head’s job had just been left vacant. When the boys in the office learned I was gunning for it, they gave me their widest grins. One thing they didn’t know: I had made up my mind sometime back to take LaSalle training that would prepare me for a better job. My study paid off so fast it surprised even me—I was picked for that shiny promotion over everyone’s head. Who wouldn’t be smiling with a neat new \$1,500 increase!”

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Name.....Age.....

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City & State.....Zip No.....

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.

All steamed up about new engine

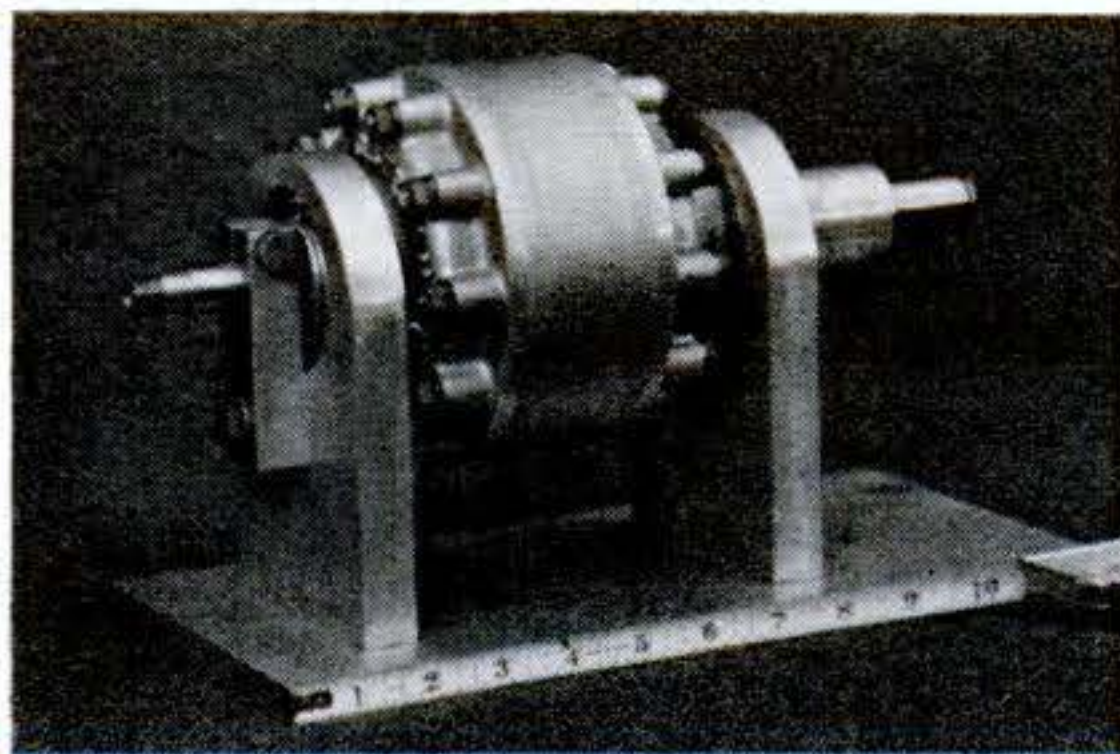
"New Revolver-Like Steam Engine" [Feb.] came to my eyes like an oasis in the desert. I have had my sights set on designing my own steam car some day. But before Gibbs' and Hosick's new engine, the prospects seemed dim. The engine indicates that steam-car interest and research isn't a thing of the past. New technological developments like flash generators, high-temperature and pressure equipment, and miniaturization should induce major research into steam-propelled autos. Steam certainly does answer modern car problems.

DON CHITWOOD, Portland, Ore.

... The Elliptocline brings to mind the X-8 torpedo hot-gas engine. We made several of these at the U.S. Naval Ordnance Test Station, Pasadena, Calif., in 1958. They were six inches in diameter, had seven cylinders (one-inch bore and stroke) with opposing pistons, and developed more than 85 hp. The run was short because the hot gas was very corrosive. The Clevite Corp., Cleveland, now manufactures a modified version for the Navy's Mark 46 torpedo.

ROBERT W. MCGREW, Pomona, Calif.

... I have designed and built a similar engine that is 5.125 inches in diameter and displaces 11.37 cubic inches. It has only two



moving parts—rotor piston and crank—and gives five power pulses per crank revolution. There are no reciprocating parts and the piston has a rolling sliding action like the Wankel engine.

CARL STEFANCIN, Middletown, R.I.

... The Colt Firearms Company made a series of similar engines prior to 1890, ranging

from four to 75 hp. The new engine is double the Colt's size, back-to-back, and uses more than Colt's six cylinders on each portion. It draws upon modern hydraulic-motor design. I see no invention, but rather an excellent updating.

TEMPLE NIETER, Evanston, Ill.

Another clip tip for tool mounters

If readers can't obtain rubber pipe clips [Shop Talk, Jan.] for hanging tools, antenna stand-offs, which are used as clips for TV lead-in wires, will work well.

ED JENKINS, Muncie, Ind.

Multiplex complexity?

"Taking 250 Pictures on One Negative" [Feb.] may be the top photographic news of 1966, but spare me from this booby trap. Disasters can happen to a negative. Imagine losing



a couple of hundred irreplaceable exposures involving expensive models, talent, time, and setups. One slip and the entire batch can go down the drain.

Don't put all your eggs in one basket is the first rule of survival.

JESSE A. LEASON, Inver Grove Hts., Minn.

... Your article on Multiplex Recording Photography tends toward wishful thinking instead of factual reporting. You should investigate the possibility of a hoax.

THOMAS HOLUP, Linden, N.J.

We did (as we do on all stories involving revolutionary new inventions). It works.

A weighty subject

Your article on the B-70, "Start and Finish of a Record Flight" [Feb.], gives the weight of the plane as 2,225 tons. I can't believe it.

BILL WELLS, Sackville, N.B., Canada.

Somebody must have been leaning on the scale. B-70 has a maximum gross takeoff weight of 255 tons.

Tom Swift Comes True

In reading "Silent Sea Engine for Nuclear Subs" and "Due This Year: Trains That Can Go 150 M.P.H." [Jan.], I couldn't help thinking of the old Tom Swift stories. He invented the electric submarine back in 1926, and also put the fastest, most powerful electric train

Continued



Here's how you can trim time and shorten steps (with a handy tool for every shop)

Equip yourself with an extension telephone near your workbench.

When calls come in, reach—don't run.

Ordering materials? Do it on the spot where you can spot what you need.

And if you don't object to being a household hero, here's an idea: Share the telephone convenience.

Find a spot for your extension where the

family can use it too. Near your bench and near the laundry room or game room, for instance.

Remember, an extension phone really gives you your money's worth. It costs only a fraction of the monthly cost of your first phone.

Get one fast. Just call our Business Office or ask your telephone man.

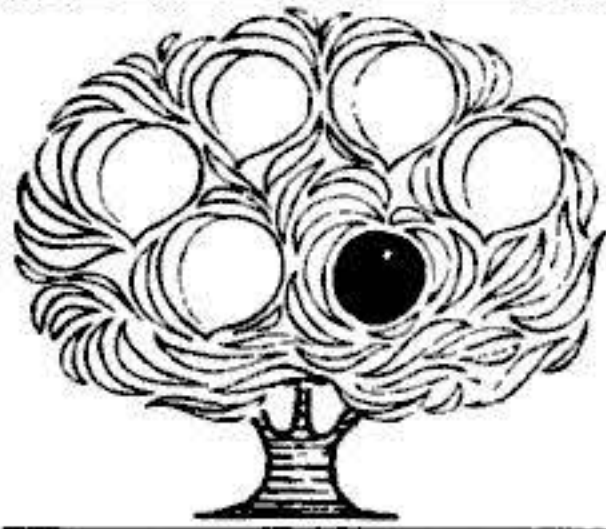


Bell System

American Telephone & Telegraph
and Associated Companies

There's a plum waiting for you on Peachtree.

Lockheed's professional employment office on Peachtree Street wants your resume. The next five minutes you spend filling it out can give your career the biggest lift of all. Lockheed-Georgia offers long term engineering opportunities in a broad range of interesting areas: The giant C-5A transport (a project unequaled in size). The C-141 fanjet StarLifter. The "go anywhere, do anything" C-130. The JetStar. For scientists, there is Lockheed-Georgia's new Research Laboratory, the largest privately-owned research facility in the South. A huge new wind tunnel for VTOL testing. And Nuclear projects. All challenging assignments, and plenty of room to grow. The living in Georgia? Great for the whole family. Outstanding schools and colleges. And major league baseball and football. How to pick this plum? Just send your resume to Charles E. Storm, Professional Employment Manager, Lockheed-Georgia Company, 834 West Peachtree Street, Atlanta, Georgia. Lockheed is an equal opportunity employer.



PERSONAL

name: _____

home address: _____

city: _____ state: _____ zip code: _____

phone: _____

EMPLOYMENT

currently at: _____ since: _____

position: _____ salary: _____

major responsibility: _____

TECHNICAL INTERESTS

major interests or specialties: _____

EDUCATION

bachelor's in:	school:	date rec'd:
_____	_____	_____
master's in:	school:	date rec'd:
_____	_____	_____
doctorate in:	school:	date rec'd:
_____	_____	_____

BACKGROUND

previously employed by: _____ for how long: _____

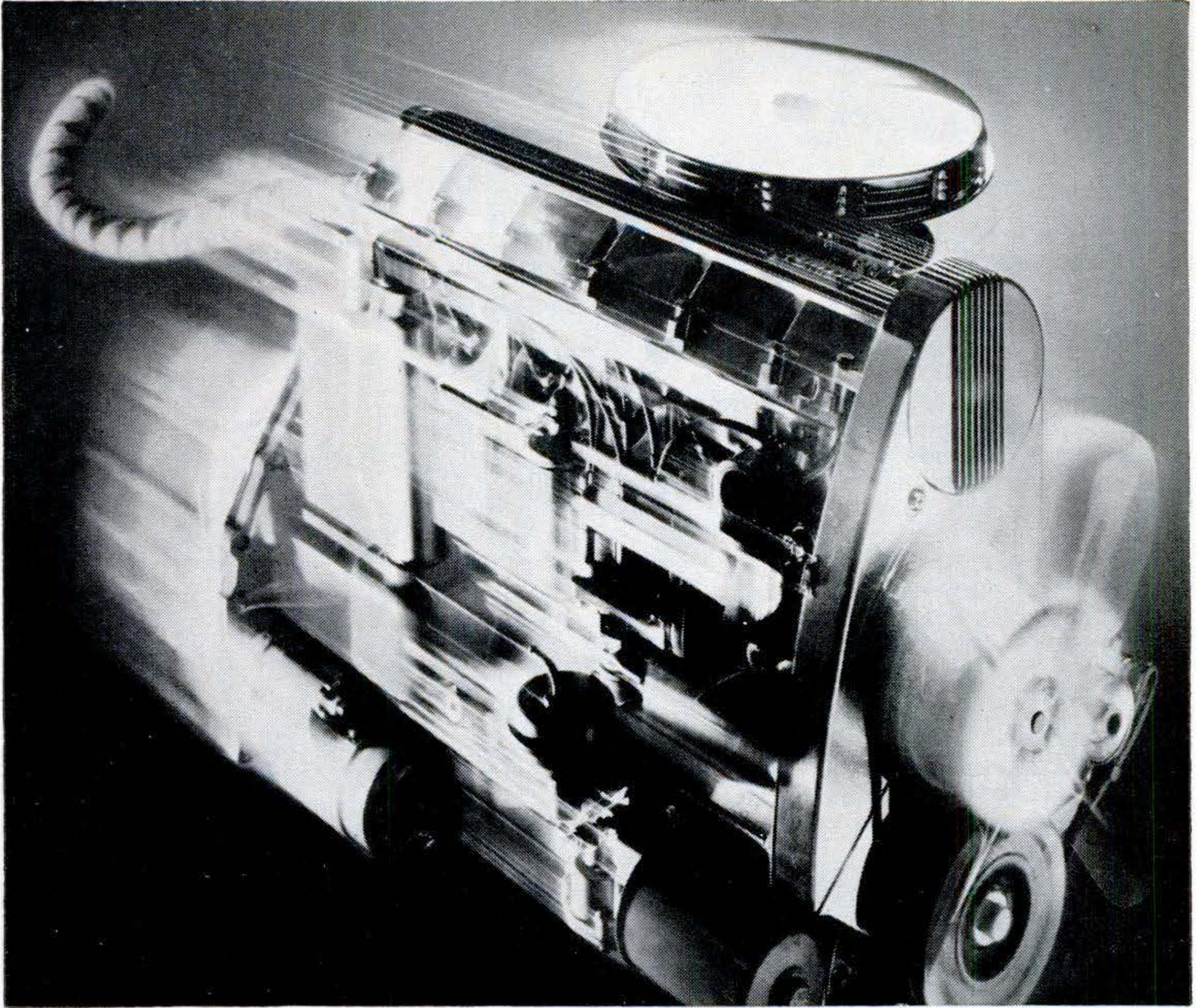
major project assignments: _____

NOTE: If you run into space limitations on this page, please attach additional information.

C-5A

LOCKHEED-GEORGIA

GIVE YOUR CAREER THE BIGGEST LIFT OF ALL
 Lockheed-Georgia Company, Marietta, Georgia
 A Division of Lockheed Aircraft Corporation



Pontiac Motor Division

Our OHC 6 is no ordinary six. Obviously.

And the special Sprint version of it is no ordinary OHC 6 either.

You know that the minute its chromed low-restriction air cleaner, 4-BBL pot and split exhaust manifold blink back at you from underhood.

But our OHC Sprint didn't come by its performance just by tacking on options. To begin with, it has its camshaft up over the valves, like the great European road machines have them. And drives the shaft with a revolutionary, glass fiber, reinforced, neoprene belt, instead of with the heavy noisy chain that every other OHC engine has.

All that not only shaves the pounds off, it does away with enough moving parts to develop its rated 207 horsepower at 5,200 rpm's.

Besides which, the OHC 6 is just an all-around

tougher engine. With heavy-duty valve springs. High performance bearings. Block-stiffening skirts around the crank, and a camshaft drive-belt which will outlast practically anything in the car but the driver.

We splashed a little glory elsewhere in the Sprint, too: a tighter, tougher suspension underneath. A three-speed, all-synchro floorshifter within. And, on the sides of 2-door models, a set of swaggering sports stripes. (The standard Pontiac safety items, like front and rear belts and such, go without saying.)

If you think all this sounds like an unusual animal, you ought to drive one. You can find the OHC Sprint option on Pontiac Tempests and Pontiac LeMans. And those you can find at your Pontiac dealers.

OHC Sprint by Pontiac



This is the day you learn about guts!

It's your first jump. You're up 1,200 feet waiting to go. But all the training and all the practice never quite prepared you for the way you feel right now. Your pack never felt heavier. Yet, you never felt stronger.

You're ready.

There are five guys ahead of you. Now four. Now three. No one hesitates. You won't either. You're sure of your training. You're sure of yourself.

In 21 days of Jump School something happened to you. You learned things you never thought you would. You did things you never thought you could. It was tough. But it made you even tougher.

Okay. You're next.

Go!

During the long seconds before you feel the welcome shock of your chute opening, you learn about another thing:

Men call it "Guts!"

And if that's all Army Airborne training gives you, you'll still be miles ahead. But there is more. You can become a trained specialist in one of many exciting fields: electronics, communications, equipment maintenance, to name just a few.

Have you got what it takes?

Army



PS Readers Talk Back

[Continued]

on the tracks. Had Tom Swift's author produced a book on flying saucers, I'd say look it up—it would have something in it that will come true in the near future.

PETER LEGON, Malden, Mass.

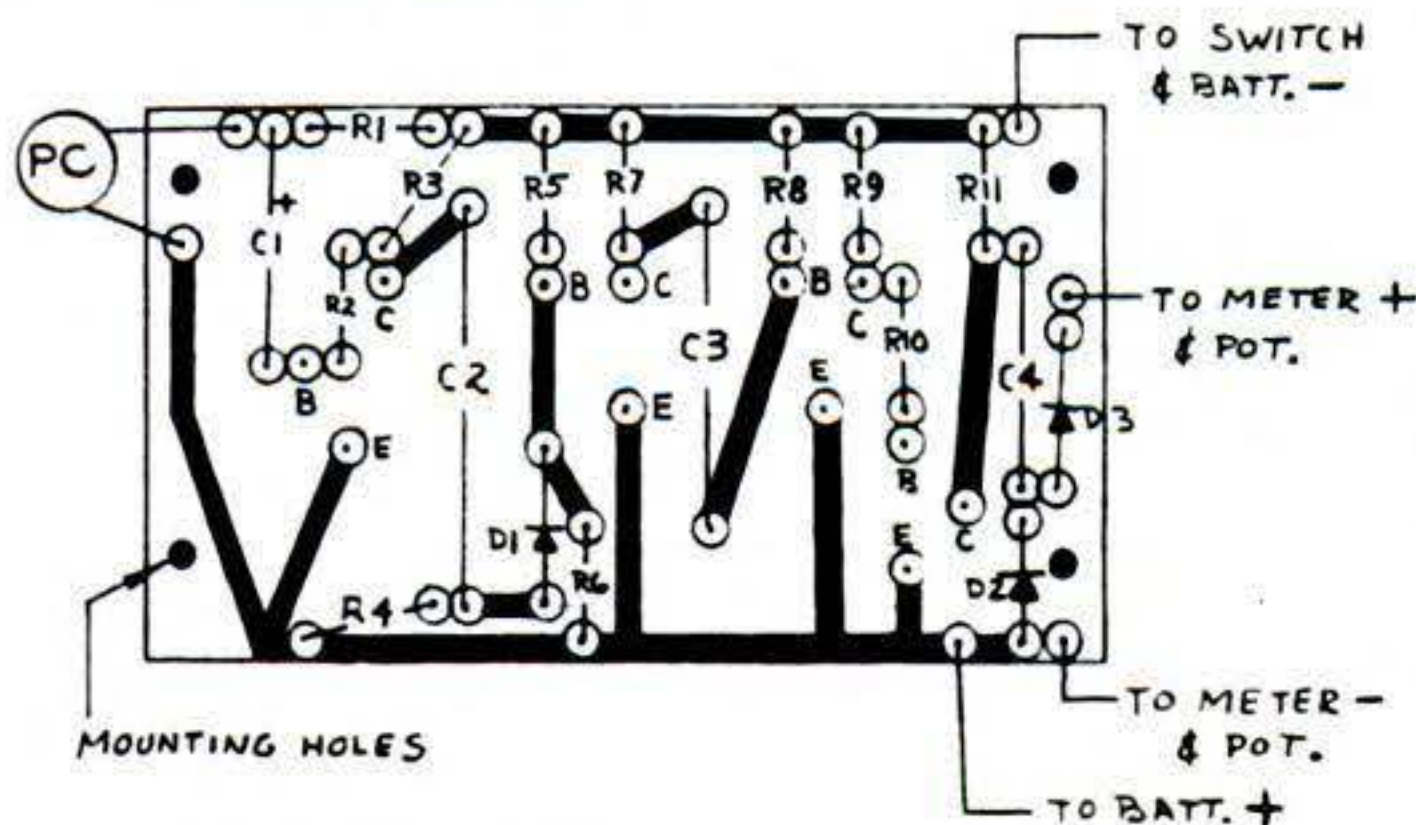
. . . Richardson's and Guha's sea engine is certainly not the first to pump salt water by electromagnetic pump. Data referring to this type of process can be found in the early work of Michael Faraday. U.S. Patent No. 957,242, dated May 10, 1910, specifically refers to the pumping of salt water by an electromagnetic pump for the express purpose of propelling a ship.

WILLIAM J. ROBINSON, Morton Grove, Ill.

Apparently Richardson and Guha were unaware of Faraday's work. Thanks for setting the record straight.

Upgrading the electric-eye tachometer

I built your tachometer ["The Electric Eye That Measures R.P.M.," Jan.] and it works very well. Others might be interested in a few changes I made. I designed an etched circuit board like this:



I also omitted the meter, building in a pair of phone tip jacks to permit use of my VOM as the indicator.

BURTON P. NOBLE, Arlington, Tex.

Nut takes the place of a die

I read the Short Cut [Dec., p. 28] about cutting a bolt in two with a hacksaw and using a die to restraighten treads. This would be ideal, but not everyone has a set of dies. I always use a nut, which is generally not hard to find.

DAVID A. PETERSON, Cincinnati.

Watching all the plates go by

I enjoyed "License Plates for '66" [Feb.] very much. I hope it will become an annual feature.

CHARLES GEORGE, Wallingford, Conn.

. . . Someone goofed! The color of the back-

Continued



How to get the facts about the Army Airborne.

Your local Army Recruiting Sergeant has the full story. He'll tell you what it takes to qualify for Airborne training, and of all the opportunities it offers.

He's listed in the phone book under U.S. Government. Why not call him today?

Meantime, get a colorful, exciting 40-page booklet about Army life and Army opportunities simply by filling out and mailing this coupon. You're under no obligation, of course.



Army

PS 4/66

OPPORTUNITIES

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Please rush me your 40-page booklet, "The Secret of Getting Ahead."

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AGE _____

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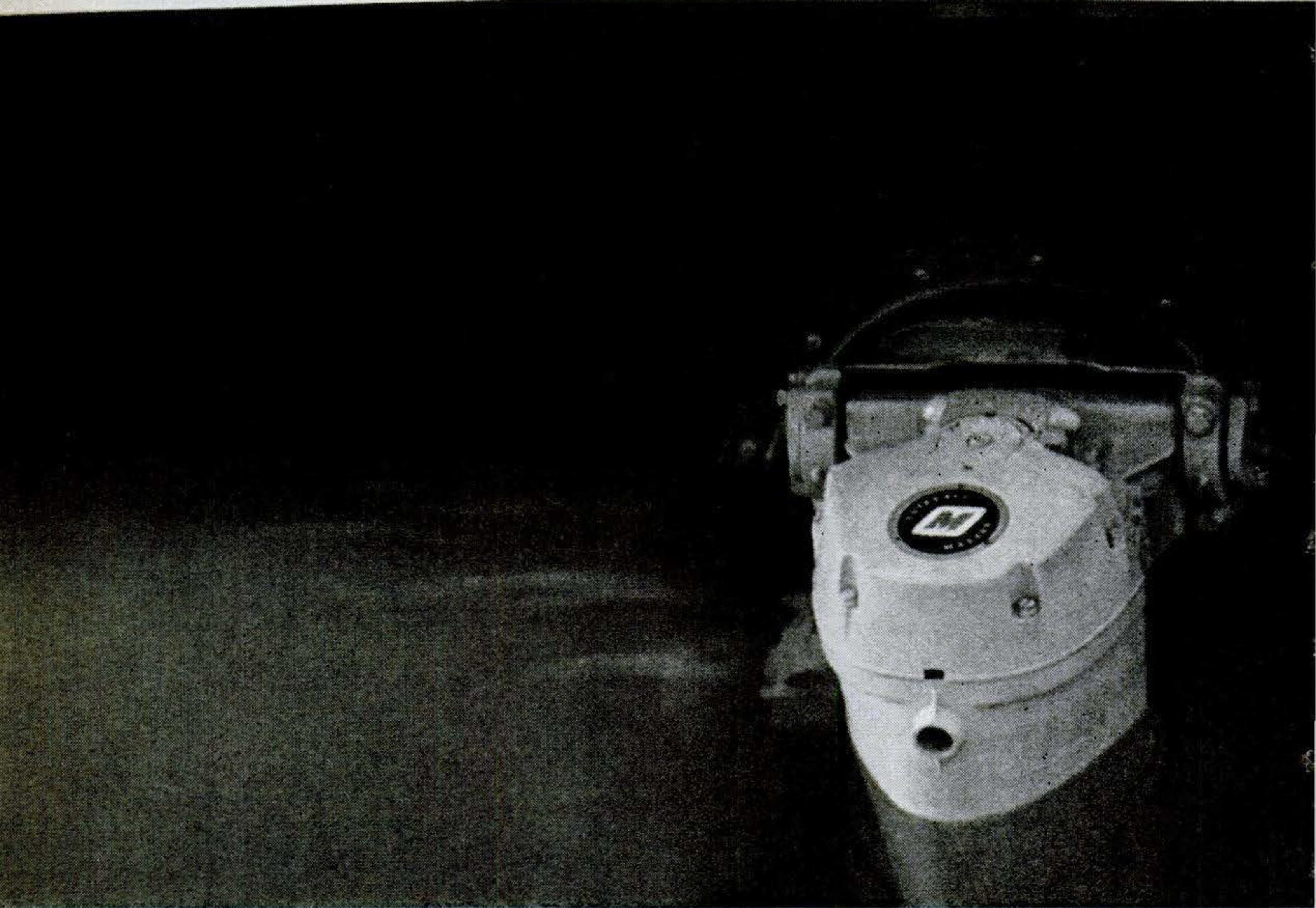
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STATE _____

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PHONE _____

EDUCATION _____



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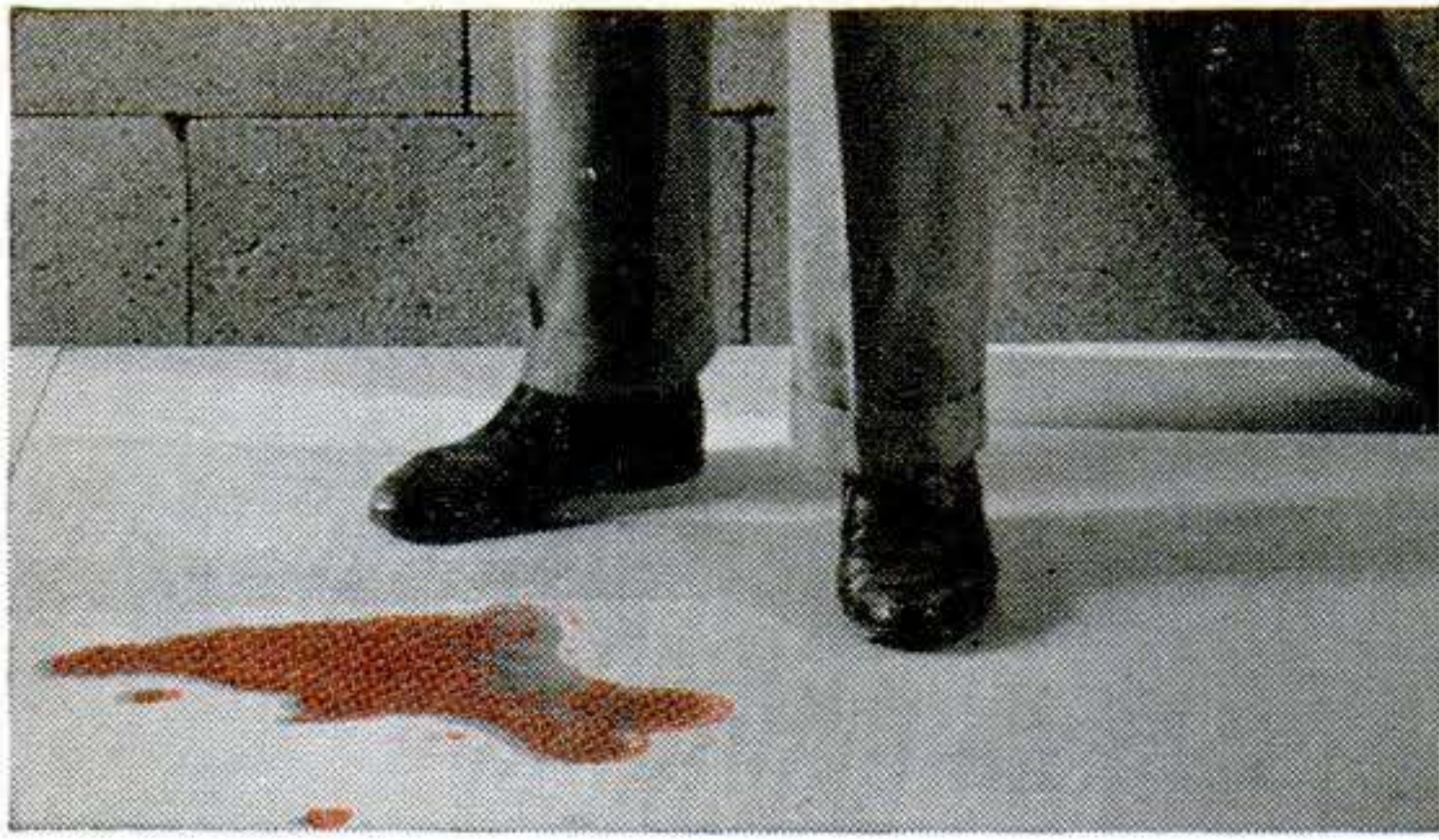
We've taken off a lot of weight in the right places

Now you can have all the power you want in a stern drive unit and put no strain at all on your transom. FASTBACK OMC Stern Drive is available with a unique mounting system that puts the power where it should be: anchored securely to the bottom instead of hanging on the transom. The drive unit merely passes through the transom, eliminates all the strain on your boat's Achilles heel. Turns tighter than any other unit, too . . . a full 90°, port to starboard.

OMC FASTBACK includes full 75° power tilt, and exclusive electric power shift as standard equipment, together with an exclusive 2-year warranty*.

Speed? OMC FASTBACK takes off from zero mph to flat out in seconds. Pulls everything from a whole ski party at top speed, including Aunt Sadie, down to a fishing lure at trolling speed.

Why not test drive an OMC FASTBACK in the boat of your choice? See your leading boat dealer today . . . or send for the FASTBACK Fact Book: OMC Stern Drive, 38 Arbor Ave., Galesburg, Illinois.



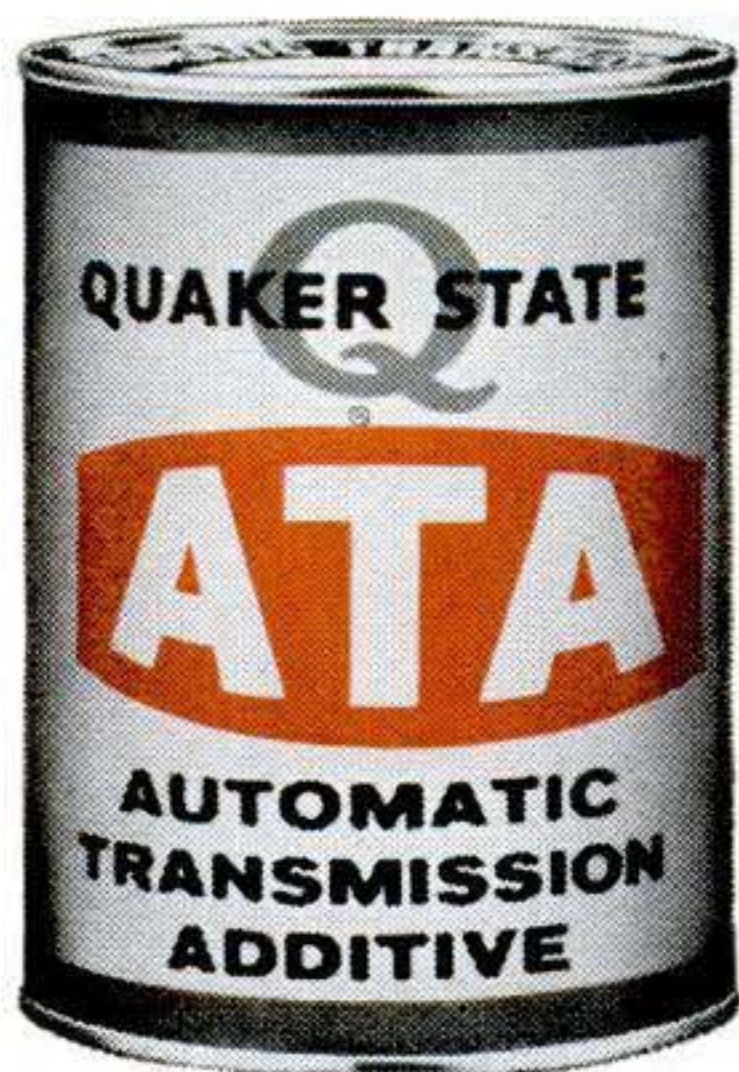
If this happens, it's your fault.

You can prevent automatic transmission leaks. Or at least help. With Quaker State ATA (Automatic Transmission Additive).

Prevents leaks. Quaker State ATA is an additive concentrate for all automatic transmission fluids. It softens and swells oil seals. Helps prevent leaks. And that's not all ATA does.

Protects transmissions. Quaker State ATA also revitalizes the fluid that's in your transmission. Revitalizes its anti-sludge and anti-varnish detergents. Renews its oiliness and friction control properties — helps your transmission shift more smoothly. All this plus helping stop leaks.

You should have used:



ATA is made by the makers of



QUAKER STATE OIL REFINING CORPORATION
OIL CITY, PENNSYLVANIA

PS Readers Talk Back

[Continued]

ground of the New Hampshire 1966 plates is forest green, not black, as pictured.

ERNEST EAMES, Manchester, N.H.

The green is so dark that it came out looking black in the printing.

. . . That was an interesting photo. Can you tell us how it was done?

HERTSEN HEERDT, Whitinsville, Mass.

The plates, obtained from the individual states and other sources, were mounted on two large boards and photographed with a four-by-five view camera using Ektachrome film.

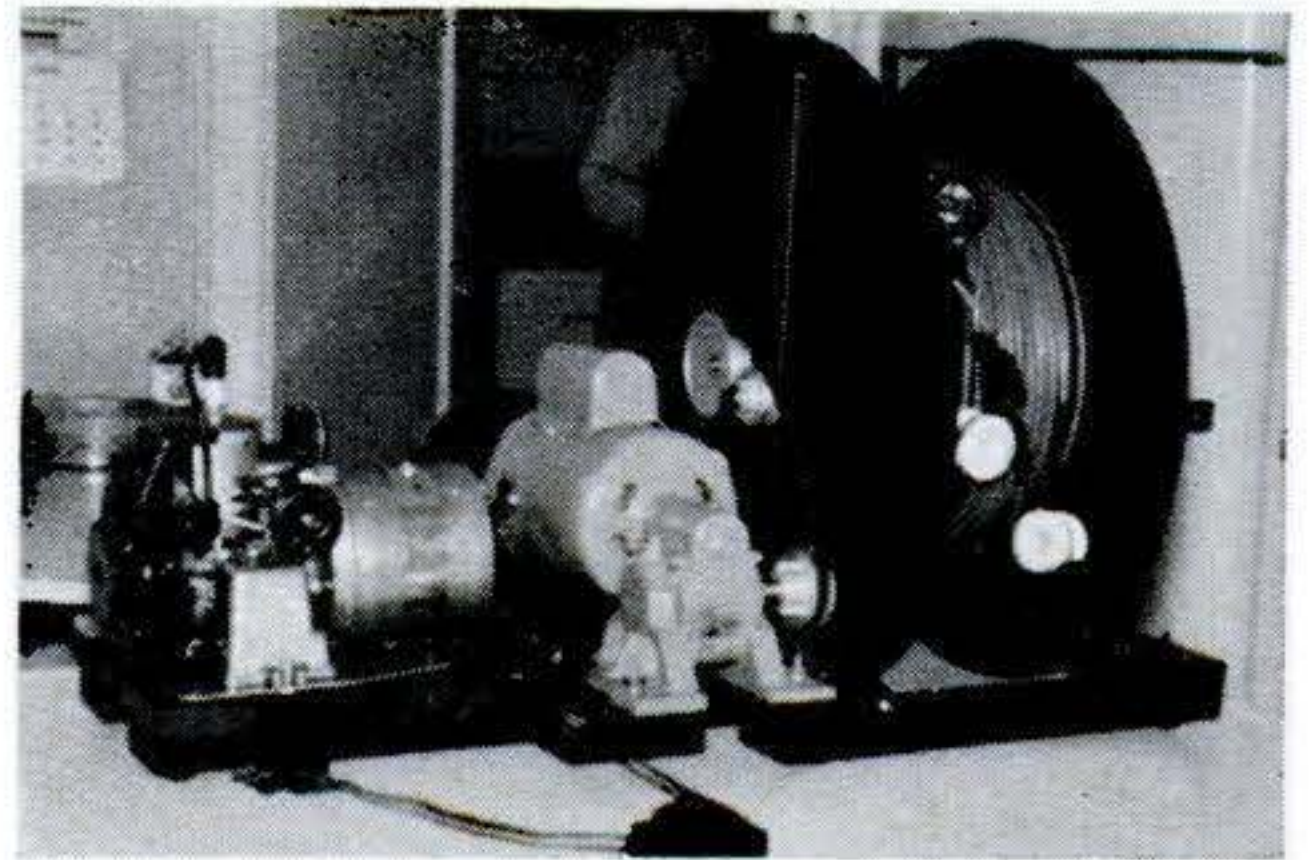
How to win with PS

I'm glad to report that my boy won the grand award at his high-school Science Fair with the seismograph featured in December ["How to Build an Earthquake Detector"].

JAMES S. REIFSNYDER, Audubon, N.J.

A ray of light in the darkness

Victims of the dark in the Northeast last year ["Blackout: Can It Happen in Your Town," Feb.] would have benefited from this Tiny



Tiger two-cycle power plant, which I bought to carry in my car trunk just for such an eventuality. The $\frac{3}{8}$ -hp., 10½-lb. plant generates 350 watts at 6,500 r.p.m. The outdoor cord carries six lamp sockets, spaced 12 feet apart.

A. OWEN AYRES, Eau Claire, Wis.

More about unevenly worn front tires

Richard Day says in "Wheel Alignment Bunk" [Feb.] that unevenly worn front tires should be moved to the back. Why spend the money to switch if the tires are going to continue to wear abnormally anyway? It seems to me that the tires would wear the same, front or back, once the alignment is completed.

RODNEY GRAHAM, Detroit.

Not so. If the tires are left at the front, the old wear pattern continues—even with correct alignment. But used at the rear, the same tires will wear evenly, remain useful.

“File away your spark plug troubles,” says Jim Clark, 1965 Indianapolis 500 winner.

“Anyone with some knowledge of motorcars is aware that spark plugs—or sparking plugs as we call them in Britain—need periodic cleaning and regapping to perform efficiently. What many people overlook is that a judicious bit of filing may be in order at the same time.

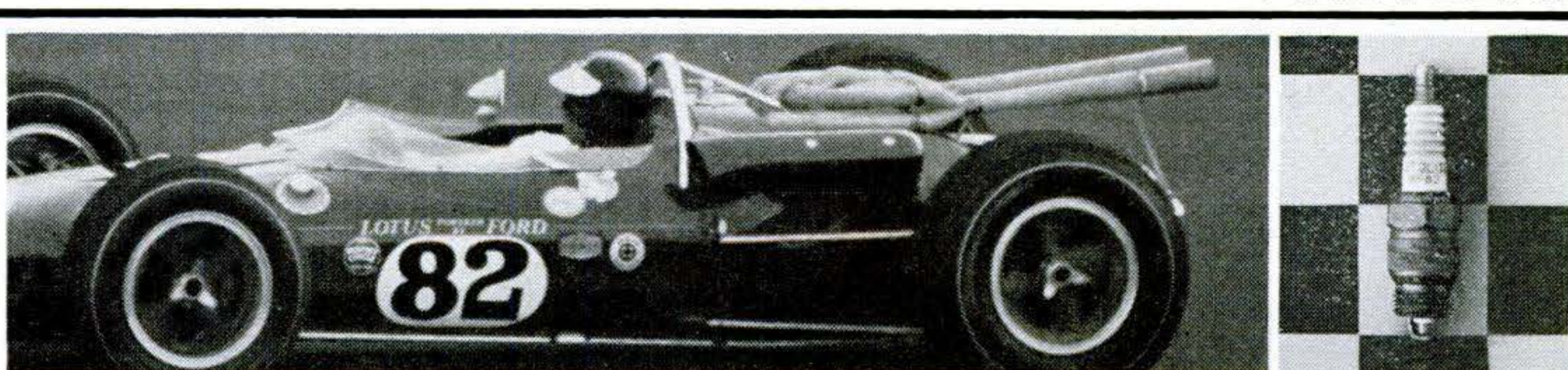
“As plugs wear, their electrodes become rounded and require higher voltage to fire. Missing can result, robbing you of power and economy. Filing the electrodes so their edges are sharp again and adjusting the gap to correct spacing with parallel surfaces restores performance.

“With sparking action occurring as often as 300 times per minute under extreme heat of combustion, the best

electrodes will eventually erode beyond a point where they can be corrected by servicing. When this happens, I recommend you install a new set of Autolite spark plugs. All Autolite spark plugs have special nickel-chrome alloy electrodes for greater resistance to high combustion temperatures, corrosion and spark erosion. And Autolite makes its passenger-car plugs with the same copper and glass seals used in Autolite racing spark plugs that helped me win the Indy 500. Some companies don't because it costs a bit more, but Autolite thinks the extra protection is worth it. So do I.”

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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.



.....

"Since I bought my '63 Ford, I've had trouble with that 'California gadget' on it. About every 4-5,000 miles I have to take the car in for repair or oil seeps from the oil cap. Any cure?"

JOSEPH KOPACZ, Hackensack, N.J.

Since you live outside California, you can have the smog control removed and go back to the standard Ford setup. They haven't yet solved all the problems for making a satisfactory device, but I don't think it will be much longer before they do.

"At speeds above 45 m.p.h., a great deal of noise comes through the area of the gearshift lever on my '65 Le Mans. It's a three-speed floor shift. Is this common on this car or is something wrong?"

LOUIS T. PARISE, Philadelphia.

You shouldn't be getting any unusual noises. Get a road check by your dealer's service manager—and save some money by catching this trouble before it really gets bad.

"When I press the pedal on my '63 power-brake Chrysler, the car slows only a trifle on the first part of the stroke. When I press a little farther, the brakes grab—and always have since new. Can the brakes be adjusted to take hold more evenly? Can my power steering be made less sensitive, and how?"

JIM BRACKER, Irvington, N.J.

Better get back to your dealer, or a good brake shop, and have that car brought up to date on all the service-bulletin specs. Also, have the linings changed and fitted more closely to the drums. Probably the brake power unit needs updating, too. To make the power steering less sensitive is a job for a specialist.

"A valve head broke off at 70,000 miles and went through a piston in our '63 Dodge with

383-inch engine. We had the repair shop install a high-lift cam when they rebuilt the engine. In 2,000 miles, the engine threw two rods. The shop claimed extra compression on the old crankshaft caused this. So we had the engine rebuilt again, with a new crankshaft. In 2,000 miles more, the engine threw one of the same rods again. This time the shop said the high-lift cam added so much compression that the rod blew. Would you agree that it was the cam that caused this?"

MRS. M. A. BOWLIN, Colonial Heights, Va.

No. Something is wrong in the oil system of this engine. Have it carefully inspected to determine why these rods are not receiving their share of the oil. There could be a lot of causes—I won't attempt to list them. The high-lift cam could cause many other problems but not oil starvation.

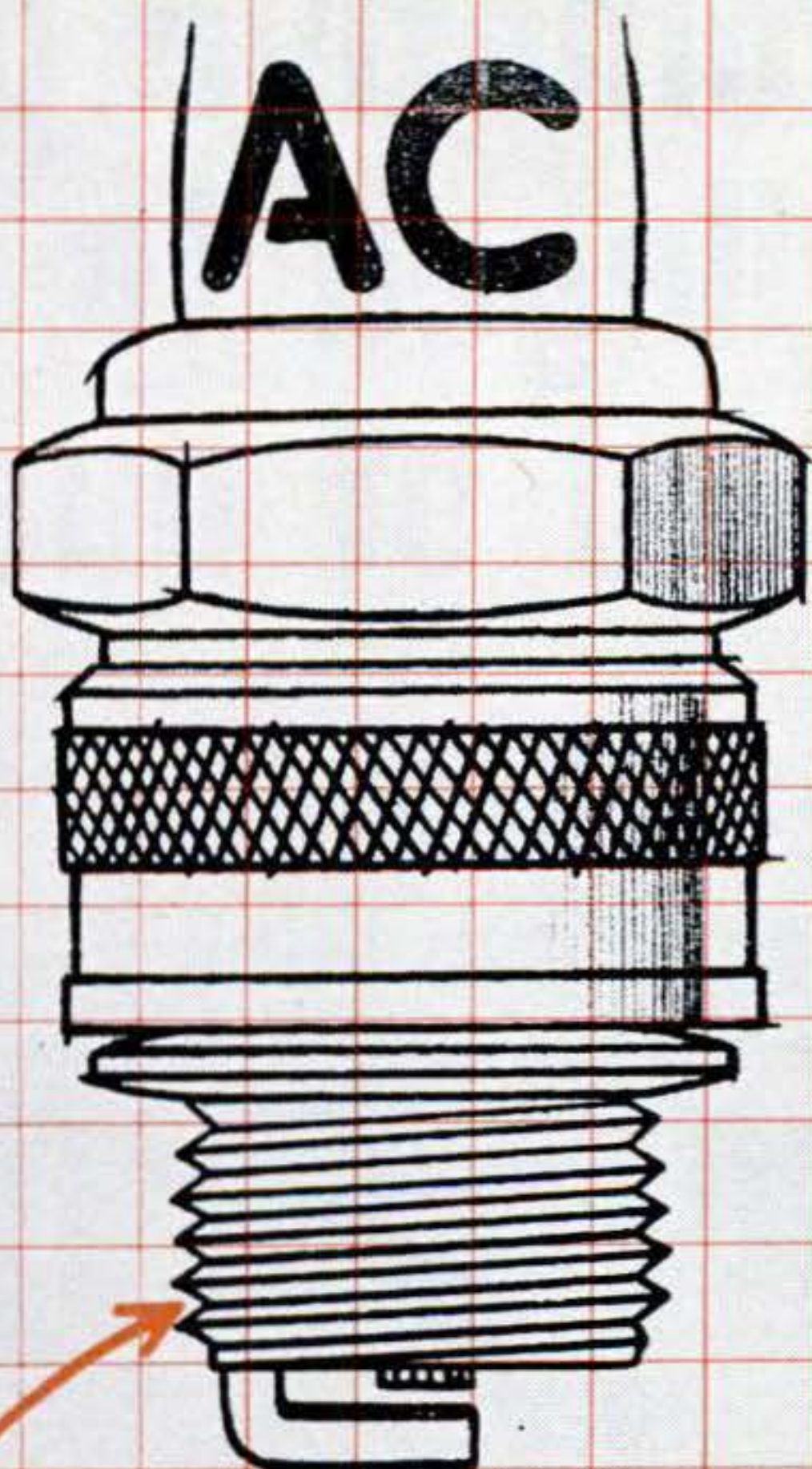
"My '64 Ford 289-inch V-8 has always stalled unless I let up on the accelerator when starting out with a cold engine. The dealer checked out the choke, throttle linkage, etc., but it didn't help. Any suggestions?"

EDWARD BREWER, Richland Center, Wis.

When the engine is real cold, you should let it warm up awhile before driving. You didn't say, but if you have an automatic transmission, make sure you have the proper lube for it, and have the adjustment checked. Have the fast idle and choke system checked out really close. If the carburetor heater isn't right, you'll never get out of trouble. Use a fuel that will vaporize readily in cold weather. In your climate, an engine water heater could help a lot.

"I am having difficulty determining the proper equipment to choose from a dealer's option list. What is the formula used to obtain the proper rear axle for performance and economy? The

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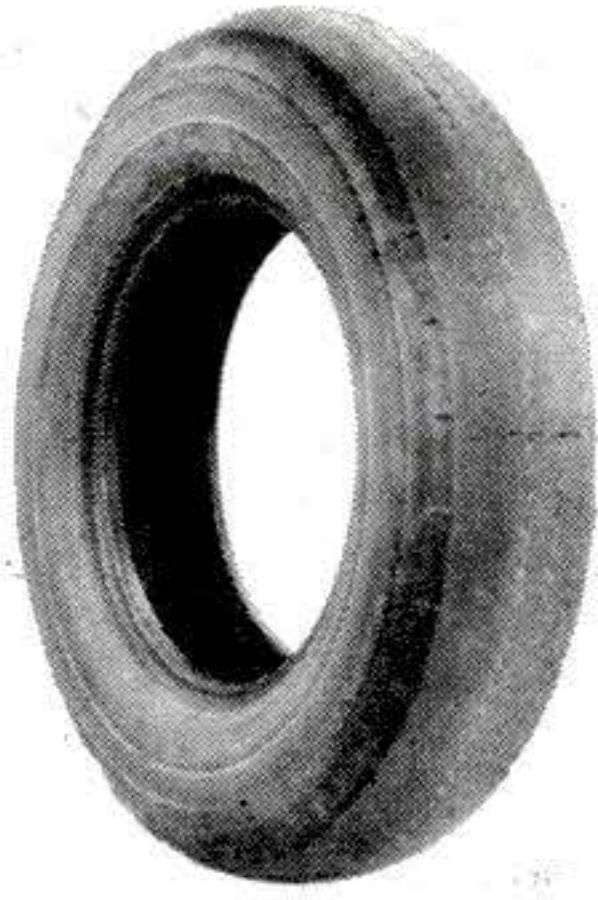
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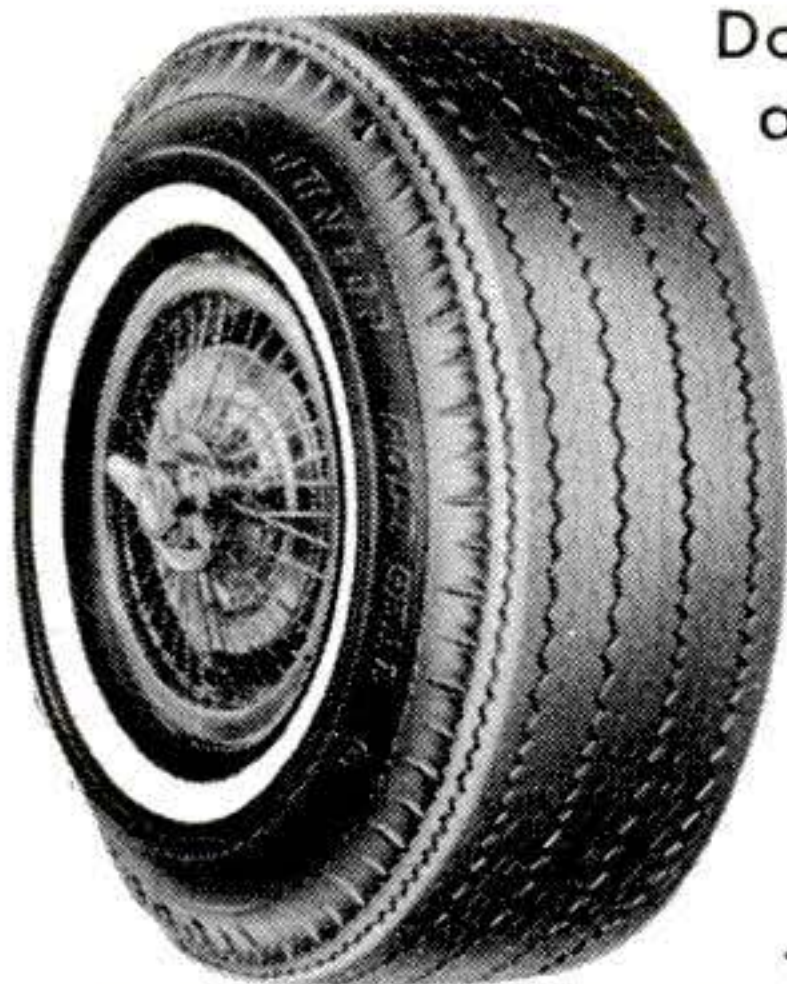
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"Say, Smokey—" [Continued]

main advantage of 'four-on-the-floor'? Would you recommend manual or automatic for sustained high speeds? Why do cars that are equipped with manual transmissions have higher rear-axle ratios?"

LEWIS LOCUST, Durham, N.C.

There is no pat formula for choosing optional drives. The standard model of any make of car usually is the best combination the engineers have been able to come up with. Take the advice of a dealer who is familiar with your area and the driving problems there. Four-speed manuals have no special advantages except for such purposes as high performance or—for the expert driver—complete power control. The newer automatics don't seem to suffer from heat damage at sustained high speeds. As for axle ratios, an automatic box takes care of heavy accelerator feet. A higher ratio with a manual box does the same thing—prevents a driver from lugging his engine, for instance.

"I'm planning to buy a new Volvo. What's the best warm-up technique on a really cold day—let it idle until the temperature gauge starts moving, or run slowly under load? Does it pay to put in a 55-amp alternator and capacitive-discharge ignition system for long engine life and maximum reliability?"

MARTIN K. BARRACK, Bronx, NYC.

The best way to warm up any engine is to idle for two or three minutes to warm the water and oil, then drive easily until your heat is up to normal. If you fast-idle on the automatic choke for too long, you get over-rich on the carburetor. That car should do very well as delivered. It's built for conditions where it *really* gets cold. You should not need the 55-amp combination.

"My '58 Rambler Classic Six station wagon with automatic was purchased for camping trips and averages only 2,000 miles a year. I've had a lot of trouble with the rear end. At 560 miles, it was a left-rear wheel bearing and hub. At 1,500 miles, it was the right-rear wheel bearing and axle, at which time the rear end was aligned. In another 2,000 miles, I had to replace the left-rear wheel bearing, hub, and axle. How can I fix this? Is there another type of rear end I could put in that would not require a great deal of modification?"

H. L. TAWZER, Corona, Calif.

Either you are overloading, or the axle assembly must be sprung. It's not normal to have that much trouble. If you're not overloading, replace the housing and use premium grease. If you must overload, you'll have to consider changing to a stronger axle assembly—and this won't be economical, considering the book value of your wagon today.

Continued

The 5-year/50,000-mile warranty on your 1966 Plymouth, Dodge, Chrysler and Imperial covers parts and labor.

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The warranty is good for 5 years or 50,000 miles. The repairs or replacements it covers are made without charge—parts *and* labor. It's the longest, strongest protection ever offered by any American car manufacturer. And because the warranty is transferable from owner to owner, it can mean more money when you trade. Expert craftsmanship and advanced safety features make Chrysler Corporation cars outstanding buys. All this and the exclusive warranty. Don't settle for less!



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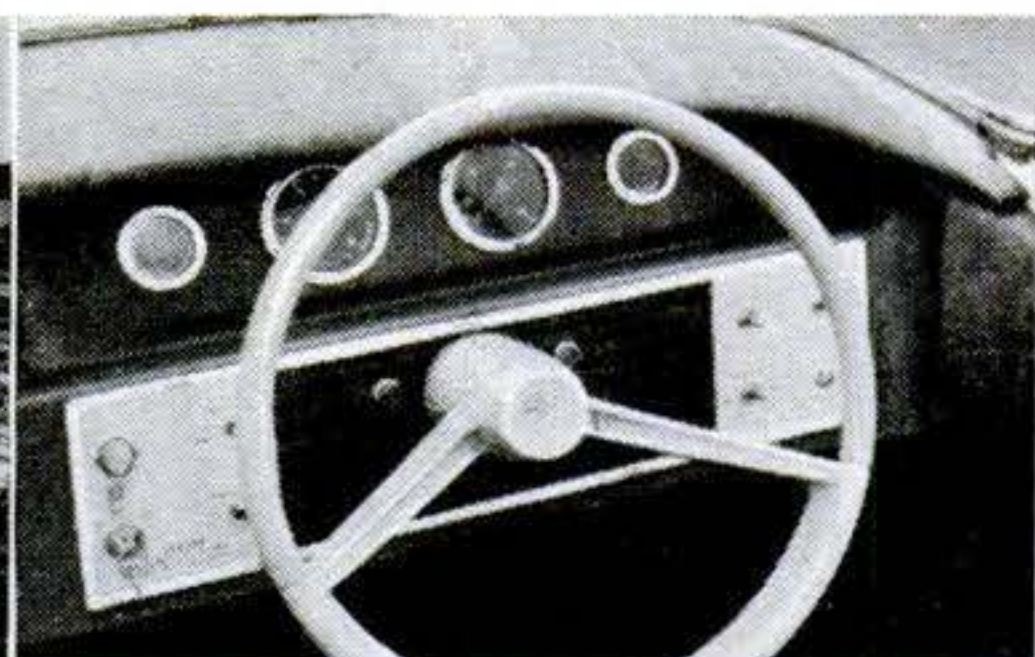
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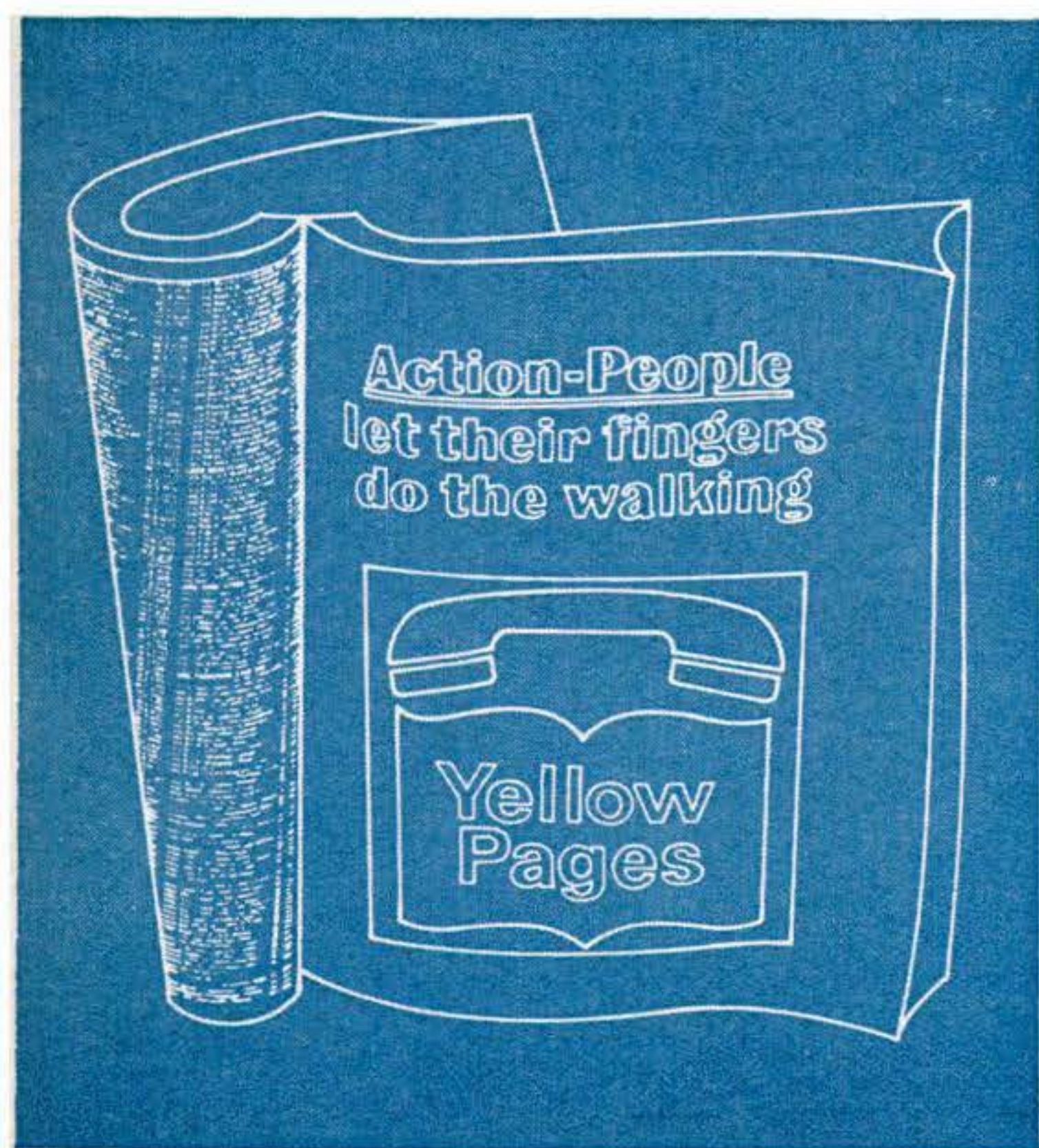
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"Say, Smokey—" [Continued]

"My '56 Chevrolet Impala has an automatic transmission and an air conditioner working off a 283-inch engine. My mileage and power are both on the low side even with the use of highest gasoline. In summer, when I put the air conditioner on, they are extremely poor. My '63 Chevy with the same equipment, but with a 327-inch engine, gives far better mileage and performance. I do a lot of driving, and the cost of low gas mileage hurts."

MAX SALIT, Arleta, Calif.

You picked a bad time to go to a smaller engine, with all your power-eating options. Your best way out: Use premium fuel and take it easy with the throttle until the car gets up to cruising speed. Keep the timing as high as possible and make sure the fuel pressure is not too high (each adjusted close to specs). Keep the transmission shift points and idle specifications down to minimum.

"I'd like to change my 1965 292-inch Chevy pickup to solid lifters from the present hydraulics. Several shops have been unable to get the vibration out of this engine, and the mileage is poor. What's your advice?"

JACK IHLY, Coeur D'Alene, Idaho.

Why get rid of the hydraulics? The vibration could be caused by many things. Start out by checking for vacuum leaks. Then get a thorough tune-up, especially on the distributor and carburetor. If that gives you a steady-running engine, but it still vibrates, the only sure cure is a balance job on all the engine's reciprocating parts. If you must go to solid lifters, change the cam, too. Hydraulic-lifter cams have a different profile. Be sure the metal in the new lifters and cam are compatible, too. Get a kit from a cam specialist. Good gasoline mileage is just one of the happy results the car owner gets from a well-tuned engine.

"I have a '59 Corvette with a 371-inch Pontiac engine that overheats in traffic. The fan has a shroud, and the radiator a 180-degree thermostat. Can you help?"

TERRY HOUGH, Lynnwood, Wash.

The Pontiac engine probably is larger than the one it replaced, and heat rejection would require a radiator larger in volume and area. I am assuming the components of the cooling system—hoses, etc.—have been checked out. If this has been done, and your car still overheats, change the radiator.

Got a question on autos? Send it to:

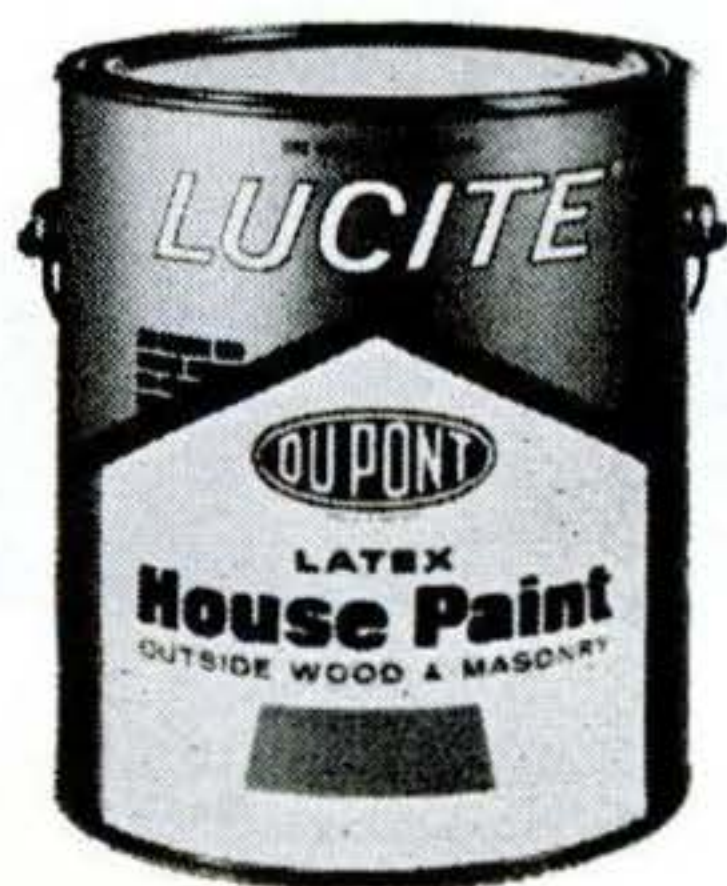
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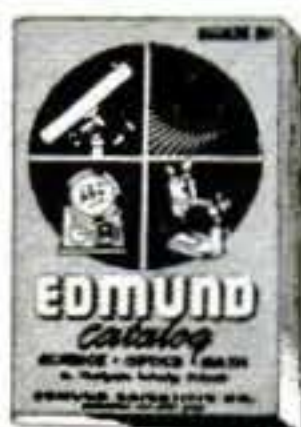


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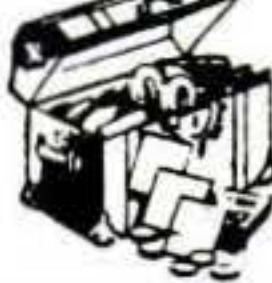


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Science Newsfront

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

By W. STEVENSON BACON

Self-powered atomic lights last 20 years

Light tubes that last indefinitely, need no power, and emit light many times stronger than that of ordinary luminous materials are now being used to light exit and other signs, in an illuminated night rifle sight, for aircraft and automobile instruments, telephone dials, and in many other applications. Known as Betalights, they are coated with a phosphor on the inside and are filled with radioactive tritium (hydrogen) gas. The radiation given off by the gas, low-energy beta rays, bombards the phosphor, causing it to light. Any extraneous radiation is absorbed by the glass walls of the tubes. The Betalights were developed by Saunders-Roe & Nuclear Enterprises, Ltd., of England.

How long can you drive?

Longer than you think, although it's not recommended. Five out of seven volunteers in an Ohio State University study of driving fatigue completed a grueling 1,400-mile, 24-hour test drive in surprisingly good shape; the other two drivers completed 21 hours. Cars used in the tests were instrumented to record 51 types of data: drivers' respiration rates, skin temperature, car movements, braking, speed, etc. As a test of alertness, spark plugs were shorted out on each car to determine if a tired driver would notice the malfunction. Purpose of the tests is to enable researchers to better design vehicles, highways, and driving methods to fight fatigue, and to provide motorists with information on how to tell when they are too tired to drive.

Russians claim 3-D TV

A three-dimensional TV system using just one picture tube is said to be under development by Russian scientists. To see the picture, the viewer looks right through the clear glass front of the picture tube at a double-sided, phosphor-coated screen inside the tube. The screen, coated with green and yellow phosphors and suspended on an axis, is rotated at 1,500 r.p.m. The 3-D effect, according to scanty Soviet reports, is created by the electron beam alternately striking the two sides of the screen.

Plastic glue mends broken bones

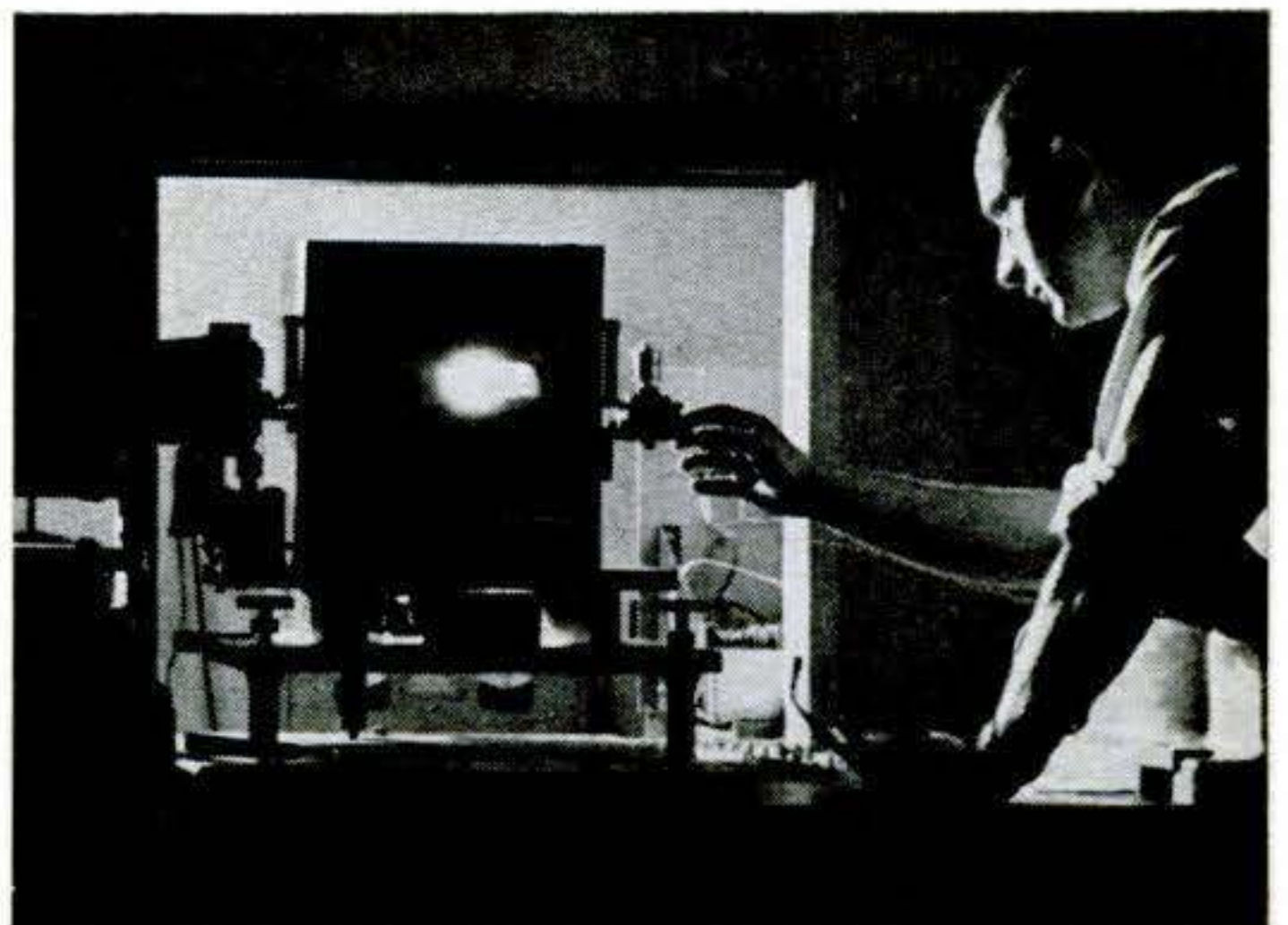
A plastic glue that mends broken bones as

good as new in 24 hours has been developed by Dr. Milton C. Cobey of Georgetown University. The plastic—used in combination with gelatin—forms a bond between bone ends that is strong enough to support body weight while the bone heals normally over a period of weeks. Temporary splints are used until the glue sets. Dr. Cobey has also been experimenting with another glue—this one for closing wounds. The glue, a commercial formula, promotes healing in seven to 10 days, and leaves thin, almost unnoticeable scars.

Nuclear power plant for heart patients

Heart patients needing an implantable cardiac pacemaker may shortly be walking the streets with a nuclear-powered version inside their chests as the result of a development program undertaken by the Atomic Energy Commission. The objective is to make a pacemaker that has a minimum operating time of 10 years—two or three times that of battery-powered models, which require continual replacement by surgery. The nuclear-powered pacemaker is expected to operate at a very low power level (several hundred microwatts) and would be fueled with plutonium-238. The radioisotope fuel would be shielded and contained within the tiny device.

Continued



Researchers hope to "see" what happens within the nucleus of the atom with this 30-foot-focal-length optical spectrograph at New York University. It is located in a light-tight room-within-a-room where vibrations of even .000004 inch are damped out, temperature is controlled to one-tenth degree.



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CARPENTRY—Largest demand area in building trades. \$4.07 average hourly wage. Over 20,000 openings yearly. Training needed. Send coupon NOW.

PLUMBING-HEATING—Earn \$4.30 hourly—average for plumbing-heating specialists. I. C. S. course has proven track record. Starts with basics. Mail coupon for FREE Success Kit.

3. Art Talent Sought

COMMERCIAL ARTISTS—Experienced artists earn \$150 and more weekly. But training is essential. Course starts with fundamentals. Job-related. Personalized instruction. Break into field full- or part-time. Write "Commercial Art" on coupon.

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SIGN PAINTING—Course prepares you to break into field. Covers all aspects: layout, design, painting, gilding, screen process. Send coupon for 3 FREE booklets.

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ELECTRONIC—Math, mechanical drawing, formulas, electricity, electronic & printed circuit drafting, others.

MECHANICAL DRAFTING—Arithmetic, algebra, geometry & trig, projection drawing, mechanical drawing, machine sketching, others.

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APPLIANCE SERVICING—More appliances mean more demand for servicemen. I. C. S. gives you know-how worth money from start. Clip coupon for Success Kit.

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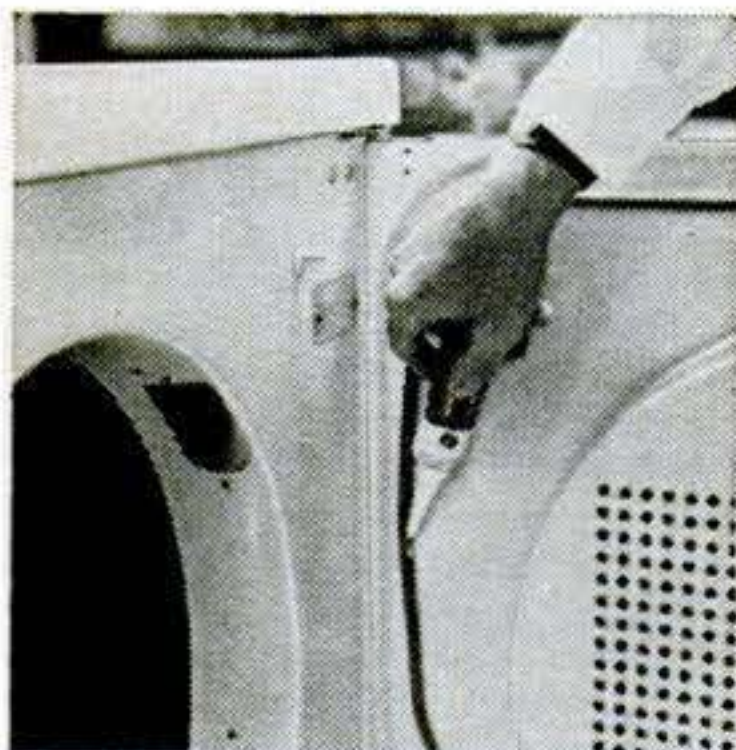
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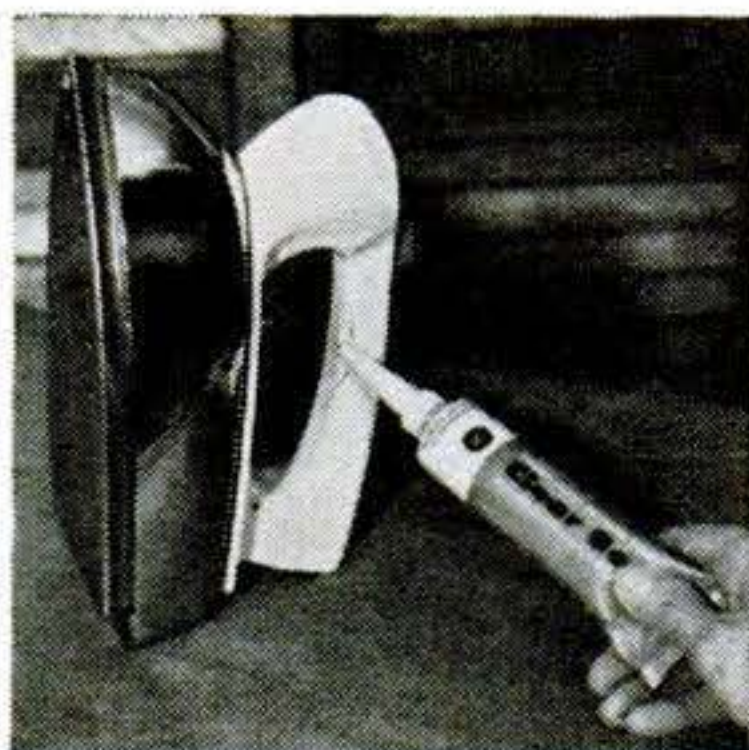
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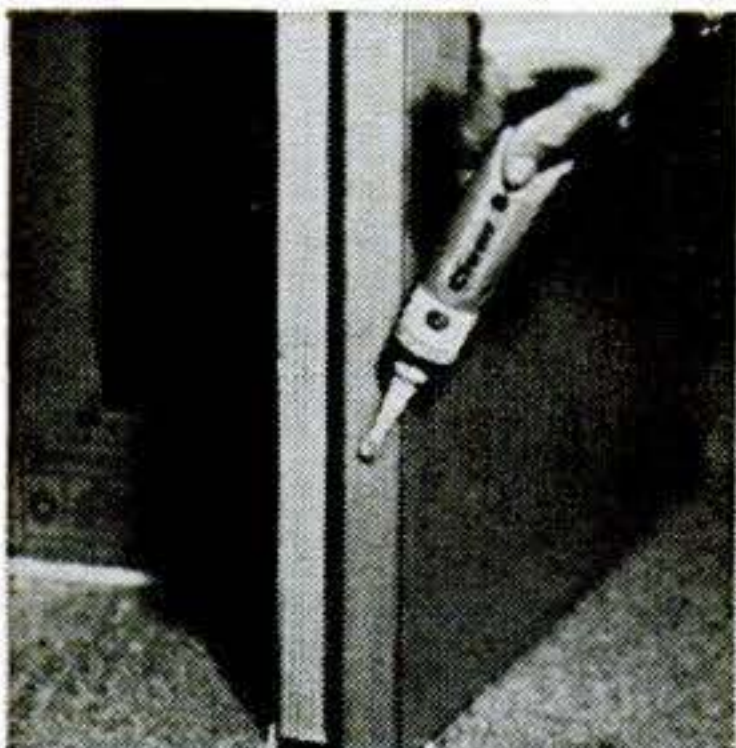
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Four Colors. Transparent, white, aluminum, black.

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-D, Silicone Products Department, General Electric Co., Waterford, N. Y.



3 oz. and 1 oz. tubes.

GENERAL ELECTRIC

Science Newsfront

[Continued]

Tinted windshields cut visibility

A sticker should appear on every car equipped with a tinted windshield to prohibit its use by persons over 30 years of age, according to Dr. Merrill J. Allen of Indiana University's division of optometry. His research reveals that looking through a tinted windshield is like reducing the power of your headlights by 25 percent—and red brake lights and traffic signals become 60 percent less visible. The effects of windshield tinting are especially noticeable in people past 30, most of whom are subject to deteriorating vision.

Emergency beacon spots downed plane

A small beacon transmitter that is automatically ejected from the wing of a plane in trouble has been successfully tested by the U.S. Air Force, and is expected to greatly simplify search-and-rescue techniques. Supported by a styrofoam airfoil, the transmitter, tuned to an emergency frequency, flutters gently to the ground, where it continues to broadcast signals to guide searchers to the crash site. In additional current tests, a crash recorder is being included in the airfoil along with the beacon. In case of a mishap, the crash recorder would give investigators some clues as to the cause.

Chameleon clothes change color

Men and women's clothing, home furnishings, and other cloth items are now being made with built-in second color. Shirts made in solid or plaid colors, for example, can be changed by simply soaking them in the packet of "magic powder" that comes with them. The powder—a solution based on citric acid—changes the original dyes from green to yellow or from brown to orange, for example. The fabric, known as Chameleon Cloth and made by Riegel Textile Corp., is said to be colorfast in either of its two colors and to cost the same as ordinary cloth.

Digging a hole to China

You'd be able to travel between New York and Hong Kong or between New York and San Francisco in exactly 42 minutes if the imaginary rapid-transit system devised by Dr. Paul W. Cooper of Sylvania Electronic Systems is ever constructed. The system, now just an intriguing dream, Cooper admits, would consist of deep straight tunnels through the earth, and would "exchange gravitational potential for motion and eventually reverse the exchange to stop at the other end." Friction-free vehicles would simply "fall" from almost any point on the earth to any other in just 42.2 minutes (based on an earth radius of 3,955 miles and gravitational attraction of 32-feet-per-second-per-second). Traveling through the moon, on the other hand, would take 53 minutes (the

Continued

Want a light ski engine for the kids plus a tough fishing motor with a 2-year warranty for yourself? Solution: the new Sea-Horse 20

Pizazz it has! This biggest of the Sea-Horse Compacts now packs 10% more horsepower. Hold your hat when you hit it because acceleration is up.

This has to be one of the best buys in the line. Combines real power with real portability. Weighs just 17 lbs. more than the Sea-Horse 9½! For the kids' ski needs, with a proper boat and a special accessory prop, it's plenty big without being too big. And for

fishing, it's fast enough to open new, farther off grounds. If you've been eyeing a pontoon boat, here again it's ideal.

Like all '66 Sea-Horse engines, the new 20 thrives on a 50 to 1 regular grade gas-oil mix. This not only lengthens plug life 50%, it saves you enough on oil in one year to pay for your oil the next. Among the 20's other virtues

are hospital quiet, thermostatic cooling, full gear shift and a fuel pump so efficient it eliminates vapor lock. There are 16 new Johnson engines this year in 10 power classes. The man to see is your Johnson dealer. He's in the Yellow Pages. P.S. Johnson also makes a full line of Johnson Boats and Johnson Skee-Horse snowmobiles.

From 3 to 100hp, every '66 Johnson features:

- Famous 2-year warranty*
- Full corrosion protection
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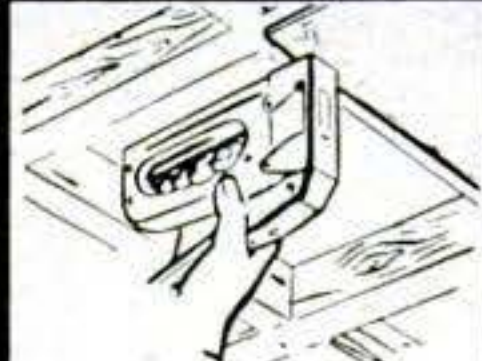
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Science Newsfront

[Continued]

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Thermonuclear power from "bullets"

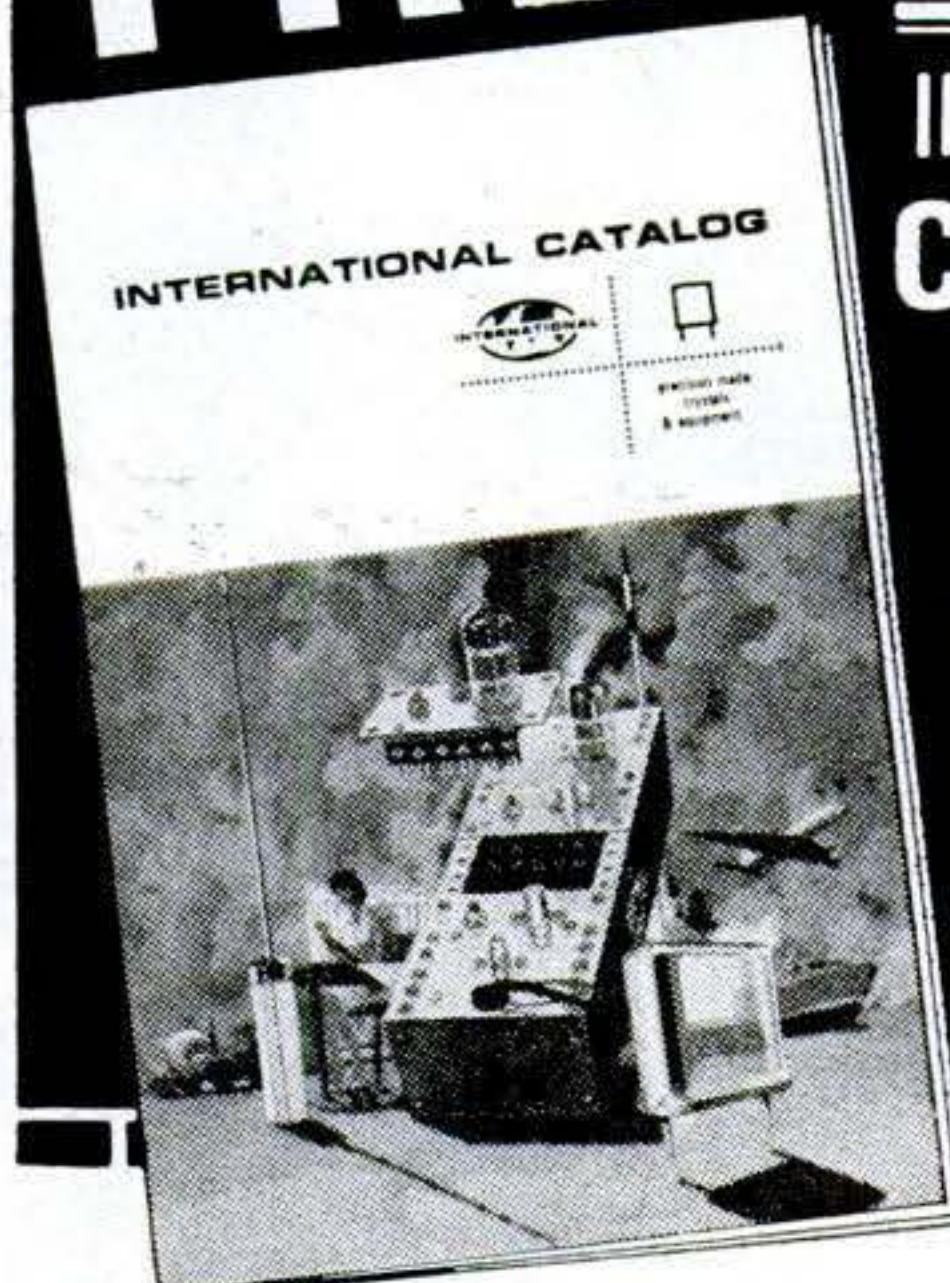
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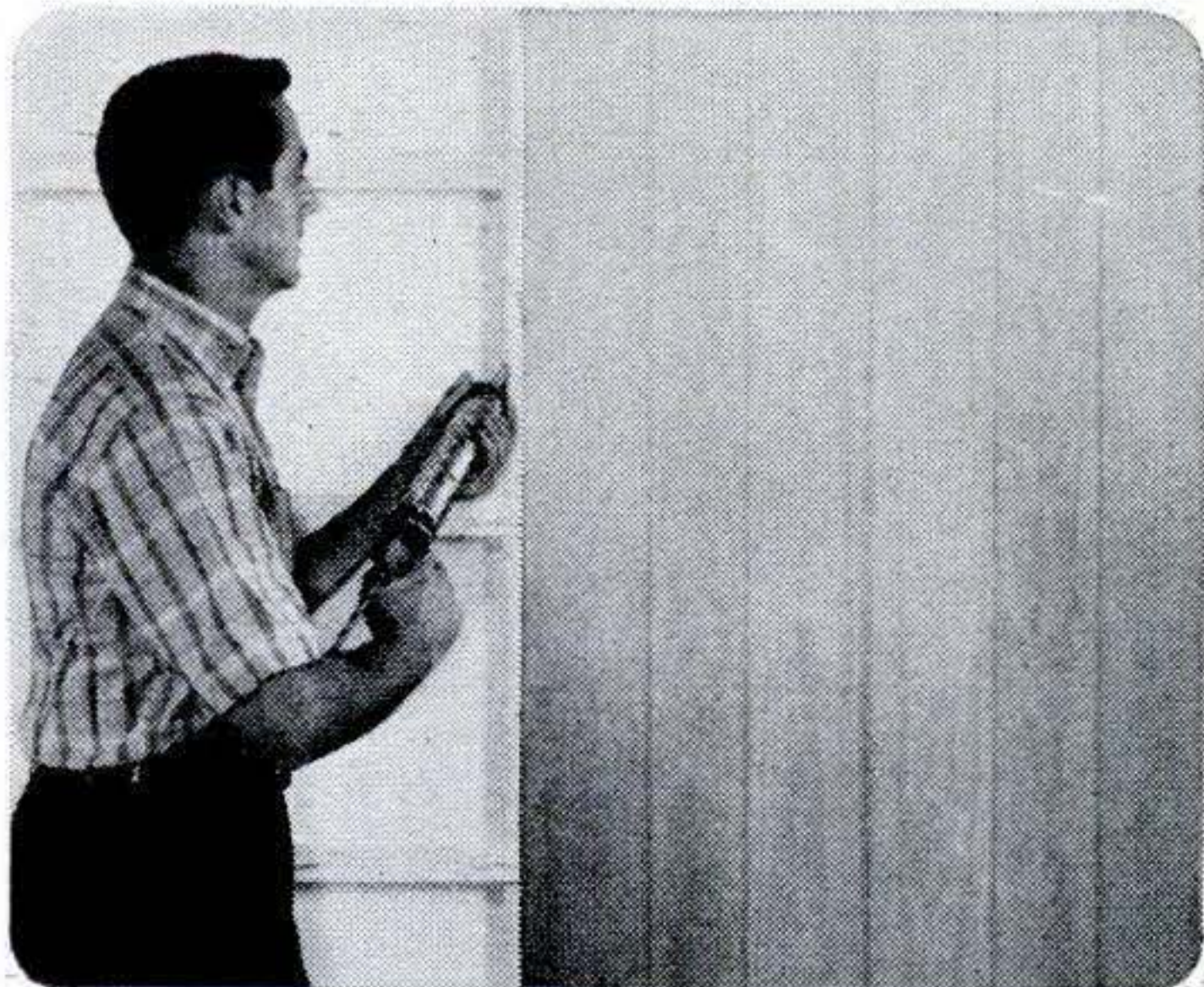
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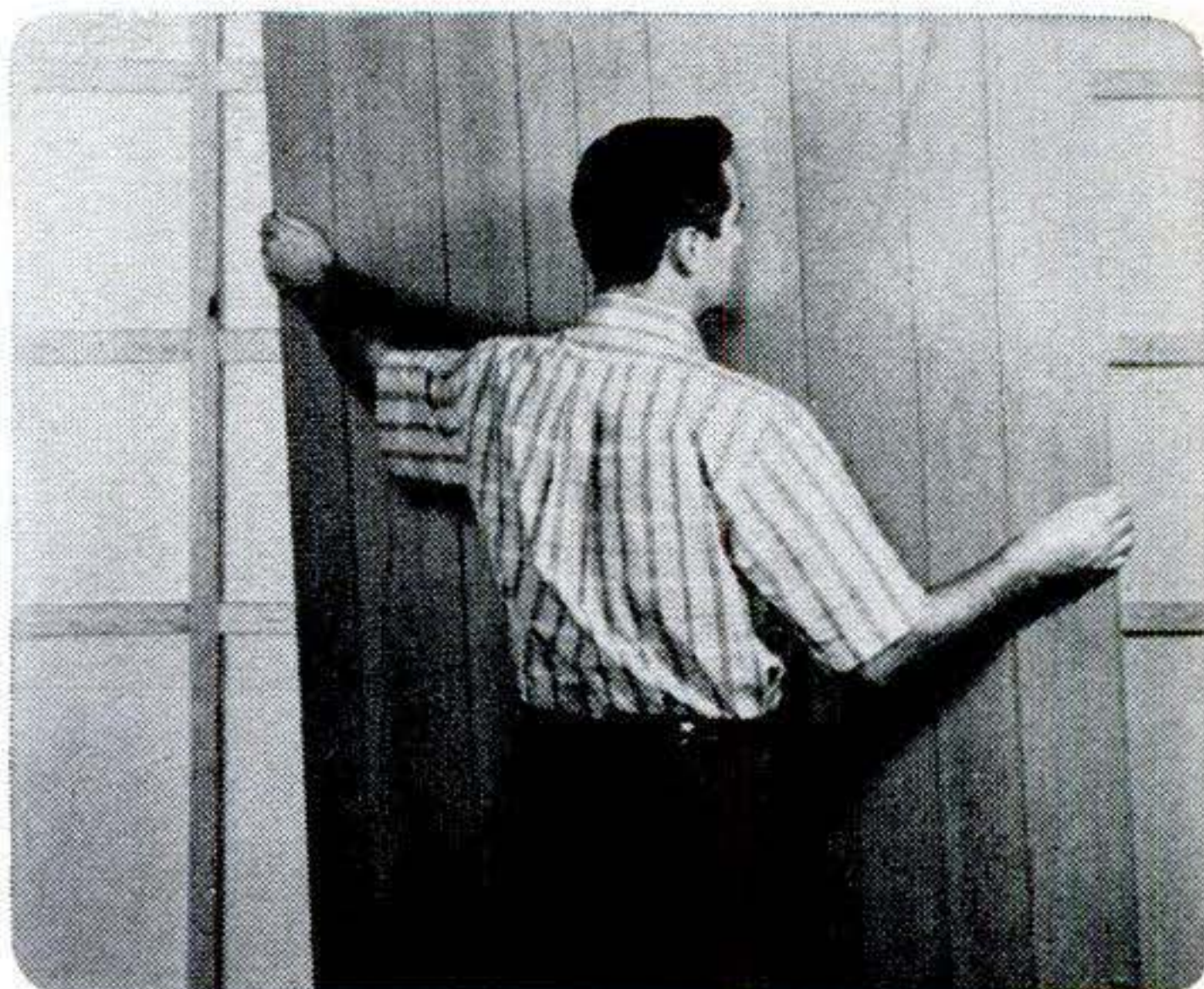
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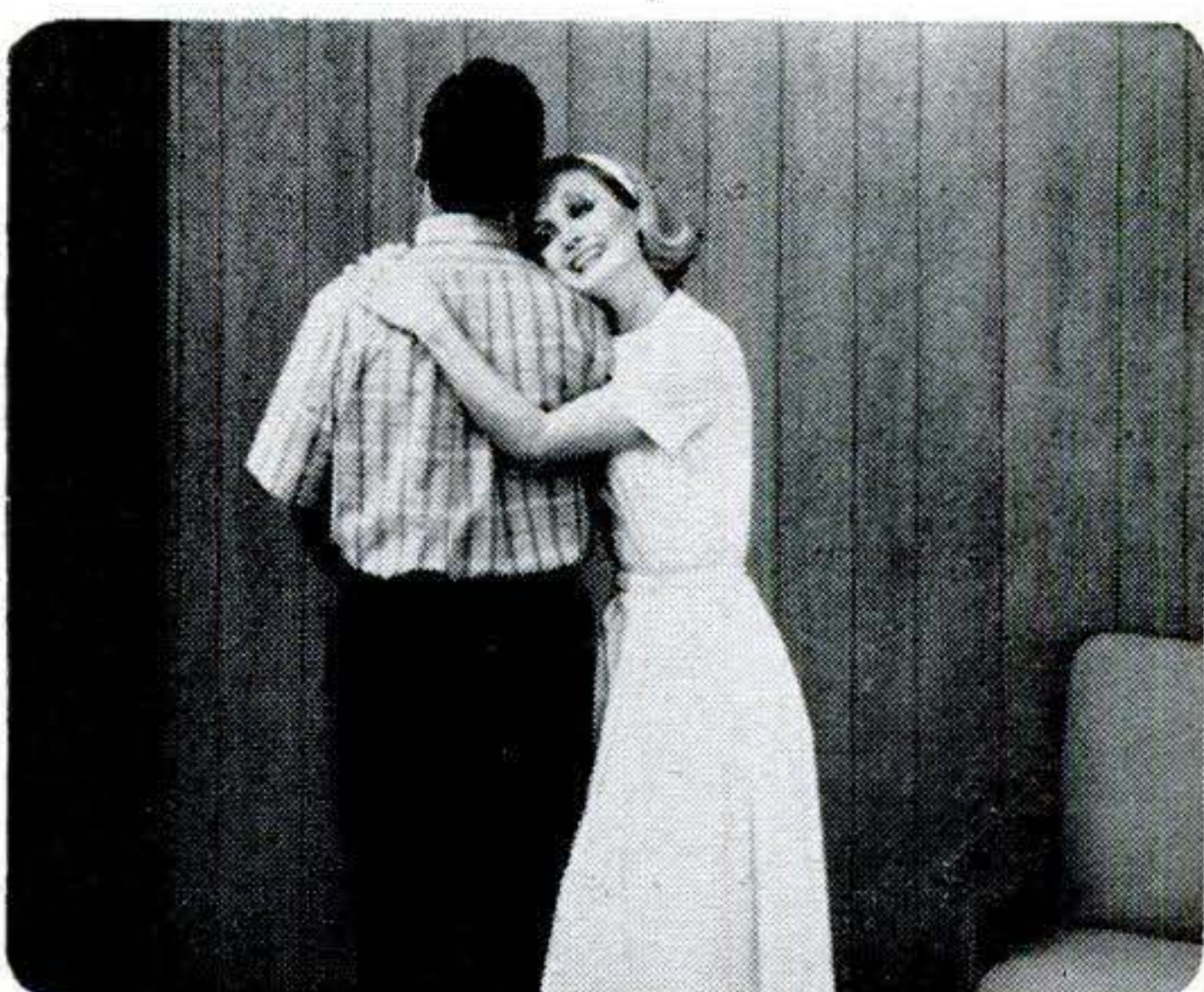


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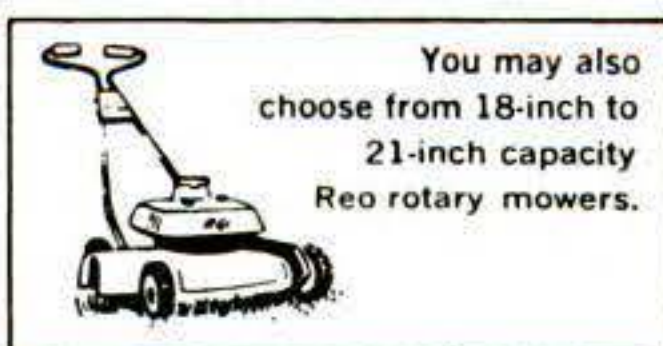
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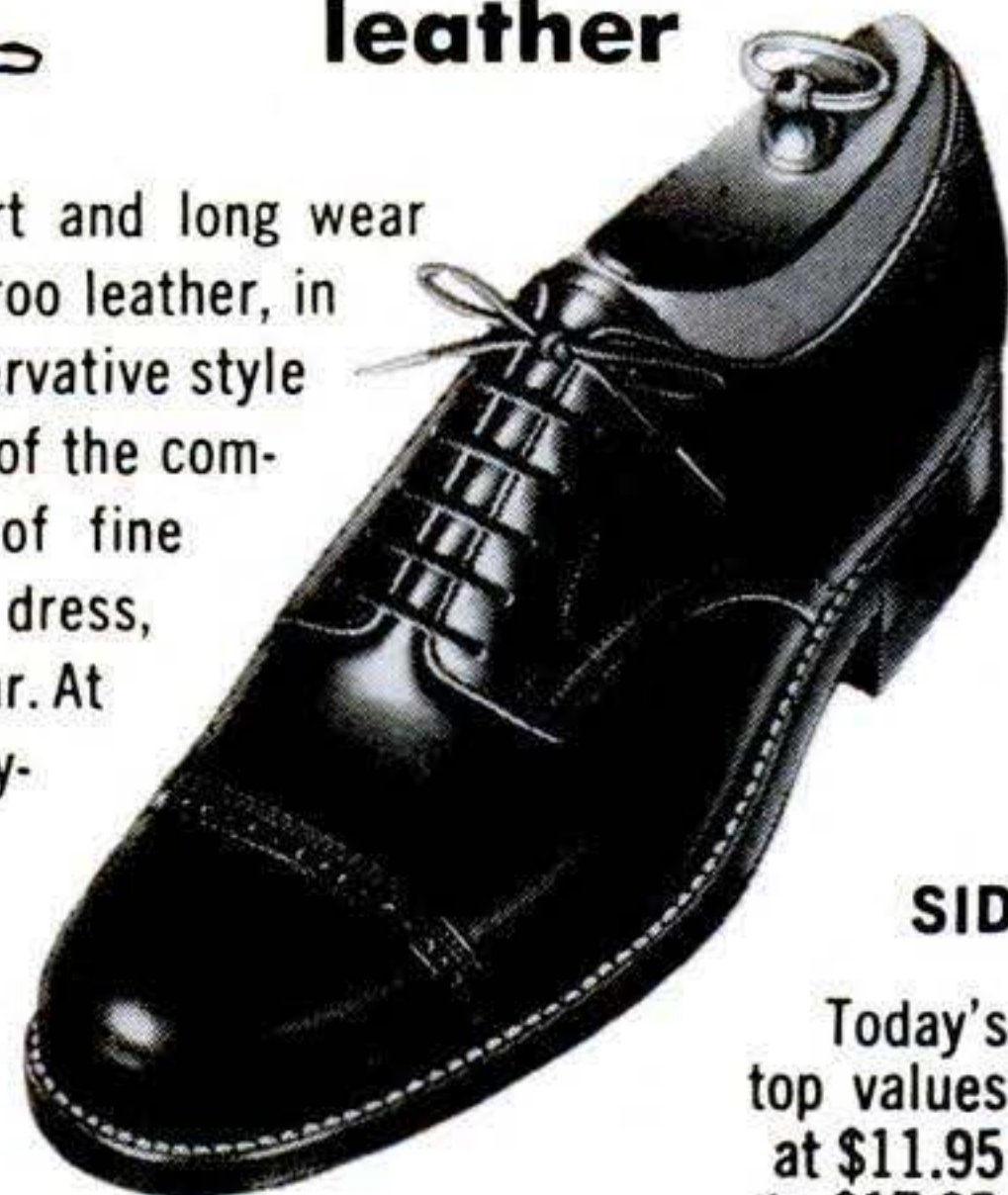


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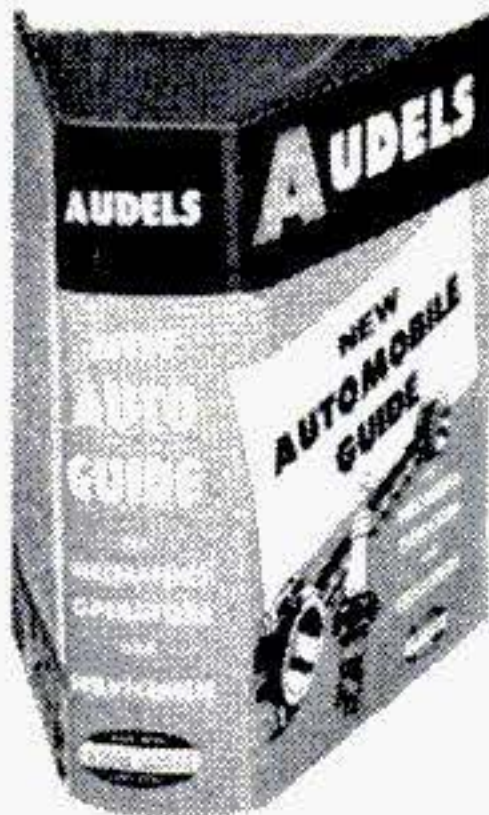
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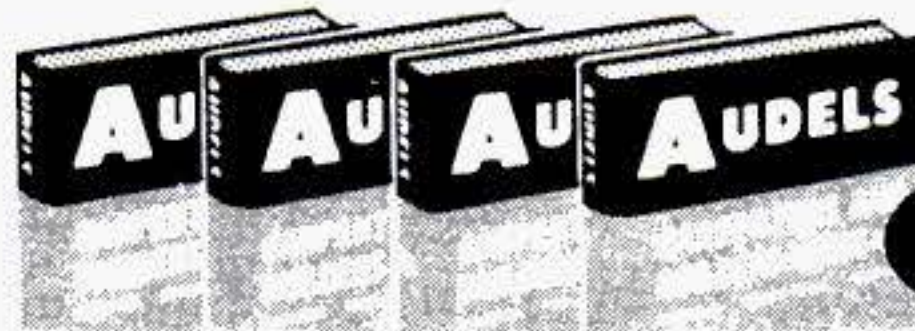
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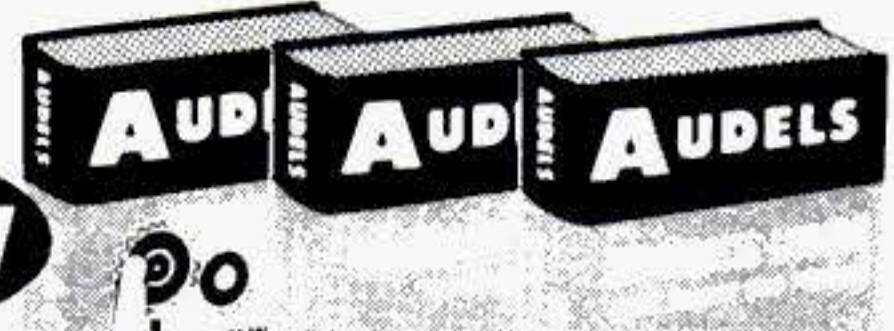
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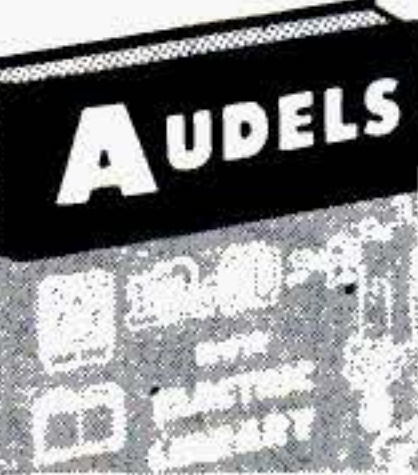
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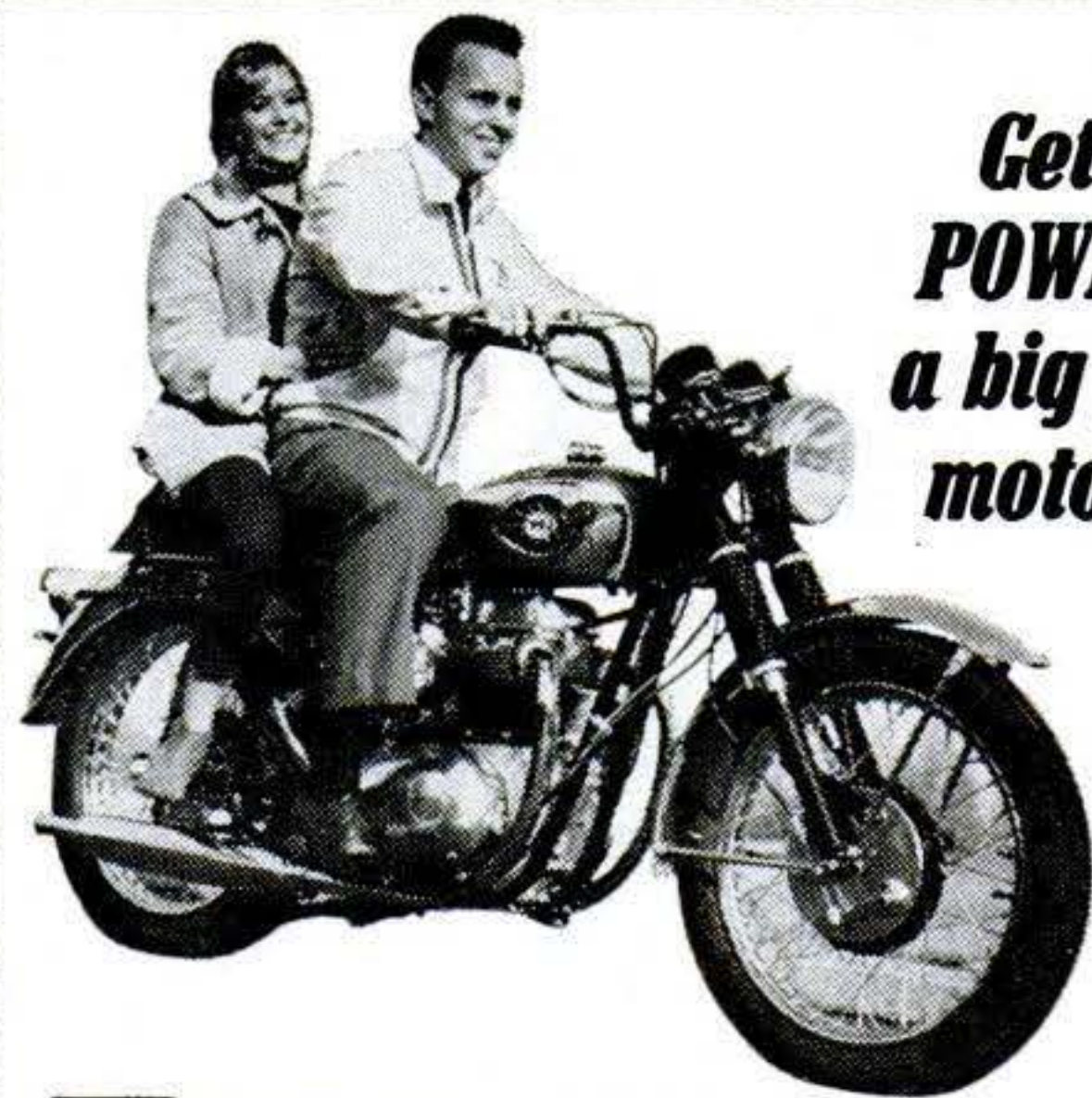
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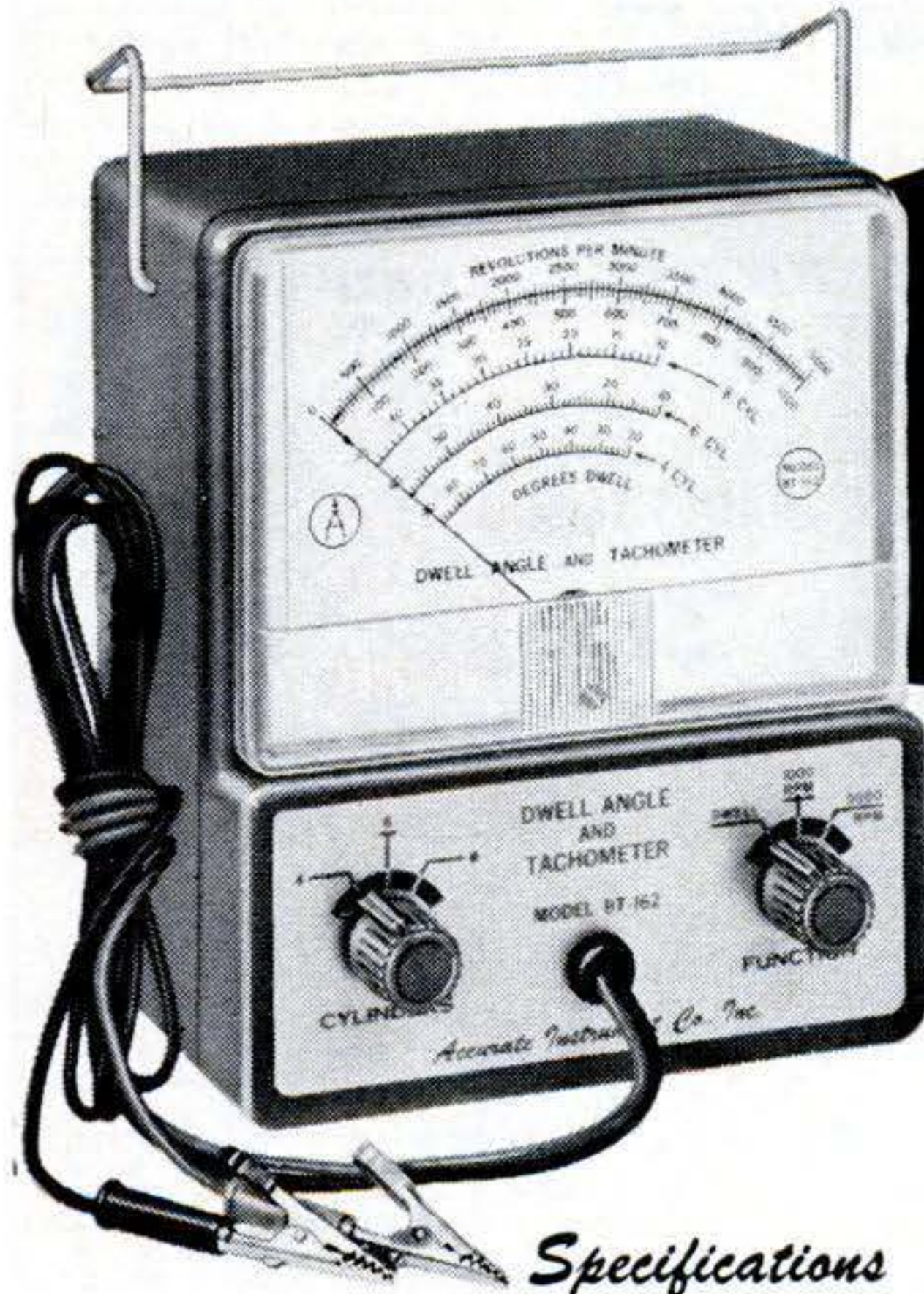
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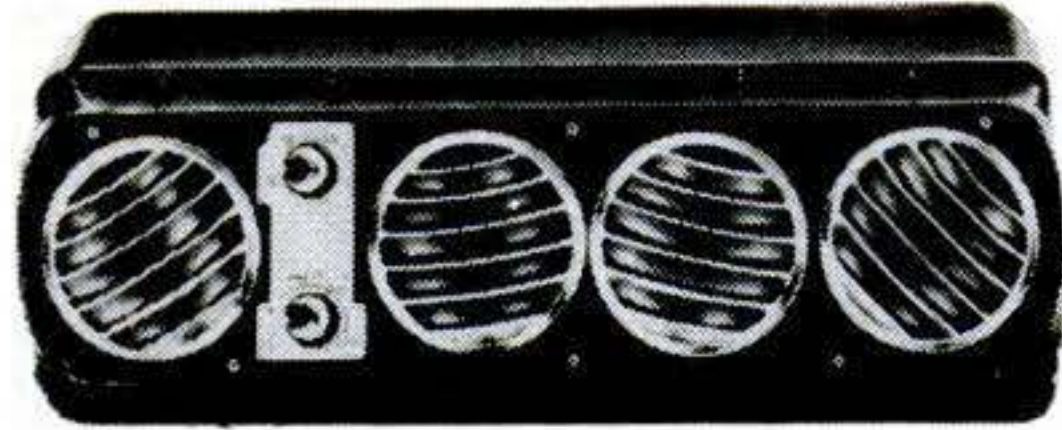
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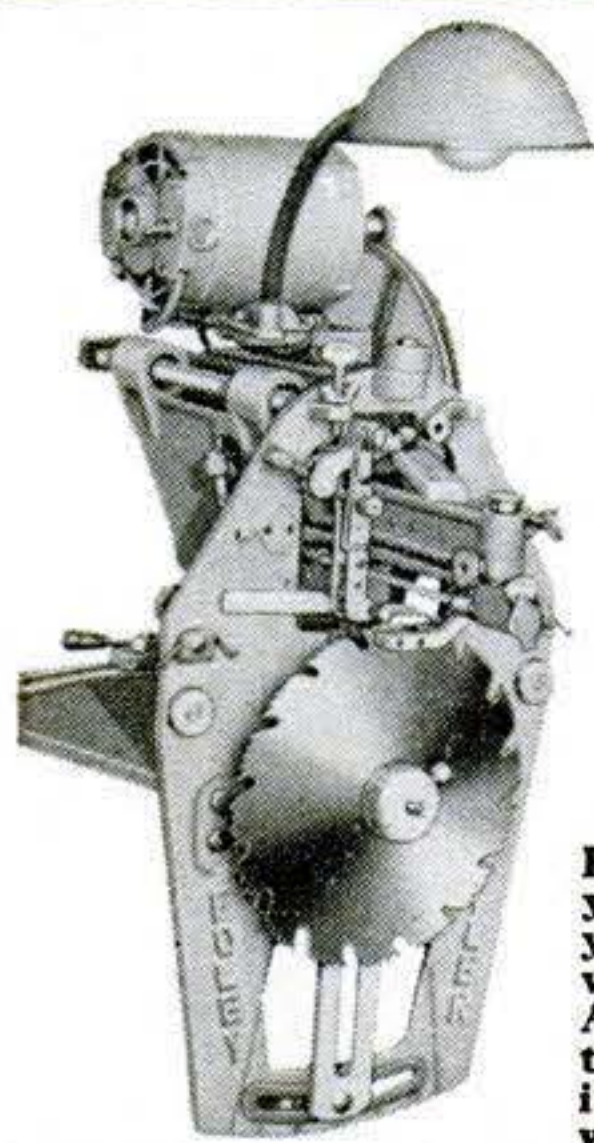
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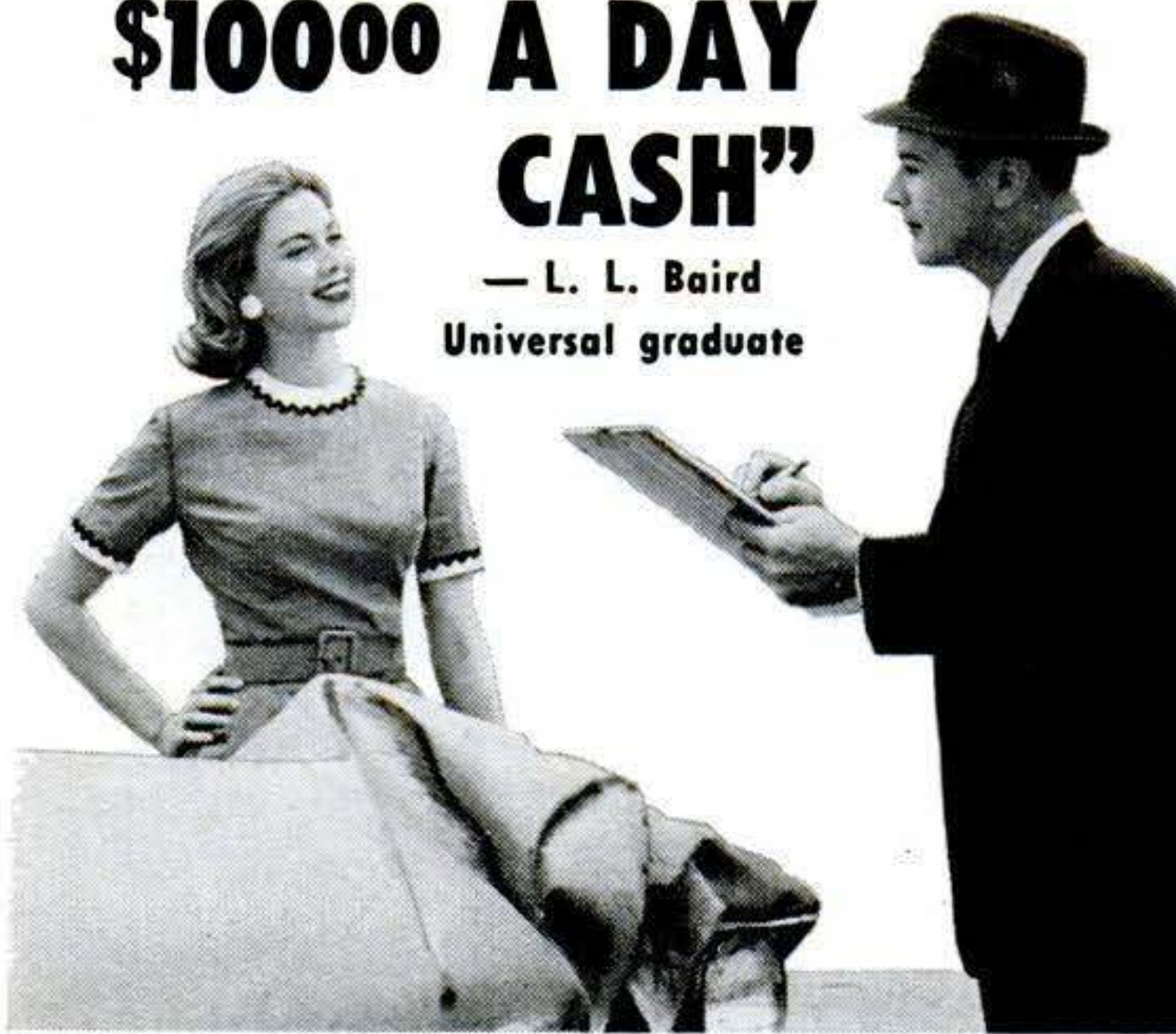
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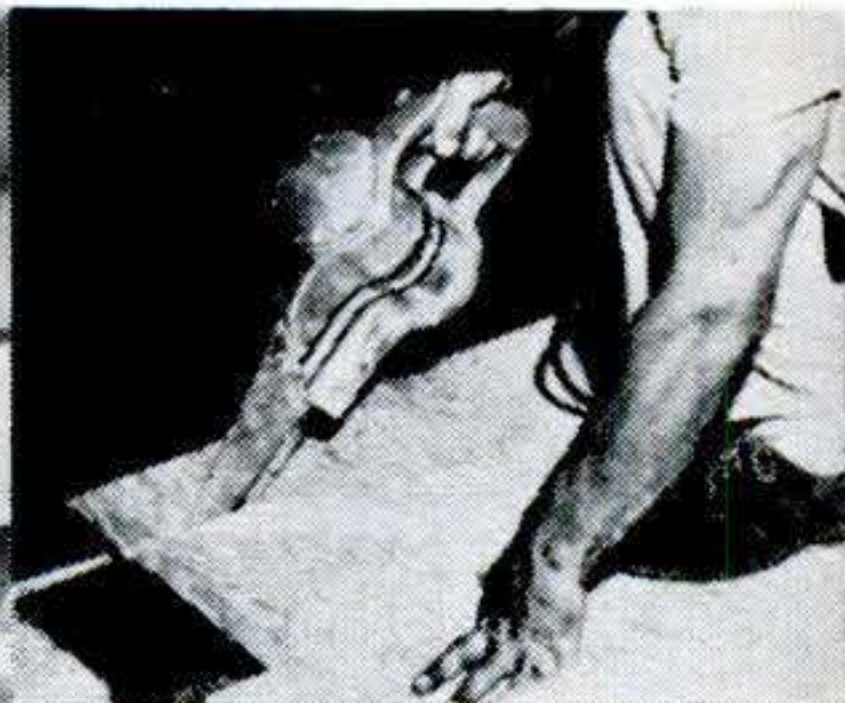
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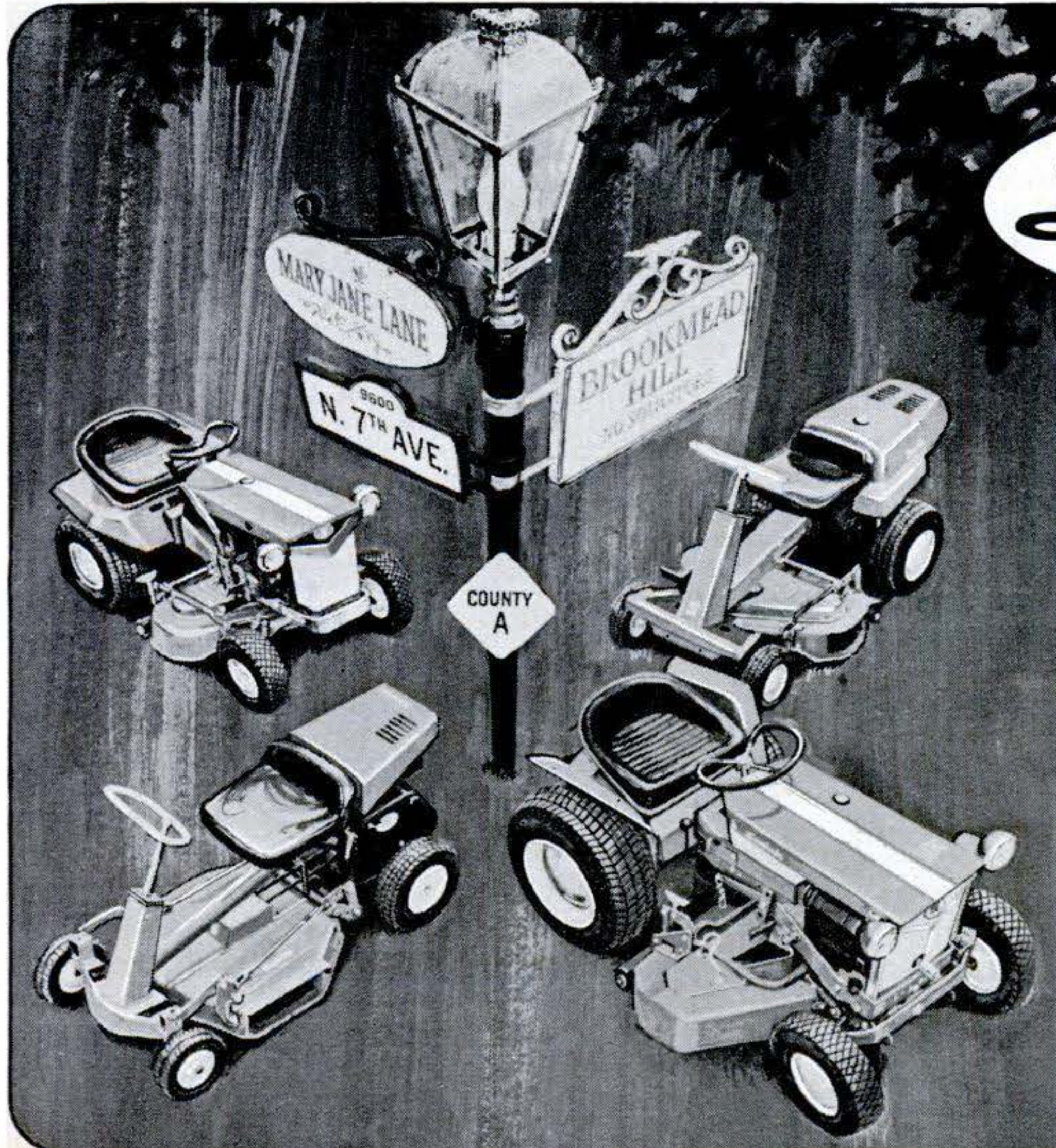
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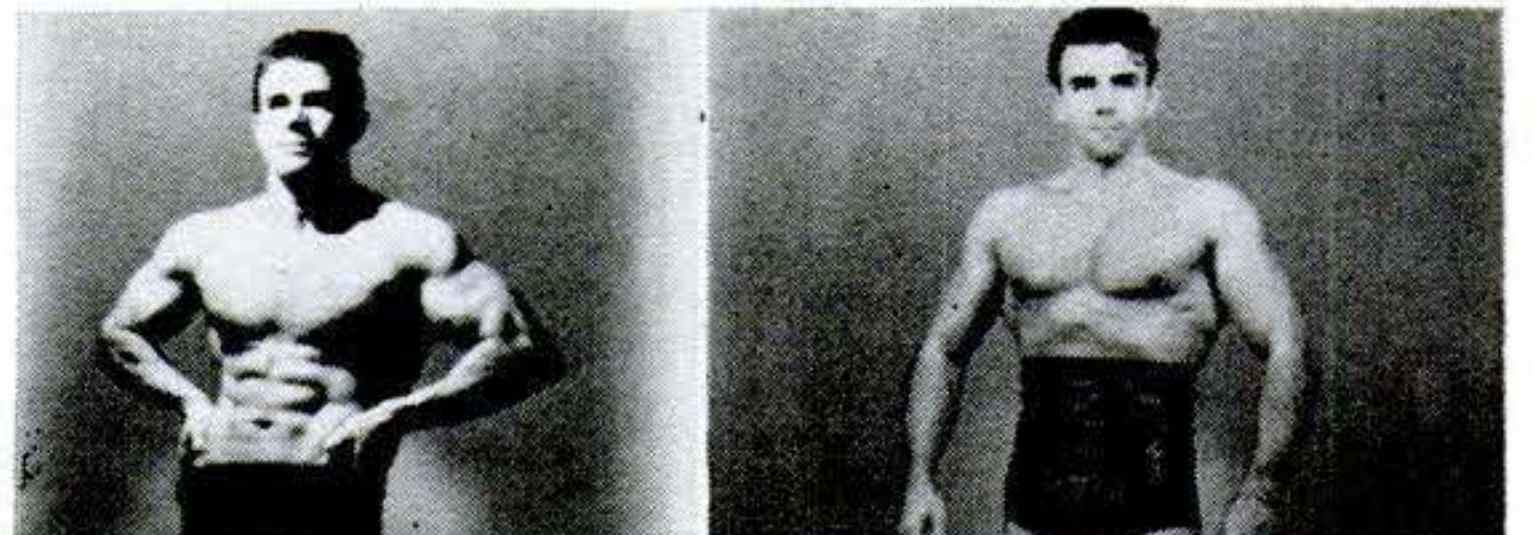
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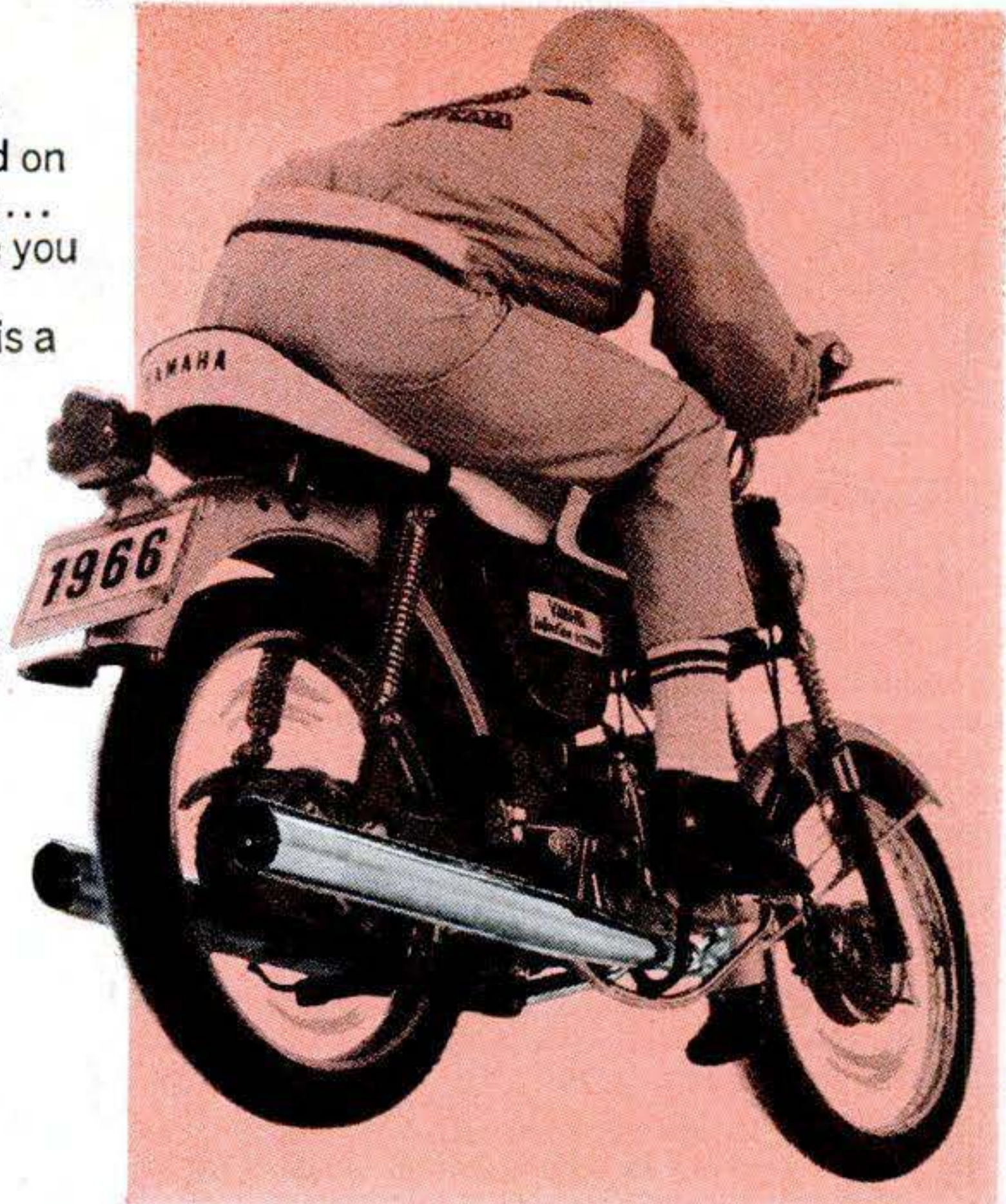
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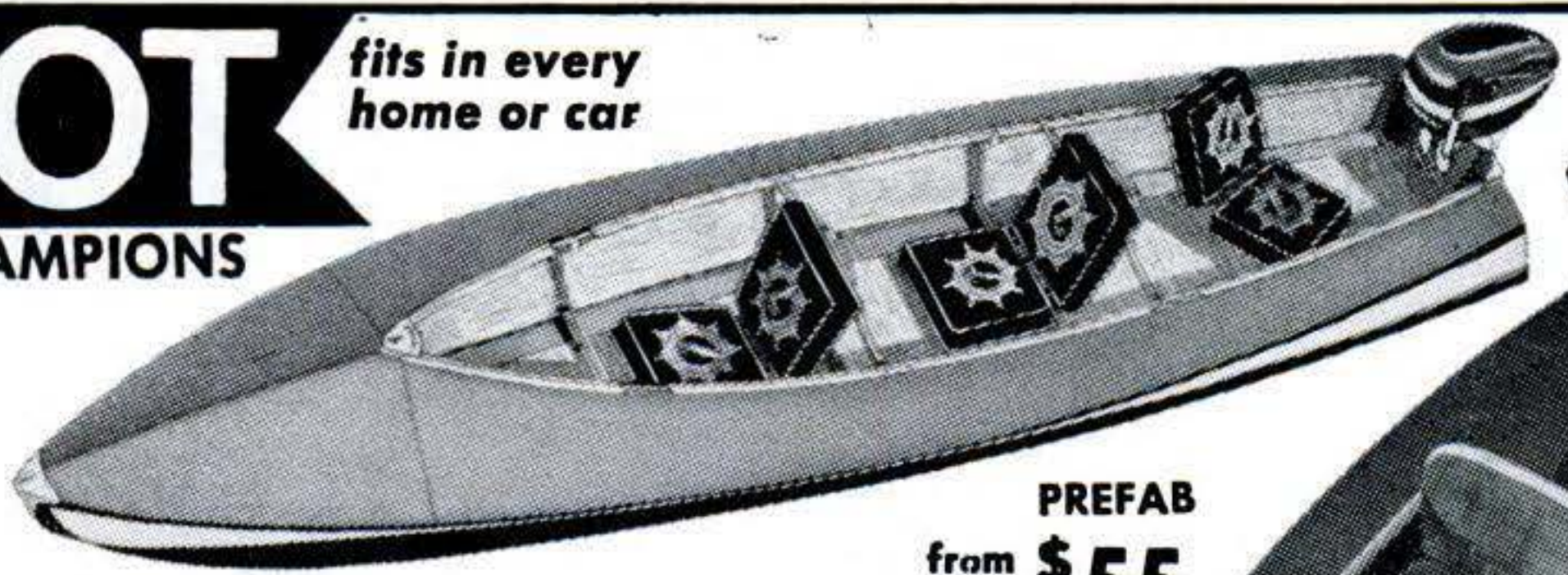
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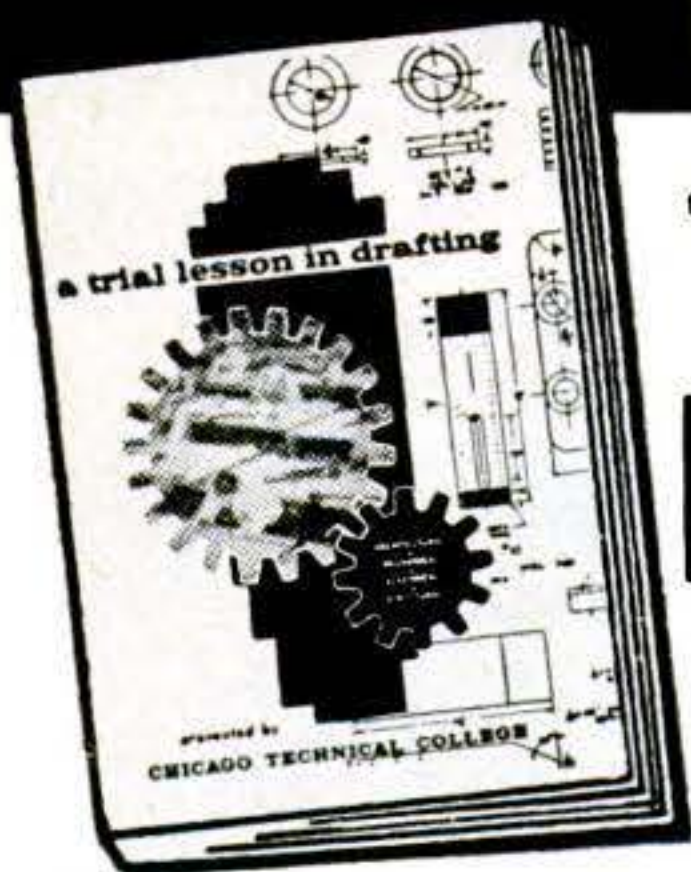


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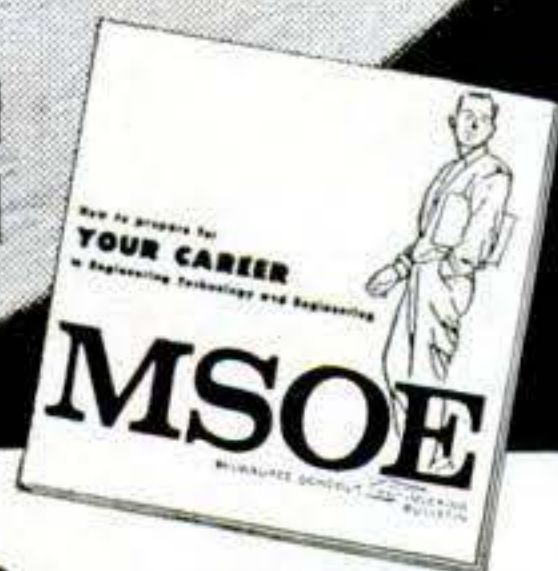
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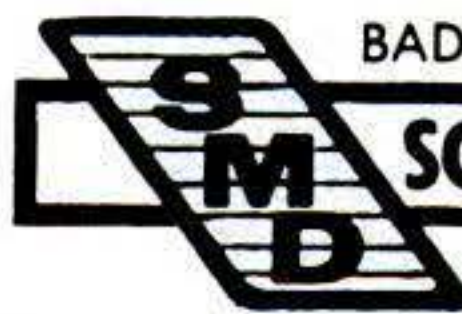
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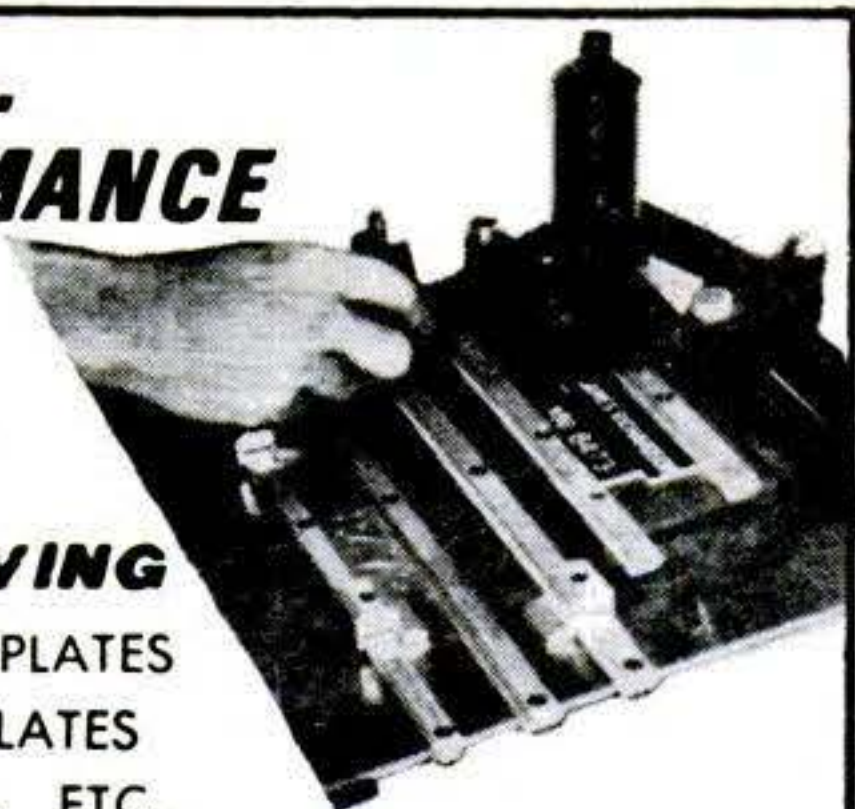
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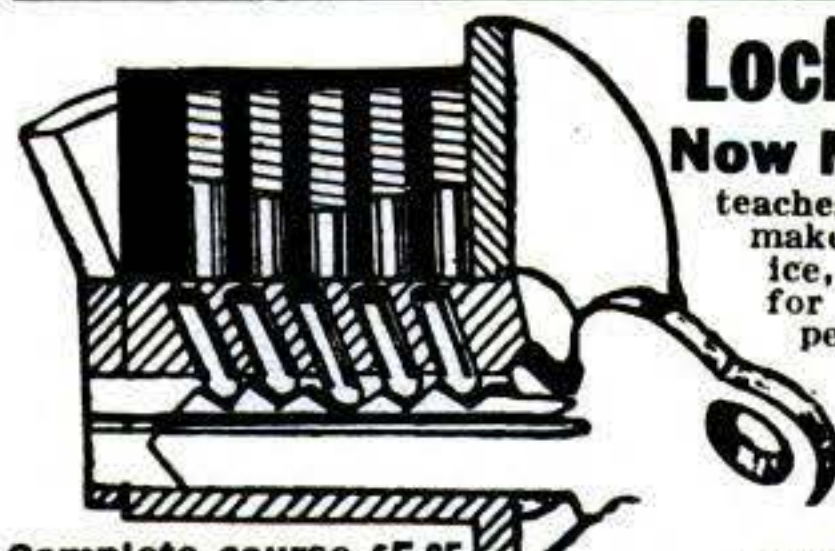
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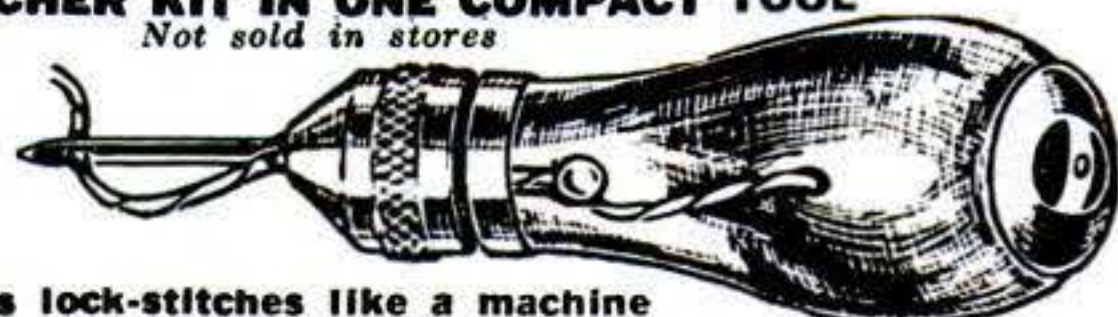
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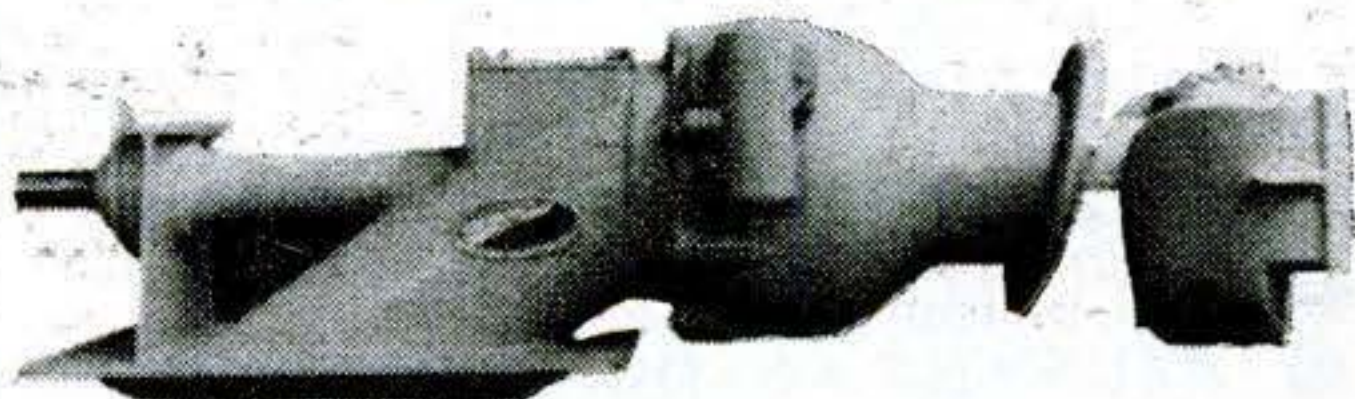


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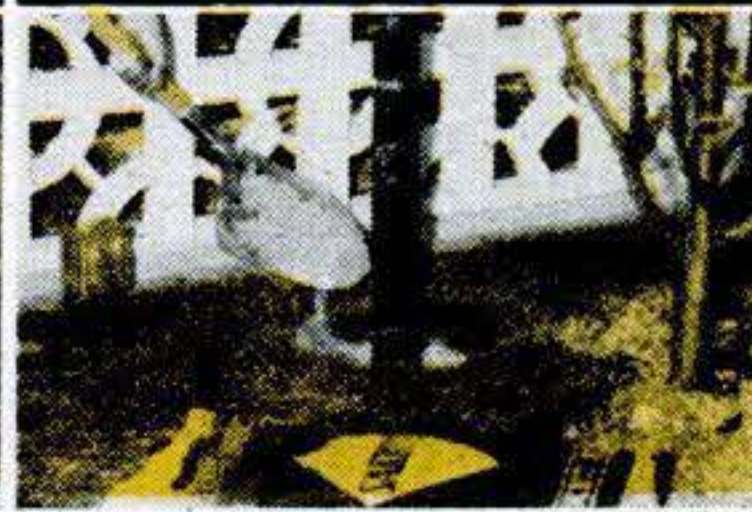
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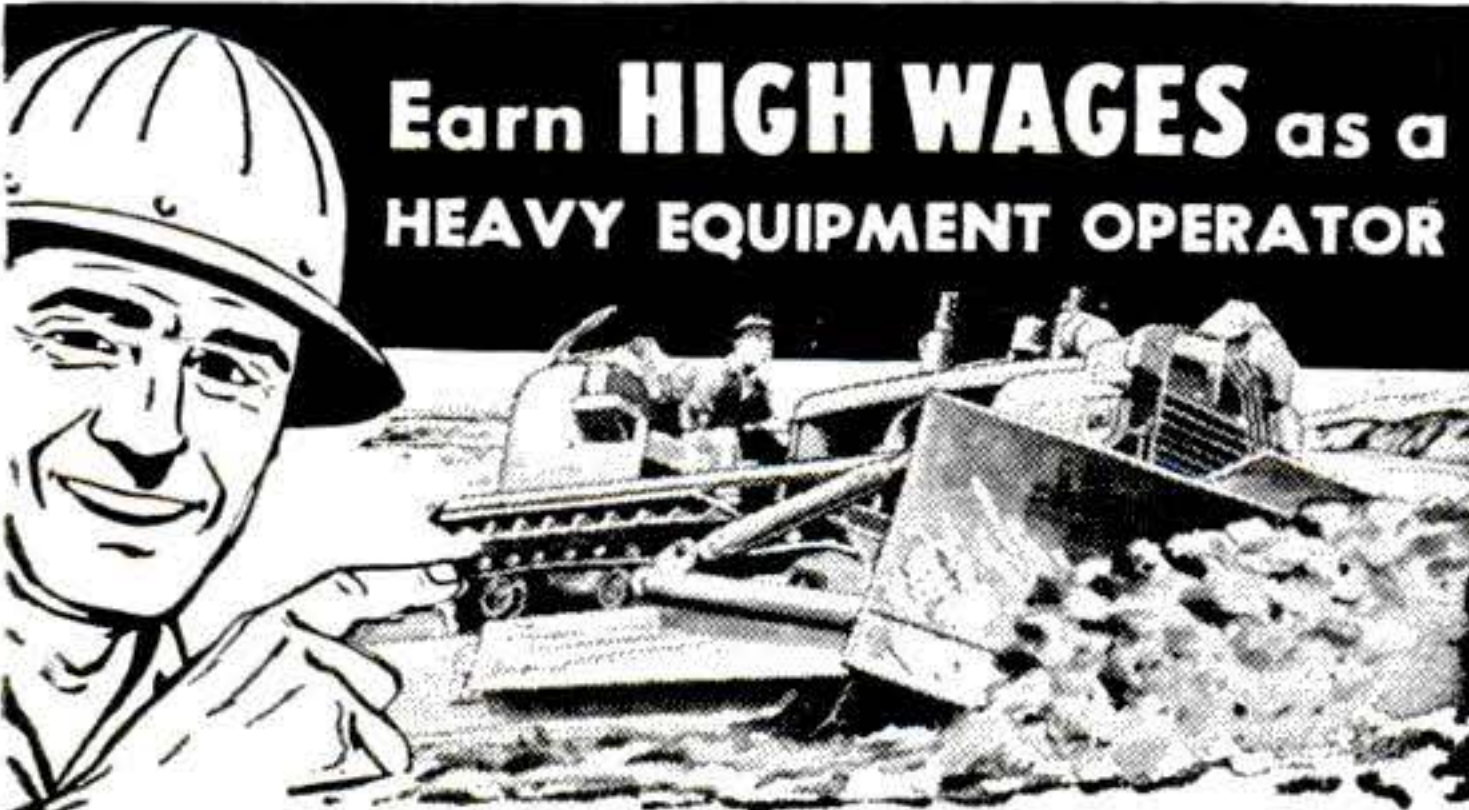
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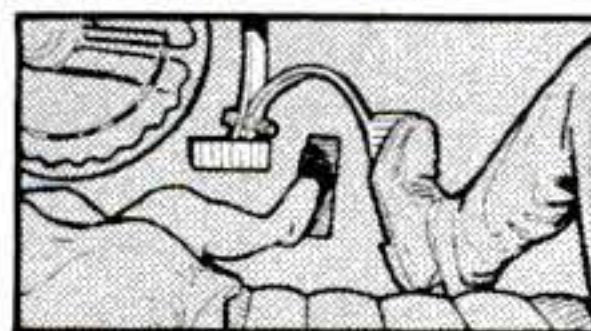
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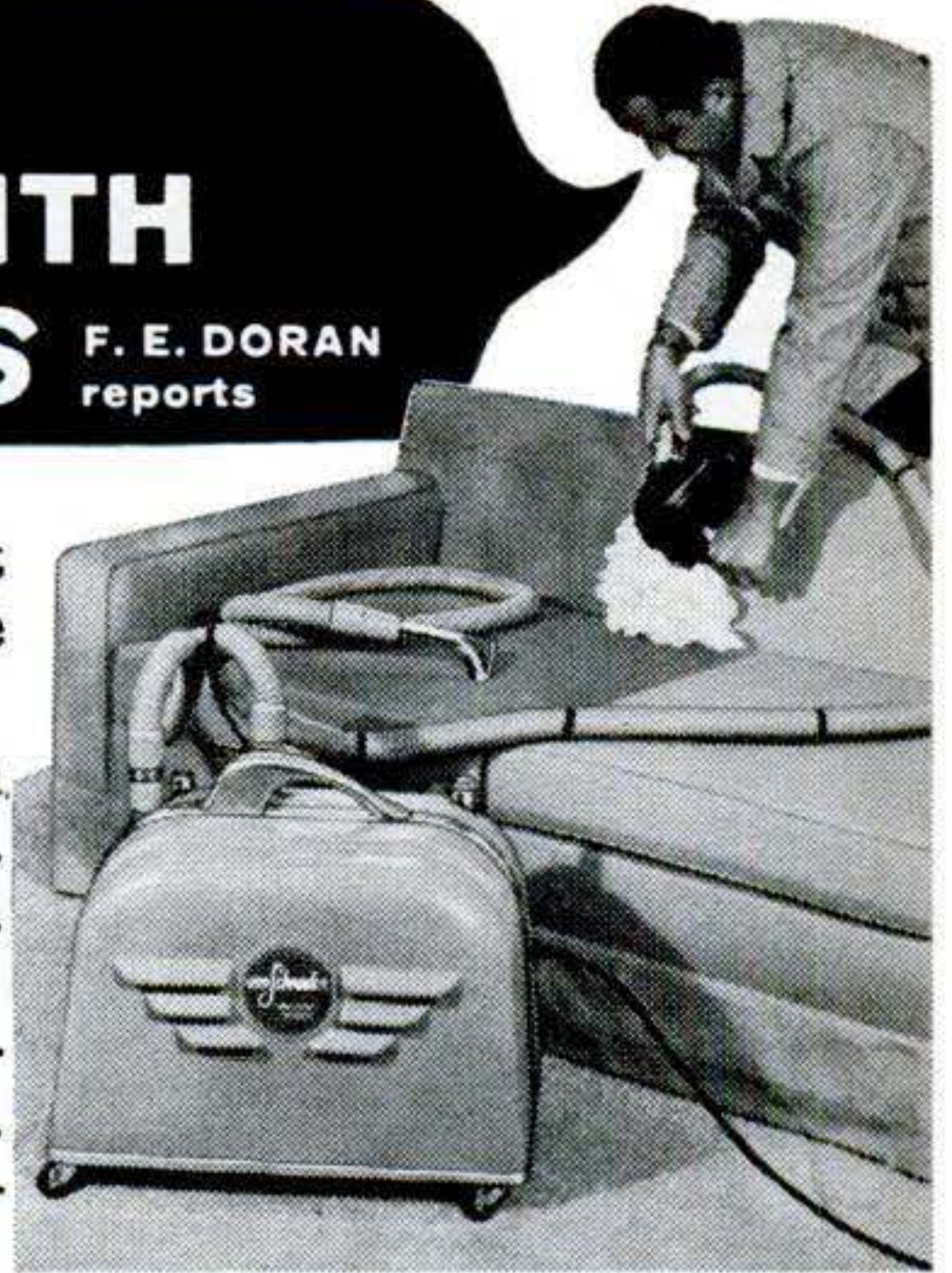
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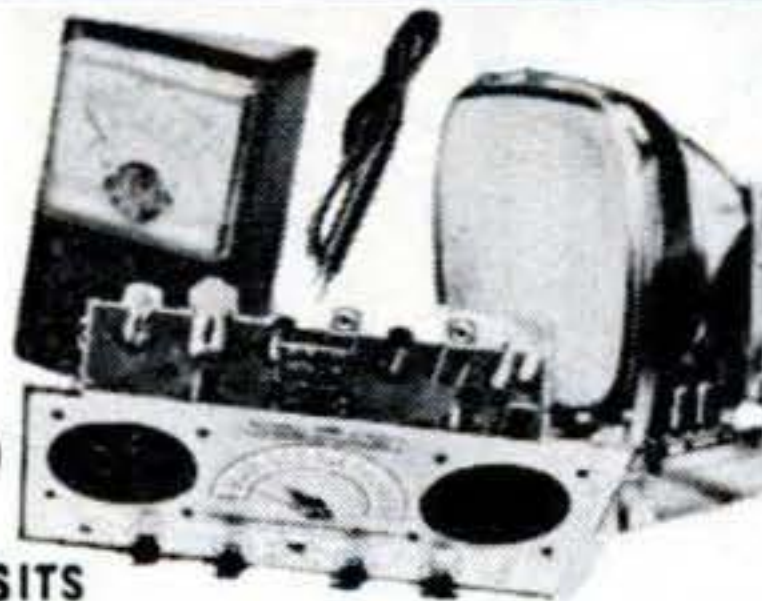
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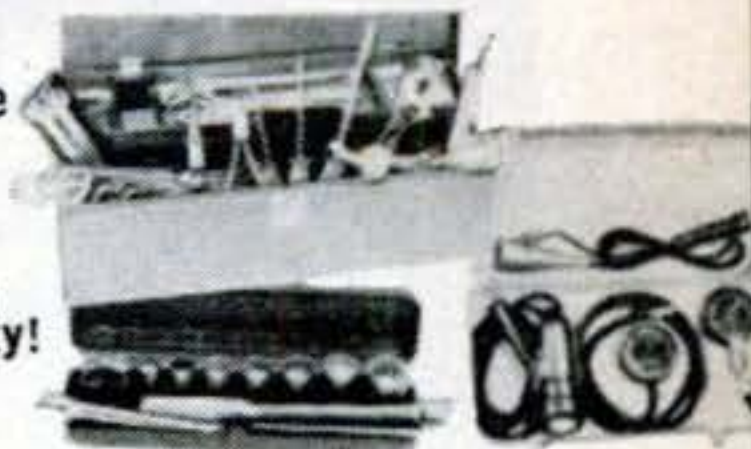
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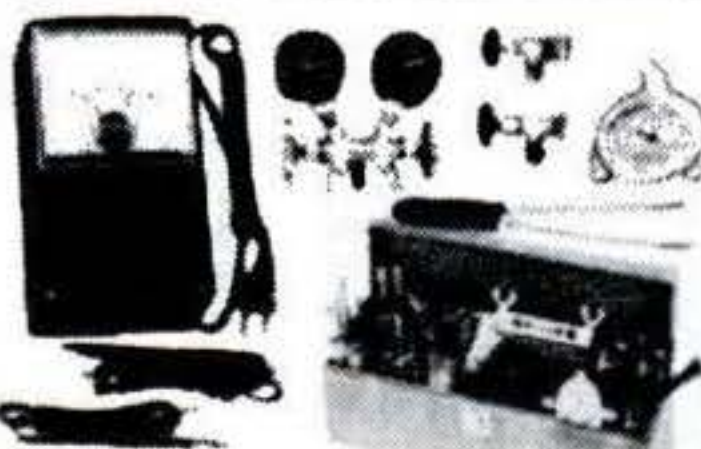
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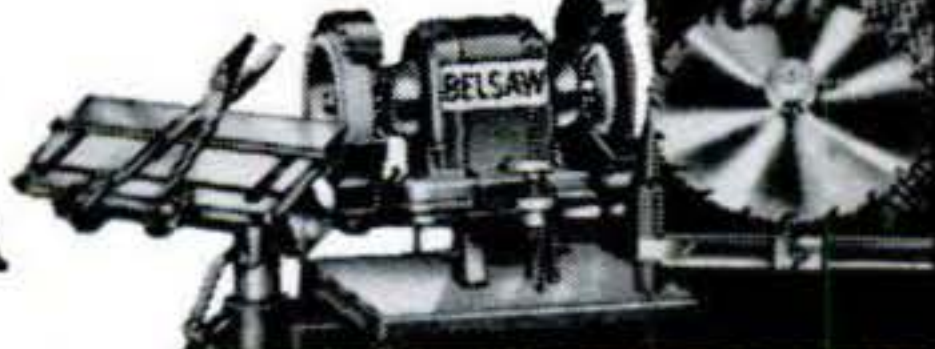
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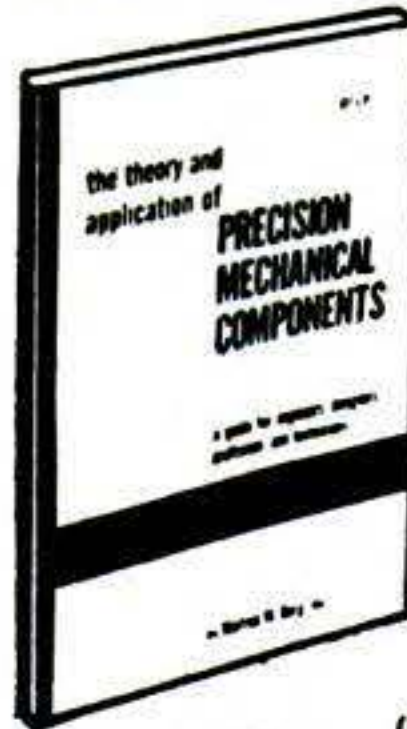
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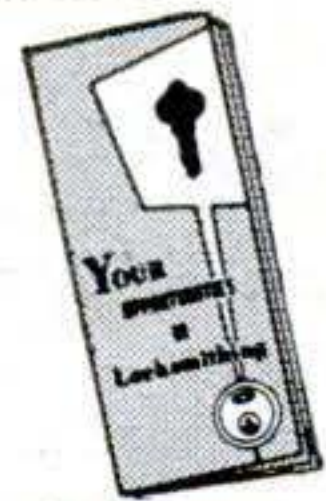
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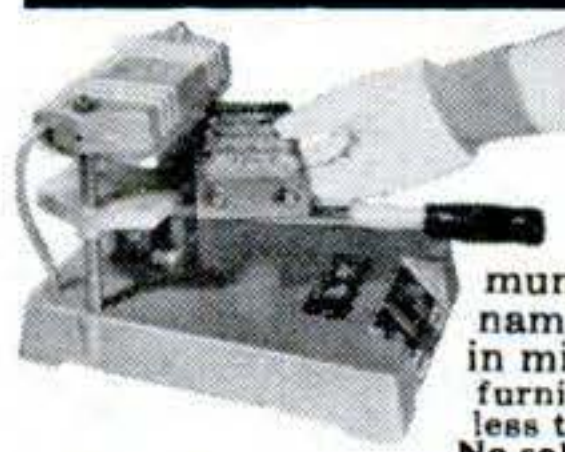
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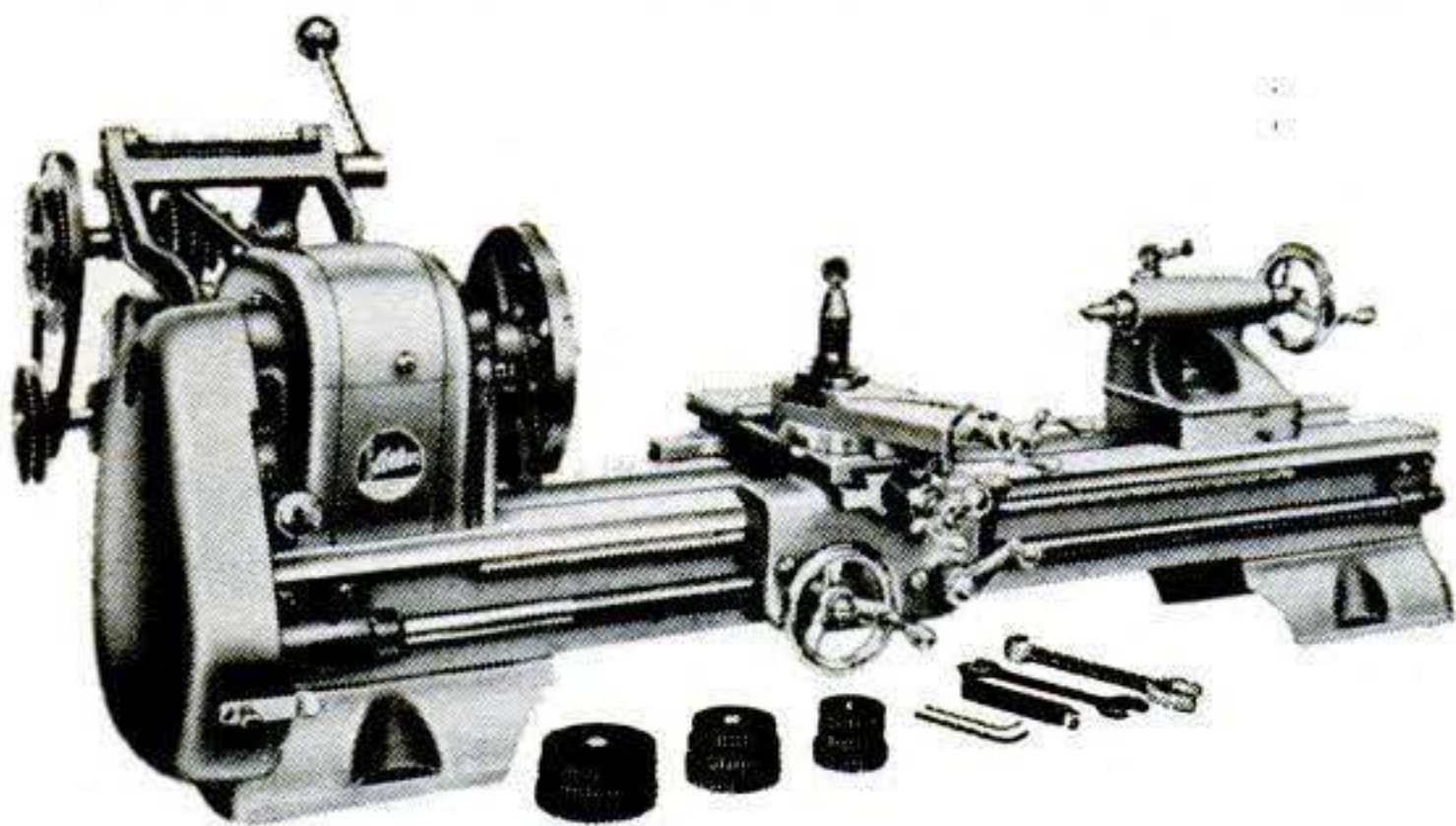
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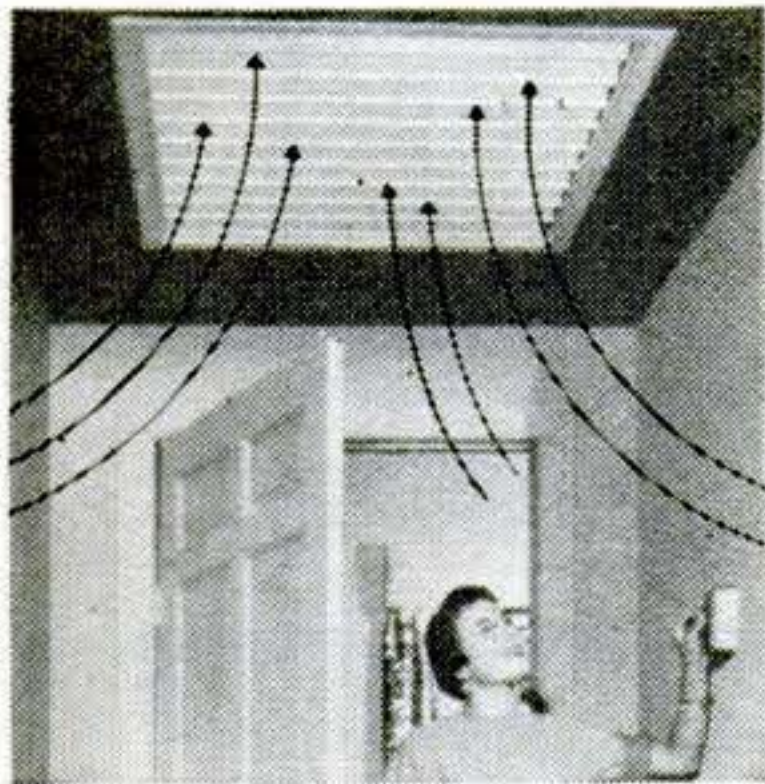
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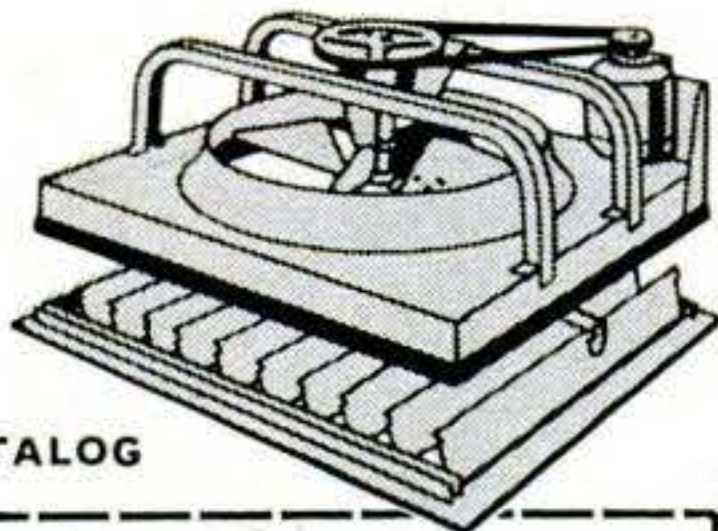
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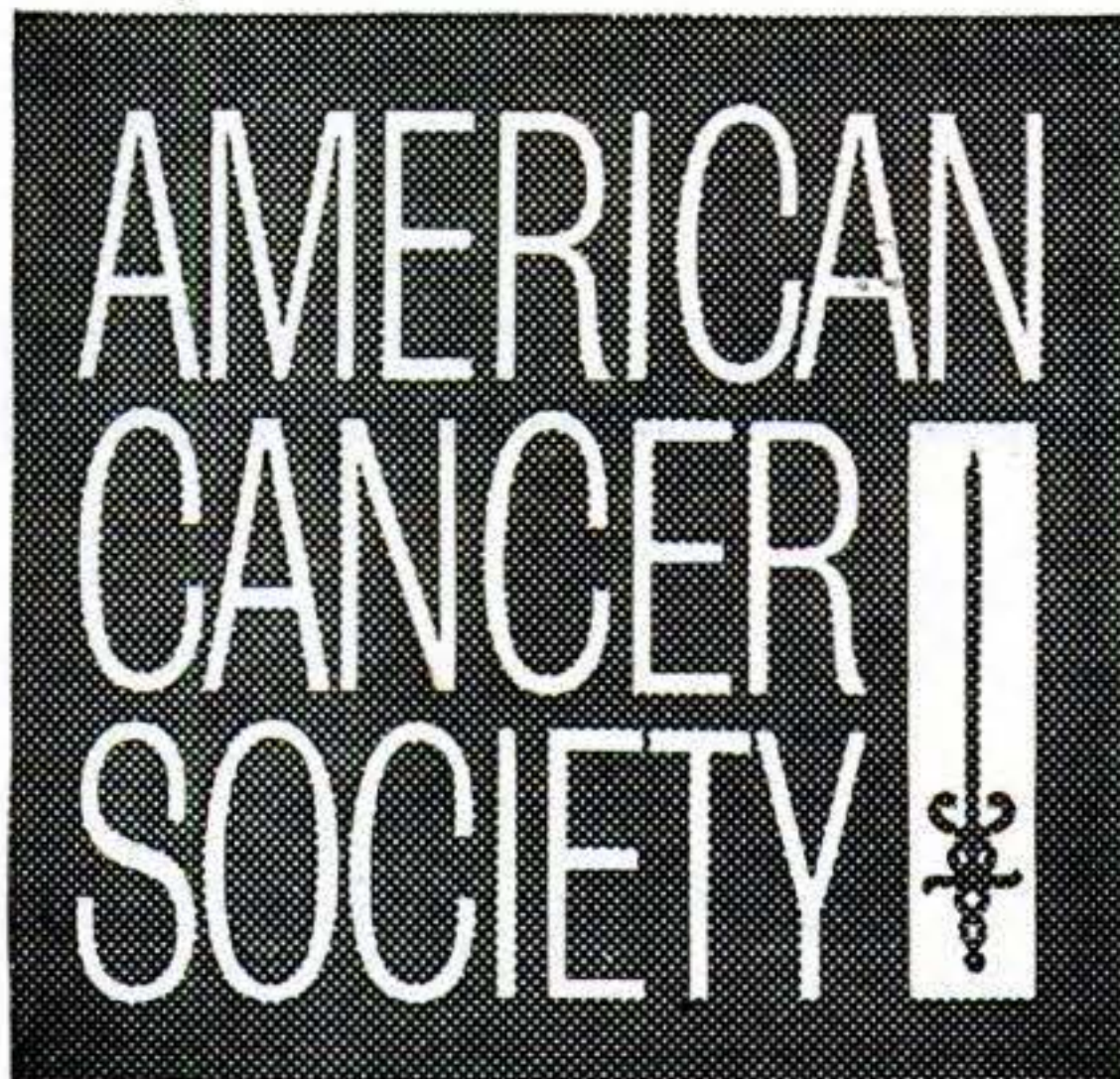
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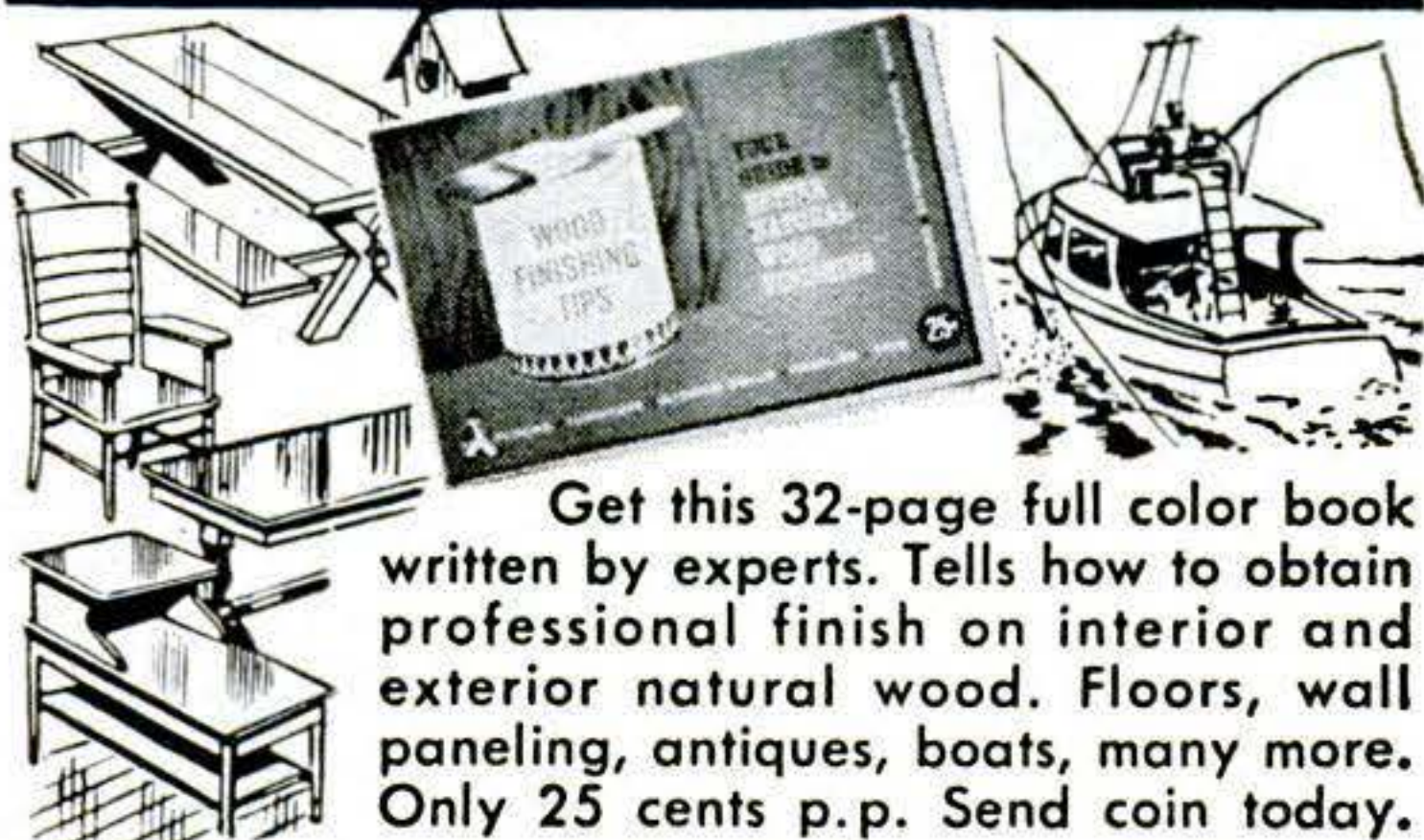
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Detroit Report...

DODGE'S DART AND PLYMOUTH'S VALIANT AND BARRACUDA will be completely restyled for 1967. I was told that these cars will now get an up-to-the-minute look, with long, sloping hoods and short decks. The Barracuda will continue as a fastback, and new fender lines will distinguish it more from the Valiant. According to rumors, all wheelbases will be increased three inches--bringing the Valiant to 109 inches and the Dart to 114.

The Panther is coming along as planned. The design and engineering for Chevy's anti-Mustang are about to be frozen, and tooling is proceeding on schedule. Some 300,000 units are planned for the first year. About 80 percent will be assembled at Norwood, Ohio, 20 percent at Chevy's Los Angeles plant. There's a rumor that only V-8 models will be made at first: Chevy won't use either the 230- or the 250-cu.-in. pushrod sixes in the Panther and may prefer to wait until Pontiac can deliver enough overhead-cam sixes. Incidentally, Ford has a Mustang with an overhead-cam Pontiac six running around.

The 1967 Mustang will keep the same silhouette. It has a new grille with a larger horse in the center, and the tail lights are blended into the body. There are some molding-area changes on the side, with a flare-out behind the door line. All body styles continue (notch-back, fastback, and convertible). The new 285-cu.-in. V-8 may become optional. The chassis will have wider track both front and rear (58 inches), longer wheelbase (111 inches), and all suspension parts will be new (shared with the Falcon/Fairlane group).

Cadillac's front-drive job will have the regular 429-cu.-in. V-8—not the experimental overhead-cam V-8. The drive-train configuration is not identical with that of the front-drive Olds, although the two will share many components. The suspension systems will be pretty much the same, and the Cadillac will share Fisher's E body with the Riviera and the Toronado. The Cadillac styling will stress sportiness, thus avoiding competition with other Cadillac models and presenting less of a challenge to the Toronado. The one-piece grille has a massive mouth-organ pattern, and the tail is squarish, in keeping with the Cadillac theme.

Corvair to be phased out? There has been little open talk about this possibility, though the Mustang is outselling the Corvair about four to one. Corvair has Detroit's only remain-

ing aluminum engine, however, and we hear that Chevrolet has canceled the contract with the supplier effective at the end of the '67 model year. That does not necessarily mean the end of the Corvair, however. Chevy is now testing cast-iron V8s in the Corvair, and this may be what they have in mind for '68.

Lincoln-Mercury's answer to the Mustang is due next fall. It's called the S-77, and the wheelbase is 113 inches. The body has rounded lines, contrasting with the square, crisp lines of the Mustang. Only a two-door coupe is planned at the moment. Both headlights and tail lights are hidden. The rear fenders have some dated lines—remember the Dodge Lancer? The grille is split vertically and has a number of vertical separations on both sides. People who saw early mock-ups said it looked like another Edsel—I'm telling you it does *not*.

Rambler is expected to push for 1967½ introduction of their Corvette-like AMX (see page 130). The basic model will have the new 290-cu.-in. lightweight V-8. A bored-out block, giving 325 cu. in., will be optional. The body may be built of fiberglass.

The grille on the '67 T-bird covers about twice the area of an average grille. It's a one-piece full-width stamping with a honeycomb pattern. The hood line is straighter than in '66, giving the car a blunter nose. It will not have pop-up headlights—Ford's engineers are against them and will not give in to the stylists.

The radials are coming: Ford has been testing Michelin X tires on light and intermediate cars, and has given the okay for radial-ply tires on the '67 Mustang. We may also see them on the Falcon and Fairlane. Biggest problem now: supply. Goodyear will not be able to make the needed 5,000 tires a day till Nov. '66.

Jan P. Norbye
Automotive Editor

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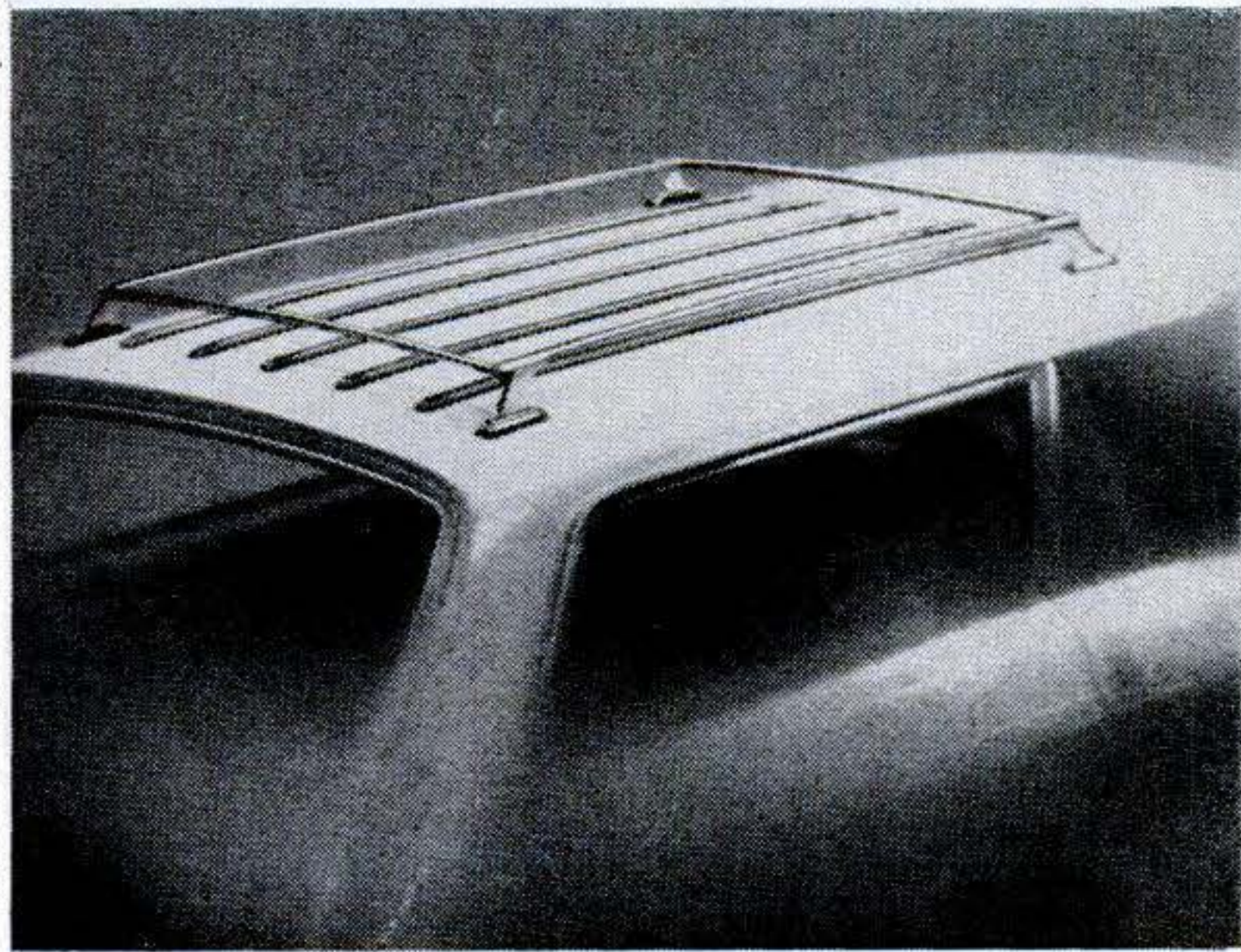
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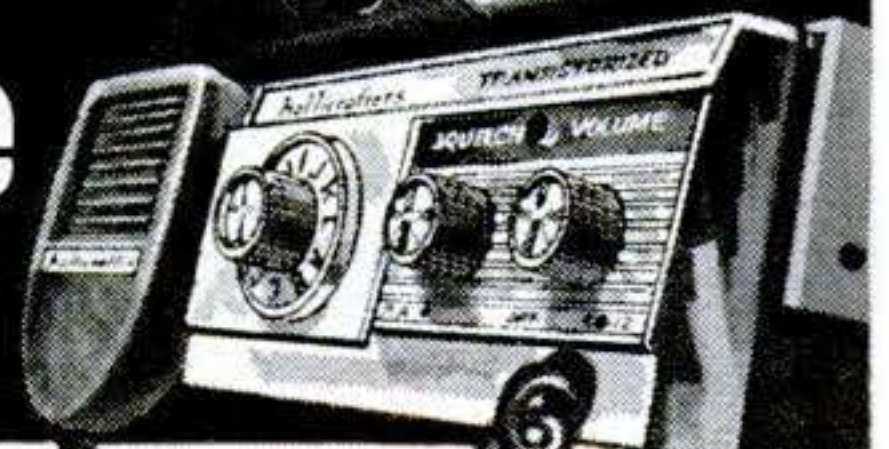
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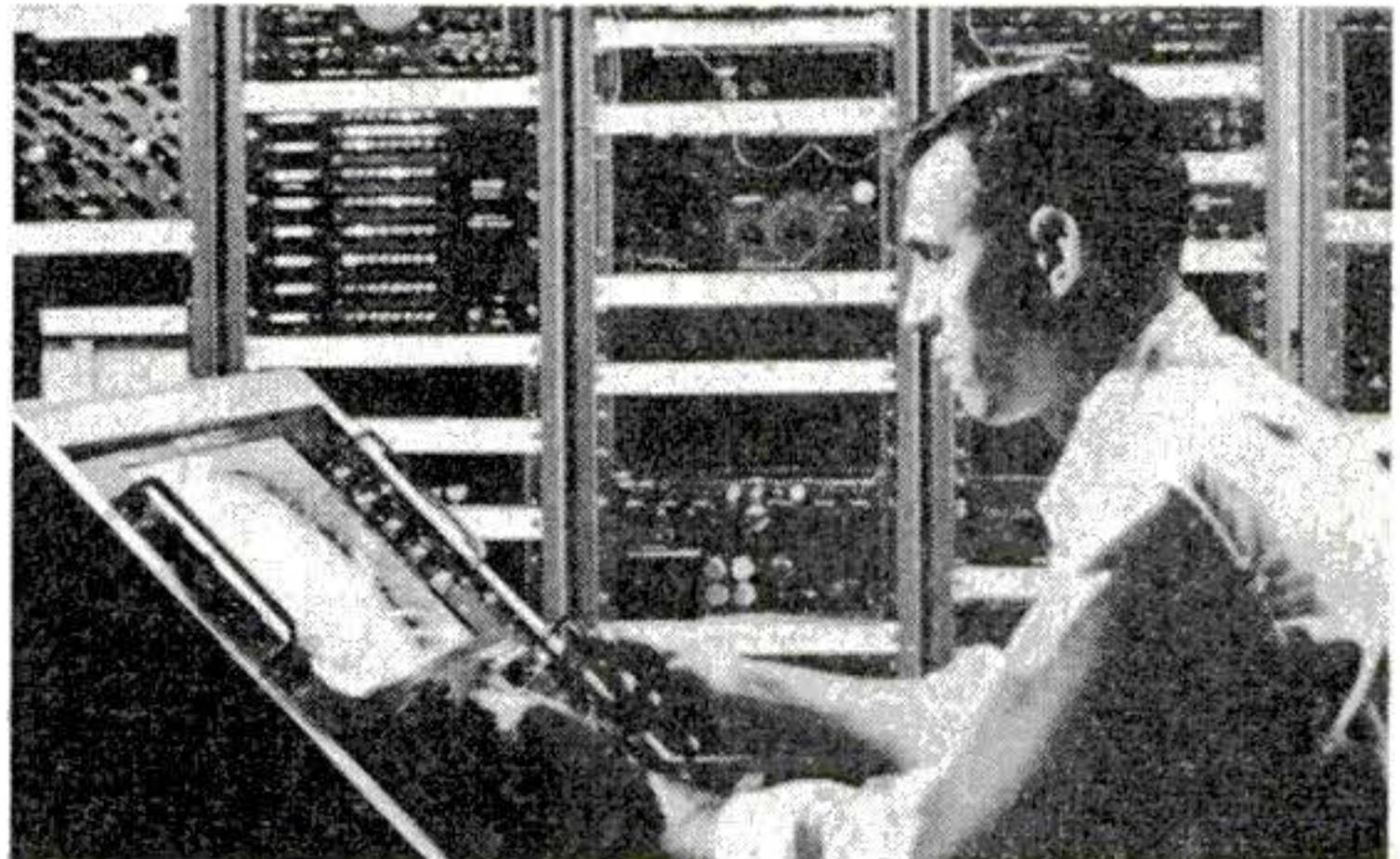
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**WHAT'S NEW
FOR YOUR CAR**



Easy-to-install bucket seat

The Trimride bucket seat has no springs, uses foam rubber. It comes in three parts (frame, bottom, backrest), adapts to any truck, sports car, bus, or utility vehicle. Mounting bracket is hinged for tilting, slide assembly allows fore-and-aft adjustment, upholstery is Ford vinyl (choice of 10 colors). Warshawsky & Co., 1900 South State St., Chicago, is the maker.



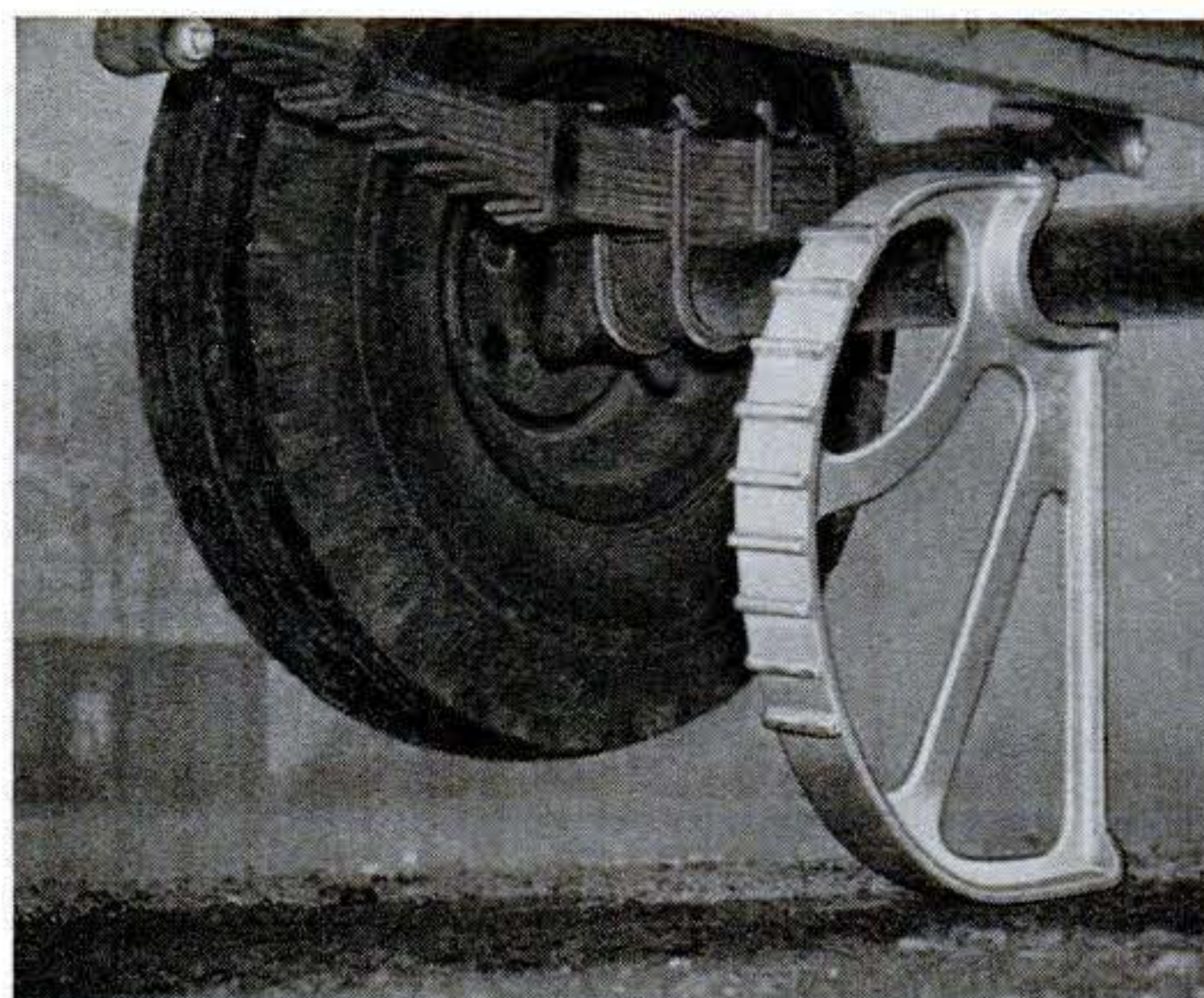
Portable car desk goes everywhere with you

A simple metal frame that hooks over the back of the car seat allows easy installation of this car desk without tools. The 12-by-20-inch clipboard folds up against the seat back when not in use, and is detachable so you can take it along if you wish. The desk is strong enough to hold a portable typewriter. PS's Auto Editor uses one to keep fuel-economy records on trips and for taking notes during road tests. Undo the thumbscrews and you can shift the desk to the back seat; it makes a fine table for lunches or children's games on long trips. It sells for \$12.95, from Mishek's, R.R. 4, Waseca, Minn.



Snap-in, snap-out tow-car mirrors

When you tow a trailer, you need mirrors to see around it; but when you unhitch, you don't want mirrors that add a lot to the width of your car. These new snap-in, snap-out ones can be mounted on either the fenders or the doors. You have a choice of mirrors made of stainless steel or a new-formula plastic. Velvac, Inc., 2081 South 56th St., Milwaukee, Wis. 53219.



Trailer jack with no moving parts

The average trailer cannot be jacked up with the jack in your car. The Kwik-Lift will fit round or square axles of most boat trailers, house trailers, and utility trailers weighing up to around two tons. It rolls into place to its full height when the tow car is moved forwards or backwards. The jack costs \$9.95. Conlan-Sieloff Industries, Box 372, Bloomfield Hills, Mich.

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New power: 250 hp V-8 engine or Hi-Torque 6. Options galore: Turbo Hydra-Matic* automatic transmission; power steering, power brakes; the smoothness, comfort and response you expect in any fine wagon. Plus "picture window" visibility. Your family will be safer, go more places, have more fun, in a 'Jeep' Wagoneer with 4-wheel drive. Drive it! **KAISER Jeep CORPORATION**
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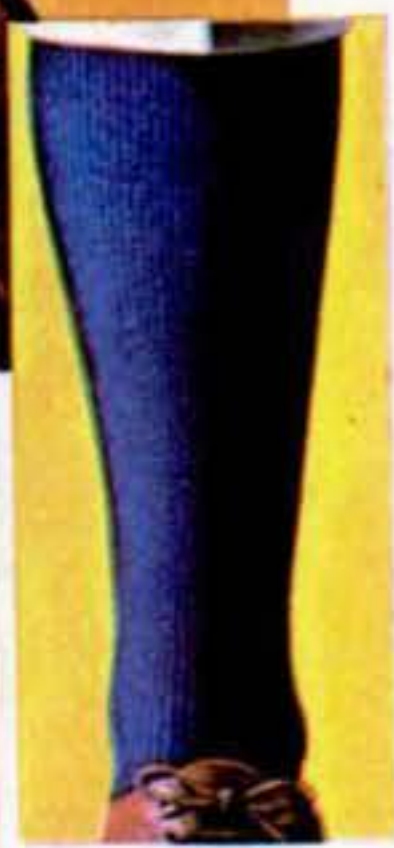
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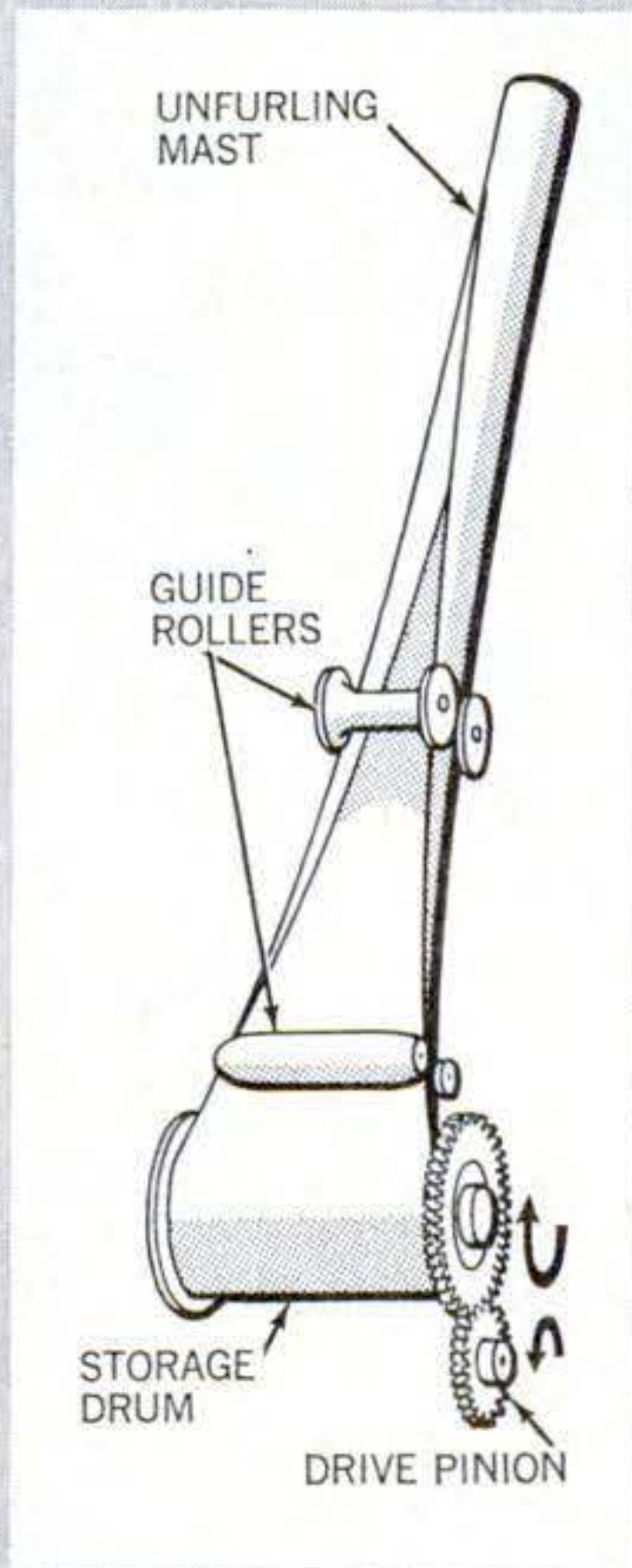
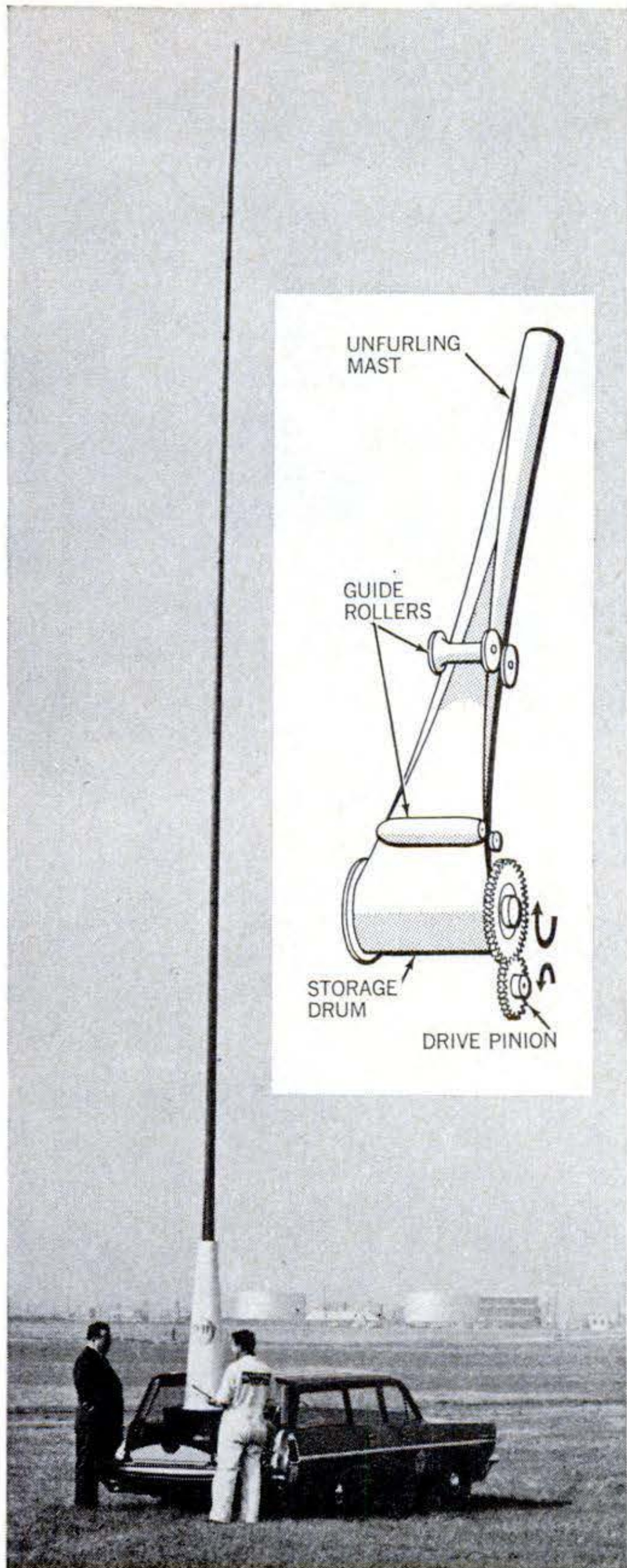
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Roll-up mast extends to 40 feet

A 40-foot tubular mast can be rolled up like a carpenter's steel tape to store on a drum and fit in a station wagon. Designed by researchers for de Havilland Aircraft of Canada, the mast is made of strip metal, heat-treated into circular sections so the edges, flattened when wound on the drum, overlap when unwound and stress is released. When extended, it has the strength of a seamless tube of the same diameter. It can be used either as an antenna or a boom.

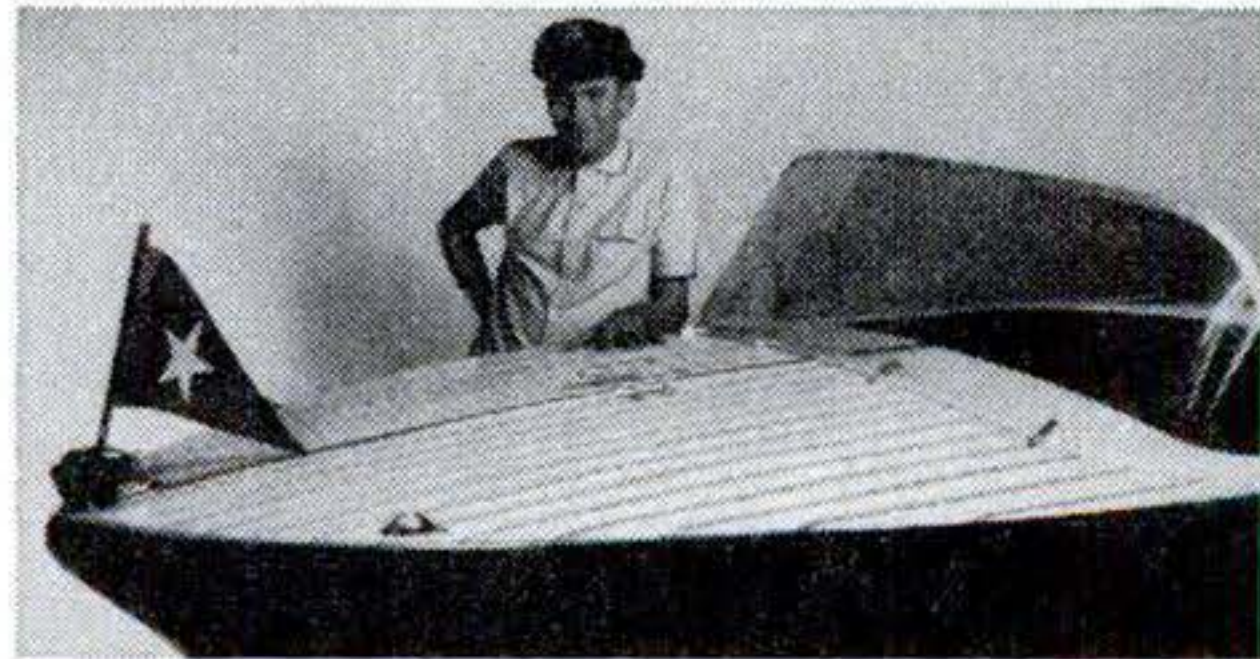
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1. Eleven year old hull still sound, but deck needs refinishing. Nautolex eliminates days of hard work, restores beauty at low cost.



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Four h.p. engine gives you the power for any mowing job . . . four speeds forward (plus reverse) means there's a speed to meet the cutting need. Add up all the features of the Fairway-4 — 26" rotary mower; rear-mounted engine; easy height adjustment; meets American Standards Assn. safety standards, and you have plenty of reason for its choice. See your Ariens dealer or write for free details.



Ariens COMPANY

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Arabesque decorates hard hat

Delicate Persian hand-embossing changes this once-ordinary construction worker's helmet into a work of art. The hard hat, issued to laborers building an Iranian dam, fell into the hands of a local craftsman. When it showed up at a village bazaar elaborately engraved, it was bought and brought home by an engineer for Aluminum Company of Canada, the original makers.



Air cells hinged to vehicle's tracks

Inflated rubber bags form treads on a tracked Army vehicle called PATA for Pneumatic All-Terrain Amphibian. Individual air cells, consisting of an outer shoe and inner bladder, are hinged to each other in a continuous belt. Punctures—even five consecutive flats—won't stop the vehicle as it rolls over rough ground, swamps, marshland, and open water. The hold will seat 10 fully equipped combat soldiers or carry 1½ tons of cargo.

Did we goof by making FORD No.1 in Pickup ride?

That is, are we risking our pickup's hard-earned reputation for ruggedness by giving it the smoothest ride going?

Not at all. Twin-I-Beam suspension is our insurance.

It works like this... each front wheel has its own axle—a forged steel I-beam, like big truck I-beams. They work independently, so that shocks at one wheel don't get passed to the other.

Or to the driver.

Ford also puts husky

I-beam radius rods up front to hold wheel alignment and reduce tire wear.



Together, they make an independent suspension that no other pickup can match for smoothness... toughness.

Engines are smoother, too. Two big, new, seven-main-bearing Sixes have such performance, we had to develop a new V-8 to stay ahead of them.

So are we worried? Not when our biggest concern is building enough to meet the demand. So far this year our sales are up 25 percent.

Come on in and check us out. Action-test a new Ford today.



BRAND-NEW

NOW—A BIG, BEAUTIFUL LINE OF OUTBOARDS

CHRYSLER 105

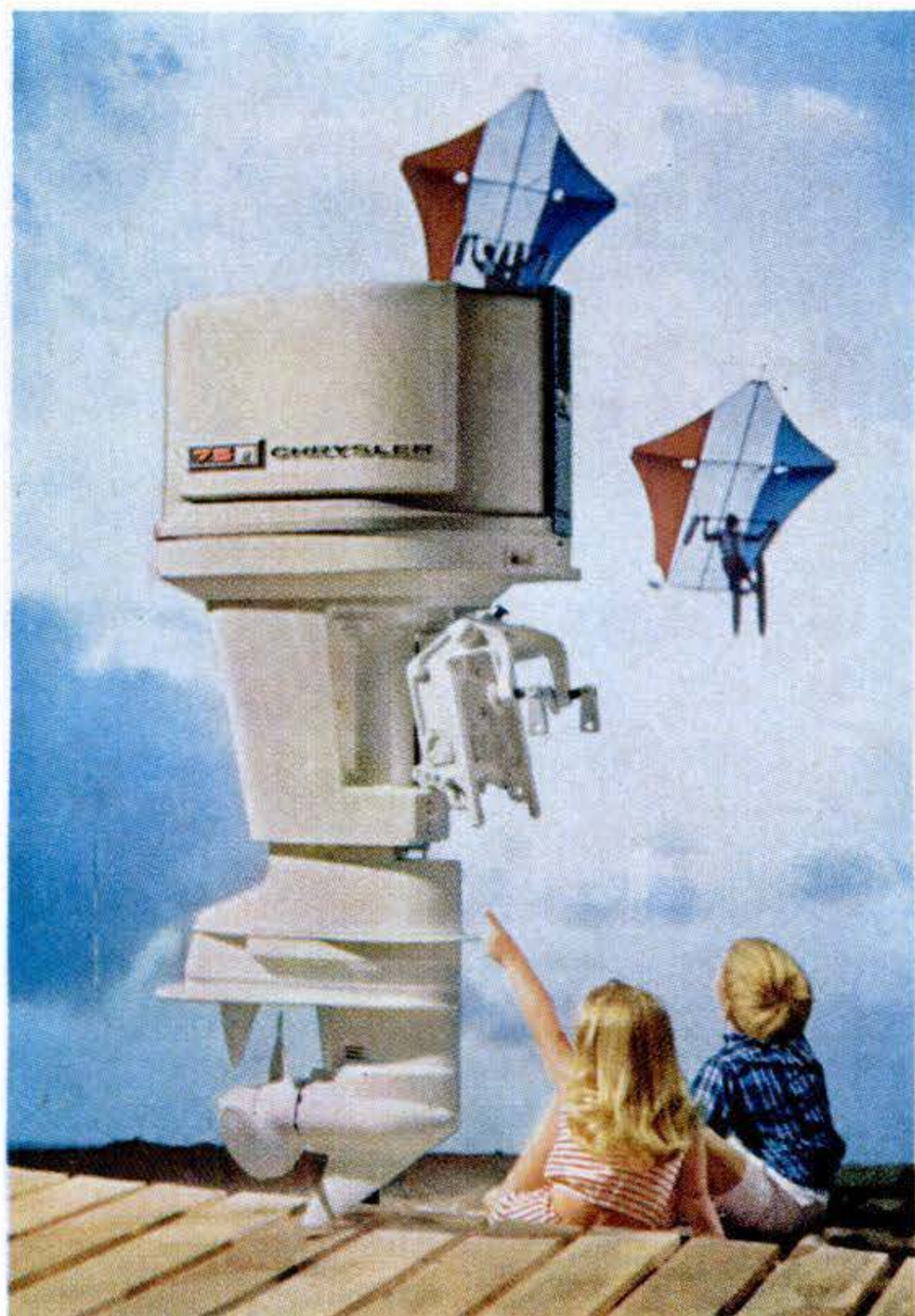
Want *top power*? Try Chrysler's spectacular 105 (*most powerful outboard ever certified by O. B. C.**). It puts out more than 25 hp. in each of its four mighty cylinders. Packed with premium-quality features: V-reed intake valves, hydraulic shock absorbers, full-length silencing, optional remote controls and power-tilt. Try it! You'll never be happy with less!

*Outboard Boating Club of America - official reporting agency for Boating Industry Association.



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Seventy-five horses of dependable power for action-packed boating fun. New in engineering design, beautifully new in styling. Long-life, "million dollar" baked-enamel finish in snow-white and royal gold. Develops a full 25 horsepower per cylinder, for more power, less weight. Same quality features of Chrysler 105. Hydraulic shock absorbers optional.



BRAND: CHRYSLER

FROM THE POWER PEOPLE...THE CHRYSLER CREW

CHRYSLER 50

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Here's big news in boating . . . a complete power line of slick, quick outboards, styled and engineered in the Chrysler tradition of leadership. Brand? Chrysler! Reputation? Quality!

Superbly styled in gleaming white and gold, to enhance the good looks of any boat, the new Chrysler line features a broad range of horsepower selections: 3.5, 6, 9.2, 20, 35, 45, 50, 75 and a spectacular 105 (see left). Choose from 21 different models, including two new Chrysler "AUTOELECTRICS"—electric starting 9.2- and 20-horsepower fish 'n fun engines with unique 360° utility light, electric starter-generator and optional remote control.

Before you buy *any* outboard, get the story on America's brand-new brand in outboarding: *Chrysler*, built by the power people. See your nearby Chrysler Outboard dealer today (his name is in your Yellow Pages, under "Outboard Motors"). Chrysler Outboard Corporation, Hartford, Wisconsin.



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CHRYSLER MARINE PRODUCTS—BOATS, TRAILERS,
OUTBOARDS, INBOARDS AND INBOARD-OUTDRIVES



Hovering helicopter controls head-on car crash

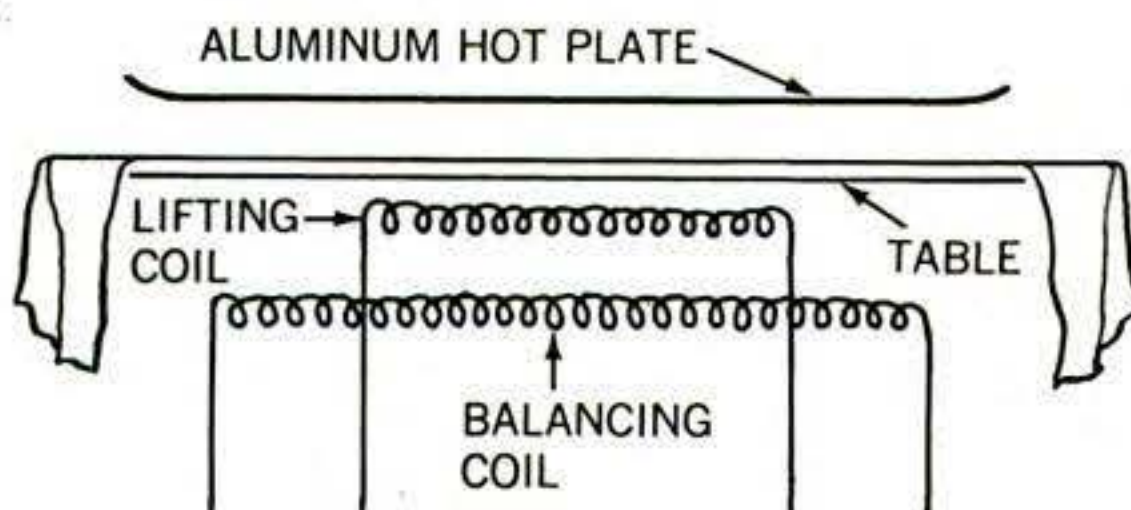
These two cars heading for a 150-m.p.h. crash won't hurt anybody. They are driverless, controlled by radio from the helicopter hovering above them. The crash was staged by Fiat in

Italy to determine how much damage would be done in a head-on smash. The radio-controlled mechanism driving the car at right is mounted on its back; the other's is in the rear seat.



Bacon and eggs grilled in air

A floating hot plate, not for sale, fries bacon and eggs at left. The aluminum hot plate is a conductor. A moving magnetic field is created by sending alternating current through the upper coil, producing lift and heat. The lower coil keeps the plate from sliding off the lifting field. DeVry Technical Institute, Chicago, put on the demonstration.



Magnetic coils are placed under table.

Cadet is for keeps!



12 hp International Cub Cadet® tractor with 48" mower. Like all Cadets, it's built of heavy castings and heavy sheet steel. Direct (no belt) drive. New and faster starting system for 20-below weather. Nothing flimsy. Cadet's no toy; it's a tractor! Year-round attach-

ments include new rotary tiller, snow blower, front and rear blades, wagon and dozens of other tools for man-size lawn, grounds or garden. For the name of your nearest International Harvester dealer, call Western Union by number and ask for Operator 25.

New IH Cub Cadets for '66 are built like a tank, handle like a sports car. Economy or Deluxe models for bristling rough or showcase lawns. 7, 10 or 12 hp. Doesn't matter. All are 100 lbs. stronger than most others. That's one reason 5-year-old Cadets are still worth up to 2/3 their original value. Can you afford to keep on replacing cheaper machines?



International Harvester Company—the people who bring you the machines that work

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Introducing the 2 family car.

The population explosion hasn't caught us sleeping.

We made the Volkswagen Station Wagon big enough to hold about twice as much as a regular station wagon.

So why not two families?

There'd be seats enough (9). And luggage space enough (13 pieces). And enough windows to go around (21).

Also, you'd be able to split fuel bills. (It

averages 23 mpg to begin with).

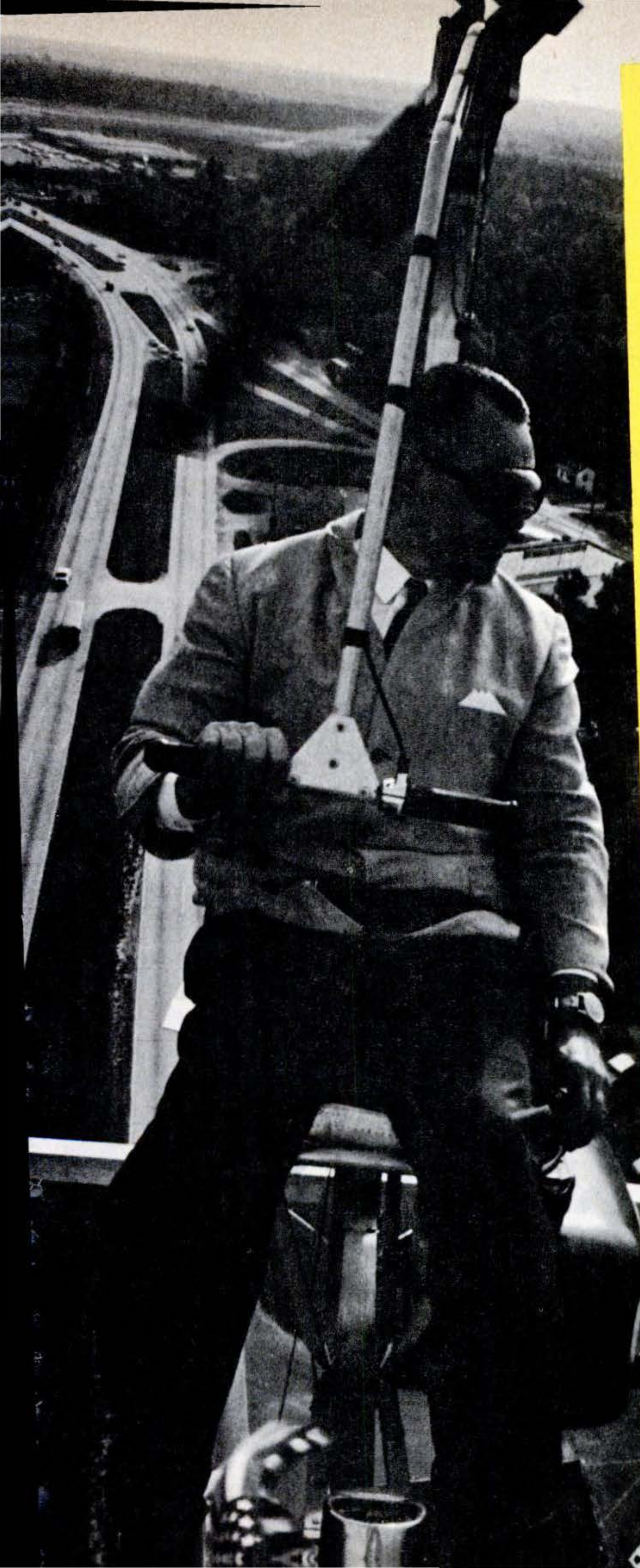
And you could park our 2 Family Wagon in 4' less space than a 1 family wagon.

The problem, naturally, is to find another family with the same tastes in drive-in restaurants and movies, and such.

However, maybe you already have enough people and belongings around your house to fill two wagons.

Then all your problems are solved.





**Popular
Science**


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MONTHLY

Is This Every Man's Flying Machine?

When you're up there in an open framework with nothing around you but air, you feel like a bird

By **ROBERT GANNON**

The Russian-born enthusiast for Gyro-flying pictured here says yes, anyone can fly. For testimony, turn the page. 

With scrounged material, you can build a

Paul Sunday started building his flying machine one fall, out in the yard. Then, as the days grew cold, he moved the whole business into the tiny kitchen of his house trailer. During the winter, when his wife complained about having to eat in the living room, Paul Sunday would square his thin frame and say, "Americans are destined to fly. I don't want to miss out on it."

Today he has his dream. Paul Sunday, Chesapeake and Ohio railroad conductor and grandfather three times over, is flying his contraption through the rolling hills of Indiana, and the homefolk of the town of Peru just can't get over the idea. Old Paul has taken to the skies in what looks like an airborne Erector set.

The machine that lifts Sunday heavenward is just one of some 1,500 helicopter-like aircraft buzzing the U.S. countryside. They're called Gyrocopters or, without engines (towed by cars or boats), Gyrogliders. As one grinning pilot, a retired milkman, put it, "It sounds corny, I know, but when you're way up there in that open framework with the wind flapping your ears and there's nothing around you but air, you honestly feel that you're a bird."

Some one-man-copter buffs design their own rigs. Most follow tested plans or build them from semi-kits. By either method, the typical Gyrocopter looks like an outsize tricycle with a ceiling fan whirling

atop. The cockpit is an open bucket seat bolted to a trellis of aluminum. The power comes from a 72-hp. engine usually snatched from a worn-out Air Force target drone. The tail looks like an afterthought.

Easy and cheap. Why are so many would-be pilots getting the bug to build their own hedgehoppers? The machines are comparatively easy to build, easy to fly, relatively safe, and cheap. With scrounged-together material, you can build one for \$300 or less; with new everything, \$735 plus engine (\$995). This compares with a cost of maybe \$5,000 for a small plane, a minimum of \$20,000 for a commercial helicopter.

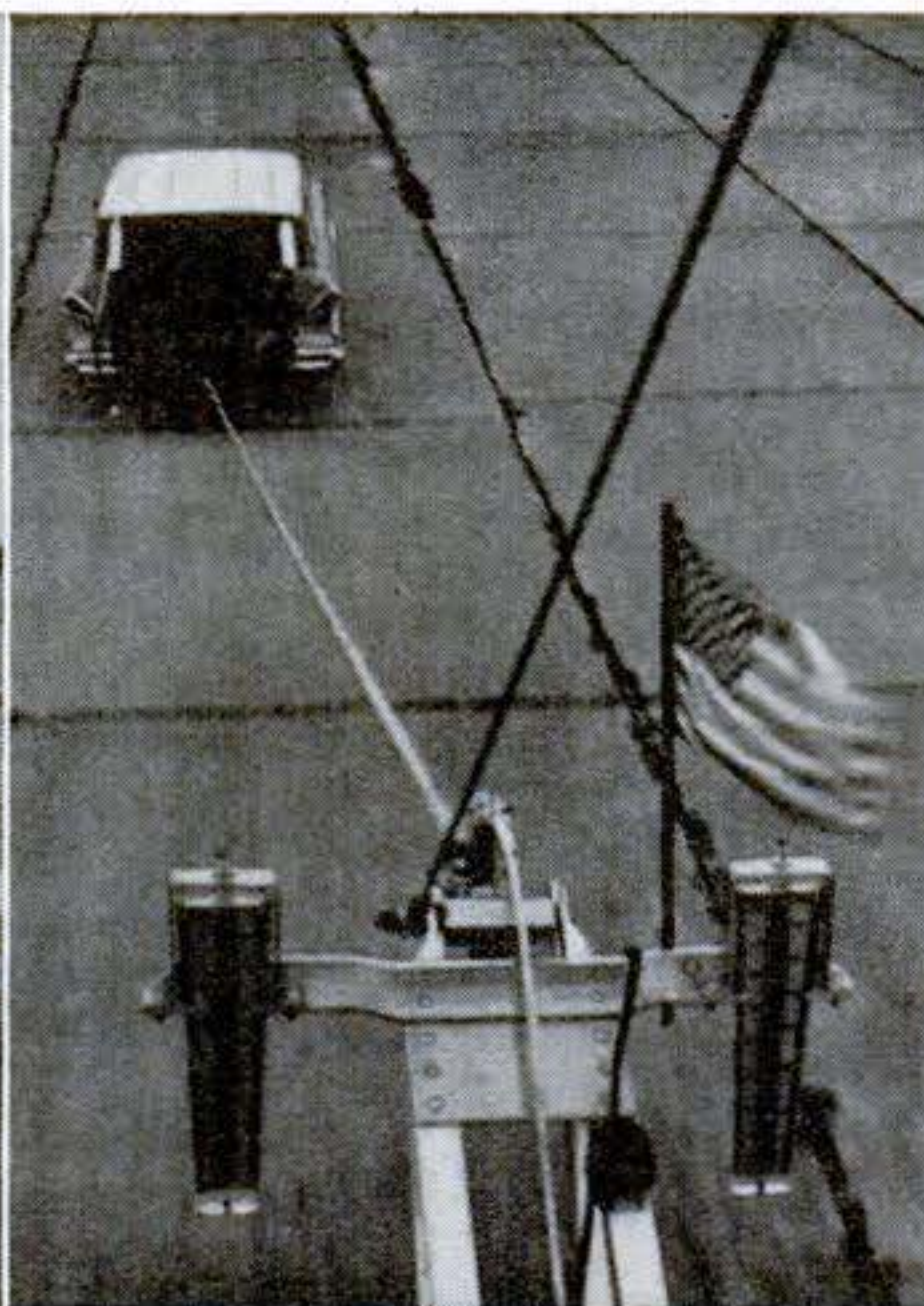
Sixty-year-old J. D. Lay of Santa Clara, Calif., put his together, with the help of his wife "who held the parts while I hand-set the rivets," with only two electric drills in the way of power tools. Sixteen-year-old Danny Cudney of Raleigh, youngest licensed Gyrocopter pilot, built his with the help of his father in the garage.

Like the old Autogiro invented by Juan de la Cierva, a Spaniard, early in the 1920s, a Gyrocopter gets its lift from a canopy of whirling blades. In that respect, it's like a helicopter. But unlike a helicopter, a Gyrocopter's blades are not powered. They are free-wheeling. They rotate because an engine and conventional propeller drive the craft forward. They also rotate from an

Continued



A Gyroglider (without engine) looks like this from the ground at the end of a tow rope tied to a car.

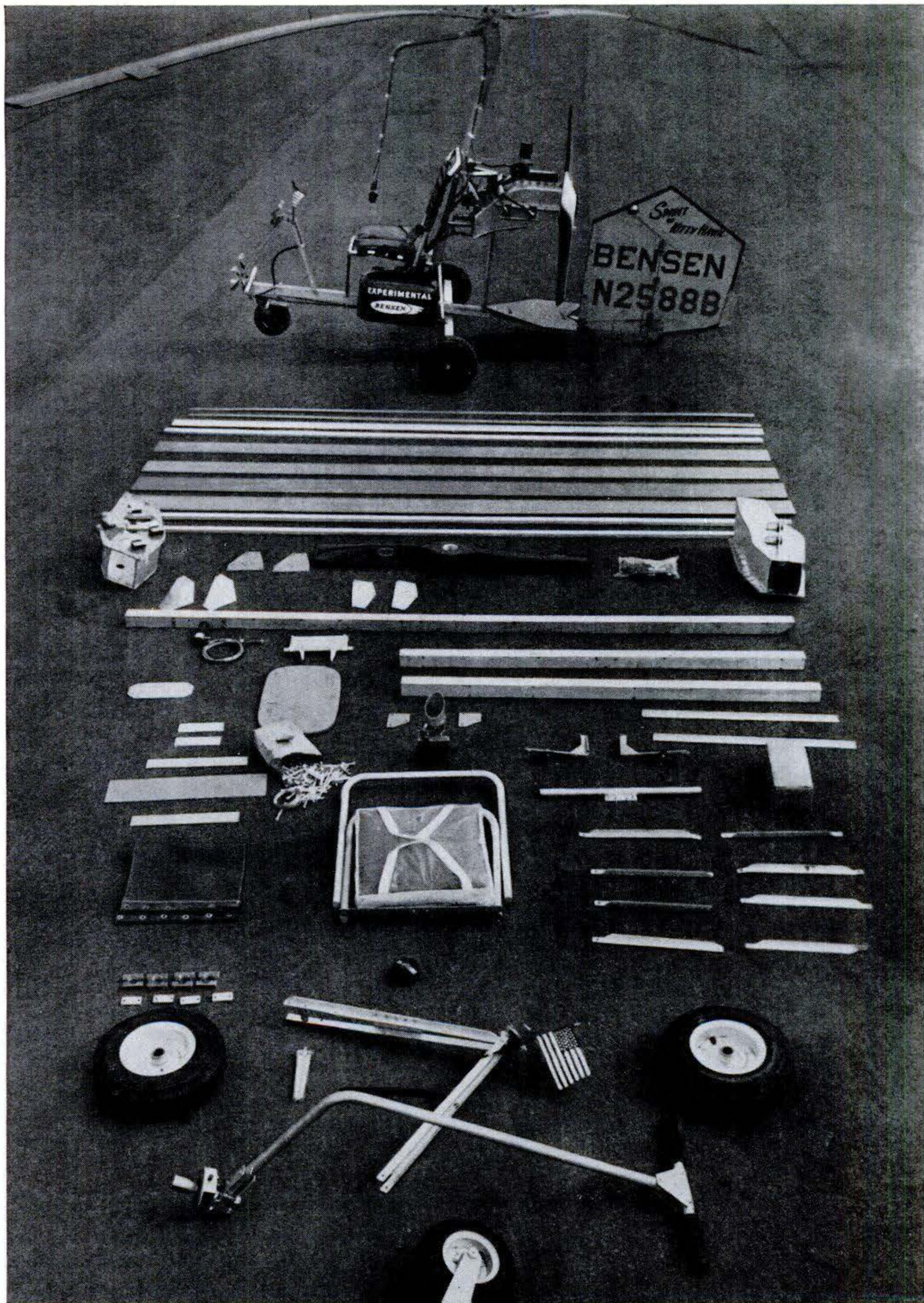


View from the air: If the wind is brisk, you need no tow—just lash your line to a post.



Pilot controls are simple. Last year an 11-year-old soloed a Gyroglider at Raleigh-Durham airport.

Gyrocopter in your garage for \$300 or less

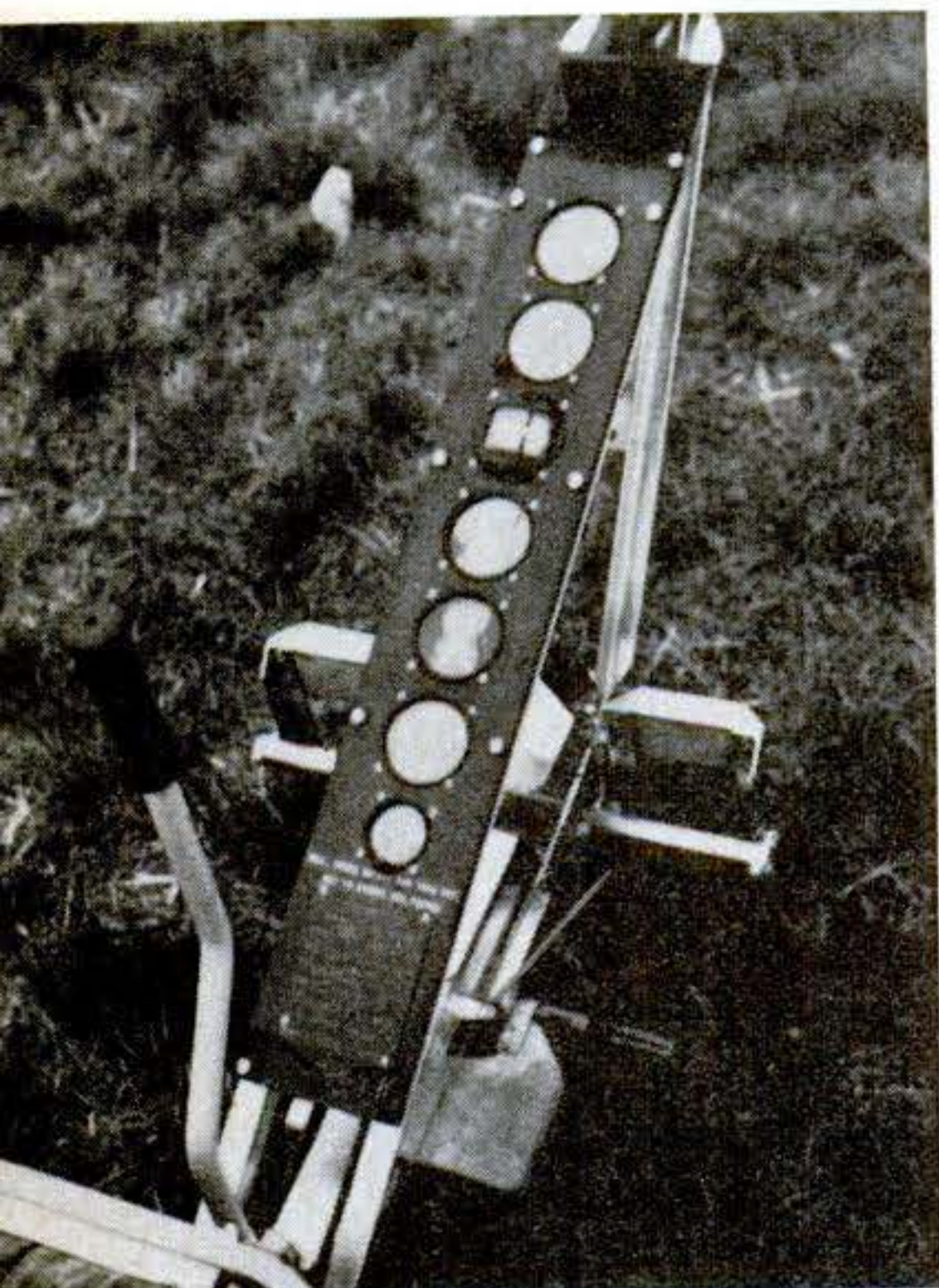


Complete kit for a Gyrocopter is shown above. Only the engine is missing. The assembled job is in the background. Kits start at \$59 for individual rotor

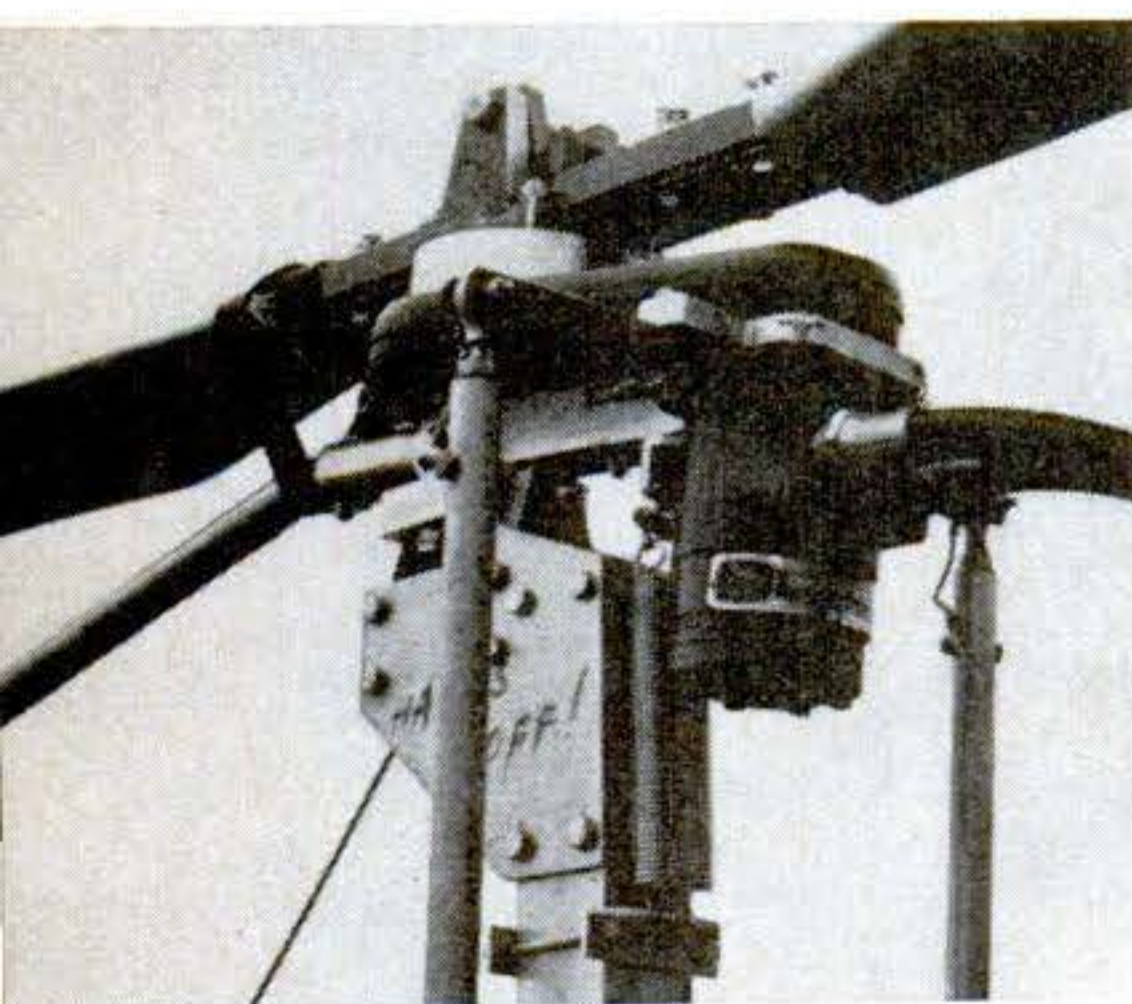
blades and range up to \$735 for a full aircraft. They do not include engine because many builders prefer to shop surplus lots nearby or by mail.



Engine frequently is a surplus four-banger built for the Air Force to power a radio-controlled target. Price: as little as \$149.



Instrumentation on this Gyro includes engine and rotor tachometers, altimeter, compass, turn-bank indicator, speed indicators.



Rotor head, of teeter-totter type, needs no vibration dampers. Gimbals permit hands-off flight. Blades are plywood and steel.

accommodating upward rush of wind incident to descent.

Today's Gyrocopters conventionally have two blades 20 feet long that swoosh around at 400 r.p.m. Their operation is simplicity itself. To quote from a POPULAR SCIENCE story 12 years ago—and the principle hasn't changed a whit today:

"The blades are mounted on a single bearing that lets them teeter-totter in rotating. The teeter-tottering, plus manipulation of the control yoke, balances out the lift of the blade advancing into the wind (toward the line of flight) and the lift of the blade retreating from the wind. Without such compensation the machine would tend to capsize—the advancing blade creates more lift."

Flying the Gyrocopter. To get going, the pilot flip-starts his prop, hops into the seat, and then reaches up and heaves the rotor to a spin. Then he revs up the engine and heads into the wind. By the time he has scooted 100 to 500 feet, the wind has whipped the rotor to lift speed, and, buzzing like an angry gnat, the craft sails upward.

Most of these flying bedsteads cruise at around 60 m.p.h. (maximum: 85-plus), carry enough gas for an hour and a half, cost somewhere around \$3 an hour to fly, can climb high enough so that the pilot requires oxygen, and, faced with a wind of 20 m.p.h., can be made to hover. In pilots' parlance, the craft is extremely "forgiving"—if you make a poor maneuver (bank too steeply, for example) you can take pressure off the controls and the machine will pretty much balance itself. That's because the craft hangs like a pendulum beneath the disk made by the rotating wing.

Most people learn this kind of flying by starting out in a rotary-wing craft with no engine at all—called by Igor Bensen, a pioneer in the field, a Gyroglider. Gyrogliders must be towed unless there is a brisk wind.

At Bensen's manufacturing plant, in Raleigh, N.C., I took my first trip recently, tucked beside Bensen in a double-seat job.

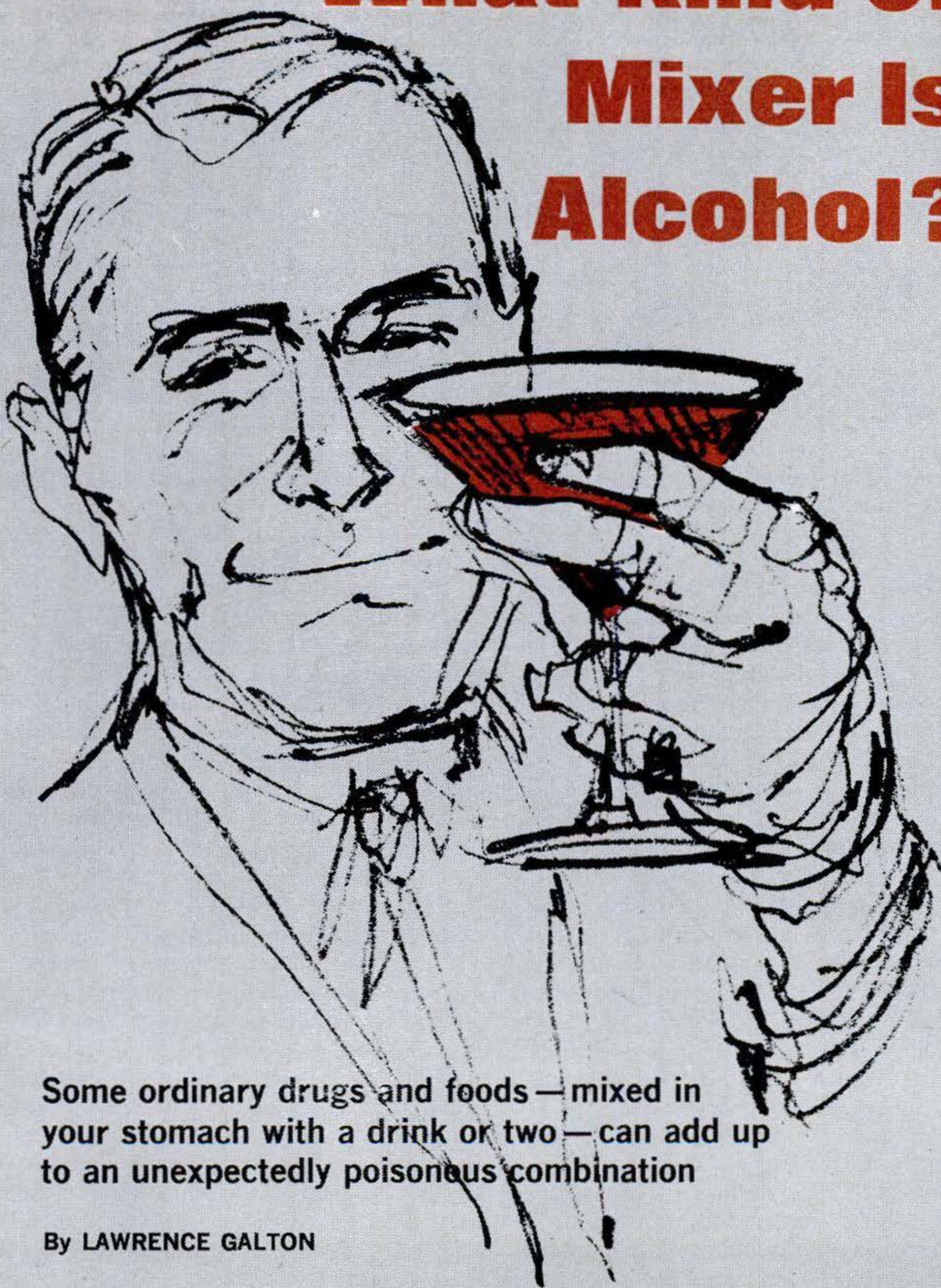
The first thing you're aware of is the rotor swishing inches from your head, like a scythe through grass. You see the tow car a hundred feet ahead as the little craft bumps forward on its foot-high wheels. The rotor swooshes faster until it is a circular blur.

Speed hits 20 m.p.h., but in the wide-open framework, it seems like 80. Then, suddenly, the ground drops out from under you. The wind sucks tears from your eyes, whistles up your pants legs. Far below, the tow car gets smaller and smaller. Then you remember how every gyro pilot talks about birds, and all of a sudden you know why.

You learn to fly a Gyroglider in slow, simple steps. First you taxi, pulled along by a car going about 10 m.p.h., and learn to balance on the two wheels. Then, with the auto traveling just a little faster than takeoff speed, you practice little hops, rising no higher than five feet or so. You do this in half-hour stretches over five or six days, getting the feel of the hanging control yoke that changes the rotation plane of the swirling, overhead

[\[Continued on page 220\]](#)

What Kind of Mixer Is Alcohol?



Some ordinary drugs and foods — mixed in your stomach with a drink or two — can add up to an unexpectedly poisonous combination

By LAWRENCE GALTON

When newspaper columnist Dorothy Kilgallen died in her Manhattan town house not long ago, it wasn't, as first reported, because of "natural causes." The intake of a combination of alcohol and barbiturates — sleeping

pills — proved to be the reason for death, according to the New York medical examiner's office.

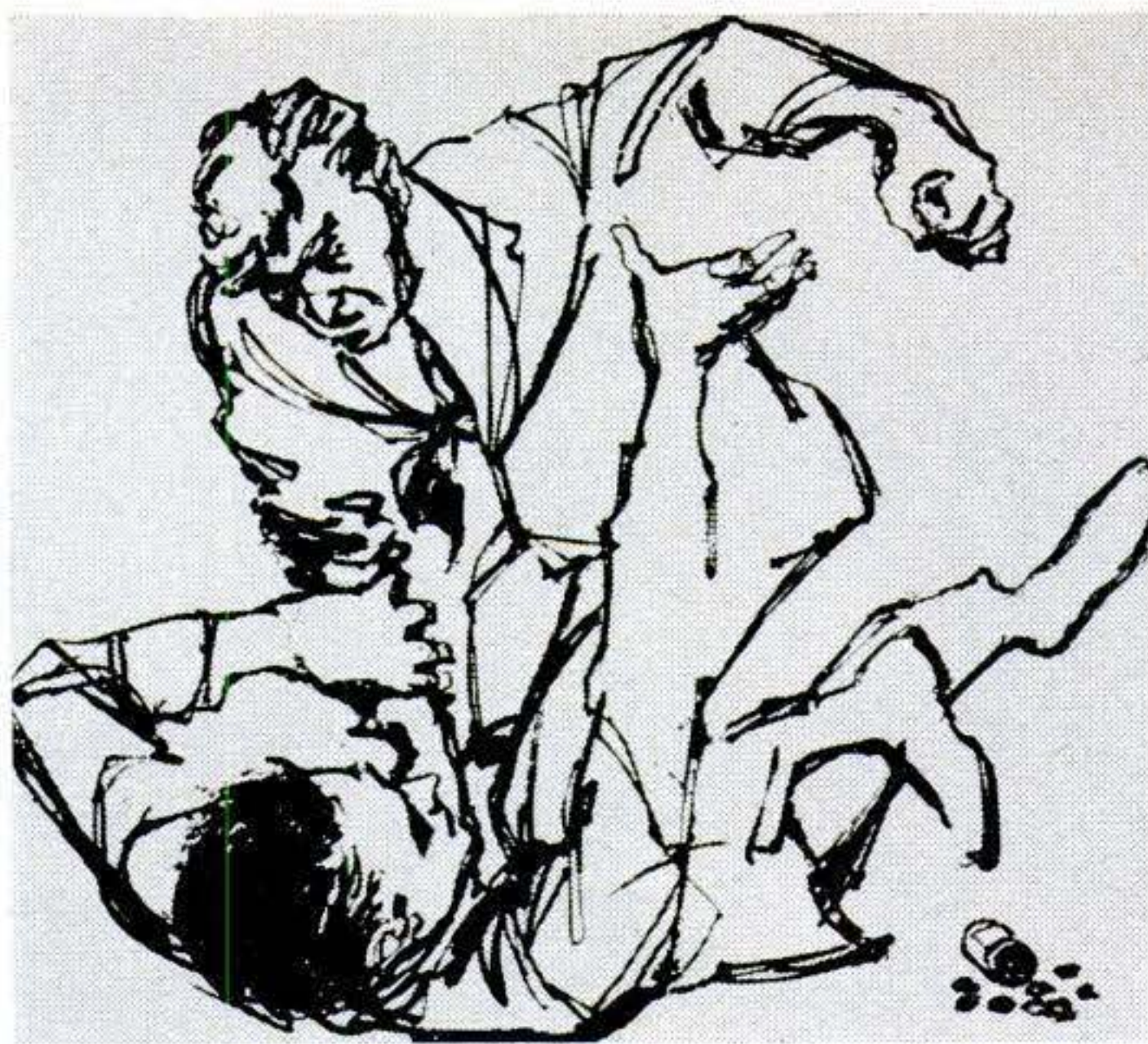
The amounts taken were not excessive. "It could have simply been an extra pill," said Dr. James L. Luke,

Continued

Unknown chemical reactions produce strange physical effects that



Sleeping pills and alcoholic beverages just don't mix, and may even prove lethal in some cases.



Nitroglycerin tablets, a heart remedy, and alcohol combine to produce violence and temporary insanity.

the city's assistant medical examiner.

Same thing when actor Alan Ladd recently played his final role. The first announced cause was heart attack. But the coroner's report indicated, as one newspaper account put it, "an increasingly familiar drama—Act 1, Drink; Act II, Drugs; Act III, Death."

For Ladd, too, a combination of alcohol and barbiturates proved lethal.

Wooing the long sleep. Apparently that three-act tragedy is being played out unwittingly thousands of times a year now. Sleeping pills are in growing use, few people realize there's any risk in combining them with drink, and it may even seem like a good idea after an evening of partying to take a few pills for a sound sleep and maybe avoid a hangover. By morning, however, the victim may be dead.

Says Dr. Joseph W. Spelman, Philadelphia medical examiner: "In 4,250 autopsies in Philadelphia in 1961, we had 1,375 positive tests for alcohol or one or another drug. You might think alcohol would constitute the largest percentage. That was not true; 344 were under the influence of alcohol. But the rest were under the influence of drugs, primarily tranquilizers and barbiturates—very often in combination with alcohol—when they died." Figures for later years, now being compiled, indicate a growing incidence of sudden deaths, some suicidal but many accidental, from drug-and-drink mixing.

As best scientists can figure out what happens when alcohol and barbiturates are com-

bined—Air Force biochemists have been busy in the research—the drugs put a kink in the body's ability to dispose of alcohol.

Ordinarily, body chemicals called enzymes break down alcohol into simple components—carbon dioxide and water. In an hour, $\frac{3}{8}$ ounce of 100-proof can be handled. But barbiturates block enzyme action.

Result: Alcohol piles up, its depressant effects on breathing and blood pressure are added to the drug's—and, in combination, what may be an ordinary sedative dose of barbiturate and an only slightly intoxicating amount of alcohol can become deadly.

Not always. Each person has his own tolerance, and a combination that may have few or no bad effects on one man may kill another. There's no sure way to tell in advance.

When it comes to tranquilizers and alcohol, the two have a "synergistic" effect. Each acts on the other to increase potency.

"At a cocktail party," says a recent Canadian Medical Association report, "the patient who has previously taken two tablets of a tranquilizer is roughly two drinks ahead to start with."

That's to start with. Talking about synergistic combinations, Dr. John D. Griffith of the Vanderbilt University School of Medicine notes: "In effect, one plus one equals four." With that kind of arithmetic in operation, alcohol and tranquilizers can add up quickly to more than just a quick drunk.

Alcohol, as a matter of fact, often doesn't mix well with a lot of other things, investigators have been finding recently.

range all the way from minor discomforts to fatal illness



Oral antidiabetes drugs, followed by a drink or two, could make you blush a brilliant fire-engine red.

Chaser for antibiotics? Peculiarly if you're taking an antibiotic like penicillin, a drink may either help or hurt. It depends on the timing.

The whole question came up a few months ago in the pages of the *American Medical Association Journal* when a woman doctor from Los Angeles wanted to know what happens when people have a snort or two on top of an antibiotic. A special AMA consultant gave her the answer.

Penicillin can be quickly inactivated by alcohol. When the drug is taken by mouth, most of it is absorbed from the gastrointestinal tract within two hours. After that, a drink won't hurt; before that, it may make the drug completely useless.

If the drink comes first, better wait three hours, advised the consultant, so the upper gut is clear enough of the alcohol for the penicillin to act like a bug bomb instead of a dud. Actually, under such circumstances, the AMA man added, the alcohol could even help: Distilled spirits create some gut inflammation, and the inflammation allows more rapid absorption of penicillin and many other antibiotics into the blood.

One bizarre combination for some people is alcohol plus nitroglycerin, a drug used for angina pectoris, the chest pain that often goes with heart trouble. No question about nitroglycerin being excellent for angina—and many doctors swear by alcohol in moderation as a heart soother. But when the two get together, there can be violence.

A Hollywood physician tells the story of



Just one drink in the air can have the same effect as four consumed on the ground, studies reveal.

a movie producer who didn't know this. Being an angina man himself who took nitroglycerin tablets on occasion, the producer decided to help out a young actor who, in the midst of a party, developed a chest pain.

He gave his young guest a tablet. Earlier, the actor had been drinking freely. A mild-natured guy when sober, he tended to become even gentler as he got drunker. But after taking one nitroglycerin tablet, he got suddenly untamed, jumped on the producer, pinned him to the floor, and tried to knock his teeth out.

He was, says the doctor, "one of those persons in whom nitroglycerin and alcohol do not mix but cause one of the most violent forms of intoxication known. It can result in temporary insanity."

Not long ago, a New York diabetes specialist turned up another queer mixing effect. Some diabetics using oral antidiabetes drugs instead of insulin flush up, after just a drink or two, to brilliant red. No great harm. The flushing is more embarrassing to observers than distressing to the diabetic, according to the physician. And he has found that any antihistamine drug taken by mouth, at least an hour before drinking, will usually avoid the complication.

One widely used chemical, thiram, can cause strange reactions in conjunction with alcohol. Thiram and its derivatives go into many fungicides, insecticides, seed disinfectants, germicidal soaps, lotions, ointments, and rubber goods. Thiram, too, is an active

[\[Continued on page 248\]](#)

Here Popular Science starts an exclusive, in-depth report on the most exciting automobile engine design in 70-odd years. How would you like to drive an engine that weighs half as much as your present engine, is only a third as big, and has 35 percent fewer parts? That's the rotating combustion—or "Wankel"—engine. Redesigned and developed by Curtiss-Wright for U. S. cars, PS has learned it is undergoing testing at Detroit's proving grounds. Some tough-minded Detroit engineers concede that it has squeezed out the gas turbine as a contender for near-future car power.

The Engine That's Giving

Here's the news on the rotating combustion engine

- Curtiss-Wright has licensed the Outboard Marine Corp., world's largest manufacturer of outboard engines, to make and sell rotating combustion engines. OMC also makes industrial vehicles, lawn mowers, chain saws, snowmobiles, and golf carts. Supplemental agreements abroad give OMC non-exclusive world marketing rights.
- The initial blasé skepticism with which Detroit greeted the first news of the Wankel engine has turned into guarded enthusiasm.
- At least five other countries—Germany, Japan, Italy, France, and England—are producing RC engines or are making plans to produce them.
- Westinghouse has designed a portable electric generator powered by an RC engine.
- It is undergoing test in a U. S. Army truck.

By **DEVON FRANCIS**

Six years ago POPULAR SCIENCE published the first report ever made to the U. S. motorist, in a magazine of mass circulation, on a new kind of automobile engine—the Wankel.

That engine has now come of age.

What follows is our third major report on the engine named the rotating combustion engine by its U. S. developer, the Curtiss-Wright Corp. Last year we told you about its use in a German sports car.

Now we are going to tell you about its prospects for installation in U. S. cars.

This report is in two parts:

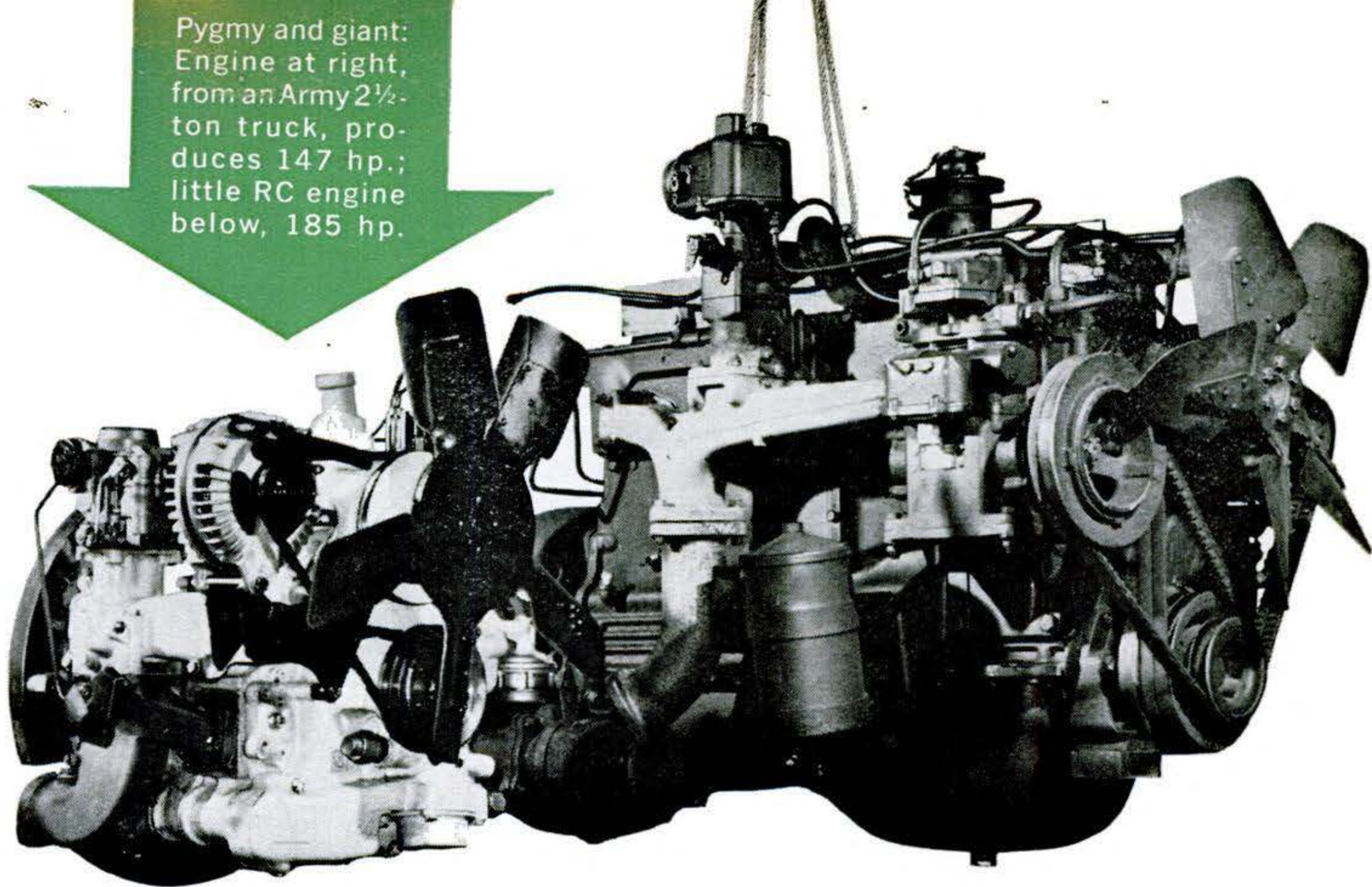
The first tells of the exceptional versatility of this new kind of power plant.

The second part puts you in the driver's seat for a ride in a U. S. automobile powered by a rotating combustion, or RC, engine.

Another engine, so what?

Detroit and its environs, the heartland of U. S. automotive production, are peopled with some of the world's most jaundiced executives and engineers. They are conservative. They are suspicious of anything new. What really excites Detroit is a fresh way to cut production costs or a money-making gimmick.

Pygmy and giant:
Engine at right,
from an Army 2½-
ton truck, pro-
duces 147 hp.;
little RC engine
below, 185 hp.



Detroit “WANKEL FEVER”

Every year the automobile companies are bombarded with inventors' and promoters' ideas for adding to or altering self-propelled vehicles. Almost all of them are pigeonholed. Detroit has been quite happy with what it had. Moreover, if it makes changes, it wants hardware that has been originated in its own labs—anything from outside costs royalties.

Proposals for motive-power changes, both from inside and outside Detroit, have been legion since the first four-cycle piston engine frightened the horses on U. S. Main Streets. None has succeeded in displacing the piston.

Detroit even regards the gas turbine, used experimentally in a few score cars by the Chrysler Corp., with heavy-lidded skepticism. The head of one big car company told *POPULAR SCIENCE* privately in recent weeks that the gas turbine no longer looked like the successor to the piston engine.

So it is significant that Detroit has the rotating combustion engine on intensive test. This is a radical departure from its standard practice, and there must be reasons.

There are. The engine is light. It is simple. It is efficient. And—all-important—it will cost a lot less than a piston engine to produce.

In almost seven years of development work, Curtiss-Wright, which holds exclusive North Amer-

Continued

Here's why the RC engine is so good

- It has a far better power-to-weight ratio (more hp. per pound) than any piston engine.
- It has no reciprocating parts; runs with almost no vibration.
- It has far fewer parts than a piston engine. It can be manufactured more cheaply.
- It “breathes” better, filling with a combustion charge during 270 degrees of main-shaft rotation against 180 in a piston engine.
- It supplies torque for about two-thirds of its combustion cycle against one-fourth for pistons.
- Its wider speed range gives it easy adaptability to existing transmissions.
- It can digest fuels of wide octane ratings.
- It suffers from no “scale effect” to limit its size. The RC engine produces three hp., or 1,000, at will.

A startling discovery about the RC engine was that it kept getting

ican license rights to the RC engine, has performed exercises in versatility that leave few unanswered questions (including Detroit's) on this new kind of motive power.

Item: RC boat engines. Most outboard piston engines are two-cycle to save weight. That makes them relatively inefficient. The Curtiss-Wright RC outboard uses 20 percent less fuel. It's quieter. It's smoother. It doesn't require oil in the fuel.

As an inboard, the RC is lighter and smaller than a piston engine. It has a half to a third of the weight. It requires a half to a third of the space.

To boost the power of a piston engine, a manufacturer customarily increases the displacement. That means more weight, more space taken for installation. The RC engine just adds rotors. Tacked on to the end of the C-W 185-hp. engine, 4½ inches provides a whopping 100 additional horsepower. Here the contrast with piston engines becomes even more dramatic—the RC engine produces more horsepower per pound as it goes up in size.

Item: For electric-generator field installations, such as those for military operations, Westinghouse has adopted the RC engine. It's the same engine that powers the automobile that Jan Norbye tells you about on page 102. As an electric-power source, the engine operates at a constant 4,800 r.p.m. The generating set weighs less than 1,100 pounds, compared with 4,700 pounds for a diesel unit.

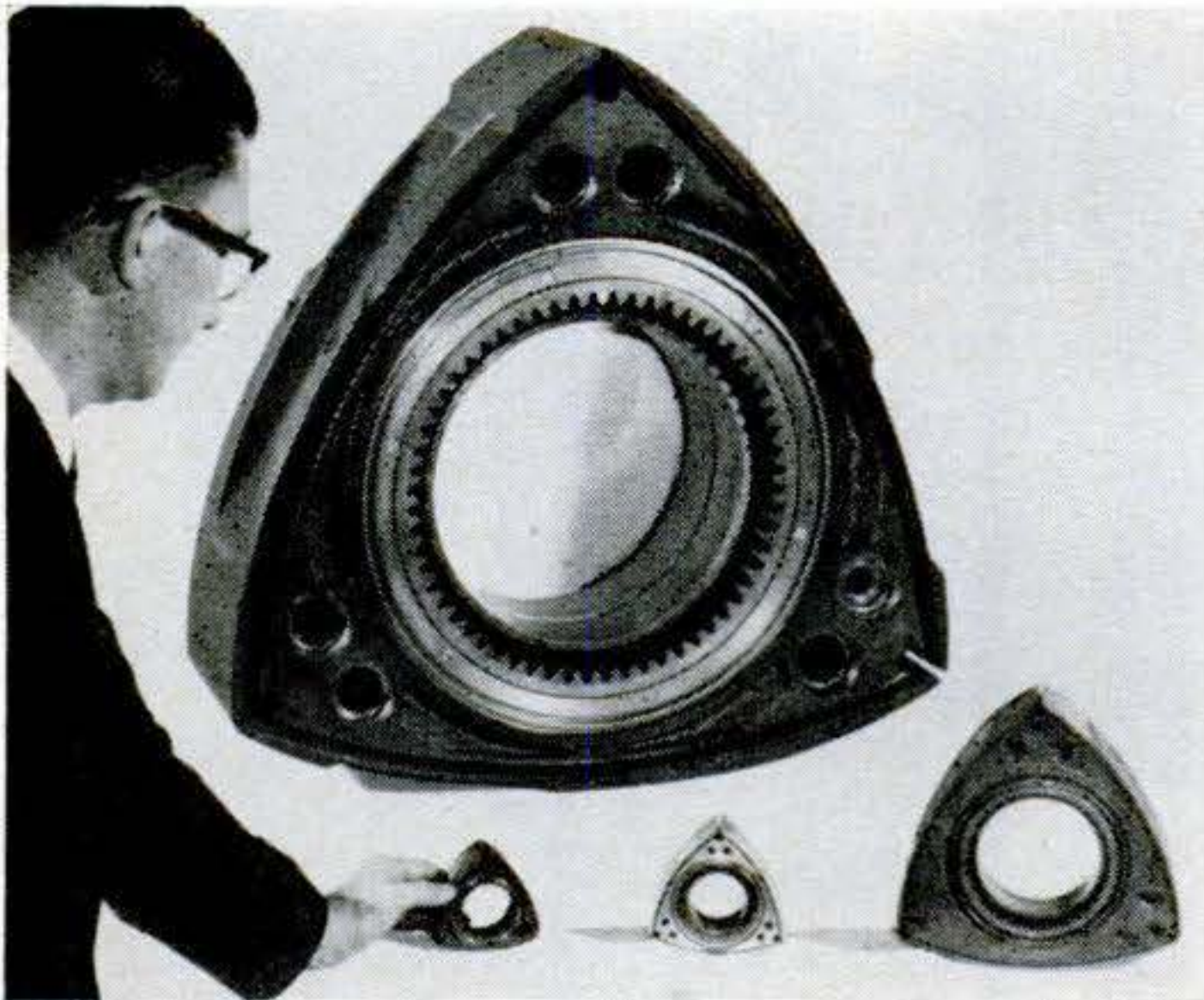
The fuel consumption is 9.5 gallons an hour. A gas-turbine equivalent uses 17 gallons an hour.

Quiet, please

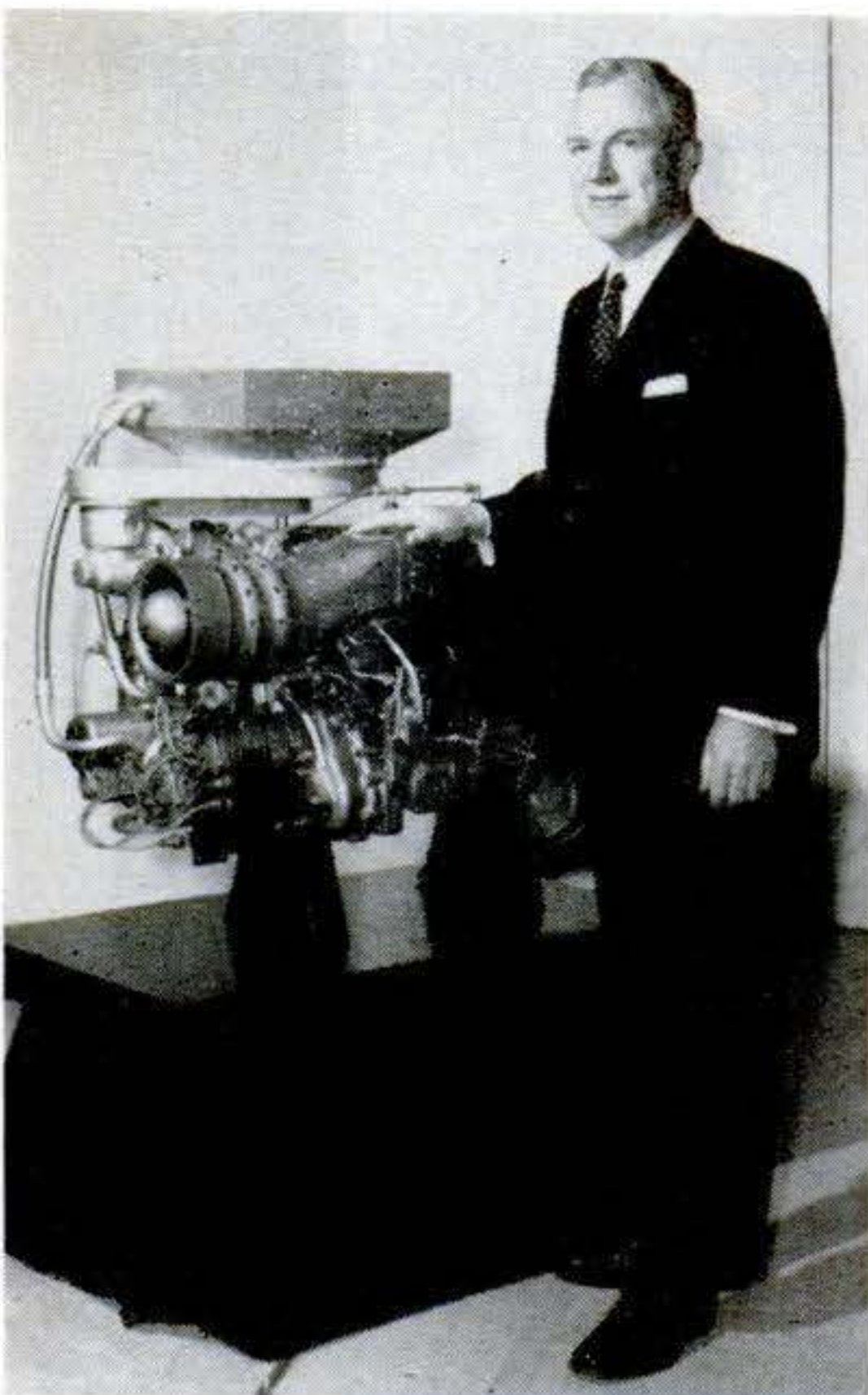
Item: Curtiss-Wright engineered an RC engine for a lawn mower. It runs like a watch. The noise level is much lower than that of a comparable piston engine. The weight of this engine—because it was built for growth—is about that of a little piston engine.

Item: C-W built a gigantic RC engine delivering 1,000 horsepower. It worked. It posed no problems. As the RC hardware goes up in size, it does not suffer from "scale effect"—that family of ailments afflicting other types of motive power as sizes go up or down from a given design package.

The RC, or so-called "Wankel," engine originated in 1956 in the tiny town of Lindau, Germany, on Lake Constance. Working in his home, a visionary, self-taught scientist named Felix Wankel had dared brave a departure from pistons. He sold his invention to NSU, motorcycle builders, in Neckarsulm.



Engines of widely varying sizes have been built by Curtiss-Wright to illustrate the RC's adaptability. These rotors are for engines ranging from four cu. in. producing three hp., to 1,920 cu. in. producing 1,000 hp.



C-W President T. Roland Berner shares with his engineers a pride of accomplishment in rotating combustion engine. Company had disposed of its interest in Studebaker-Packard Corp. before launching engine development.

more efficient as it went up in size

Dr. Max Bentele, now a chief C-W scientist, was responsible for bringing the engine to the U.S.

Curtiss-Wright ran its first RC engine on March 4, 1959. The seals were miserable. It spewed oil and gas fumes so liberally that the attending engineers, fretful over their new baby, were reduced to coughing spells in the laboratory. They knew they had a long way to go. But the thing worked.

A legacy from Lindbergh's day

C-W had the know-how in engines. It had been a Wright engine that carried Charles A. Lindbergh from New York to Paris in 1927. It had been C-W fighter planes powered with C-W engines that fought the Japanese in China in World War II, and bombers with C-W engines that carried the atomic bomb to Hiroshima and Nagasaki.

Despite problems, the company's progress on re-design of the RC engine was spectacularly fast. The horsepower achieved, and the test-bed hours logged without breakdowns, began to look almost too good to be true.

By October, 1959, the engineers were extracting 100 hp. out of only 60 cu. in. of displacement. In March, 1960, they produced the world's first multi-rotor RC engine, with 425 hp. It ran like a dream.

Champagne celebration

In June, 1959, the engine made an endurance run of 25 hours. In November it ran 100 hours.

"You get 1,000 hours of continuous running," the then president of the company promised his engineers, "and I'll throw you a champagne party."

That was roughly the equivalent of 30,000 miles of motoring. The engineers drank their champagne on Dec. 31, 1959.

Not until the company had accumulated 28,000 hours of testing, far more than Detroit spends on any new piston engine, was the decision taken to expose the RC engine to potential customers.

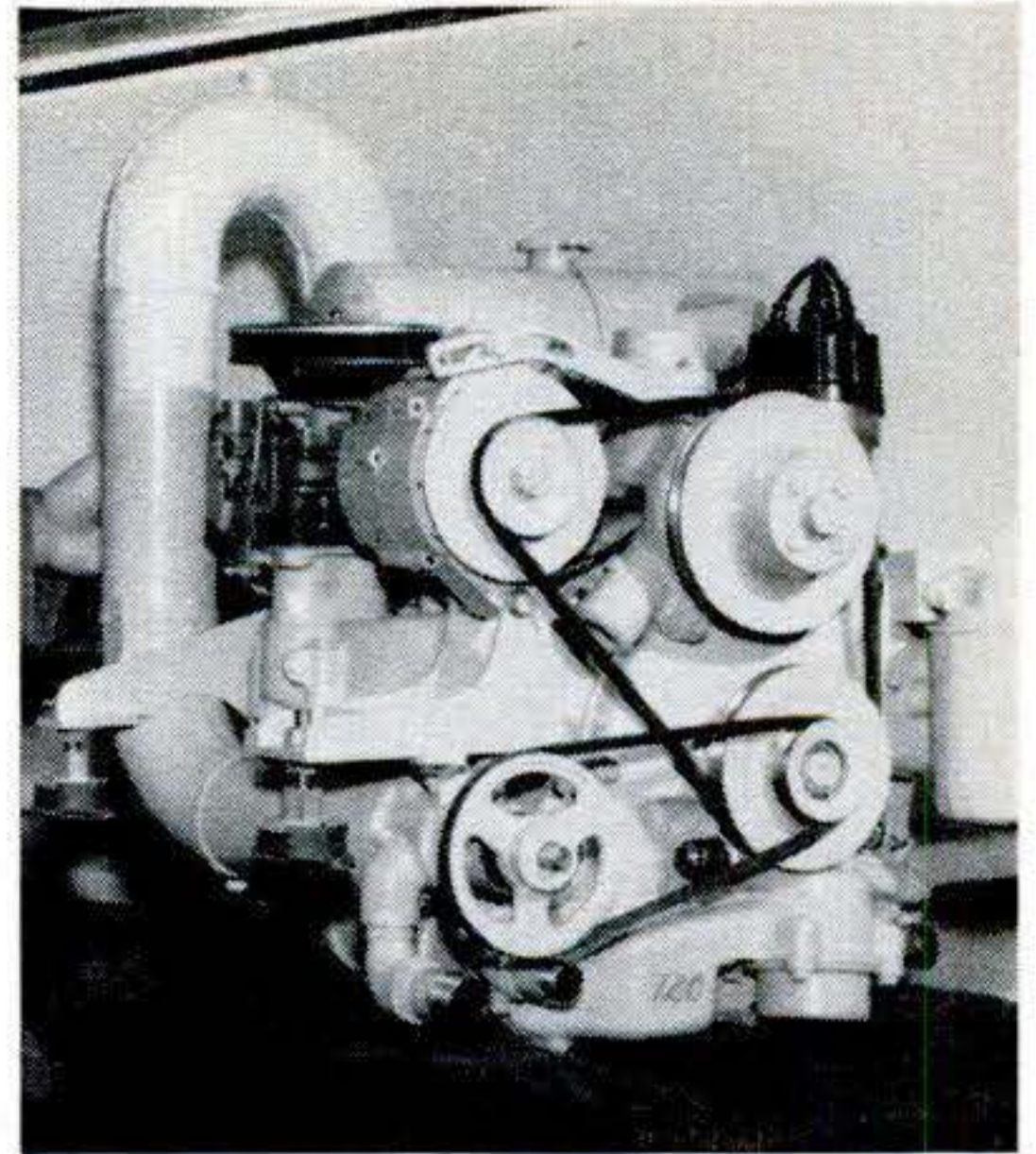
"This engine," remarked Charles Jones, C-W's chief design engineer for RC engines, the other day with a grin, "will run on high-test gas, or heating oil, or—with fuel injection—on cognac or Chanel No. 5."

Yes, Detroit has Wankel fever.

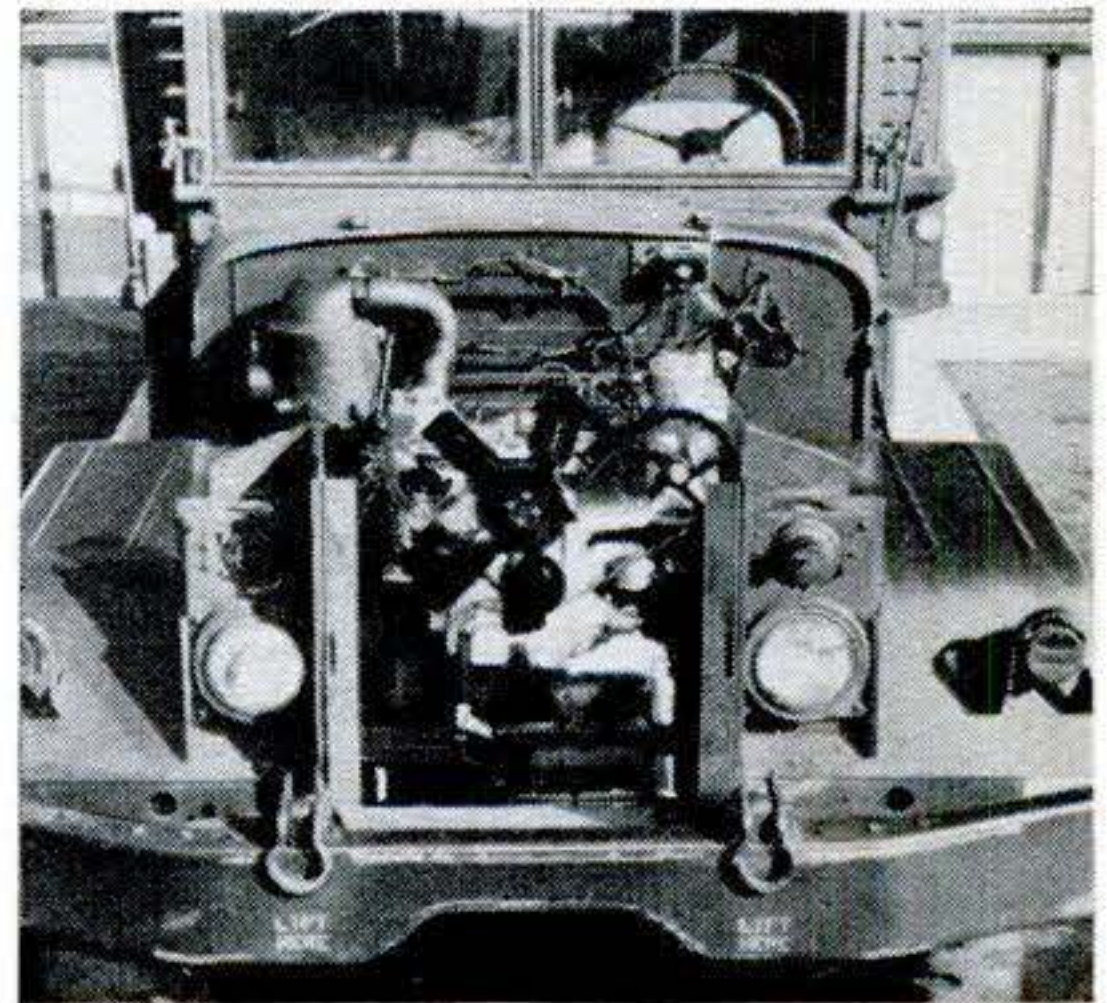
"We're not testing the RC engine routinely," said one engineer. "Our program is intensive."

And when will the RC engine become a commonplace on the U. S. highway? That depends. Detroit has hundreds of millions of dollars tied up in dies and tools, machines and transfer links, to make piston engines. Those have to be paid for in retail sales. Our guess is that one Detroit manufacturer will have an RC engine in a low-volume car within three years.

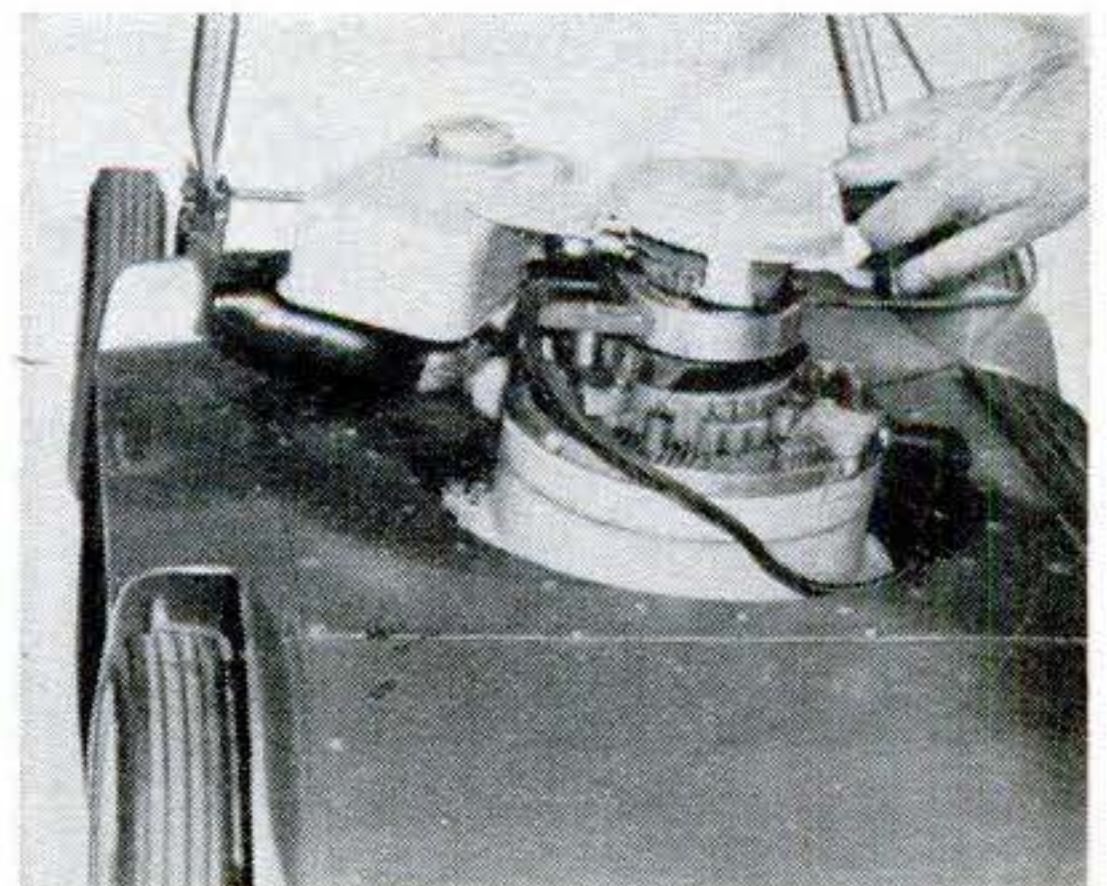
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RC marine version has been tested extensively on waterways in the vicinity of the company plant at Wood-Ridge, N. J. All RC engines have good cold starting, firing up at minus 20 degrees F. at a cranking speed of 83 r.p.m.



RC 185-hp. engine, replacing big, 331-cu.-in. six-cylinder job in Army truck (see picture, page 99) is lost in engine compartment. Engine was so small that accessories had to be put on long brackets so workmen could get at it.

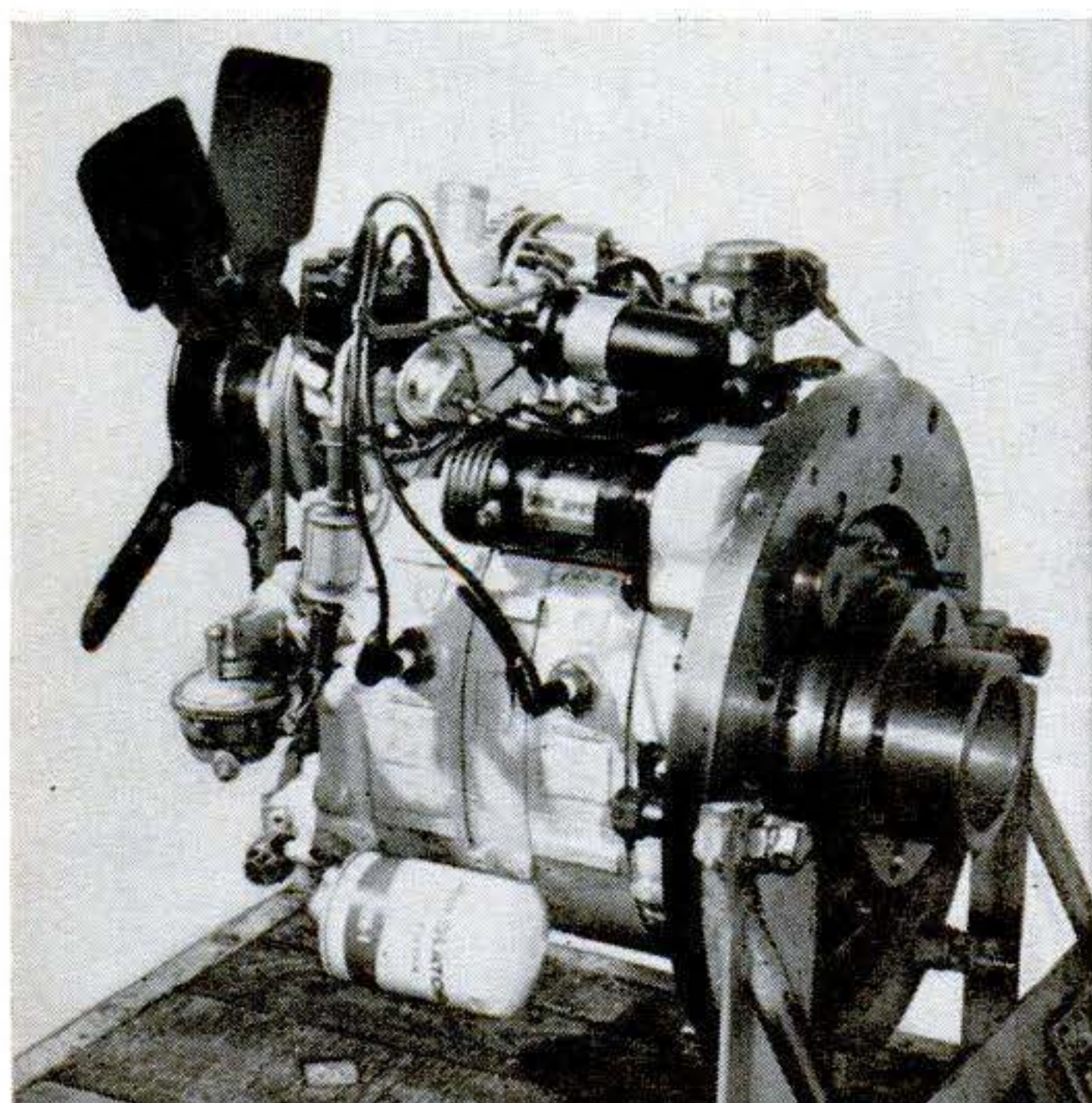


Tiny lawn-mower engine revolves at 3,600 r.p.m., and, like the one for aircraft, is air-cooled. Ten inches high, it measures 13 by 10 inches in profile. Like all RC engines, it is exceptionally quiet and silk-smooth.

Come along for a revealing look inside and a Test Drive of U.S. Car with a

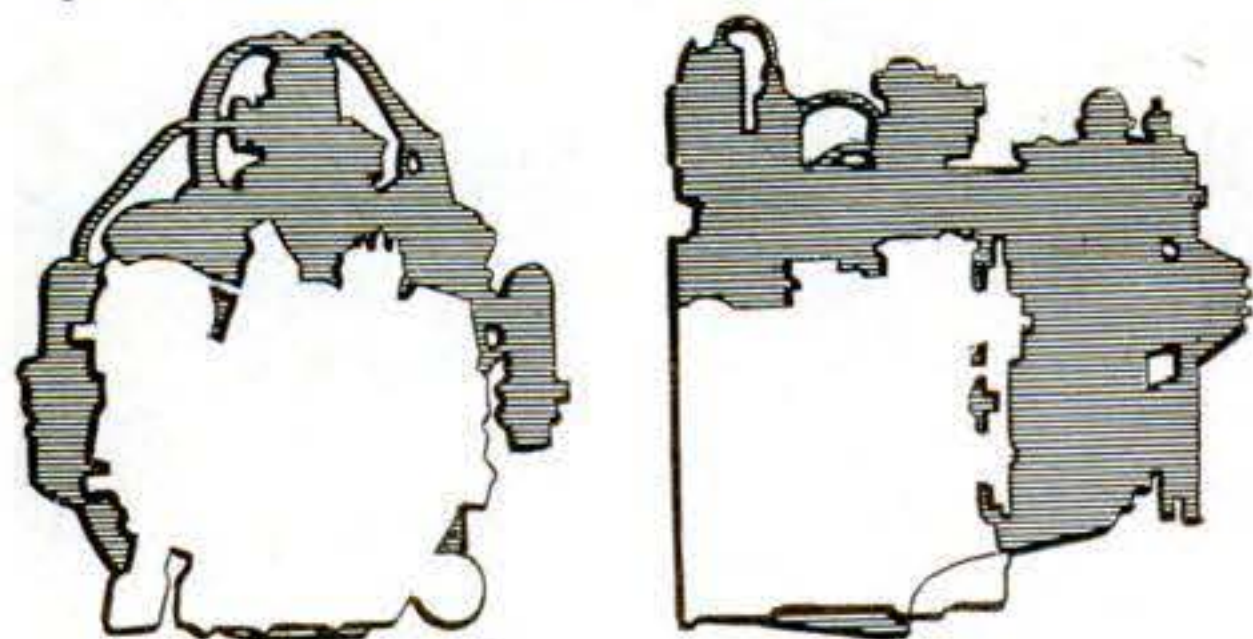
An exclusive report on the one miracle engine ready to challenge the monopoly of the auto piston engine, Curtiss-Wright's RC2-60

By JAN P. NORBYE / PS Automotive Editor



RC engine uses standard accessories wherever possible. The distributor is partly blanked off and fires only two spark plugs. Fuel pump, carburetor, oil filter, ignition coil, starter motor, and alternator are all off-the-shelf components.

Chevy's 283 V-8 dwarfs RC engine



	RC2-60	V-8
HORSEPOWER @		
R.P.M.	185 @ 5,000	195 @ 4,800
WEIGHT (LB.)	237	607
L x W x H (IN.)	18 x 22.1 x 21.5	29.5 x 28 x 31.5
VOLUME (CU. FT.)	5	15
NO. OF PARTS	633	1,029
NO. OF MOVING PARTS IN POWER SECTION AND DRIVE LINE	154	388

Sooner than you think, you may be driving a car with a rotating combustion engine. I went to Curtiss-Wright to find out for myself everything you should know about it:

- Why I think the RC engine will replace piston engines in many Detroit cars.
- What it's like to drive an RC-powered car and how it performs.
- How the RC differs from the NSU-Wankel engine.
- What Curtiss-Wright has achieved in seven years of hush-hush development work.

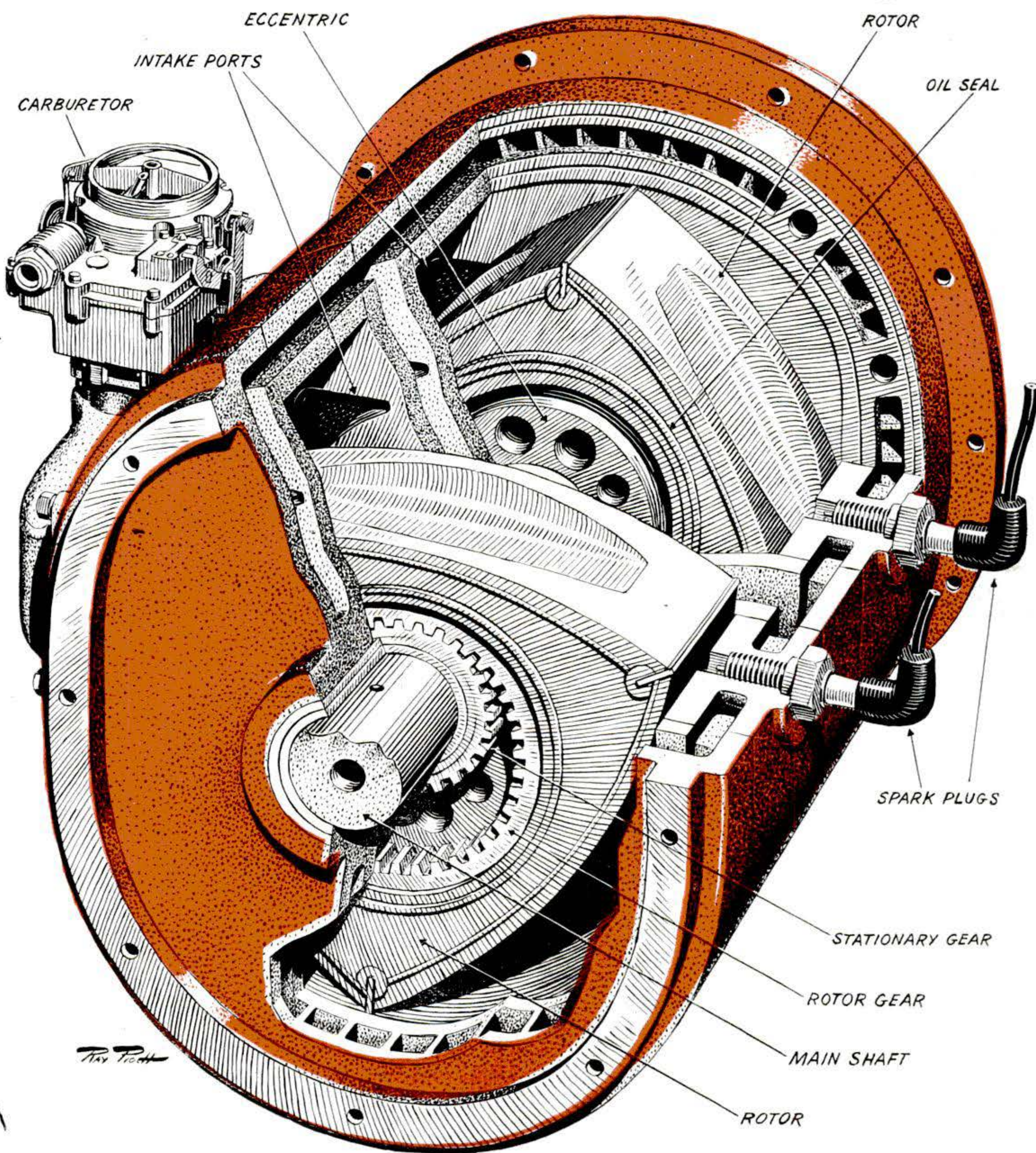
Driving a "power-without-pistons" car.

On the outside, the car looked like a standard example of a popular Detroit model. But instead of its regular engine under the hood, I saw a much smaller unit that looked not unlike a vacuum cleaner. I was allowed to drive this car for as long as I wanted, but I am not permitted to tell you what make and model it is.

When I turned the key, the RC engine came to life instantly. It had a steady idle at 800 r.p.m. and a dab on the throttle sent the revs up to 2,000 in a flash. Above 2,000 r.p.m. it began to develop a new sound—a sound I had never heard before. I have driven gas-turbine cars; I remember the scream of the supercharged 16-cylinder BRM racing car; and I have been in Ferrari's test house with four V-12s going at full bore. But this was a new sound.

As the engine began to wind, the pitch was lower than a turbine's, although there was something of the turbine in it. Yet it had the evenly pulsating rhythm of a good six in perfect tune—without giving any in-

Rotating Combustion Engine



dication of reaching top speed when pushed to the 6,000 mark. It would seemingly go on and on accelerating forever.

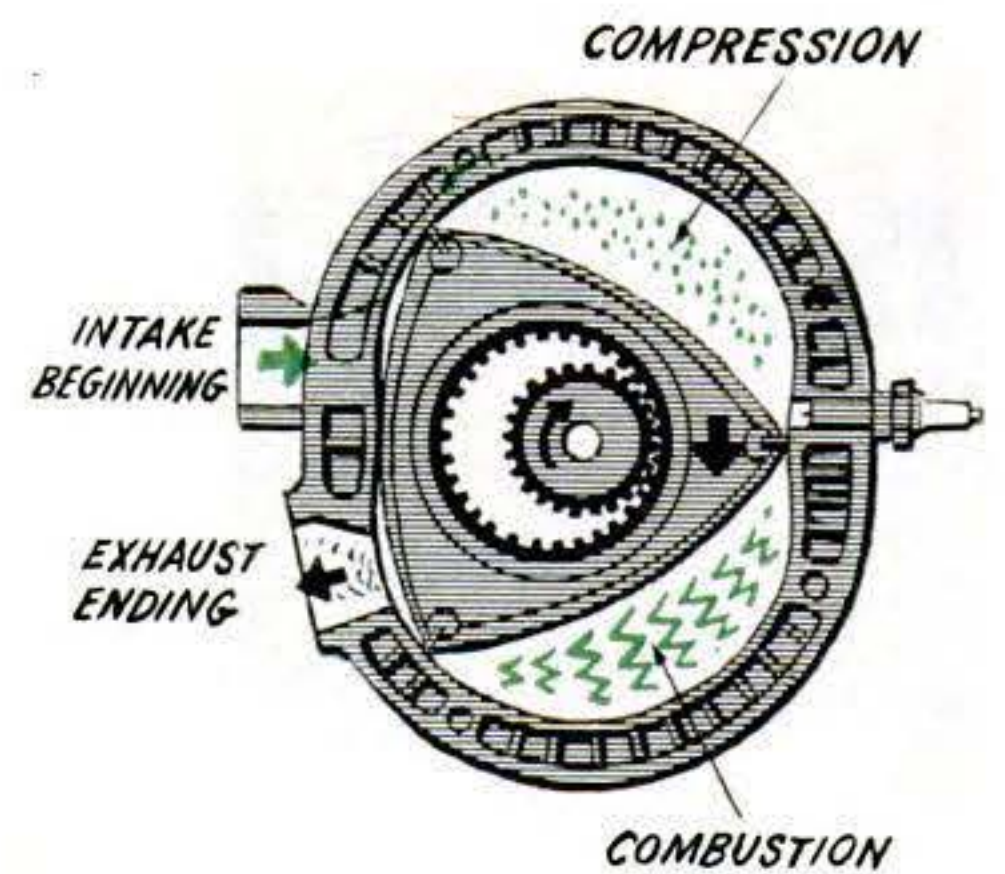
The 120-cu.-in. twin-rotor RC engine was coupled to a standard three-speed automatic transmission in off-the-shelf condi-

tion; even the shift points were left "as is." As a result, the transmission was poorly mated to the torque curve of the RC engine, with upshifts occurring at a little over 4,000 r.p.m. when they should have been

Continued



How it works: The RC



The main shaft (left) carries the rotors on two eccentrics. Their eccentricity (distance between main-shaft center and eccentric center) is 0.75 inches. The rotor radius is 5.75 inches and rotor width is 3.00. The low ratio between radius and eccentricity (6.9:1) assures a compact housing and allows a compression ratio of over 10:1.

Three operational phases are in progress at any given moment. You can see how the rotor assures gas flow throughout the entire cycle. The output shaft makes

delayed to somewhere between 5,400 and 6,000 r.p.m. for maximum performance.

The test car had 2,924 miles on it (with the RC engine) when I climbed behind the wheel. From a standing start, it accelerated to 60 m.p.h. in 10.6 seconds (average of six runs). It did the 25-70 m.p.h. run in 12 seconds flat.

How does this compare with piston-engined cars of similar power, size, and weight? Turn to page 116 and look, for instance, at the performance of the 200-hp. Mustang. As tested, the Mustang was 140 pounds lighter than the Curtiss-Wright car, and the RC engine is rated at 185 hp. Yet the C-W car came within 0.6 second of equaling the Ford's 0-60 m.p.h. time, and within 1.5 seconds of matching the Ford's 25-70 m.p.h. time.

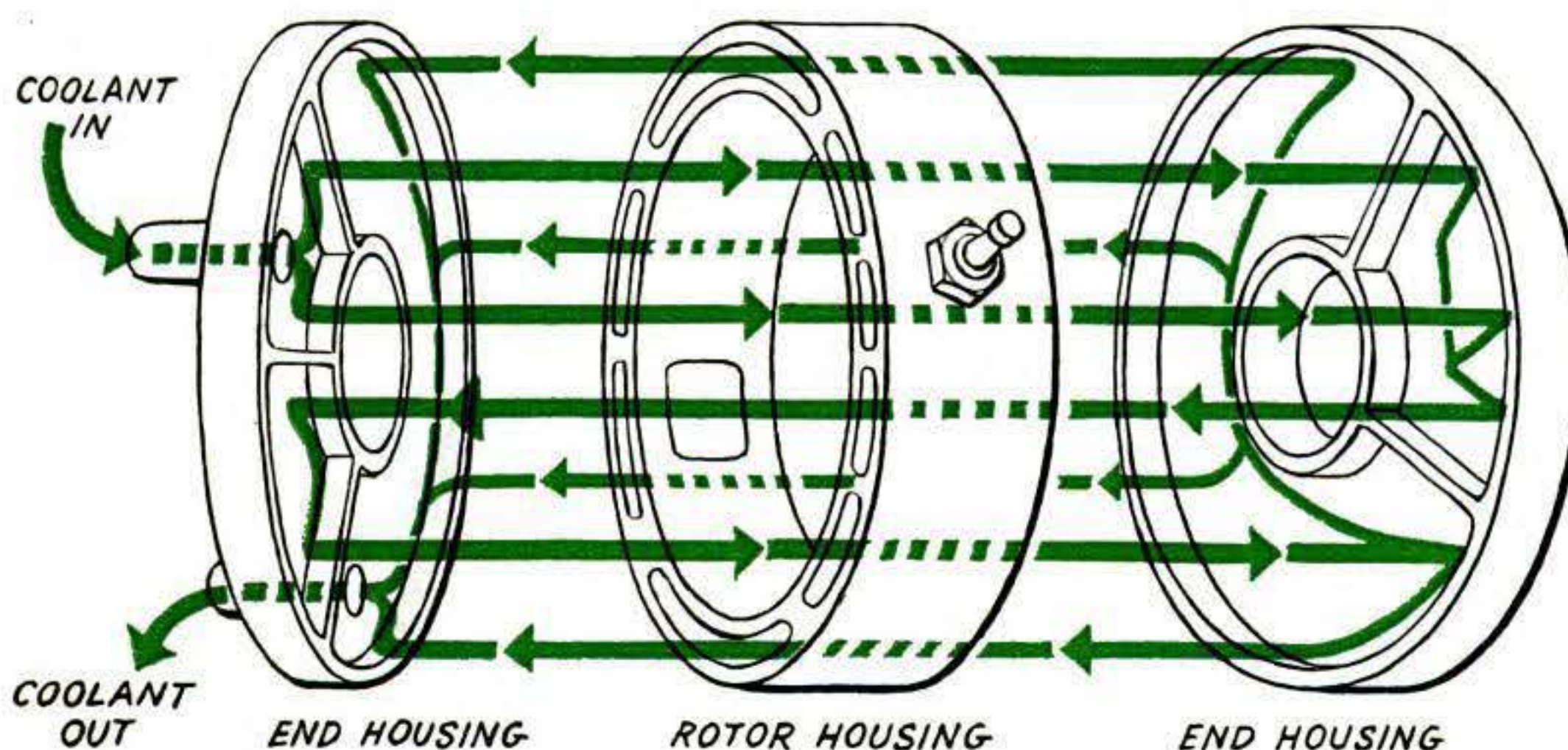
Back at the C-W factory, I stepped out of the car, convinced that with a suitable transmission I could have cut the times well below the V-8 Mustang's.

How soon might you have one? Next week, Detroit *could* start tooling up for

RC engine manufacture. From what I saw at Curtiss-Wright, and my experience with the test car, I think that the RC2-60 is practically ready for Detroit in its present form. But Burton Riemer, chief development engineer of C-W's RC program, is the first to point out that more work is planned.

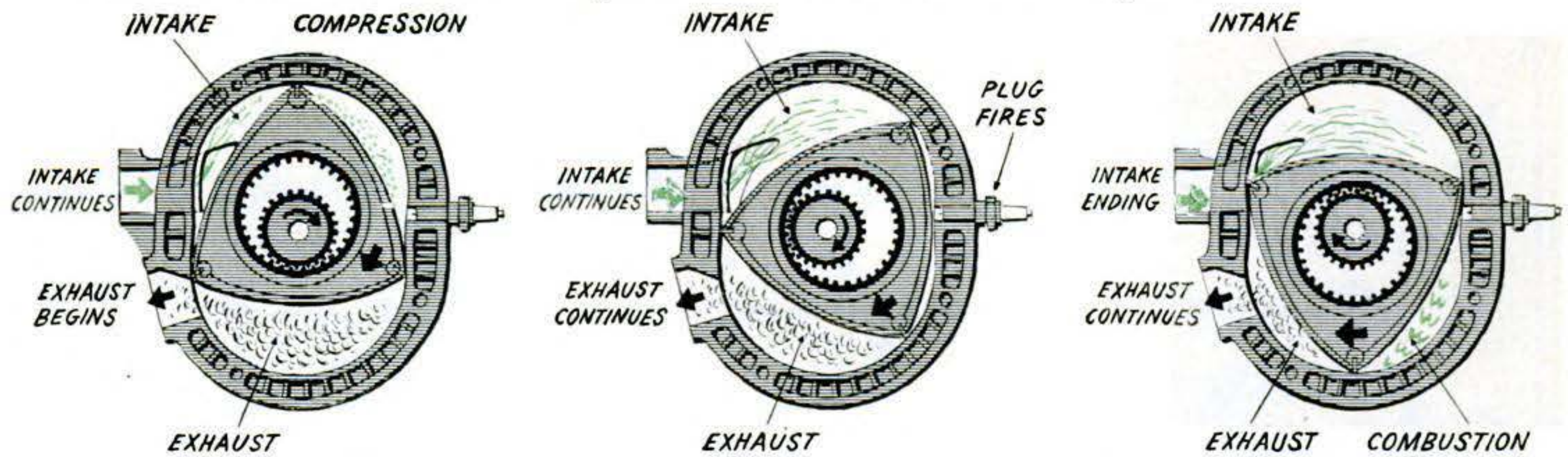
Inside the RC2-60. The "2" stands for twin-rotor; the "60" for 60 cu. in. per trochoidal working chamber. A "trochoid" is the experts' name for the figure-eight outline with the fat waist described by the rotor apexes. The two hollow, cast-iron rotors are mounted on a forged-steel main shaft with the eccentrics for the rotor gears 180 degrees opposed. The main shaft carries a counterweight at one end and a light flywheel combined with a balance weight at the other end.

The effect of using two rotors instead of one is about the same as using a V-8 instead of a four. It's never dependent on the flywheel to keep it running, and it has better initial acceleration. The RC2-60



Coolant flow is threaded back and forth through the rotor housing. Large passages are used to slow down coolant flow where little cooling is needed, and narrow passages speed up coolant flow where extra heat dispersal is required.

combines the four-stroke cycle with eccentric rotary motion



three revolutions for each rotor "orbit." The 3:1 ratio is assured by a stationary reaction gear with 48 teeth, mounted concentrically with the main shaft. It meshes with

a ring gear on the rotor, which has 72 teeth (2:3). But it's the eccentrics that turn the main shaft—not the center gear, which is fixed to the end cover. When the rotor ad-

vances 30 degrees, the eccentric advances 90 degrees. For each time an apex begins the intake phase, the main shaft starts another complete revolution.

takes regular gasoline. The compression ratio is 8.9 : 1, and the carburetor is a two-barrel Rochester (from a 401-cu.-in. Buick V-8) with 1 7/16-inch throat diameter. Intake gas velocities and air-fuel ratios are similar to the Buick's. The intake manifold is bolted to the rotor housing and feeds into three apertures: one between the rotors and one at each end. By having two intake ports for each rotor, better filling is obtained. Wankel engines as used in the NSU Spider have peripheral intake ports, but C-W prefers a side intake. Later on, you'll see why. All Wankel and RC engines use peripheral exhaust ports, as the scavenging action of the rotor sweeps the burned gas out in a tangential flow. Exhaust pipe and silencer are standard parts, and exhaust emissions are similar to a piston engine's. Smog-control systems like the Air Injection Reactor could be bolted on.

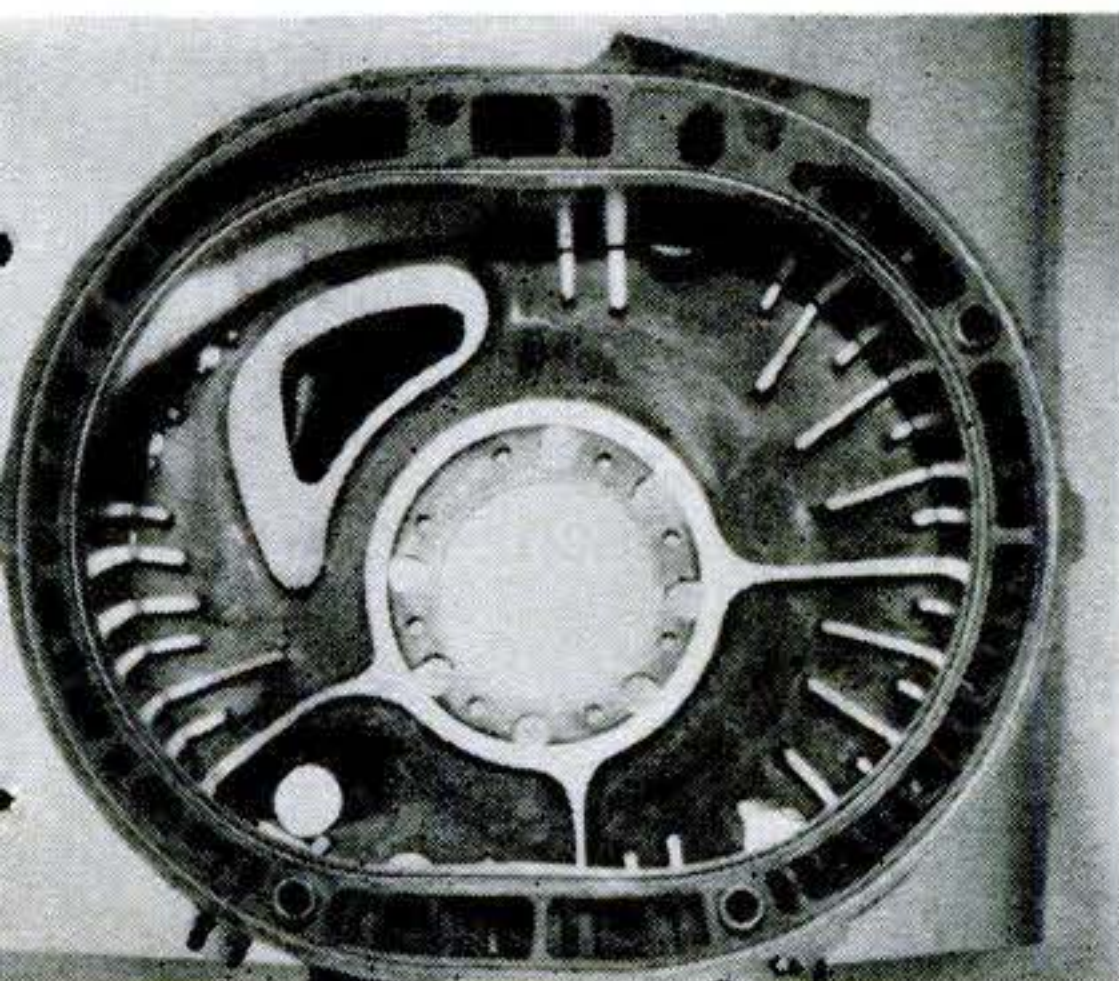
The combustion process. Each of the three segments of rotor rim has a recessed combustion chamber, comparable with the chambers in the cylinder head of a piston

engine. But while the gases in a piston engine are contained within an area always facing the valves and the spark plug, the gas flow in an RC engine is continuous. Because of the rotor's motion and the ever-changing shape and volume of the combustion chamber, the combustion process is quite different.

The RC engine gave rise to a new term, gas-transfer velocity, which we don't have in piston engines. The fresh gas travels in "pockets" between the rotor-rim segments and the trochoidal track. When the pocket widens during the power phase, the gases spread almost to the next apex with incredible speed. The RC has extremely high gas-transfer velocity.

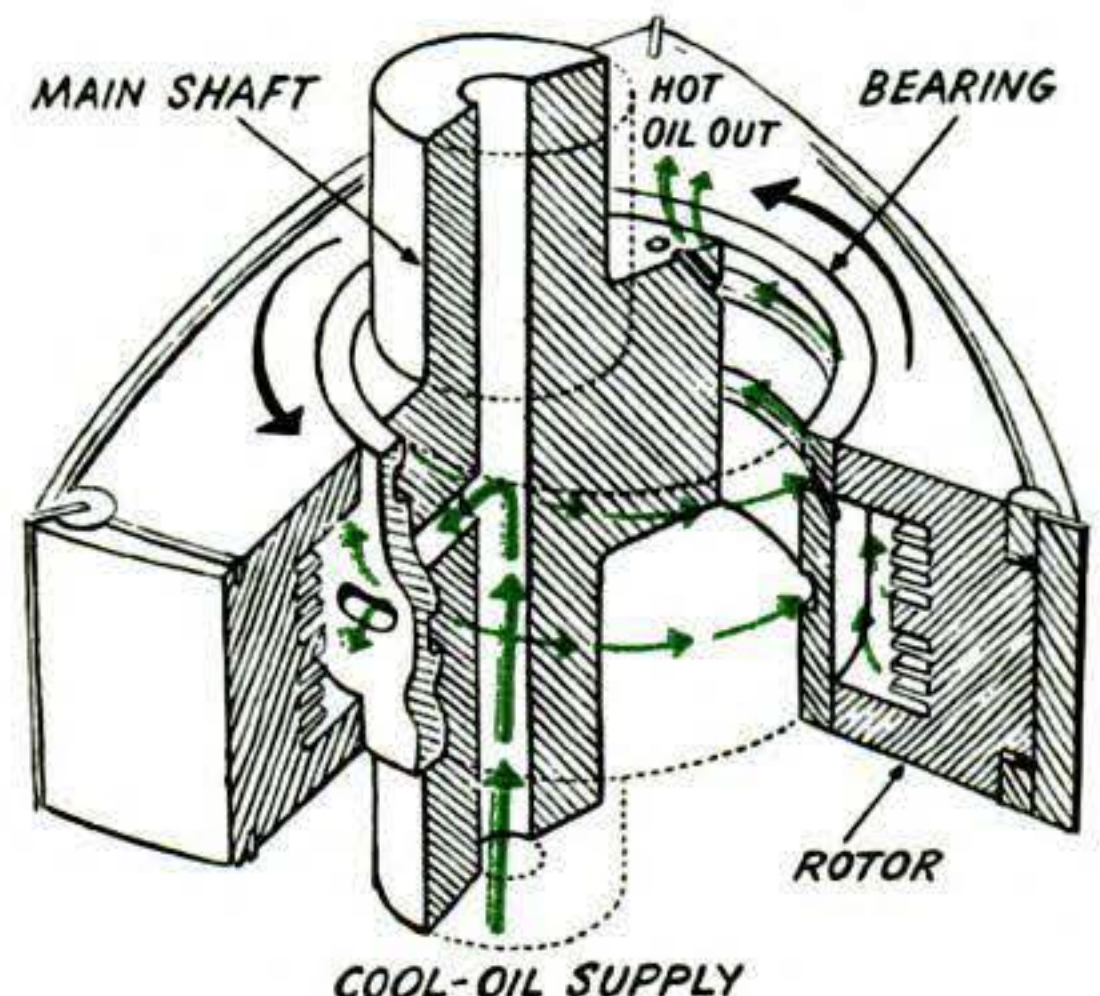
The combustion spreads just as in a piston engine, with a flame front. In a low-turbulence combustion chamber, the flame front would advance from the spark like ripples from a brick dropped in a pool of water. In the RC engine, the flame front, surprisingly, cannot keep up with the gas transfer.

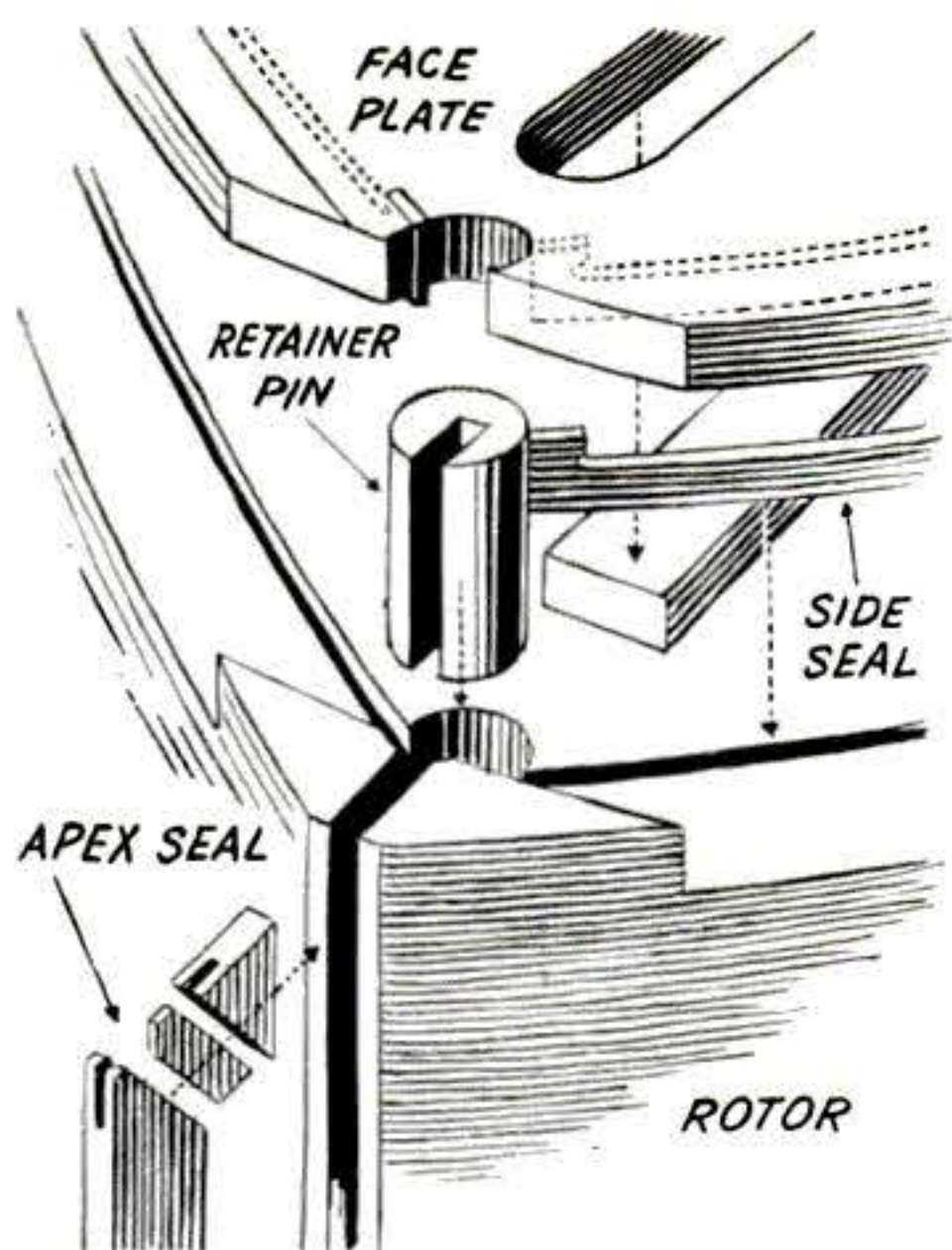
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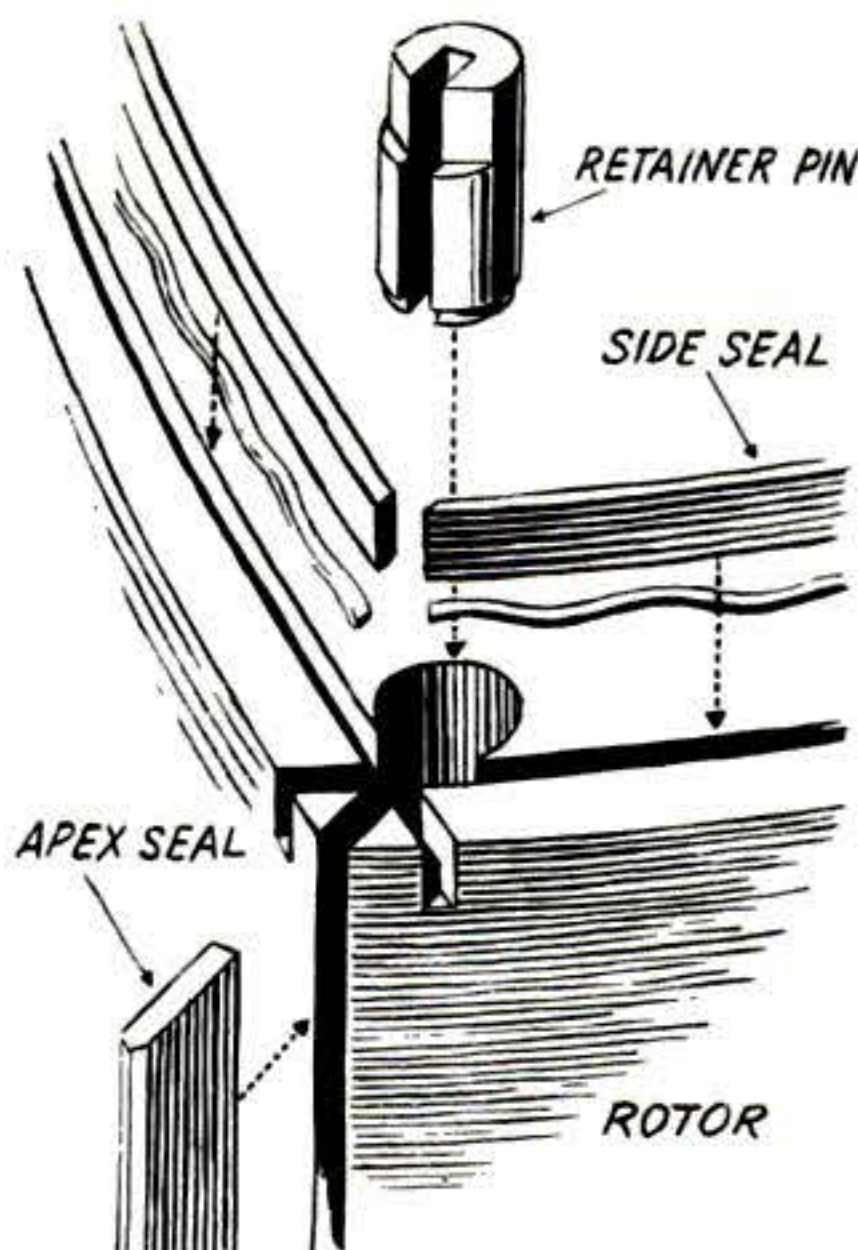
Ribbing in the end covers directs coolant flow in the "snaked axial flow" system developed by Curtiss-Wright. The kidney-shaped opening (upper left) is a side intake port.

Early rotor-cooling system used pressure-fed oil with an intricate circulation path. Now, the rotor motion is used to force oil to hot spots.

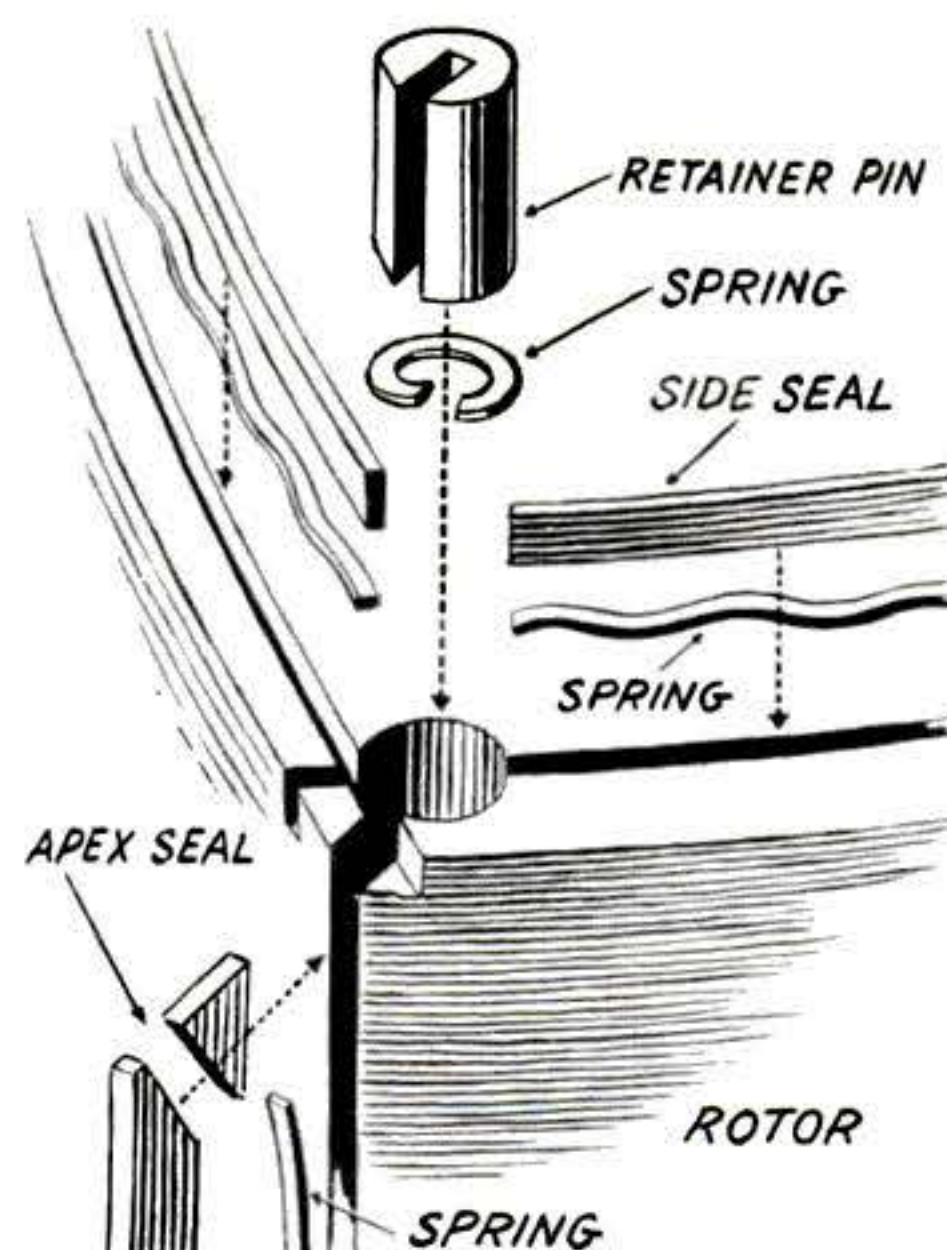




Seals, 1959 version: Apex seals had fragile corners because of too many parts. Side seals were shim strips inserted in grooves on a separate sealing plate.



Seals, 1963 version: Solid-bar apex seal had durability but did not seal corner properly. Grooves for iron-alloy side seals were machined in rotor itself.



Seals, 1966 version: Apex seal corners have a floating triangle for corner sealing. Corrugated springs give all seals a light pressure against facing surface.

You would expect that the gases ignited first would ride the crest of the gas-transfer wave, thus speeding up the flame-front advance. That isn't so. Instead, the flame front has to make it on its own, and may never catch up with all the gas. C-W has found that, in common with piston engines, the RC engine tends to leave some unburned gas at the end of the power phase. Development work on the RC engine is now concentrated on reducing this "end gas."

Why side intake ports? After early tests with NSU Wankel engines (with peripheral ports), C-W decided to move the intake ports around to the sides, where the gas flow is parallel with the rotor axis. The aim was to improve specific fuel consumption. A side port reduces overlap between the exhaust and intake phases, permitting earlier intake closing. Coupled with increased spark duration, C-W not only achieved better fuel economy, especially during part-throttle operation, but also improved low-speed performance.

The torque curve in the RC2-60 rises from 160 pounds-feet at 1,000 r.p.m. to 180 at 1,500, stays almost flat up to 2,000, and then power really comes on. At 3,000 r.p.m., a torque of 205 pounds-feet is at hand, and the curve climbs to 210 at 4,000 before falling off. At 5,000 r.p.m., torque is still as high as 196 pounds-feet.

Sealing the rotor. Just as a piston needs rings, the rotor needs seals. Without seals the RC engine could not run. Gases, fresh

and burned, would be free to mix, and compression would be almost zero. The methods developed by C-W now promise a seal life of 100,000 miles, but it took many years to get to this point.

The seals must be lubricated to function properly. NSU specifies mixing oil with the fuel, and Mercedes-Benz (another Wankel licensee) has patented an oil-injection system. But Curtiss-Wright feeds oil to the seal slots from inside the rotor. Oil consumption in the RC2-60 is about the same as in a piston engine—say, 1,000-1,100 miles per quart.

Early tests with the RC engine were plagued by chatter marks in the trochoidal track. The apex seals are normally pressed against the track by gas pressure. During gas-pressure reversals, the seals tilt in their slots. As the rotor revolves, the seals are also subjected to slight radial movement, now toward the center, now away from it. The chattering was proof that the apex seals were chopping against the wall—a phenomenon similar to piston-ring flutter under extreme piston acceleration. C-W solved the whole problem by a combination of redesigned seals, better materials and cooling-system configurations.

You might think seal tips would wear worse than piston rings because their sliding velocities are higher (up to 108 feet per second in the RC engine; no more than 63.5 in a typical V-8 such as Chrysler's 318-cu.-in. unit). But the seals have an advantage in that they always move in one

direction while the piston rings are rubbed two ways. In addition, the piston rings stop and restart twice in every crankshaft revolution, while the seals are in continuous motion.

Cooling the rotor. The same oil that lubricates the main-shaft bearings, rotor gears, apex seals, end covers, and side seals also cools the rotor. The rotor gets very hot, and the heating is not symmetrical, so there's a big risk of distortion. But the rotor is kept cool by a quantity of oil circulating inside it, fed in by ordinary oil pump, and led out to an oil radiator when hot. The eccentric motion of the rotor forces the oil to the extremities when it's most needed, so no high-pressure pump is required.

Rotor-housing wear. Early RC engines wore out the apex seals in brief tests and were also troubled by substantial wear of the trochoidal track. One of C-W's first steps was to use nitrided cast iron for the inner walls of the housing. Next they tried molybdenum spray, with some success. Then they chrome-plated the trochoidal track and it wore down 0.001 inch in 200 hours.

Now, C-W has a secret metal-spray coating which has cut trochoidal track wear to 1/50 that of chrome plating. The metal-spray coating was put through a 528-hour test, and wear was measured: 0.00004 inch. It may have been even less, but no available instruments could give more precise readings.

Several C-W engineers point out that their successes in the RC development have been a direct benefit from their research on aircraft engines.

RC engines in the future. Compared with a V-8 of similar output, the RC engine is lighter, smaller in size, cheaper to produce, and simpler to service. The RC puts out twice the power per pound (engine weight) of a comparable V-8. Once in mass production, the RC could be built at a cost of a little more than \$1 per hp., against just under \$2 for present-day piston engines.

A smaller and lighter power unit offers greater freedom for the general architecture of the car. Useful space can be increased, and weight distribution can be improved. Now if front drive really goes over big in Detroit, the RC engine promises simplified installation of the entire power train.

PS



Lower wheels remain level on hard roads.

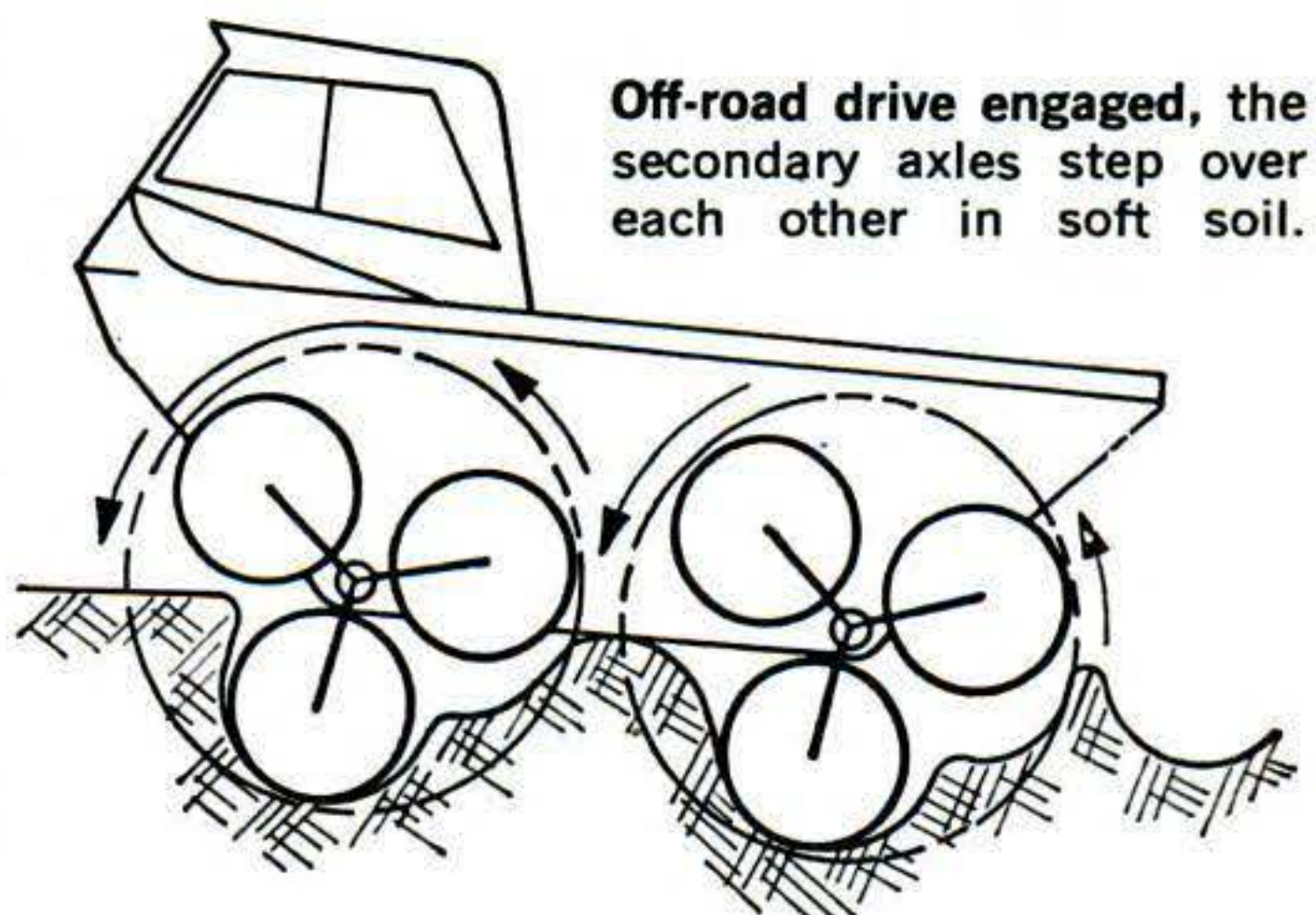


Secondary axles step over each other in mud.

Off-road truck "walks" on its wheels

Triple-wheel assemblies mounted on secondary axles step over each other on this new off-road vehicle to "walk" through soft soil, swamps, and deep mud, or paddle across a stream. On hard surfaces, the "walking" drive is disengaged, and the Lockheed-developed amphibious vehicle rolls along on two wheels of each three-wheel set, like an ordinary truck.

Small wheels equipped with wide-base, low-pressure Goodyear Terra-Tires are mounted on the secondary axles, which are located radially about the main axle by means of large spokes.



Off-road drive engaged, the secondary axles step over each other in soft soil.

Saving a City from a

A lost chlorine barge, sunk by a hurricane, menaced Baton Rouge with 600 tons of poison gas. Here is the inside story of how they found it and ended the peril

When Hurricane Betsy rampaged over southern Louisiana last September, our inland shipping suffered its worst disaster. Left in Betsy's wake were 200 sunken or stranded vessels. But the most urgent question was the fate of one particular craft.

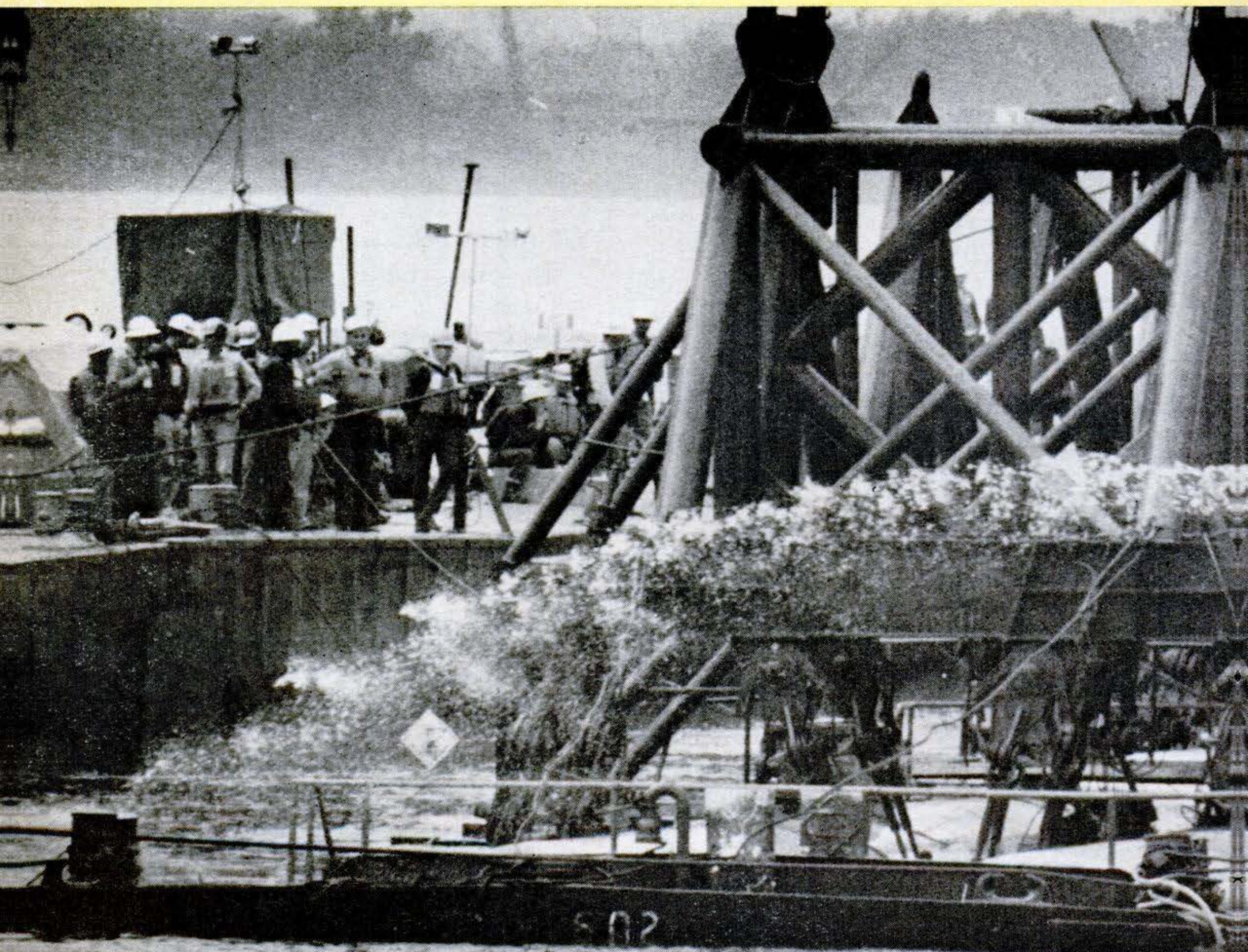
Tied up awaiting a tow at a Baton Rouge dock had been the unmanned barge MTC

602, with a cargo of 600 tons of deadly chlorine. Some time in the night of Sept. 9, Betsy ripped it from its moorings. By next morning, MTC 602 had vanished. Apparently the runaway barge, swamped by a wave, had nose-dived to the bottom of the Mississippi River—at some place unknown.

If the liquid chlorine in the barge's four tanks escaped, it would turn into a greenish-yellow poison gas that could kill tens of thousands of people. Bubbling to the river's surface, the gas could be swept by a breeze into Baton Rouge, a city of 150,000.

At the U. S. Army Corps of Engineers Operations Center in New Orleans, Lt. Col. Lawrence W. Norton II, the crew-cut, hard-boiled Deputy District Engineer, got the

Up comes the MTC 602, just breaking water below bridgelike "strongback" lifting it. Salvagers,



Cloud of Death

By THEODORE IRWIN

word from his commanding officer: "Larry, we've got to send someone to search for that chlorine barge. You're it."

Norton could picture the bargeful of liquid chlorine lying on the bottom like a ticking bomb. All he asked was, "When do I leave?" Then he drove fast to Baton Rouge.

President Johnson had ordered the full forces of the federal government to be made available. Norton, as Search and Recovery Project Officer, was assigned to coordinate all efforts to find the sunken barge—and to remove it, without spreading a cloud of death over the region.

"I knew I had a tiger by the tail," he told me. "The day after Betsy, I had flown

a helicopter down the river for 115 miles, following every bend. Not the faintest trace of that barge!"

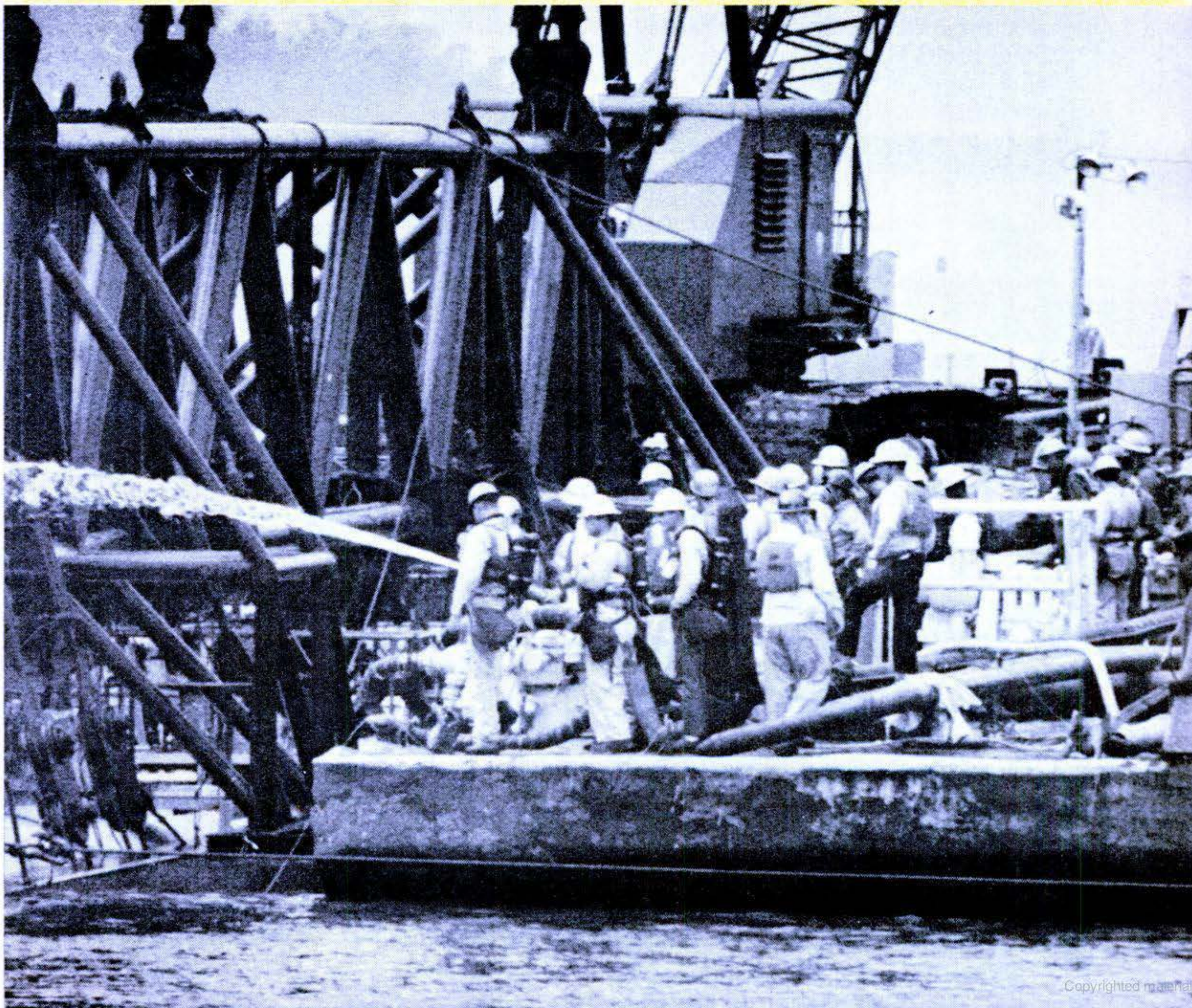
In the next nine weeks, as Baton Rouge braced for a potential catastrophe, he lived through a nightmare of suspense. He averaged three hours' sleep a night, wondering if anything had been overlooked that might cause a devastating leak.

"We had a lot to worry about," he says. "As the river level fell, could a ship ram the wreck? Would a dropped anchor smash a chlorine tank? Would a weakened safety valve of a tank blow? One of our first moves was to close the river to shipping along a 38-mile stretch.

"The Coast Guard sent out helicopters,

Continued

gas masks at ready, remove mud with water jet for firm footing to jump aboard and check for leaks.



First came the task of finding the barge—then, of raising it

picket boats, and cutters. Our patrol boats, with fathometers going, located four sunken objects, and the Navy spotted 11. But none was the missing MTC 602.

"Dragging the river with chains between two boats proved fruitless. Thirteen Army divers from Fort Belvoir and Fort Eustis, Va., and 19 Navy divers drew blanks. On orders from Washington, two Navy planes and the destroyer Hyman, using electronic sub-hunting gear, scoured the river for four days—in vain."

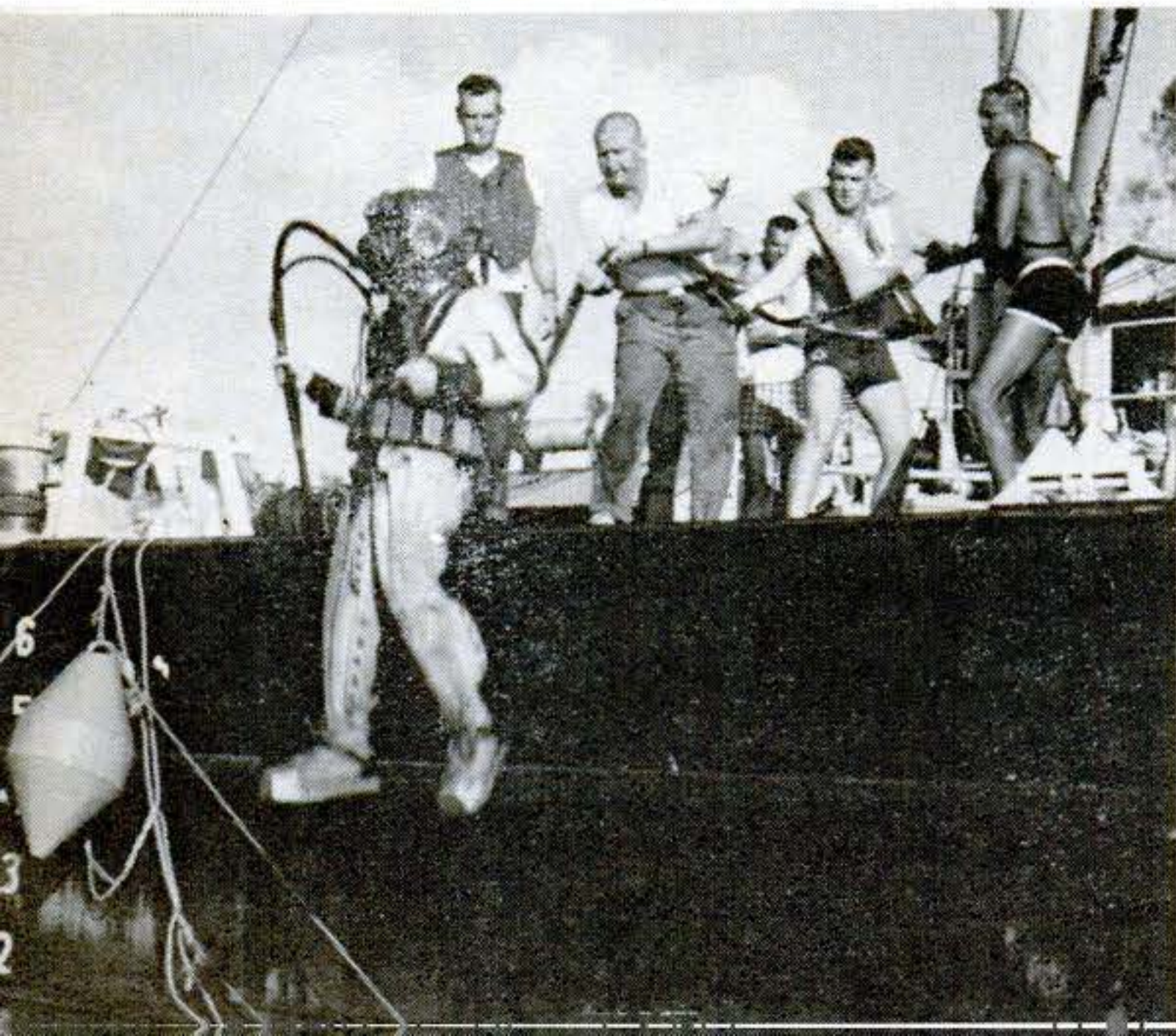
Baffling mischance. This sub-searching gear had successfully spotted a sunken chlorine barge near Natchez, Miss., in 1962 [PS, April, 1963]. It didn't work at Baton Rouge because eight other barges happened to be on the surface right above the sunken MTC 602. The airborne gear picked up only the floating barges, which masked the one beneath.

"All this time we maintained surveillance by squirting ammonium hydroxide in the water," Norton goes on. "If a white cloud appeared, we'd know chlorine was leaking.

"Someone said to me, 'You could look for that barge all your life and never find it.' I refused to believe that."

Pressure to find the barge and open the river to traffic kept mounting. Then the searchers heard of two remarkable devices called a Precision Sonar Profiler and a Sea Scanar. Only a few weeks before, these aids had confirmed the location of an airliner that crashed in Lake Michigan. They had also been used by Coast Guard vessels to thread Arctic channels on Dew Line ex-

Army diver jumps into the river from deck of Coast Guard vessel to feel out a "suspect," in search for sunken chlorine barge. He and others drew blanks, until sonar device finally located the lost craft.



peditions; by salvage companies, in harbors; and by commercial fishermen.

The sonar sets, developed for antisubmarine warfare by Honeywell, Inc., scan a river bottom by sending out sound impulses from a boat. Echoes from the bottom, bouncing back, give a reading or profile of the riverbed—which is automatically plotted on electro-sensitive paper, by a recorder carried aboard, in as little as 10 seconds.

Sophisticated versions of the sonar instruments were rushed from Houston. Attaching them to survey boats, the Engineer task force swept the muddy Mississippi river bottom with sound waves. To these acoustic "fingers," probing slantwise as well as straight down, vessels on the surface were no obstruction.

At 5:30 p.m. on Sept. 16, just a week after Betsy struck, the first contact was made. Two "humps," much like the size and shape of the cylindrical chlorine tanks, magically appeared on the graph paper.

Found—the lost barge. Navy divers went down at the indicated location. They cut two metal seals from tank valves. Identification was positive—it was the MTC 602.

The barge was in 60 feet of water, just off the Louisiana State University campus. Notified 10 minutes after the profile came through, Norton hurried to the spot.

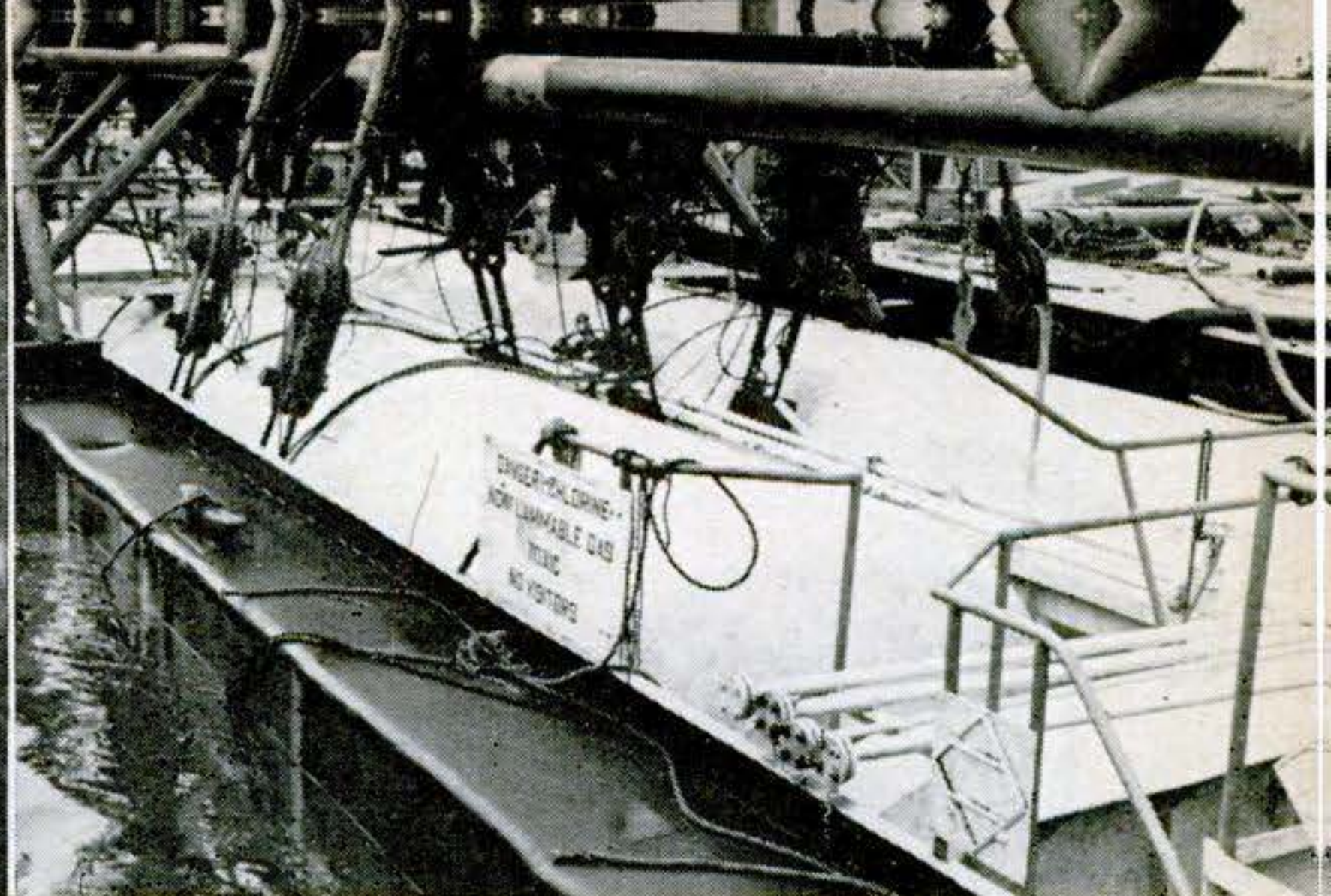
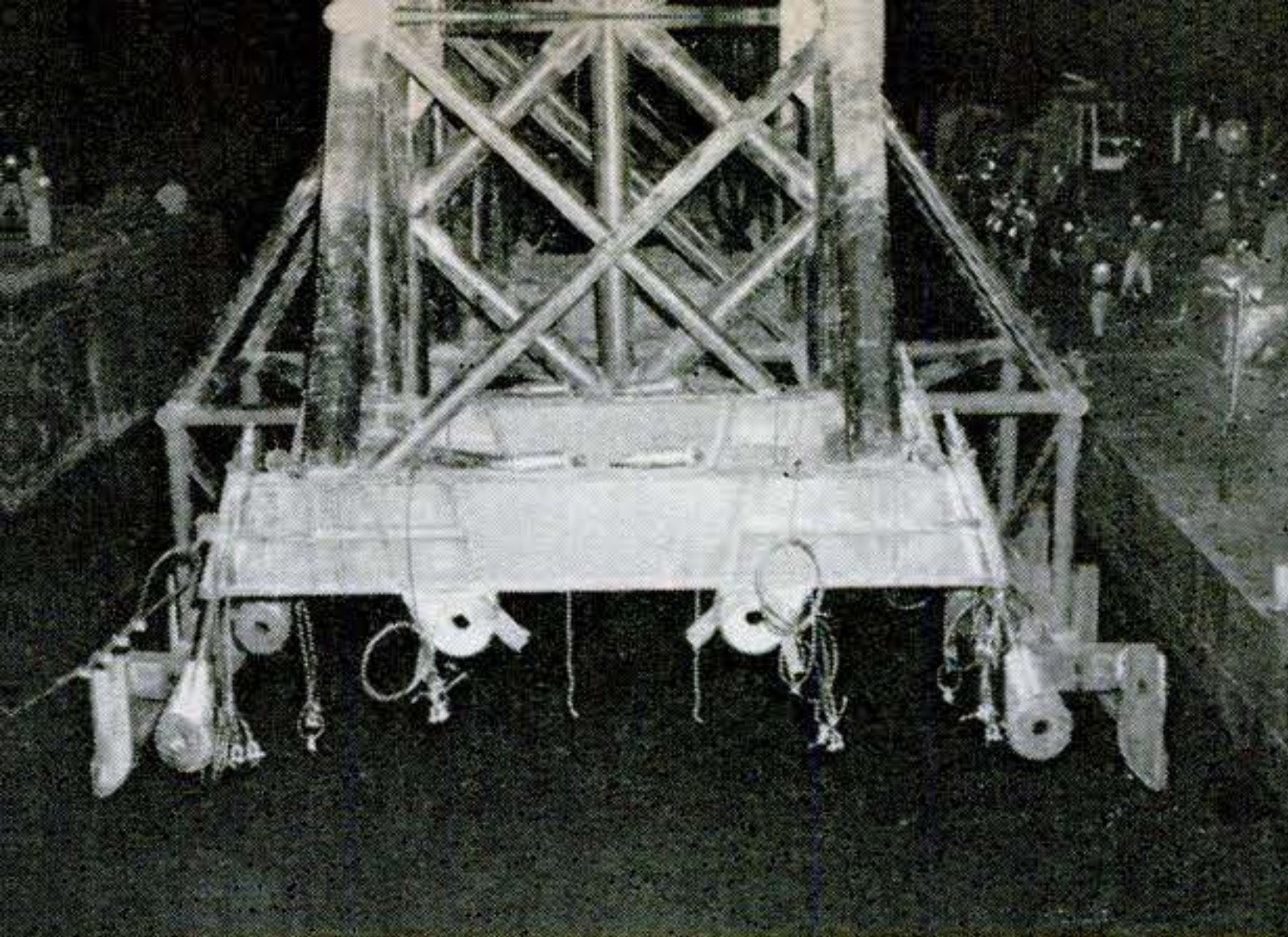
Finding the lost barge was reason for rejoicing. But, as Norton tells it:

"We still had a tough job ahead. How could we pull up that poison-laden barge without rupturing the tanks and causing a holocaust? Just how tightly was it sucked to the bottom?"

"We all knew what happened four years before, when a chlorine tank car on a freight train was rammed and punctured by a hopper car at Morganza, La. There, the escaping fumes instantly killed a child and sent 64 people to hospitals. That was only 30 tons of chlorine. We had 600 tons!"

Salvage experts converged on Baton Rouge from all over the nation. There also were technicians from the barge's builder, Bethlehem Steel, and from the contractor selected to do the salvaging. The Chlorine Institute sent six barge-loading foremen. Every angle, every possible contingency, was minutely studied.

They couldn't risk trying to lift the barge from the outside; its skin plate was only 5/16 of an inch thick, and slings



Strongback is lowered into murky water of Mississippi, to be made fast to the sunken barge for the Big Lift. End view of massive structure shows pad eyes and other rigging connections at bottom.

End of Big Lift has brought chlorine barge safely above water. Steel-cable hoisting slings had to be attached to chlorine tanks themselves, as seen here, since barge's hull was too thin to withstand strain.

would cut through it like a knife. On the Natchez job in 1962, the chlorine tanks were strapped to the barge; the straps could be cut, and the tanks lifted separately. But on the MTC 602 at Baton Rouge, the tanks were *welded* to the barge.

This procedure was finally worked out: Divers would cradle the four tanks in 16 steel-cable slings—four to each tank—padded with oak blocks. The slings would be hooked, through 32 “pad eyes,” to a tremendous bridgelike frame called a “strongback” that would be lowered into the water. The strongback, specially designed for the project, would hang from lifting blocks on a giant 800-ton derrick with twin 240-foot towers. As the derrick pulled up the strongback, it would lift the four tanks at once, and the barge would come along.

The divers had the most rugged assignment—to hook up all connections, then put the strongback on top. Thirty-two teams hired by the contractor, the J. Ray McDermott Co., worked day and night seven days a week. With visibility almost zero in the murky water, fingers had to do the work of eyes. The current was tricky, sometimes moving at three feet a second. Occasionally a diver became disoriented, confusing the port side of the barge with the starboard side.

And the hardware the divers handled was heavy. Slings were 2½-inch cables. Each shackle connecting a sling with the strongback weighed about 200 pounds; each pin for a pad eye, 75 pounds. Everything but hand tools had to be controlled by power air lines. Generally a diver could stay down only 90 minutes a day. At times he'd come up so exhausted that it took

three men to lift him up out of the water.

Working bare-handed by finger-feel meant skinned knuckles. One diver caught his hand in the wrong place and had to have nine stitches to sew him up. Another slashed off the tip of his thumb. Diver Joe Savoie got his hose hooked on a tree that had fallen across the sunken barge. “I couldn't pull any slack,” he said later, “or let go to try to move—I'd risk the bends. So I stayed put for 15 minutes, until another diver pulled me free.”

Every time a diver emerged, Norton waited tensely for his report. What was the condition of the barge? Any serious damage? Once, a diver reported he had found a hole big enough to stick his arm through, but didn't know where it was. It worried Norton. (Later they found there was no such hole.) Another time, bubbles suddenly rose to the surface, and Norton was concerned lest something had ruptured a chlorine tank. But these were only air bubbles, apparently released by displaced mud.

The underwater job took 20 long days and nights. Everything had to be “glued” together, tied up in one rigid package. Sixteen slings had to be attached and connected to the strongback. Working blind, it took a lot of tedious maneuvering.

The fateful day. At last came Lift Day—Friday, Nov. 12. All Baton Rouge and much of the nation held its breath.

That morning the skies were overcast. A faint mist hung over the river. Army and Coast Guard helicopters hovered at the scene—ready to alert the public from loudspeakers and follow the deadly cloud, if it appeared. Gas masks were issued to those

[Continued on page 238]

PS Tests the Compact



If you think that sporty styling is more important than useful space, you'll want to read our test report on these cars with the sloping stern

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

This year's new wave of fastbacks is the splashiest lineup yet. They come in all sizes and price ranges—from the high-priced Toronado to the midrange Charger.

But those destined to top the best-seller list are the modestly priced Barracuda, Marlin, and Mustang. These three entries in the fastback sweepstakes are sporty, all right, but their looks just camouflage stan-

dard cars unless you get them with front disk brakes, handling packages, special wheels, and other race- and rally-inspired options—all available at realistic prices. Without these extras, the Barracuda feels like a Valiant and the Marlin just like a Classic.

Well, how good are they? I lived with the three cars for a week and ran them

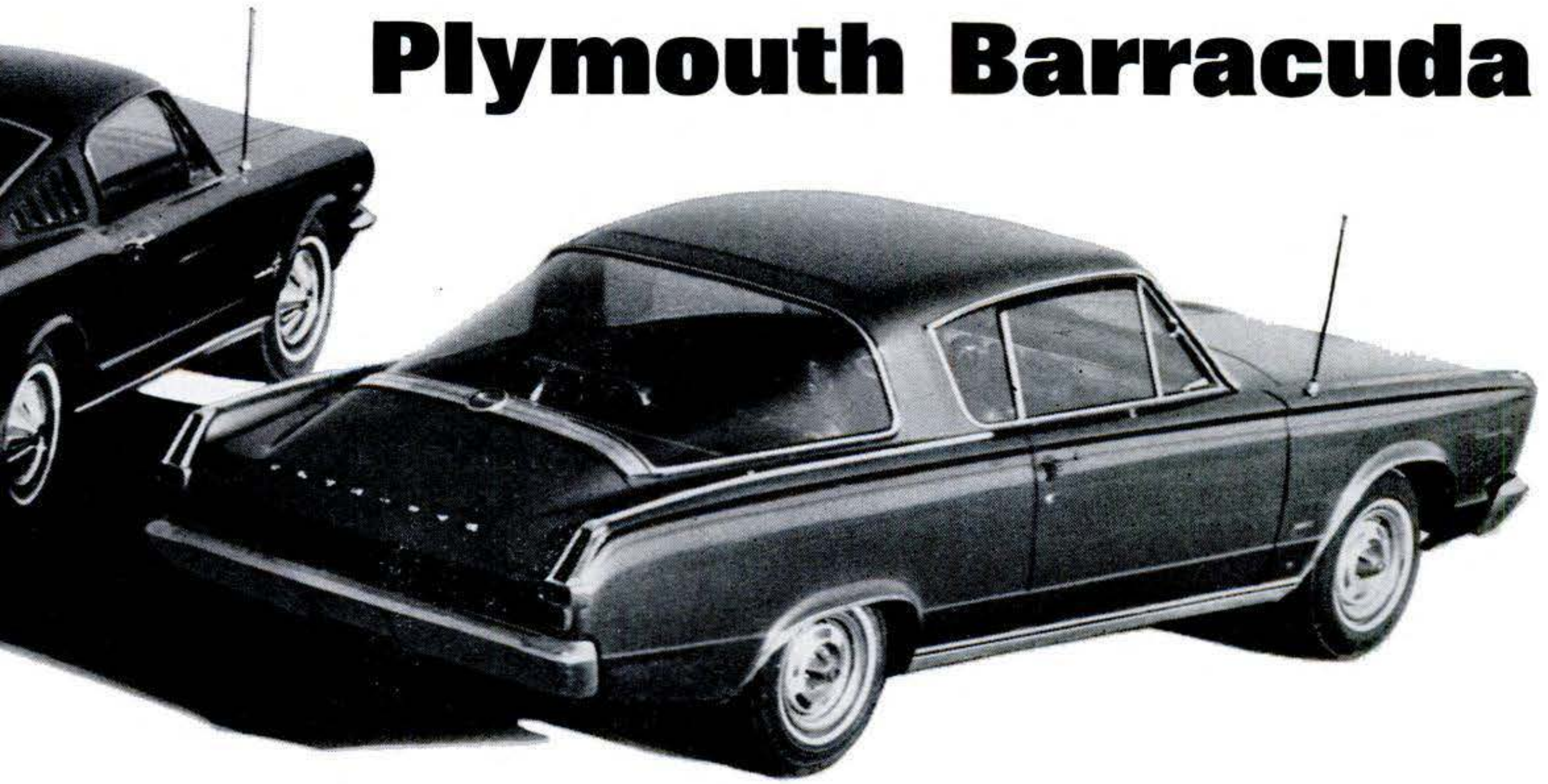


MARLIN has best ride comfort. Hefty stabilizer bar restricts body roll, but car understeers to excess—following its nose, not its front wheels.



MUSTANG has initial understeer, but is well balanced. All four

Fastbacks: Rambler Marlin Ford Mustang Plymouth Barracuda



through every kind of test. Here's what I found out:

How they ride. The Marlin is all coil-sprung. The Mustang has coils in front and semi-elliptics in the rear. The Barracuda has torsion bars up front and semi-elliptics in the rear. The Marlin seems to have the best-balanced ride on good roads and bad. The Marlin is also well isolated. Its interior

is quiet, even when the wheels are bouncing around. I was satisfied with the Marlin's shock damping, too. It hits a bump and gets it over with. It doesn't divide it up into a harmonic pitching that can bring on travel sickness.

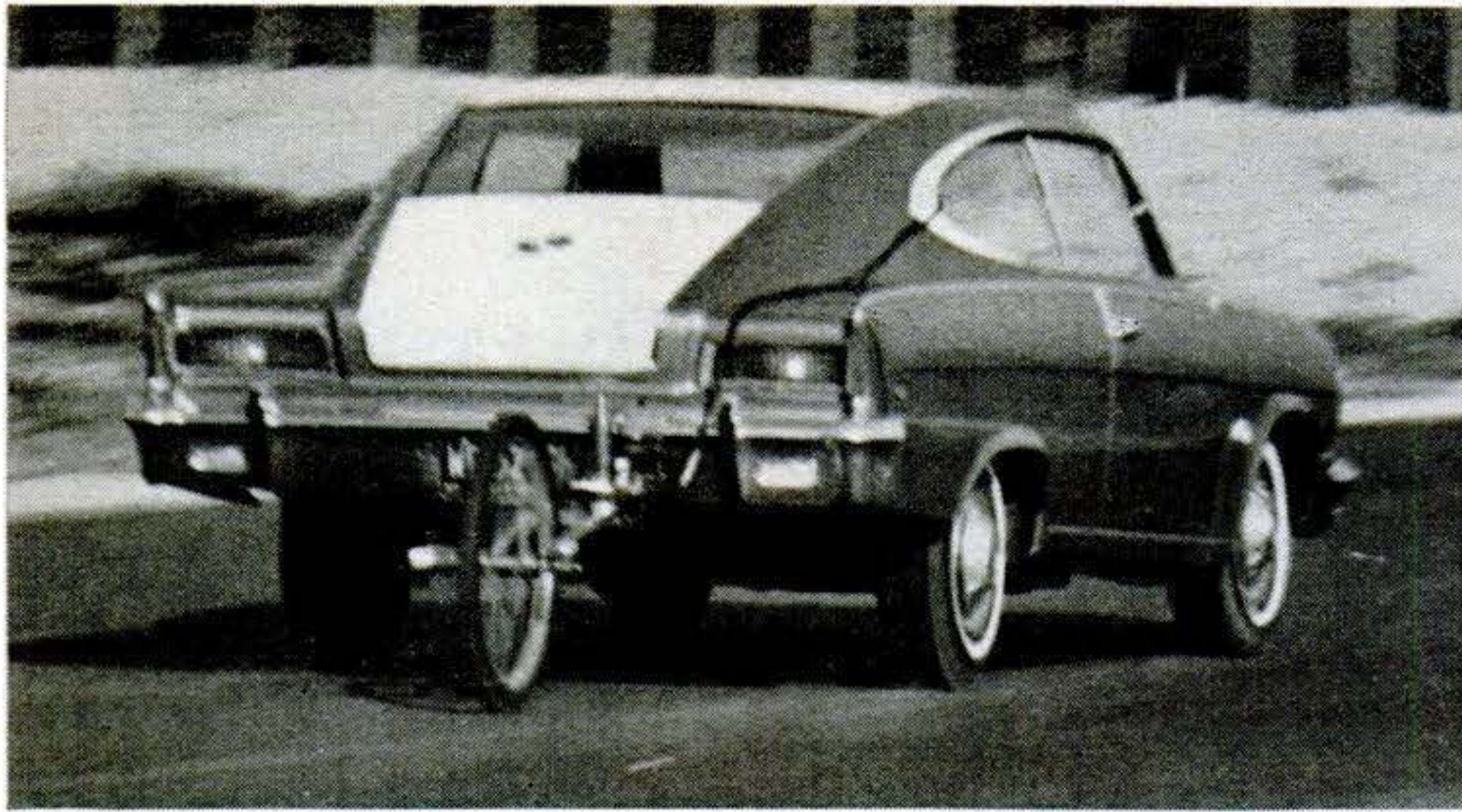
The Barracuda gives you an average ride—some pitch on bad surfaces at about 30 m.p.h., but okay on the whole. The Mus-

Continued



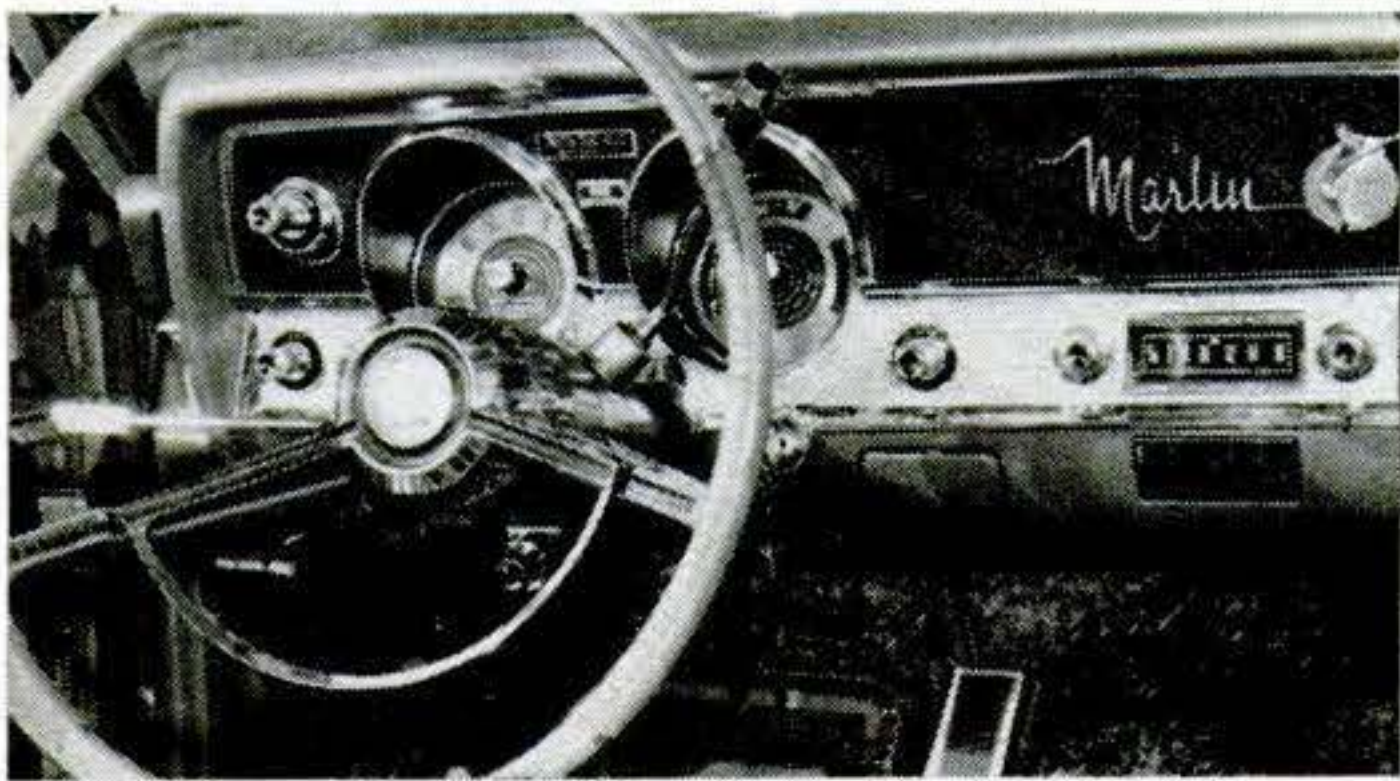
wheels drift, but rear wheels never lose grip. The car always felt safe.

BARRACUDA, also well balanced, has more understeer than Mustang. Resuming a straight course after a fast bend often calls for corrections.

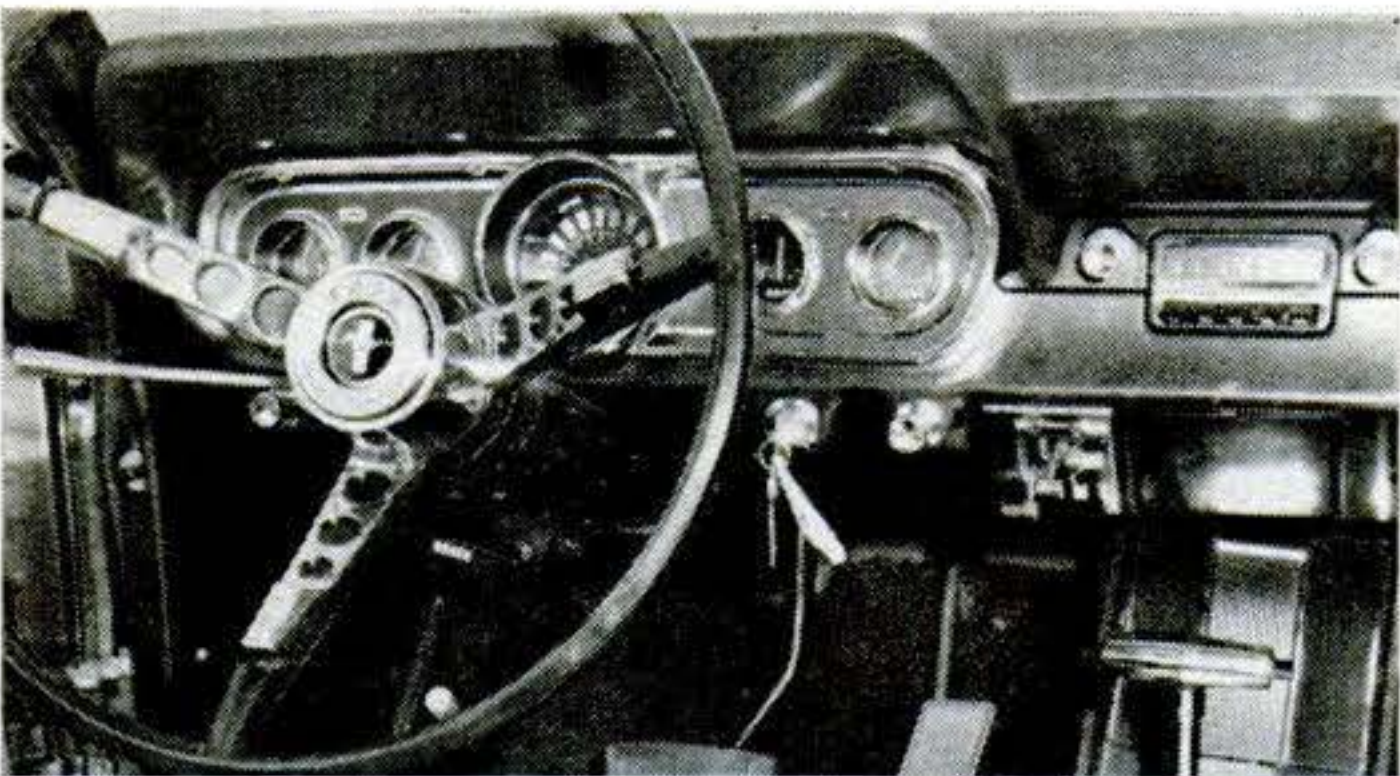


MARLIN brakes faded early. Rear wheels didn't even lock at the end. Braking erratic with car overheated; side pull was strong—and sudden.

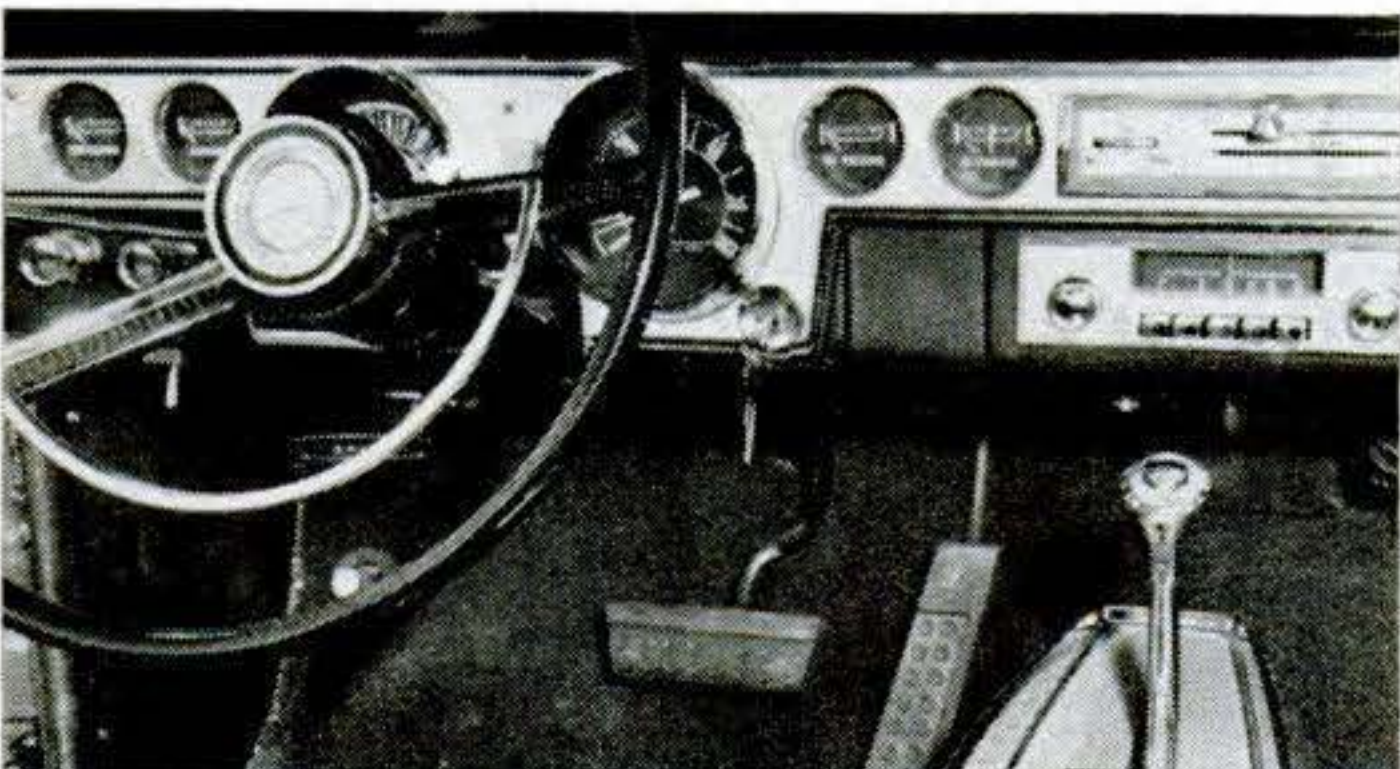
MUSTANG'S rear wheels locked up, spreading smoke and rubber



MARLIN has transmission selector lever on the steering column. Positions of lever are easily visible. Chrome on the floor pedals is slippery.



MUSTANG has a good instrument panel, console shift, and a 16-inch wheel, which has no horn ring. Chromed extensions on wheel spokes blow the horn.



BARRACUDA has sensibly sized and covered pedals. Its instrument panel is nicely convenient. Test car had optional tachometer and console shift.

tang acts a little harsh on the rear suspension—a penalty for the excellent stability of the rear axle, which takes even big bumps without the general balance of the car being affected. There isn't too much vertical wheel movement and the car has no tendency to change direction because of the way the road leans. It keeps going where you point it.

How they steer. In satisfying demands for reduced steering effort, the auto makers have lost a good deal of feedback. The public has put up with it because it assumes you can't have power steering that also feeds back all the information a manual steering wheel puts in your hands. But it is possible to do this, as Corvette and Mercedes-Benz have shown. All three cars in this group had power steering. The Mustang comes closest to a satisfactory system. Yet it doesn't quite have enough feedback. Some people might also find the steering effort a little high, although I like this bit of resistance in the steering wheel.

Manual steering systems use a high steering ratio to keep turning effort low. Power steering does away with the need for high steering ratios, and most auto makers have reduced the number of turns from lock-to-lock, American Motors included. But the Marlin's power steering is still painfully slow.

The Barracuda's steering system seems a little vague in centering and feels imprecise on slight wheel movements, but the car went around corners with the usual aplomb of a Valiant.

How they wiggle-woggle. If you think it's a new dance, you're almost right. Actually it's our test for a car's ability to steer



smell. Car had good brakes, but developed some fade in front.



BARRACUDA brakes were poor. Front-brake fade set in early, and locking-up the rear wheels failed to shorten braking distances significantly.

out of a highway emergency. Suppose there's an accident up ahead. The driver in front doesn't react and rams the car in front. You can't possibly stop in time. There's about 60 feet of clearance to change lanes. Your speed is 60 m.p.h. Look in the mirror and out the side window. Clear? Turn fast! If you're still going straight ahead after a half turn of the wheel, it doesn't wiggle-woggle well. By the time the steering catches up with your signals, you've slammed into the car in front. Some cars move out of their lane just fine, but then fail to line up in the other lane, and sometimes go out of control. Ideally, a car should go through this maneuver without causing the driver worry about its feasibility.

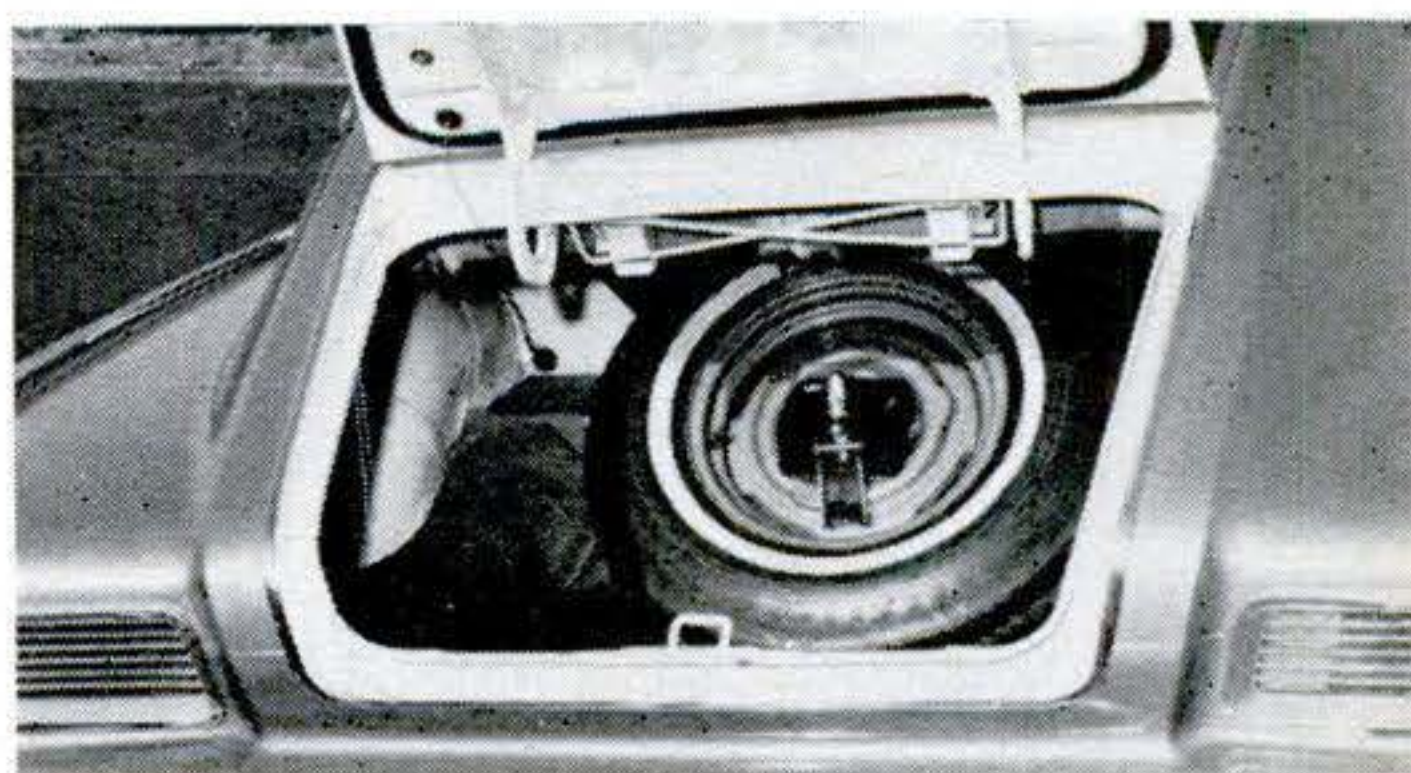
I didn't use a car in front for my testing, but marked the track where it should be and tested the cars one at a time.

The Mustang turned without hesitation and kept its stability. The Barracuda didn't react as positively, and seemed a little bewildered about lining up in the other lane, but not enough to worry me.

The Marlin was a problem. It usually hit the "car" in front. Where it got by, I had to do some fancy wheel-twirling to straighten it out. The car has very strong directional stability—to the extent that it doesn't follow the front wheels but keeps going straight. Its understeer is hazardously excessive. The lack of response that could make all the difference in a highway emergency in good weather is even more critical in rain or snow. And when I tested the cars under wet conditions, the lack of response was even more pronounced in the Marlin.

How they stop. All the cars had standard

Continued



MARLIN trunk is huge, but the lid is only 26.3 in. wide (52.4 on Ford, 52.8 on Plymouth). Rear seat is like Classic sedan's—fixed, doesn't fold down.



MUSTANG has low and wide trunk. Spare wheel hogs space. The rear seat folds away to carry odd-shaped loads. Fuel-tank cap is below the trunk-lid lock.



BARRACUDA carries spare below trunk floor. The tank filler neck sticks through the left fender. Rear seats fold away to create station-wagon-like area.

drum brakes—with power assist on the Marlin and the Barracuda—no power on the Mustang. I made five warm-up stops in five minutes with each car, followed by a panic stop from 80 m.p.h. The readings on our Tapley meter (an instrument for recording deceleration) after the final stop were:

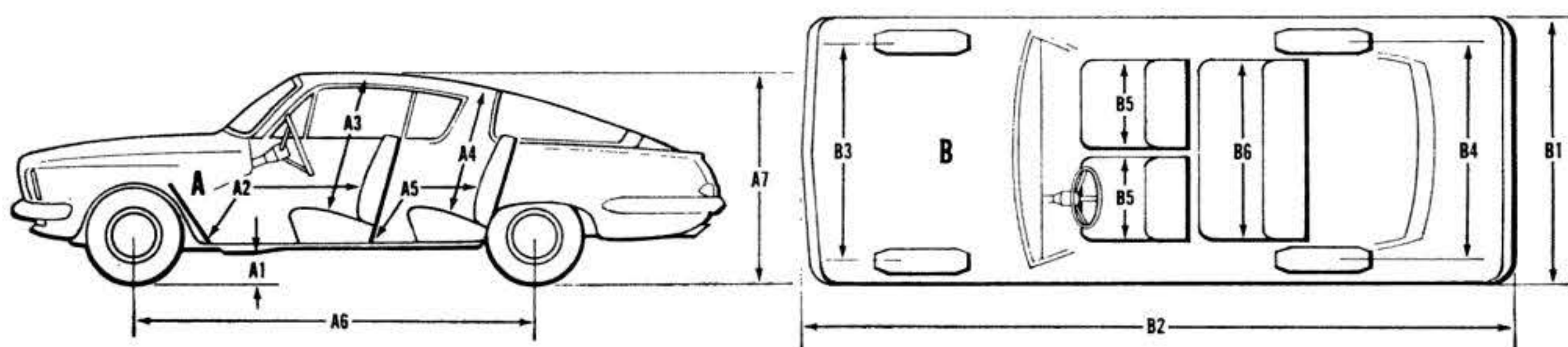
- Mustang81 percent
- Barracuda69 percent
- Marlin63 percent

The theoretical maximum deceleration rate possible from braking the wheels of an automobile is one G (32-feet-per-second-per-second), and this rate is taken as the

figure for 100-percent braking efficiency.

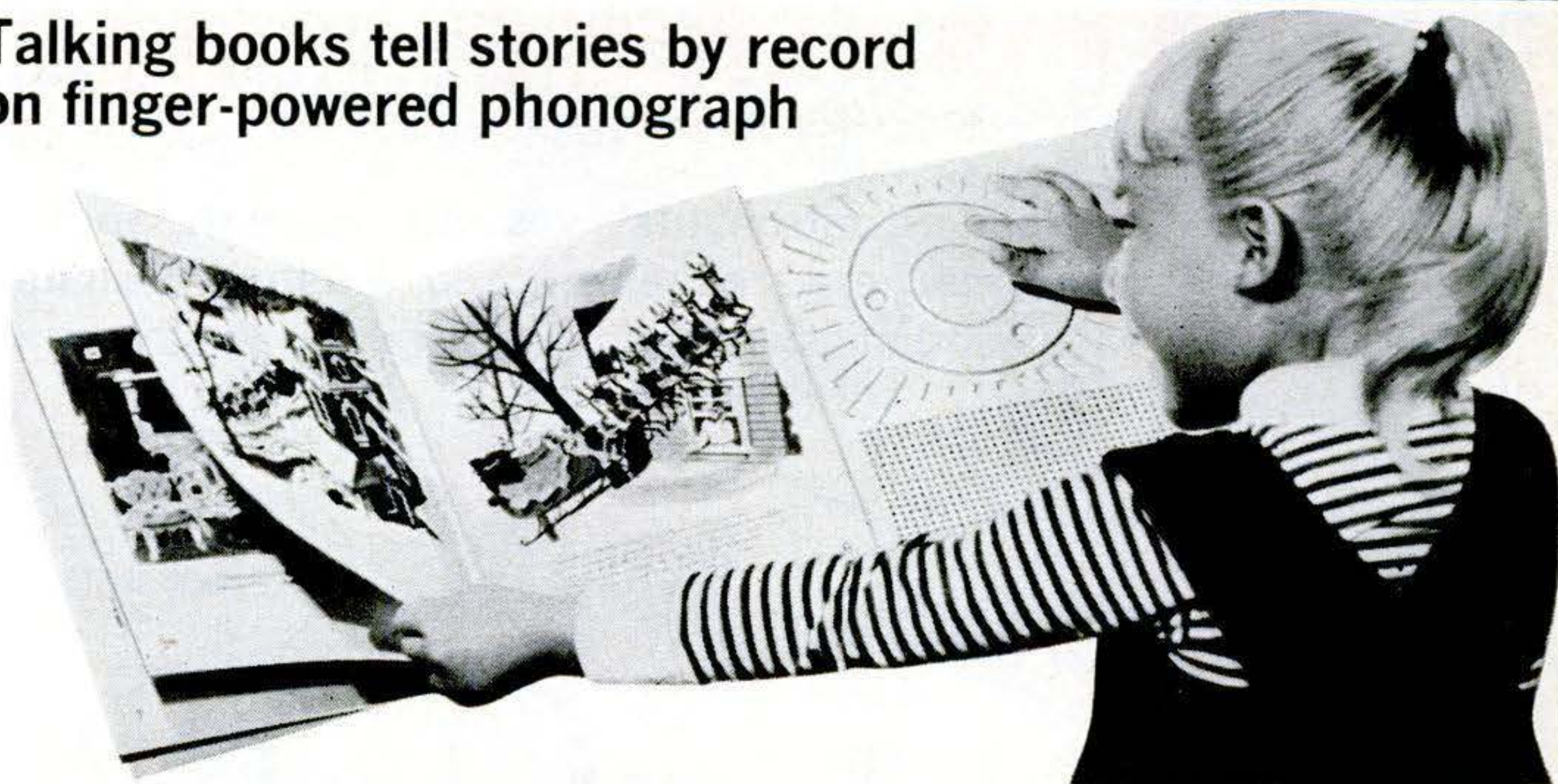
Conclusion. The Mustang brakes are very good, the Barracuda brakes poor, and the Marlin brakes very poor. But the figures don't tell the whole story. The Ford and Chrysler products came to a halt in a fairly straight line, while the Rambler was highly erratic. Strong side pull set in on the third warm-up stop, now to one side, now to the other. On my fifth run, the right front wheel grabbed so hard that the car was almost pulled off the track at high speed. I had to get off the brake and experienced

[Continued on page 246]



	RAMBLER Marlin	FORD Mustang	PLYMOUTH Barracuda
DIMENSIONS (inches)			
A1 Ground clearance	7.7	5.2	6.8
A2 Front leg room	42.0	44.3	43.5
A3 Front head room	37.0	37.4	38.0
A4 Rear head room	33.2	30.6	33.0
A5 Rear leg room	38.7	30.3	35.3
A6 Wheelbase	112.0	108.0	106.0
A7 Overall height	54.2	51.0	56.0
B1 Overall width	74.5	68.0	70.1
B2 Overall length	195.0	181.5	188.2
B3 Front track	58.6	56.0	56.6
B4 Rear track	57.5	56.0	56.3
B5 Front-seat width	22.0 (2)	21.6 (2)	22.2 (2)
B6 Rear-seat width	53.0	39.8	47.2
SPECIFICATIONS			
Engine type	OHV V-8	OHV V-8	OHV V-8
Bore & stroke	3.75 x 3.25	4.00 x 2.87	3.63 x 3.31
Displacement	287 cu. in.	289 cu. in.	273 cu. in.
Compression ratio	8.7:1	9.3:1	10.5:1
Carburetion	Single 2-bbl.	Single 2-bbl.	Single 4-bbl.
Power @ r.p.m.	198 @ 4,700	200 @ 4,400	235 @ 5,200
Torque @ r.p.m.	280 @ 2,600	282 @ 2,400	280 @ 4,000
Transmission	Flash-O-Matic 3-speed and torque converter	Cruise-O-Matic 3-speed and torque converter	TorqueFlite 3-speed and torque converter
Axle ratio	3.15:1	2.80:1	3.23:1
Tire size	7.35x14	6.95x14	7.00x13
Steering ratio	20.8:1	22.0:1	18.8:1
Turns (lock-to-lock)	4.27	3.5	3.5
Turning radius	18.6 ft.	19.0 ft.	18.55 ft.
Brake-swept area	267.07 sq. in.	251.3 sq. in.	251.3 sq. in.
Curb weight	3,288 lb.	2,875 lb.	2,985 lb.
Basic price	\$2,707.00	\$2,713.00	\$2,637.00
Price as tested	\$3,525.00	\$3,132.00	\$3,197.00
PERFORMANCE			
0-60 m.p.h.	11.7 sec.	10.0 sec.	8.5 sec.
0-80 m.p.h.	21.6	18.4	15.0
25-70 m.p.h.	11.9	10.5	8.6
40-60 m.p.h.	5.6	5.0	4.3
SS 1/4-mile—elapsed time	19.4	17.9	15.7
SS 1/4-mile—terminal speed	76.6 m.p.h.	79.0 m.p.h.	81.6 m.p.h.
Fuel economy—overall	16.3 m.p.g.	21.2 m.p.g.	15.4 m.p.g.

Talking books tell stories by record on finger-powered phonograph



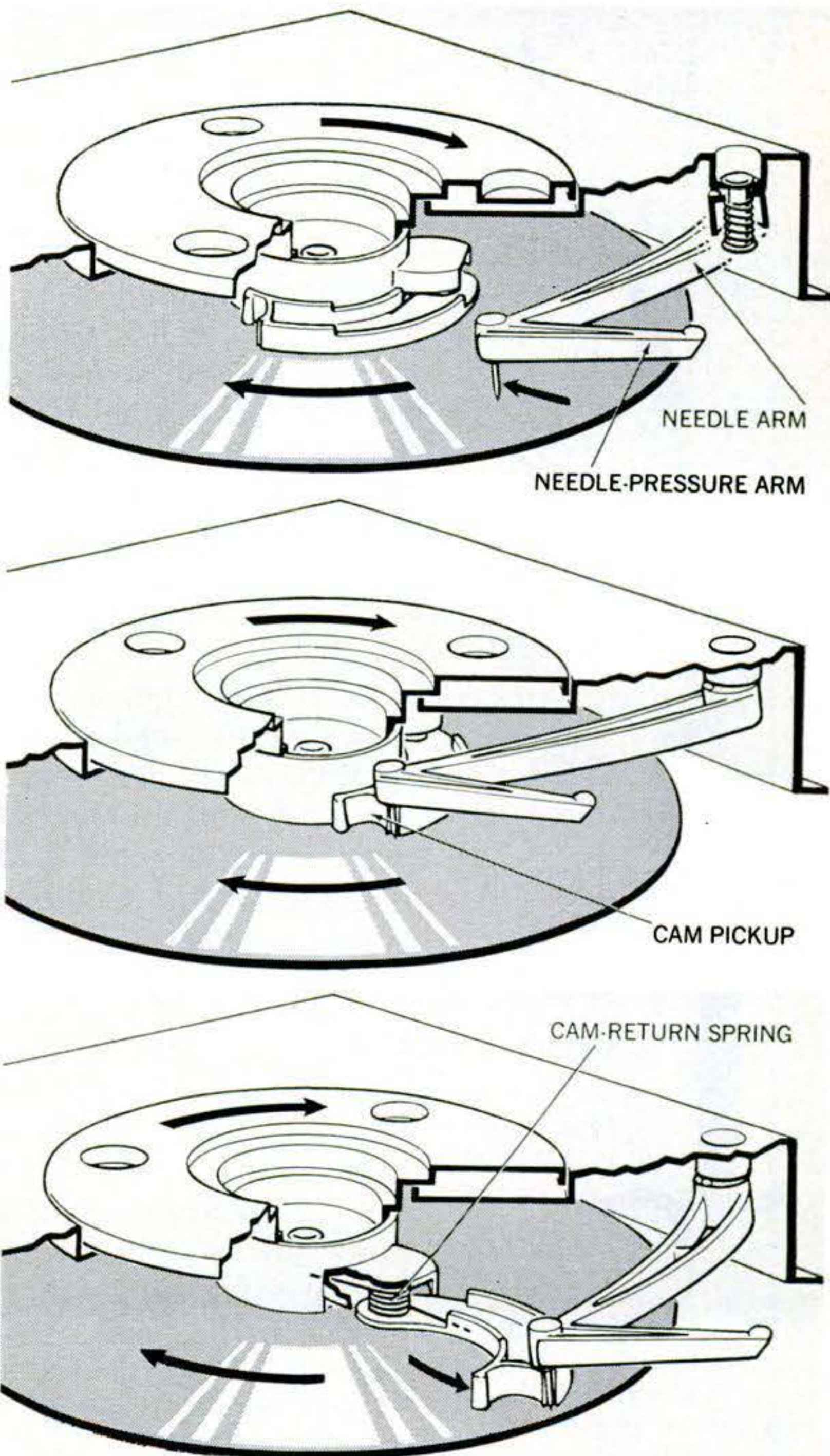
A clever invention that delights small children and fascinates grown-ups, this book narrates its story through a record on a finger-rotated turntable as the pages are turned. Opening the cover reveals color-picture pages and a phonograph carrying a record with dialogue and appropriate sound effects.

The record, turned by finger in a circular dial, is made of high-impact styrene; it can be turned back without groove damage to replay a missed sentence or two. Speed of rotation can be learned quickly by the child, and can be varied for best understanding of the narration. There are no batteries or wires.

Drawings at right show the mechanism inside the sound box: 1) Kept in the sound grooves by a pressure arm rubbing against the top of the sound box, the needle is shown while playing; 2) at the end of the record, the needle is caught and lifted by a slot in a spring-return cam at the center of the turntable; 3) it is replaced in an outer groove at the start of the record, and the record is ready for replaying when the spring in the cam pivot returns the cam again to the center of the turntable.

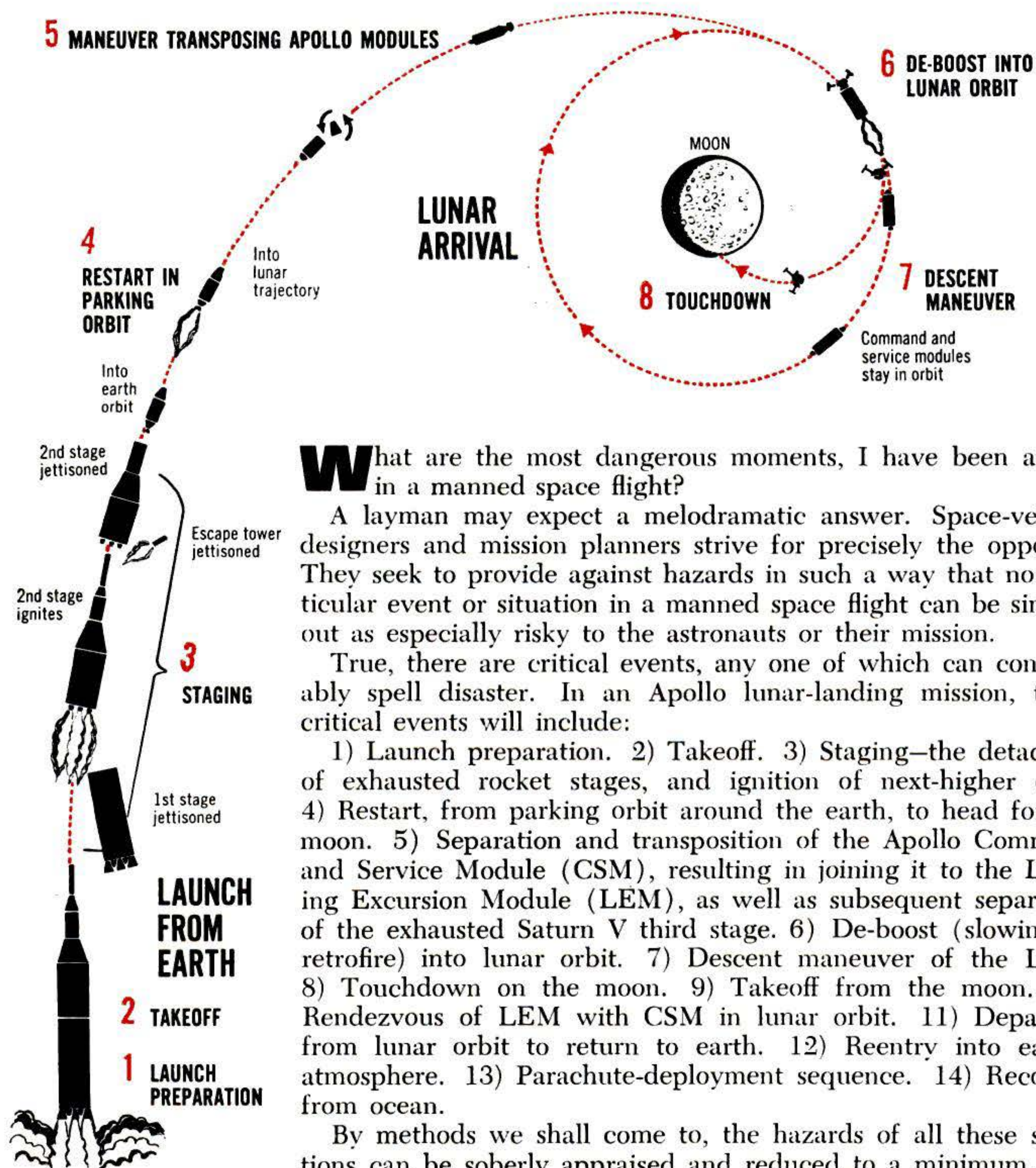
Available are more than a dozen titles, including *Mother Goose Favorites*, *The Little Red Hen*, *Little Red Riding Hood*, *The Night Before Christmas*, *Tommy and His Drum*, *Sylvester*, *the Little Duck Who Lost His Quack*, and others, all narrated by TV actors.

Talking books are made by Sonic Educational Products, El Cajon, Calif., and sold postage paid for \$3.98 by Sam Richards, Traders, Bantam, Conn. 06750.



Beating the Perils of Manned

To safeguard astronauts' lives and assure the success of their ventures, here are the ways space-vehicle designers and mission planners provide against dangers



Mission to moon conceivably could meet with disaster at any of these 14 critical points. Planners seek to make none riskier than rest.

What are the most dangerous moments, I have been asked, in a manned space flight?

A layman may expect a melodramatic answer. Space-vehicle designers and mission planners strive for precisely the opposite. They seek to provide against hazards in such a way that no particular event or situation in a manned space flight can be singled out as especially risky to the astronauts or their mission.

True, there are critical events, any one of which can conceivably spell disaster. In an Apollo lunar-landing mission, these critical events will include:

1) Launch preparation. 2) Takeoff. 3) Staging—the detaching of exhausted rocket stages, and ignition of next-higher ones. 4) Restart, from parking orbit around the earth, to head for the moon. 5) Separation and transposition of the Apollo Command and Service Module (CSM), resulting in joining it to the Landing Excursion Module (LEM), as well as subsequent separation of the exhausted Saturn V third stage. 6) De-boost (slowing by retrofire) into lunar orbit. 7) Descent maneuver of the LEM. 8) Touchdown on the moon. 9) Takeoff from the moon. 10) Rendezvous of LEM with CSM in lunar orbit. 11) Departure from lunar orbit to return to earth. 12) Reentry into earth's atmosphere. 13) Parachute-deployment sequence. 14) Recovery from ocean.

By methods we shall come to, the hazards of all these situations can be soberly appraised and reduced to a minimum. Resulting safeguards will aim to assure an Apollo mission's success from start to finish. And, even if the mission should fail, they are still to provide for bringing the astronauts back safely.

Getting out of a tight fix. Suppose, for example, that while an Apollo spacecraft's crew are orbiting the moon before landing,

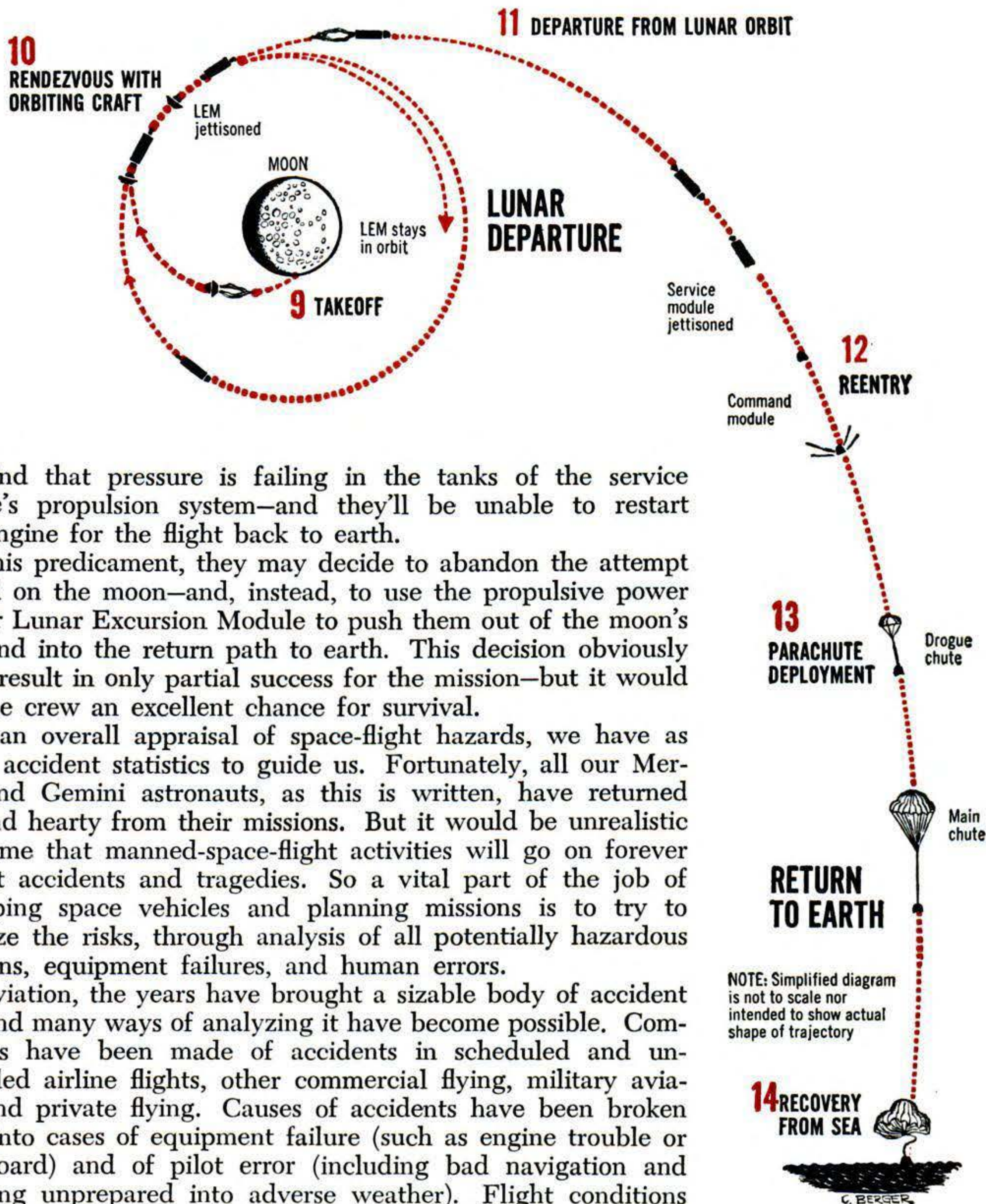
Space Flight

By Dr. Wernher von Braun

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



On visit to PS, Dr. von Braun (holding papers) discusses his coming articles with Editor-in-Chief Ernest V. Heyn (far right), Executive Editor Hubert Luckett (between them), and Senior Editor Alden P. Armagnac (left).



they find that pressure is failing in the tanks of the service module's propulsion system—and they'll be unable to restart their engine for the flight back to earth.

In this predicament, they may decide to abandon the attempt to land on the moon—and, instead, to use the propulsive power of their Lunar Excursion Module to push them out of the moon's orbit and into the return path to earth. This decision obviously would result in only partial success for the mission—but it would give the crew an excellent chance for survival.

For an overall appraisal of space-flight hazards, we have as yet no accident statistics to guide us. Fortunately, all our Mercury and Gemini astronauts, as this is written, have returned hale and hearty from their missions. But it would be unrealistic to assume that manned-space-flight activities will go on forever without accidents and tragedies. So a vital part of the job of developing space vehicles and planning missions is to try to minimize the risks, through analysis of all potentially hazardous situations, equipment failures, and human errors.

In aviation, the years have brought a sizable body of accident data, and many ways of analyzing it have become possible. Comparisons have been made of accidents in scheduled and unscheduled airline flights, other commercial flying, military aviation, and private flying. Causes of accidents have been broken down into cases of equipment failure (such as engine trouble or fire aboard) and of pilot error (including bad navigation and venturing unprepared into adverse weather). Flight conditions when accidents happened have been analyzed, too: takeoffs, landings, and flying under conditions of high or low visibility, smooth or turbulent air, icing, thunderstorms, and so on.

For space hazards, a new method. Without such data for space,
Continued

NOTE: Simplified diagram is not to scale nor intended to show actual shape of trajectory

“Reliability analysis” guides planning against space hazards

how can we get a good handle on space-flight hazards? Considerable progress has been made. Far from being a mere paper study, lacking practical significance for want of experience to go on, is the new art of “reliability analysis.” It provides most valuable hints to the space-vehicle designer as to where he should make an extra effort to reduce a potential hazard.

The basic approach to a reliability analysis is quite simple. Usually one begins with an arbitrarily chosen “reliability target” for the whole flight mission. Suppose this is an Apollo-Saturn flight to the moon and back, including a lunar landing. Let us assume—and my figure is for illustration only—that a reliability target of 90 percent is set for the entire mission, including safe return to earth. That would mean that nine tries out of 10 must succeed.

We now parcel out this overall reliability target to the three propulsion stages and the one guidance stage of the Saturn V launch vehicle, and to the three modules of the Apollo spacecraft riding in the Saturn V's nose. Suppose—again, solely for illustration—we allot a reliability requirement of 99 percent to *each* of these seven elements of the whole space vehicle.

According to the laws of probability, the overall reliability of the entire space vehicle will then be the product obtained by multiplying together seven .99s, which is .93 or 93 percent. This betters our overall 90-percent target by three percent, which we may allot to hazards unrelated to equipment, such as successful touchdown on the moon and rendezvous in lunar orbit.

Now we can go on to the next step and see if the booster stages and spacecraft modules really offer the 99-percent reliability demanded of them. This calls for “qualification-testing” all critical components of a stage or module, under environmental conditions more severe than the actual flight environment of a space vehicle, before they are admitted to the assembly. The tests are applied, not to parts of any actual space vehicle, but to similar pieces from the same manufacturing line.

Often this procedure shows that certain parts of a stage simply cannot be made reliable enough to pass the severe tests. Invariably the answer is redundancy—provision of a back-up component that can take over the job if the other one fails.

Redundant components are nothing new in engineering. Your car has two headlights, in case one goes out. Large aircraft have two or more engines, and several independent radios. In manned space flight, with its unprecedented demands for near-perfection, providing redundancy has become a highly sophisticated art.

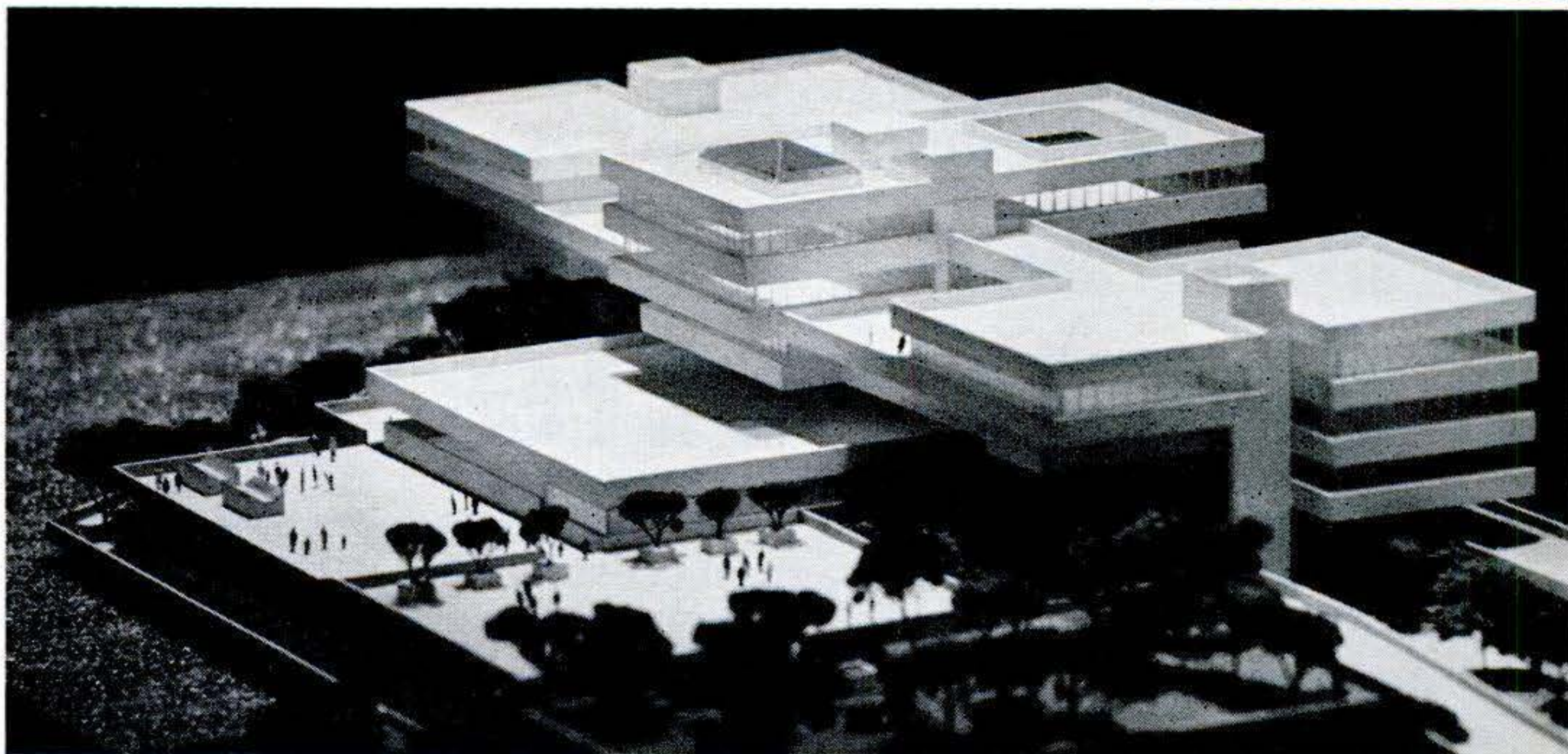
Wherever advisable and possible, Project Apollo-Saturn provides redundancy not only in components, but also in alternate choices of operational procedures. Thus, midcourse navigation between earth and moon can be performed by astronomical navigation aboard the spacecraft, as well as by radio and radar tracking from the ground. Life support can be provided either by the crew compartment's pressurizing system or, if that fails, by the astronauts' space suits.

Usually the reliability-allotment game is played through several times before the figures are finally cast in concrete. The higher the target is set, the greater will be the weight and complexity of the system, until handicaps offset further gains.

Dual stakes—lives, mission. Reliability requirements for crew survival and mission success are by no means identical. For instance, if the launch vehicle develops serious trouble during boosted ascent, the mission will be lost anyhow. But we are still faced with enabling the crew to abort safely and return to the earth's surface. The reliability to be expected of various conceivable abort modes, during a space-flight mission, can be quite different.

After all humanly possible precautions are taken, whatever hazards remain in a manned space flight result from the overall complexity of manned space missions and the vehicles needed to fly them. When all is said and done, we still have to live with the fact that every time a space vehicle takes off, there are hundreds of thousands of not-so-perfect human beings involved in the act.

Since the dawn of the Space Age, many people active in our national space program have been involved in travel and household accidents. Even some of our astronauts have not been spared. So, in appraising the overall risk of flying to the moon, we should not completely disregard the hazard of the astronauts' travels to their training stations and their final automobile ride to the launch pad. P 5



New York school for UN children to rise over river on pier

Nearby land in New York's Manhattan being too scarce, the United Nations will build a school for children of its staff and delegations on a pier in the East River. A model of the

school shows six floors with roofs at many levels that will double as traffic-free playgrounds. The school will accommodate 1,000 pupils, contain an auditorium, library, and gymnasium.

Fountain in bank lobby never splashes customers

The fountain at right, in the lobby of a bank building in Washington, D.C., runs up and down with recirculating water without splashing—either on the floor or on onlookers. Water is pumped to the top through a plastic tube at the center, then runs back down drop by drop on 270 individual strands of nylon at the edges. Cost: about \$10,000.



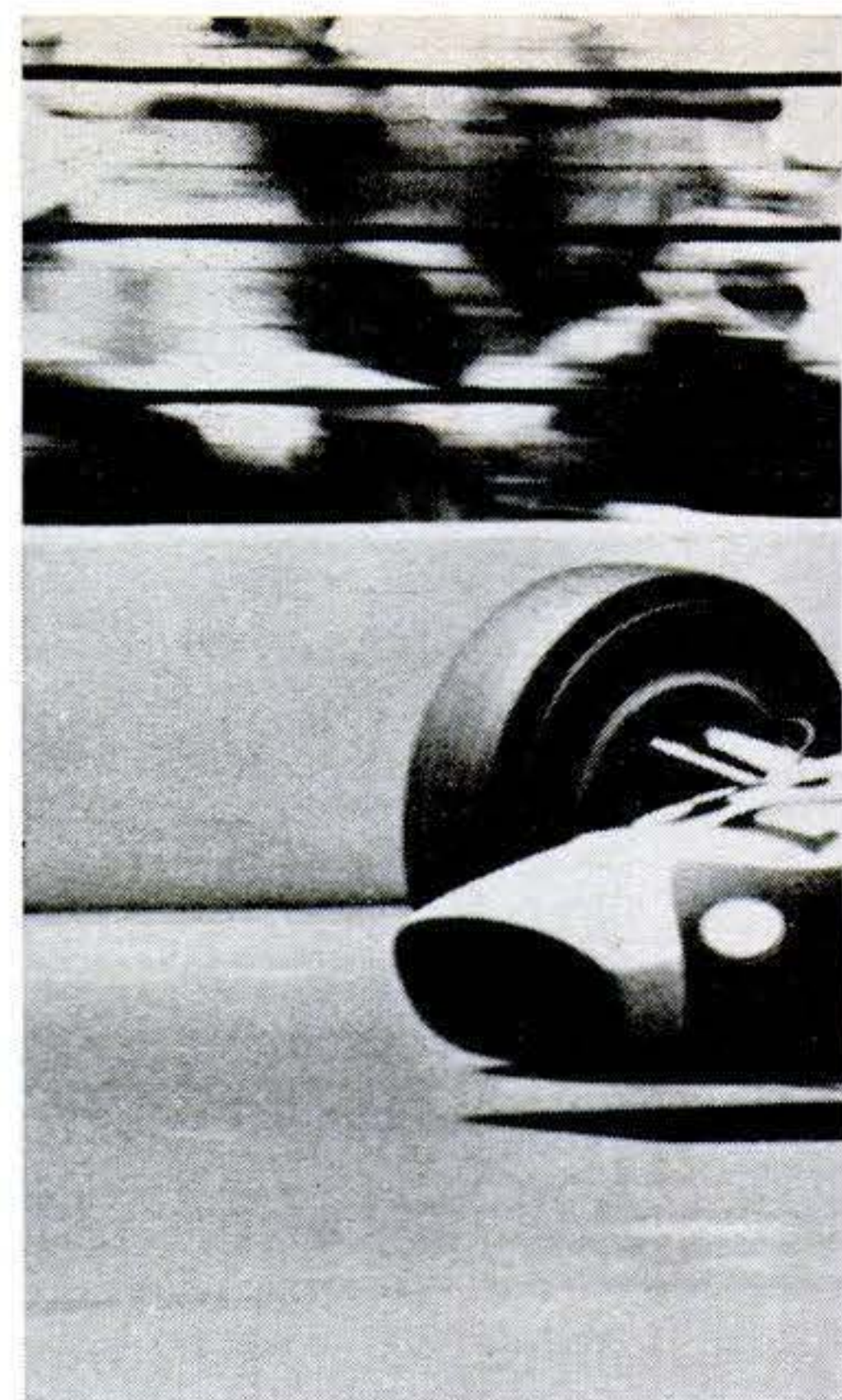
FB-111: our new supersonic strategic bomber

Now phasing out B-52s and B-58s at SAC air bases, the Air Force will replace them with beefed-up versions of the movable-wing F-111 fighter. The new FB-111 will pack the same bomb load as the B-52, each wing mounting six pylons carrying clusters of four bombs or missiles each. The pylons rotate to compensate for changes in wing sweep. The long-range FB-111 at Mach 2.5 is twice as fast as the B-52.

What It Takes to Win at INDIANAPOLIS

The world's most famous and successful racing driver tells here—for the first time—the inside story of his headaches and final triumph in the 500

By JIM CLARK



Streaking past grandstands,

- Read: ● *How Clark's office in London received threats from cranks prior to the race.*
- *Why he hid away in his garage before the race.*
 - *What annoyed him most—the changing rules.*
 - *Why he chose to tag Parnelli Jones in 1963.*
 - *How the yellow caution light left him puzzled.*
 - *About the derision heaped on his "funny"—rear-engine—racer.*
 - *How he managed an almost incredible 9,000 engine r.p.m. in winning.*



Successful on third try for crown, Clark enters winner's circle. Car builder Chapman is at right.

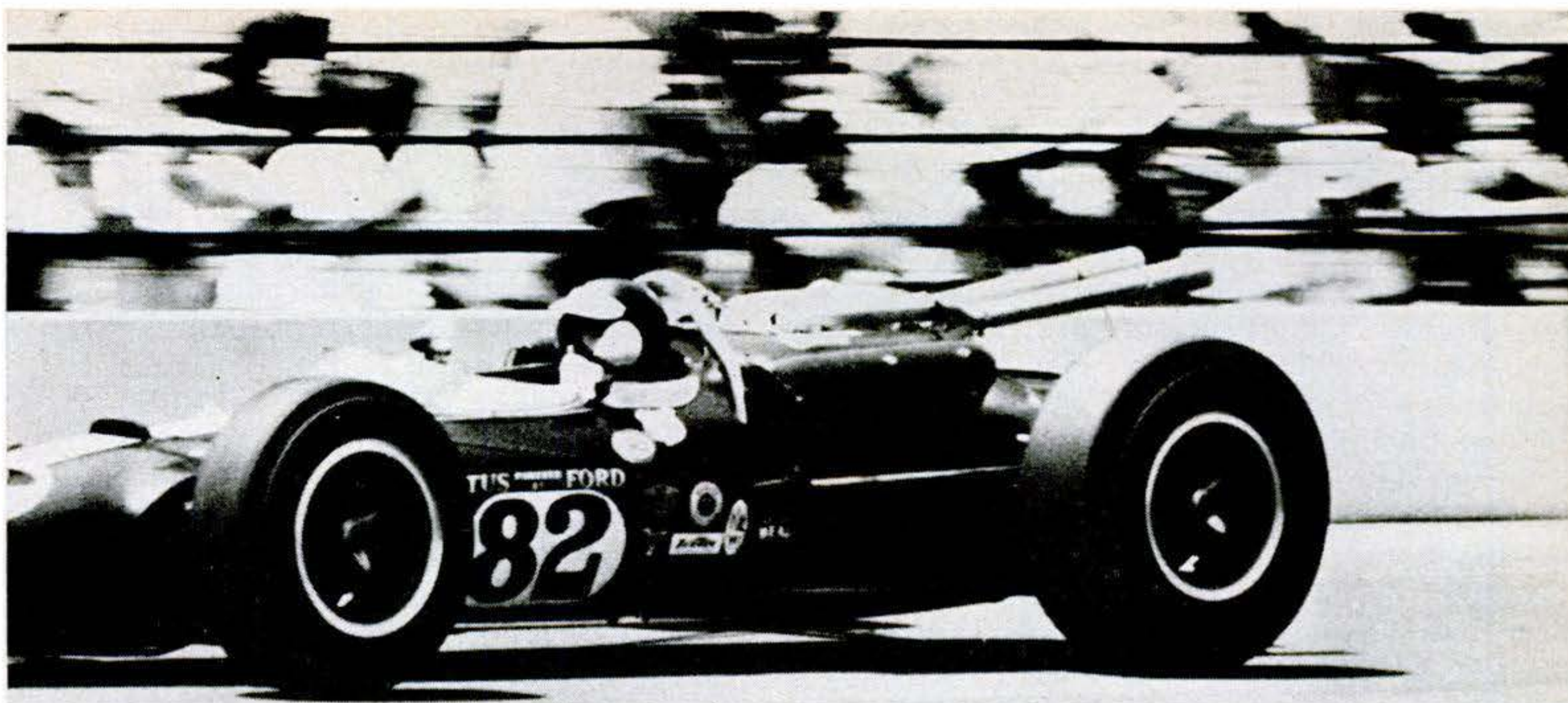
If my experience is anything to go by, it takes two things to win the Memorial Day 500 at the Indianapolis Speedway: three years' hard slog and a clear understanding of the rules of the race.

That, of course, may be the oversimplification of the year. Naturally, there is a lot more to it. Before I relate what preceded my win in 1965, let me get a few things off my chest.

Without wishing to sound carping in any way, I think if the rules had been fully explained to me back in 1963, when Lotus competed for the first time at Indy, it would have saved a great many people a great deal of effort in the course of the next couple of years.

In 1963, you may remember, I finished second to Parnelli Jones, when Parnelli's car was spewing oil all over the track. After the race there was all sorts of controversy about whether Parnelli should have been black-flagged out of the race because his car was potentially dangerous. Since he was not black-flagged, the discussion is pretty academic. But the real confusion in my mind was over the exact meaning of the yellow-light rules. No one had explained to me exactly what was meant to happen when the yellow "hold position" light came on.

Don't get me wrong: The decision to stay behind Parnelli during the later stages



Clark's Lotus Ford averaged a record 150.68 m.p.h. for the 200 laps, led for 190 laps.

of the race was mine. I estimated that his car could not last the full distance, and chose to keep behind him rather than risk leaving the track by trying to rush past him through all the oil that was covering the track surface. But I think that I would have been in a better position in the race earlier on if I had fully understood the yellow-light rules. The light was on for several laps of the race.

The tire problem. Ironically, the following year Lotus lost the race because we did not understand the rules concerning the type of tires permitted. I qualified on Dunlop tires—specially developed for the Lotus-Ford. Dunlop were not entirely happy about the rubber mix being used during qualifying runs, and, during the long gap between qualification and the race itself, improved the mix, and could have provided us with a better tire.

But the rules state that cars must run in the race on the same type of tire, with the same tread pattern and mix, and same size, as those on which the car qualified. So the Dunlop research team's work stayed unused in the pits, and I drove on tires which were known to be inferior to the best that Dunlop could do. In the race, my car's left-rear tire threw a tread while I was doing about 170 m.p.h. and the resultant unbalance of the wheel caused the suspension to collapse. I was lucky to be able to bring

the car to a safe stop. Not surprisingly, Dunlop rather lost interest in Indianapolis after this, and in 1965 we ran on Firestones.

Judging by the Lotus experience, it is just no good to try to win at Indianapolis with anything other than a new car, because each year there are changes in the rules which necessitate at times major modifications. In 1963 we had the first Indy car Lotus had ever made; but 1964's car was a development of it, and the winning car in 1965 was completely new. In my opinion, it was Colin Chapman's absolutely fresh approach to building Indy-type cars which led to his designing three potential winners in three years.

Despite the fact that we did not win at the Brickyard until last year, we were second in our first outing, the fastest car on the track second time out, and won against the traditional opposition in the Milwaukee 200 two months after our first experience at Indianapolis.

The "funny" cars. No greater compliment could be paid to Colin's unequalled ability as a designer, however, than the fact that in 1964 "funny" (rear-engined) cars were present in force on the starting grids. In 1965, Lotus-Fords came first, second, fourth, and seventh. The laugh was definitely on the "unfunny" cars.

Preparations for the 1965 win started al-

Continued

"In its unpainted form . . . the car looked very much like an airplane

most immediately after the 1964 race. In '64 we had a miserable race, not merely because we didn't finish, but because of the ghastly crash on lap two when two drivers were killed and five more injured. Although one acquires a short memory in motor racing, this sort of thing does have an effect on a driver's outlook.

Nevertheless, it was decided to compete again in 1965, and Colin's team of designers got down to the job of drawing up plans for the Lotus Type 38, which was to be something as new to motor racing as the first Lotus monocoque Grand Prix car had been in 1962.

Building a new car. In September of 1964, definite steps had been taken towards building the first Lotus 38s. The general idea was to have a monocoque structure in stressed aluminum with the Ford 4.2-liter V-8 power unit. The '65 race was to be a Lotus-run effort, so far as Ford was concerned. Obviously there was not much doubt that Lotus could produce the finest car, suspension- and weight-wise, but for the first time Ford wanted Lotus to be responsible for the servicing and general maintenance of the engine as well.

As a result, Dave Lazenby, Lotus chief project engineer, went to Dearborn for a familiarization course on the power unit, and later Jim Endruweit, the team's chief racing mechanic, spent some time boning

up on the engine at Ford of England's headquarters.

Liaison between the Lotus staff at the works at Cheshunt, 17 miles north of London, and the Dearborn technicians was very close. Lotus fitters, mechanics, and designers visited Ford America's headquarters several times to check on countless details concerning the engine—particularly to make sure that it would fit into the minimum amount of space in the car.

Fueling. The chief problem which the designers had to overcome was the fueling system. For 1965, the Indianapolis organizers were insisting on very precise refueling arrangements for all competing cars. Not only had all competing cars to make at least two stops for fuel during the race (whether fuel was taken on or not, the supply pipes had to be connected to the intakes on the cars), but there were very exact rules about the storage tanks in the pits to ensure a safe gravity fuel feed to the cars' tanks.

Similarly, the rules laid down exact dimensions of the intakes, to prevent fuel being sloshed in through overlarge fillers. In the event, we had two aircraft-type flexible tanks running down each side of the car (since the rules specified that no fuel could be carried over the drivers' legs) with intakes on either side of the car's "fuselage" just in front of the windshield. A reserve

Clark answers a dozen questions on the critical aspects of racing

These questions were put to Jim Clark in the course of an interview by David Scott, POPULAR SCIENCE European Editor.

You have adjusted exceptionally well to oval-track driving from pure road racing. Which do you prefer and why?

I still prefer road racing. It is a much more complete type of racing with many more problems of braking, gear shifting, handling a car on varying types of surface and corners.

A. J. Foyt [a former winner] says there are two "grooves" at Indy that permit the highest speed. Is there really a groove, and how do you find it?

The fastest line through a corner depends on how a car is handling. There is no single perfect line, in my view.

When you won the 500 last year, you were able to ease off a bit toward the end of the race, your average dropping from 157 m.p.h. to about 155 m.p.h. Did you drop down in top speed in the straights to save the engine, or did you slow down on turns to save tires?

Both.

Does your driving style at Indy differ from that of the fastest American drivers, such as Foyt, Jones, and Ward?

My style varies as much as Foyt's does from Jones', or Jones' from Ward's. It isn't a national thing.

You seem to get back on the throttle at an earlier point in the turns than most of your rivals. Is this something you do intentionally, or do your cars demand to be driven that way?

I find a car goes faster if one puts one's foot on the throttle.

What would you say is the biggest repair

with wheels instead of wings"

tank was placed alongside the gearbox. The total capacity was 60 U.S. gallons.

By February of 1965, the first two cars were nearing completion, and a third was well on the way. In its unpainted form, with gleaming aluminum panels riveted in place, the car looked very much like an airplane with wheels instead of wings. This was not altogether an unfair comparison, since a great deal of thought had gone into the aerodynamics of the car's shape. A long, tapering nose cone held the front of the car on the road at around 190 m.p.h. and above.

About the only concession to traditional Indianapolis design practice was the use of unequal-length wishbones on the suspension to cope with the Speedway's all-left-hand turn configuration.

The try-out. I tried out the car for the first time at the beginning of April at the Snetterton race circuit in England. This was purely a functional testing session on a road circuit without banked corners, so there was no question of breaking records. Running on alcohol, I was seeing around 7,500 r.p.m. in top gear on the fastest part of the circuit—equal to around 155-160 m.p.h. and not fast enough to excite any Indy veterans. (In the race itself we were running up to about 9,000 r.p.m.) Both Dan Gurney, who also tested the car at Snetterton, and I were very pleased with



Clark and Colin Chapman discuss strategy before the race. The word had gone out: "If the car holds up, Clark is invincible." Win was worth \$168,500.

the general feel of it. We later took two cars to the Silverstone track for further test prior to a race at Trenton, N.J., and despite miserable weather managed some quite presentable lap times in cars which were not designed to run on road circuits.

A week later the cars were at Trenton practicing for the 100-mile American championship race, while a third Type 38 was shipped out to Dan Gurney in California. Roger McCluskey and I spent a couple of days testing the cars at Trenton, until Roger's throttle jammed and he crashed the car badly. With one car left at Trenton, and the other Type 38 in California, we decided not to risk running in the Trenton event. We sent the unbent car straight to

Continued

job a pit crew can handle and still get a car back in contention?

Any repair job that takes more than two or three minutes in the pits must almost certainly put a car out as a race winner.

Last year you made two quick fuel stops, the first one ahead of your rivals. What was the strategy behind the timing of these stops and the amounts taken on?

I prefer not to comment on questions of race strategy. I may be there again!

At Indy the right-hand front tire wears quicker than the others. What preparations are made to change this tire during the race, and who makes the decision?

I don't agree that the right tire necessarily wears faster. In any case, tires are all made to go the full race distance.

You must have seen some pretty bad mistakes made at Indy. Are there any driving

errors that you would particularly warn a rookie on your own team against?

I'll keep that for the private ear of my own rookie.

Do you use your brakes much at Indy, or do you just ease off before entering the turns?

I use my brakes very little.

Do you drive 500-mile races on an empty stomach, or do you have a good meal before the start? What kind of refreshments do you take during the race?

Nothing after a fairly light breakfast; no refreshments during the race.

When your rear suspension collapsed at Indy in 1964, you kept the car under control and parked it very neatly. How did you do this? Do you have a training program for coping with emergencies, or do you instinctively do the right thing?

It was purely instinct and a little bit of luck.

"For qualifying . . . we added 20 percent of nitro to the fuel"

Indianapolis and instructed Cheshunt to build another car—but quickly.

When I first drove the Lotus 38 at Indianapolis, the car really felt at home. We spent some time getting the fuel-injection system sorted out, which proved a difficult business because we were using a boost venturi system aimed at cutting down alcohol consumption without affecting the power output of the engine. The care lavished on tuning this complicated system paid off in the end, because the unit gave no trouble at all during the race itself.

On alcohol: 500 b.h.p. The chassis and suspension required virtually no tuning, which gave us plenty of time to experiment with fuel consumption. With accurate fuel-use figures, we would be able to decide exactly when I should pit for fuel during the race itself. We compared power output of the Type 38 with the previous year's Type 34 and found we were getting nearly 500 b.h.p. on alcohol with the 38, against 420 b.h.p. on petrol in 1964.

But despite this, there was little difference in on-the-road performance between the two cars, due to the extra weight of the Type 38. For qualifying, however, we added 20 percent of nitro to the fuel and things really started to happen. With a new engine, running on a 20/80-percent nitro-alcohol mixture, we were getting about 570 horsepower to push a car weighing 1,260 pounds. When I started practicing with this combination behind me, I could immediately feel the benefit of the increase in power.

On May 16, 1965, at around 1:30 in the afternoon, I went out to try to qualify for the 1965 Indianapolis 500. Although qualification runs at midday give an idea of how a car will perform on race day, the middle of the day is not popular with seasoned Indy drivers since the heat drains some power from the cars' engines. I was not altogether worried, since I did not worry about getting the fastest qualification time—and I had a plane to catch at 5:30 that afternoon to fly back to Scotland. I was second fastest to A. J. Foyt, and left the Brickyard well pleased with the situation.

The basic work had been done with the car, and it was too late for any further major modifications to be done to it. Several hundred skilled people on two conti-

nents had worked backbreakingly hard for seven months to produce the best car they possibly could. Behind this effort was another two years' hard work, which had culminated in near triumph—but near anything is not good enough in racing. There is only one winner.

The pit stops. Meticulous preparation before the race was matched by precision work during the event. We had a team of stock-car pit minders, the Wood brothers, to refuel and service the car during the race. We knew that the absolute minimum of time had to be spent in taking care of the two mandatory pit stops, and with this team of boys looking after the stops we had it! On lap 66, for example, I took on 55 gallons of fuel in 20 seconds—slightly slower than we had managed to complete a similar operation during rehearsals for the stops.

This compared very favorably with the best times ever for pit stops, remembering that this was the first time we were not allowed to use pressure refueling.

Without wishing to give the impression that the race was a walkover, it is true to say that the entire 500 tiring miles came as almost an anti-climax to the months of preparation and practicing which had preceded them. When it was all over I had won, leading the race for all but 10 of the 200 laps, and I must admit I was pretty tired.

It was not only that my shoulder was sore from holding the car into the turns four times a lap, and that the strain of driving for 500 miles at an average speed of more than 150 m.p.h. had sapped my strength. It was not only the nagging fear which every driver has towards the end of a race in which he is well placed that something will rob him of victory—it was more nervous fatigue caused by the tremendous build-up to the race, and the exposure to the vast publicity machine which is a vital part of the Indianapolis 500 organization.

Before the race I had been asked countless times: "Is it going to be third time lucky, Jimmy?" What a stupid question to ask—but it was an understandable thought in everyone's mind, including mine. Inevitably, having been so near to victory twice previously, this imposed a nervous

[Continued on page 218]



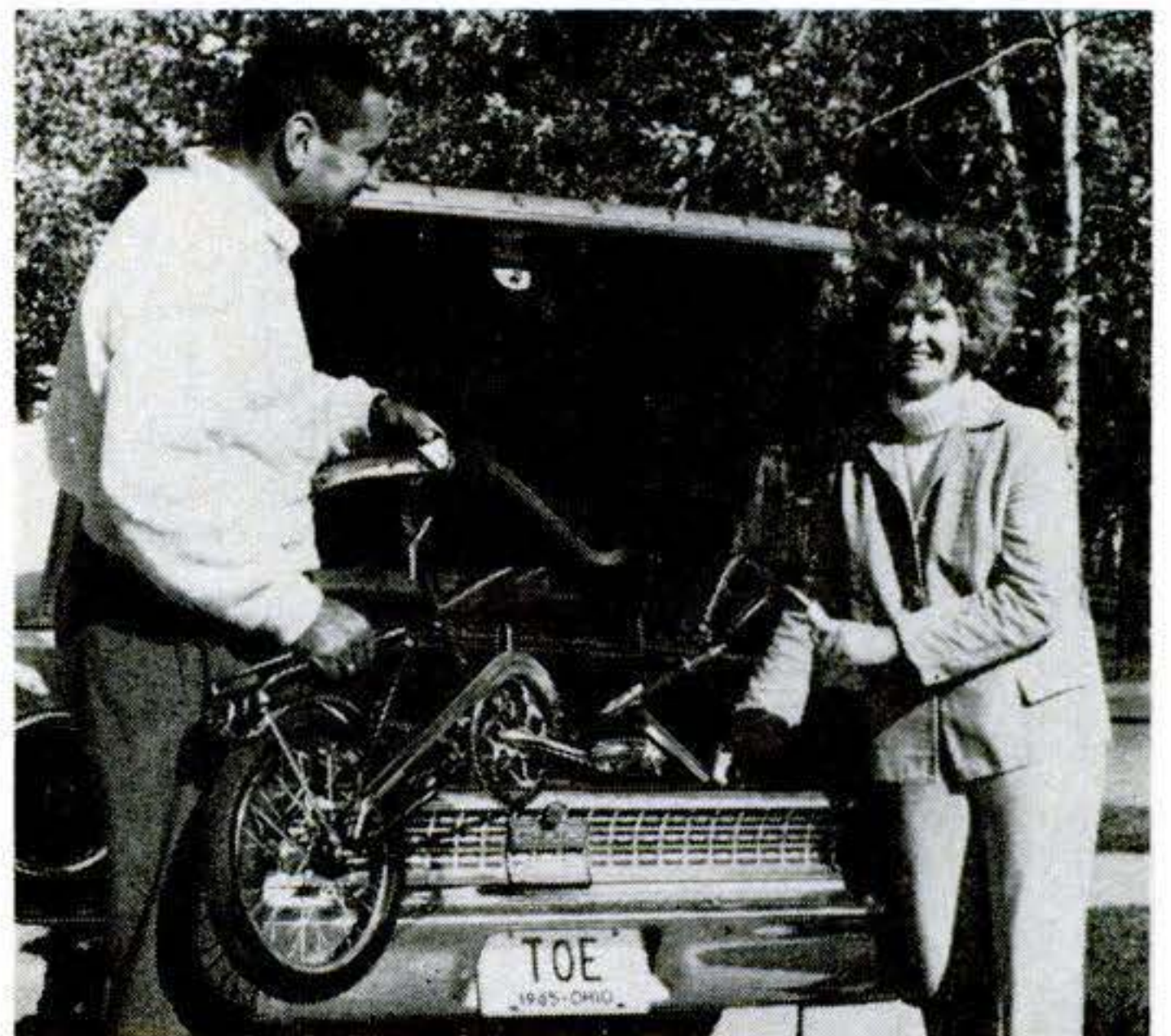
With seat adjusted to proper height, small-wheeled Hi-Lo will fit every member of family comfortably.

Take-apart bike stows in car trunk

With a twist of a locking device, this 16-inch-wheeled bicycle can be taken apart and carried in two sections in a car trunk, boat, or plane. Put back together and locked with another twist, it's ready for riding.

A bike for small fry to grow with, its seat can be lowered to fit when they're small, raised to keep pace with their size. Hi-Lo, made by MTD Products, Cleveland, is geared to attain the same speed as standard 26-inch bicycles.

Taken apart, one or more bikes can be stowed for transport in car trunk to ride on country lanes.

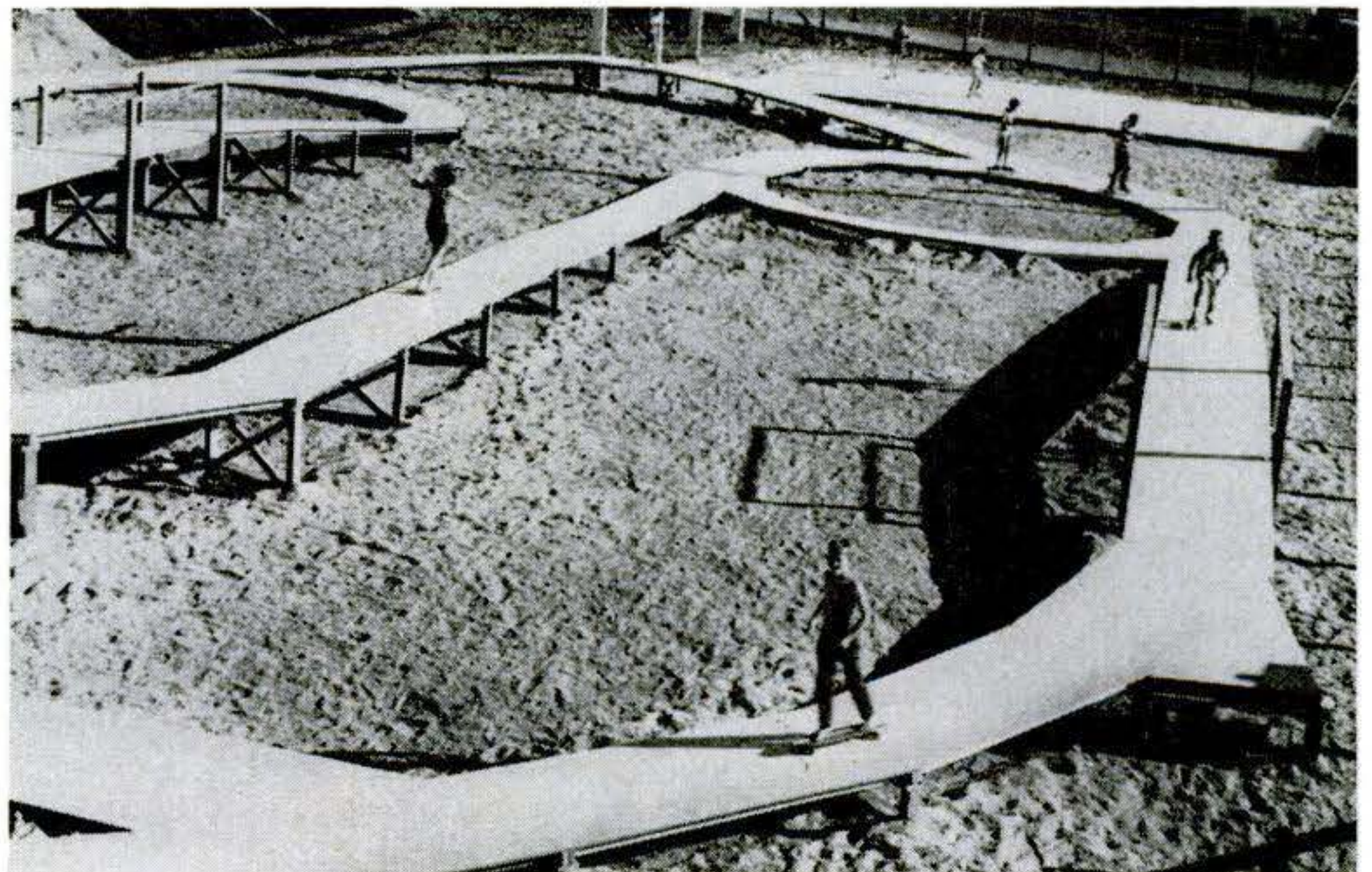


Outdoor plywood rink built for skateboards

An open-air plywood rink on a half-acre sand lot in Kelso, Wash., is the country's first skateboard track.

Raised on short stilts of varying length, it forms a sloping course over a cushion of sand that softens spills. A ride around it covers 600 feet.

Kids pay 50 cents an hour by day; at night, under lights, 75 cents.



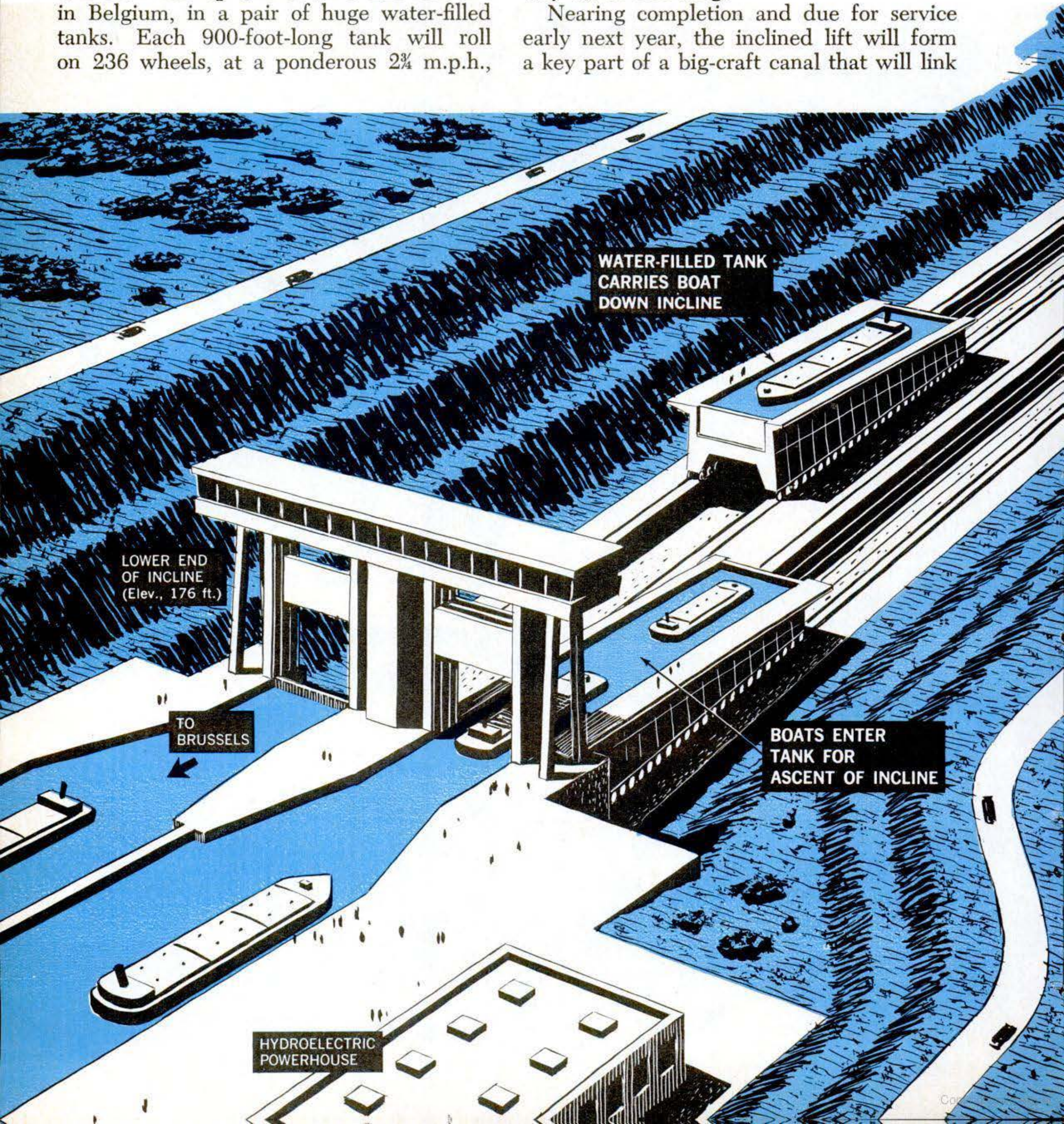
Ships Float Uphill and Down

An inclined railway hauls big canal boats
over the hill in water-filled tanks

Canal boats as big as 1,500 tons will soon ride up and down a 220-foot hill in Belgium, in a pair of huge water-filled tanks. Each 900-foot-long tank will roll on 236 wheels, at a ponderous $2\frac{3}{4}$ m.p.h.,

along a four-rail track on an inclined railway 4,700 feet long.

Nearing completion and due for service early next year, the inclined lift will form a key part of a big-craft canal that will link



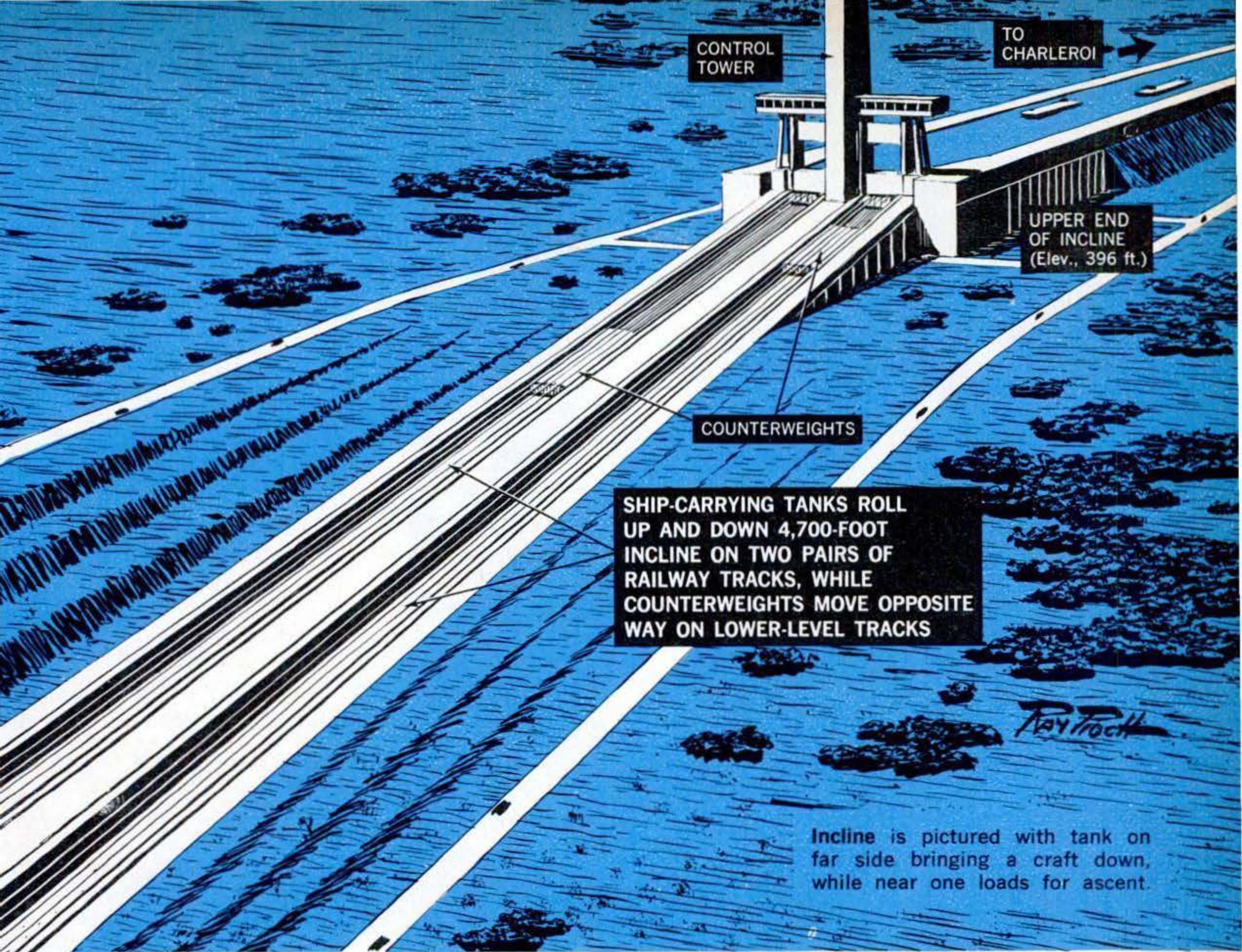
LOWER END
OF INCLINE
(Elev., 176 ft.)

TO
BRUSSELS

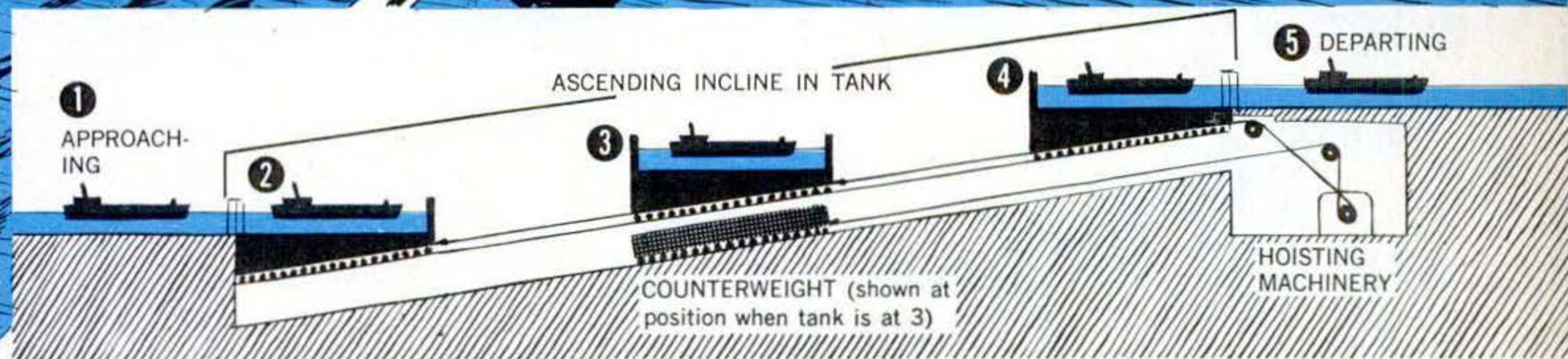
WATER-FILLED TANK
CARRIES BOAT
DOWN INCLINE

BOATS ENTER
TANK FOR
ASCENT OF INCLINE

HYDROELECTRIC
POWERHOUSE



Incline is pictured with tank on far side bringing a craft down, while near one loads for ascent.



How incline works: To ascend 220-foot hill, canal boat successively approaches incline, enters tank, is hauled up incline in tank, reaches top, and pro-

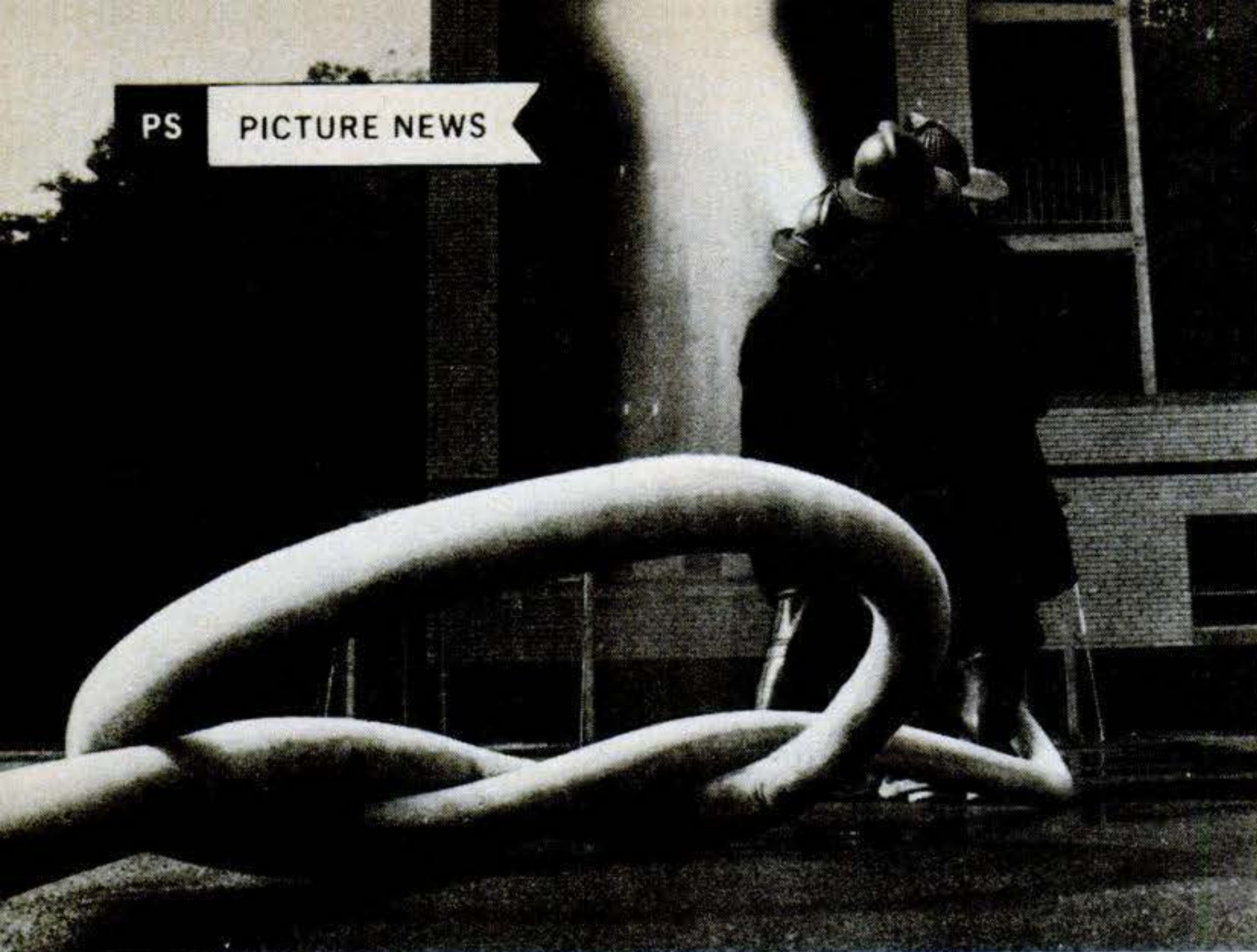
ceeds on way. Counterweight (shown in midway position only) balances most of tank's weight. Electric-powered hoist does the rest.

industrial Charleroi with Brussels and the seaport of Antwerp beyond. The new waterway will shorten the winding route of a present small-boat canal and eliminate most of its dozens of locks.

When one of the lift's tanks has been latched to the end of the lower-level canal, and gates are raised, a canal boat is floated right into the tank. Then gates are lowered, the tank is unlatched, and tank and craft are hauled by cables up the five-degree slope. The tank latches to the end of the upper-level canal, gates are raised, and

the boat goes on its way. Reversing this procedure serves for descent.

The two tanks move independently. Their wheels are flangeless to minimize friction; to keep them on the track, extra guide wheels bear against side rails. Counterweights balance most of the tanks' weight and keep the power required for each tank's hoist to a reasonable 1,020 hp., provided by six 125-kw. electric motors. Excess canal water, flowing from the upper level to a hydro plant below, generates the needed current.—David Scott.



Hose spurts water while tied in knot

Pittsburgh firemen at left tied a knot in a new kind of fire hose to test its ability not to kink.

A special interweaving process of the hose's inner polyester jacket, developed by H. K. Porter Co., permits it to be bent sharply over fences and other obstructions without restricting the flow of water.

The new hose is made in 50-foot lengths in 1½- and 2½-inch inside diameters.



British boat rams in air for float cushion

Like a hovercraft, a new British Aquaglider rides on a cushion of air, but, instead of using a lift fan, it rams air under its flat bottom by its own movement, trapping it there by low-hung sides and stern.

The prototype is essentially a 9½-by-22-foot shallow-draft unsinkable raft filled with plastic foam. A drop-down bow provides access for passengers when beached. Cruising is at 30 miles an hour.



Experimental AMX is fastback sports car

The shape of things to come from American Motors was seen in Detroit in January when Rambler exhibited a mockup called AMX at SAE's engineering congress.

It's a fastback of Corvette-like looks with many safety features: no windshield corner posts, hood with resilient leading edge, recessed rectangular headlights, no outer door handles. It may come in 1967½.



Make Your Home

- more valuable
- more comfortable
- better looking

40

pages of new ideas!



LEARN HOW

rough-textured siding has become the big news indoors for paneling

you can extend your living space with a wood deck

you can install sliding glass doors for access to the deck—and the rest of outdoors

the new and better removers take off old paint faster

you can give your front door an inexpensive face-lift

you can build useful storage centers all over the lot

PLUS

a roundup of important new products for the home

APRIL 1966 | 131

Rough siding, such as U.S. Plywood's Planktex above, is now popular as indoor paneling, too.



ROUGH STUFF: the big news in wall paneling

Solid wood, plywood, or hardboard—you now have a wide choice of materials with texture

By DARRELL HUFF

Even fine hardwoods now come rough. Townsend's rough-sawn Watted Walnut is end-matched $\frac{3}{8}$ " t&g boards.

The big paneling news these days is pretty rough stuff—and very pretty it is indeed!

It goes under such names as Roughtex, Cedar-Sawn, Planktex, FactriSawn, Trendtex, Ruf-Sawn, Cedar-Etched, Knotty Cedar, Pecky Cypress, Wormy Chestnut, Marbletone, Rusticwood—and many more.

The tremendous interest in wall-paneling materials with texture is a surprise even to the people who make them. Many of these wood products were brought out primarily as

Expose either rough side, shown here, or smooth face of Union Lumber's Noyo Factrisawn redwood. Both $\frac{3}{4}$ " and $\frac{3}{8}$ " boards come in 6" and 8" t&g.

exterior sidings. But architects and do-it-yourself home owners alike are latching onto them and snatching them indoors.

Why? Texture adds depth to a wall. The natural and rugged look is homey and inviting in any room. And since many of these panelings are low-cost softwoods, it is important to have texture that will conceal possible scuffing, scratching, scarring, and denting in rooms meant to be lived in hard.

You can make your choice among these etched, saw-textured, and pecky panelings
Continued

Abitibi's Imperial Pecan below is a hardwood veneer over a hardboard backing. This paneling comes with a smooth finish, but V grooves help give it texture.





Redwood all the way is the story of this appealing room. Walls and ceiling are Simpson's saw-textured redwood t&g boards, available in 4", 6", and 8" widths. In economical 11/32" thickness, they're called La Honda. Built-ins are redwood, too.

Use uniform widths—6", 8", or 10"—of Georgia-Pacific's saw-textured redwood, or mix them for random effect. These rough boards need no finish.

Maximum contrast to the rough-stuff boards and panels is provided by factory-finished hardwoods. The panel seen here is U.S. Plywood's cherry.





You can see and feel the texture of natural wood in Marlite's Wormy Chestnut, first in a new line of textured, plastic-finished hardboard panels that this firm is producing. The panel reproduces every surface detail of the real wood.

Board-on-board, a traditional siding pattern, is effective indoors, too. Union Lumber Company's saw-textured boards add texture to strong shadow lines.

Resawn face of cedar boards retains stain twice as long as smooth lumber can. This t&g pattern is offered by members of Western Red Cedar Lumber Assn.





Masonite's Royalcote PeckyTeak brings woody warmth and lively texture to man-made panels. The 4'-by-8' hardboard sheets go up fast with Royalcote adhesive.



1966 additions to U.S. Plywood's prefinished line are Salem Korina (Black Coffee shown here), Tudor oak, Craftsman Glen oak, butternut, Old English elm.



Factrisawn Santa Rosa paneling is made by members of California Redwood Assn. For 29-percent saving, this board-on-board alternates 1/2" and 1" stock.

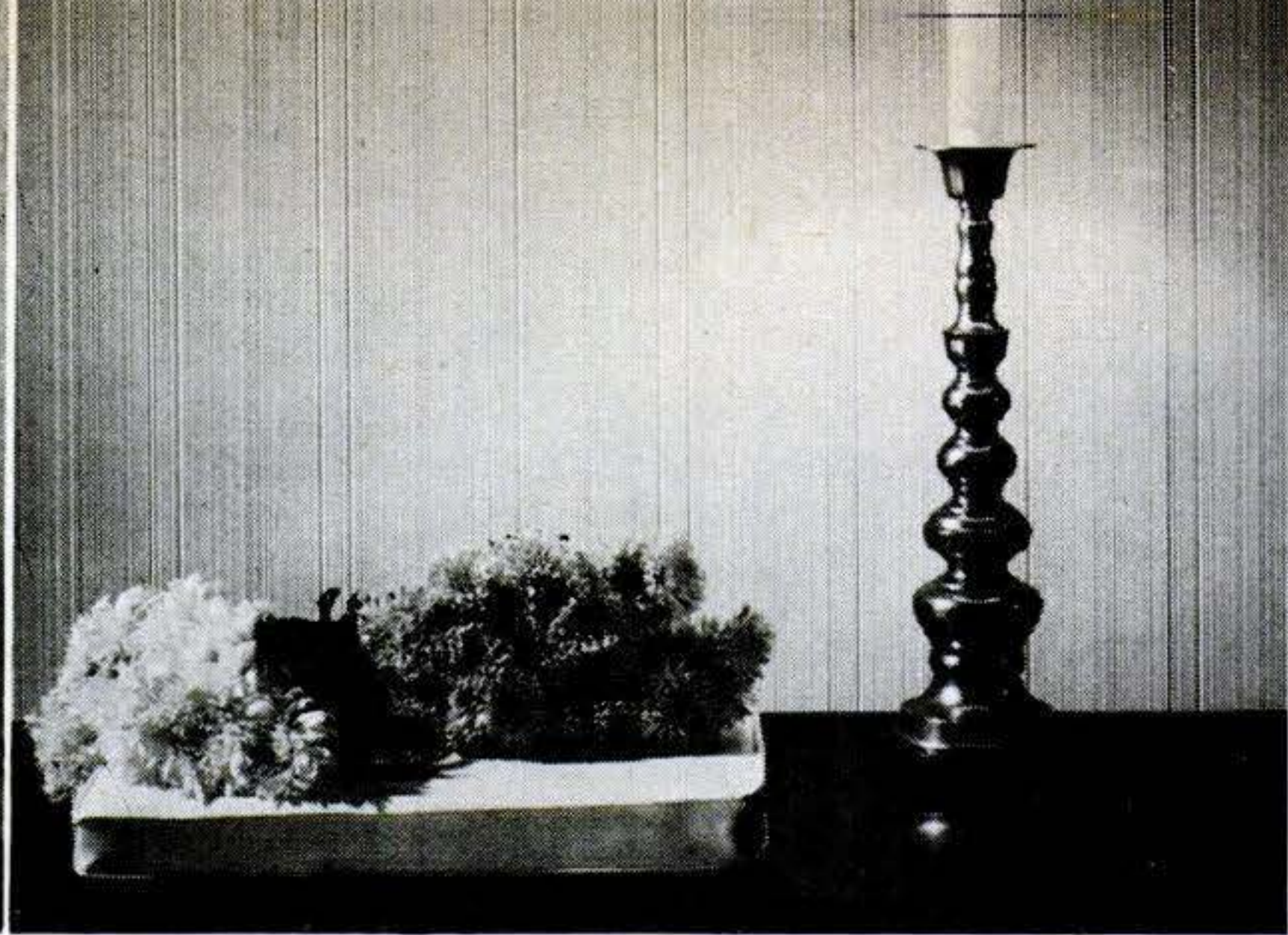


Channel rustic is another siding pattern now moving indoors. Here you see it in Simpson's saw-textured redwood. You'll find it in Western red cedar, too.

Georgia-Pacific's Gold Crest paneling, in walnut here, has a plastic finish. Black grooves can be quickly changed to other colors with pressure-sensitive tape.

Potlatch offers art prints along with its new Masterpiece line of period-style paneling. Included is Lawrence's "Pinkie" on Windsor panel. *Continued*





Masonite's Marbletone has the appealing indentations and striations of marble. This comes in 4'-by-8' panels for easy installation with special adhesive.

Rough-textured paneling doesn't always look like the natural wood. Georgia-Pacific's striated paneling is an example. Other producers have such panels, too.

BUYING GUIDE: ROUGH-WOOD PANELING

PATTERN	NAME	LUMBER	DIMENSIONS	WHO MAKES IT
TONGUE-AND-GROOVE	Saw-textured paneling-siding	Redwood	1" x 6", 8", 10"	Georgia-Pacific
	3-Way Rustic, one side smooth, one side FactriSawn		1" x 6", 8", 10", 12"	Simpson
	Noyo Thrift FactriSawn one side		Thin: 3/8" x 6", 8"	Union
	G-P cypress paneling (pecky)	Cypress	1" x 4", 6", 8", 10"	Georgia-Pacific
	Rough-sawn cypress paneling		Various widths in t&g and shiplap	
	End-matched pecky cypress		1" x 6", 8", 10", 12"	Townsend
	Rough-sawn hardwood paneling	Wattled walnut, colonial cherry, colonial red oak	End-matched, 1/2" x 4", 5", 6", 7", 8" (oak 4", 5", and 6" only)	
BOARD-AND-BATTEN	FactriSawn board-and-batten	Redwood	12" boards, matching battens	Members of Calif. Redwood Assn.
	Cedar board-and-batten	Western red cedar	1" x 12" boards, 1" x 3" battens	Members of Western Red Cedar Assn.
	TrendTex board-and-batten	Prestained white pine	1" x 12" boards, 1" x 3" battens	Potlatch
BOARD-ON-BOARD	Santa Rosa FactriSawn	Redwood	Alternating 1/2" and 1" boards, 6", 8", 10", or 12" wide	Members of Calif. Redwood Assn.
	TrendTex board-on-board weathered gray	Prestained white pine	1" x 6" boards	Potlatch
CHANNEL RUSTIC	Channel cedar	Western red cedar	1" x 8" and 1" x 10"	Members of Western Red Cedar Assn.
	FactriSawn Channel rustic	Redwood	1" x 6" to 1" x 12"	Members of Calif. Redwood Assn.

from three main types: boards, plywood, and man-made panels.

Price range is about the same in all three categories. It runs from 20 to 30 cents a square foot for most of the plywoods and thin lumber.

So, with a great majority of the richly textured panel materials, you can bring in a full-height wall 12' long for less than \$35. And \$100 will panel a fair-size room.

Planning on plywood? These big panels, 4' wide and 8' to 10' long, go up fast and are outstandingly economical.

For an all-over band-saw pattern, there's Simpson's Ruf-Sawn, in warm California redwood. If you prefer cedar or fir, U.S. Plywood has a rough-sawn panel—Rough-tex.

U.S. Plywood's entry in the rough-redwood sweepstakes is Planktex. Tiny saw grooves at 8" intervals are held within the top ply to produce a board-to-board effect.

Instead of band-saw texture, Evans Cedar Etched panels are brushed to give the texture of weathered wood. Wide but shallow grooves in the Western red cedar produce a subtle shadow line at intervals of 2", 4", 6", or 8" as you prefer. These panels may be had without grooves, too, and in saw-textured surface as well as etched.

All these and others are about 3/8" thick, the usual paneling choice for economy and easy handling. You can find somewhat different patterns, including many with deeper shadow lines, if you go to 5/8" panels, more often used for exterior siding.

Solid wood? In its new, rough-faced versions, the oldest kind of paneling is new

[Continued on page 216]

BUYING GUIDE: TEXTURED-PLYWOOD PANELING

TEXTURE	NAME AND WOOD	GROOVE PATTERN	WHO MAKES IT
BRUSHED (ETCHED)	Cedar-etched	3/8" grooves on 2", 4", 6", or 8" centers; also ungrooved	Evans Products
	Rusticwood brushed redwood	3/8" grooves 4" or 8" o.c.; or alternating 4" and 12" o.c.	Simpson
NATURAL PERFORATIONS	Copper-inlaid vintage fir	1/2" strips of copper 4" o.c.	Georgia-Pacific
EITHER SAWN OR ABRADED	Ivy League fir or cedar	Wide, shallow grooves 4", 8", or 16" o.c.	U.S. Plywood
STRIATED	Striated fir	All-over planed pattern	Georgia-Pacific and U.S. Plywood
ROUGH-SAWN	Cedar-sawn	3/8" grooves on 2", 4", 6", or 8" centers; also made without grooves	Evans Products
	Planktex rough-sawn fir or redwood	Narrow grooves on 8" centers for plank effect	U.S. Plywood
	Rough-sawn fir	Kerfed 4" or 8" on center	Georgia-Pacific
	Rough-tex cedar or fir	Saw texture aligned across face; no grooves	U.S. Plywood
	Ruf-Sawn redwood	Ungrooved	Simpson
	TrendTex pine	Ungrooved, prestained	Potlatch



Design by Dave Swartwout Associates

Extend Your Living Space with a Deck

By DARRELL HUFF

Does your house give you a cramped feeling, especially during leisure hours or when entertaining? Then add to its living space by building an outdoor deck.

The carpentry can be rough. That makes deck building one of the easiest of construction jobs. By the same token it gives you a remarkable amount of luxury for the cost.

Where to put it? Place your deck where it will extend the living areas of your house. Direct entrance to living or dining room is ideal. Nearness to kitchen is helpful, too. If your house, like many these days, has a sliding glass door to the outdoors, this may suggest a spot for the deck.

Locating your deck to use house walls for protection can easily double its usefulness without adding a cent to its cost. Study your climate to see whether you need protection from wind or sun, or both.

Protection of your privacy from neighbors or passersby may be an important consideration, too. You can provide this with a high, solid railing, but it's easier and cheaper to let existing walls do it.

What's a deck for? A deck's for fun. What kind depends on the family that will use it.

For a pair of adults, a deck may need to supply only space for dining, reading, loung-

Continued

High-level deck at the back doubles as sheltered storage area

ing, possibly sunbathing—and probably entertaining. A family with young children may need a deck large enough to provide play space well separated from adult activities.

In determining size and shape, consider which and how many of these things the deck must make space for: picnic table and chairs, easy chairs, a chaise or two, hammock, sunbathing pad, Ping-Pong or other game table, cooking equipment, plants in containers.

Any deck well above the ground will require some kind of safety railing. You can meet this need by building a bench on one or more sides. Then you will not only need less furniture but also less space for placing furniture.

Low level? From the construction point of view, decks come in two varieties—low level and high level. Low-level ones are usually simpler to build. They often require no posts, no main beams, no railing. But they are feasible only when the lot is flat and the house sits close to the ground.

A typical low-level deck will consist of a floor of two-by-fours nailed to joists spaced approximately 3' apart. The joists will rest directly on concrete piers or blocks, preferably supported in turn by pads of poured concrete. Piers or pads should extend down to solid soil or rock; and local conditions may

also require that they go below frost line.

If your site slopes, or the floor level of your house is well above grade, you should regard your deck as high level. A deck even a foot or two above the ground will require a safety barrier where there are no steps. And any deck much higher than this will usually need supporting posts differing only in length from those for a very high deck.

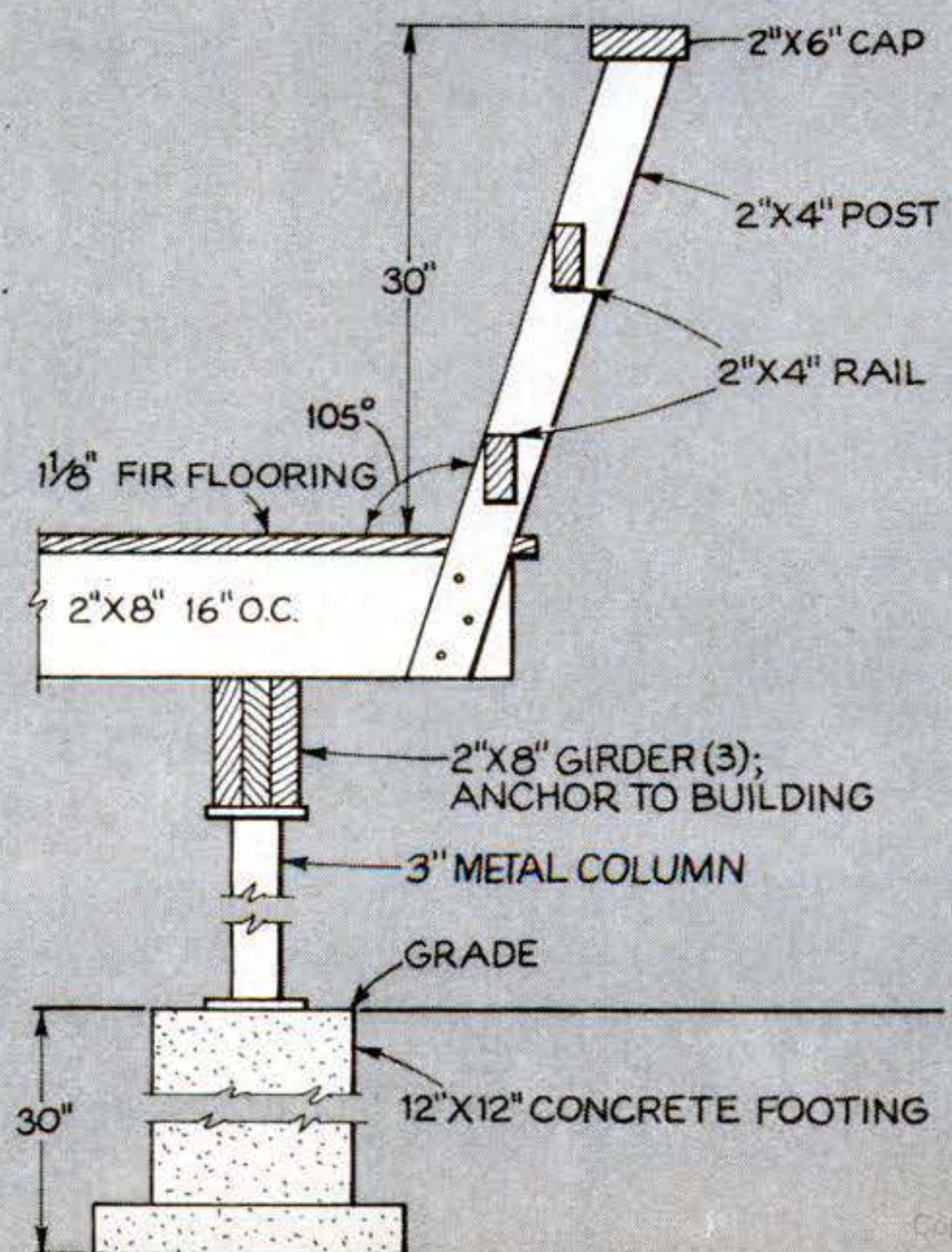
High level? A high deck requires three additional elements. To begin with, you will probably need a supporting member attached to your house. This can often be omitted from low-level types, which may not be tied to the house at all. Such a support may be a timber such as a two-by-twelve, spiked to the house framing or anchor-bolted to the foundation. A two-by-four nailed to it forms a ledger on which one end of each joist rests. The joist should then be toenailed to ledger and timber.

These joists are supported near their far ends by a beam. It, in turn, is held up by posts resting on piers. These posts may come at the extreme ends of the beam, but usually they are placed a foot or so in to reduce the span. Likewise, if the joists cantilever a foot or so beyond the beam, they will be stiffer because of the shortened spans.

Continued

A strong railing is one of the first essentials of any high-level deck. For the deck pictured on the facing page, a railing was made from two-by-fours capped by a two-by-six. For a better appearance,

the posts were angled outward at 105 degrees. At outside corners, the angled posts were tied together with pieces of two-by-four placed flat, as shown in photo below (left). Sketch shows other details.



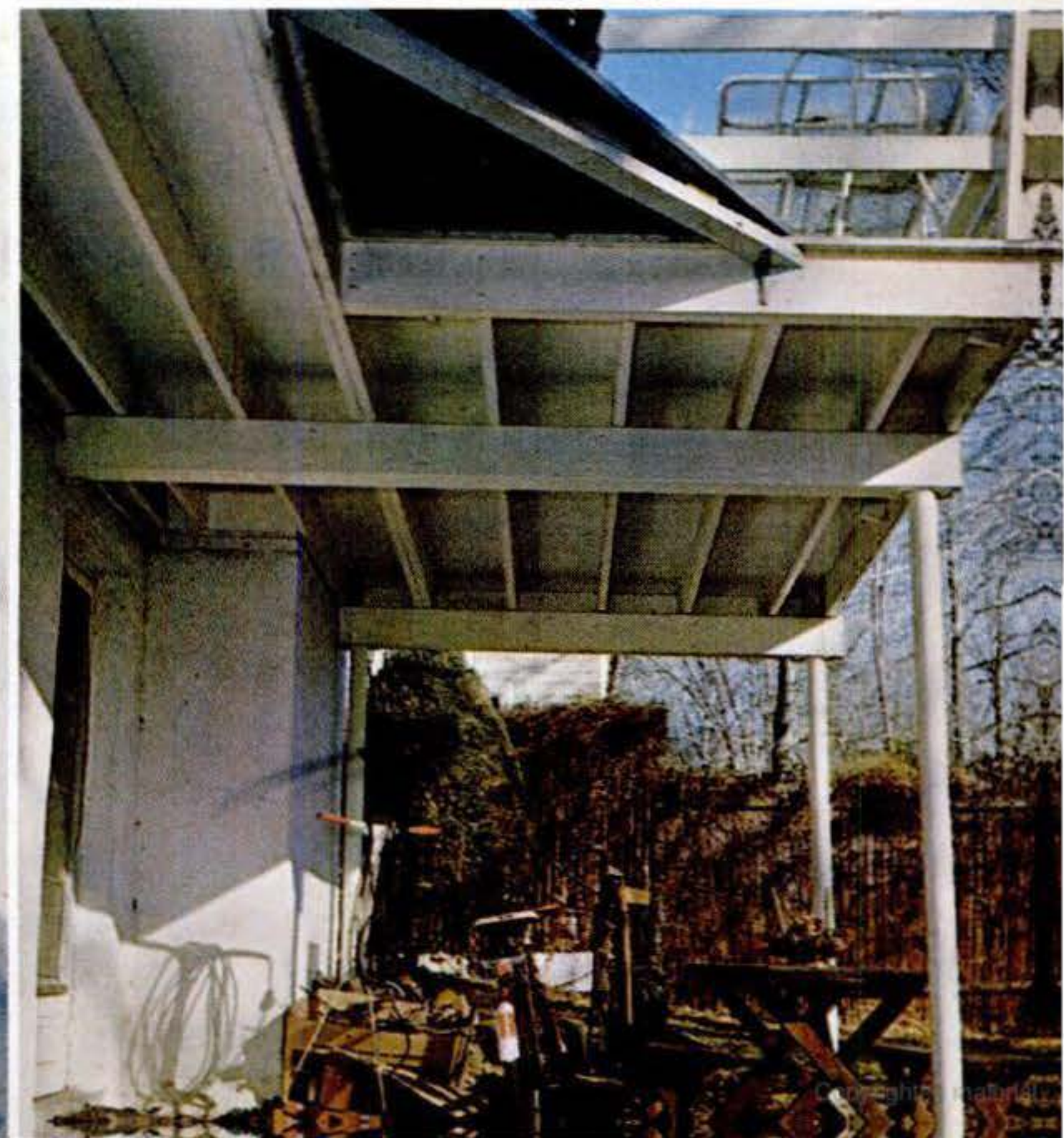


Simple deck on the suburban home of Julian Bers in Larchmont, N. Y., cost around \$700, was put up by a

builder in three days. You might use space under it as a carport as well as to store items shown.

Narrow walkway (below) leads to deck from a new door installed in place of dining-room window. Walkway was architect's solution to the problem of keeping the garage entrance clear of the deck structure.

Iron columns and girders made of three-by-eights support other three-by-eights placed on 16" centers. The cantilevered construction and an angle brace support the walkway over the garage door.





Treetop deck built on sharply sloping lot converts useless space into outdoor living area. Bench on one

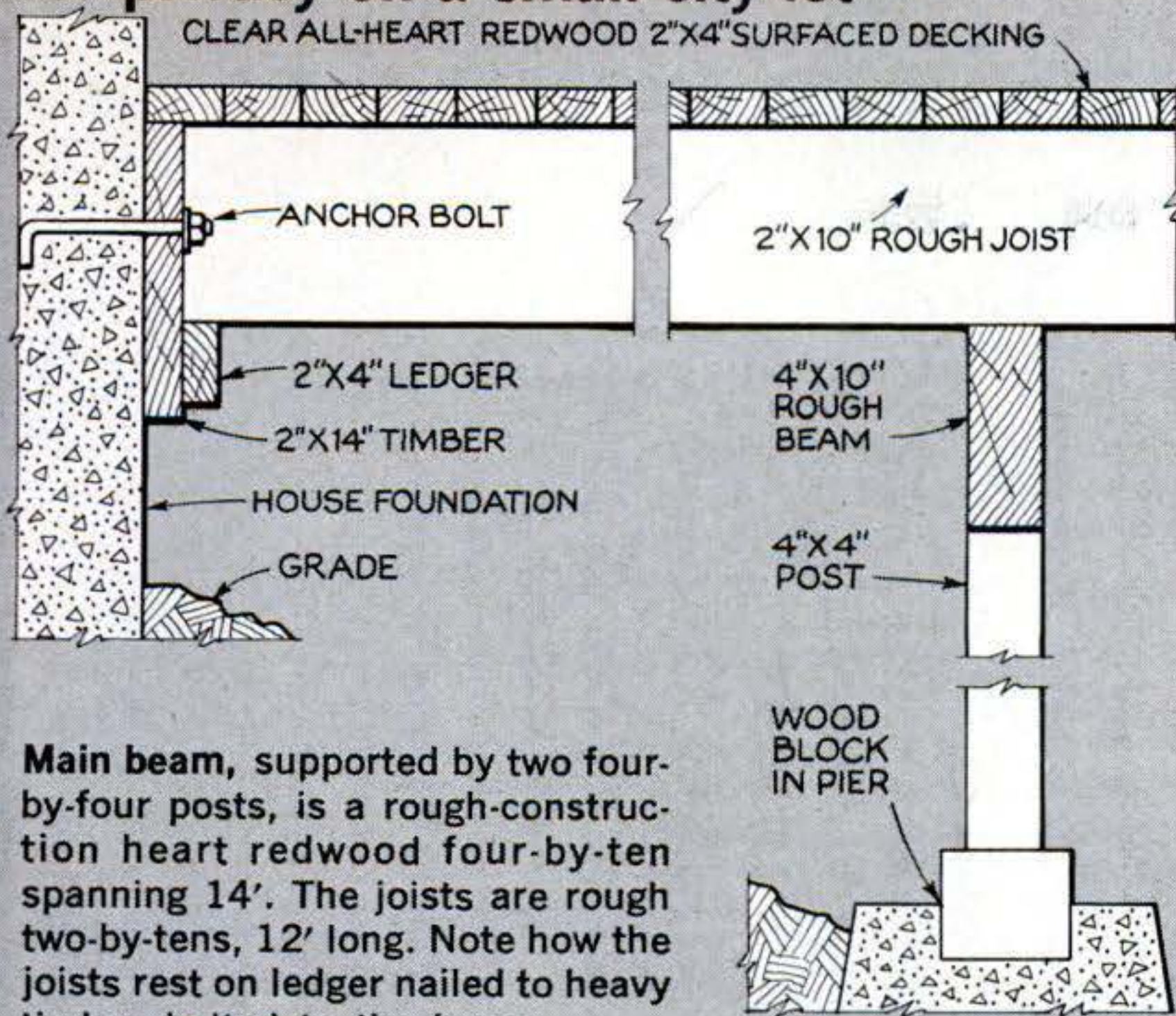
side and railing on other are built of rough redwood. Redwood two-by-fours were used for the decking.

Poolside deck makes both pool and yard more usable. Built-in bench provides both safety barrier and seat-

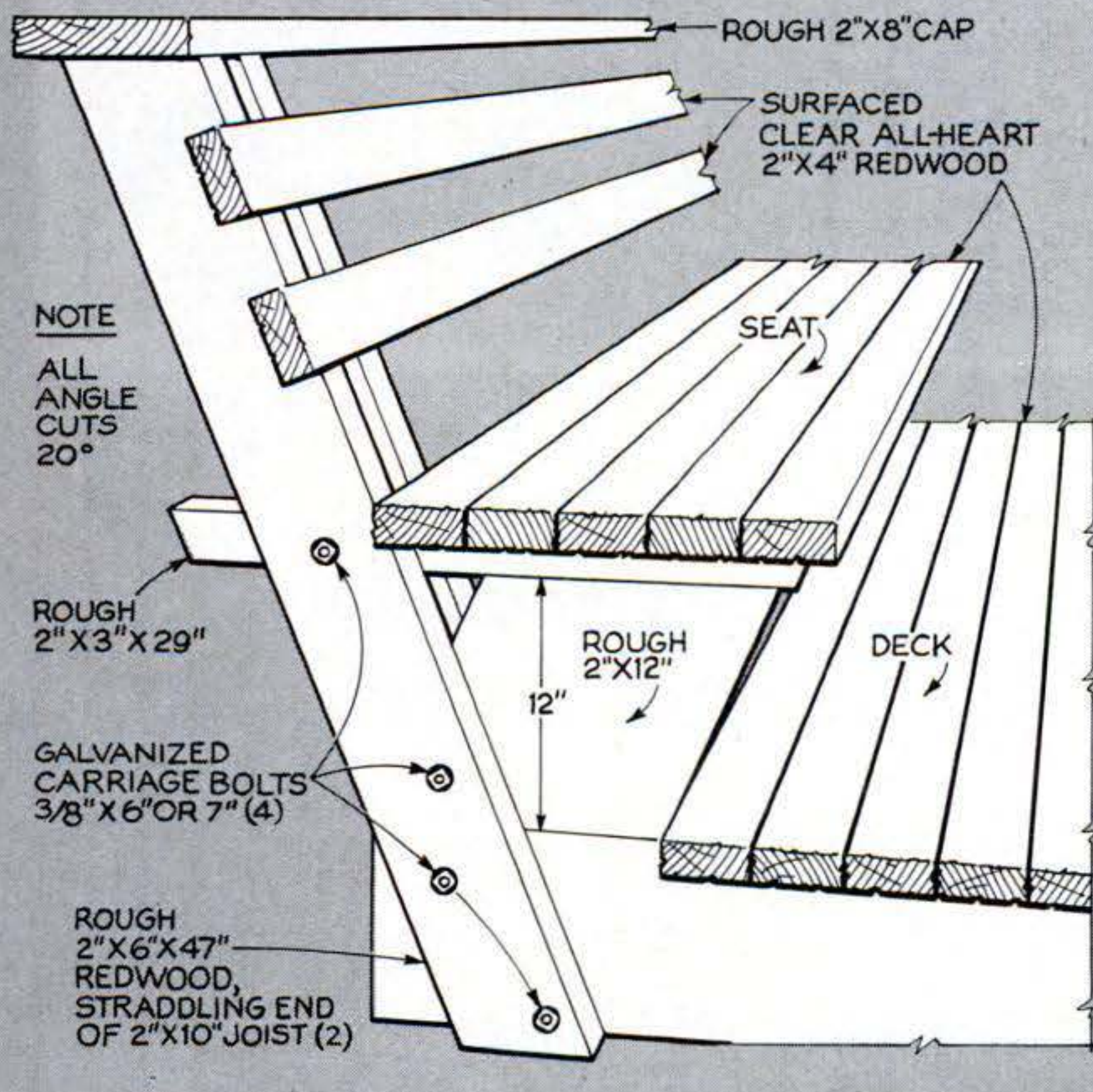
ing, has two-by-six top to contrast with two-by-four decking of redwood left to weather naturally.



How the author built his treetop deck for privacy on a small city lot



Main beam, supported by two four-by-four posts, is a rough-construction heart redwood four-by-ten spanning 14'. The joists are rough two-by-tens, 12' long. Note how the joists rest on ledger nailed to heavy timber bolted to the house.



NOTE
ALL ANGLE CUTS 20°

Bench uses five lengths of two-by-four for seat, two for back. Top is redwood two-by-eight — wide enough to hold pots.

The third different characteristic of high-level decks is their need for safety railings. Strength is the first consideration. It is easily met since two-by-four uprights are adequate if no more than 5' apart. If young children will use your deck, several horizontal members may be added.

What lumber? If your deck is to be painted, any good construction lumber will do nicely.

Douglas fir and other members of the pine family are a good choice. It's best to use pressure-treated lumber for especially damp conditions or contact with the ground.

For a low-maintenance deck, choose a lumber—such as the all-heart grades of California redwood—that needs no protection from rot or termites. Then don't paint it.

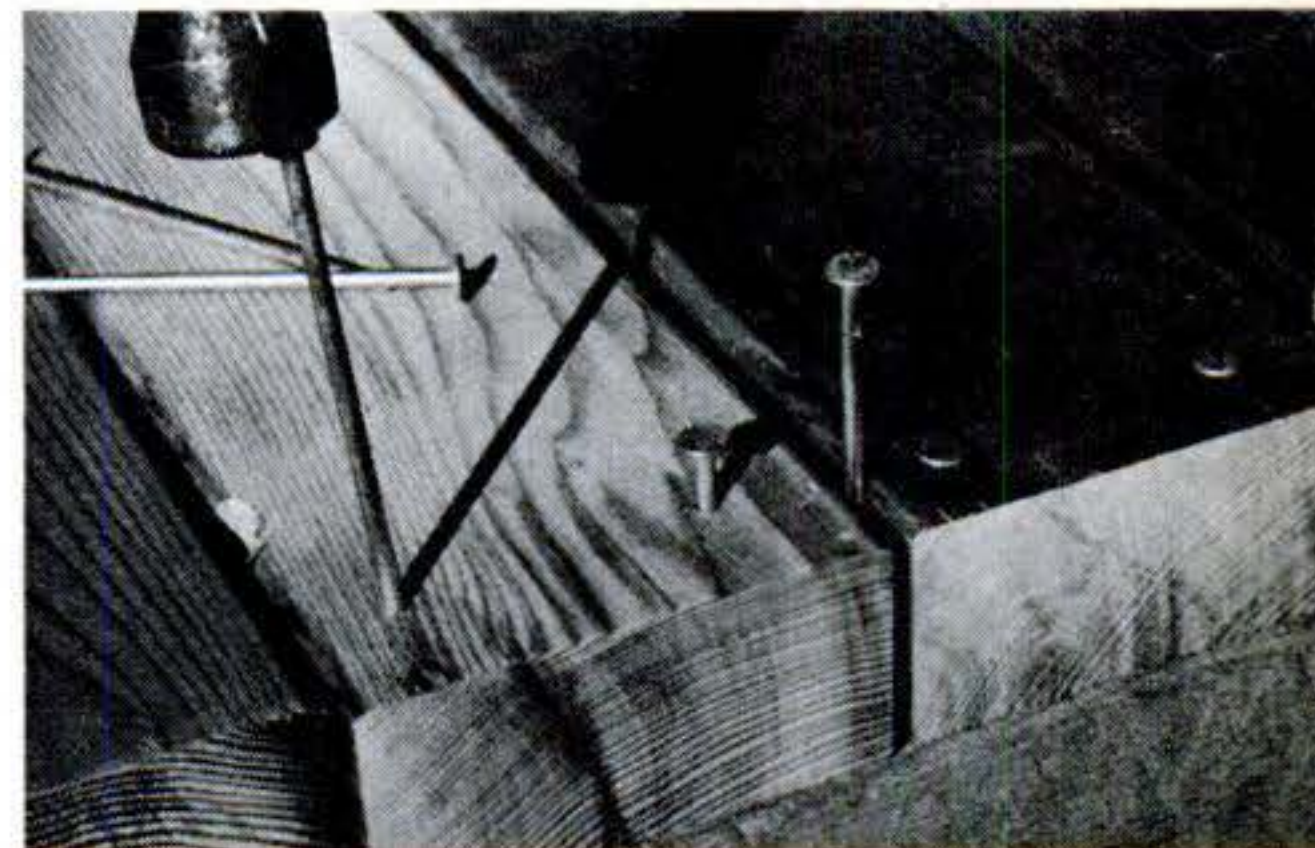
[Continued on page 214]



As first step, author bolted a supporting timber to house foundation. With a frame house it might have been spiked to framing. A two-by-four ledger was nailed flush with the bottom of this timber.



Two corner posts were needed to hold up main beam supporting other ends of the joists. These are rough redwood four-by-fours toenailed to redwood blocks cast into poured-in-place concrete piers.



Decking was nailed twice at each bearing. Nails also make temporary spacers. Spacing, needed for drainage, should not exceed 1/4" to bar spike heels.



Kitchen carpets are the newest thing for the home. This outdoor-indoor carpet doesn't mildew, resists

most food stains. Spilled foods can be sponged up. Ozite Corp. makes the Town 'n' Terrace carpet.



Mosaic patterns of translucent color bars give brilliance to the new Fiesta fixtures in the Moe Light line. The pull-down unit shown above is one of the 16 styles available. Made by Thomas Industries. Louisville, Ky.

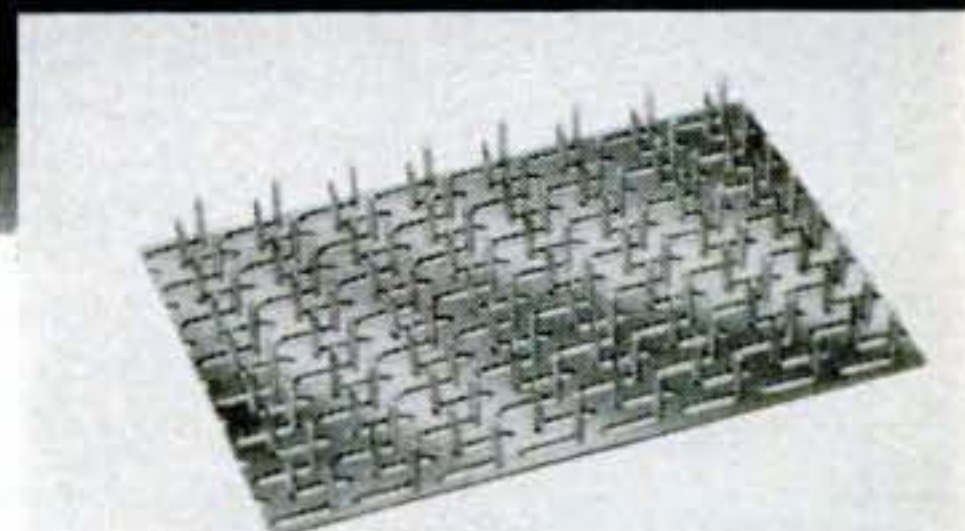
Colorful Products to Improve Your Home

The look of real slate is captured in these Johns-Manville Colorbestos mineral-fiber roof shingles. They have realistic, varied textures and jagged sloping edges. Rated Class A by UL, the 1/4"-thick shingles come in six colors for use solid or mixed.





New multiprong connector plate (close-up, right) joins lumber without nails. How strong is the joint? In the test shown above, two-by-fours spliced end-to-end with a Gang-Nail on each side supported a 150-pound man. This is more side pressure than wall studs get in use.



Gang-Nails: Strong Grip for Home Jobs

Here's an ingenious connector that's been used by builders for several years. Now it's available at hardware stores for home use. So next time you put up a partition wall, frame out a door, or assemble a fence, you might want to use Gang-Nails to fasten the joints. They eliminate tricky toenailing of studs, trusses, rafters, and other framing members. And you get a tight, secure joint that won't twist or pop.

It's a rigid metal plate with rows of pointed nails on a single plate. A few hammer taps on a wood block placed over the plate will sink all the nails without danger of splitting the wood. The plates are thin enough to lie almost flush with the surface.

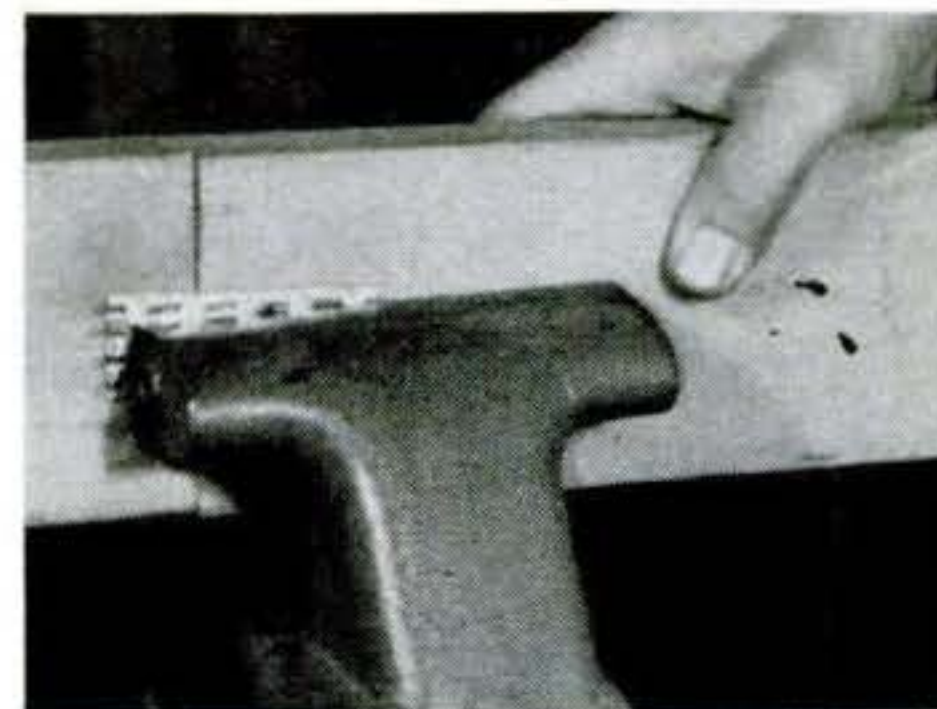
You can use Gang-Nails for fence railings, door panels, gates, outdoor furniture, doghouses, planters, greenhouses, etc. And you can reclaim expensive lumber scraps by splicing boards with Gang-Nails. This helps when you need a piece of stock longer than you have on hand.

Gang-Nails cost from two to five cents each. You can buy them at most hardware stores and lumberyards in four sizes: Type B-1, 2" by $\frac{9}{16}$ "; B-2, 1" by $\frac{11}{16}$ "; B-3, 1" by $2\frac{13}{16}$ "; B-4, $1\frac{1}{2}$ " by $2\frac{1}{4}$ ".

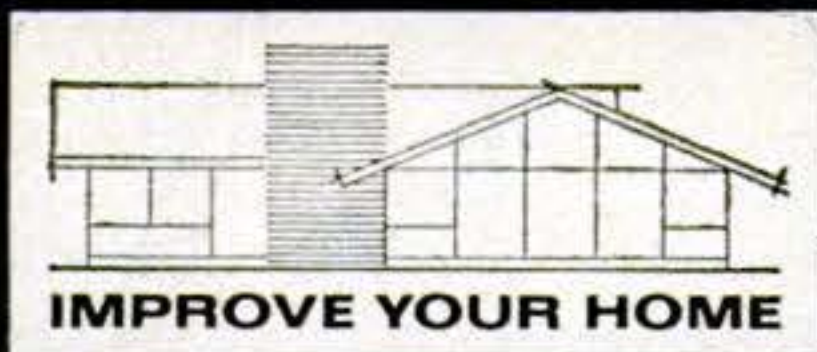
They're made by Automated Building Components, Inc., 7525 N.W. 37th Ave., Miami, Fla. 33147. The company also makes a portable hydraulic press to drive plates into both sides of a joint assembly in two seconds. This is for the professional builder. In the home workshop, a vise will serve just as well to press home the multiprong connector plates.—*Ralph Treves.*



Studs are joined without toenailing. The Gang-Nail connector plate, with dozens of integral metal prongs, holds joints so they won't twist or pull apart. Lumber ends won't split, joint won't pop.



Scrap pieces of lumber are joined with a Gang-Nail on each side to make practical lengths and eliminate waste of costly lumber. Plates can be hammered in or squeezed in a bench vise as shown.



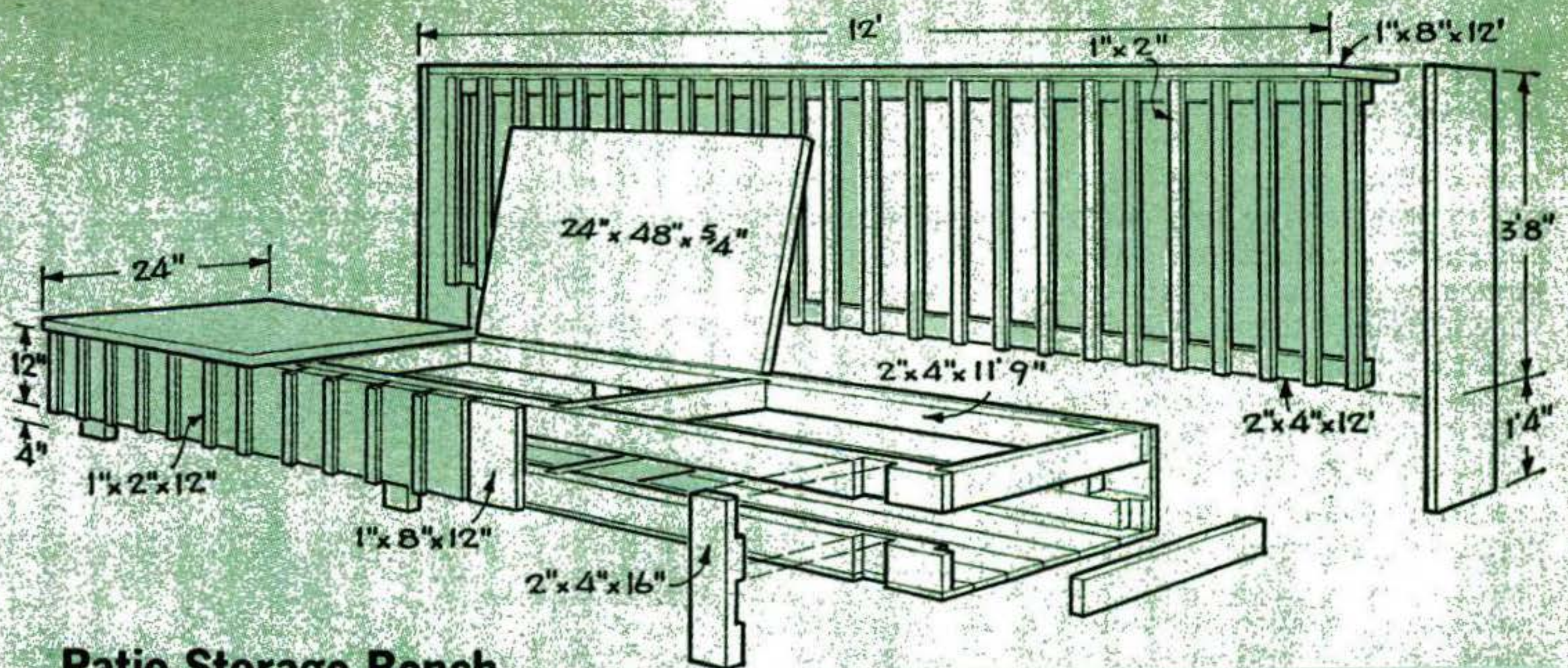
Store It Where You Use It

Why walk around the end of the house, between the rose beds, across the driveway, and down the basement stairway to get something you normally use on the terrace? Give some thought to an idea that is taking hold hard in the best-designed new homes: use-size storage units for everything you need outdoors, *where you need it*.

It's old-fashioned to think in terms of making space in your garage or basement for all the supplies and equipment you need to paint a house, barbecue a steak, mow a lawn, fix a fence, wash a car, water a lawn, or spray a Japanese beetle. It makes better sense to provide small storage units strategically located near the point of use.

Here's a house-and-yard full of ideas for such storage. In each case you'll see that the design adapts the cupboard or cabinet or closet to the spot where it will be used. It may be built around a tree, along a fence, or in a cranny of the house. It may double as a place to sit. In no case is it necessary for the storage unit to look like a storage unit. By using matching colors and materials, and the natural camouflage of plants, or by actual blending with the existing structure, you avoid the look of boxes nailed to the house.

The sketches are aimed at average needs. Adapt them to your own, and turn storage into a convenience instead of a chore.



Patio Storage Bench

The comfortable, king-size bench on the opposite page is actually a capacious storage unit. The board-and-batten construction that worked best here might be V board or another design to suit your house. If you don't need the screen, omit it—or make it lower, to serve only as a backrest. Construction? A pair of two-by-four frames supported on six two-by-four legs half-lapped into the frame. The bottom is tongue-and-groove western hemlock or other flooring. Nail it to the bottom frame (upside down) before assembly.

With the sides on, you have one long, semipartitioned bin. Put on three hinged lids, using glued-up 5/4" ponderosa pine or 3/4" exterior plywood. Foam cushions top off the handsomest outdoor lounging spot in town.



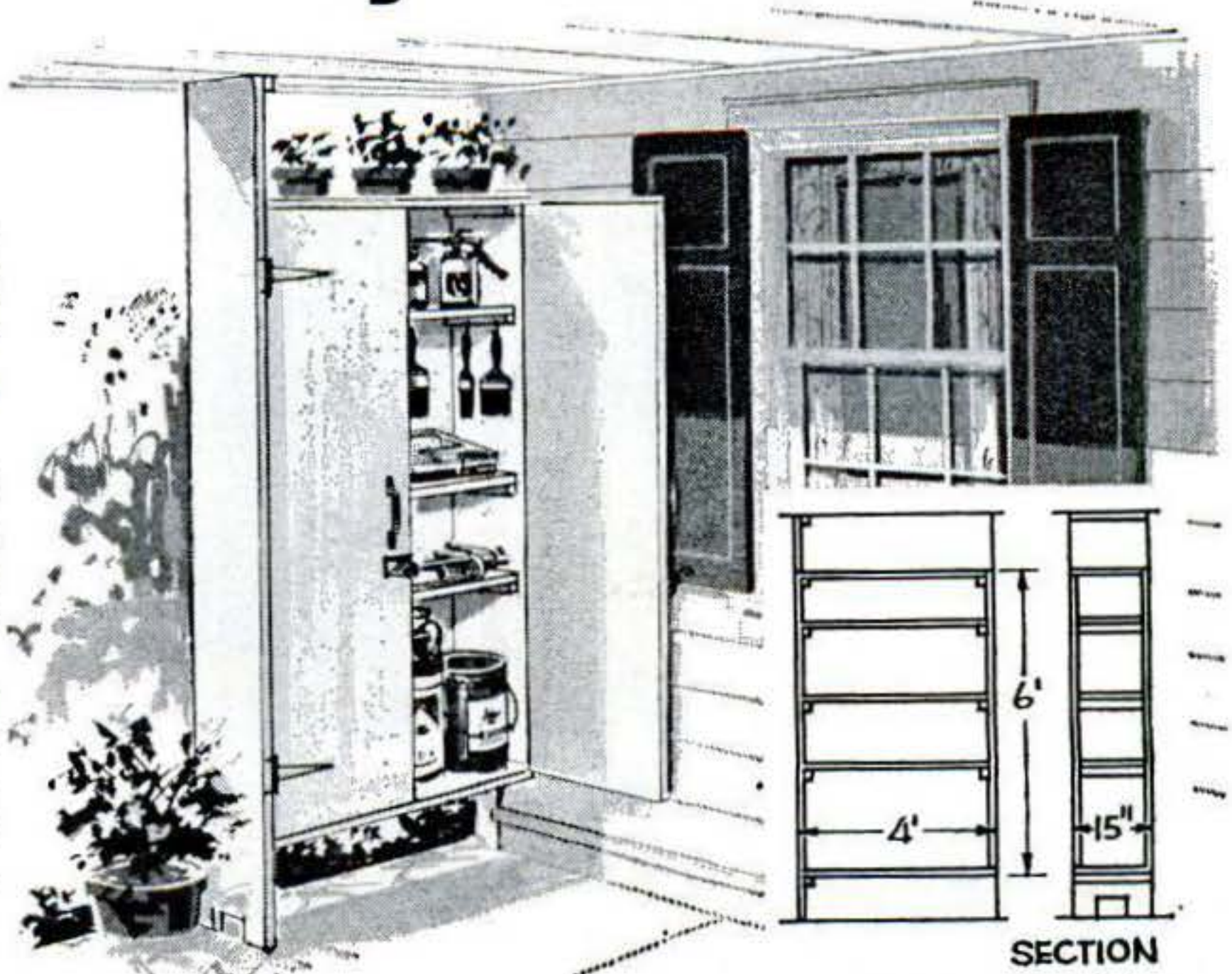
...That's the New Way

DRAWINGS BY SIGMAN-WARD

Back-Porch Storage

This shelf cabinet catches all the odds-and-ends items you find in most kitchens that should go outdoors—mop pails, flowerpots, brushes, clothespins, nonfreezing paint.

The shelves are cleated against the house at one end. The other ends are supported by a vertical from floor to porch ceiling. There's open space over the top to let air and light into the porch area. Use the clean, flush design of plywood for the doors and the upright. The back, however, may be of vertical boards, rough-sawn siding, or whatever complements the house.



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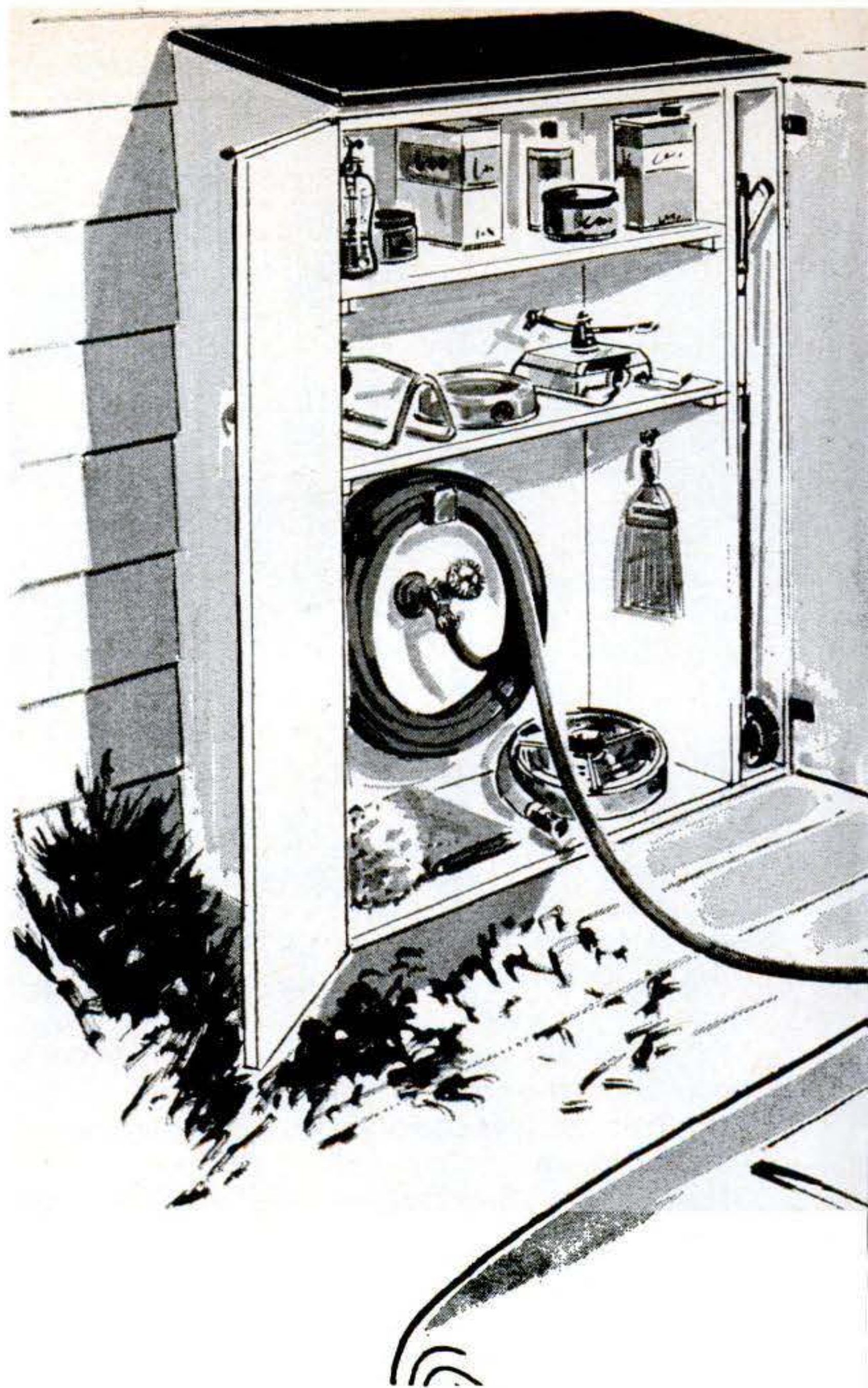
Outdoor Water Center

This unit centers on the outdoor faucet where you get the water for lawn watering, car washing, and other outdoor needs. Usually the best location is on the side or end of the garage—but other factors may affect your choice of location. Dimensions suggested in the drawing (far right) are only guides. The basic requirement is enough space around the faucet for the hose rack and the garden hose you normally handle.

Figure on shelf space for hose nozzles, sprinklers, and couplings, as well as for car-washing mitts, sponges, brushes, and the like. You'll want to store here all your soaps, detergents, whitewall cleaners, spot removers, upholstery cleaners, and other car-wash materials. It's a good place, too, for garden chemicals that you mix with water—such as insecticides, herbicides, and others, along with the required sticker-spreader solutions and measuring cups. The vertical bin at the side is optional, for long-handled car brushes.

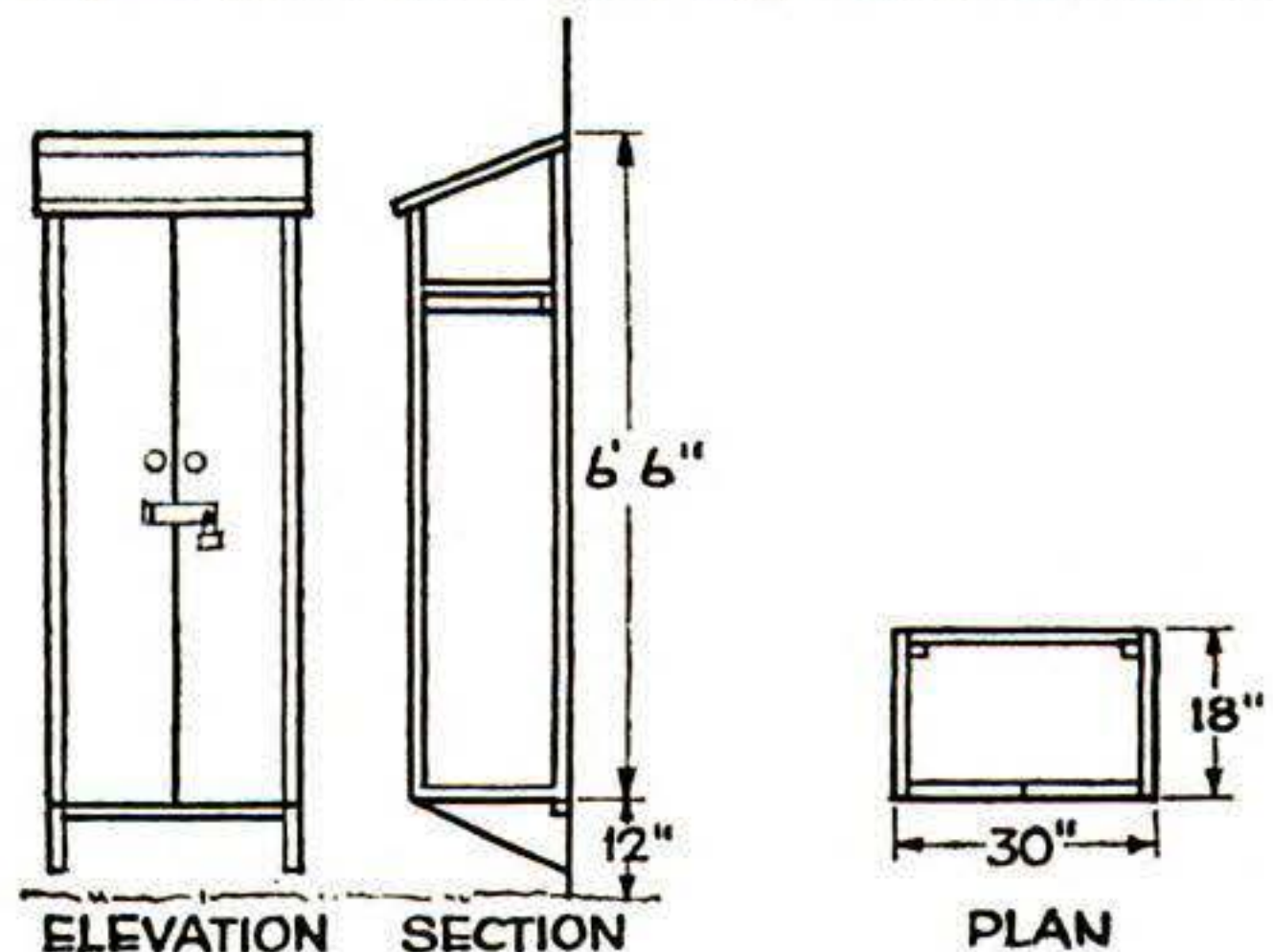
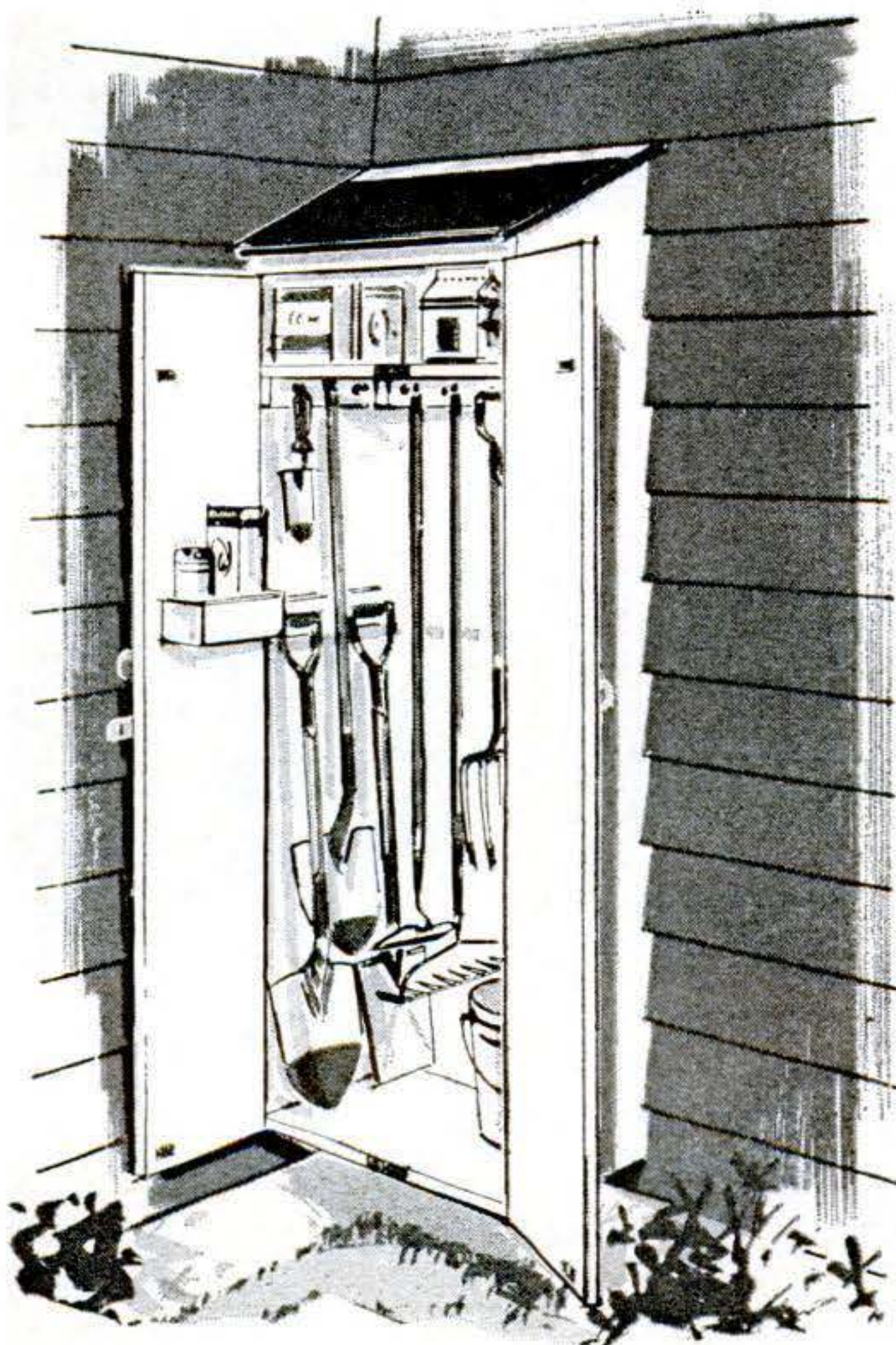
Construction is simple. Use $\frac{3}{4}$ " exterior-grade plywood, screwed at the corners, with the shelves cleated to the sides, as shown. Hinges are standard kitchen-cabinet hardware; if they're chrome plated, they won't rust. Put a hasp and lock on the outside, if you need them.

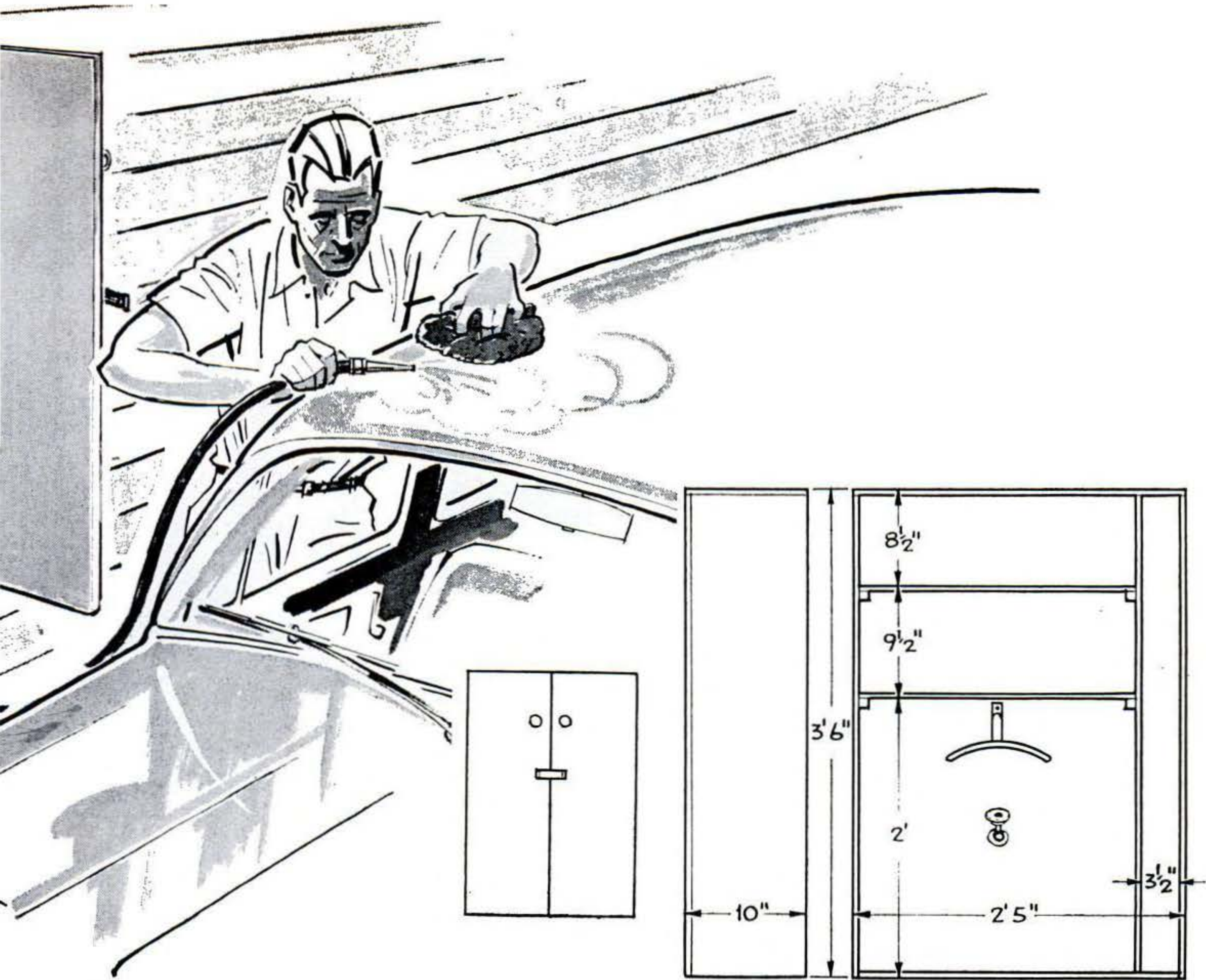
The cabinet should be mounted off the ground. Paint it to match the house.



Closet for Garden Tools

The place for this tall, slim cabinet is in a corner or on a wall close to the garden, where it houses all your garden tools. Build it of plywood, and provide nails for hanging—or better, use the handy steel racks sold at garden centers. You can eliminate a back by cutting the sides and mounting them against the sheathing. Caulk around the edges. Use flashing and roll roofing at the top—a good trick with any wall-mounted unit.



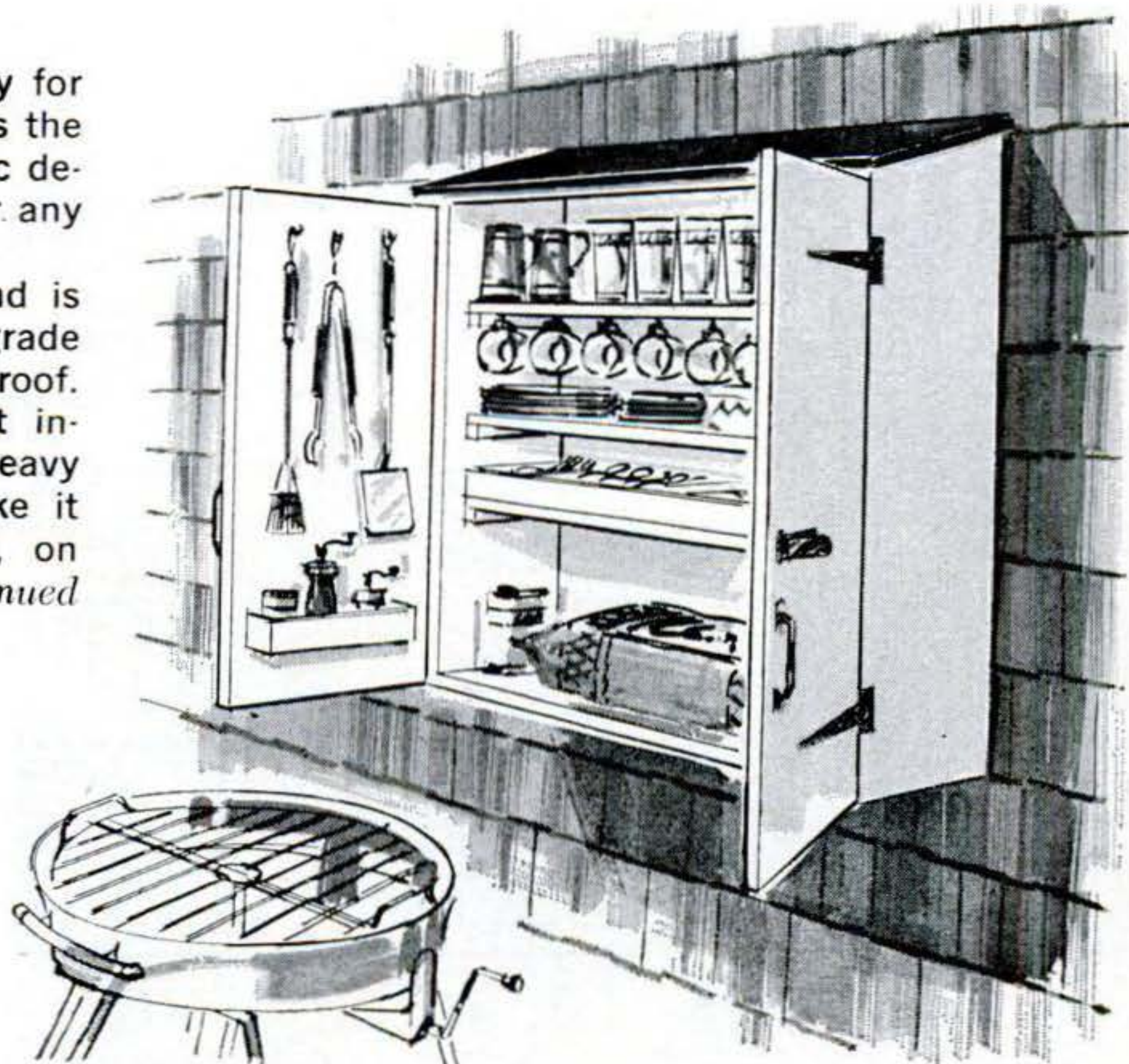
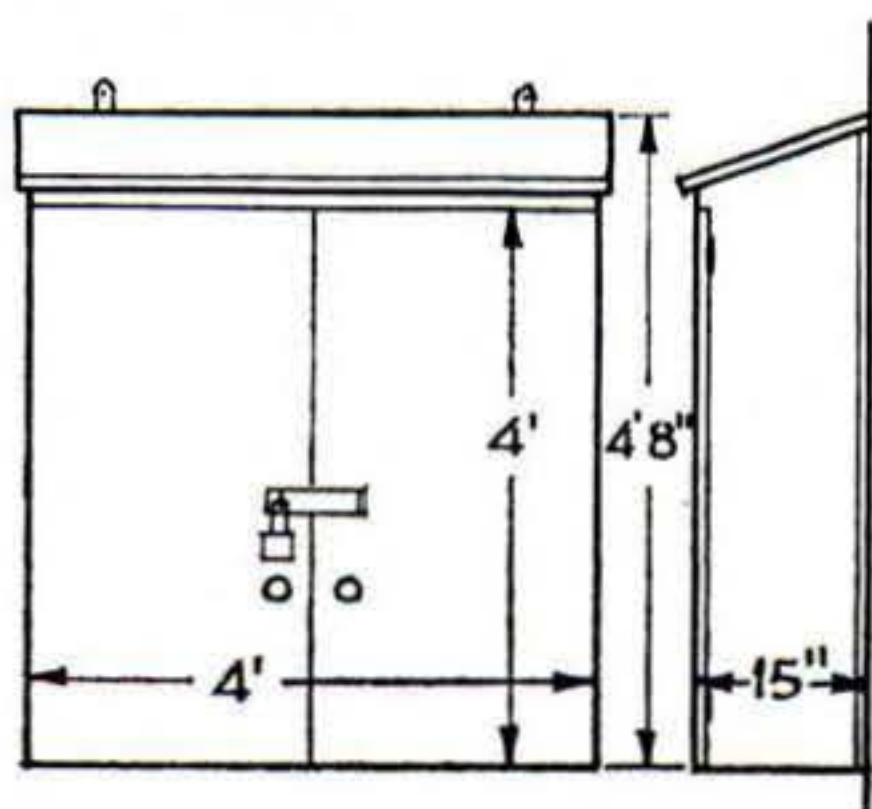


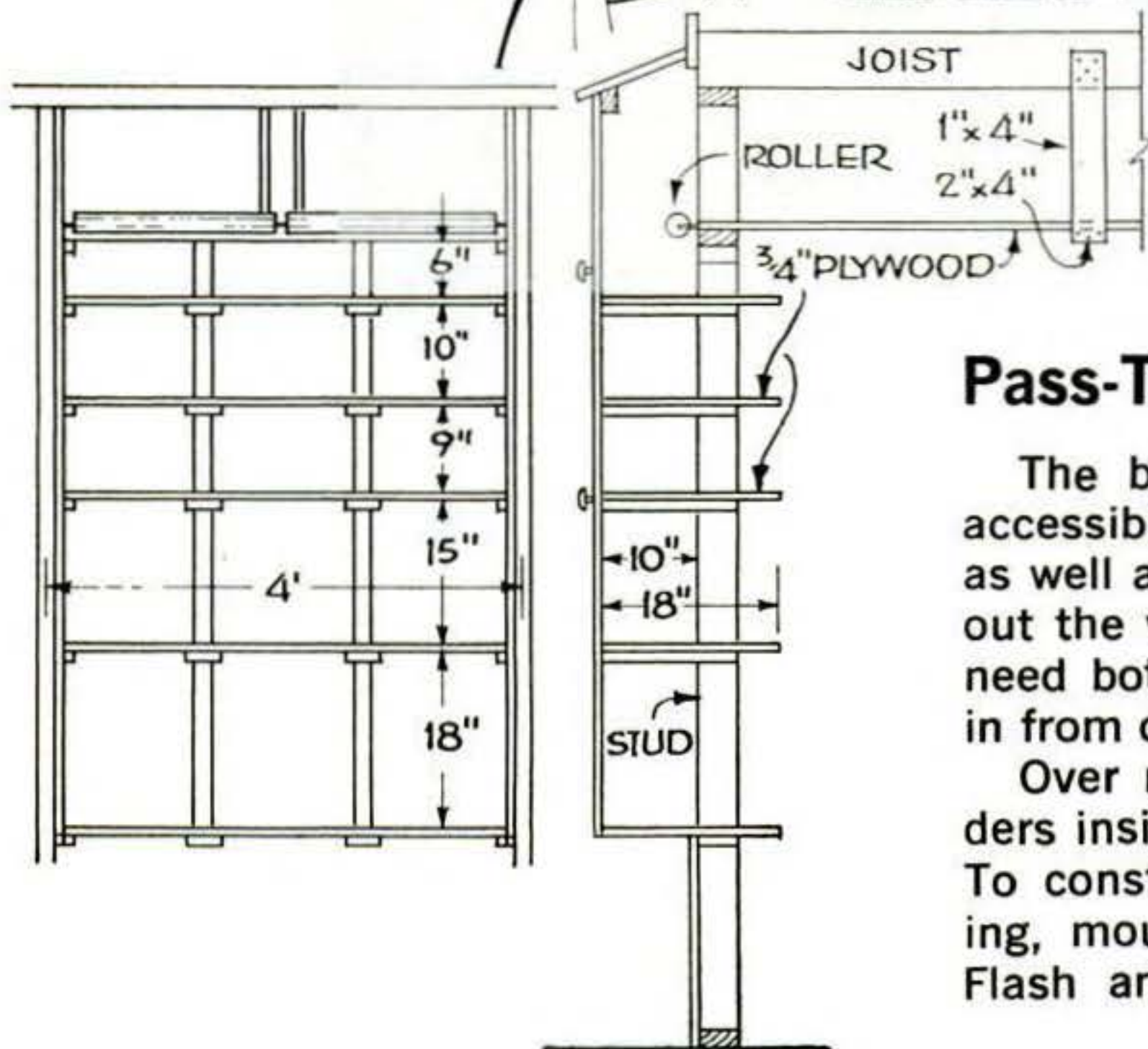
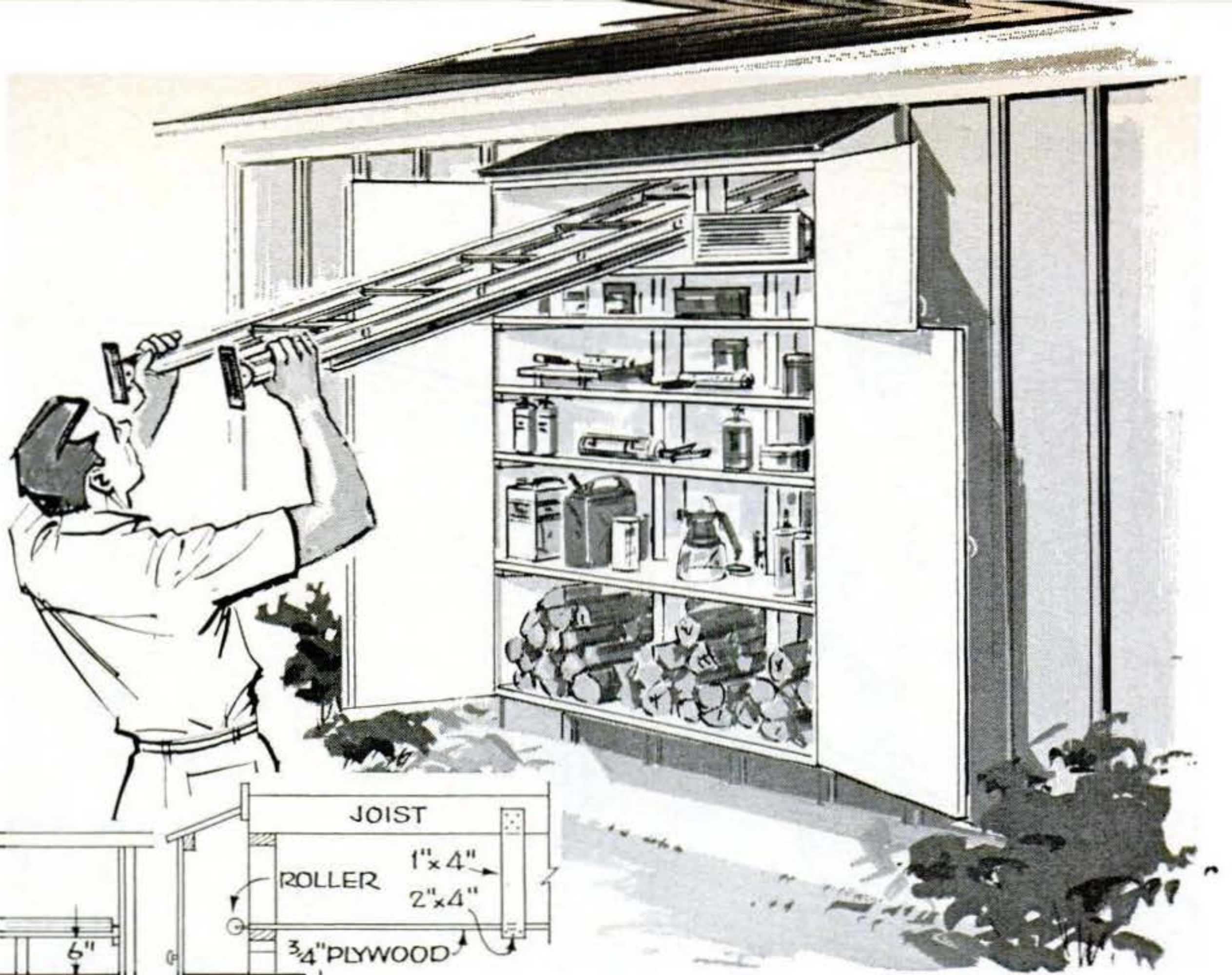
Barbecue Cupboard

With this cabinet, you're ready for the next outdoor meal as soon as the dishes are done. Follow the basic design shown, making provision for any special equipment or supplies.

The cupboard has a back, and is tightly constructed of exterior-grade plywood, so that it is weatherproof. Instead of making a permanent installation, hang the cabinet on heavy hooks and eyes so you can take it down for winter storage inside, on wall hooks.

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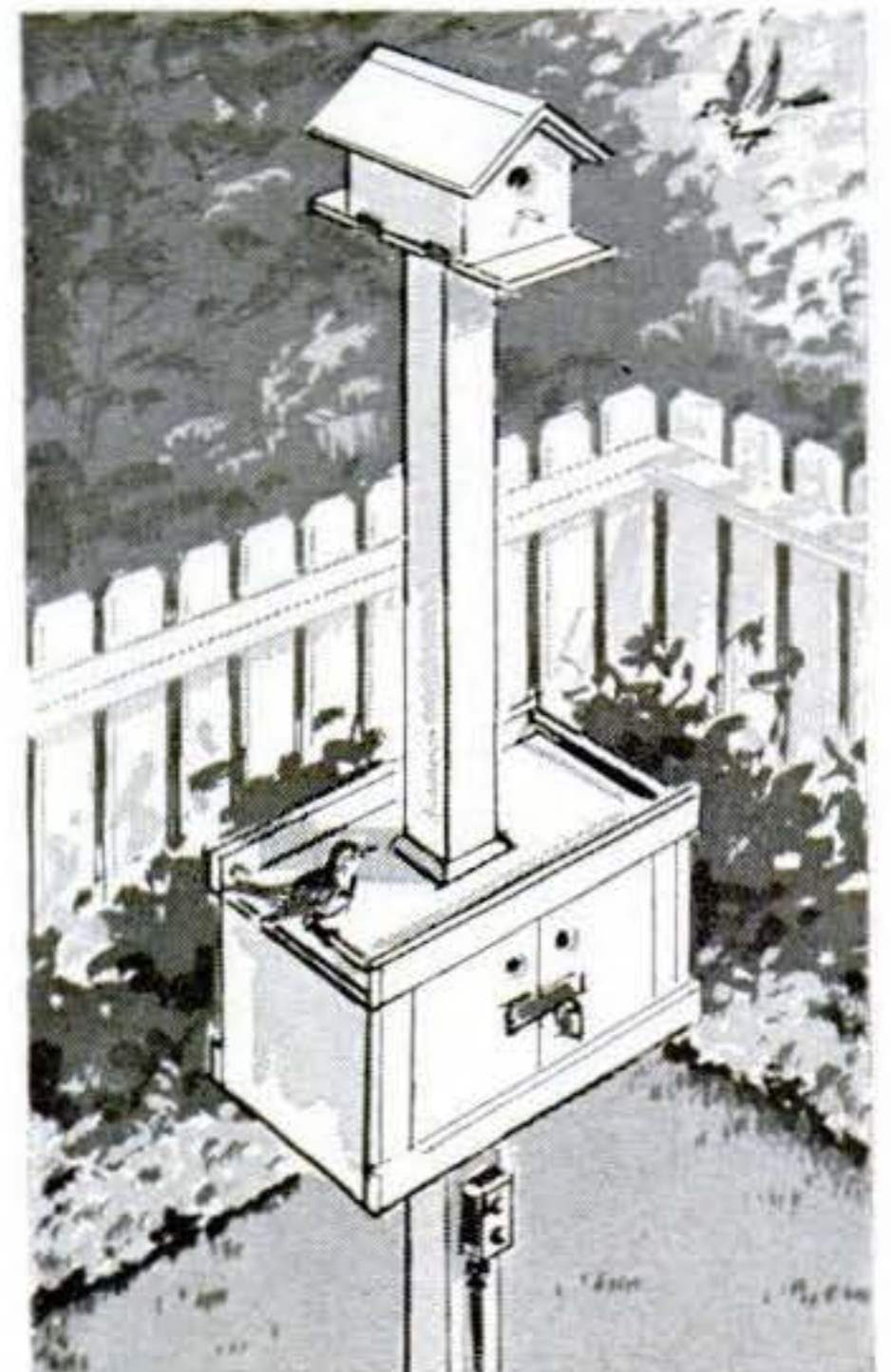
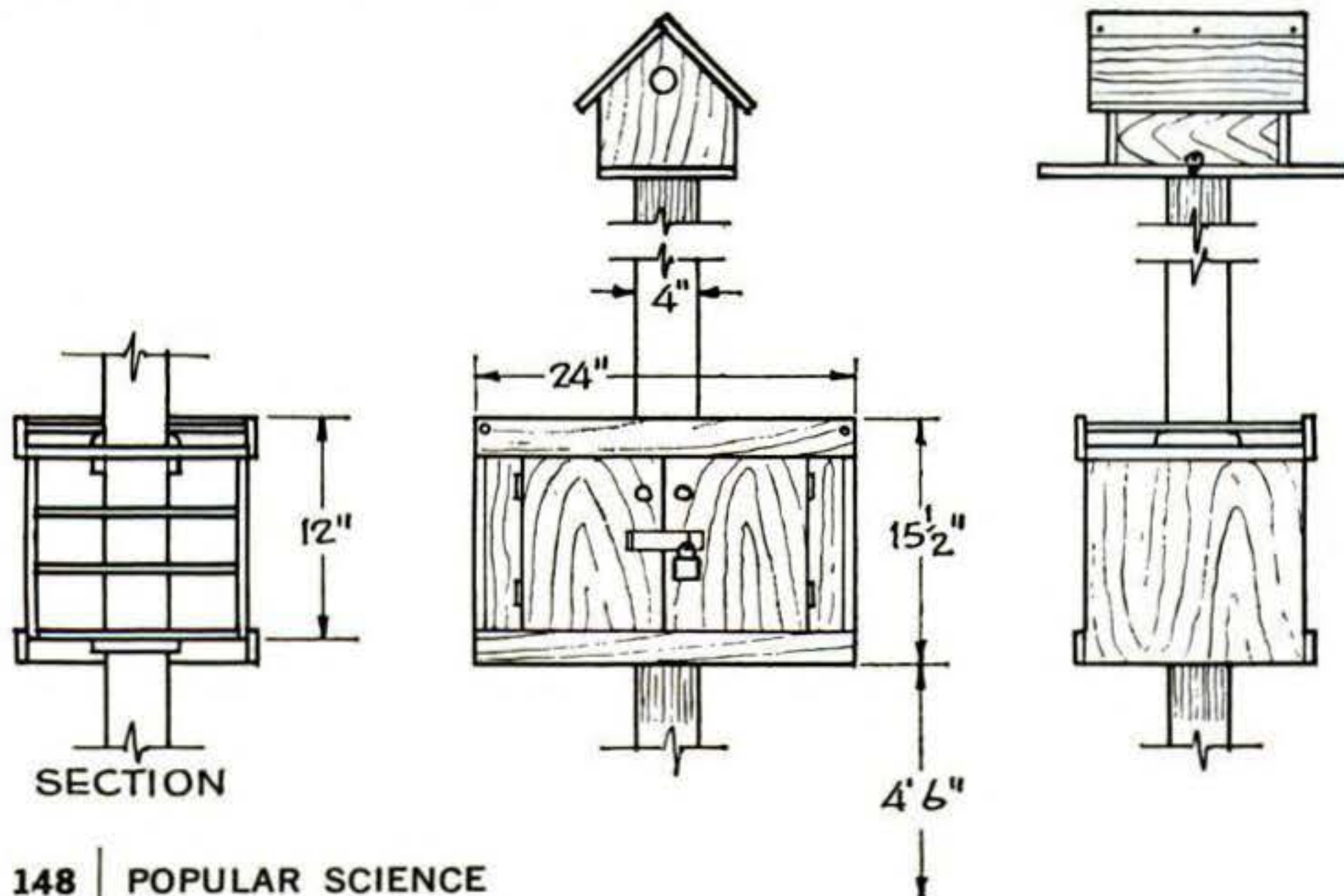
Pass-Through Storage for a Garage

The big feature of this bank of shelves is its accessibility from the inside, where they're open, as well as from the outside, behind doors that shut out the weather. Its best use is for items that you need both inside and out, that you'd normally put in from one side and remove from the other.

Over rollers installed at the top, you shove ladders inside; the ends rest on ceiling-hung supports. To construct the unit, remove siding and sheathing, mount shelves and case on the open studs. Flash and sheathe the top; mount doors snugly.

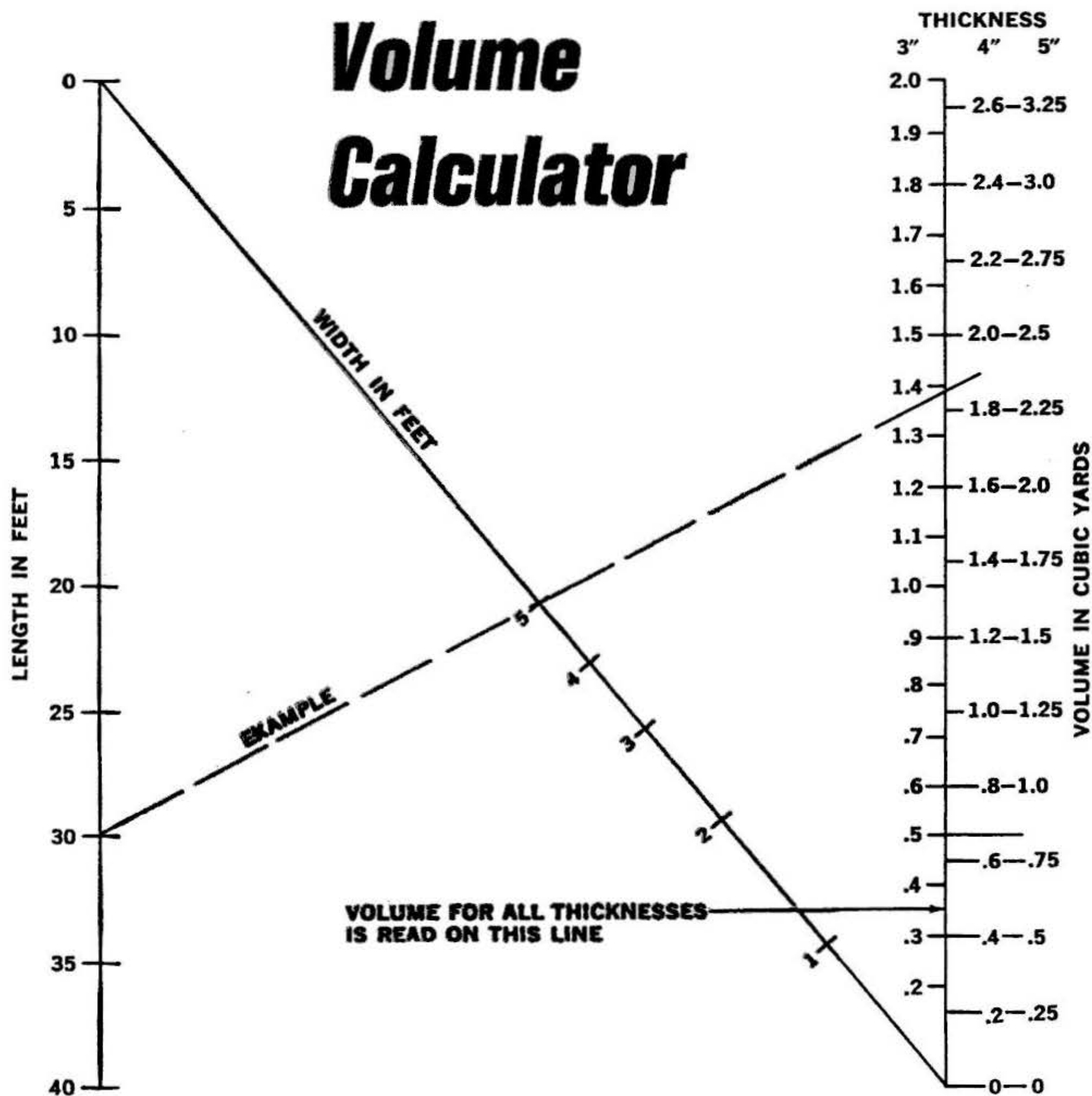
Garden Storage Is for the Birds, Too

No need to run to the house for small garden tools if you store them in this locked box. And you can feed the birds on top of the box, and mount a wren house atop the post. Cut holes in box; rest it on cleats nailed to the post. **PS**





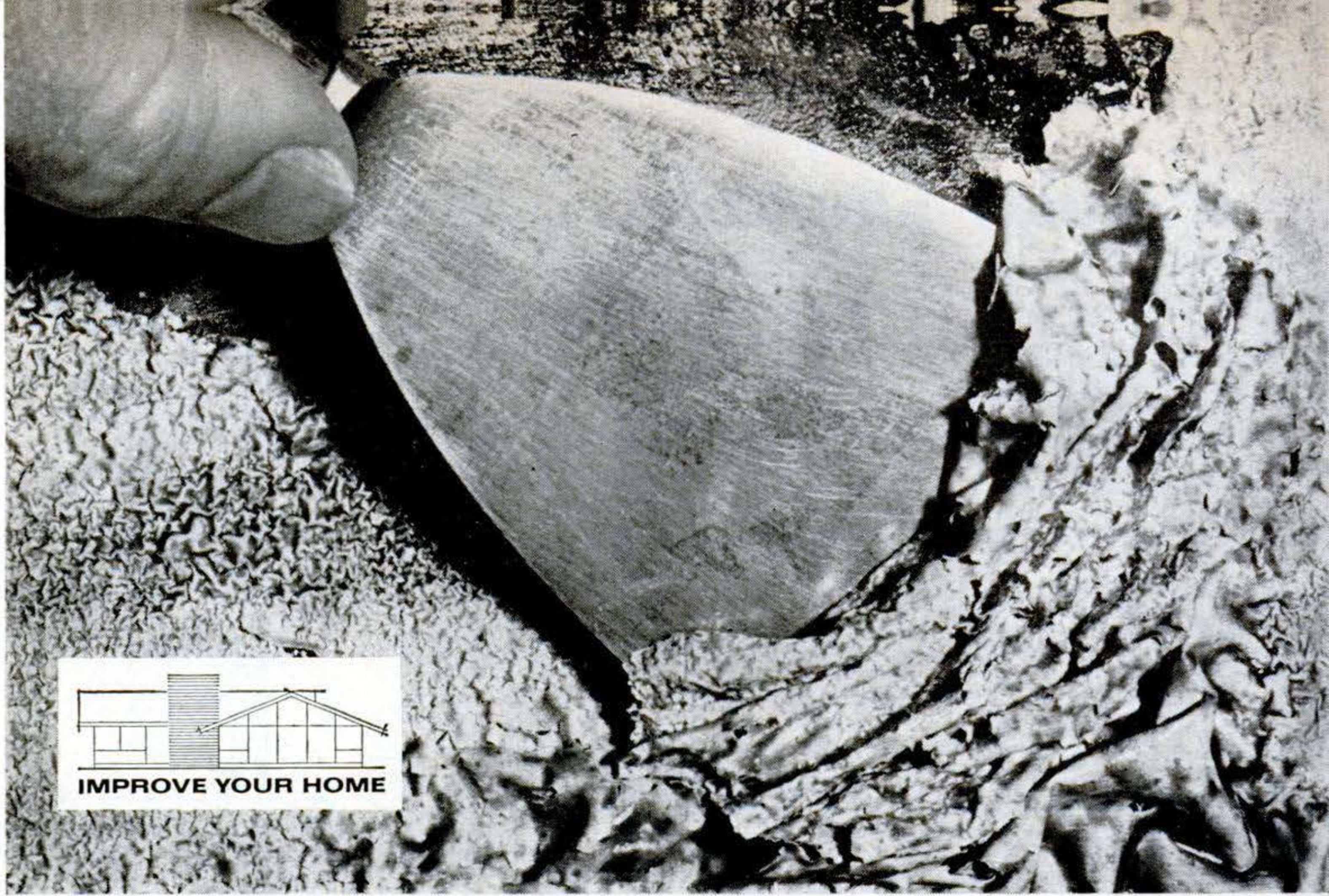
Concrete Volume Calculator



You buy ready-mix concrete by the cubic yard. If you want to pour a sidewalk, patio, basement floor, or driveway, you can find out how much concrete you need to order with a few math calculations. But you can save time and avoid mistakes by simply laying a straightedge across this handy calculator. Here's how you do it: Need concrete for a sidewalk 30' long, 5' wide, and 4" thick? Lay the straightedge from the point 30 on the "Length in Feet"

line on the left through 5 on the "Width in Feet" diagonal line. You'll read 1.85 cubic yards under the 4" thickness on the volume line.

You can use this calculator for any combination of length, width, or thickness this way: For 50' length, use twice the volume found for 25', keeping the other dimensions the same. You can use the sum of the volumes found under 3" and 4" to find out the volume for a 7" thickness.



Chemical remover, one of three ways to remove a finish, dissolves coating so it can be scraped off with a wide-blade knife.

BEST FINISHES FOR WOOD:

PAINT REMOVAL...

how to do it right

By JACKSON HAND

There are three ways to get an old finish off:

- You can use chemicals that dissolve the coating and make it easy to remove.
- You can use mechanical means, such as sanders or scrapers, that forcibly break up the film.
- You can use heat, which destroys the film by baking out its resins, making it easy to lift off with a scraper.

Of the three, chemical removal is best for furniture. It leaves the surface ready for refinishing. An electric heater is good for removing house paint, and it can be used on smaller work when surfaces are flat. But

it leaves a residue that must be cleaned up by sanding or with chemical removers. This suggests the idea of using heat as a rough remover when there are so many coats of paint that cutting through them would be slow and costly with chemical removers.

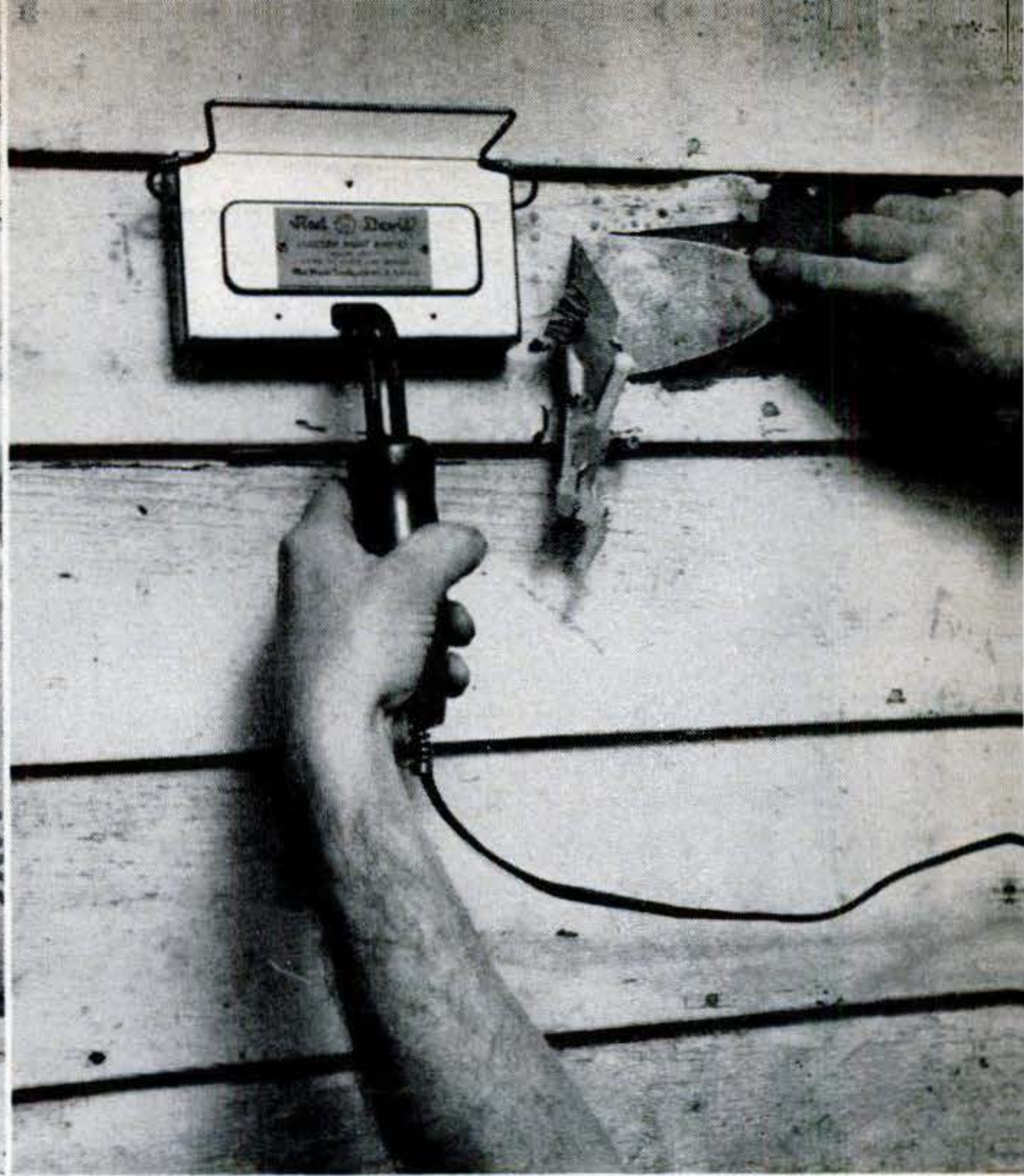
The trouble with scraping and sanding is that you cannot take off the finish without also taking off some of the wood beneath it. This is all the more true with a power sander. You might be willing to remove some of the wood on a rough project, but generally speaking fine work cannot tolerate wood removal. A reason for this is that old wood takes on a surface coloration (even under finishes), and if some of this color is removed you get unpleasant blotches.

The true place of sanding is in cleanup

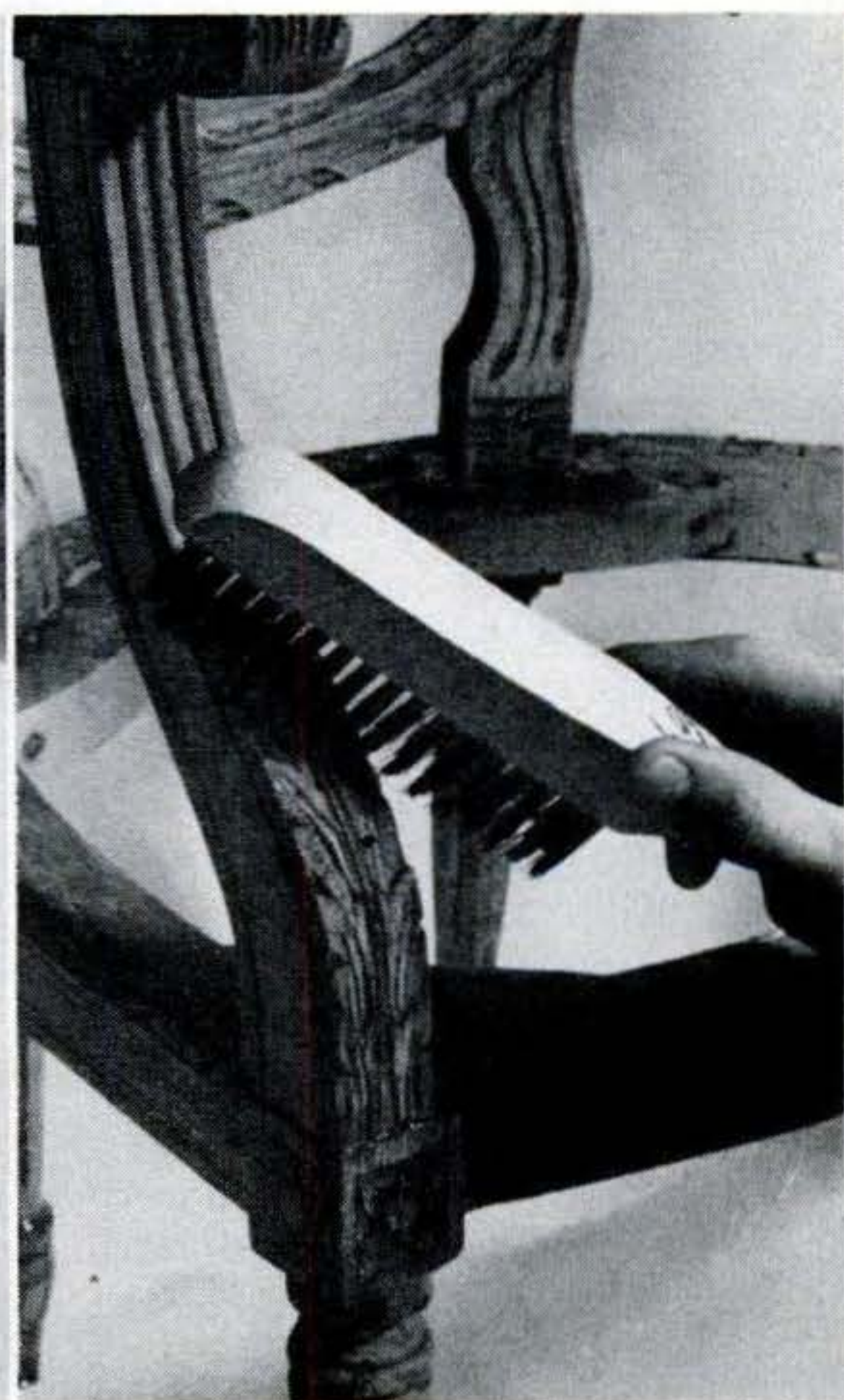
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Sanders and scrapers mechanically break up and remove the old paint film.



Heat softens the film so it can be removed with a scraper. The photo above shows the new Red Devil electric paint burner.



For a clean, neat job, follow these simple rules

Set furniture legs in a shallow tin can to catch runoff, and apply remover as thick as possible.

Soft wirebrush—even a suede brush—cleans carvings best. A pointed stick cleans grooves.

Carry off sludge by scraping it into a can held at the edge of the surface. Use a wide-blade putty knife.

after the chemical removers have done most of the work.

How to pick a paint-and-varnish remover. All paint removers are also varnish removers. In fact, varnish, shellac, and lacquer are so much easier to remove than paint that the manufacturers strive for paint removers, knowing that the other materials will come off easily enough. And the industry calls them paint removers even though you may use them on varnish.

At one of my favorite paint stores I bought five pint cans of paint remover. The prices ranged from 69 cents to a buck-fifty. How come the difference?

As I read the labels, tested the contents, and finally talked to some manufacturing chemists, I found out.

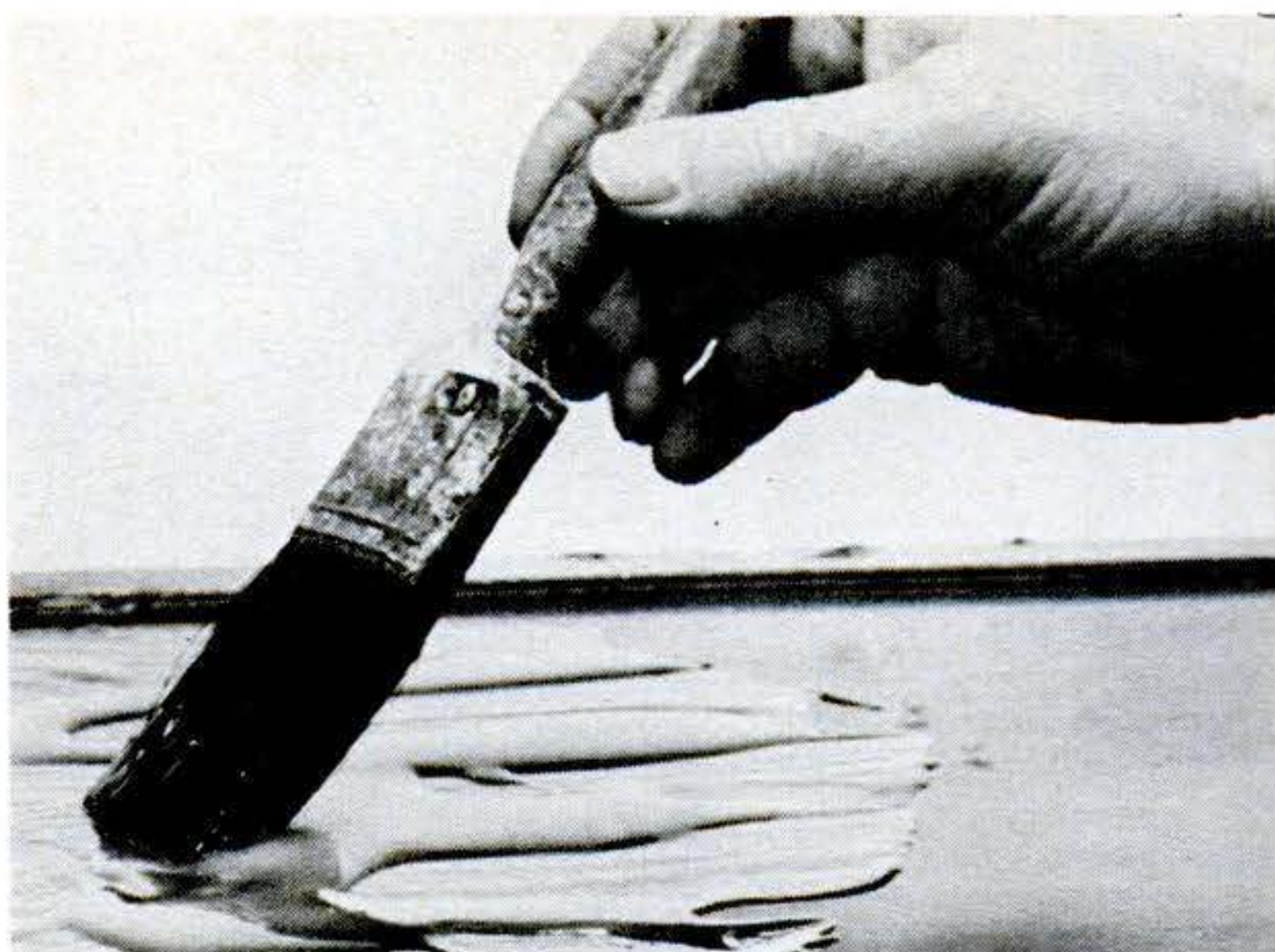
The least costly contained the least costly chemicals—benzol and acetone. It was labeled **EXTREMELY FLAMMABLE!** It worked slower than the others. It contained a waxy substance that had to be cleaned off the stripped wood or subsequent finishes wouldn't dry. For a little extra work, time, and fire hazard, you can save money.

The two materials at 95 cents and a buck-ten contained essentially the same materials—acetone, toluol, methanol, and methylene chloride. Both are labeled flammable and carry warnings about harmful vapors, as well as "may be fatal or cause blindness if swallowed." In use, they cut through finish faster, and, most critically, they do not require any post-stripping cleanup with additional solvents. Once the softened finish is scraped and wiped away and dry, you're ready for the new finish.

At \$1.50, there is an abrupt change. First, the label says it's nonflammable, although you are still not supposed to imbibe the stuff. Second, you can wash away the remover and the softened finish with water. When the work is dry, it is bone-clean, ready for a new finish. So for a little extra money, you gain a great deal of convenience, ease, speed, and thoroughness.

The key ingredient in the better removers is methylene chloride. It is the best, fastest-working of the solvents. Moreover, it is a fire-retardant. When a formula contains enough methylene chloride, it is nonflammable, even though it may also contain other ingredients that are highly flammable by themselves. In a top-grade paint remover, the methylene chloride is combined with other solvent chemicals so you can use them on everything, including the new-

Put it on and take it off—



Pour on as much remover as the surface will take without runoff. Quantity counts, especially on thick, old paint. Spread around with light brush strokes.

est, toughest synthetic finishes. Just about all of the major manufacturers of paint and varnish removers put out a complete range of prices and performances. Wilson-Imperial, for example, puts out five.

A water-wash paint remover contains several ingredients in addition to solvents. It has methylene chloride and other film-cutting materials. Methyl cellulose or special waxes are added to provide enough body so the material will stay on vertical surfaces. The waxes also slow down evaporation. An emulsifier is added that, in combination with water, lifts the remover and the softened finish from the surface of the wood so it can be sluiced off clean. When you finish, you get perfectly clean wood.

There are other paint and varnish removers. One is lye in a strong solution with water. Its only advantage is economy in large quantities. You might use it in a big tank to take paint off a houseful of shutters. It is extremely caustic, and is considered dangerous to use.

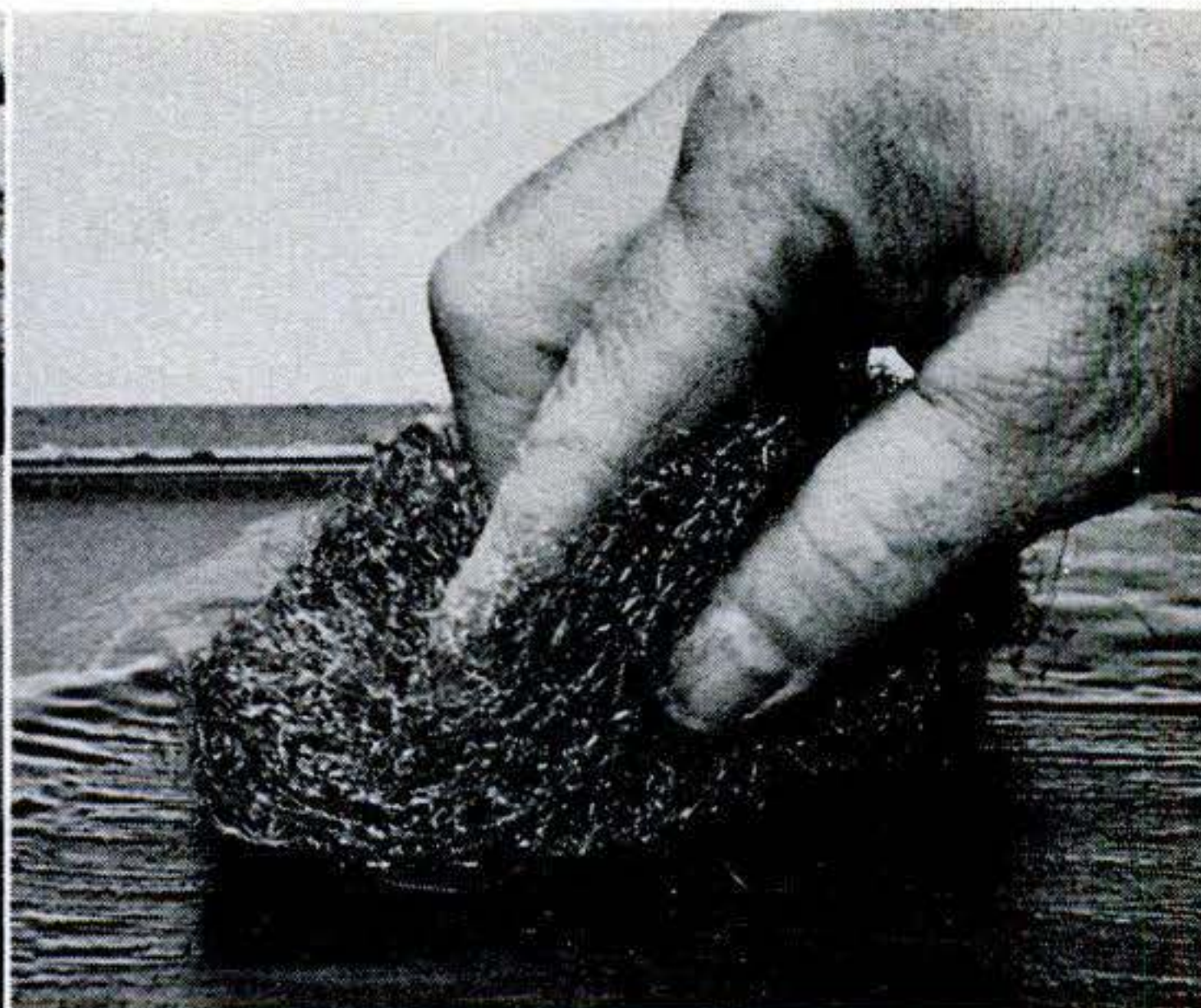
Another product, called Double-X, is largely trisodium phosphate with other ingredients, such as sodium peroxide and other bleaches, in water. It is used boiling hot. It is very effective against shellac and old varnish, particularly on badly deteriorated floors. You could use it on furniture, unless there are veneers that might lift under the hot water. It has the advantage of bleaching out quite a bit of stain—although it also bleaches the wood.

A boiling-hot, saturated solution of tri-

here's the easy-to-follow sequence for using paint removers



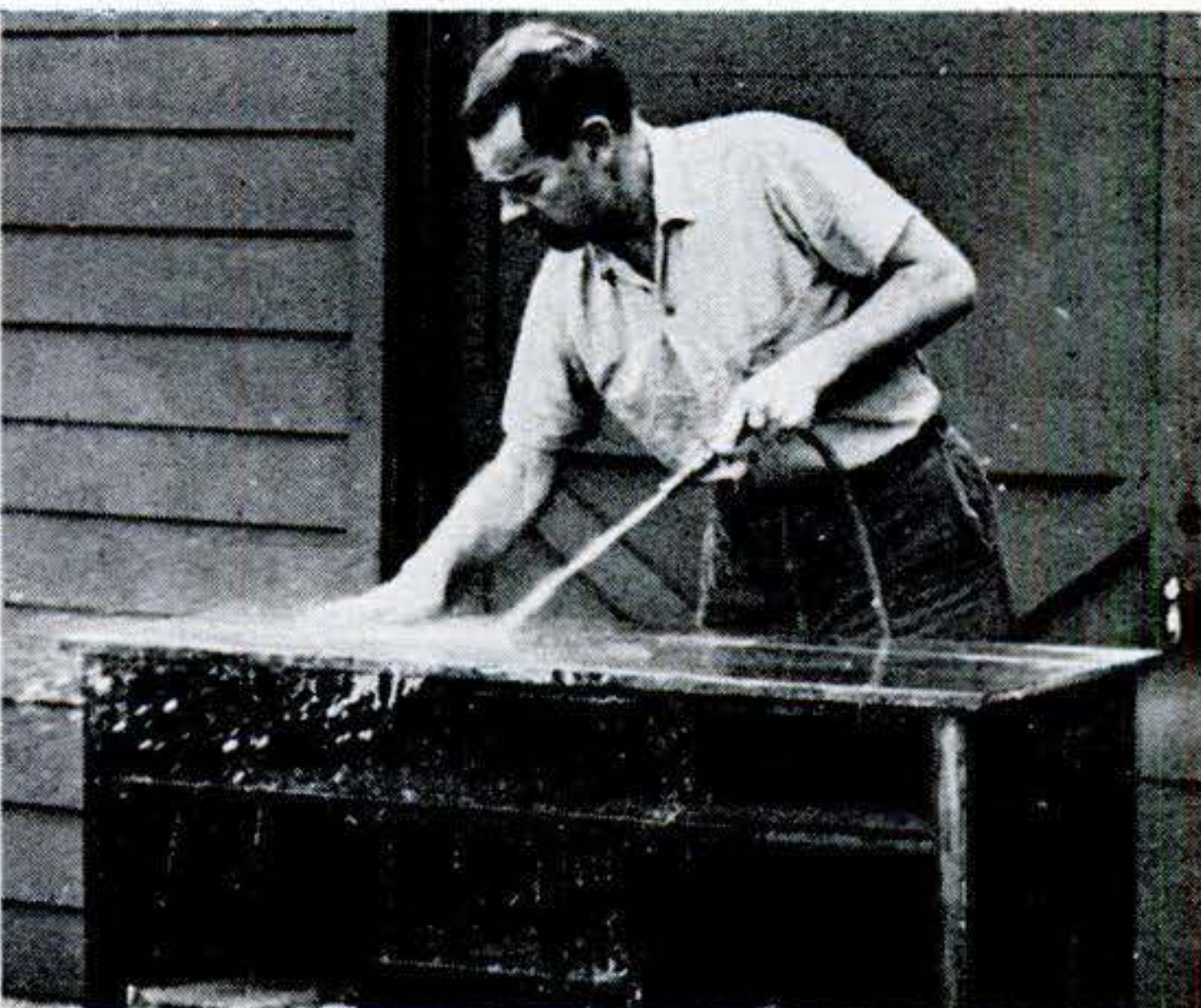
Test the film to see if it's soft by rubbing your finger hard over a small area. If you rub (not scrape) through to bare wood, the sludge is ready to remove.



When the sludge is soft, use a pad of fine steel wool and work over the entire surface, rubbing gently with the grain. This cuts loose stubborn spots.



Squeegee off the loosened finish. The best tool is a rubber kitchen scraper. If you use a wide putty knife, be careful not to damage the softened wood.



Water-wash removers need a lot of water. Hose down big pieces; put smaller ones in the bathtub. Other removers are wiped off with a rag.

sodium phosphate does about the same job, without bleaching.

How to use a paint remover. Certain easy-to-learn techniques apply to all paint removers:

- Spread it thick. Do not brush back over it; stirring it up speeds evaporation. With most formulas, the remover does not use itself up or wear out or neutralize in the presence of a film to be dissolved. What happens is that it evaporates. The more you put on, the longer it takes to evaporate—the longer it works. Use the side of the bristles and put it on thick. The less coverage you get, the better.

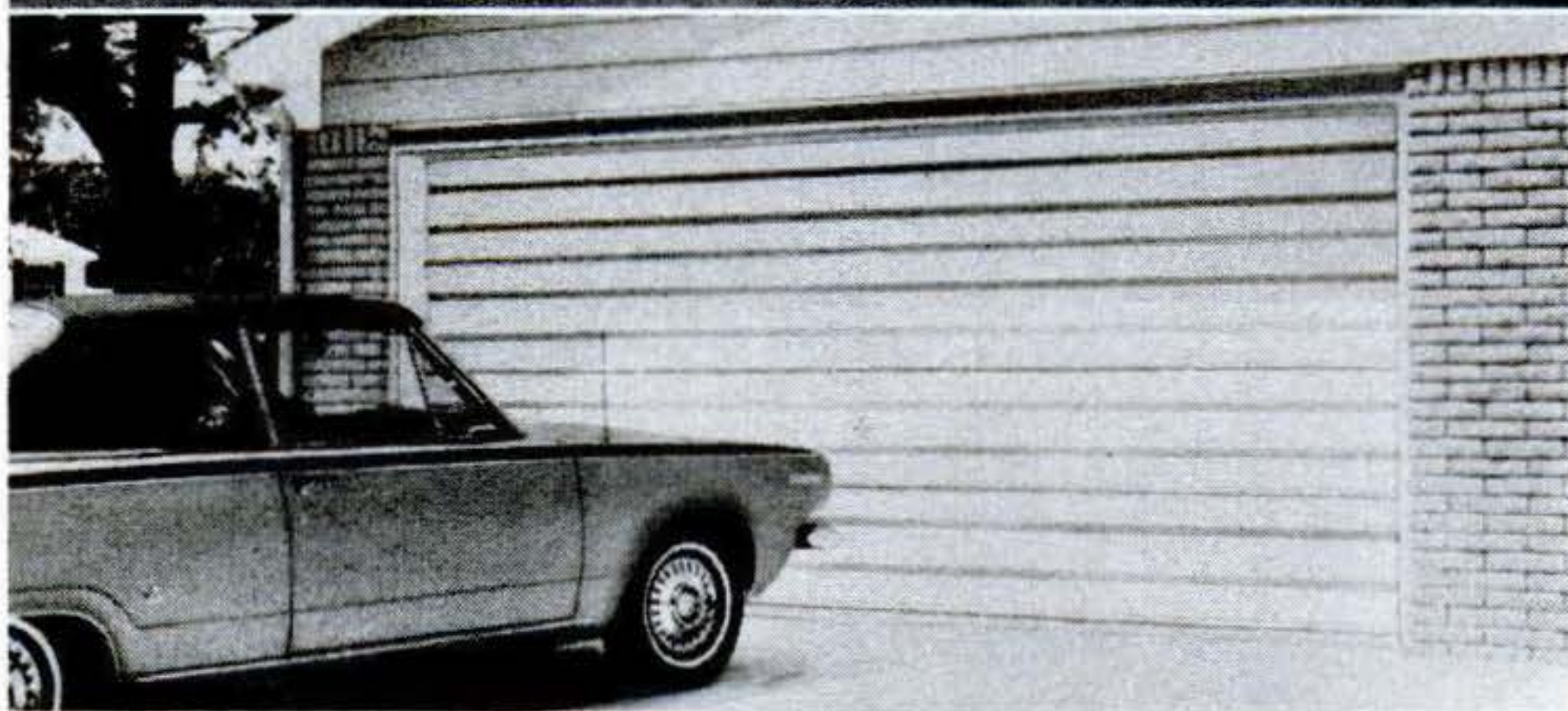
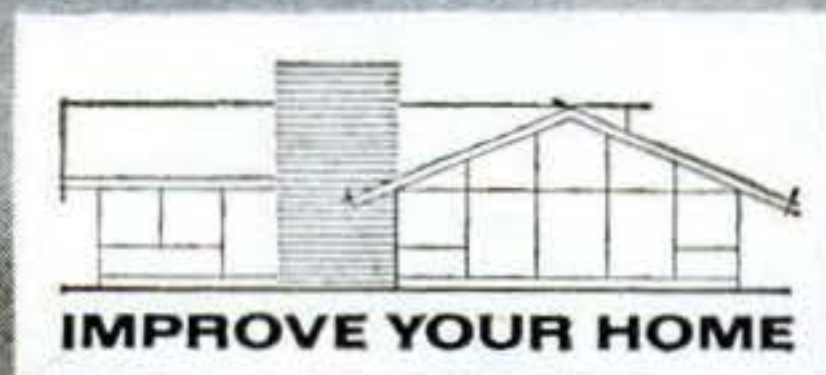
- If the material seems to dull over or get skimpy in spots, brush on more.

- In about half an hour, maybe less, test softening by pressing your finger into the surface with a small circular motion. If, by finger pressure only, you can penetrate to the bare wood beneath, the remover has done its work.

- If at the end of half an hour you cannot rub your finger through to bare wood, the reason is that the remover has evaporated before it has had time to cut through all the old finish. Now you can choose between two procedures, equally effective. Either brush on another application of remover over the half-cut sludge—or slough off whatever comes easily with a scraper. Then apply more.

[Continued on page 240]

Want a New Garage Door?



Berry one-piece doors of fiberglass and aluminum (above and at left) let sunlight in your garage. Most of the parts come already assembled to make it easy to put one up yourself. They never need paint.



Taylor fiberglass doors come in two sizes only. Two single panels, joined with special hardware, make a double-width door. The fiberglass panels won't warp, split, shrink, or shatter. They're steel-reinforced.

Or a Carport Fast?

—look what you can buy!

Here are four new products that let you do the job yourself. They're lightweight, easy to put up, and don't need painting.

Occasional dusting or rinsing keeps the Berry fiberglass-and-aluminum garage door, made by Stanley, looking like new. Roller carriers, bottom weather seal, leveling brackets, and hinges are factory-assembled, so the doors go up fast and easy. During the day, the translucent doors transmit light from outside; at night, they flood the driveway with light from inside.

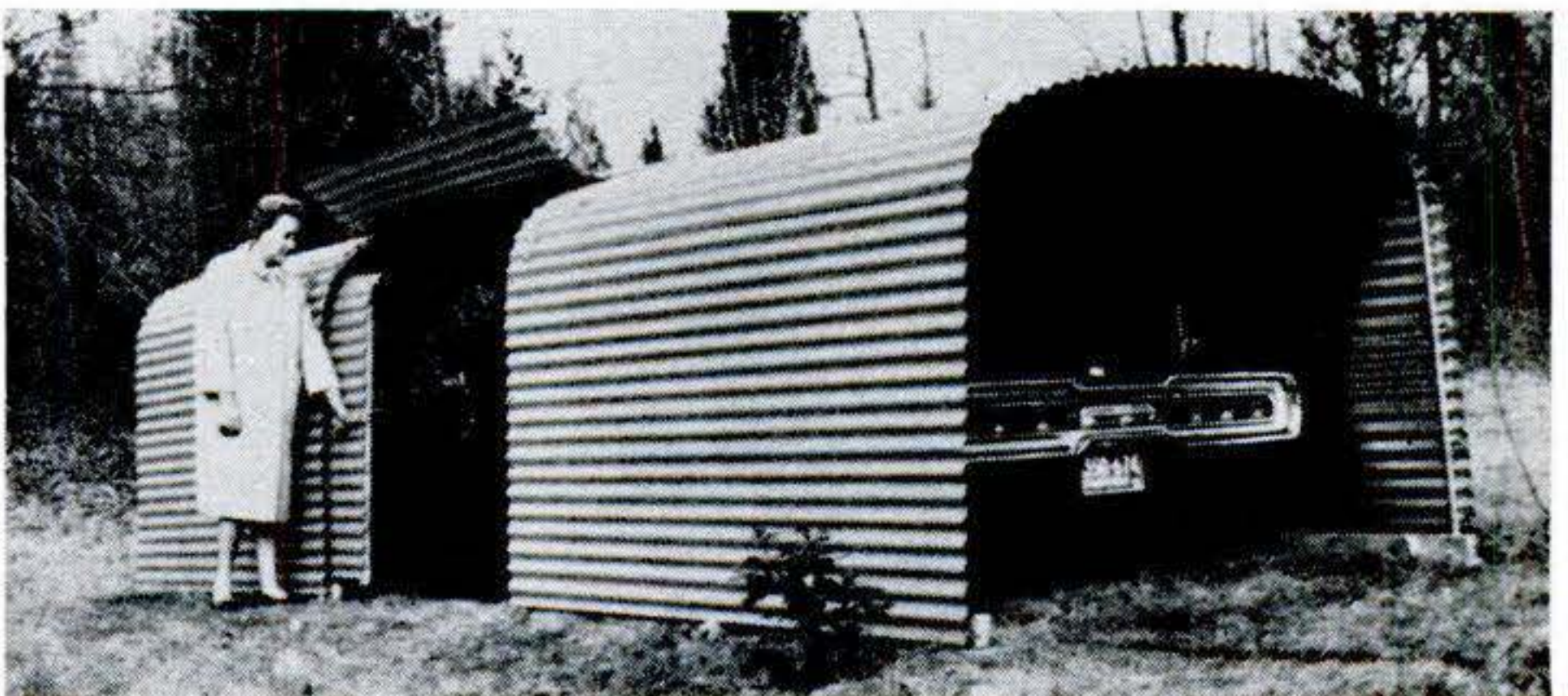
The featherweight fiberglass doors made by Taylor Garage Doors (Detroit) have aluminized- and galvanized-steel reinforcement for strength. The doors are made in one piece, in 8'-by-7' and 9'-by-7' sizes. You make a double-width garage door by using two single panels and special hardware.

The Flexalum Portiko is designed so you can put it up yourself. It can be attached to a house or erected free-standing to give you a patio roof or carport in quick time. It comes in three stock sizes: 10' by 16', 10' by 20', and 12' by 20'. The all-aluminum roof has a two-coat baked-on enamel coating. These are sold through Alcan Aluminum Corp., NYC 10030.

If you have two cars and garage space for only one, you can solve that problem fast with a Car Cove. Made by Swenson Engineering, Branford, Conn., this low-cost shelter can be put together in a few hours from a kit.



Flexalum Portiko gives you a carport or a patio roof fast. It comes in three sizes and can be erected free-standing or attached to a house. An integral gutter system can be drained at any point.



Open-end Car Cove makes a permanent, drive-in shelter for any size car. You can build it from a kit in a few hours. The driver enters and leaves through a doorway opposite the car's left front door.

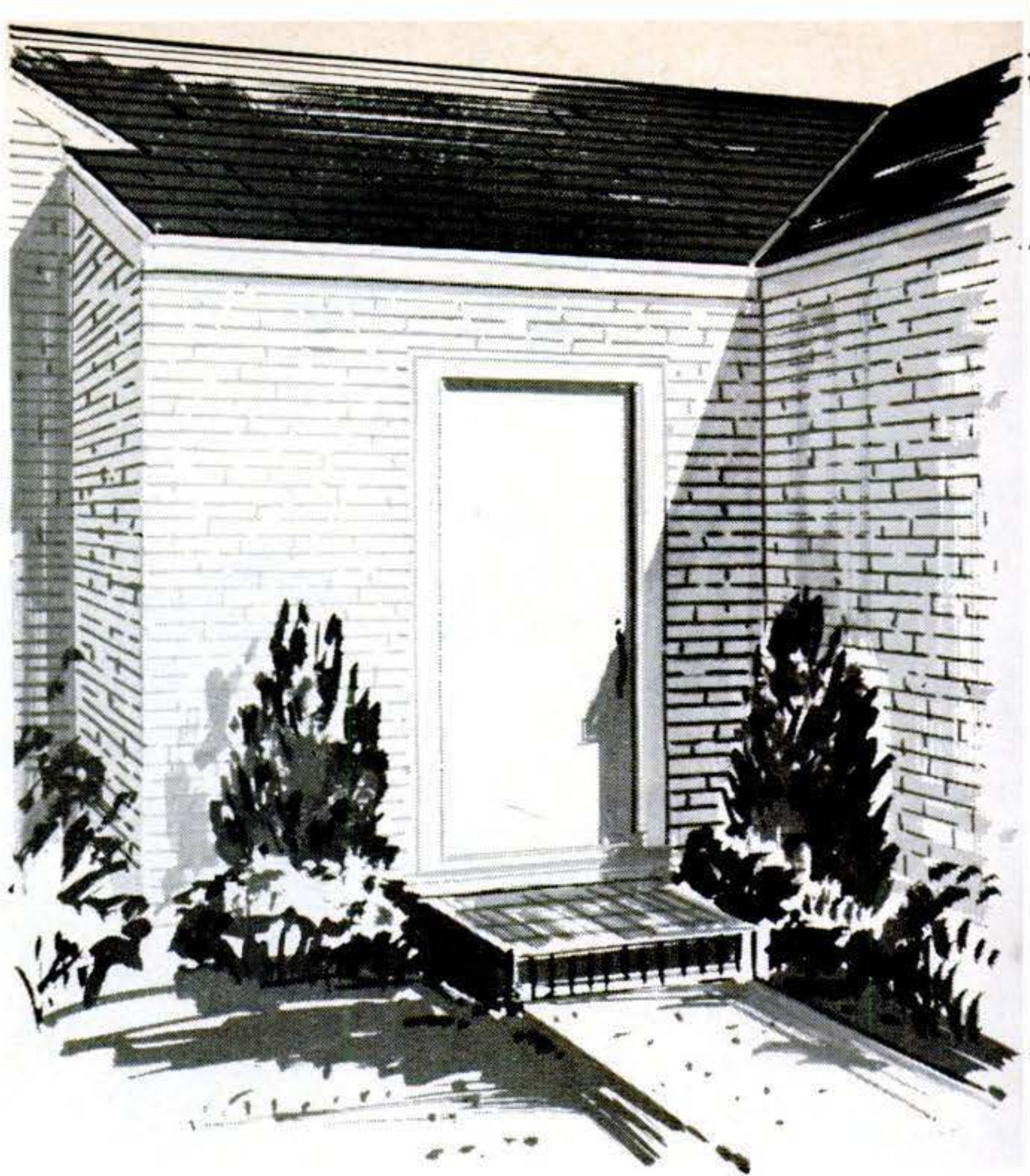


IMPROVE YOUR HOME

FACELIFT for Your Front Door

Here's a sure way to boost the value of a home and get more pleasure from it

By WILLIAM J. WARD JR., A.I.A.
DRAWINGS BY SIGMAN-WARD



When you look at a house, you probably look first at the front door. Then your eyes become aware of windows and other details. This being so, if you improve the entrance, you've greatly improved your house both in appearance and value.

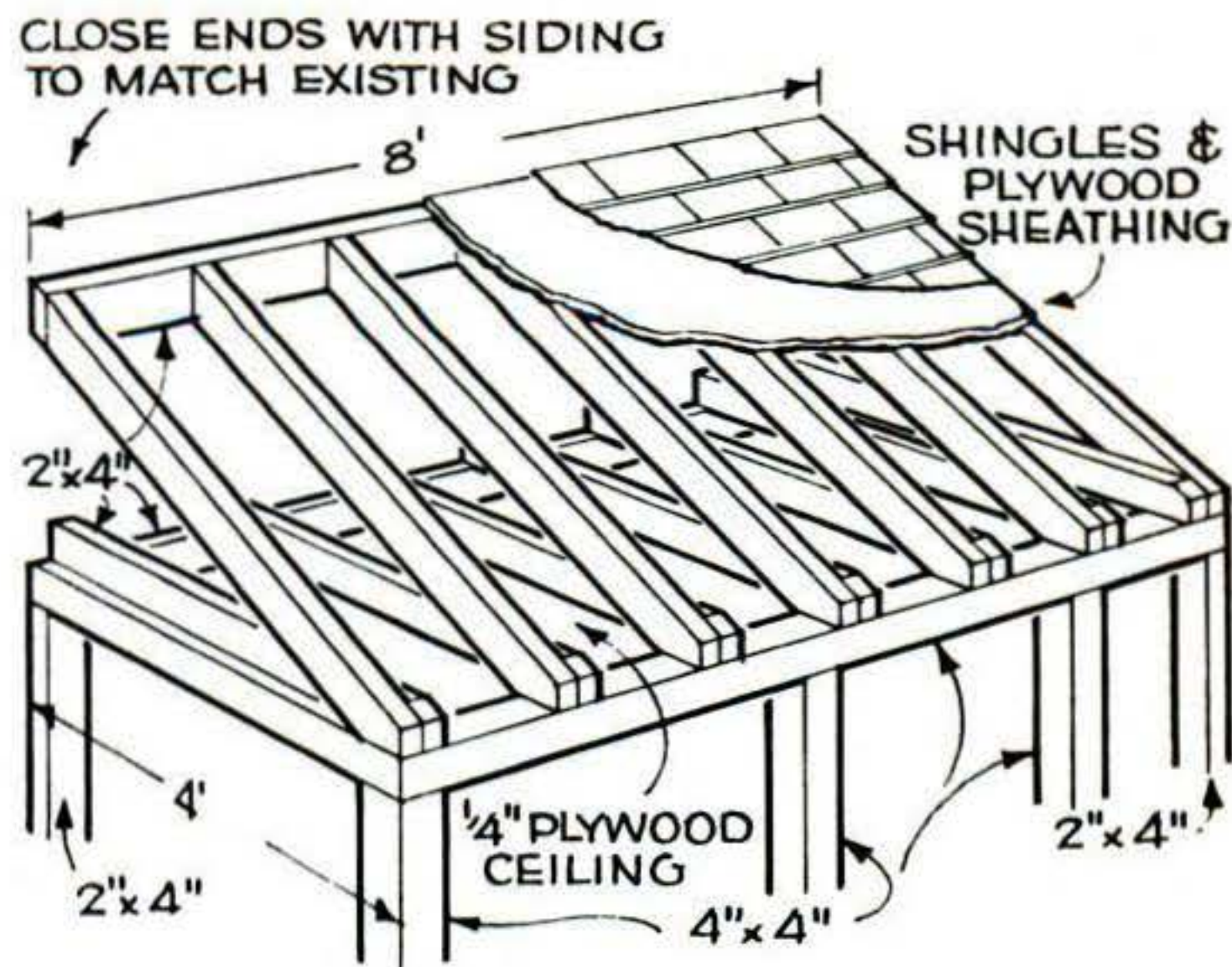
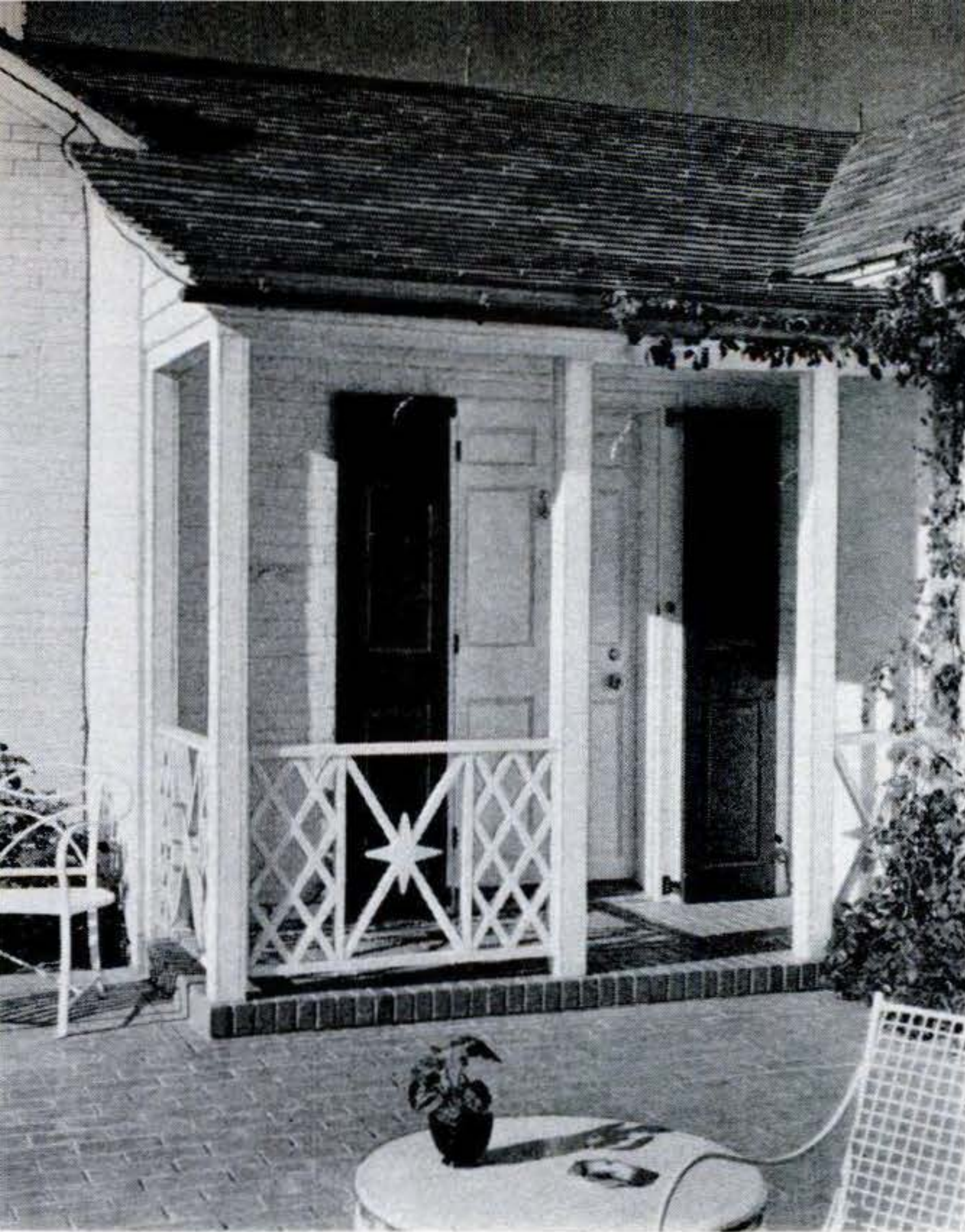
How can you do this? In several ways. You can replace the door with one of more

appropriate styling. You can install a complete packaged entranceway. You can re-style the door with molding. You can add a sheltering roof above the door, or shutters and decorative lights on either side of it. You can even add a porch.

In all the designs shown here, only standard materials are used. You can buy or

A house with good proportions like this can still look unfinished. By continuing the garage roof across the front door and cutting a door into the side of the garage, you have a porch and two sheltered doorways. The house no longer looks bare and the porch will take a chair or two. Use framing as for the porch at top of page. For a permanent structure, make the floor of masonry. This will provide a base for the porch columns. For a wood floor, provide ventilation and footings for the columns.





What a porch can do: The drawing at far left indicates how bare the house looked before the attractive porch was added. The plan above suggests what a simple construction job it all was. The porch roof, naturally, is made of the same materials as the house roof; gutter and leader will match, too. Shutters frame the door. For a porch like this, it's a good idea to install a flush ceiling light that can be angled to shine on the front door. (Design: National Homes, Photo: Hedrich Blessing.)

Continued

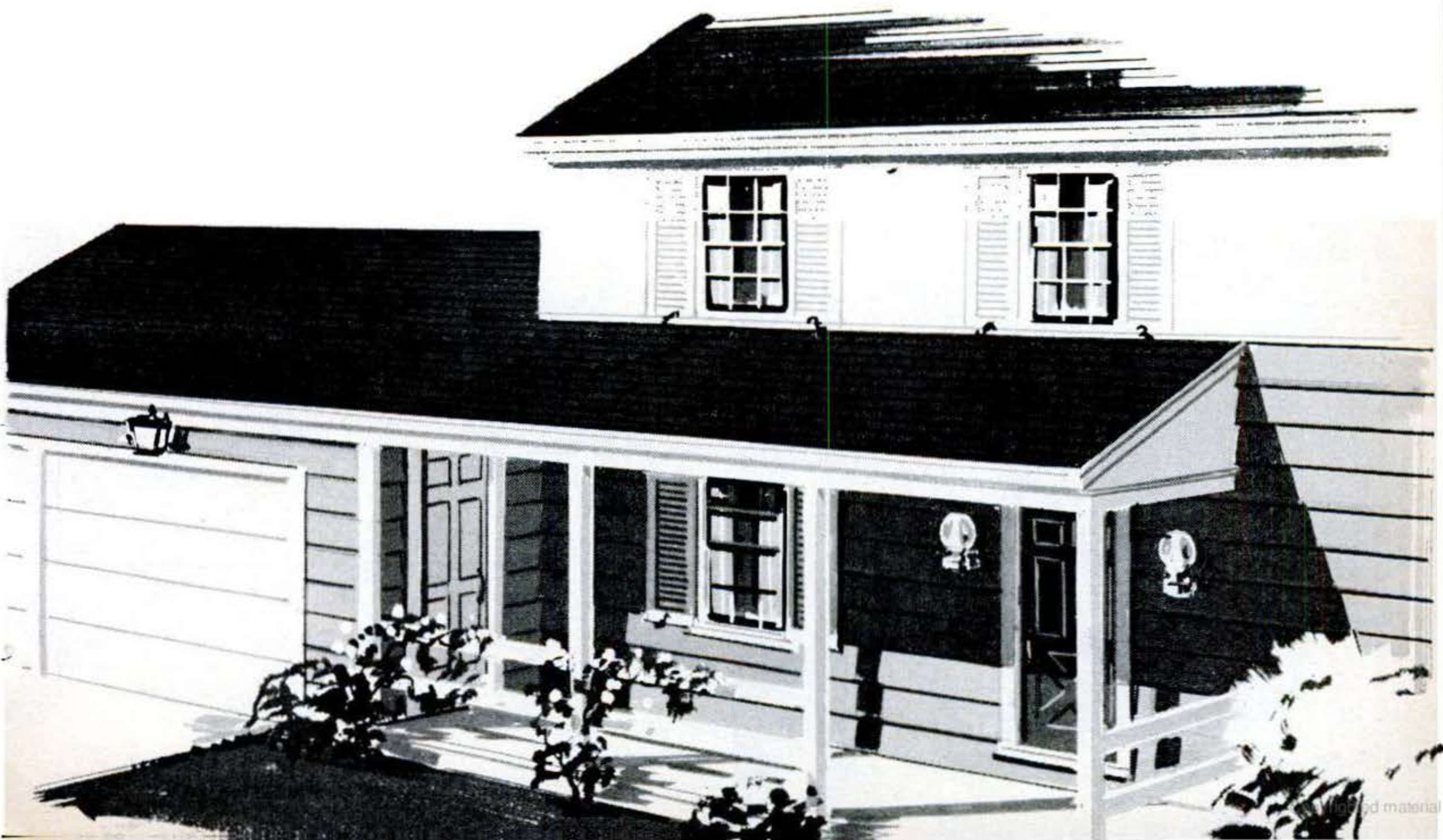
order all of these from your local lumberyard. There you will also find information on Colonial-style packaged entranceways that you can install yourself.

To meet the cost, you can probably borrow from your bank, or perhaps you will want to extend your mortgage.

Before you do any work, ask your local

building department what kind of permit, if any, you need.

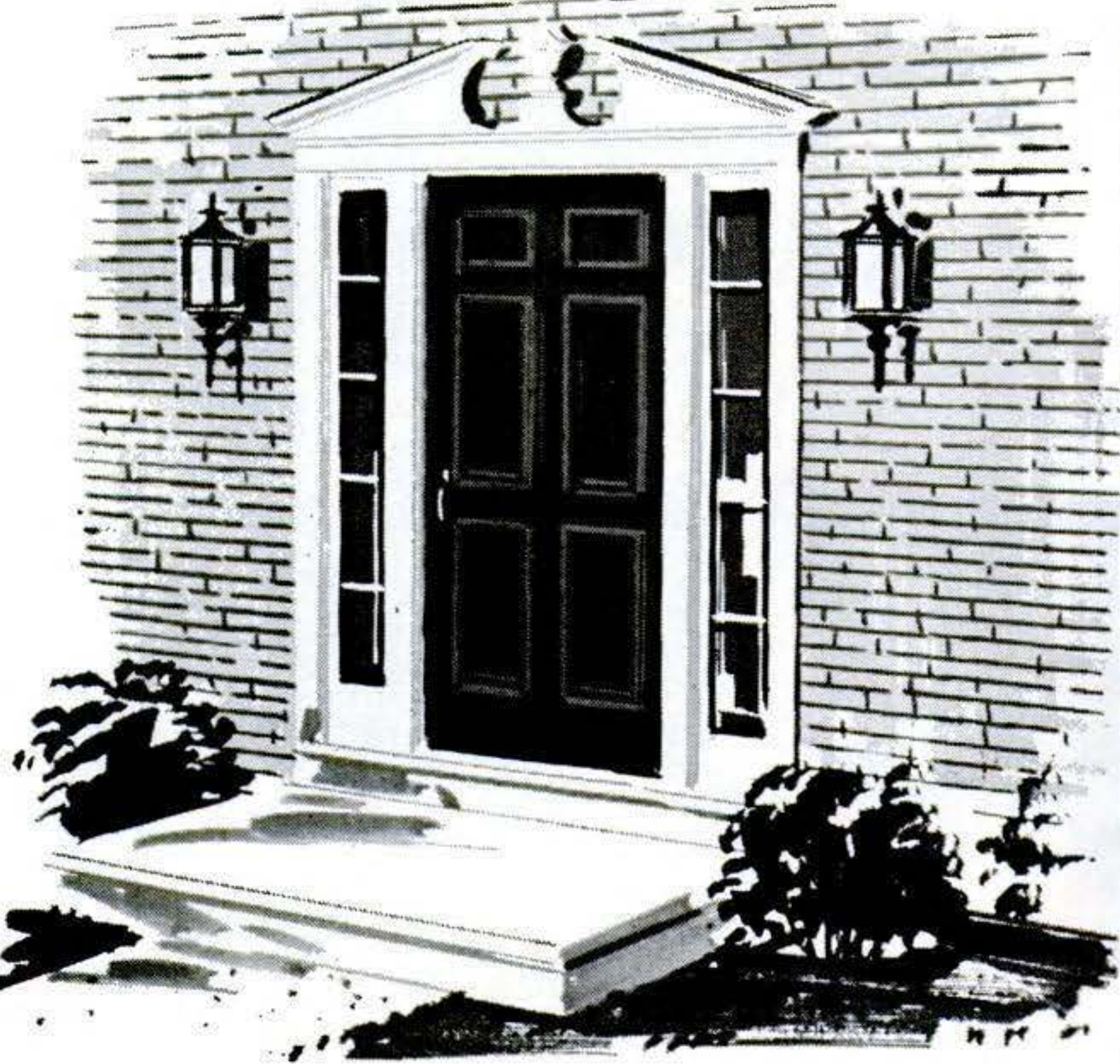
Any front-door facelifting may well involve planting and new walks. If you put in shrubs, don't buy what may grow up to hide the house. Your local nurseryman will know what's appropriate. Better still, consult a landscape architect.



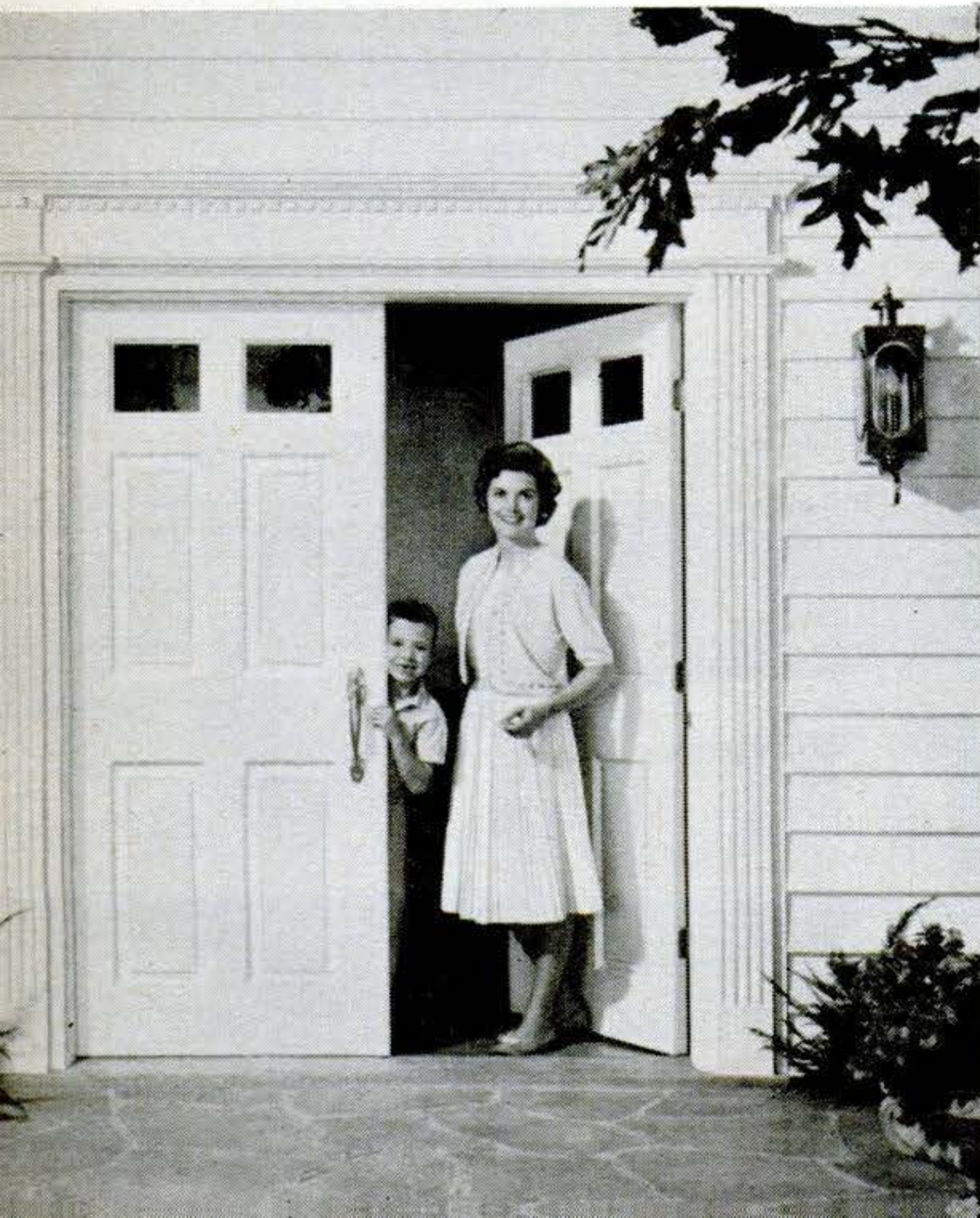
Perhaps you'll want to install a new front door or dress up the



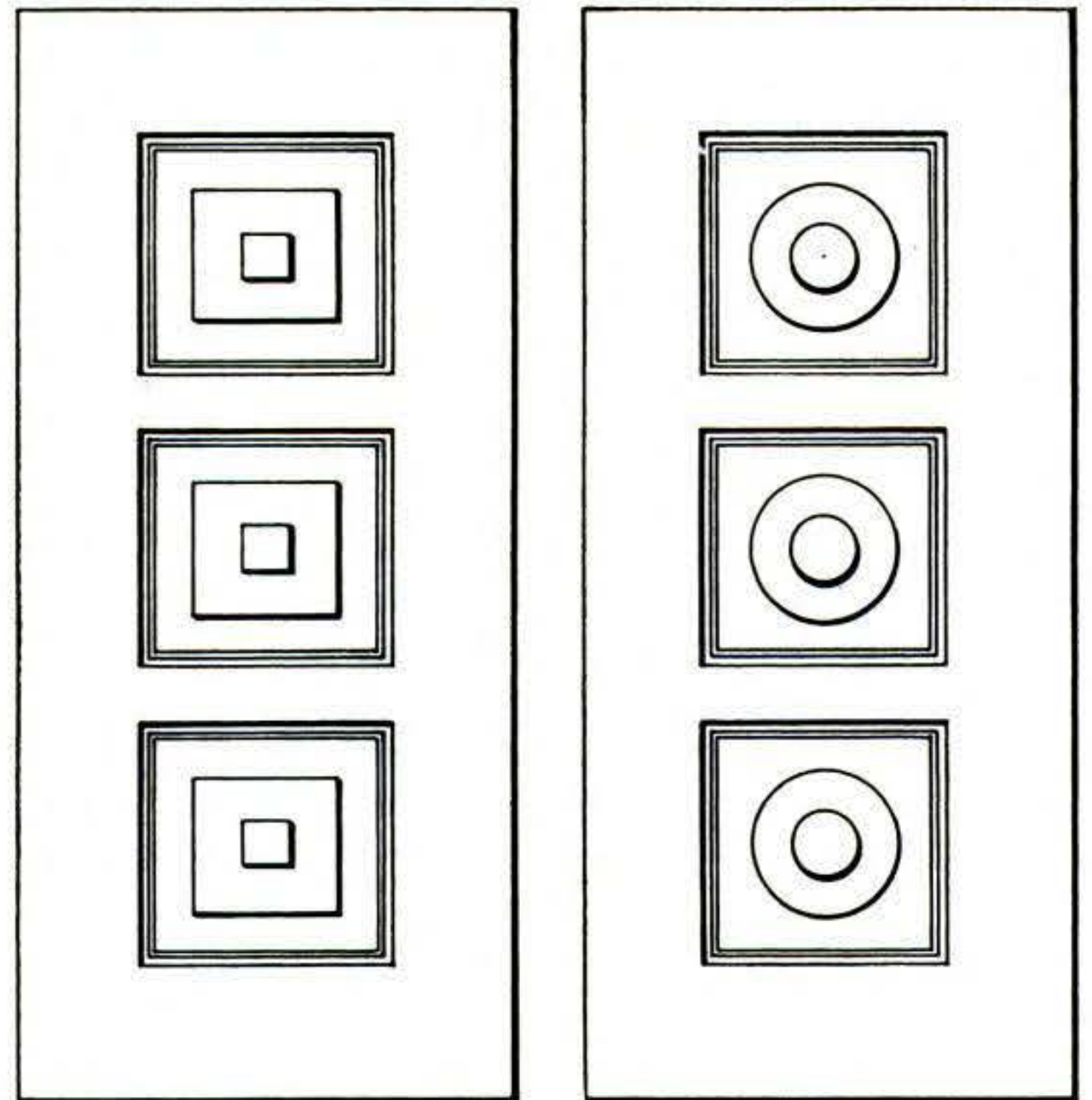
A standard design, Colonial houses like this are seen in developments all over the U.S. It will never get out of style, and will always command a good resale price. Yet it had no strong focal point. The entrance just missed being good (drawing at left, below). All it needed was a pediment above the door, and a pair of lamps of Colonial design on either side of a standard six-panel door.



Double doors of the kind used in many of the country's earlier houses are found in more and more of today's houses. If you have adequate hall space inside, consider widening your own doorway.



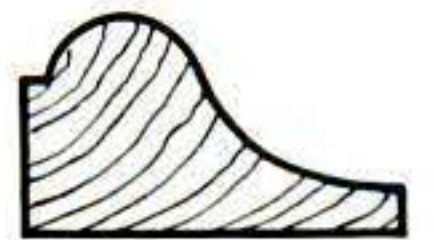
Using standard moldings, you



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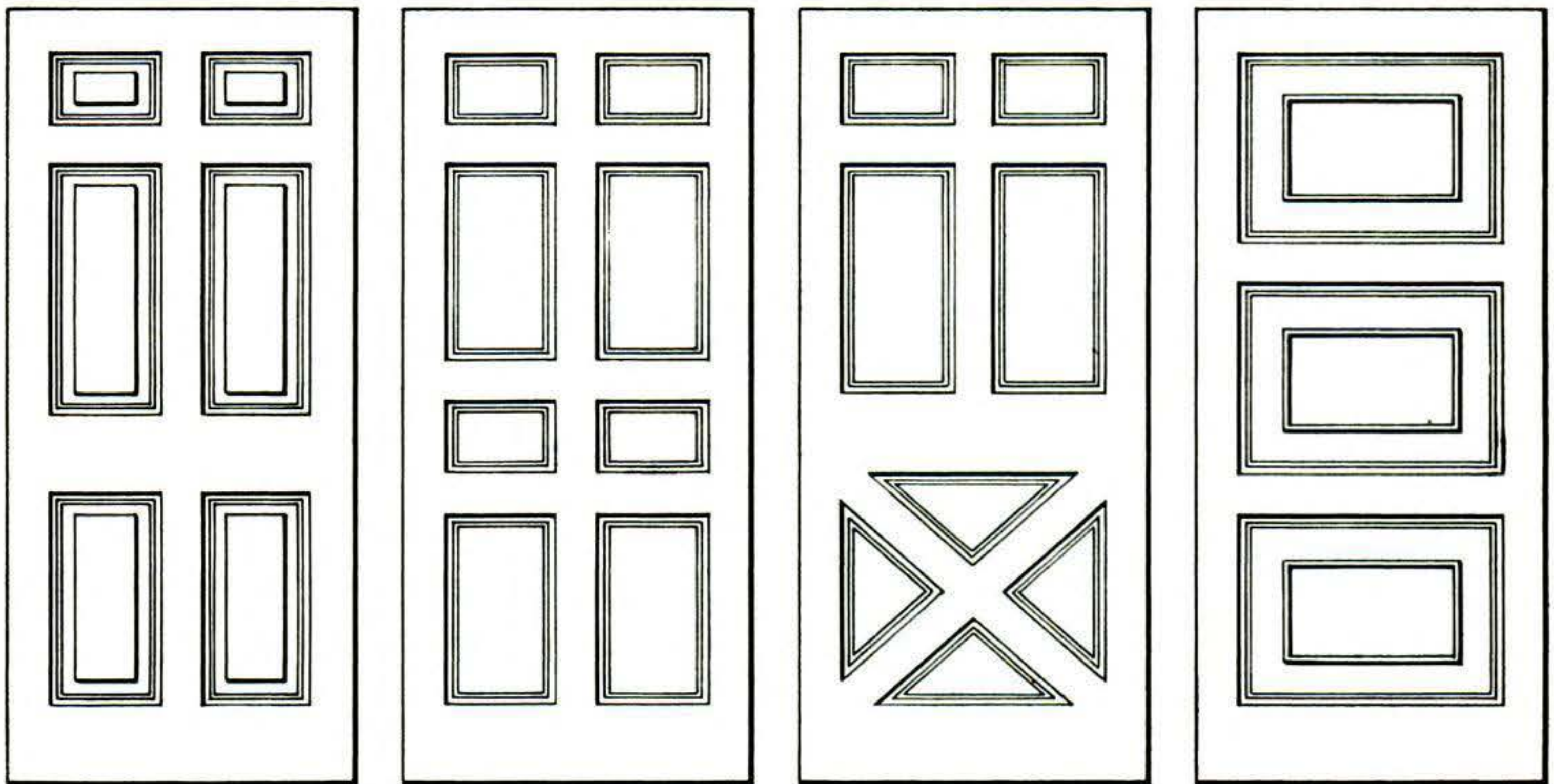
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old one with molding to improve the looks of your home

Windows and doors are improved enormously by adding shutters. By putting a ready-to-install arched lintel over the door head and molding on the slab door (drawing below) you not only create traditional character but make your doorway more of a focal point. Add side lamps that are big enough in scale and hark back to the old days. Also change the hardware to a thumb latch and add a knocker.



can create many attractive designs on ordinary slab doors



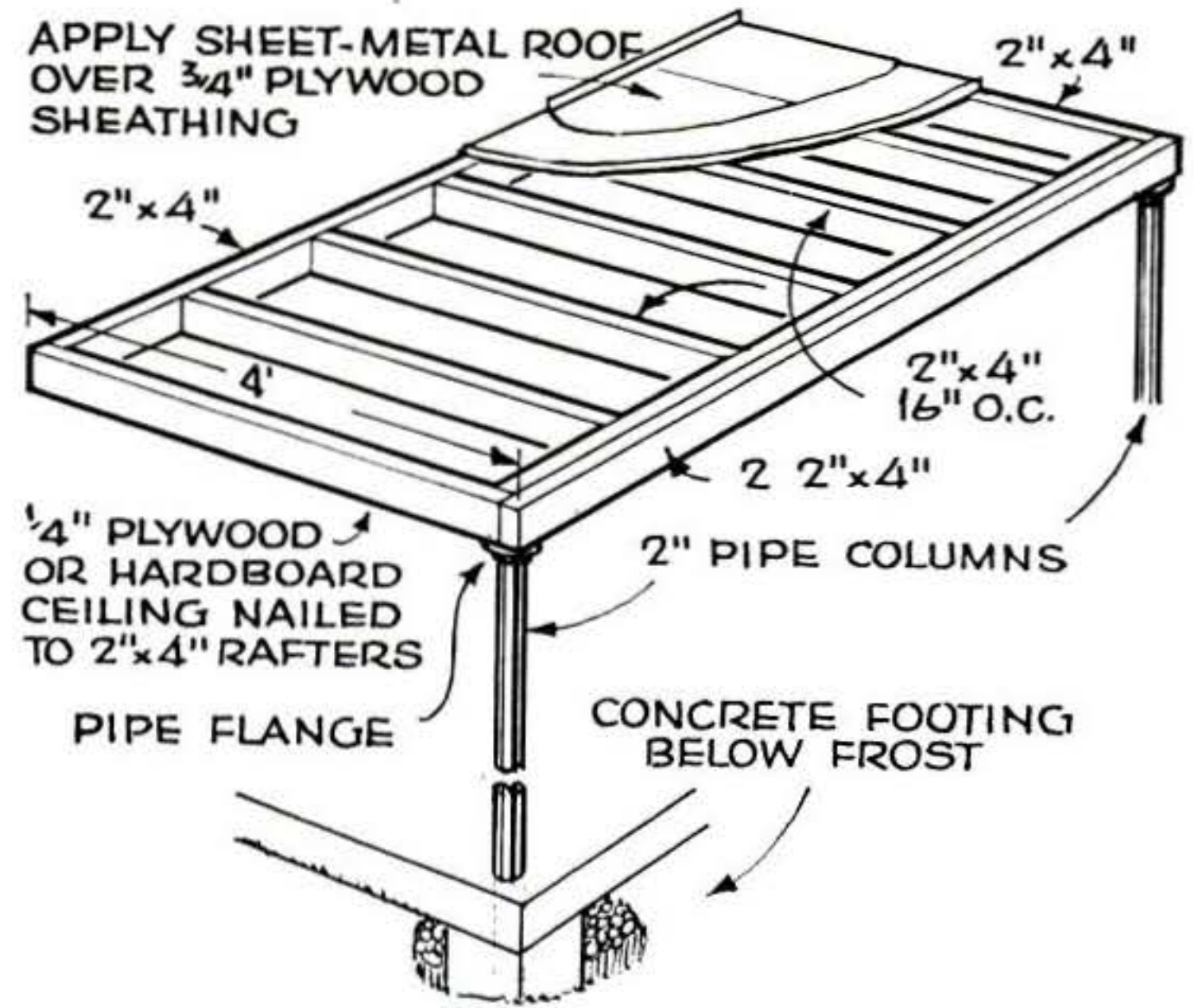
Six standard paneled doors are sketched above and to the left. You can buy them all—or you can make them by attaching moldings like those shown in profile at left to slab doors. Apply with brads and wa-

terproof glue. If yours is a hollow-core door, use glue only. The center rectangle in a traditional door panel is raised. To get that effect, glue rectangles of hardboard within the moldings. *Continued*

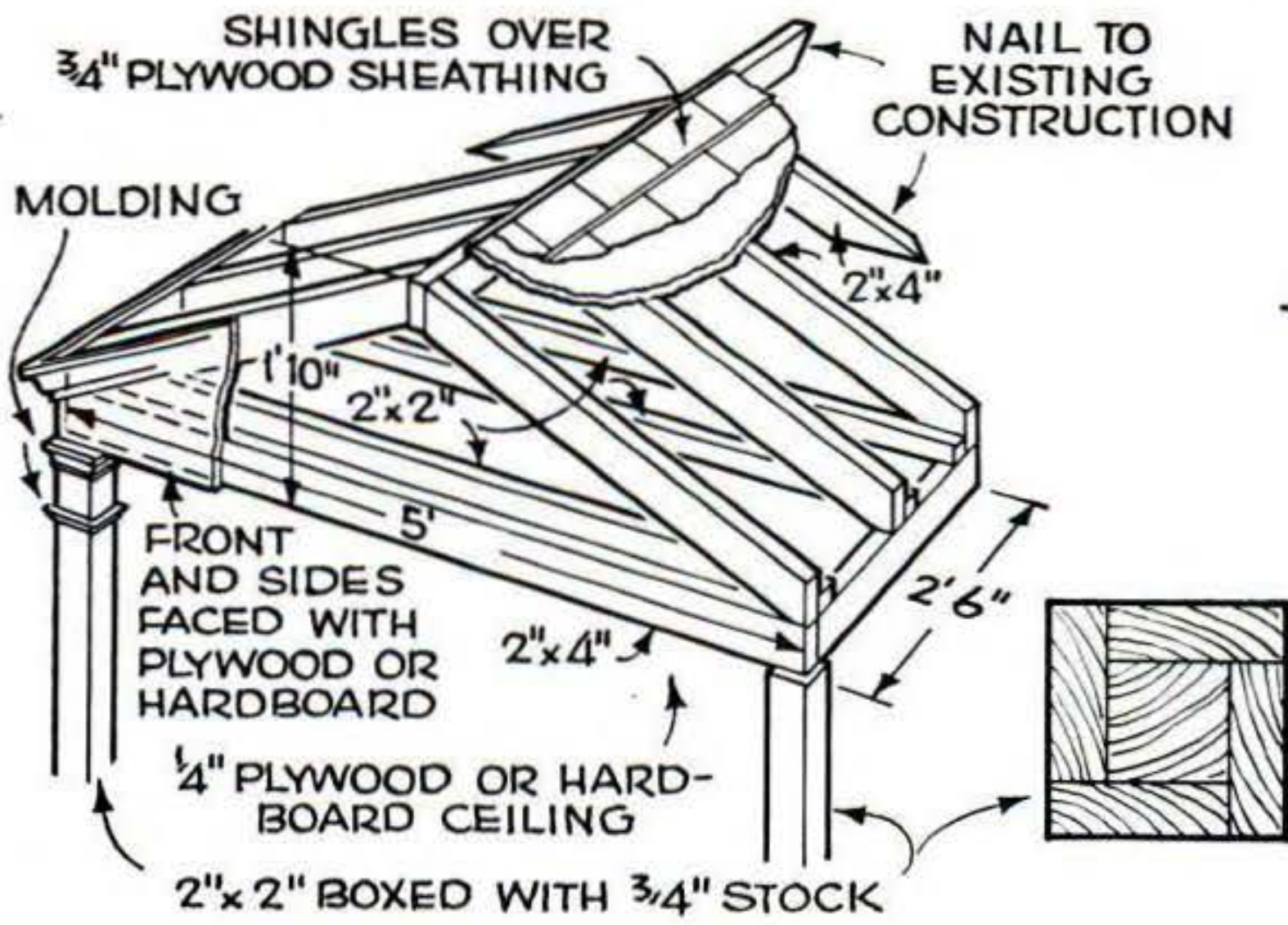
Look at the magic you can work at little cost by adding a projecting



If your house is of contemporary design, you can very properly decorate and shelter the front door with a flat-roofed porch. You can put this up yourself, as shown in the drawing at right. Columns of 2" pipe are strong enough to support such a roof. Use a flange at the top of each column to fasten it to the underside of the roof. A masonry-slab porch is better than a wood floor. If you do use wood, anchor the pipe supports in concrete. Replace a plain door with a paneled one.

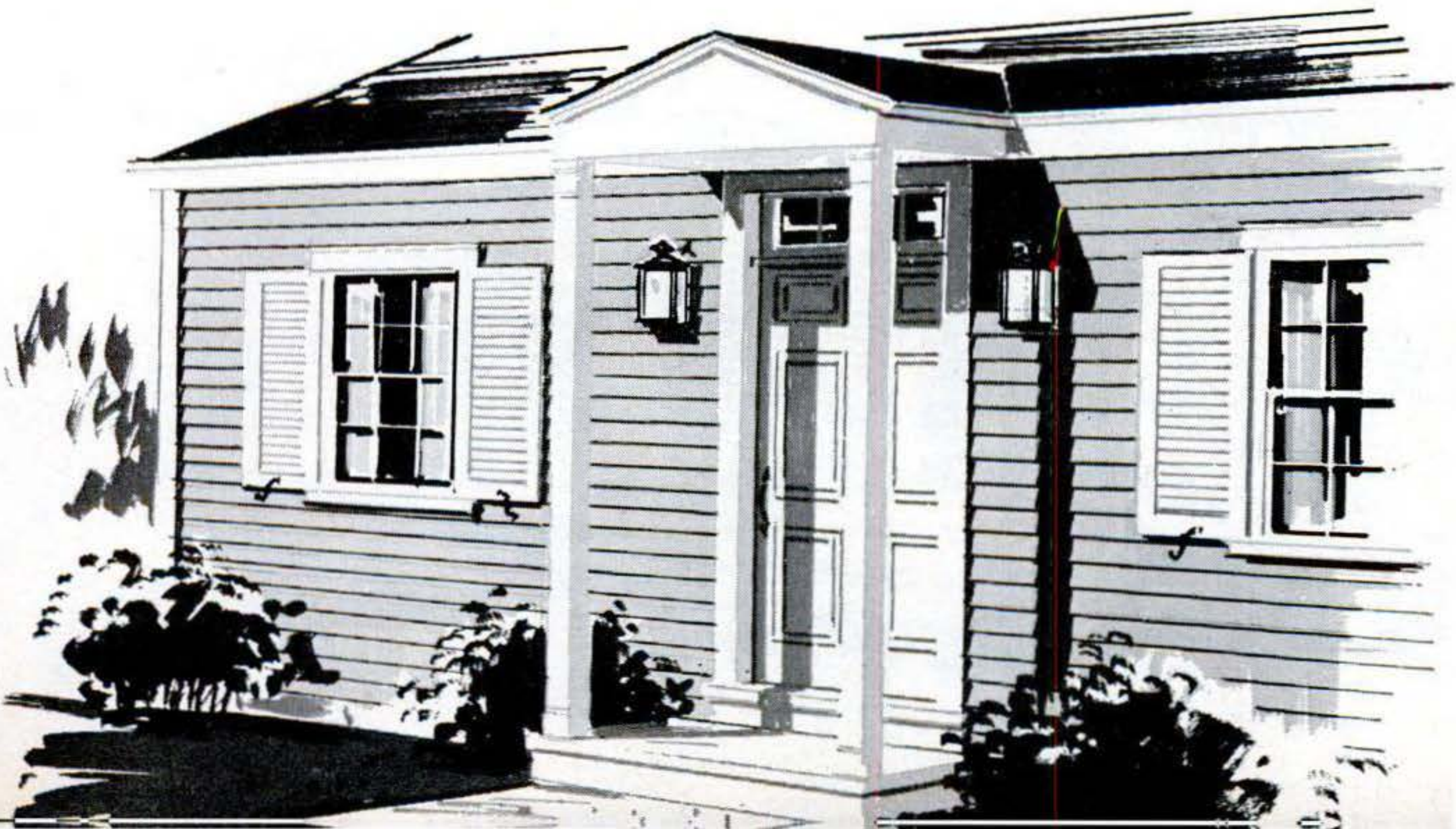
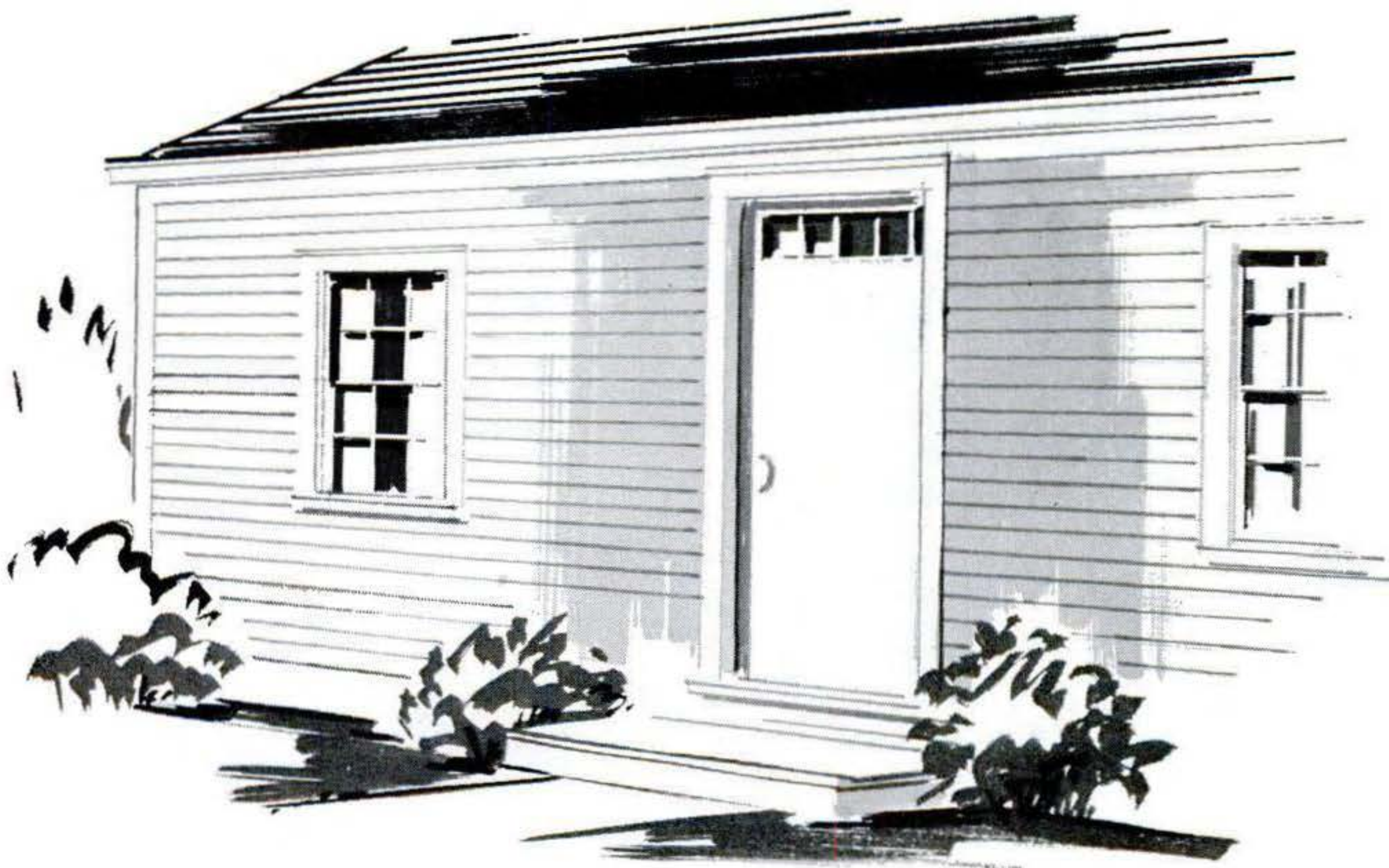


roof over your entrance to break up a long, uninteresting line



What is loosely called a Cape Cod house is well represented in real-estate developments. A little work will make such a house a more nearly authentic reproduction of the original. For this, we suggest a gable-roofed porch, shutters at the windows, new side lamps beside the new paneled door. (Or you can apply moldings to an original slab door to convert it to a Colonial six-paneled door.) And if you can change windows from one to six lights per sash, you'll certainly be pleased with the result.

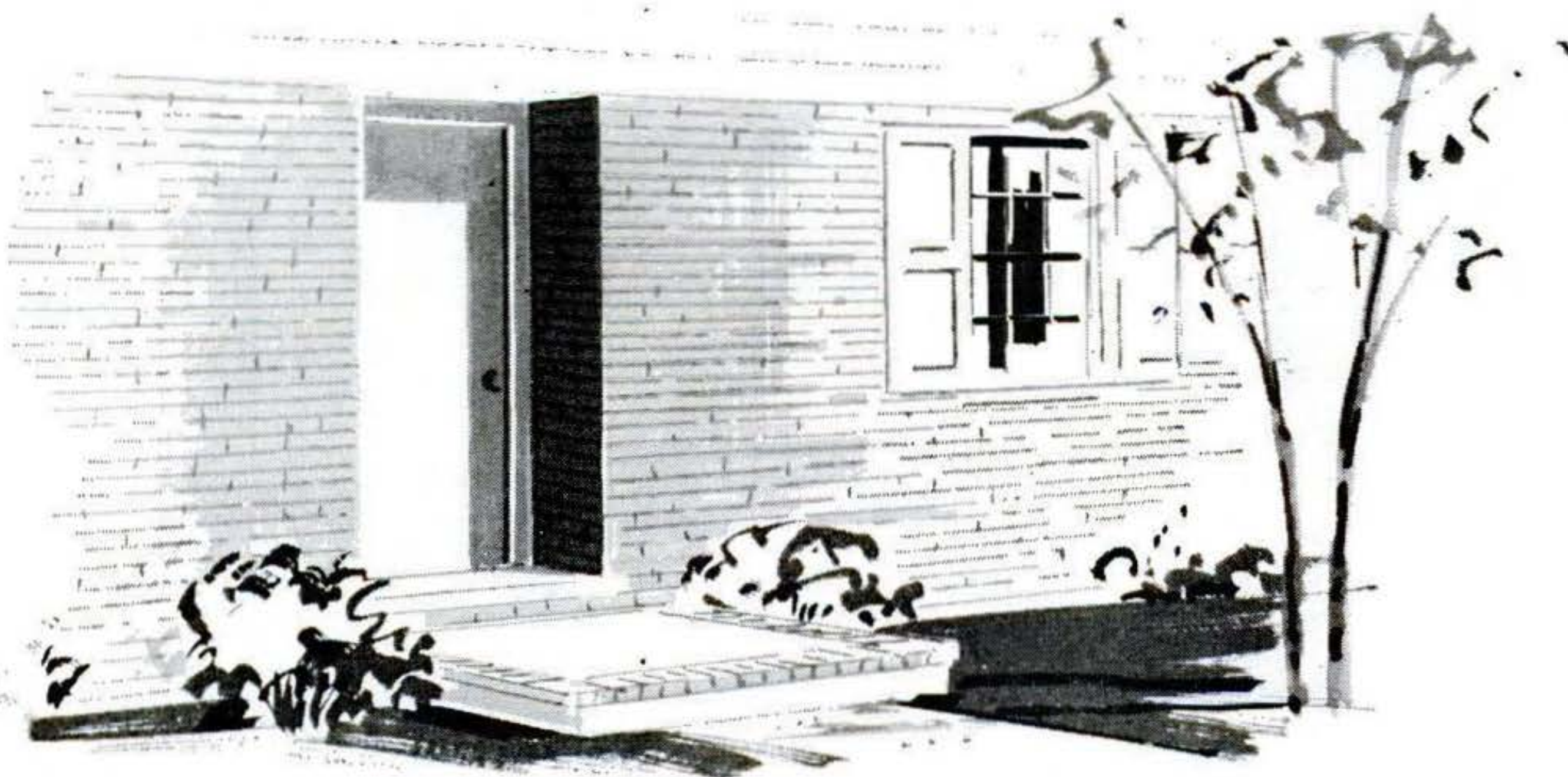
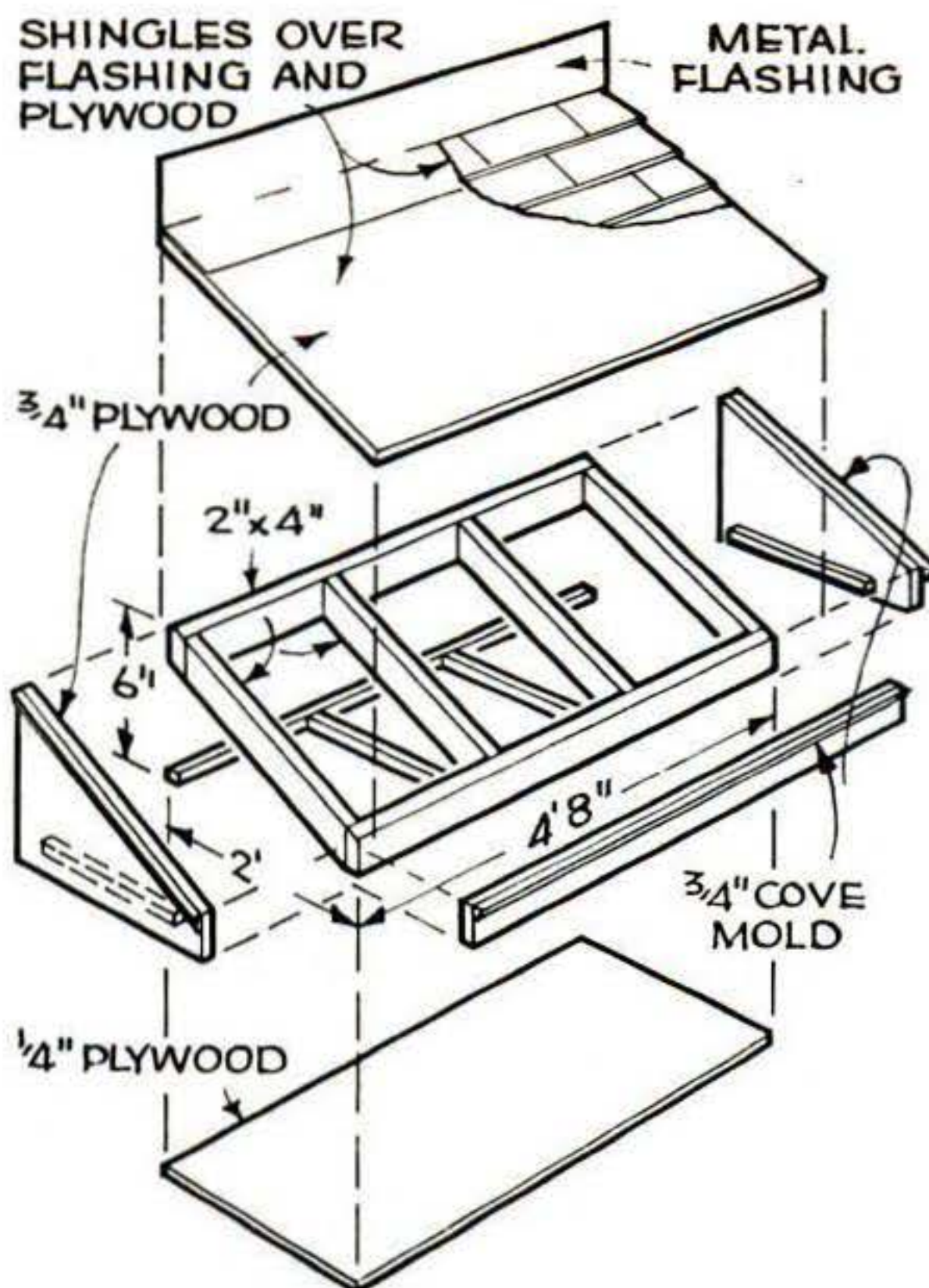
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Focus attention on the door with a simple canopy roof



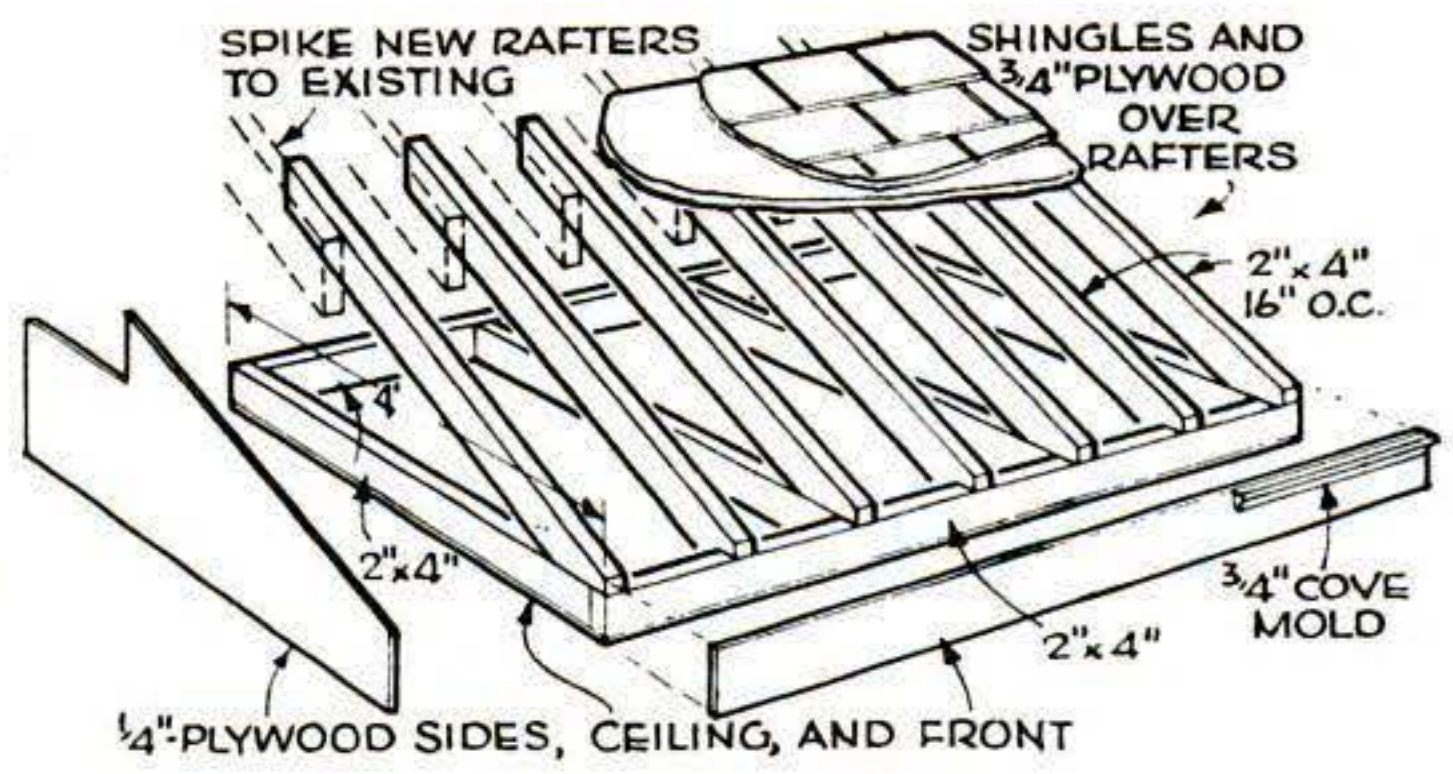
Georgian or Regency styling is suggested by this house. The recessed door provides some protection from the weather. But alone, it is plain and uninteresting. As you can see, even a simple overhead shelter gives more cover and—most important—lends interest to the doorway. Fluted pilasters 4" or 5" wide on either side give a touch of design distinction. Other changes include a new paneled door and carefully selected side lamps. The roof is simple, hardly more than one day's work.



One-story houses require special doorway treatment



Ranch-style homes are improved by extending the roof to overhang the front door. Side lights and wrought-iron side railings offer still more design improvement to the entry and thus to the house as a whole. The pitch and covering of the shelter must be the same as that of the house itself. For the best appearance, size the overhang so that each side comes even with the three edges of the stoop.





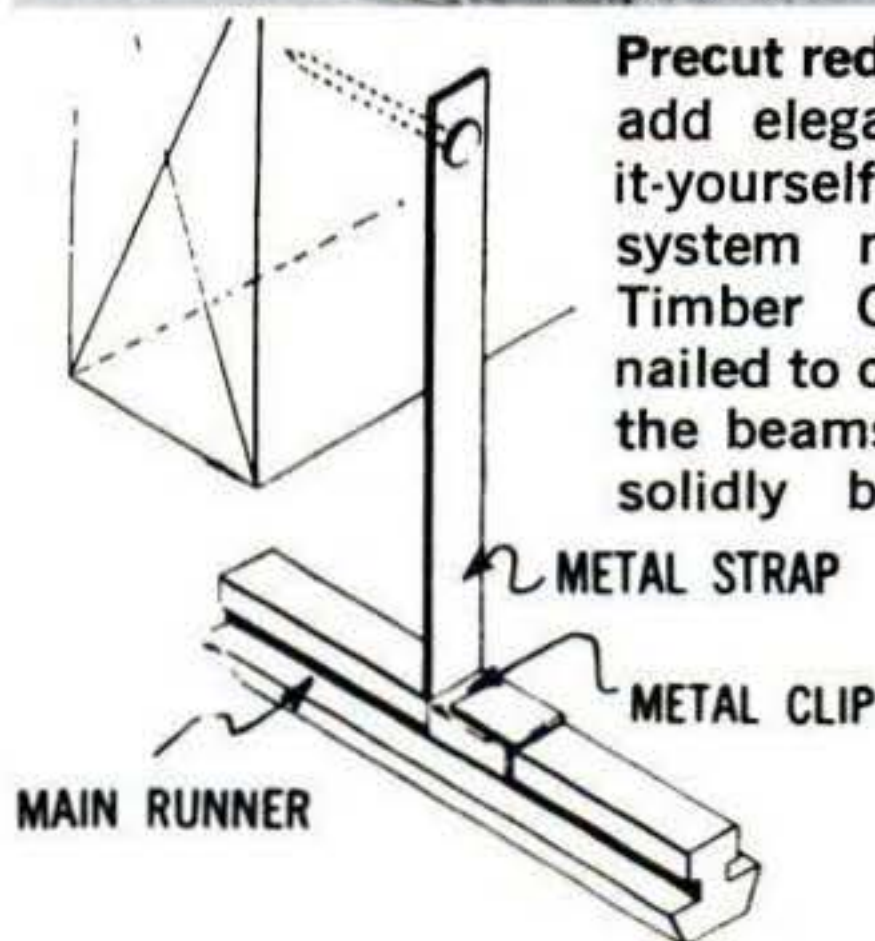
Celotex Snap-Fast vinyl-surfaced metal beams with walnut wood-grain finish go up on any ceiling. Metal clips support the beams. The clips lock onto suspended-ceiling grid members with a twist. Metal splicer (right) joins sections.

Beams Make News in Suspended Ceilings

Now you can have the charm of wood-beam ceilings in construction that goes up quick and easy. Here are two suspended-ceiling systems that let you do it yourself. It's the fast way to remodel your attic, basement, or garage. You don't need special tools, and everything needed comes in kits. You just hang the grid on straps nailed to the ceiling joists and drop the ceiling panels in place.

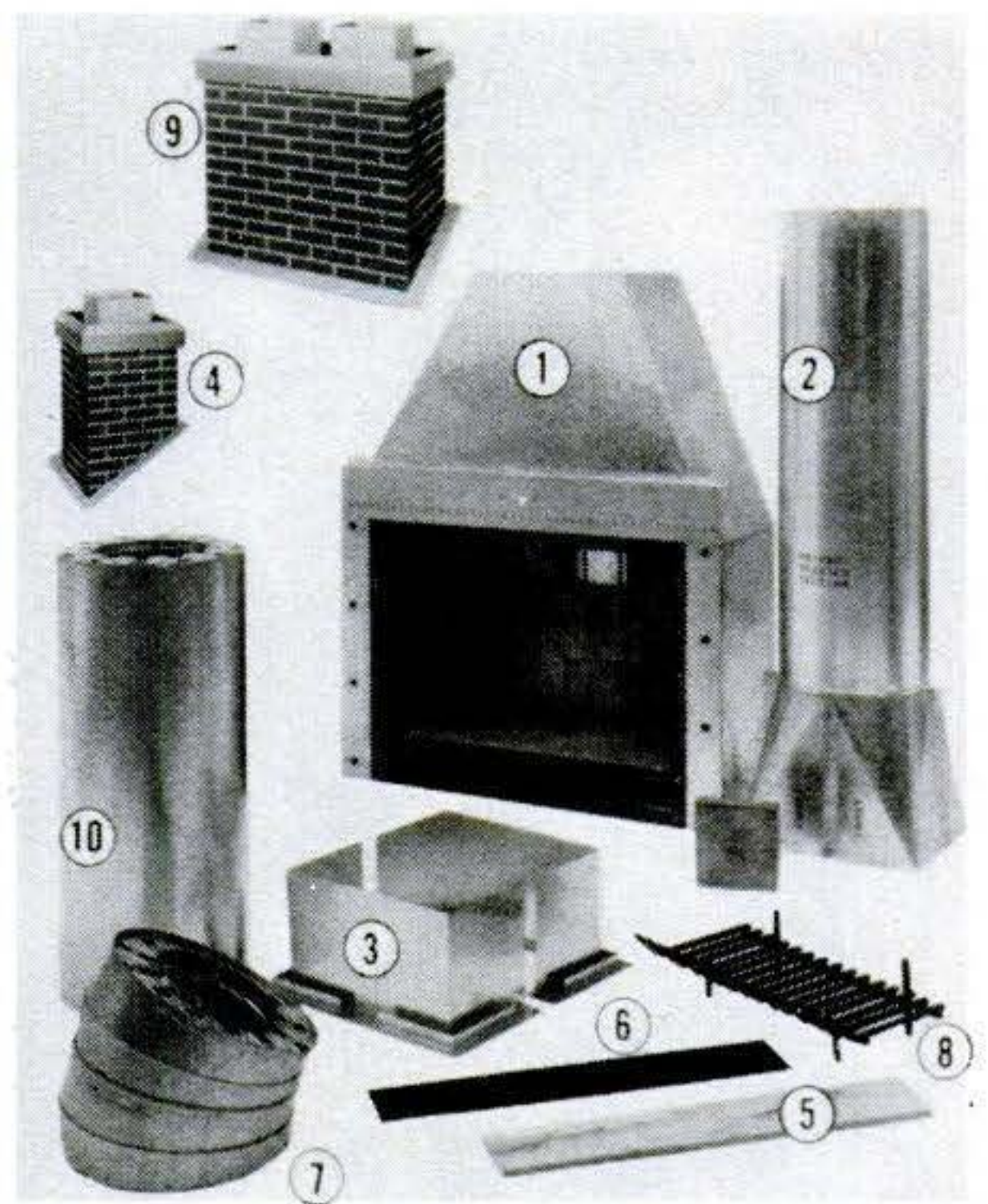
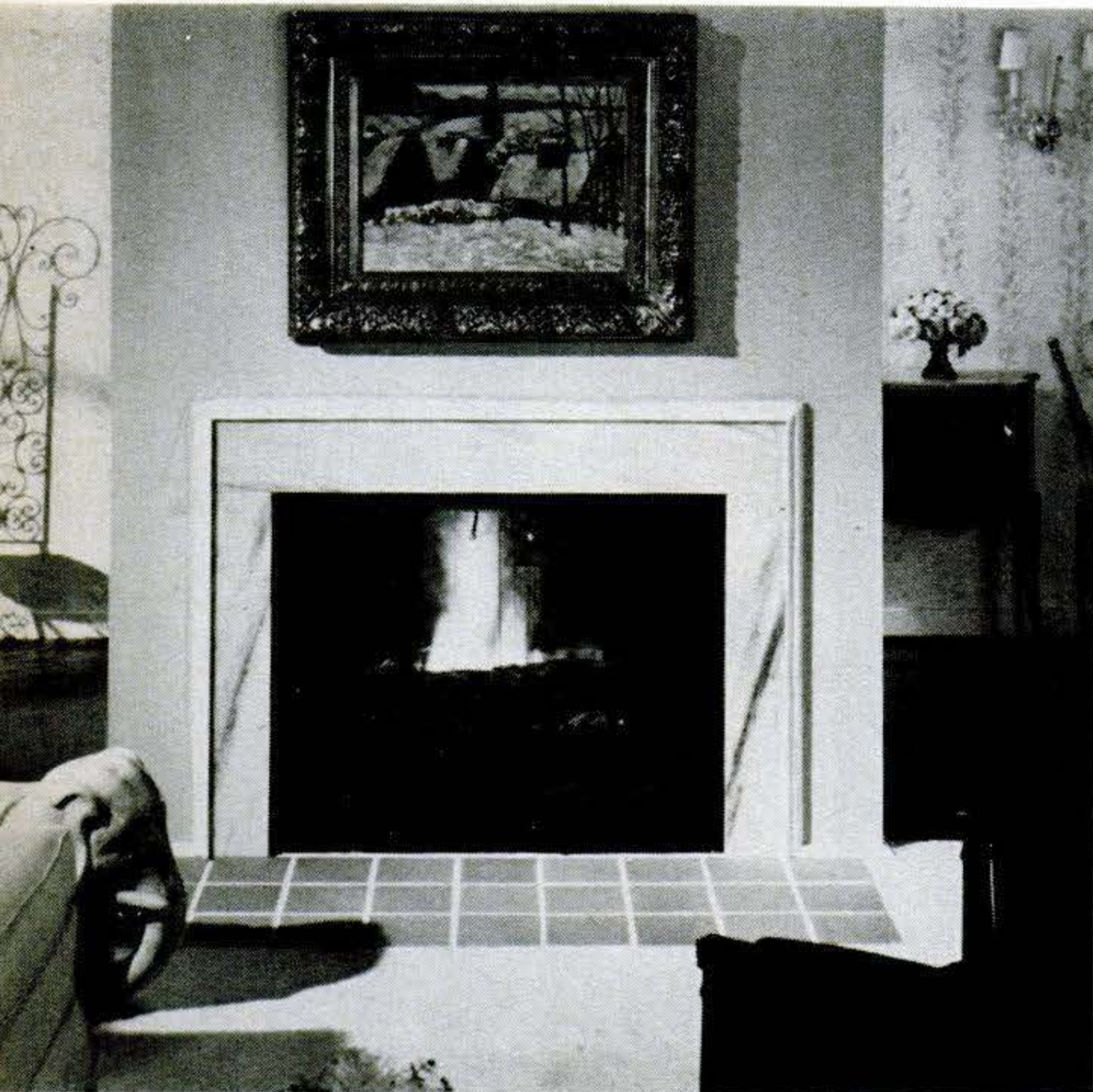
The new Snap-Fast ceiling beams (shown above), made by Celotex Corp., Tampa, Fla. 33602, are metal covered with walnut-grained vinyl. They snap into place over metal clips. The clips lock onto the suspended-ceiling grid with a twist. With other types of ceiling construction, you fasten the beam clips with screws driven through the ceiling material into the joists, or with anchor bolts.

The ceiling system at right, offered by Simpson Timber Co., Seattle, Wash. 98101, uses 10'-long redwood main runners. A special metal clip joins the ends of the runners for longer spans. It goes up with little cutting and fitting to form 2'-by-4' modules.



Precut redwood ceiling beams add elegance to a new do-it-yourself suspended-ceiling system made by Simpson Timber Co. Hanger straps nailed to ceiling joists support the beams. Ceiling boards fit solidly between the grids.

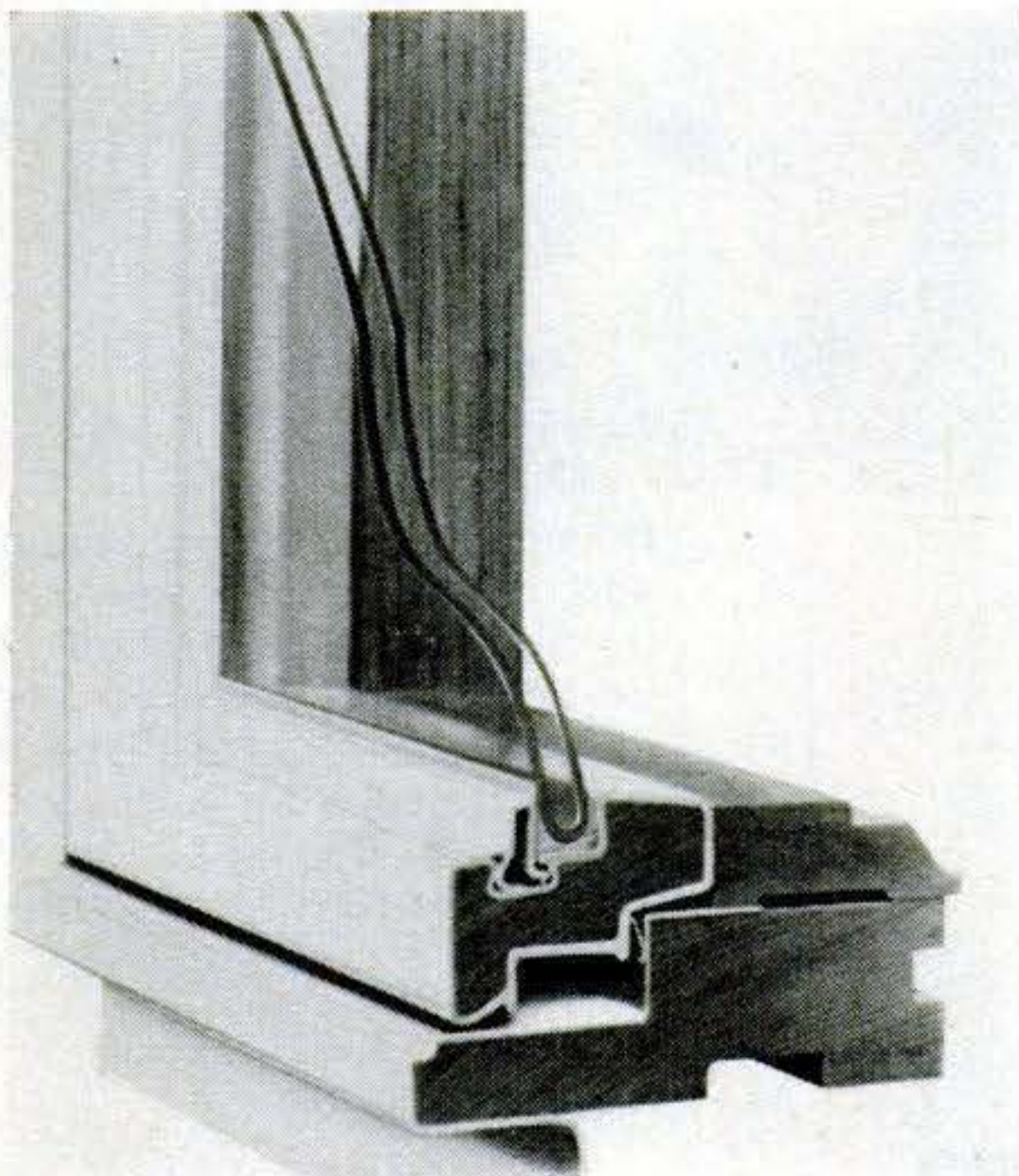
NEW PRODUCTS



Parts of the new fireplace shown above are: main unit (1), bottom of chimney (2), firetop spacer (3), chimney housing (4), fireplace facings (5 and 6), elbow (7), grate (8), double chimney (9), and extra chimney sections (10).

Do-It-Yourself Fireplace

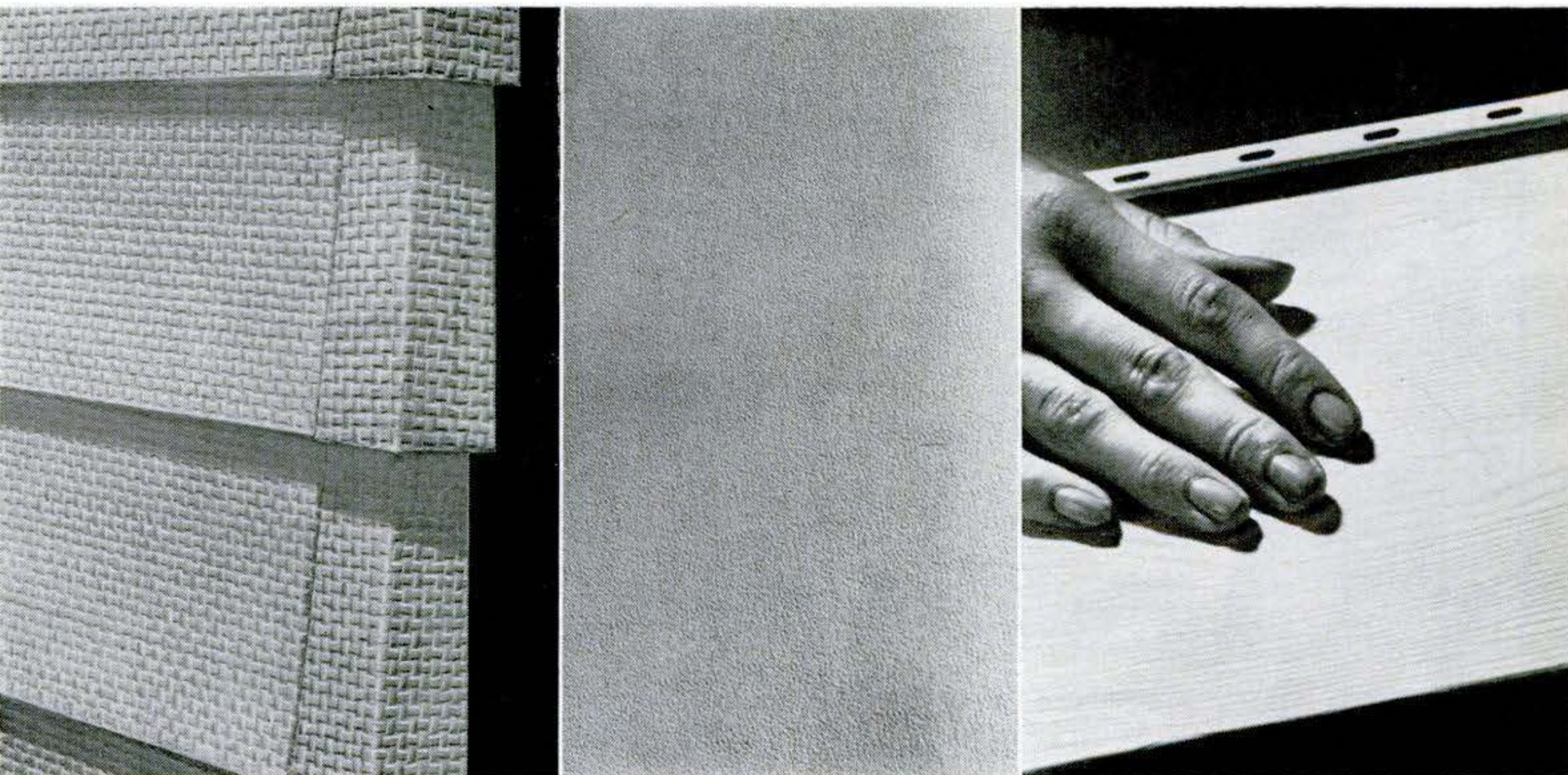
You can have a real wood-burning fireplace just about anywhere in your home. And, best of all, the cost is only a third of what you'd pay for a conventional masonry structure. It's the brand-new Heatilator Mark 123 fireplace just announced by Vega Industries, Syracuse, N. Y. The Underwriters Lab has approved it for zero clearance to combustible surfaces, mostly because of the insulation used. It goes right on the floor, no foundations are required, and it takes only hours to install.



Vinyl-Clad Windows

These new windows and doors look like wood painted white. But they take about as little upkeep as aluminum, and give you the high insulation qualities of wood. They're made by extruding rigid vinyl directly over preservative-treated wood millwork. The plastic covers the sash and the exterior surfaces of the frames, and both surfaces of the door panels and frames. The corners are mitered and welded. Called Perma-Shield, they're made by Andersen Corp., Bayport, Minn. The sash come in casement, awning, and fixed-window styles in 21 sizes; the gliding doors in five sizes. All the hardware and the insulating glass come with the units as standard.

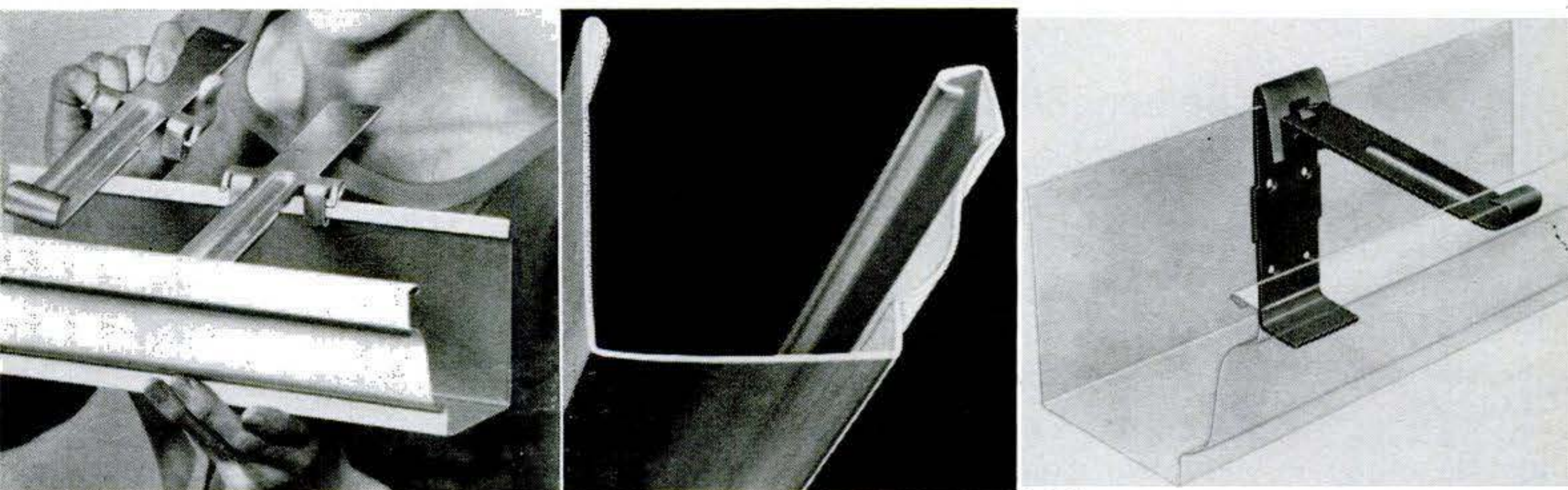
FOR IMPROVING YOUR HOME



Aluminum Siding

Textured surfaces are the news in pre-finished aluminum siding. These three come in six or more long-wearing colors. Innovation 8, at left, is made by U.S. Aluminum (Franklin Park, Ill.). Weyerhaeuser's Panel 15, center, consists of an aluminum face and back bonded to 5/16" exterior plywood.

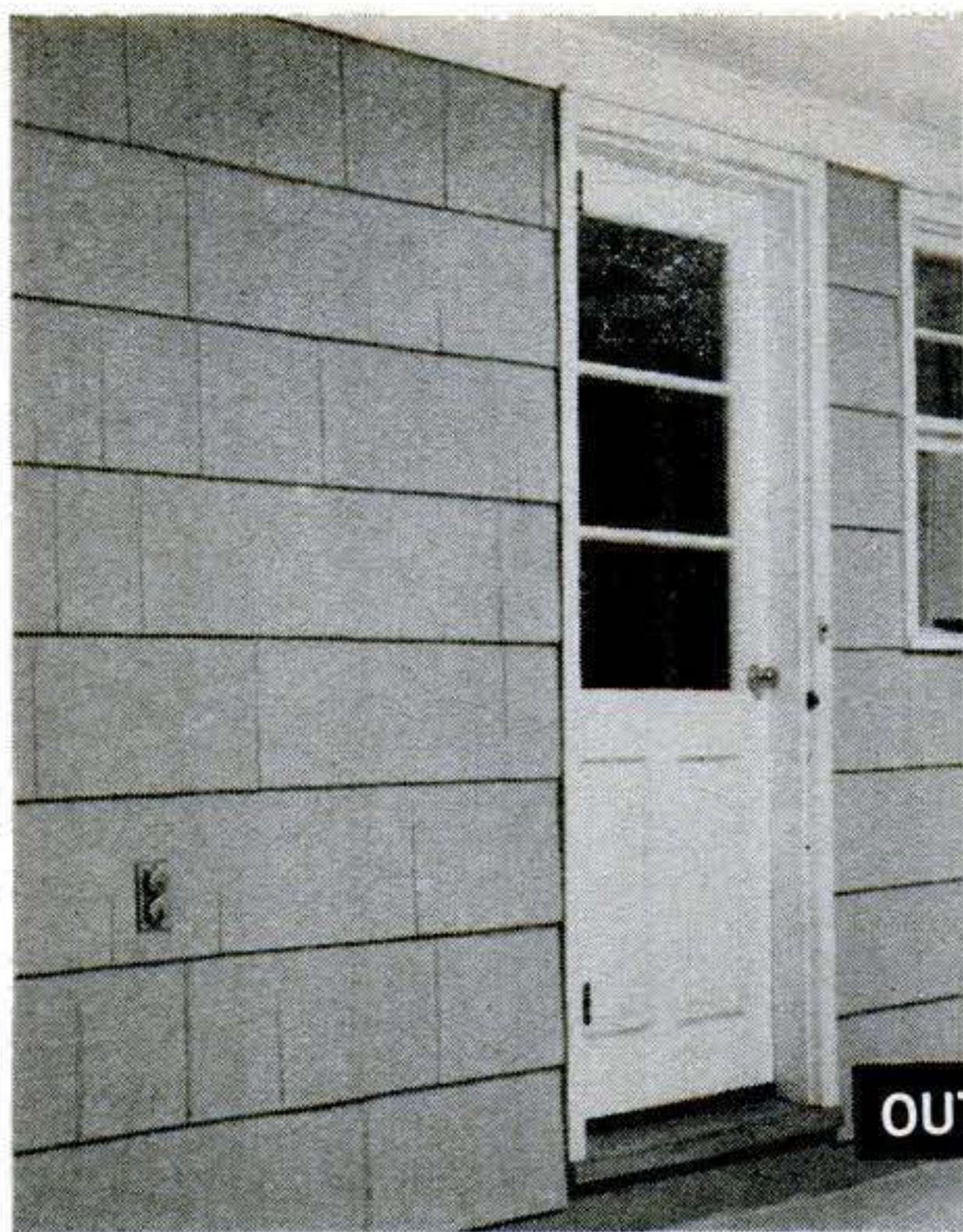
Made in panels as large as 4' by 10', it provides a finished exterior (the pebbled surface shown), structural sheathing, and reflective insulation all in one. Kaiser Aluminum developed it; Weyerhaeuser will distribute it. The new Alcoa siding at right has a wood-grain texture. It's 8" wide.



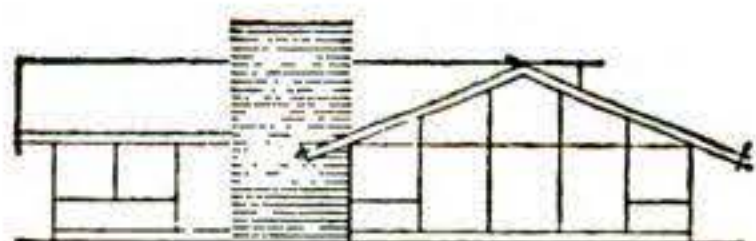
Long-Life Gutters

Special aluminum hangers make it easy to install aluminum gutters. At left, above, are two of Alcoa's hangers, which you nail to the rafters. They're available for Alcoa's 4" box-type and 5" ogee gutters. The hidden hanger at far right is for new 5" gut-

ters from U.S. Aluminum. You nail it to fascia board. At the center, you see Monsanto's new 5" rigid-vinyl gutter, which will supplement the 4" vinyl gutters that came out in 1964. The white vinyl never needs paint. Metal brackets support the gutters.



Before and after: Typical door, above, leading from the kitchen to a screened porch was not especially inviting. To the left of it, there was plenty of space for locating a new double-width glass door. Outlet beside door was not moved.



IMPROVE YOUR HOME



What You Gain from

The benefits are many, the job is easy, and you can practically always find a spot to install them

By JACKSON HAND

Almost anyplace where there's an ordinary door, you can put in a sliding glass door—and the benefits are numerous:

- You get a whole picture-windowful of light, since both the door and the area it slides across are glass. A good view is that much bigger, too.

- You gain useful floor area, since you don't have to maintain a clear space for a door to swing in.

- You move through the door more smoothly because you never have to step

back, after pulling on the knob, to get out of the way.

- There's an attractive look to sliding doors in either traditional or modern rooms, and very often changing over from a regular hinged door seems to make the whole house more livable.

How to plan for a sliding door. All you need is a blank wall *beside* an existing door and equal in size to the door—or a scratch larger. If the wall is twice the size of the door, you can have a three-section area of glass; more if the area is wider. Three-unit



Before and after: At first, the kitchen cabinets to the right of the door seemed to be a serious problem. But it was found possible to move them to another location in the kitchen, leaving sufficient space to cut out the wall for the new doors. The job of installing the unit was completed in a weekend, except for some clean-up. Luckily, no wiring had to be shifted.

SLIDING GLASS DOORS

doors usually have only one section that slides. Four units may have the two center sections movable.

Since you'll cut out that entire wall area, check it for wires and plumbing, heating or ventilating runs. These won't necessarily rule out conversion, but they present problems you are wise to take into account from the beginning.

When you've decided how much of an opening you want to fill with sliding glass doors and glass panels, the next step is your building-supply dealer.

How the units come. Sliding glass doors are put up in ready-to-install packages, usually calling for no more work than putting together a frame, which may come knocked down. Although you can order custom sizes, standard units will take care of most situations. The standard sizes are shown in the accompanying table; they are

approximate—slight variations are found among manufacturers, and some differences between metal and wood.

Most building-supply dealers do not carry a wide range of sliding doors in stock, but they can usually get them quickly from warehouses in major cities. You simply tell the dealer the width you want and the direction in which the door should slide.

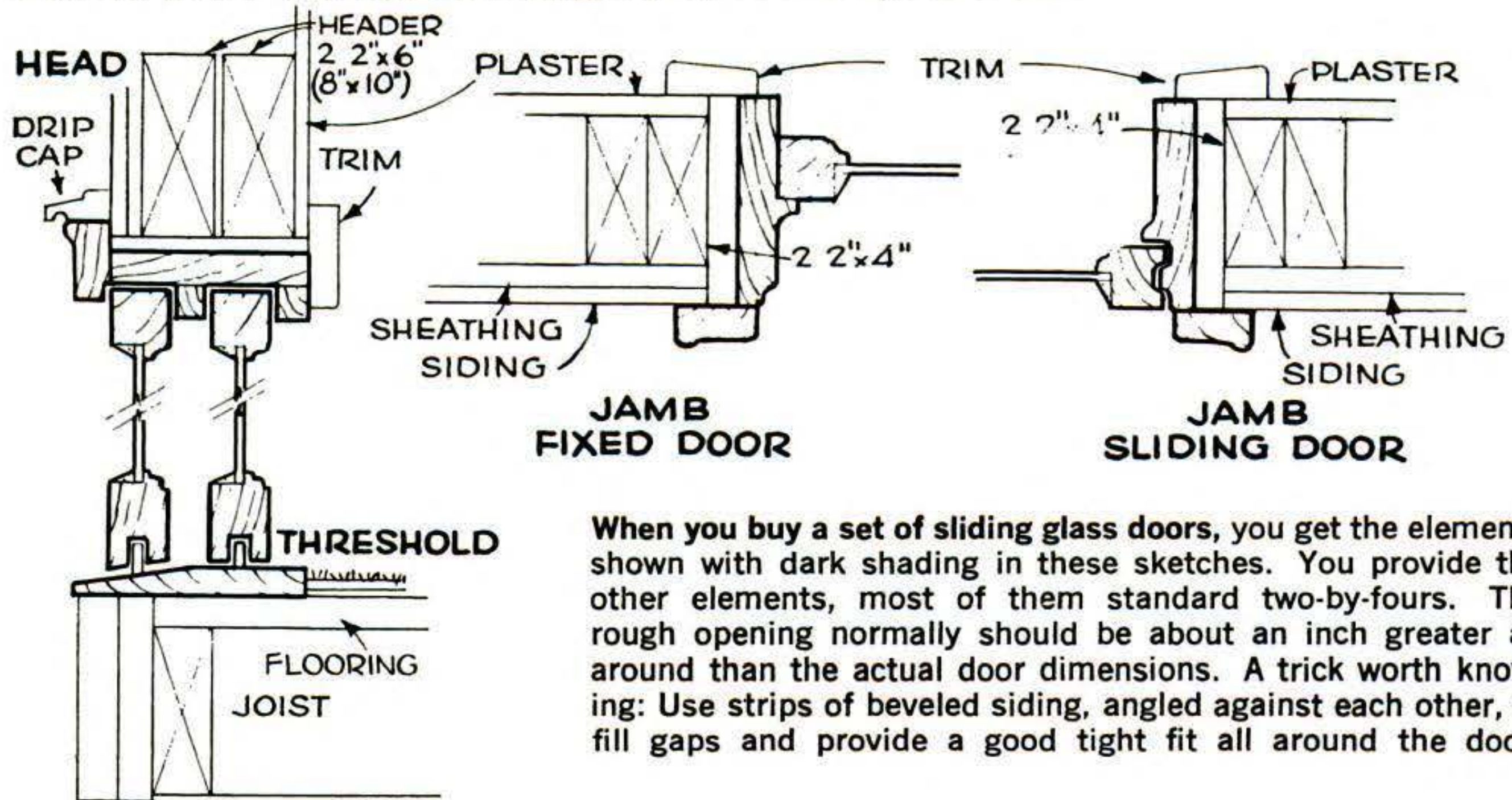
Some manufacturers offer glazing options. You can have plain glass, tempered glass, or double-glazing with plain or tempered glass. Cost variations for a two-section unit look about like this:

Plain glass	\$ 95
Plain double-glazed	160
Tempered glass	130
Tempered double-glazed	260

These are round-figure prices for a metal-frame model. The differences are typical of

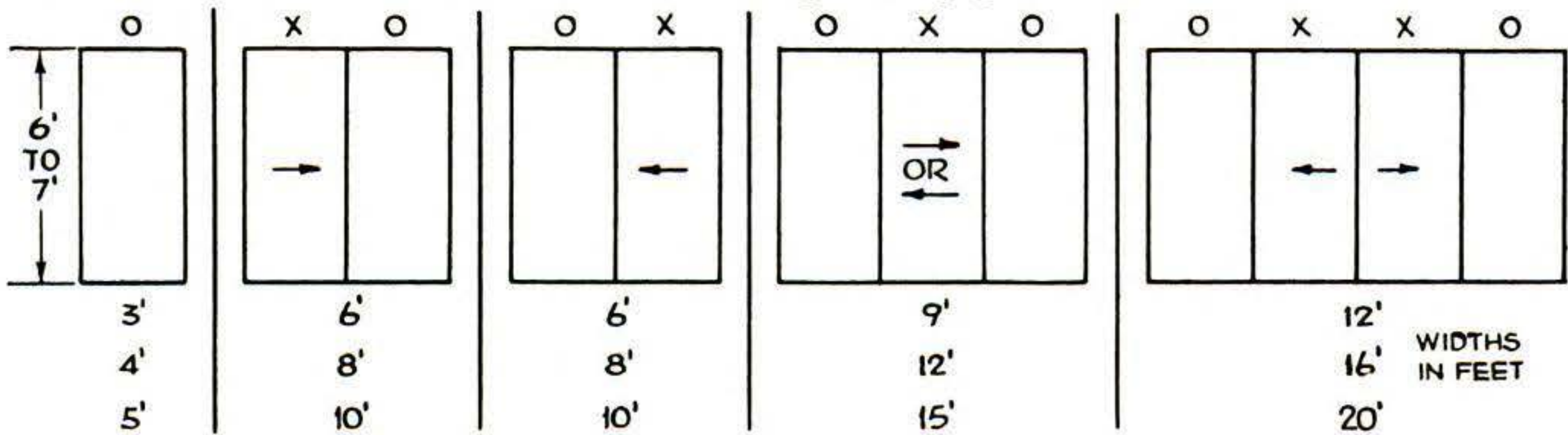
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How to frame in new sliding glass doors for your home



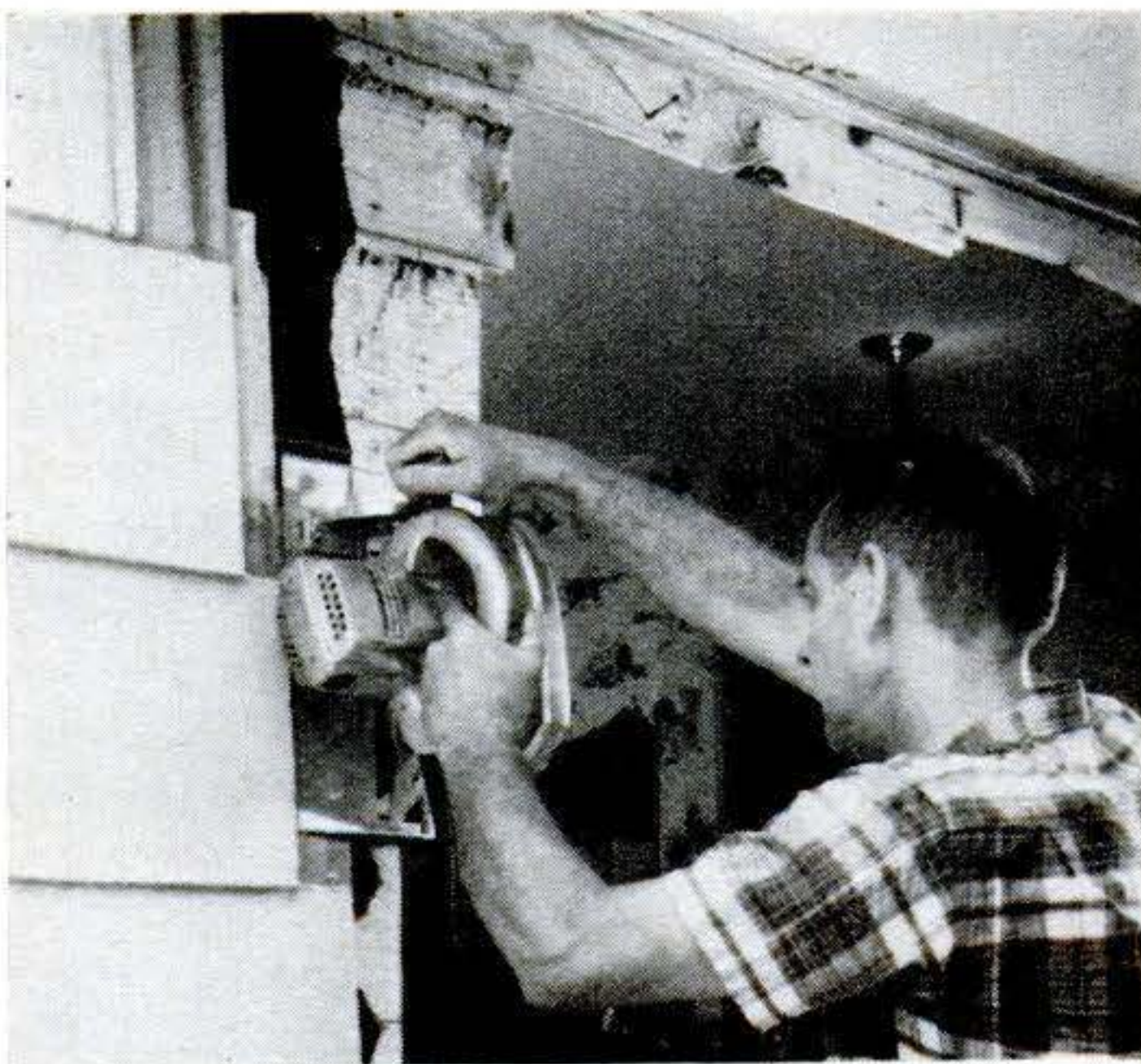
When you buy a set of sliding glass doors, you get the elements shown with dark shading in these sketches. You provide the other elements, most of them standard two-by-fours. The rough opening normally should be about an inch greater all around than the actual door dimensions. A trick worth knowing: Use strips of beveled siding, angled against each other, to fill gaps and provide a good tight fit all around the door.

You can choose from these units when you buy glass doors



Standard sliding-door setups are shown in these sketches, along with the approximate sizes that

are available. The fixed sections are indicated as "O," the movable sections as "X."



A portable circular saw makes quick work of cutting out a section of the wall for the new doors. You could also use a saber saw. If you own neither, better rent one to increase your cutting accuracy.

all variations in glazing. Note: In many localities, building codes require tempered glass for sliding doors. Check at your city hall.

What to look for when you shop. Study this checklist before you go out to buy:

- Wood or aluminum? Suit yourself. Metal usually allows a slimmer silhouette. But some of the best wooden windows carry buried steel for strength and are just as slim. From the standpoint of durability, there is little to choose from between metal and preservative-treated wood, kept painted.

- Check for continuous metal from outdoors to indoors. It should not exist, or you'll get frost on the inside. The best construction breaks straight through metal with an insulating strip.

- Check insulation, weatherstripping.

[\[Continued on page 252\]](#)

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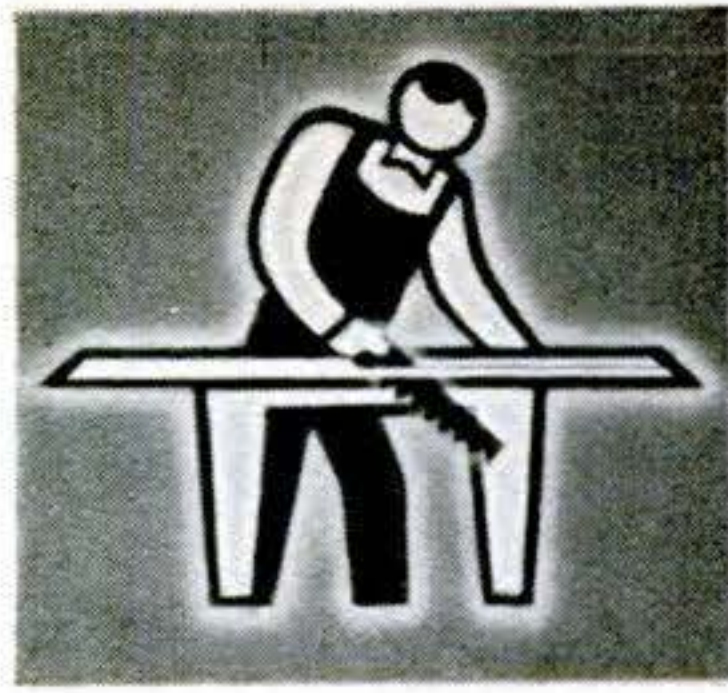
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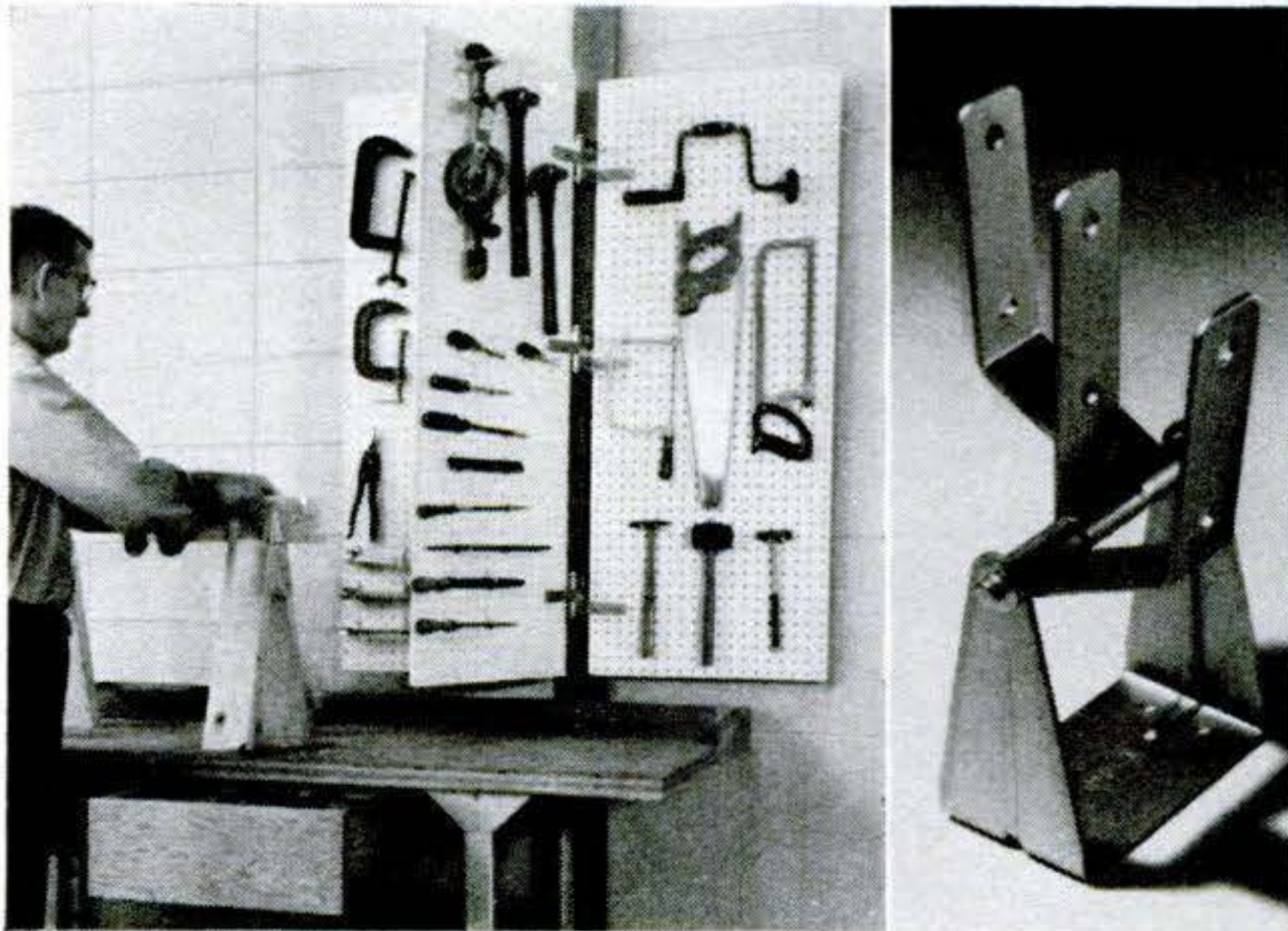
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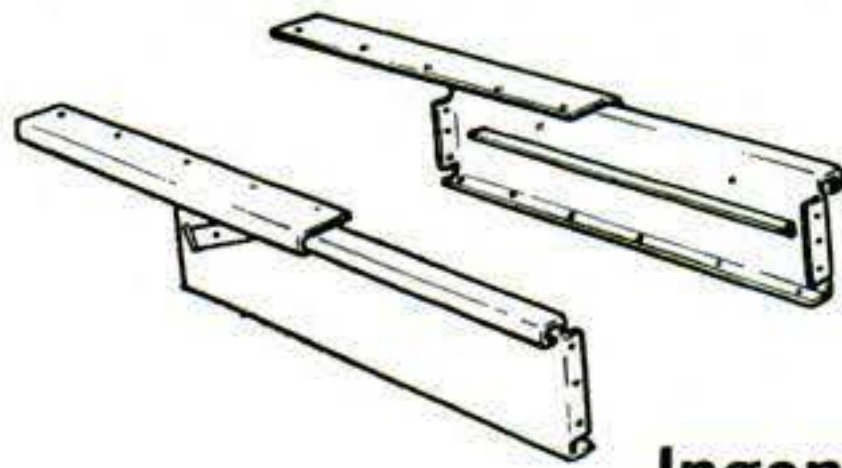
Shop Talk

By ROBERT P. STEVENSON

How to store your hand tools on hinged wings: Chapter II



If you think you've already seen something like the hinged tool board in the photo at the far left, you're right. You have. We first published the idea last November [page 146]. Before the issue was a week old, the John Sterling Corp., Richmond, Ill., let us know about an easier way of mounting the panels—with the new three-panel hinges (see photo) that they sell for about \$1.40 each. Sam Owen, of Sterling, also tells us his company has still another product of considerable interest to home-shop people: an item called Sides-N-Slides—for drawers. This simplifies making underbench drawers like the one below the tool board. The set includes right and left steel drawer



sides, plus matching steel slides that you screw under the bench top (sketch). To complete the drawer, you make a front, back, and bottom of $\frac{1}{4}$ " or $\frac{3}{4}$ " wood or plywood. Inside rails on the metal sides will carry a sliding wood tray for greater storage capacity. This hardware costs about \$7.50 a set.

Ingenuity at work: How to locate heat pipes in the ceiling

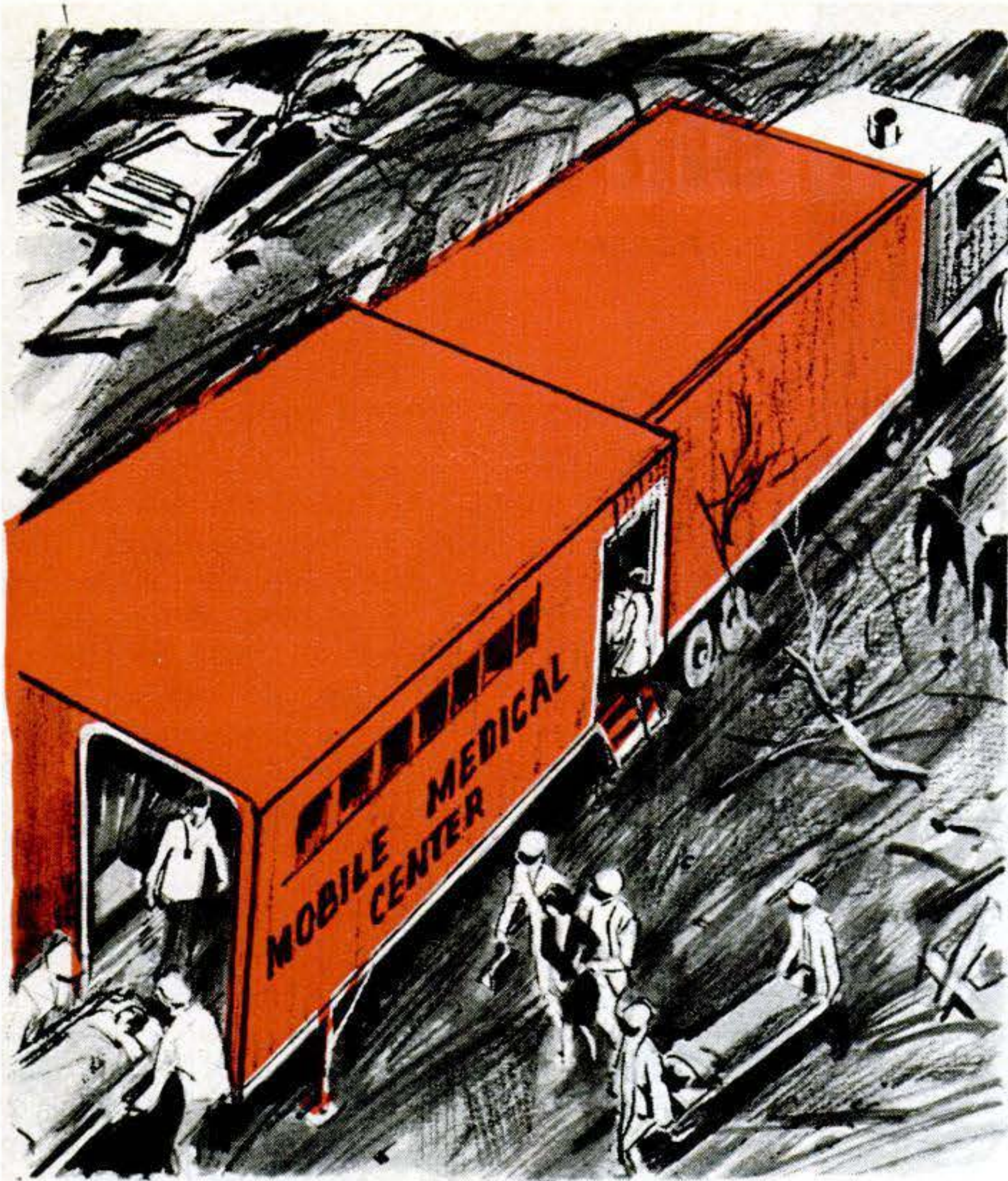
"My home is heated with radiant heat in the ceiling," writes Scott K. Schwab of Cokeville, Wyo. "I wanted to install a light fixture but was concerned about hitting a heat pipe. Then I remembered that when I painted the ceiling, the paint dried first over the pipes. So I sprayed water where I wanted the fixture. In a few minutes, by watching the water dry, I was able to tell where the pipes were and where to cut the hole."

Got an idea for a new auto tool? It could win a prize

Auto mechanics use many special tools. The people at K-D Manufacturing Co. think there are still others not yet invented. So they are offering an award of \$500 to anyone submitting a new automotive hand-tool design that is considered marketable. The contest continues until August. For an entry form and other information, write Dept. S, K-D Mfg. Co., 526 N. Plum St., Lancaster, Pa. 17602.

Odds and ends of interesting shop information

Stanley is applying a fluorescent material to the markings and graduations of its new measuring tools to improve visibility in poor light. . . The Arrow Propeller Co., Paducah, Ky., offers a free brochure telling how to match the firm's propellers to engines of air-boats, snow sleds, dusters, and the like. . . A revised edition of "Newest Ways to Expert Woodworking" now is available from Black & Decker. Price: \$3.95. Write the Sales Promotion Dept., Consumer Products Div., Black & Decker, Towson, Md. . . You can build a fence using translucent fiberglass panels. Send a card, asking for Plan 505, to Filon Corp., 12333 S. Van Ness Ave., Hawthorne, Calif. 90250.



New Ideas from the Inventors

Parked trailer doubles size. A trailer could do extra duty once it reached its destination if it opened up like this recently patented model. A rear section with fold-up flooring would telescope over the wheeled, cargo-carrying front section. It could be extended—and propped—to provide additional working or living space when stopped, or telescoped to travel like a conventional towed trailer.



Coin gun aims for toll basket. If you have trouble lobbing coins southpaw into the automatic exact-change toll baskets used on many turnpikes and bridges, this spring-loaded gun might make your driving easier. Releasing a cocked spring would propel a ball—and coin—through the barrel. A magazine in the gun handle would store coins, usually quarters, to save fumbling for them at toll stations.



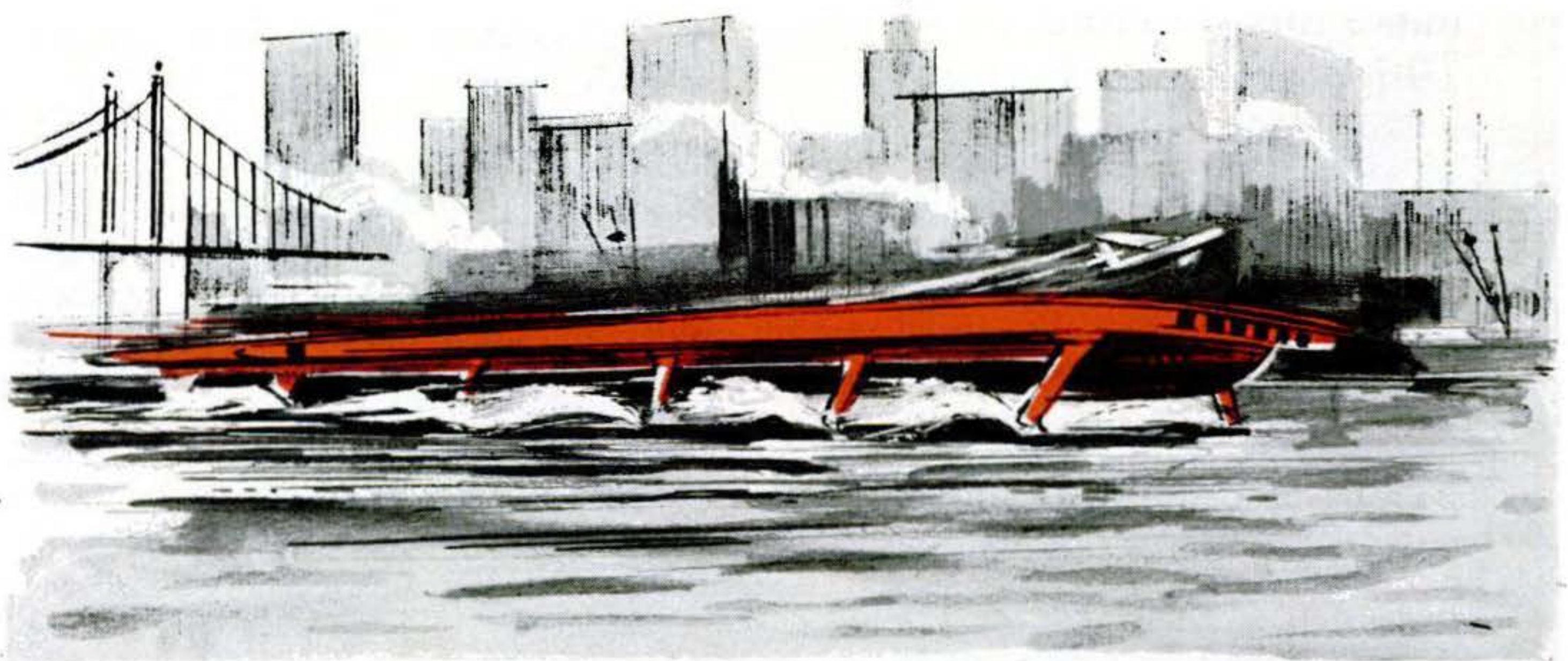
Adhesive squeezes foam pads. Compressible foam rubber or plastic might find more uses if it could be stored and shipped in less space. This Army patent would accomplish this by impregnating foamed pads with a quick-setting, water-soluble adhesive, and pressing them flat to save space. When they were to be used, they'd be dipped in water to dissolve the adhesive and let the pads spring open to their full size.



Boat case carries gear. You could carry your boat and fishing equipment to the lake in one lightweight case if you had a folding craft like this. Aluminum panels with sealed-on plastic overlapping hinges would unfold to form a one-man boat, fold up to a compact package with room inside for a pole, bait box, a pair of oars, fishing clothing, and other outdoor equipment.



Tank feeds paint roller. You could paint a wall or a room more quickly and evenly with a self-feeding roller like this. The half-exposed applicator roller would be backed by a reservoir and a transfer roller. Crimped lips would wipe excess paint from the outer roller for uniform spread and would also leak-seal the canister. The transfer roller could be motor driven.



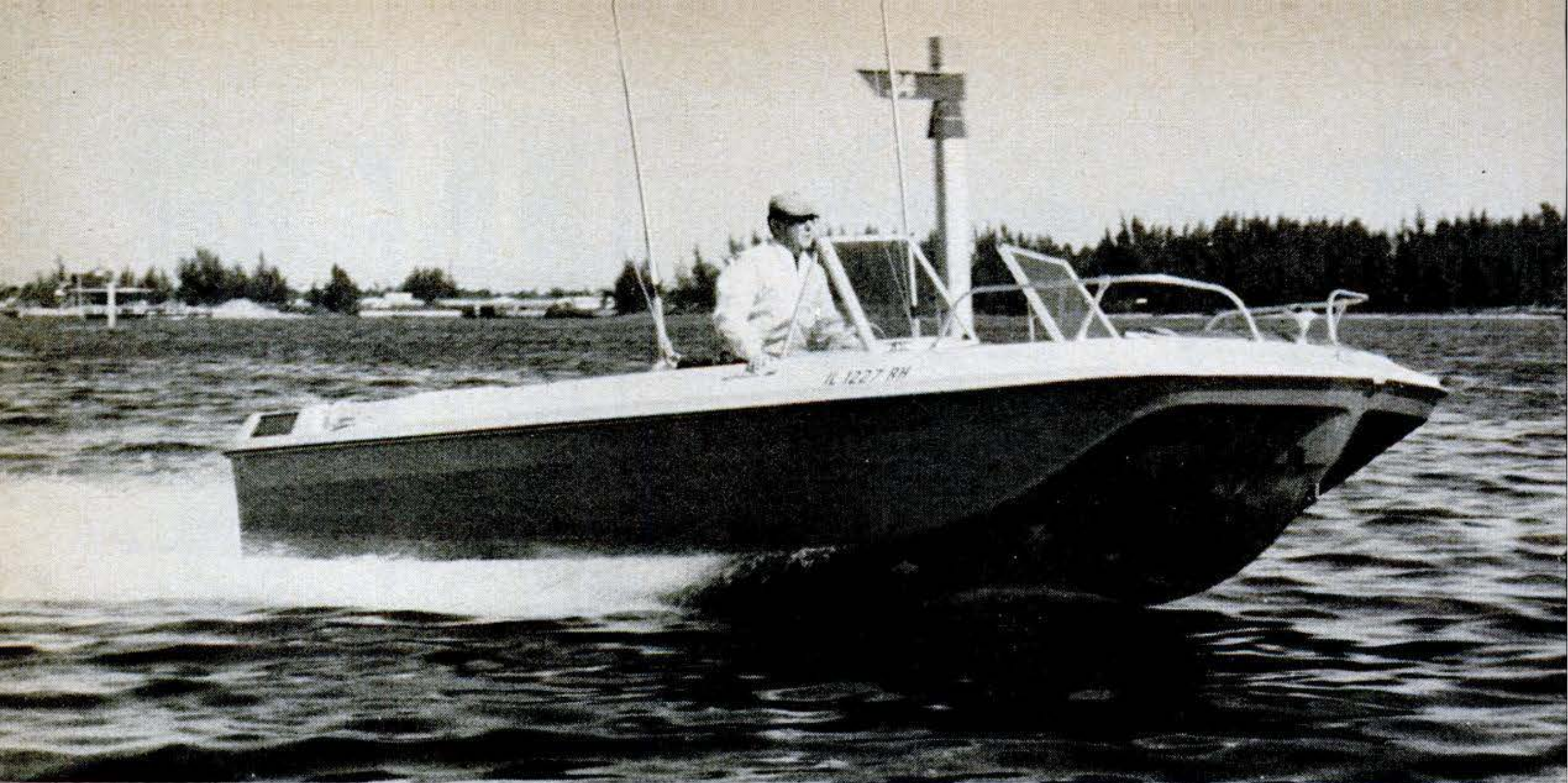
Speeding runway extends airstrip. Planes might take off and land at more convenient downtown locations if river space were used for runways. The inventors would employ jet-

powered hydrofoil flattops to accelerate planes to near-takeoff speed and to meet arriving planes at near-touchdown speed. They'd taxi to loading ports in space-restricted areas.

The following patents have been issued on these inventions: Telescoping trailer—No. 3,116,085 to F. G. Uttley, Kitchener, Ont., Canada; Toll gun—No. 3,191,588 to J. G. Thew, Westport, Conn.; Foam adhesive—No. 3,189,669 to S. Goldfein, Falls Church, Va.; Boat case—No. 3,184,768 to J. E. Thomson, Pittsburgh; Roller tank—No. 3,138,814 to G. C. Carrona, La Jolla, Calif.; Jet

runway—No. 3,191,566 to F. H. Wilken and H. Roberts, Demarest, N.J.

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.



PS BOATING

Surfer goes almost 100 miles on a full tank (24 gallons) of gasoline. She's rakish, versatile, very spacious, and can do better than 40 m.p.h.

REPORT FROM THE HELMSMAN'S SEAT:

New Johnson Surfer

Three keels and 200 horses make this versatile fiberglass 19-footer a great performer

By JIM ROE/PS Boating Editor

You can't help liking Johnson Motors' Surfer. I spent a solid week in early January living with her and hated to part company. The Surfer is 19 feet of multi-keel fiberglass boat available with 150- or 200-hp. stern-drive propulsion. Mine packed 200 hp.

I boarded her at Skipper's Marina in Naples, Fla. Headquartering there, it was no trouble finding all sorts of water conditions in which to try out this hot new boat. Miles of mangrove-lined inland waterways, hundreds of bays with unexpected shallow spots, and the open Gulf of Mexico were the proving grounds.

The Surfer's engine started up the instant I pushed the starter button. I swung her out into the Intracoastal Waterway, swooshed past a porpoise at play, and

headed for Marco Island at 4,000 r.p.m. The speedometer read 40 m.p.h. Poking my head above the windshield, into the wind rush, convinced me that the instrument was telling the truth.

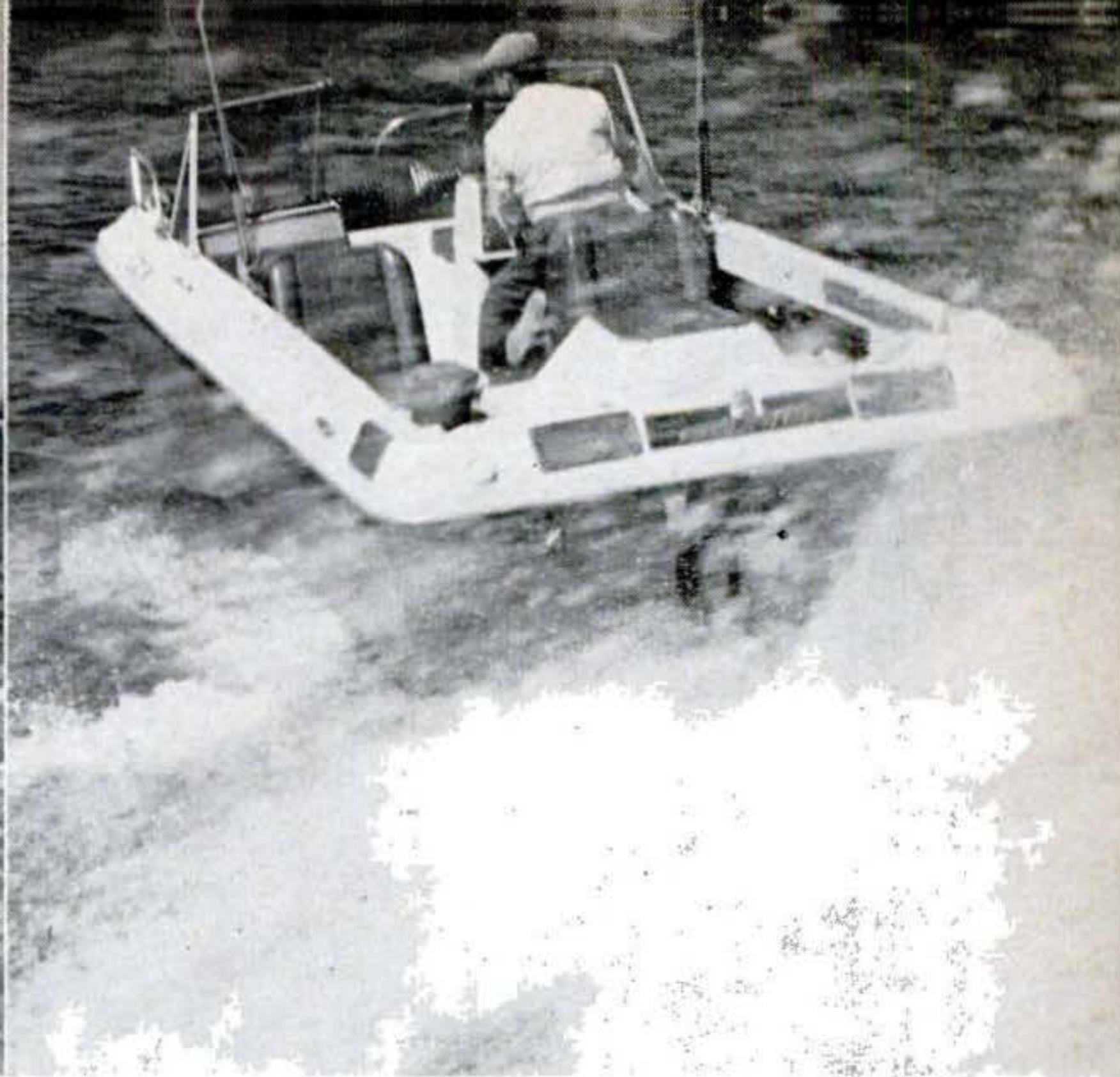
Newest and biggest of the boats made by Johnson, the Surfer is exceptionally roomy. A beam of 88 inches and *two* cockpits—one up front—give her the usable space of a boat considerably larger than 19 feet. A pair of convertible back-to-back seating units amidships accommodate four people while underway. Or they make up into two single lounges for sunning or snoozing.

Just aft of the port seating unit is a hinged table that forms a handy snack and work platform. And forward of the windshield, in the up-front cockpit, there's room for four or five riders who like the wind on their faces. It's also a fine place from which to fish or, when poking along, to study the underwater world. A tonneau cover, provided as standard equipment, keeps rain out and gives the forward area a decked-over look.

She's soft-riding and dry. The Surfer has a cathedral-style bottom. Johnson calls it a SeaFoil hull, and describes the bottom



She holds course like a train on tracks, even when astride a bigger boat's wake. The tri-keel hull form is the secret of her directional stability.



She turns on a dime without banking and with no tendency toward spinning out. Although she tosses water, none comes aboard to douse passengers.

Is Fast, Roomy, and Stable

as a stabilized soft-V bottom. By any name, the hull form is excellent and obviously the product of much experience and careful pre-production testing. The boat's construction, too, is first rate: beefy fiberglass with a solid sandwich of foam plastic between the bottom and cockpit sole. The foam core does four important things: It makes the boat virtually unsinkable, contributes to overall structural strength, absorbs shock and vibration, and fills space that could otherwise trap explosive or flammable fumes.

The cathedral-hull form, together with the shock-absorbing foam in the bottom, make the boat one of the most uniformly comfortable I've ever known. Time and again I took her across choppy bays without feeling the usual teeth-rattling sensation of traveling fast over an old-fashioned washboard. Nor did the one-to-two-foot chops seem to slow her down at any point. With the throttle full ahead, the speedometer read the same steady 40 m.p.h. it did in smoother water.

Out in the Gulf of Mexico, horizon-hiding swells showed me that she wouldn't plow or become a steering problem in big water.

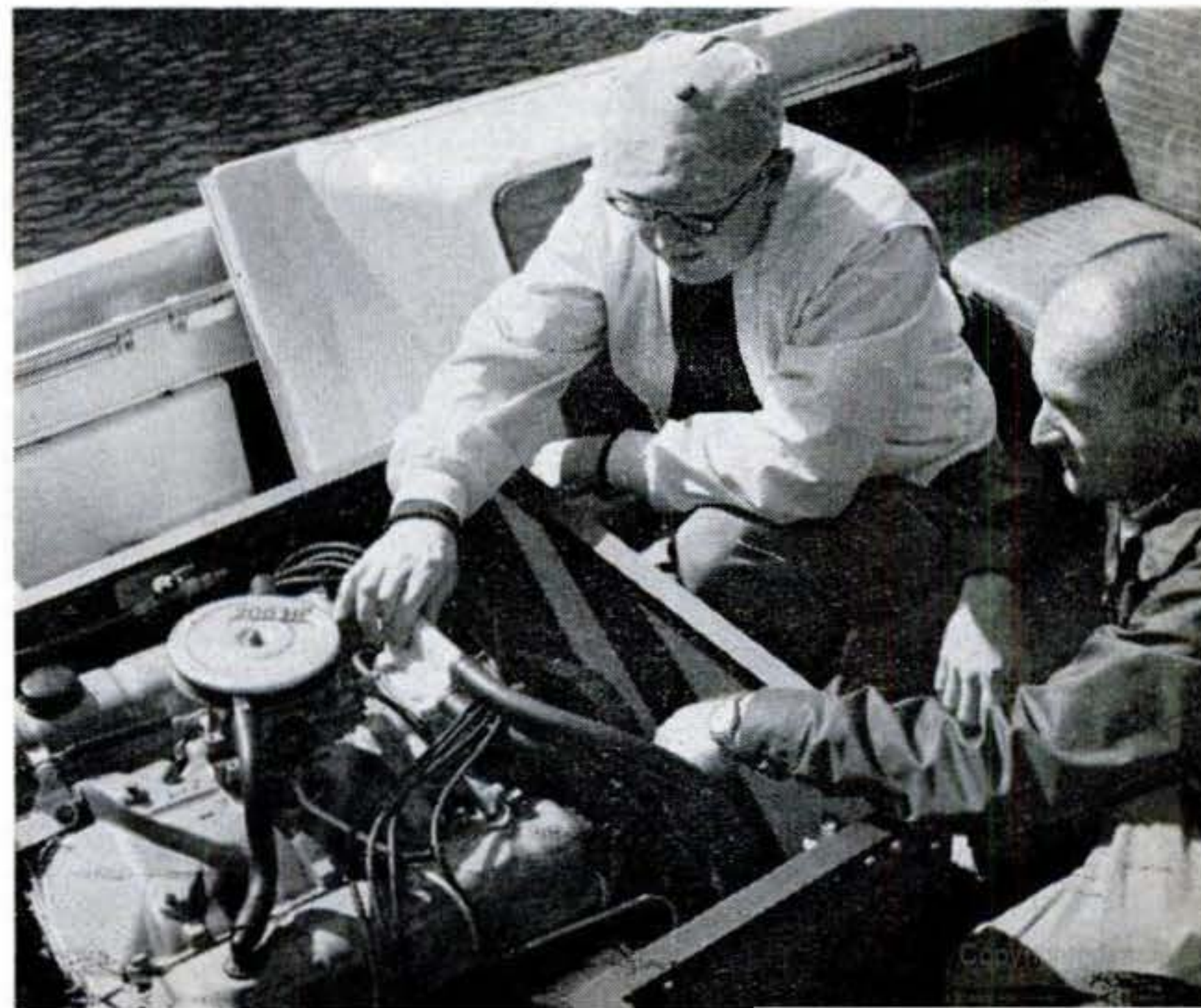
In my week of living with and going

places in the Surfer, hardly a drop of water came aboard—not even in turns, or when taking her over the wakes of passing craft. That, coupled with the smoothness of the ride she gives, makes her a comfortable boat in my book.

She takes off like a bat. Shove the throttle ahead and the Surfer gets right down to business. She's up on a plane before you

Continued

Her 200-horse stern drive is amazingly quiet. The Johnson engine, based on a Buick V-8 block, has a displacement of 300 cubic inches. The craft is also available with a 150-hp. V-6 stern drive.



know it. In fact, her get-up-and-go is such that I caution anyone to be seated and holding on to something solid when the Surfer's rate of acceleration is about to be checked. It's her only potentially hazardous feature. But then 200 horses are a lot of power for a 2,300-pound boat. As a result, she does everything much more quickly than many drivers would expect.

A push on the throttle moves you from here way over to there in a big hurry. In addition, the Surfer's big power plant de-

velops great torque. So it's important that the stern drive's trim tabs be perfectly adjusted. If they're not, steering becomes hard work.

She's quiet and economical. The 200-hp. V-8 power plant, although big, is unbelievably quiet. To test this, I sat in another boat while Don Schlerf of Skipper's Marina brought the Surfer within 10 feet of me at 40 miles an hour. I heard absolutely no sound until she was so close that I could hear the slap of rippled water against the hull. As she passed by, there was only a soft whine of power, no roar. Her quietness stems mainly from an efficient underwater exhaust and a well-constructed, insulated engine box. They promote pleasant boating where people can enjoy the conversation of friends and the cries of the gulls, instead of feeling they're participating in the Indianapolis 500.

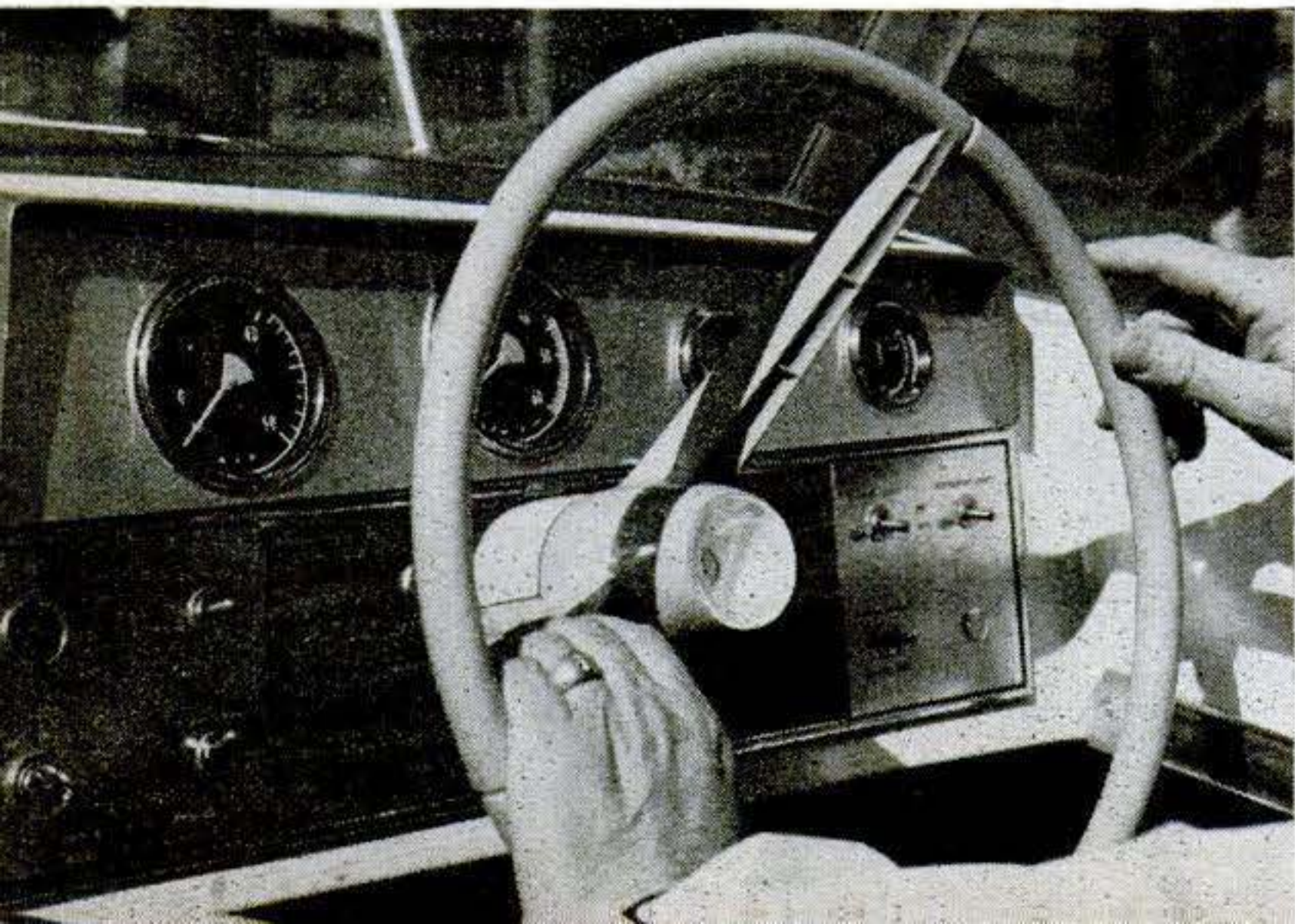
The Surfer comes with a built-in 24-gallon fuel tank. Despite the high horsepower, 24 gallons give her a generous range. The exact hours and number of miles one can go on 24 gallons are highly variable, of course, but I judge that her cruising range approaches 100 miles in normal water. I found that we could run clear from Naples to Marco Island and back at full speed, and top off the tank again by adding just 12 gallons of gas.

Another of the pleasing things about the
[\[Continued on page 243\]](#)



Surfer's interior is exceptionally roomy, the up-front cockpit alone seating five or six passengers. Here, PS Boating Editor Jim Roe removes the tonneau cover, part of the Surfer's standard equipment.

Helm is well instrumented but uncluttered. A fuel gauge and a cigarette lighter are incorporated in the dash. The engine control is a single-lever unit combining both throttle and shift.



JOHNSON SURFER SPECIFICATIONS

Centerline length	19' 1"
Beam	7' 4"
Weight (with 200-hp. stern drive)	2,300 lb.
Load capacity	9 people or 2,000 lb.
Power	150-hp. or 200-hp. Johnson stern drive
Fuel-tank capacity	24 gal.

Standard Equipment:

Lighted instrument panel incorporating speedometer, tachometer, ammeter, and fuel-tank gauge; key ignition; single-lever engine controls; power-tilt mechanism; cigarette lighter; navigation lights; deck hardware; combination bilge pump and blower; mechanical steering; battery box and 12-volt battery; safety-glass windshield with removable center section; tonneau cover for forward cockpit; convertible back-to-back seats; hinged table with storage recess for center section of windshield. A variety of accessories, including convertible top, side and aft curtains, are available at extra cost.

Styling:

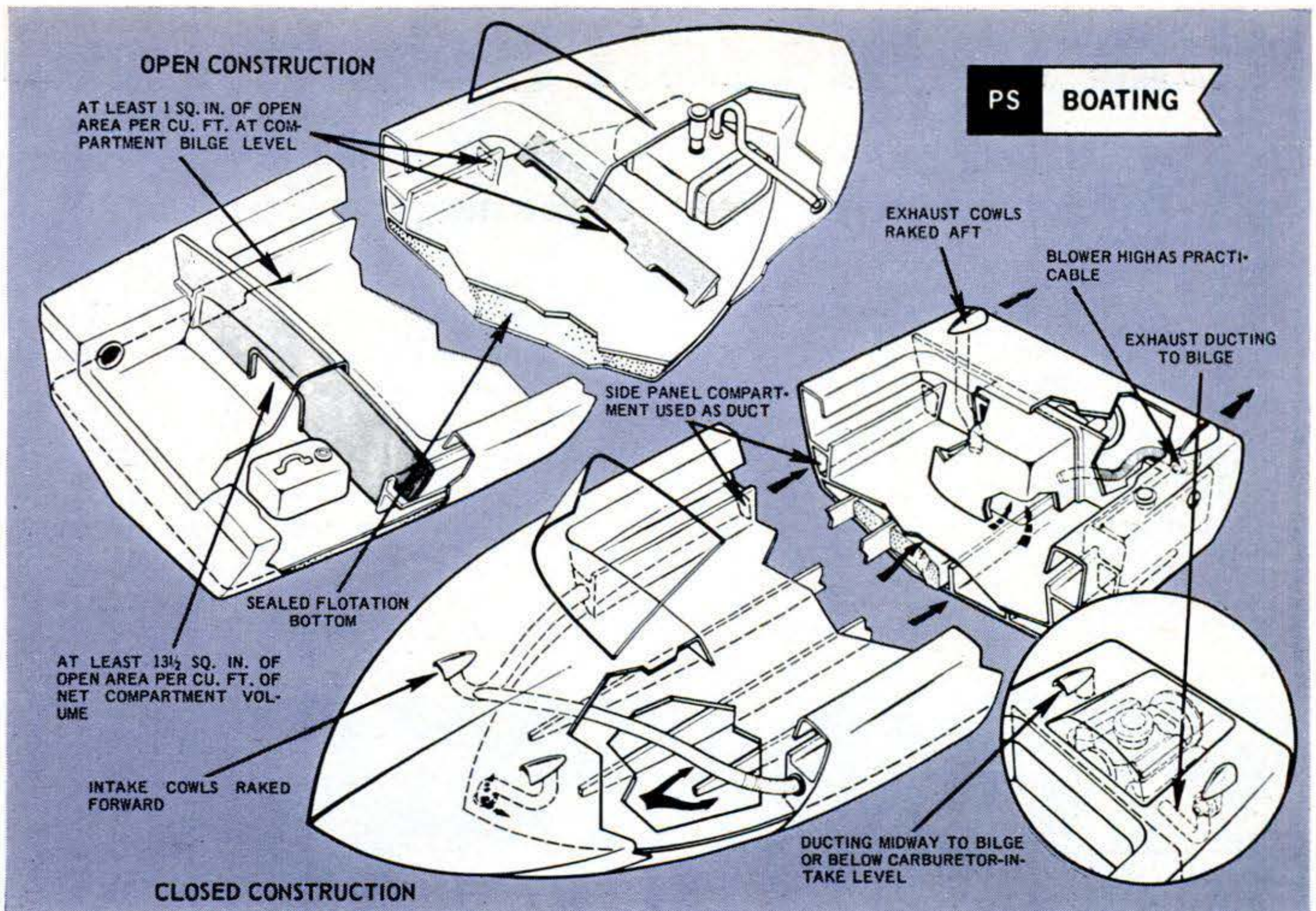
Deck: white. Hull: turquoise, with matching drive unit. Interior: vinyl bucket seats, nonskid vinyl floor, simulated wood-paneled side trim.

Price:

\$4,825 with 150-hp. stern drive. \$4,975 with 200-hp. stern drive.

Manufacturer:

Johnson Motors, Waukegan, Ill.



Coast Guardsmen will be referring to these drawings when inspecting powerboats this season.

This spring, will your boat pass the Coast Guard's—

VENTILATION INSPECTION?

You have only until June 1 to see that your boat conforms to the ventilation regulations of the Motor Boat Act of 1940 as amended last year. Starting then, the Coast Guard and boat law-enforcement officials will be inspecting powerboats, including outboards, with a fresh eye.

Here in part is what will be guiding those boat inspectors:

1) All motorboats (except open boats) using "fuel having a flashpoint of 110 degrees or less, shall have at least two ventilator ducts, fitted with cowls or their equivalent, for the efficient removal of explosive or flammable gases from the bilges."

2) The term open boat means those "with all engine and fuel-tank compartments and other spaces to which explosive or flammable gases and vapors may flow, open to the atmosphere and so arranged as to prevent the entrapment of gases and vapors within the vessel."

3) The wording of the clarifying amend-

ment makes it clear that transom louvers and vents do not constitute an adequate ventilation system. It specifies cowls and ducts for enclosed compartments and states that one cowl (for exhaust) must face aft so wind can blow over it to create suction. Another cowl (for intake) must face forward so air can blow into it freely.

Just how stringent the inspection officials will be remains to be seen. However, if your boat's engine or fuel supply is in a compartment, the lower of the two drawings will help you determine the alterations or additions needed. The upper drawing shows the minimum ventilation a boat needs to be classified as an open boat not requiring cowls and ducts.

The drawings are the Boating Industry Association's diagrammatic interpretation of the amended regulations. Its more detailed text interpretation is obtainable upon request: Boating Industry Assn, 333 N. Michigan Ave., Chicago.

How to Install a Fuel Tank

Is your boat ready for her first built-in tank or an extra tank for more range? Here's all you need to know to put one in

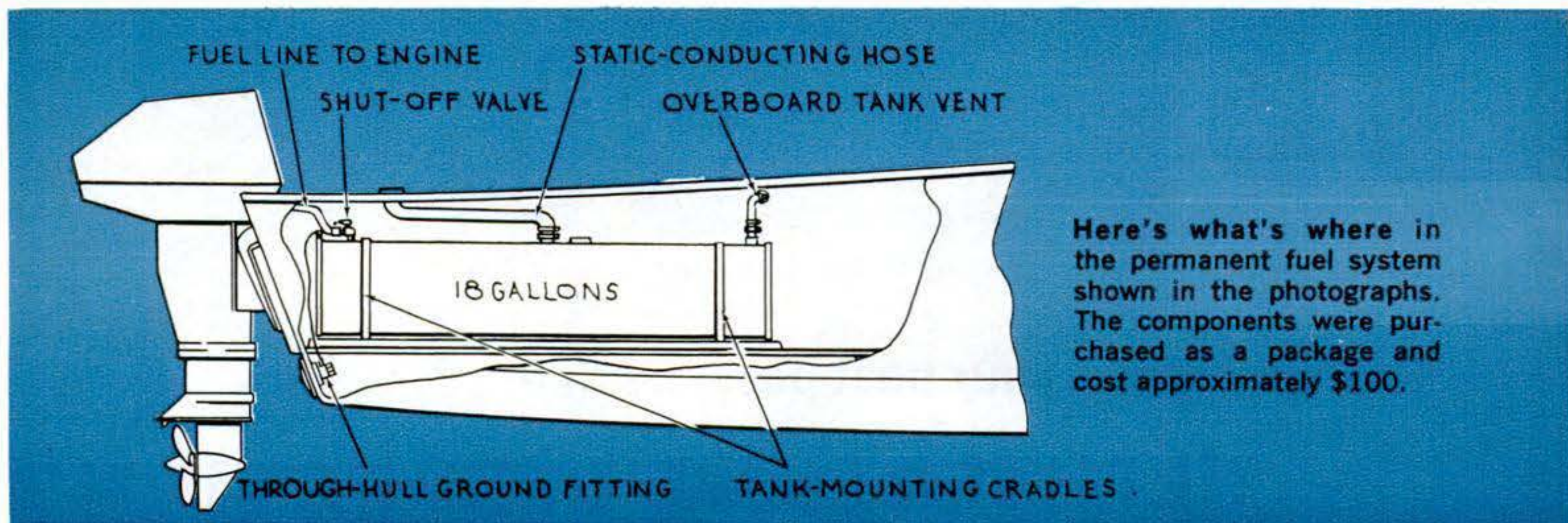
By CHARLES R. MEYER

A permanent tank that you fill through a deck pipe makes it easy to fuel an outboard. It's safer than portable tanks and neater. For stern-drive and in-board craft, an extra tank, to increase range, can be easily connected to the present fuel line. To tap the tank, you turn a valve.

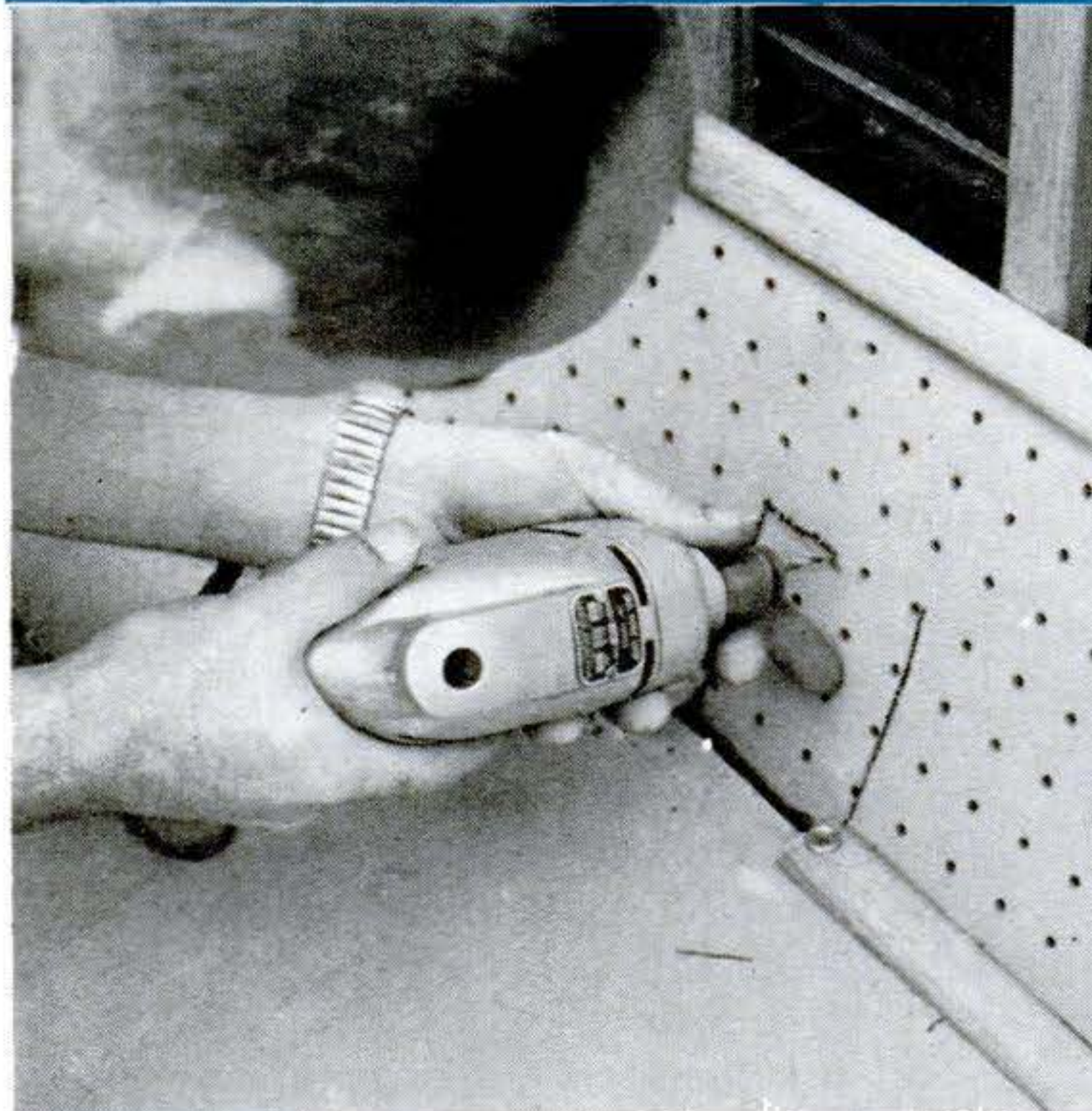
Strategic placement of added tanks can even improve a boat's performance—get her up on plane faster or correct a list caused by uneven weight distribution.

Installing a tank is simple and takes little time, particularly if you buy the tank, mounting hardware, and hookup parts as a package. The long, slim, 18-gallon tank pictured here took about an hour to mount and connect. Accompanying sketches show

Continued

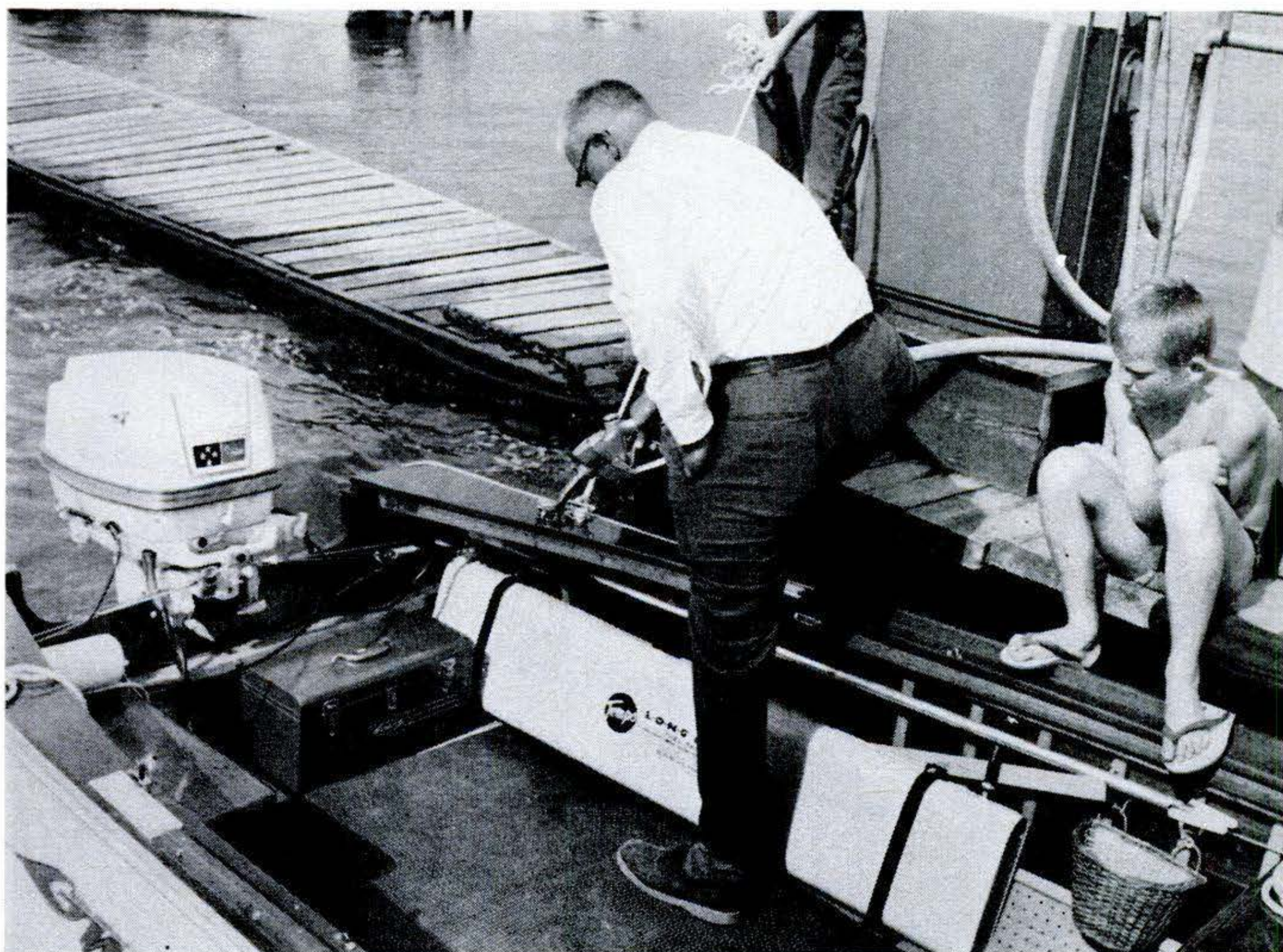


Here's what's where in the permanent fuel system shown in the photographs. The components were purchased as a package and cost approximately \$100.

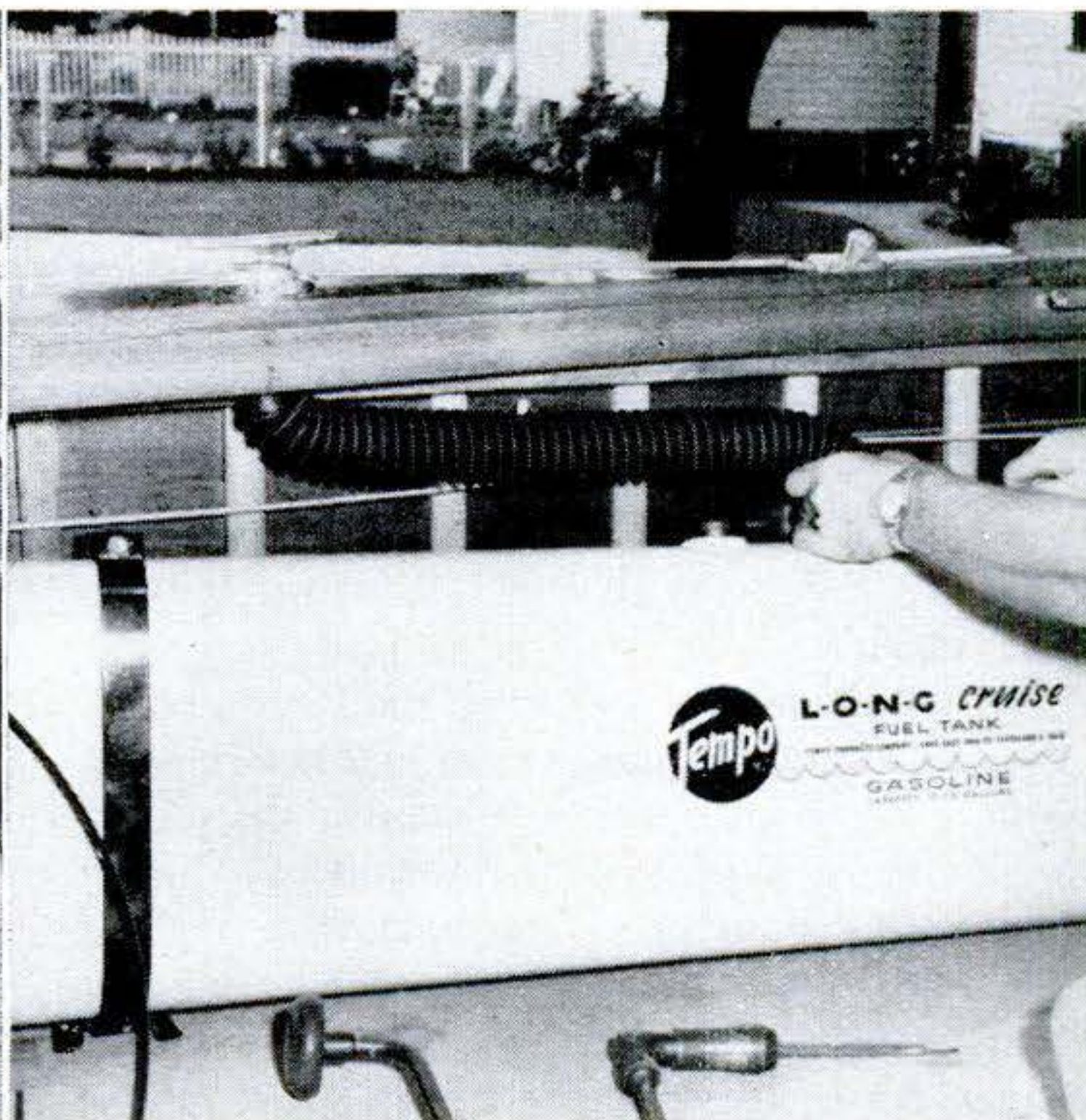
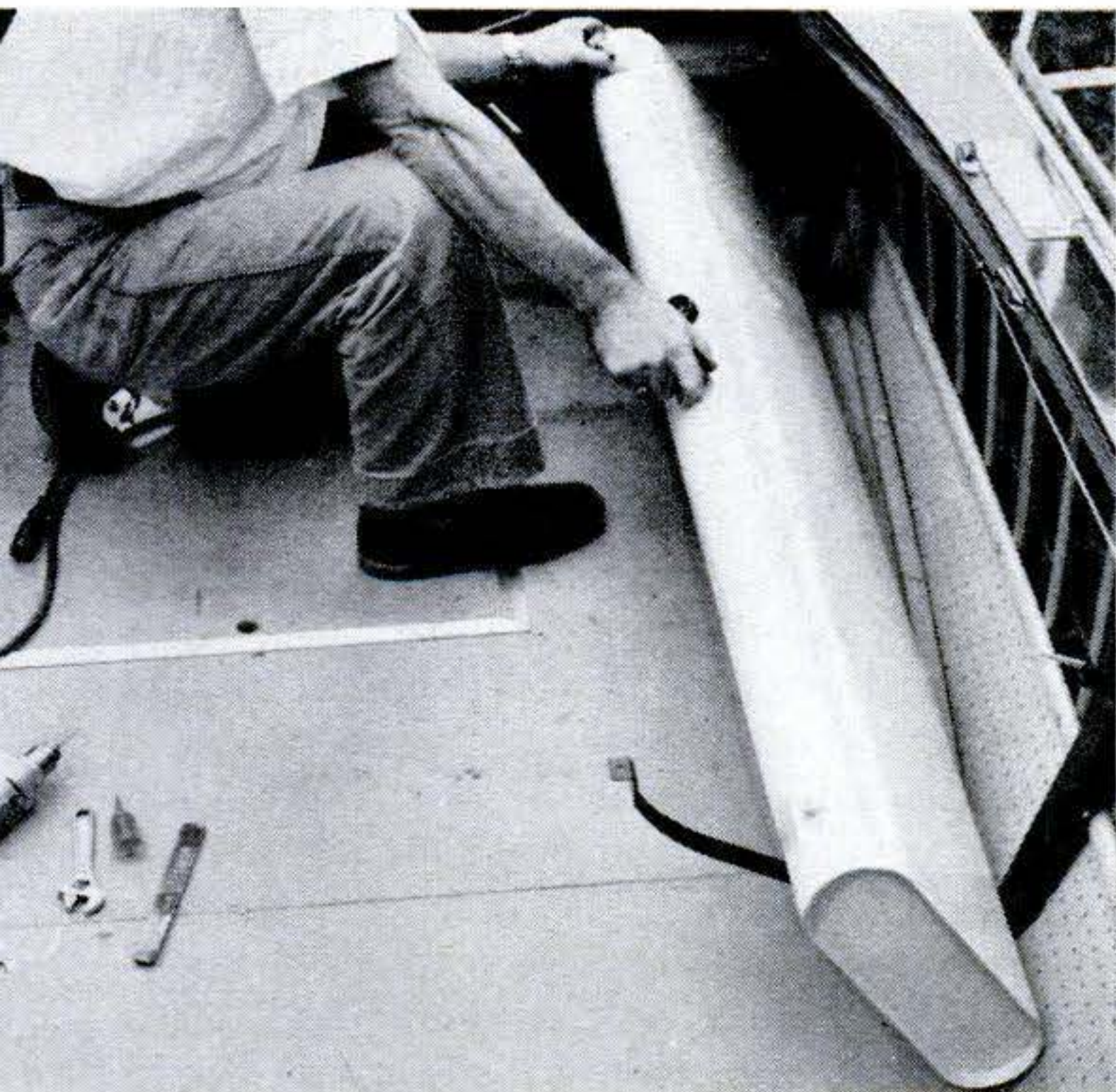


Pick a location where the tank won't be in your way, adversely affect the boat's trim, or be difficult to install. Here a low cockpit liner is notched so a cradle can be fastened to a frame as well as the floor, and the tank set close to the hull side.

Use stock mounting cradles if they're available for the tank you select. They are easily positioned, despite hull curves, for best tank alignment and secure fastening. In addition, they chock the tank off the floor so that air can flow freely beneath it.



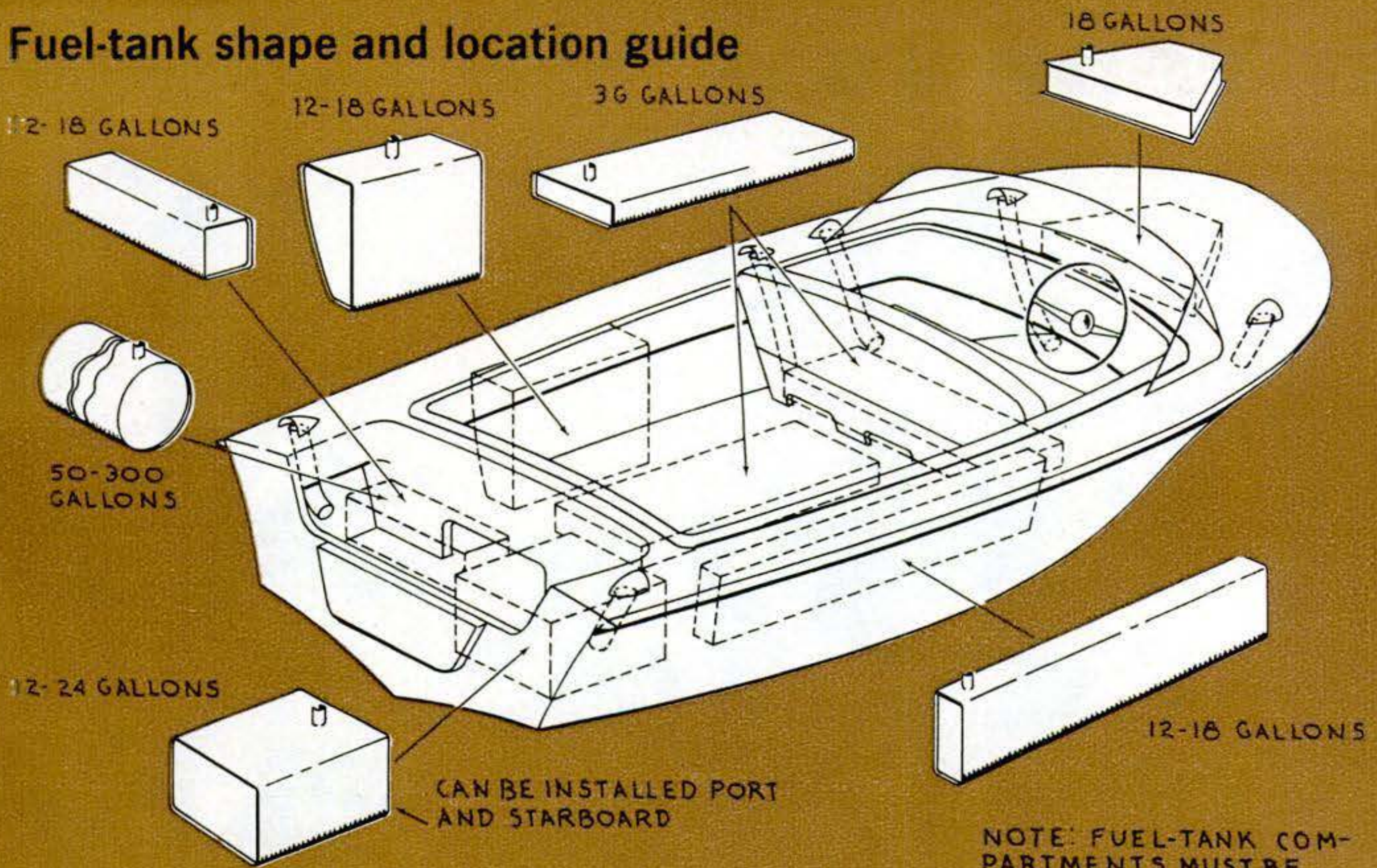
Mount the deck pipe so it leads spillage outside. Always hold pump nozzle against the pipe.



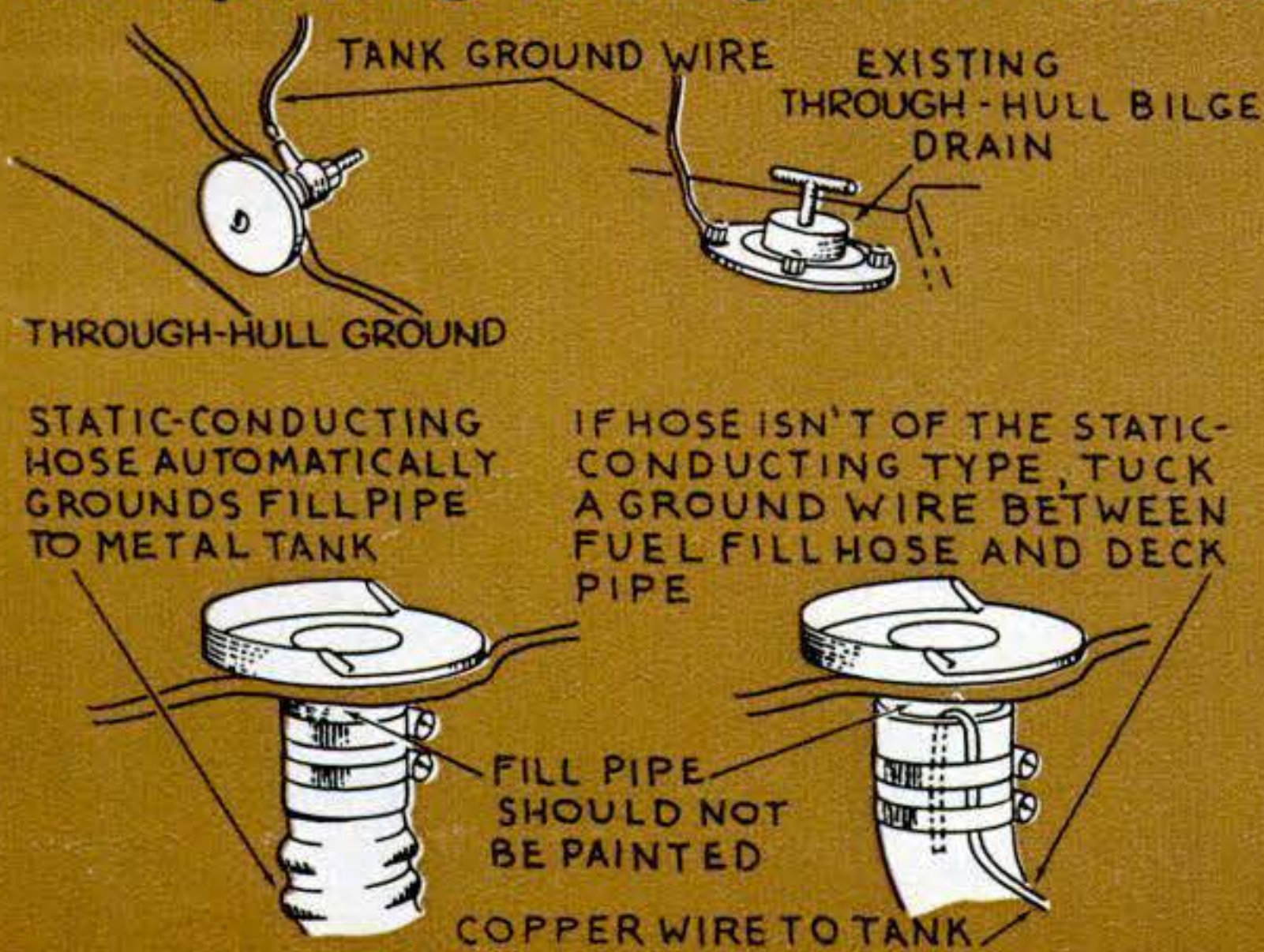
Double-check cradle-and-tank alignment before you permanently attach the mounting cradles. Also, see that the fill pipe, vent, and fuel-line openings are in the clear for hookup and routing. Next, cut or bore holes for the deck pipe and vent fixture.

Be sure hoses are tightly clamped and that the deck pipe and tank are both grounded. If clearance between tank and deck here were less, this hose could be a straight run clamped to 90-degree elbows and sloped slightly downward.

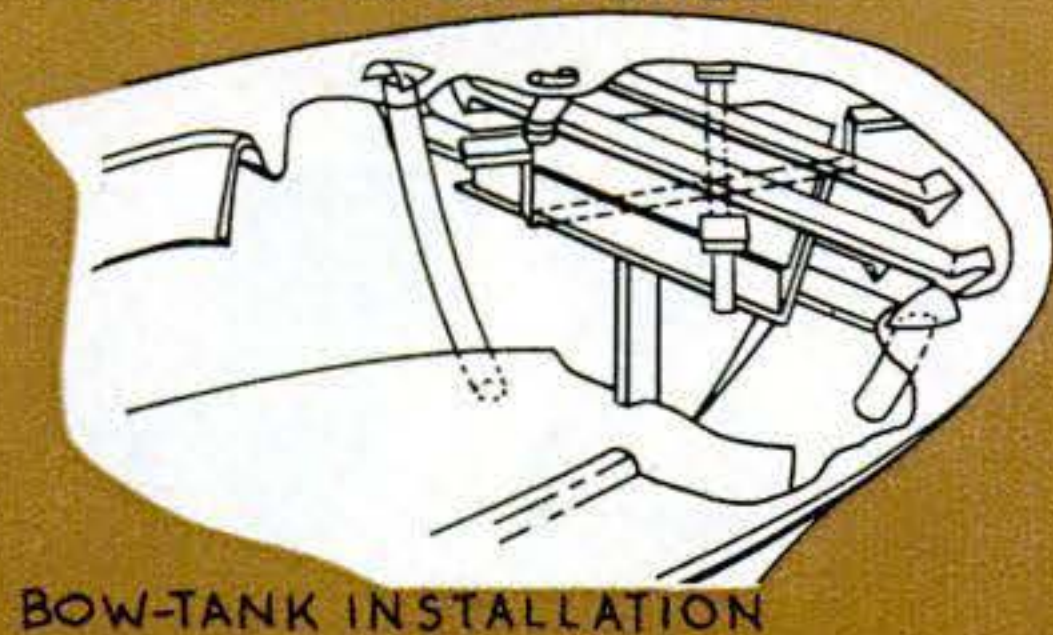
Fuel-tank shape and location guide



Fuel-system grounding and installation notes



BECAUSE OF THE RELATIVELY GREATER VIBRATION FORWARD, BOW TANKS REQUIRE STURDY SUPPORT FROM ABOVE AND BELOW. THE TANK FILLPIPE HOSE SHOULD BE DOUBLE-CLAMPED AT BOTH ENDS



you where as well as how to install one. Let them, along with the following tips, be your guide.

- Install only a fuel tank made for boats—no automobile gas tanks. They're not baffled for boats and won't hold up under the constant exposure to dampness. Corrosion makes them a safety hazard.

- Don't put a tank smack on the floor or compartment bottom. See that it's raised, so air flows freely beneath it. Use stock mounting cradles if they're available for the tank you select. They automatically chock tanks high enough for proper ventilation. Fasten them to the boat with bolts.

- Be sure the underside of the deck fuel-fill fixture is unpainted. Paint may insulate it against ground connection.

Only with a tank that's exposed to the atmosphere, rather than in an enclosed compartment, will a boat be considered an open boat and pass inspection when officials begin enforcing the amended federal motorboat regulations this spring. If any fuel tank, even a portable one, isn't out in the open, be sure to study the new ventilation rules on page 179. It might save you from getting a citation. Install the required ventilation cowls and ducts now and you won't lose boating time later. **PS**



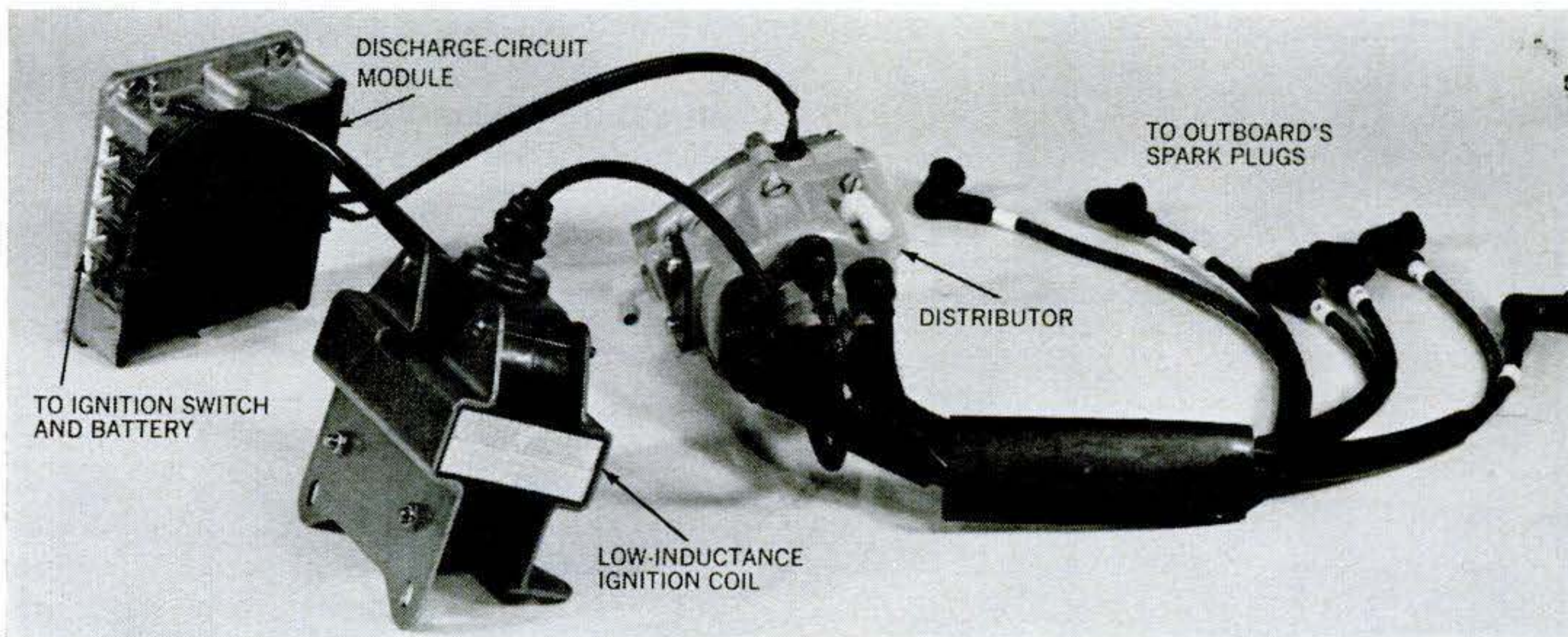
Floating lawn-mower engine pumps air to two divers

With this diving rig, you and a friend can wander the underwater world to a depth of 25 feet and stay down for better than 40 minutes at a clip. It consists of a two-hp. engine and a pair of air pumps in a 19-inch-diameter frame, two 25-foot hoses, each with mask and body harness, and an inflatable ring buoy. When ready to go diving, you slip the buoy over the frame and inflate it with air from one of the pumps. The Air Buoy follows you on the surface. Johnson Motors. \$279.



New electric-start is compact

This lightweight, low-profile nine-horsepower outboard motor comes in electric-start as well as manual-start models. The 59-pound electric-start unit features a combination starter-generator smaller than a one-pound coffee can, and is priced at \$365—only \$35 more than the manual-start unit. McCulloch Corp. is the manufacturer.



Outboard ignition boosts spark-plug life and starts big motors despite a weak battery

A new ignition unit converts storage-battery energy into much higher voltage, guaranteeing starts even when the battery is low. The system's key components are a discharge-circuit module that collects battery energy, and a low-inductance ignition coil that acts as a step-up trans-

former. "Thunderbolt" ignition was developed by the Kiekhaefer Corp., maker of Mercury outboard motors, and is standard on the 95-hp. Merc 950SS and 110-hp. Merc 1100SS. Coupled with the new surface-gap spark plugs, it is said to virtually eliminate pre-ignition.

Big News in Small Cameras:

ELECTRONIC



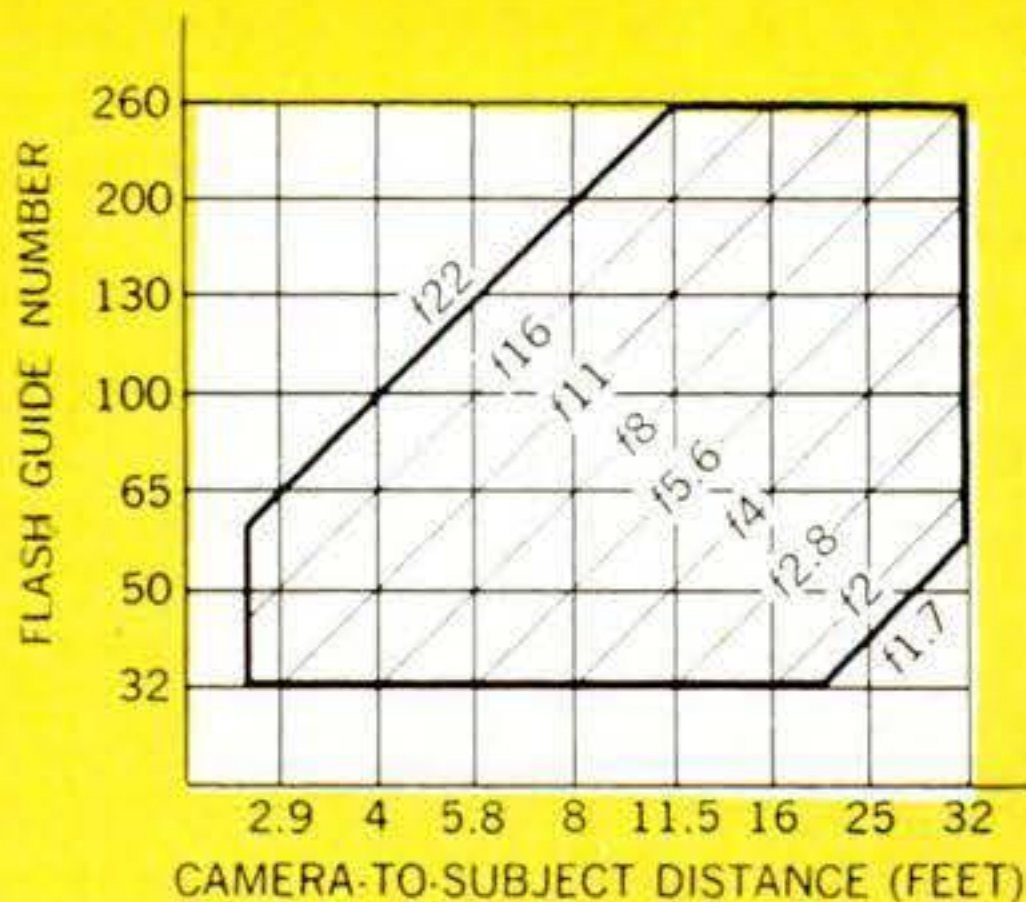
Gears and springs—and possibly even *f* stops—may soon be as obsolete on amateur cameras as kerosene lanterns on automobiles.

Electronics is the word these days, and on the newest small cameras the shutter release no longer releases a spring—it closes an electrical connection. Even separate diaphragm and shutter mechanisms may be on the way out—several new cameras combine these into a single unit that controls both the size of the lens opening and how long the lens will stay open.

What advantage is there for you in an electronic shutter? Two things. First, superaccuracy. The shutter is no longer dependent on springs and gear linkages that can get stiff with cold, or are limited to a specific number of settings, or that suffer—in the nature of things mechanical—from inherent slight inaccuracy. The electronic shutter is not only inherently more accurate but it is capable of an infinite variation in speed and lens opening to achieve perfect exposure. If the CdS cell tells the shutter to shoot at $1/356\frac{1}{2}$ second, that's what it does.

The second big advantage is durability. There is almost nothing that can wear out.

When you press the shutter-release button, you close a circuit that sends current to an electro-magnet that opens the shutter/diaphragm. The circuit incorporates a tran-



Flash-coupled focusing system on Olympus 35 LE eliminates arithmetic. You set guide number on ring. As you focus, diaphragm opens or closes to correct aperture (table above). With a guide number of 65, at 10 feet, aperture is about *f*/5.6. About \$100.

Yashica Electro 35 has transistorized shutter with speed range of 30 seconds to $1/500$. Manual setting permits you to set aperture. Warning bulbs indicate over- or under-exposure. Cost: about \$100.



SHUTTERS

By EVERETT H. ORTNER / PS Photography Editor

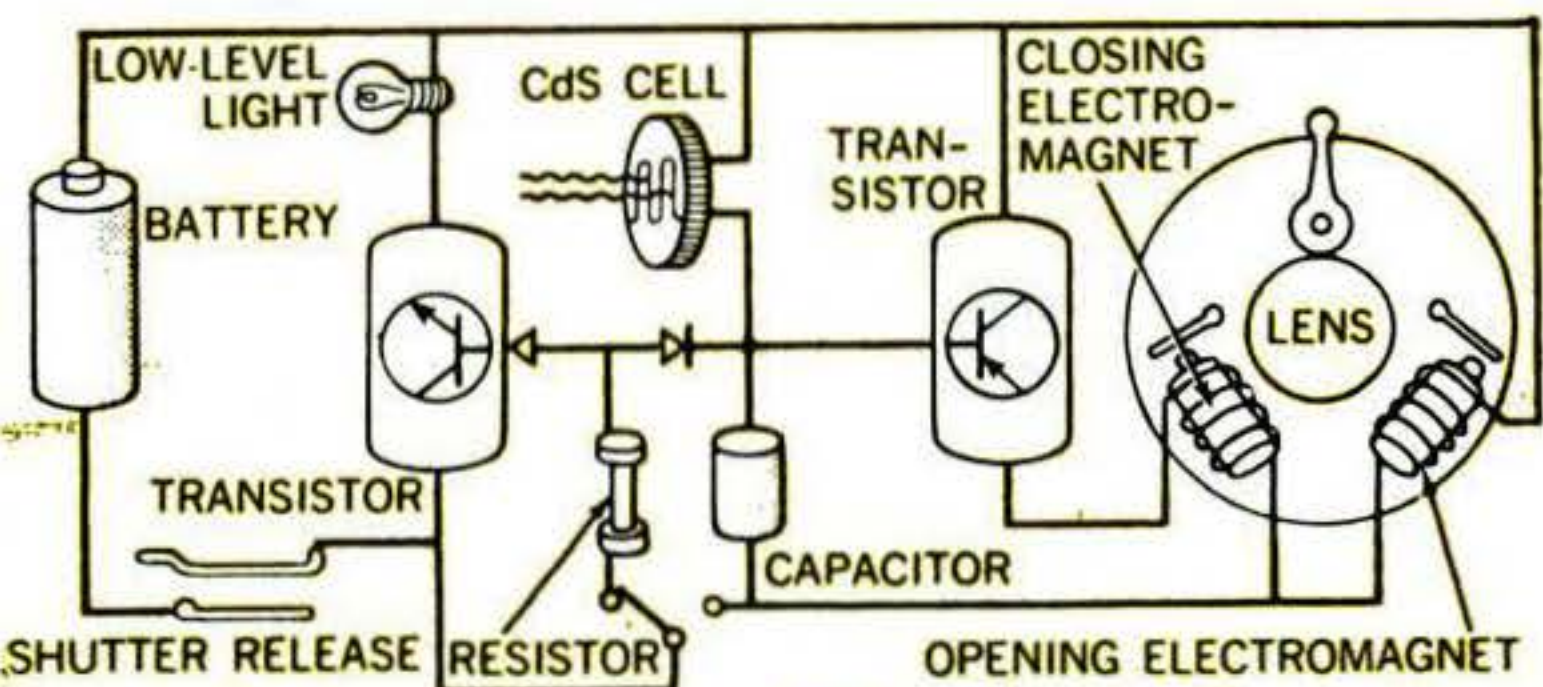
sistor that keeps passing current to a capacitor until it is switched off. The rate of current storage in the capacitor is regulated by a CdS cell—the stronger the light, the more current passed in a given time. When full, the capacitor trips and releases its current to the rest of the circuit, robbing the transistor in the opening circuit of its base current, and allowing other transistors—in the closing circuit—to pass current to a second electromagnet that closes the shutter.

As you might guess from this, the shutter is capable of a fantastic range of exposure—in the Yashica Electro 35, for example, it will stay open as long as 30 seconds, while the capacitor fills, to make a perfect night exposure. The exposure can vary even while the shutter is open, if the intensity of the light changes.

What are the disadvantages? In some cameras with a “programmed” shutter/diaphragm, such as the Olympus 35 LE or the Minolta Electro Shot, the lens-opening and shutter-speed combination is fixed—in infinite graduation and without reference to f stops—and you don't know the combination. The camera may, for example, shoot at $f/2$ at 1/16 second—a speed at which you would not hand-hold it if you knew. It might shoot at $f/4$ at 1/70 second, which, if you were shooting your kids diving into the pool, you might have preferred to be $f/2.8$ at 1/140 or $f/2$ at 1/280.

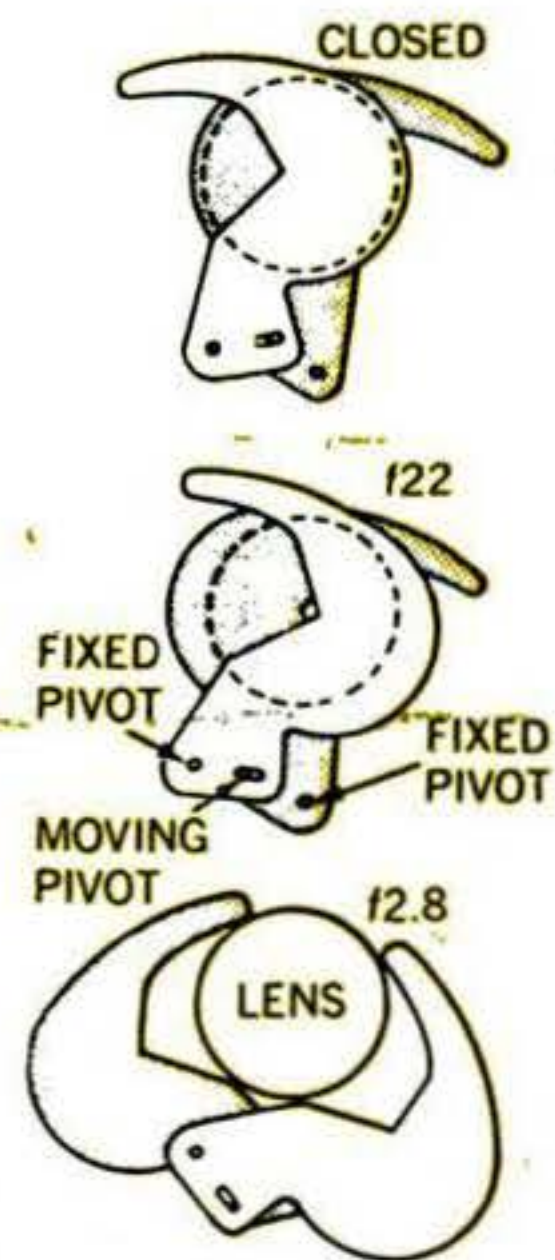
With the Argus 270 (which takes an Instamatic cartridge), at least you know what the camera is going to do. A moving pointer in the viewfinder shows shutter/dia-

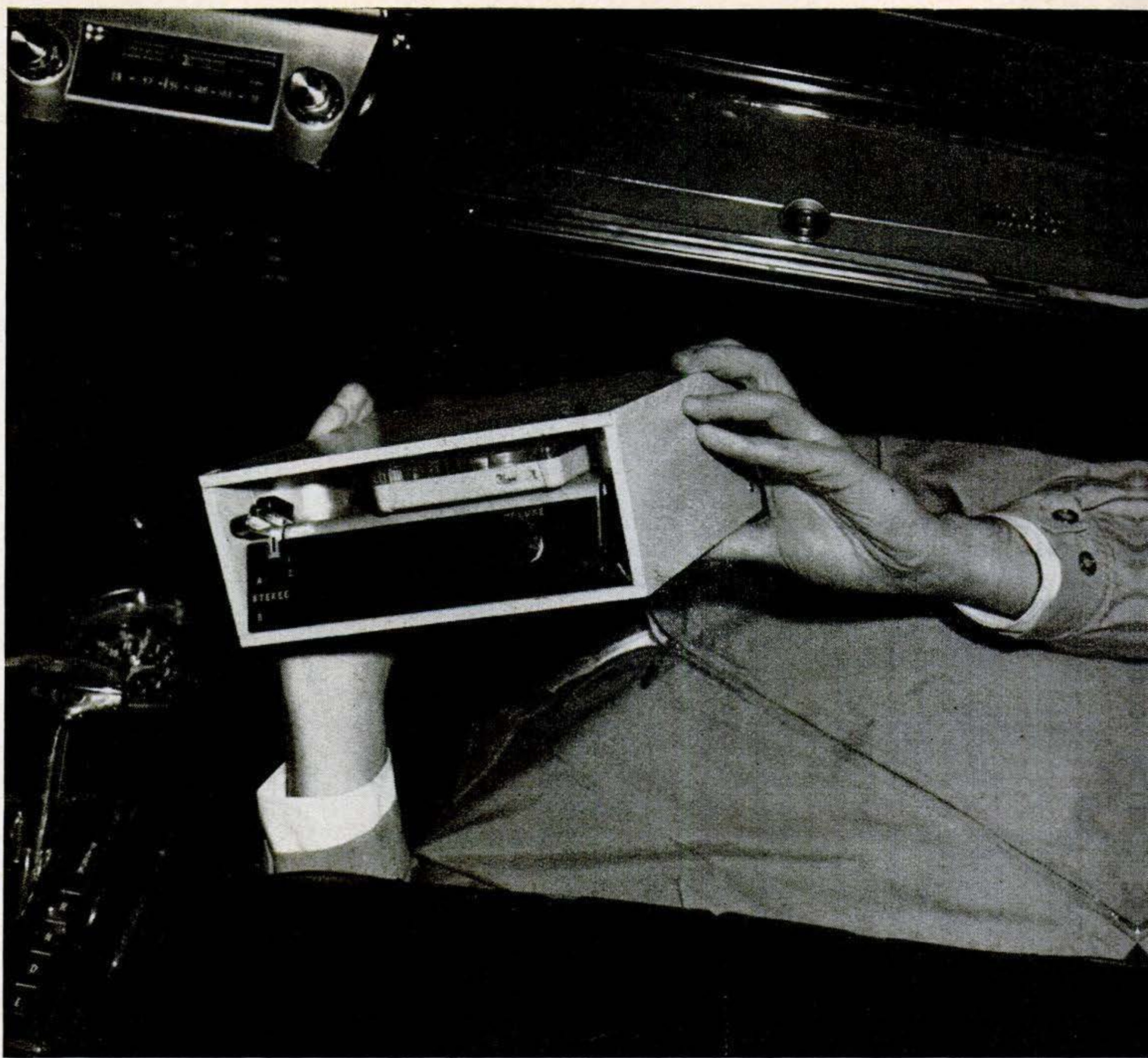
[Continued on page 236]



Minolta Electro Shot 35 has six-transistor, “programmed,” single-unit shutter/diaphragm (simplified diagram above). Shutter release closes circuit, activating electromagnet to open shutter. CdS cell controls current flow to capacitor which, when full, releases its current, depriving first transistor of base current and, through control transistor, activating closing electromagnet. About \$115.

Argus 270 features cartridge loading (Instamatic) and a programmed shutter/diaphragm. Ingenious mechanism is diagramed at right. Blades always move at same speed (1/30 second at full opening), but at smaller openings, with less travel distance, speed becomes equivalent to up to 1/600 second. Blades open and close around individual fixed pivots, but the extent of travel—and hence lens opening and speed—are limited by a moving pivot that rides in a slot in each blade. Position of this pivot is controlled by CdS exposure system. Pointer in viewfinder indicates aperture/shutter-speed settings. Cost: about \$70.

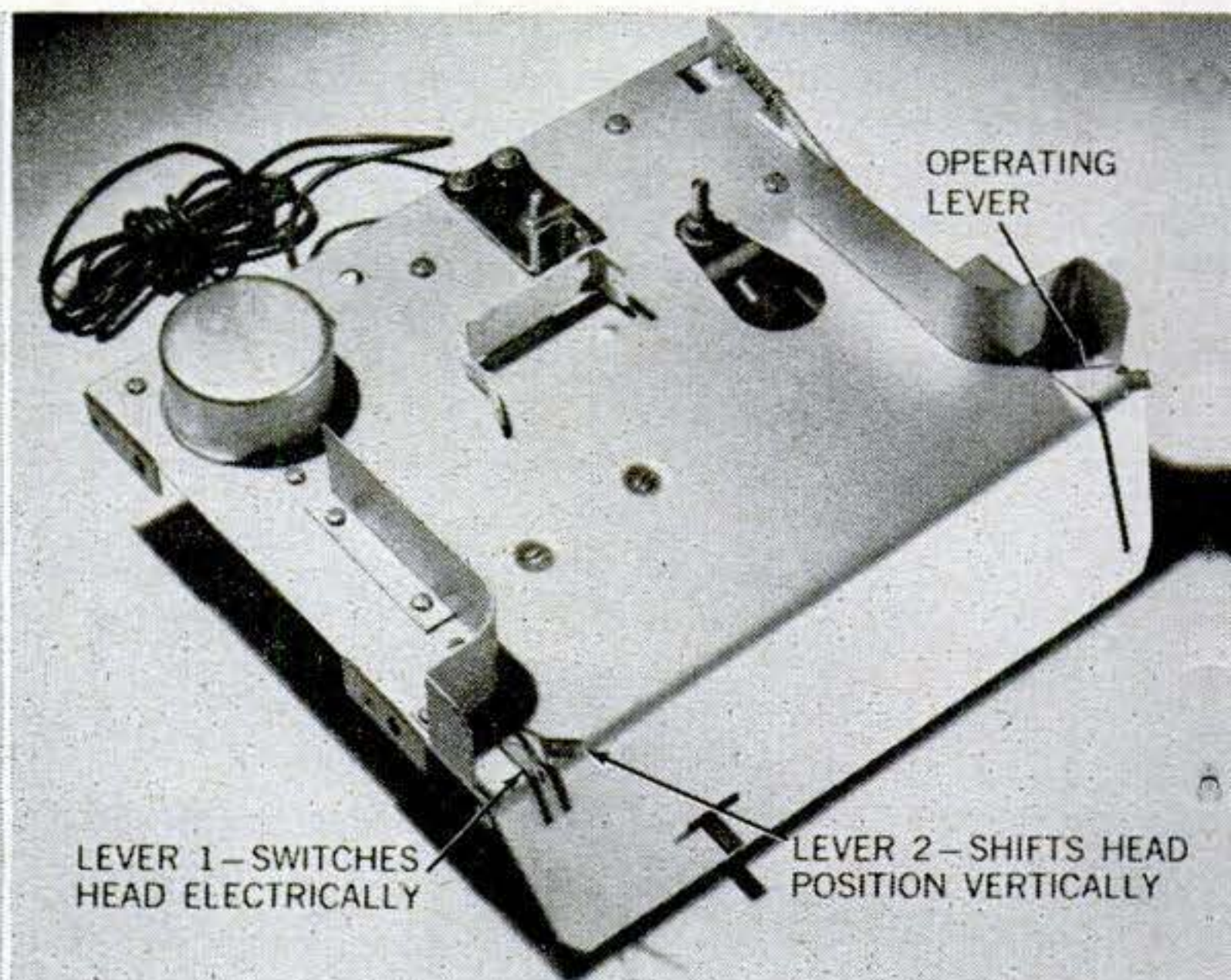




The player fits neatly beneath any dash. Mount the speaker in the rear-seat package shelf.



The "300" cartridge is loaded with 394' of lubricated tape, spliced to form a continuous loop. Monaurally recorded cartridges contain four adjacent music tracks, and play for a total of one hour.



This is what the postman brings: the preassembled tape transport. It has two track-selector levers: Lever 1 operates an electrical selector switch; Lever 2 shifts the tape head's position up and down.

You Can Build a TAPE PLAYER for Your Car

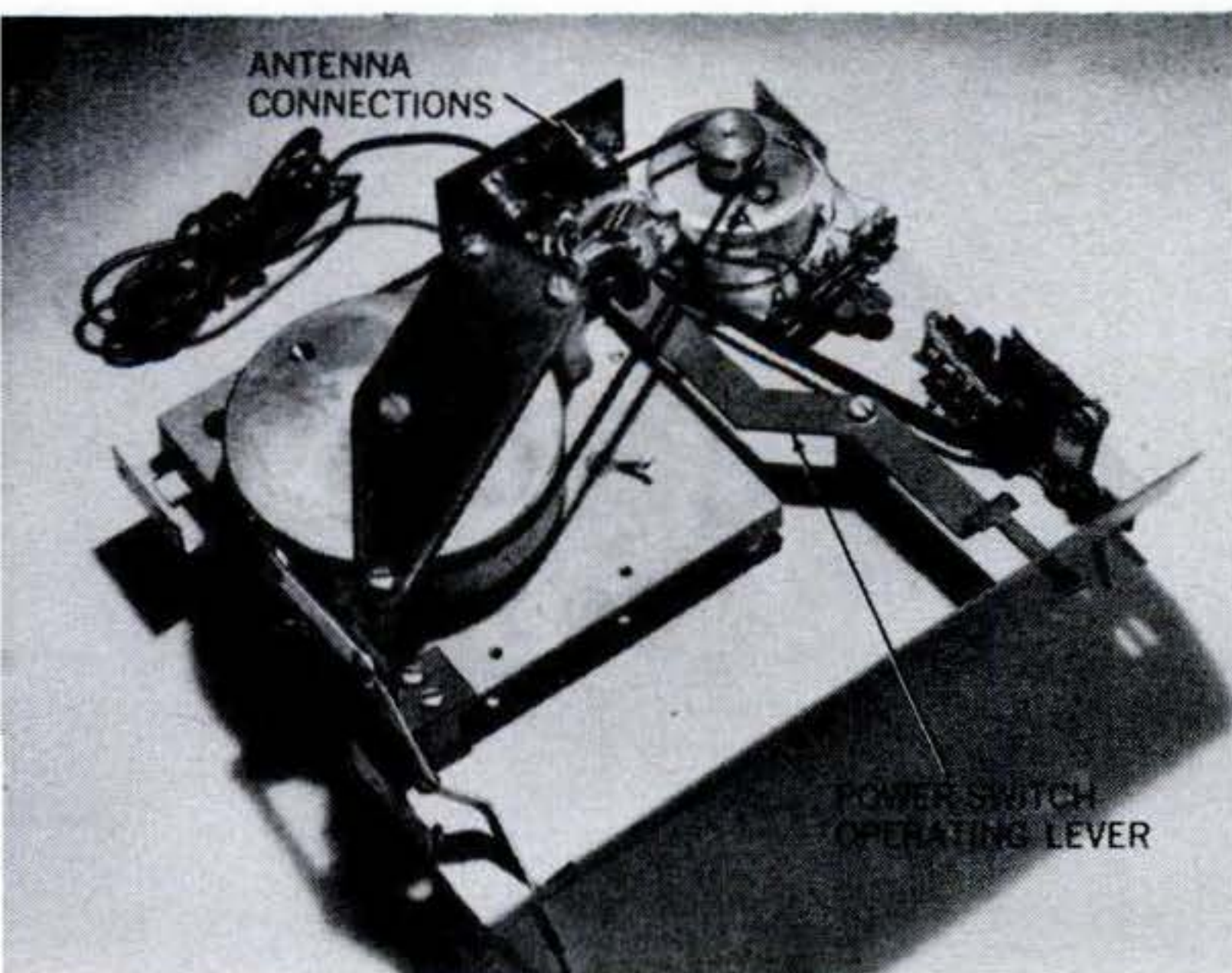
A preassembled tape transport makes it easy. Just add an all-transistor amplifier and you have highway hi-fi

By RONALD M. BENREY / PS Electronics Editor

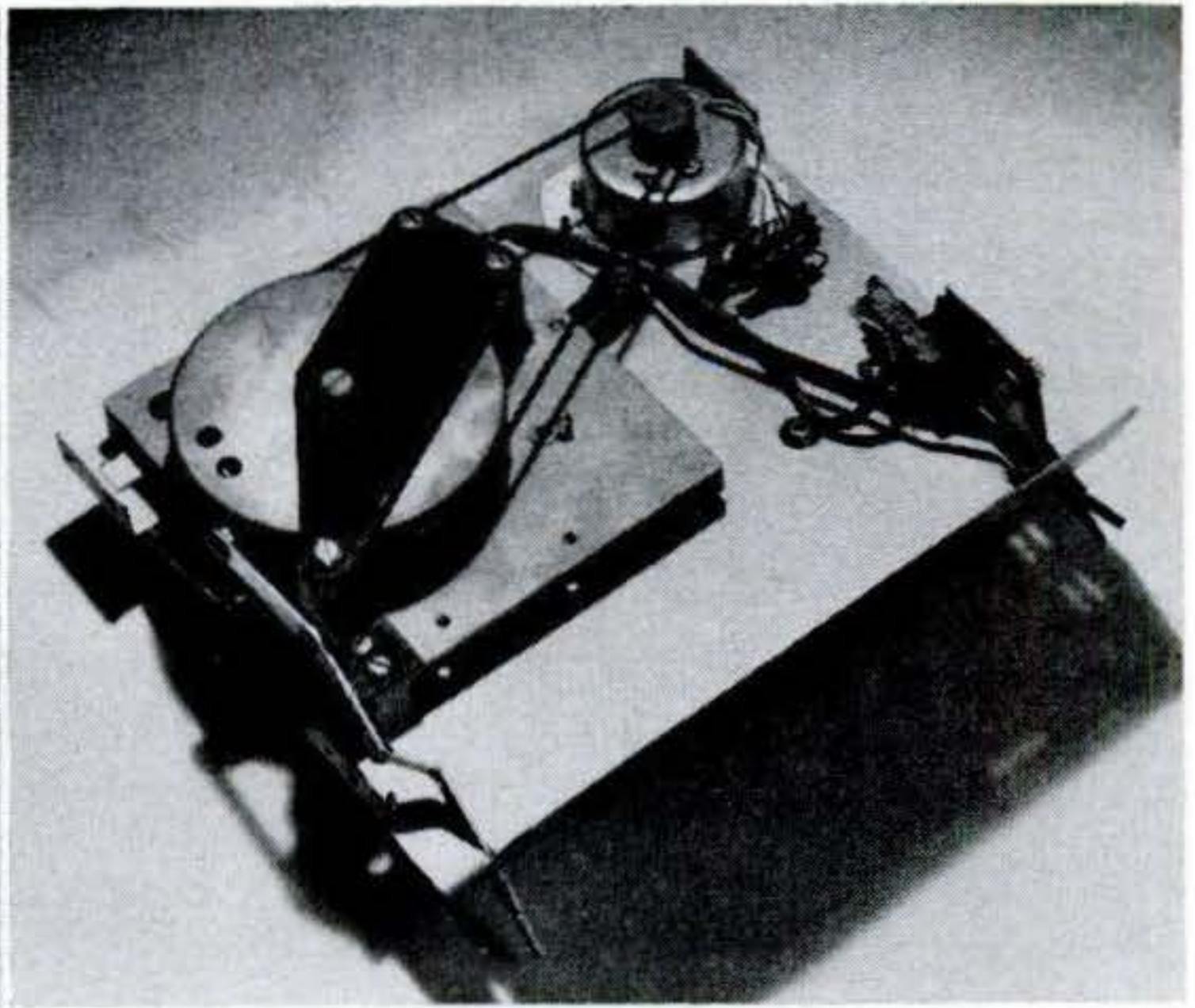
Bach, Beethoven, and Brahms come along with me every time I go for a drive, thanks to the tape-cartridge player hanging below my car's dash. This amazing miniature hi-fi system lets me listen to good music, without commercials, wherever I am: out on the highway, up in the mountains, or deep in a tunnel. I can operate the player without taking my eyes off the road—I just pop in a prerecorded tape cartridge and flip the operating lever into "play" position. There's no threading or rewinding, since the tape is permanently sealed inside the cartridge. Best of all, my tape player cost \$50 less than commercially installed units, because I built it myself. You can build one, too, in a few evenings, for less than \$60. The secret is the preassembled tape transport you order by mail (see parts list). Since the tricky mechanical assembly is complete, all you do is wire the two-watt power-amplifier chassis.

The player handles both standard "300"-size, and double-length "600"-size, four-track tape cartridges. Monaural cartridges contain four adjacent, independent tracks of music. You select a particular track by positioning two tape-head control levers (Levers 1 and 2 in the lower right photo on the facing page).

Continued



Before modification: The transport was originally designed for a tape player that connects to a car radio. Some of the fittings are unnecessary and must be removed. See photo at right for details.



After modification: As shown, you must remove the antenna connector and slide switch bracket (it's held on by two sheet-metal screws), and unbolt the switch-control arm assembly (with its support shaft).

Lever 1 operates the three-position slide switch S1 (built onto the transport—see schematic diagram) that electrically switches between the tape head's two windings. Lever 2 operates a two-position mechanical linkage that shifts the tape head vertically.

The three positions of Lever 1 are labeled (from top to bottom) "A," "Stereo," "B"; the two positions of Lever 2 are "1" and "2." These lever-position combinations select the various tracks:

TRACK	LEVER 1	LEVER 2
1	A	1
2	B	1
3	A	2
4	B	2

Note: To play a stereo cartridge, set Lever 1 at "stereo"—this electrically blends the left and right stereo channels to form a single monaural channel. Then use Lever 2 to select between the two stereo selections on the tape.

Building it. Start by assembling the amplifier module; it's built into a small aluminum minibox. The first step is to mount the driver power transistor Q3, and the two

output power transistors Q4 and Q5. Note that Q3 and Q4 must be electrically insulated from the aluminum box. Do this by placing the mica washers, supplied with the transistors, under them when you bolt them in place. Smear a bit of silicon grease on both sides of each washer before installing it. The washer and silicon grease are excellent electrical insulators, but allow heat dissipated by the transistors to flow into the box, which serves as a heat sink.

Mount Q5 flush against the aluminum surface—do not use an insulating washer.

All of the other components connected to Q3, Q4, and Q5 are mounted between two rows of terminal strips bolted inside the aluminum box.

Transistors Q1 and Q2, and their associated components, form a high-gain pre-amplifier circuit that boosts the tiny signal generated by the tape head to a level strong enough to drive the output amplifier stage. Most of the components are mounted on a small strip of perforated phenolic chassis board (Vectorboard). Use push-in terminals (flea clips) as soldering points. Mount

Continued

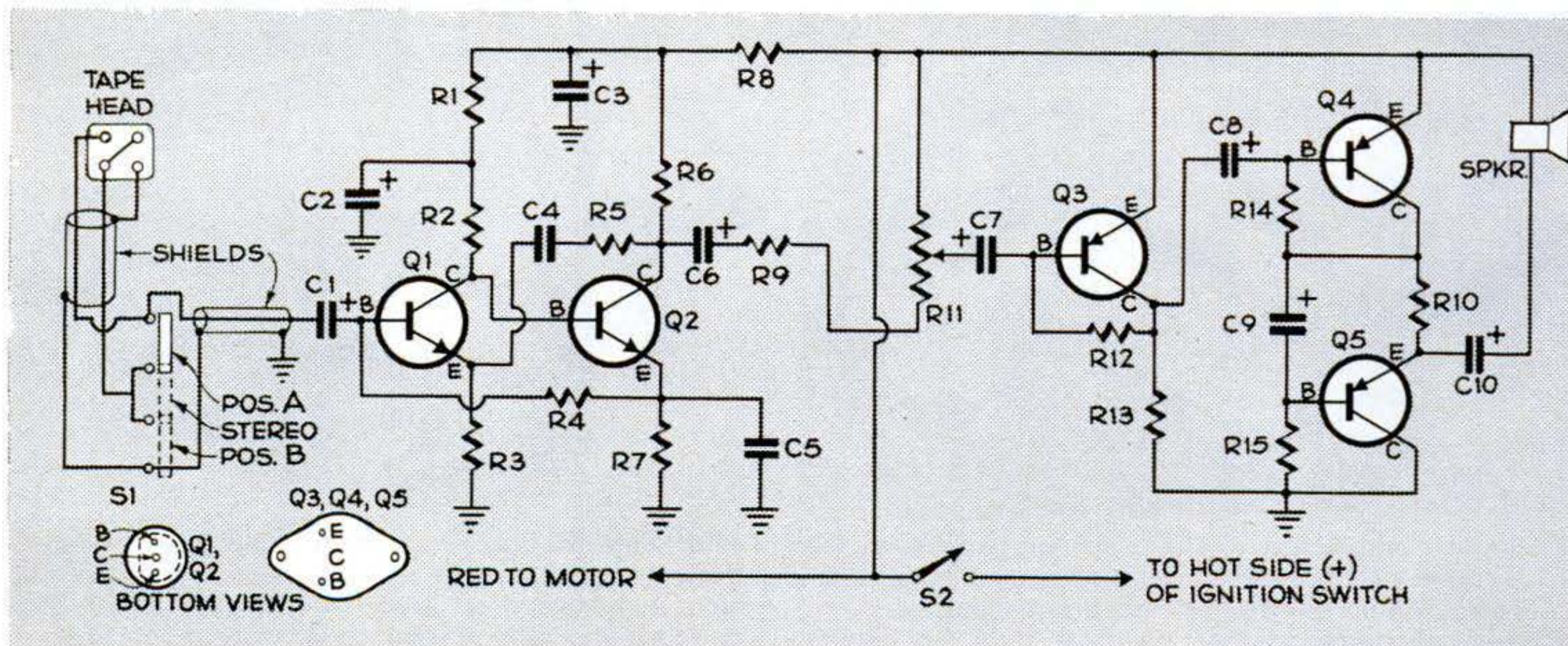
PARTS LIST

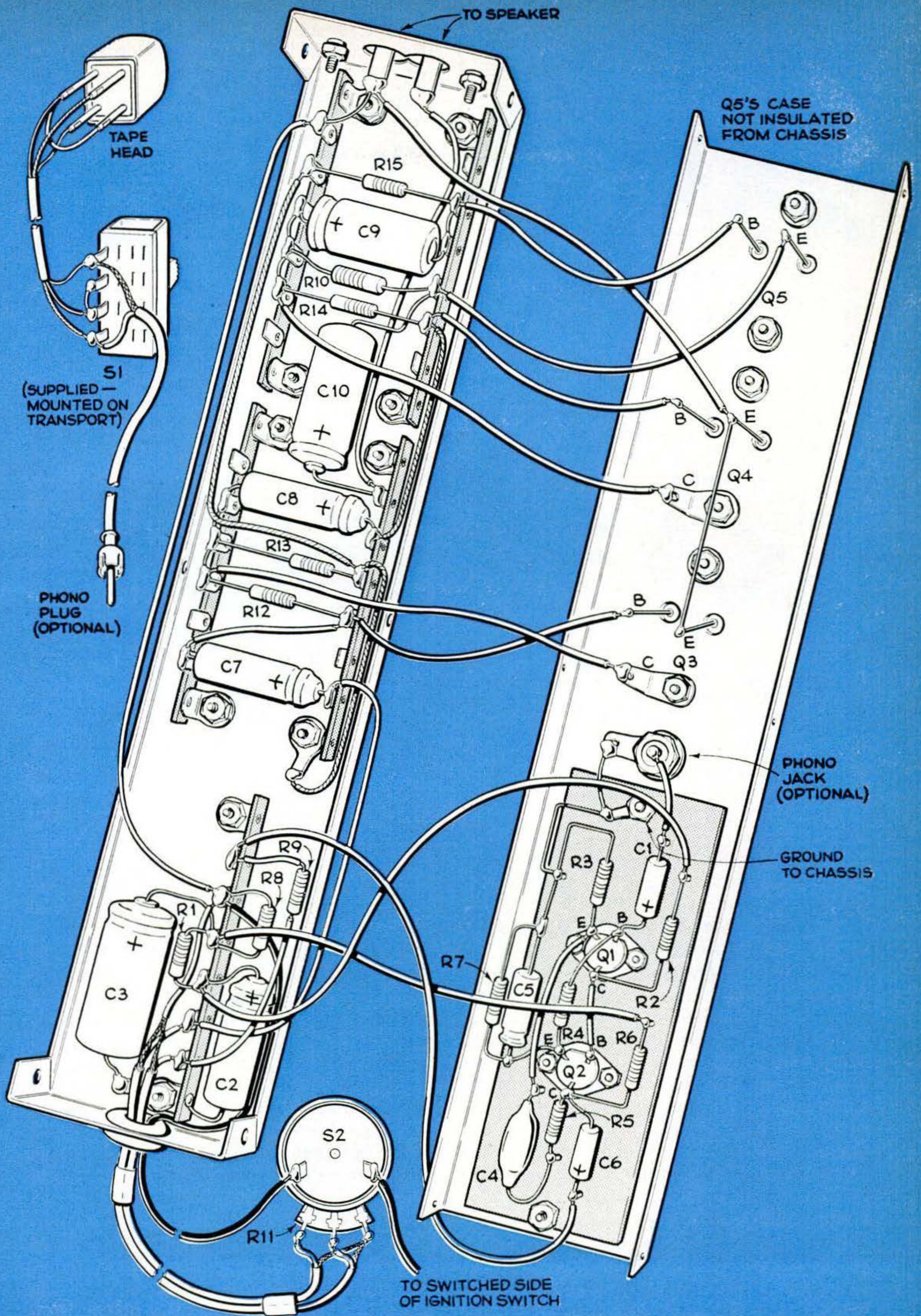
- R1, R6—4,700-ohm, 1/2-watt carbon resistor
- R2, R9—10,000-ohm, 1/2-watt carbon resistor
- R3—47-ohm, 1/2-watt carbon resistor
- R4—180,000-ohm, 1/2-watt carbon resistor
- R5—47,000-ohm, 1/2-watt carbon resistor
- R7—1,500-ohm, 1/2-watt carbon resistor
- R8—820-ohm, 1/2-watt carbon resistor
- R10—1-ohm, 2-watt carbon resistor
- R11—500-ohm, audio-taper

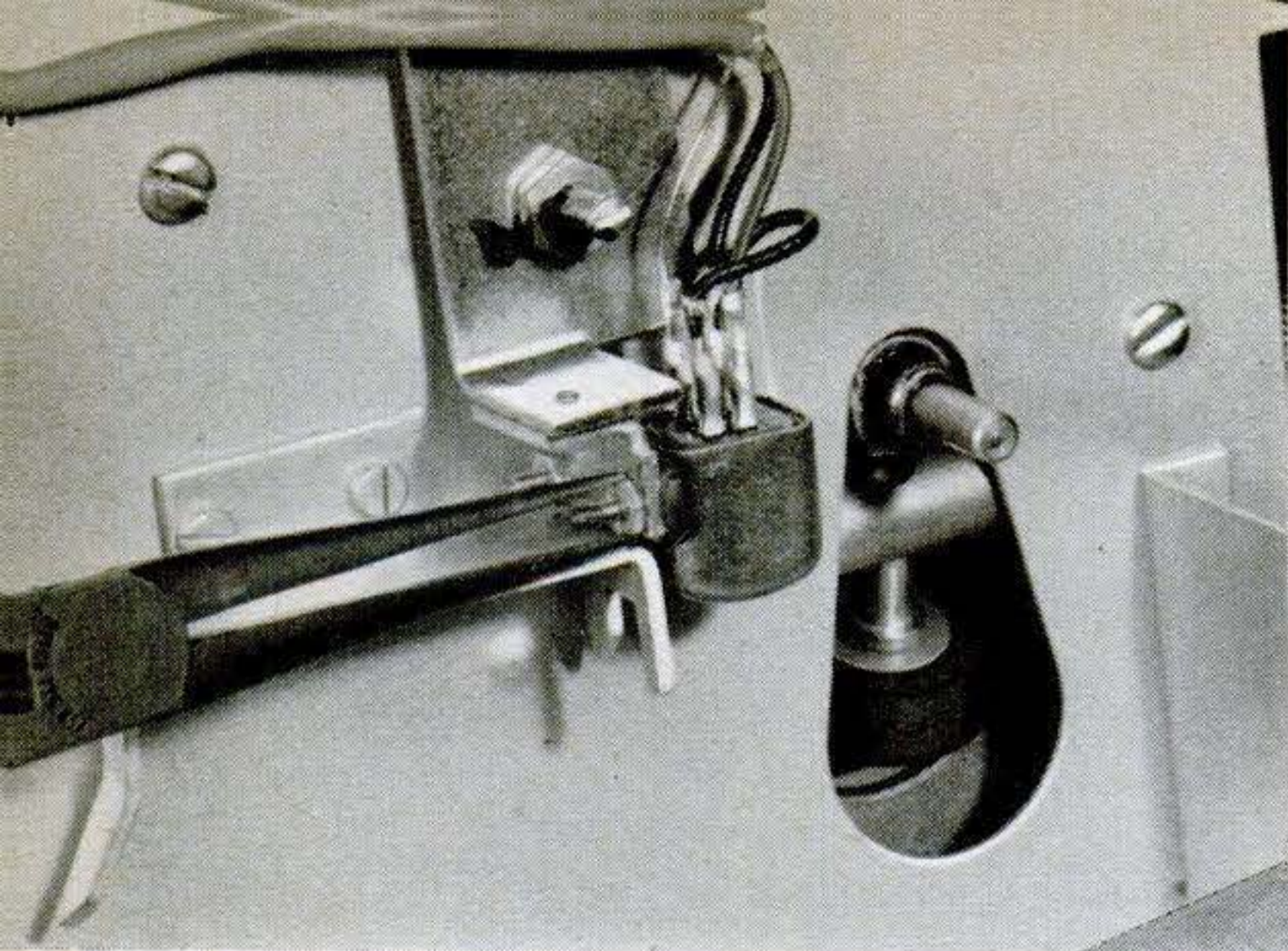
- carbon potentiometer
- R12—15,000-ohm, 1/2-watt carbon resistor
- R13—68-ohm, 1/2-watt carbon resistor
- R14, R15—470-ohm, 1/2-watt carbon resistor
- C1, C6—10-mfd., 10-volt electrolytic capacitor
- C2, C7, C8—100-mfd., 25-volt electrolytic capacitor
- C3, C10—500-mfd., 15-volt electrolytic capacitor
- C4—.0033-mfd. paper capacitor

- C5—100-mfd., 3-volt electrolytic capacitor
- C9—250-mfd., 15-volt electrolytic capacitor
- Q1, Q2—NPN transistors, type 2N2925 (GE)
- Q3, Q4, Q5—PNP power transistors, type 2N1971 (Delco)
- S1—slide switch (supplied with tape transport)
- S2—SPST on-off switch mounted on volume control R11
- Speaker—4-ohm auto-radic speaker. Mount in any convenient location.

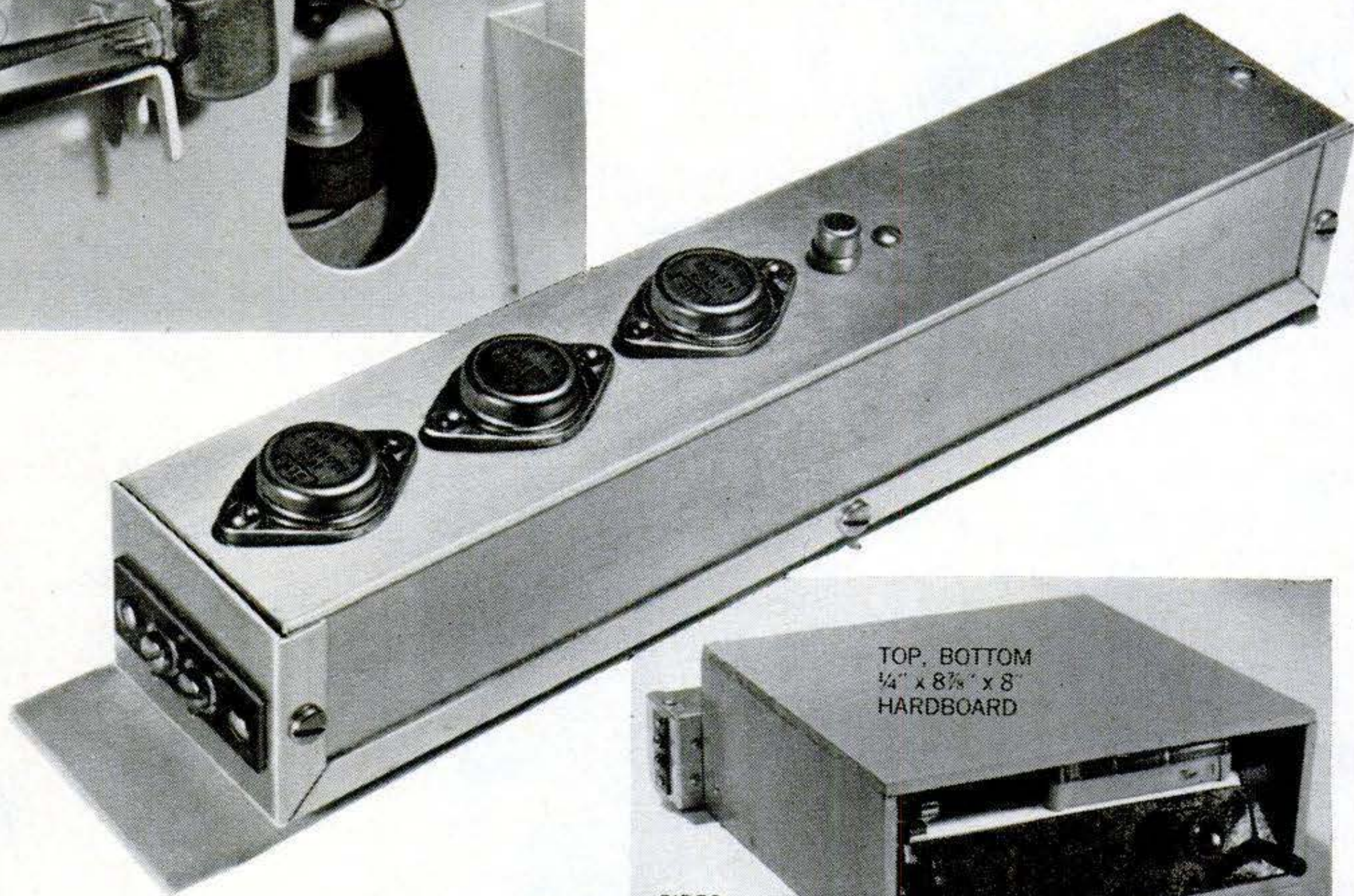
- Misc.—shielded audio cable; Vectorboard; push-in terminals; silicon power-transistor mounting grease; phono plug and panel-mount socket.
- Tape transport and tape head (for address of supplier, and additional construction details, send a legal-size, self-addressed, stamped envelope to TAPE PLAYER, c/o Popular Science, 355 Lexington Ave., NYC 10017.)



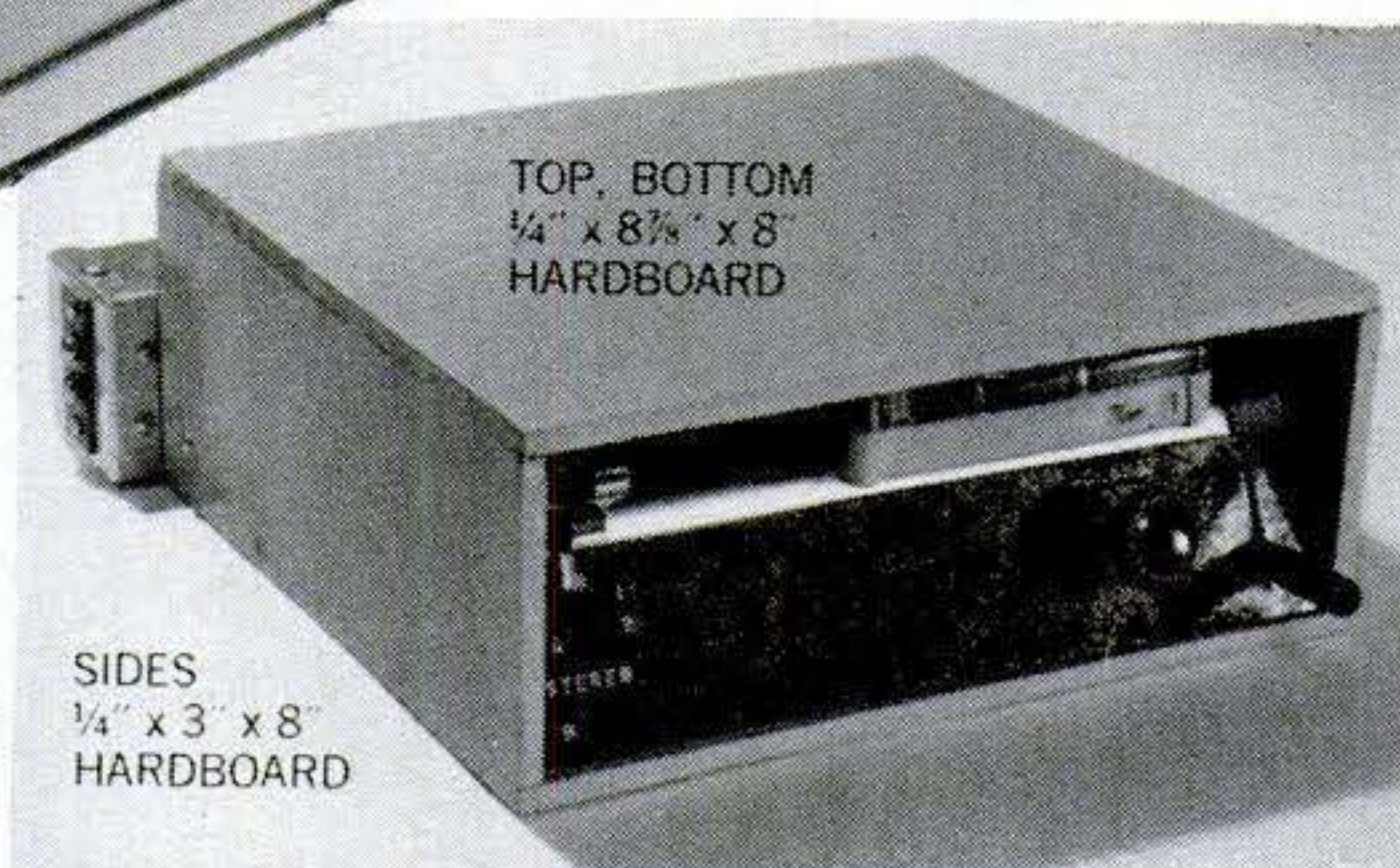




Azimuth adjustment involves a bit of trial-and-error fiddling. Start with the tape head perfectly vertical. Then play a selection on the unit and listen carefully for high-frequency response. Adjust azimuth slightly with needle-nose pliers, and listen again. Stop adjusting when you are happy with the highs.



Mount the amplifier module on the rear of transport enclosure with angle brackets, as seen at the right.



the two transistors in plastic miniature sockets. Keep a close watch for correct capacitor polarity as you work.

Mount the volume control, R11, on the tape transport. Connect it to the amplifier with two lengths of shielded audio cable. Make sure the outer braid does *not* touch the case or chassis anywhere.

Modifying the transport. Only slight modification is necessary. Here's how:

As shown in the photos on the bottom of page 187, remove the metal antenna-connector bracket by unbolting the two sheet-metal screws holding it to the transport's chassis. Then turn the transport over and unbolt the single support shaft that holds the switch-operating arm. Next, snip away the two-conductor shielded cable that runs to the motor wires. Do not disturb any of the components on the terminal strip mounted in front of the motor. Finally, rewire the motor connections: Connect the black-and-white motor wire to the chassis (ground) at the nearest convenient point; connect the free end of the small coil soldered to the motor's red-and-white lead (this end was connected to the red wire inside the shielded

cable) to the switched side of switch S2.

Mount the tape head as shown in the photo at the top of this page. Place a $\frac{1}{8}$ " aluminum spacer on the lower mounting bolt, a $\frac{1}{8}$ "-thick rubber grommet on the upper bolt. The soft grommet lets you adjust the relative sideways tilt—or azimuth—of the head for the best high-frequency response (see caption, top right, for details).

Connect S1 to the amplifier input with shielded cable. You can either solder the cable directly to the input point on the pre-amplifier chassis board (be sure to solder the outer braid to a grounding point), or, as shown in the pictorial diagram, you can wire a phono plug to the end of the cable and mount a corresponding input jack on the aluminum box.

The cabinet. You can make a simple enclosure for the transport from $\frac{1}{4}$ " tempered hardboard (photo above). Paint the sloping front of the transport a contrasting color. Fashion knobs for the operating levers from plastic tubing. Use angle brackets to mount the amplifier module on the rear of the transport, and to suspend the player from the dash.

PERSONAL-USE REPORT: The Lounge Chair You Listen To



Once upon a time, musical chairs was strictly kid stuff. Not any more. Here's a reclining chair that hides a built-in, automatic, stereo tape-cartridge player behind a door in the armrest. The Lear-Jet tape machine is similar to underdash players for car installation [PS Sept. '65], and plays the same prerecorded, eight-track, continuous-loop cartridges.

A power amplifier under the seat drives two speakers at ear level in the backrest. To operate the player, just pop in a cartridge—no threading, rewinding, or tape handling. The rig plays 80 minutes of stereo music while you lean back and listen.

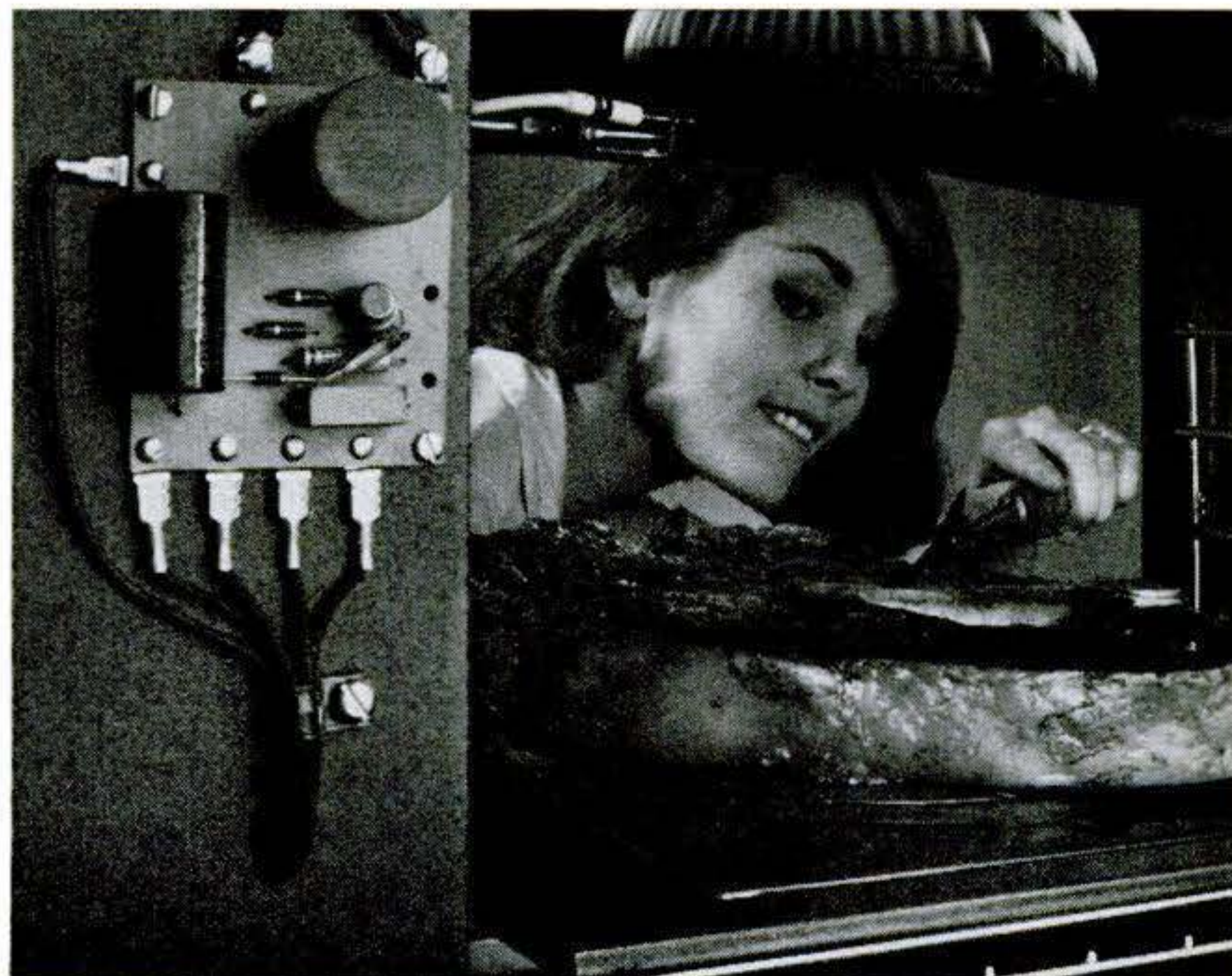
How does it sound? Like a good-quality AM table radio. The built-in speakers are rather small, and tape speed is a very slow $1\frac{1}{8}$ inches per second, which severely limits high-frequency response. Wind noise masks this in a moving car, but in a quiet living room, I found the lack of highs noticeable, and occasionally annoying, when I listened to treble-filled classical selections. Fidelity was perfectly adequate, though, for less-demanding pop tunes and "background" music.

Depending on style and upholstery, a "Stereolounger" costs from \$255 to \$400. Berkline Corp., Morristown, Tenn.—*R.M.B.*

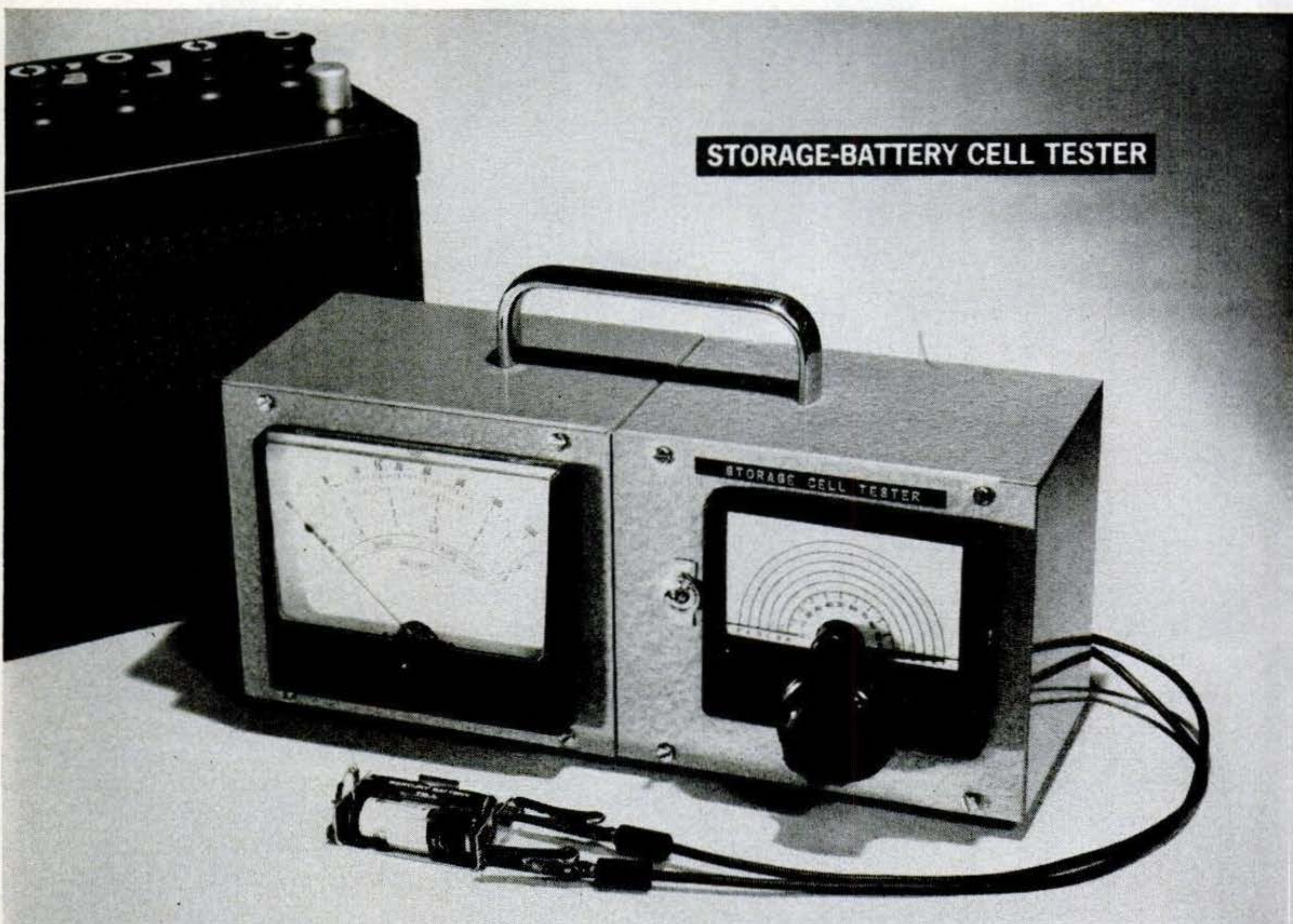
Solid-state "pilot light" proves electronics is at home on the range

Problem: How to eliminate the pilot lights on gas ranges and other gas-fired appliances, which waste gas and throw off excess heat?

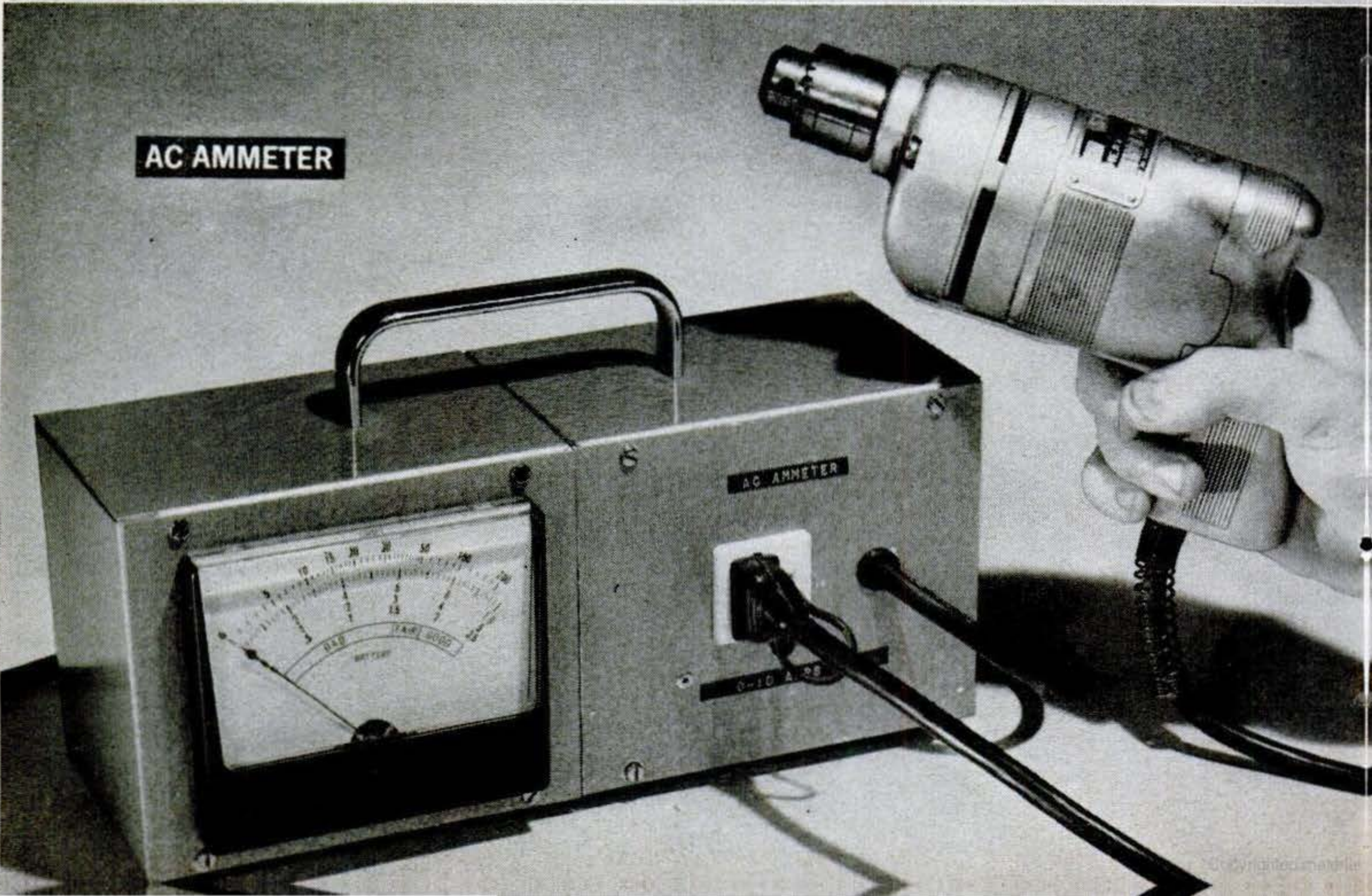
Solution: an "electronic match" similar to an automotive capacitor-discharge ignition system. A silicon-controlled rectifier acts as an electronic switch. The SCR repeatedly empties a charged capacitor through a spark coil to generate a series of sparks that ignite the gas jet. A flame-sensitive disconnect switch then turns off the device. It's made by the Wilcolator Co., Elizabeth, N.J., for use on new ranges.



Popular Science's



STORAGE-BATTERY CELL TESTER



AC AMMETER

9-in-1 Troubleshooter

This month: Complete the instrument by adding a storage-battery cell tester, and an AC ammeter

By **RONALD M. BENREY** / *PS Electronics Editor*

Here are two test meters—one measures voltage, the other current—that are definitely unusual. Both are designed as modules that plug into the universal meter housing described in February PS and pictured below (right).

• The storage-battery cell tester is a highly accurate potentiometer-type DC voltmeter with a measuring range of 1.8 to 2.8 volts—perfect for monitoring the voltages of the individual cells in a lead-acid storage battery. It works by balancing the storage cell's unknown voltage against that of an adjustable internal voltage standard. When they are equal, the panel meter, M1, shows a zero reading, and you read voltage off the variable standard's calibrated vernier-drive scale.

• The AC ammeter measures current flow through an AC-powered appliance, from 0 to 10 amperes, without any direct connection to the appliance. Its heart is a homemade current transformer that produces an AC voltage output proportional to current flow. A simple voltmeter circuit converts the voltage into a meter reading corresponding to AC current.

The cell-tester module. Its internal adjustable voltage standard consists of a variable-ratio voltage divider—resistor R3 and potentiometer R2 (see schematic diagram on next page)—wired across two series-connected mercury pencil cells.

R2's shaft is driven by a planetary-gear vernier mechanism to increase resolution—four turns of the vernier's knob rotate R2's shaft one half turn.

Make test leads by connecting an alligator clip to one end of each of two 5' lengths (one red, one black) of rubber-insulated flexible test-lead cable. Connect the other ends directly to the terminal strip on the module panel. When you install the module in the meter housing, pass the test

leads out through the opening in the housing's rear panel.

Note: On many newer storage batteries, the individual cell terminals are hidden beneath a rubber or plastic top. Use two straight pins (from your wife's sewing basket) as temporary terminal extensions—just push them through the soft top until they contact the terminals below.

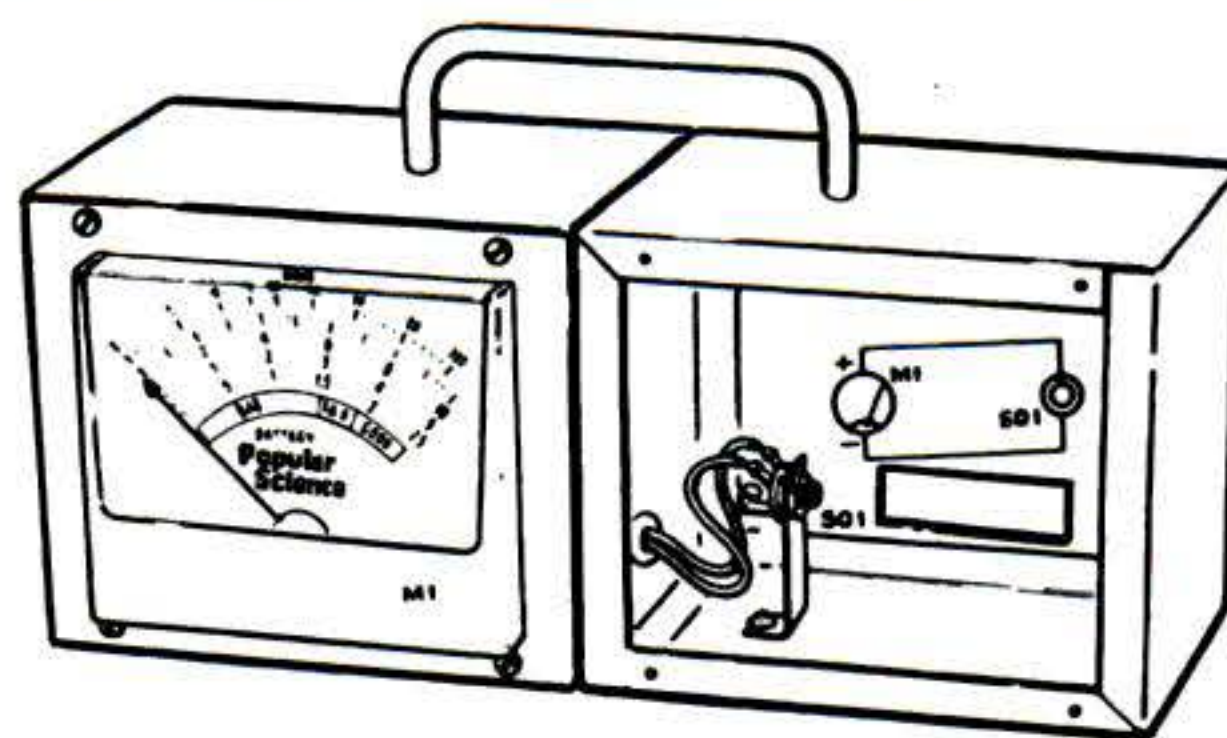
Calibration and use. Calibration is a straightforward mechanical operation. Begin by temporarily removing the vernier dial. Connect the calibrator (see diagram) and adjust R2 for a zero reading on M1. Turn the vernier's knob until its pointer is full clockwise (100 on its logging scale), mount it on R2's shaft, and tighten the set-screw.

The 0-to-100 linear logging scale on the dial now corresponds to a linear 1.8-to-2.8-volt DC voltage scale, calibrated in hundredths of a volt.

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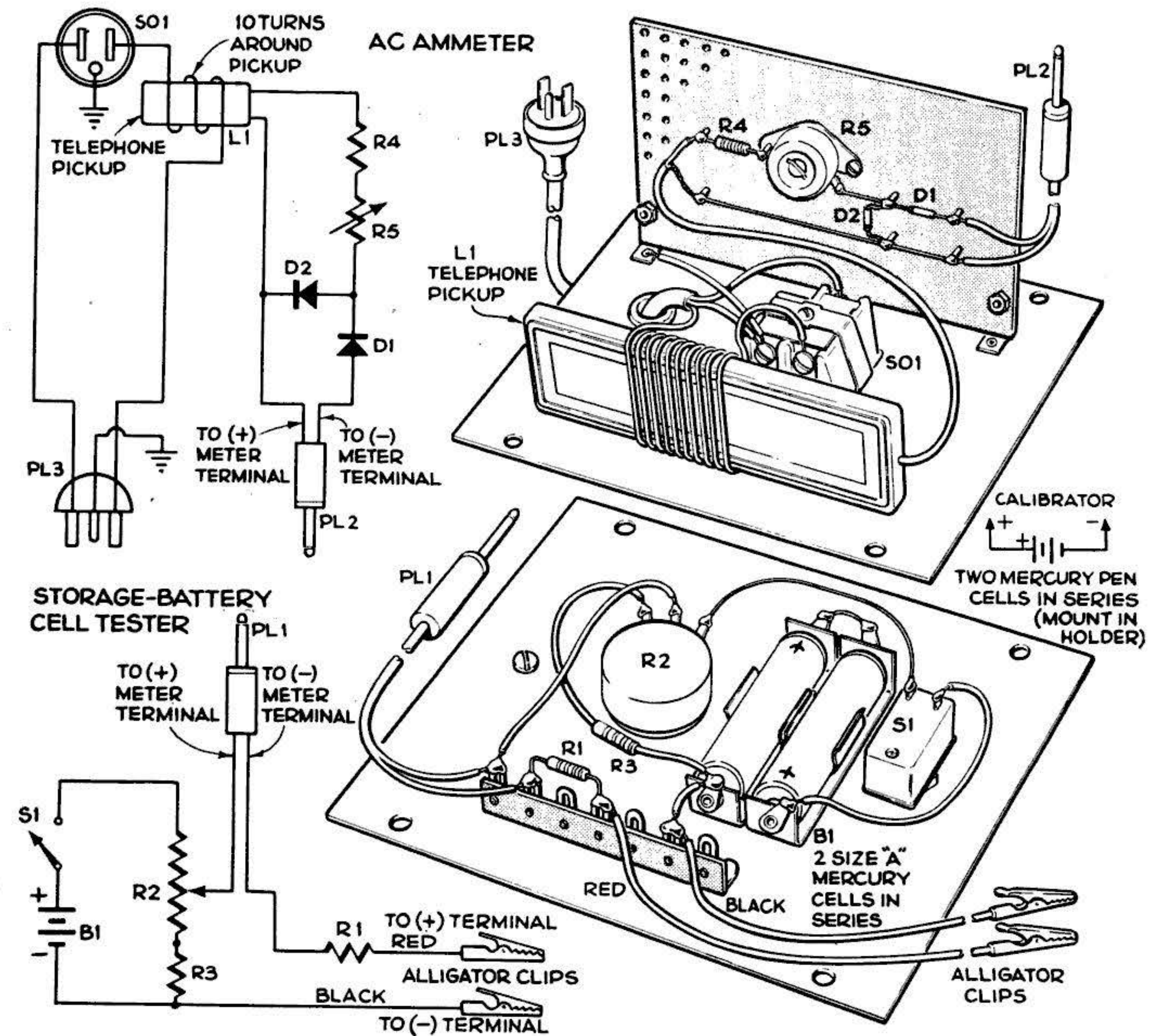
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The universal meter housing



Make it by bolting together two 5"-by-6"-by-4" aluminum "utility" cases. Cut extra right-hand front panels for the various modules from sheet aluminum. M1 is a Simpson Wide-View, model 1329, 0-1-milliamperes DC panel meter. SO1 is a standard phone jack—mount it on an insulated angle bracket. See pages 114-117 of February PS for more information.

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PARTS LIST

- | | | | |
|--|---|---|---|
| <p>R1—1,000-ohm, ½-watt, carbon resistor</p> <p>R2—2,500-ohm, single-turn, precision rotary potentiometer (I.R.C. type, 151-2,500 ohm, Allied Radio stock no. 31-Z-550-C.)</p> <p>NOTE: Resistors R3 and</p> | <p>R4 are 1% tolerance precision units</p> <p>R3—698-ohm, ½-watt, film resistor</p> <p>R4—6,040-ohm, ½-watt, film resistor</p> <p>R5—1,000-ohm, hum-adjust potentiometer</p> <p>D1, D2—1N34A (or equal)</p> | <p>germanium diodes</p> <p>L1—telephone pickup coil</p> <p>PL1, PL2—phone plug</p> <p>PL3—3-pin, 120-volt AC power plug</p> <p>SO1—3-pin, panel mount, 120-volt AC socket</p> <p>B1—2 size "A" mercury pen cells mounted in</p> | <p>within a holder.</p> <p>Calibrator—same as B1</p> <p>S1—SPST toggle switch</p> <p>Misc: alligator clips, Vectorboard, flea clips, 3-wire power cord, test-lead cable, vernier-drive mechanism (Millen type 10039 or equal)</p> |
|--|---|---|---|

Before you take a reading, always set the vernier's pointer at 2.8 volts. Then connect the test leads, flip on toggle switch S1, and turn the vernier's knob to obtain a zero reading on M1. Turn off S1 as soon as you have a meter "null."

AC-ammeter module. To an appliance, this circuit looks and acts like a simple extension cord. There's a big difference, though—one side of this "extension cord" forms the 10-turn primary winding of an instrument current transformer—the secondary winding is a telephone pickup coil, L1.

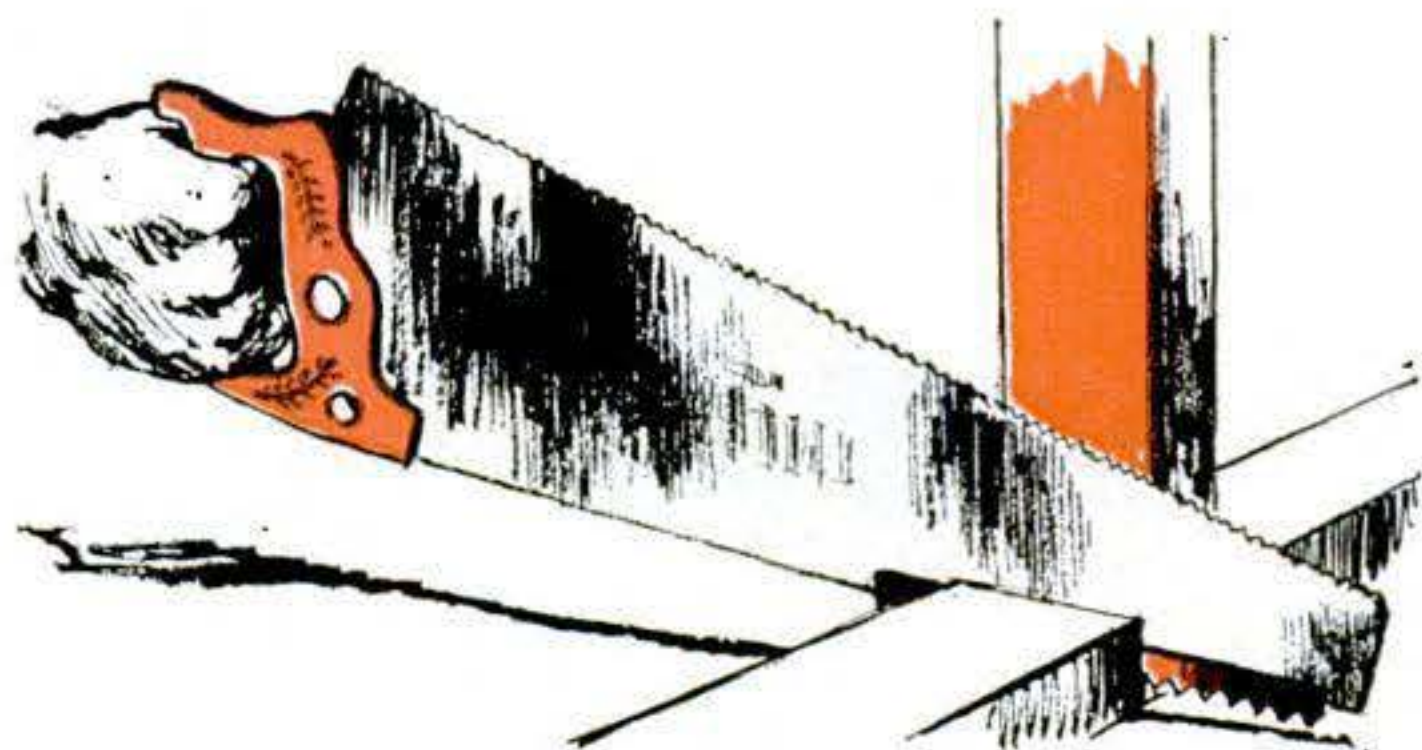
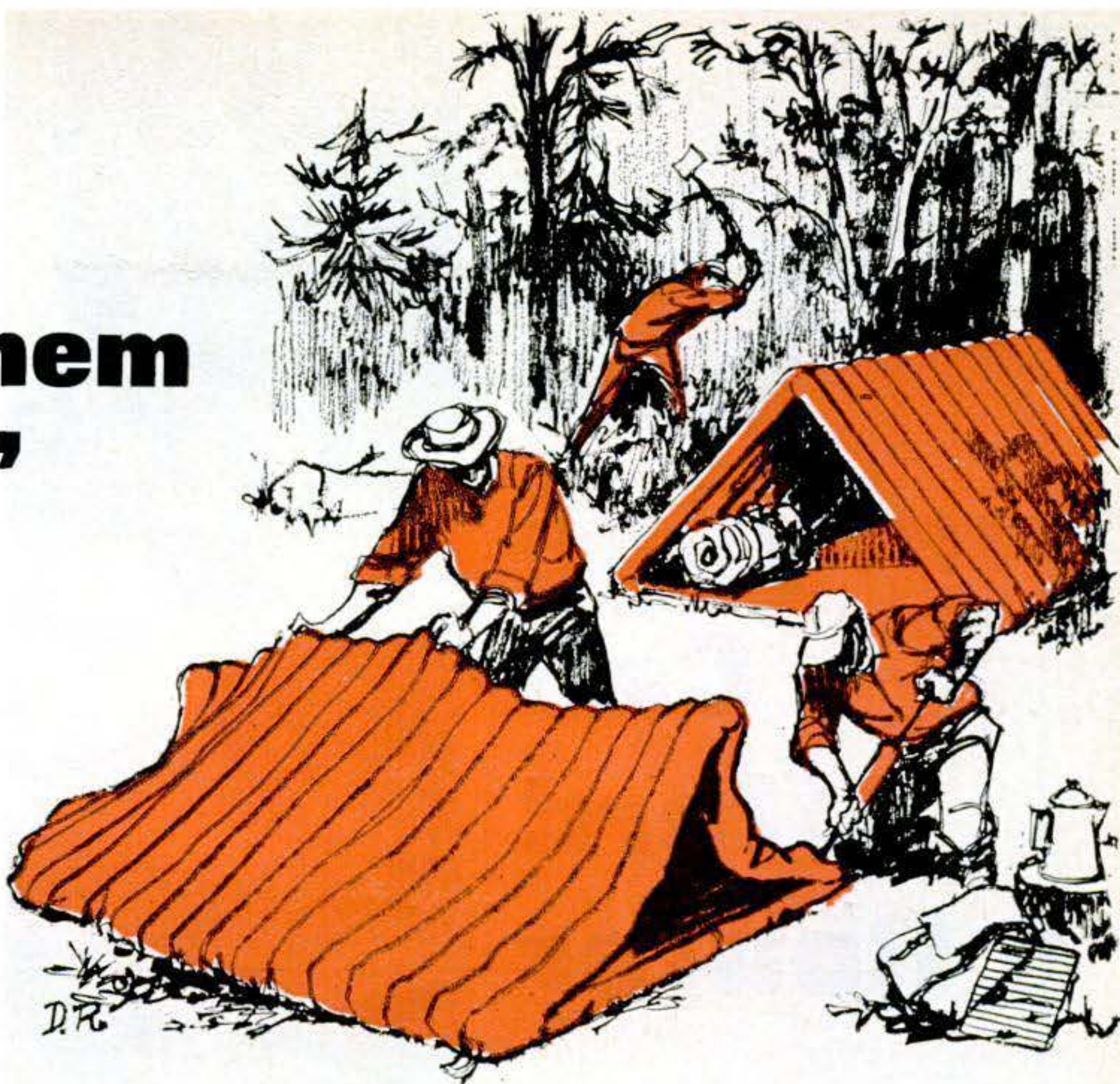
The voltage induced in the secondary is proportional to the current flowing through the primary.

Mount L1 with an aluminum angle bracket cemented (with epoxy) to its case. Mount the AC-voltmeter components on a piece of perforated phenolic chassis (Vectorboard).

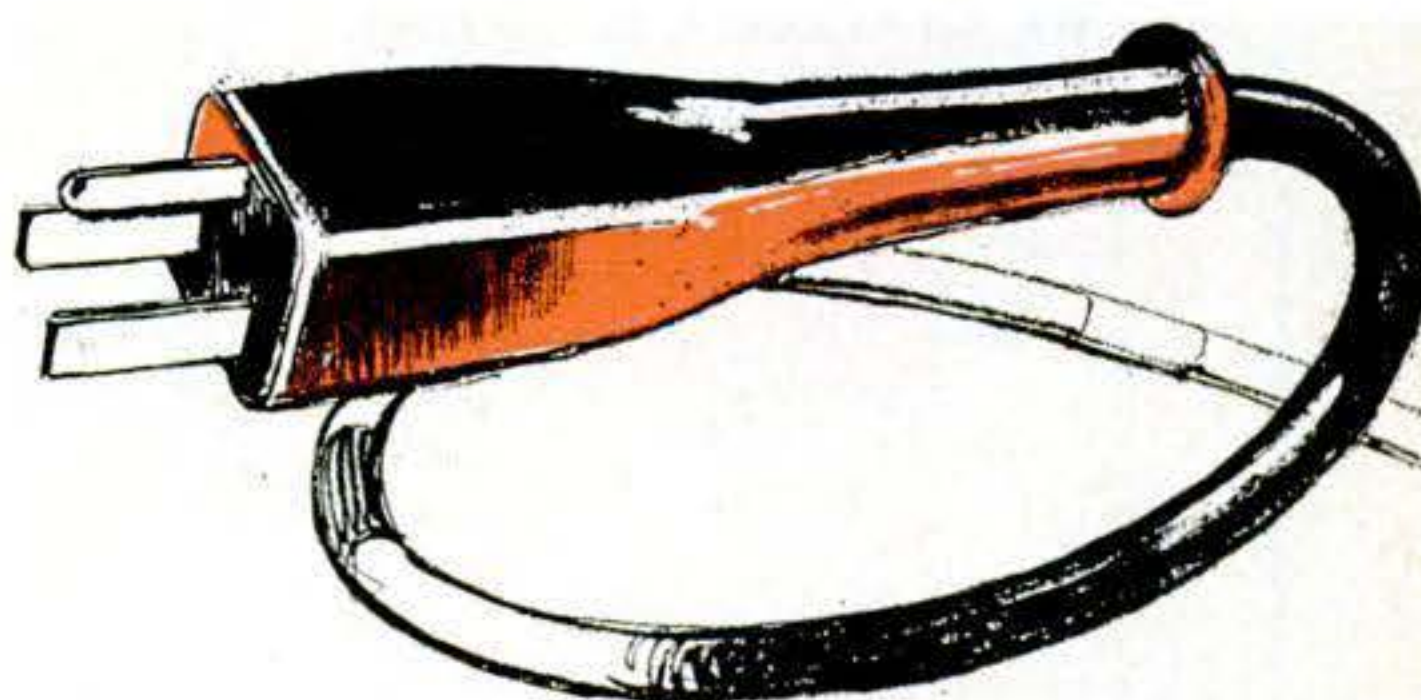
Calibration. A table lamp equipped with a 150-watt bulb makes a fine calibrator. Plug it into the panel-mounted power socket, and adjust potentiometer R5 for a meter reading of 1.25 amperes AC.

"I'd like to see them make..."

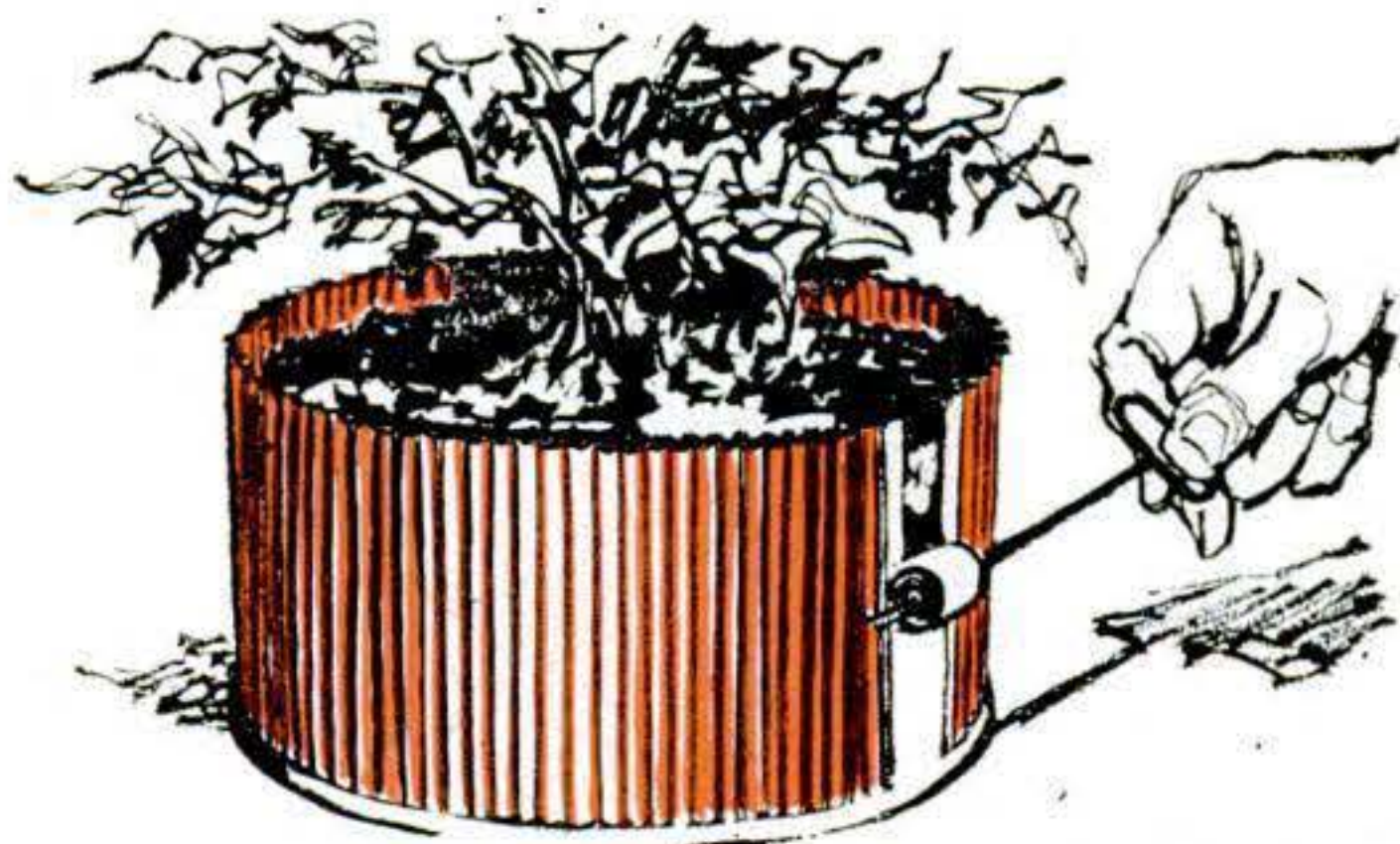
A blow-up tent, foam-rubber-padded for insulation, and lined with Mylar. You'd just lay it on the ground, pump air between liner and insulation, and be housed.—*W. E. Hoelzel, Chicago.*



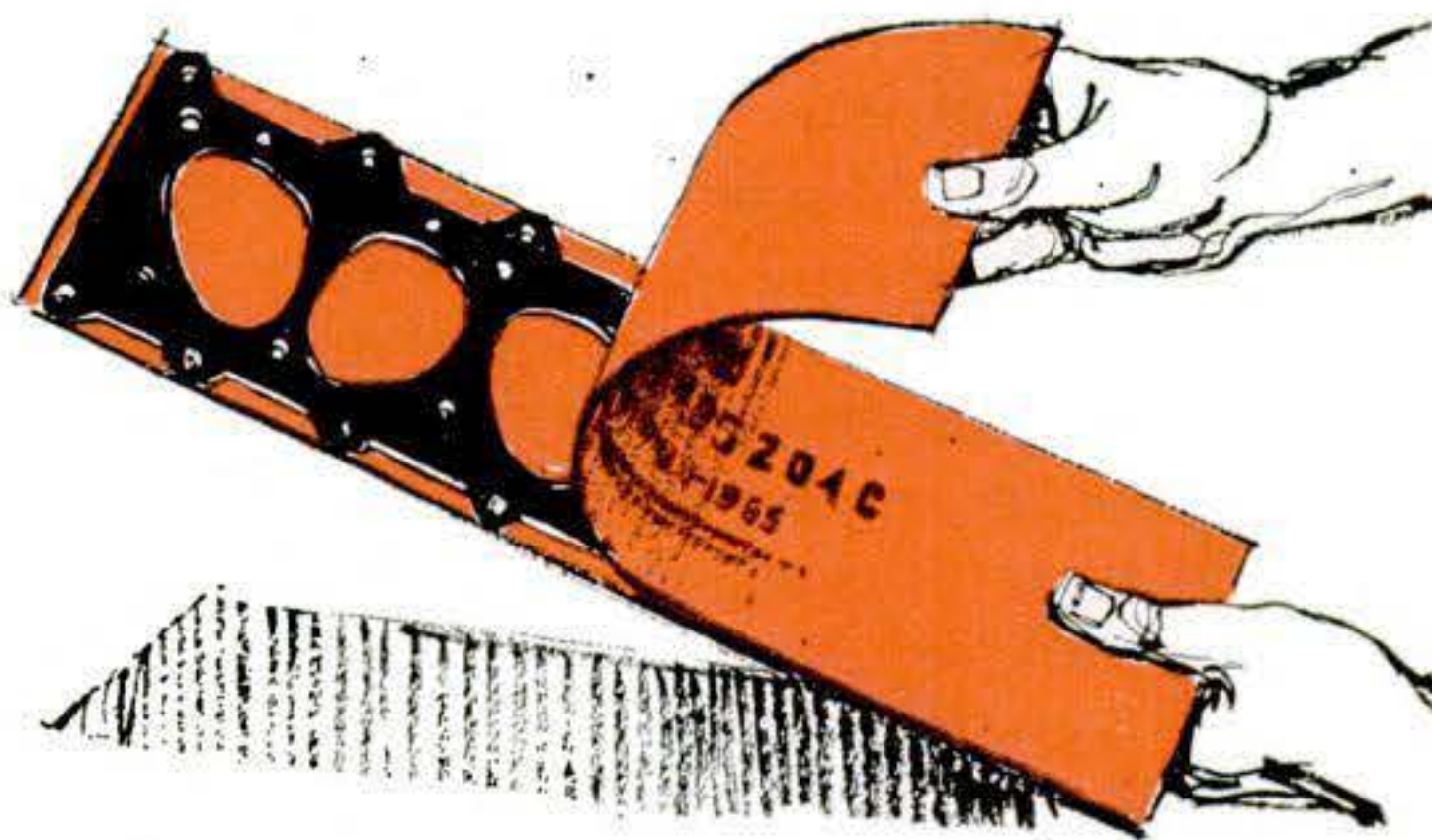
Reversible handsaw with some coarse teeth on the back. Carpenters could use it for making the finish cut when sawing out doorsills on concrete slabs.—*R. R. Horst, Lima, Ohio.*



Yankable electric cords for shop machines, vacuum cleaners, mowers, etc. The wire would be protected by the long neck of a flexible rubber plug.—*C. E. Johnson, Hayward, Calif.*



Metal plant cans with an opening strip down one side so you could get out the plant without breaking it off or damaging roots with tin snips.—*L. R. Trussell, Escondido, Calif.*



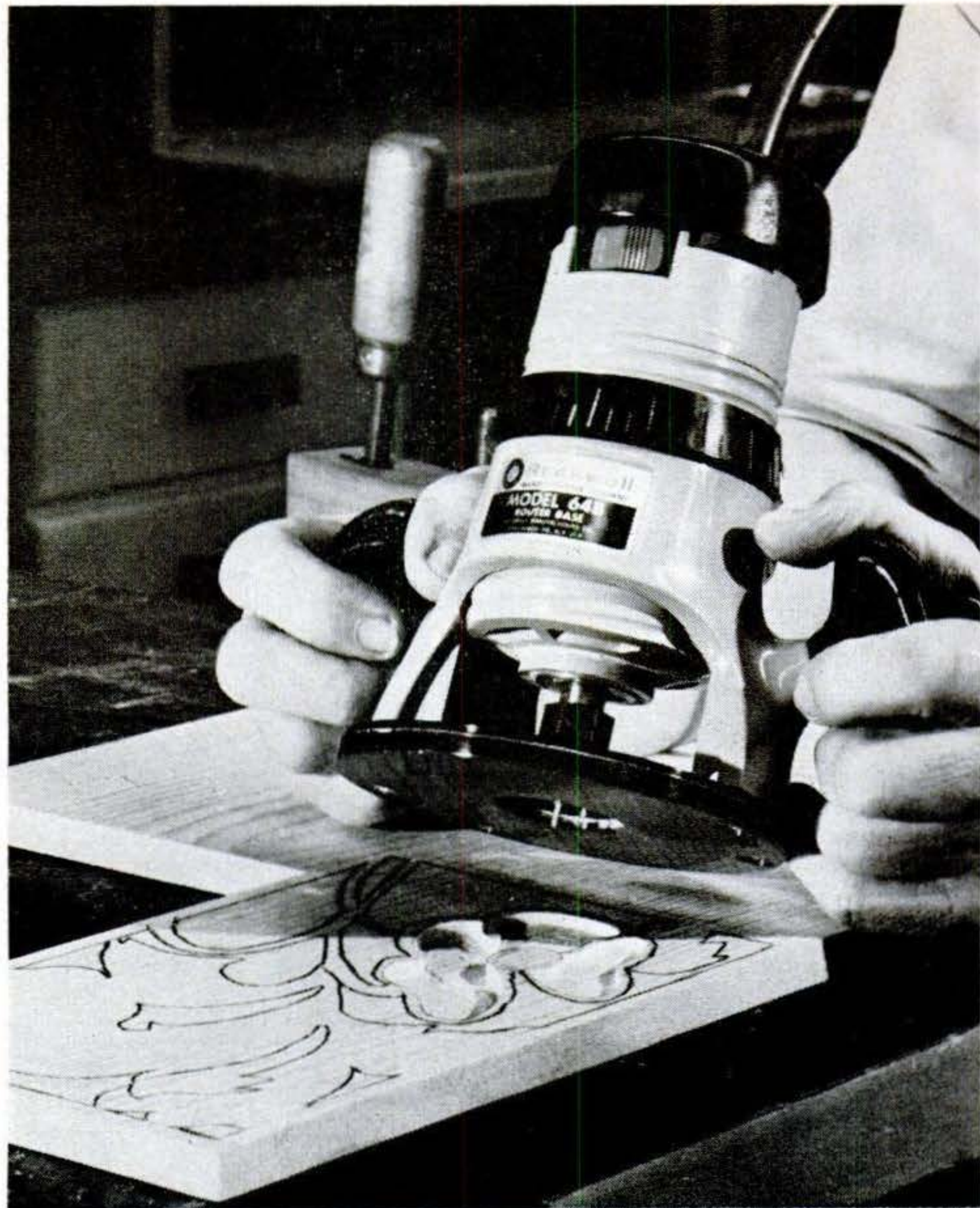
Head gaskets with a nonhardening sealant already applied, protected by peel-off paper. They'd save auto mechanics' time and be less messy.—*Mel Busch, Jeffersonville, Ohio.*

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

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Now Everyone Can Afford a Router

By CHARLES E. RHINE
PS Home Workshop Editor



Rockwell router, Model 64, sells for \$39.95. It's powered by a $\frac{1}{2}$ -hp. motor that runs at 28,000 r.p.m. As seen above, it makes fast work of freehand routing of decorative designs in woodwork.

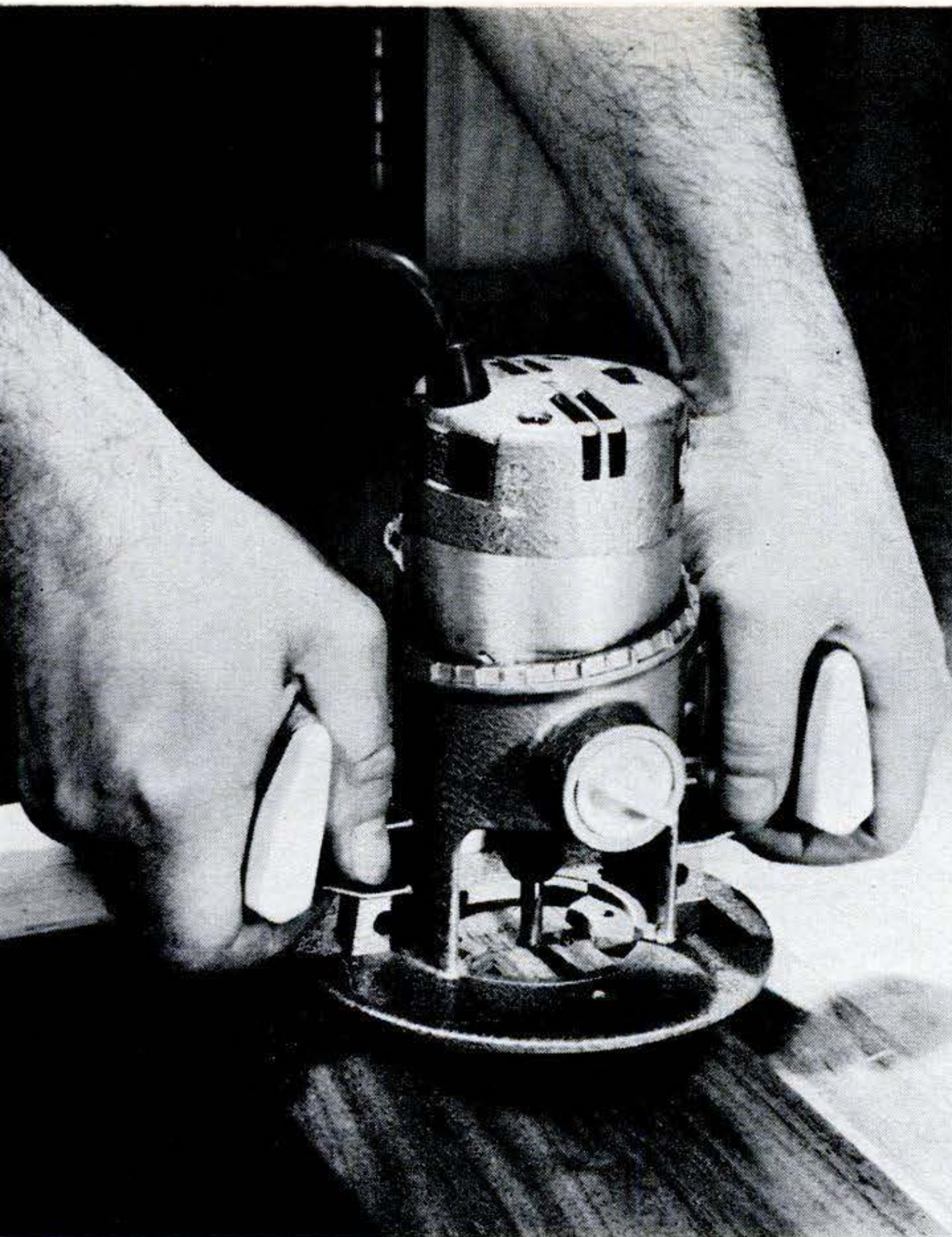
By reducing size and power, Stanley and Rockwell come

A lot of home craftsmen have no idea of all the woodworking jobs a router can do. Maybe this is because the tool was considered too expensive—from \$45 to \$145—for the average home shop. At any rate, this tool for advanced carpentry and furniture making has been largely confined to professional cabinet shops. But now both Stanley and Rockwell have come out with low-priced routers that do all the jobs the heavy-duty models do. And you can enjoy expert woodworking the easy way.

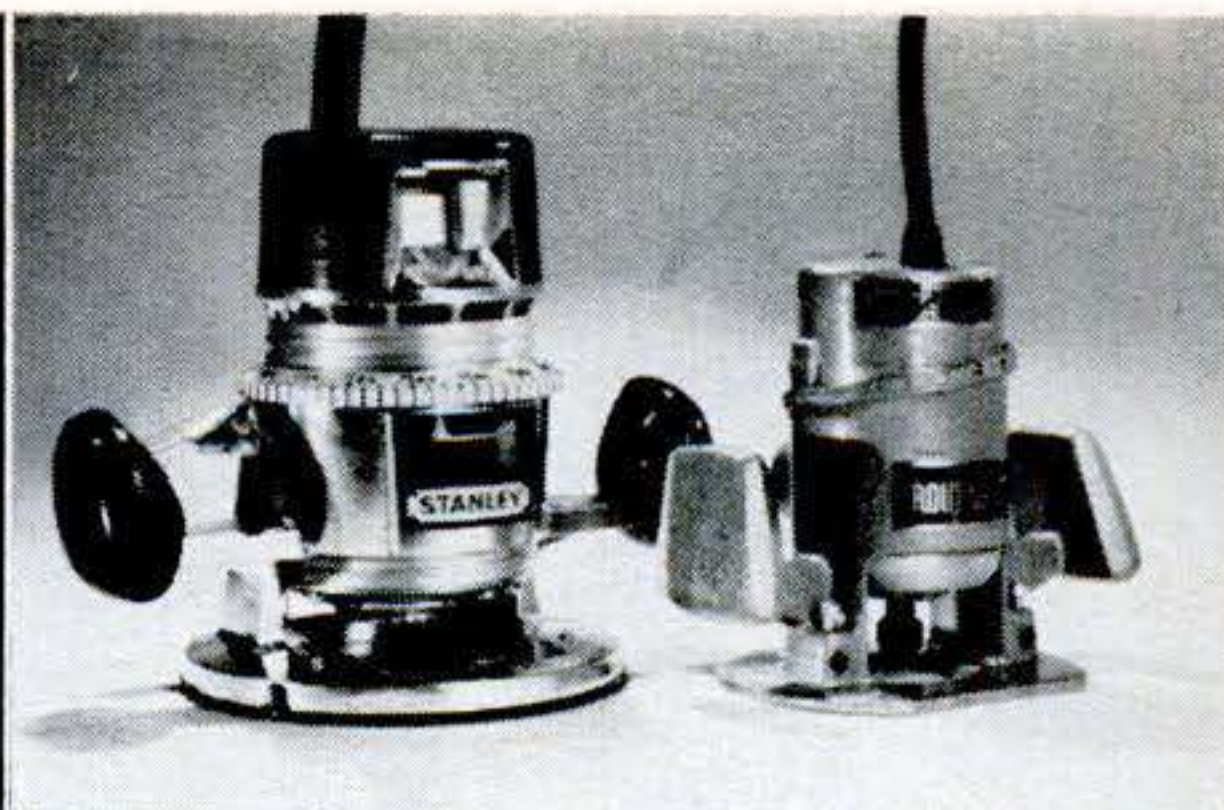
The Rout-About. Stanley's new router sells for only \$32.50. It operates at 25,000 r.p.m. with a 2.7-amp, $\frac{1}{4}$ -hp. AC motor and makes a cut smoother than you can get with sandpaper. Its light weight—only $3\frac{1}{4}$ pounds—makes it easy for beginners to handle.

The Rout-About takes standard one-piece $\frac{1}{4}$ "-shank router bits. You need two wrenches (they come with the router) to tighten a bit in the chuck. You adjust cut depth by rotating the motor up or down along the spiral guide on the base. The guide is marked in $\frac{1}{32}$ "-depth increments to help you get an accurate setting. A handy thumbscrew locks the motor in position.

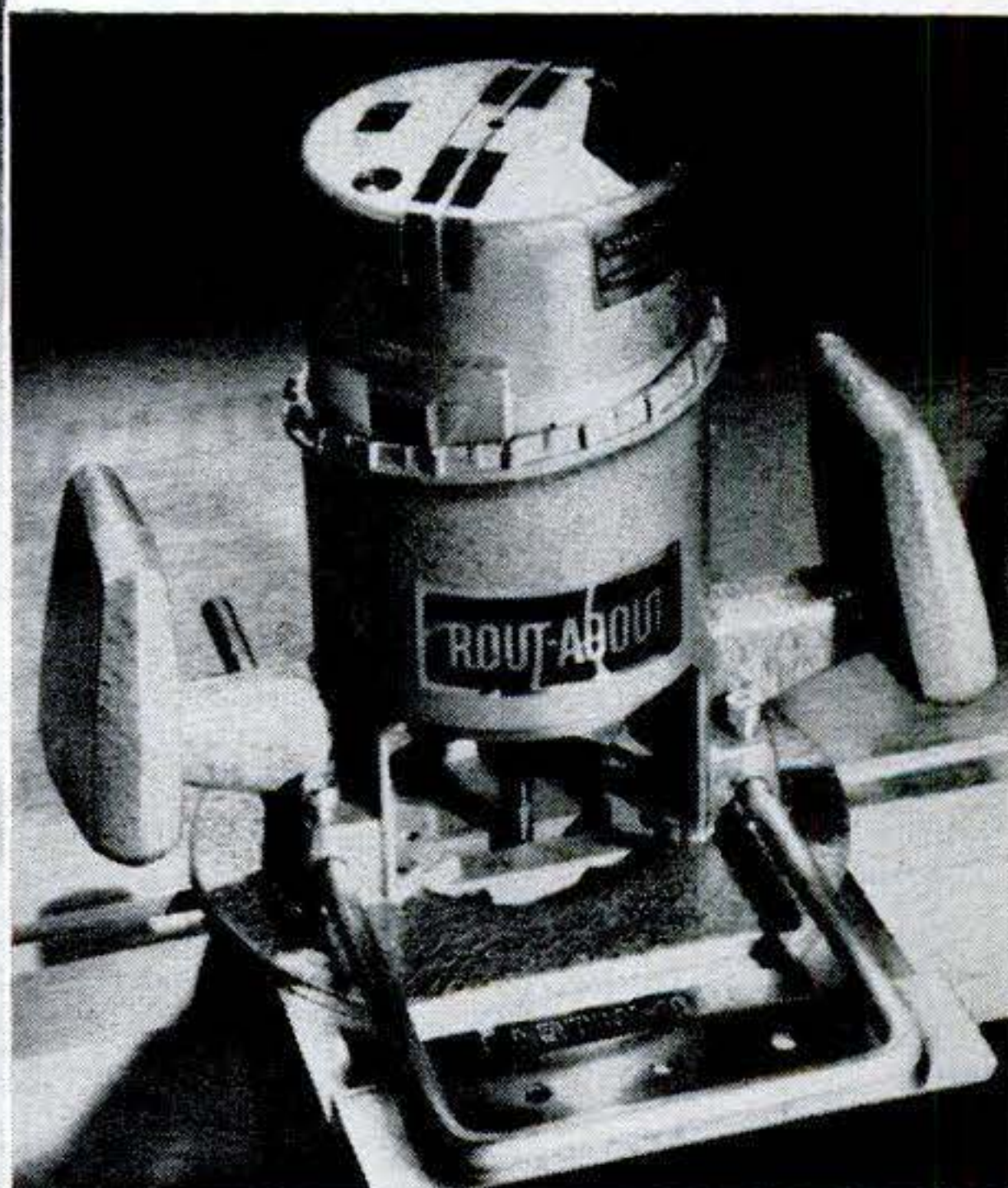
The motor housing and the base are made of aluminum. The front section of the base has a flat surface that helps you guide the router accurately along a straight edge. The motor has automatic brush holders that shut off the tool when the brushes become too worn. It comes with 6' of three-wire grounding cord. The router comes with a straight-and-circular guide, which is in-



Stanley's new router costs \$32.50. Its 1/4-hp. motor gives you 25,000-r.p.m. cutter speed. The Rout-About is shown making a dado, using a straight board as a guide.



Rout-About stands up to its 7/8-hp., \$70 big brother. Although it won't cut as fast, it'll take on any job the larger one will.



Straight edge-guide, inserted in holes in the base, positions the cutter for routing grooves or rabbets the length of board.

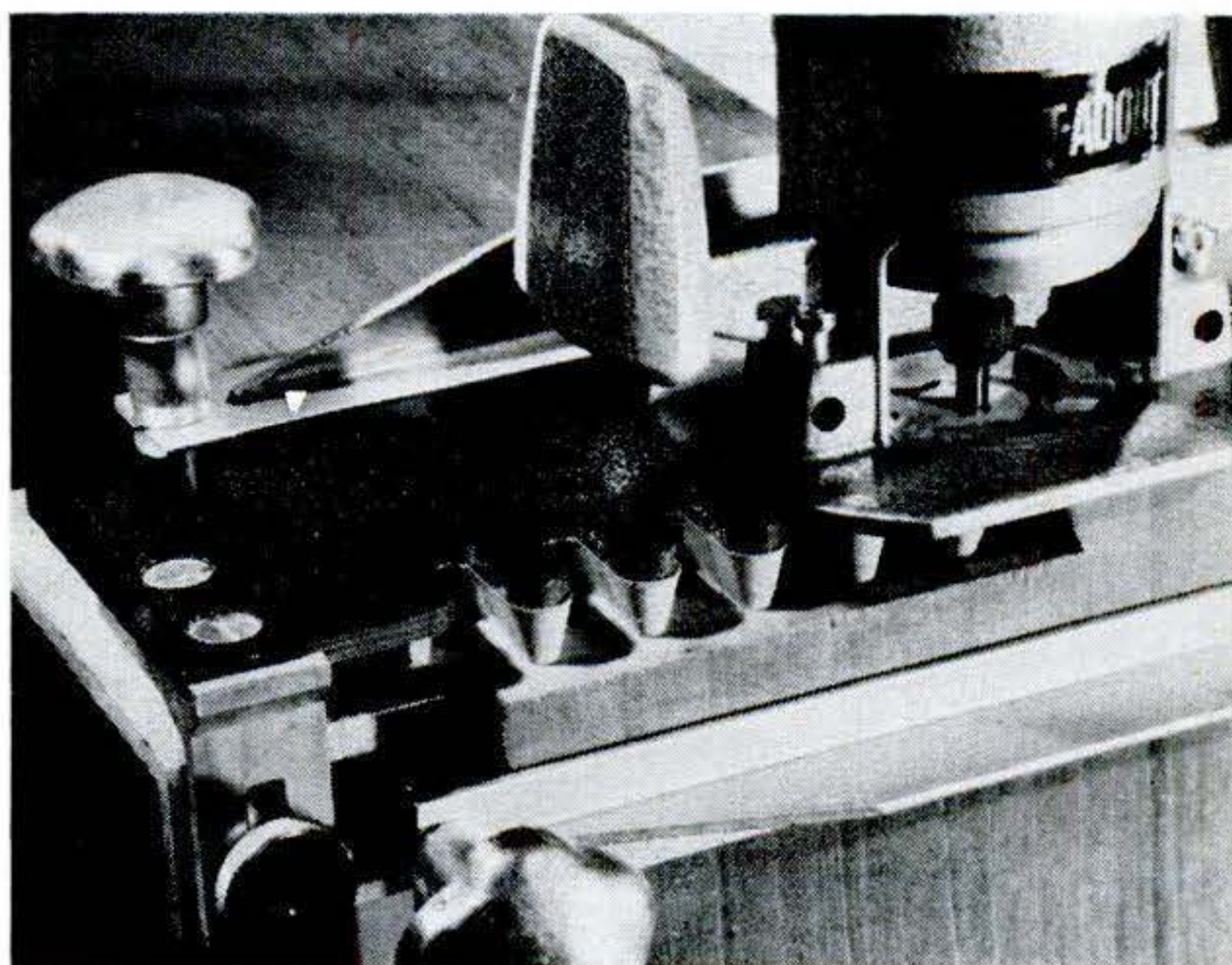
up with tools that cost less and are easier to use

serted in two holes in the router base. Tightening two screws clamps the guide at the desired position for straight cuts. Mounting two acorn nuts in holes on the guide edge makes it a circular guide.

The Model 64. Rockwell's new router sells for \$39.95. It has a 1/2-hp., 3.5-amp, all-ball-bearing motor that runs at 28,000 r.p.m. This is fast and powerful enough for chip-free routing in wood, plastic, and composition materials. The tool is 7" high and weighs only 4 1/2 pounds.

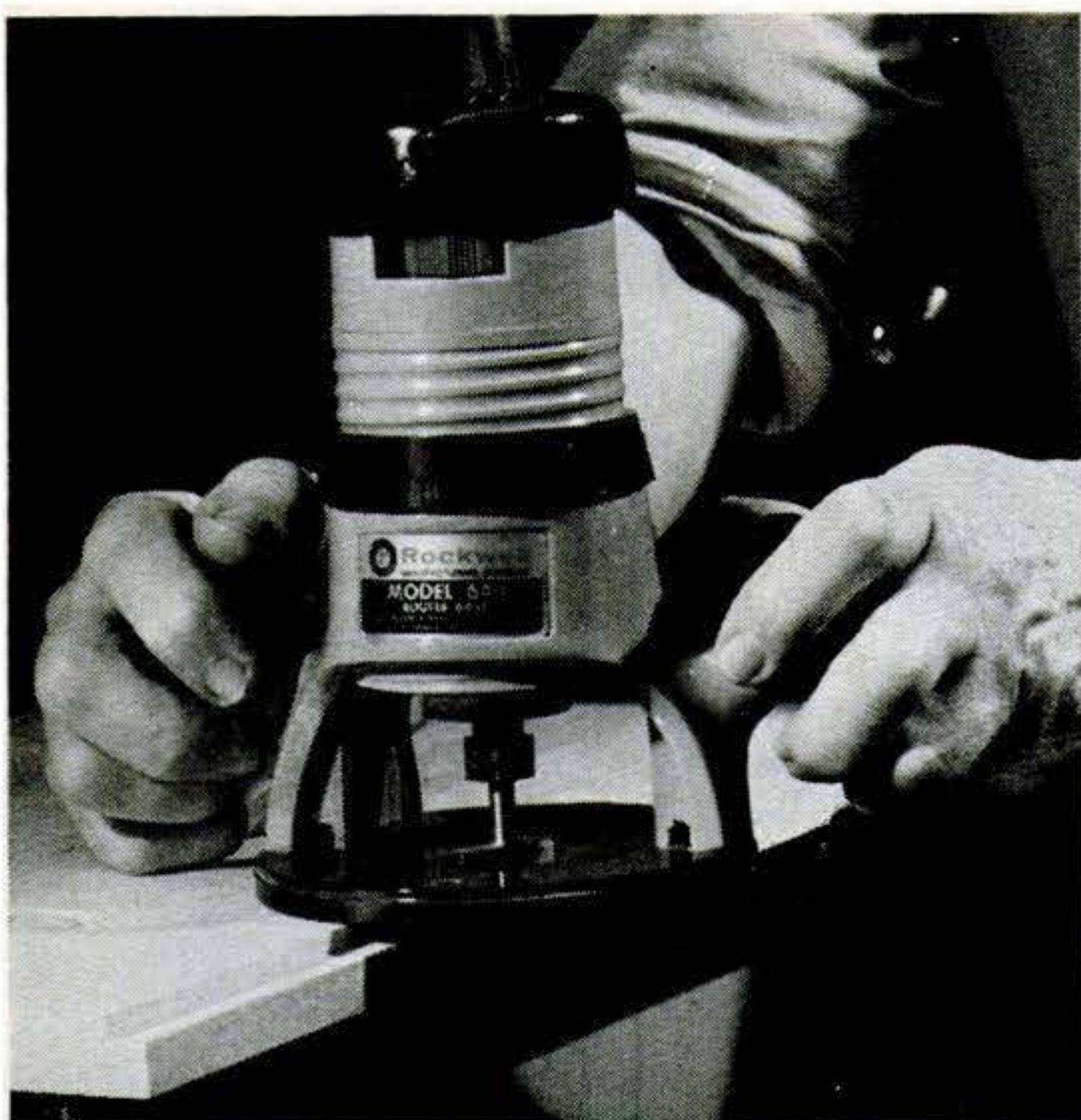
The router is the latest addition to the company's Green Line tools, which are housed in lightweight, unbreakable thermoplastic to protect you against electrical shock and

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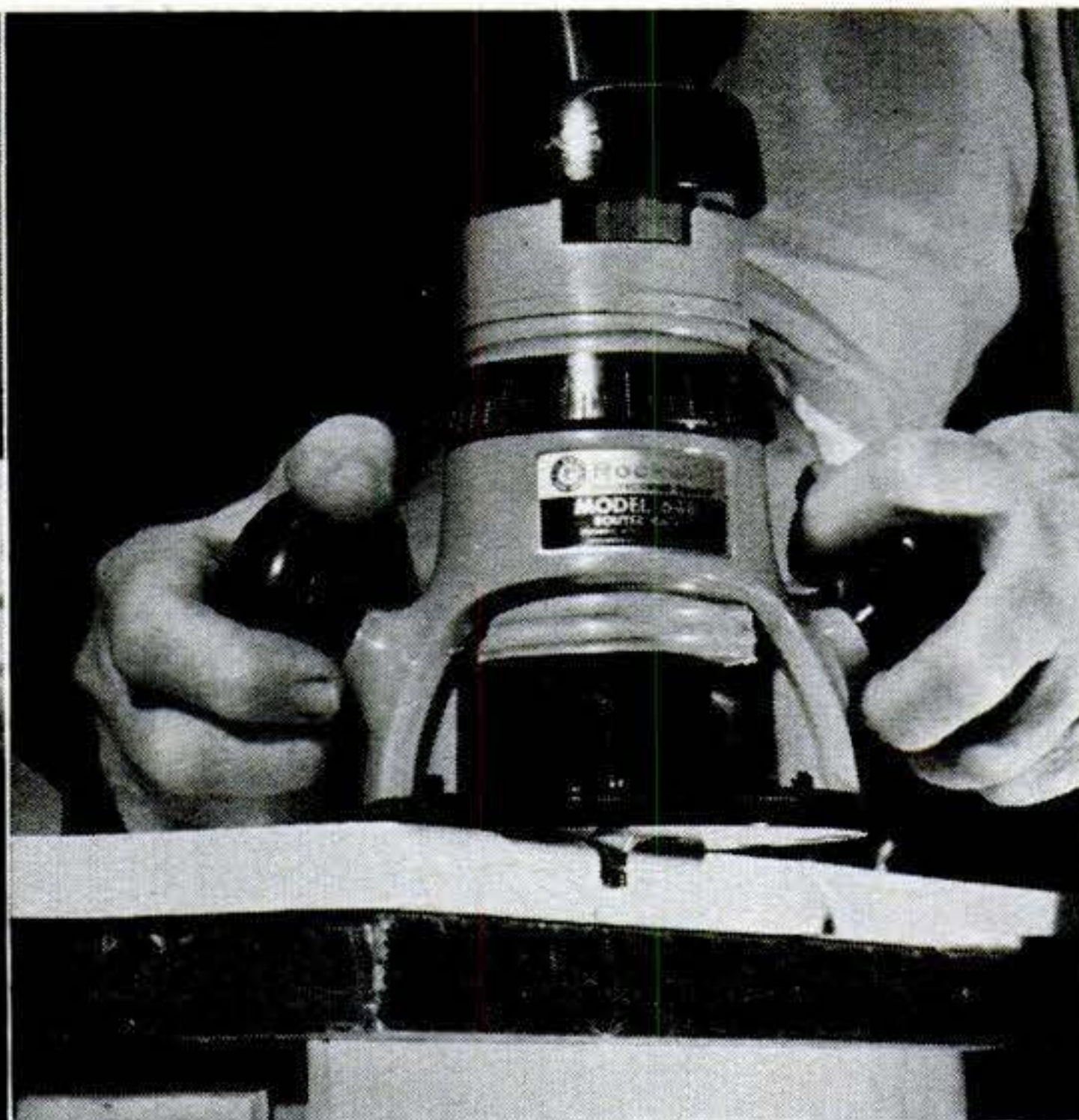


Dovetail cutter and jig that costs less than \$20 lets you turn out perfectly matching dovetail drawer joints with ease.

Small routers make it easy for beginners to do expert work



Rabbet cuts, used to make the common lap joint for cabinetmaking, are a simple job with a router.



Beading, molding, and other professional touches become part of your repertory for woodworking jobs.

eliminate the need for a three-wire plug or grounding adapter.

It, too, takes $\frac{1}{4}$ "-shank bits that are easily changed with a wrench set provided for the purpose. A glass-smooth plastic baseplate keeps the work surface from being marred or scratched.

The depth of cut is adjusted by twisting a ring on the motor housing. A thumb-screw draws the base tight against the motor so it cannot slip during operation. Large contour knobs make the machine easy to handle, and a sliding on-off switch is positioned for easy fingertip control.

The router comes with an edge guide for making straight or curved cuts and for edge planing, parallel grooving, dadoing, or slotting.

The Green Line router motor is detachable for use with a shaper table attachment. This is a stationary tool that handles straight, angle, or bevel shaping and jointing operations. This is especially useful on narrow stock, which is difficult to handle with a router alone. The maximum depth of cut is $\frac{3}{4}$ " for shaping and $\frac{3}{32}$ " for jointing.

Other accessories you can get that will let your router do more jobs faster include an attachment for trimming plastic laminates and wood veneers, and a hinge butt template. You can also get a dovetail jig that will let you turn out precision-fitted dovetailed drawers at factory speed.

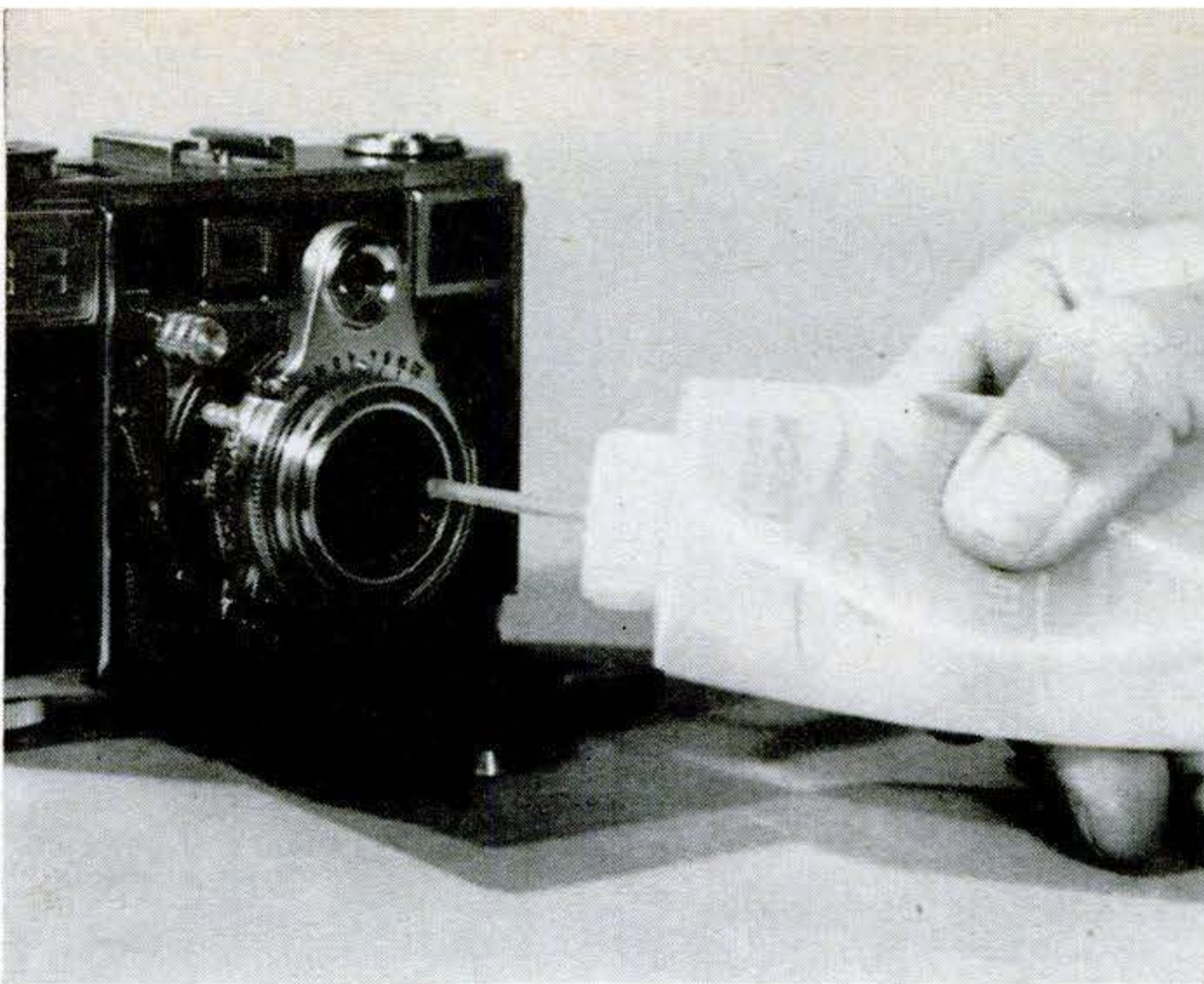
What will they do? These home-shop routers won't take the heavy slices or cut as fast as the big $\frac{3}{8}$ - and $1\frac{1}{4}$ -hp. routers of professional cabinetmakers. You may have to make two or three passes on some jobs. But the tools are light and easy to handle, and will make all the classic woodworking joints, grooves, rabbets, mortises, half-laps, dadoes, and tongue-and-grooves. Even more. You can add those fancy, decorative touches that make furniture and cabinets look custom-made.

The router stands alone in its ability to carve out recessed designs. You can use it freehand, or you can use templates to make exact duplicates of any irregular shapes you want.

Chuck a molding cutter in your router and you can save many dollars by making your own molding from plain stock.

A router is a must for making furniture with plastic-laminate tops. About the only way you can get good results with this material is to use a special carbide-tipped cutter and edging accessory to trim, join, and bevel the edges of the rigid plastic.

If you're serious about woodworking, you'll want all the advantages you get with a router. These new low-priced models make it easier to own one. But don't forget that you'll need an assortment of cutters and maybe a dovetail jig or some template guides. PS



Squeeze bottle blows dust off camera lens

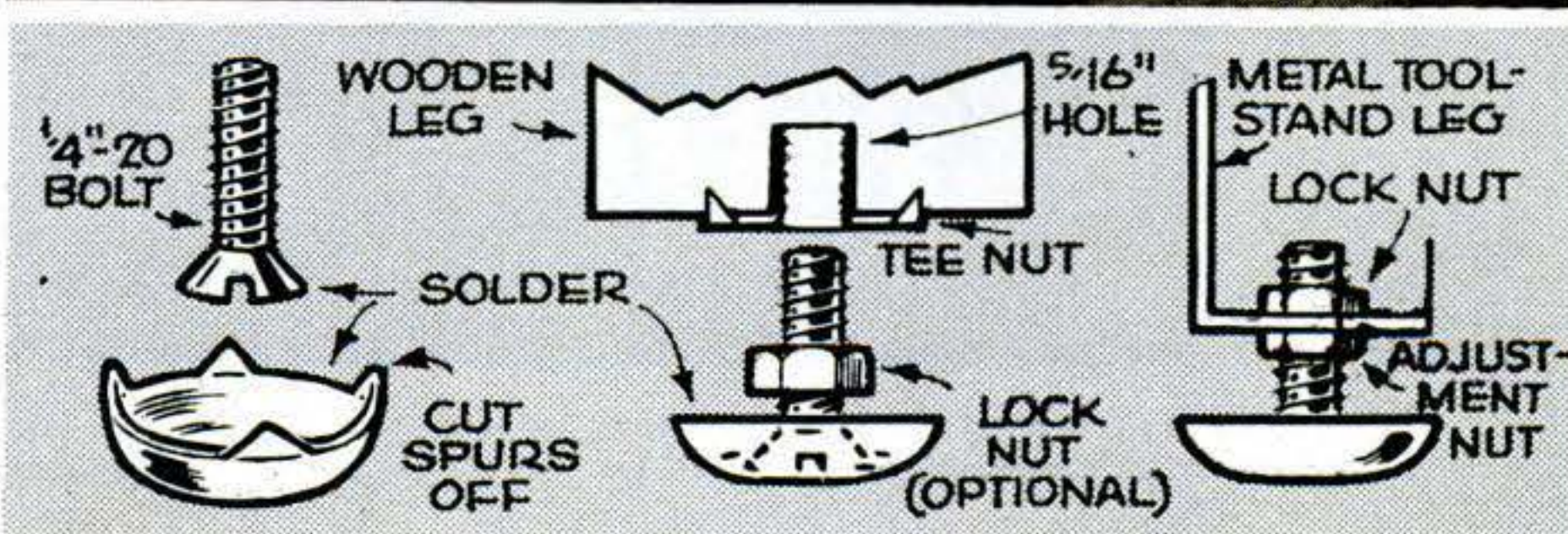
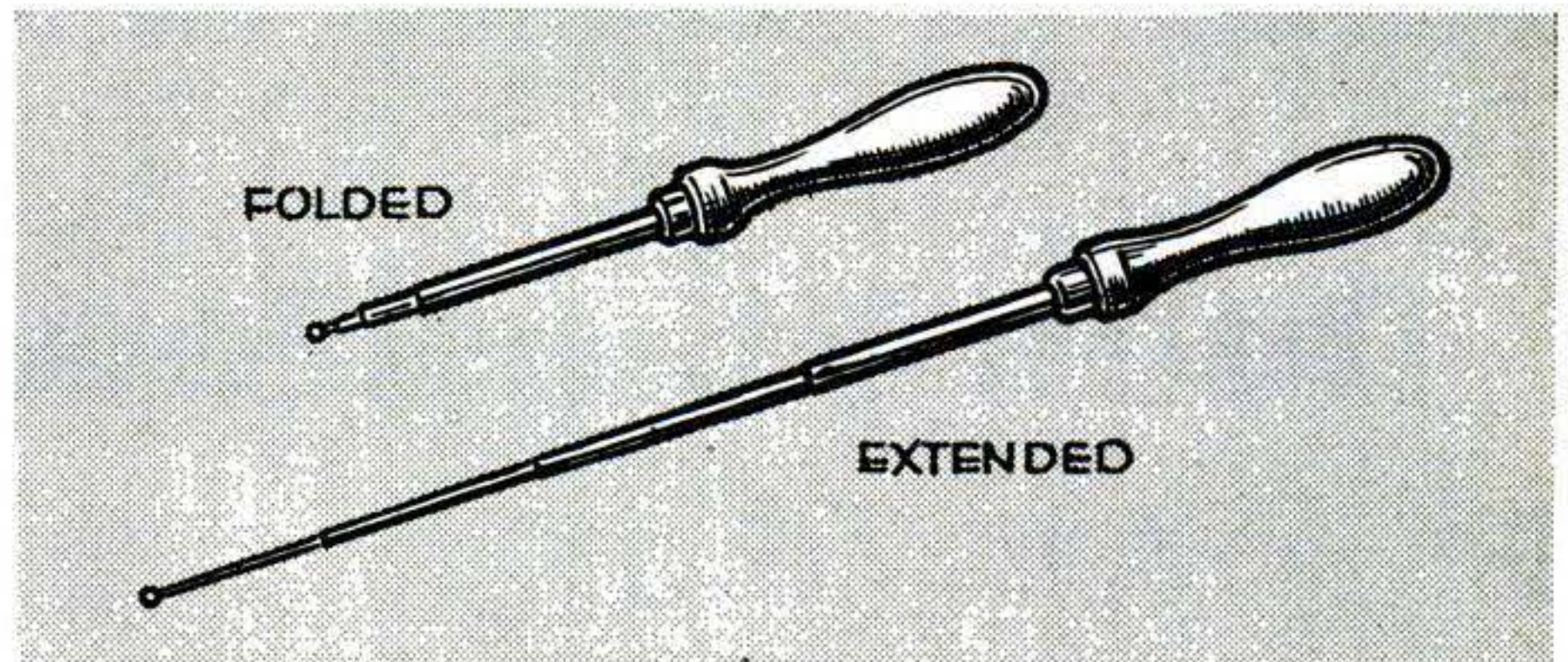
A small plastic squeeze bottle of the type shown at left (this one contained a home-permanent lotion) is useful for blowing dust off camera surfaces. The trick is particularly useful for cleaning the lens, as the photo shows, and any inside surfaces that are hard to reach.

KEN PATTERSON
Regina, Canada.

How to make a lecture pointer from a car aerial

An old car aerial you can pick up at any junkyard makes a handy pointer. Put a file handle on the butt end. Make it any length you want by extending it. Collapse it for storage.

L. S. McCREADY
Kings Point, N.Y.



Adjustable gliders keep your tool stands level

Small threaded gliders like those on washing machines will make tool benches or furniture stand rock steady on unlevel floors. You can make them from standard hardware items found in most home shops.

Nip the three spurs off ordinary $\frac{3}{4}$ " furniture glides with side-cutting pliers. Stand a 1"-long $\frac{1}{4}$ "-20 flathead bolt in each, heat with a torch flame, and flow in solder.

Drill a $\frac{5}{16}$ " hole in each furniture leg and drive in a $\frac{1}{4}$ " tee nut as shown. Then screw in the glider and adjust as necessary. A lock nut may be used if vibration is present. On pressed-steel legs found on tool stands, use a nut under the foot to adjust the height, and a nut above it to lock the adjustment.

HARRY WALTON
White Plains, N.Y.



Tires smoking, rubber screeching, award-winning Buick Special flies nose-down to a complete stop

Does Your New Car Have

Ford doesn't test brakes the same way Chevrolet does. Even Pontiac and Buick don't use identical tests. So even if every auto maker can prove to himself that his cars have the best brakes, it's not necessarily so.

The real truth comes out in the brake tests of the Pure Oil Trials. It's the same for all cars, and for five years it has been the *only* public test (conducted by NAS-CAR in conjunction with Pure Oil Co.) of the normal production car's power to stop.

POPULAR SCIENCE began pleading for better brakes after the second year of the trials, and last year we instituted a Gold Cup as an annual award for the car with shortest stopping distance in the Trials.

This year the trophy was won by a Buick Special, which came to a complete standstill from 65 m.p.h. in 168.2 feet.

Two days of brake testing also showed:

- The average braking distance is coming down—but still has a long way to go.

- Braking stability, on the whole, is better than in previous years.

- Brake fade continues to be the most serious problem.

- The top 10 cars stopped within nine feet of the winner, but the worst took 115.4 feet more to come to a stop.

- The top 10 included cars as light as 2,500 pounds, as heavy as 4,400 pounds.

Fuel economy and acceleration are also tested in the Pure Oil Trials. Fuel consumption is measured by letting each car run at a steady 40 m.p.h. as far as it can on a weighed gallon of premium gasoline (same fuel for all cars). A big surprise came when the traditional winner, Rambler's American, lost out to a Corvair (25.003 m.p.g.). In contrast, the two Americans entered came 1-2 in the acceleration test for six-cylinder compacts. Worst fuel economy? That dubious distinction goes to a Mercury Monterey (13.740 m.p.g.)



Pontiac Bonneville stopped shortest in the luxury-car class with a braking distance of 173.1 feet. Runner-up was an Olds Starfire with 179.2 feet.



from 65 m.p.h. in 168.2 feet.

Robert L. Kessler, right, general manager of Buick Motor Division, accepts the POPULAR SCIENCE Gold Cup for the Buick Special's performance in the brake test of the 1966 Pure Oil Trials from Hubert P. Lockett, PS Executive Editor. Buicks also stopped better than other cars in the medium and deluxe V-8 classes.



Famous Pure Oil Trials show brakes are somewhat better in '66 —but some cars did very poorly

By JAN P. NORBYE / PS Automotive Editor

THE POWER TO STOP?

The acceleration test is a good guide to your car's ability to merge with traffic on a superhighway and to pass slow traffic on normal roads. You start from 25 m.p.h.—not from standstill. Times for all the sports intermediates clustered around the winning Chevelle SS 396 (6.545 seconds from 25 to 70 m.p.h.).

The other cars ran pretty much as in years past, acceleration times being closely related to engine displacement. Pontiac had persistent trouble with detonation on most of its cars, while all others were free from knocking. It may be that Pontiac engines have higher octane requirements than oth-

er engines with similar compression ratios.

Pure Oil's brake test is designed to show how well a car would serve you if you had to make a high-speed emergency stop immediately following severe use of the brakes. Each car makes 10 stops from 65 m.p.h. at a deceleration rate not exceeding 16-feet-per-second-per-second to stimulate the heat buildup in the brakes when you drive in stop-and-go expressway traffic or on winding mountain roads. The payoff comes when the driver enters an 11-foot-wide lane with markers on both sides, at a speed of no less than 65 m.p.h., and makes one panic stop.

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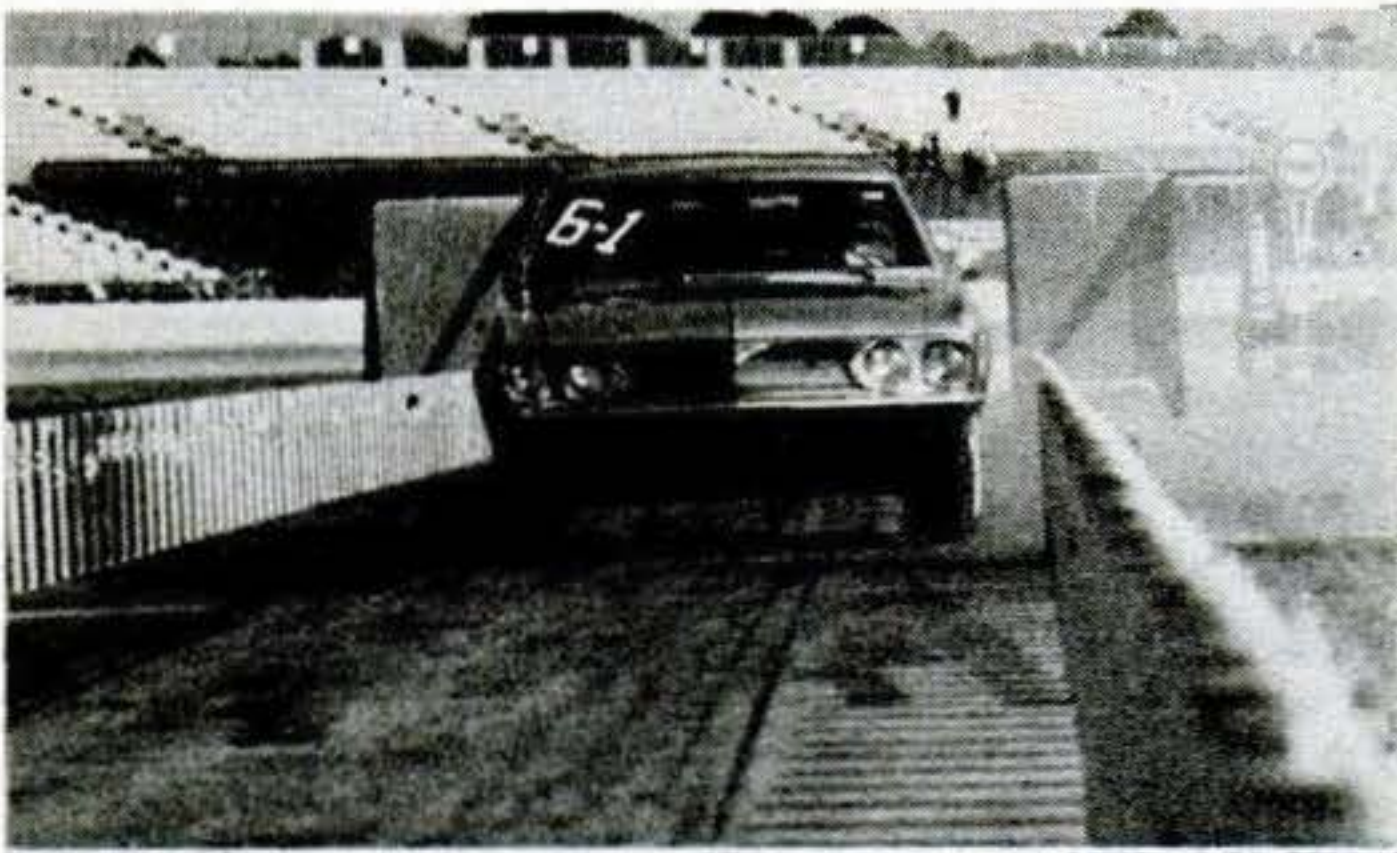
Buick Wildcat skidded 175.3 feet to record shortest stopping distance among deluxe V-8s. Nearest rival was a Pontiac Bonneville with 182.9 feet.



Buick LeSabre 400 made one of the straightest stops in 179.6 feet—short enough to show it boasts the best brakes among medium V8s.



Pontiac Le Mans—last year's Trophy winner—had best brakes in the small V-8 class. It stopped in 175.4 feet, with a Buick at 177.5 feet.



Chevrolet Corvair 500 came to a stop in 175.3 feet; its sister car was second best in the compact six-cylinder class with 180.3 feet. Dodge Dart was third.



Pontiac GTO locked all wheels, skidded to a short stop—178.9 feet—winning the sport-compact brake test from a Chevelle SS 396 with 179.6 feet.



Corvair Corsa took braking honors among sport compacts with a stop in 174.3 feet; its sister car stopped in 174.7 feet. A Barracuda was third.

Braking distance is measured from the point of brake application to the point of complete standstill. A two-foot penalty is added for each marker knocked down.

Watching from a few feet away, I was impressed with the validity of this test:

- Some cars failed to lock any wheel at any time.

- Some cars had trouble with grabbing brakes.

- Some cars had trouble with rear-wheel locking, causing them to yaw while still at speed.

These are severe shortcomings that the auto makers' own brake-testing procedures have apparently failed to demonstrate adequately.

On the top 10 cars, all wheels locked instantly when the driver slammed on the brakes, and they came to a stop in fairly straight lines, without touching the markers. They were: Buick Special V-6, 168.2 feet; Pontiac Bonneville, 173.1; Corvair Corsa, 174.3 and 174.7 (two cars); Buick Wildcat and Corvair 500, 175.3; Pontiac Le Mans, 175.4; Oldsmobile F-85, 176.2; Pontiac Tempest Six, 176.6; Ambassador 880, 177.1; Buick Special V-8, 177.5.

The average stopping distance for 59 cars was 193.05 feet. Last year's tests gave an average of 196.2 for 57 cars.

In a panic stop from 65 m.p.h., the front brakes do 66-70 percent of the braking on most cars. For this reason, there is greater risk of brake fading in the front wheels than in the rear ones. Many cars suffered from front-brake fade: Oldsmobile Starfire, Chrysler New Yorker, Chevrolet Caprice, and Buick Wildcat. This meant rear-wheel locking. Dodge Polara, Oldsmobile Cutlass, and Buick LeSabre showed signs of fade on all wheels—gently rolling to a stop beyond the 200-foot line. Olds also had stability problems with its Jetstar 88s and Dynamic 88s. The wheels did not lock at the same time, and the drivers had to get off the brake, back on again, fighting their way to a stop.

The Chryslers, Dodges, and Plymouths were private entries without direct or official sanction from the Chrysler Corp., while all Ford and GM cars were factory entries with factory drivers. Chrysler products seemed to show a general lack of preparation which helps explain their poor showing. However, the corporation had an observer present at the trials, so perhaps next year will see Chrysler back in force. **PS**

How They Scored

CLASS	MODEL	ENGINE TYPE	DISPLACEMENT (cu. in.)	CARBURETOR	HORSEPOWER	WHEELBASE (in.)	TRANSMISSION	AXLE RATIO	ECONOMY		ACCELERATION		BRAKING		TOTAL POINTS
									MILES PER GALLON	POINTS	TIME (sec.)	POINTS	STOPPING DISTANCE (ft.)	POINTS	
CLASS I LUXURY	Buick Wildcat Gran Sport	V-8	425	4-bbl.	340	126	auto.	3.23	14.259	6	8.225	8	192.31	7	21
	Chrysler New Yorker	V-8	440	4-bbl.	350	124	auto.	2.76	15.129	8	9.460	5	220.6	6	19
	Oldsmobile Starfire	V-8	425	4-bbl.	375	123	auto.	3.08	15.906	9	8.010	9	179.2	9	27
	Oldsmobile Starfire	V-8	425	4-bbl.	375	123	auto.	3.08	16.452	10	7.600	10	225.5	5	25
	Pontiac Bonneville Brougham Conv.	V-8	421	4-bbl.	338	124	auto.	2.93	14.863	7	9.030	7	173.1	10	24
	Pontiac Bonneville Brougham Conv.	V-8	421	4-bbl.	338	124	auto.	2.93	14.255	5	9.080	6	192.3	8	19
CLASS II DELUXE—8-CYLINDER	Buick Wildcat	V-8	401	4-bbl.	325	126	auto.	3.07	15.299	6	8.325	10	175.3	10	26
	Buick Wildcat	V-8	401	4-bbl.	325	126	auto.	3.07	15.988	8	8.575	9	213.8	4	21
	Chrysler Newport	V-8	383	2-bbl.	270	124	auto.	2.76	16.209	9	11.490	3	202.8	6	18
	Mercury Monterey	V-8	390	2-bbl.	265	123	auto.	3.00	13.740	3	10.320	4	250.2	3	10
	Oldsmobile Dynamic 88	V-8	425	2-bbl.	310	123	auto.	2.93	17.489	10	9.500	8	210.8	5	23
	Oldsmobile Dynamic 88	V-8	425	2-bbl.	310	123	auto.	2.93	15.450	7	9.650	7	188.8	7	21
	Pontiac Bonneville Conv.	V-8	389	4-bbl.	325	124	auto.	2.73	15.110	4	10.035	5	182.9	9	18
	Pontiac Bonneville Conv.	V-8	389	4-bbl.	325	124	auto.	2.73	15.259	5	9.985	6	187.8	8	19
CLASS III MEDIUM—8-CYLINDER	Buick LeSabre 400	V-8	340	4-bbl.	260	123	auto.	2.93	18.167	9	9.590	7	222.9	4	20
	Buick LeSabre 400	V-8	340	4-bbl.	260	123	auto.	2.93	18.409	10	10.355	5	179.6	10	25
	Chevrolet Caprice	V-8	396	4-bbl.	325	119	auto.	2.73	17.263	8	8.230	10	181.7	8	26
	Chevrolet Caprice	V-8	396	4-bbl.	325	119	auto.	2.73	17.005	7	8.240	9	180.8	9	25
	Dodge Polara	V-8	383	2-bbl.	270	121	auto.	2.76	16.213	5	11.890	2	283.5	2	9
	Oldsmobile Jetstar 88	V-8	330	2-bbl.	260	123	auto.	2.78	SV	—	10.565	4	195.3	5	9
	Oldsmobile Jetstar 88	V-8	330	2-bbl.	260	123	auto.	2.78	SV	—	11.240	3	235.1	3	6
	Pontiac Grand Prix	V-8	389	4-bbl.	325	121	auto.	2.73	16.972	6	9.150	8	189.3	7	21
	Pontiac Grand Prix	V-8	389	4-bbl.	325	121	auto.	2.73	15.627	4	10.150	6	189.9	6	16
	CLASS IV SMALL—8-CYLINDER	Buick Special DeLuxe	V-8	300	2-bbl.	210	115	auto.	2.78	19.222	10	10.975	5	177.5	9
Buick Special DeLuxe		V-8	300	2-bbl.	210	115	auto.	2.78	18.873	8	10.750	6	177.7	8	22
Comet Capri		V-8	289	2-bbl.	200	116	auto.	2.80	19.200	9	11.335	4	182.0	6	19
Oldsmobile Cutlass		V-8	330	4-bbl.	320	115	auto.	3.08	18.446	7	8.675	9	181.5	7	23
Oldsmobile Cutlass		V-8	330	4-bbl.	320	115	auto.	3.08	18.022	4	8.620	10	202.3	4	18
Pontiac LeMans Sport Coupe		V-8	326	2-bbl.	250	115	auto.	2.56	18.251	5	9.430	8	183.3	5	18
Pontiac LeMans Sport Coupe		V-8	326	2-bbl.	250	115	auto.	2.56	18.279	6	9.825	7	175.4	10	23
CLASS V STANDARD—6-CYLINDER	Buick Special	V-6	225	2-bbl.	160	115	auto.	2.93	21.393	8	14.070	9	168.2	10	27
	Buick Special	V-6	225	2-bbl.	160	115	auto.	2.93	21.387	7	13.950	10	182.2	3	20
	Ford Fairlane	OHV-6	200	1-bbl.	120	116	auto.	2.80	22.714	10	17.590	3	181.8	5	18
	Ford Fairlane	OHV-6	200	1-bbl.	120	116	auto.	2.80	22.707	9	18.180	2	184.9	2	13
	Oldsmobile F-85	OHV-6	250	1-bbl.	155	115	auto.	2.78	20.656	5	14.860	7	181.9	4	16
	Oldsmobile F-85	OHV-6	250	1-bbl.	155	115	auto.	2.78	20.160	2	16.405	4	176.2	9	15
	Pontiac Tempest Custom Sport Coupe	OHV-6	230	1-bbl.	165	115	auto.	2.78	20.202	3	15.440	5	180.6	6	14
	Pontiac Tempest Custom Sport Coupe	OHV-6	230	1-bbl.	165	115	auto.	2.78	21.354	6	14.965	6	176.6	8	20
	Rambler Classic 550	OHV-6	232	1-bbl.	145	112	auto.	3.15	20.029	1	18.375	1	190.4	1	3
	Ambassador 880	OHV-6	232	2-bbl.	155	116	auto.	3.15	20.279	4	14.530	8	177.1	7	19
CLASS VI COMPACT—6-CYLINDER	Chevrolet Corvair 500	H-6	164	2 1-bbl.	95	108	auto.	3.27	25.003	10	20.555	5	175.3	10	25
	Chevrolet Corvair 500	H-6	164	2 1-bbl.	95	108	auto.	3.27	24.387	8	20.170	8	180.3	9	25
	Dodge Dart	OHV-6	170	1-bbl.	101	111	auto.	3.23	21.192	4	22.895	4	183.6	8	16
	Ford Falcon	OHV-6	170	1-bbl.	105	110.9	auto.	2.83	23.843	7	20.555	6	187.9	7	20
	Ford Falcon	OHV-6	170	1-bbl.	105	110.9	auto.	2.83	23.562	5	20.310	7	265.4	4	16
	Rambler American	OHV-6	199	1-bbl.	128	106	auto.	3.08	24.483	9	16.600	10	202.4	5	24
	Rambler American	OHV-6	199	1-bbl.	128	106	auto.	3.08	23.705	6	18.520	9	190.9	6	21
CLASS VIIA SPORT COMPACT (INTER-MEDIATE)	Buick Skylark Gran Sport	V-8	400	4-bbl.	325	115	auto.	2.93	16.799	7	6.745	6	183.8	7	20
	Buick Skylark Gran Sport	V-8	400	4-bbl.	325	115	4-spd.	3.36	16.104	4	6.695	8	183.1	8	20
	Chevelle Super Sport 396	V-8	396	4-bbl.	325	115	4-spd.	3.31	18.092	10	6.575	9	179.6	9	28
	Chevelle Super Sport 396	V-8	396	4-bbl.	325	115	4-spd.	3.31	17.728	9	6.545	10	250.0	4	23
	Ford Fairlane G. T.	V-8	390	4-bbl.	335	116	3-spd.	3.25	16.008	3	6.950	3	DNS	—	6
	Ford Fairlane G. T.	V-8	390	4-bbl.	335	116	3-spd.	3.25	SV	—	—	—	DNS	—	0
	Oldsmobile 442	V-8	400	4-bbl.	350	115	auto.	3.23	17.212	8	6.730	7	226.7	5	20
	Oldsmobile 442	V-8	400	4-bbl.	350	115	auto.	3.23	16.674	6	6.915	4	184.7	6	16
	Pontiac G. T. O.	V-8	389	4-bbl.	335	115	4-spd.	3.55	15.534	2	—	—	—	—	2
	Pontiac G. T. O.	V-8	389	4-bbl.	335	115	4-spd.	3.55	16.536	5	6.790	5	178.9	10	20
CLASS VIIB SPORT COMPACT (SMALL)	Chevrolet Corvair Corsa	H-6	164-S	1-bbl.	180	108	4-spd.	3.27	23.661	9	9.660	8	174.7	9	26
	Chevrolet Corvair Corsa	H-6	164-S	1-bbl.	180	108	4-spd.	3.27	23.720	10	10.720	7	174.3	10	27
	Ford Mustang	V-8	289	2-bbl.	200	108	3-spd.	3.00	23.397	8	9.590	9	179.9	7	24
	Ford Mustang	V-8	289	2-bbl.	200	108	3-spd.	3.00	22.880	7	9.470	10	183.3	6	23
	Plymouth Barracuda	V-8	273	2-bbl.	180	106	auto.	2.93	20.461	6	11.000	6	176.3	8	20

SV, score void; DNS, did not start.

Class winners: I—Olds Starfire. II—Buick Wildcat. III—Chevrolet Caprice. IV—Buick Special DeLuxe. V—Buick Special. VI—Chevrolet Corvair 500. VIIA—Chevelle Super Sport 396. VIIB—Chevrolet Corvair Corsa.



When the town skinflint tried to blame a neighbor for his flat tires, Gus soon punctured his little scheme

Gus Settles a Case

Gus was having his morning coffee break when Chief Eldon stalked into the office of the Model Garage. The Chief sank unbidden into a chair. His loose-fitting uniform, sad eyes, and sagging jowls gave him, as always, the look of a sleepy but amiable hound dog.

"Came to send you out on a job, Gus," he said. "In fact, I'll drive you to it. You'll need a rotor—for a 1957 Dodge V-8."

"Isn't that a pretty old crate for a slick police department to be using?"

Eldon snorted. "You know it is. Fact is, it belongs to a neighbor of Silas Barnstable. He has no phone, and Silas wasn't offering to use his, so I said I'd let you know. Fact is, I wanted to talk to you first. This situation you'll walk into has more loose ends than an octopus."

"With Silas in it, that figures."

"Uh-huh. Well, Silas called me into it, and I'm going to see he doesn't pull any fast ones. He has an eviction hearing on this morning's court docket. The tenant's a Cuban refugee who came up from the Mi-

ami area. This man Ortiz leased a house from Silas and began looking around for work. He's a dental technician, and he's wangled some small jobs to do at home to prove his skill.

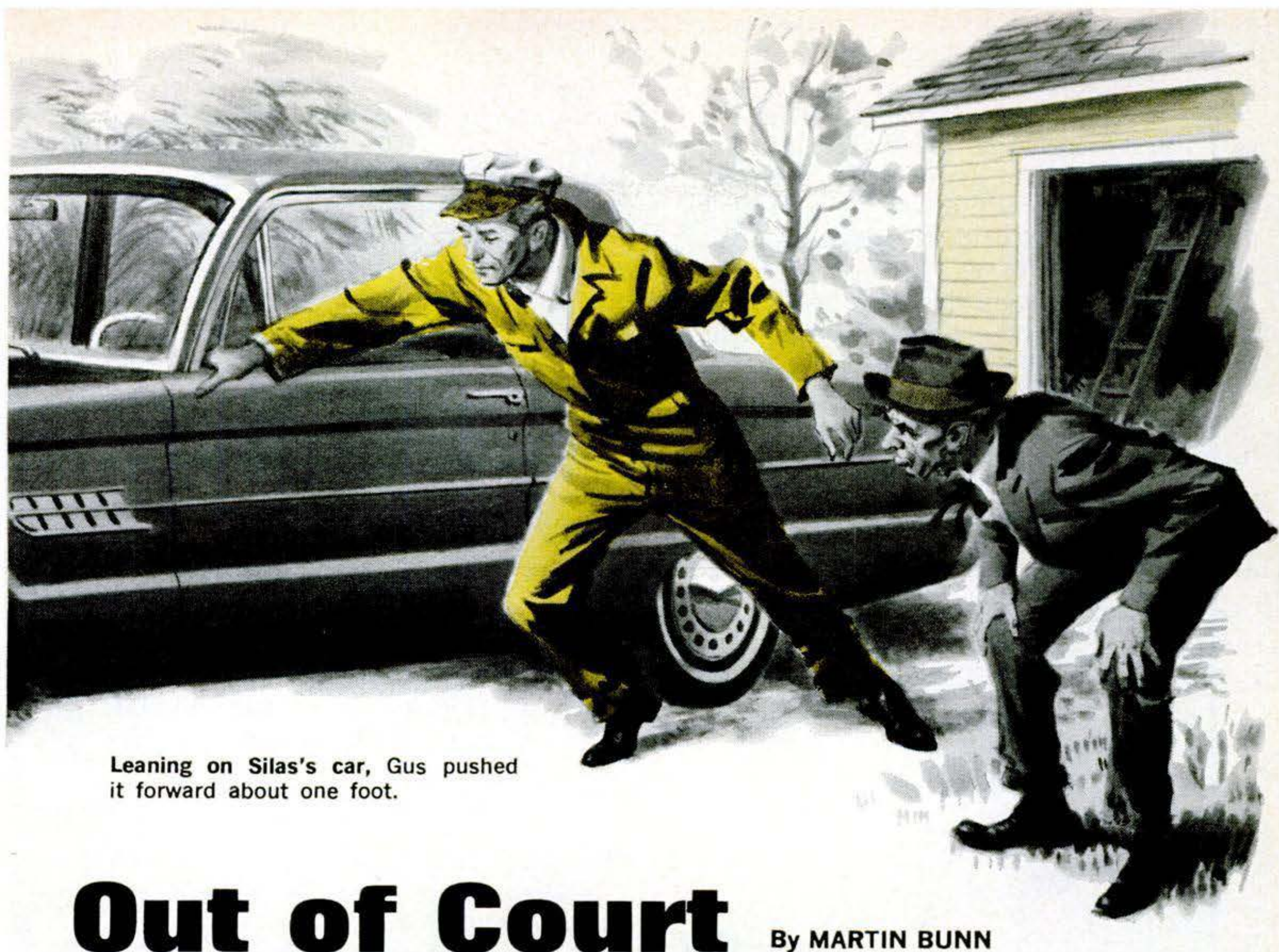
"The house he rented is next door to Silas's own house. Of course, Silas spotted Ortiz busy in the cellar workshop he'd set up, and Silas ordered him to quit using the house for commercial purposes."

"Silas always has been a big noise with a short fuse," remarked Gus.

"The worst comes later," said Chief Eldon. "Get in my car and I'll tell you about it while we drive there."

Taking a tool kit and the rotor, Gus got into the police car.

"Ortiz did stop doing work at home," the Chief went on, setting the car in motion. "And he got a job, starting next week. But meanwhile, Silas filed for eviction, charging Ortiz with malicious mischief and being an unruly tenant. There's one double garage for the two houses. Four times in



Leaning on Silas's car, Gus pushed it forward about one foot.

Out of Court

By MARTIN BUNN

two weeks, Silas claims, his left-front tire's been nearly flat in the morning. Last time, he made me come to see it.

"So Silas is charging Ortiz with flattening the tire to get even for not being allowed to work at home. But I did some snooping and I found that Silas got an unexpected offer for that house—which he can't sell while Ortiz's lease holds."

"I don't see where this distributor rotor comes in," remarked Gus.

Chief Eldon grunted. "That's the latest loose end. The eviction hearing's an hour from now and Ortiz's old car is blocking the steep driveway from the garage to the street. Soon as that happened, Silas hollered for me to come see how Ortiz is trying to keep him from court. Of course, he could take a taxi—he's just using this to build a stronger case against Ortiz."

The police car stopped before two small houses with a driveway between them.

"Want me to try to find out whether that tire went down by itself?" Gus asked.

"That—and whether Ortiz could have

staged that car breakdown in the driveway," added the Chief. "I won't protect Ortiz if he's guilty, but I'd hate to see him framed just for Silas's benefit. It could cost him his new job, besides making it tough for him to find another place to live."

The Chief led the way down the driveway. Near its bottom stood a dowdy black sedan, its rocker panels rusted out, its body paint lusterless. In the turn-around area was Silas's sport coupe.

From one of the houses scurried a small man with a round face, a shoe-brush mustache, and thin gray hair.

"I am Bernardo Ortiz," he introduced himself. "I speak not much English. You fix my car?"

"This is Gus Wilson," said Eldon. "He'll see to your car in just a minute."

The little man bobbed his head in an abbreviated bow. Gus and the Chief walked around to the left-front tire of Silas's car. It looked fully inflated. Gus removed the

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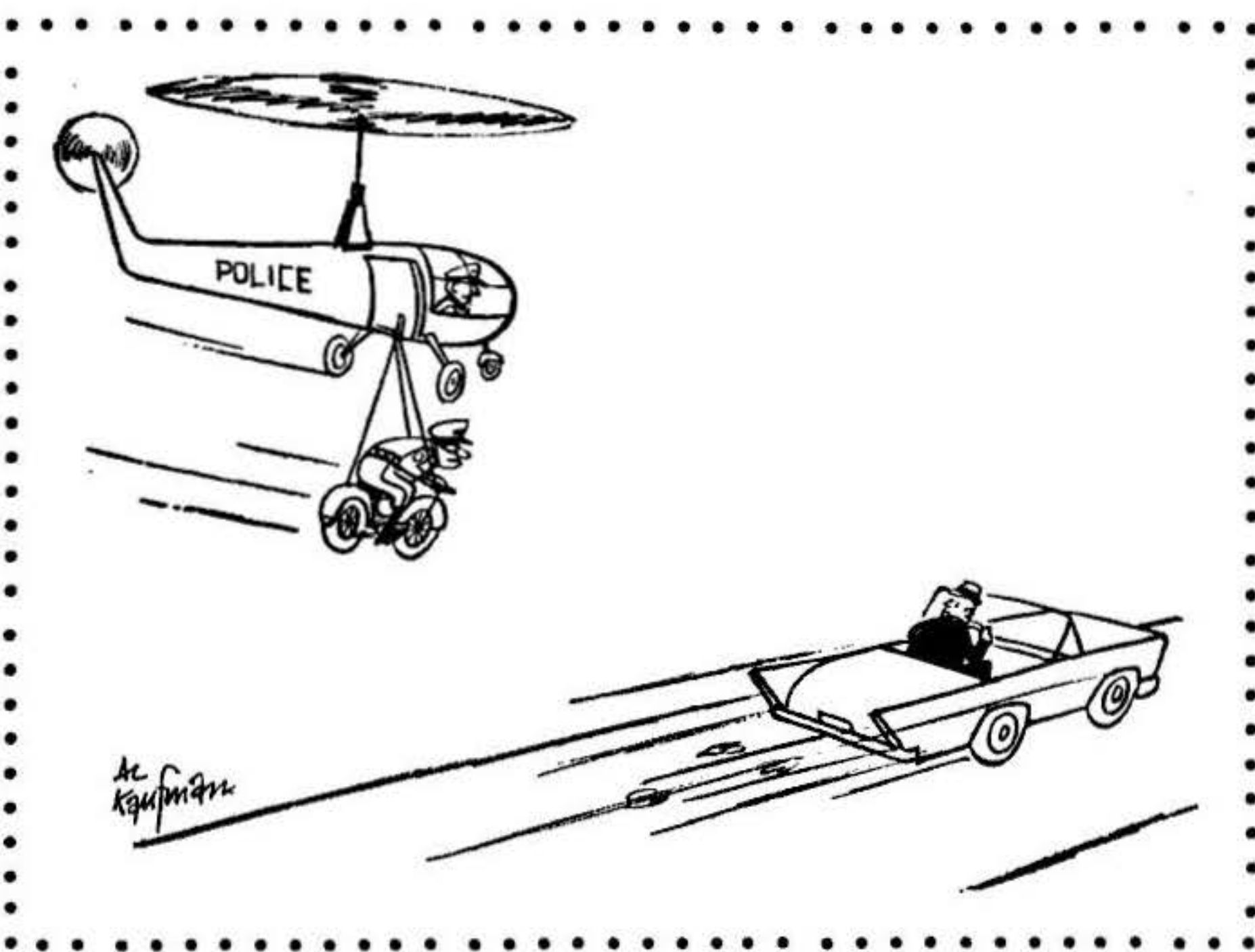
valve cap and put a little saliva on the stem. No bubble appeared. He let his eyes travel slowly around the rim.

"I never asked you to snoop around my car, Gus Wilson." Silas Barnstable, his skinny frame draped in a rumpled black suit, strode indignantly up to Gus. "And I ain't payin' for this call neither. It's that Cuban feller who'll have to."

"Well, now, I heard this tire's been going flat, and as you're an old customer I thought I'd have a look at it. It's a tubeless, I see. You got a tube in it?"

"No, I ain't. Why waste money for a tube it don't need? 'Tain't goin' flat—it's bein' sabytaged, and I know by who."

"Maybe it has a cut or a puncture."



"Nope. First time it went flat, I pumped it up. Used the car all day, and it stood up three days after. Four days, last time. Wouldn't do it if there was a puncture. Now get that other car out of my way."

"As soon as I've checked the pressure," returned Gus. Leaning on the car, he pushed it about a foot, then applied an air gauge. After making the saliva test again and replacing the valve cap, he showed Silas the gauge reading. It was 26 pounds.

Silas growled under his breath. As Gus walked back to the Dodge, Ortiz scurried ahead of him to open the hood.

"It is like twice before," the little Cuban said anxiously. "Three times it breaks that thing inside the dis . . . dis . . . but I do not do this myself, not on purpose."

The distributor cap dangled from its cables. On the distributor shaft was part of a rotor. Fragments lay inside the shell.

Gus painstakingly lifted them out, making sure none remained. Then he shook the distributor shaft. It had no more side play than normal in a car of this age. He inspected the cap. There were no visible cracks or carbon traces, but all eight contacts inside it were pitted and blackened.

"One day when we are coming from Miami," said Ortiz, "the engine did not run good. So a man fixed. Two days after, it stopped. Inside are pieces like this. Two weeks ago it makes noises, and again that thing inside is broke. But I do not do this thing myself."

"Sure you done it," growled Barnstable.

"Now, hold it, Silas," said Gus mildly. "Did you see Mr. Ortiz stop the car here?"

"Heh! I sure did," cackled Barnstable. "I thought he'd try something this morning, so I watched. He druv a little way up the driveway, then the engine spit and quit, right where it would do him most good."

Gus looked at Eldon. "He couldn't break that rotor from the driver's seat. But there has to be some reason three rotors broke, and I'd better find it before putting on a new one."

There were no burrs or deformations on the shaft to account for the trouble. The new rotor fitted perfectly. The edges of the distributor

case and the cap were clean and undamaged. Puzzled, Gus set the cap in place and snapped on the spring clips that held it. Then he tried to twist the cap to make sure it was properly seated.

To his amazement, it moved from side to side a visible fraction of an inch. Only the clips kept it from moving farther.

"Something's wrong," said Gus. "I'll have to call Stan to check a part number. Okay to use your phone, Silas?"

With a grunt of annoyance, Silas led Gus into the house. Eldon stalked to the police car and made a radio call.

Only on the third dialing did Gus get through, and then it apparently took Stan several minutes to find the proper parts book. Silas grumbled loudly over the delay. As he and Gus returned to the Dodge, they found Chief Eldon back also.

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"It's the right cap," reported Gus, after taking it off and inspecting it carefully. He replaced it, and once more moved it from side to side. Suddenly he bent closer, exclaiming in surprise.

"This must be it. Look, Chief. See that lug on the distributor cap? It's supposed to fit into the slot in this spring clip. But somebody bent the clip to hold the cap on tighter. That bowed out the part with the slot in it, so the lug didn't engage.

"Free to shift, the cap threw off the timing. That made the engine cough and spit, besides burning the contacts. Whenever it shifted more, it broke the rotor."

Carefully Gus bent the spring clip to its original shape. Snapped into place, its slot engaged the cap lug securely. The engine started promptly and kept running.

Ortiz smiled. "I don't understand all, but I think this thing will not break now?"

"The rotor won't break," said Gus. "But you better get a new distributor cap some time. The contacts in this one are bad."

"I thank you. Now I must pay."

"Hurry it up," grumbled Silas. "Get this car out so I can tend to business."

Ortiz paid the bill, then drove into the street. Silas headed for his car.

"Just a second," called Gus after him.

With Silas standing impatiently by, Gus unscrewed the valve cap and applied the gauge so expertly that no air escaped. He looked at it, then showed it to Silas.

"It's a trick!" bellowed Barnstable.

Gus handed the gauge to Chief Eldon.

"I was careful not to lose any air. It's lost a pound of pressure since last checked,

and Ortiz hasn't even touched Silas's car."

"No, he hasn't," agreed Eldon. "I kept an eye on him while at the radio, too. But are you sure about this, Gus?"

"I made sure when I rolled the car a little way. See how the tire rim's dented up a little from hitting a stone or curb? That spot was up when we came. I moved the car to bring it down to the bottom."

"Knew it! You tricked me!" bellowed Barnstable. "You made it lose air."

"I did," confessed Gus. "Exactly the way it lost air every time it went flat. A tubeless tire will leak if it doesn't seat perfectly all around the rim. That rim dent is too small to matter most of the time. But whenever the car stands with the dent near the bottom, where the tire bulges under the car's weight, the bead pulls away from the deformed rim slightly. Then it leaks enough to go flat in a few hours."

There was a brief silence.

"Suppose you two'll swear to this in court, hey?" demanded Barnstable.

"Not yet," returned Chief Eldon. "I'll ask the judge to impound the car overnight. If the tire goes down with that dent at the bottom, Ortiz will have a false-charge complaint of his own."

"I'll drop the case," said Silas in a strangled voice. "Gotta phone my lawyer." As Silas went inside, Gus and the Chief walked toward the police car.

"I had to stall for time," said Gus, "to let that tire lose a little air. But I think Silas really believed Ortiz flattened it. He just has a suspicious nature."

"I guess it's lucky," said Eldon with a rare grin, "that I have, too." PS



As handsome inside as out, Ford GT cushions driver and passengers in semi-reclining seats with perforated upholstery that circulates cool air. Windshield is heated electrically. Controls are fitted to driver.

British Ford GT is fastest, costliest

Built by Ford Advanced Vehicles, Ltd., near London, this Ford GT is as handsomely custom-tailored as a Saville Row suit, hits 148 m.p.h.,

is priced at \$15,500 before tax. A docile road version of the Le Mans racers that broke lap records at the French track, the 289-cu.-in. rear V-8 is detuned to 335 hp., but will still make 58 m.p.h. in the first of five gears.

“When we give you a 25-month warranty you can be sure that your OK used car has been inspected and road-tested.”



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Chevrolet Division of General Motors, Detroit, Michigan.

Every Chevy dealer authorized to use the OK warranty backs up every OK used car like this:

1. Every OK-tagged car has been inspected, road-tested and reconditioned as necessary to be in serviceable condition when you buy it.

2. For thirty days after purchase: he will pay 50% of parts and labor repairs (excluding tires, tubes, glass, radio or air conditioning), required to return the car to serviceable condition should it fail mechanically under normal use conditions (not collision) provided the repairs are made in his shop . . . and the balance is paid in cash . . . and that those repairs do not qualify for adjustment under any new vehicle warranty; and he will furnish replacement tires, tubes and/or labor at a 25% discount from his normal retail prices if you pay

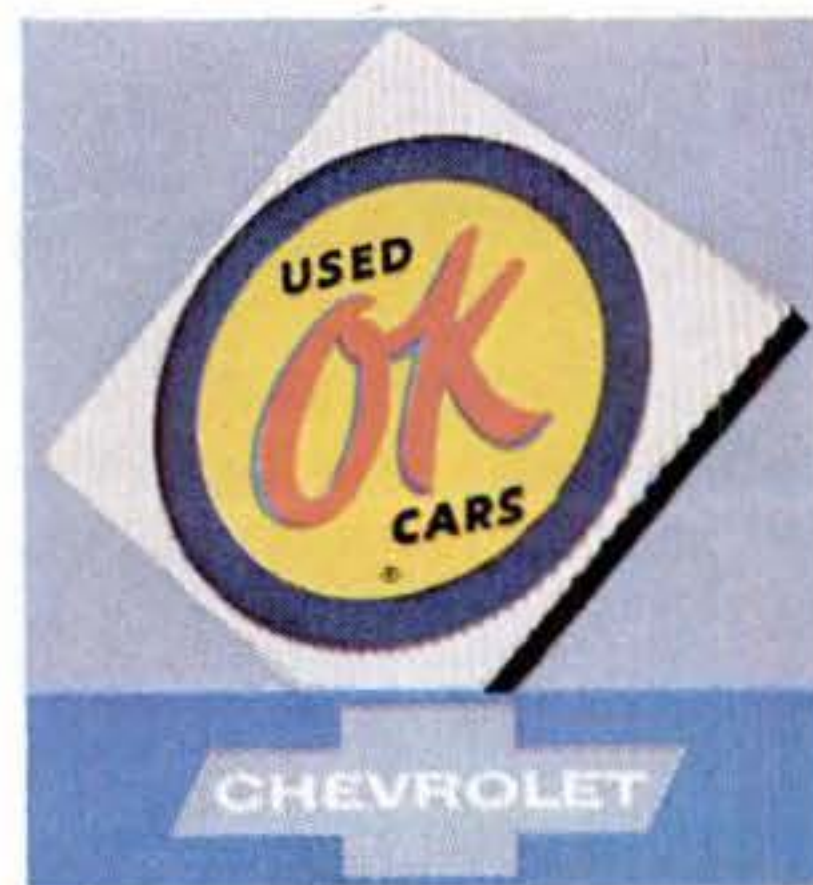
the rest in cash.

3. For the next two years on work done in his shop, the dealer will pay 15% of all parts and labor repairs.

4. This dealer warranty is, of course, void if the car is used "for hire"; it's not transferable; and it's not valid unless signed by both a dealer's authorized department head and purchaser, and presented when a claim is made.

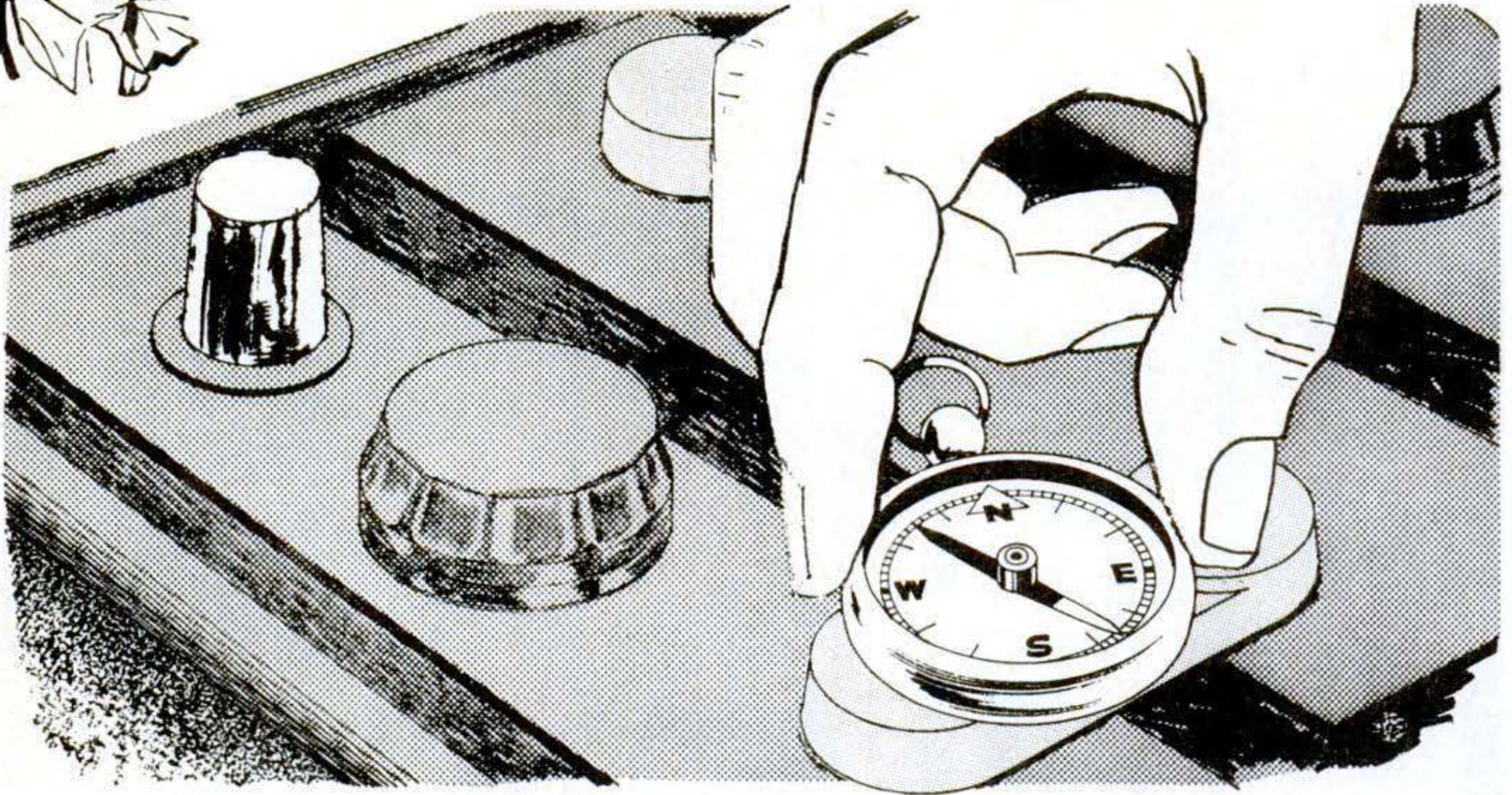
5. *This Warranty is expressly in lieu of any other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose, and any other obligations or liabilities on the Dealer's part, and Dealer neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of the vehicle.*

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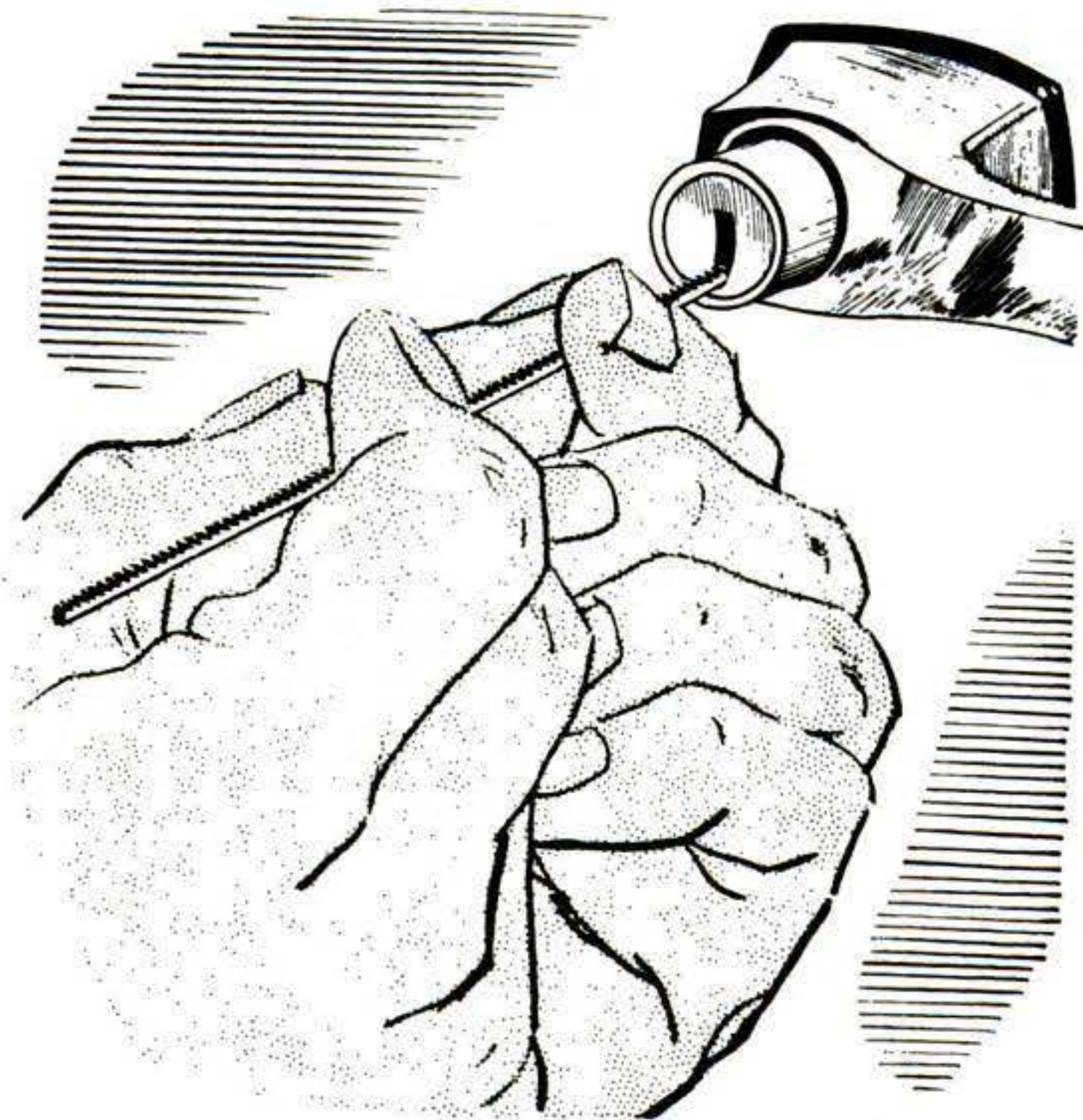


Hints from the Model Garage



If you should drop the battery when lifting it from your car, or have other reason to believe that there's an electrical leak between the battery cells, you can use an ordinary compass to make a check. Here's how: Set the compass on one of the connectors between the cells. If the needle

is deflected at right angles to the connector, electric current is flowing between the cells. Make two or three tests with the battery in different positions to be positive that the trouble is with the battery — and that the needle is not merely pointing to the earth's magnetic pole.



A broken-off key in a door, trunk-lid, or ignition lock need not be a problem even if it is invisible. Hunt up an old jigsaw blade, twist it so that its teeth will mesh with the key, and insert it in the lock. Pull out the blade, and the missing piece of key will come with it.



Want additional gauges? Many car owners do — and many have difficulty getting housings. The caps from spray cans (plastic or metal) will serve fine. If you don't want to cut new holes in the dash, mount extra gauges under the dash and in the hole left by a discarded clock.

Continued



KICK

No other stern drive outpulls a MerCruiser

MerCruiser's kick is swift and powerful. It leaves a dull day behind at the dock. It sends you skimming across the water and makes lakes smaller and rivers shorter. It's the kind of action you expect from the performance leader in stern drives. There are eight MerCruiser models, with piston displacement ranging from 67.6 cubic inches (MerCruiser 60) to 409 cubic inches in the mighty MerCruiser 310—world's most powerful stern drive. To turn this kind of power into white water, MerCruiser offers the widest choice of propeller sizes—up to 20 inches in diameter. And MerCruiser's exclusive Jet-Prop exhaust gives you an extra push by improving

engine breathing and firing exhaust gases through the propeller hub. Economy? Seven MerCruisers have 4-cycle gasoline engine economy—the eighth is a fuel-saving diesel. See all the exciting new MerCruisers for '66—60, 110, 120, 150, 170, 225, 310-hp gasoline; 60-hp diesel—at your MerCruiser dealer. He'll show you why more people buy MerCruiser than all other stern drives combined!

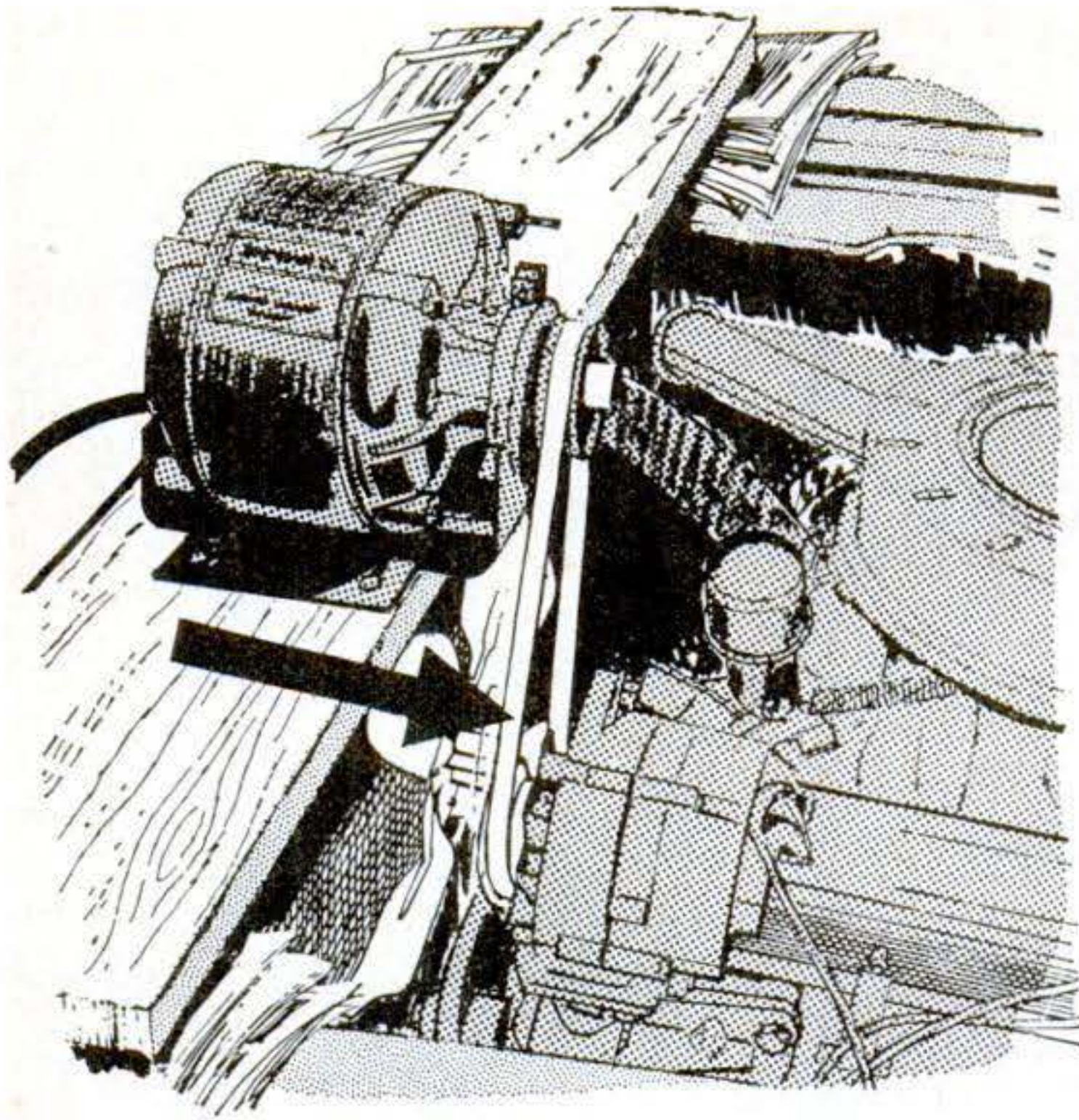
60, 110, 120, 150, 170, 225, 310-hp gasoline; 60-hp diesel



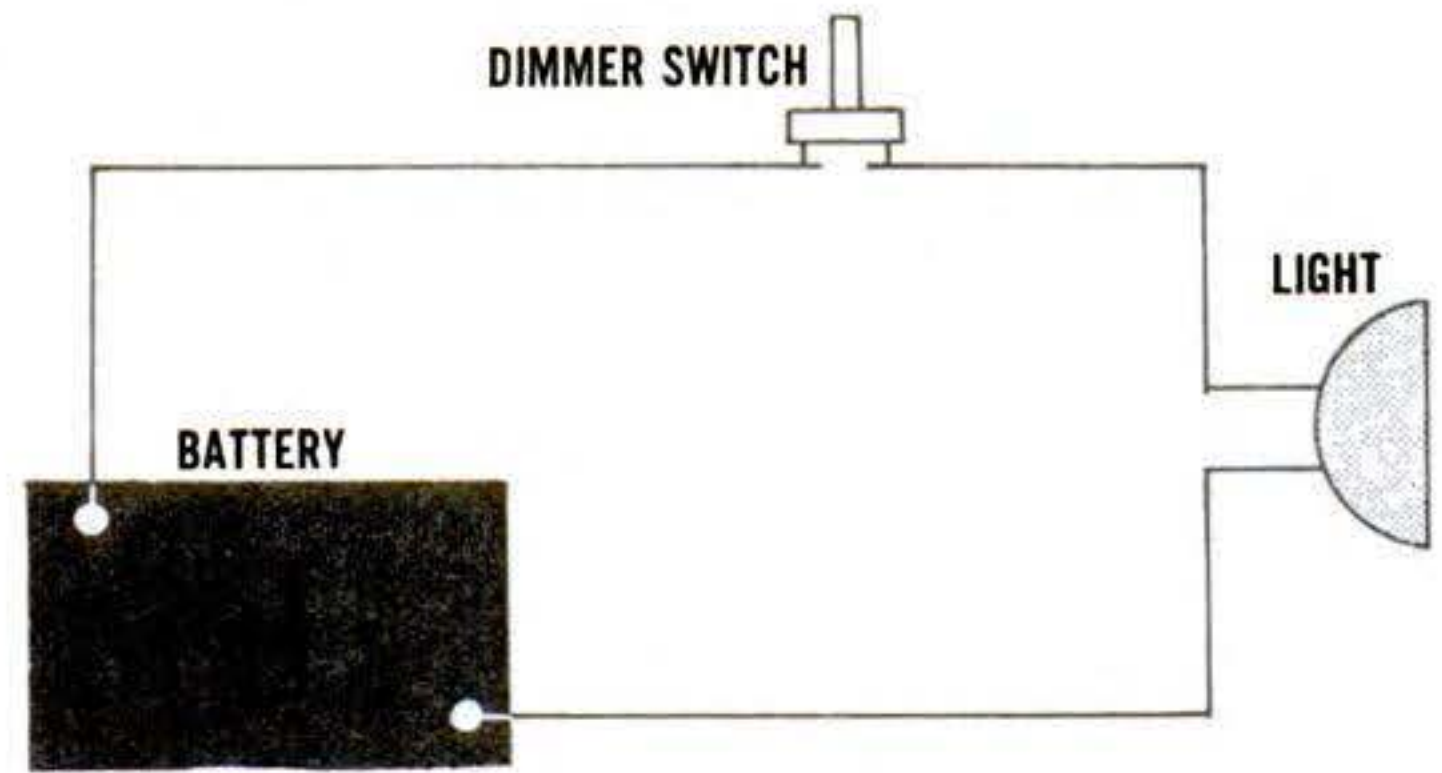
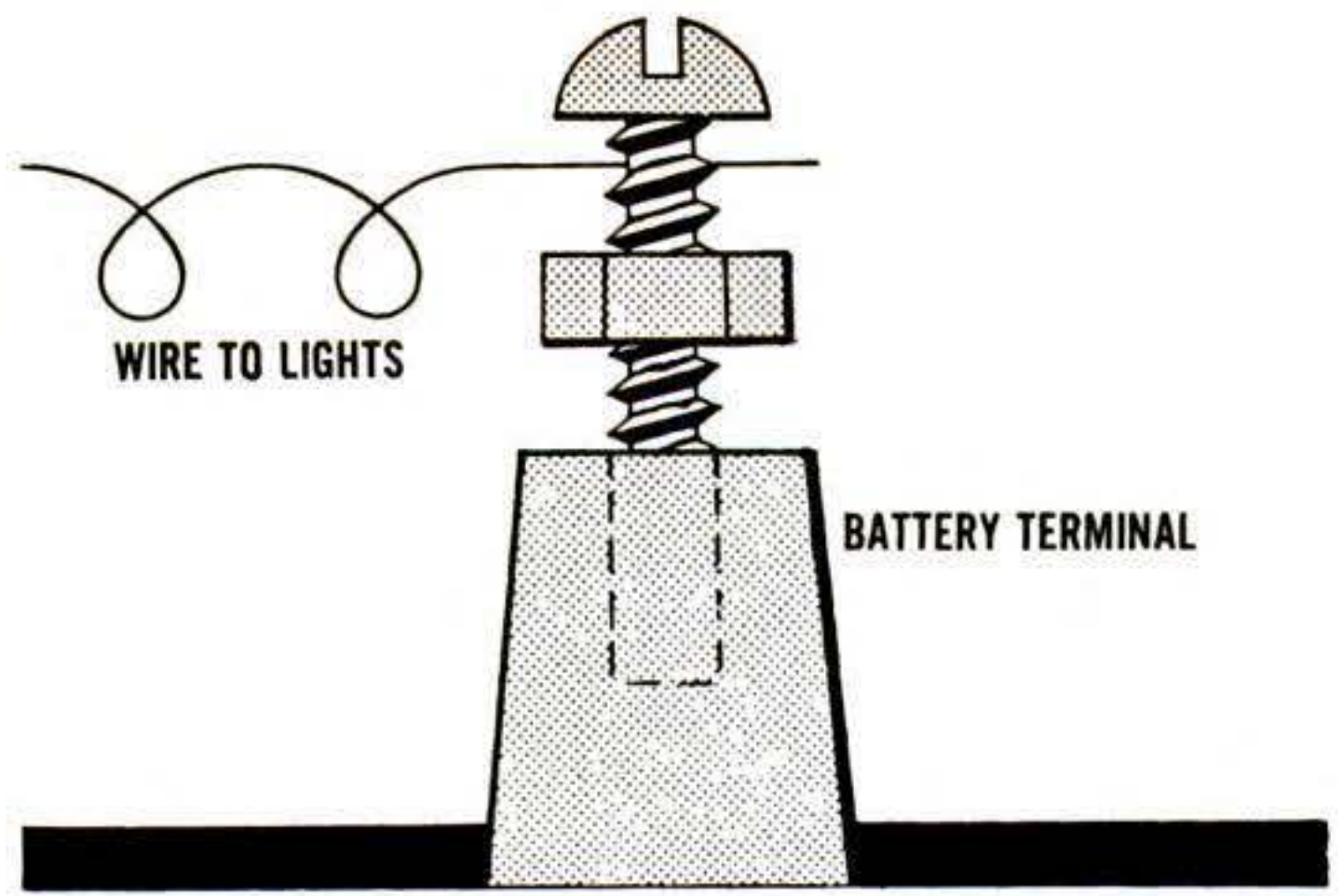
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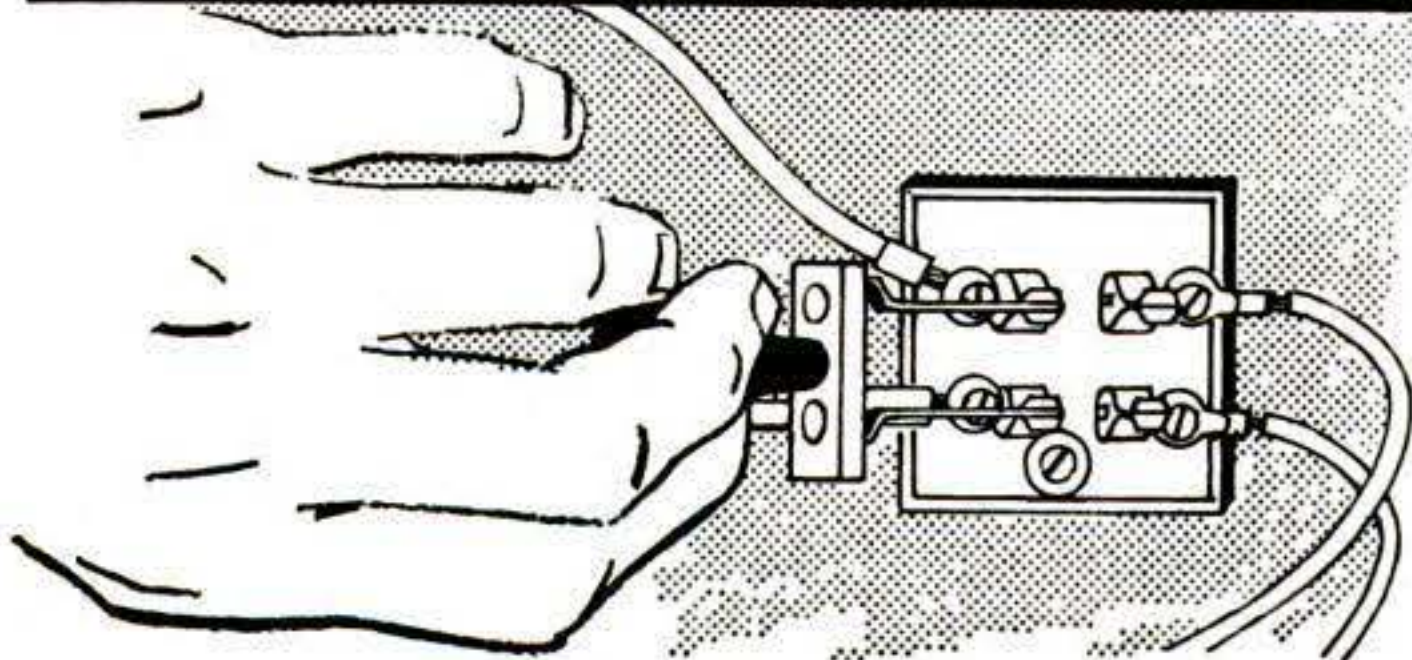
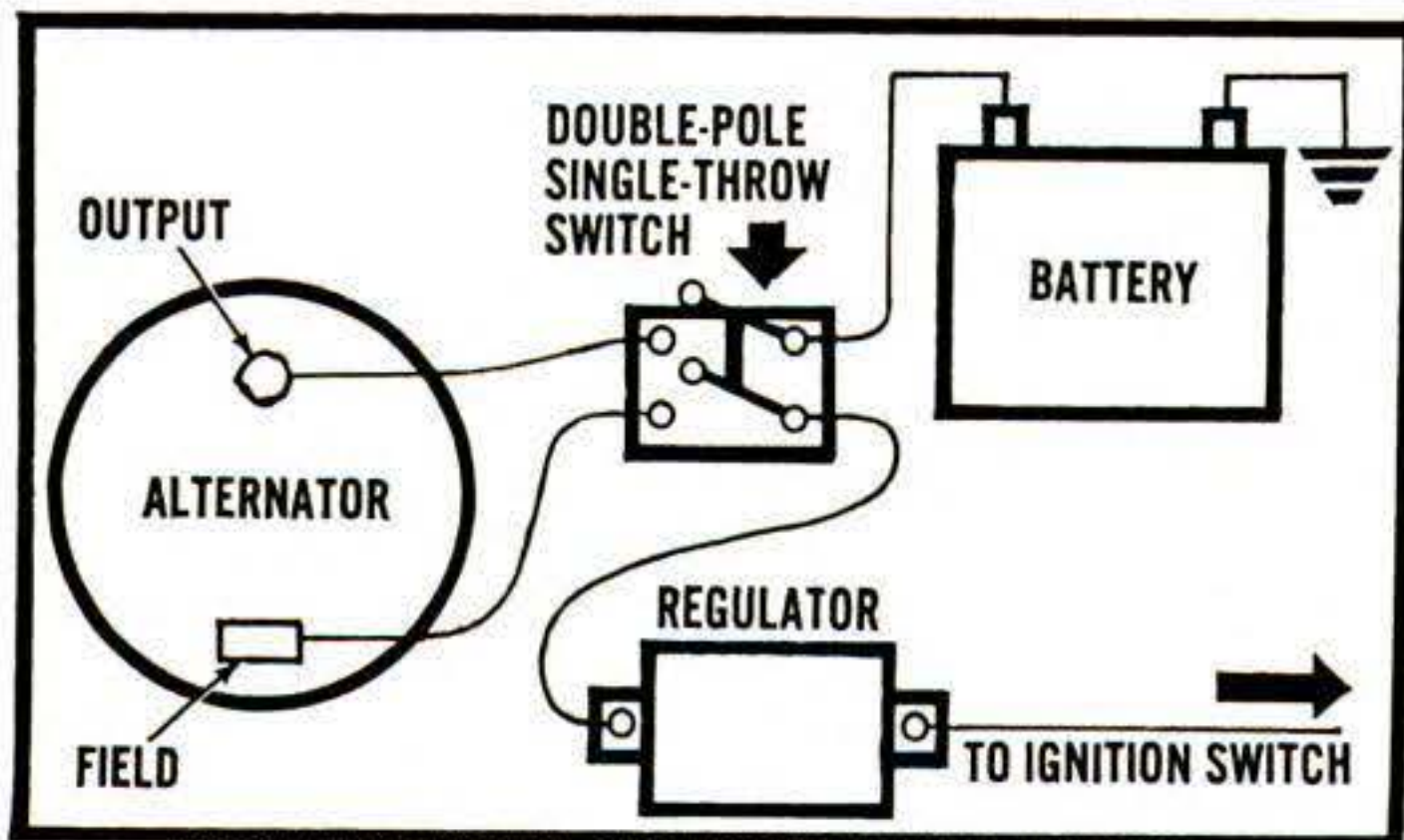
More Hints from the Model Garage



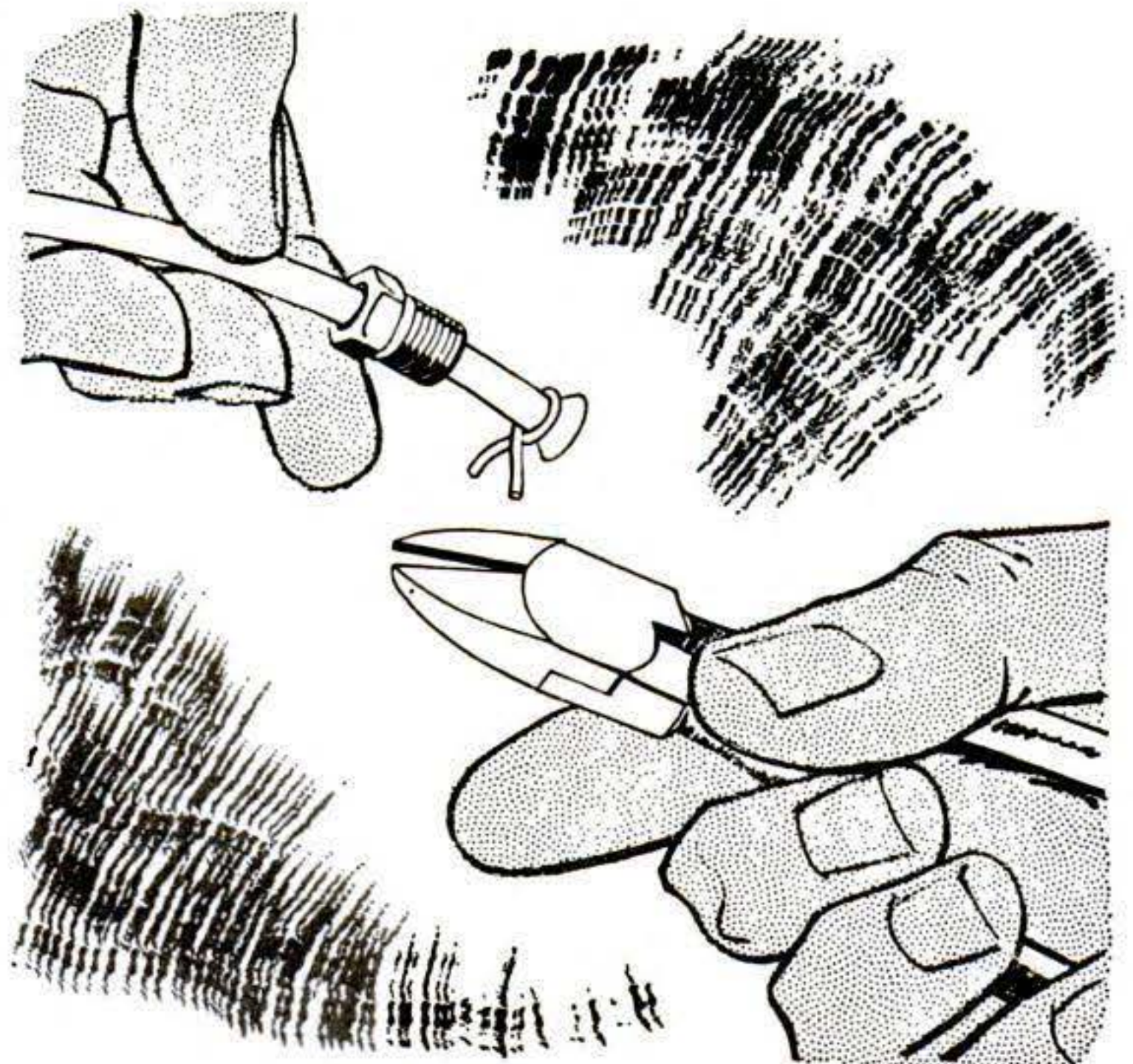
An emergency battery charger can be easily improvised if you have a bench saw with a separate motor and a spare belt. Run the belt from the motor to the alternator (or generator), start motor and run for 15 minutes. This should recharge your battery enough to start the engine.



Need a remedy for loss of headlights? Drill a small hole in the center of each battery terminal, insert stainless-steel screws, and wire them via a dimmer switch to auxiliary lights, bypassing all normal circuits. Be sure that you ground the new wiring independently.



Prevent damage to the alternator on your car by installing an on-off switch to disconnect the alternator from the battery and the voltage regulator. When recharging the battery (or when you are using the battery as a booster) open the switch to save the rectifier diodes.



When there's consistent leakage from a coupling on a copper fuel line, here's a fix: Loosen the coupling and bend a ring of bare copper wire around the tubing just behind the flared end. Draw up the coupling and the ring will seal the union. If necessary, use two windings of wire.

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with three other passengers and their sport gear tucked neatly inside.

And when your wife and kids see the new custom interior with bucket seats and a lot of other new comfort and convenience features, you're likely to have several new sports enthusiasts in the family.

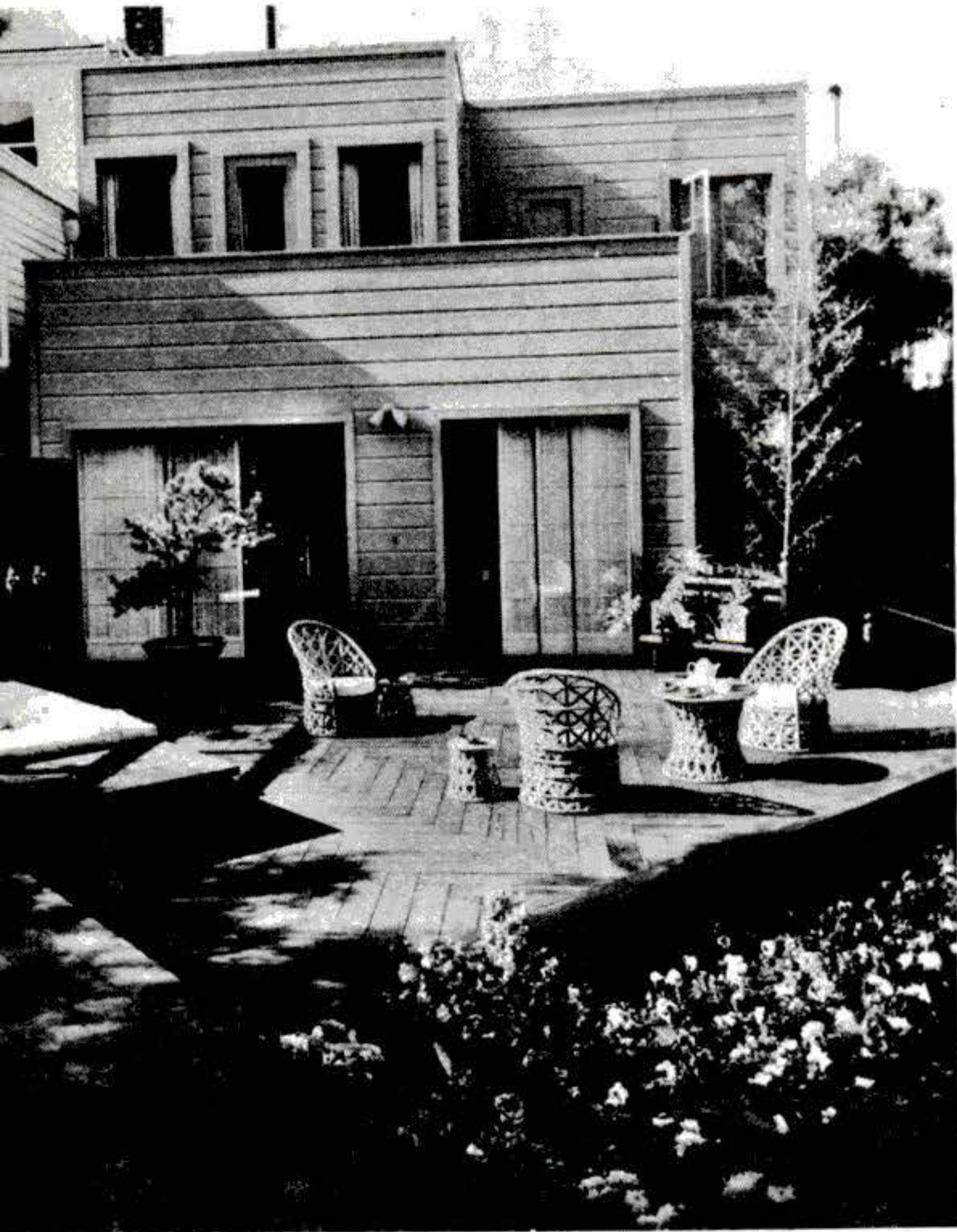
So be a sport about it. Take your family down to a nearby INTERNATIONAL Dealer to look over and test drive the new SCOUT SPORTOP . . . and to let your imagination go. You'll come out with a real winner.



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CHICAGO, ILLINOIS

Extend Your Living Space with a Deck

[Continued from page 141]



City house on small lot needs space-making virtues of the wood deck almost more than houses on spacious lots. A low-level deck like this can rest its joists on concrete piers or blocks without need of posts.

For supporting members, an economical grade of redwood is construction heart. Grades containing sapwood are better avoided since these creamy-white streaks are as subject as any other lumber to decay.

You may wish to use rough lumber for the posts, beams, and joists, and possibly for railing members. Use a surfaced type, however, for the decking itself and for any built-in seating.

One joy of a wood deck compared with a paved patio is that it is pleasant underfoot, even barefoot. But splinters in rough lumber put an end to this pleasure and may reduce the usefulness of the deck.

Since knots limit the span of your decking material and detract from the appearance of the job, you may prefer to go into a better grade for the deck floor. "Clear all-heart" is the redwood to specify in this case. Even in two-by-four it will take a 3' span nicely.

If you must exceed that span, or if you are using a lumber grade containing occasional

knots, you should go to two-by-six instead. Even wider lumber is sometimes used for decks, but the result is usually less attractive and the danger of cupping from dampness is increased.

What nails? Ordinary nails will rust and streak. Use galvanized nails (and be sure they are the hot-dipped type, rough to the touch) for the structural parts of the job.

Galvanized nails will do for applying the decking, too, but they involve one risk. The zinc on the heads may be chipped off by the hammer, permitting them to rust and streak. You can avoid this danger by using aluminum nails. I find the hardened aluminum-alloy ones (such as Hy-Tensil) the easiest to drive successfully.

For nailing down 2" decking, 16d nails are about right. Use two nails at each bearing for two-by-fours, three nails with two-by-sixes. Drive them at a slight angle and you'll increase their holding power.

Which finish? If you're using lumber without built-in weather resistance, painting your deck like your house will give it good protection. So will use of a stain formulated especially for decks. Cabot's decking stains, with an alkyd-resin base, come in shades of red, brown, and gray and may be used with any kind of lumber. Decking stains require far less maintenance than ordinary paints.

Redwood may be given a finish or left natural. Unfinished redwood may darken in streaks but eventually will settle down to a weathered gray. If you're in a hurry, treat it with a commercial bleach.

If you prefer to keep something closer to the original redwood color, use a water repellent. Put on two coats, and brush, don't spray. Redwood treated this way will slowly lighten in color, usually ending with a light buckskin tan. One water-repellent product (Thompson's Water Seal) comes in clear or a variety of pigmented types to produce almost any color effect you might want.

About the only hard-and-fast rule for finishing is one that comes from long experience with redwood used outdoors. Never use varnish or any other clear coating. Redwood doesn't need it. You would just be putting yourself to all that expense and work for nothing. And that, of course, would be against one of our major principles: that a deck is for *fun*. P S



Pontiac Bonneville

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General Motors does.**



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Rough Stuff: The Big News in Wall Paneling

[Continued from page 136]



Adhesives are the modern way to put up wall paneling. Here, mastic from a can is being used to apply Simpson's thin redwood t&g boards directly to a wall. There's no problem of concealing nail holes.

again. And here you have a wide choice.

Popularity secret of tongue-and-groove paneling lies in the blind nailing it permits. Finishing nails toed through the tongue of one piece are hidden by the grooves of the next.

Georgia-Pacific's saw-textured redwood paneling-siding is smooth on one side, rough on the other. For exceptional economy there are $\frac{3}{8}$ " tongue-and-groove redwood boards. Simpson's La Honda offers a uniform rough-

Matching moldings of real wood are supplied by Masonite for its hardboard panels. Example of some of these Royalcote vinyl-clad moldings are shown here.

ness, Union's Noyo Thrift the band-sawn texture called FactriSawn. Townsend offers three rough-sawn hardwoods—Wattled Walnut, Colonial Cherry, and Colonial Red Oak. All are tongue-and-groove V-groove boards $\frac{1}{2}$ " thick.

Where tongue-and-groove gives you butt joints or V grooves, channel patterns produce wide joints that look like reverse-batten siding.

In a family or rumpus room or wherever you want an especially rugged look, board-and-batten is fitting. Potlatch Forests offers both boards-and-battens in TrendTex, rough-sawn in pine prefinished to a weathered gray, and also a rough-faced pine plywood in this finish.

Man-made panels? Catching the big trend, these have textured versions, too. Pecky Teak is a realistically textured hardboard in Masonite's line of Royalcote wood reproductions. The same company's Marblitone is an equally convincing way to get the look of travertine marble—characteristic fissured veins in an inexpensive 4'-by-4' sheet, easily applied with adhesive.

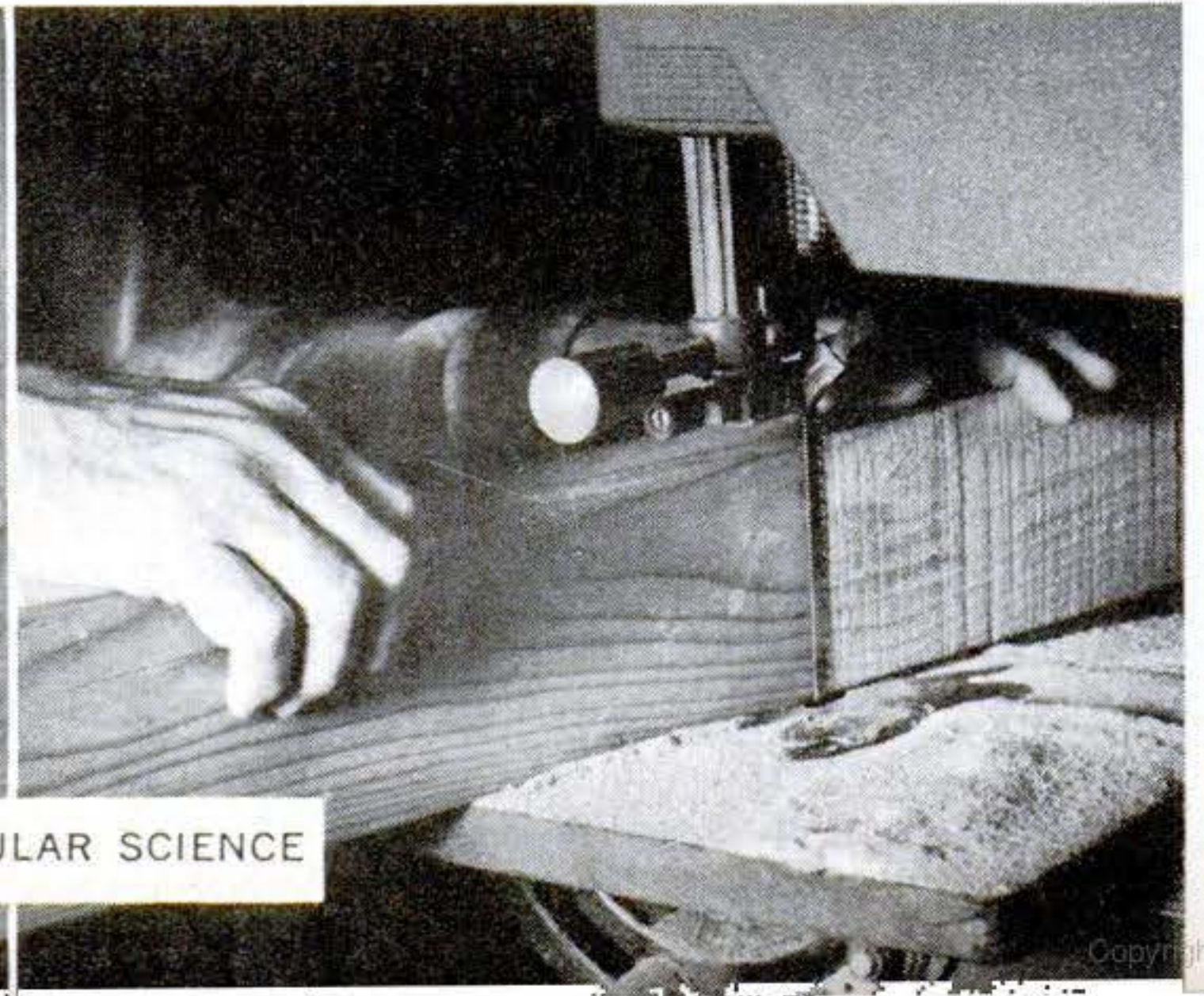
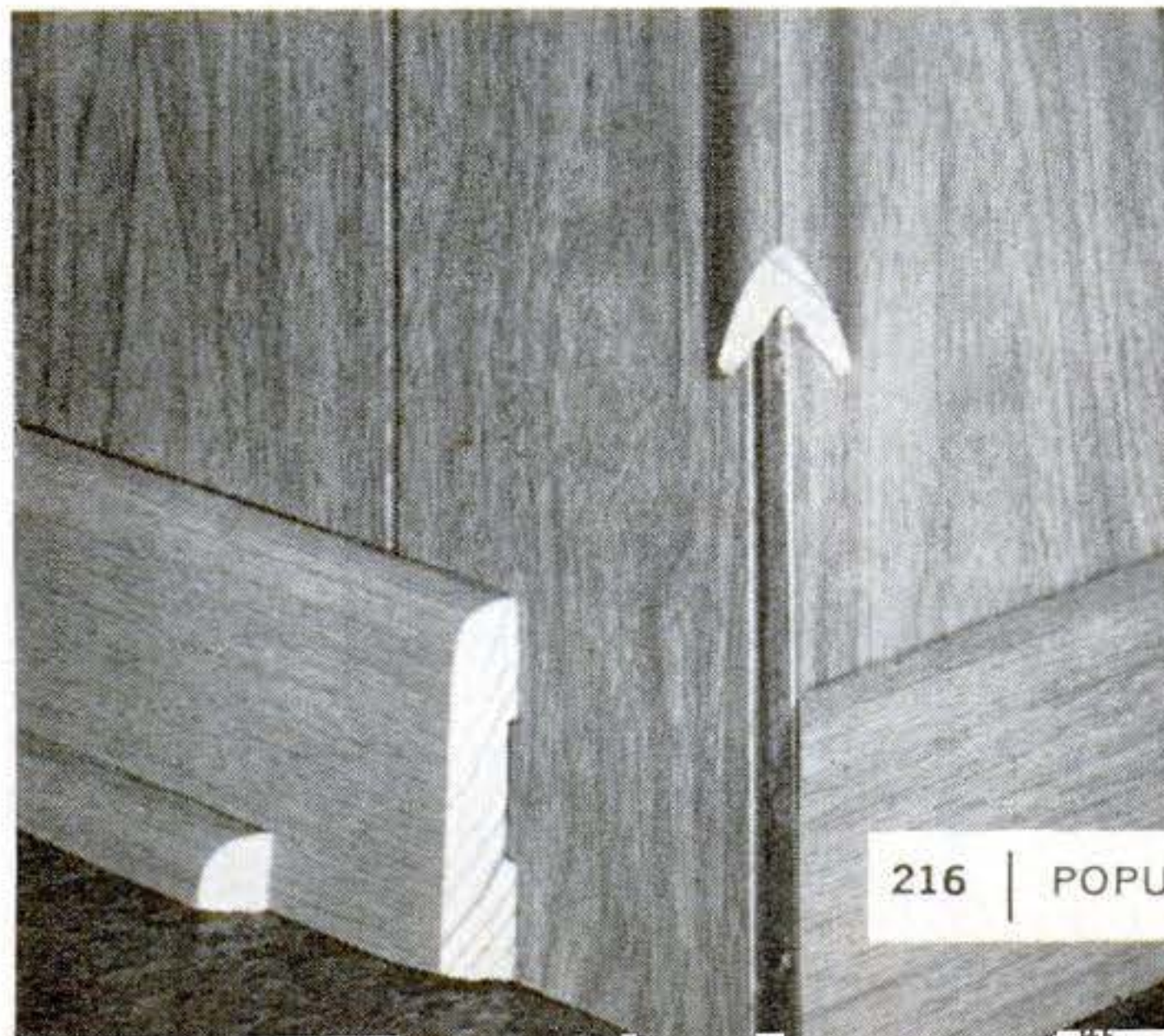
For an almost everlasting surface that still offers delightful color and depth, there's textured Marlite paneling. Because the finish is baked onto Tempered Duolux hardboard, Marlite can be cleaned with a damp cloth. In Wormy Chestnut finish (light or dark), textured Marlite is made in tongue-and-groove panels 18" wide and 8' long, for simple installation with clips and adhesive.

What, no nails? Second big news is the end of that old bugaboo of panel installers—all those annoying nail holes to fill.

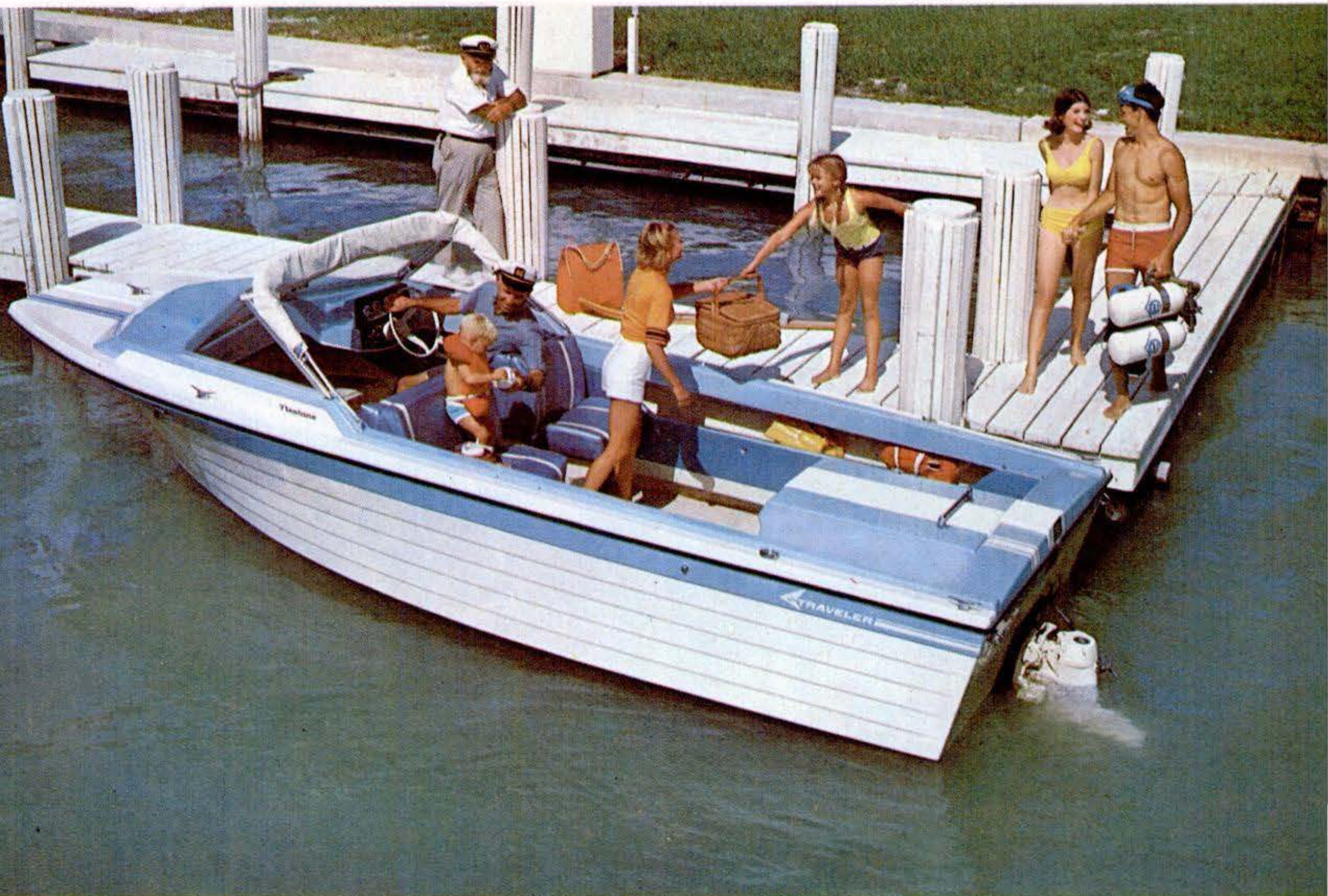
You can now get new and remarkably potent adhesives especially designed to grab

Continued

You can make your own rough-surfaced trim and moldings to match textured panelings. Here's how to use a band saw. A coarse sanding belt also will work.



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Rough Stuff: The Big News in Wall Paneling

plywood or hardboard panels and hold them tightly to the wall. The method works for bonding paneling to plaster or drywall as well as to studs or furring strips.

These adhesives come in easy-squeeze cartridges, like caulking. Instructions call for a continuous bead applied to wall where edges of panels will go, intermittent stippling of adhesive on other bearings.

Installation by adhesive is not only easier and neater; it's faster. Testers at U.S. Plywood did a sample installation by traditional nailing methods, then duplicated the job with Weldwood Panel Adhesive. The stickum cut the job time neatly in half.

What else is new? Third major paneling news runs precisely counter to the rough-stuff trend: new patterns of ultrasmooth pre-finished hardwood plywood with the look of hand-rubbed oil-finish furniture.

The traditional V-grooved panels are being crowded by distinctive new types. In its Acryglas-finished hardwoods, for example, Georgia-Pacific offers a choice among narrow and broad grooves, contrasting color stripes, and wood-inlay bands. The half-inch chan-

nel grooves in one, called Gold Crest, can take pressure-sensitive tapes in gold, black, or white for a quick change at any time. These highly finished panels are offered in cherry, walnut, rosewood, pecan, and almost anything else that grows as a tree.

Further information about products mentioned in this article may be obtained from the manufacturers. Their addresses:

Abitibi Corp., 21500 Greenfield Rd., Detroit 48247; California Redwood Assn., 617 Montgomery St., San Francisco 94111; Evans Products Co., 1121 S.W. Salmon St., Portland, Ore. 97208; Georgia-Pacific Corp., Commonwealth Bldg., Portland, Ore. 97204; Marsh Wall Products (Marlite), Dover, Ohio; Masonite Corp., 29 N. Wacker Dr., Chicago 60606; Potlatch Forests, Inc., Wood Products Div., Box 8850, Chicago 60666; Simpson Timber Co., 2000 Washington Bldg., Seattle, Wash. 98101; Townsend Lumber Co., Stuttgart, Ark.; Union Lumber Co., 620 Market St., San Francisco 94104; Western Red Cedar Lumber Assn., Yeon Bldg., Portland, Ore. 97204; Western Wood Products Assn., Yeon Bldg., Portland, Ore. 97204. PS

How to Win at Indianapolis

[Continued from page 126]

strain on me. It also made me the object of more speculation than ever before.

Not all of this speculation was founded on good will, however. Although I was not allowed to know about it at the time, my office in London was receiving warnings of impending disaster and threats from cranks who resented the fact that a foreigner in a "funny" car might win an all-American show. But I could not help appreciating the tenseness of the atmosphere around the Speedway on the night before the race.

Race day. I managed to get a good night's sleep at the Speedway Holiday Inn, but the countless parades and exhibitions laid on for the benefit of the crowds had heightened the tension inside me.

I dare say that my feelings were no different from those of every other driver, but when every radio and TV reporter in the U.S. wanted last-minute interviews just before the race started, I fled. I hid myself away in the Lotus garage and stayed there, trying to relax until the race started by cleaning and recleaning my goggles, until the last minute.

The press, radio, and TV ballyhoo before

the race was as nothing to the performance that went on after it was all over. I suppose I gave the same basic interview to 50 different TV stations—after all, what can you do when you are asked the same question 50 times?

I talked with journalists, race officials, and hangers-on for what seemed like hours—and was wickedly misquoted by at least one British national newspaper. This paper, in common with both British TV channels and BBC radio, virtually ignored the Indianapolis win, except to make some snide comments about some imaginary antipathy by American interests following the race. In fact, the generosity of American race fans to our win at Indy was most impressive.

Whether I shall be racing at Indianapolis again remains to be seen.

What has been achieved, meanwhile, by our invasion of Indianapolis, is a complete rethinking of the tools for the American championship job. The eclipse of the old front-engined roadster by rear-engined European-type racing cars is in many people's view a move away from "horse and buggy" motor racing into the 20th century. PS



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PS

FORD



Is This Every Man's Flying Machine?

[Continued from page 94]

rotor. Then you rise to the limit of the rope.

You find that when you push the yoke sidewise the rotor tips and you move in the opposite direction. You learn that by working the pedals you swivel the rudder to more positively swing you around. Push the yoke forward, and the rotor tips backward and the gyro climbs. Pull the yoke back, and the rotor tilts forward and the gyro glides.

Then you cut loose from the tow car and make several low-altitude free-flight landings to make sure both you and the machine are ready for powered flight. Your confidence builds, and slowly your hops lengthen until one day you set your jaw, twist the motorcycle-like handle grip on a gasoline-powered version full open, and rise into the sky.

A safe, soft landing. One comforting thing about gyro-ing is the knowledge that if the motor cuts out (or the rope breaks) you settle to earth, rotor whirring, soft as a double-bladed maple seed. For proof, look at Jim Simmons, an X-ray technician from Loma Linda, Calif., who built a motorless rig in his garage. On his second towed flight, the rope broke. "I couldn't believe my eyes when that line dropped away," he said later. "But I settled down nice as anything."

Dr. H. B. Monroe, president of Wayne Technical Institute in Goldsboro, N.C., says, "We live in a world that has largely deprived us of the joy of using our hands. With this thing, a man can take his hands and use them to make something exciting." Dr. Monroe built his own machine in his school office.

Its qualities make it perfect for outdoorsmen. This spring, when Joe McMillan, a rancher from Arthur, Neb., turned his 110 head of cattle out to pasture, somehow they disappeared. McMillan strapped himself into his Gyrocopter, used a country road for takeoff, and buzzed into the sky to check his 1,800 acres. A half-hour later he spotted where winter snow drifts had mashed down a fence. "It would have taken me all day in a Jeep to find that break," he said later.

In Nevada, an archeologist specializing in Indian relics, spies likely looking sites from the air. In the Philippines, a missionary uses a Gyrocopter to island-hop on

his rounds. In Peru, along a stretch of the Andes, a plantation owner uses his rig to visit a field on the other side of a mountain ridge. Takes him a half-hour to get there. By auto, it's a three-day trip.

Gyrocopters are mostly for fun, though. Which is just as well with the Federal Aviation Agency, aircraft-licensing agency. As the rules are now written, you can't use Gyrocopters for any real purpose—only for kicks. And that makes Bensen furious.

"That's just one more place where the F.A.A. goofed," he says.

Man behind the machine. Bensen, 48, is the driving force behind the whole Gyrocopter movement. As president of Bensen Aircraft, maker of Gyrocopters, kits, and parts, he not only sells the most popular craft, he coined the term Gyrocopter. A full-faced man with pixie-pointed eyebrows, Bensen speaks like a North Carolinian brought up in Russia, which he is, and his cohorts call him "the Bela Lugosi of the gyro circuit."

Today Bensen estimates his company corners about 90 percent of the Gyroplane market, selling \$1.4 million worth of cop- ters and parts annually.

Gyrocopters are classified "experimental." This means, in part, that 1) the pilot must have a Student's Pilot Certificate, which he gets after a medical exam by his family physician and a talking-to by the F.A.A.; 2) the craft must be checked over by a local F.A.A. representative; and 3) it must have been constructed by the hobbyist—he can't pick it up ready-made at the factory. (He can buy the parts, though—a complete rotor, for example.)

The touch of danger is lurking even though the device is aerodynamically about the safest aircraft around. In the past 13 years, according to Igor Bensen, a dozen people have been killed flying Gyrocopters. But, he points out, 24 sky divers were killed last year, and four skateboard riders died in a three-month period in 1965.

Despite the casualties, the safety record of Gyrocopters is, on the whole, good.

If the F.A.A. does indeed open wide the door, the boom in back-yard gyro-ing should be impressive. At least 150,000 people—more than enough to fill a city the size of Austin, Tex.—are already interested enough to have paid hard cash for gyro plans from Bensen. PS



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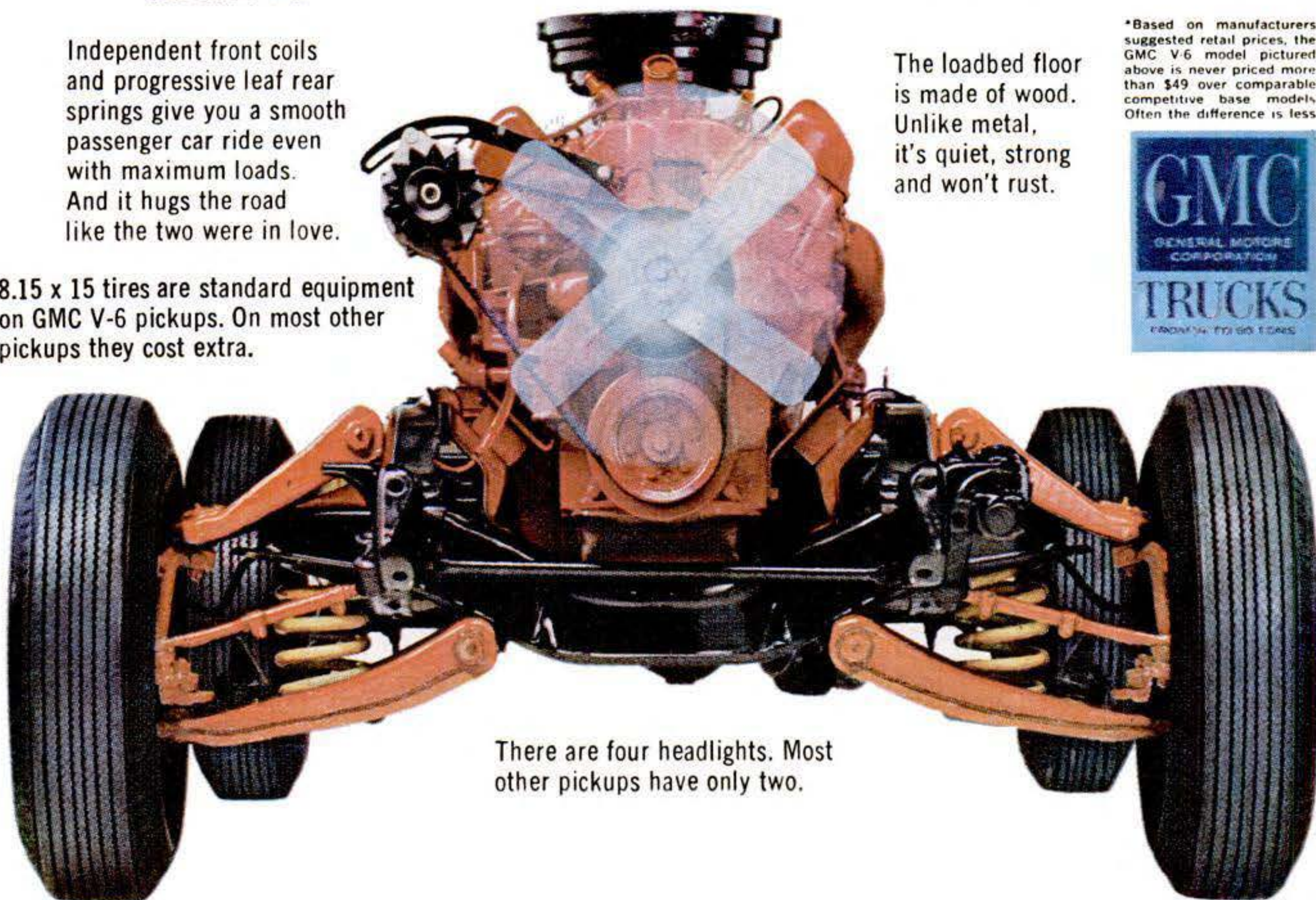
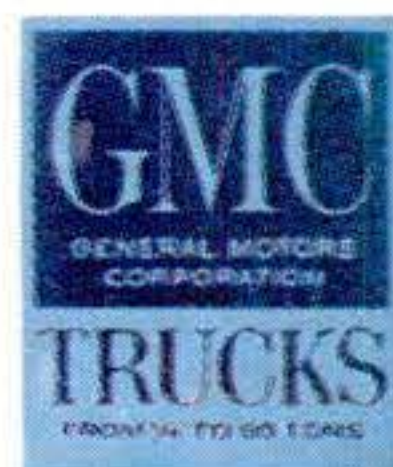
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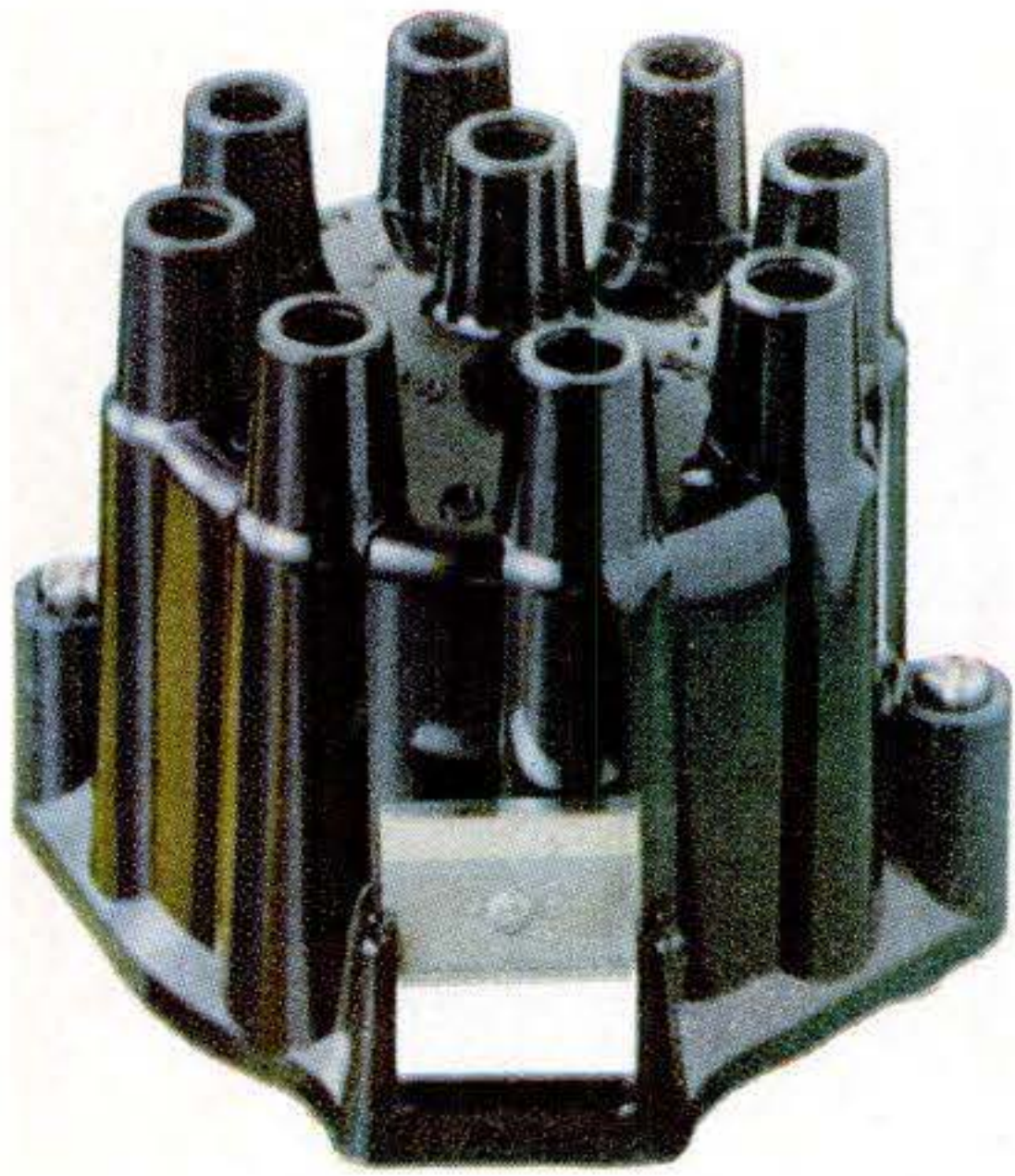
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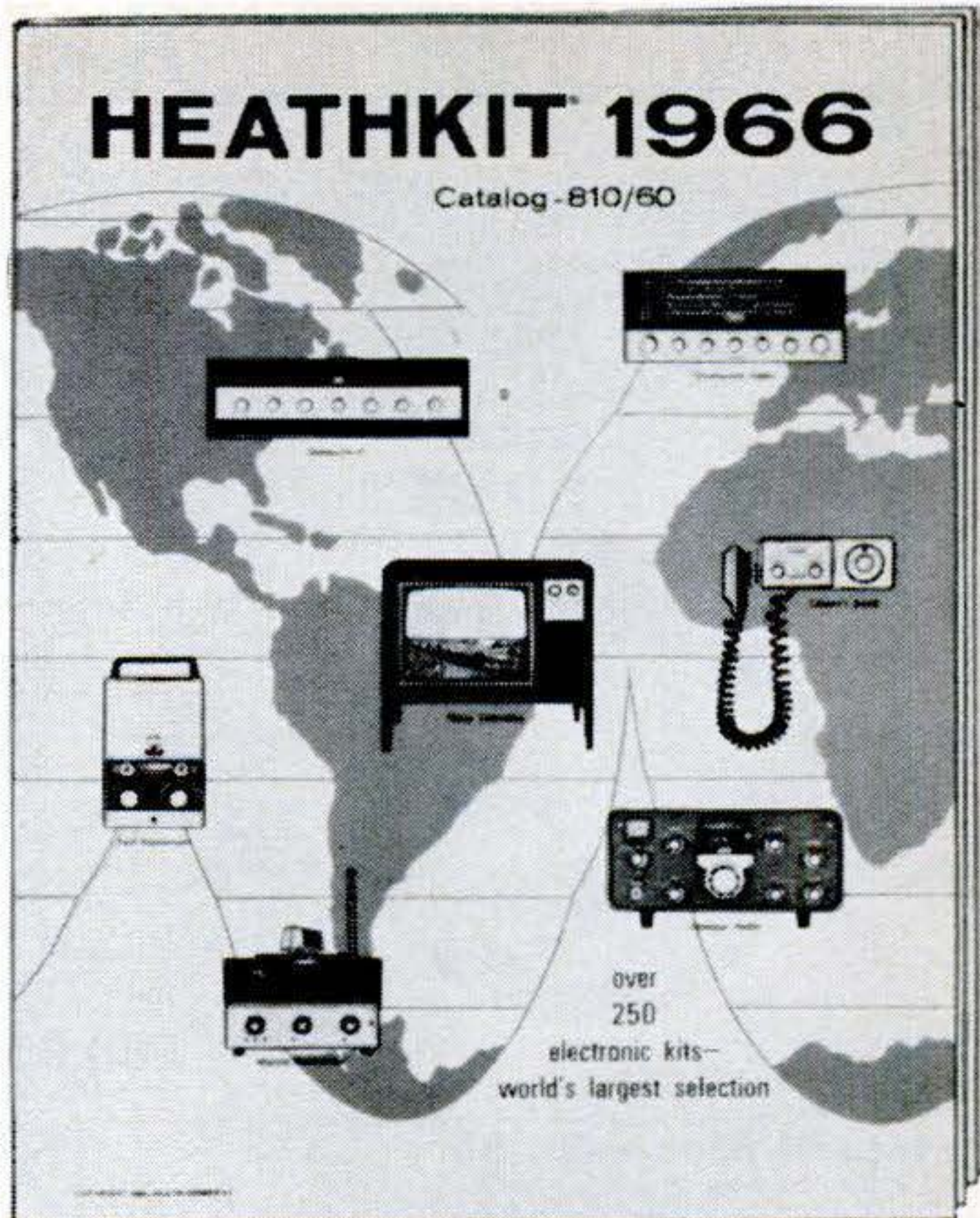
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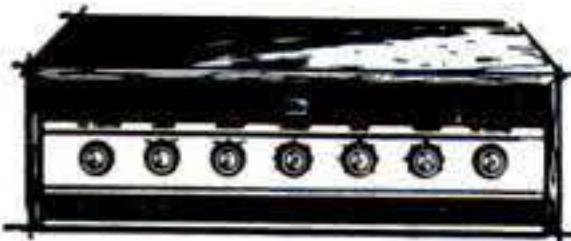
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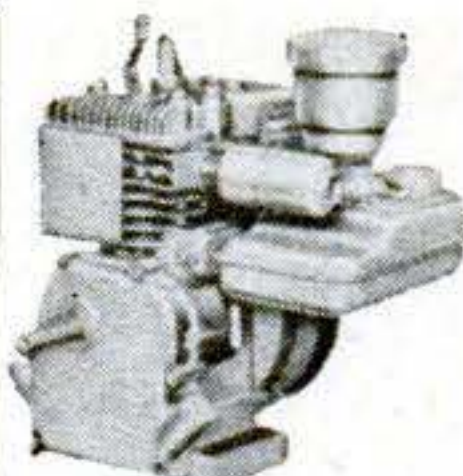
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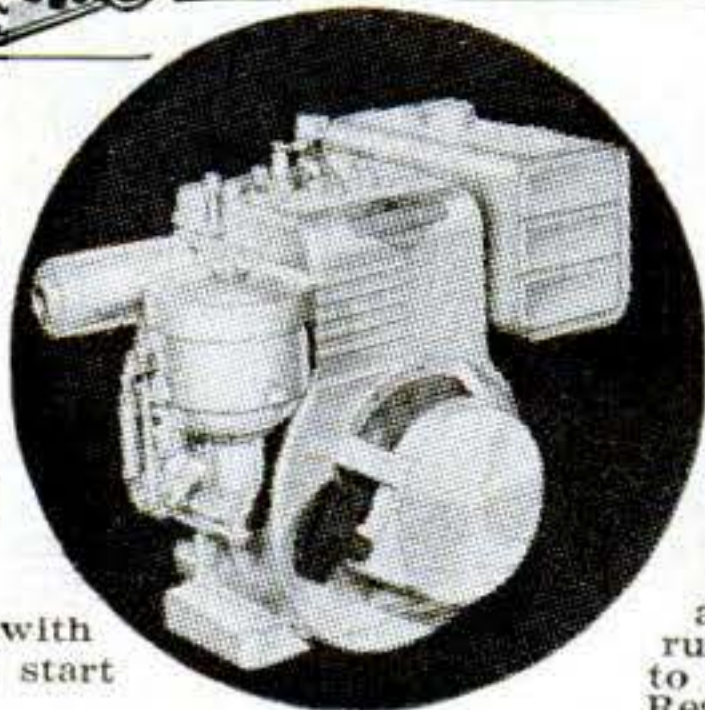


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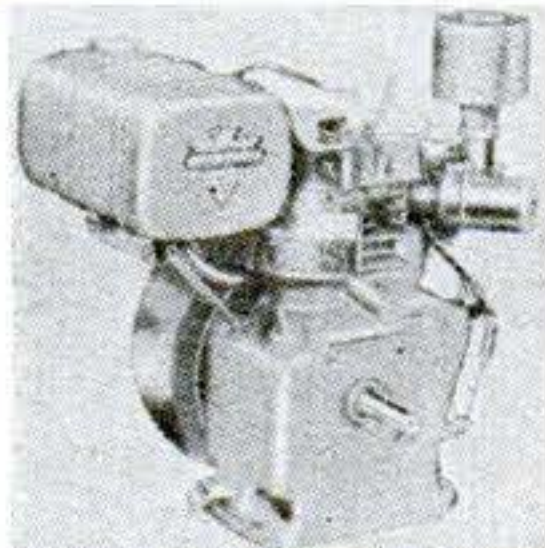


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Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start 5/8" std. shaft
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3 1/2 h.p. Clinton—39.95
A big engine with big power. Model 406, 4 cycle, rope start 3/4" std. shaft.
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Remember these engines are absolutely perfect and standard and under factory warranty. Money back guarantee. Order now while stocks are complete. Factories—we buy new engines.

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The Everlite is the only battery charger that will recharge all types of dry cell batteries up to 12v including flashlights (all sizes, lantern, hotshot, telephone, ni-cad, mercury hearing aid, radio, tape recorder, toys and camera batteries. The Everlite is so powerful (charges 3 times faster) that the Model 66 can boost car batteries to assure fast starts on cold mornings. Practically non-breakable, simple and foolproof—even a child can use it with complete safety. Plugs into any 115v AC outlet. Can't over-charge, can't burn up, guaranteed for one year. Save real money by using the Everlite Battery Charger plus the convenience of having fresh batteries always when you need them. TRANSISTOR RADIOS. The Everlite will play all battery powered radios and, at the same time, charge the batteries. The performance, power and capacity of the Everlite cannot be equalled even at three times our price. FREE battery tester included.

Model #65 **\$5.95** Model #66 (with car battery booster) **\$7.95**
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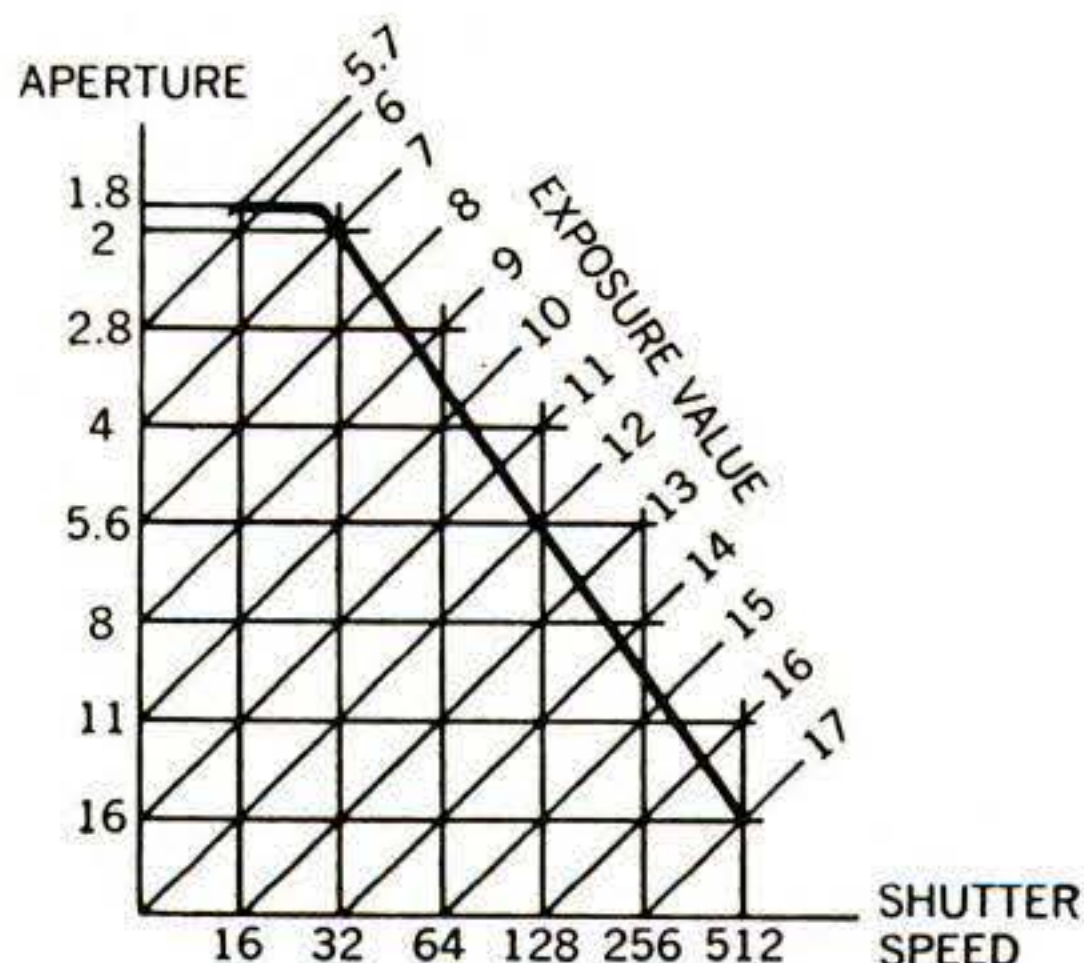
Electronic Shutters

[Continued from page 185]

phragm settings. (The Argus is not electronic, but one-unit shutter/diaphragm and programed settings make it pertinent.)

The Yashica Electro 35 is still more flexible. You can shoot fully automatic (programed) if you wish, but there is also a manual setting that permits you to select the aperture opening while the camera selects the shutter speed.

The Olympus, Minolta, and Yashica all have a little warning light in the viewfinder. It goes on, if there's not enough light, as you start pressing the shutter release.




Programed settings (heavy diagonal) are shown for Minolta Electro Shot but are close to those for other cameras with single-unit shutter/diaphragms. Only one combination of lens opening and shutter speed is possible. Camera ignores conventional *f* stops and shutter-speed settings, giving continuously varying combinations. At exposure value of 13, for example, camera would shoot at about 1/180 second, *f*/7.

One nicety on the Olympus and Minolta ought to—and probably will—be on all cameras. This is the flash-coupled focusing system that takes the arithmetic out of flash. All you do is set the guide number of your bulb or electronic flash on a ring. As you focus, the diaphragm automatically opens or closes to exactly the right aperture.

Who was first with an electronic shutter? The Polaroid Corp., 2 1/2 years ago, when it brought out the Polaroid 100 [PS, Oct. '63]. The Germans took up the idea and brought out a couple of magnificent electronic shutters—unfortunately of a size and cost that limit them to studio cameras and professional photographers. The Japanese, however, whittled them down, mounted them in small cameras, and are, I guess, shooting pictures of each other all the way to the bank.

PS

A black and white photograph of a woman's hand, adorned with a bracelet and a ring, holding a paintbrush. The brush is positioned over a wooden surface, which is partially visible at the bottom left of the frame. The background is a light, textured surface.

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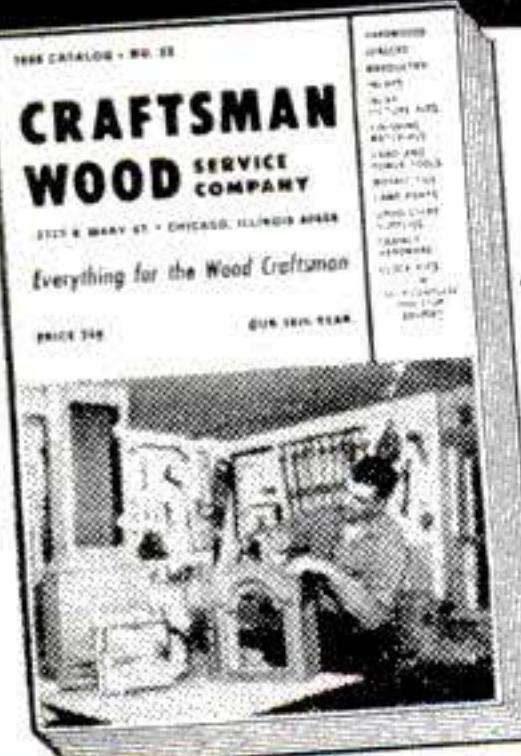
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work with don't
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Saving a City from a Cloud of Death

[Continued from page 111]

on duty in the danger zone. The National Guard posted 600 men in case mass evacuation became necessary. Hundreds of hospital patients and old people had already been moved out, the day before.

Standing by were gasoline-powered wind machines, the kind used in movies to create gales. If the chlorine escaped, engineers would try to roll back the fumes behind a windwall, to give crewmen a chance to scramble off the salvage ships. The water was constantly checked for chlorine traces. Every detail of the plan was coordinated with State civil-defense forces.

At 8:00 a.m., Norton gave the order for the Big Lift. Cables leading from the derrick to the strongback drew taut as violin strings. Steadily, tension rose on each boom of the lifting gear: 200,000 pounds . . . 300,000 pounds. The barge stirred. Cables strained and quivered.

At 8:55, the MTC 602 broke loose from the mud and swung free. Slowly, a foot a minute, the cables hauled it up.

First the strongback broke the surface. Then came the barge, inch by inch, until watchers could see the tops of the clammy tanks and the warning sign:

**DANGER! CHLORINE
NONFLAMMABLE GAS
TOXIC**

Quickly, inspectors from the Chlorine Institute jumped aboard and checked all valves and domes for leaks.

All clear! Though it seemed like a lifetime to Norton, the Big Lift took only two hours and 15 minutes. By 11:30 he gave the "all clear" to State Civil Defense, which announced it to the public. Baton Rouge had been saved from a cloud of death.

Two hours' pumping drained the barge of water and made it buoyant again. Surprisingly, the only damage to the hull proved to be a few small holes above the waterline, which were easily welded. Next day, MTC 602 was floated 43 miles downstream and its lethal cargo safely unloaded.

Salvage Project 602 was done. It had cost an estimated \$1 million—but not a single fatality. Baton Rouge's Mayor W. W. Dumas suggested that people go to church that Sunday and bow their heads in thanks. "It was an ordeal I can tell my grandchildren about," says Colonel Norton. "But I never want to go through anything like it again."

PS



New '66 Mercury Comet has reserve strength for trailer towing. Rugged 289 or 390 cubic inch V-8's, available with all models.

The best cars going for towing . . . are Ford-built!

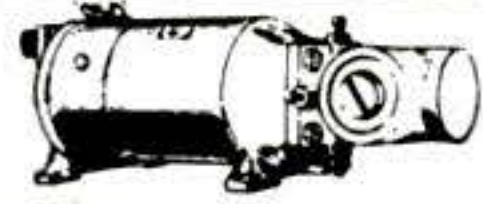
Vacations on wheels are easier, safer and far more fun with a '66 Ford Motor Company car. Reason? They're better built; solid, smooth and easy to handle with extra power per pound to make towing a breeze! Trailers with a static tongue load of less than 200 pounds can be towed easily by any Ford-built car with no special equipment other than the proper hitch. Extra-rugged bodies, sturdier suspension systems, wide stance wheels and brawnier brakes are just a few built-in bonuses for better trailering. Bigger loads? No problem! With the easily installed load-equalizing hitch and a minimum of heavy-duty options, many of our cars will tow trailers weighing up to 5,000 pounds, and handle tongue loads up to 600 pounds! Let your Ford or Lincoln-Mercury dealer help you choose the car that is just right for your recreational needs. The best cars going for towing are Ford-built!



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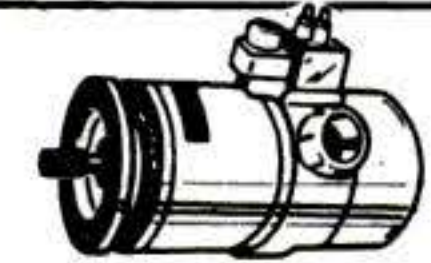
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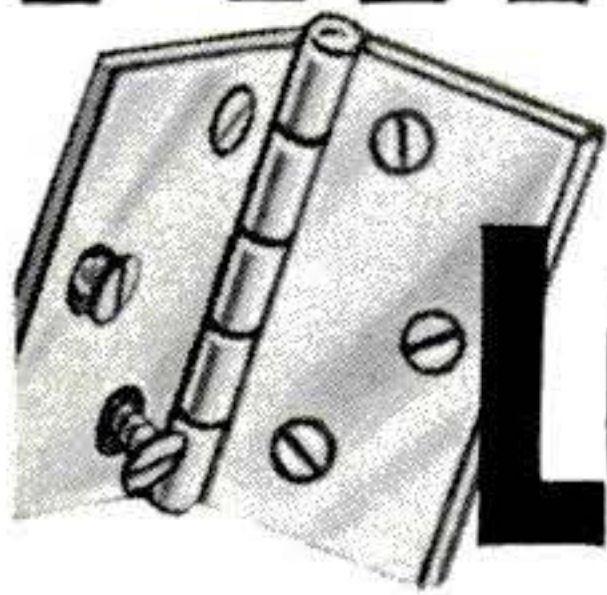
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Paint Removal . . . How to Do It Right

[Continued from page 153]

The easy way is wash-away. At the top end of the price scale, this is what you do:

- Put it on as thick as it will go on a flat surface or suspend itself on a vertical surface.

The experts say that it is lazier to put more remover on over the untouched sludge, better in the long run to squeegee off what comes easily, then let the new application of remover take over from there. At any rate, after 20 minutes to half an hour, all that is left is emulsifier, thickener, and other nonsolvent chemicals. They neither help nor harm the effectiveness of the new material.

- Recoat any areas that go skimpy.
- Test with a finger rub at 20 minutes.
- If your finger cuts through, use a towel or fine steel wool and water to rub loose the sludge.
- Flush away the residue with plenty of water and a bristle brush.
- Use a soft wirebrush to work the old finish out of carvings, crevices, fluting, reeding, etc.
- Wipe off as much water as you can with towels or rags. Let the wood dry overnight. Then you can sand and prepare the surface.

Nothing beats the garden hose and a big wad of steel wool for quick and complete cleansing of the wood. Unless you are working on delicate veneers, plenty of water, following plenty of wash-away remover, is the quick and easy way to a bare surface.

Many refinishers prefer to work outdoors, which is a good idea, if you keep out of the sun. Temperature is no factor in efficiency of methylene chloride removers; they work as well cool as warm. However, warmth increases the speed of evaporation. The stuff boils at 110 degrees. Still, working outdoors avoids unpleasant or harmful vapors.

I took some work and some remover into freezing outdoor temperatures for a test. Methylene chloride took off varnish as readily in the cold as it did indoors.

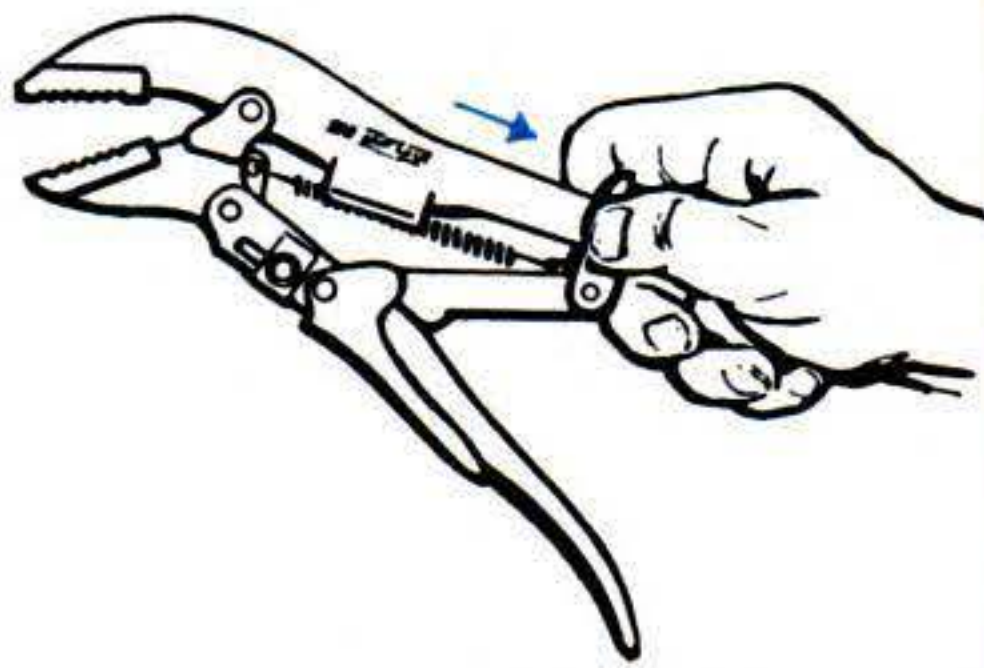
Answers for special problems. If you must remove one of the modern finishes—catalytic coatings, epoxies, urethanes, etc., standard removers may not have kept pace with them. But an electric-element remover will usually dishearten the toughest finish.

When there is stain under the finish, it may or may not lift off with the film. The same is true of filler in coarse-grained woods

NEW Clamping Tool You Can Operate with ONE HAND

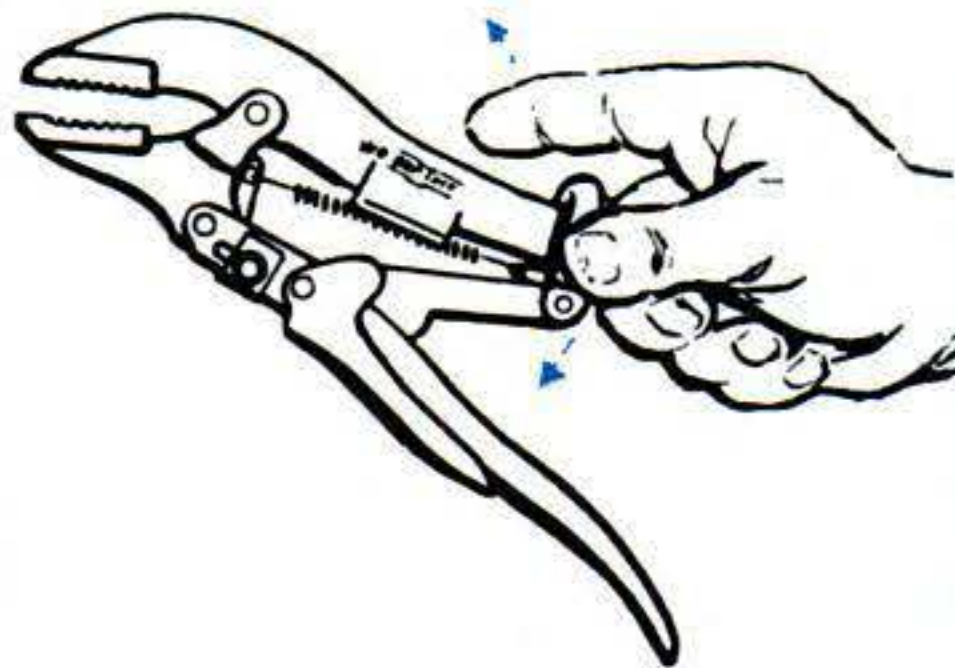
CHANNEL LOCK®

No. 910 GripLock



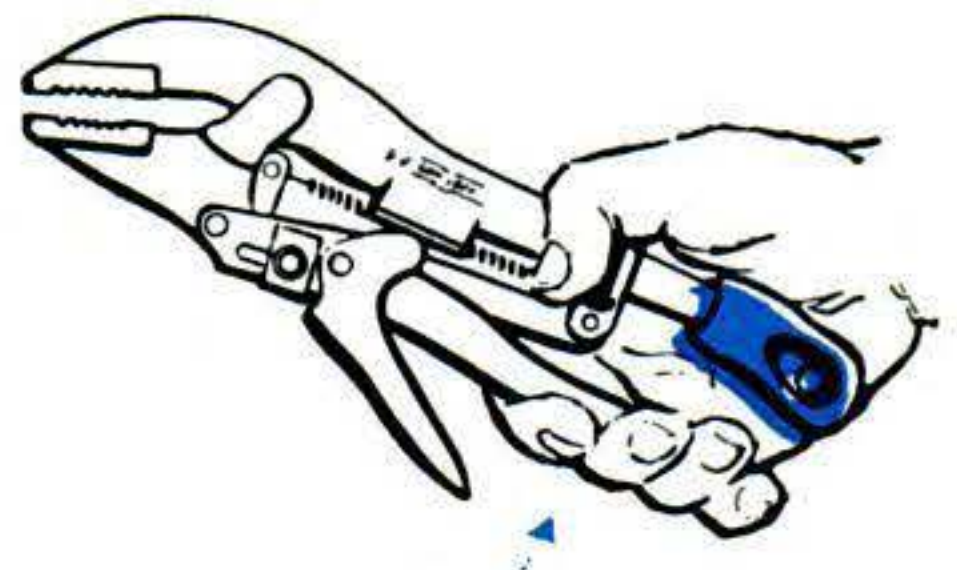
1. OPEN IT!

With one hand, easily to a full 1 3/4". Just pull back on the patented jaw operator. (Pat. No. 2997903)



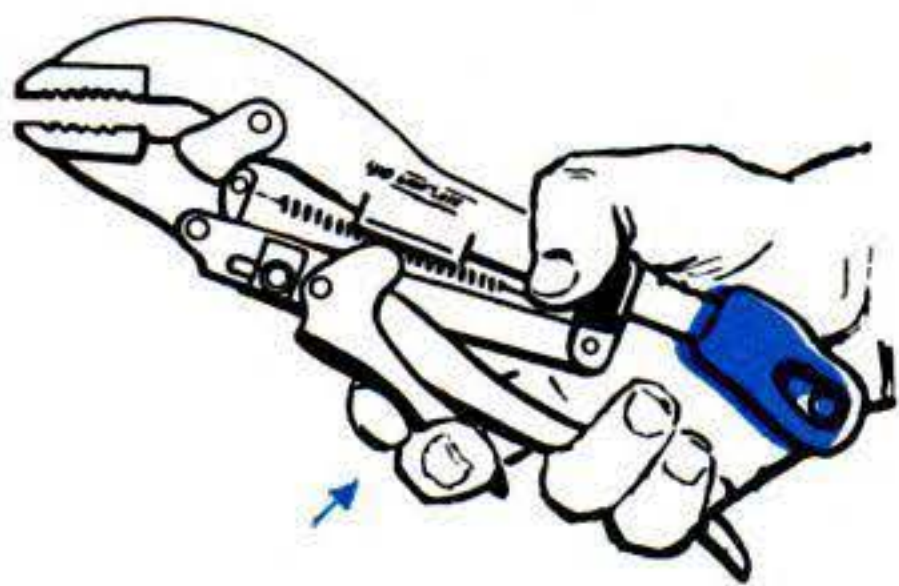
2. LET GO!

The spring closes the jaws. No screw to adjust. Another patented feature. (Pat. No. 2531285)



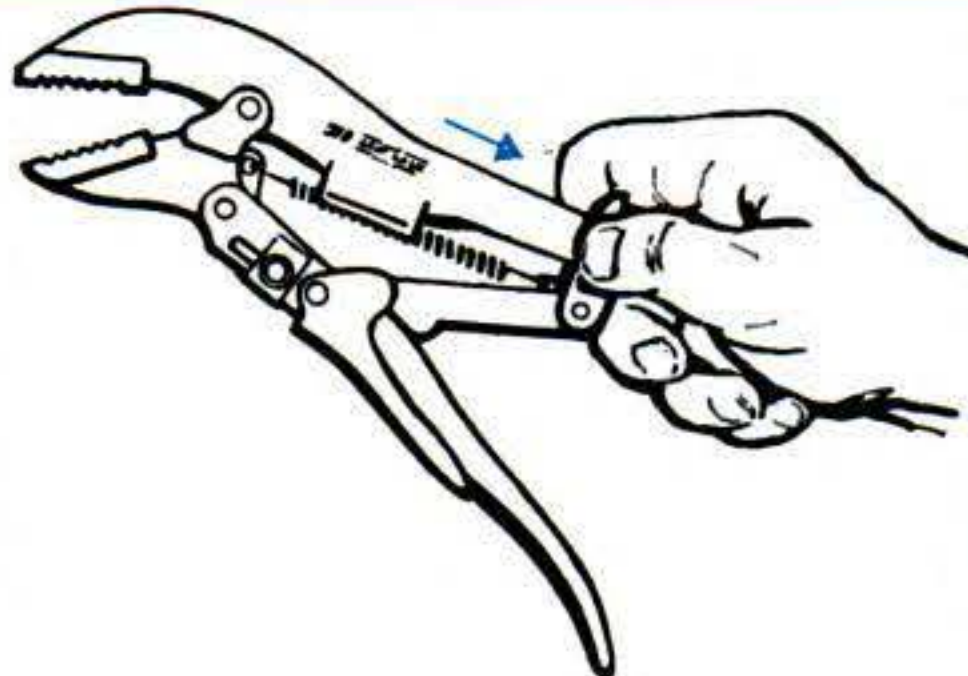
3. LOCK IT!

Still with one hand. Simply close the handle to lock the jaws on the work.



4. E-Z RELEASE!

With one finger-tip operation, trip the patented release lever. (Pat. No. 2576286)



5. OPEN IT!

Two-finger pull on the jaw operator releases jaws from the work.

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Paint Removal . . . How to Do It Right
such as walnut or mahogany. Water-wash removers take away more stain and filler than any other, but if there is stain left, try a quick wash with Clorox or a standard wood bleach such as Blanchit. Oxalic acid in a strong water solution usually kills aniline stains. But remember: Such bleaches also lighten the color of the wood while removing stain.

Furniture made in the past 15 or 20 years probably has a water stain both in the wood and on the surface, to blend the color of the wood into a uniform tone. Avoid wash-away removers and excessive sanding if you want to retain this blending. Many refinishers prefer the come-what-may color of natural wood, and deliberately remove this blending with soapy water and bleaches. Very fine sandpaper completes the water-stain removal.

Since there is no sense in removing finish from areas that do not need refinishing, use masking tape or newspapers—or care—to keep remover off such surfaces. If you smear these places with remover, you'll mar them to a degree where complete removal may be necessary.

Don't dig into wood. If you use a putty knife or other scraper, be careful not to dig into the wood, which is sure to be softened at the surface by the remover. Although this softness disappears as the remover dries, it makes the wood delicate while it is saturated.

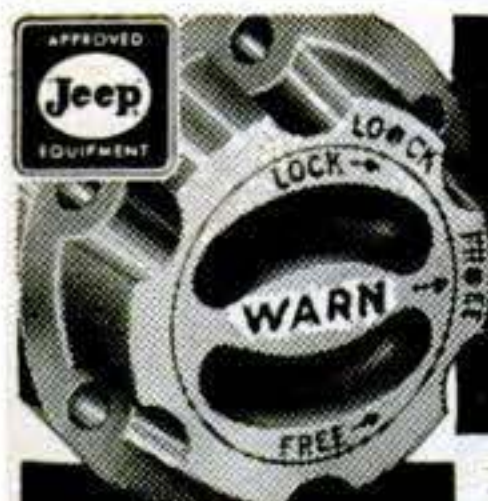
When only the tops of tables, chests, etc., need refinishing, work the remover up to a quarter-inch or so from the edge, to avoid dribbling it down the sides. Take off the remaining finish with sandpaper.

On a big job, when cost is a factor, use a cheap remover to take off the heaviest coating. Then finish up with a quick application of wash-away.

After a water washup has dried, if you find tiny areas of residual finish, don't waste time reapplying remover. Sandpaper will usually cut quickly through the spots of finish, since they have been weakened by the remover.

Don't be afraid to use warm water and a detergent for cleanup. It will not harm the wood except in the case of fine old veneers.

A final test of cleanness—readiness for new finish—is easy to make with a piece of fine sandpaper. If it clogs up with gummy substances, the surface is waxy or dirty. If the dust is powdery, it is clean. **PS**

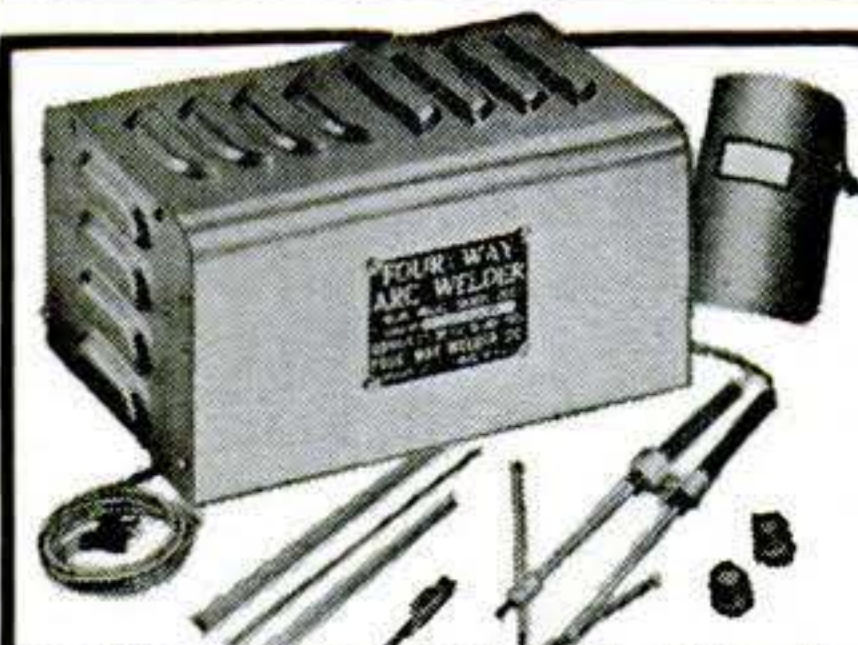


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New Johnson Surfer Is Fast, Roomy, and Stable

[Continued from page 178]

Surfer is her great stability. You can literally flout all the rules in maneuvering her and get away with it. You can zigzag full-tilt through a chop, and cross vicious-looking wakes at nonrecommended angles. In fact, you can successfully drive right along the top of a 30-footer's wake and remain perched there, wondering why in the world you aren't being tossed aside for your foolishness. The boat's multiple keels keep her on course as if she were on tracks.

If you're accustomed to a deep-V or round bilge hull, high-speed turns with the Surfer will surprise you, too. She'll turn sharply without banking to any extent. You can go in one direction one instant, scoot off at almost a right angle the next.

You stay dry. Spin the wheel hard over at high speed, and a lot of water goes sail-

ing through the air. But none of it comes into the boat, and the hull shows no tendency to spin out or trip.

She runs aground—no problem. Oh, sure, I managed to run her aground. Not intentionally. It's easy to do in the many uncharted bays in this mangrove country. But the boat's stern drive was equal to the occasion, even though we went up on the mud at some speed. A hydraulic safety mechanism in the drive unit took over, allowing the unit to kick up, thus taking the propeller out of harm's way.

By adjusting the lower unit's angle with the power tilt, it was a fairly simple matter to back out of the shallow area, leaving only a large patch of muddy water to mark what might have been a full-scale problem in a conventional inboard boat. PS

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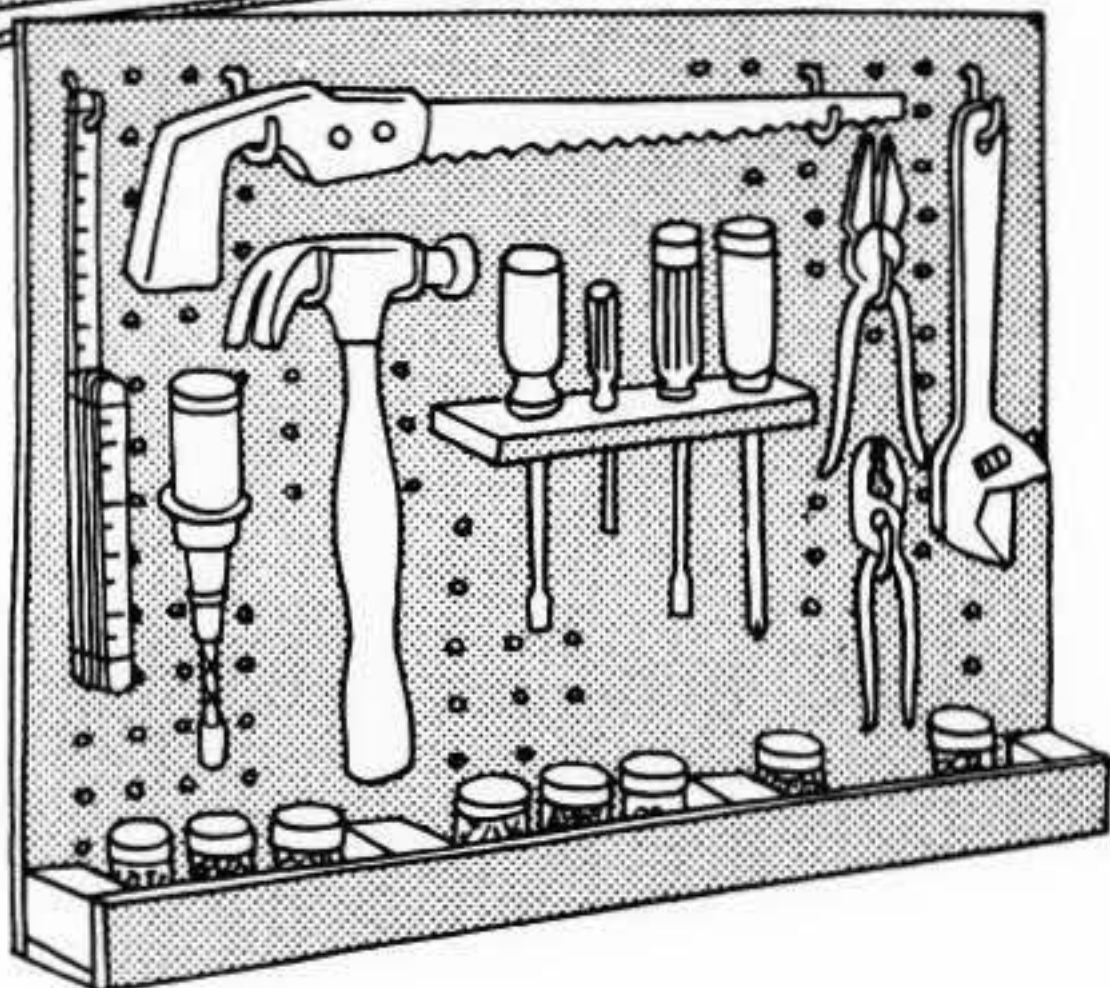
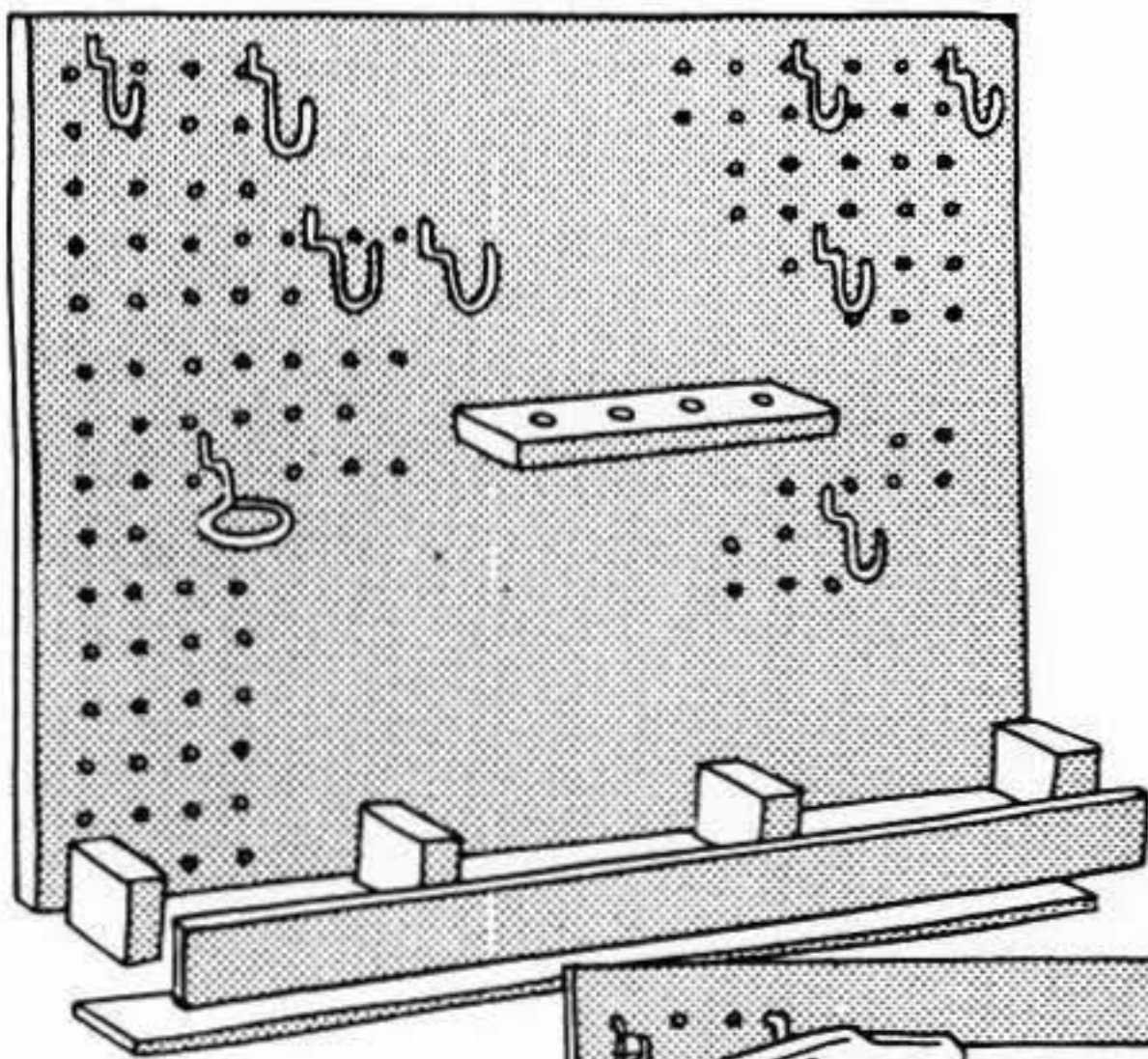
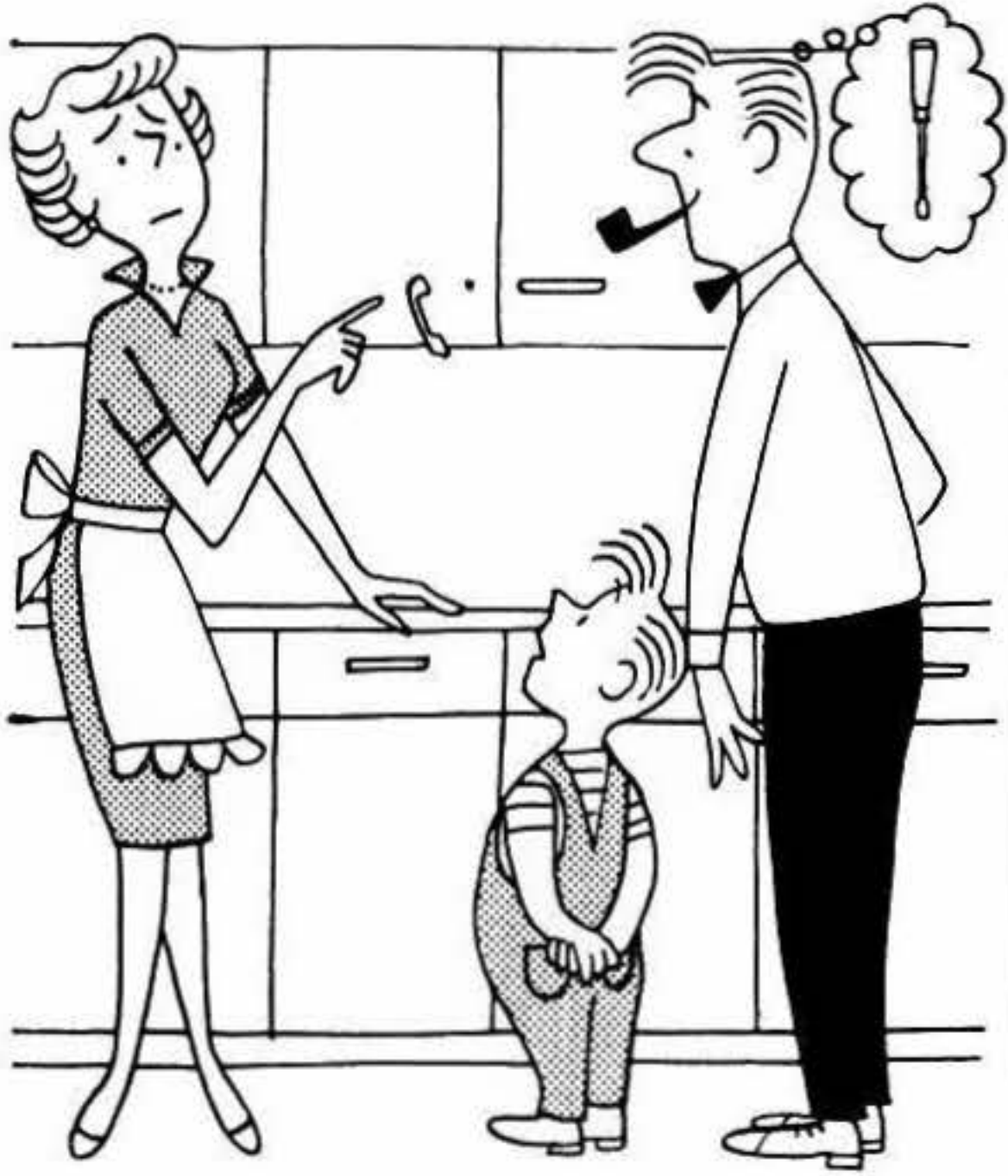
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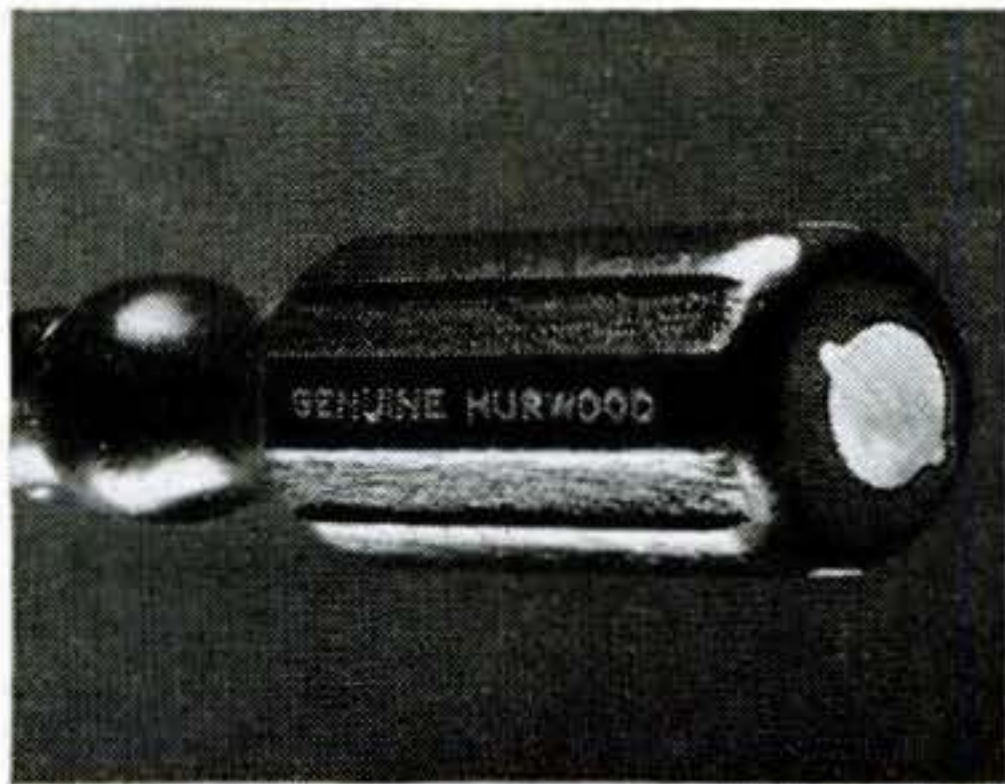
Wordless Workshop

By ROY DOTY

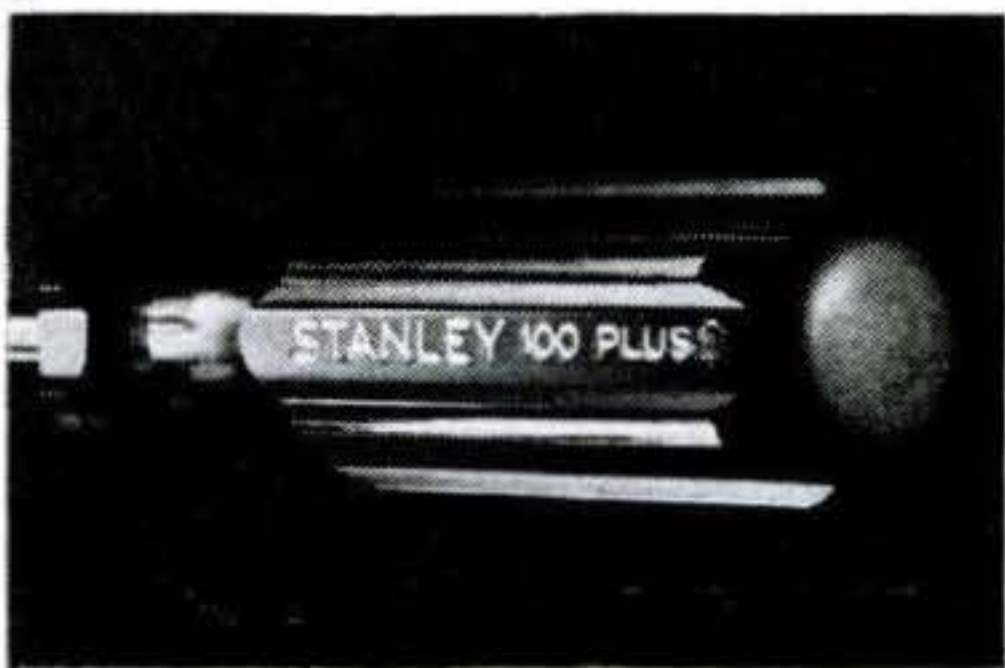


There's one kind of screwdriver Stanley doesn't make.

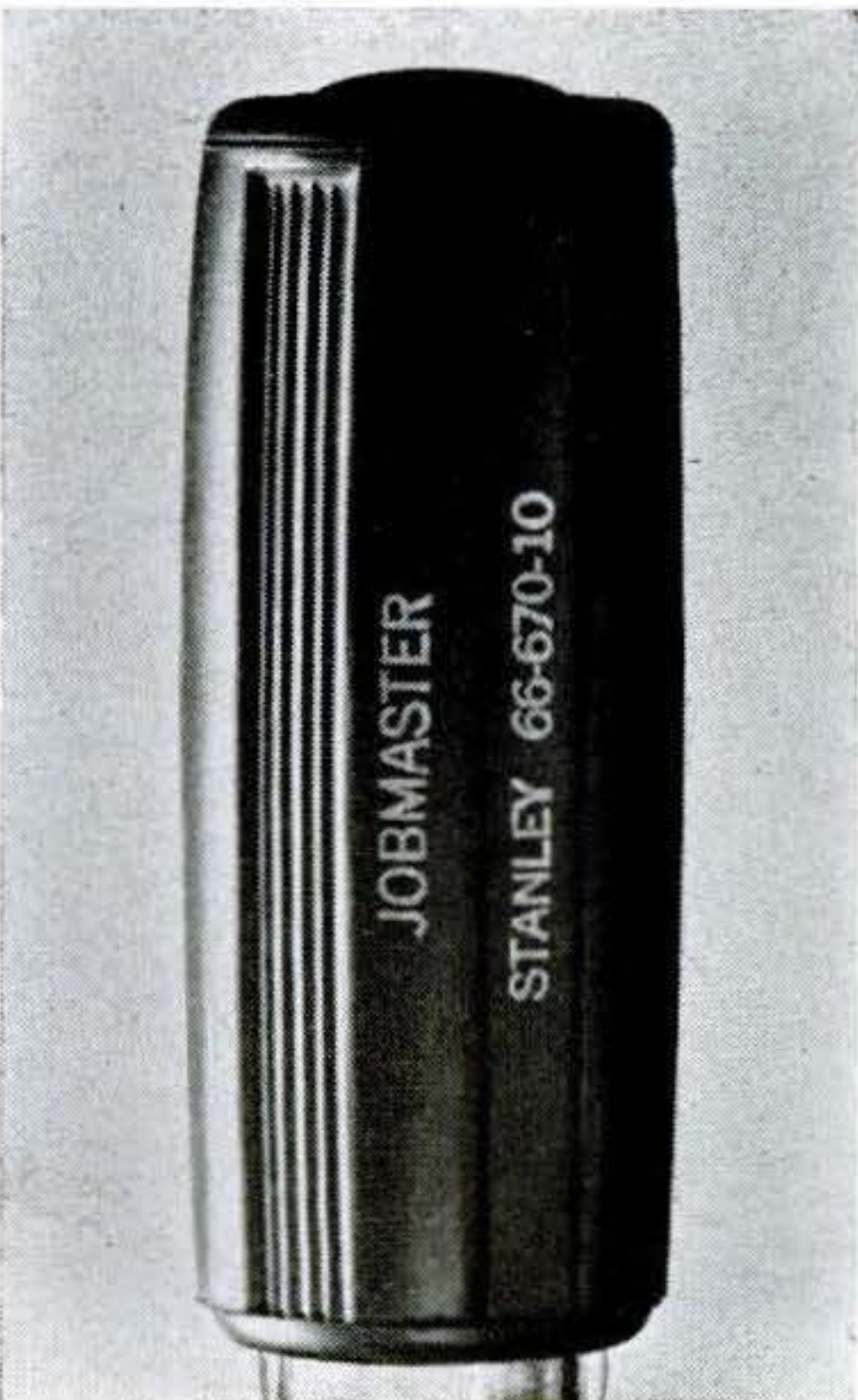
We make drivers with
wood handles . . .



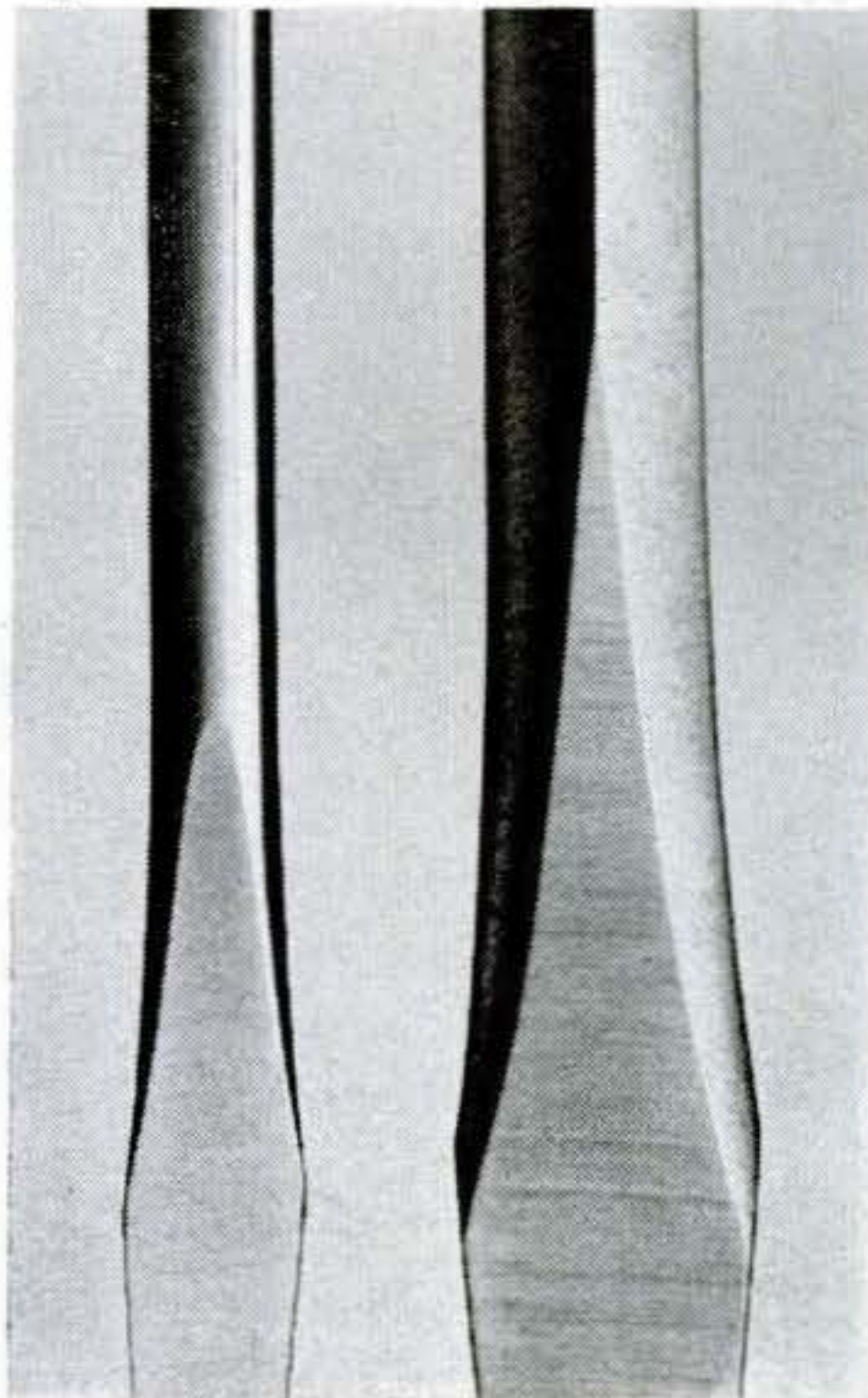
plastic handles . . .



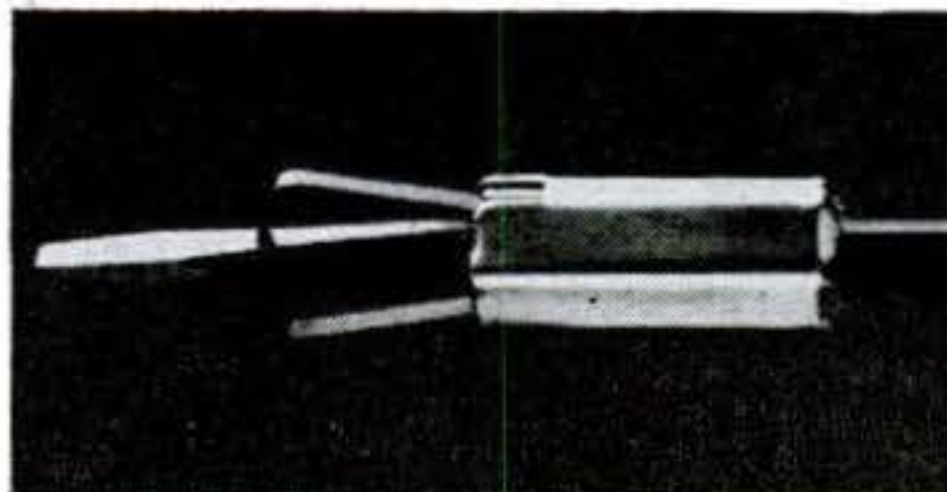
rubber grip handles . . .



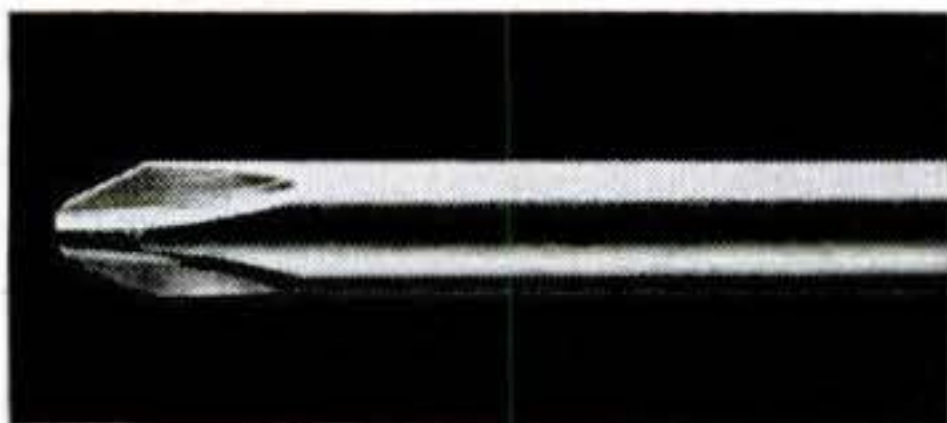
round bars . . .
square bars . . .



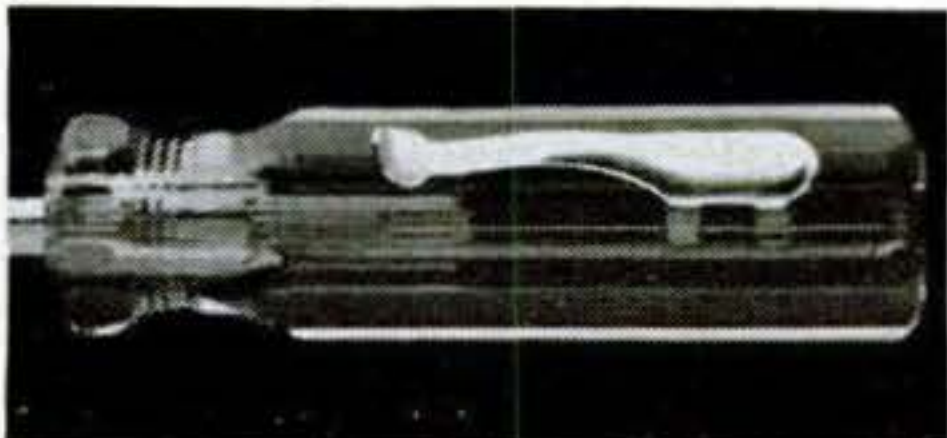
hexagonal bars with
screw holders . . .



Phillips points . . .



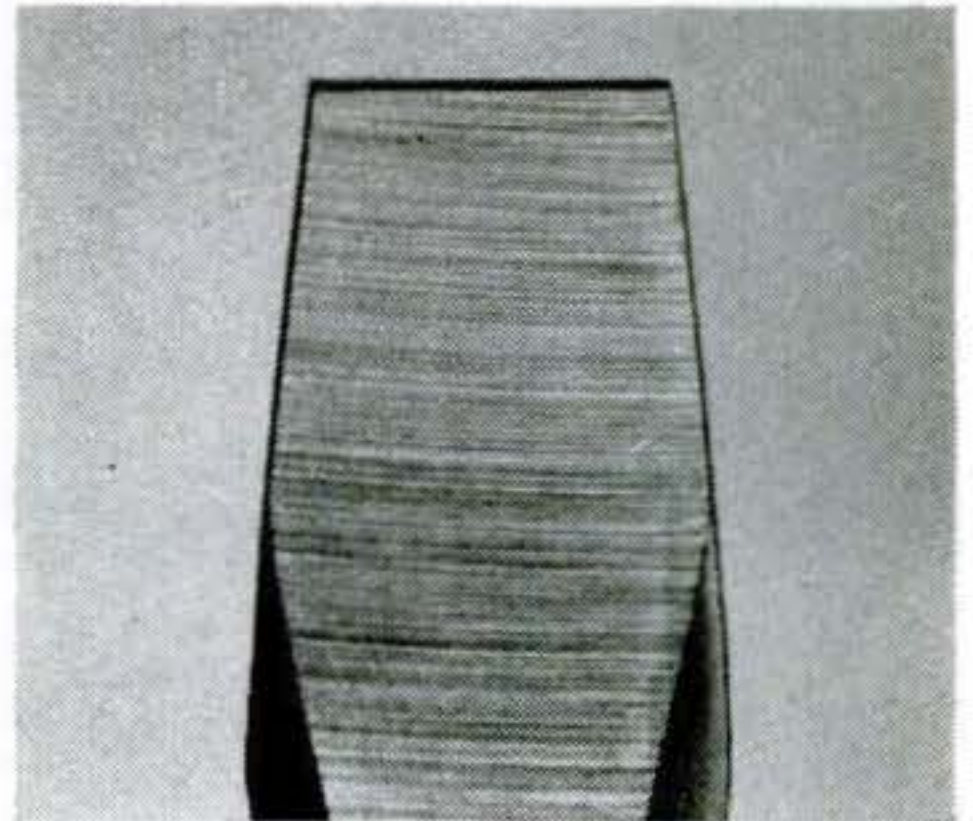
pocket clips . . .



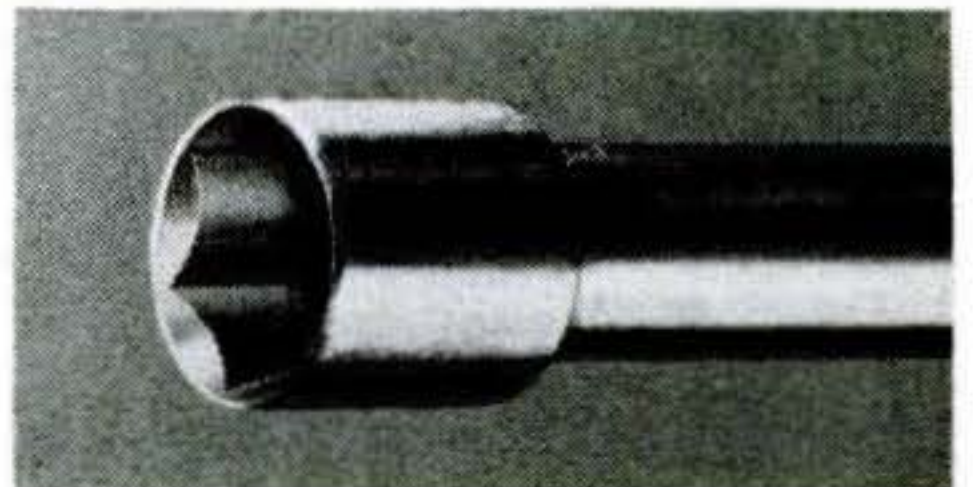
tiny drivers . . .



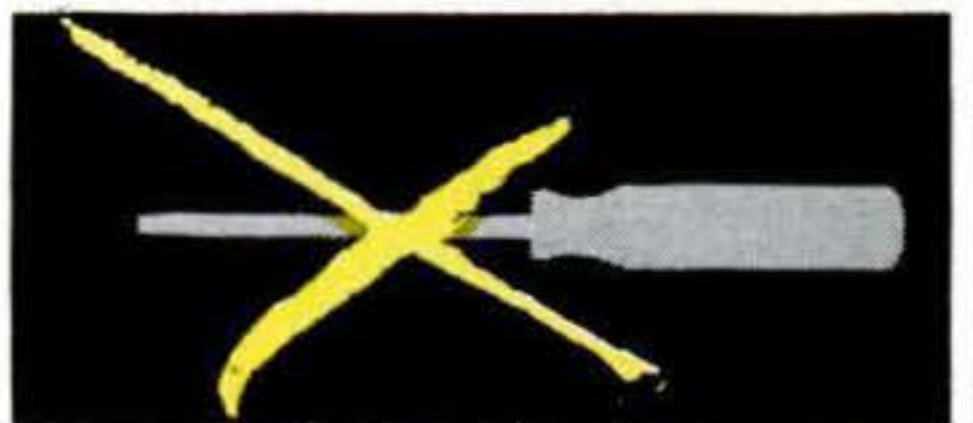
giant drivers . . .



nut drivers . . .

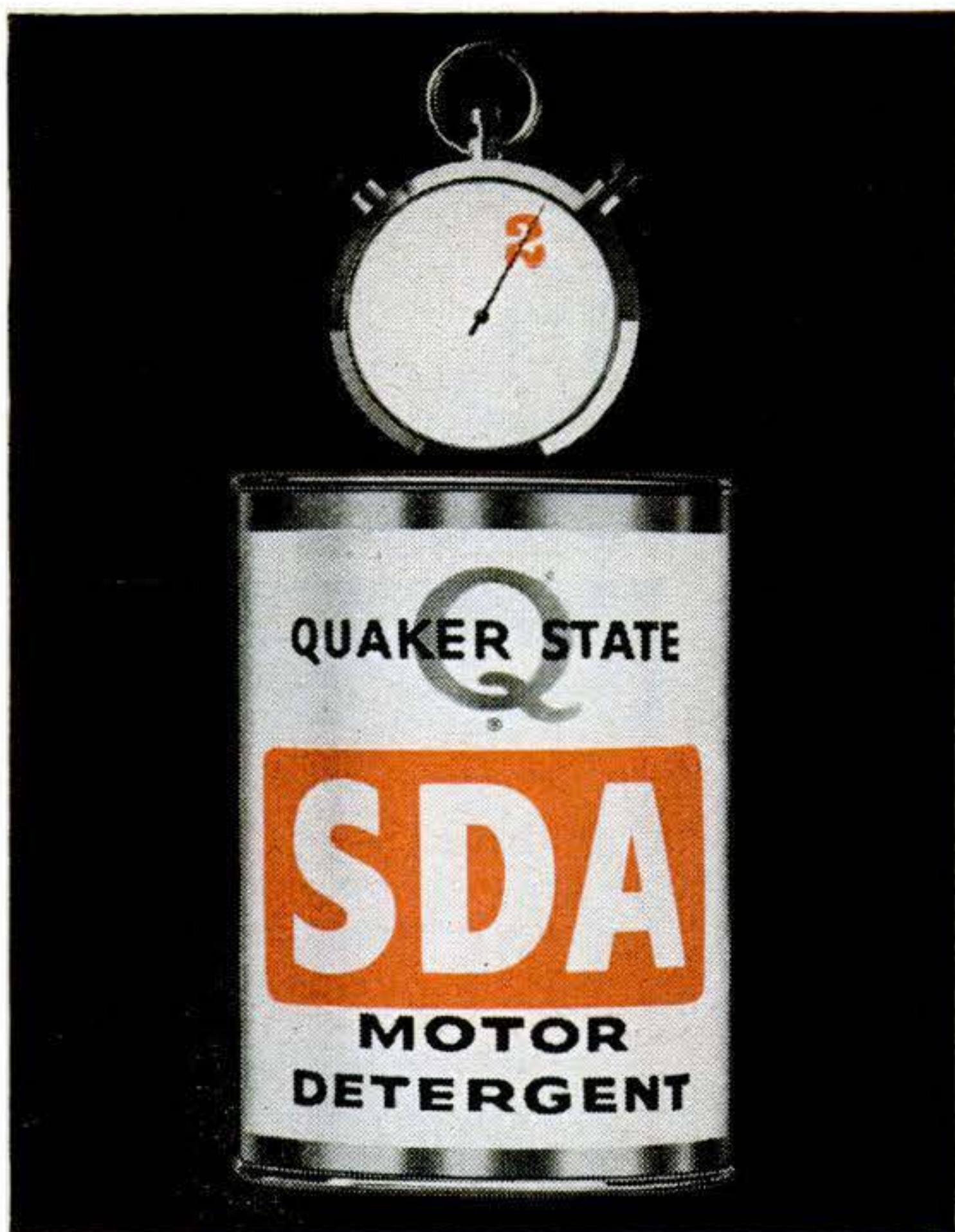


everything, in fact, except
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Testing the Compact Fastbacks

[Continued from page 116]

some scary moments in fighting for control. In the end, the brakes gave out completely. I used all my force on the pedal and could not bring the car to a complete stop—it just rolled on and on.

Rambler is justly proud of its dual master cylinders. But it's only a fail-safe system; it does nothing to improve braking efficiency. I'd consider the disk-brake option an absolute essential on this car.

Power units. All three test cars had V-8 engines with pushrod-operated overhead valves and wedge-type combustion chambers. The Rambler was the quietest but also the least responsive. The Marlin and the Mustang had base-model V-8s; the Barracuda had the high-performance version. In its standard form, the Plymouth 273-cu.-in. V-8 develops 180 hp. at 4,200 r.p.m., with a torque of 260 lb.-ft. at 1,600 r.p.m. The high-performance engine gets about 30 percent more power from the same basic unit by raising compression ratio, raising valve lift, and fitting a four-barrel instead of a two-barrel carburetor. At over 550 pounds, both the Rambler and Plymouth engines are relatively heavy, by modern standards. The Ford V-8 weighs about 455 pounds. The 289-cu.-in. Ford engine is the present star of lightweight cast-iron engines. In fact, its predecessors (in 221- and 260-cu.-in. versions) were responsible for the demise of aluminum engines.

The interiors. Only the Marlin has adjustable backrests which permit almost any driver to find an ideal seat-to-wheel-to-pedal relationship. The maximum seat-to-wheel distance on the Marlin is over 22 inches (with a realistic backrest angle), while the maximum on the Mustang is 18 inches and on the Barracuda, 16 inches.

The Marlin's seats have better-quality springs and upholstery and they are higher from the floor (nine inches), but this doesn't necessarily mean a better view. The Barracuda's driver's seat is eight inches above the floor, the Mustang seat only 5.5. I don't like the terribly thick corner posts of the Marlin and Mustang—the Barracuda's are not so thick but are still displeasing.

I found that for normal city and suburban transportation, I preferred the Mustang. When I needed room for passengers, I used the Barracuda, because the Mustang's rear seat really isn't one. PS

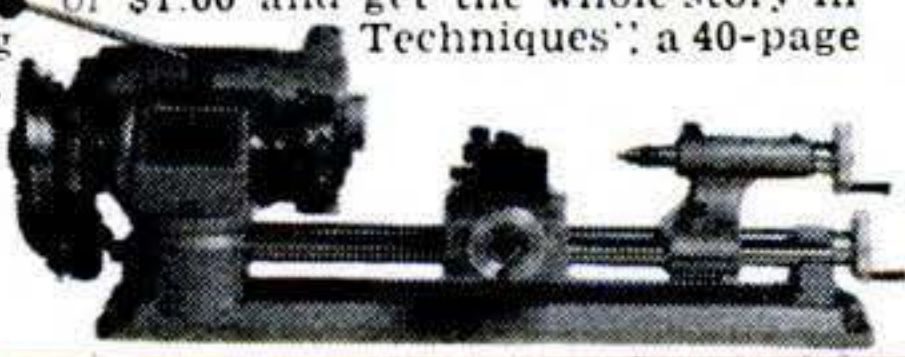
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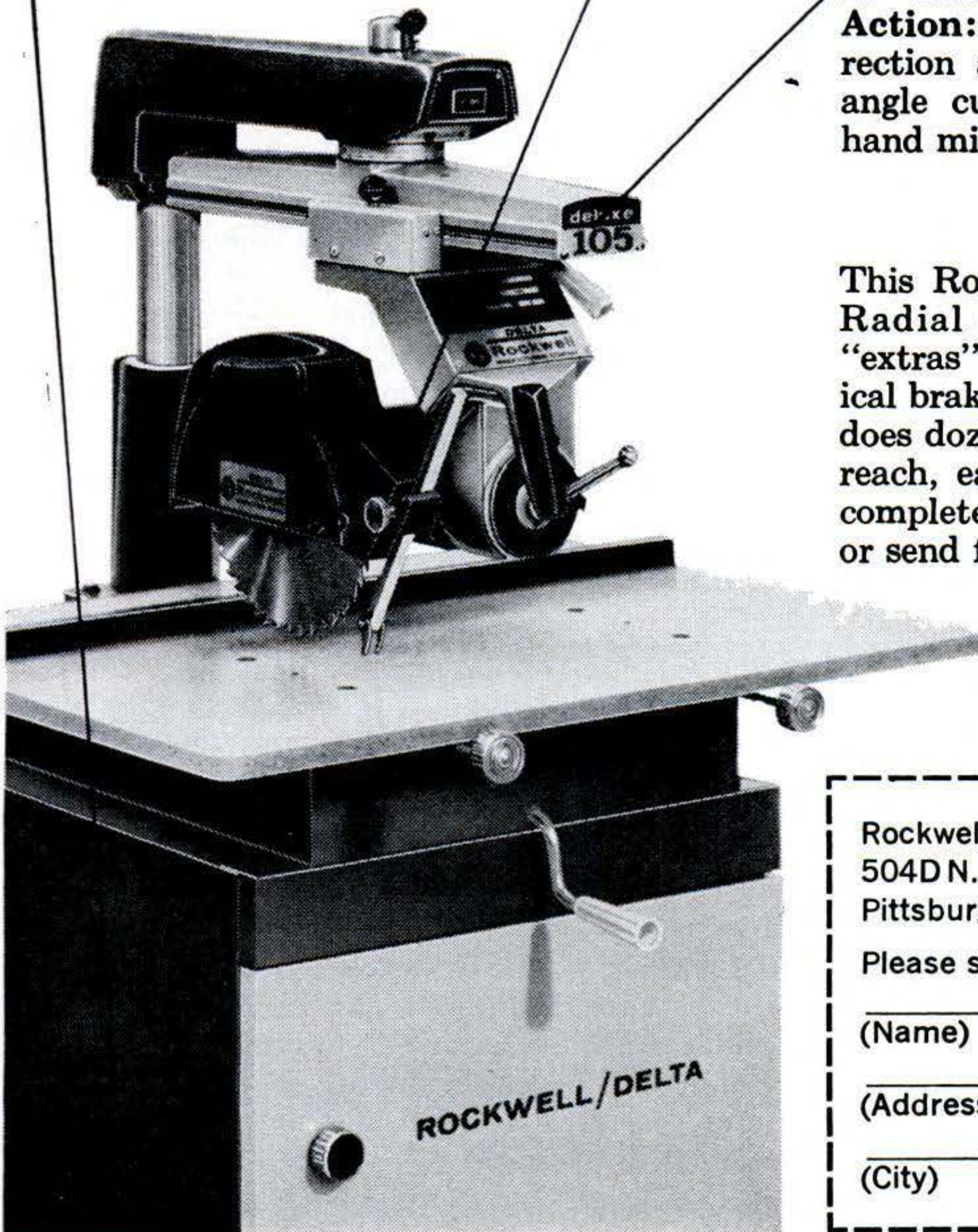
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BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY



U.S. PATENT NOS. 3057040 AND 3063189

What Kind of Mixer Is Alcohol?

[Continued from page 97]

ingredient of Antabuse, a drug used to treat alcoholism.

When an alcoholic takes Antabuse, then tries to take a drink on top of it, he becomes distinctly unhappy with pounding headache, violent nausea, hot flashes, flushing, palpitation, and breathlessness.

But in some people, just *external* exposure to thiram can be enough to produce alcohol sensitization. A Philadelphia dermatologist not long ago reported on a woman whose face became embarrassingly flushed every time she drank a cocktail and took a bath with soap containing thiram.

Fond of mushrooms? It's been known—at least by doctors—that alcohol and some mushrooms (the inky-cap kind called *Coprinus atramentarius*) don't mix. The reaction is similar to that produced by alcohol and Antabuse. But it usually has been noted only when drinks are taken with, or soon after, the mushrooms.

Recently, in the New England *Journal of Medicine*, two doctors reported something new. They had seen four acutely ill patients on an emergency basis, all at once, all complaining of the same symptoms. Each had had a bottle of beer, experienced a metallic taste in the mouth followed by burning and prickling sensations in the arms and legs, palpitation, racing heart, nausea, and vomiting.

The puzzled physicians asked a lot of questions and found that the four, together, had eaten a meal containing inky caps the night before—entirely without ill effects. They had been on their way, in fact, to pick some more of the mushrooms the following afternoon when they stopped for the beer and immediately became ill.

Just how the beer, taken 18 hours later, managed to react so violently with the mushrooms is something of a mystery. There wasn't any treatment for the poisoning—and none was needed. After two miserable hours, all four patients were as good as new.

Recently, evidence that cleaning solvents and cocktail parties don't mix was reported by four New York physicians. They told of 19 patients who had developed kidney failure because of drinking alcohol and getting whiffs of carbon tetrachloride fumes. In two instances, the kidney failure followed soon after the solvent was used to clean clothes spotted in the midst of a cocktail party.

The beginning symptoms in such cases,

What Kind of Mixer Is Alcohol?

the physicians warn, are nausea, vomiting, diarrhea, and stomach pain—much like and easy to confuse with those of a GI virus infection. It took heroic measures to save 18 of the 19 patients.

What happens to make the alcohol/carbon tet mixture dangerous isn't clear although some investigators think the two combine to form ethylchloroformate, a kidney-poisoning compound.

Drinking and flying. It's an old story, of course, that drinking and driving don't mix. Worse is drinking—even a little—and flying.

Airline pilots are forbidden liquor not only during flight, but for 24 hours before. Now government aviation officials are getting concerned over drinking by some pilots of the 100,000 light private planes flying on or near commercial air lanes.

In 1964, 436 private pilots were killed in accidents. When the bodies of 193 were autopsied, 78–40 percent—contained alcohol, indicating they had been drinking during or just before the flights. Only eight had an alcoholic blood level high enough to indicate tipsiness.

But, according to Dr. Sheldon Freud of the FAA's Office of Aviation Medicine, "one drink in the air can produce the effect of four consumed at ground level." And currently the FAA is considering a rule that would make it illegal for a private pilot to touch a drop in the air and for eight hours before going up.

On top of that, two Air Force medical investigators are worried about the popular practice of a drink or two for passengers on high-altitude, commercial jet flights. At the last American Medical Association annual convention, they reported that if there were to be sudden decompression of a plane's cabin, the alcoholic equivalent of even one martini would reduce resistance to the effect of the lack of oxygen.

Not so incidentally in these days of concern over cholesterol and heart attacks, it turns out that alcohol and the ordinary American diet (rich with fat from animal sources) mix to shoot up blood cholesterol levels.

But there's cheering news from one of the pioneer cholesterol investigators, Dr. Laurence Kinsell of the Institute of Metabolic Research, Oakland, Calif.: With a diet rich in unsaturated fats (largely from vegetable sources), there may be no need to forego a cocktail if your cholesterol is high.

Typical of Kinsell's findings: When a sub-

Continued

Photographed at Cypress Gardens by Buddy Gaines



Unretouched underwater photo of Stren[®] and competitive premium monofilament being fished under similar conditions. "Stren" is on left, and its low visibility is apparent. Which line do you think is most apt to hook your fish?

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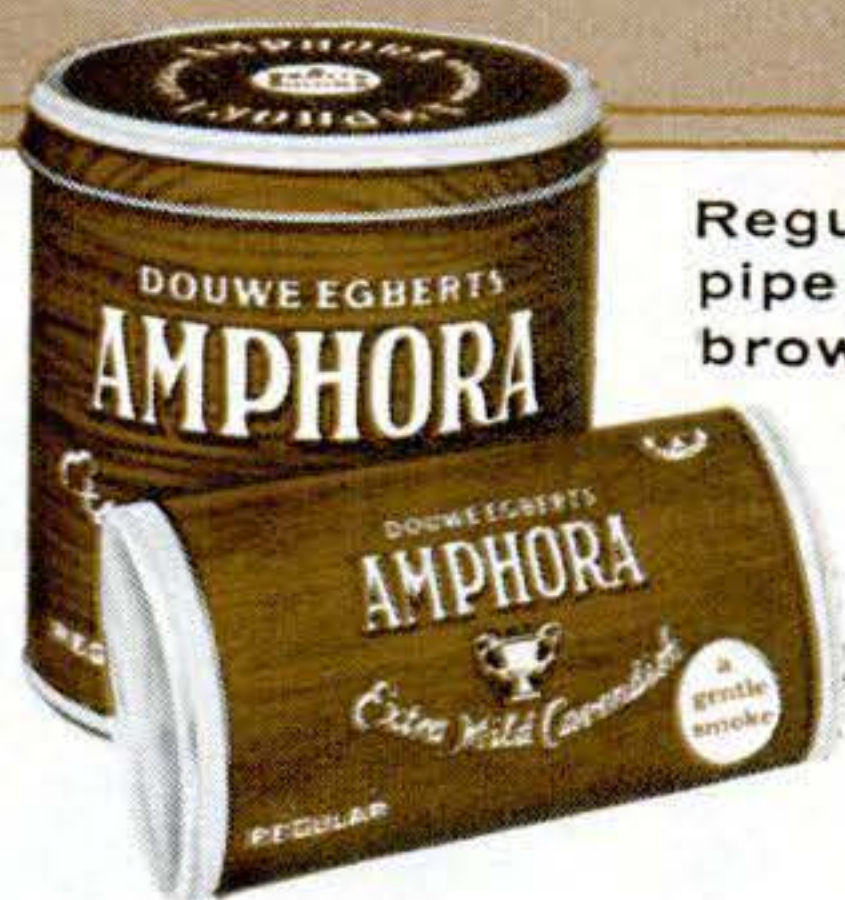


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What Kind of Mixer Is Alcohol?

ject was fed a diet heavy with unsaturated safflower oil, his cholesterol level dropped from 300 to a relatively safe 200. When the diet was switched to one high in animal fats, cholesterol shot to 400. And with a drink it went to nearly 500.

But then, in a subsequent trial, when the same subject was put back on safflower oil and his cholesterol declined to 200, it stayed right there when he took a drink.

"It would appear," says Dr. Kinsell in cautious scientific language, "that ingestion of unsaturated fat protects against the hyperlipemic [cholesterol-heightening] effect of alcohol."

Allergic tipplers? It now seems that alcohol and allergy may not mix well—or, more precisely, that the mixture may be an important factor in alcoholism. Evidence comes from a study of 442 alcoholics at the Keeley Institute, Dwight, Ill.

On the chance that compulsive drinkers, who are often considered unduly sensitive to liquor, might really be allergic to something in liquor, Keeley researchers gave their alcoholic patients allergy skin tests with barley, corn, rye, hops, malt, and other ingredients of alcoholic beverages.

All proved sensitive to at least one; the average was sensitive to seven substances.

Then test meals, using only one such substance at a time, were tried. After the meals, many of the patients, though completely "dry," became fidgety, excited, even unsteady.

When they were advised to get weekly desensitization treatment against the substances to which they had reacted, 200 complied. Although more time is needed to evaluate results completely, they've been encouraging in some individuals for whom the weekly injections of corn, rye, and other liquor ingredients appear to be lessening the compulsion to drink.

Meanwhile, at the University of London, Dr. Francis Camps and a team of investigators are hot on the trail of something that may mix with alcohol in a happy new way. It's a compound of fructose, a form of fruit sugar—plus vitamins B and C.

There's some preliminary evidence that the concoction speeds the body's disposal of alcohol. That could mean fast sobering up for a drunk. And there'll be some hopefuls waiting for word that it may work another way: Mix alcohol and fructose-B-and-C and you relax without getting tight or suffering from hangover.

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(continued from page 172)

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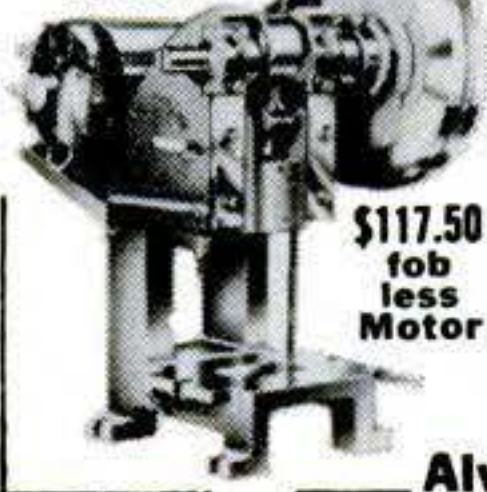
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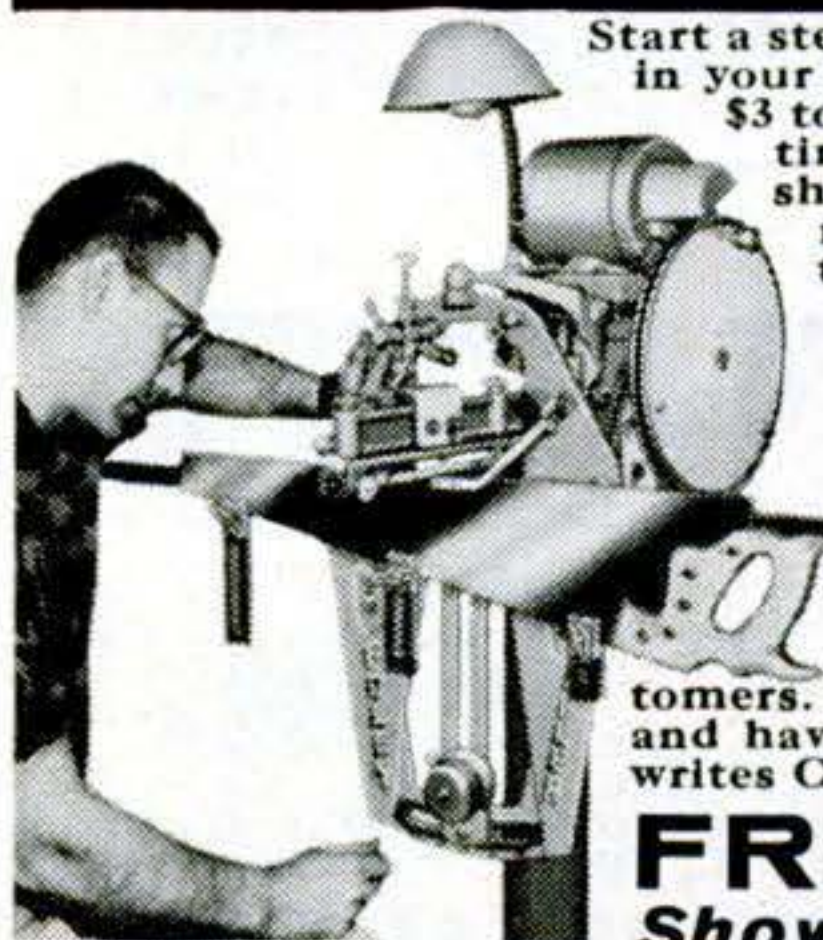
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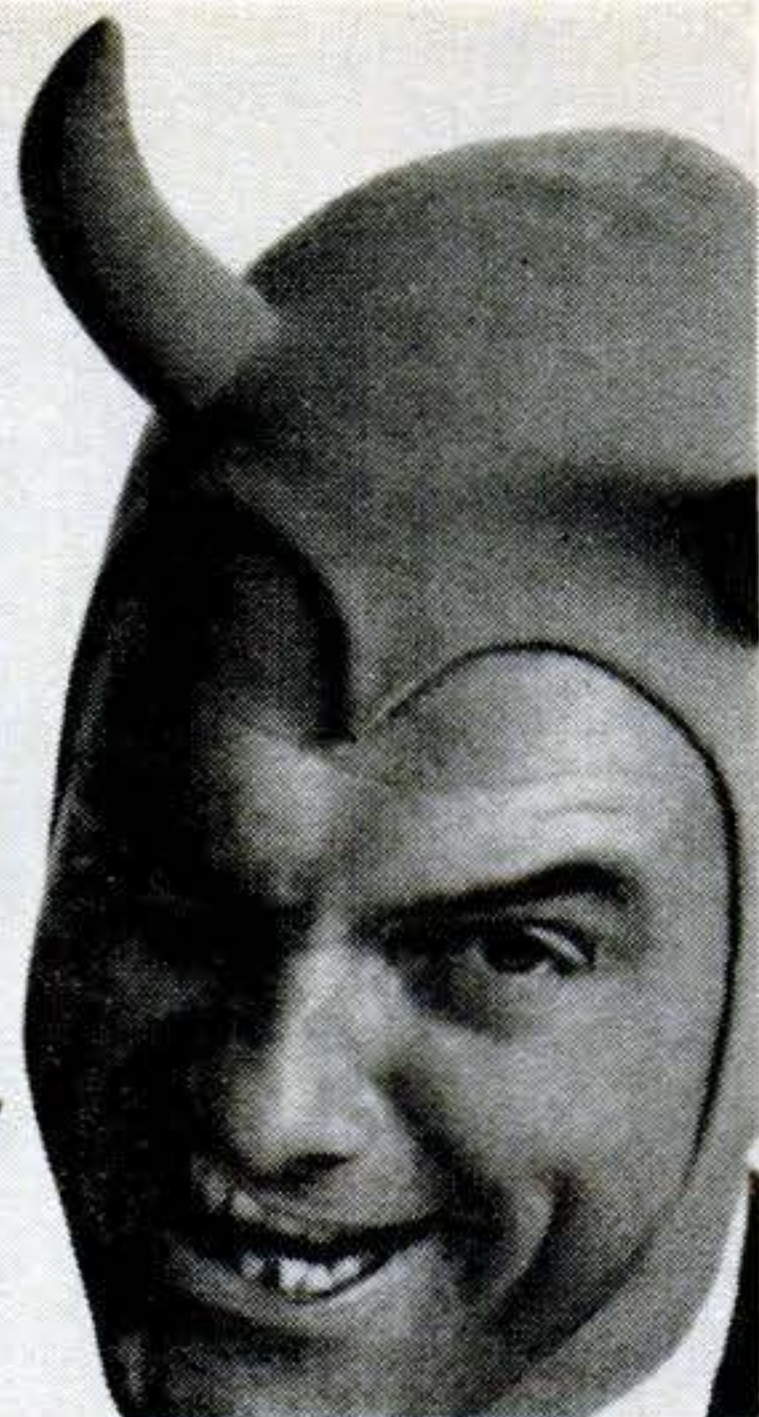
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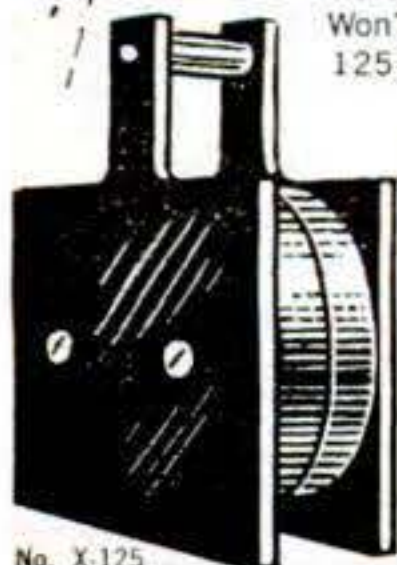
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What You Gain from Sliding Glass Doors

[Continued from page 170]

- Check the sliding action, the bearings. Some doors move at the touch of a finger—and never get sticky. Others bind and need adjustment. A glass door is heavy and needs stalwart sliding devices. Nylon rollers and glides are good, and do not rust in that groove at the bottom.

- Check the locking mechanism and the method by which the doors interlock.

- Check availability of screen units.

Installation is simple. It is no harder to install sliding doors than those that swing. You need doubled two-by-fours at both jambs (verticals at each side). You need doubled two-by-sixes for headers (cross-pieces, jamb to jamb) for sliding doors up to 6' in total width. Over that, many builders go to two-by-eights, or two-by-tens, to hold the doors securely. The threshold usually goes at floor level.

Usually, one side of the old doorway is left, and is merely duplicated on the opposite side. Since you are concerned only with the rough opening (as specified for the door you buy) you follow these steps:

- 1) Unhang the existing door and remove all of its trim, exposing the bare framing.

- 2) Measure laterally for the width of the rough opening and hang a plumb bob. Mark this vertical both inside and outside.

- 3) Carefully remove the wall up to this line. Usually, the outside wall surfacing must be taken off past the line, to a point where there is a natural joint. Save the siding, shingles, or whatever, for patching later. On the inside, do a careful cutting job on the plaster. Later, the new trim will cover the rough edge.

- 4) Install the double two-by-fours at the proper position, and the headers. Your sliding doors will come with instructions for your specific job; they will be similar to the drawings shown here.

- 5) Stand the assembled frame in the opening and make it plumb, true, and square before you fasten it in place.

- 6) Install the doors, and replace any needed siding.

- 7) Nail up the trim.

Metal doors have special slip-joints at the corners of the trim, so that you can adjust them precisely, then run in the screws.

Most sliding doors have adjustments in runners and bearings, making it possible to set up fingertip handling of the door once it has been installed.

PS



Mend it!

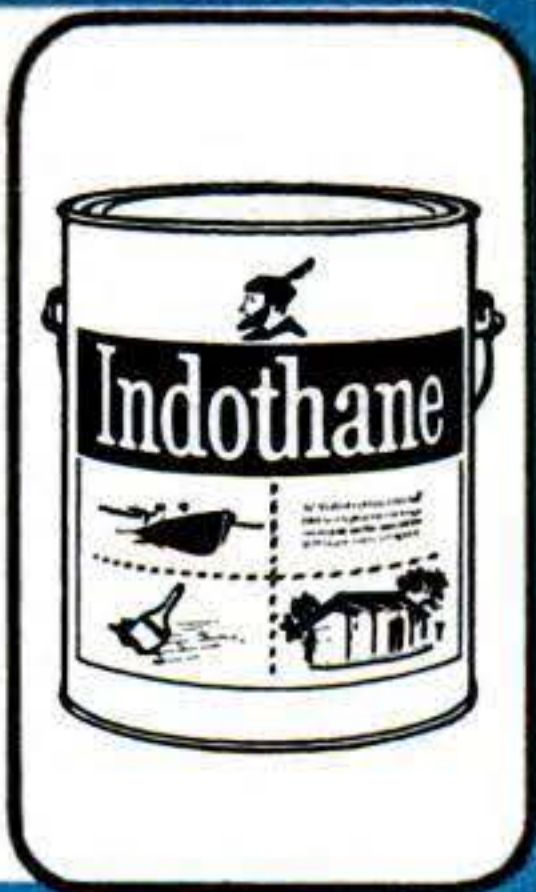
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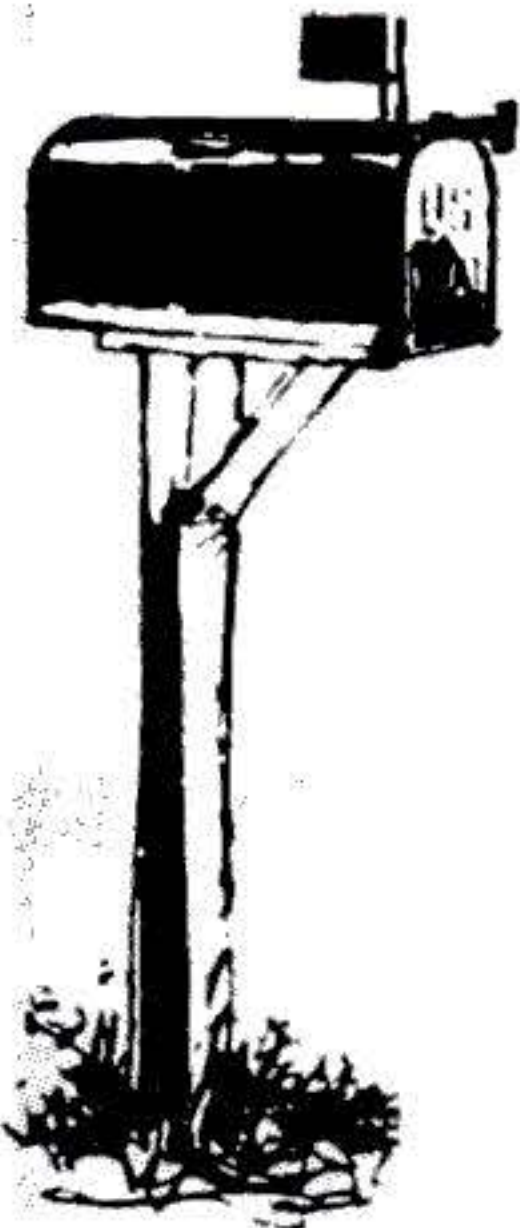
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USE THIS HANDY INDEX TO FIND WHAT YOU WANT

Advertising, Agencies for Advertisers . . .	53
Agents Wanted . . .	43
Antiques, Relics & Indian Goods . . .	29
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
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
Gifts . . .	49
Government Surplus . . .	11A
High-grade Salesmen . . .	44
Hobbies, Collections . . .	31
Home Craftsman . . .	65
Import-Export . . .	38B
Inventions Wanted . . .	61
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
Old Stamps Wanted . . .	27
Personal . . .	80
Phonograph Records . . .	35A
Plastics . . .	40
Printing, Multigraphing, Etc. . .	57
Printing Outfits, Supplies . . .	58
Profitable Occupations . . .	22
Radio, TV, Electronics, Hi-Fi . . .	36
Remailing Service . . .	80A
Rubber Stamps & Office Supplies . . .	56
Science & Chemistry . . .	41
Special Services . . .	51
Sorting Goods, Guns, Fishing Tackle, Etc. . .	15
Stamp Collecting . . .	28
Treasure Finders & Geiger Counters . . .	77
Trees, Shrubs, Roots & Herbs . . .	20
Wanted to Buy . . .	72
Watch Repairing . . .	78
Welding, Soldering . . .	8

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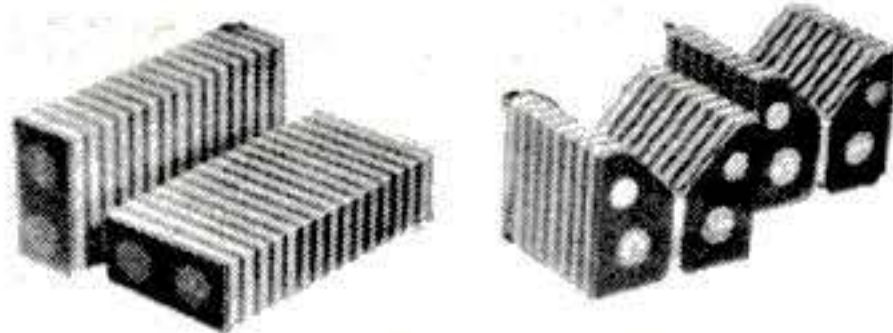
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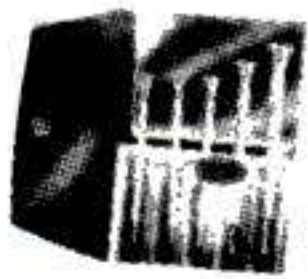
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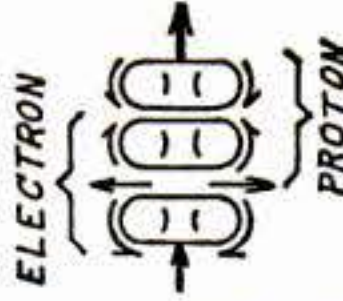
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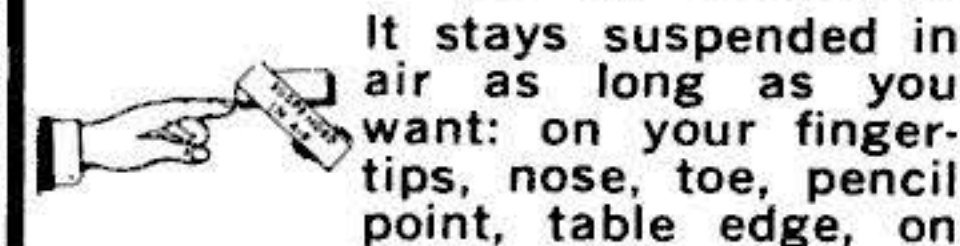
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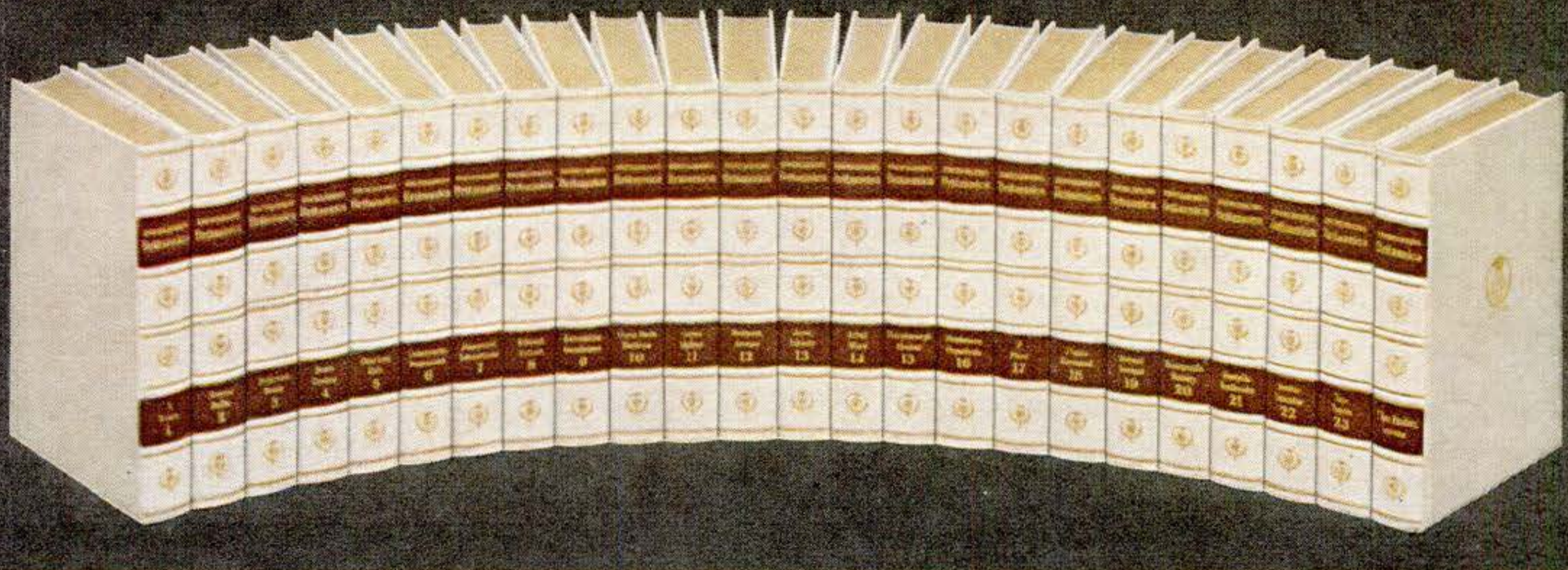
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