

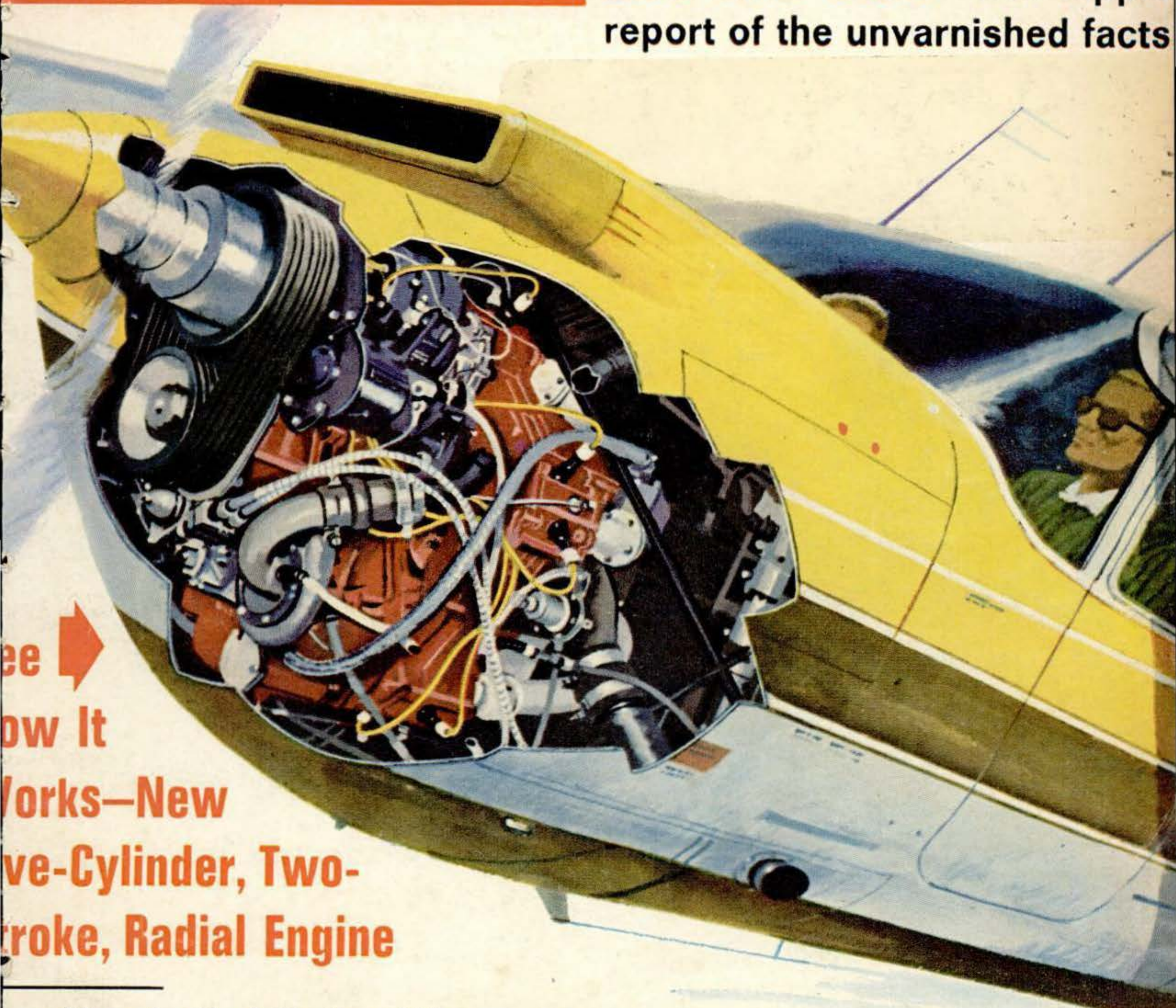
DECEMBER 1967 35 CENTS

Popular Science

MONTHLY

**BUYING A USED CAR?
"I'll Cheat You If
You Don't Watch Out!"
By an Odometer Artist**

MY LSD TRIP A non-cop,
non-hippie
report of the unvarnished facts



See  how it works—New
Five-Cylinder, Two-
Stroke, Radial Engine

**New Non-Lethal Police Weapons
Control Riots...By ERLE STANLEY GARDNER**

Biggest Naval Guns to Boom Again in Vietnam

HOW YOU CAN Buy the Right Snowblower...Choose a 3/8" Drill...Build a
Unique Coffee Table...Pick Your Own Christmas Gift...
Winter Camping in Comfort...Get Improved Tools Coated with Teflon-S

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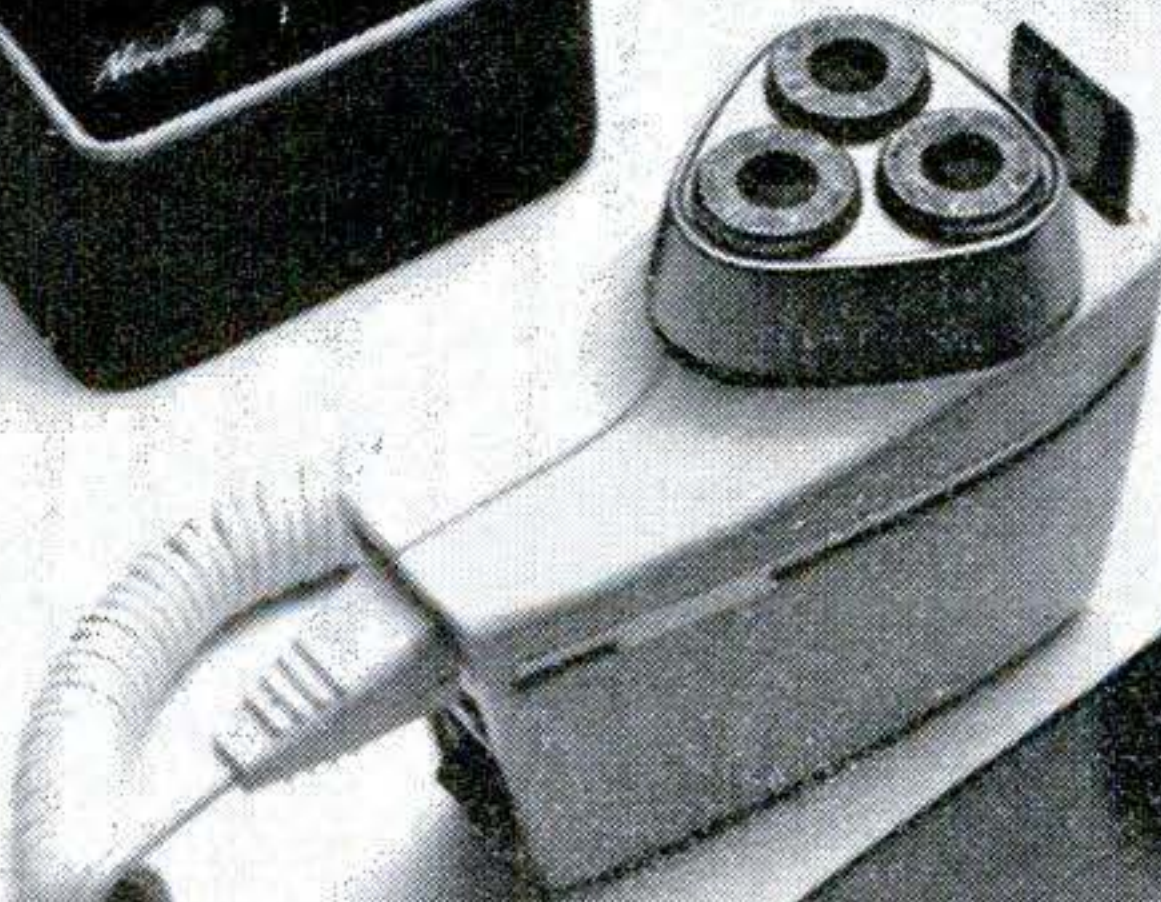
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The close, fast, comfortable electric shave.

HIGHLIGHTS OF THIS ISSUE:

Amazing New Five-Cylinder, Two-Stroke Radial Engine **PAGE 45**

The two-stroke grows up: This one by McCulloch may power lightplanes of the future.

Can New Non-Lethal Weapons Control Riots? **PAGE 48**

BY ERLE STANLEY GARDNER

With our new scientific arsenal, riots *can* be controlled bloodlessly, says noted author.

My LSD Trip **BY ROBERT GANNON** **PAGE 60**

A jolting non-cop, non-hippie report of the unvarnished facts by PS's own reporter.

"I'll Cheat You If You Don't Watch Out" **PAGE 76**

An "odometer artist" tells how used-car mileage is faked—and how to spot the signs.

Coffee Table That Solves a Problem **PAGE 124**

It stores your encyclopedia volumes and it's a table, too! Complete with blueprint.

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COMING NEXT MONTH

PS starts the New Year right with a lively calendar of features for the man who wants the hottest news and know-how on everything from the ABCs of repairing his car to the latest report on antimissile missiles. If that sounds like you, here's what you'll find in January—

- Norbye/Dunne test the Ambassador SST, Fury III, Galaxie 500, and Impala.
- Jim Roe tests the biggest and smallest outboards (a 125-horse giant and a midget 1½).
- Darrell Huff relates the fascinating story of how he built his dream house.
- PS' auto experts tell you all about the new electronic fuel-injection systems that improve performance, save gas, and *could* be the answer to smog control in cars.
- Noted medical writer Lawrence Galton asks (and answers) a universally important question—"What Gives You a Headache?"

PLUS New Tools from the Hardware Show . . . How to Set Up a One-Motor Shop . . . How to Install Plumbing Drains . . . And a whole lot more.

AUTO UPKEEP

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- [160 Hints from the Model Garage](#)

PS Previews the Christmas Gifts You'd Like to Get

The perfect gift? It might be a set of drill bits, a light meter, a stereo tuner, a new set of shocks for your car. Here's what we selected—with you in mind.

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Boy, have you got it made.



(Girls with pimples have to mess with 73 different medications to find one that works.)

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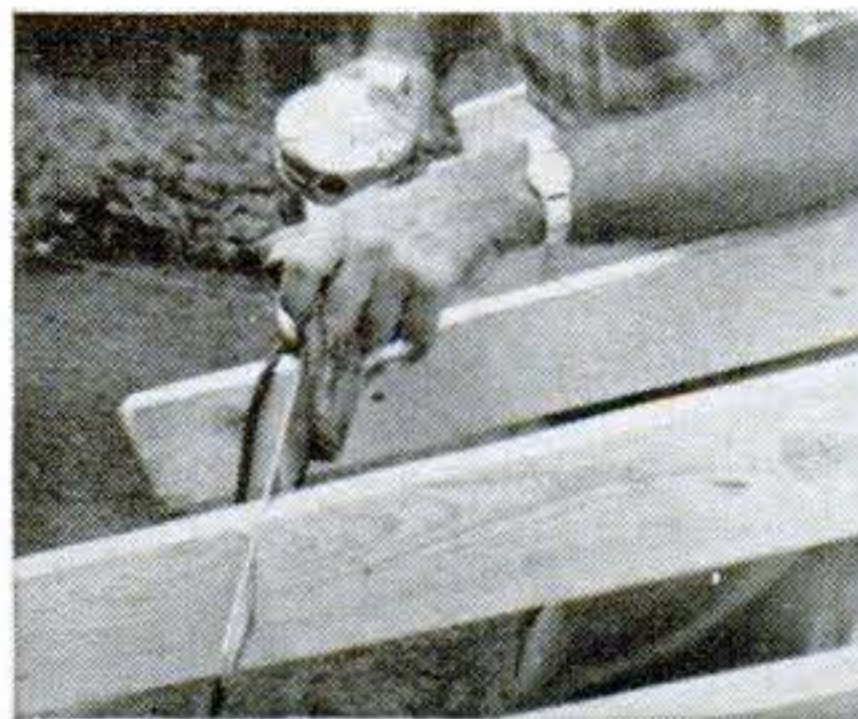
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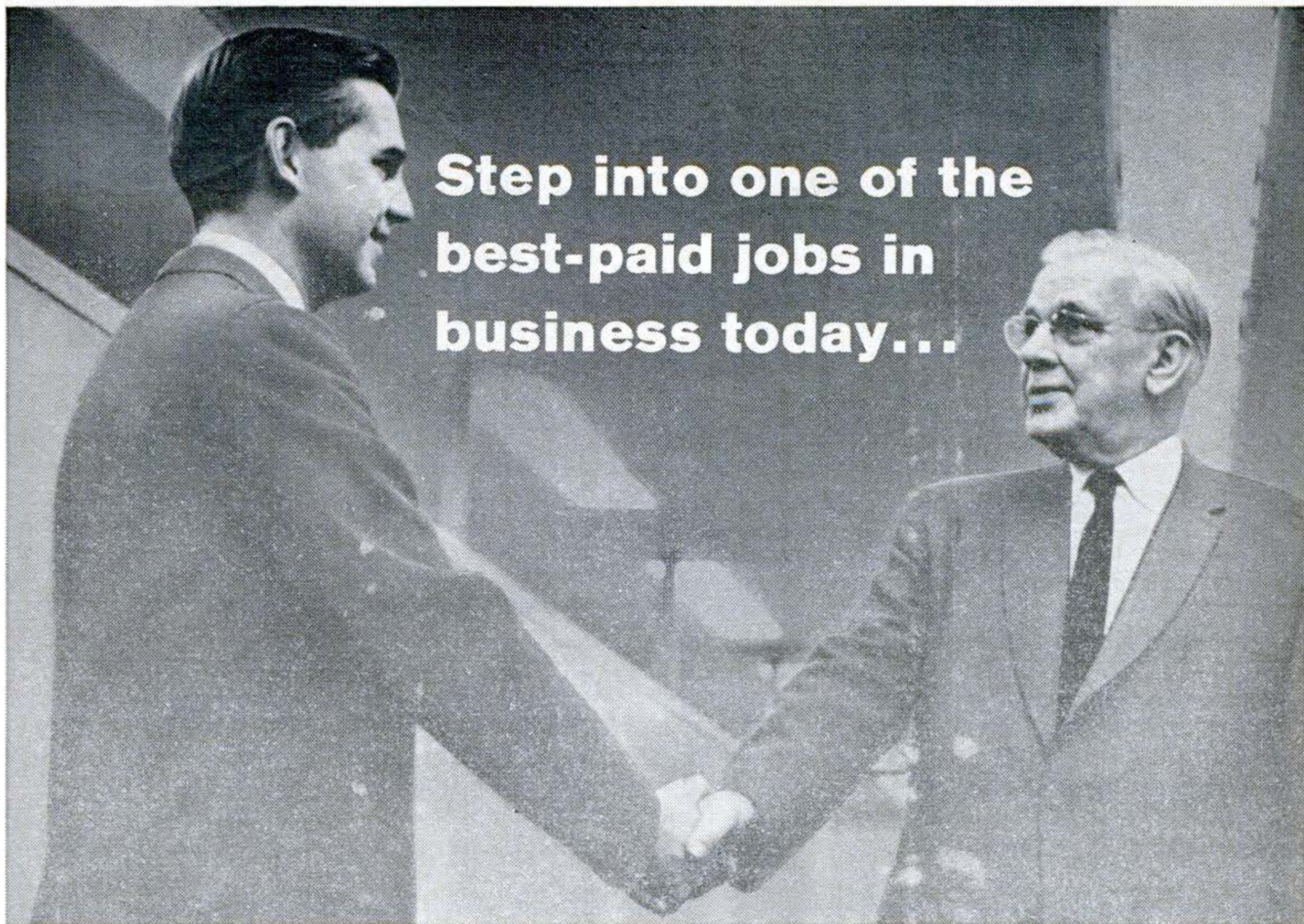
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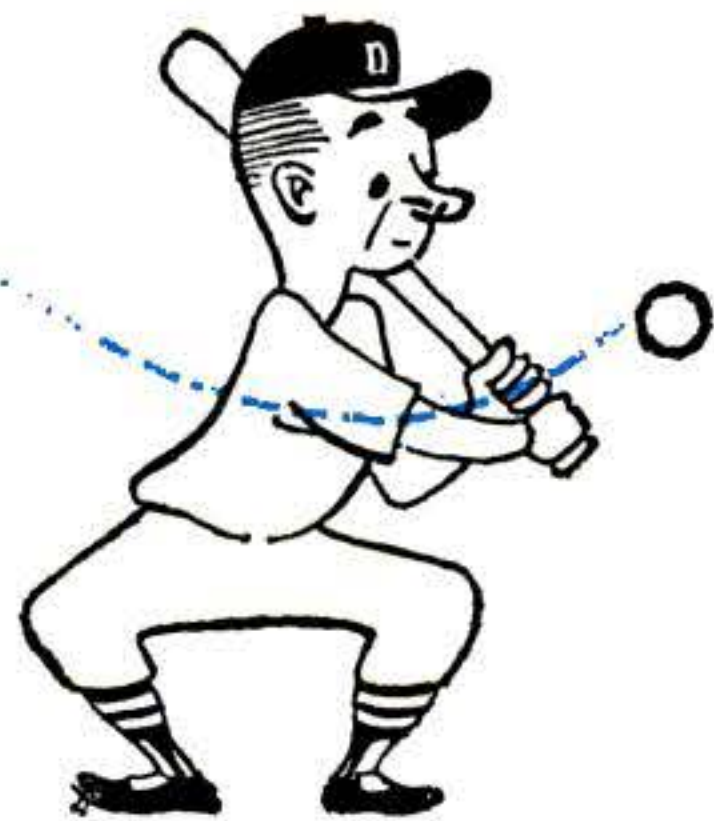
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PS Readers Talk Back



What makes a ball curve?

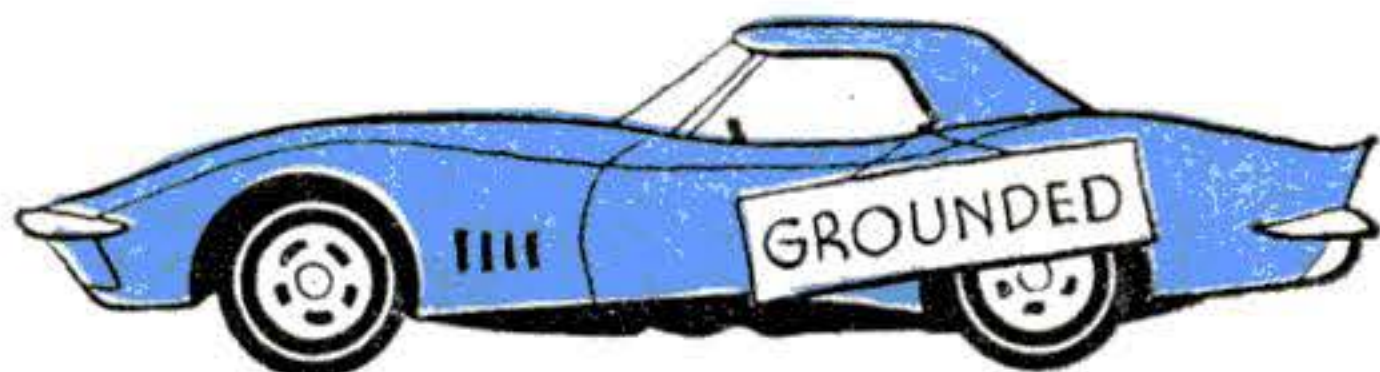
Ken Swezey describes what makes a ball curve in Bernoulli's Paradox [Oct.], but I don't think this description agrees with the sketch. If the higher relative velocity occurs on the lower side of the ball in the sketch, why is the pressure higher here? The story says the ball curves toward the side past which the air moves fastest. I am told by baseball pitchers that the sketch is correct. So the explanation in the story must be wrong.

PAUL SISCO, Somerville, N.J.

Both the sketch and explanation are correct. On the "low-pressure" side of the ball, the velocity of the air clinging to the spinning ball is added to the velocity of the air rushing past the ball as it moves through the air. On the "high-pressure" side this film is moving in the opposite direction and subtracts from the total velocity of the air.

The winning '68 cars

Your story on the new cars, "PS Picks 13 Winners" [Oct.], prompts me to ask: winners for whom? Mechanics, morticians, and gasoline companies? When you suggest that practical and sensible men go out and buy such cars as the Corvette, you have insulted our intelligence. Such cars should not be



allowed on the road. For every auto accident caused by too little power, there are 1,000 caused by too much power. I suggest you fire your auto editors and give us a man who knows and appreciates what the average fellow needs and wants in a car.

ROGER McCLAY, Lucasville, Ohio.

Corvette fans to the barricades!

Body-building bike exerciser

I made an exerciser similar to the "Bike Exerciser You Can Build" [Oct.]. It did not offer enough resistance. In place of

the drag wheel, I mounted a wood pulley on an auto generator. Once polarized, the generator will always produce a current and the output can be fed through resistors for exercise. Now I get plenty of exercise. I can work up a sweat in 10 minutes. I recommend that when you start to use the exerciser you take it easy at first and build endurance slowly.

CLIFFORD H. WORMCKE, Little Neck, N.Y.

Discovering what causes tension

Isn't it wonderful the way Drs. Hans Kraus and Edmund Jacobson, both MDs, found out that people's nerves and tension affect muscles and cause neck aches, backaches, and headaches ["Don't Let Tension Push You Around," Oct.]. Next they will find out that nerves control all functions, organs, and cells in the body—things chiropractors (quacks according to the AMA) have been preaching to people for 70 years.

KENNETH E. YRI, D.C., Olympia, Wash.

Likes rear windshields

In "How to Get a Periscope View of Traffic" [Picture News, Sept.] Karl E. Smith, inventor of the periscope rear-vision mirror, seems to have no respect for the drivers who follow him. Most people rely on being able to see through the car ahead of them so they can get advance warning of a hazardous traffic situation and possibly avoid a rear-end collision. This is why most drivers don't like riding behind buses, trucks, and campers. The mirror is fine, but use a rear window, too.

WILLIAM LAHR, Compton, Calif.

The flying-saucer probe

Dr. Condon's highly capable group at the University of Colorado has given the investigation of UFO phenomena ["The Great UFO Probe," Oct.] an air of scientific respectability. But individuals on both sides of the issue are expecting this study to result in a scientific cure-all. Thousands of military and private individuals have been investigating UFOs for 20 years with no concrete results. It is ridiculous to believe

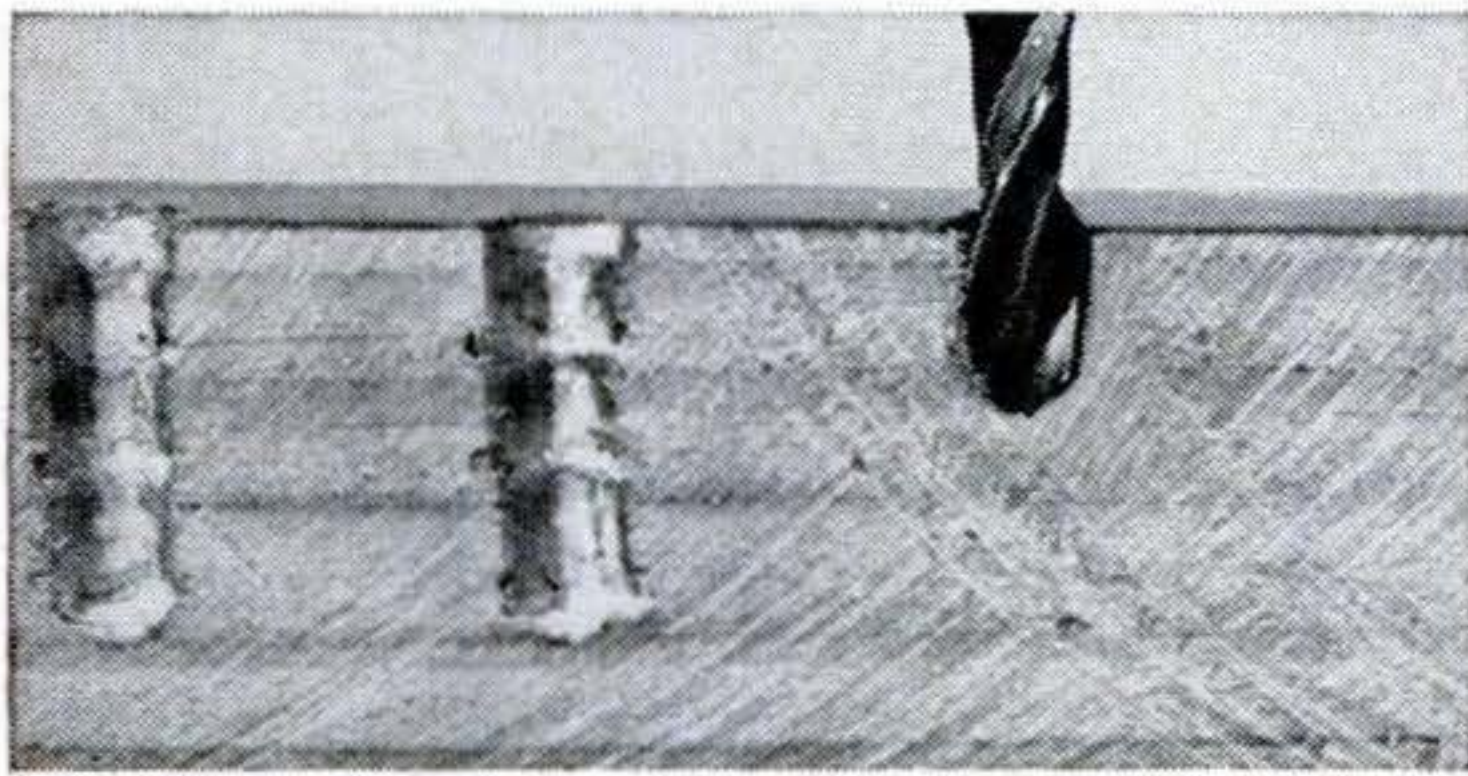
Continued

Seven workshop headaches.

Seven Mystik Tape Cures.

1. Drilling a Finished Surface:

When you're drilling a finished wood surface, the drill can skid out of the punch and scar the finish. You can avoid this by sticking a piece of Mystik Clear Plastic Tape over the spot you want drilled. This skidproofs the surface. So you won't have to worry about damaging the finish.



2. Removing a Tap Washer Without Scratching the Chrome:

When you're changing a faucet washer, wrap the chrome packing nut with Mystik Electrical Tape. You'll avoid scratching the nut with the wrench.

3. Keeping Wood From Splintering When Sawing:

A strip of Mystik Masking Tape placed on the underside of the wood, along the cutting line, will keep the edges from splintering while you saw. (This is especially helpful when you cut plywood.)

4. Losing Small Parts:

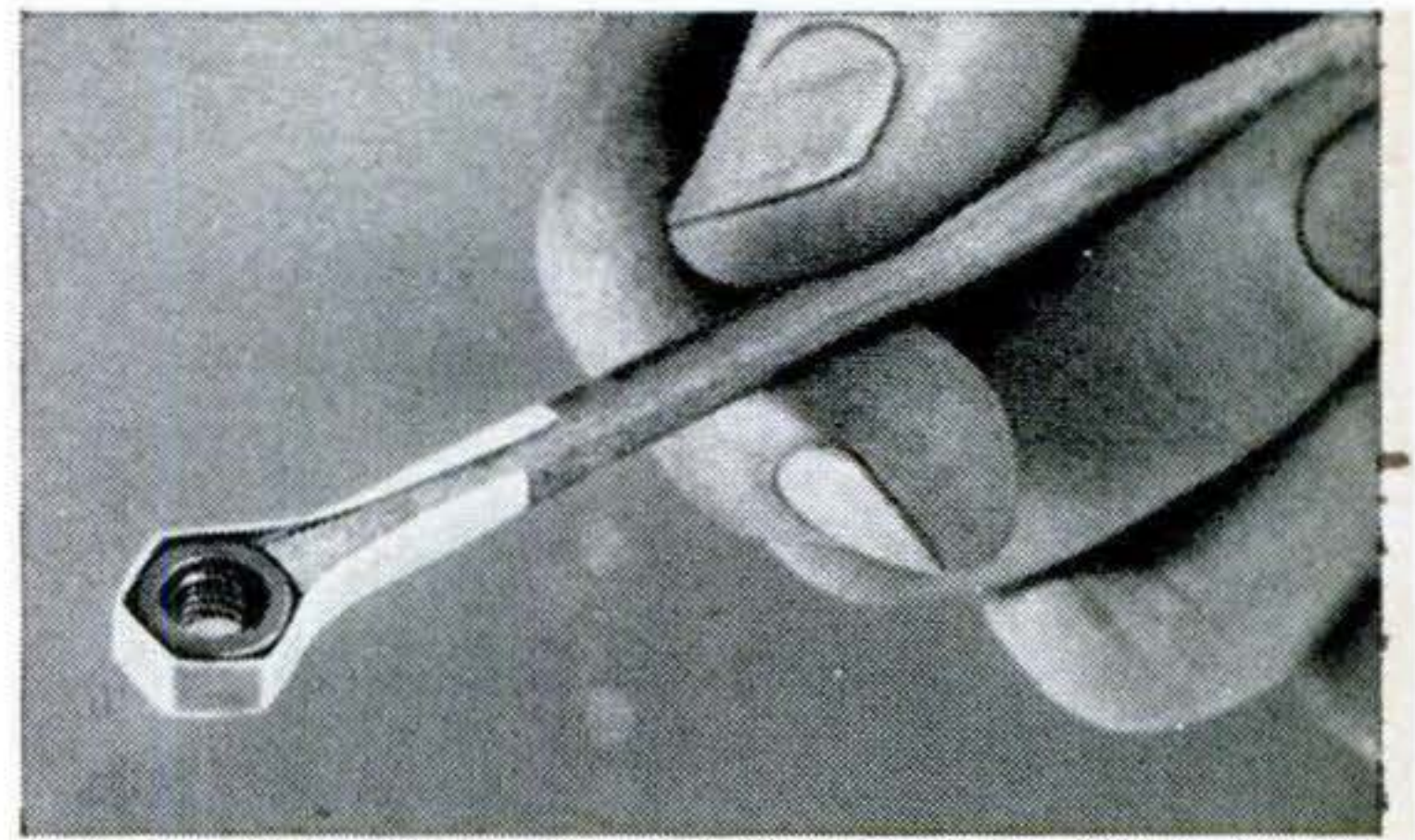
Mystik Double-Faced Tape makes a great no-spill parts rack when disassembling and reassembling a small motor. Stick a

strip of the tape on your bench and press the parts on it in the order of disassembly. This makes reassembly easy.

5. Tools Without Handles:

If you don't have handles for all your files or hacksaw blades, wrap Mystik Electrical Tape around the tangs, and you'll fashion a working handle.

6. Threading a Nut To An Inaccessible Bolt:



If you have to thread a nut and bolt in a place you can't reach with your fingers, cut a piece of Mystik Masking Tape (as wide as the nut is thick) and use it to mount the nut on the end of a pencil, butting the side of the nut to the pencil. This way, you can hold the nut in place while you turn the bolt into it.

7. Holding Tacks on Hand-Tool Heads:

If you're working with small tacks, place a piece of Mystik Double-Faced Tape over the hammer head. The tack will stick easily to the tape. You can then give the tack a firm, direct hit.

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ampere draw at 0° F.

The reason is simple. The DieHard is bigger. Not on the outside. On the inside. Its new polypropylene case is not only 60% stronger at 0°, the walls are more than 50% thinner than the usual thick, heavy rubber battery walls. So there's more room inside for more acid and bigger plates—the things that determine a battery's strength.

There is no other car battery of its size that will deliver so much power as the DieHard. And it's backed by a 60-month, no-fine-print guarantee. When Sears guarantees, Sears guarantees.

There are over 2000 places you can buy the DieHard. They're all Sears, Roebuck and Co. stores. You can Charge It on your Sears Revolving Charge.

The Sears 5-year guarantee:

“Free replacement within 90 days of purchase if battery proves defective. After 90 days we replace the battery, if defective, and charge you only for the period of ownership, based on the regular price less trade-in at the time of return, prorated over number of months of guarantee.”

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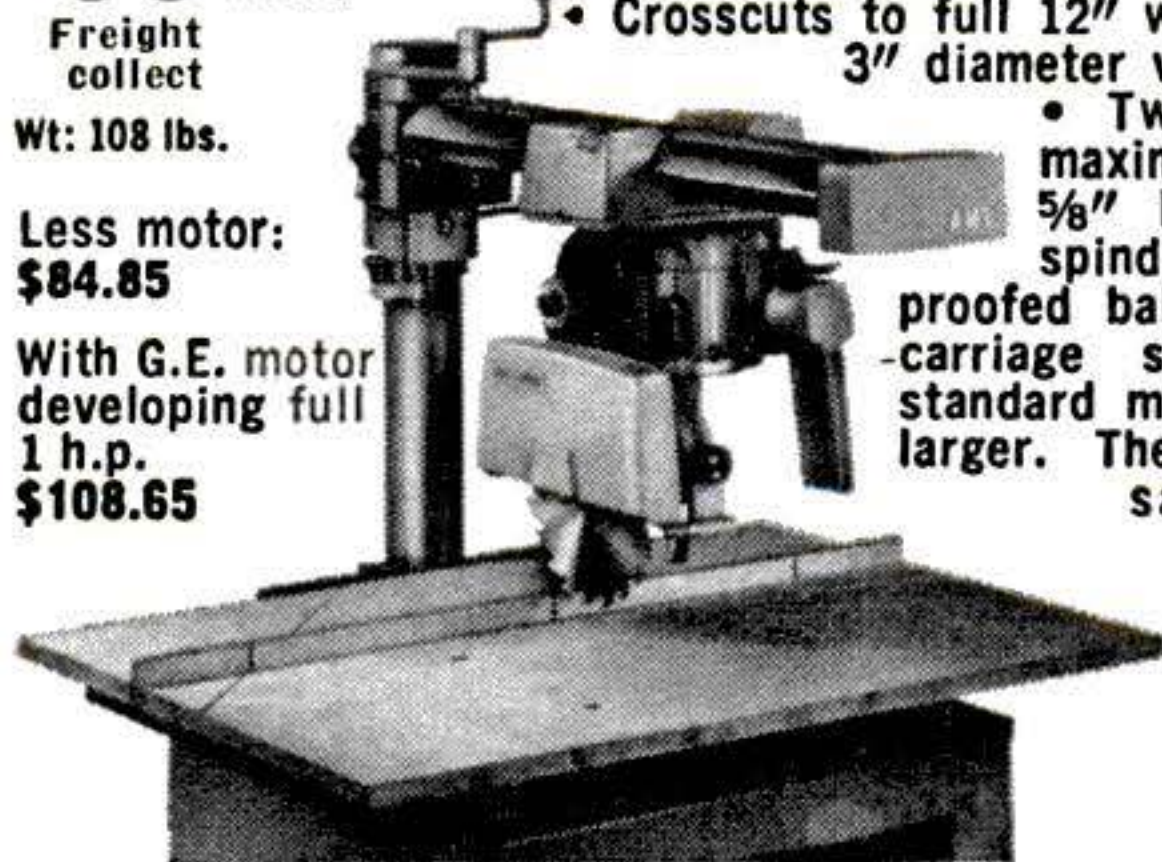
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PS Readers Talk Back [Continued]

that the short-lived Condon study will answer all the questions. The report should be an excellent technical treatise, a baseline for future efforts. Let's not use the report as a catchall or scapegoat for petty personal opinions.

JOHN F. SCHUESLER, St. Charles, Mo.

. . . The first UFO sighting is attributed to 1947, but other UFOs appeared over America 50 years earlier. On Nov. 24, 1896, a cigar-shaped object flew over San Francisco and Red Bluff, Calif. The object seems to have covered the 162 miles between San Francisco and Red Bluff in a few minutes. The velocity figures out at over 1,000 miles per hour—and this happened seven years before the Wright Brothers' flight.



KENNETH LARSON, Culver City, Calif.

PS pointed out that some alleged UFO sightings go back to Biblical times.

Lighting up in an Urbmobile

Your October cover shows a man lighting a woman's cigarette while riding in an Urbmobile. He was using a flint-and-wick lighter. Don't Urbmobiles have built-in lighters?

DAVID HOOKER, Long Beach, Calif.

Not yet.

More oil for your car

In fairness to packaged additives, "Oil for Your Car" [Sept.] neglected to point out that these products usually rely on chemicals similar to those used by the oil companies in producing their finished treated oils. Another misunderstanding may develop from the explanation of film-strength test machines PS referred to as gimmicks. Practically all test laboratories, including Lubrizol's, use such devices as an aid to evaluating certain important properties of lubricating oils. Suitable antiwear chemicals found useful in actual engine operation likewise show up favorably on these machines.

J. H. BAIRD

The Lubrizol Corp., Cleveland.

. . . I would like to compliment you on the well-written text of your article, "Oil for Your Car." In addition to the educational value of the technical data presented, most motorists will benefit by recognizing the

Continued

TOM McCAHILL SAYS:

“Good Appliance Repairmen are Scarce as Edsel Dealers!”

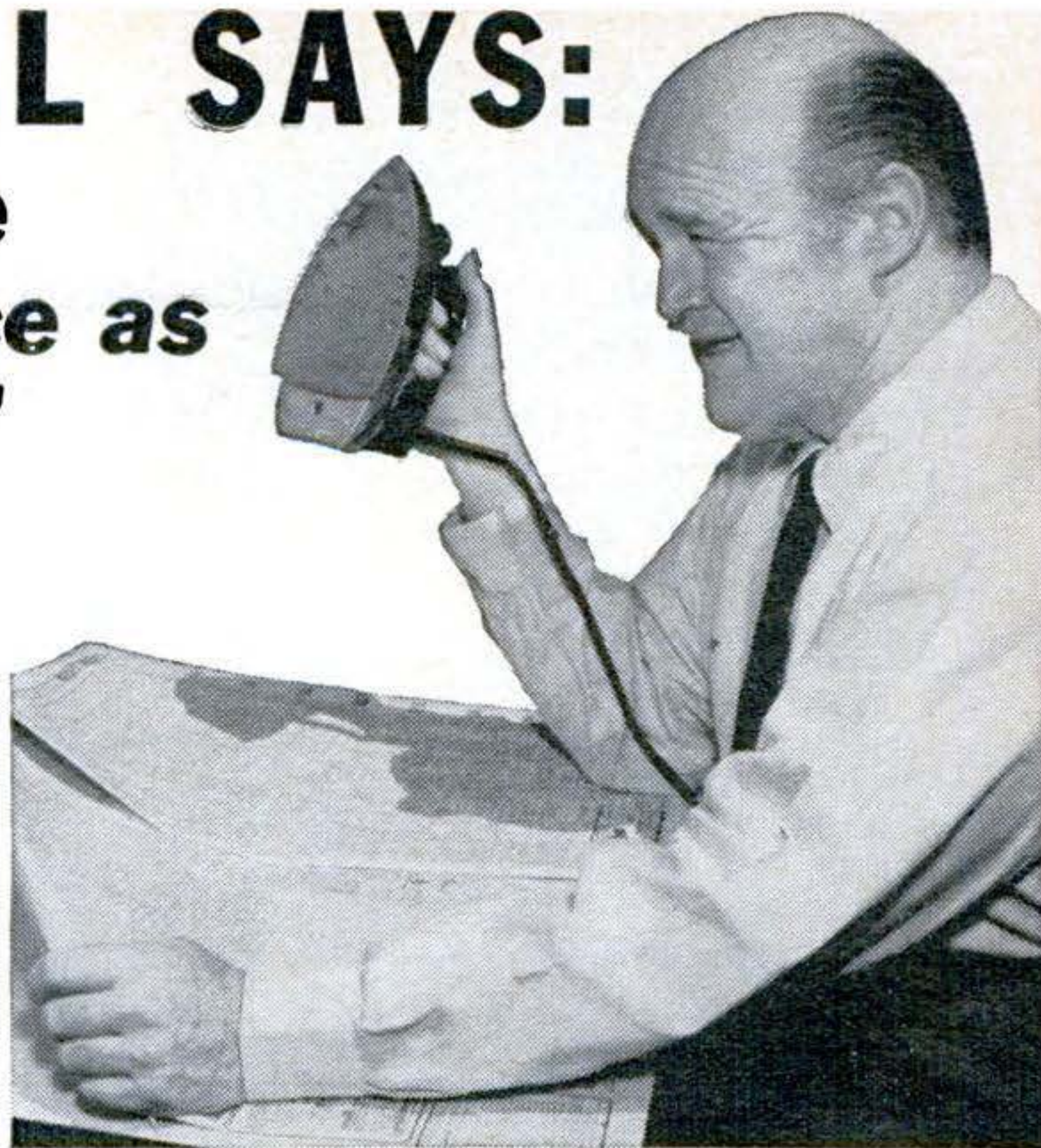
I don't think anything disturbs me as much as trying to find an appliance repairman . . . and finding out I'll have to wait my turn because he has more business than he can handle.

With over 400 million Appliances now in use, and more coming every year, there just are not enough repairmen around to take care of every Mrs. Jones who wants a broken Appliance mended in a hurry! And that's why a smart guy could really clean up in the Appliance repair field.

Some years back, almost anyone could do a fast repair on an iron or toaster with a bit of fancy tinkering. But today's complicated Appliances call for a special brand of know-how the average Joe doesn't have without training. Appliances are loaded with thermostat controls, solenoids, and special devices. Unless a repairman has a working knowledge of these parts, he won't even get to first base.

That's why I want you to take a good look at the home study course offered by the Appliance Division of the National Radio Institute. They show you all about repairing home and commercial Appliances—even farm Appliances and small gasoline engines. If you're interested, they also include a special package covering air-conditioning and refrigeration repairs. The cost is surprisingly low, and even includes a special Appliance Tester.

NRI is one of the biggest and best schools in the field, and has been around since 1914. They have a staff of 150 people in Washington, D.C., who are



equipped to guide you through the easy course with expert and personal instruction.

Take it from Tom . . . this is one of the easiest and most rewarding fields a guy can enter today. You don't need a college education, you don't even need to know the first thing about Electrical Appliances when you begin your training.

There's nothing to lose . . . except the price of a stamp on your letter or postcard. Fill out the coupon below *now*, before you turn the page. Get the full rundown on the training that can increase your spare time income or provide you with a business of your own a lot sooner than you think. In just a few short months you could be ready to take the first profitable step towards a new and rewarding career. Do it!

Tom McCahill

TOM McCAHILL

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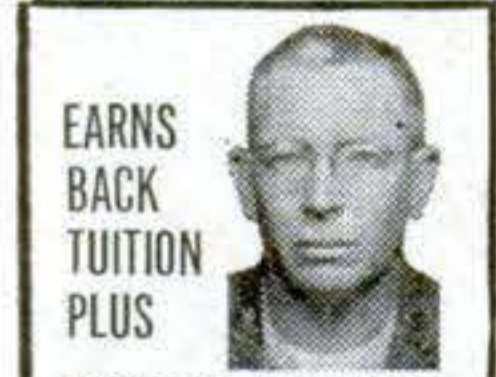
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PS Readers Talk Back [Continued]

validity of your statement that "Time, not distance driven, is the key factor in determining how often oil should be changed."

At the same time, I would like to clear up an obvious misunderstanding concerning the placement of our Atlantic Imperial and Atlantic Aviation Motor Oil cans in the photographs on pages 69 and 70. Both our Atlantic Imperial, a multiviscosity oil, and our Atlantic Aviation, available in single viscosities, exceed "all car makers' specs."

**R. K. ALLEN, Atlantic Division,
Atlantic-Richfield Co., Philadelphia.**

... It was helpful to see brand names mentioned and what specifications they conform to. I would like to find out more about the brands that were not mentioned. Were all omitted brands unmentioned because they did not pass car manufacturers' specifications?

HARRY G. HILL, West Allis, Wis.

We did not have the information on oils not shown in the story. Some brands did not meet the specs. Some had not completed



engine tests, or were unwilling to make test results available to PS. Other companies did not respond to our efforts to obtain information.

... Does a VI improver, as thick as it is, go through your oil filter properly without hurting the engine?

RALPH L. JOHNSON, Brockton, Mass.

Yes, the VI improver will pass through the oil filter when mixed in recommended proportions with your crankcase oil.

... I would like to update your article with the fact that Esso Extra motor oil is now qualified against the Ford M2C-101B specification. When we responded to your inquiry, we were still in the process of qualifying the oil. This oil now meets both GM-4754M and Ford M2C-101B specifications.

**W. E. ZUMWALE,
Humble Oil and Refining Co., Houston.**

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

The Safety Shaver. It took the sting out of shaving.

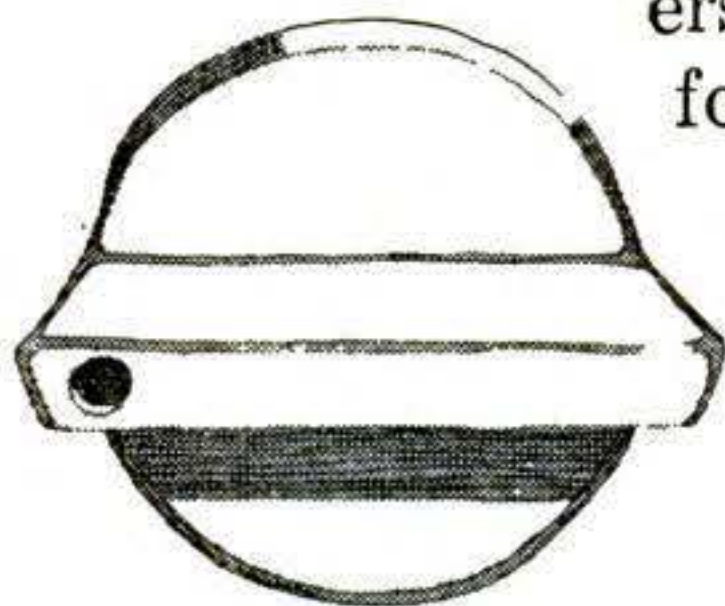
Considering we make our living making shavers it pains us to admit this—but quite frankly, shaving can often be a pain in the face.

There's that 11 A.M. blah feeling in the cheeks. The burning sensation in the chin. Irritation written all over the neck.

The fact is, too many shaving instruments are just too close for comfort. And some are just too comfortable to be close.

We can discuss this problem with candor because we think we've licked it. With The Safety Dial that raises and lowers the shaving heads to

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It works like this: When the shaver heads are dialed up or down, The Safety Combs (which remain stationary) expose exactly the right amount of cutting surface for your particular kind of face—letting in all of the whiskers and keeping out all of the skin.

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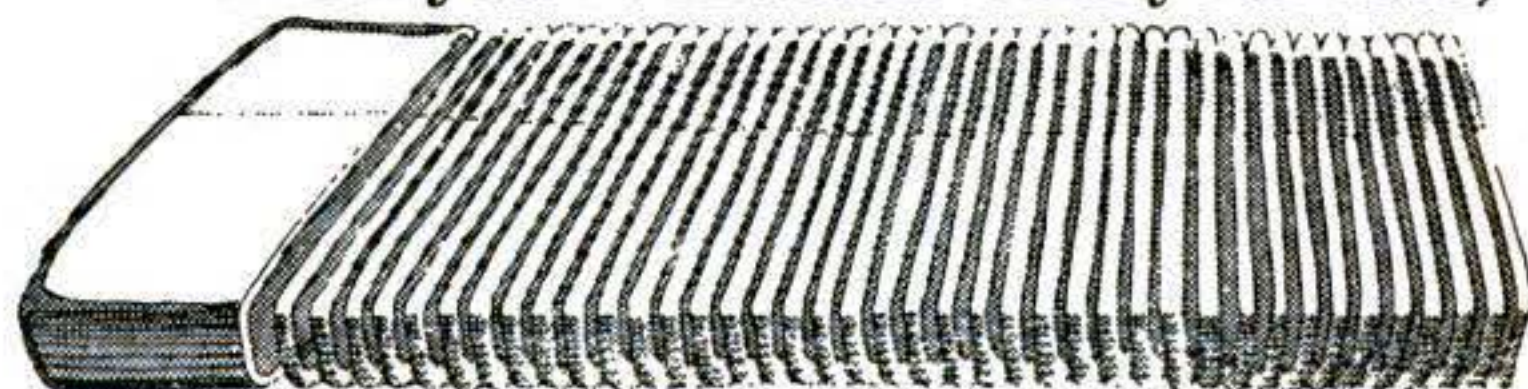
And should you have a face tough as nails, you set The Safety Dial at S4.

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The Safety Combs.

turn the dial to trim and straighten out your sideburns.

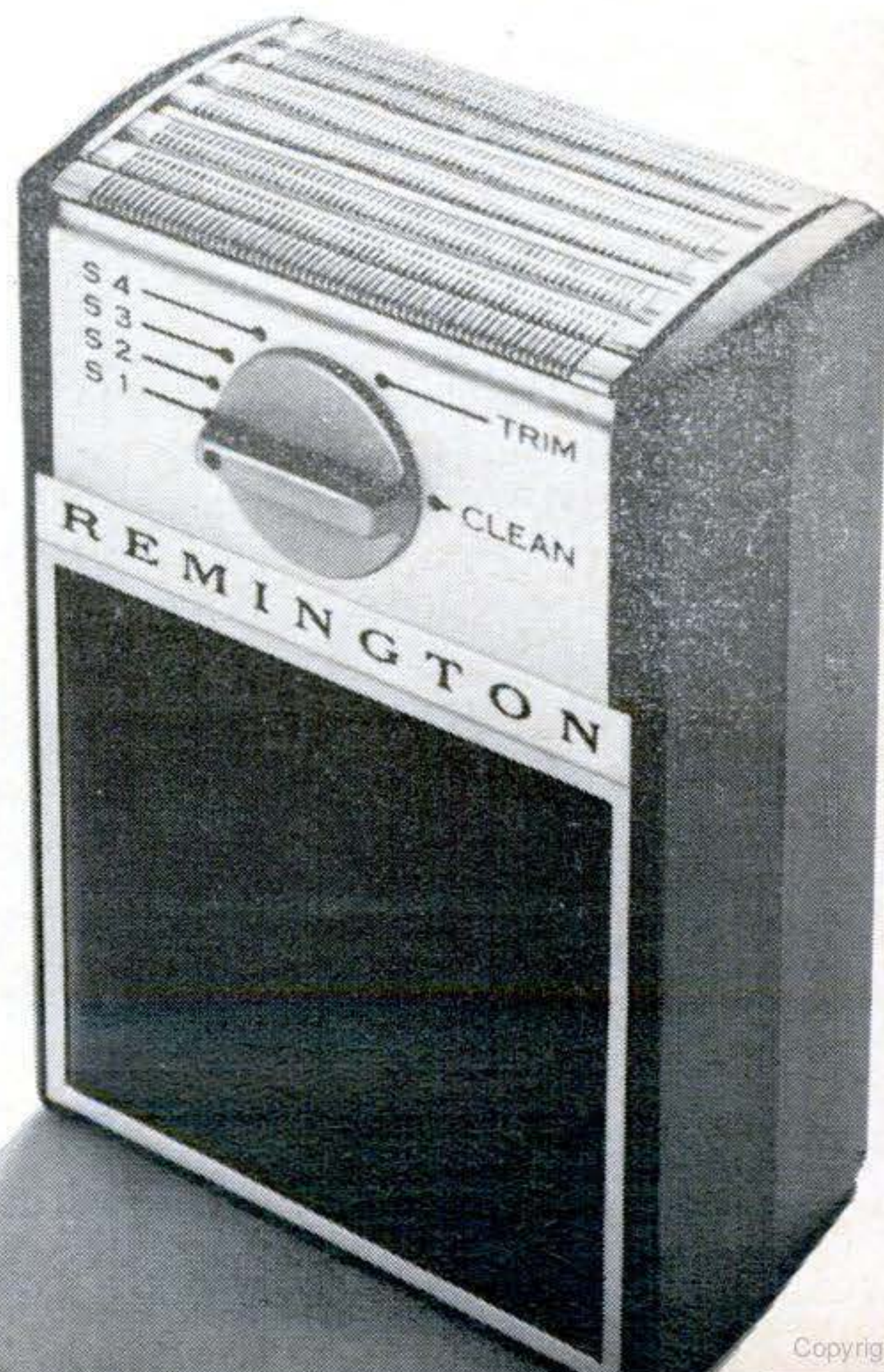
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"Say, Smokey—"

A clinic on cars by America's most famous mechanic

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



.....

"I have trouble with the carburetor on my 1966 Pontiac Le Mans 326 during cold weather if I try to accelerate before the engine is warm. The dealer put in a new kit and drilled the two jets larger. That helped. But now I get a lot of water and soot."

KENNETH WALKER, Terre Haute, Ind.

Better get the factory-recommended jets back in that carb and have the choke updated to what the factory recommends. Get the carburetor adjusted exactly to what Pontiac says, and you'll be out of trouble.

"Would it be possible to fit a Plymouth 426 hemihead engine and Hurst four-speed or His and Hers shift into a Camaro?"

MICKEY WOOLUM, Flint, Mich.

Yes, but not without plenty of problems. The engine installation would make the car a lot heavier and subject to "push" and understeer. If you want more steam, install a Chevy 427—it will fit nicely. Watch your step, though. You may wind up switching ends unless you change the suspension to match the weight-distribution change.

"My buddy and I were talking about recapped tires. He claims he wouldn't buy them because of their poor safety record. What is their record when purchased from a 'name-brand' dealer?"

DAVID ISERT, East Brunswick, N.J.

Your buddy is right—in part. Recaps are not as safe as new tires. I hasten to add that recaps from a good capper are good, but nobody can recap a tire and make it as good as the original. The carcass already has done the job it was designed for—to wear out the tread that came with it. Re-using it for high-speed driving on our super-

highways may lessen the odds on your becoming a grouchy old man.

"For three years Buick has advertised that one of its women drivers averages a little over 18 miles per gallon on a round-trip across the U.S. The car was a LeSabre, with power brakes and power steering. I've never been able to equal this mileage."

HOWARD RISLER, Jacksonville, Fla.

Buick isn't fibbing. The woman driver does this with a production car tuned to factory specs—and she has been trained in economy driving. If you have the patience to learn that, you can equal her mileage.

"What do you think of an electric fuel pump on a standard engine like the Chevy 283? Would it help prevent missing at the high end? What would it do for gas mileage? Secondly, why is the opening on air cleaners restricted so much? They funnel down to a hole that seems smaller than the carburetor throat. Why are the hood scoops closed even on the 427 Corvette?"

PATRICK MORGAN, Los Angeles.

Brother! You've got more questions than a hippie at a Chamber of Commerce meeting! The original pump and fuel system, in good condition, do the job just fine. If you have a high-speed miss, it can be cured with the standard tune-up procedure, not by putting in an electric fuel pump. The electric pump doesn't affect mileage if it's installed properly. Let the air cleaners and hood openings alone! Sometimes it appears that the engineers are a bunch of idiots, but air cleaners are sophisticated in design and suited to individual engines. Air scoops are mostly the brainchildren of the stylists.

Is ACron asking too much?

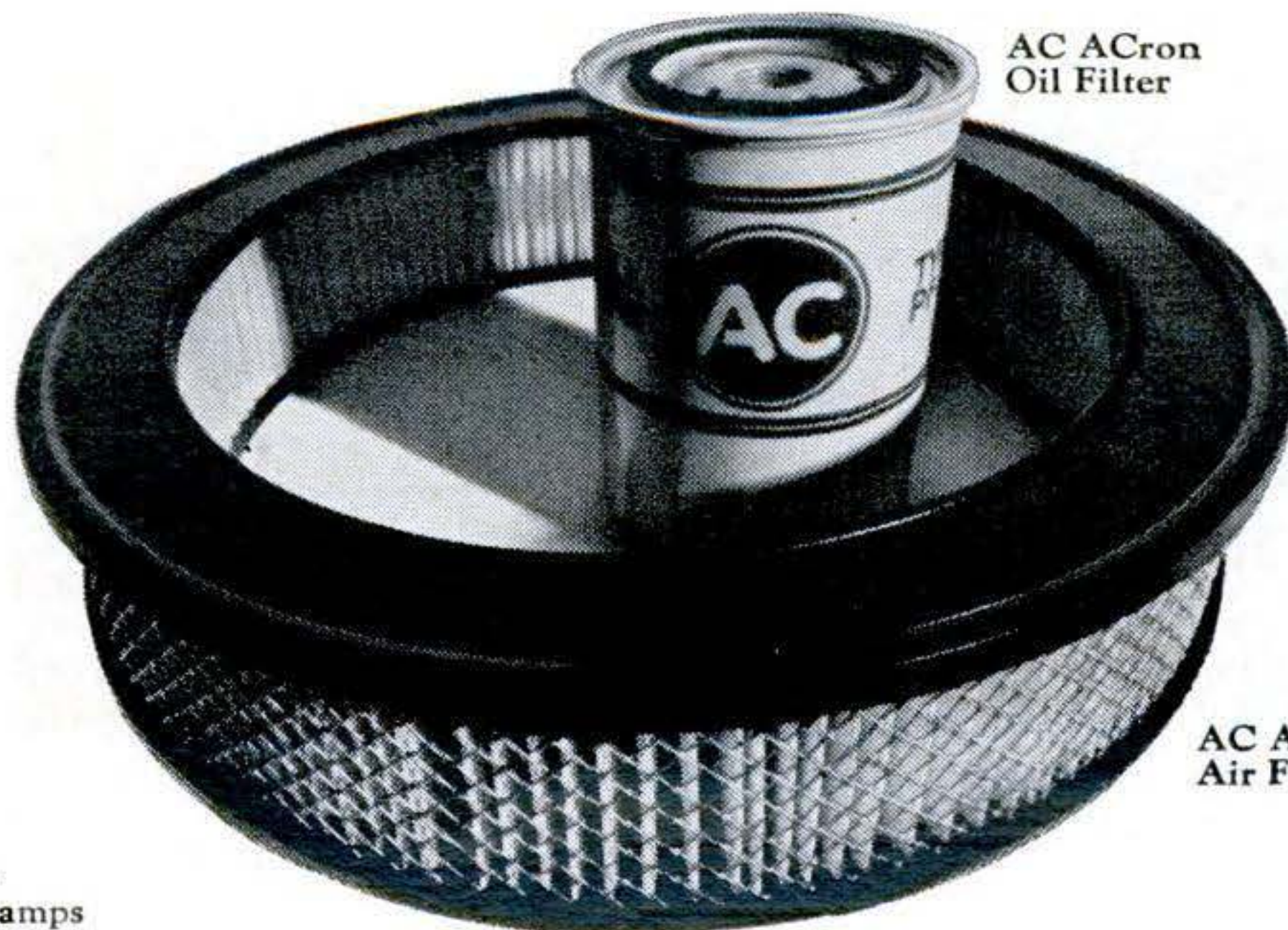
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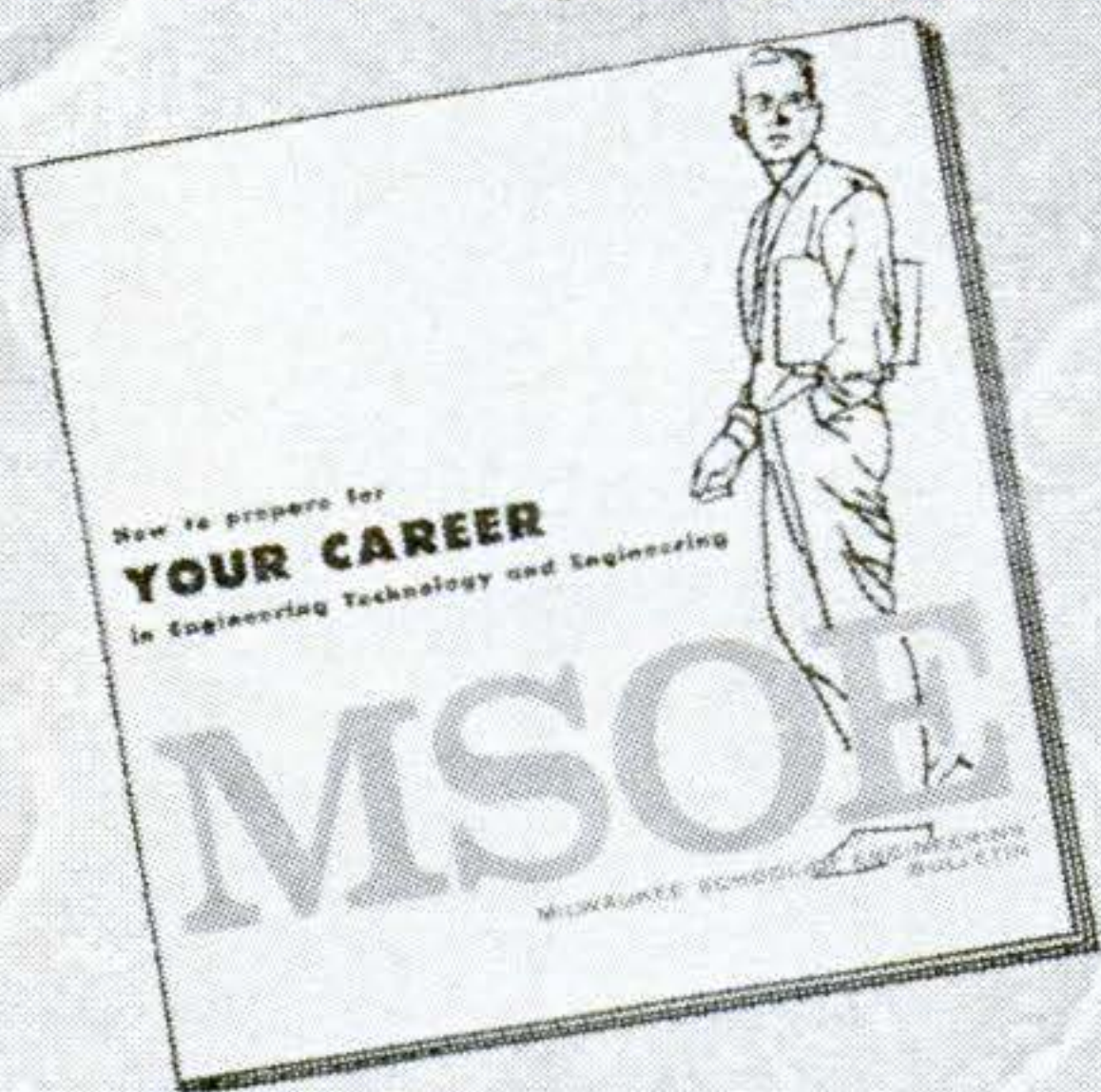
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"Say, Smokey—"

[Continued]

"We are building a Pontiac '61 with manual transmission to run in 'modified production' races on drag strips. We plan on shaving the heads .030 and adding three 'deuce' carbs and a 310-degree duration cam. The engine will not be bored or stroked. Also, we plan to install the Royal Bobcat kit. Will the stock con rods take the punishment of an extra 1,000 r.p.m. or so? On another project, what is the maximum I could shave off the head of a '55 Ford 272 cube? It doesn't have much compression even after a valve and ring job."

DANNY ANDRUS, Ville Platte, La.

Stock Pontiac rods just don't have it when it comes to a very much souped-up engine. Try to get a heavier set from Pontiac—though, in truth, I don't believe they're generally available. Somebody might have a set in old stock. You can get high-performance con rods from Mickey Thompson, Long Beach, Calif. I would say that the maximum you could shave the '55 Ford heads would be .065, but you will need high-compression pistons along with the shave job to get into the 12:1 bracket you want.

"Can you recommend a tire and/or tread pattern that will stop my '64 Chevy van? I realize that the weight distribution doesn't help, but the van won't stop within a reasonable distance. Feedback is good, and I can hold the tires up to the edge of adhesion on a dry pavement, but when it's wet I get 'scratch' starting off in second gear. The van has 7:00-by-14s with a six-ply rating."

PATRICK MURPHY, Inglewood, Calif.

Get 5½-inch wheels for your van and go back to four-ply, passenger-type, low-profile tires. These will not be as strong as those you now have on the van, but with the width, the soft rubber, and a fairly soft carcass, you'll get good traction.

"When we first got our 1965 Olds Vista Cruiser, the gas would splash out when we refilled, even though it was only three-quarters full. Since then we've discovered that if we put the car on an up incline, it doesn't spill. Does this have something to do with the strong gas odor every time we turn a corner or stop suddenly?"

MRS. NED PERSELLO, Alliance, Ohio.

Your fuel-tank vent is located badly. It should be at the highest part of the tank when the car is level. Nothing smells worse than stale fuel in a body compartment when the draft is right—or wrong. It's not safe, either. A talk with your Oldsmobile dealer should uncover a routine fix.

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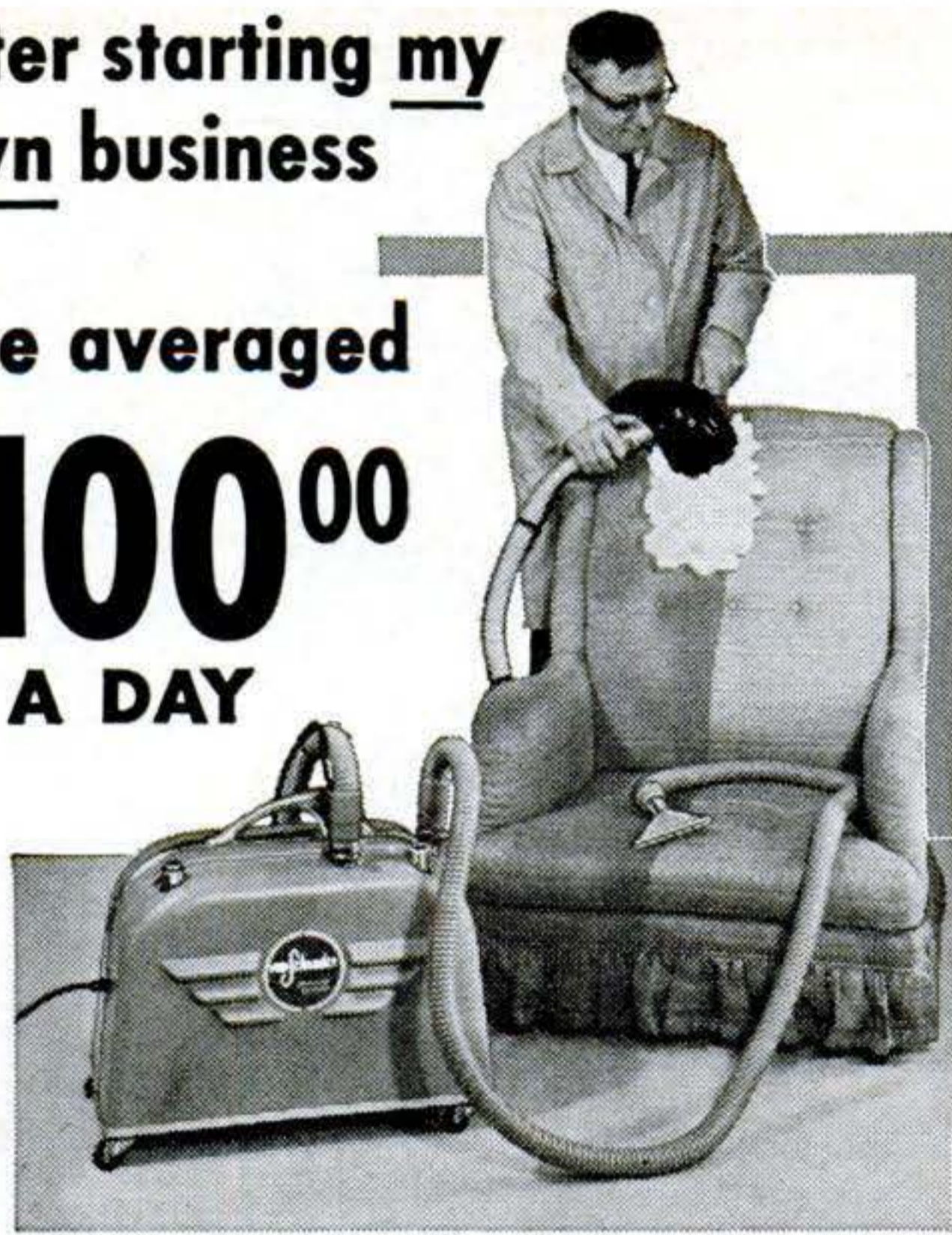


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"Say, Smokey—"

[Continued]

"I installed Michelin radial-ply tires on my '67 Pontiac Le Mans with a six-cylinder engine, four barrels, and heavy-duty shocks, and I've had nothing but trouble since. The tire dealer says the wheels must be bad, and the car dealer says the tires must be out of round. One wheel and three tires have been replaced. They have been balanced dynamically—all of them—a dozen times. We get shimmy. Is this, together with overall vibration, characteristic of radials, or is something else out of balance?"

TABB SCHREDER, Archbold, Ohio.

Radial tires are simply not as soft as conventional tires. They do cause a somewhat harsher ride, which magnifies noise and vibration. Have your tires trued on a Kem Truer machine. Then have them balanced. Assuming the front end is tight and properly aligned, you will be shimmy-free. Let me remark that radial-plys probably will become popular soon, but car design will have to be tuned to tire design before the public will accept them.

"Twelve months ago I replaced a defective TorqueFlite transmission on my '58 Dodge with one from a '58 DeSoto. The original had oil-cooler fins, but this one doesn't. So far—with 8,000 miles elapsed—all is well, but my garageman tells me I will get overheating on a long highway run."

ALAN JAMIESON, St. Hubert, Que.

Your garageman is right, up to a point. A cooler is better for extreme service, such as in hilly country, long, fast drives, or trailer-pulling. It's obvious that for the use you put your car to, your DeSoto transmission will do okay.

"Several years ago I saw a device for adding moisture to carburetor air. It was some type of ceramic that was water-saturated for the carb to draw air through. Do you have information on such a device?"

COY C. JORDAN, Raleigh, N.C.

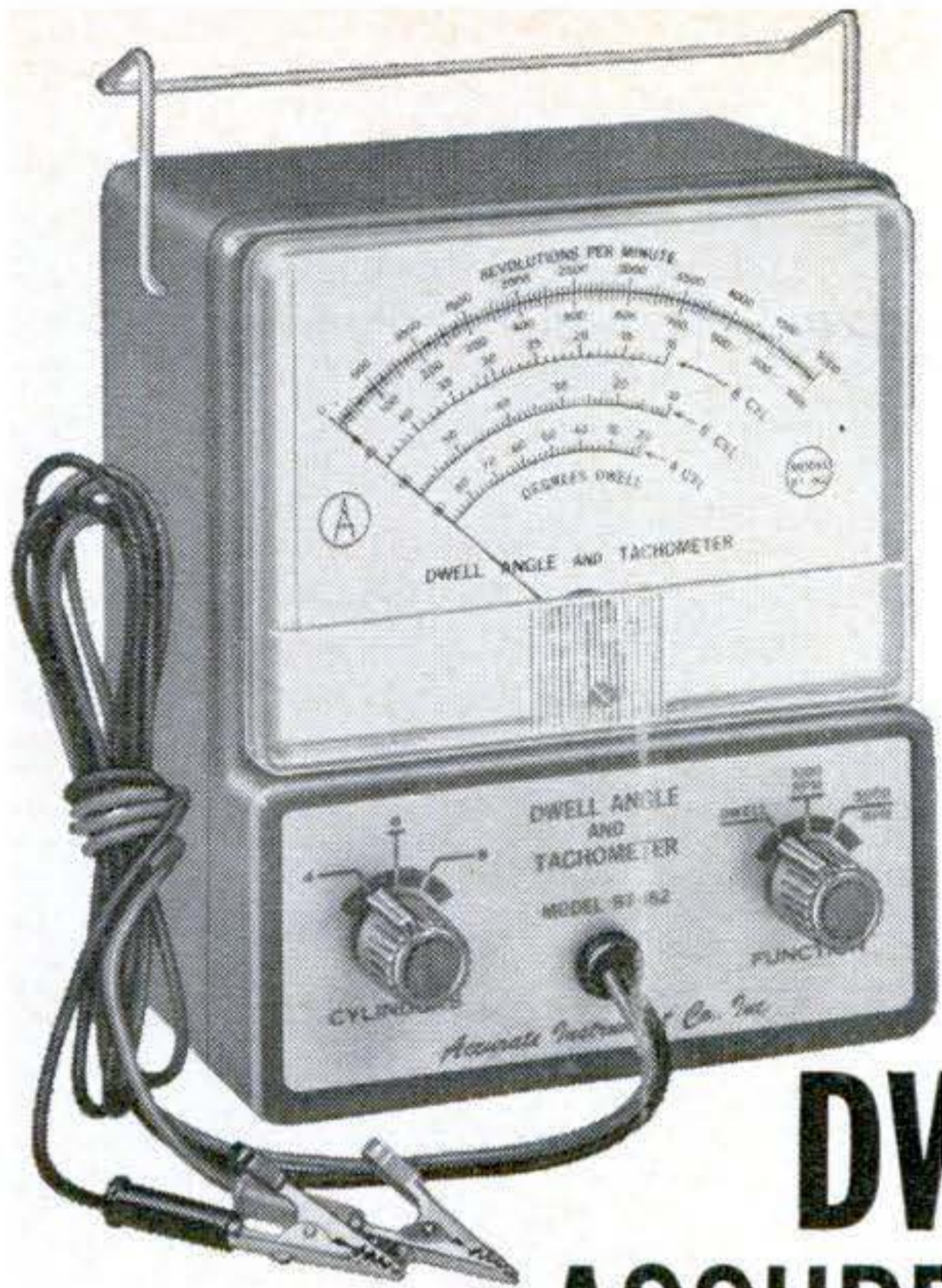
I don't know who might make this one, but isn't there more to using it than just adding it on? If it should work, wouldn't you have higher combustion temperatures, and what would that do to your valves? How about the problem of getting the right air/fuel mixture? What about the chance of carburetor icing? If the gadget were practical, wouldn't it be on Detroit's cars?

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



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- ✓ Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions. Incidentally, the 5,000 RPM maximum range of the Model BT-162 is adequate for all car engines without any exceptions.

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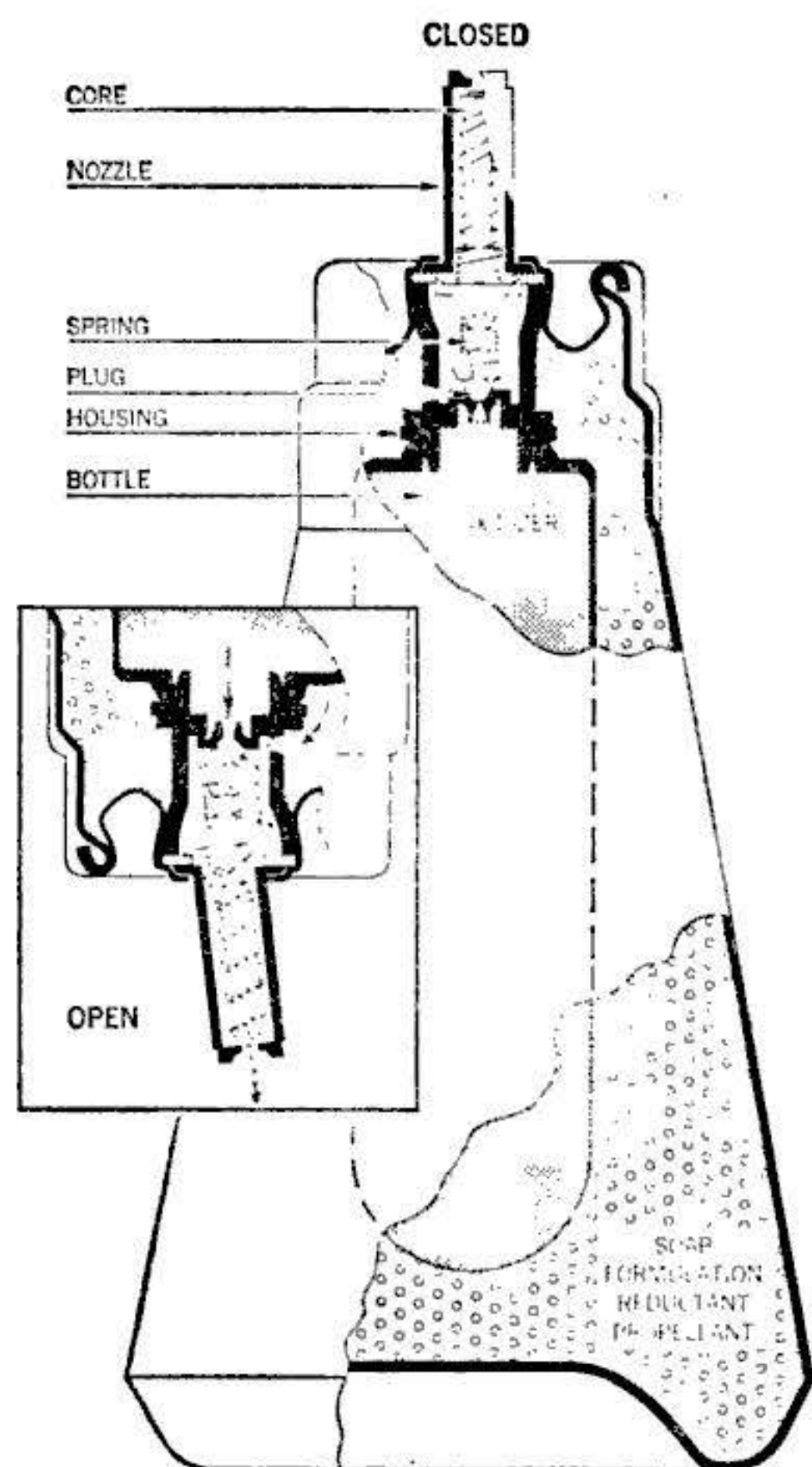
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Science Newsfront

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

By W. STEVENSON BACON



Hot shaving lather out of a cold can? Borrowing rocket technology from Cape Kennedy, this new thermal shaving lather packs soap, propellant, a reductant (material that oxidizes to create heat), and an oxidizer in the same can. As shown in the drawing above, the oxidizer (hydrogen peroxide) is in a special plastic bottle inside the aerosol. When the can is turned over and the nozzle pressed, a double valve mixes the oxidizer with the reductant and soap in the right amounts. They react chemically, heating the lather to a warm, comfortable 150 degrees and softening the beard for shaving. Called "Nine Flags Thermal Shaving Foam," the lather was developed by The Colton Company.

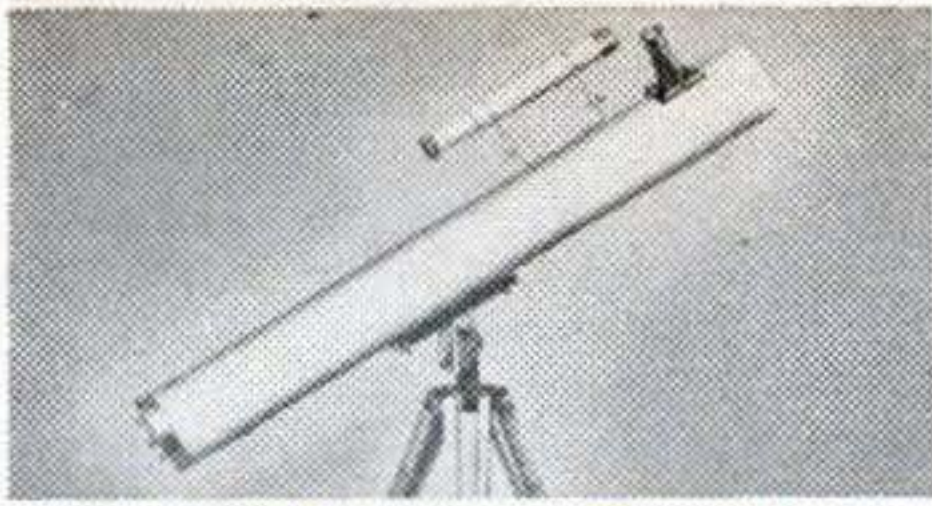
Bright-red helium-filled balloons floating from floor to ceiling of a concert hall could add real sparkle to Beethoven and Bach—not to mention rock and roll. Sound waves striking the balloons scatter off at all angles, and sound penetrating them comes out in a different direction. In a concert hall filled with them, the music would seem to come from all sides. Since filling a concert hall with balloons would be a bit impractical, Professors Vern O. Knudsen and Leo P. Delsasso of UCLA have tested their balloon theory only in a reverberation chamber. But they think the same effect can be achieved by building halls with bumps on walls and ceiling, or even with suspended spheres.

Steam-engine submarines? Yes, indeed—fueled with liquid oxygen and diesel oil. Strange as the idea may seem, Robert K. Catterson and James C. Swain of Battelle Memorial Institute are convinced that an underwater combustion power source would be more efficient than any other type for certain kinds of missions. They argue that for power outputs above 10 kilowatts and for mission times up to 20 hours, a combustion engine and fuel would weigh less and take less space than any other type. Such engines could also supply enough muscle for underwater salvage work, construction, mining, or drilling. The waste heat could warm the submarine and the liquid oxygen provide emergency life support.

One-shot paper batteries cut from sheets of "energy paper" promise to make simple, cheap power sources for youngsters' toys, small appliances, and other gadgets. They may also be useful as emergency power packs for motorists and boaters. Energy paper, being developed by Philips Electric of the Netherlands, consists of a sandwich of dry paper impregnated with ordinary table salt, a layer of potassium persulfate and paper fiber, and a conducting foil. To activate a paper battery you simply wet the top layer and cover it with a thin zinc sheet. Big sandwiches provide more current, and by stacking them in layers, voltage is increased.

If your windshield wipers leave streaky, lacy films of water across the glass, you may not need new blades. The problem, recently tracked down by infrared spectroscopy, is that a small amount of organic material stays on the glass even when all the dirt is removed. What's worse, it adheres to the glass and physically changes its surface. The driver sees a lacy curtain or film of water that scatters light and becomes a nuisance after dark. GM, which did the research, is selling a new product called Optikleen which is said to dissolve the organic contaminants.

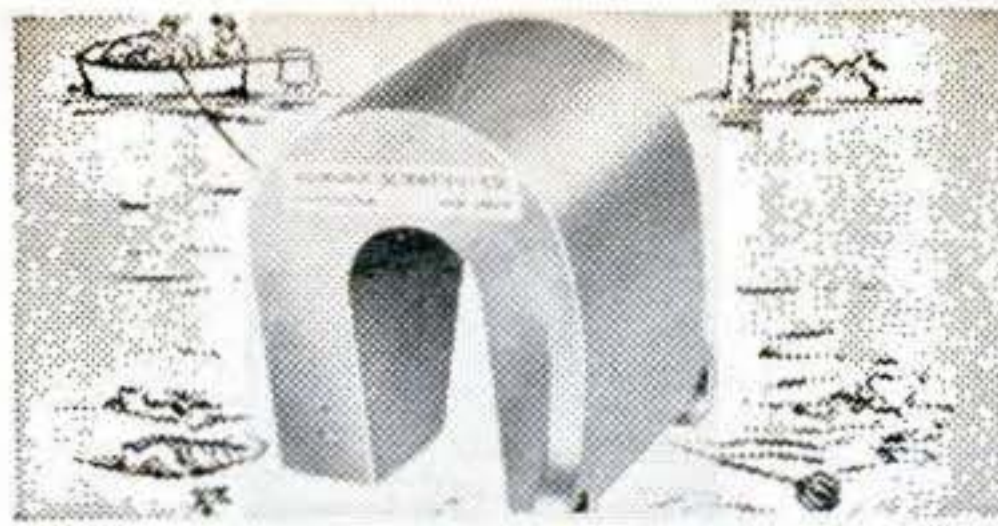
There's now a sure cure for hiccups—but only your doctor can use it. After trying such time-honored remedies as frightening patients with loud noises, asking them to hold their tongues, or giving them ice to swallow, physicians at the University of Chicago found that all they had to do was insert a flexible tube into a nostril and rub the pharynx, the back of the mouth where the nasal passages join the throat. This stimulates the



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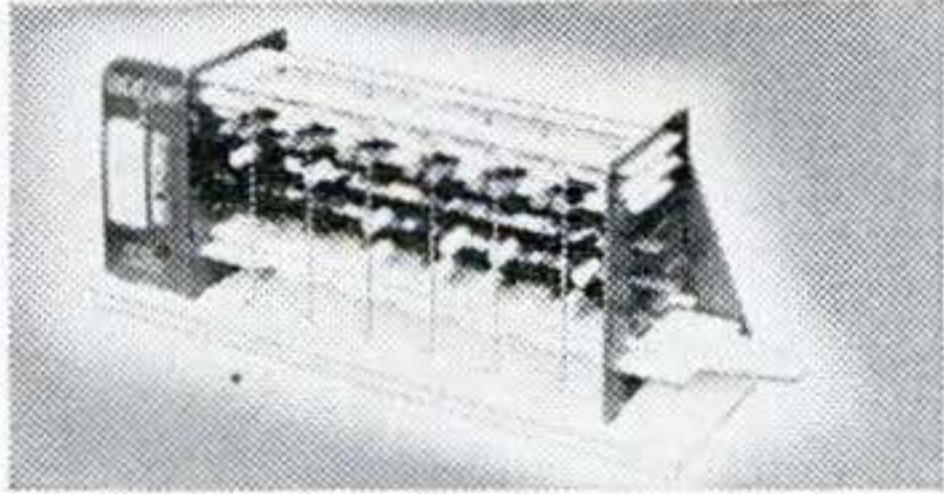
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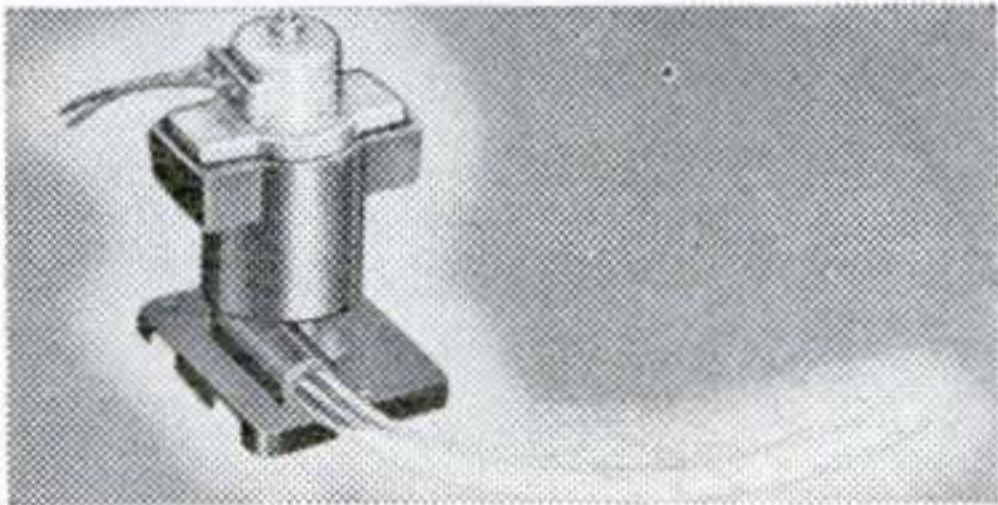
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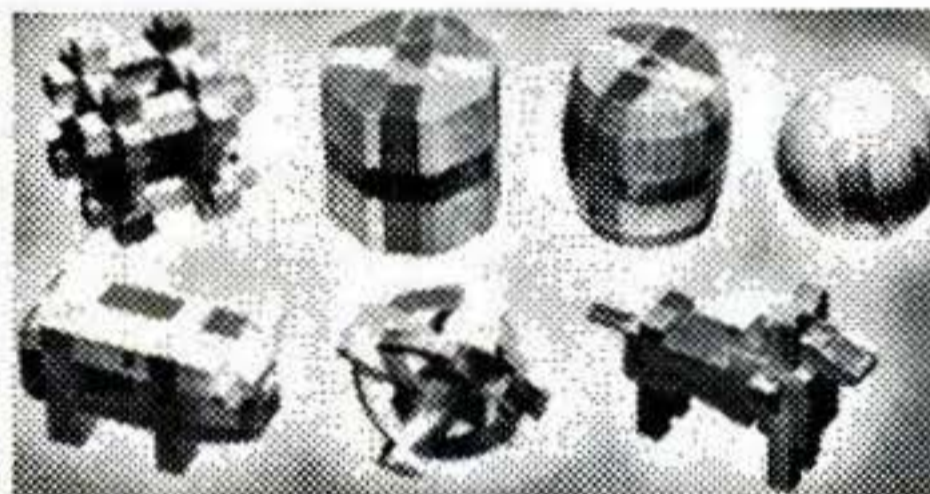


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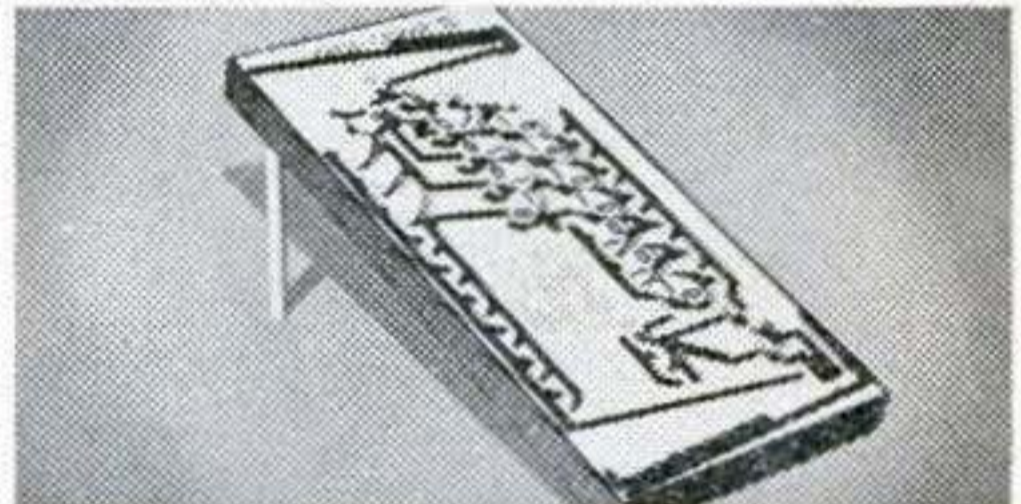
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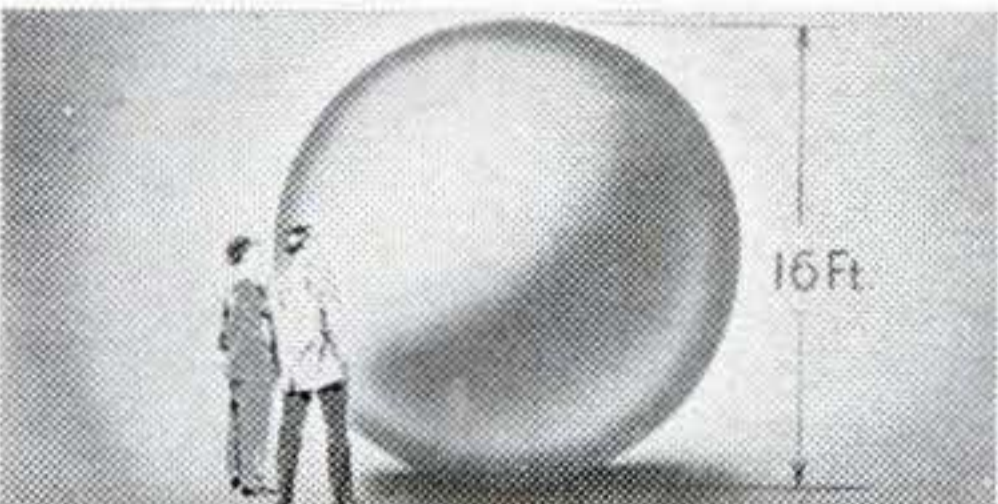
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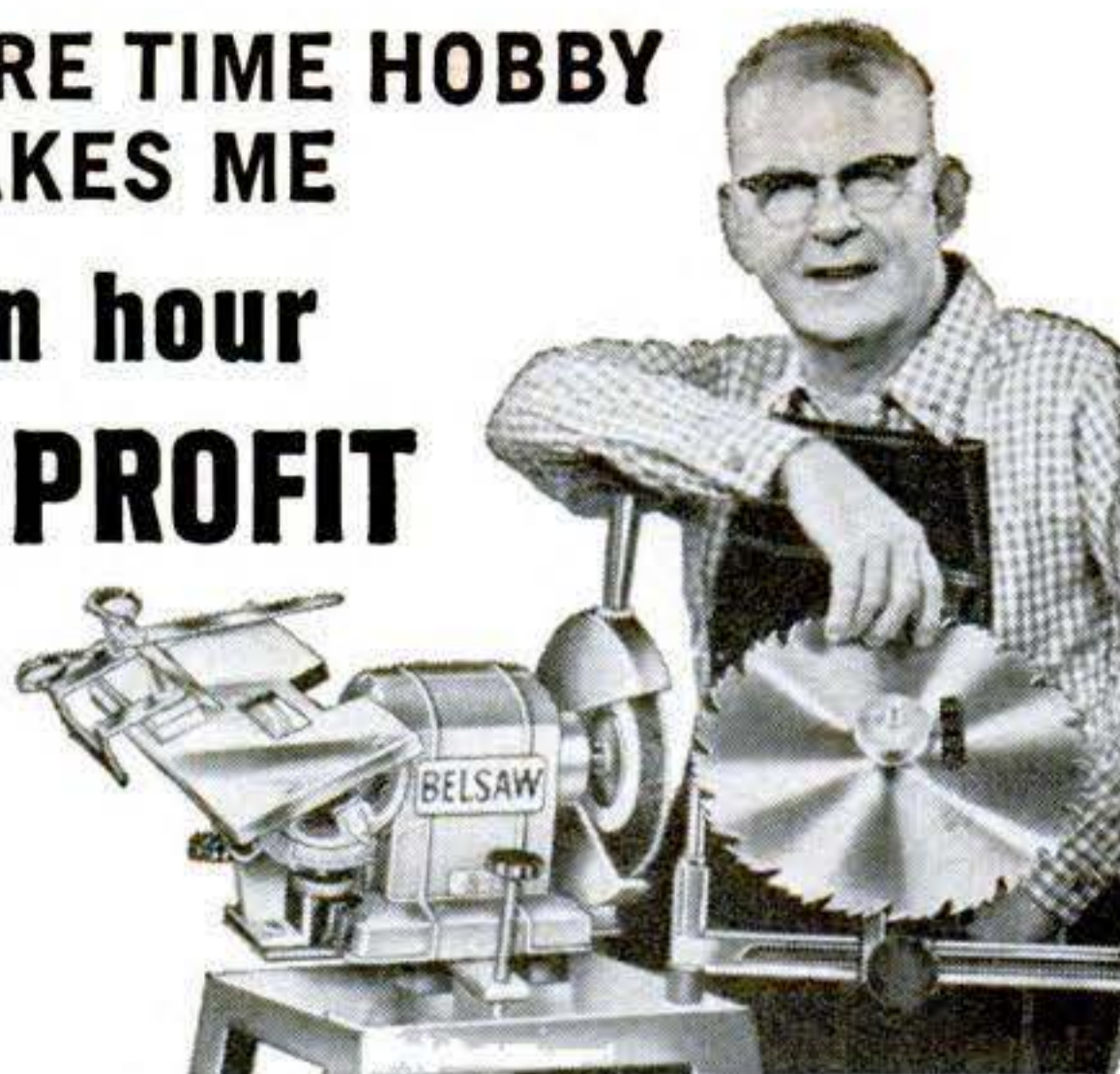
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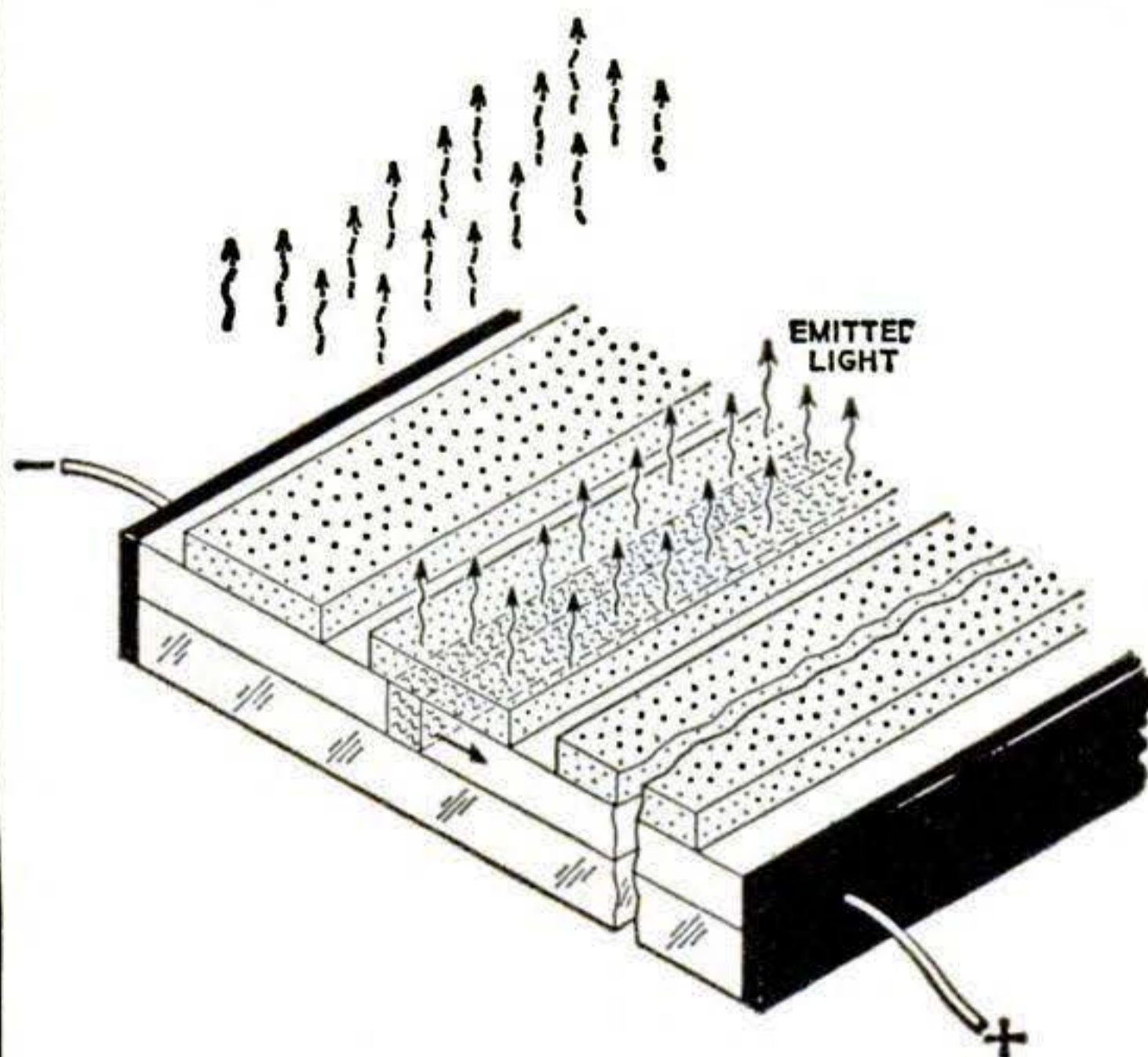


Science Newsfront

[Continued]

pharyngeal nerves which cause the hiccups and quickly stops them.

A simple, entirely new way of displaying lighted characters, outlines, or even images may result from a unique solid-state device invented at Bell Telephone Laboratories. The device, called SALS for Solid-state Acousto-electric Light Scanner, might also lend itself as a scanning light detector—a tiny integrated circuit that would perform most of the functions of a large, complex TV cam-



era. A SALS is made by depositing 20,000 transistor-like devices on a piece of cadmium sulfide. When it's connected to a strong pulsing voltage, a strange phenomenon occurs: Acoustic energy is emitted and absorbed by electrons within the substance, raising their energy levels and causing them to emit flashes of light as they return to a lower level. This light is emitted from each of the 20,000 devices in turn, traveling across the cadmium with the speed of sound. By using lower voltages, the SALS scans and detects incoming light.

Winters are just as cold as they used to be—and they may be getting a lot colder. According to Dr. James P. Lodge of the National Center for Atmospheric Research, dirty air is causing a radical drop in temperature. The earth's average temperature has dropped a half-degree since 1950, and the present average is about what it was in 1850. As a result, the frost line can be found about 100 miles farther south. Recent weather has been in agreement with Lodge's calculations of the amount of cooling to be expected from the quantity of pollutants now in the air. If the present rate of pollution continues, he says, there'll be another Ice Age by 2030.

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Science Newsfront

[Continued]

Dirty paintbrushes, small machine parts, jewelry, dentures, and other objects can be scrubbed microscopically clean in minutes with the first low-cost ultrasonic cleaner designed for home use. In ultrasonic cleaners, high-energy, high-frequency sound waves form millions of microscopic bubbles in a container of cleaning fluid. These bubbles form and collapse in tiny implosions, releasing energy that cleans dirt from an object. The new device, developed by Electromotion Components Corp., Farmingdale, N.Y., owes its low cost (about \$39) to a highly simplified way of creating ultrasound. A spark gap generates 90 kHz AC, which is changed to sound energy by a ceramic crystal fastened to the cleaning tray.

A new home "sun lamp" for fruit, developed by Sylvania, is said to give fresh produce a vine-ripened flavor all year round. Basically it's a small 22-watt circular fluorescent lamp with blue and red light peaks at 4,300 and 6,300 angstroms. Green fruit bought at the supermarket is placed under the light for three to six days. The red light restarts the growing process, while the blue regulates plant "breathing," controlling enzymatic action and other chemical processes. Fruits have good firmness, texture, and color.

You can squirt an instant building out of a barrel with a new method being used in Vietnam. A lightweight outer shell is first built from fiberglass-reinforced plastic panels. When that's up, barrels of polyurethane foam are pumped out and expanded into a solid foam-plastic core to hold up the building and insulate it. The method, recently described by S. B. Swenson of the U. S. Army Engineers Research and Development Laboratories at Fort Belvoir, Va., has been used to build rot- and rust-proof jungle shelters in jungle areas and cold-resistant houses in Greenland. Swenson feels that plastics could also provide low-cost emergency housing in urban areas.

To judge a man's honesty, shut your eyes and listen to him talk—even if you're on a jury. Better yet, read a transcript of the trial without even setting eyes on the suspect. Psychologists at the University of Michigan, Dr. Norman Maier and James Thurber, have been staging interviews between "suspects," students who pretended to be cheating on exams, and "jurymen," their professors. In all cases, those who listened to tape-recorded testimony or read a transcript of it proved to be better judges of the guilty than those who had seen and heard the interviews. **PS**

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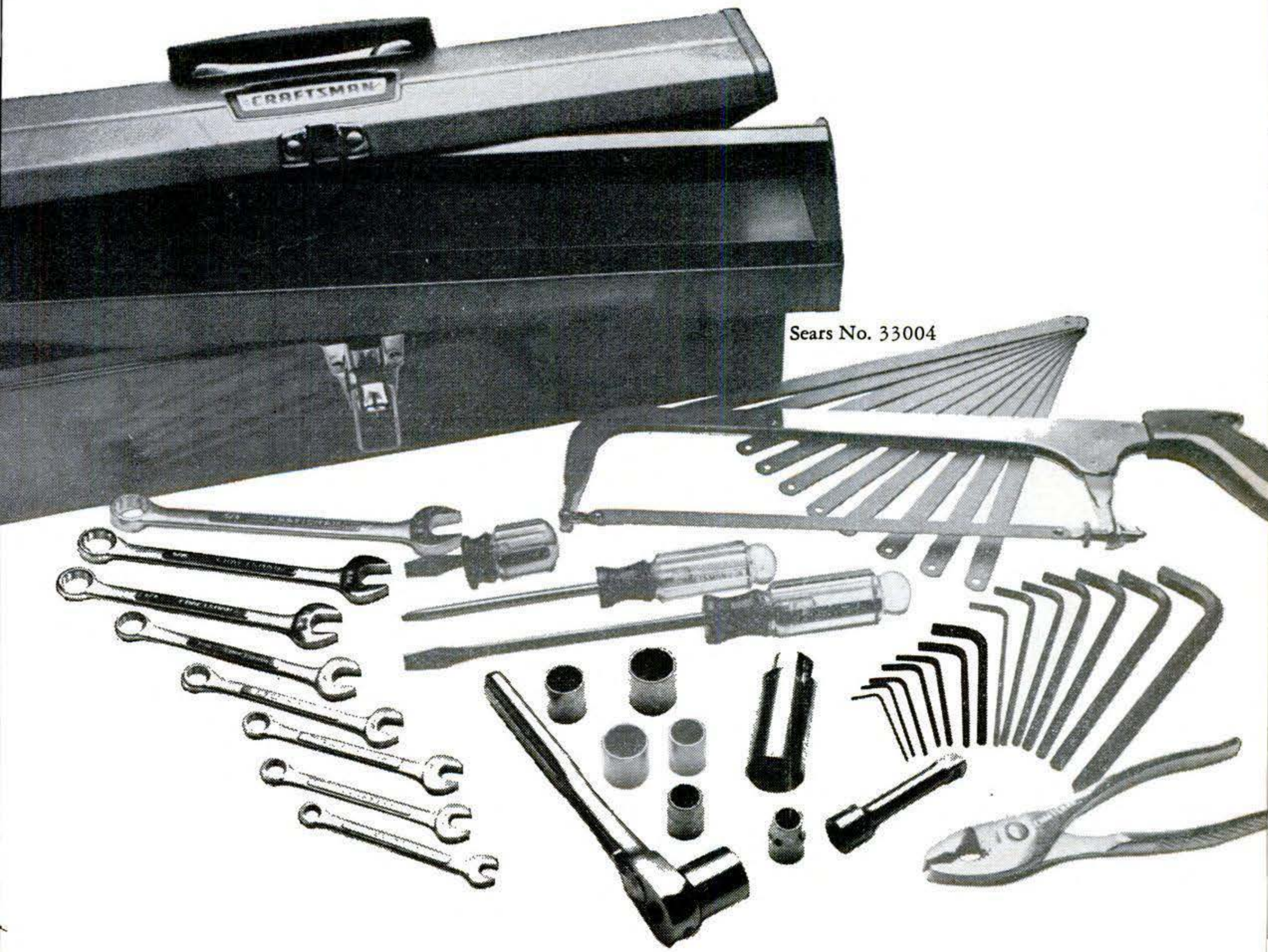
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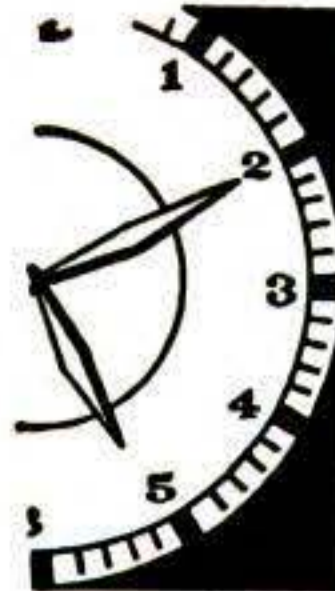
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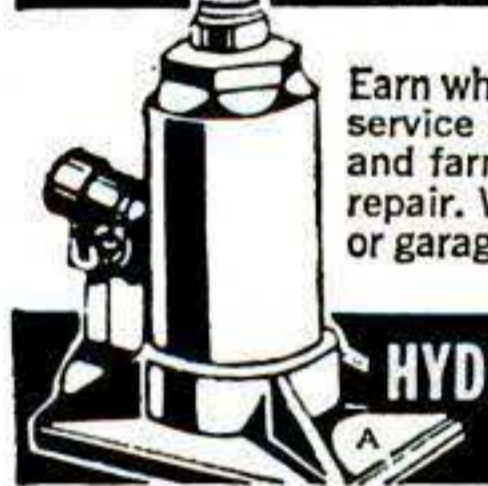


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Detroit Report...

FORD'S SUBCOMPACT "DELTA" IS PLANNED AS A 1970 MODEL. The Delta is a simple and straightforward car, using cut-down versions of present Ford bodies and power trains. Base engine is the 200-cu.-in. six. Wheelbase is 104 inches, and the body is basically a shortened Falcon. The car will carry six persons and cost under \$2,000 if target plans are reached. Of course, the car may also be dropped before it gets into production, just like the Cardinal project.

GM's all-plastic car will be ready for inspection by company bigwigs in a couple of months. The car is strictly experimental, built as a study of how far it's possible to go with plastic parts. Four supplier companies are working on solving the problems right now: General Tire and Rubber, Owens-Corning, Molded Fiber Glass, and A.O. Smith. In contrast to the Corvette, which has a steel frame under its fiberglass-reinforced plastic body, the C-1 prototype will have an all-plastic unit body.

GM also has an electric two-seater, much smaller than the Electrovair shown last summer. It looks much like Ford's British-built Comuta [PS, Sept.], with room for the driver and only one passenger. The car uses GM's chemical batteries, giving longer life than the conventional lead-acid batteries.

Wild, new Thunderbird? Ford dealers are being shown a proposed 1970 T-bird that bristles with radical design features. It has pushbutton-operated sliding doors, and the windshield meets the door glass with no corner post in between. Backup lights and turn signals are built into the C post of the all-out fastback body.

Oil blacklists are coming closer. Ford printed owner-manual lists of recommended oils for buyers of '68 Ford cars but at the last minute withheld them. The problem: The lists are quickly outdated because new oils are qualified every week. Olds has a different approach. Service managers are notified which oils to avoid, and the blacklisted oils are not used in Olds service departments.

New Honda minicar is lowest-priced '68 model at \$1,275 (West Coast). The Honda 600 is a front-wheel-drive, two-door, four-seater sedan, and the air-cooled two-cylinder engine puts out 45 horsepower at 7,000 r.p.m. It has a choice of four-speed manual or automatic

transmission. PS will have a full report in an early issue. Second-cheapest '68 model will be the rear-engine, rear-drive Fiat 850 two-door sedan, at about \$1,400. The 850 chassis requires no lubrication.

About 18,000 Corvairs were built in '67. If you want a '68 Corvair, you must get a Chevy dealer to order one from the factory. No Corvairs are delivered to dealers without a direct order. Speculation is rife, once again, that this is the Corvair's last year.

Ford plans another electric car. This will be an American-built experimental model with a sophisticated power cell instead of plain lead-acid batteries (as in the Comuta). The new car will be about the same size but will go faster and farther, and will charge more quickly.

Next year's Mustang will have a bigger rear seat, although the car will stay at its present handy size. It will be fully redesigned for '69. The rear seat will be pushed back to give occupants more leg room—making the trunk even shorter and further emphasizing the long-hood, short-deck styling. The side sculpturing will disappear, and the lines will be cleaner and straighter, say Ford insiders.

Remember those rumors about a front-drive station wagon from GM? It may not be rolling into view, because some engineers feel that the same advantages (flat floor, lower chassis) can be obtained in a cheaper way. What is it? Independent rear suspension. By replacing the big rear axle with open, double-jointed drive shafts, considerable space savings can be made.



Detroit Editor



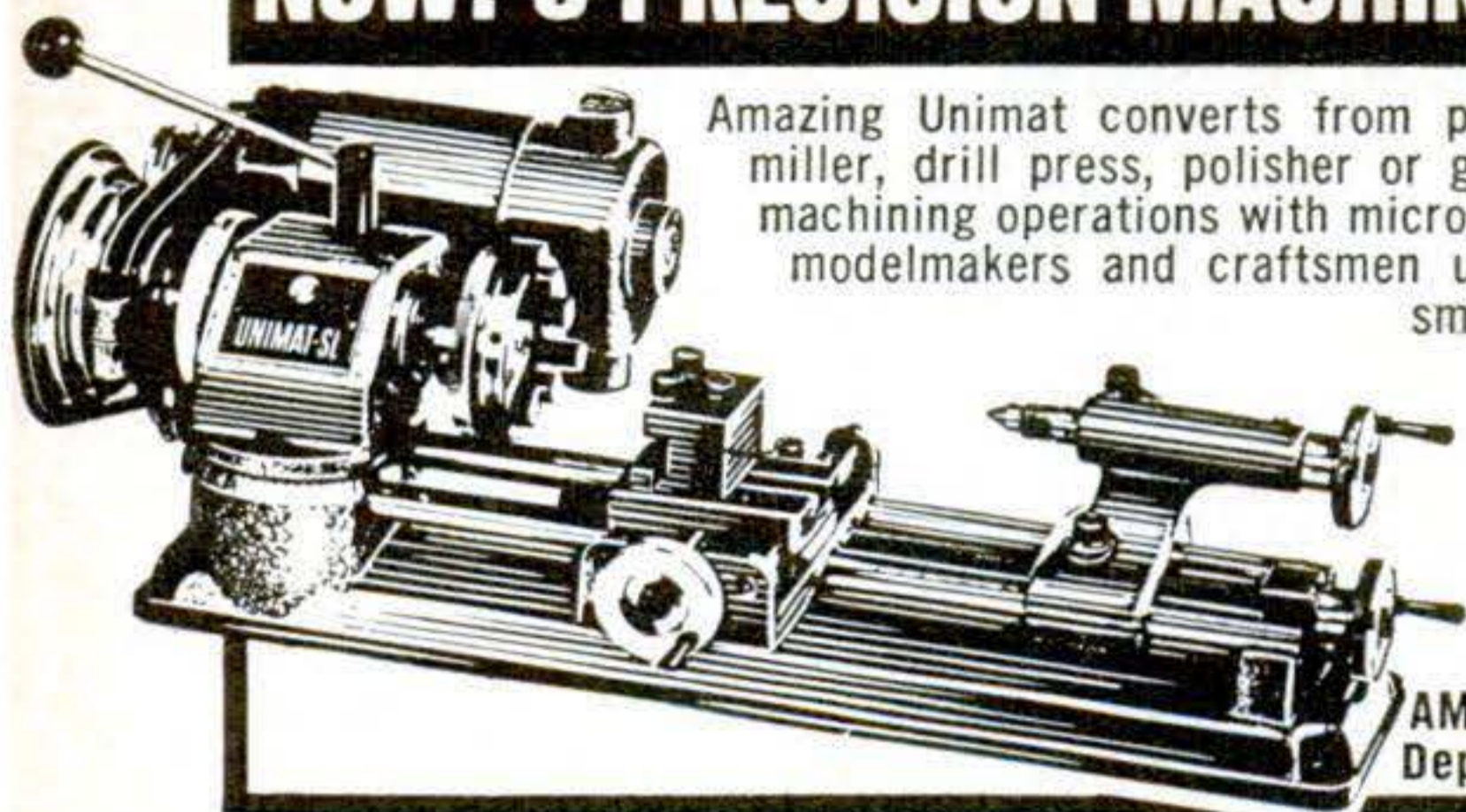
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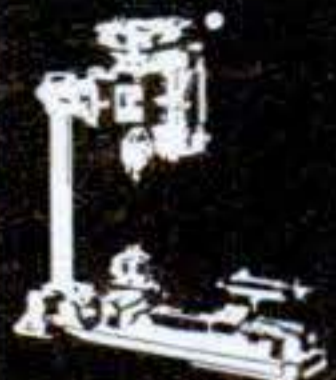
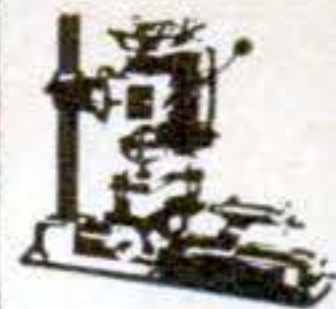
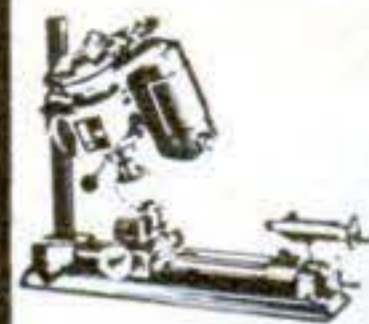
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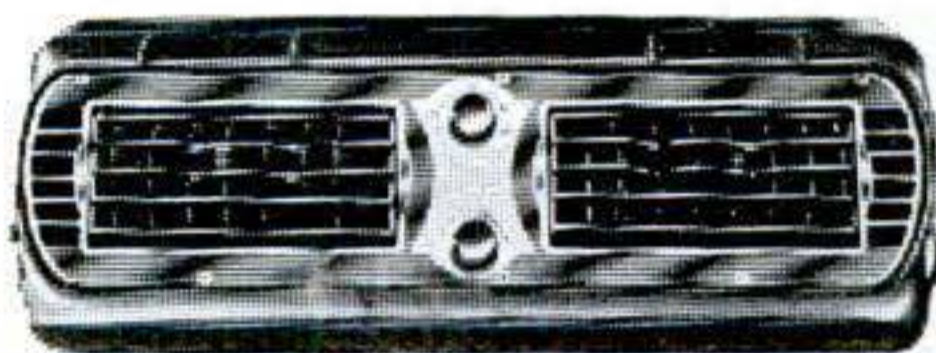
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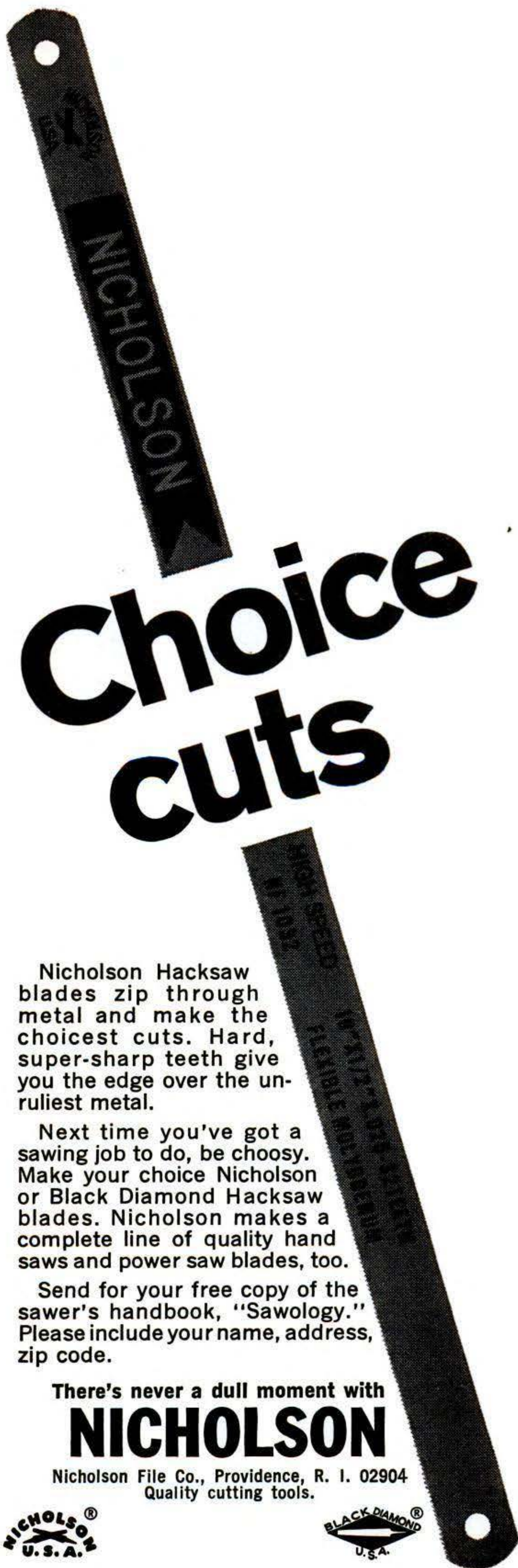
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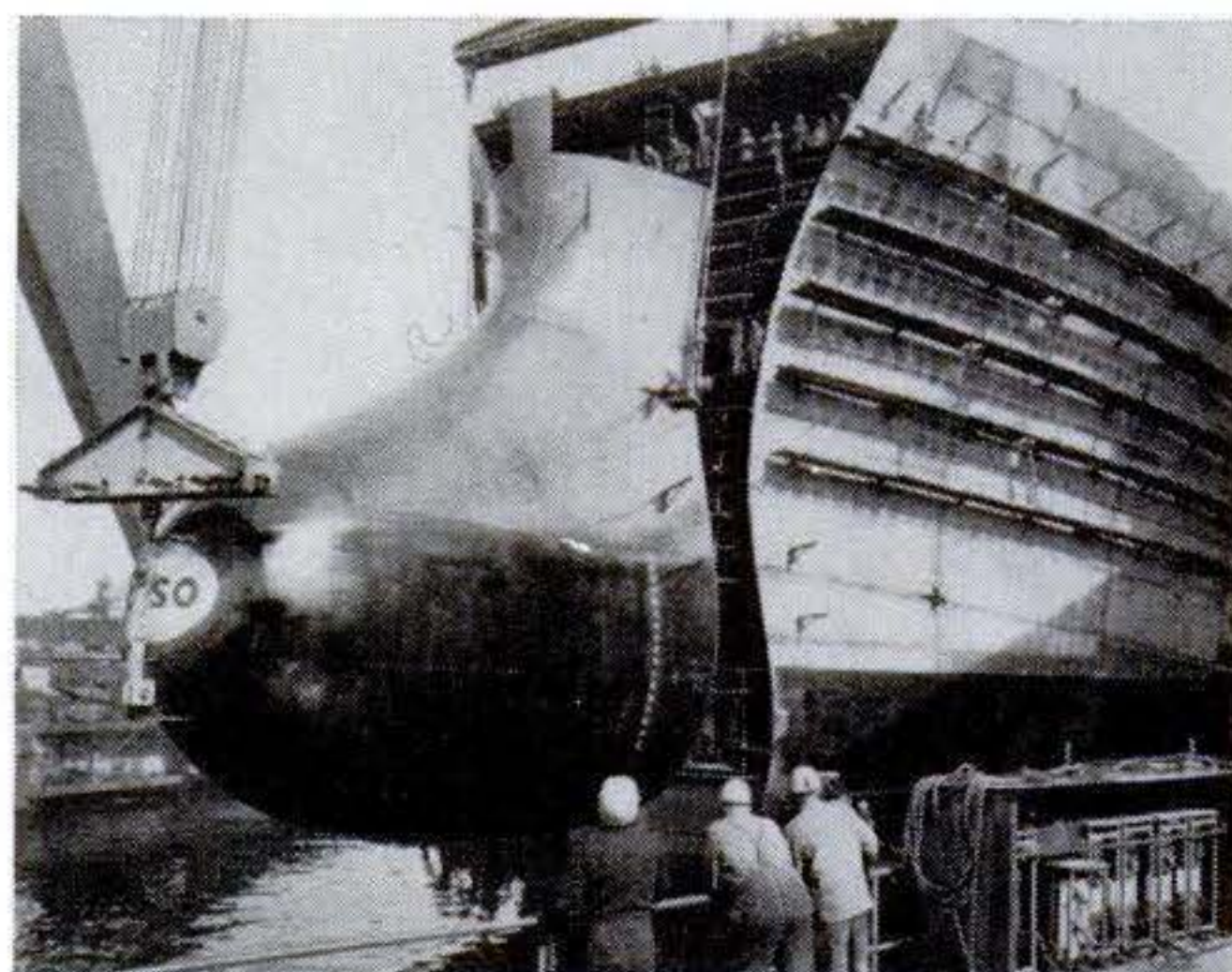
PS

PICTURE NEWS



Sidewalk cash dispenser

Customers of a British bank who need cash after hours just drop a credit card into a slot in this bank dispenser, punch an identification number (not on card) on the buttons, and out comes £10 (\$28). To foil card thieves, the mechanical teller clams up if the wrong number is punched.



Bulbous beak for biggest boat

The biggest ship ever built in a European yard is this 191,000-ton Esso tanker, here being fitted with a bulbous, 200-ton lower bow. The upper bow weighs 70 tons. Constructed at Kiel, Germany, the vessel entered service recently hauling oil from the Middle East around the tip of Africa.

Ask the man who knows the territory



"When you've got to get around in snow, pick a Johnson Skee-Horse snowmobile! Now you have 16 horsepower pulling for you — in an arctic-tuned, American-built two-cylinder power plant (Johnson dependable!) . . . with new reverse gear for maneuverability . . . Torque-Sensor Drive that gears automatically to hill and load. Really rugged! And quiet? With my new Johnson Skee-Horse, I can sneak up on the most wideawake kid in town!"

Ask the man who knows the product. Your nearby Johnson dealer invites you to compare — with any other brand — these first "second generation" snowmobiles on the winter scene! Three Skee-Horse models for 1968 — electric or manual starting Wide-Trac track. For catalog and "Fun Guide to Snowmobiling," both free, write Johnson Motors. Dept. PS-S81 Waukegan, Illinois 60085.

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Lighter! Faster! New Skee-Horse packs less weight and more action! New sleeker styling, too!



Reverse Shift! In its class, only our Wide-Trac 20 offers forward-neutral-REVERSE gear for complete mobility!

A handful of compact power 30,000 rpm!

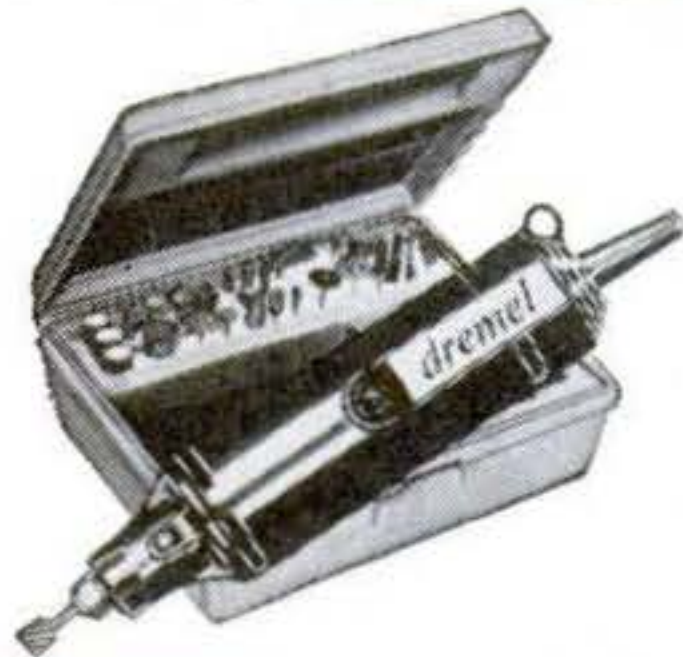


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No. 270 with bronze bearings \$29.95
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No. 271 Moto-Tool Kit \$39.95
Complete with No. 270 Moto-Tool and 34 accessories for grinding, polishing, carving, sharpening, sanding, routing, etc.

DREMEL MFG. CO., Dept. 127-L, Racine, Wis. 53401

New, 144-page "Dremel Handbook of Crafts, Hobbies, and Projects." Only \$1.00.

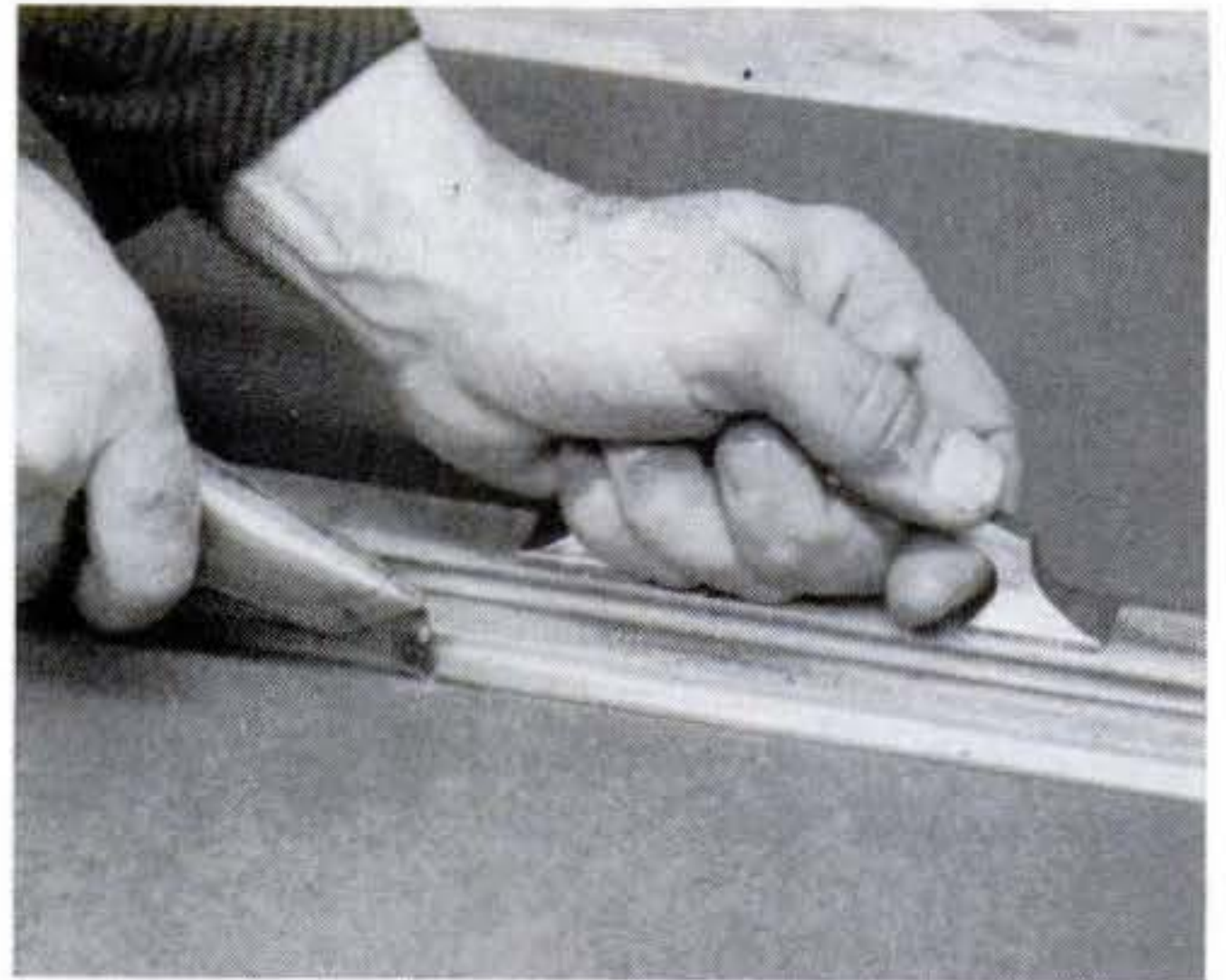
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SHORT CUTS AND TIPS

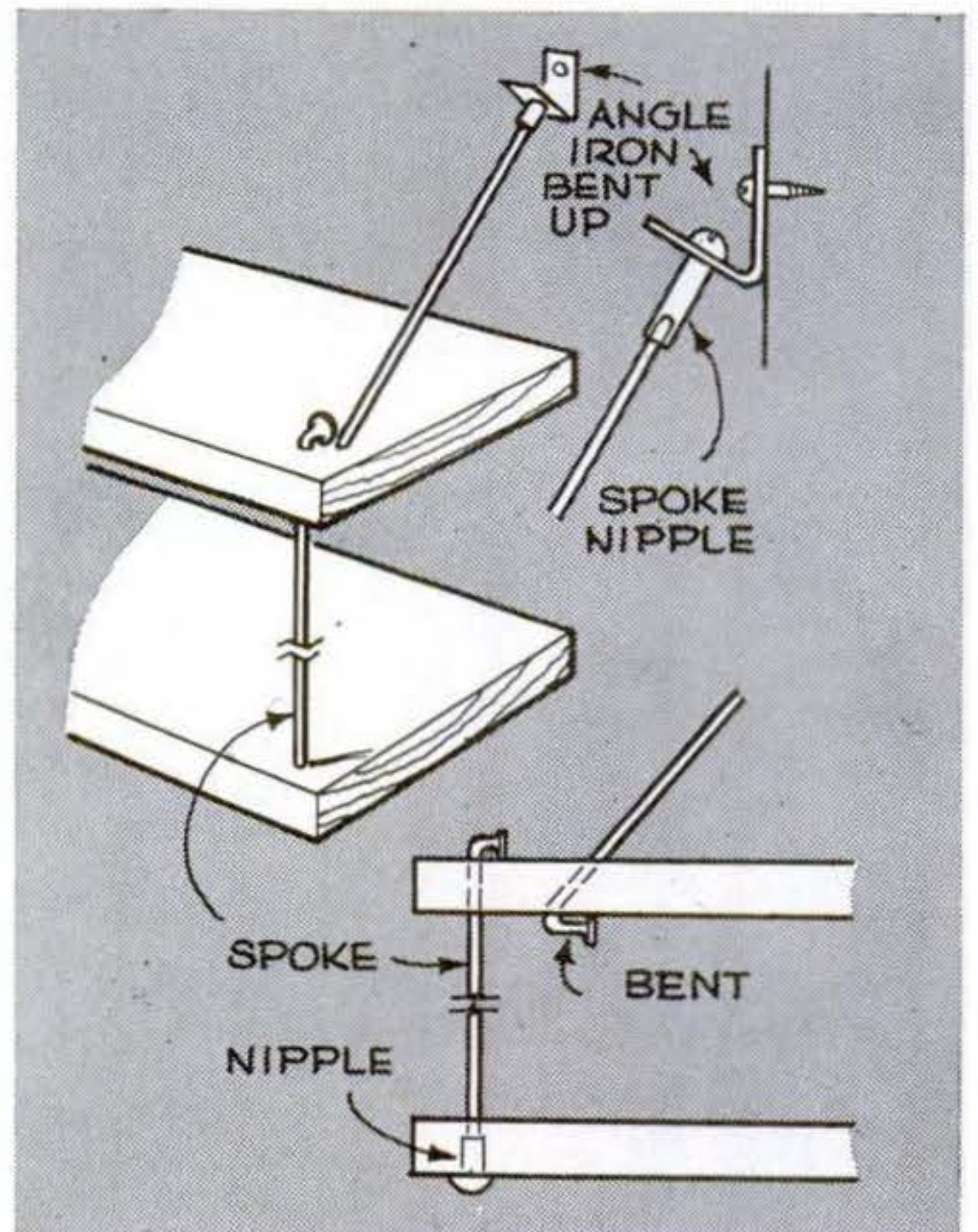
FROM HERE AND THERE



Cabinet handle added to straightedge

A plastic draftsman's straightedge makes a fine tool for general shop use. Apply a few dabs of rubber cement to the bottom and let dry for skidproofing. Add a cabinet handle (countersinking screwheads) and it's easier to control.

R. CAPOTOSTO, Greenlawn, N.Y.



Bike spokes support shelves

You can make braces and hangers for shelves using bicycle spokes. They are light, strong, and easy to work with. Get them in varying lengths to suit any job.

CAREY BAKER, Johnstown, Pa.



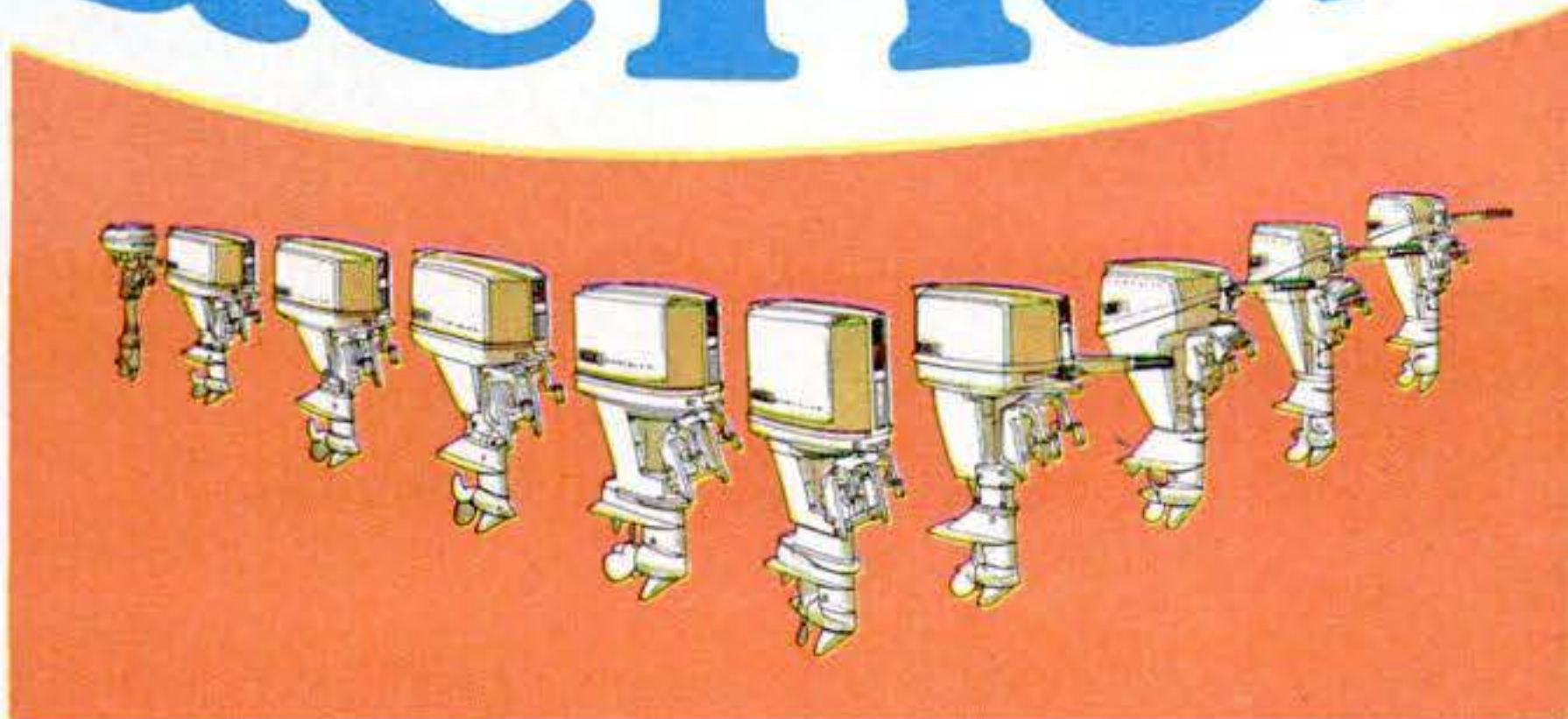
The Chrysler Crew has more that's new! More new fun-engineered outboards for racing, skiing, fishing, cruising!

Looking for big all 'round outboard power? Power to race? Ski? Cruise? You just found all the power you need right here—starting with Chrysler's fiery 55—the only two-cycle, two-cylinder outboard in its power range. There are 35's and 45's, too—and spectacular 75 and 105 performers. Each is loaded with the latest outboard engineering advancements: Fuel

economizer throttle, thermostatic cooling, exceptional sound-proofing, and the big 75 and 105 are now equipped with Chrysler's exclusive new MAGNAPOWER, outboarding's most advanced, most dependable ignition system! 35 models in all, including 8 brand-new, low-profile, high-performance fishing models. See them at your Chrysler Crew dealer's today!



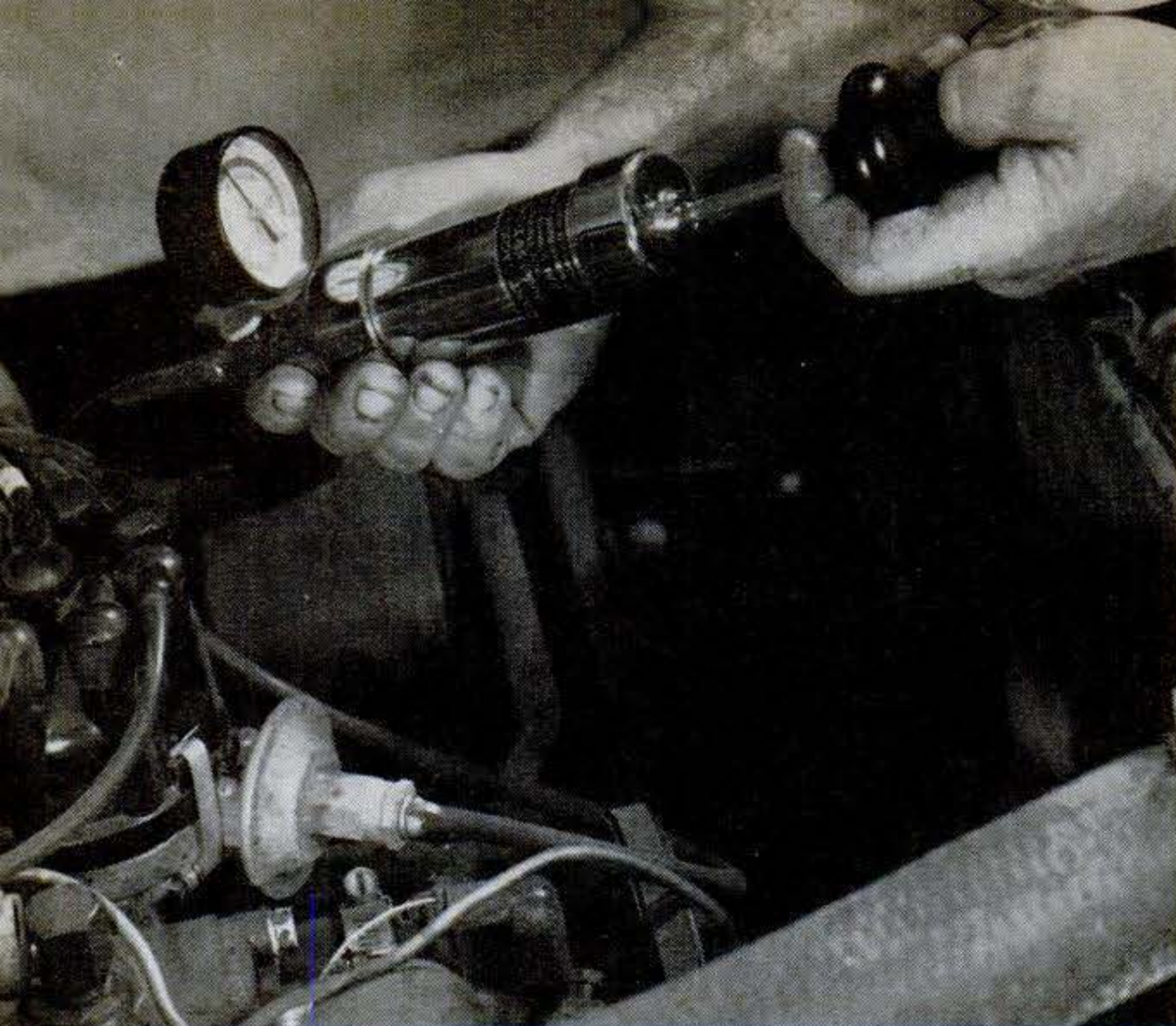
action Line!



Chrysler's new Action Line offers 35 outboard models, 18 brand-new, in ten horsepower ratings from the thrifty 3.5 fishing outboard to the bruising 105 hp. for big boat fun!

A tough choice, because they're all tough to beat—the Chrysler 35, 45 or the 55—the world's only 2-cycle, twin-cylinder outboard rated 55 hp. by O.B.C.

MARINE PRODUCTS  **CHRYSLER CORPORATION**

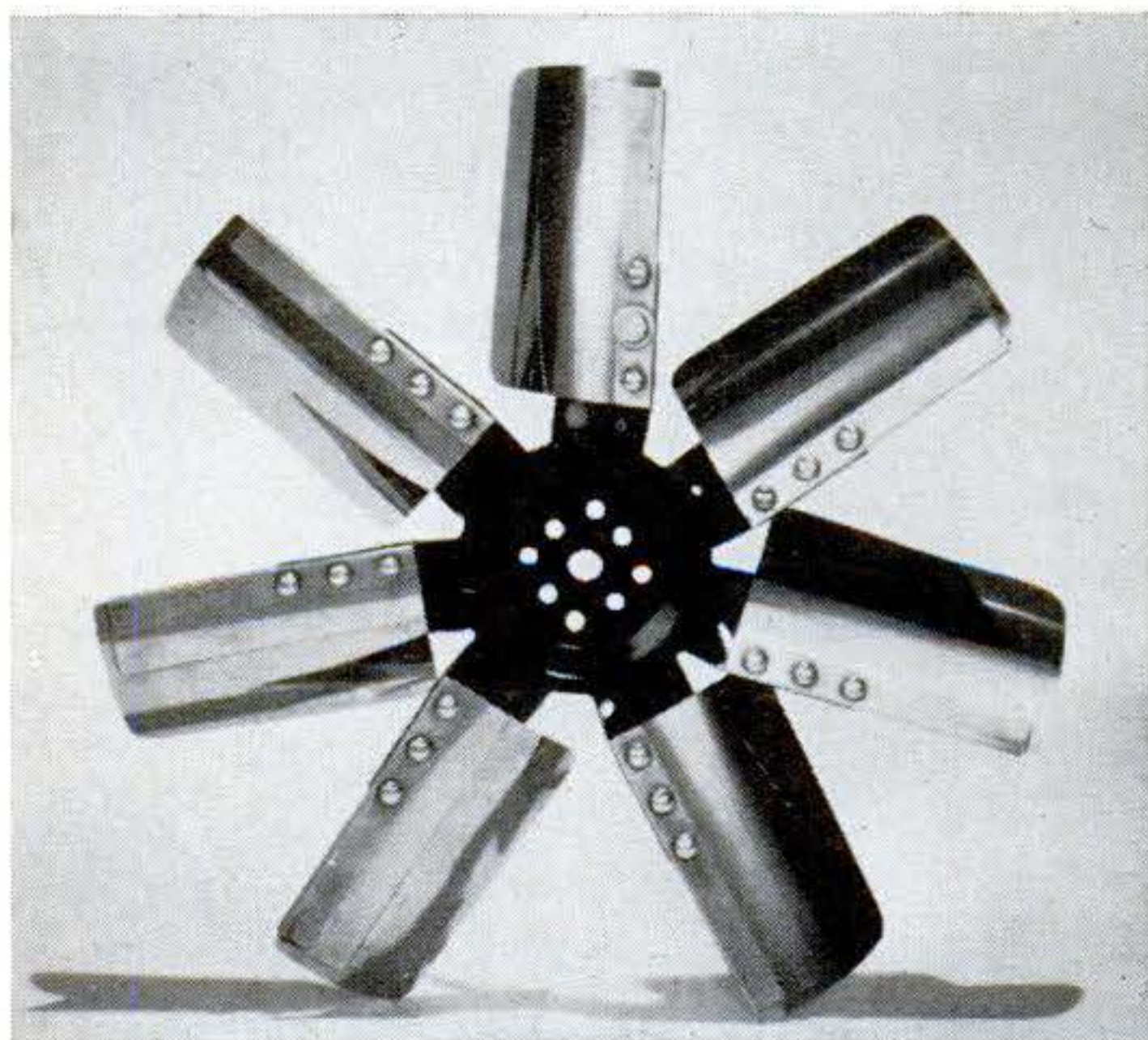


WHAT'S NEW

FOR YOUR CAR

Vacuum tester has many uses

This new tool at left is called the Stant SVT-260A vacuum tester and can be used for testing the distributor vacuum advance, transmission vacuum-modulator controls, vacuum controls on air conditioners and heaters, throttle-control valves, brake-booster vacuum tanks, and various other vacuum-operated units. Instructions come with the unit from Stant Mfg. Co., Connersville, Ind. 47331.



Flex-blade fan cuts power loss

Forget about viscous couplings and other fan clutches—this flexible-blade fan adjusts pitch to engine speed. The blades flatten when the engine speeds up, minimizing overcooling, cutting fan noise. It's made by the Schwitzer Division of Wallace-Murray Corp., 1125 Brookside Ave., Indianapolis 46207.



Headlight grilles for imported cars

This chrome-plated grille protects your headlight glass against flying stones and parking mishaps. Installation is easy—just clip onto the headlight rim. A set for Volkswagens costs \$10; for MG, Triumph, and other British sports cars, \$9. J. C. Whitney Co., 1917 Archer Ave., Chicago 60616.



Lightweight trailer for cars or boats

Here's a low-loading, ultralight trailer that comes in three sizes with load capacities of 1,500 pounds, 2,400 pounds, and 3,400 pounds. Tires are six-ply high speeds. All models have dual safety chains, aluminum loading ramps, front dolly wheel, dual stop and turn signals. Electric brakes are optional at extra cost. Prices range from \$525. Trailex, Inc., 600 W. Main St., Canfield, Ohio 44406.

'68 Buick. Now we're talking your language.



The new 230-hp., V-8 engine runs on regular gas. It's standard on all Skylark Custom models.

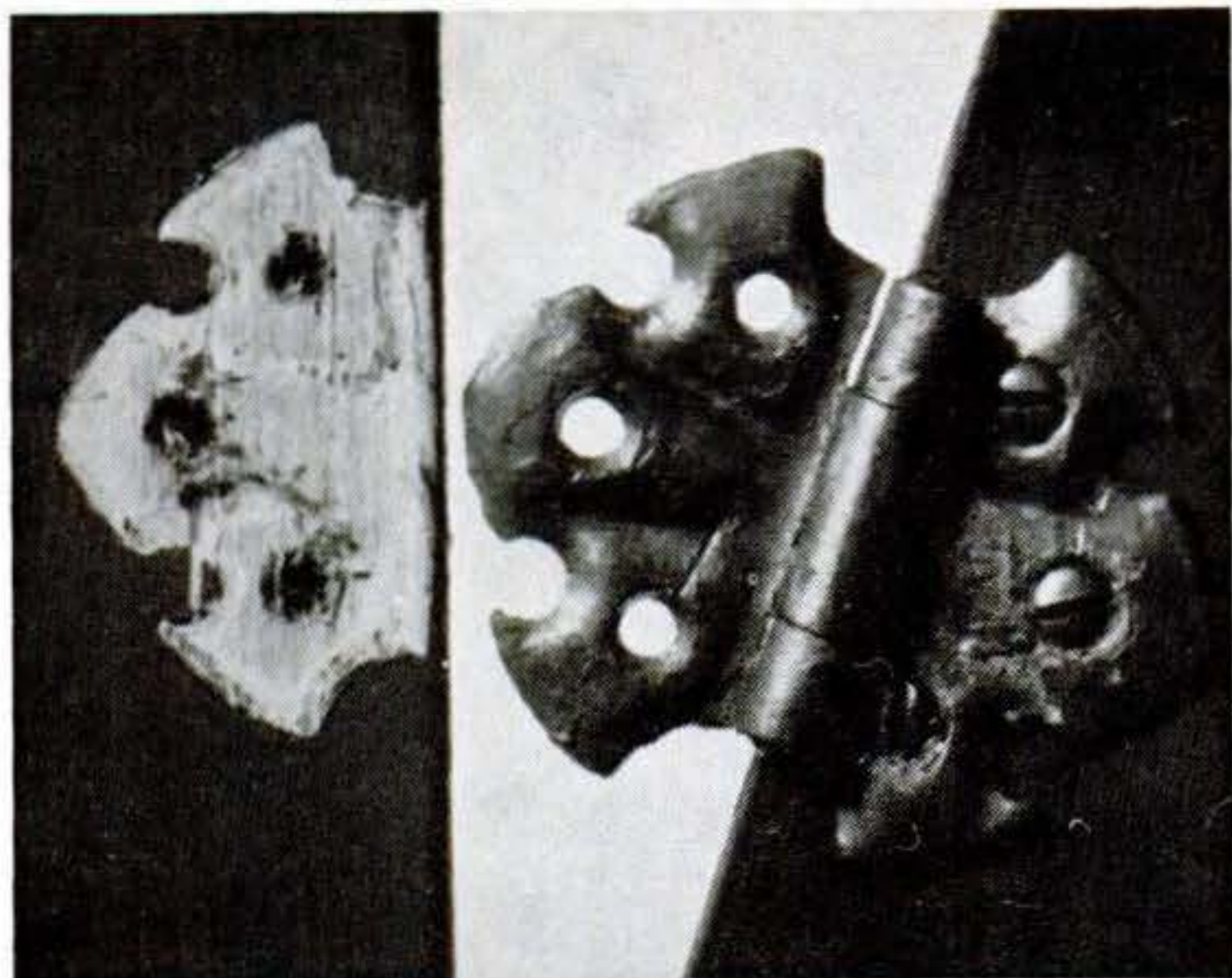
On the Skylark two-door models, we shortened the wheelbase from 115 to 112 inches. Widened the front track to 59 inches. The result: quicker handling, flatter cornering, better front-end stability. And above all, easier parking.

Every Buick comes with a full line of GM safety equipment, including energy absorbing steering column and seat belts with pushbutton buckles for all passenger positions.

Wouldn't you really rather have a Buick?



FIX IT WITH PLASTIC WOOD... IT WILL STAY FIXED!



That loose hinge will stay put, when you use the great little fixer-upper: PLASTIC WOOD. It's the way to fix anything made of wood...because when it hardens, it's just like wood. Handles easy as putty. Does a "pro" job on busted furniture, loose screws, filling nicks, gouges—you name it! Great outdoors...resists weather. 5 colors, so you can match the job you're working on. Don't be without PLASTIC WOOD!



A repairman can cost \$15 a shot.



3-IN-ONE® costs 1¢ a shot.

You can head off many unnecessary repair bills, with a few drops of 3-IN-ONE Oil! Cuts down wear on moving parts...things last longer. Also

3-IN-ONE can keep rust from getting started. When you spend good money for a sewing machine, power drill, bike, etc....shouldn't you spend a few cents to protect them? Regular. Electric motor oil. Or handy new spray can. 3-IN-ONE...it's wise insurance.

SHORT CUTS AND TIPS

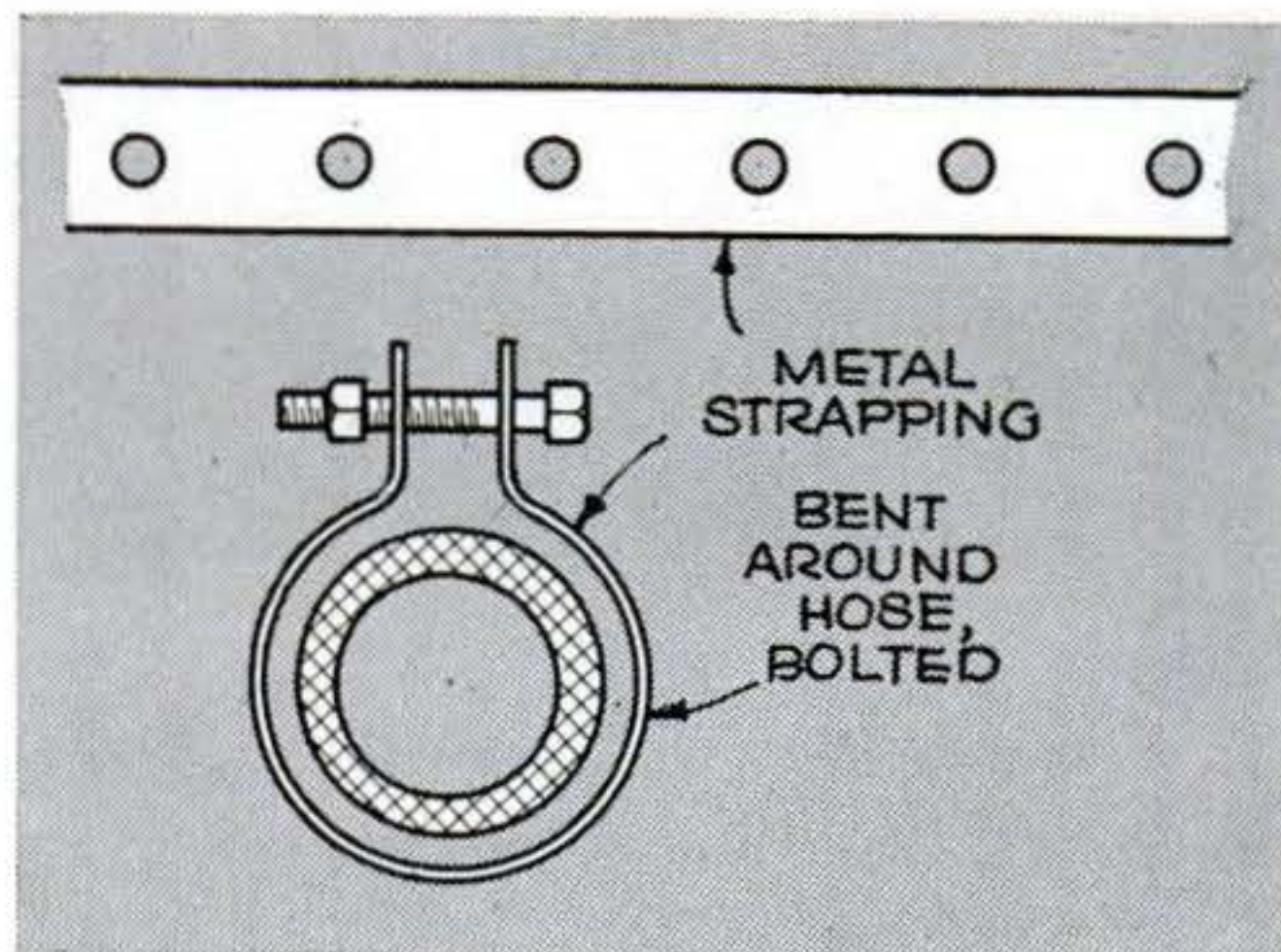
FROM HERE AND THERE



Distributor cap makes a desk aid

Pencils, pens, and other desk paraphernalia stay put when parked in a distributor cap. Clean the cap, apply a coat of cream enamel, and decorate with flower designs. Make one for the shop for twist drills and punches (omit floral design).

WALTER E. BURTON, Akron, Ohio.



Hose clamps from metal strap

Perforated metal strap can be substituted for a hose clamp for special jobs. It is flexible, and you can bend the required length around hose, tubing, or pipe. Secure it with bolt and nut or a screw.

MICHAEL ZUROY, Ludlow, Vt.

You don't even have to be sneaky about it. The Skeeter really *is* a family machine.

Not that it won't hold its own in fast company — because it *will*. Especially this year with its new higher power, lighter weight, and high speed gearing.

But the important thing is — *the Skeeter is not just a one-man machine*. With two adults aboard and a Sleigh-Mate sled on behind, it will still go faster than most people will care to run over most kinds of terrain.

And wherever it goes — it goes *quietly* — up to 50% more quietly. Which means you can enjoy the winter wilderness without spoiling things for everyone else around.

This year — if you get into a tight spot — you can *back out*. Just flip the reverse lever and spare yourself the work of tugging and hauling the machine around. (Your wife will like that.)

The new Evinrude Skeeters have *luxury* features you're not likely to find on other machines. Electric starting. A new 4-way control that pre-sets everything for starting, automatically. A fully enclosed engine with a tilt-up hood. Sports car dash panel. Built-in storage space. Overnight parking stand. You name it — Evinrude's got it.

A visit to your Evinrude Skeeter dealer could make this the greatest Christmas since Father's Day.

Send for free '68 Skeeter catalog. Evinrude Motors, 4285 N. 27th Street, Milwaukee, Wisconsin 53216.

EVINRUDE
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Christmas!

**what a wonderful
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Whips through snow like a team of huskies.

Now's a great time to be a 'Jeepster' owner! Snow? Forget it! Make your own tracks. Settle back in those bucket seats. Then, flip one lever into 'Jeep' 4-wheel drive...and make the deep stuff say "uncle"! Choose the jaunty 'Jeepster Commando' Station Wagon or bold, brash 'Jeepster' Convertible

with continental spare. 4-wheel drive and 4-cylinder engine are standard on all models. Add your choice of sporty options like husky V-6 with (or without) Turbo Hydra-Matic* automatic transmission; sports console; power brakes; air conditioning. There's also a jaunty Roadster model. And a snappy Pick-

up. All smooth performers on the road...all tougher than nails when you're out in the rough. **Holy Toledo...what a car!** You've got to drive it to believe it. See your 'Jeep' dealer for a test drive. Check the Yellow Pages.

'Jeepster' and 'Jeepster Commando' are trademarks of vehicles made by and only by
KAISER Jeep CORPORATION
TOLEDO, OHIO 43601.



'Jeepster'
4-wheel drive fun cars

HERE'S HOW IT WORKS:

Amazing New Five-Cylinder, Two-Stroke Radial Engine

If you thought two-stroke engines were strictly for lawn mowers, there's news: This fuel-injected, liquid-cooled, 190-cubic-inch version may power the lightplane in your future

By **JAMES W. WRIGHT/PS** West Coast Editor

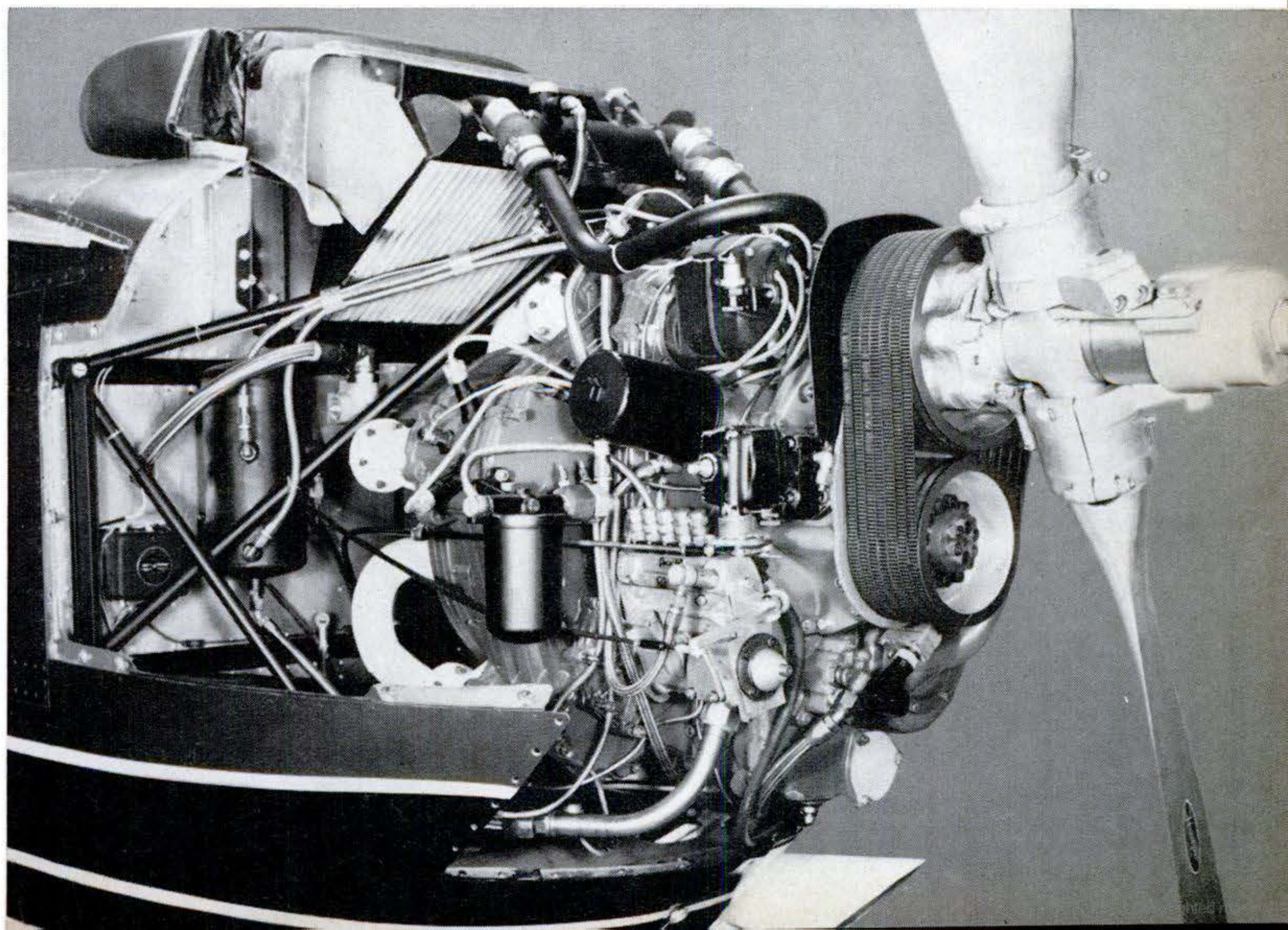
Highest power per pound for any production gasoline engine is claimed for this neat little 270-hp.

You know those little two-stroke engines you see on lawn mowers, chain saws, and go-karts? Well, they've grown up. In one of the most revolutionary engine developments in recent years, engineers are putting the two-stroke to work flying airplanes. A few highlights:

- A new McCulloch Corp. airplane engine has the highest specific power output of any production-designed, gasoline-burning engine in the world. Despite its

Continued

two-stroke designed for lightplanes. Note V-belt coupling to prop; like engine, it's simple, reliable.





Cessna 337 Skymaster flies with new engine as pusher. It has been tested thousands of hours.

light 365-pound weight, it delivers 270 horsepower.

- Like all two-strokes, it is simple and reliable as well as being light. This means greater safety in the air, more speed or payload, and a great deal less maintenance.

- Mechanically speaking, the engine has a number of unusual refinements responsible for its amazing performance: fuel injection, liquid cooling, turbo-supercharging, and oil-lubricated crankcase (no mixing of oil with gasoline here).

- On the other hand, it has all of the conventional two-stroke's mechanical simplicity: no valves to stick or burn, no camshaft—and none of the cost and weight of these parts.

How it happened. McCulloch, famous as the world's largest builder of chain saws, third largest in outboards, and the maker of the hottest go-kart engines available, knows a lot about two-strokes. (One of their go-kart engines, for example, weighs a scant 10 pounds and develops a whacking 12 hp. from six cubic inches.)

In searching for a new field to conquer, they uncovered an unfulfilled need in the lightplane market. Although they had built thousands of two-stroke (flat four and six) engines for flying target drones, they had never before gone into FAA-certified power plants for airplanes. There would be, they were told by airplane manufacturers, a definite demand for an engine that would have these qualities:

The highest possible reliability in the air, smoothness (low vibration), and quietness under all operating conditions. It should be economical, not only in initial cost, but easy to install and maintain, and have low specific consumption of readily available fuel, such as aviation

gasoline. High performance for both weight and size was needed to get aerodynamic efficiency.

While McCulloch engineers thought they could meet these specifications, two-stroke engines for airplanes were considered an offbeat idea.

“If you want to get into airplane engines, why not build turbines?” McCulloch was asked. Investigation showed that the gas turbine is just not ready for the less-than-300-hp. lightplane power plant because of its high fuel requirements and cost.

Building an engine. The most obvious feature of the McCulloch TSIR-5190 is that it is liquid cooled. Because of some radical improvements in heat exchangers and coolants, liquid cooling offers definite advantages, among them a quieter, cleaner engine that is easier to put inside a lightplane.

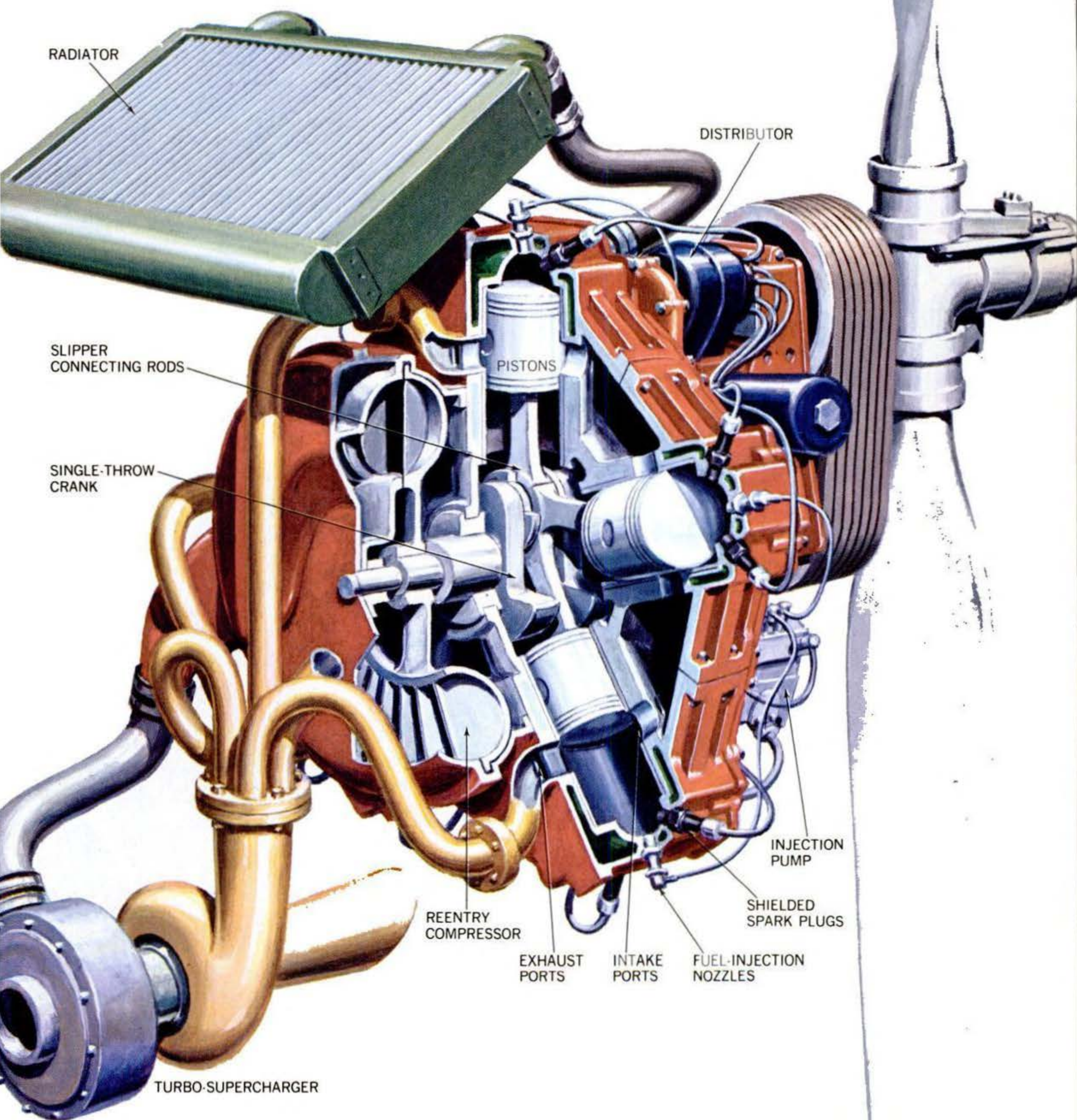
Liquid cooling may even make the engine lighter than an air-cooled equivalent. J. L. Dooley, engineer in charge of McCulloch's Advanced Development Division, says that even including the sealed glycol radiator and coolant circulating pump, the engine is lighter than a comparable air-cooled engine because the power output in a liquid-cooled engine can be increased so markedly.

The cooling system is fully sealed, with the coolant passages cast integrally within the one-piece, die-cast (aluminum) cylinder block. Coolant is passed around the exhaust-port bridges (exhaust-bridge temperature is considered to be one of the limiting factors of engine output), as well as around the cylinders, cylinder heads, and plugs.

This insures more uniform cooling of

[\[Continued on page 166\]](#)

Liquid-cooled, fuel-injected two-stroke develops 270 hp.



Five cylinders in a radial arrangement around a single-throw crankshaft operate on a two-stroke combustion cycle. Slipper con-rod bearings are practical because there is no tension on the rods in normal operation. Timed gasoline fuel injection and pressure lubrication eliminate the usual oil-in-the-gas problems of conventional two-strokers. Oil is not mixed with the fuel, so spark-plug fouling is not a problem. Scavenging air is supplied by a turbo-supercharger aided by a crankshaft-mounted reentry compressor for starting and acceleration. Two sets of intake ports on opposite sides of the cylinder admit air from the plenum chamber, which is pressurized by the blowers. Liquid-cooling chambers are cast as an integral part of the aluminum cylinder block. The cooling system is sealed.





Can New Non-Lethal Weapons Control Riots?

The noted creator of Perry Mason tells you about the weird new police weapons that could control civil disorders, or even desperate criminals, without endangering the innocent

By ERLE STANLEY GARDNER

With crime, civil disorders, and other disturbances at record highs, our police need modern means of coping with new challenges to law enforcement.

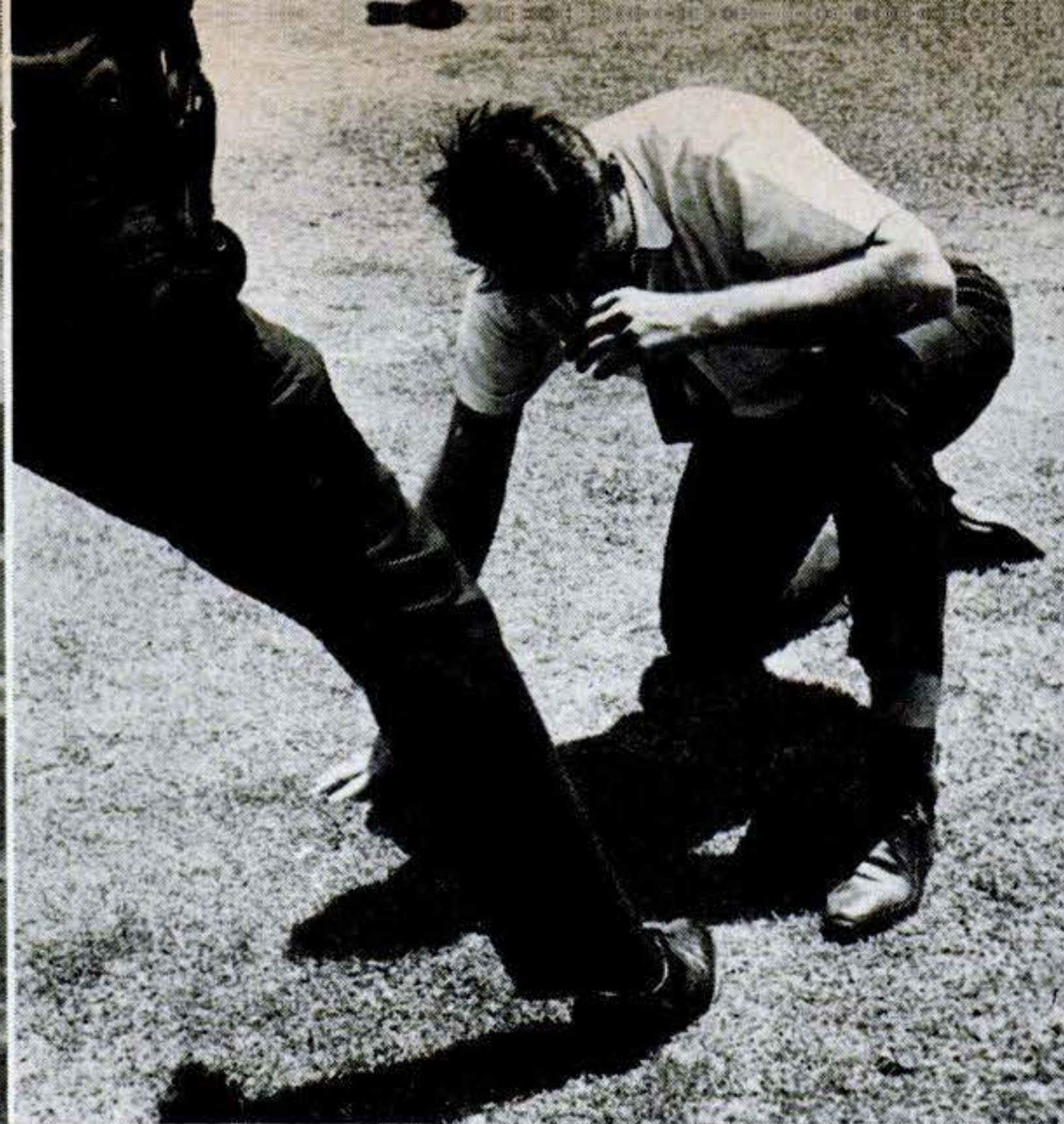
Every year, police officers kill and are killed while performing their duties. Are these deaths necessary? In an age when science can split the atom or take us to the moon, it is unthinkable that this same science can't give our law officers better tools for their job.

Present-day police weapons are unfitted

for the present-day situations confronting the officer responsible for keeping the peace. The handgun is both a lethal and an awkward weapon. While we have given him nothing better for coping with an armed criminal, for most of the jobs the policeman has to do, it is almost useless. It is an all-or-nothing weapon.

Fortunately, movements are under way to give the police weapons more in keeping with their responsibilities.

Continued



Non-lethal weapons subdue the violent without physical harm

Chemical Mace, an extremely effective incapacitating gas, is a highly purified form of tear gas (phenylchloromethylketone) mixed in a liquid carrier. Unlike ordinary tear gas, it affects only the person hit with it, violently but without causing permanent injury. The device shown has a 20-foot range.

A bill to establish a National Institute of Criminal Justice is among legislation pending before the Congress that is certain to be acted upon. As conceived by Representative James H. Scheuer of New York and other congressmen, it would devote millions of dollars to finding new crime-fighting tools and techniques.

Let's see how one of these new devices, now under development, might save a life in a typical law-enforcement situation.

A police officer sees a car flash by at excessive speed. He usually has no alternative but to give chase, using his red light and siren. Eventually, after many risks—to himself and to innocent motorists—he forces the offender to the curb.

He has no way of knowing whether he has been chasing just an irresponsible driver or is dealing with a potential killer. The policeman is armed with a revolver. The man he is apprehending may well be armed, too.

The officer must get out of his patrol car and approach the suspect. The suspect, with his hands concealed inside the car, can have his gun cocked and ready to shoot.

Who shoots whom? If the suspect shoots first and kills the officer, it is just

Hit with heavy drops of spray, policeman's assailant suffers a burning sensation and intense tearing. His eyes close and he falls to the ground, recovering 20-30 minutes later. Chemical spray interacts with skin oils, and the recipient carries a personal cloud of tear gas with him. Bystanders are unaffected.

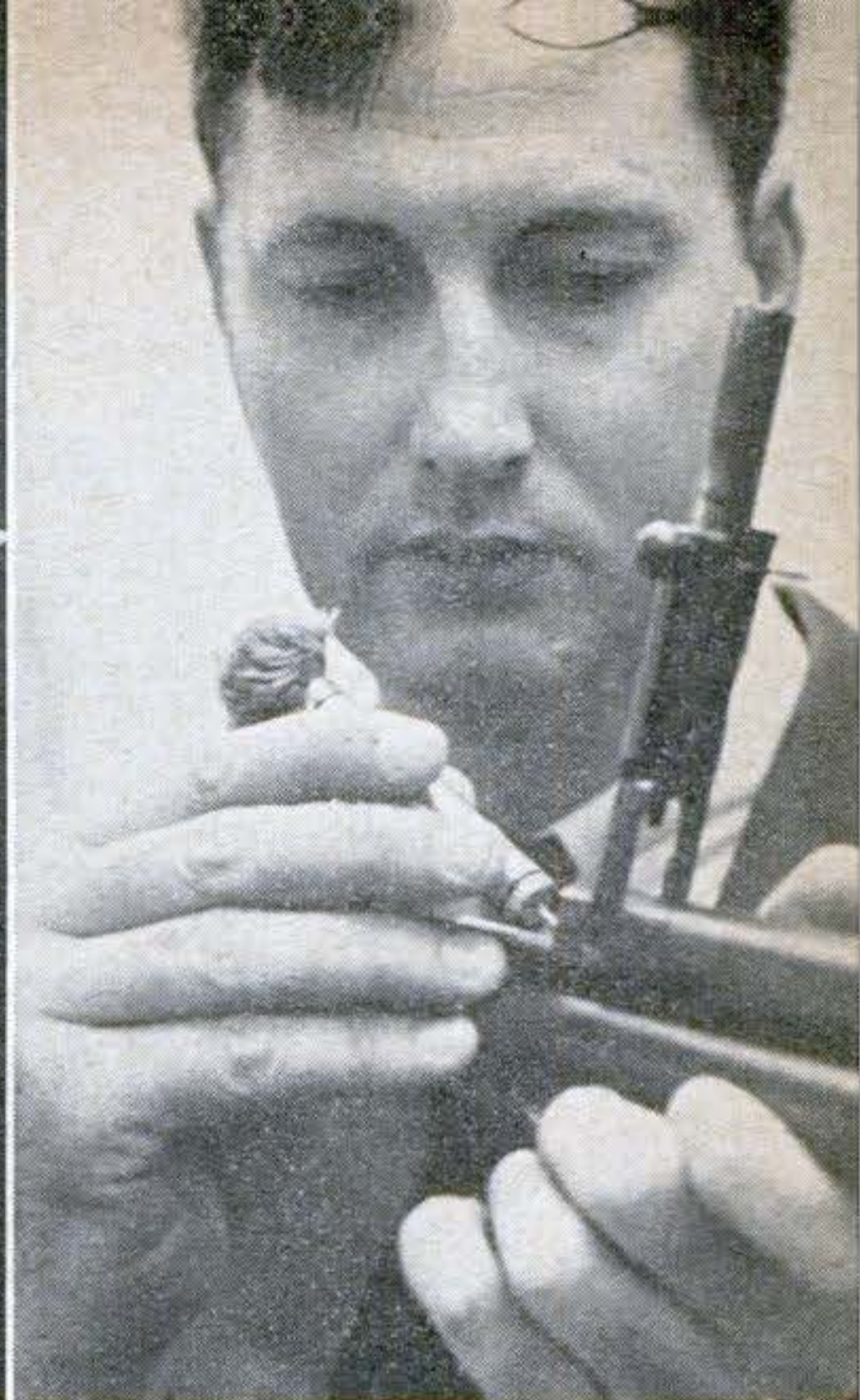
too bad. The department gives the brave man a funeral; a few dollars go to his widow. The man who fired the shot may or may not be caught.

If, however, the officer shoots first and it turns out that he has misjudged the suspect and shot a man whose only crime was speeding or car stealing, there is a terrific furore about police brutality.

If the officer could avoid the 90-mile-an-hour chase and the resulting confrontation, a life might well be saved. It could be done by equipping the police car with a device that would shoot a plastic container marking the speeding car with an identifying dye. The officer could then quit the high-speed chase and radio ahead for a road block.

Inventors are working on many other new crime-fighting weapons. Some have already been perfected. The old-fashioned nightstick is not just a billy club any more. Already on the market is one that delivers an electric shock—without injury. Another nightstick can spray a disabling gas, or a dye that will indelibly mark the person at whom it is pointed.

The nightstick as a real weapon. An inventor is working on another remarkable nightstick which, in addition to these fea-



A bottle shatters against a tough, transparent riot shield made of a new plastic called Merlon polycarbonate. The shield weighs less than five pounds but withstands the heaviest blows from clubs, bricks, and rocks. For protection against snipers, a lightweight bulletproof nylon vest (not shown) has been developed by Davis Aircraft Products. Final touch: riot helmets with transparent plastic visors.

Guns that shoot tranquilizing drugs to quiet the violent are being developed. Psychiatrist Dr. William C. Conner of Emory University demonstrates one type he has used on volunteers. Originally designed by Palmer Chemical and Equipment Co. for use by wildlife rangers and zoo employees, the gun fires a dart-syringe. Problem remaining: to choose the best drug for law-enforcement purposes.

tures, will have a series of hollow tubes encircling it. Each of these tubes is actually a miniature small-caliber rifle barrel. At the butt end of the stick is a spring-loaded firing mechanism. Pressing a button fires bullets from the tubes in rapid succession. If this invention can be perfected, the recoil will be exactly in line with the holding force. Thus there will be no tendency for the weapon to jump after each shot and so destroy the aim—making it easier to disable a criminal without killing.

Already available is a hand-held device that ejects a spray of fine droplets that instantly tranquilize any person, or even a group of persons. There is no bloodshed, no violence; the people simply lose their aggressive impulses.

Flashlight aiming beam. Still another development in the works is a flashlight-revolver that will throw a concentrated beam of light with a small black dot in the exact center. When a button is pressed, the revolver fires a projectile at the exact point covered by the black spot.

As matters now stand, an officer making an arrest at night has to hold a flashlight in one hand and, if needed, his gun in the other. If the person arrested has a

firearm and tries to use it, the officer must try, simply by the feel of the weapon, to put a bullet within the circle of light thrown by his flashlight.

With the new weapon, a projectile will speed unerringly to the exact point necessary to subdue the prisoner.

In the future, officers cruising along in a squad car at night may have a radar field that will react when passing a pedestrian who is carrying a revolver.

Already a “sniffer” has been developed by which it is possible to detect certain odors. For instance, the faintest possible trace of nitroglycerine in the atmosphere can be picked up at once. A person trying to smuggle a bomb aboard an airplane would be detected the minute his baggage started down the loading ramp.

Handling crowds. New weapons are being perfected for handling unruly crowds. If members of a mob intent on wanton destruction suddenly find themselves sprayed with a liquid that turns a deep red and cannot be removed for days, they may think twice before breaking the law the next time.

Tranquilizing darts can supplement an officer’s “hardware.” Tear gas, now wide-

Continued



Erle Stanley Gardner (left), best known as a mystery writer and creator of Perry Mason, has a deep interest in police science. He and Ernest V. Heyn (right), POPULAR SCIENCE Associate Publisher and Editor-in-Chief, recently planned this article at the Gardner ranch in Temecula, Calif.

ly used, can be replaced in certain circumstances by a new gas that takes away all belligerent impulses and leaves the subject docile as a kitten.

Lights and sound. These weapons lend themselves to the control of civil disorders, currently one of the most challenging areas of police work. Other possibilities for controlling unruly crowds without injury or death include machines that flash lights of such high intensity and broadcast sound at such high level as to produce unbearable discomfort.

Already developed, but not in production, is another "soft" weapon that could help prevent fatalities: a truck-mounted foam thrower that literally buries mobs under mountains of soap bubbles. Rioters are harmlessly isolated from one another and lose their sense of direction.

Versatile tanks. A 20-ton anti-riot tank is another recently demonstrated device. It includes a directional electronic noise-maker, a tear-gas gun at the front, and a nozzle that projects a stream of water at the tank's rear to disperse crowds or fight fires. A bulletproof plastic dome at the top has firing slits for other weapons. The tank can carry up to 15 policemen at speeds of 35 miles an hour.

Nor has the policeman himself been neglected. The latest in protective gear includes a lightweight shield that can stop anything from thrown missiles to bullets. A helmet with a transparent plastic visor gives the same protection to head and face. New lightweight bulletproof vests

made of nylon can protect policemen from snipers. The vests, which have detachable front and back sections, can even stop high-velocity rifle fire.

Science, in fact, is making great strides in the whole field of crime detection.

One firm, for instance, has worked out a method by which magnetic dust can be placed upon various materials in such a way that latent fingerprints can be developed on paper, just as the police can now develop latent fingerprints on a metallic surface or a sheet of glass.

This method is so effective that latent fingerprints have even been developed on a sheet of cleaning tissue so that the expert can make a valid comparison.

With such promising new developments under way, we should be able to look forward to more effective law enforcement. The new weapons will reduce fatalities and injuries by making it possible to use only the amount of force needed to subdue a criminal, or to stop riots before they get started.

Salute to the policeman. But there is one other "weapon"—outside the field of hardware—a weapon you can wield in the war against crime.

It is difficult to get the right kind of men for police work. What would do more than anything to attract the supply of new, intelligent recruits we must have is a feeling of public appreciation and awareness that the police are working for you.

The officer, as a matter of course, risks his life to protect you and your family and your loved ones.

It would put an excessive burden on the taxpayers if officers were paid what their job is really worth—in folding money. But there is another kind of compensation. I am referring to a demonstration of respect for the law and the officer who upholds it, a greater attempt to understand his problems, and an occasional verbal pat on the back.

What would happen if someday you approached a policeman and said, "Officer, I just want to shake hands with you. I want you to realize that as a citizen I appreciate what you're doing."

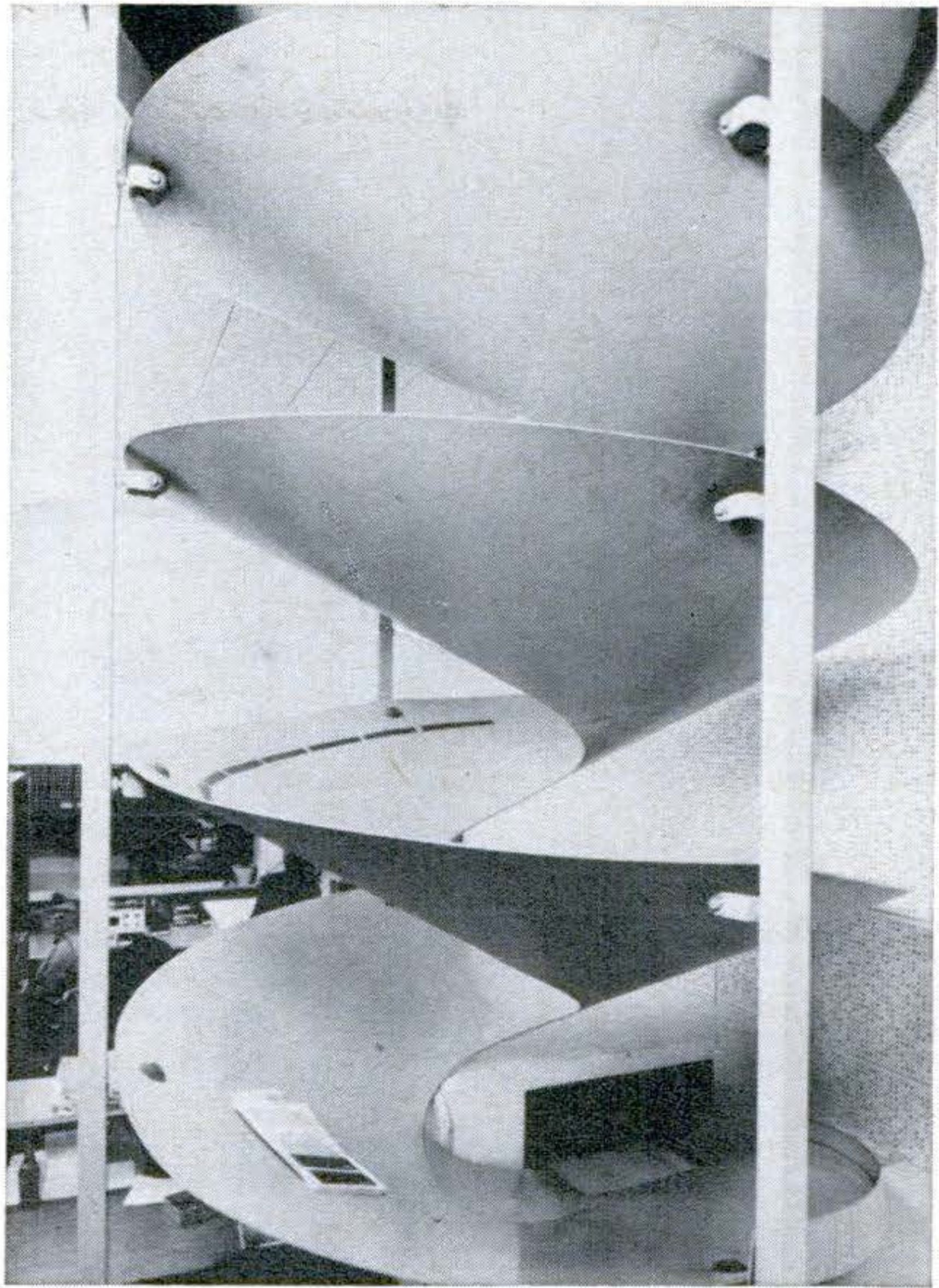
On second thought, you'd better not do it. That policeman might faint dead away and strike his head on the curb when he fell. P 5



Dialed book goes onto a spiral chute (right) which delivers it to reading room.

In this library you dial a book

Even libraries are getting automated. In Holland's Technical University at Delft, a patron looks up the location of a book he wants—and dials for it. The digits on the dial denote the stack, shelf, and location on the shelf. The idea filled a need to speed up delivery of reading matter as demand began to outstrip clerking facilities.



Low tractor for jet loading

A new "stretched," ground-hugging version of United Air Lines' three-engine Jetliner posed a problem—how to slip a tractor beneath it to pull dollies containing preloaded baggage and cargo. So the company designed this 35-inch-high minitractor. Stewardess Jeanne Ketchem helps demonstrate.



Hot sheets for accident victims

Get yourself hurt on a mountain or in a cave in Europe, and rescuers can see that you're kept warm while they carry you to safety. A 12-volt backpack battery in this British invention provides current for heating elements in plastic sheets which are wrapped around the patient.



New Chevelle is a bit bigger all around—longer, wider, higher, and heavier—than last year.

THE NORBYE/DUNNE REPORT

CHEVELLE MALIBU V-8

America's most popular intermediate



Acceleration from 25 to 70 m.p.h. to simulate a merging or passing situation took 12.3 seconds. Average time from standstill to 60 was 12 seconds.



With disk brakes on the front wheels, the Chevelle Malibu V-8 stopped in 144 feet from 60 m.p.h. after warm-up, without locking or skidding on any wheel.

Want big-car luxury, comfort, and ride in a medium-size car? Chevelle may be your answer

PHOTOS BY BILL MORRIS

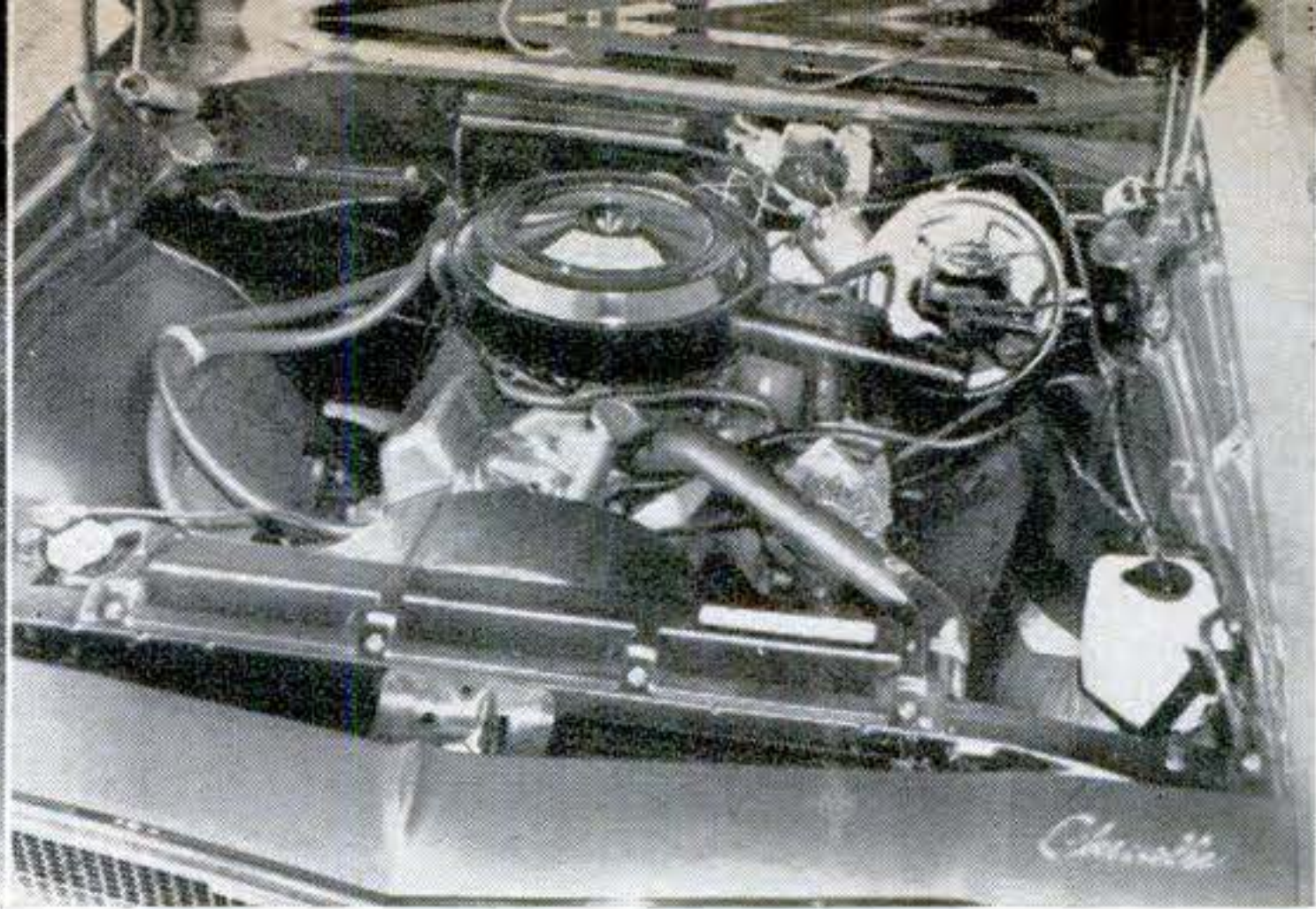
PS *Automotive Editor Jan P. Norbye and Detroit Editor Jim Dunne spent a full week with a new Chevelle, driving it on all kinds of roads and putting it through a series of rigorous tests at the Bridgehampton race circuit on Long Island, N.Y. It is really better than last year's Chevelle?*

The '68 Chevelle is a truly new car, with one-inch-longer wheelbase and one-inch-wider track front and rear, a new, beefier perimeter frame and revised body mounts, refined rear suspension, and an enlarged V-8 engine. There's more passenger space, but trunk space has been severely cut.

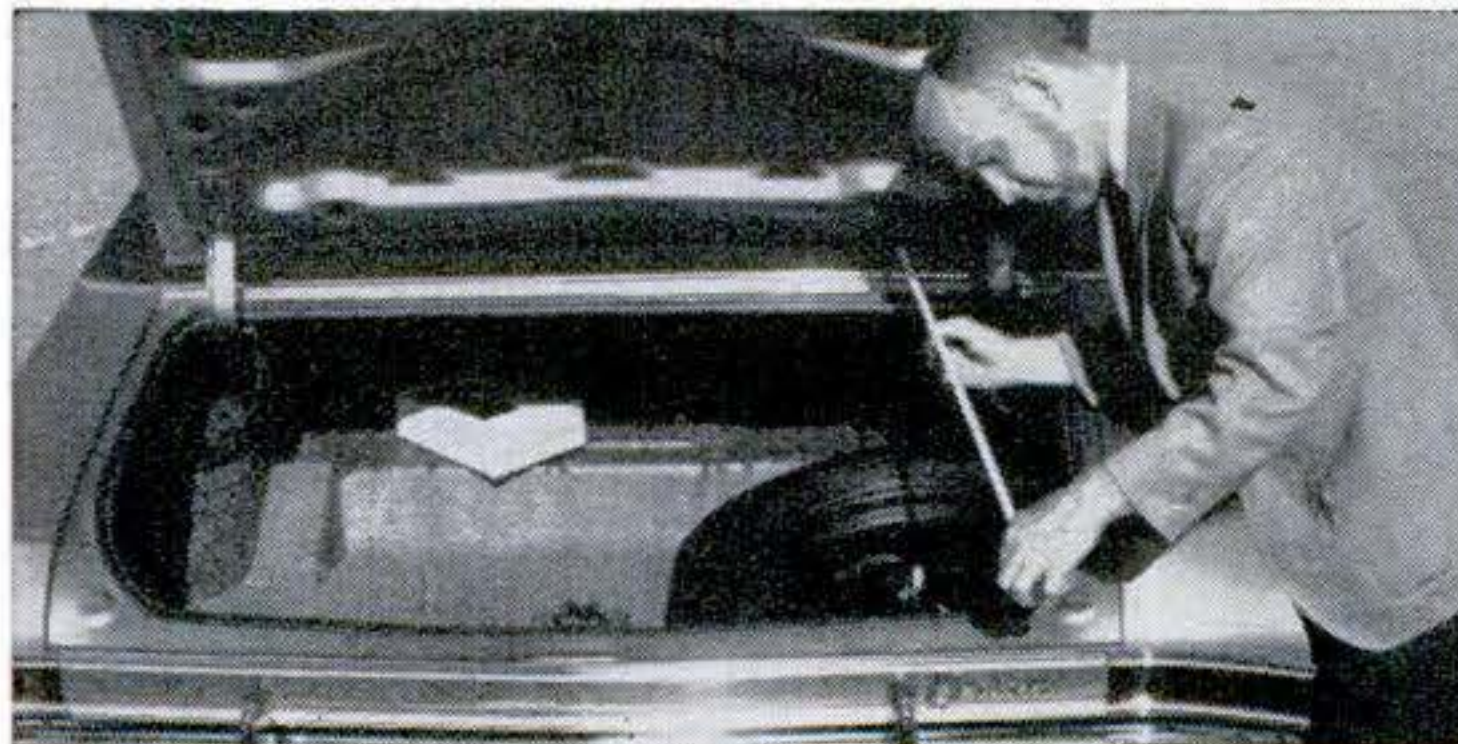
The new Chevelle is 3.8 inches longer than the old one and 107 pounds



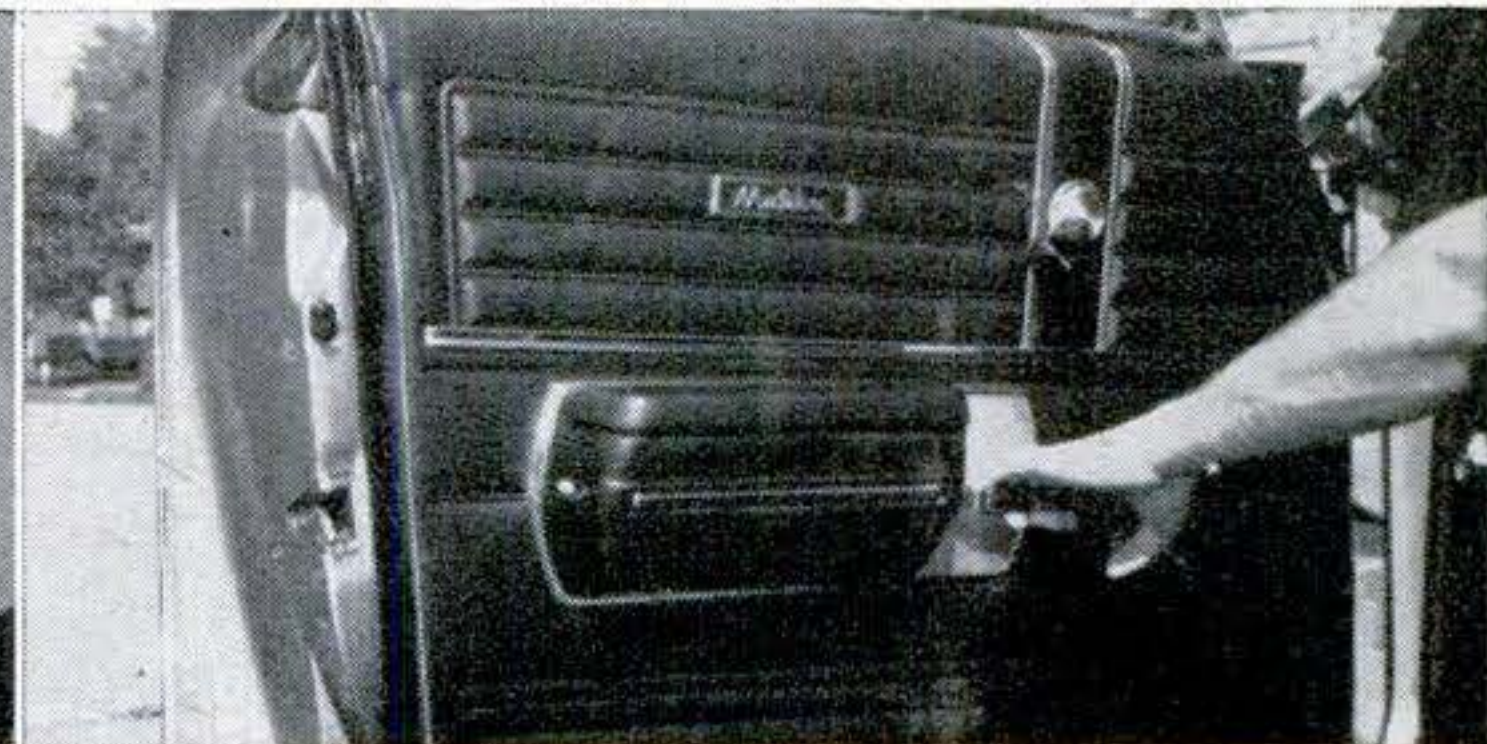
PS test equipment includes (from left): pressometer, stopwatch, fifth-wheel speedometer, Tapley meter, and pressometer sending unit (on brake pedal).



Chevy's 307 V-8 has the distributor hidden behind the air cleaner, and there's little access room to get at the two rear left-bank spark plugs.



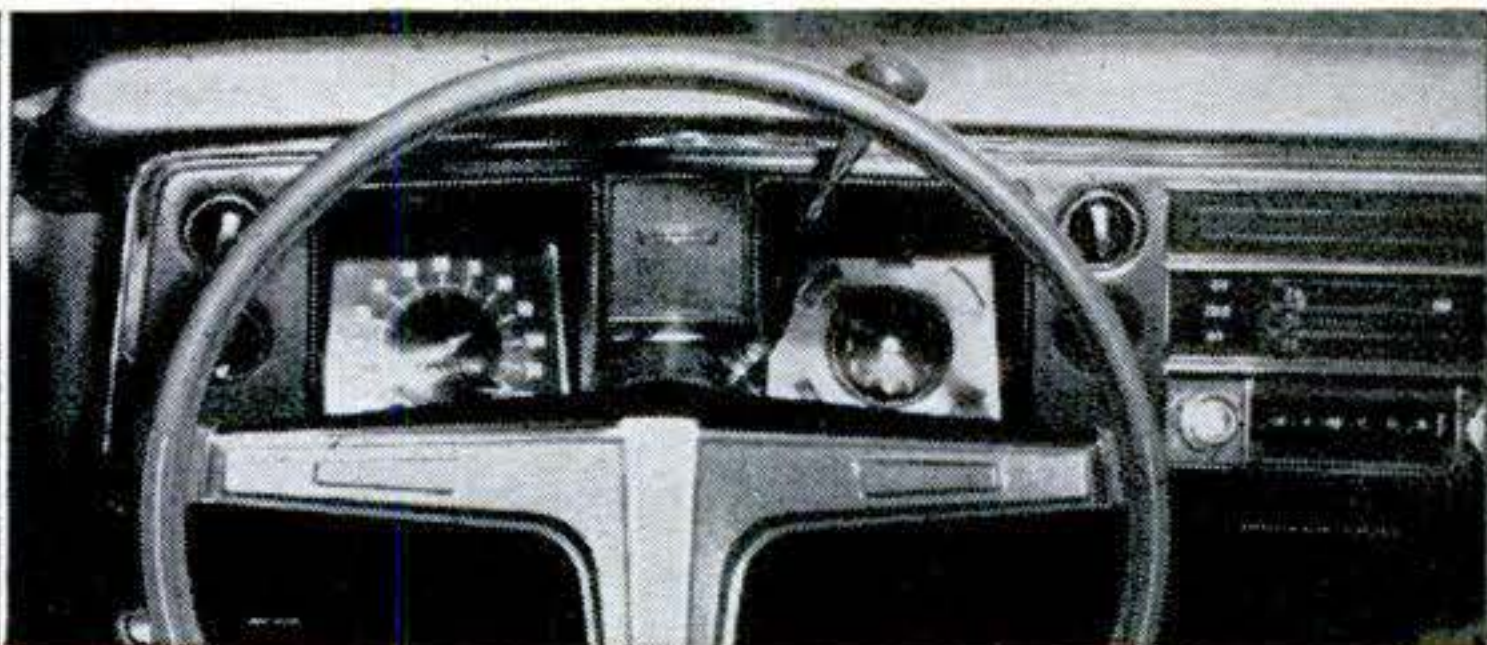
Chevelle trunk is shallow and spare wheel takes up half the floor space. Useful trunk space was 17.1 cubic feet in '67 model; now it's only 12.8.



Huge crushable armrest acts as cushion in side impact, while spring-steel door handle will bend away. Vent-window crank is a nice luxury-car touch.



Recessed ignition lock is fine for safety but inconvenient for men with big fingers. The recess should be big enough to allow a good grip on the key.



Instruments are recessed and entire dash area is padded. Horn ring is replaced by keys in steering-wheel spokes. Amps and temp have only idiot lights.

heavier. In acceleration tests, the new 307 V-8 gave the exact same figures as the 283 V-8 we tested in '67. Our 0-60 time was 12.0 seconds, 0-80 was 22.5 seconds. Since the transmission reacted better on kickdown, going from 25 to 70 took only 12.3 seconds against 13.8 with the old car. Fuel consumption was higher—14.05 m.p.g. against 16.4 last year.

We specified disk brakes on this car and they were an enormous improvement over the standard drum brakes. Actually, the brakes on this new Chevelle broke all records. We test brakes by making 10 easy stops from 60 m.p.h. at one-minute intervals to warm things up and then stopping as quickly as possible without locking any wheel. The Che-

velle came to a complete stop from 60 m.p.h. in 144 feet. Fantastic. Last year's Chevelle needed 259 feet to stop, in an identical test procedure.

Disk brakes not only stop you in a shorter distance, but pedal pressure stays the same as when the brakes are cool and there is no side pull at any time. Disk brakes should be the most popular option this year—they add only \$80 to the cost of the car.

The interior has been designed with safety in mind. In addition, there are many luxury-car touches: hideaway wipers—articulated on the driver's side—and vent-window cranks, for example. You get a feeling of luxury, too, from the

Continued



Sudden high-speed lane change is Chevelle's weak point. Up to 55 m.p.h. it's okay. At higher speeds, the steering response is slow.

rich materials used on the upholstery and door panels. The heavy padding on all interior surfaces adds to the higher-priced-car feeling.

The ride is definitely luxurious. The Chevelle is one of the quietest-riding cars in its class. But the engine is not particularly quiet. The passenger compartment is far better insulated from road shock and vibration than from mechanical noise. Wind noise is very low, too, so more engine noise gets through to you.

The car handles pretty well overall, though why they use such a slow steering

ratio with power assist is a mystery. It took $4\frac{1}{4}$ turns, lock to lock. In addition, pump catch set in very early in low-speed maneuvers, such as the slalom test with pylons spaced at 40 feet. Maximum steady speed was 18 m.p.h.

But it feels great on a long, high-speed curve. It doesn't lean much, and it's beautifully balanced. Perhaps it should have done better in the high-speed lane change. But steering response is slow, and there is a certain amount of body movement and tail-wagging which stiffer springs would cure. However, if you go to stiffer springs, the boulevard ride will be lost.

The standard V-8 Chevelle will no doubt satisfy most people for all-around use. It has enough power to haul a 1,500-pound trailer at any legal speed. Performance enthusiasts who can afford the gas bill will go for the SS 396. And there's a nice, smooth, 230 six available. **PS**



On a long, constant-radius turn the Chevelle is ideal. The car is stable and fully under control, with a marked initial understeer and some body roll.



If you accelerate hard in the turn, rear-wheel slip angles will build up, and the car heads nicely for the next straightaway in complete balance.

Facts on the Chevelle Malibu V-8

DIMENSIONS (inches)

Wheelbase	116
Front track	59
Rear track	59
Length	200.8
Width	76
Height	53.5
Front leg room (max.)	42.7
Front head room	38.2
Rear leg room (min.)	34.7
Rear head room	37.1

ENGINE

Type	OHV V-8
Displacement	307 cu. in.
Bore & stroke	3.875 x 3.25 in.
Compression ratio	9:1
Carburetion	Single 2-bbl. Rochester
Power @ r.p.m.	200 @ 4,600
Torque @ r.p.m.	300 @ 2,400

CHASSIS

Transmission	Powerglide (2-speed)
Axle ratio	3.08:1
Tires	Uniroyal Laredo
Tire size	7.35 x 14
Brakes	Disks front, drums rear
Steering ratio	20.4:1
Turns, lock to lock	4.25
Turning diameter	40.6 ft.
Curb weight	3,395 lb.
Price (basic)	\$2,608
Price (as tested)	\$3,053



Rebel stands out for huge glass area and good visibility, high ground clearance, and big bumpers.

THE NORBYE/DUNNE REPORT

RAMBLER REBEL 770

...practical, sturdy, and quiet

Facts on the Rambler Rebel 770

DIMENSIONS (inches)

Wheelbase	114
Front track	58.6
Rear track	58.5
Length	197
Width	77.2
Height	54.6
Front leg room (max.)	42.6
Front head room	39.8
Rear leg room (min.)	38.6
Rear head room	37.75

ENGINE

Type	OHV V-8
Displacement	290 cu. in.
Bore & Stroke	3.75 x 3.28 in.
Compression ratio	9:1
Carburetion	Single 2-bbl. Holley
Power @ r.p.m.	200 @ 4,600
Torque @ r.p.m.	285 @ 2,800

CHASSIS

Transmission	Borg-Warner auto- matic (3-speed)
Axle ratio	3.15:1
Tires	Goodyear Power Cushion
Tire size	7.35 x 14
Brakes	Disks front, drums rear
Steering ratio	20.9:1
Turns, lock to lock	4.25
Turning diameter	37.5 ft.
Curb weight	3,163 lb.
Price (basic)	\$2,519
Price (as tested)	\$3,115

It's no car for grandma—but you might want the lively V-8 and the supersafe disk brakes

PHOTOS BY BILL MORRIS

The new Rebel got the full treatment from PS testers Jan P. Norbye and Jim Dunne. Their comments on power, handling, comfort, and safety may surprise you:

The Rebel was an all-new car last year, and the changes for '68 are minor, like the new door handles, safety marker lights, and redesigned tail lights. Rebel

Continued

Instrumentation is simple and straightforward. All gauges and knobs are identified by lighted labels at night. The dash padding is generous.

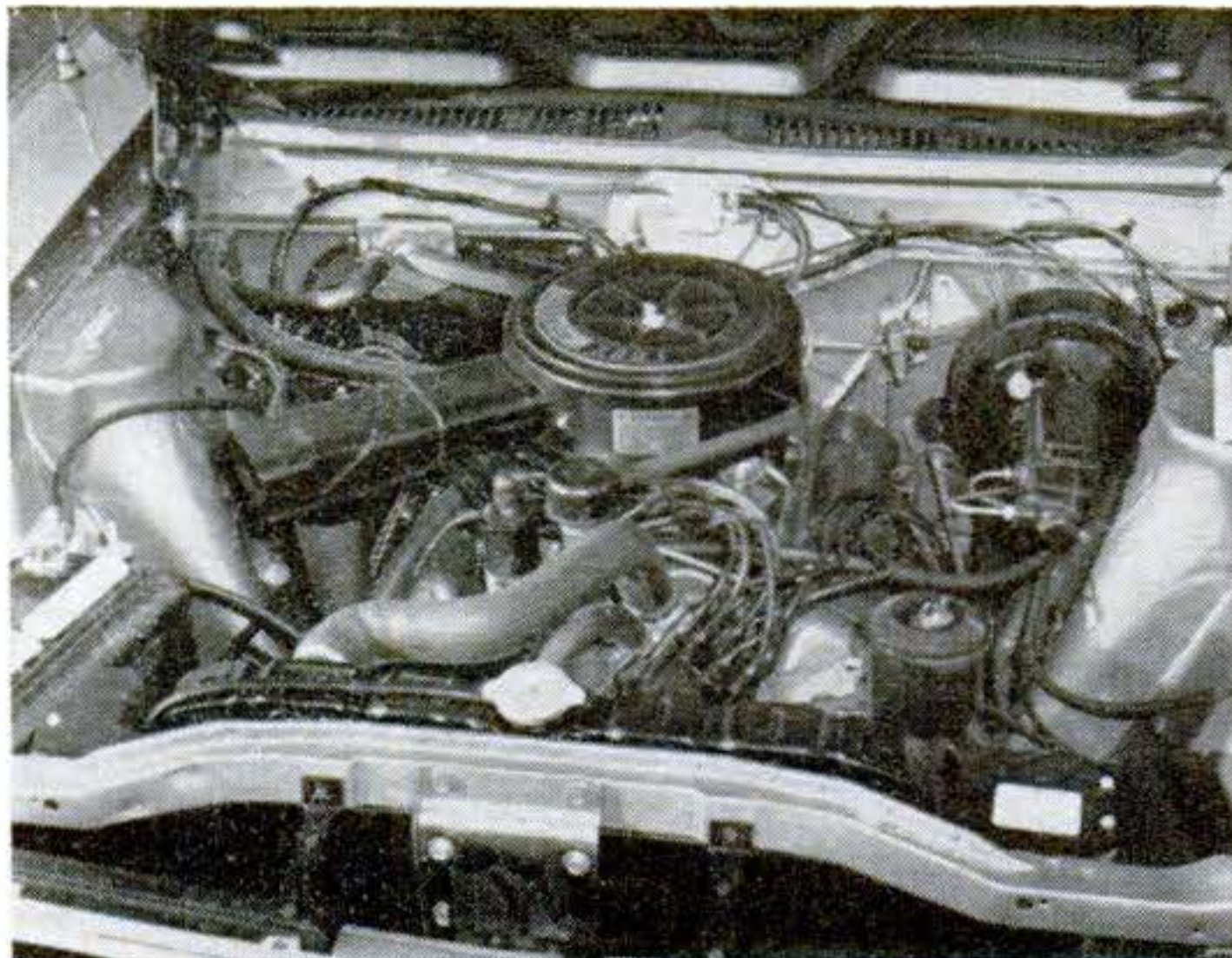




Brake pedal is mounted high off the floor. Toes can get caught when your foot swings over—or do all Rambler drivers use their left foot on the brake?



Spacious interior is marred by the high transmission tunnel, seven inches in back, 8½ inches in front. Front passengers face smooth panel surfaces.



Engine accessibility is uncommonly good for a V-8, even if the power unit sits very low in the chassis. Spring towers leave plenty of room to reach plugs.

is the only one of Detroit's intermediates not to undergo a complete styling change for '68. Actually, the clean and boxy four-door body makes a lot of sense. The Rebel is 3.8 inches shorter than the Chevelle, four inches shorter than the Fairlane, and 5.7 inches shorter than the Belvedere. But if you add up the figures on leg room, head room, and hip room, you'll find that the Rebel has more interior space altogether than the other intermediates. The inside dimensions are the same as in the Ambassador.

With a bigger inside and smaller outside, the car is easier to park. With its shorter wheelbase, it also has a tighter turning circle than the other intermediates. Some short-wheelbase cars give you a bad ride, but there are no ill effects on ride comfort from the Rebel's 114 inches between wheel centers. It proved free of pitch motions at all speeds on all road surfaces.

The all-coil suspension system also proved satisfactory in all the handling tests. There is a good deal of body roll on hard turns, but you never risk losing control. The power steering seems terribly slow, however, with 4¼ turns lock to lock. You don't really need power assist with that 20.9 steering ratio—we would have liked something around 17.5, with no more than three turns lock to lock (or variable-ratio steering).

The controls and gauges are well placed, right in front of the driver. You can tell the interior is designed for safety when you look at the smooth surface of the whole panel. At night, *all* labels on



Rebel reached 60 in 11.2 seconds, 80 in 21 seconds. Speeding up from 25 to 70 took 11.2 seconds. At an indicated 60 m.p.h., true speed was 59 m.p.h.



Ten half-g warm-up stops from 60 m.p.h. produced no fade, no increase in pedal pressure. With hot brakes, Rebel stopped in 144 feet from 60 m.p.h.



Slalom test between cones spaced at 40 feet gave 20-m.p.h. maximum speed. Faults: slow steering and beginning pump catch in the power assist.



Two sudden lane changes within 180 feet at 60 m.p.h. were tried on Rambler several times. It didn't knock down a single marker of lanes and barriers.



Despite strong body roll, there's no loss of handling precision. Rear end tracked well, and the car understeered firmly in all high-speed maneuvers.

the controls light up, so you don't have to pull or twist a knob to find out what it does. Ashtray and glove box are of useful size and well placed.

Too bad you can't get the reclining seats in this standard four-door sedan—only in the 'coupe and two-door hardtop model. It's a great fatigue-reducing device that should be standard.

Brake performance was great. The front disks really do the job. The Rebel stopped in 144 feet from 60 m.p.h. without wheel locking, after 10 warm-up stops. We have never tested a car with better brakes. No fade at all. No side pull or grabbing.

As for speed, it tops well over 90. We did 0-60 in 11.2 seconds, 0-80 in 21 seconds, and jumped from 25 to 70 in 11.2 seconds, with kickdown to Low.

Average fuel consumption was a creditable 15.4 m.p.g.

Under-the-hood accessibility is remarkably good for a V-8. The distributor is right in front of your nose, and you can even get at the rear plugs on both sides without too much trouble. You can probably even change the oil filter without getting your clothes dirty.

The Rambler engine is remarkably quiet, whether it's idling or working on

full throttle. AMC engineers have done a great job of silencing the rush of intake air and keeping mechanical noise down. It's not a matter of noise insulation. The hood doesn't have any sound-deadening material on it at all.

The body is quiet, too. The Rebel is exceptionally tight—no squeaks, cracks, or rattles as in some other cars with unit construction. There was no body shudder or shake on rutted roads.

While tar strips don't cause even a ripple in the ride of the car, you do hear a loud "thump" every time. This noise transfer is typical of many unit-body cars. We have never driven a Rambler that had better body sealing. Up to 70 m.p.h. wind whistle is absolutely nonexistent.

Trunk size is impressive. It offers 18.2 cubic feet of useful space. Believe it or not, a six-footer can lie down full length on the trunk floor without touching the inner fenders on either side.

For high performance, there is an optional 280-hp. 343-cu.-in. V-8. For the economy-minded, there are 145- and 155-hp. versions of a rugged 232-cu.-in. six.

This Rebel has a lot of good features to offer that you don't find in other intermediates.

PS



RASMUSSON

What is the scientific truth about LSD? In this vivid, powerful article, Popular Science reporter Bob Gannon tells from first-hand experience the full story

MY LSD TRIP

A non-cop, non-hippie report of the unvarnished facts

By **ROBERT GANNON** ILLUSTRATION BY DANA RASMUSSEN

11:01 a.m. *One minute ago I was given an injection of LSD. I'm in a mental hospital in Philadelphia, here to experience my first psychedelic trip. Motivation: curiosity.*

11:09—First effect: The ceiling has started to crawl around. It's warping like a psychedelic poster. And the cream wall has turned a lighter shade. Now it's aqua. Now—things happening too fast. Can't write. Too much . . .

The foregoing was written a few weeks ago as I was slipping into the mystical world of unreality produced by the hallucinogenic drug lysergic acid diethylamide (LSD). I was lying on an examination cot, a quart of orange juice on the table next to me, in a small, office-like room in the Eastern Pennsylvania Psychiatric Institute (EPPI). My "guide" was Dr. Karl A. Ray, a resident psychiatrist with whom I had formed a strong bond during the preceding few days.

Things would have been a lot simpler if I had gone to some hippie pad on Manhattan's Lower East Side. But I preferred a research lab for a number of reasons: I was sure the LSD was pure, an antidote (chlorpromazine) handy, the experiment legal, and that I would be screened by a battery of tests to insure that I wasn't the kind to flip out permanently.

The other patients, I found out later, had diagnosed my difficulty as chronic alcoholism. One reason was that alcoholism, usually frustratingly tough to solve, is one of the problems currently being treated there by LSD therapy.

How does LSD help? "We don't quite know, actually," says Dr. Charles Shagass, who is running the EPPI program. He is in charge of Temple University's clinical services at the institute and is a professor of psychiatry as well. He's been working with LSD since 1950. "The treatment has a lot to do with the recall of forgotten or repressed events, with insight, and with a re-evaluation of the patient's self-image."

An alcoholic—or a homosexual, drug addict, exhibitionist—under LSD may, for some so-far elusive reason, suddenly understand why he has these problems, and what to do about them.

Continued

LSD has aroused widespread public concern. The popular press has sensationalized, moralized, viewed-with-alarm, titillated, exaggerated, and distorted the facts. Advocates and defenders of LSD have proselytized enthusiastically, claimed unproven benefits, and glossed over the dangers of unsupervised use of this powerful mind-affecting drug. Many lawmakers seem to have adopted the same dogmatic approach that gave us the unenforceable prohibition laws. They've shown little interest in exploring more effective ways of controlling LSD use.

POPULAR SCIENCE assigned its dare-anything reporter, Bob Gannon, to experience an LSD "trip" under responsible supervision. He participated in one of the most respected scientific research projects. The data from his experience now forms a useful part of the scientific literature on the subject.

Here, then, is an up-to-the-minute factual report on the truth about LSD so far as it is now known.—The Editors.

“Under LSD I found myself in a swirling

After five days of tests, Dr. Shagass concluded that I was neither an incipient psychotic nor a “borderline” case, someone disturbed enough that he might be pushed permanently into psychosis. (And he also now had a “normal” yardstick against which to hold future tests.)

Now I was ready for the voyage. The drug was made by Sandoz Pharmaceuticals in Switzerland (the only legitimate manufacturer) and is distributed exclusively by the National Institute of Mental Health. My dose, based on body weight of 152 pounds, was 173 micrograms. This sounded small (an aspirin tablet contains 300,000 micrograms of aspirin), but Dr. Shagass assured me it wasn't.

LSD not only is one of the most powerful drugs known to man, but tests have revealed that so-called “street LSD” may contain as little as seven percent pure LSD. So when a hippie believes he is taking 1,000 micrograms, he may be getting as little as 70. Further, my dose was injected, and “this gives two or three times the wallop of oral administration,” says Dr. Shagass.

Nine minutes after the shot I was off, swinging up in my beautiful balloon. I tried to take notes, but except for those first two, couldn't. Things happened too fast. What follows is based on what I remember, on Dr. Ray's notes (in *italic*

paragraphs), and on snatches of my blurred speech captured by a tape recorder.

Stage I—SENSORY

11:15—*Patient dizzy. Resisting somewhat. Says “Wow” a lot. Fascinated.*

Around the doors and windows, oddly out of square, a phosphorescent blue glow settles. It's gorgeous. I blink and it turns pink, then back to blue. I'm floating, undulating. I look at Dr. Ray and see a startling transformation: His features refuse to stay regular; they wobble fluidly.

It's wild, the whole thing, wild, and I feel myself wide-eyed and grinning. This is great—and now I *know*. Suddenly the psychedelic paintings make sense. All the clichés are real. Bob Dylan's words ring true. He's been here.

11:30—*Patient lying down. Speaks of undulation. Trying to interpret but vocalization too slow. Maintaining reality by changing position, he says.*

The room, the dull, drab, insipid, cream-walled room, is alive with color. It flowers from electric blue to green to orange. I close my eyes and the hues continue tumbling. All color is Day-Glo, but more so. I rip my glasses off; they're holding things back.

The shifting patterns speed up, and I begin to tremble. I stumble to the cot

Psychiatry and LSD

Thirty minutes after Swiss chemist Albert Hofmann, discoverer of LSD, popped some into his mouth in 1943, he was certain he had gone quite insane. Later he decided that LSD produces the long-sought “model psychosis”—a laboratory archetype with which psychiatrists could experiment.

He was wrong. LSD sessions are not models of insanity. The trips not only aren't much like psychosis, they're not like each other.

Today LSD is being used in psychotherapy, primarily as an insight-producing tool. The U.S. Public Health Service, in fact, is spending \$400,000 a year in support of five of the 50 or so approved LSD studies now going on.

Typical of these studies is the series conducted by Eastern Pennsylvania Psychiatric Institute's Dr. Charles Shagass (who directed

Gannon's experience), who uses LSD on carefully screened patients as an adjunct to conventional therapy. He feels that the drug is virtually worthless for people with either psychosis or such generalized neurotic problems as depression. But for patients with a single, obvious problem—alcoholism, phobia, homosexuality, drug addiction—the results of treatment with LSD may be dramatic.

Some psychiatrists even find success with patients with severe problems. Dr. A. Joyce Martin, of London's Marlborough Day Hospital, for instance, says, “We have treated 60 cases (with LSD) in the last three years . . . All but two responded.”

Just how cures are effected remains a mystery. Explains University of Virginia psychiatrist John Buckman: “Many therapists

whirling maelstrom, my mind a kaleidoscope”

because figuring out how to hold my body upright is too much work. I'm losing all control. The shifts are coming too fast, the sensations too swift, the flashes and sensory impressions and images swoop by too quickly. I try to tell Dr. Ray what's happening, but he's too slow to grasp, and my vocal chords are inadequate. I get out three words and I'm off on another plane, in a world of color shifts and echoes, and chambers in chambers, like a nautilus's shell, a compartmented funnel, a honeycomb Ferris wheel.

Too fast. *Slow*, so I can think, so I can interpret. Please!

11:45—*Patient breathing deeply. Trying to interpret, then decides not to. Asks for rocks. Says “John Cage.” (?) “What I start to say no longer matters.” Fearful at times, but seems to be enjoying it—has secretive, playful expression.*

I am enjoying it. That's why I so desperately want things to slow down so I can keep up.

Before I came to Philadelphia I talked with Dr. Timothy Leary, head guru of the psychedelic movement. When I told him my plans he suggested that I take along some object that is meaningful to me. The only thing I could come up with was a pair of tektites—half-inch, black, glassy minerals—that I found in the Texas scrubland years ago.

Now I ask Dr. Ray for them. He slowly sets them before me on the cot. (Everything outside myself is in slow motion.) I gaze at them for a minute. “They're just silly little tektites,” I say, pushing them away. Dull. I have much more interesting things to think about.

For example, the echo. I say “Puhh,” and off in the distance echoes “Puhh, puhh, puhh.” Sounds like John Cage electronic music. “Say ‘puhh,’” I tell Dr. Ray. He does. It works for him, too. But he can't hear. He doesn't know because he's never been here. *He's one of the others.*

Stage II—ANALYTIC/SYMBOLIC

12:00—*Patient groaning. Says thoughts too fast. Tries to get senses working together, he says. Perspiring greatly. Talks of being movie projector.*

I'm scared. Things are happening too fast. I'm a professional observer and here I find myself a kaleidoscopic participant. I didn't think things would happen so fast. Wait. *Slow down a minute. Stoppp!*

I'm a movie projector. I have a closed loop film running slowly through my lens. It's of emotions. I'm angry, then loving, then lustful, hating, depressed, elated, *out of my mind.* The film goes faster and faster. Another film is threaded in, superimposed on the first at a different

Continued

believe that a transcendental experience—a feeling that it is a good world and one is a part of it—is a curative experience in itself.”

Adds Dr. Shagass (who discusses hoped-for results with patients before each LSD session): “We're all suggestible to some extent. LSD increases this suggestibility.”

Dr. Shagass' LSD procedure is similar to that of most who use high-dose therapy. (Some administer tiny amounts in connection with conventional sessions.) In one program, he selected 20 men and women with problems ranging from sexual promiscuity to embezzlement, then matched them with a group to be treated conventionally.

The LSD patients were given intensive therapy for a week or two before being given LSD, during which suggestions for improvement were discussed. Then each was injected with a single dose of LSD. Little direction was given by the attending doctor; the patient

could mentally travel wherever he would.

Dr. Shagass' typical LSD patient in the program fared considerably better than his matched counterpart for six months to a year after his session. Then he would show signs of relapse, necessitating another LSD session.

Most long-range LSD therapy has been done with alcoholics, a group quite difficult to treat. One study, reported by Saskatchewan psychiatrist Abram Hoffer, was concerned with 24 of “the most difficult alcoholics.”

In this program, a patient would undergo intensive psychotherapy for three weeks, then would be given a single large dose of LSD. During the session his doctor would discuss his problem, and make “strong suggestions that he discontinue the use of alcohol.”

A year later, half of the patients had either quit drinking altogether or cut down considerably—an astonishingly high percentage compared with any other kind of therapy.

LSD...How Dangerous?

speed. This one is senses: feeling (I'm cold, then swimming in sweat), sight (the room distorts, swings away, flashes multihued), feeling (my hand sleeps, my legs ache, I'm famished—no, nauseated;) sound (outside, a car roars its motor; the reverberation lasts hours).

Add another reel of intellectual concepts: paradoxes, boxes in boxes. Centrifuges. Gears mesh—no, not quite. Analyze, analyze, and one more piece of film: of subconscious, primordial figures—Rorschachs. Monsters coming toward the surface.

Reality—where? *There*. Grab it! I reach out and grasp Dr. Ray's hand. My swinging halts; I jar to a stop and realize where I am, what I'm doing. I ask the time. 12:10? Impossible. I've been here for weeks. Ray's hand turns white, gets cold, turns green and begins to disintegrate. I jerk away, repelled, and I'm swinging off again.

I'm totally insane. I know because I can see reality as it flicks past, just a little slit of sunlight. I'm in a giant maelstrom, swirling, whirling, with reality only a small slot in the side. I'm terrified because I know they made a mistake. I *did* flip over and I'm not ever going to get back. I must grab that reality flashing past. I groan and the sound is recognizable and I shudder to a stop—then slip off again.

Reality is Dr. Ray sitting there calm like Clark Kent. Thank God he's there. I grab his hand—but it slips away. I see the orange juice and motion for a drink. Ray pours me a phosphorescent, sparkling cupful. I *will* it to my mouth, but somehow it doesn't come. So with a tremendous effort I reach out, pick up the paper cup, and with both hands lift it toward me. Slowly it collapses. My arm, now translucent, reveals the muscles and tendons. Getting them all to work together is an enormous task. I'm not very good at it, and by the time the drink touches my lips most of it has squashed away.

But the taste—oh, my God the taste. No one has ever tasted orange juice before. Maybe it's because the fluid is glowing—so bright I close my eyes. No matter; I see it still. The taste is so great I stop in my swing, and again be-

[Continued on page 168]

LSD is the most controversial drug of our age. While members of Dr. Timothy Leary's Neo-American church use it as a religious sacrament and thousands of hippies turn on with it regularly, detractors blame it for causing everything from sexual promiscuity to cancer.

The concern is understandable, if only because of the enormous number of people affected. One student LSD seller in a typical Midwest college, for example, claims that in a single month he passed enough LSD for about 1,700 trips. Philosophy professor Houston Smith estimates that some four million Americans tried LSD in 1966.

Yet, except for a small number of government-approved experimenters, LSD is outlawed. Most of the illegal supply comes from makeshift labs run by amateur chemists. It is synthesized by "cracking" lysergic acid amide, something like extracting petroleum. This produces a variety of alkaloids from which the LSD is easily isolated. (If the chemist is sloppy, his potion will include unwanted alkaloids, some of which dampen the LSD effect.) One aspirin-size tablet could turn on 5,000 people.

The drug itself—colorless, odorless, tasteless—has remarkably few consistent physiological effects on the body, and no known lasting ones.

In the brain, however, something more dramatic occurs. No one is certain, but what probably happens is that the drug releases certain body enzymes which in turn produces "shorts" in the synapses—junction points on nerve cells—triggering a variety of "disturbances." If a short occurs in the visual center, the user may see a swoop of color; if a complicated synapse, such as a defensive mechanism against anxiety is shunted, the user may become frightened.

How dangerous is LSD? Nobody knows for sure, though nearly everyone has a strong opinion. Here are some of the accusations, along with the best estimates of the truth:

LSD leads to suicide. The big problem here is lack of statistics. The current rate of suicide in America is 11.6 per 1,000 population. But it is not known how many LSD users there are, nor how many suicides resulted from its use.

Dr. Charles Savage, Director of Research at Spring Grove State Hospital, Md., who

administers therapeutic LSD to mental patients, had two suicides in 15 years, "about the same as for non-LSD therapy."

Dr. Giampiero Bartolucci of the Eastern Pennsylvania Psychiatric Institute, however, warns that "in hippie surroundings, a person who is depressed, but who ordinarily can defend himself, may go into deep, unbearable feelings of depression, become impulsive, and commit suicide."

LSD can lead to psychosis. It can, particularly if the taker isn't prepared or if he takes LSD without an experienced guide. About five patients a week are admitted to Manhattan's Bellevue Hospital psychiatric wards suffering from schizophrenia and paranoia caused, or triggered, by LSD. There are also "a great number who come in with other problems as a result of LSD: They jump off buildings, fall down stairs, or lie in the street and are run over," says Charles Martin, deputy assistant commissioner of Bellevue.

Adds Dr. Timothy Leary, head of the LSD-for-everyone school (who, when I interviewed him in his 60-room, Millford, N.Y., mansion, had just completed his 400th trip): "I've personally seen about 3,000 people take LSD. Of them, only four cases of prolonged psychosis developed. And all four had been in mental institutions before."

LSD is an aphrodisiac. In some cases it does cause sexual excitement. But often too many things are happening for the user to concentrate on a single, elaborate procedure.

LSD—addictive, and forerunner to such drugs as heroin. No evidence to support either contention. And according to Leary, the more one uses the drug the less one needs. He claims that he requires only half as much as when he began.

Post-session "flip-outs." Occasionally someone re-enters a partial LSD state months after his last experience, and according to Dr. Duke Fisher of the Neuropsychiatric Institute of the University of California, such a flip-out may come not only to habitual users but to those who have tried it once.

LSD may cause brain damage and other physical effects. Psychiatrist Harold A. Abramson, editor of "The Use of LSD in Psychotherapy," states that "Contrary to assertions in the popular press, when LSD is administered as part of a therapeutic medical program, 'irreversible psychotic changes' and 'brain damage' do not occur. Certain irresponsible statements that it does produce such adverse effects have not been supported by valid scientific evidence."

However, recently some needle-induced diseases have been cropping up among LSD users—hepatitis, phlebitis, abscesses. (Acid-soaked sugar cubes now are passé.)

Birth defects. A recent issue of the *Saturday Evening Post* stated that LSD probably caused defects of the lower intestinal tract and a misshapen head of a Portland, Ore., baby whose mother had taken a single dose of LSD in her first month of pregnancy. The next week's issue of *Time* said that the baby's head is actually normal, and that the intestinal abnormality probably is unrelated to the mother's LSD.

Dr. Samuel Irwin of the University of Oregon Medical School, who has worked with the child, cleared things up. "It's very simple," he told me. "The *Post* article was completely irresponsible. Just write it off."

Chromosomal changes. More alarming, perhaps, are reports that LSD causes malformation of heritage-carrying chromosomes. The first report came from geneticist Maimon M. Cohen of Buffalo's State University School of Medicine. He mixed LSD with blood samples, then compared the cells with nonexposed cells. The procedure "produced a marked increase in the frequencies of chromosomal breaks and rearrangements compared to untreated cultures," he reported in *Science*.

Later, Cohen's findings seemed to be verified by Drs. Samuel Irwin and Jose Egozcue of Oregon. When they checked white blood cells of nine non-users against eight acid heads, they found that the users' chromosomes showed an increase in breaks.

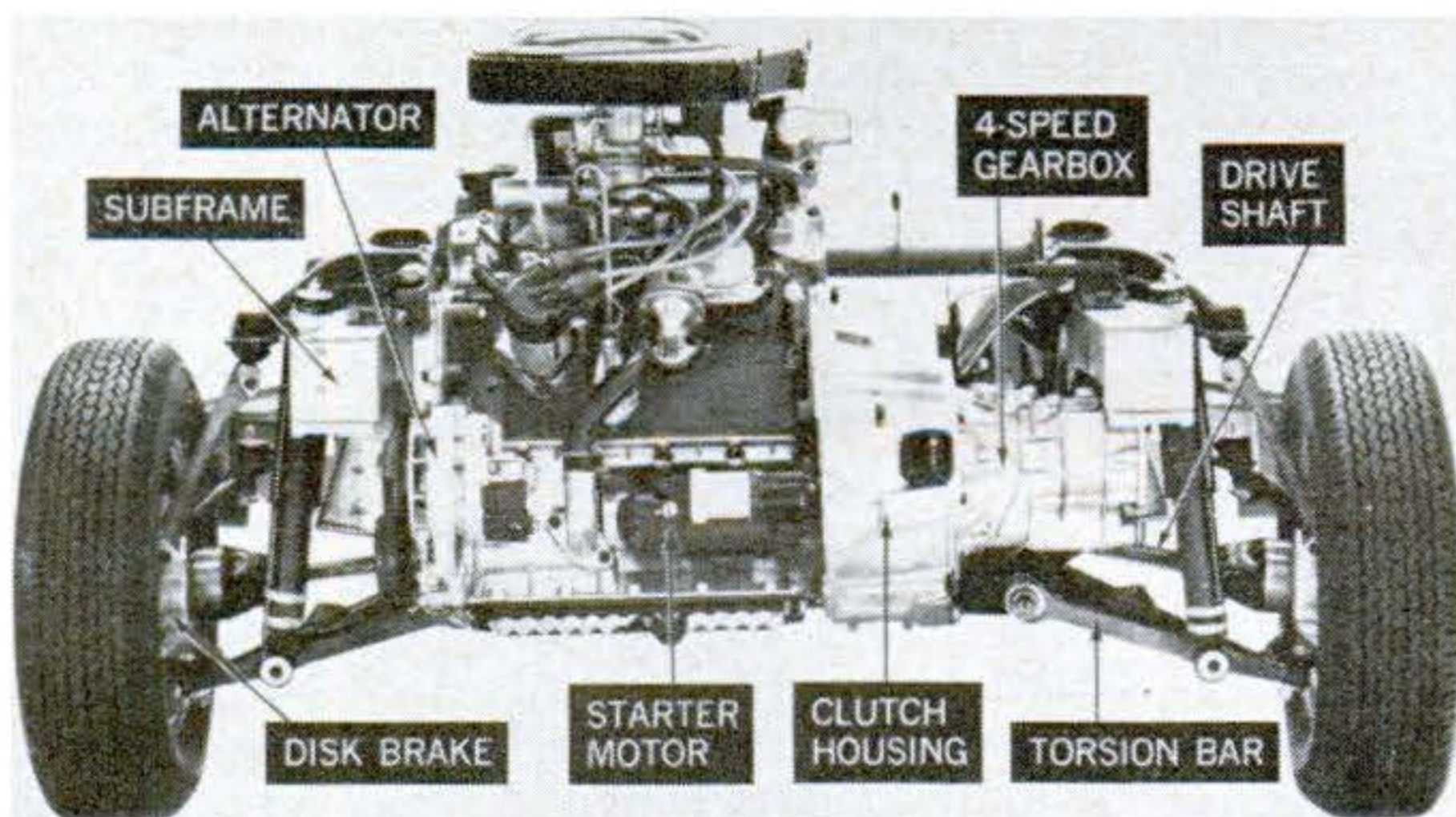
On the other hand, EPPI's Dr. Shagass automatically sends before-and-after LSD-session blood samples (including mine) to the National Institute of Mental Health for chromosome testing. "So far we've seen nothing to get worried about," he says. (And my count was about the same before as after.)

"Naturally, I'm concerned about such reports," adds Tim Leary, "because I've taken more LSD than anyone in the country. If LSD is the cause of anything, I assure you I want to know about it. But what they've actually found in Oregon is that six out of eight LSD users showed changes in the chromosome structure of the order of magnitude you'd expect from one chest X-ray."

"I don't think I could say that," counters Oregon's Dr. Irwin. "I don't think we know enough about X rays to say that similar types of damage can be precipitated. Remember—some of our LSD users had taken the drug almost 200 times."

So in this area, like most others, we're right back where we started. Any drug as powerful as LSD (and its relatives) should be handled gingerly. Such a drug suddenly being used by millions of Americans is guaranteed to cause violent adverse reactions. The questions are, how many, and how widespread? Final answers are still a long way off.

First of the '68 cars from



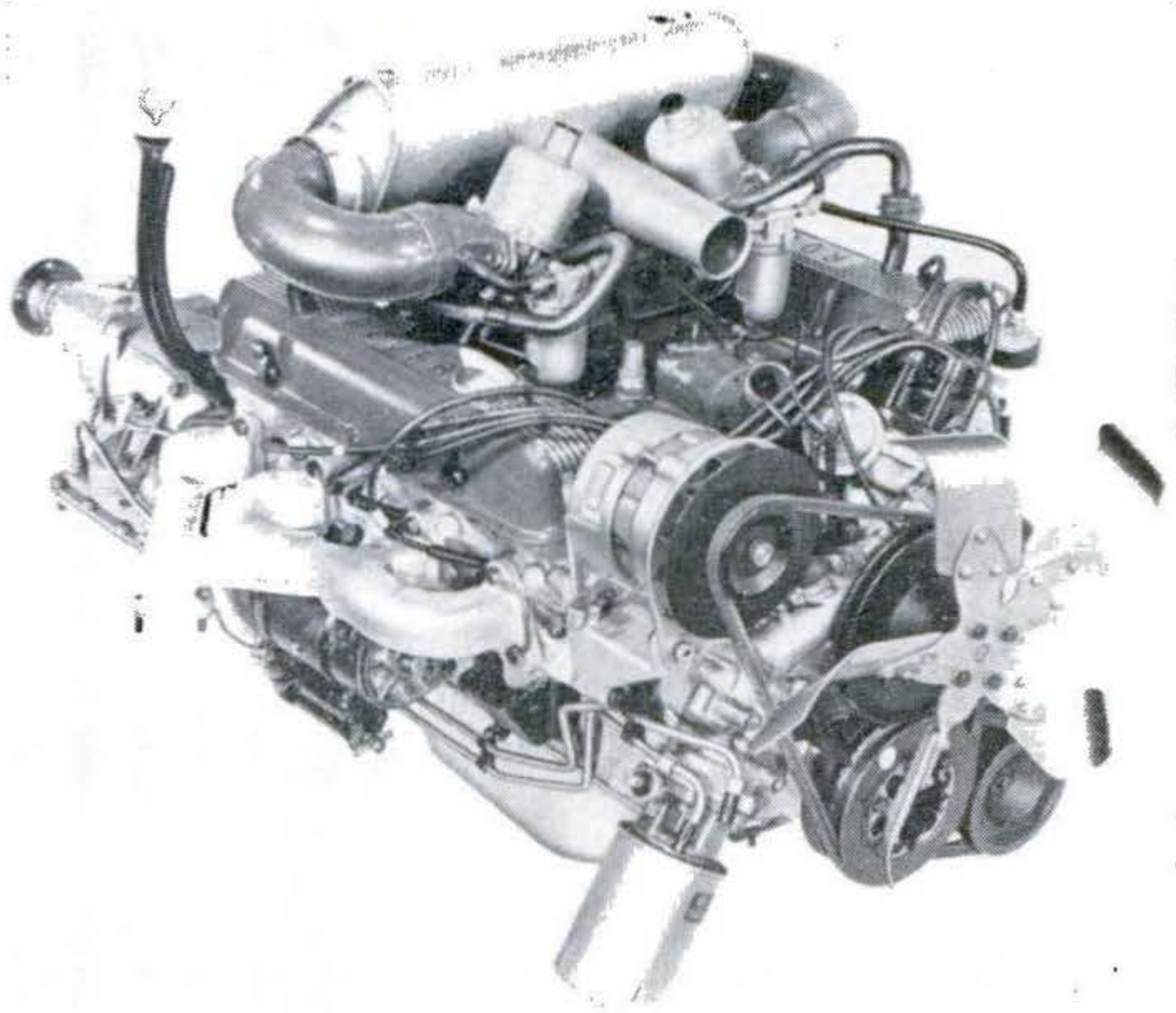
Simca 1100 is a front-drive baby Chrysler from Paris. The transverse four-cylinder engine and outrigger transaxle derive from the Fiat-designed Autobianchi. The engine is tilted back to give a low hood, and puts out 56 hp. at 5,800 r.p.m. Ferodo semiautomatic transmission is an option. Torsion bars are used in front and rear suspension systems; disk brakes at front are standard. Wheelbase of 99 inches gives generous interior for a small car. There are two-door sedans and wagons, too. Chrysler says no decision has yet been made on marketing this car—a logical companion to the Simca 1000—in the U.S.

Citroën Dyane is slotted between the 2 CV and the Ami-6, the French auto maker's ugly ducklings. Dyane shares the power plant of the 2 CV—a 21-hp. air-cooled flat-twin that drives the front wheels and gives the car a top speed of 62 m.p.h. It can take the 1,224-pound featherweight up to 47 miles on a gallon of gas. The four-door body has a tailgate, like a wagon, and a roof that rolls back when you yearn for a breeze.

Bond Equipe 2-Liter GT is a new full-four-seater fastback built on the Triumph Vitesse chassis. The modern fiberglass body has an overall length of 166 inches. The engine is a 95-hp. 122-cu.-in. pushrod six that can give you 0-60 acceleration in 11.5 seconds and 100-plus top speed. The radio antenna is concealed under the car's plastic roof to avoid the annoying wind whistle that comes with repetitive flexing of outside rods.



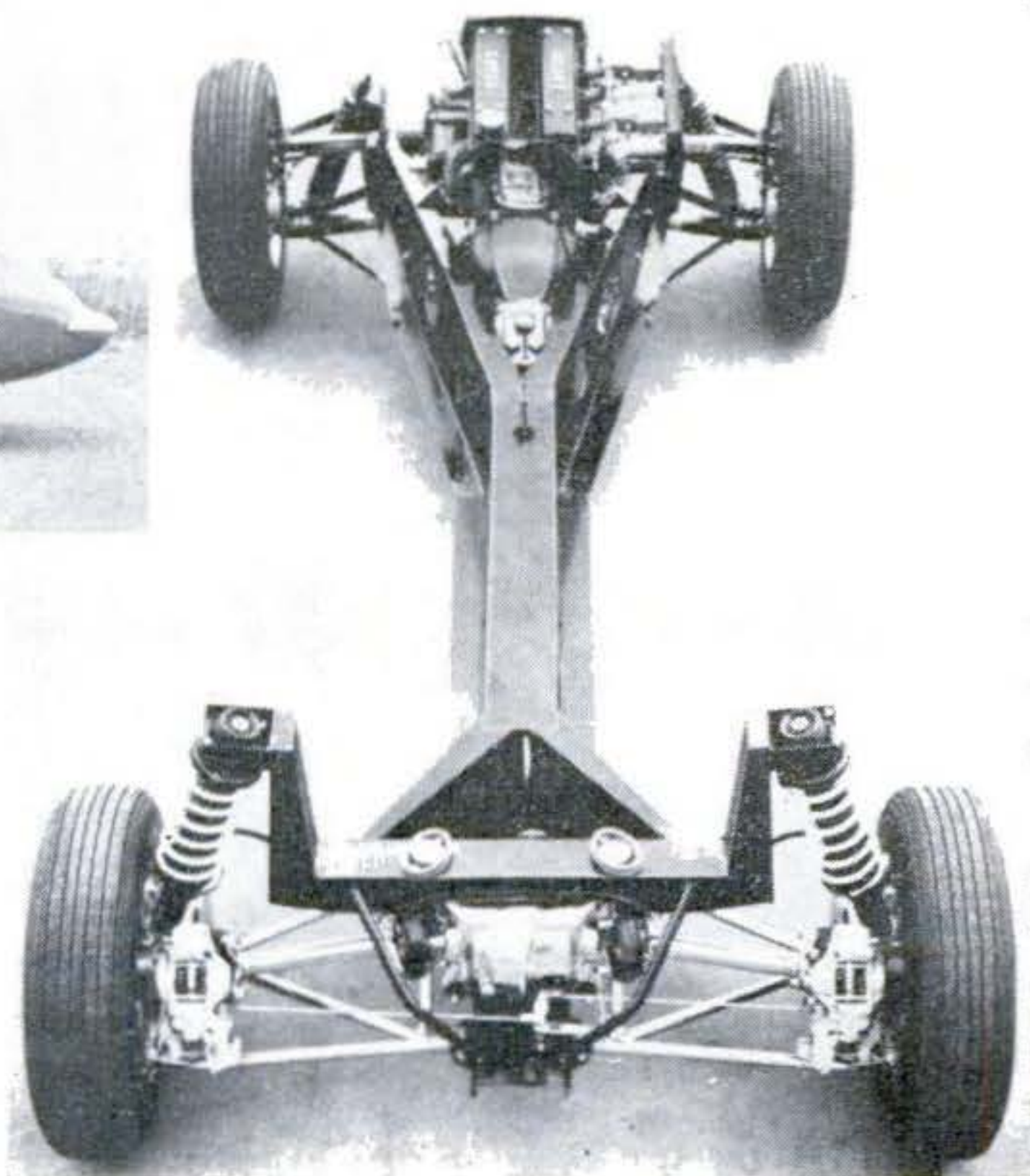
Europe



Rover 3 1/2-Liter is a new V-8 model based on the staid-looking top-of-the-line 3-Liter that has been with us since 1959. The 184-hp. 215-cu.-in. engine is based on the aluminum V-8 used by Buick, Oldsmobile, and Pontiac until '64. It turns to 5,200 r.p.m. in Rover tune with a 10.5:1 compression ratio. The new V-8 is 200 pounds lighter than the six in the 3-Liter and 30 percent more powerful. Maximum speed is 115 m.p.h.; 0-60 time is just over 12 seconds. Two bodies are available: sedan and coupe. A Borg-Warner automatic transmission, power steering, and power disk brakes are standard.



Lotus Elan Plus 2 is a racing-inspired sports car that has been stretched to bring it to young-family size. It has enough back-seat room to accommodate a couple of kids and the trunk offers 6 1/2 cubic feet of space. The backbone frame has been lengthened and the track widened. Power is provided by a Ford-based 93.8-cu.-in., twin-overhead-camshaft, four-cylinder unit that turns out 118 hp. at 6,250 r.p.m. Top speed is 120-m.p.h. All four wheels of the Lotus Elan Plus 2 are equipped with 10-inch disk brakes.



Our Biggest Naval Guns to Boom Again...in Vietnam

Now being taken out of mothballs, the mighty New Jersey will go to war once more—this time, the one and only active battleship in the world

By ALDEN P. ARMAGNAC

In a great drydock at the Philadelphia Navy Yard, as this is written, the mighty 16-inch-gunned battleship New Jersey is being readied for combat. When the \$27-million, nine-to-10-month task is done, the 45,000-ton vessel will join the U. S. Seventh Fleet in action off Vietnam.

Groomed for her third war since her completion in 1943, the 887-foot New Jersey will become the world's one and only active battleship. To naval observers who thought her type extinct, viewing her comeback is like seeing a dinosaur in a museum come to life and gnash its

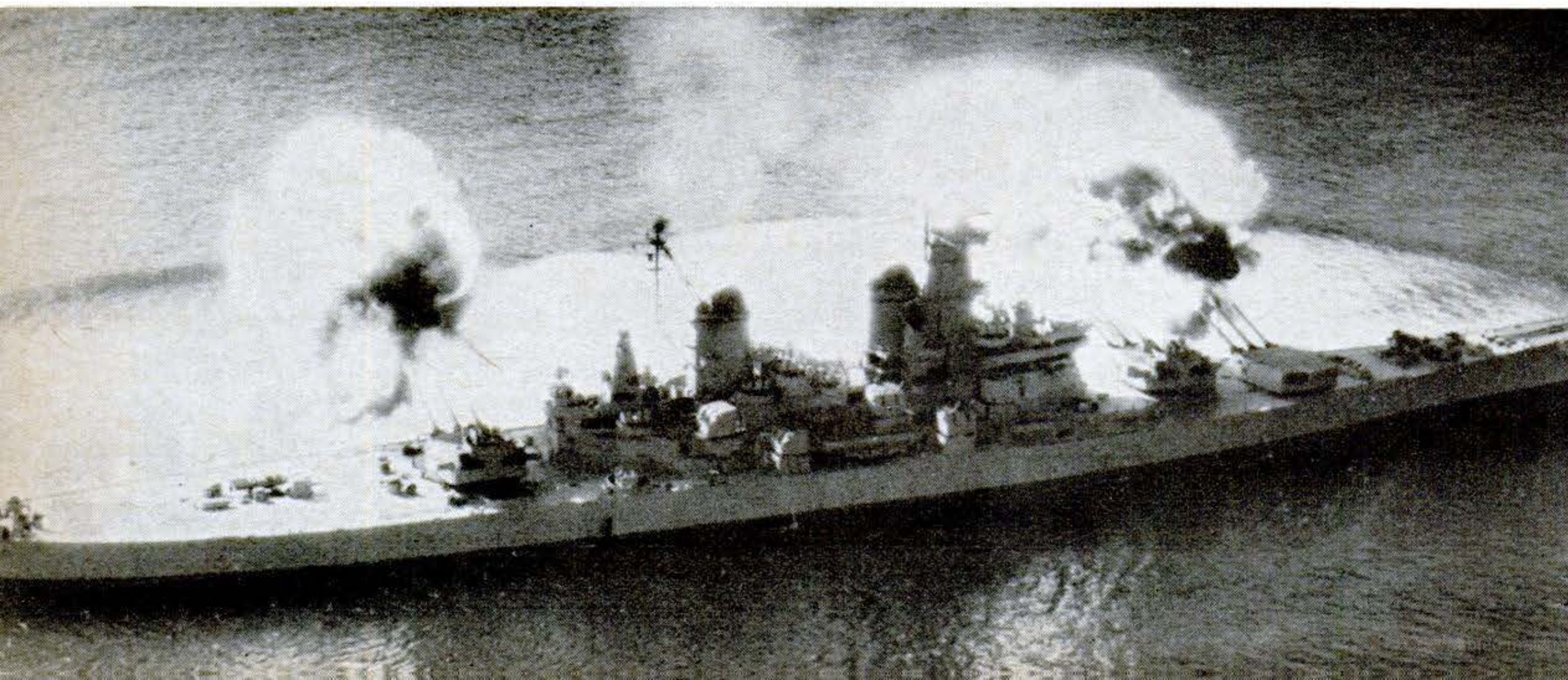
teeth. But only a battlewagon from the past—mothballed for 10 years—can fill a need posed by the strange quirks of current history.

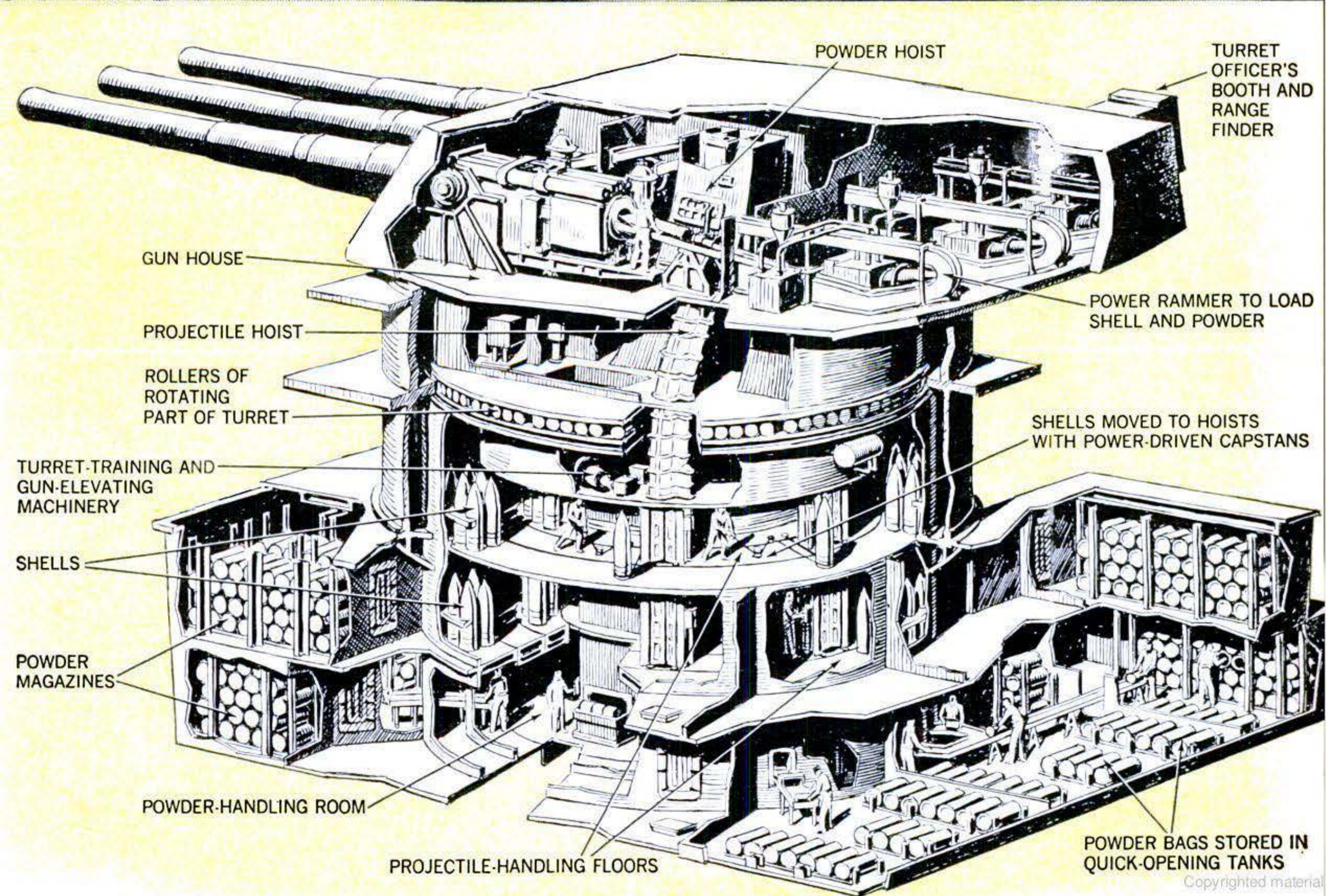
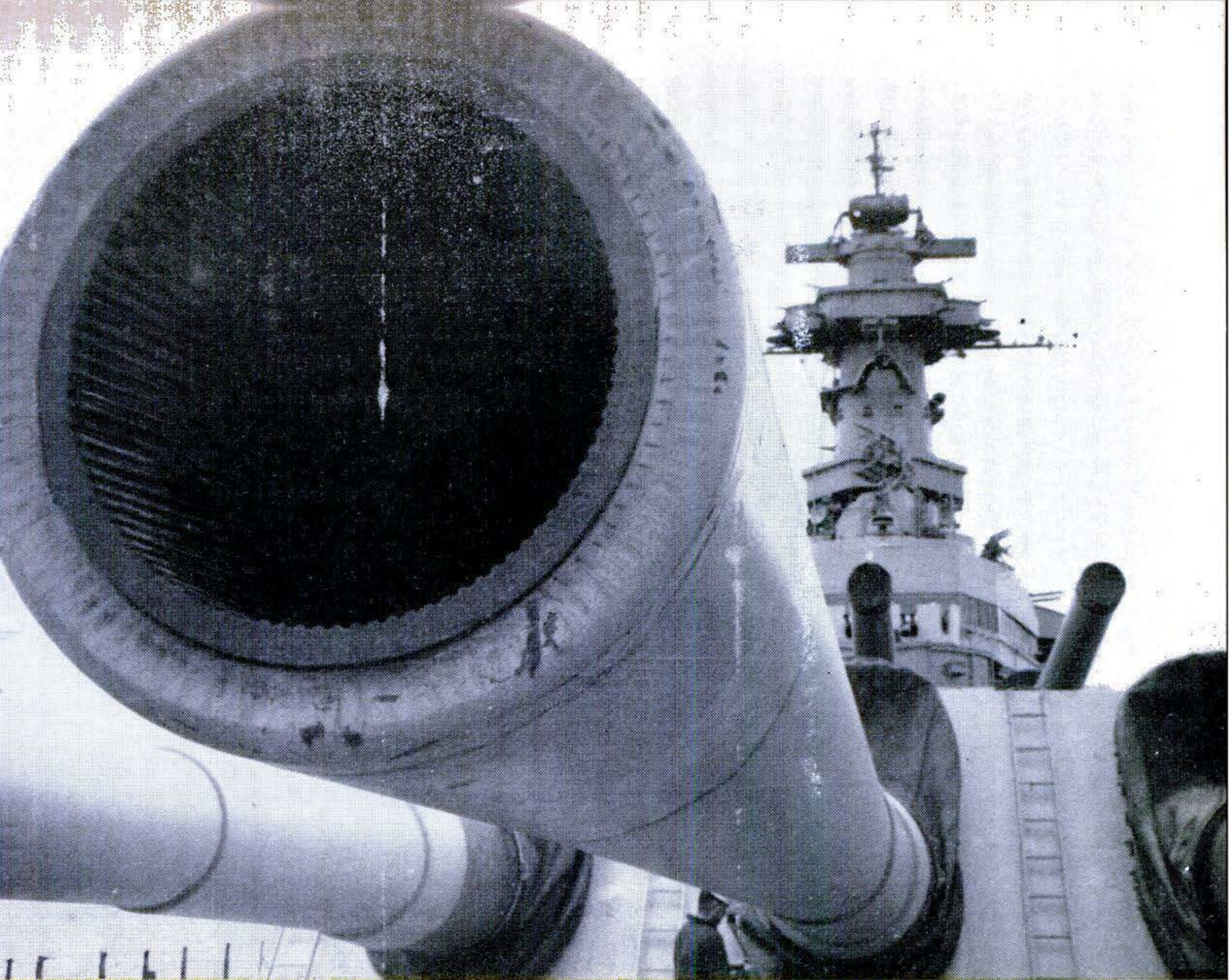
Along the North Vietnam supply trail to the south, Seventh Fleet "gunnery ships" are shelling coastal targets, in what the Navy calls Operation Sea Dragon. Destroyers' five-inch guns and cruisers' six-to-eight-inchers are bombarding ammunition dumps, missile sites, rail and highway links, coastwise barges. To do it, the thin-skinned warships run a gauntlet of counterfire from shore batteries, comparable in range and often dismay-

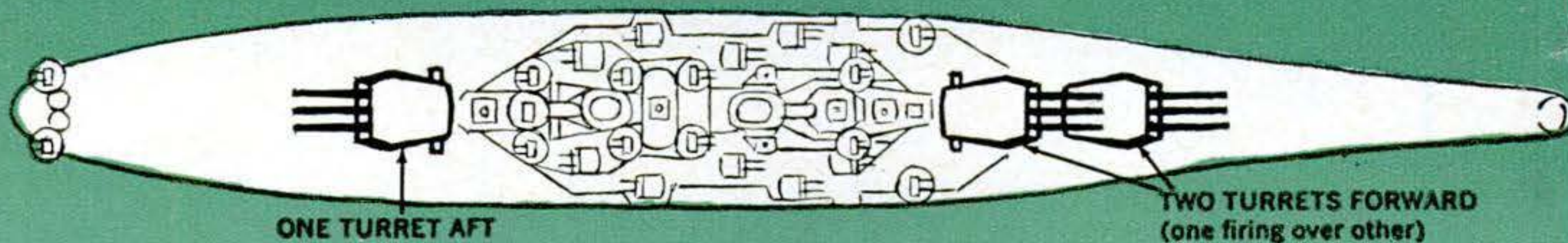
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Bombarding Vietnam coastal targets will re-enact New Jersey's role off Korea—where photo shows it firing all nine 16-inch guns at once, and being driven sideways through water by their terrific recoil. In top view on opposite page, you look into business

end of big gun on New Jersey. Below it is cutaway view of one of a battleship's 16-inch-gun turrets—a six-story fortress that requires a crew of 77 to man. View shows how its three guns are fed with shells and powder—each gun by separate hoists of its own.







Battleship New Jersey (photo at top) displaces 45,000 tons and is propelled by mighty 212,000-hp. power plant at 33 knots or more. It packs its punch

ingly accurate. At least three cruisers and nine destroyers have taken hits. Some crewmen have been killed, many more wounded. For a big-gunned and heavily armored battleship, in contrast, the mission is made to order.

What a battleship can do. Guns of 21-mile effective range enable a ship like the New Jersey to blast shore targets from beyond reach of coastal guns. Armor up to 18 inches thick cuts risk of moving closer, to hit inland areas. Tall-as-a-man projectiles of 1,900 pounds fell bridges and pierce fortifications that resist destroyers' and cruisers' shells. Those all-weather, day-or-night capabilities were demonstrated by the sister battleships Iowa, New Jersey, Missouri, and Wisconsin in just such shore-bombardment operations off Korea in the early 1950s.

Last May, therefore, the Navy began an \$800,000 study of the time and cost to restore one of these subsequently mothballed battleships to service. On August 1 the Defense Department announced its decision to reactivate the New Jersey. The nine-or-10-month estimate of the

in three turrets, each with three 16-inch guns, arranged as in diagram—two turrets forward, one aft. They can fire either singly, or all at once.

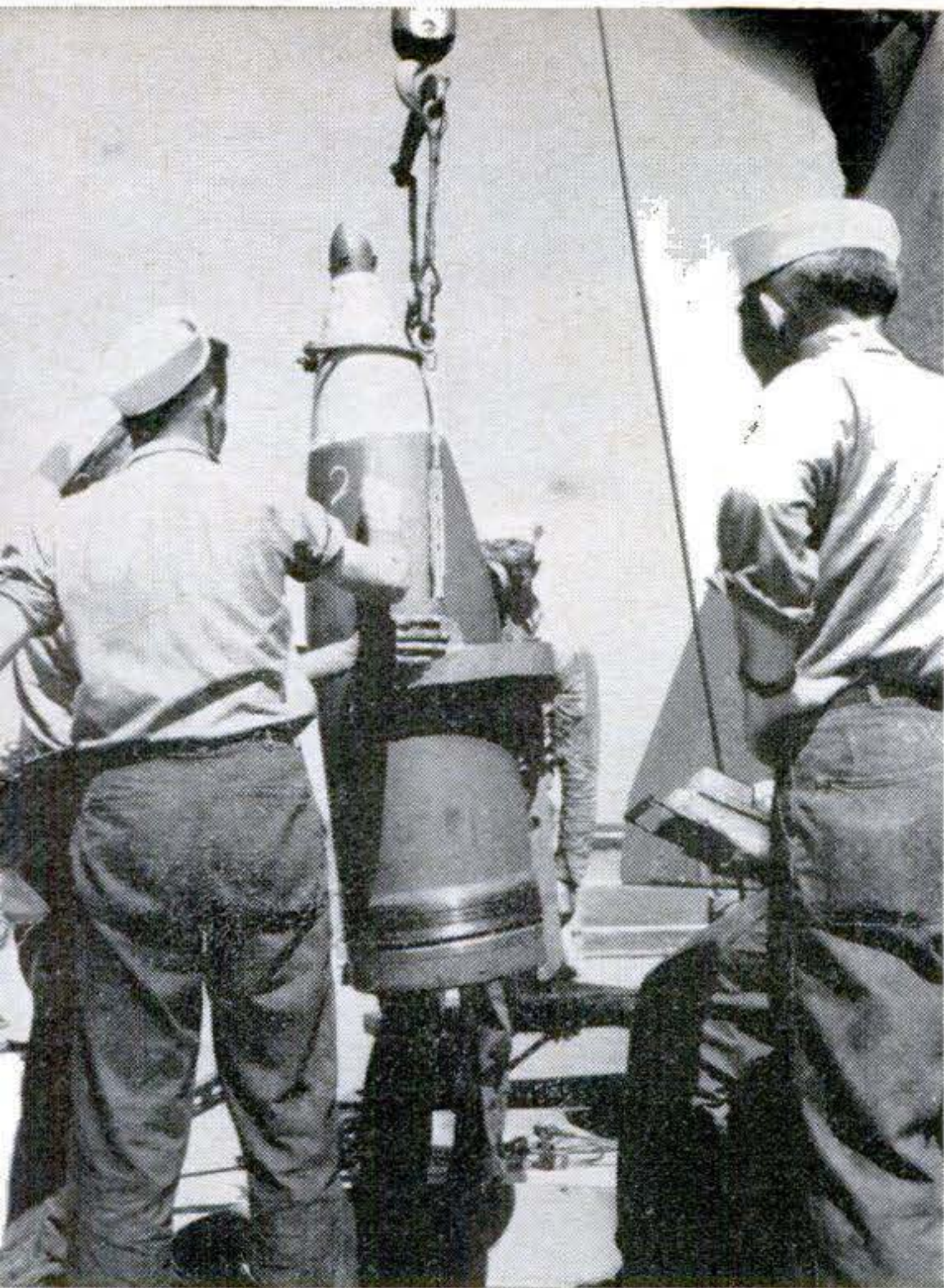
needed time, made in its announcement, indicated the ship might be ready to go by next May or June. A crew of 1,470, about three-fourths of her past complement, would suffice.

It took only four months to "de-mothball" the New Jersey for Korea. Extensive alterations to modernize her electronic equipment account for the extra time now. Her gear for radio communications will be updated to make it compatible with that of other ships of the fleet, and she will get sophisticated new radar installations.

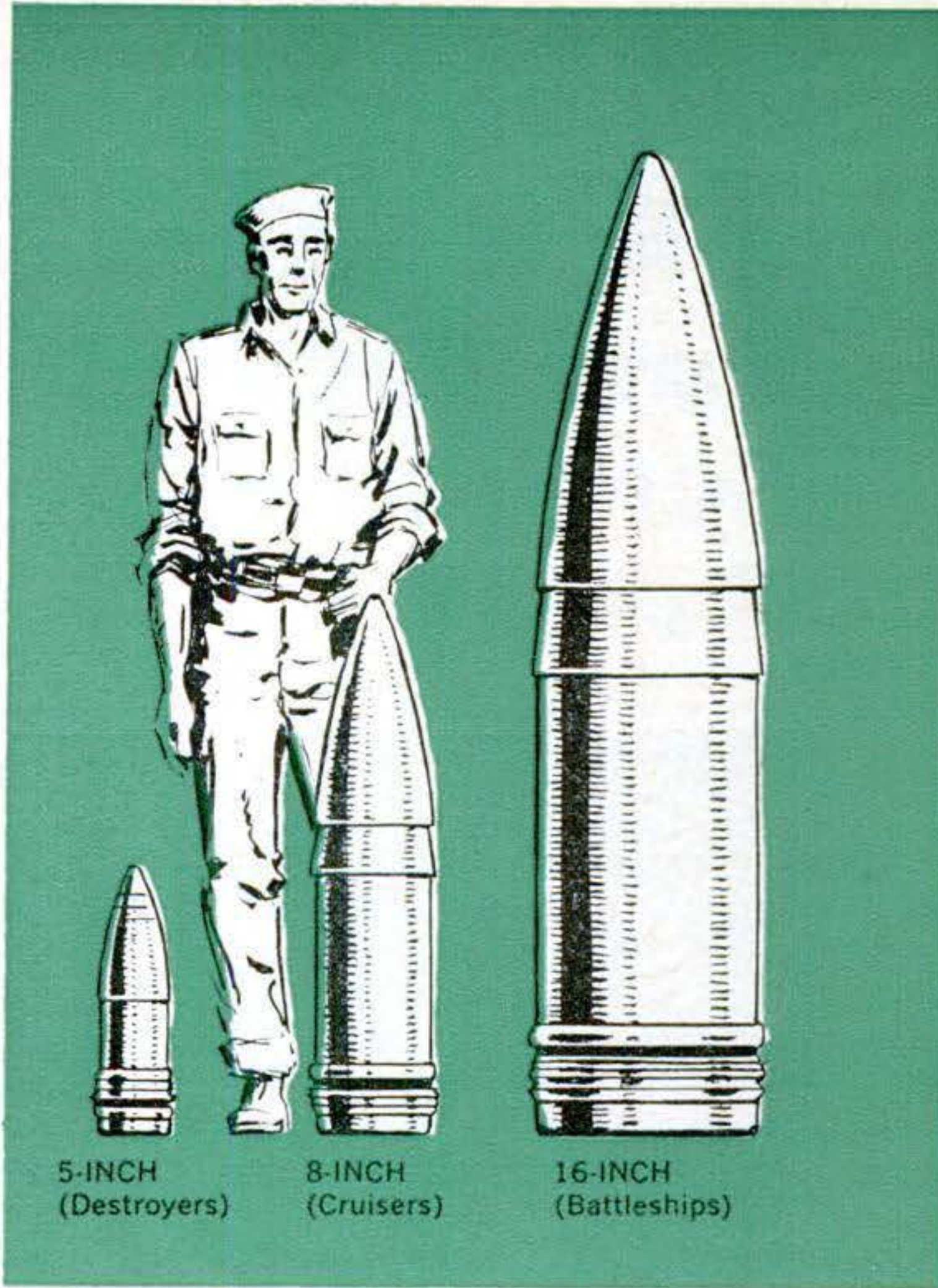
Navy's biggest guns. All told, the New Jersey carries about 100 guns, from 40mm up—but the ones that pack her punch are her nine 16-inchers, by far the Navy's biggest.

Three thickly armored turrets—each a fortress six stories deep, with a minimum crew of 77 inside—mount these great guns. What it is like when they speak, I have seen as a PS reporter on the wind-whipped deck of the Iowa, the first of the New Jersey's "Iowa class."

A buzzer's amplified warning braces



Sixteen-inch shell, being handled by New Jersey's crewmen, weighs 1,900 pounds. Warship can hurl it effectively at a target as far as 21 miles away.



5-INCH
(Destroyers)

8-INCH
(Cruisers)

16-INCH
(Battleships)

Biggest projectiles fired by a destroyer, cruiser, and battleship are compared in size—giving a vivid illustration of a battleship's hitting power.

you for the crash. The elevated muzzles belch orange smoke. Your ears are stuffed with cotton—but the concussion hits you all over. Watch salvo after salvo and you have taken a beating.

In daylight the speeding projectiles elude the eye—but at night, a red tracer coating makes a spectacular sight of three of them arching in formation across the black of the sky.

Guns like these, plus massive armor and fleet-worthy speed, define a “battleship”—the kind of warcraft that long was the measure of a nation's sea power. Originally its primary mission was to fight other battleships. Their major clashes—at Jutland in World War I, at Surigao Strait in World War II—were the classics of naval history.

Then, naval styles changed. Carriers challenged battleships' supremacy. Missiles came into favor over guns. Dealing battleships their final blow, the threat of nuclear weapons made their armor seemingly useless—and scattered the close battle formations of these “ships of the line” into dispersed forces of warcraft miles

apart upon the ocean. And so, by now, two decades have passed since any navy has built a battleship—and the old ones, most of them sent to the junkyards, are gone from the seas.

But the naval changes have outrun events. As it has turned out, no one since World War II has cared to risk using nuclear weapons—even small “tactical” ones. Instead we are seeing “limited” wars, fought with conventional munitions. The world may have scrapped its battleships too soon.

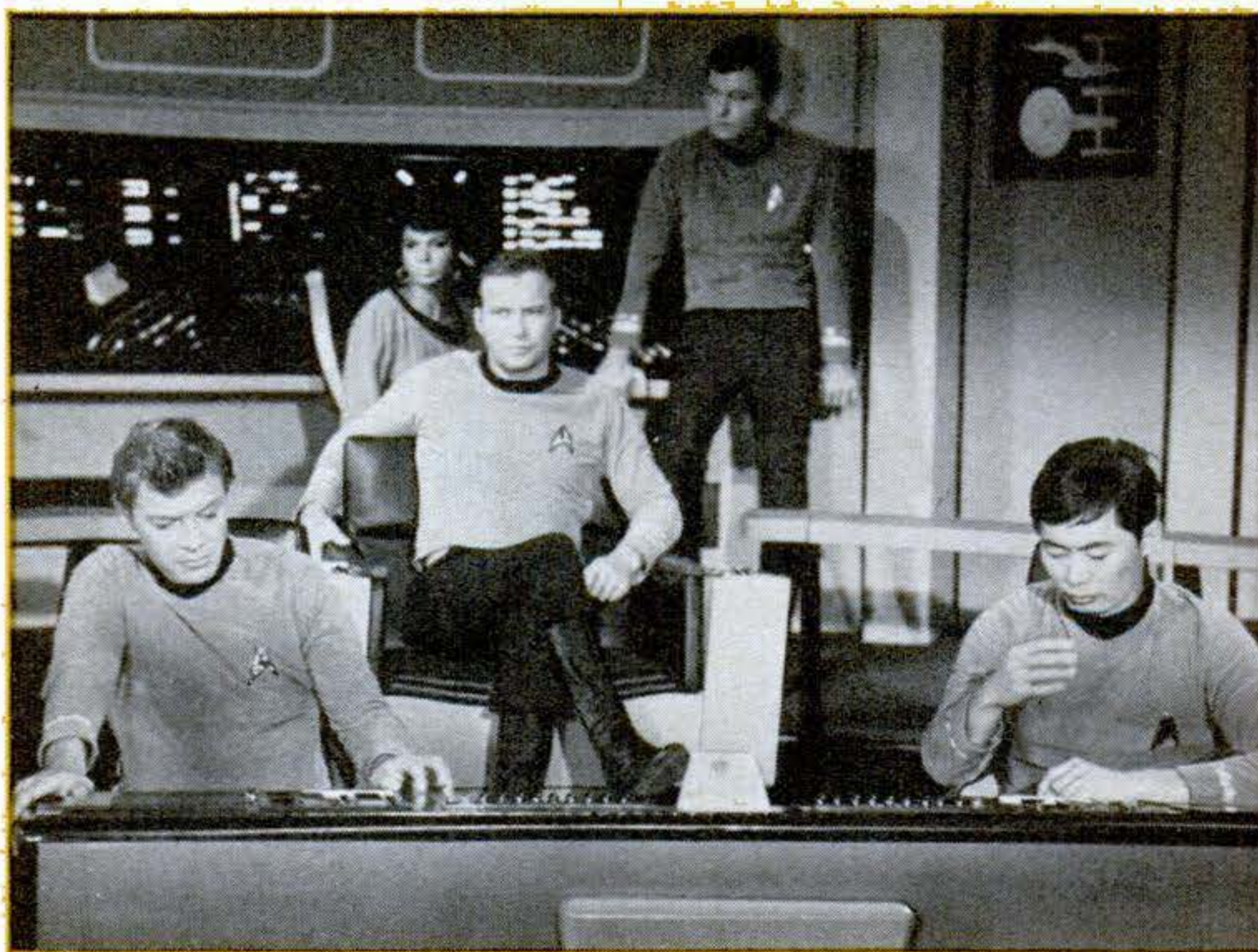
Fortunately the U.S. Navy, alone among those of the world, never quite wrote off battleships. It had them when they were needed in Korea, and it can recommission one now, because it had found a way of keeping such formidable veterans handy just in case.

Into mothballs—and out. De-mothballing the New Jersey means reversing a mothballing process, for keeping laid-up warships rustfree and fit, pioneered by the U. S. Navy after World War II. A triumph of technology over what had

[Continued on page 188]

TV's STAR TREK:

How They Mix Science Fact with Fiction



Shape of things to come? Placed 200 years in the future, the USS Enterprise (right) is a spaceship capable of exceeding the speed of light. It explores the distant reaches of our galaxy, visiting far-flung planetary outposts—all on TV, of course.

Command bridge, a bubble on top of the saucer section of the Enterprise, is the province of Captain James T. Kirk (played by William Shatner). Larger than today's naval cruisers, the starship has two engine nacelles attached to the engineering section. Main crew section (saucer) is 11 decks thick.

You're ready to believe that the fantastic adventures of television's popular spacemen will be possible in 200 years, for their "science" is a logical projection of present knowledge

By JAMES W. WRIGHT/PS West Coast Editor

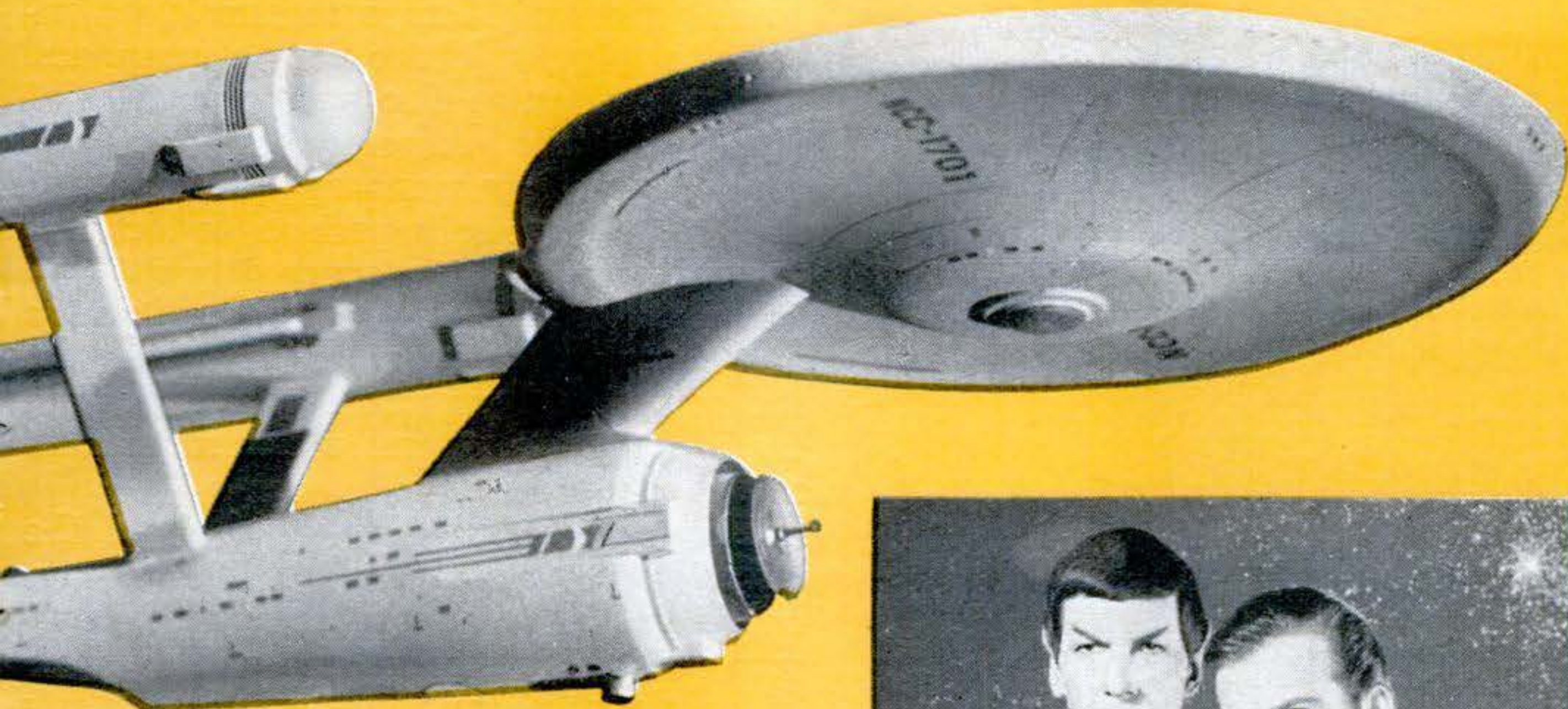
If you're one of the 20-odd million viewers who tune in each week to NBC-TV's highly popular Star Trek science-fiction series, you could be getting a much closer look at the future of space exploration than you realize.

The reason? The show is the only science-fiction series in history that has the cooperation and advice of the National Aeronautics and Space Administration; that employs a research firm to go through each script with an eagle eye

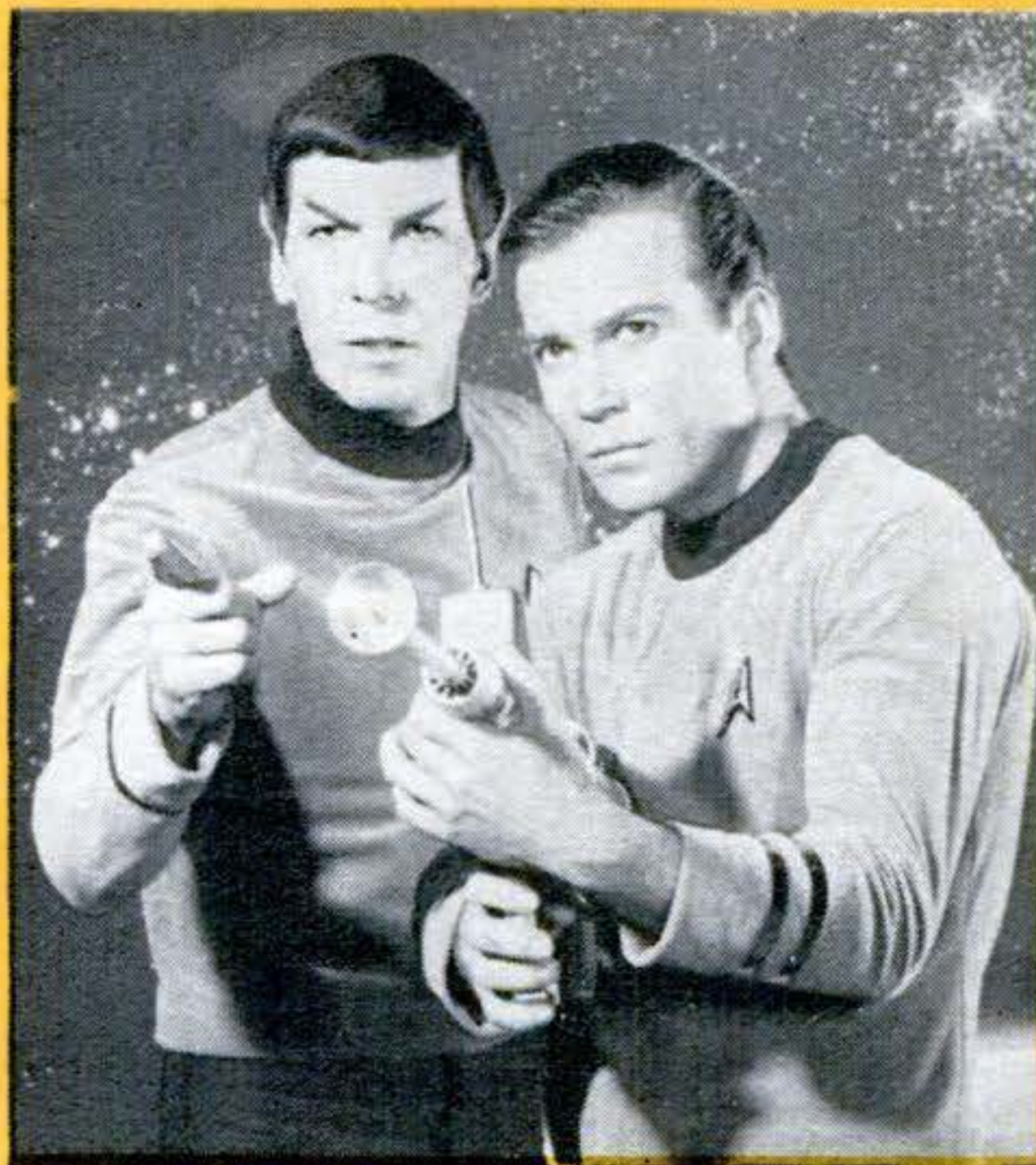
weeding out things that are completely impossible or untrue; and that maintains both an extensive technical library and contacts with scientists across the U. S.

No less an authority than Dr. Isaac Asimov, a professor of biochemistry and widely regarded as one of the world's top science-fiction writers, has called the program "the first good television science fiction." The show's audience—which includes a large number of space technicians, scientists, college professors, students—seems to agree.

It's conceivable that if the accelerated



USS Enterprise carries several shuttlecraft like the Galileo (above) that transport six or seven men on short missions within a solar system.



First Officer of Enterprise, Spock (left), comes from planet Vulcan. Played by Leonard Nimoy, Spock has pointed ears, extra-sensory-perception abilities.

space programs of today are continued, our own Apollos and Geminis might evolve into something the size and scope of the TV starship Enterprise. It is somewhat larger than a present-day naval cruiser, and carries a crew of 430.

Matter and antimatter. The Enterprise engines use matter and antimatter for propulsion. This is based on an accepted theory: Antimatter is any form of matter composed of antiparticles. Antiparticles are any group of elementary particles, such as positrons, antiprotons, antineutrons, etc., having masses equal to the neutron, electron, proton, etc., but with opposite charges and reversed magnetic moments. Contact between these contrasting particles results in immediate annihilation and the release of energy.

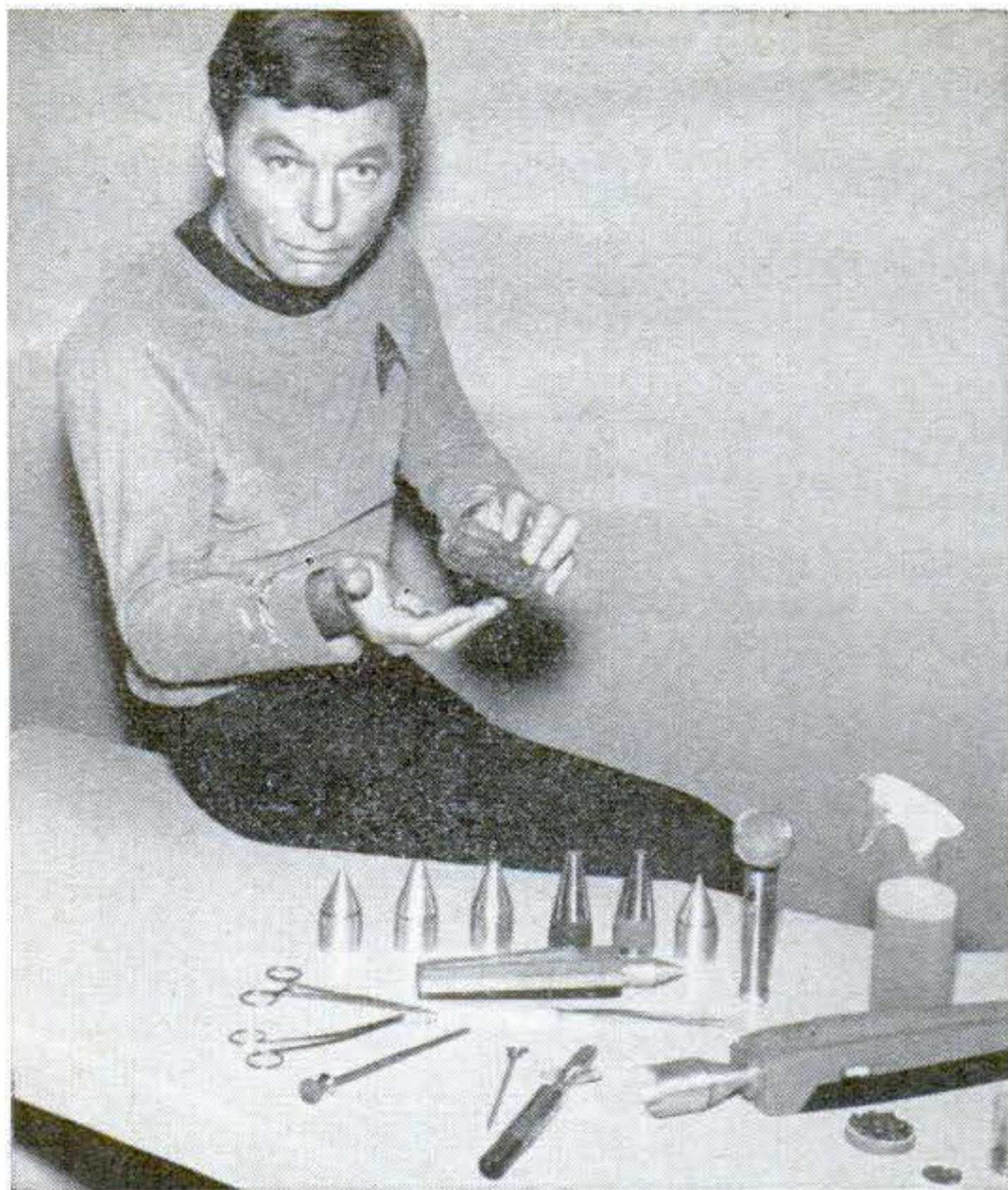
Stretching theory a bit, this release of

energy enables the Enterprise to travel faster than the speed of light. This is measured in "warp factors." Warp factor one is the speed of light—about 186,000 miles per second. Warp factors two, three, and four and so on are based on a geometric progression of light velocity. Warp factor two is about eight times the speed of light, four is 64 times, and so on.

The main weaponry of the Enterprise is its banks of "ship's phasers,"—artillery-size versions of the hand phasers and phaser pistols carried by the crew. These weapons are, of course, refinements of today's familiar lasers.

As a defense measure, the ship can put out an "invisible force barrier" that will protect it from almost anything. In concept, it's not too unlike current plans for

Continued



Dr. McCoy (DeForest Kelley) shows surgical tools of future. The uniforms of starship crew were suggested by actual NASA designs for long-range missions.



Pistol phaser is used as an emergency cutting torch in a dramatic Star Trek episode. The small recording device is the tricorder shown in detail below.



Tricorder, a descendant of the transistor radio, is actually a portable sensor-computer-recorder. Like other devices, it's in the realm of possibility.

antimissile defense systems which will use bomb-generated X rays to knock out incoming missiles above our atmosphere.

The Enterprise also has "navigational deflector beams" (a refined super-radar) which, guided by scanners, sweep out far ahead of the vessel's path to deflect meteoroids, asteroids, or space debris.

The entire ship relies heavily on its rows and rows of "computer banks." They set the course and maintain it, and operate the life-support systems, which include atmosphere and gravity.

The computer banks—which hold the entire body of recorded knowledge—can be connected to any of the ship's intercom or viewing screens and will (verbally or visually) analyze practically any known information in seconds.

For quick travel: "beaming." At distances less than 16,000 miles, travel from ship to planet surface and return is provided by the "transporter." This device can convert matter into energy and "beam" it to a fixed point, then reconvert it back into its original form. It is used for both crew and cargo.

Among the portable devices used by the crew is the "tricorder," a portable sensor-computer-recorder. The epitome of miniaturized solid-state electronics, it can be used to analyze and keep records of almost any type of data on planet surfaces, besides sensing and identifying various substances.

Gene Roddenberry, Star Trek's creator and executive producer, has a passion for accuracy and scientific probability. He consults several leading medical authorities for information about the plausibility of various rare diseases his writers invent. In return, a medical group recently asked for, and received, a tape of the "beep" that the Enterprise crew uses in connection with their small hand communicators.

The medical men wanted the beep as a one-of-a-kind signal that would be instantly recognized by doctors who carry small pocket receivers tuned to their emergency calling service.

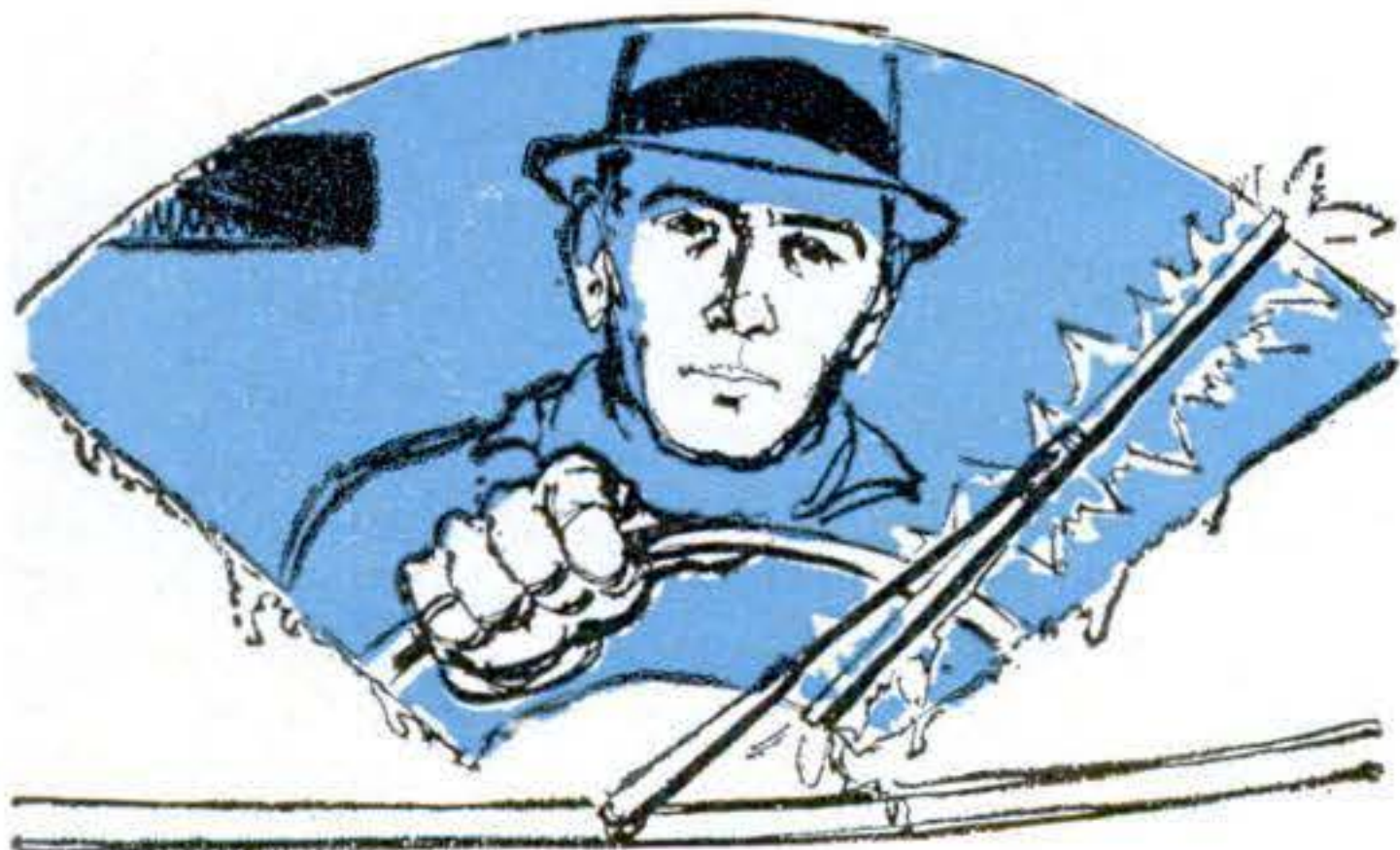
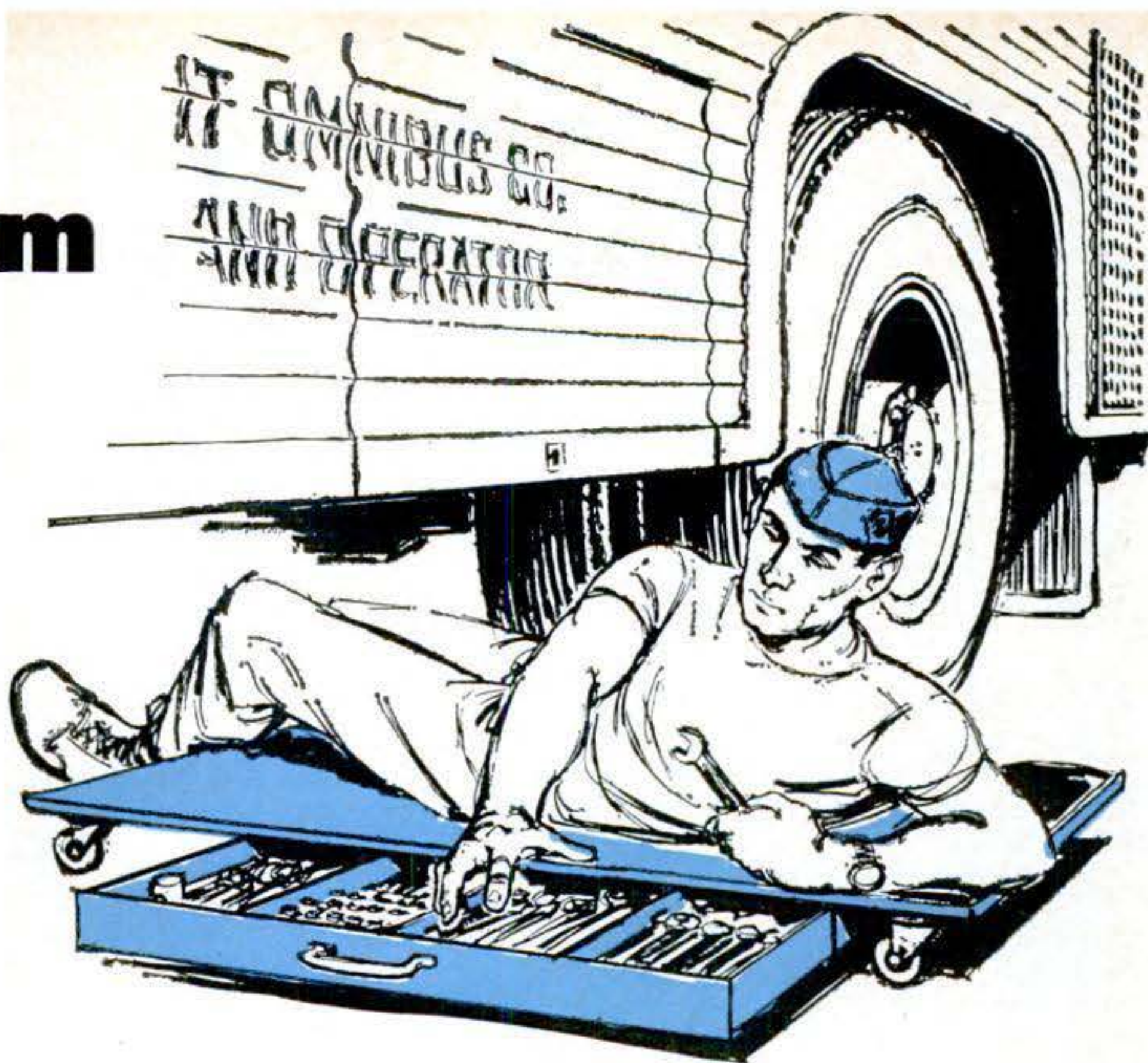
And recently, the U.S. Navy sent a group to study the layout of the Enterprise's command bridge. The functional and efficient bridge served as a model for a new communications center they were designing.

P S

"I'd like to see them make..."

DRAWINGS BY DANA RASMUSSEN

Mechanic's creepers with a compartmented tool drawer. With each tool in its own spot, you could easily find the right one.—*L. M. Workman, Wichita, Kans.*



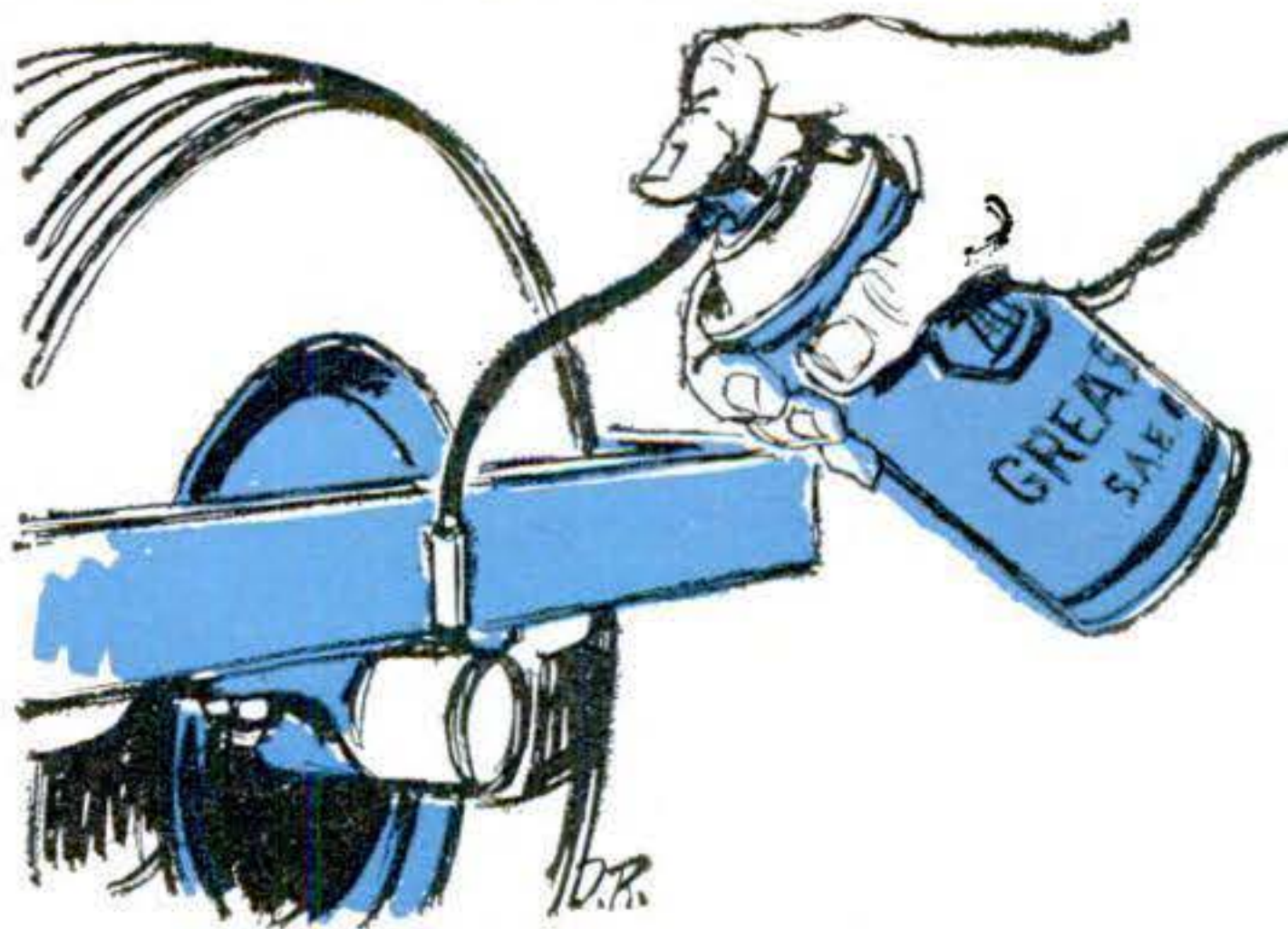
Heater coils in windshield-wiper blades. Turned on in bad weather, they'd keep snow and ice build-up off the blades and windshield.—*M. J. Nowaski, Coldwater, Mich.*



Boots and overshoes that would give people more traction on ice. Why not embed metal studs—like those in car tires—in rubber soles? —*Elmer M. Zarn, Chinook, Mont.*



A fold-down step for the wall at each side of the closet. Then shorties could reach high-up items, double-piled on an overhead shelf.—*R. H. Morgan, Montville, N.J.*



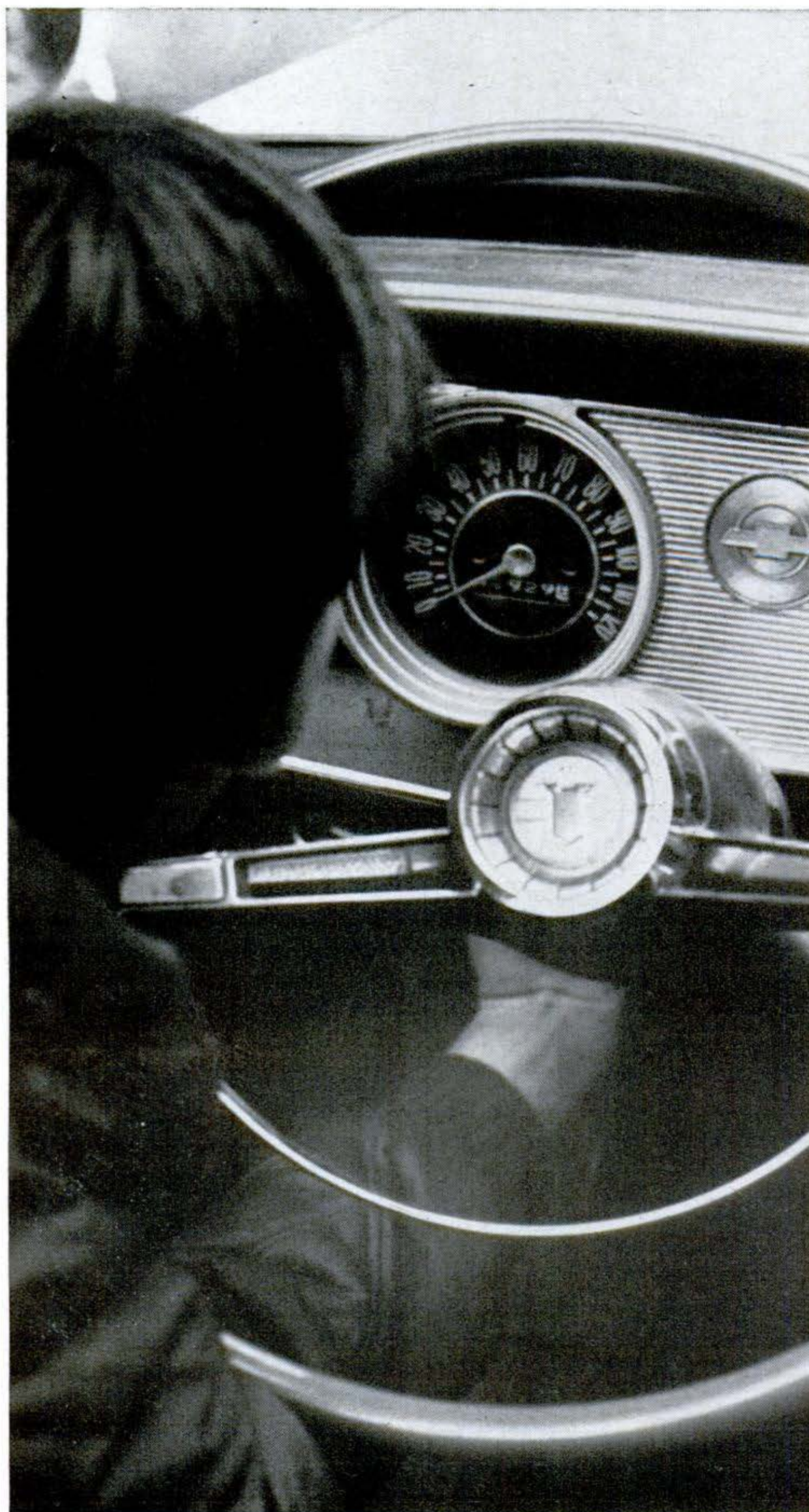
Canned grease in a disposable aerosol can. A nozzle attachment would give you a grease gun for little jobs around the home or shop.—*E. E. Swanson, Whittier, Calif.*

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

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

BUYING A USED CAR?

“I’ll Cheat You If



EDITOR'S NOTE

In this remarkable article, a self-confessed “odometer artist”—who understandably chooses to remain unidentified—reveals how easily he and his colleagues turn back the mileage on used cars to make them sell faster and at higher prices.

The presentation here is designed to give no information to the crook that he does not already have. To the honest buyer, who, heaven knows, needs all the help he can get, this article is offered as a guide to self-protection.

An artist at work

Series of photos (taken with speedometer head removed from unit for better view of tool in use) show mileage being lowered on a Ford. After removing the automatic



You Don't Watch Out"

By an "Odometer Artist": The inside story of how used-car mileage is faked—and how to spot the telltale signs

This year millions of Americans will buy a used car. They'll buy different makes and models, and at different prices, but most of them will have one thing in common—they'll drive home a low-mileage car. And that low mileage will have been a factor in their decision to buy. Unknowingly, many of them will have played their part in the "great odometer game."

The game is played by each individual for his own reasons: A car owner resets his high-mileage model to get a better deal at trade-in time; a dealer resets to produce a low-mileage car that will sell at greater profit. They both reset to get increased time under a fixed warranty, forcing the automobile manufacturers to

assume the liability for needed repairs.

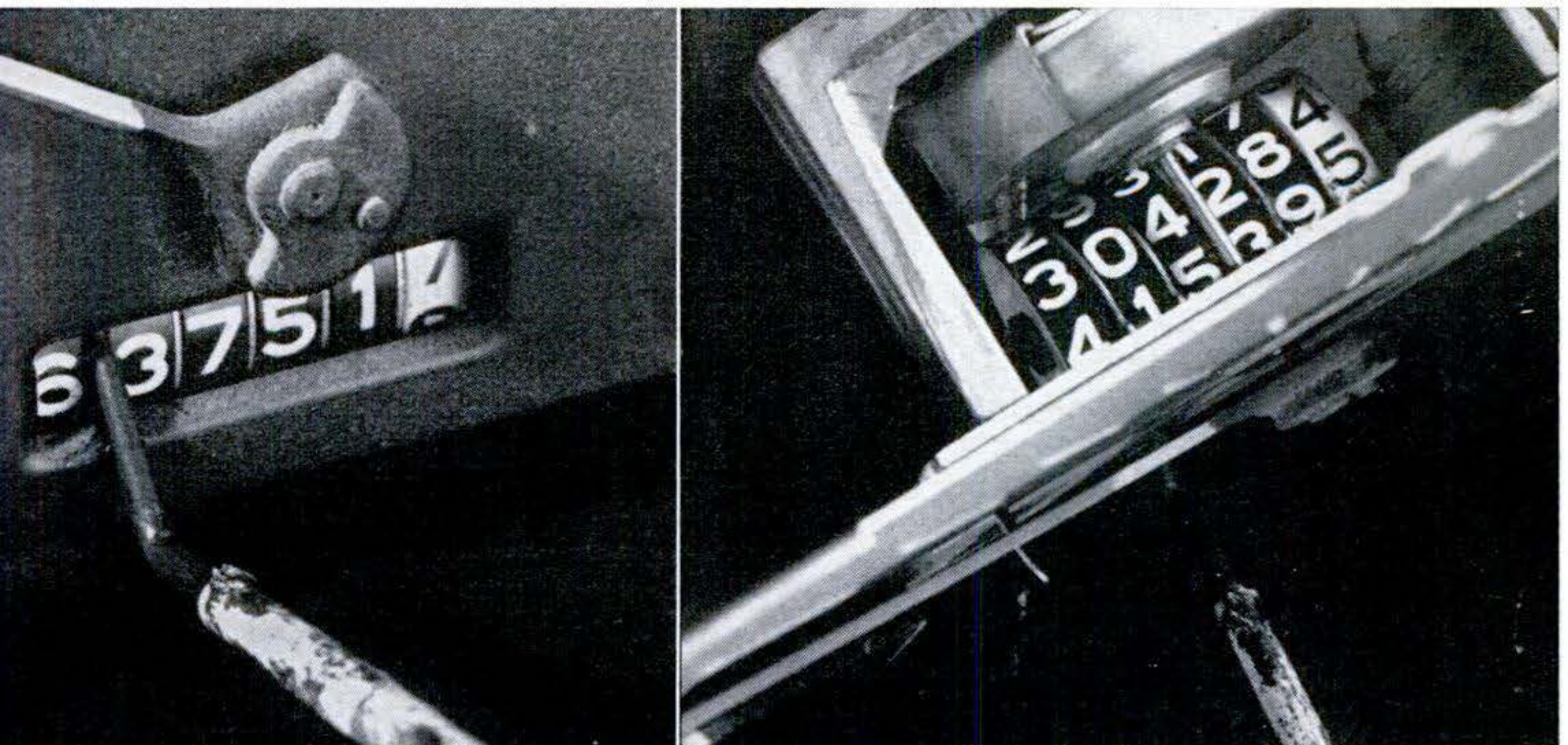
On the inside. For the past three years, I have worked with a group of professional "odometer artists." The game I have described is played every day of the week in every locality I've worked. It is, perhaps, America's biggest fraud. Of course, the public knows about odometer resetting. They picture it as an occasional occurrence by some few shady dealers—a time-consuming process involving removal, or the use of a drill or geared-down motor. And they believe, falsely, that the numbers will never be in alignment after resetting.

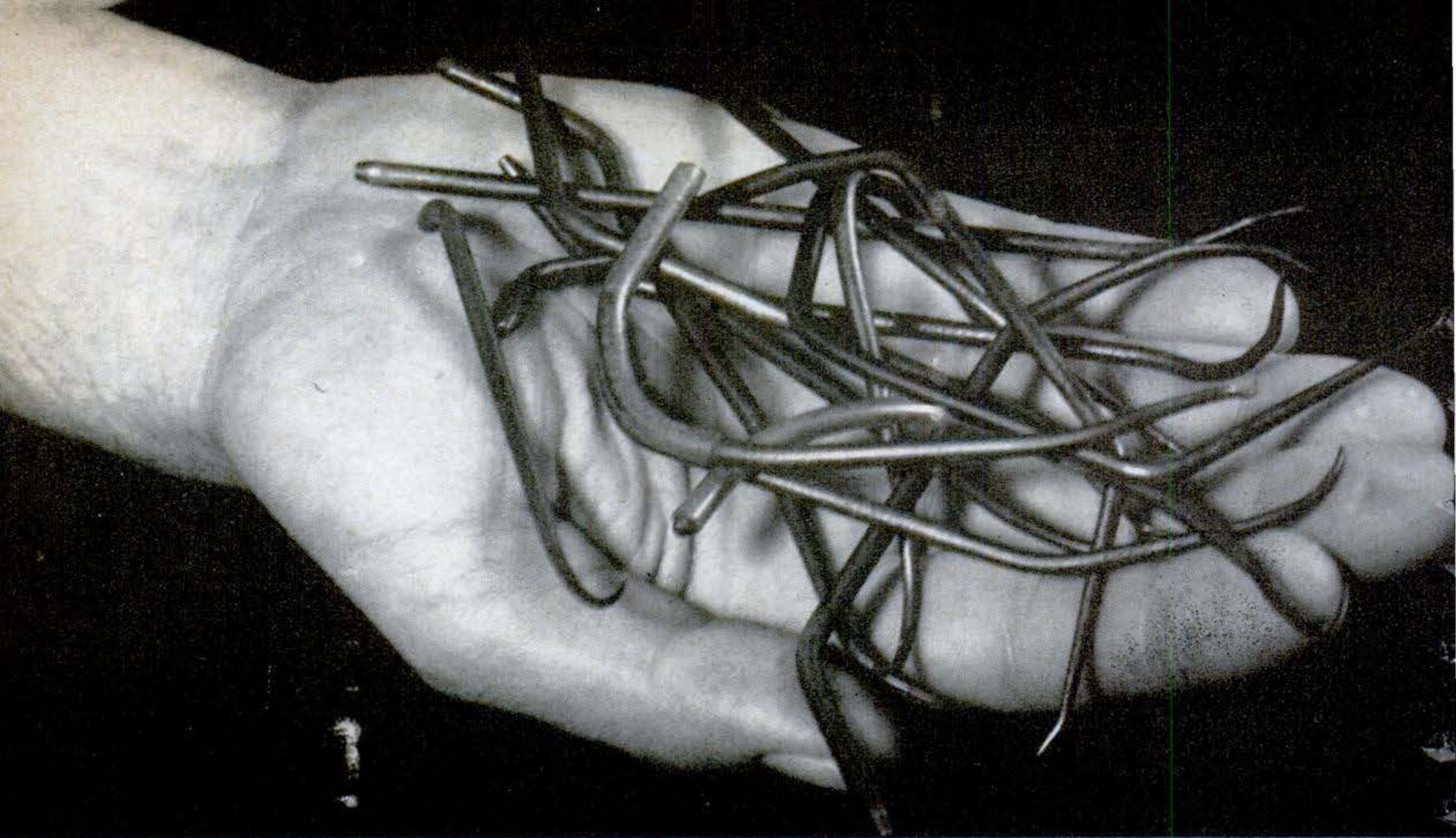
They may find it hard to believe the state of the art as I know it.

Today, odometers are reset in minutes,
Continued

transmission quadrant, the pro breaks the plastic below the odometer numbers. Replacement of quadrant will hide all traces. Below, the point of the tool is inserted to roll the first digit. This is usually the only number turned, but all numbers can be turned.

Typical construction of odometer drums used on all American cars can be seen in this photo. The assembly is composed of six plastic drums separated by five metal spacers. The spacers referred to in the article are clearly visible between drums.





Here are some of the tools of the trade

A handful of tools—reshaped ice picks—will handle a good cross section of late-model American cars. There is enough similarity among all manufacturers' odometers so that each tool will usually work on

several different makes and models. The method of access dictates the shape of the tool. Most foreign cars have odometers with external gears; a small screwdriver, bent to shape, is used on these cars.

and on a tremendous scale. An artist can reset 50 to 100 cars a day. He works a regular route, using a few simple tools, and may earn an annual income exceeding that of many professional men. Average income for a full-time artist is \$15,000 to \$25,000 a year. This gives you some idea of how many cars are reset.

The tools of the trade. Common ice picks, heated on a stove, are bent to the required shape for each car. This simple but effective tool is responsible for the birth of the "artist" and for the great increase in resetting. Most artists make their own tools; but similar tools are available to dealers. "Salesmen" visit car lots, dealers, garages, and service stations, demonstrating and selling a set of 14 tools for \$49.95.

Use of the tools requires practice, however, and most dealers prefer to hire an artist. And, too, I've had dealers tell me their lawyers advised them not to reset or let their salesmen reset their autos. An artist usually uses 20-22 tools.

Resetting today is standard in the automobile business. Its extent can be explained simply—if there's high mileage on a car, it's reset. A dealer who doesn't

reset odometers is the exception. The simple ice pick has made the job a lucrative one. Here's why:

- It's fast. Resetting (known as "picking") can be done without moving cars from the lot. Usually the cable isn't even disconnected and the speedometer still wears its coat of dust afterward. Most cars can be reset to a lower mileage in five or six minutes and—with a good artist—the numbers will be perfectly aligned.

- It's cheap. Cost has been greatly reduced by the "pick." It will be further reduced as more and more artists appear. In most areas, \$3.50 to \$5 is a standard price—pretty cheap for the value increase in the car.

- It's available everywhere. Every locality has its artist. I know of no state east of the Mississippi that isn't covered—not only in all large cities, but even in towns with only two or three small lots. From two to nine artists are walking the streets of Atlanta, Nashville, St. Louis, Miami, Chicago, Huntsville, Memphis, New Orleans, and Birmingham. In New Orleans, incidentally, you simply call an answering service to get an artist.

I worked through these areas for two years on a regular route of both new- and used-car dealers. Based on these two years, I'd say that almost all used cars on the market today are reset. Because the cost has dropped, dealers are resetting older cars they would have ignored a few years ago. To remove and reset a late-model Chevrolet's odometer used to take from one to four hours; today it's "picked" in about five minutes.

More cars are being reset for warranty purposes, too. The big customer here is the new-car dealer. I would estimate that at least three out of 10 demonstrators today have been reset. This is usually a big business for an artist at model change-over. Ten thousand miles still under warranty is a good selling point.

Individuals are also resetting more each year for warranty. You can't even be sure of the mileage on rental cars. Several agents of one major rental company reset cars two and three times each for warranty purposes.

I wouldn't even venture an estimate on how much car manufacturers spend each year because of reset odometers.

In the years I've worked in the field, I've watched the practice of resetting grow out of control. On lots, there are '65 and '66 models showing 20,000 miles that I know to be reset from 90,000 miles—usually salesmen's cars. To the average driver the mileage would appear realistic.

The cars are reset by appearance alone. They are almost never reconditioned.

The resetters have filled the highways with cars in need of repair, driven by owners who believe the odometer figures and fail to realize the amount of car wear accumulated in the 50-60,000 miles that don't show up.

The only thing that can stop the fraud is public knowledge of the extent of resetting—and the ability to recognize the signs an artist leaves.

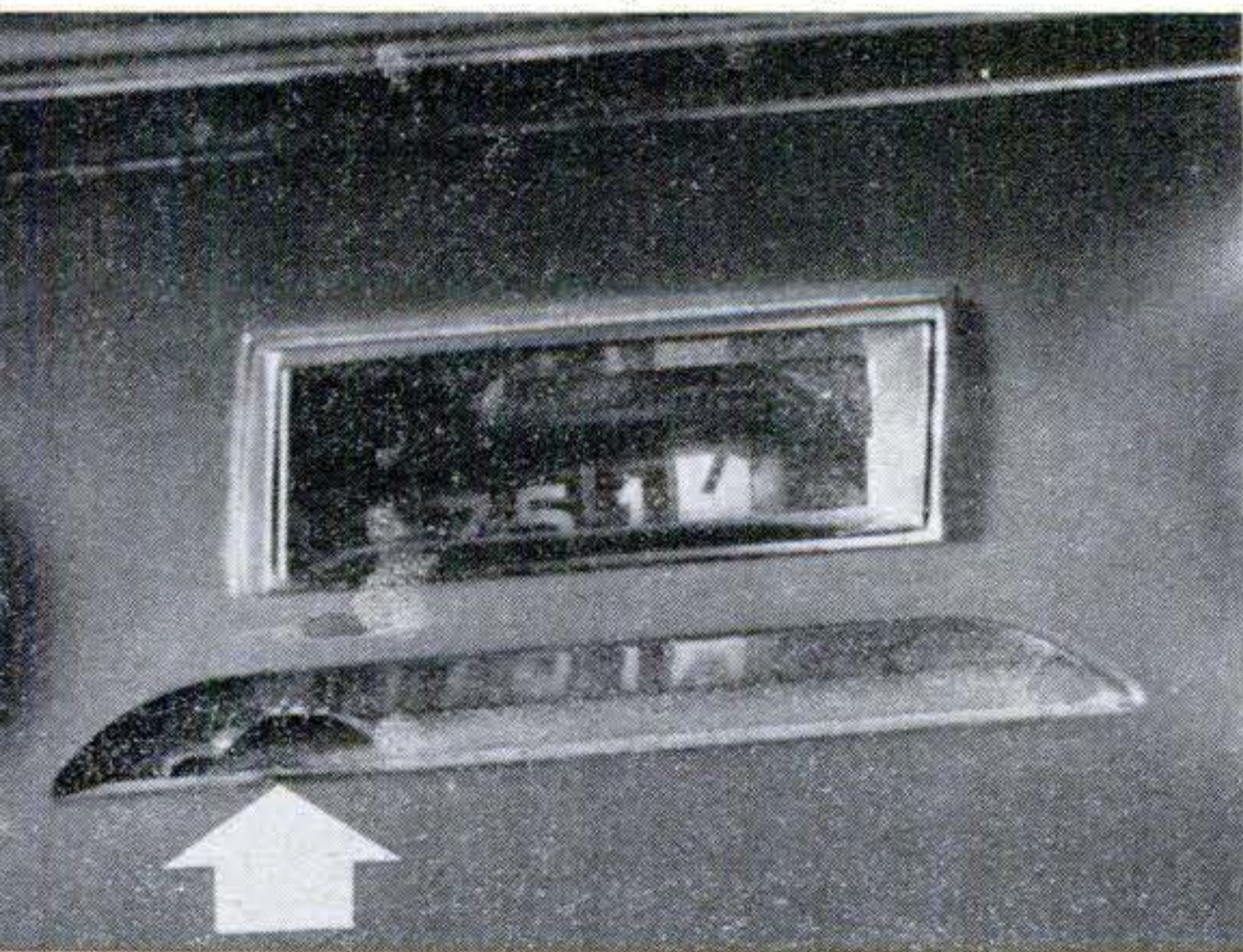
How an artist uses a pick. These tools are sharp enough to penetrate the cardboard tubes used between the instrument lights at the rear of the speedometer case and the indicator lights on the instrument panel. The tubes localize and direct light to the panel. The picks are strong enough to pry the number to any position.

That's the secret of the game. The pick, held in front of the numbers, is positioned between the number to be rolled and the spacer next to it. A simple pull, with the pick acting as a wedge, and the number rolls. The number showing is pulled slowly and gently until it has moved at least partially out of view. Each subsequent pull will then roll one to three numbers.

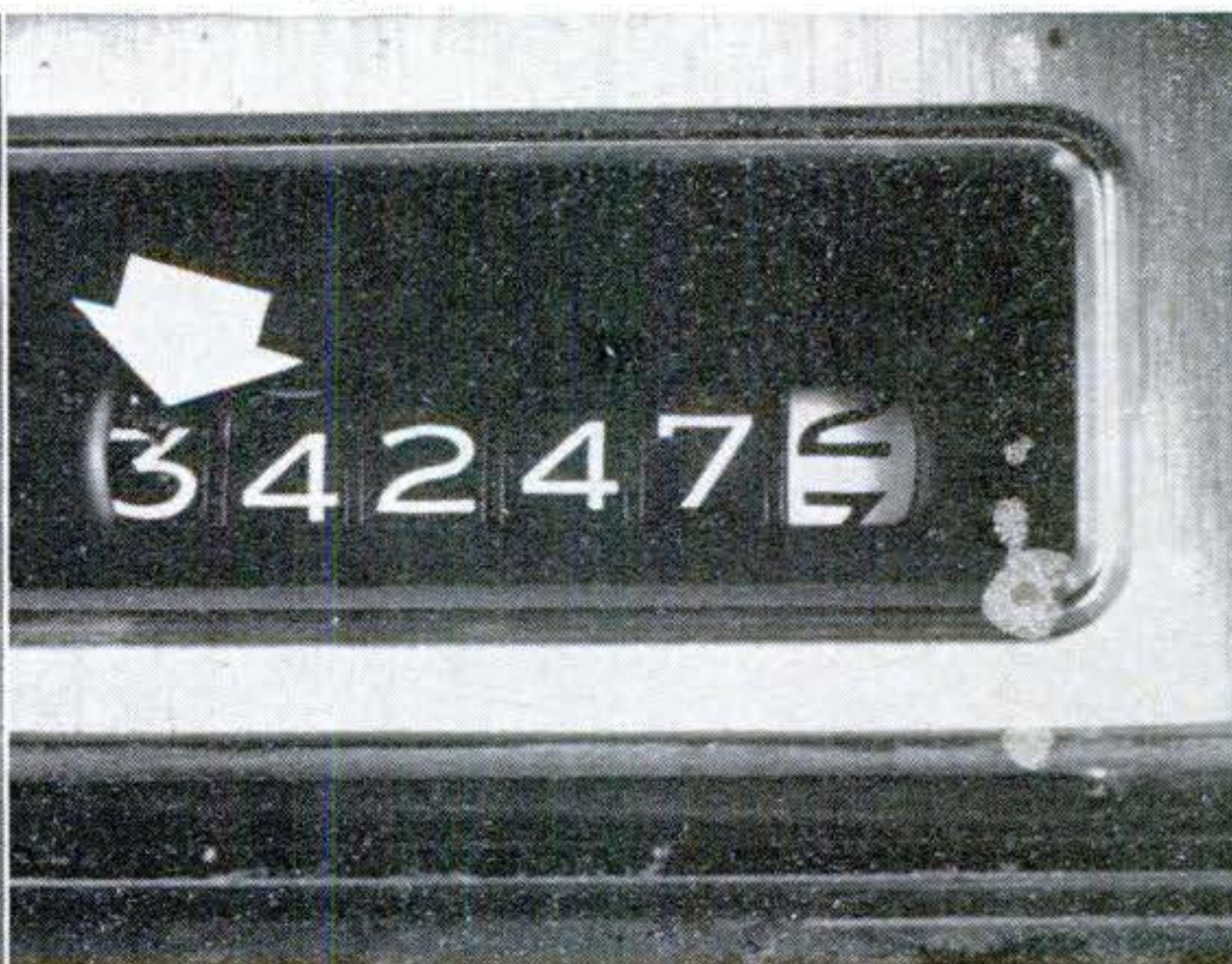
The entire operation takes less than three minutes. The picks are kept sharp; one slip will scratch completely through a number. Usually you work against a

[\[Continued on page 176\]](#)

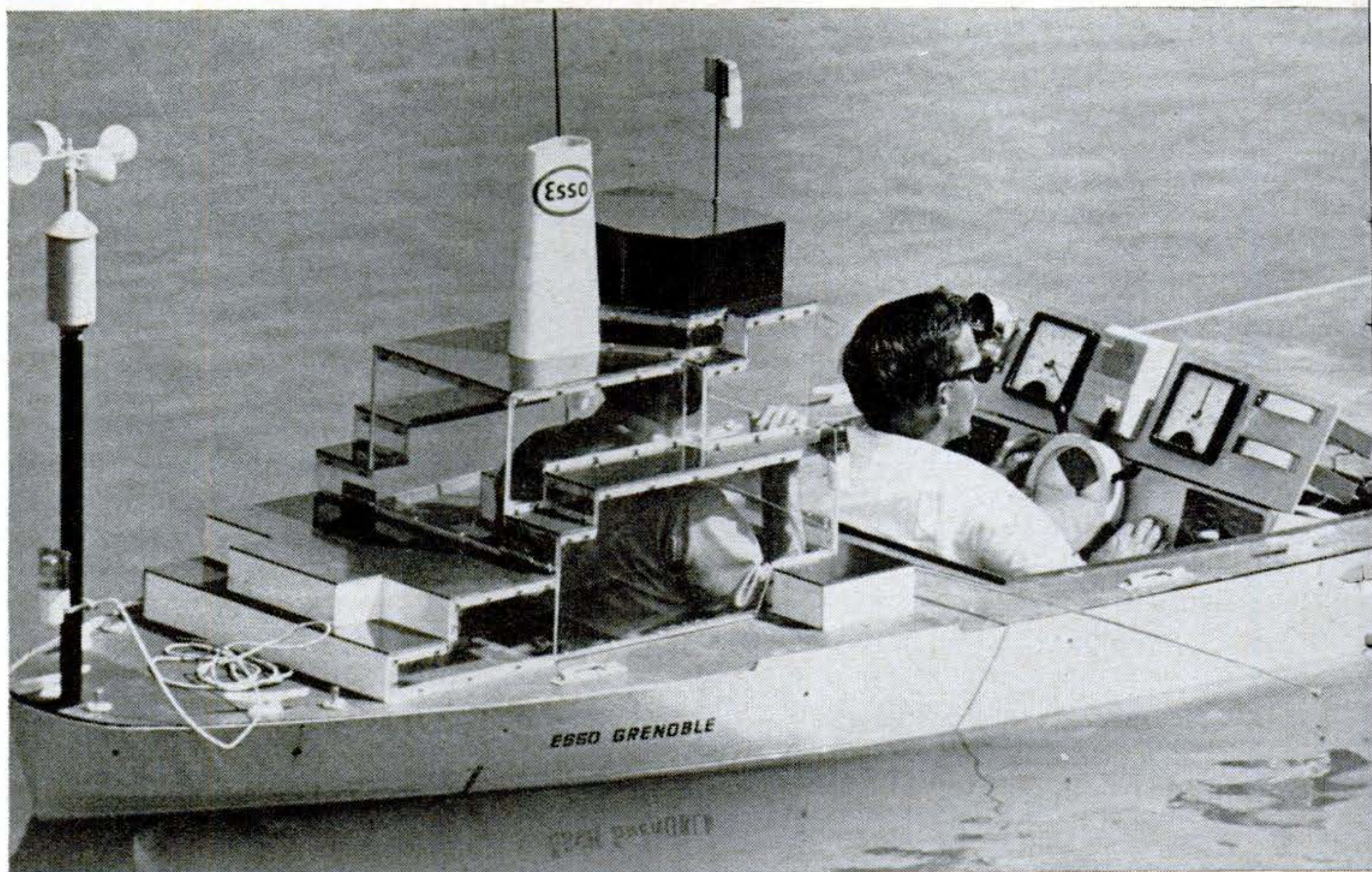
Two clues to phony odometer readings



Access hole made in plastic below odometer numbers can be found on 1960-62 Fords by removing the transmission quadrant. Function of plastic is to illuminate quadrant with speedometer bulbs.



First clue to look for in any used car is indicated by arrow. Nothing in a speedometer unit will scratch an odometer number. Scratches indicate only one thing—a tool has been used to reset the mileage.



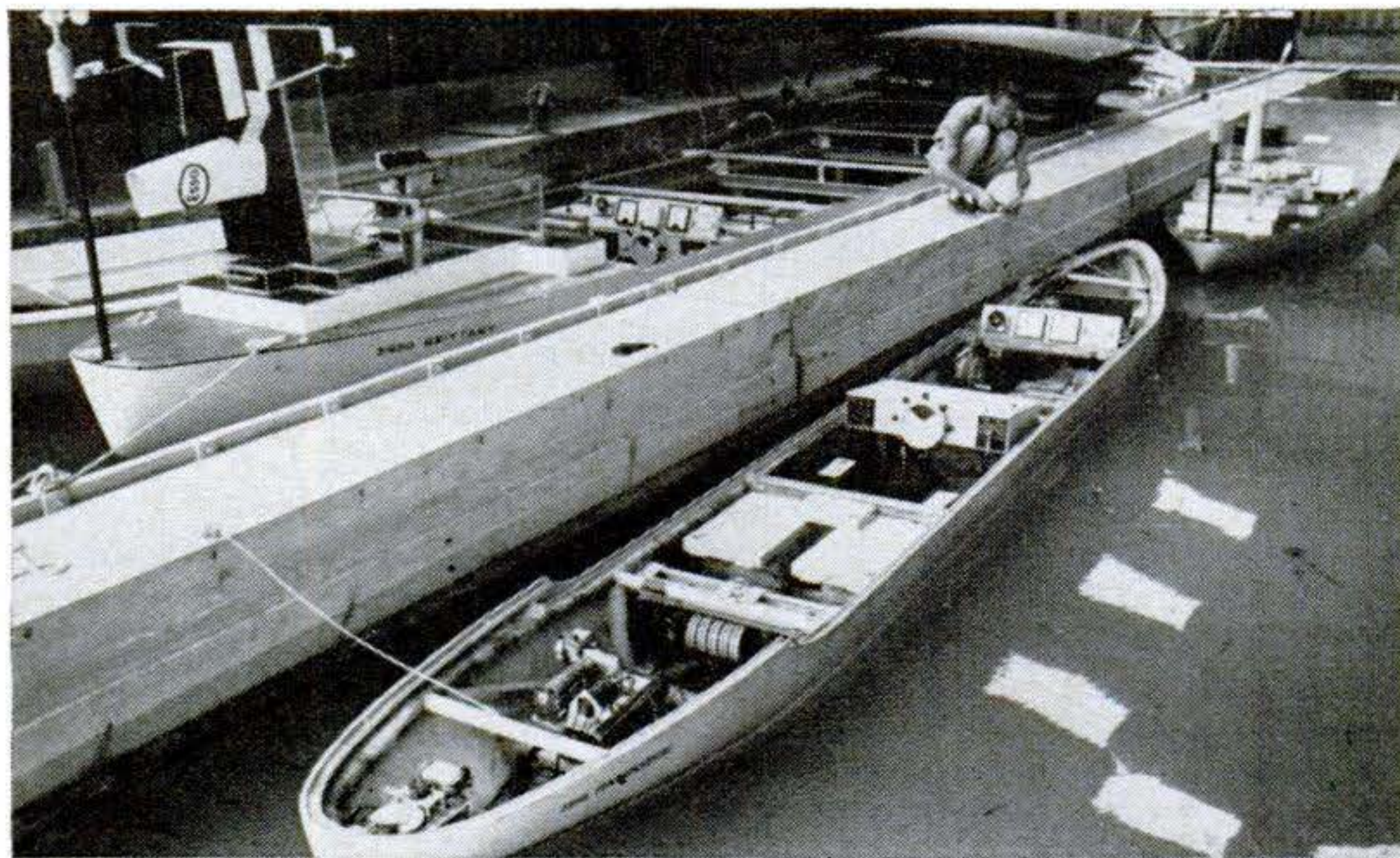
"Bridge" has radio, engine-room telegraph, instruments for items like rudder angle, prop r.p.m.

Tiny tankers train pilots

On a remote lake in southern France, the Standard Oil Co. of New Jersey is training officers of its tanker fleet to handle the leviathans of 190,000 deadweight tons now on the construction ways. Biggest of present-day vessels they will replace are less than half that size. The training vessels are built to 1/25 to 1/40 scale.

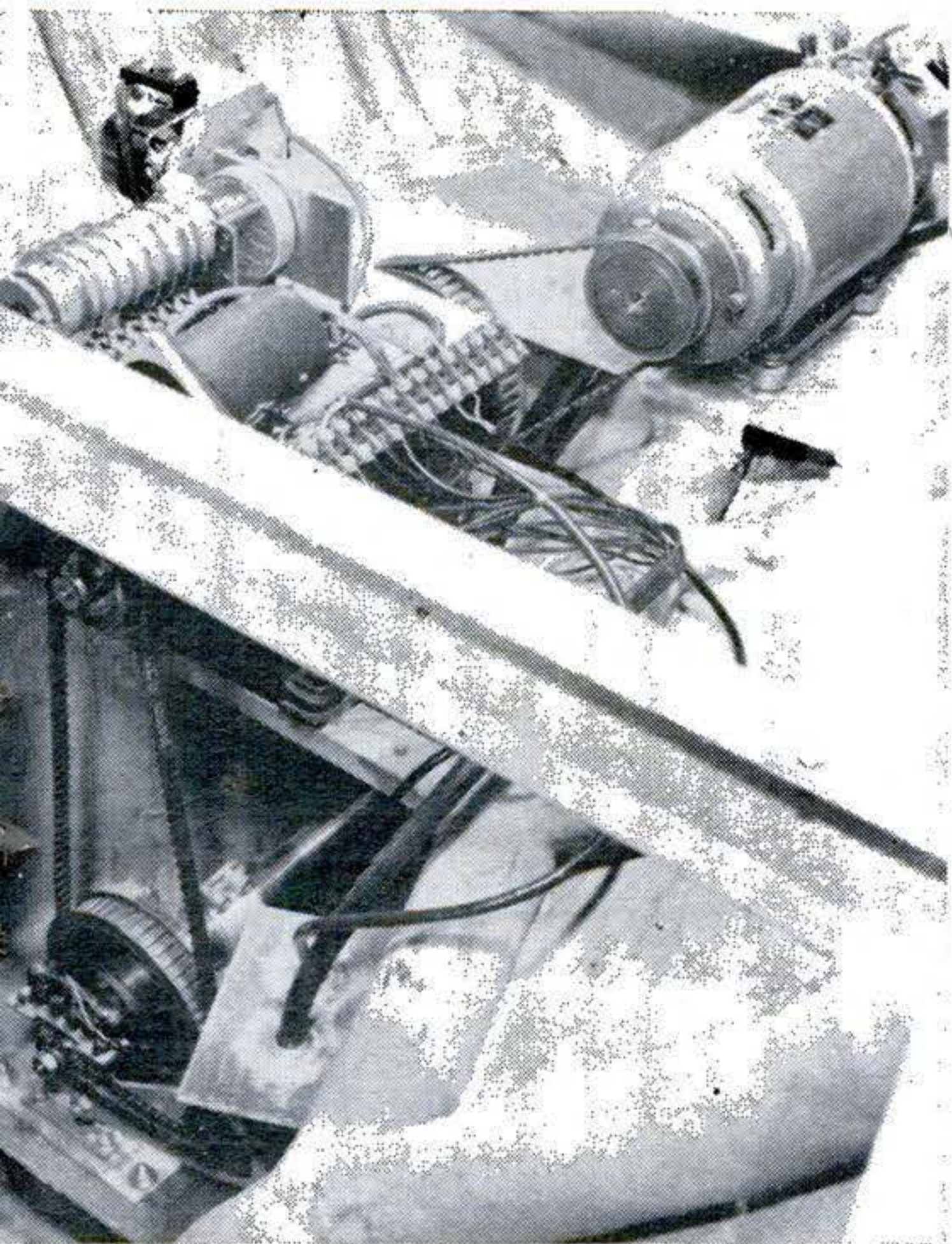
The tiny tankers, propelled by a .425-hp. electric motor, are the scale equivalents of the old and new vessels. They sharpen the crews' ship-handling skills in normal and emergency situations. Machinery can simulate 20-foot waves on the quiet lake water.

Included in the training is tying up to offshore moorings equipped with underwater



Little tankers can tie up (left) to miniature piers as well as to offshore buoys. Foreground tanker has had deck removed. Full-scale tanker will have 30,000 hp., and measure 1,000 feet in length.

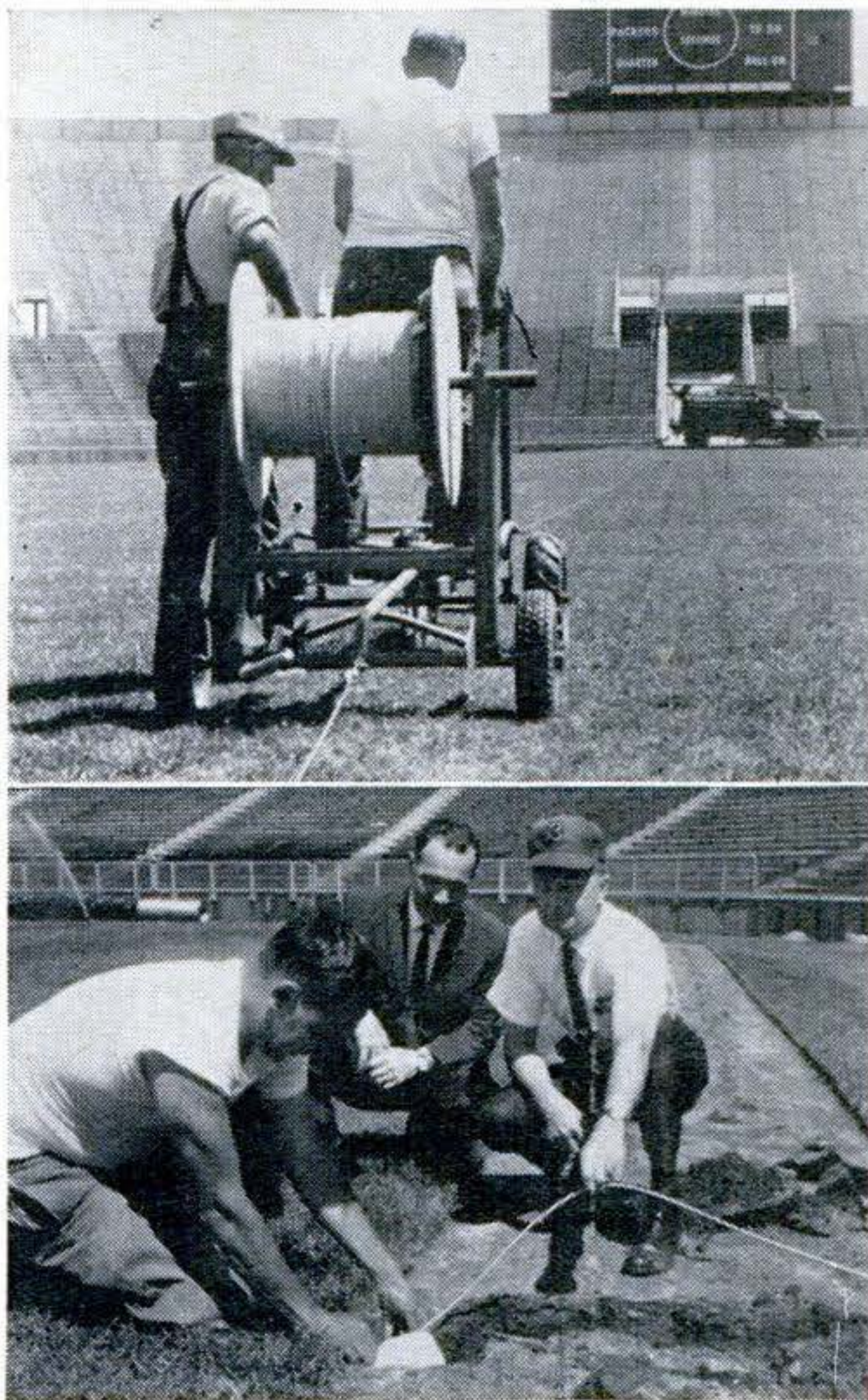
Sharpest bend in the Suez Canal (right) is duplicated in scale. Anchor chain will break at scaled-down equivalent of force on big chain. The lake and canal cover eight acres. Machinery simulates waves.



Motor, electrical circuitry, and rudder-control mechanism have built-in time lag to simulate conditions on full-scale vessel. Biggest model has six-foot beam, is 42 feet long, and displaces 15 tons.

pipes to take on or discharge oil. That's necessary because few harbors will take the new tankers' draft of 56 feet.

The big ships will be able to use the Suez Canal in ballast but not with a full load of 58,800,000 gallons. Loaded, they will have to go around the Cape of Good Hope plying between the Middle East and Europe.



Electric soil heating requires embedding special cables six to eight feet below the turf and one foot apart down the length of the gridiron.

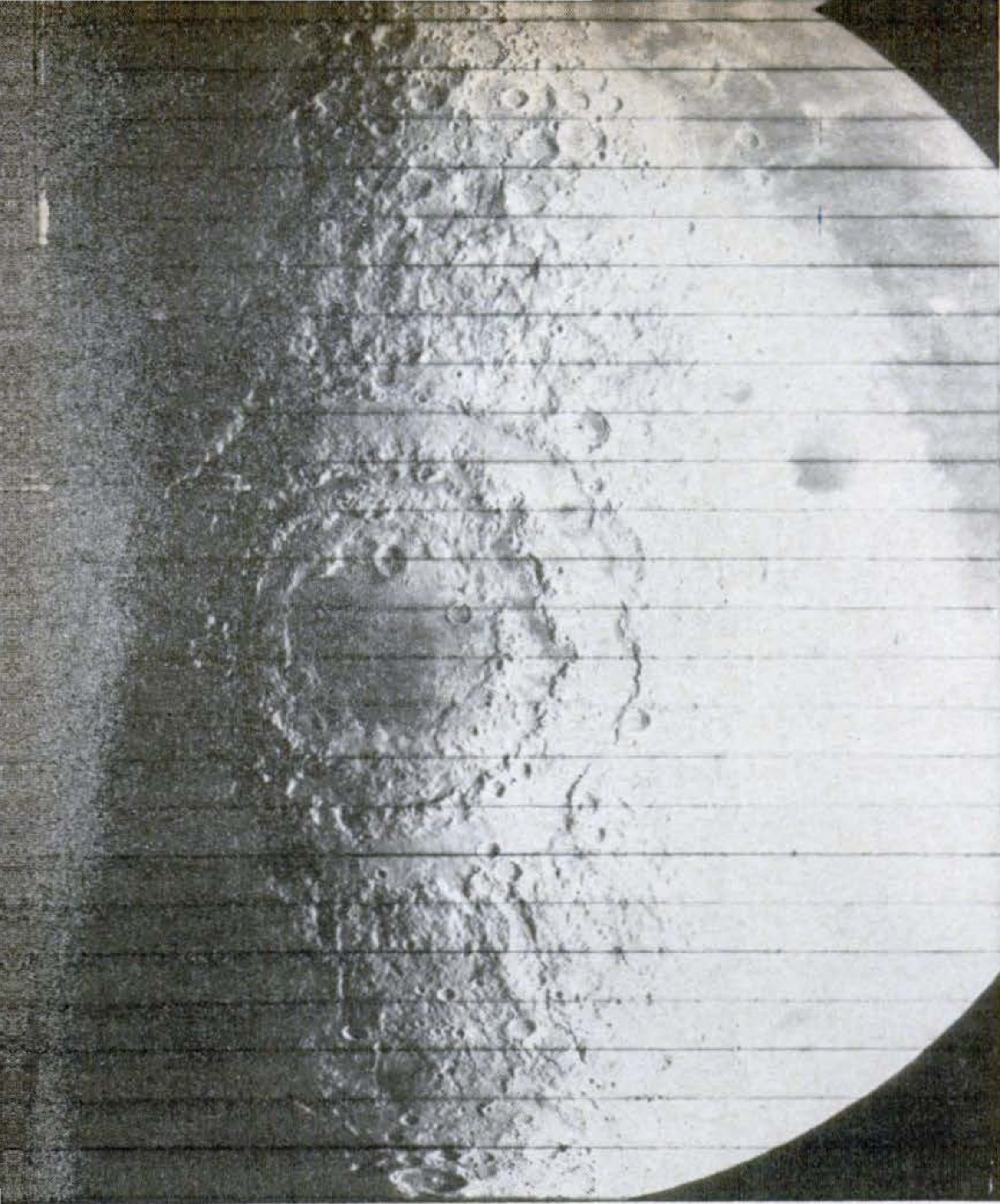
Heating pad keeps Packers' turf soft

The famous professional Green Bay Packers football team is playing on soft, frostfree ground at Lambeau Field this winter season. Fourteen miles of electrical cable are used to heat 73,000 square feet of gridiron. The current required would light 7,800 bulbs of 100 watts.



Citroën car has eyeball headlights

The headlight that the pretty girl is pointing to on the French Citroën DS-19 is one of two that are coupled to the steering wheel—their beams are thrown in the same direction the car turns.



Most spectacular sight of moon's far side is gigantic "bull's-eye" of Orientale basin—seen head on in this magnificent Orbiter 4 photo from 1,690-mile height, and charted at far right of map below.

What's on



By **DR. WERNHER
VON BRAUN**

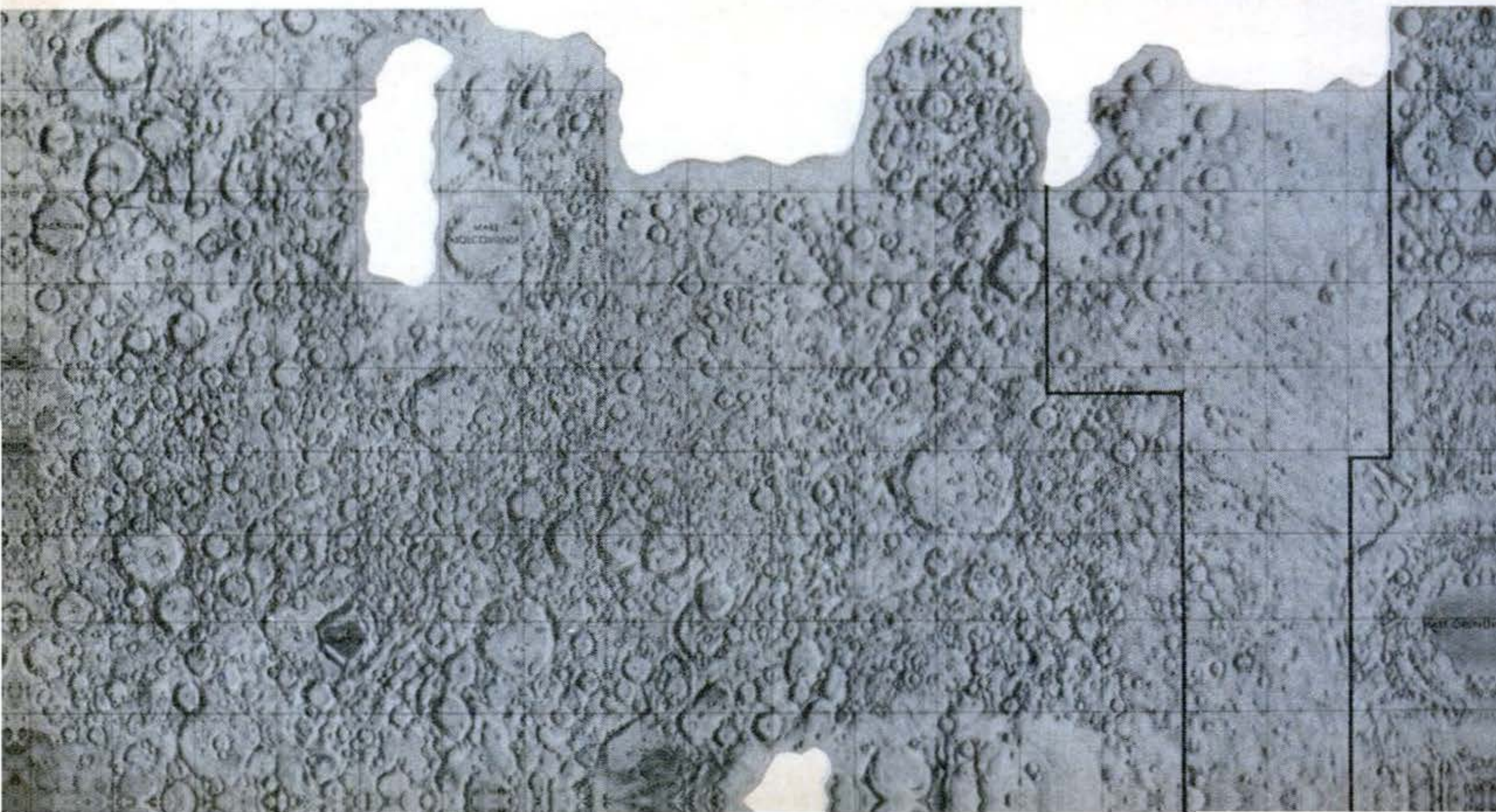
Director of NASA's George C. Marshall
Space Flight Center, Huntsville, Alas

A history-making
feat of astronomical
exploration, begun by
Russian spacecraft and
now completed by our
Lunar Orbiters, bares
the secrets of the
moon's hidden half

ORBITERS 1-2-3-4 (USA)

ZOND 3 (USSR)

ORBITER



Making first U.S. photos behind the moon, Lunar Orbiter 1 scans mysterious hidden side (foreground), and looks back past it at earth (small crescent).



The Other Side of the Moon

When Orbiter 5 radioed its final pictures to earth late last August, what was behind the moon was a mystery no longer. Brought to completion was the achievement of photo-mapping the moon's far side—the part, perpetually hidden from earth, that astronomers long had thought would never be seen.

That history-making feat climaxed a whole series of photographic triumphs by our five Lunar Orbiter spacecraft. With unprecedented clarity and high resolution, their cameras pictured lunar landscapes previously explored only by telescope from earth. Dramatic slant-angle views peered into famous craters' gaping depths. Overhead shots looked squarely down at scenery on the moon's rim, visible from earth only at a grazing angle. Behind the moon the Orbiters did most of the mapping and by far the best, in being the most-detailed.

Russian craft gave first look. Our Orbiters were not the first spacecraft to view the other side of the moon. Its exploration began on Oct. 7, 1959, when the Soviets' Luna 3, flying past in a long-stretched elliptical trajectory, took the first pictures of the unseen side from a distance of about 40,000 miles. At the critical time of picture-taking, Luna 3 was directly between the sun and moon, and so its full-moon photos lacked the shadows needed to discern more than a few conspicuous far-side features.

In 1965, another Soviet probe, Zond 3,

flew past the moon's far side at less than 7,000-mile distance and obtained better, sidelighted photos. They were subsequently used to assemble a partial map of the hidden side.

Our own Lunar Orbiters may have been Johnny-come-latelies, but the superior quality of their pictures makes up for it. Through them we now know both sides of the moon better than our own earth. Their photos are so close-range and sharp as to reveal even the tracks left by boulders rolling down a lunar hillside.

What the far side is like. The pictures show the moon's other side to be quite different from the one facing us.

An outstanding discovery is the far side's lack of large mares, or "seas," the smooth dark plains that form the facial features of the Man in the Moon. These mares, being free of steep mountain ranges, were selected as landing sites for our Surveyor spacecraft and for our coming manned landings. In contrast, the terrain behind the moon appears thickly cratered and rugged.

Instead of mares, at least three great basins surrounded by concentric rings of mountains have been discovered on the moon's far side. It has been proposed to call these remarkable formations "thalassoids," which is Greek for sea-like.

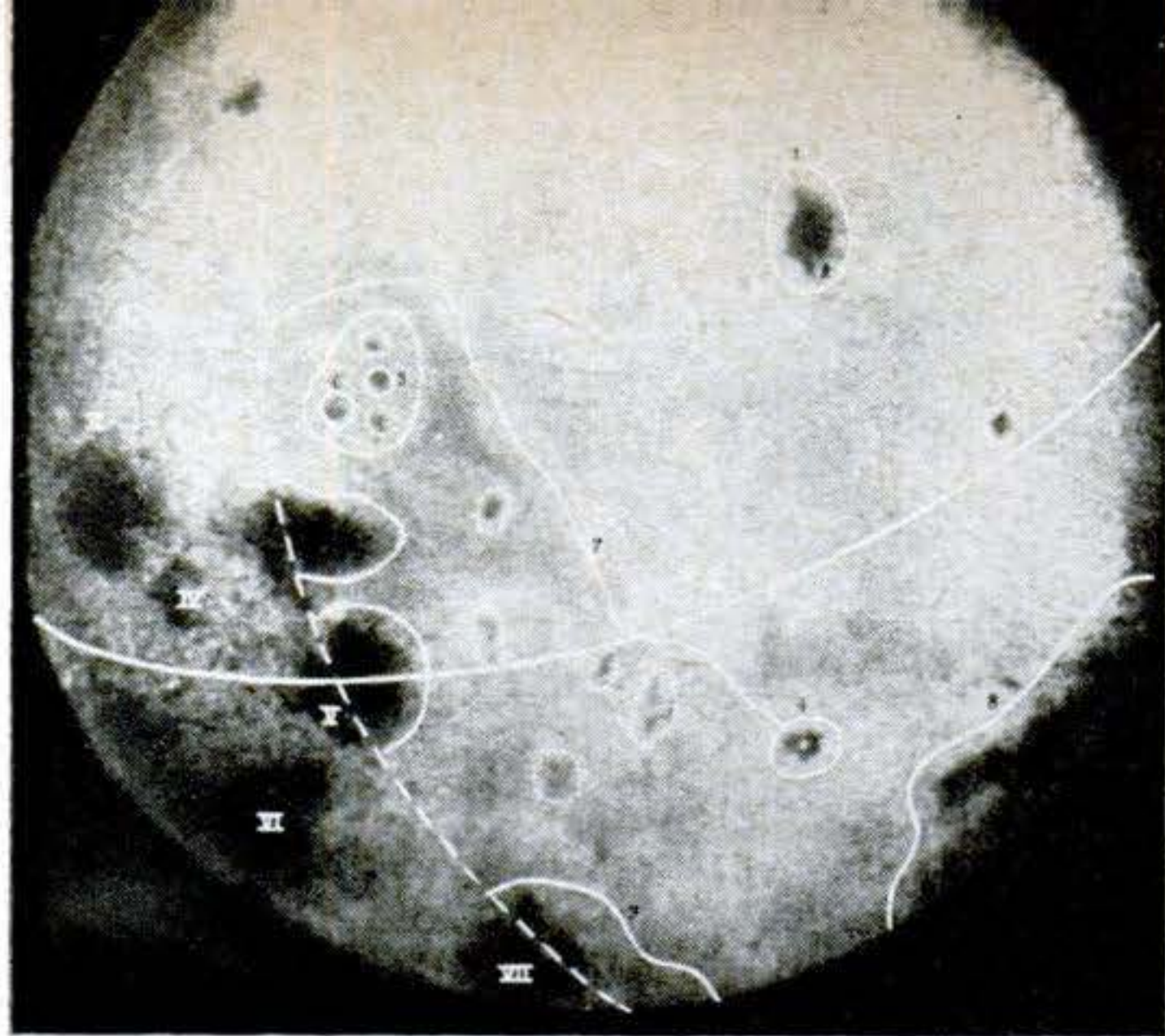
A huge "bull's-eye." Largest of the thalassoids is Orientale basin, ringed like a target's bull's-eye with seven circular mountain chains. Between outermost rims, the gigantic formation is 600 miles in diameter. It is such a spectacular find that Dr. Gerard Kuiper, eminent University of Arizona astronomer, was moved to comment, "If it were fully visible on the side of the moon facing the earth, a whole mythology would have been built up around it."

Actually the major part of this forma-

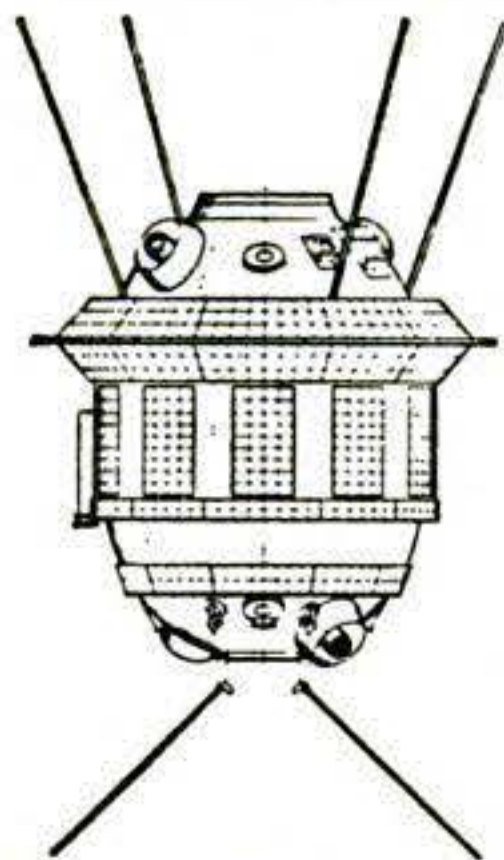
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A U.S. map of the moon's hidden side—before Orbiter 5 filled in the blanks

Central part of historic "Lunar Farside Chart" presented by U.S. at Prague last August is based on photos by Orbiters 1-4 and Zond 3, whose respective contributions are shown. Two semicircular parts, not pictured, cover regions nearer poles and come solely from Orbiter 4 views. Unexplored areas (white blanks) have since been mapped by Orbiter 5. Orbiters' discoveries end long Soviet monopoly on proposing names for features of far side.



First view of moon's far side, above, was from Russia's four-foot-diameter Luna 3 (inset).



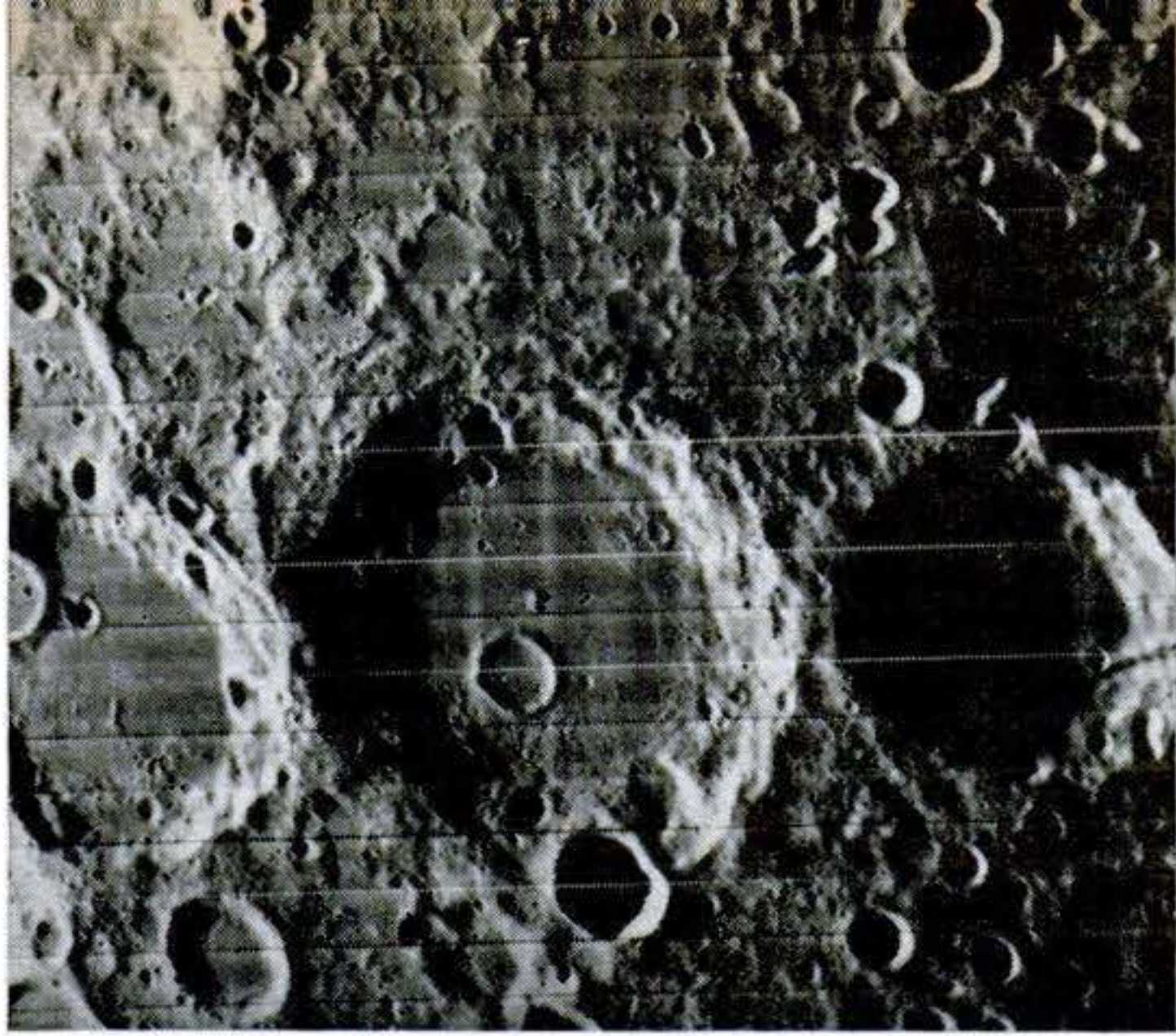
tion lies just beyond the western, or left, edge of the moon's near side. Just enough of it extends into the visible face to have been glimpsed from earth, and to have been named

Mare Orientale—before astronomers knew what the whole of it really looked like.

The impact of a colossal meteorite, 30 to 60 miles in diameter, is believed to have formed Orientale basin's 186-mile-wide circular plain and its rings of mountains—of which the outermost, the Cordillera Mountains, rise to 20,000 feet. At the foot of the next inward ring, a dark irregular area looks to geologists to be filled with volcanic material that welled to the surface after the impact. Telephoto viewing reveals chunks thrown from the basin—and even radial lines showing their trajectories. The mountain ranges, on the whole, look much like the concentric ridges that would be formed if a boulder crashed into a pond covered by a foot-thick layer of ice.

Christening the finds. Giving the new-found lunar features their names—which are bound to be permanently enshrined in future textbooks and maps—makes an interesting sidelight of the Soviet-U.S. competition in exploring the other side of the moon.

For features visible in Luna 3's photos, the Soviet Academy of Sciences proudly and promptly proposed names including the Moscow Sea, the Tsiolkovsky and Lomonosov craters, and the Soviet Mountains. Zond 3 brought the number of



Latest views' remarkable quality is shown by Orbiter 5 photo of hitherto-unknown craters, at site within one of blank spots of earlier far-side map.

Soviet-proposed names for new features to a total of 228.

Then came our turn, as a result of our Lunar Orbiter program, managed by NASA's Langley Research Center, Hampton, Va. As NASA's Orbiters explored the back of the moon, and made additional discoveries, a committee of our National Academy of Sciences likewise set about drawing up a list of American-proposed names for them.

Last August, when the International Astronomical Union met in Prague, Czechoslovakia, the Soviet and American delegations both came prepared to offer their lists of names for adoption. The Russian astronomers brought along a map locating the Soviet finds. In turn, the Americans presented a newly produced "Lunar Farside Chart"—already bearing several of the Russian-proposed names, and compiled with an assist from Zond 3, but mostly based on mapping by Lunar Orbiters 1 to 4.

Comparing the charts revealed discrepancies—and both were incomplete. Even as the U.S. map was exhibited, Orbiter 5 was charting its blank spaces.

So the Americans proposed, and the Russians agreed, to defer the formal christening for three years. By then a complete, internationally accepted map of the moon's far side should be available. Meanwhile, the IAU decided, it would designate far-side craters and other features simply by numbers. How many will ultimately get names may be gauged by the more-than-700 named features of the moon's visible face. **PS**

How Lunar Orbiters Took Dramatic Moon Pictures

Five successes in five tries was the phenomenal score of the windmill-shaped Lunar Orbiters, launched over a one-year period from Aug. 10, 1966 to Aug. 5, 1967.

Designed and built for NASA by Boeing, they became the world's first spacecraft to photograph the moon from orbit around it. So well did Orbiters 1 to 3 accomplish the program's primary mission—a close-up photo survey of prospective sites for Apollo manned landings—that the others were able to concentrate on picturing scientific targets and mapping broad areas of both the front and back of the moon.

Each Orbiter took pictures simultaneously with a lens of 24-inch focal length, for telephoto views, and one of 80mm (3.15-inch) focal length for wider-angle photos. The Eastman Kodak camera system recorded the pictures on a roll of fine-grain aerial-photo film, 70mm (2.76 inches) wide. A photo lab aboard Orbiter developed it and yielded a film negative for radio transmission to earth—by an advanced, extreme-high-definition RCA version of a TV-like scanning process.

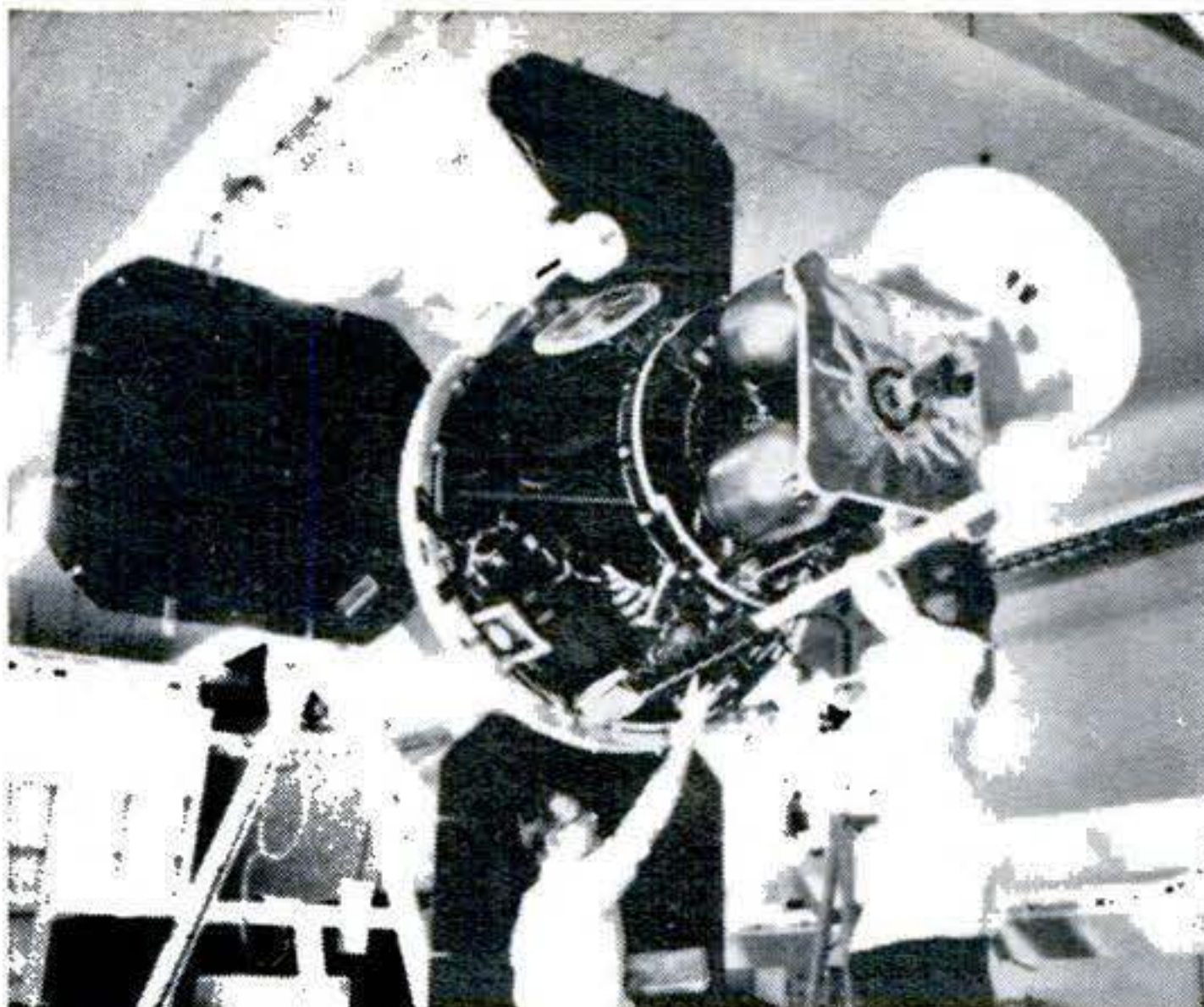
Earth stations, with dish antennas up to 210-foot size, received the signals and converted them back into photos. A banded appearance results from the scanning pattern; each ribbon-like strip is a positive enlargement of a transverse strip, only 1/10 inch wide, of the film aboard Orbiter.

Orbiters 1, 2, and 3 circled the moon in near-equatorial orbits. They swooped down from 1,150-mile height to within 28 miles of the surface, to get pictures that could distinguish objects as small as a card table. Lest their 4,500-m.p.h. speed blur a photo, the film was given a compensating motion during exposures.

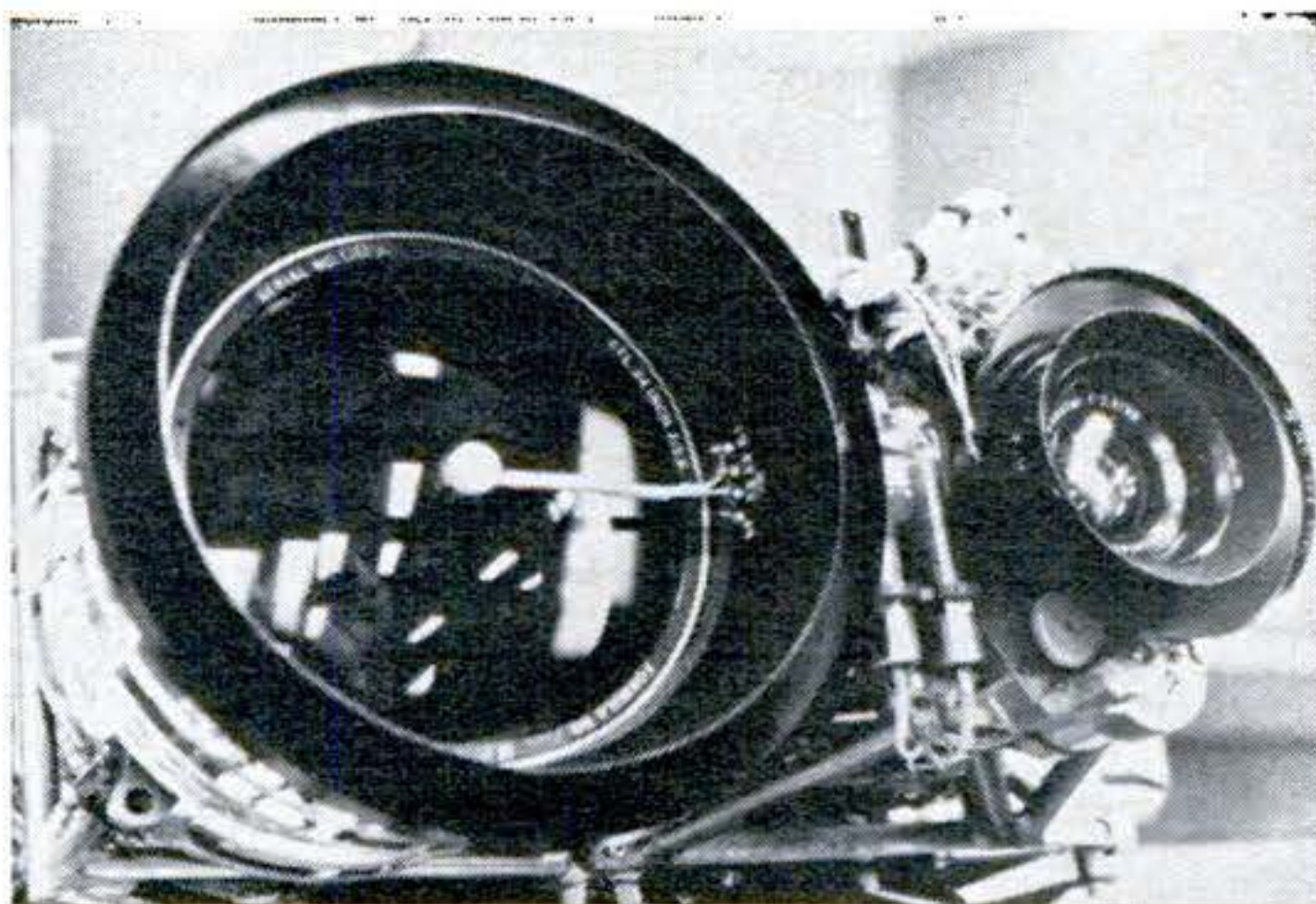
The last two Orbiters were put into near-polar orbits. Orbiter 4, coursing at a height of 1,650 to 3,800 miles, made high-altitude photos of large areas. Orbiter 5, from orbits successively 125-3,700 and 60-930 miles high, pictured regions unexplored before.

All the Orbiters performed feats of unprecedented intricacy for unmanned spacecraft. Orbiter 4, which set the amazing record, successfully obeyed more than 7,000 commands and executed 670 separate attitude maneuvers.

The result of the five Orbiter flights is a pictorial atlas of more than 1,600 superb moon photos. For years to come, NASA says, it will be "the definitive source of lunar-surface information."—Alden P. Armagnac.



Lunar Orbiter, being readied for moon mission, carried two cameras and photo lab. Extended solar panels gave 850-pound spacecraft a span of 12 feet.



Eyes of Orbiter were these powerful lenses. Larger one, more than four inches in diameter, made telephoto views; other one, wider-angle pictures.



Photos from Orbiter, radioed across 240,000 miles of space, were picked up by huge antennas including this 210-foot-wide dish at Goldstone, Calif.

Electric Power Aplenty for the Small Boat

By WILLIAM L. HENSLEY

Take a small boat like mine and add a radiotelephone, a spotlight, a cabin fan, an electric bilge pump, a depth finder, a few extra cabin lights, and you've got a problem: where to get the electricity to run them all. Sure, my boat's engine has a conventional generator/storage-battery electrical system, but that was designed, primarily, to power standard electrical gear and supply current to the starter motor. It just can't supply enough juice to keep all my electrical auxiliaries purring happily.

Solutions? Two are obvious: Add an independent battery to power part of the equipment. The hitch here, of course, is that this battery must be carried ashore frequently for recharging. Or the existing electrical system must be beefed up by substituting a heftier generator, or—better yet—an alternator. But this is only a partial fix, since the improvement is effective only when the boat's engine is running. Switch off the engine, and we are back where we started.

The best solution (and the one I finally settled on) is to install a ship's-generator system, driven by a small auxiliary engine. The unusual thing about mine (seen in the pictures), is that I built it myself mostly out of junk parts.

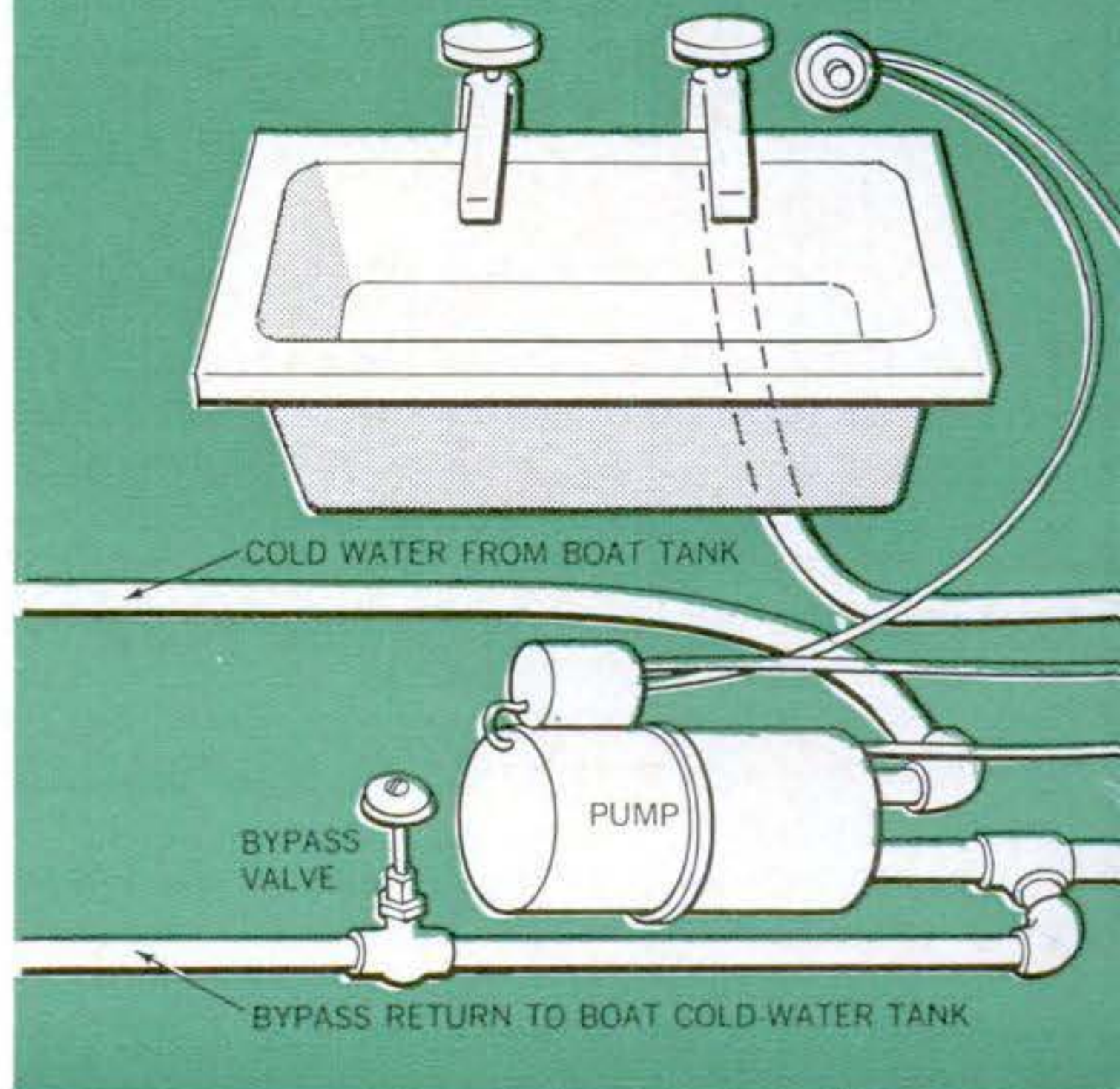
The generator system. I began with a six-volt automotive generator and voltage regulator salvaged from a '47 Chevrolet (any similar pair would work as well, of course). A search through a lawn-mower shop turned up a suitable engine—a venerable Briggs and Stratton one-banger.

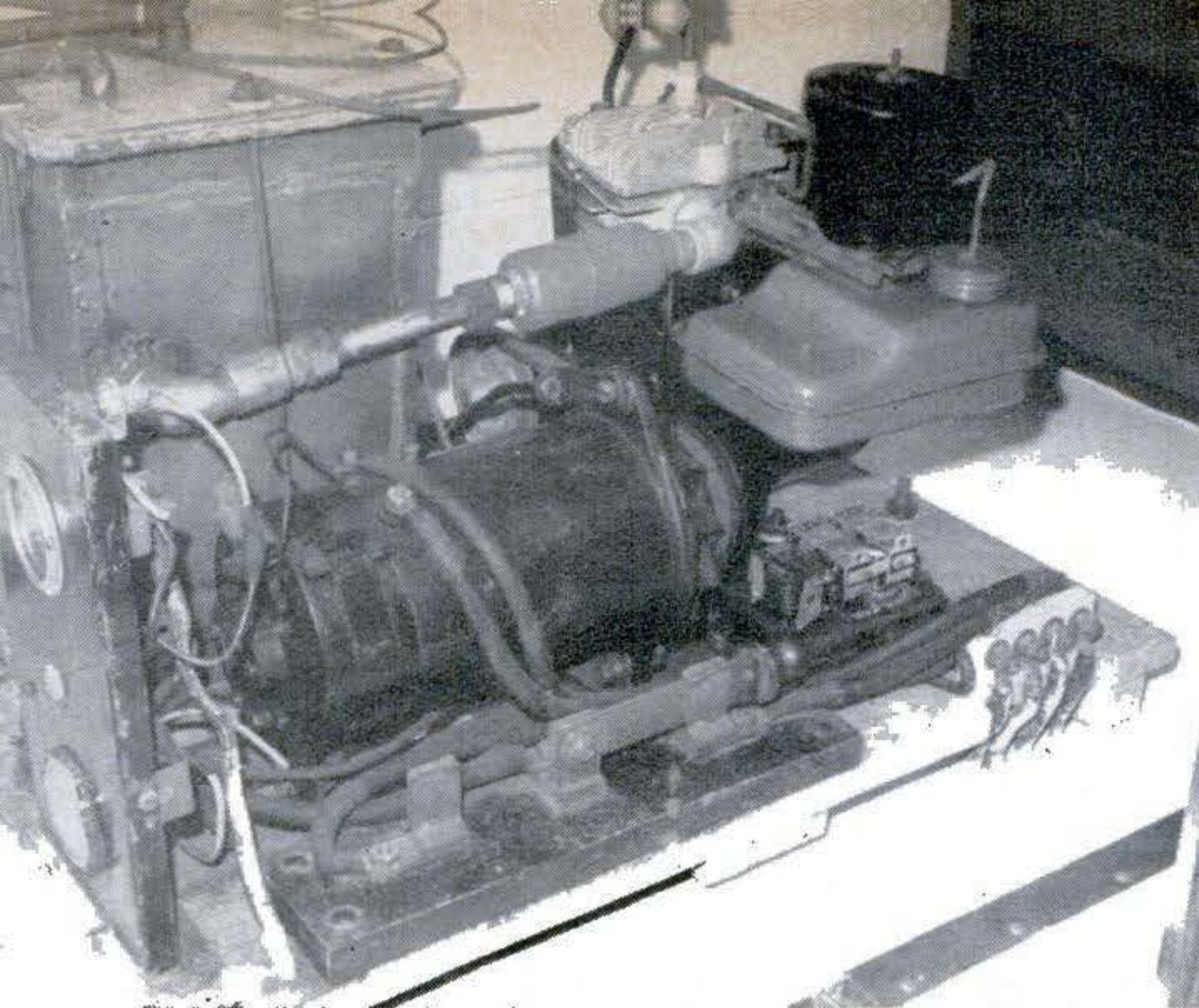
About then, I got a really hot idea. Why not use the exhaust heat from the engine to heat water for the galley? There

would be enough heat in the engine's exhaust to heat two gallons of water from 65 to 180 F. each hour.

The hot-water plant. The one I designed is simplicity itself: Exhaust from the engine travels through 10 feet of copper tubing inside a two-gallon water tank I built from copper sheeting (bought at a local building-supplies house). The cooled exhaust gases are carried by a hose to a muffler (not shown in the pictures) and are discharged outboard near the water-

Complete generator/hot-water system is shown in this diagram. Small muffler on the exhaust line damps out pulsations that could make the water tank vibrate. Also, the water tank, engine, and generator are bedded in sheet-rubber gasket material to reduce vibration. I installed the unit on the deck of my boat, as shown in the photo (above, right), and built a ventilated cover for it out of mahogany-faced plywood. Note that the engine's gas tank is vented outboard as required by the Coast Guard.





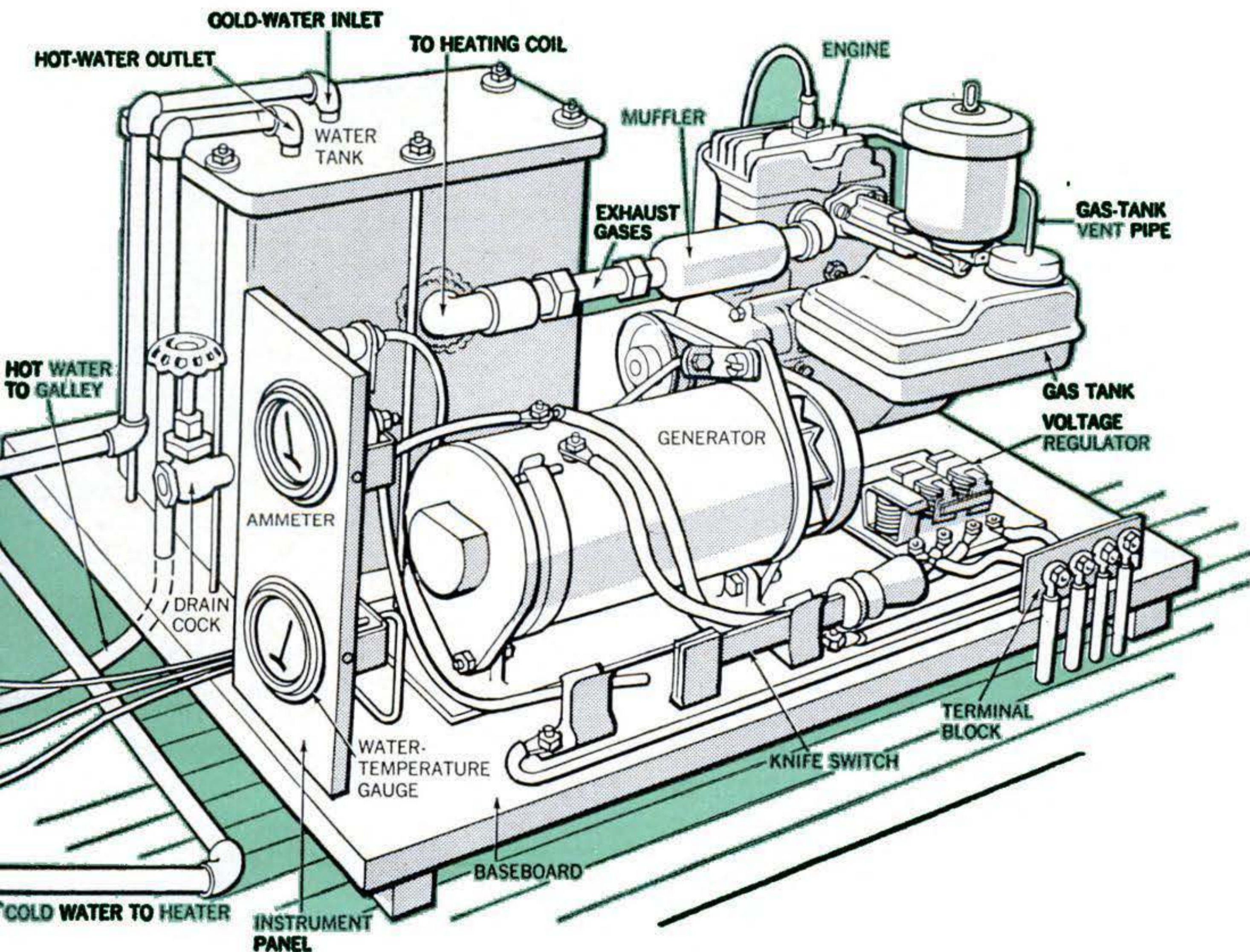
Home-brew ship's generator is a sensible low-cost solution to an electric-power shortage on a small boat.

With a wooden foul-weather cover in place (above, right), the generator system doubles as a deck seat.

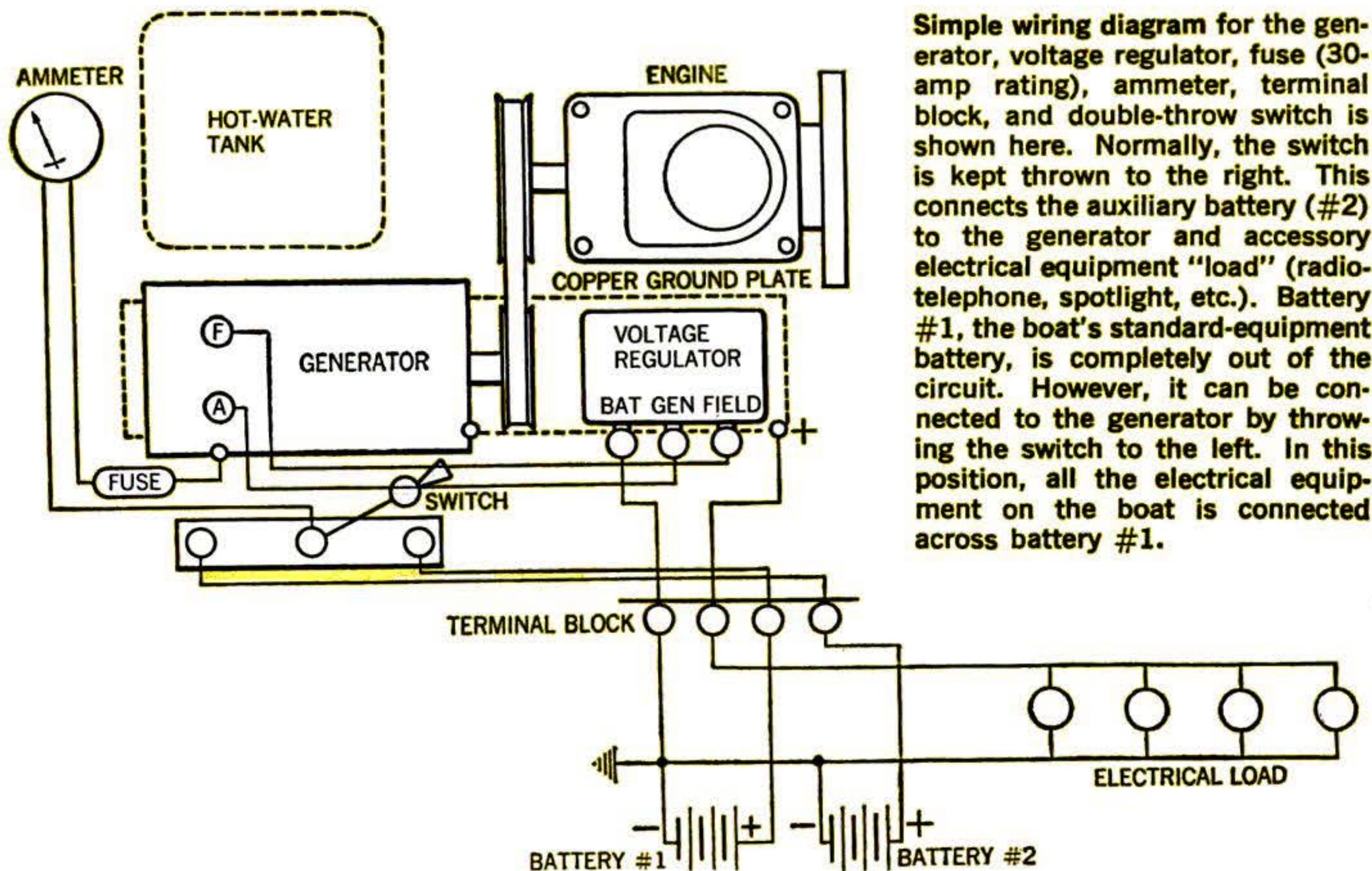
line. I cut the platform shown in the illustrations from the top of an old oak table. After I mounted the major components on the board, the next step was the electrical wiring.

The wiring. An old Chevy shop manual gave me the generator-circuit wiring diagram, and pointed up a slight complication: The generator and regulator were designed for positive-ground operation.

Continued



The ship's-generator system delivers 30 amperes DC



Simple wiring diagram for the generator, voltage regulator, fuse (30-amp rating), ammeter, terminal block, and double-throw switch is shown here. Normally, the switch is kept thrown to the right. This connects the auxiliary battery (#2) to the generator and accessory electrical equipment "load" (radio-telephone, spotlight, etc.). Battery #1, the boat's standard-equipment battery, is completely out of the circuit. However, it can be connected to the generator by throwing the switch to the left. In this position, all the electrical equipment on the boat is connected across battery #1.

On boats, though, a negative ground is essential to keep electrolysis in check. I solved this by simply mounting the generator and regulator together on a copper "ground" plate. This plate then became the positive terminal in my system.

To lessen the chances of a short circuit between the plate and my boat's electrical ground, I further insulated the unit by supporting the platform on the deck with four rubber plugs. These not only insulate, but act as vibration dampers, too.

I finished off the electrical circuitry by adding an ammeter and a single-pole, double-throw knife switch. The switch lets me connect up my boat's original battery (#1) or auxiliary battery (#2) to the generator.

To get the rig working, I bolted a four-inch pulley to the engine's shaft and coupled it to the generator with a fan belt. The generating set worked perfectly: It delivered a 30-amp charging current when I started up the engine.

But, alas, there was a bug in the hot-water system. Although the water in the tank got hot as planned, none of it ended up in my galley sink. I discovered

that the standard diaphragm pump in the sink displaced less volume per stroke than the flexible copper sides of my water tank: As the pump worked, the copper walls flexed back and forth, but no water was pumped.

The solution. Back at the auto junk yard again, I bought a hydraulic pump from a convertible auto top. The one I found (from a nameless old car) is driven by an internal six-volt motor, making it ideal for this system. The pump is controlled by a six-volt starter solenoid I mounted on the pump casing; the solenoid is in turn controlled by a pushbutton switch at the galley.

The pump forces cold water from the boat's main tank into the bottom of the copper tank. Hot water is led from the tank to the galley sink via plastic tubing.

The car-top pump worked so effectively that I had to add the cold-water bypass shown in the diagrams. I experimented to find the correct setting of the bypass valve so that just enough pressure is produced in the cold-water line to the heating tank, and excess water returns to the main cold-water tank. PS

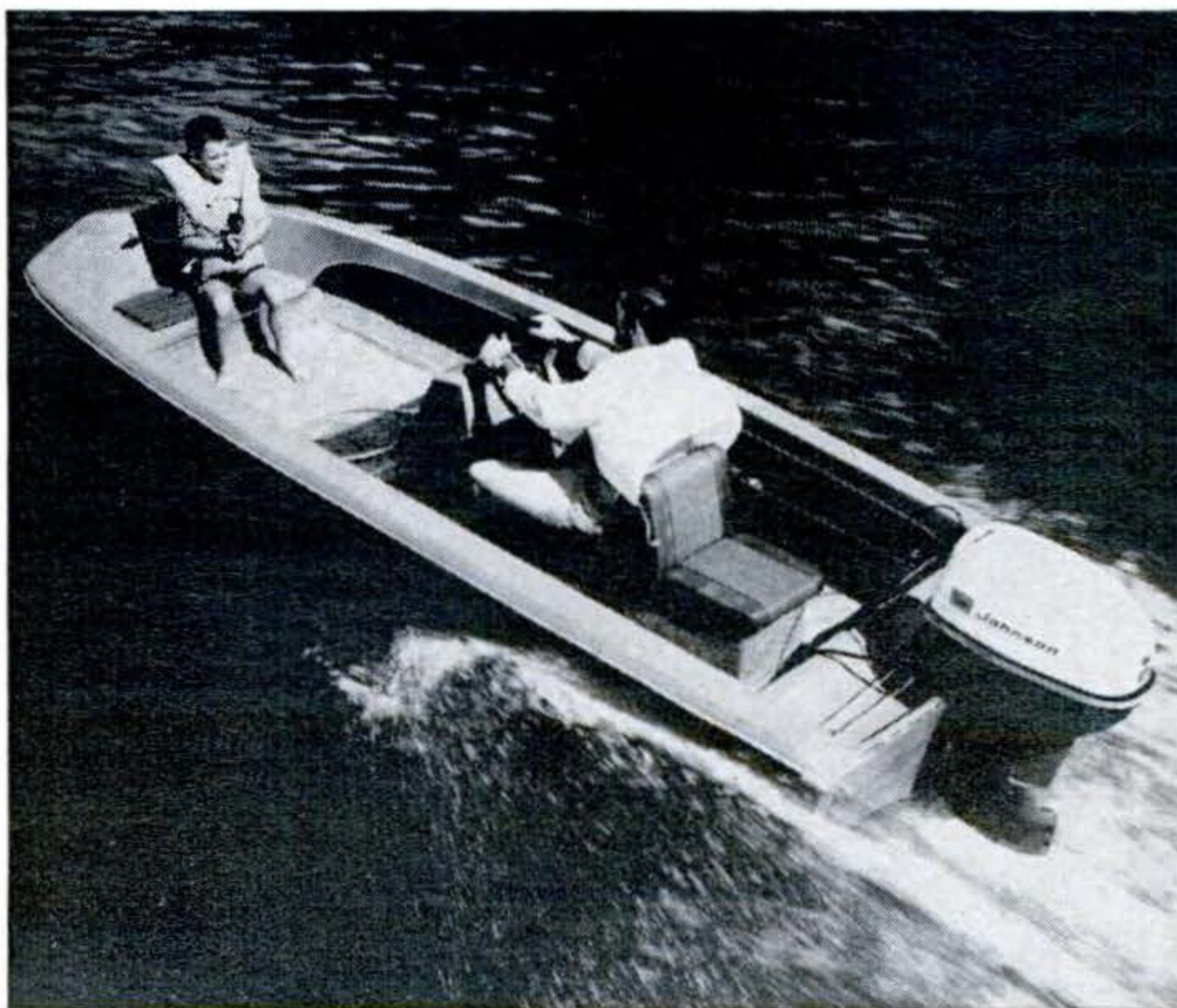
Winner Viscount 21 has self-righting flotation

Photos at left show the self-righting tendency claimed for this new boat. "Positive-flotation" concept involves polyurethane foam installed above the cockpit deck, holes drilled in deck to allow escape of trapped air below, passage of water to bilges to lower center of gravity. It was a tough job to capsize the Viscount 21, but easy to right her. At upper left man on chine moves bottoms-up boat off balance and starts it on upward roll. This roll continues unassisted. To simulate engine weight, test boat was loaded with steel. Winner Boats, Dickson, Tenn. 37055.



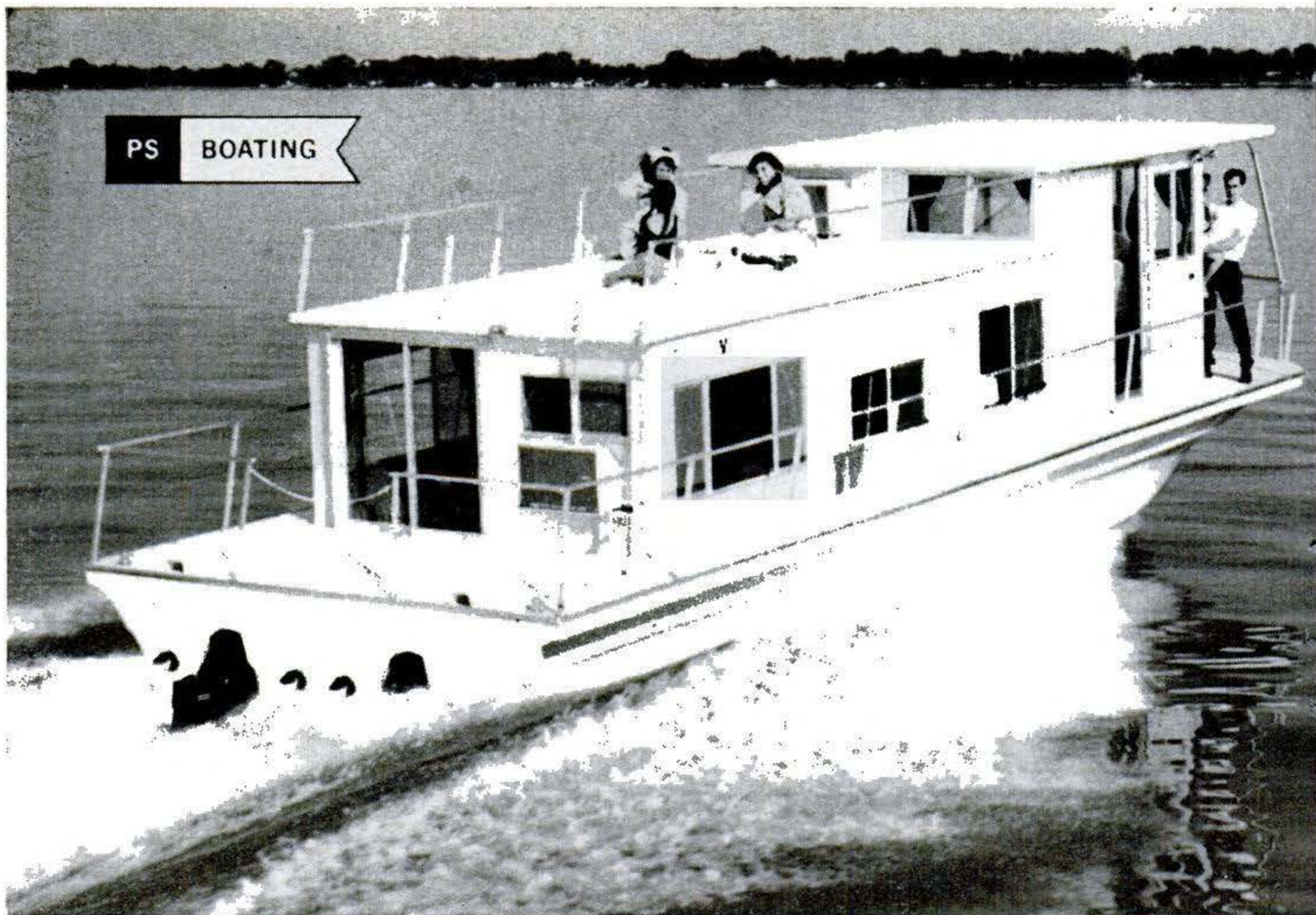
New 9.9-hp. fisherman

Here's one of Chrysler's new fishermen for 1968. A low-profile compact model with 9.9 hp., it's light in weight for easy carrying and storing. Also available: two 9.9-hp. Autoelectric models with key-switch electric starting



Fish 'N Ski from Glastron is boat of many uses

No matter how varied your boating interests are, this new 14-footer is ready and rarin' to go. Its center-station controls open up all sides for easy casting, trolling, or docking. Beneath the back-to-back vinyl seats, there's a large twin fiberglass circulating bait or ice well. There's storage, too, beneath the bow seat and the covered bench seat. The boat takes motors from 10 to 50 hp. About \$599 f.o.b. factory. Glastron Boat Co., Box 9447, Austin, Tex. 78756.



She'll do 32.8 m.p.h. on a measured course, and not even spill the coffee! The 40-foot Drift-R-Cruz is

so tough it was one of 16 (of 63 starters) to finish the Bahamas 500-mile ocean powerboat race.

POWERHOUSEBOAT! nimble

With a pair of MerCruiser III's, this 40-footer combines the best of outboard and inboard

By **JIM ROE** / *PS Boating Editor*

Actually, it was a great day to test a boat. It was raining briskly. The temperature was in the low fifties, and dropping, as a strong wind shifted further into the northwest. That shift was bringing cool Canadian air and white caps to Wisconsin's Lake Winnebago. But we rode dry and in comfort inside the deckhouse of a Drift-R-Cruz houseboat.

We were out to test not only the handling abilities of the houseboat, but the twin 1968 MerCruiser III stern-drive

units tucked away below decks. These new power-and-drive combinations were designed for big jobs like this 40-foot fiberglass boat. Each of the twin 327-cu.-in. engines developed 250 hp. Each was swinging a big 20-inch wheel at the stern. And each was handling as smooth as silk, for the 1968 MerCruiser III is equipped with a slick hydraulic marine transmission. This transmission, close-coupled to the drive, gives you a stern drive that shifts from forward to neutral to reverse with nary a clank or clatter, and all the positive handling ease once enjoyed only on large inboard cruisers.

At the controls. I found myself enjoying the best of both worlds: outboard steering control along with inboard smoothness and twin-engine maneuverability. With 40 feet of straight-sided boat to catch every crosswind, you want all



Morse single-lever controls actuate hydraulic marine transmissions, make shifting each 250-hp.

MerCruiser III yacht-smooth. Inset: Visual indicator shows the tilt positions of the stern-drive units.

silky-smooth, 500 horses strong

the helpful directional control you can get. With the port engine in forward, the starboard in reverse, we pivoted the Drift-R-Cruz in her own length.

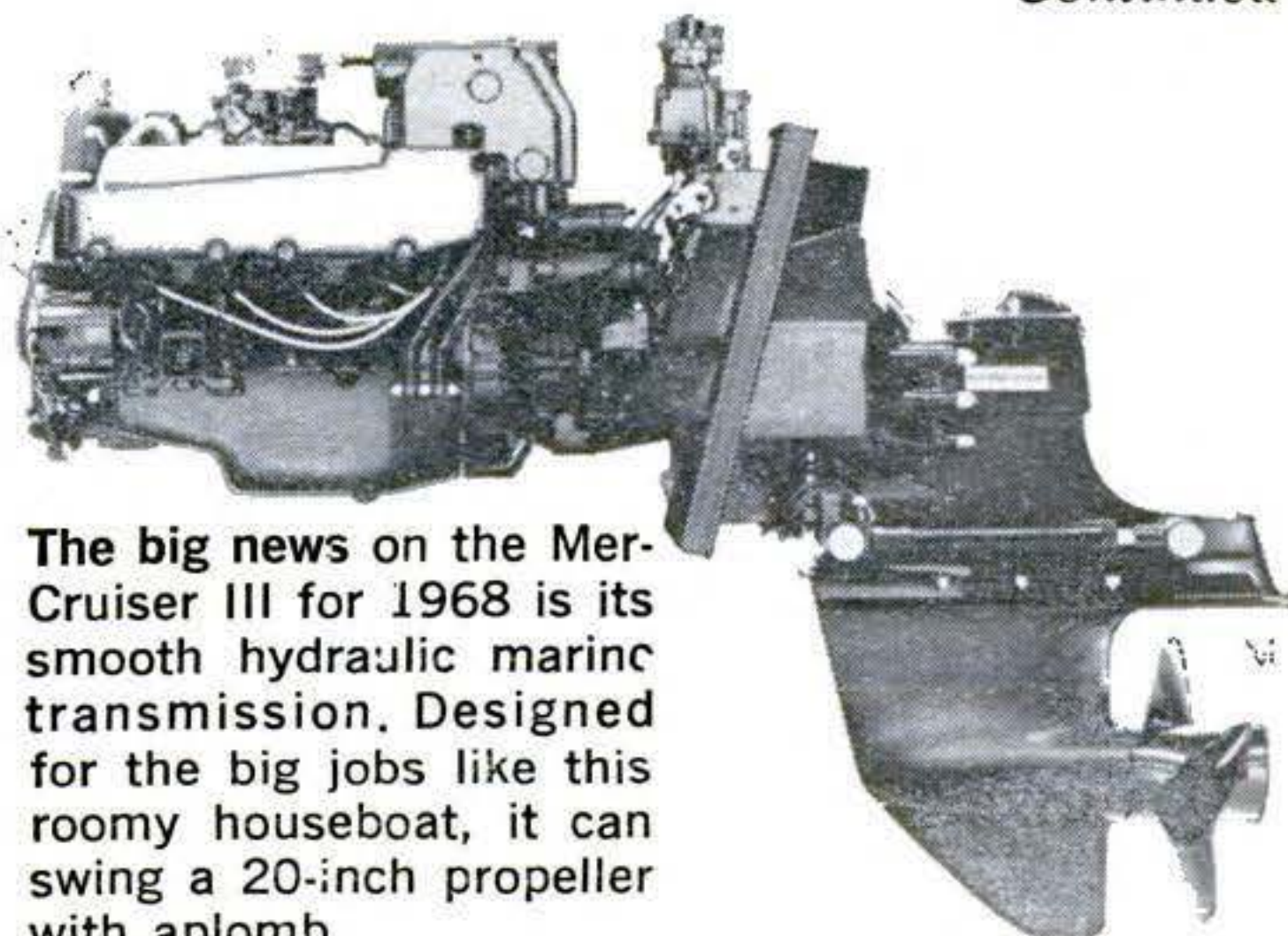
In docking alongside a sea wall, the steerable (power steering, to boot!) outdrive units can be used to swing the stern smartly toward or away from the wall as needed. And with a combination of water current and strong crosswind, I was able to bring the bulky boat smoothly into her slip with no trouble.

Power with trimmings. This 250-hp. engine has an 8.8:1 compression ratio, and uses regular automotive fuel. It has Kiekhaefer's capacitance-discharge, breakerless Thunderbolt ignition. The electrical system is enclosed in a sealed and waterproof panel that's prewired to the system with a quick-disconnect fitting.

Power trim is standard equipment.

The outdrive units can be raised and lowered with the touch of a button to bring the heavy boat in better trim whether it's fully or lightly loaded. And should you go aground or damage a propeller it is simple to lift the units to

Continued



The big news on the MerCruiser III for 1968 is its smooth hydraulic marine transmission. Designed for the big jobs like this roomy houseboat, it can swing a 20-inch propeller with aplomb.



Twin stern-drive units are spaced far enough apart to give inboard maneuverability with one operating in forward, one in reverse. Power steering gives them fingertip control for "outboard" maneuverability.

DRIFT-R-CRUZ HOUSEBOAT SPECS

Length overall: 39' 2"	Beam: 11' 11"	Freeboard: Forward 35" Aft 30"	Draft: Hull 12" To bottom of stern drive 30"
Approximate weight: 15,000 lb.		Construction: Fiberglass	
Accommodations: Forward deck, 6' 5". Aft deck, 5' 9". Sun deck, 9' 2" wide, 18' 6" long. Pilot house, living-dining-sleeping cabin 27' 2" long. Enclosed head, shower. Standard equipment includes two Bahama beds, one convertible divan; galley equipment; wall-to-wall carpeting.			
Price: Varies with power, in \$13,500 to \$17,000 range.			



drift free or change a prop. A pair of tiny outdrive-shaped indicators on the dashboard give you a constant picture of the position of each outdrive unit.

The new MerCruiser III also uses the Kiekhaefer jet-prop, with the propeller hub vented to reduce drag. Air, drawn in through vents in the driveshaft housing and lower unit, is exhausted through the propeller, thus achieving a performance similar to jet-prop exhaust. At the same time, Kiekhaefer engineers say, this does not reduce reversing efficiency.

In addition to turning the 40-foot houseboat on a half-dollar, the 500 MerCruiser horses push it through a measured mile at 32.8 m.p.h.—all 15,000 pounds of it.

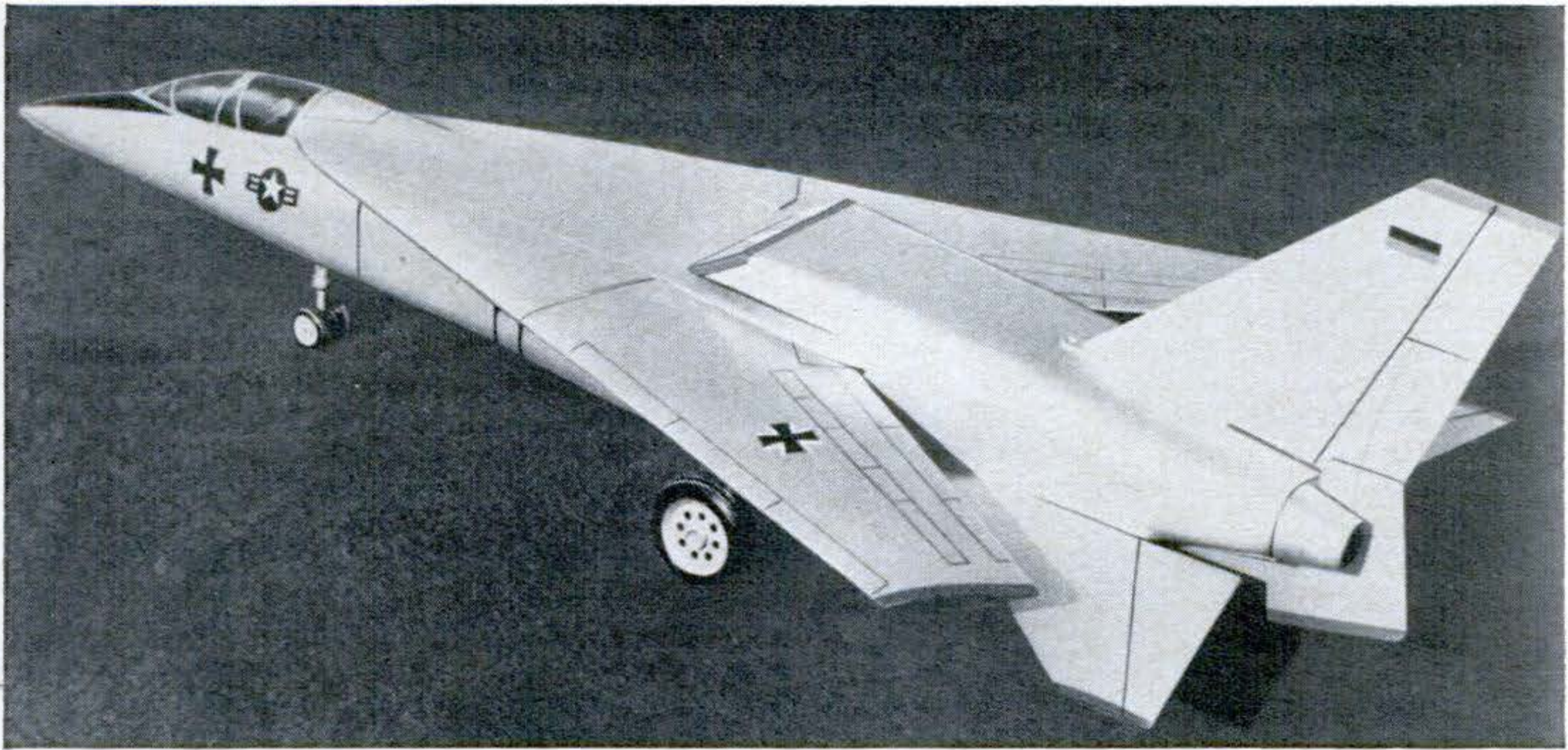
The Drift-R-Cruz under way. The 40-foot houseboat has a beam of 11 feet, 11 inches. Freeboard is low: 35 inches forward, 30 aft. It seemed to possess good lateral stability when under way in the chop of Lake Winnebago. And in moderately sharp turns at high speed it behaved very well; in very sharp turns it did not feel comfortable.

Inside, the deckhouse is not divided by bulkheads. The pilothouse area forward is at deck level, while the galley, head, and after portion are recessed. There's an electric refrigerator, three-burner electric range and oven, hot and cold running water, and a head with a shower stall. A faithful Onan generator aft between the two power plants supplies 110-volt current.

There are some changes I would suggest: The surface of the outer deck, when wet, was as slippery as a banana peel. Below decks, fuel-tank provision seems inadequate. The twin 45-gallon tanks would take you probably 90 or so miles before running bone dry—not much cruising range, and little reserve leeway.

But the Drift-R-Cruz is rugged and roomy (a sister hull was one of the few boats to complete the tough Bahamas 500-mile race). With a few changes for improved safety and convenience, the MerCruiser-equipped craft would make a really great floating homestead. **PS**

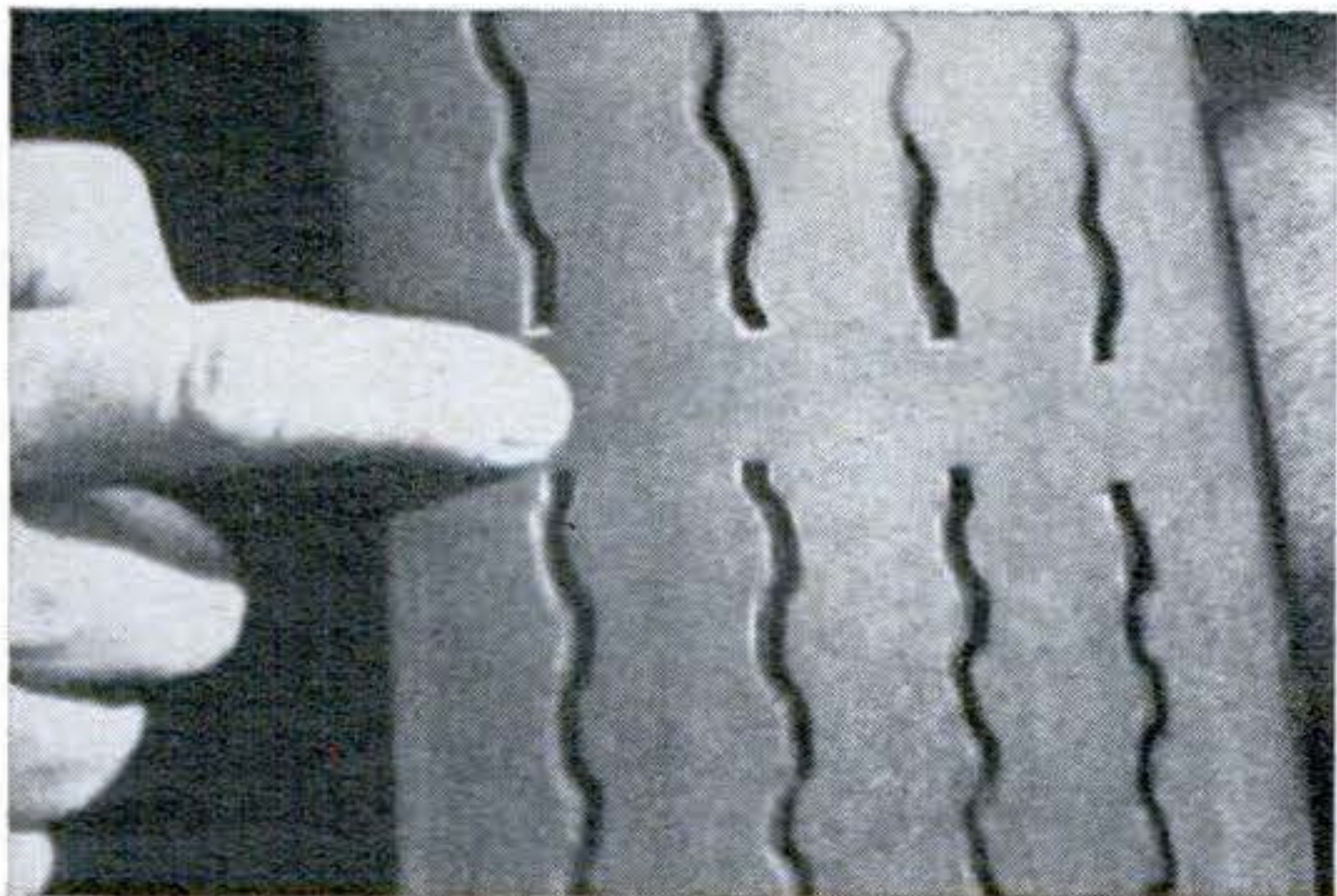
Yep—20-inch wheels on a stern drive! These big propellers come in mighty handy when the boat to be moved weighs in at nearly eight tons, as does the 40-footer we tested on Lake Winnebago.



Extra engines disappear into fuselage when wings are swept back for high-speed flight.

Swing-out engines will lift new fighter plane

A new fighter plane, a joint U.S.-German project, will have auxiliary swing-out jet engines on arms forward of the wing to direct thrust downward for vertical takeoffs, or tilt for short takeoffs. The exhaust from the regular rear-mounted jets is deflected to help lift, too. The wings sweep back (as in photo above) for high-speed flights, forward for takeoffs and landings.



Wups! It's time to re-tire

Tread-wear indicators are becoming a standard feature on tires supplied with new cars, and rapidly are being put into replacement tires, too. A smooth bar appears across the tread at several points when it's down to 1/16 inch—discard time.



A magic wand for the Viet war

It looks just like a stick, but it's a new weapon—an electronic probe to enable U.S. Navy men to detect rifles, grenades, and ammunition that the Vietcong try to smuggle into battle aboard junks. Battery-powered, it has an audio-readout circuit.



Top-Notch Stereo Receiver

By RONALD M. BENREY / *Electronics Editor*

No doubt about it—the all solid-state Heath AR-15 is one of the finest stereo receivers (integrated AM/FM tuner plus amplifier) I've ever listened to.

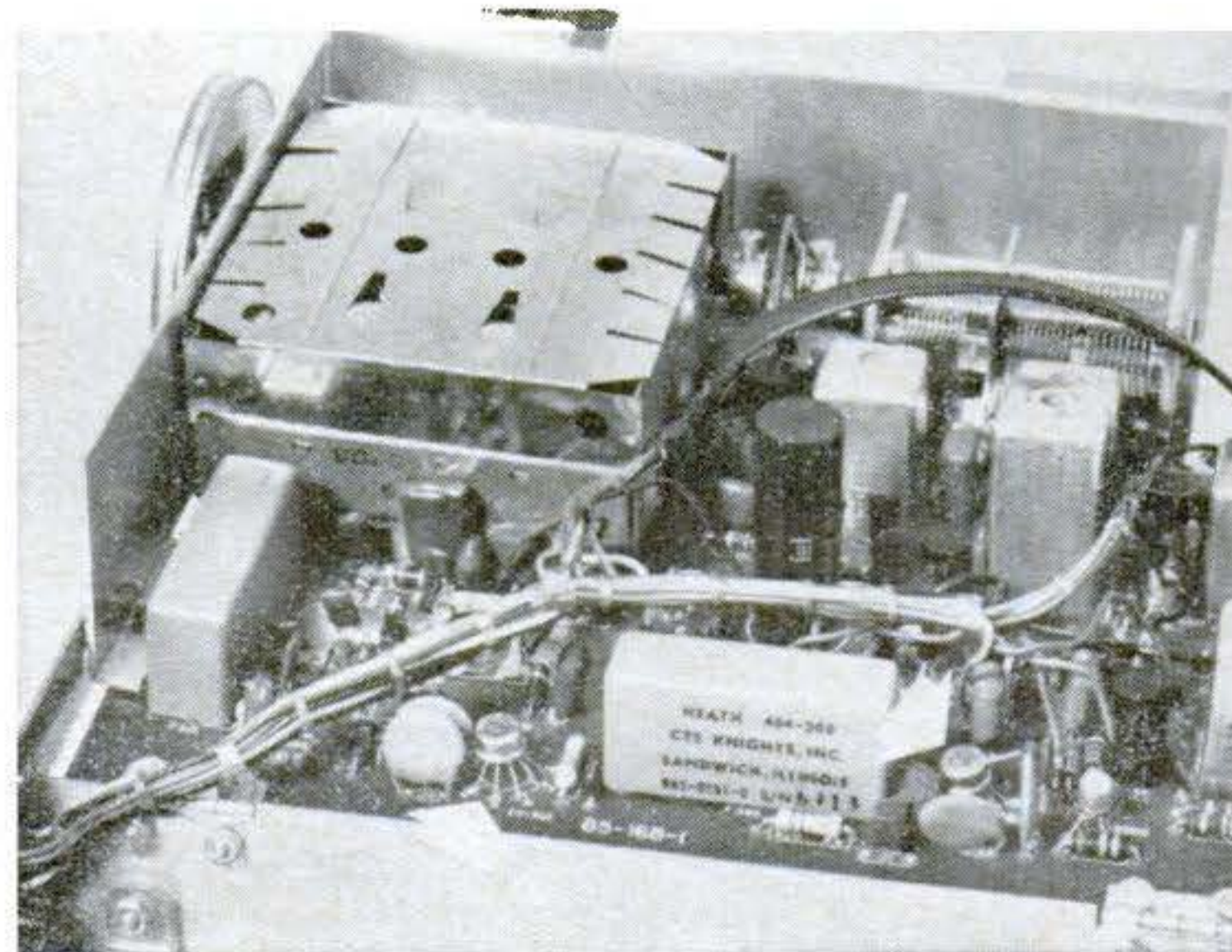
- Its stereo FM-multiplex tuner ranks with the hottest available. In my tests, it consistently locked onto weak, deep-fringe FM signals with the tenacity of a bear trap.

- The 50-watt-per-channel stereo amplifier can drive even the most inefficient speakers to ear-shattering levels. Its frequency response is so wide, and its inherent distortion so low, that it's hard to imagine that any other amplifier—at any price—could produce significantly better sound.

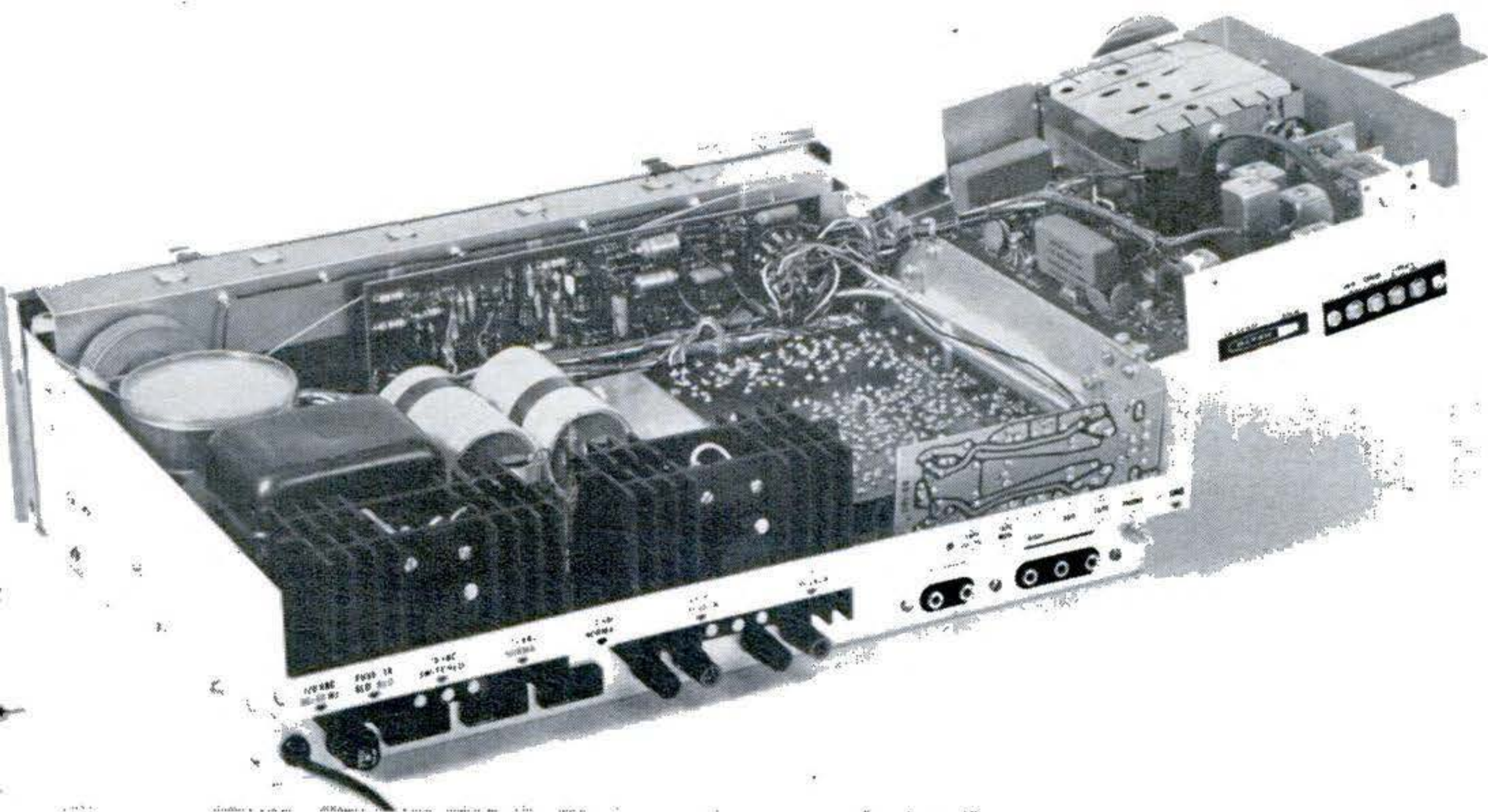
As you'd expect, the AR-15's price tag is as impressive as its performance. The kit costs \$330, plus \$20 for the walnut cabinet shown above. (A factory-wired version is available for \$500.)

Not for novices. In Heath fashion, the instruction manual is comprehensive and easy to follow. But this isn't a kit for

beginners. Wiring took me over 25 hours, and, near the end, I found myself working in many tight corners. The circuit includes 69 silicon transistors, 43 diodes, two integrated circuits, and thousands of



One of the most advanced FM tuner circuits available is responsible for AR-15's excellent multiplex performance. The tuner's front end (square metal can above) uses field-effect transistors to boost sensitivity. Its IF strip has two fixed-tuned crystal filters (gray rectangular cans) instead of finicky adjustable transformers, and two integrated circuits (arrows) replace conventional transistors.



Tightly packed chassis of AR-15 contains seven printed-circuit boards tied together by three wiring harnesses. The AM/FM tuner subchassis is hinged to the main chassis (above) so it can be swung out for servicing.

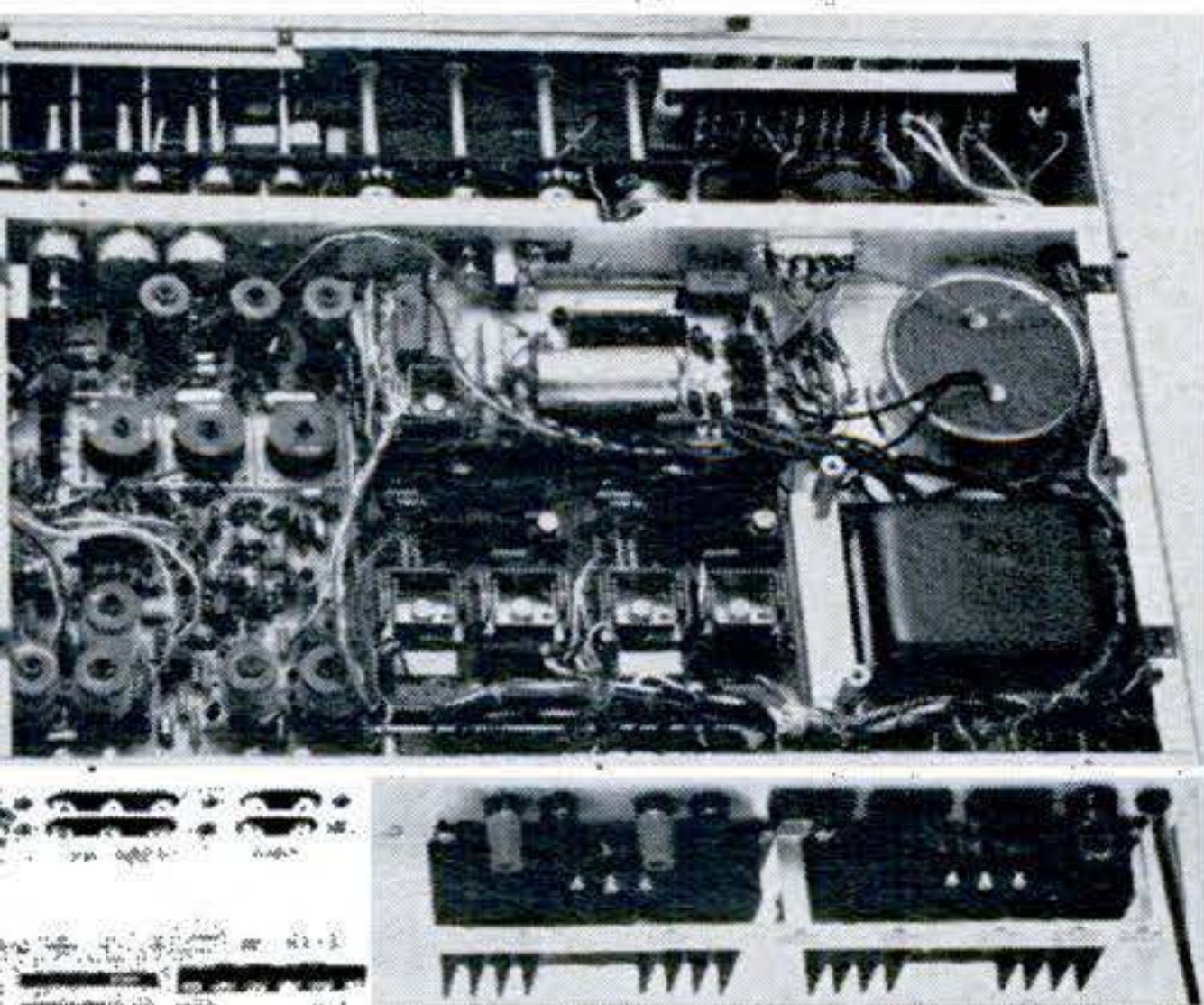
Comes in a Kit

other components, all crammed into a 17"-by-5"-by-15" package.

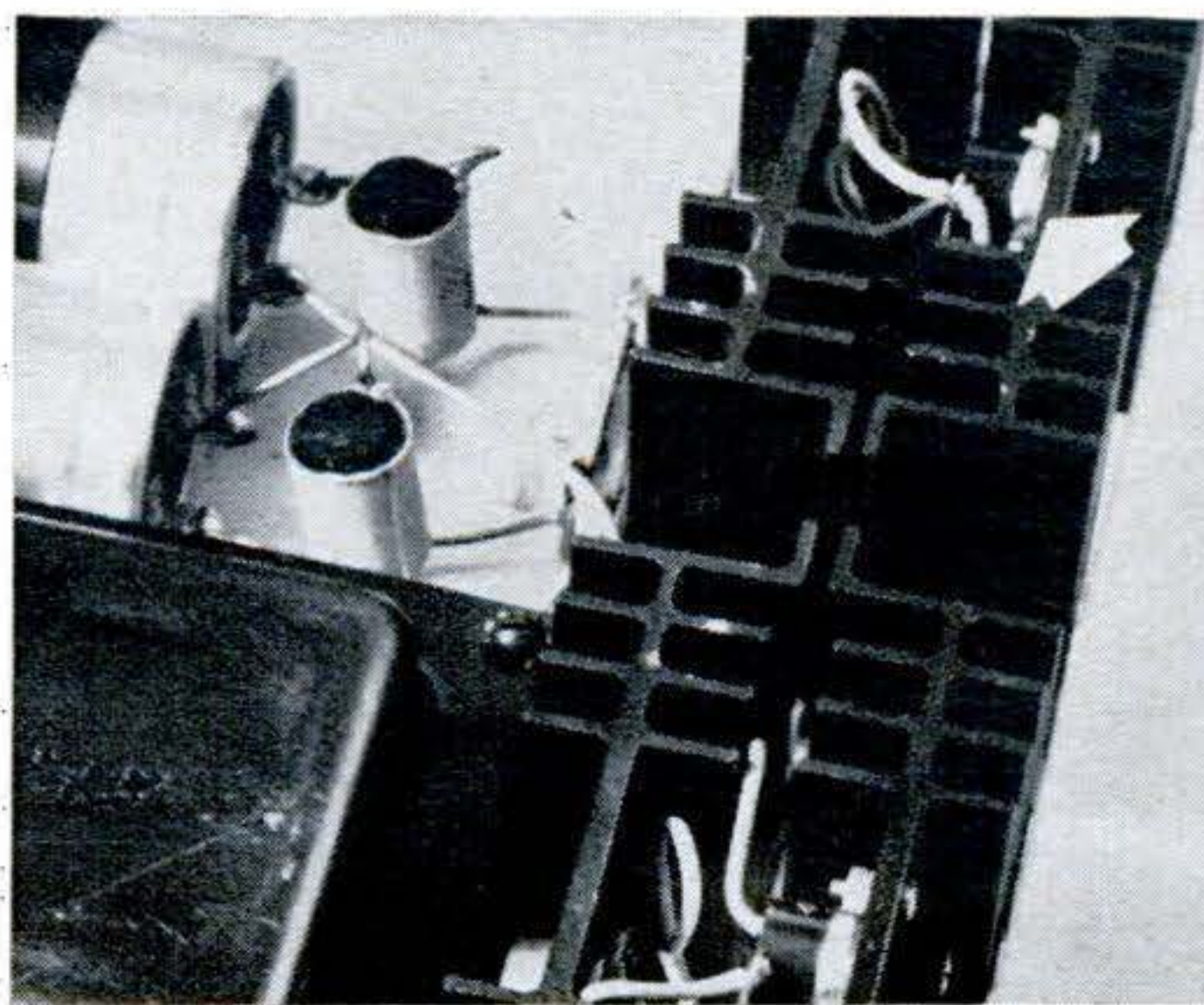
A valuable assembly aid is a built-in test-meter circuit. At the flip of a switch the FM/AM tuning meter becomes a

volt-ohm meter for checking circuit operation and testing most of the set's components.

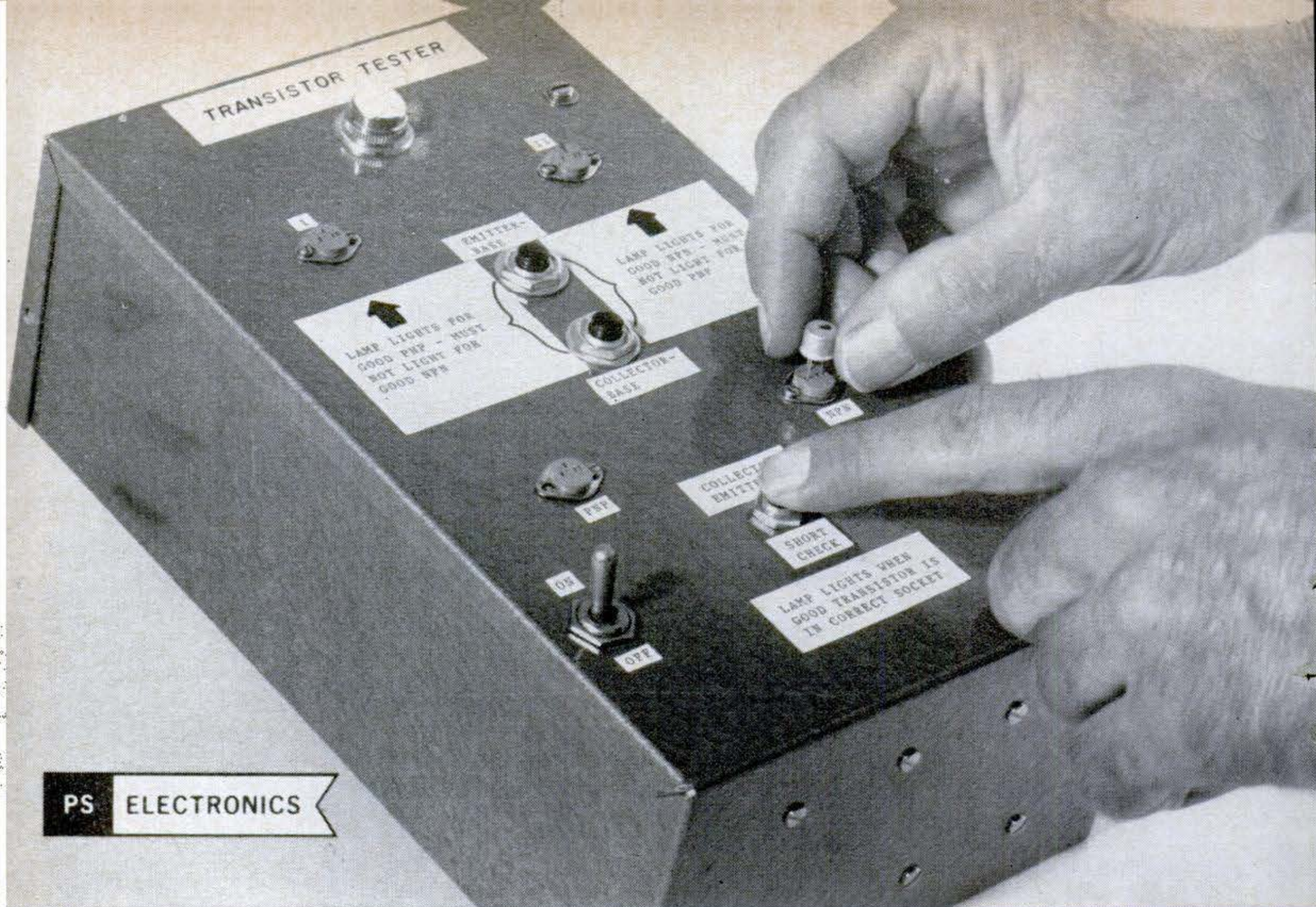
The AR-15 is sold by the Heath Co., Benton Harbor, Mich. 49022.



Underside of the chassis shows a maze of printed-circuit boards and interconnecting wires. Note the forest of control shafts visible at the top of the picture—the AR-15 features a comprehensive control panel that includes all of the usual controls plus individual level potentiometers for each of the 10 amplifier input jacks (concealed behind the drop-down Heath nameplate on the front panel).



Four output-stage power transistors (two for each channel) are mounted on finned aluminum heat sinks and protected against overheating by temperature-sensitive switches (arrow). If, due to component failure or short circuit, the heat-sink temperature exceeds 65 degrees C., the switches turn off the amplifier's power supply and flash on a red "Hi-Temp" warning light on the front panel.



You can build this Super-Simple Transistor Tester

Low power? High power? Silicon? Germanium?
This gadget tests all junction transistors

By JAMES G. SLOAT

Why do you need a transistor tester? Just total up the number of transistors you own—inside the many different transistorized electronic devices around your home—and you've got your answer.

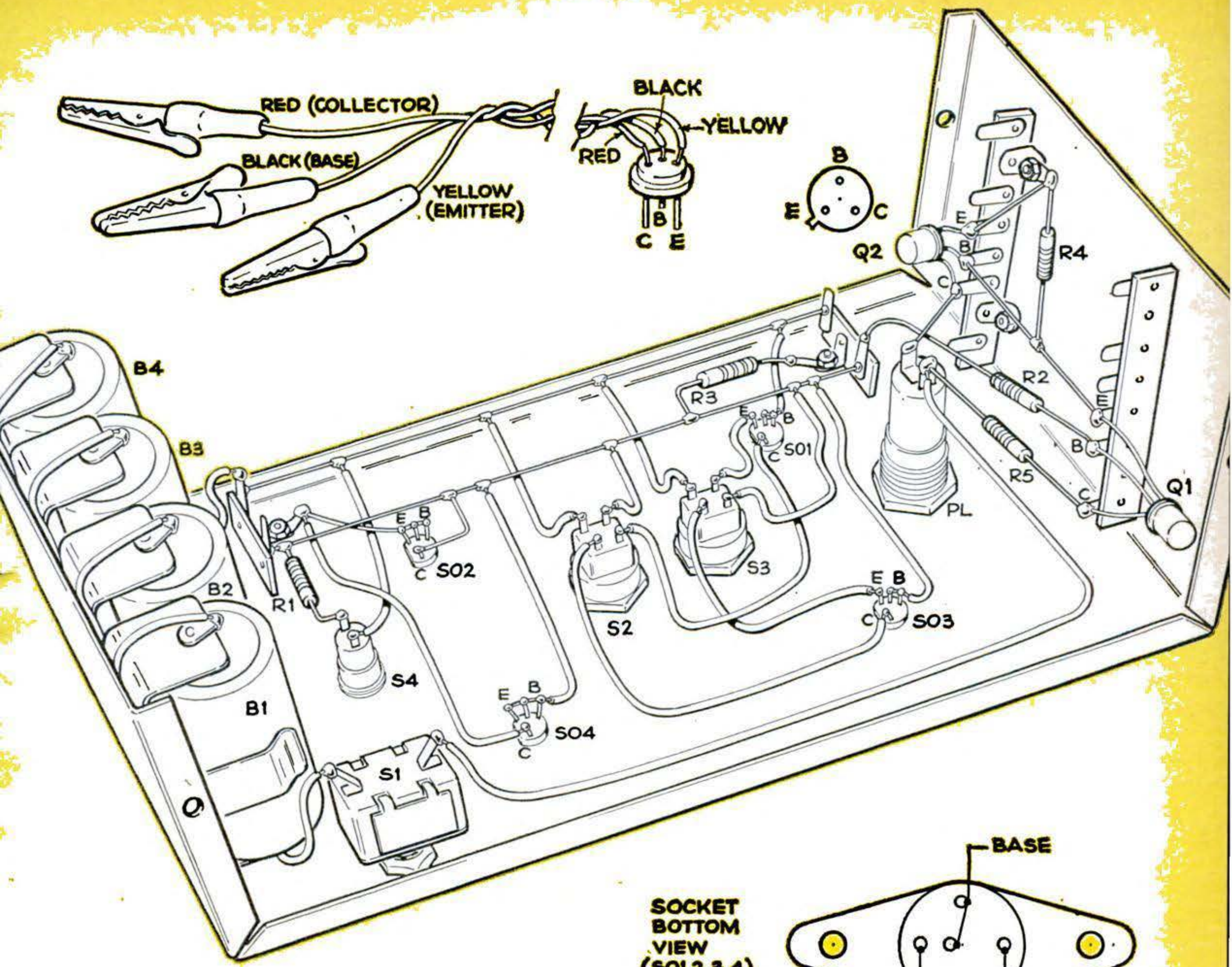
The low-cost transistor tester shown above can tell you in seconds whether or not a transistor is good. There are no meters to read—the good/bad indicating device is a small pilot light. I'll tell you how to interpret the test results later in this article.

How it works. Transistors Q1 and Q2 (see diagram) in

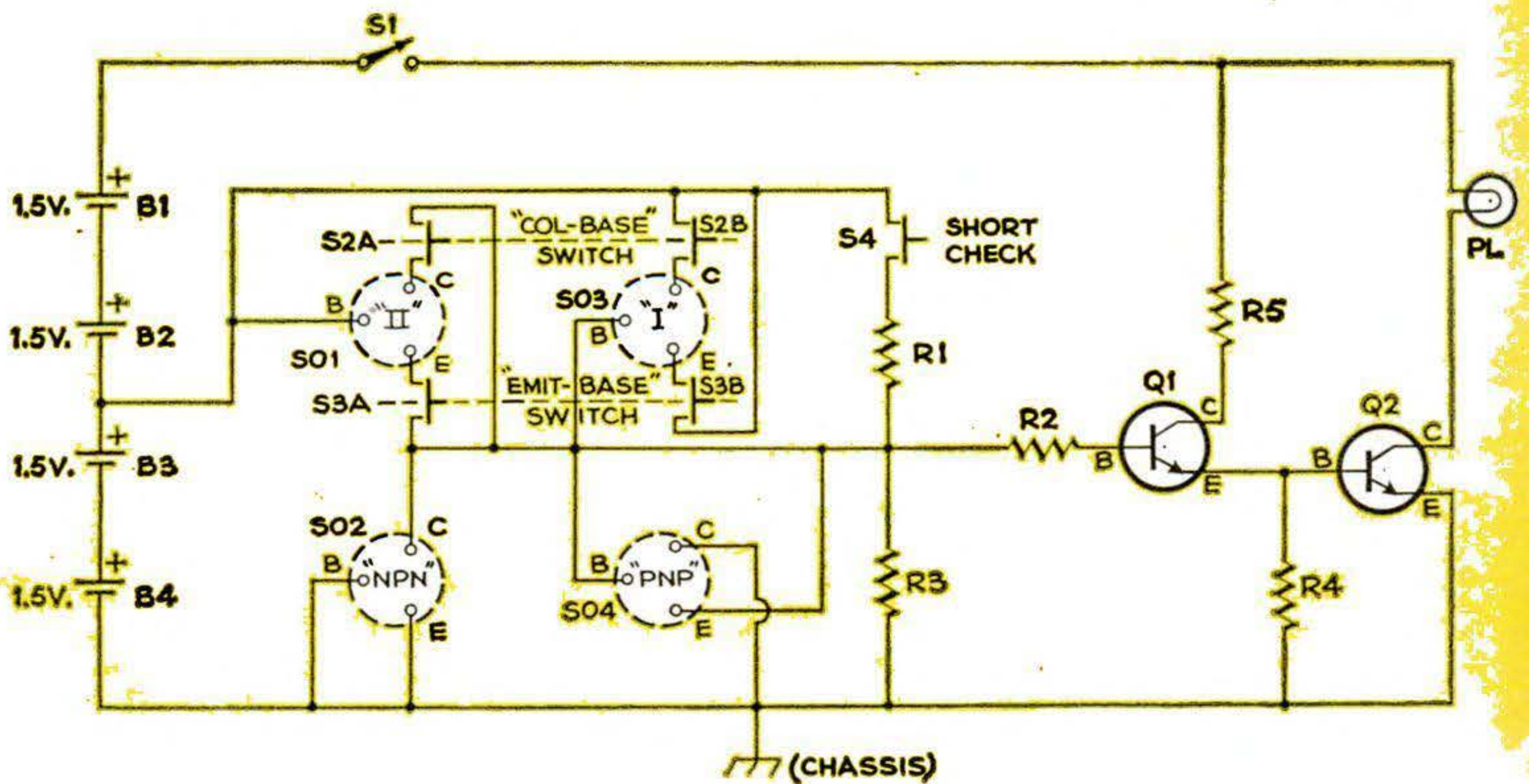
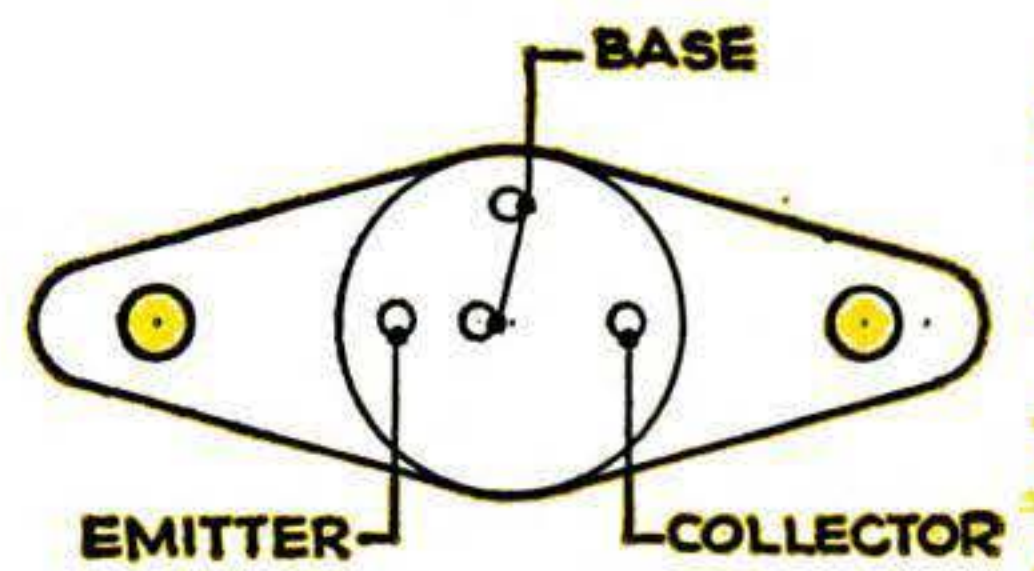
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PARTS LIST

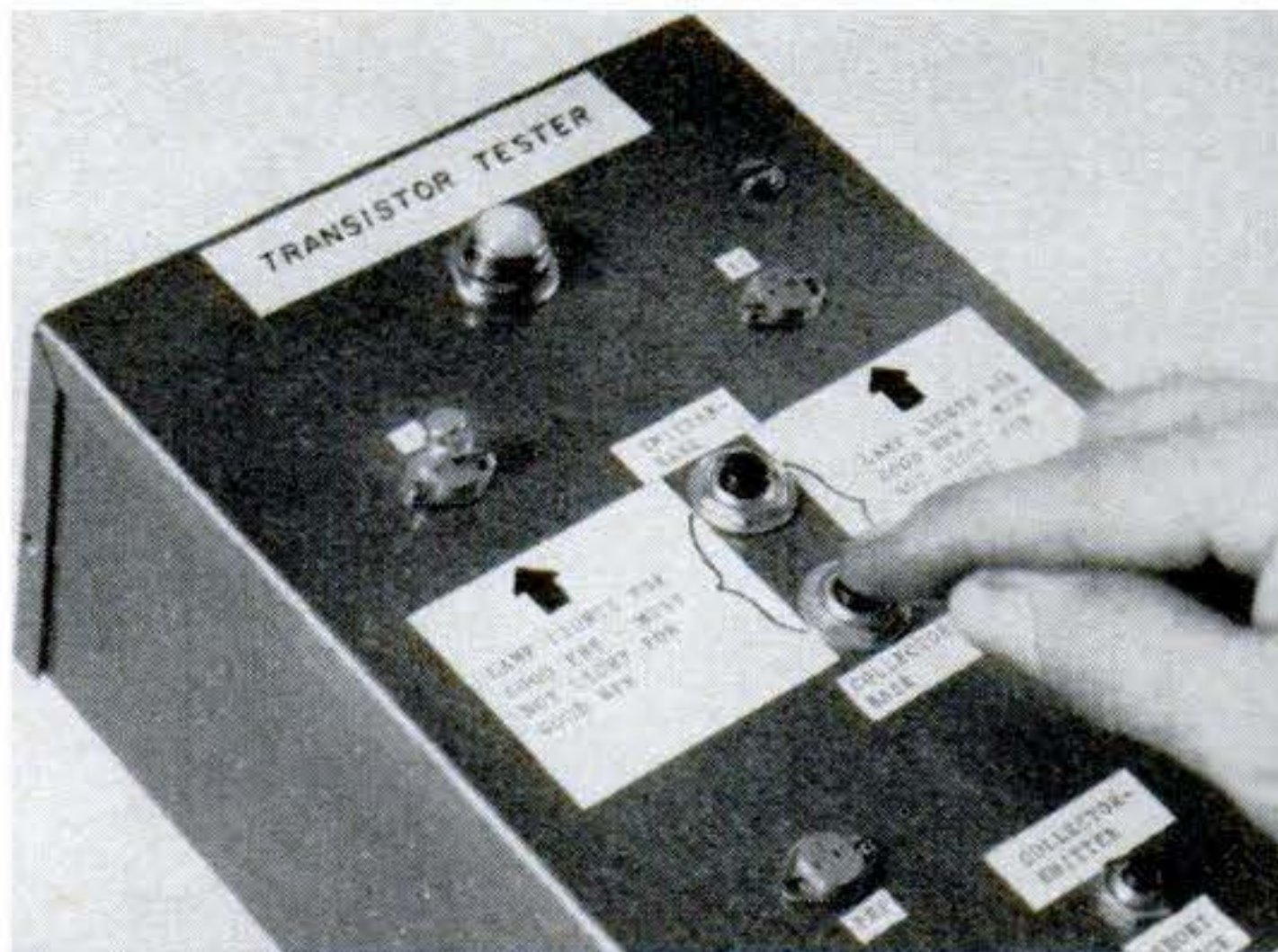
- R1, R5—220-ohm, ½-watt carbon resistor
- R2—330-ohm, ½-watt carbon resistor
- R3—2,200-ohm, ½-watt carbon resistor
- R4—10,000-ohm, ½-watt carbon resistor
- Q1, Q2—Texas Instruments 2N697 transistor
- S1—SPST toggle switch
- S2, S3—DPST pushbutton switch
- S4—SPST pushbutton switch
- PL—#47 pilot lamp in panel-mount holder
- Misc.—Aluminum minibox (see text); four dry-cell holders (Keystone 175); four D dry cells; four transistor sockets (Elco 05-3301, or equivalent); three insulated alligator clips.



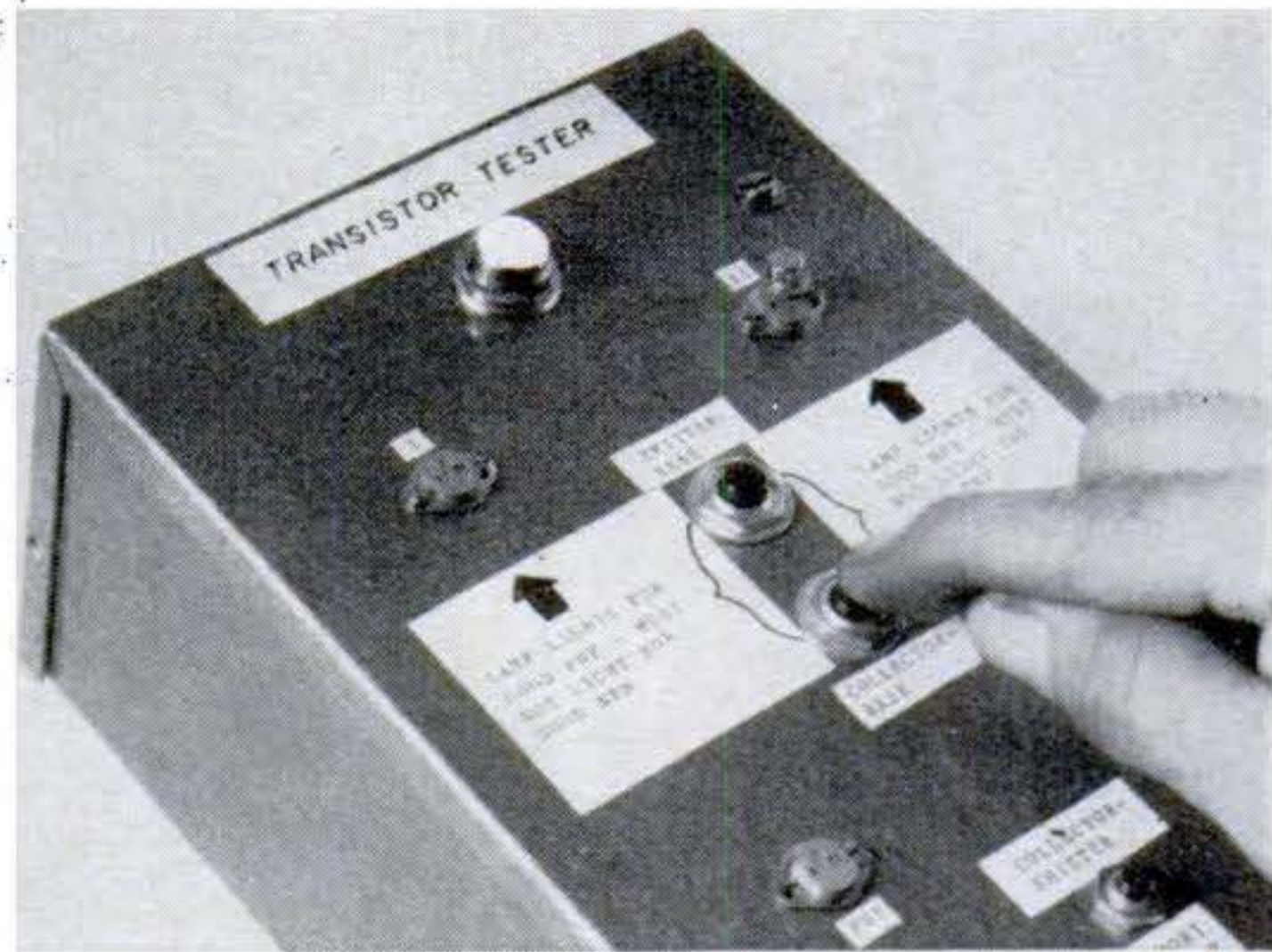
SOCKET
BOTTOM
VIEW
(S01,2,3,4)



Here's how to test a typical low-power transistor



1. Insert the transistor into socket I (SO1), and press switches S2 and S3, in turn. Note if the bulb lights when either pushbutton switch is pressed.



2. Shift the transistor to socket II (SO2), and press switches again. Note bulb, as before, and refer to text below to interpret what you see.

the tester's circuit are interconnected to form a sensitive DC amplifier that controls the pilot-light bulb PL. The lamp will light whenever a small current is fed into the base terminal of Q1.

The rest of the circuit is a straightforward switching arrangement that lets you connect the different junctions within the transistor you wish to test to the amplifier circuit.

The idea is simple: Any conventional junction transistor acts as if it consists of two junction diodes mounted back to back, when you look at only two of its three leads at a time. One is the emitter-base junction (seen between its emitter and base leads); the other is the collector-base junction (seen between its collector and base leads).

We can test these junctions individually by attempting to pass small direct currents through them. And that's what this tester does. If the currents do get through, the two-transistor amplifier detects them, and lights the pilot lamp.

Building it. A 10"-by-6"-by-3½" aluminum minibox serves as a chassis. Mount the switches, sockets, and battery holders as shown in the diagrams.

Make the power-transistor adapter shown out of a discarded low-power transistor. Cut off the case top, and remove the crystal. Then solder three test leads to the terminal pins (on many transistors, the case is the internal collector terminal). Add an insulated alligator clip to the free end of each lead.

To test a power transistor, clip the test leads to the appropriate terminals, and plug the transistor-case end into the correct panel-mounted sockets as specified below.

Using it. The simple testing procedure is pictured above: First, plug the transistor into socket I (SO1) and press switches S2 (Emitter-Base) and S3 (Collector-Base) in turn. Repeat the test with the transistor in socket II (SO2). The following rules apply:

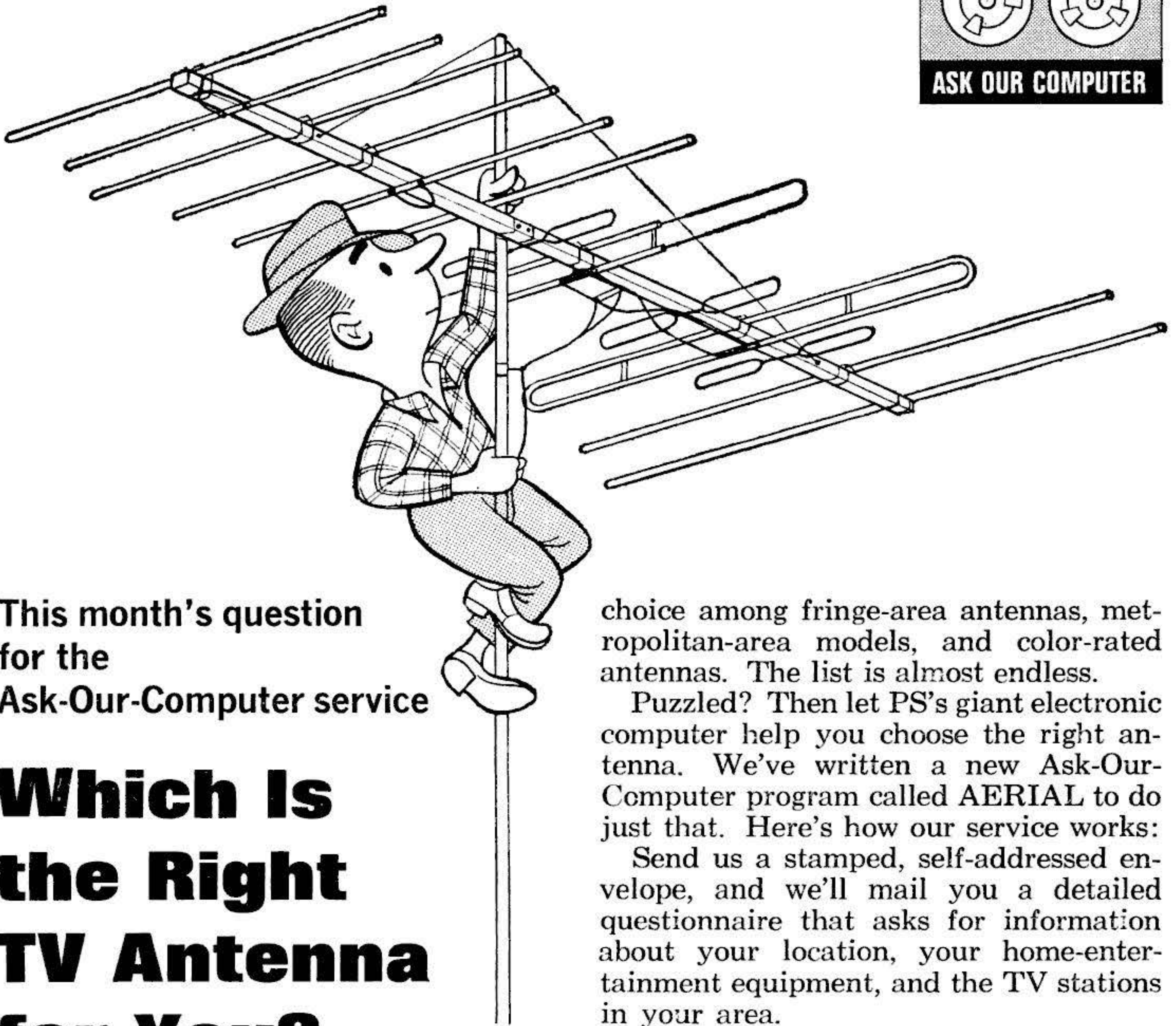
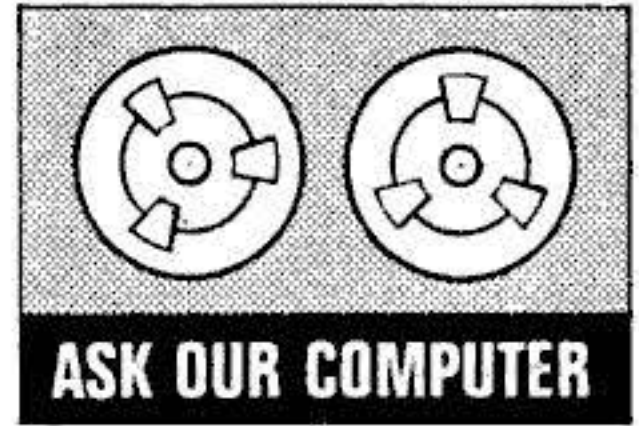
When either of the buttons is pushed—

- The lamp *will* light when a *good* PNP transistor is in socket I.
- The lamp *won't* light when a *good* PNP transistor is in socket II.
- The lamp *will* light when a *good* NPN transistor is in socket II.
- The lamp *won't* light when a *good* NPN transistor is in socket I.

You should summarize these rules on small labels pasted on the checker, as we did (see photo on first page). By making these tests, you can check the junctions in a known polarity transistor or, by working backwards, you can determine the polarity of any *good* transistor.

Next step is to check for collector-emitter short circuit—a common cause of transistor failure. Plug the transistor into either socket SO3 (if it is a PNP transistor) or SO4 (for an NPN unit). Then press switch S4. The lamp will light when a *good* transistor is in the *correct* socket.

If the transistor passes this test, and the ones above, it is good. PS



This month's question
for the
Ask-Our-Computer service

Which Is the Right TV Antenna for You?

If you get lost floundering
through the TV antenna "jungle,"
let the PS computer take your
hand and lead the way

Been thinking about replacing your old weather-worn TV antenna? If you have, then you know there is a veritable jungle of models to choose from. Some are designed specifically for very-high-frequency (VHF) operation—channels 2 through 13. Others will pull in ultra-high-frequency (UHF) signals—channels 14 through 86—as well. Still others claim to do double duty, picking up FM broadcasts as well as TV.

And then, of course, you can take your

choice among fringe-area antennas, metropolitan-area models, and color-rated antennas. The list is almost endless.

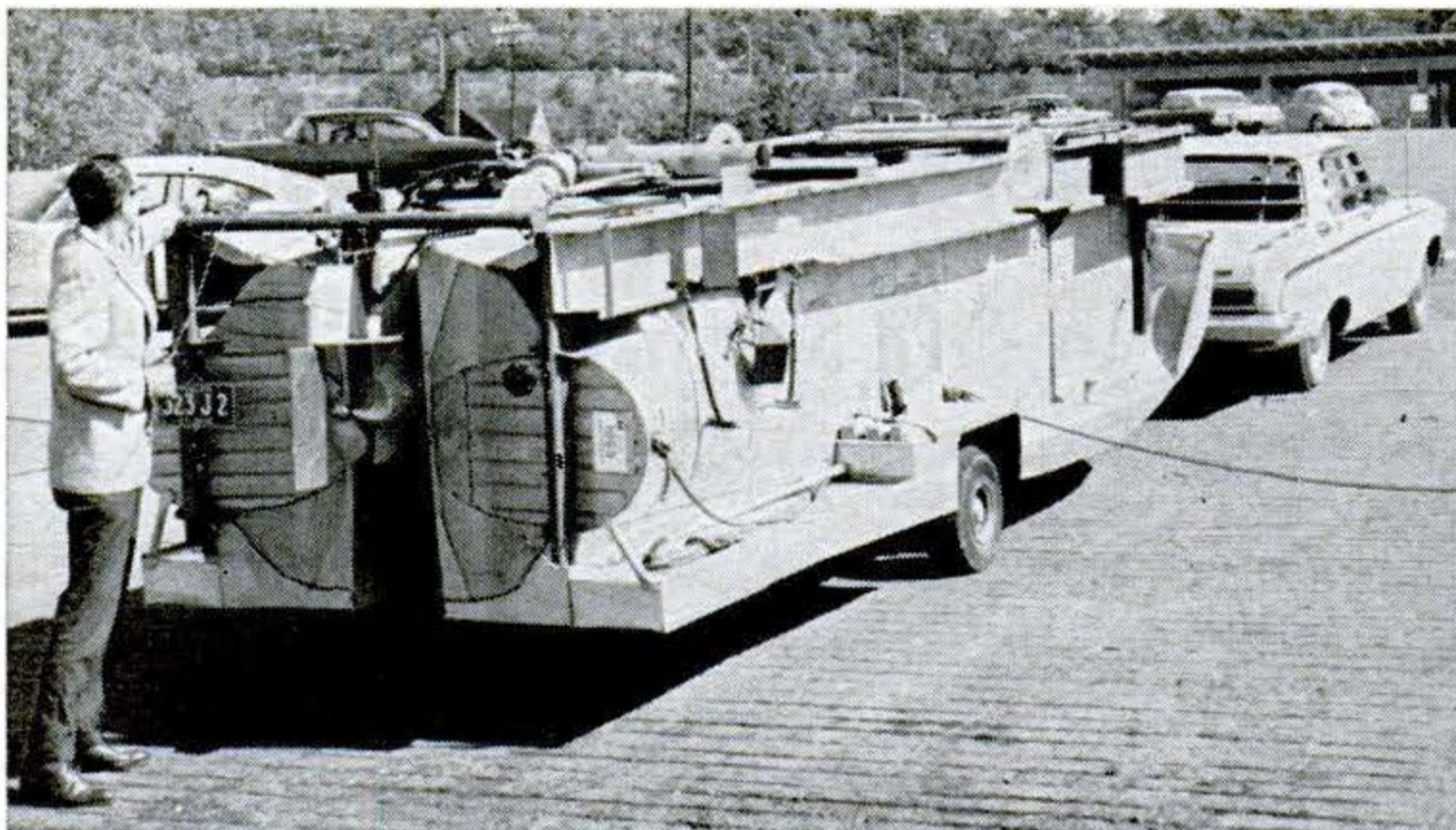
Puzzled? Then let PS's giant electronic computer help you choose the right antenna. We've written a new Ask-Our-Computer program called AERIAL to do just that. Here's how our service works:

Send us a stamped, self-addressed envelope, and we'll mail you a detailed questionnaire that asks for information about your location, your home-entertainment equipment, and the TV stations in your area.

When you return the completed questionnaire to us, with a \$1 service fee, our computer operators will feed the data it contains into the machine. The computer will analyze the information and determine the type of antenna you need. Then it will compare your requirements with the specifications of currently available antennas, and print out a list that tells you which model (or models) comes closest to meeting your needs. You will receive the actual list produced by the computer.

Send your stamped, self-addressed envelope (legal size) to Ask-Our-Computer, Program #7, POPULAR SCIENCE, 355 Lexington Ave., NYC 10017.

If you have any suggestions for problems that would make suitable and useful Ask-Our-Computer programs, write them on a postcard, and mail them to Ronald M. Benrey, PS Electronics Editor.



Autamaran arrives at riverside in this picture sequence, with car pulling catamaran on trailer.

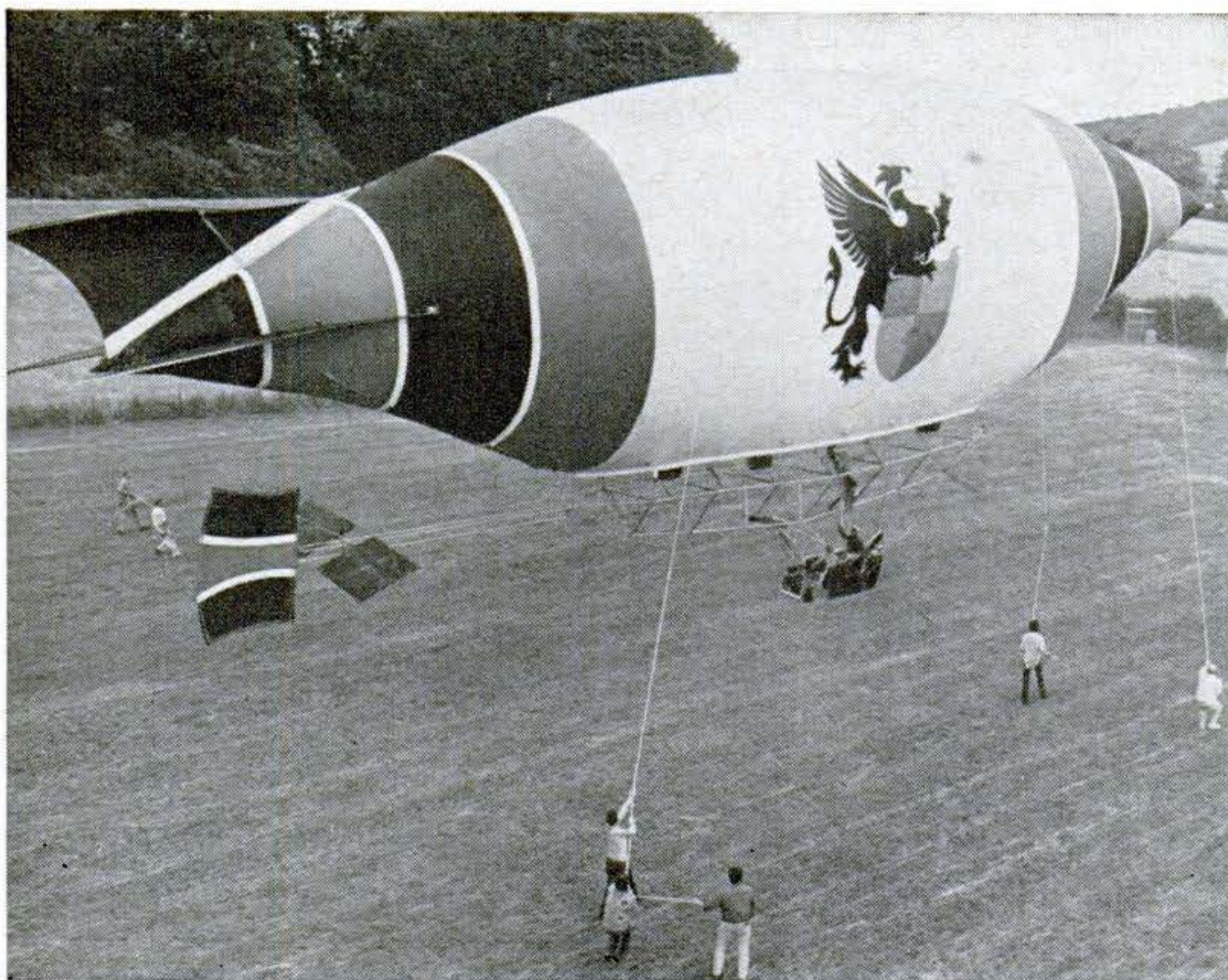
Car propels homemade catamaran

A Cincinnati engineer, John Brush, has spent a dozen years contriving a way to make his family car run on water as well as on land. Now he's got it. His 1963 car drives nicely on lake or inlet. Brush and his family have cruised on the Great Lakes, the upper Mississippi, the Ohio River, and the St. Lawrence. In fact, he drove his car—on waterways—to Canada's Expo 67.

Brush accomplishes this feat by mating his automobile to a catamaran. He calls the

result his Autamaran. He merely connects the car's drive shaft to the boat's prop shaft. The Autamaran cruises at 15 m.p.h. on water and can do 25. At top speed the car's speedometer reads 110. On land Brush gets about 15 m.p.g., on water about two.

He figures his hybrid vehicle has cost him \$20,000. To get at the connecting point on the drive shafts, he removes the rear seat and a plate on the car floor. A crank drops the prop into the water.



Balloon will fly in Van Dyke movie

The first airship to be licensed in England in 30 years is part of the plot in a movie titled *Chitty Chitty Bang Bang* that will star Dick Van Dyke in the next few months. Designer of the 137-foot dirigible is Ken Adam, creator of the James Bond movie gimmicks. It's filled with 36,000 cubic feet of helium and powered by a Volkswagen engine that belt-drives two props.



Then the boat is backed into water. A ramp permits the car to be backed onto deck over twin hulls.



Brush checks the drive-shaft coupler (left), then loosens nuts holding

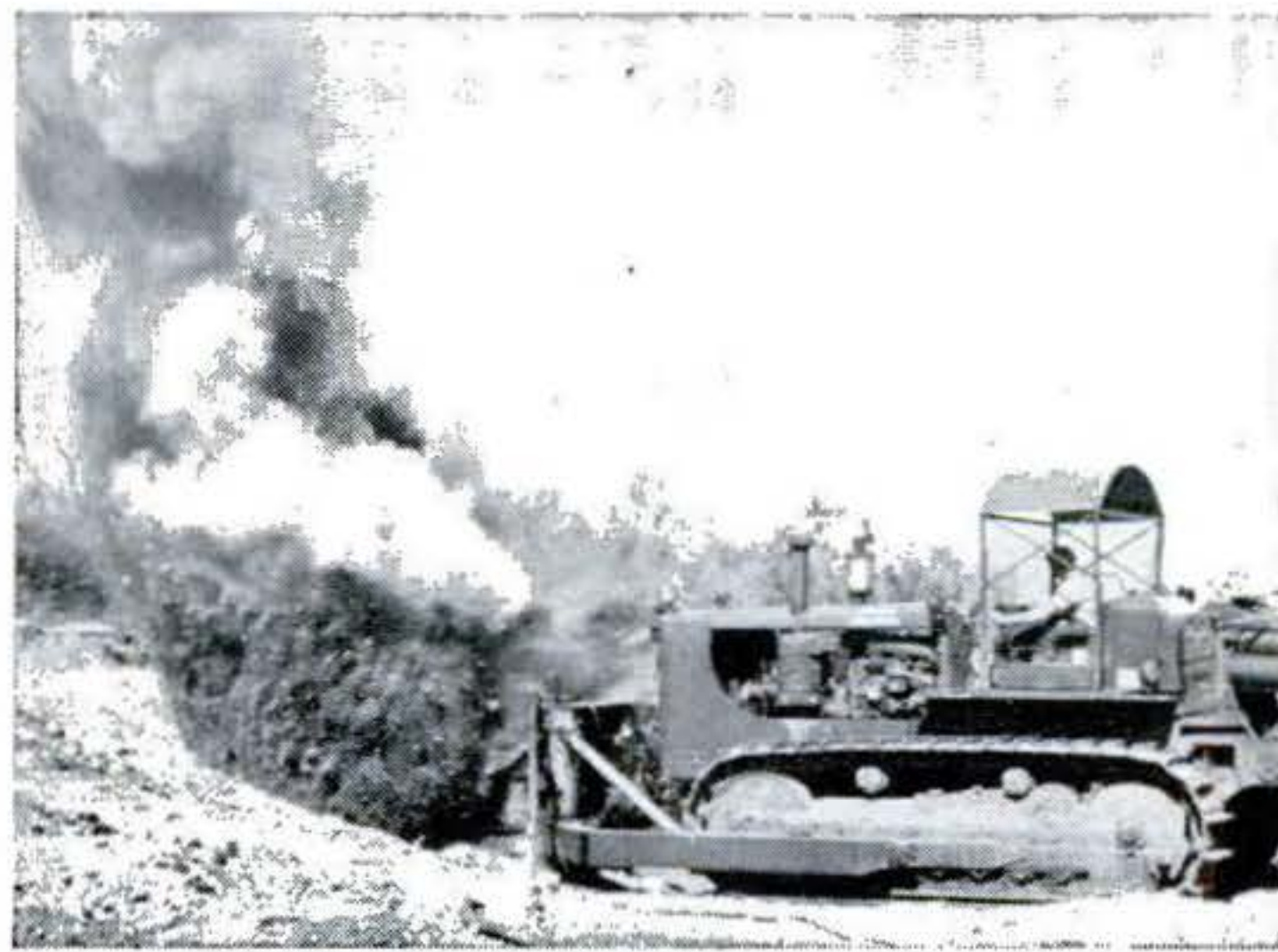
car's drive shaft to the differential through universal. At right, it

is dropped into position for bolting to the catamaran's prop shaft.



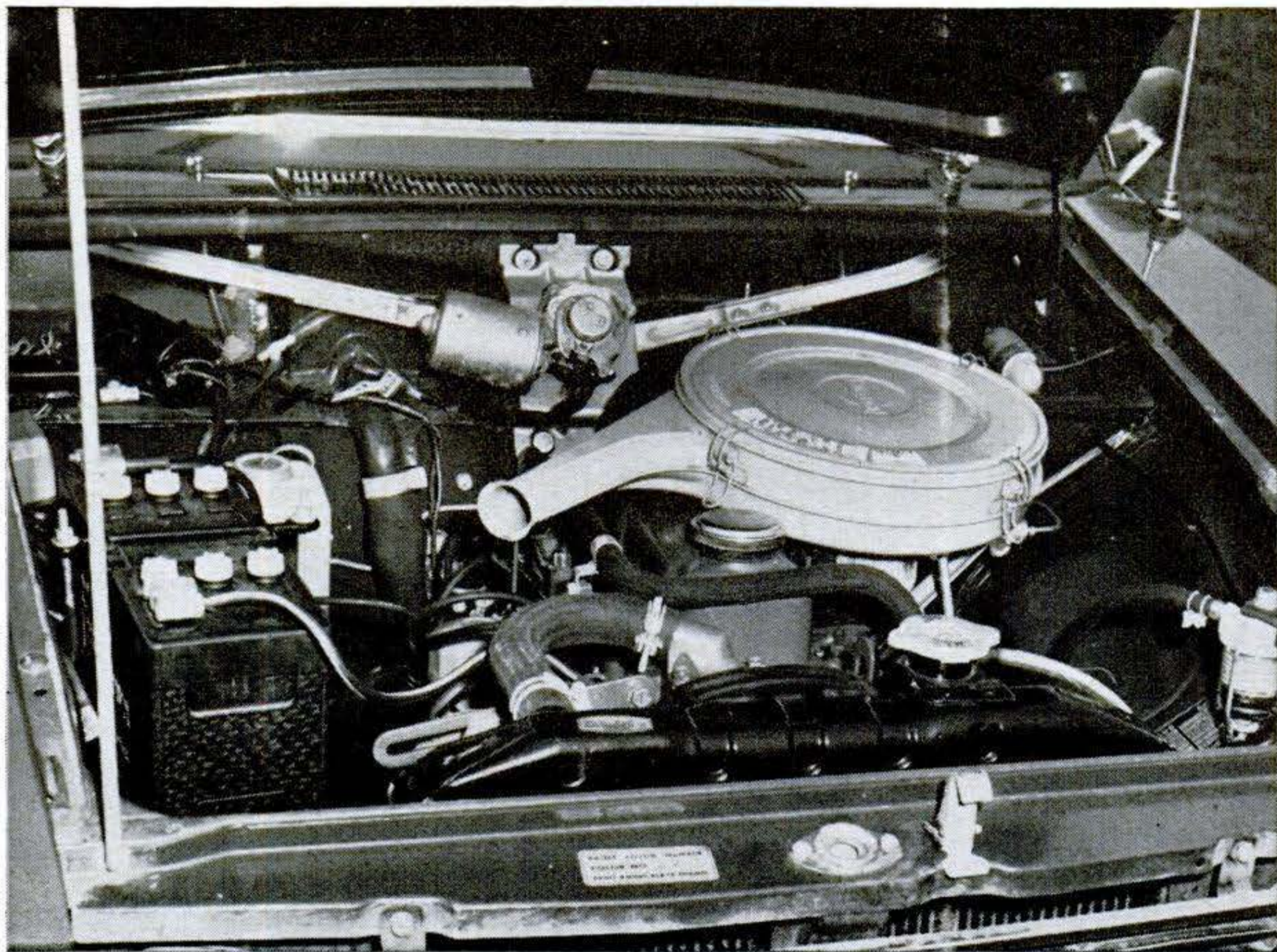
British bus features TV

Some of England's intercity buses now show TV programs as U.S. airliners show movies. The driver controls four screens from a master panel. The sound is piped through loudspeakers or into earphones. There is an antenna on the roof. A converter working off the bus battery supplies power.



Earth mover blasts through soil

An experimental bulldozer that can move 15,000 cubic yards of soil an hour is being tested by The Southwest Research Institute, San Antonio, Tex. A combustion chamber behind the blade, fueled with gasoline or diesel oil and ignited by a spark plug, blasts the dirt loose, and the blade removes it.



Engine compartment is well laid out and extremely tidy in appearance, as photo above shows. Accessibility to all units requiring periodic service is good, and even low-stressed parts look hefty, as if intended for a truck.

PHOTOS BY BILL MORRIS

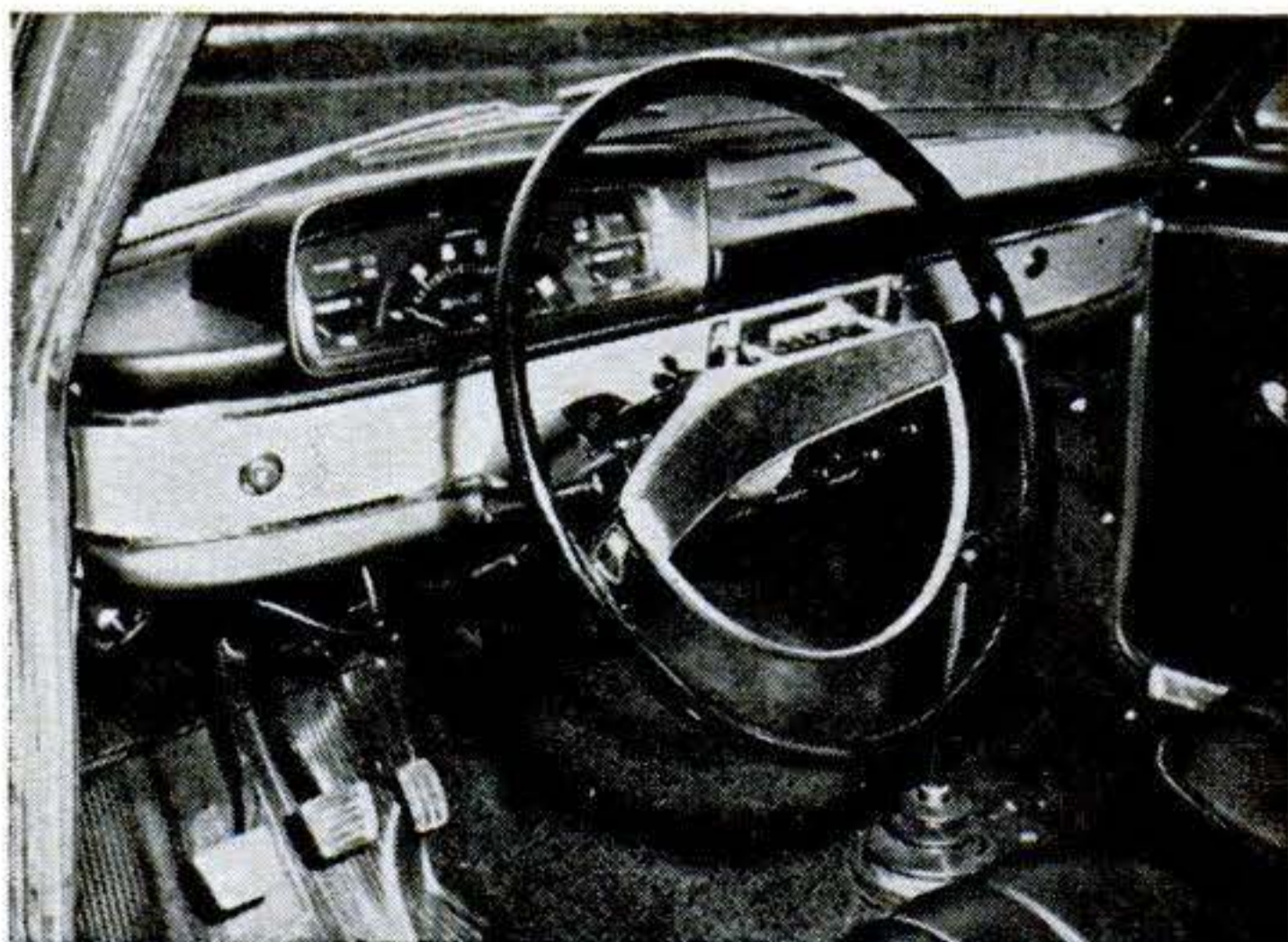


DATSUN

...the hottest-

A well-built small car with an attractive price tag tackles the VW market—and does well

By JAN P. NORBYE / *PS Automotive Editor*



Instrument panel is beautifully clear and sensibly laid out. Pedals are small but properly spaced.

Suddenly there are so many Datsuns around that Volkswagen is beginning to worry. Sales are up about 150 percent since 1966 and continue to grow. Why are 3,000 Americans buying this little Japanese car every month?

It costs only \$27 more than the VW and has a front-mounted water-cooled engine, just like a big car. Datsun also has an excellent reputation for reliability. I know people who have owned Datsuns for years, and they swear you can't wear them out.

You turn the key and it always starts right away. You drive it a long time without servicing it, and nothing goes wrong. You arrive on time, for it will cruise at any legal speed—up to 85 miles an hour, in fact—though with some engine noise. The body is rattle-free and has a comforting solid feel about it. You know that expensive impression some European luxury cars give you? Well, Datsun does the



selling Japanese import

same thing with a low-priced car. It will give you good fuel economy (about 30 m.p.g.) and takes up little parking space.

What's the interior like? It seats four. The seats looked expensive to me, but I wasn't very comfortable. The backrest was short and straight, and had no curvature for the back. Space utilization inside the car is generally good, though head room is poor. Trunk space is restricted. The front doors open wide enough to let you get in and out easily. Entry to the back seat is inconvenient because the wheel well steals a lot of space and the doors have a restricted opening angle.

The ride is hard and often choppy. When I say hard ride, I mean sports-car hard, not just small-car hard. This is the most severe complaint against the car, but I understand the factory will fit softer springs on new cars for the American market. All in all, the Datsun is good value for the money.

Facts on the Datsun PL-411

DIMENSIONS (inches)

Wheelbase	93.7
Front track	47.5
Rear track	47.2
Length	157.3
Width	58.7
Height	56.3

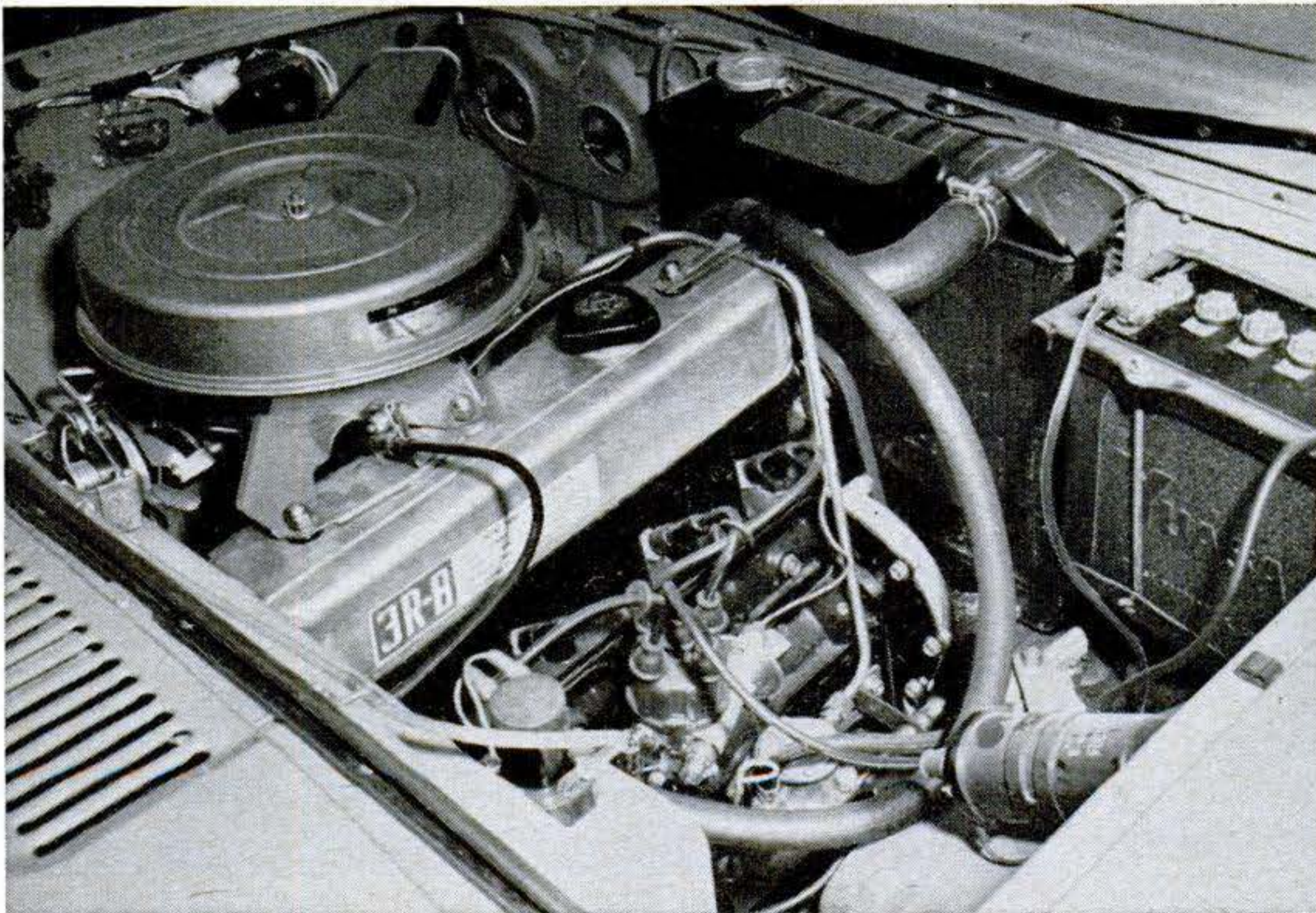
ENGINE

Type	OHV 4-in-line
Displacement	79.3 cu. in.
Bore & stroke	2.874 x 3.055 in.
Compression ratio	8.2:1
Horsepower	67 @ 5,200 r.p.m.
Torque	77 lb.-ft. @ 2,800 r.p.m.

CHASSIS

Transmission	Manual 4-speed (floor shift)
Axle ratio	4.11:1
Tires	5.60 x 13
Brakes	All drums (9-in. diameter)
Steering ratio	15:1
Turning diameter	33 ft.
Curb weight	1,951 lb.
Price (basic)	\$1,666

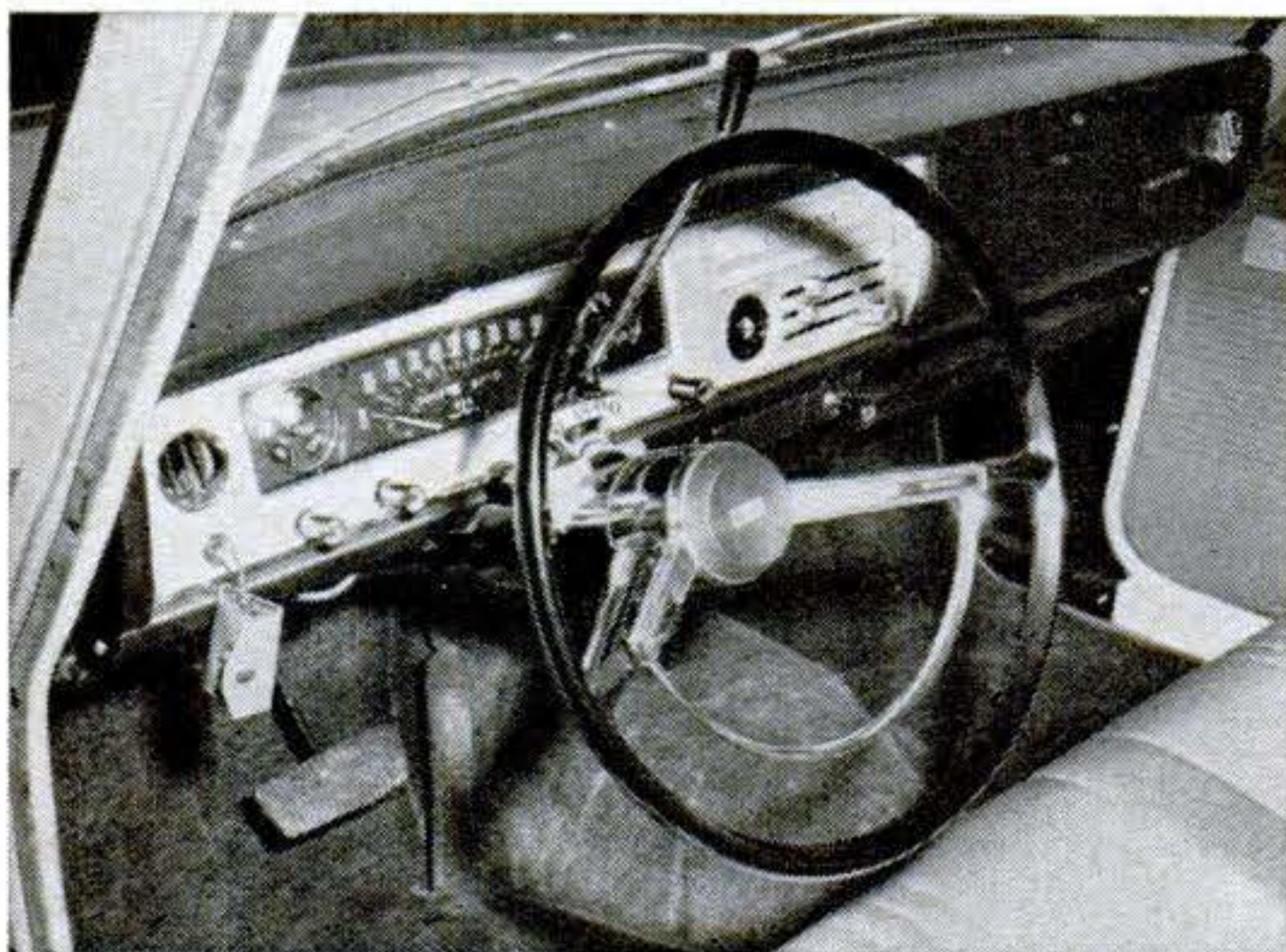
TOYOTA...a powerful new high-quality small sedan



Toyota's four-cylinder 90-hp. engine, a robust and quiet overhead-valve unit with a three-main-bearing crankshaft, nestles under a forward-hinged hood.

Japan's biggest auto maker comes up with a real ace: the rugged and racy Corona

By JAN P. NORBYE / PS Automotive Editor



Neat interior design is capped with uncluttered panel on padded dash. Note left-hand ignition lock.

There's nothing quite like a Toyota. It's a small sedan with a four-cylinder engine, but it goes like a six-cylinder compact. It will go from standstill to 60 in less than 17 seconds, cruise all day at 85 when asked to.

It's not as roomy as a Rambler American, but it offers acceptable comfort for four. Ride comfort is very good, and it seems to get better the worse the roads are. On good roads you don't really notice the ride, but on rough roads you ride in unexpected comfort.

Like other Japanese cars, the quality of the bodywork is impressive: no rattles, nothing coming loose every so often, good insulation from the road noise.

Under the hood, you find engineering details that many makers of small cars skimp on: nylon bushings instead of a plain mechanical connection; ball bearings instead of cotter pins. Toyota quality goes into things you don't often look

Longer, wider, and lower than a Volkswagen, the Toyota has strikingly individual styling and presents a big-car look with its four headlights.



PHOTOS BY BILL MORRIS

at, like battery ground straps and transmission linkages, as well as door handles and steering wheels. Everything looks as if it's built to last forever—not just until the week after the warranty runs out.

On the highway, the engine is fairly quiet, but you're aware that you're not driving a big car. Side winds can take it off course. Cornering, the Toyota is stable, the steering precise. Body roll is moderate even on sharp turns.

Brakes? Most European auto makers fit front disks as standard on a car of the Toyota's performance potential, but the Japanese stay with drums. (Disks aren't even optional on the Corona.) However, its drums have fins for extra cooling and proved adequate in normal use.

At a base price of \$1,760 (the automatic transmission in our test car lists for an additional \$165), the Toyota is a car well worth looking at.



DIMENSIONS (inches)

Wheelbase	95.3
Front track	50
Rear track	50
Length	161.8
Width	61
Height	55.9

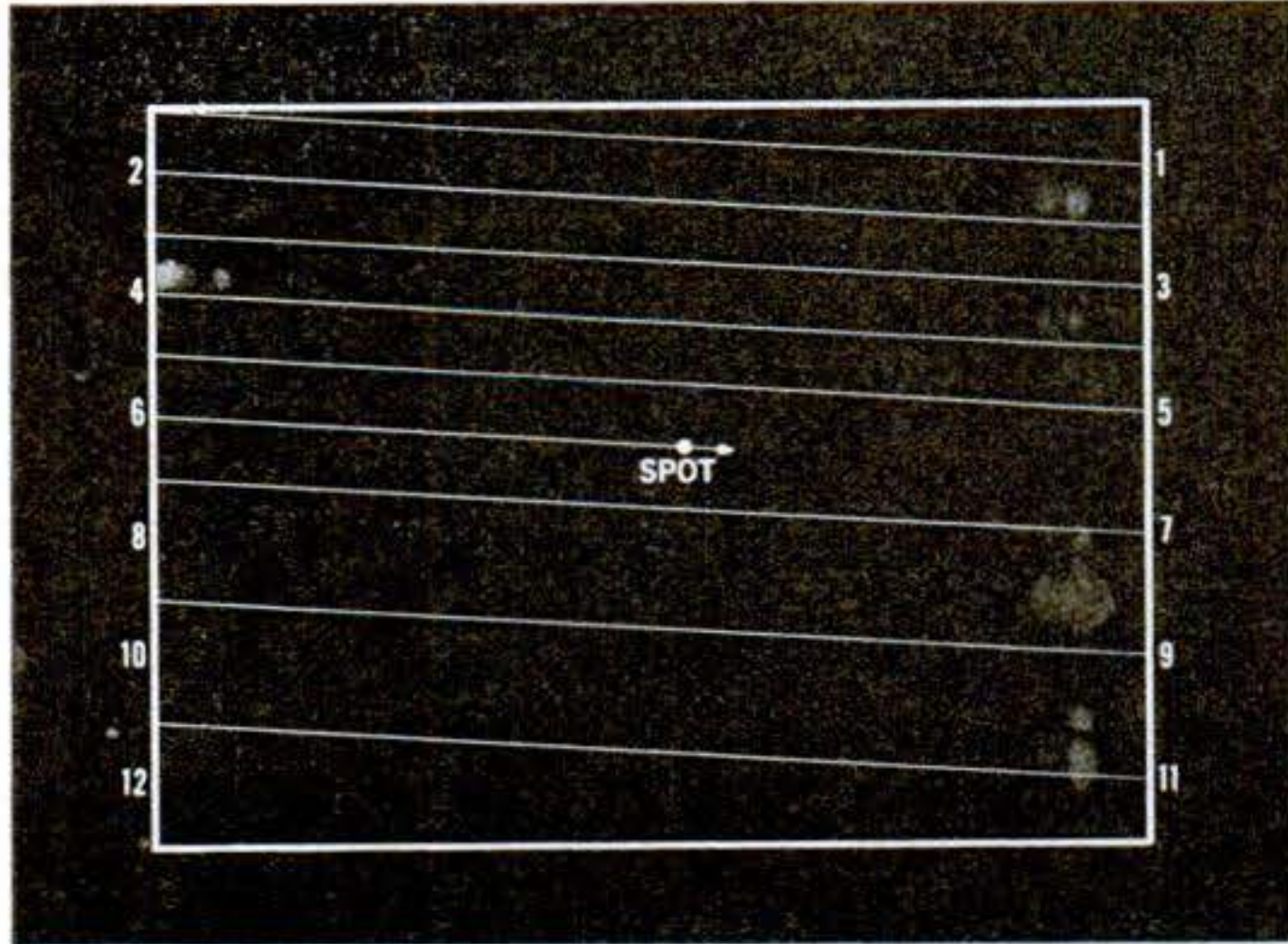
ENGINE

Type	OHV 4-in-line
Displacement	115.7 cu. in.
Bore & stroke	3.46 x 3.07 in.
Compression ratio	8:1
Horsepower	90 @ 4,600 r.p.m.
Torque	110 'b.-ft. @ 2,600 r.p.m.

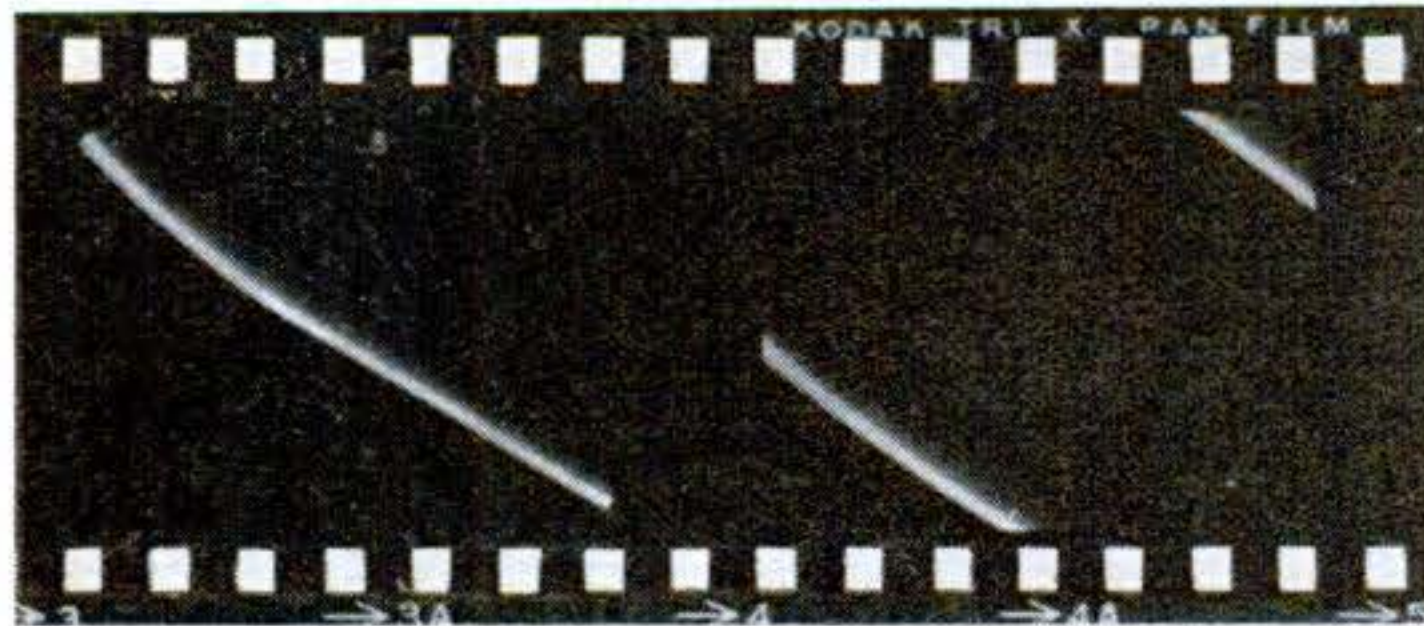
CHASSIS

Transmission	automatic 2-speed (manual 3-speed standard)
Axle ratio	3.7:1
Tires	5.60 x 13
Brakes	All drum (9.1-in. diam.)
Steering ratio	20.8:1
Turning diameter	26.4 ft.
Curb weight	2,139 lb.
Price (as tested)	\$2,060

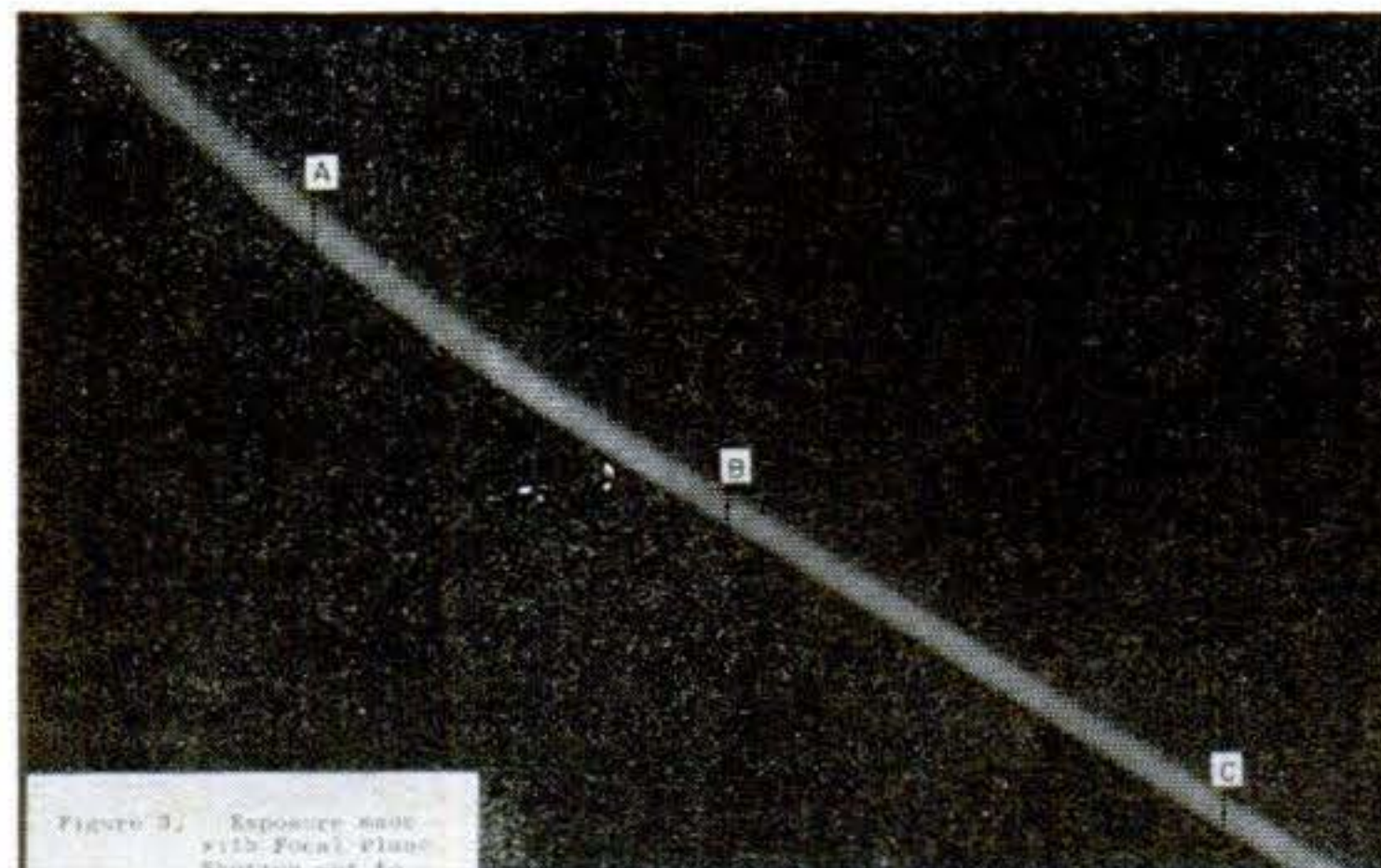
Smart Way to Check a



Moving spot of light, generated by TV cathode-ray tube, scans the viewing screen in an interlaced pattern—first the odd lines, then the even ones—to produce exactly 525 lines every 1/30 second. Hence there is a precise time interval between lines of each pattern of .0000635 seconds (1/15,750).



Different phases of scan cycle were caught in these two frames, taken at 1/1,000-second setting. At left, TV spot had just begun cycle; picture shows complete top-to-bottom progress. At right, exposure was started with spot part way down screen. Diagonal at upper right shows completion of scan.



Complete diagonal (enlargement of left frame above) is desired picture. Line count at points A, B, and C is nine. Thus exposure is consistent, and equals $9 \times 1/15,750$, or $1/1,750$ —too fast. Curve in diagonal shows shutter coming up to speed on release.

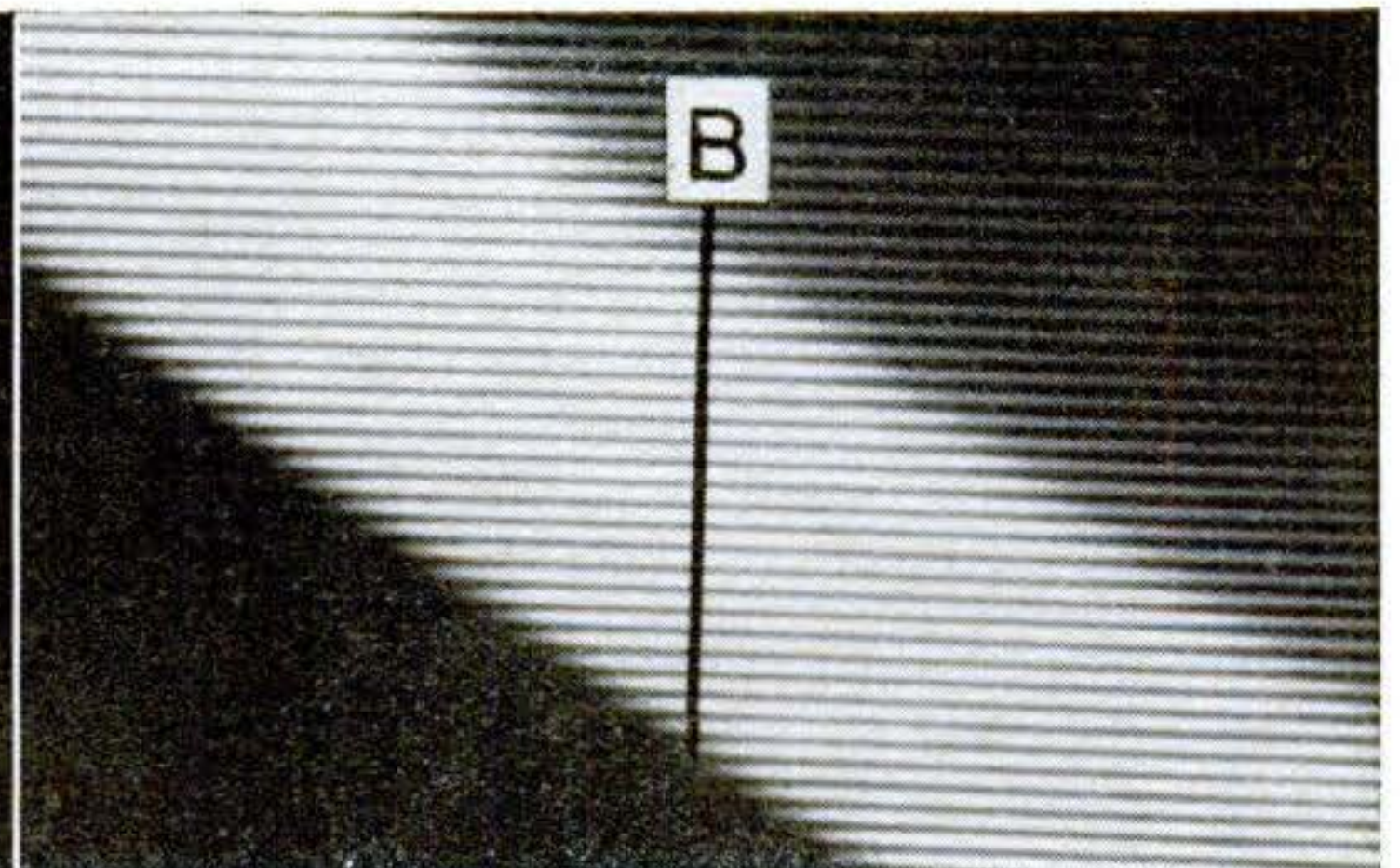
By JOHN W. HAMBLÉN

If your pictures are consistently over- or under-exposed, don't take a hammer to your light meter. The culprit, chances are, is the shutter of your camera.

Here is a superbly accurate way of checking your shutter, with your television set as a test instrument. It uses the fact that your TV picture does not come from a grid of lines simultaneously produced on the screen, but is instead made by a spot of light that moves across the screen ("scans") 525 times every 1/30 of a second in an interlacing pattern: half of the lines, the odd-numbered ones, say, in 1/60 second, the even-numbered ones in the next 1/60.

Snap the picture. Photograph the screen at a speed of 1/60 second or faster, and your camera will record the actual number of lines traced by the spot of light as it traverses the screen once. At speeds between 1/30 and 1/60 second, the film will show one traverse (half the lines) plus a portion of the next. A perfect 1/30-second exposure would show a perfect, complete TV picture.

The time it takes to produce each line is 1/15,750 second. When you count the lines recorded by your camera and then



Test of second camera at 1/1,000 setting showed this result. The line count at point B of diagonal is 25. Hence effective exposure is $25 \times 1/15,750$, or 1/630 second, much slower than it should be. Slight variation in density of white lines is due to TV set.

Camera Shutter: Use Your TV

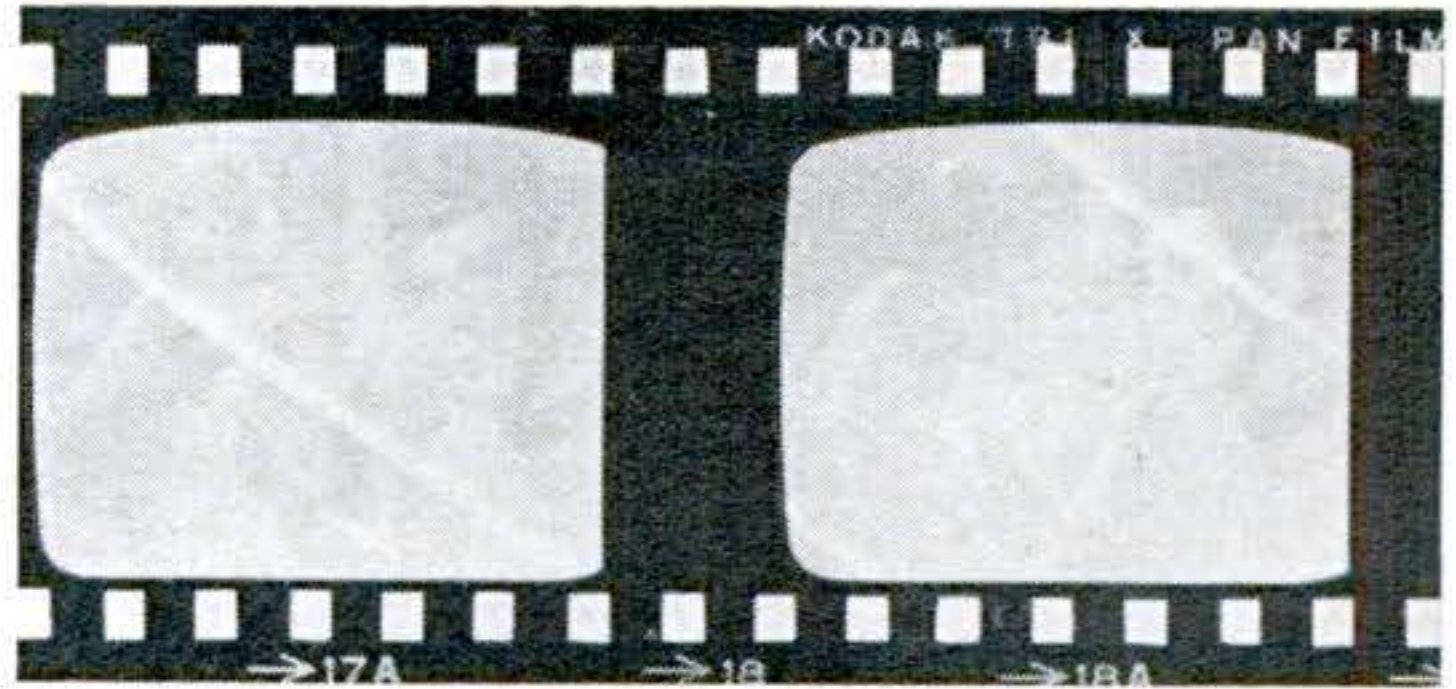
multiply that number by 1/15,750, you get the true exposure speed of the shutter: the exact time it was open. Ten lines, for example, would show a true shutter speed of 1/1,575 second ($10 \times 1/15,750$); 15 lines, 1/1,050 second ($15 \times 1/15,750$).

You can time your camera's shutter speed accurately regardless of whether it has a between-the-lens shutter or a focal-plane shutter. With the between-the-lens shutter, you end up with a simple horizontal bar. With the focal-plane shutter, the image will take the form of a diagonal line. Here's why:

The focal-plane shutter is basically a curtain, like a window shade, with a slit cut across it. When the shutter is released, the slit sweeps across the film—horizontally, in most cases—exposing it, progressively, as it travels.

When you take a picture of a TV screen, the shutter slit, sweeping from side to side, catches the TV spot in motion—scanning from left to right and top to bottom—and records, progressively, as it uncovers the film, portions of lines that are being produced. The result is a diagonal pattern. If, at the beginning of exposure, the spot is in the middle of the screen, you will get two short diagonals—one where the spot has completed

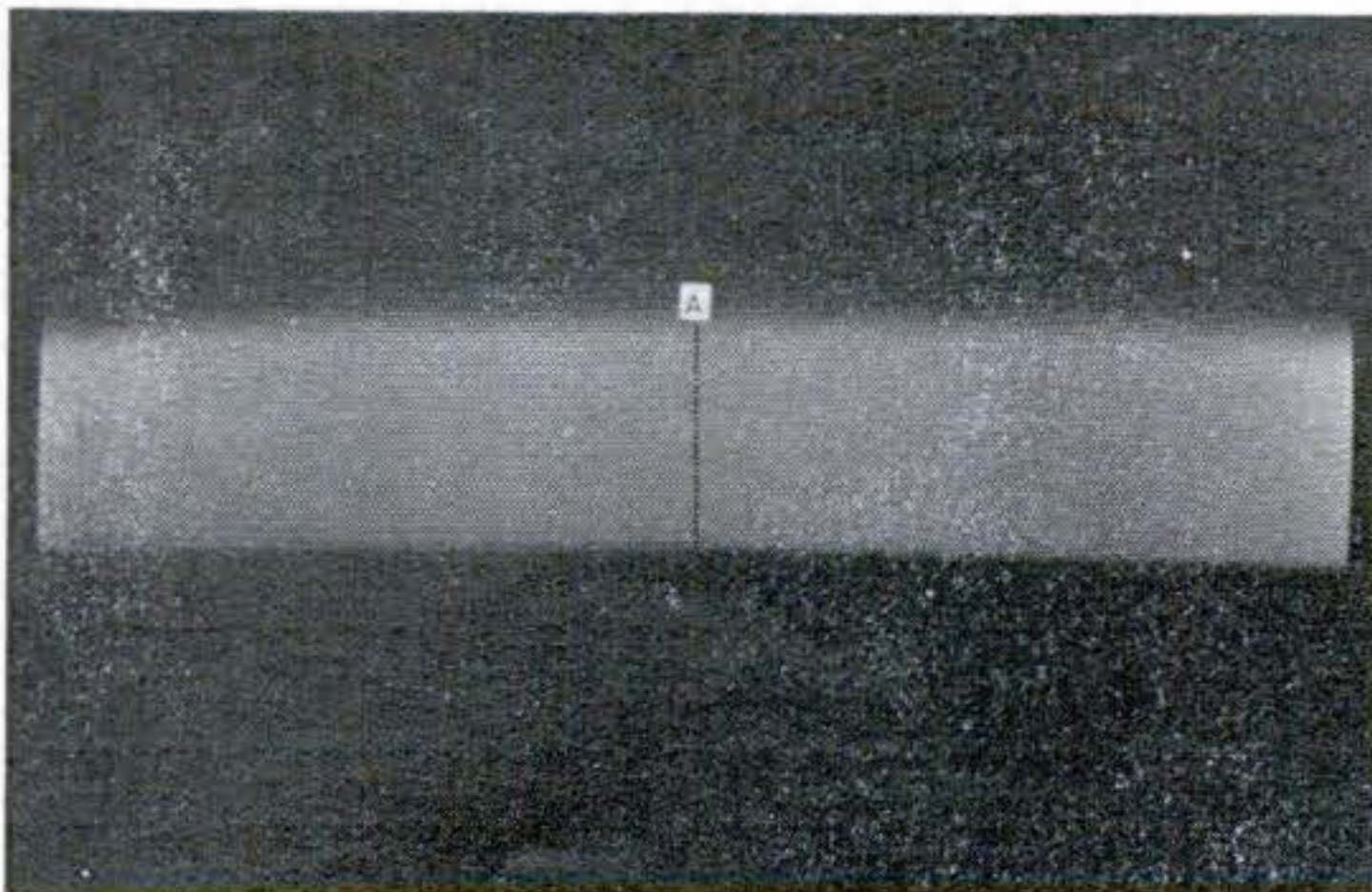
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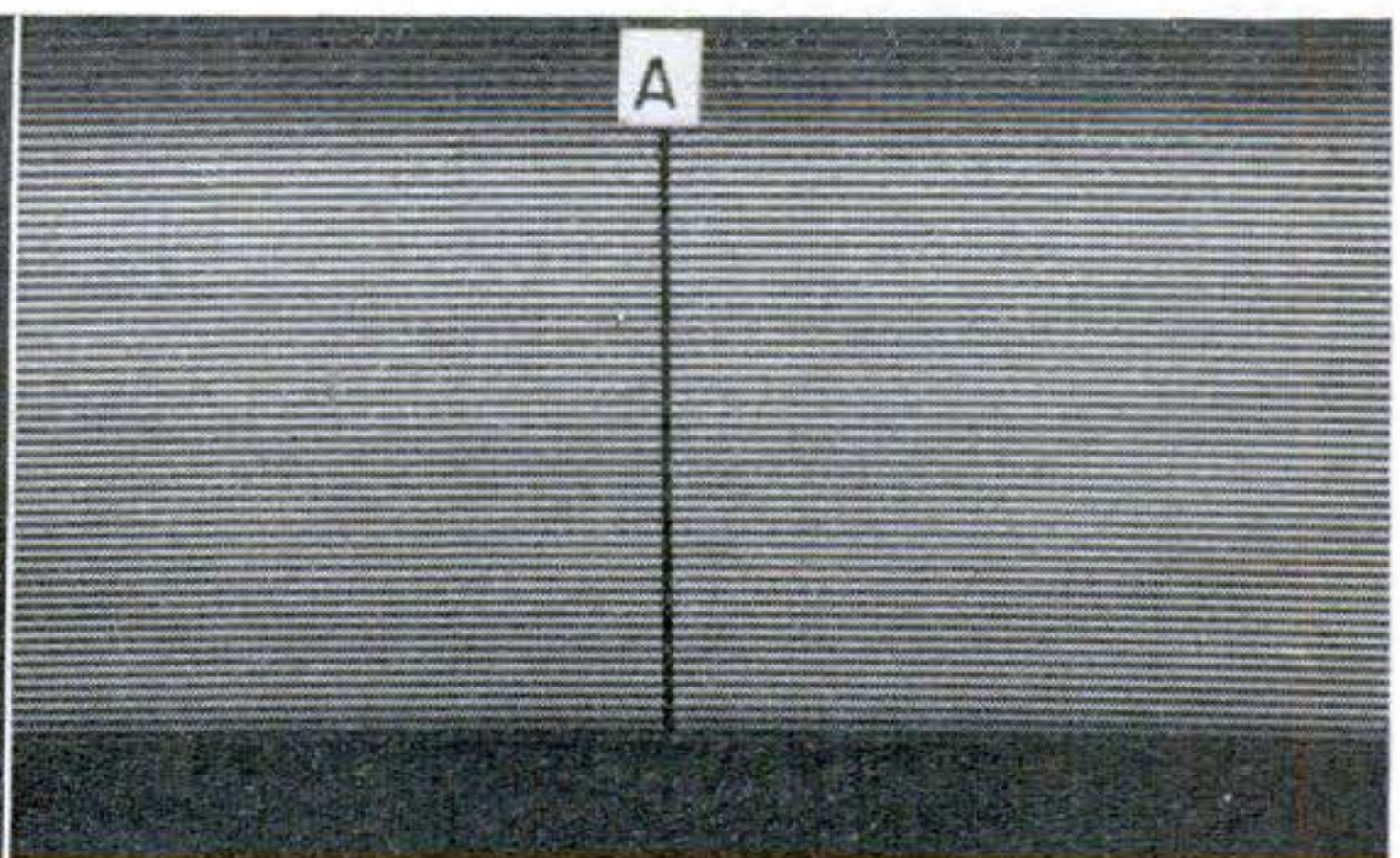
At setting of 1/60 second, these two frames resulted. At perfect 1/60 exposure, picture would show one scan only (half of 525 lines). Here shutter was a bit slow, and recorded part of next interlace scan. Exposure time is thus 1/60 plus time represented by 14 lines in diagonal: 1/1,130 second—not bad.

SHUTTER-CALIBRATION TABLE

TV LINES	EXPOSURE TIME	TV LINES	EXPOSURE TIME
1	1/15,750	75	1/210
2	1/7,875	80	1/197
3	1/5,250	85	1/185
4	1/3,938	90	1/175
5	1/3,150	95	1/166
6	1/2,625	100	1/158
7	1/2,250	110	1/143
8	1/1,969	120	1/131
9	1/1,750	130	1/121
10	1/1,575	140	1/113
15	1/1,050	150	1/105
20	1/788	160	1/98
25	1/630	170	1/93
30	1/525	180	1/88
35	1/450	190	1/83
40	1/394	200	1/79
45	1/350	210	1/75
50	1/315	220	1/72
55	1/286	230	1/68
60	1/263	240	1/66
65	1/242	250	1/63
70	1/225	260	1/61



Horizontal bar was produced by camera with between-the-lens shutter, set at 1/500 second (as indicated on shutter scale). Bar portrays actual TV scan pattern, because shutter does not employ slit-sweep method of focal-plane shutter. Counting



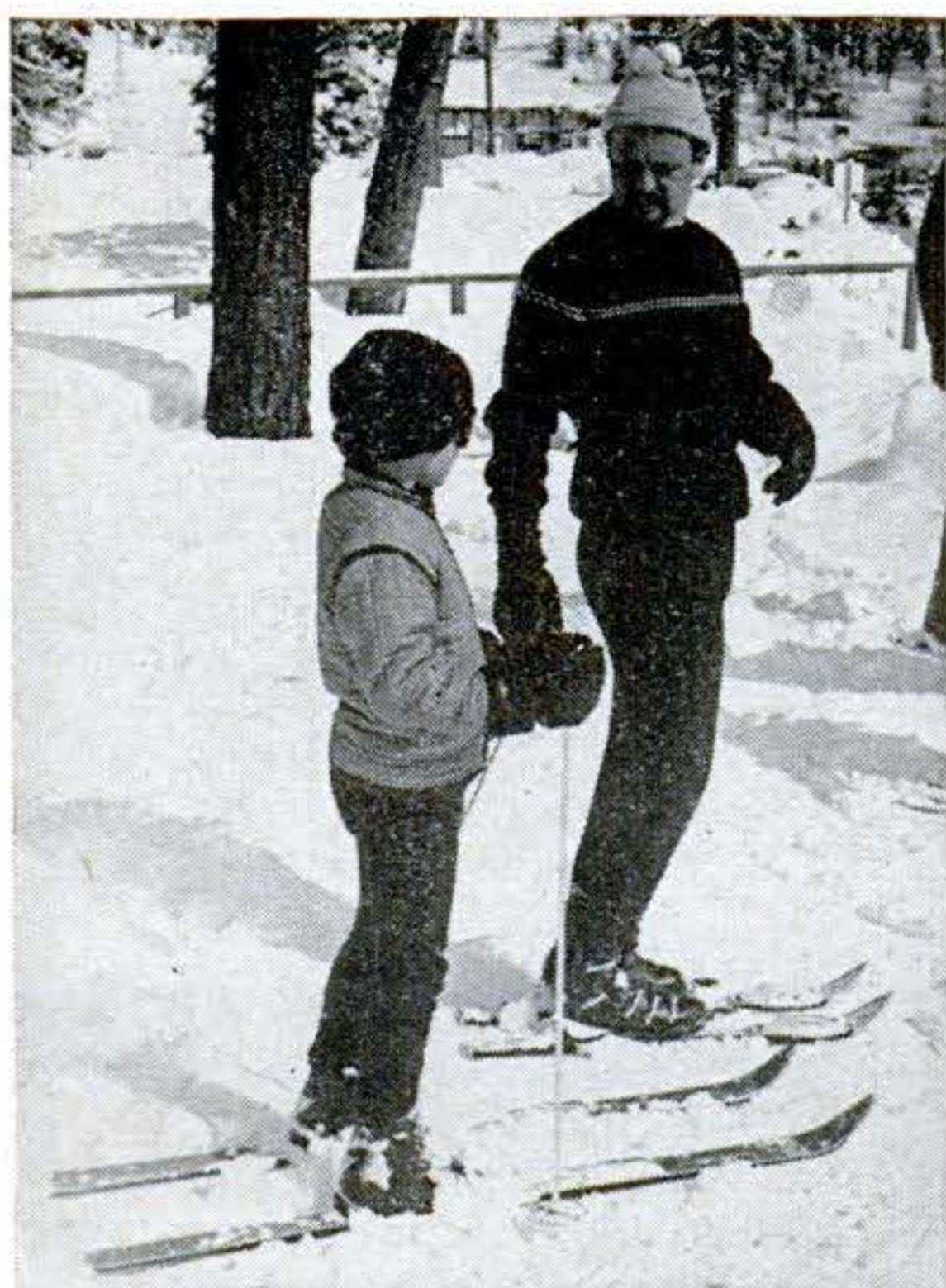
lines at center of pattern (shown in enlargement at right) produced figure of 55, or a true shutter speed of 1/286 second. For easy reference, to avoid calculation, you can use the table above. It shows true exposure time, from 1/15,750 second to 1/61.

Now you can learn to ski in *one day*



Inventor Clif Taylor holds up his new Short-EE ski. Little job makes it possible to learn

SHORT-EE SKIS...Your short.



Kid on standard skis thought reporter Fischman was using four-year-old's skis.

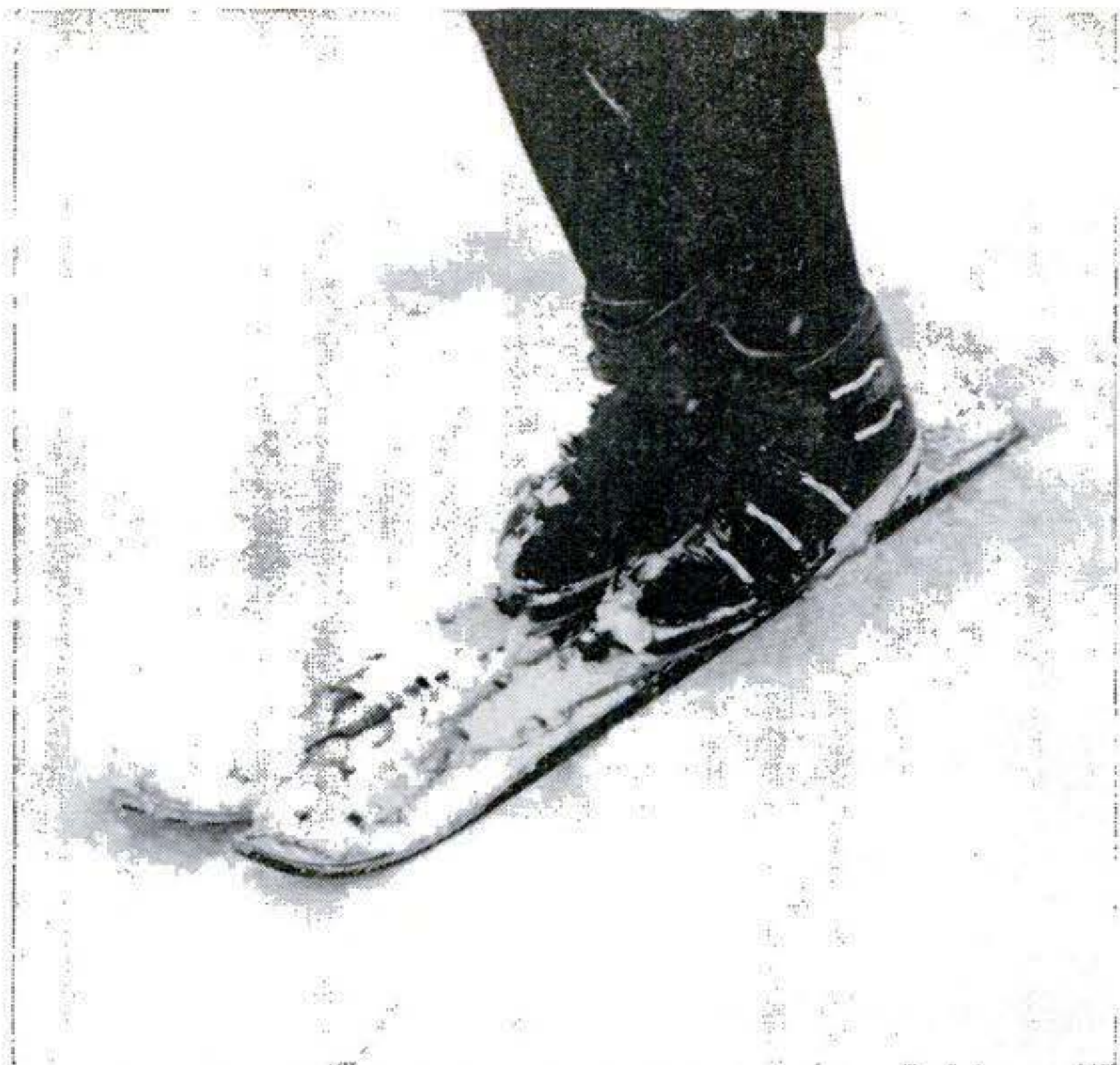
You can, too, schuss! Just strap on these unusual new skis and head for the nearest snowy slopes

By **WALTER IAN FISCHMAN**
PHOTOS BY JOHN L. CORBETT

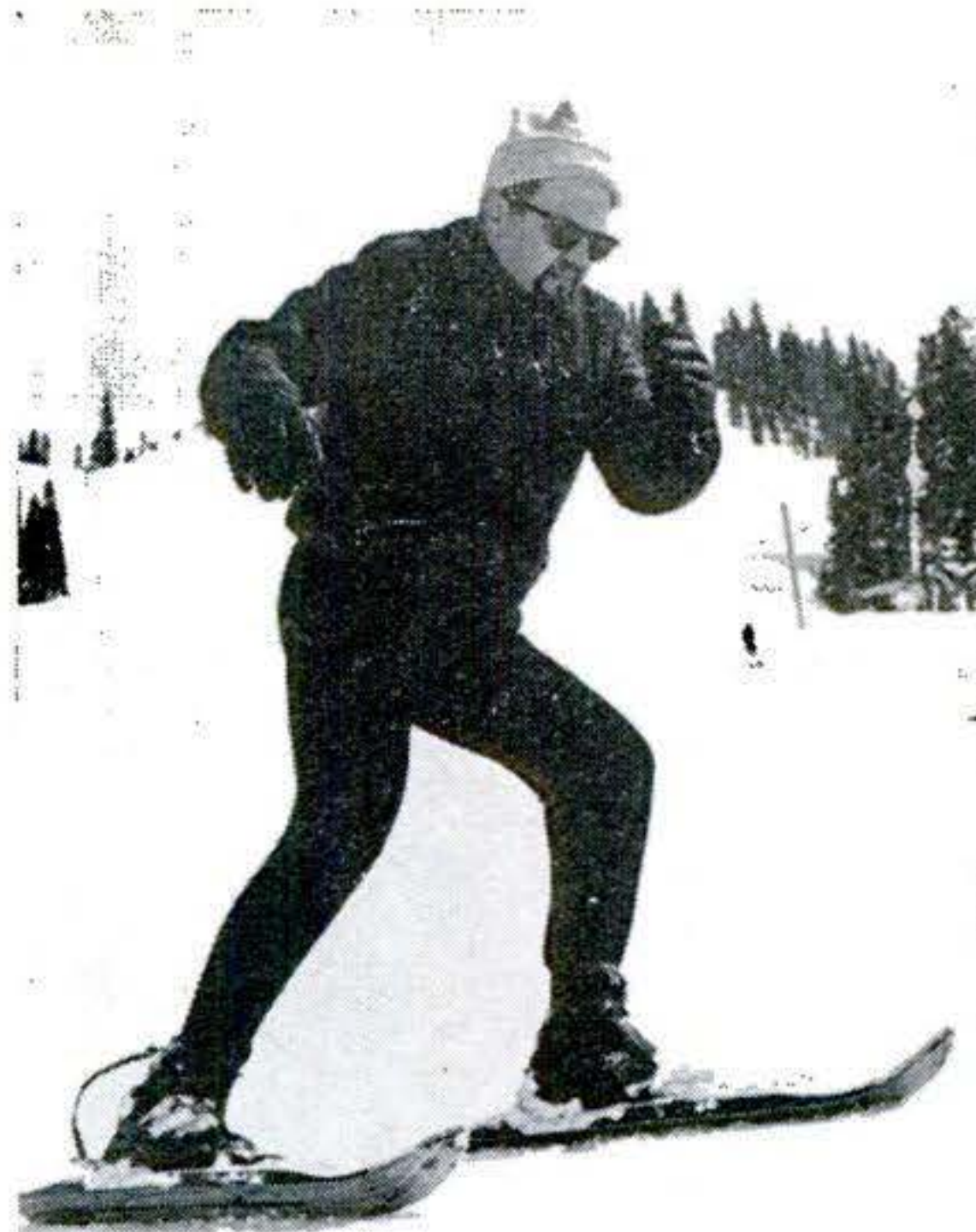
Last month I learned to ski. I mean really ski. I can come down what's laughingly known as a beginner's slope under fairly decent control, staying upright most of the time and going just about where I want to go.

What's such a big deal about this? I'll tell you. I learned in just *one day*. The teaching method I followed, called Instant Skiing, was developed by Clif Taylor, one of the nation's top ski instructors. I wore Short-EE skis.

And short the skis are. Designed by Clif, and made by the Northland Ski Co., they are less than three feet long and just thick enough so that



Standard bindings fasten Short-EE skis to boots. A fast-acting toe release pops skis loose to protect your ankles.



First efforts of beginner Fischman look clumsy as he tries balancing on Short-EEs.



how to ski in one day, skip much of the drudgery that goes with learning how to skim down a glistening mountain.

cut to winter fun

there's no give at all to them. The bindings that hold the skis to your boots are standard with fast-acting toe release. A new model also has a heel release. The combination is neatly calculated to pop the ski loose before any sudden stress can start pulverizing your ankle bones.

That's another plus with the Short-EE ski method. Not only do you learn far faster—you stand little chance of really hurting yourself.

Getting with it. To start me off, Clif picked a flat stretch of snow, fastened me into a pair of Short-EEs, waited a bit to make sure I'd remain upright, and then went into his spiel.

"You go straight downhill for speed. You turn left and right for control. You ski with your feet together because it's the safest, easiest, and most powerful way to ski. Ski with the lower half of your body. Use your ankles for small turns, your legs for medium-size turns, and your hips for the biggest turns.

"Okay, now let's try it out," Clif said. He'd picked a gentle slope that appeared to have all

Continued



You dispense with poles, Short-EE skiing, so Fischman (right) hangs onto instructor.



Falls are inevitable for a fledgling, skier Fischman discovers early in the game.



After one day of instruction—and no hand to hold—Fischman sails down a slope like a veteran.

the drama of a kid's sandpile—until I realized that I was sliding downhill. Panic! I stiffened, stood straight up and clutched for a skyhook while the skis shot out from under me. Happily, snow offers more gentleness than, say, a paved parking lot, and I felt more foolish than hurt.

Clif waited patiently while I got to my feet.

“I straightened my knees?”

Clif nodded and explained that the standard posture with knees slightly bent actually gives control. “Think of them,” he said, “as shock absorbers.”

You don't use poles—not with Short-EEs. Ever. It's an unnerving sensation, especially since everybody else uses poles.

With Short-EEs you stay upright, turn and maneuver with body balance alone. As Clif explains, if you keep your body relaxed and your hands extended away from your body some, you'll have a bit of leverage to turn against. Surprisingly enough, it works.

Turns are a key element of his method. In a way, it's like learning to ride a bike. Remember? When you started to fall, you turned the wheel in that direction. Sure you weaved all over the pavement, but you stayed upright.

It's pretty much the same deal with

Short-EE skis. You maneuver with a series of linked turns like an endless S. Clif says turns are for turning, stopping, and also for just keeping your balance.

To the mountain! About 10 minutes and seven falls later, we were heading for the lifts. I looked at Clif as if he were some kind of maniac. I could barely manage on a slope slightly gentler than a wheelchair ramp, but a real hill? Not for this novice!

Clif pointed out that it really wasn't any steeper—just longer so we'd have more time for skiing without that weary trudge back up the slope.

At the top I took a good long look down the hill. That was the moment when absolute hard-core panic took over. Steep? Whoever invented the word “down” had that slope in mind. And scared? Oh, yes, I was scared. But there's only one way to get down to the bottom.

“Come on,” said Clif. “Follow me down.” Since there wasn't anything else I *could* do, I followed.

A strange thing happened on that downhill run. For the first time I began to understand what Clif was trying to teach me. What's more important, my legs began to understand, too. Buoyed by the confidence of following along in Clif's precisely carved trail, I began to have a ball. I got the feeling that perhaps I might actually learn how to ski.

Although Clif calls his method Instant Skiing, you could call it Instant Fun. The Short-EE ski technique bypasses a lot of the dreary drudgery of learning how to ski. A novice using standard-length skis can spend days or weeks plodding along on level ground and then slowly easing down a slope in an awkward position called snowplowing—the skis form a V with the tips together. This crab-like stance is used to control downhill speed and to turn.

Once they get snowplowing down pat, long-ski users shift to parallel skiing.

With Clif Taylor's abbreviated barrel staves, it's parallel skiing all the way.

His practice exercises are calculated to draw a sneer of disdain from the old-time Austrian instructors. For example, there's a thing called “In again, out again, Finnegan.” In this maneuver, you head downhill a bit, make a turn as though to

[\[Continued on page 180\]](#)



PS Previews the Christmas Gifts You'd Like to Get

Tired of ties, socks, handkerchiefs, wallets? Here are some mouth-watering items chosen with you in mind. Just clip or underline them as a gentle hint—she'll appreciate it

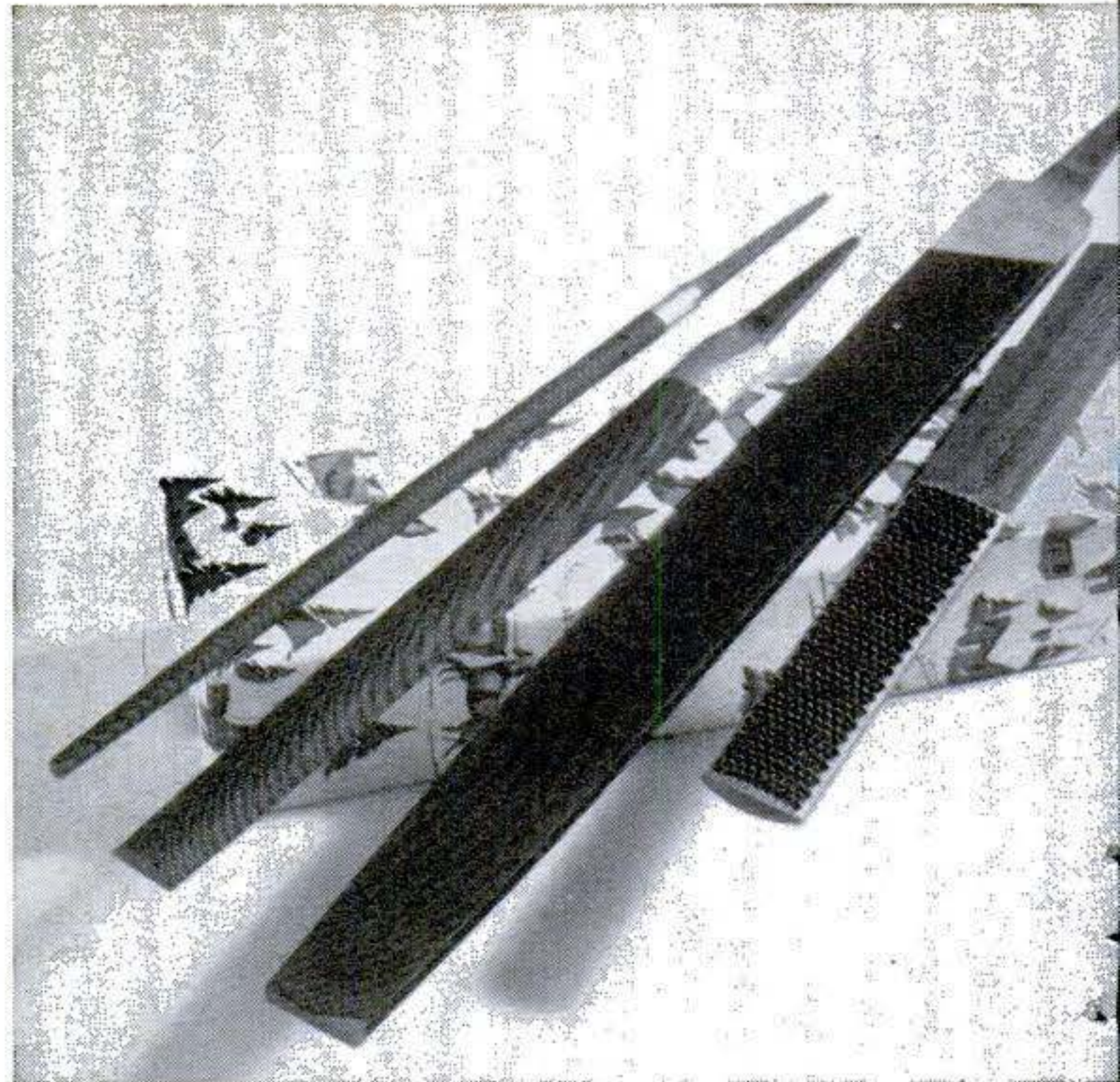
PHOTOS BY ORLANDO GUERRA



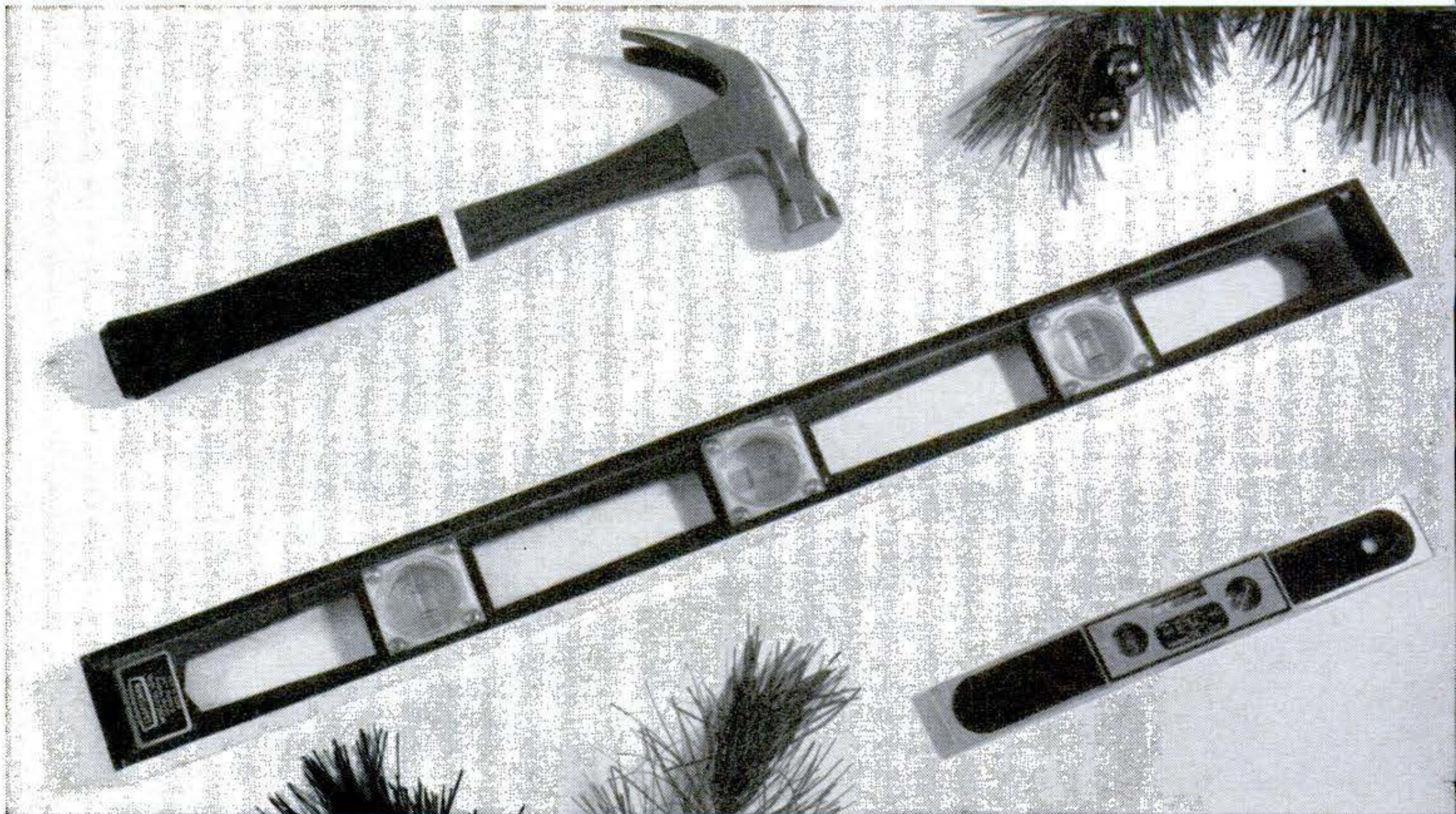
The perfect gift? Depending on your interests it might be a set of drill bits, a light meter, a stereo receiver, or a set of Koni shock absorbers. On the next 12 pages the Editors have selected gifts that appeal to them and will, we hope, appeal to you.



Set of spade bits. These are the most convenient tools for boring large holes in wood with an electric drill. If you own auger bits for the small sizes, add Irwin Auger's 886M set of Speedbor "88" bits and you'll be all set for holes up to 1". The set, with rack for mounting on a board: \$5.50.



Selection of files. Very few home owners have all the files they could use. The four above would handle just about any job you'd need to do in home and shop. Shown from left are a round file, a half-round bastard, a smooth file, and four-in-hand rasp. All are by Nicholson. Total: about \$5.15.



Top-grade hammer. If you need a new hammer, ask for the best. Above is a good example—a 16-ounce from Plumb, a company that specializes in hammers. You'll never break the handle. It's made of fiberglass, guaranteed not to break, bend, or collapse in any kind of normal use. The handle has a cushioned grip. Price: \$6.25.

Very special level. Any man will find use for the Craftsman Mono-Vial Level (above, center). It levels. It plumbs. You can even remove one of the three plastic vials for use in a restricted area where you need a small but accurate level. You can then return the vial precisely to its place in the 24" aluminum frame. Sears, \$6.89.

Magnetic torpedo level. A torpedo level belongs in every toolbox. The one directly above has built-in magnets that cause it to cling to steel or iron structures as you take plumb or level readings. This leaves both hands free for adjustments until you achieve the reading you want. Made by P & C Tool Co., Portland, Ore., it's \$3.95.



perform or nut driver. You'll never go wrong in asking for a perform plane (\$3.98) or Stanley's ingenious new Hex-A-Matic Nut Driver. Collet fingers adjust automatically to drive or loosen 10 sizes of hex nuts or hex-head screws and five sizes of socket-head cap screws. The complete driver: \$5.49; a chuck-in accessory (at bottom of photo) for Stanley spiral ratchet screwdriver, \$4.99.



Adjustable dado. Taking the place of a series of dado cutters, this Rockwell Tru-Cut Adjustable Dado fits table or radial saws with a $\frac{5}{8}$ " or $\frac{3}{4}$ " arbor. You can adjust cutting-width ranges from $\frac{1}{4}$ " to $\frac{13}{16}$ ". The teeth are replaceable if one is damaged. Price is about \$25.

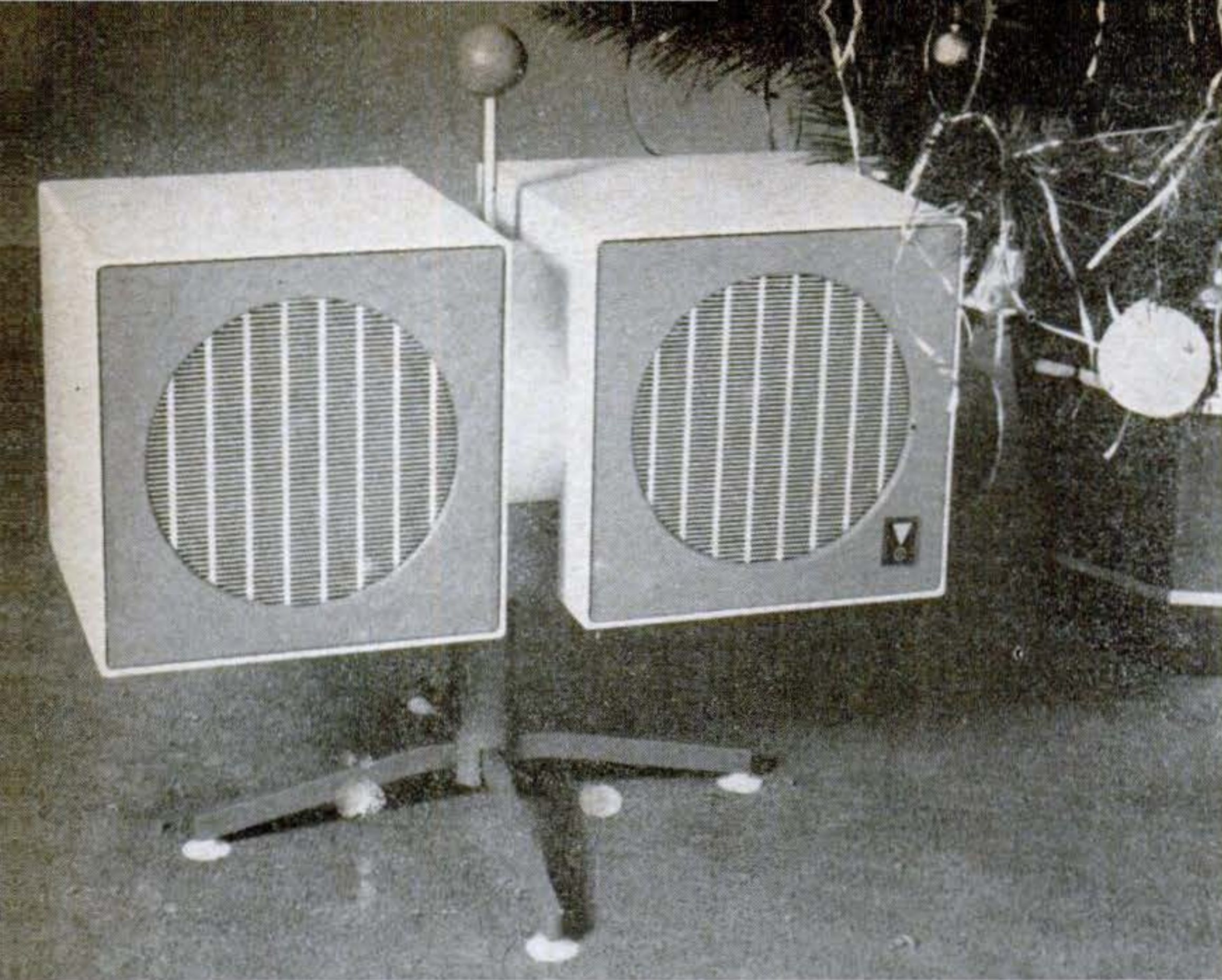


Rivet tool. For shop projects and home repairs, Pop rivets can take the place of sheet-metal screws, nuts and bolts, adhesives, or soldering or brazing. United Shoe Machinery's K 110 Rivetool kit is a good choice. The tool sets rivets up to $\frac{3}{16}$ " diameter. The kit consists of the tool, box of rivets, and storage case (not shown). \$5.95.

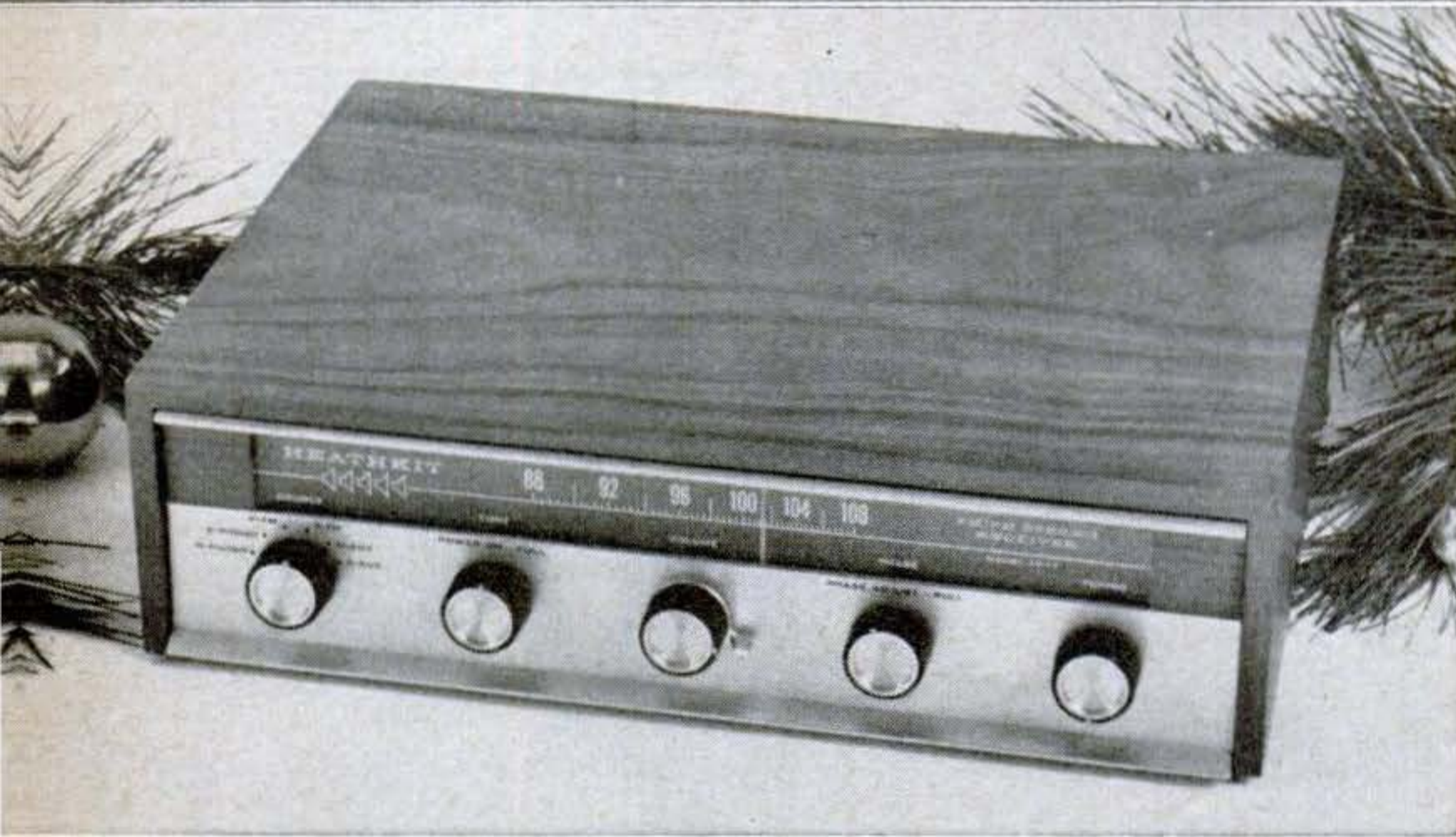
Metal snips. Any householder needs to cut sheet metal from time to time. For this, give him Wiss Metalmaster Snips (M3R), designed for straight cutting and shallow arcs in up to 18-gauge. Cutting edges are serrated to prevent slipping. Handles are high-strength alloy steel, have vinyl grips. Deluxe version, \$4.98.

New locking pliers. Channellock's 910 Griplock will serve as a portable vise for hundreds of jobs. It operates without screw adjustment. One hand opens it, locks it on the work, and releases it when you're through. The 10"-long tool comes in both straight-jaw (shown here) and curved-jaw styles. \$4.90.

Continued



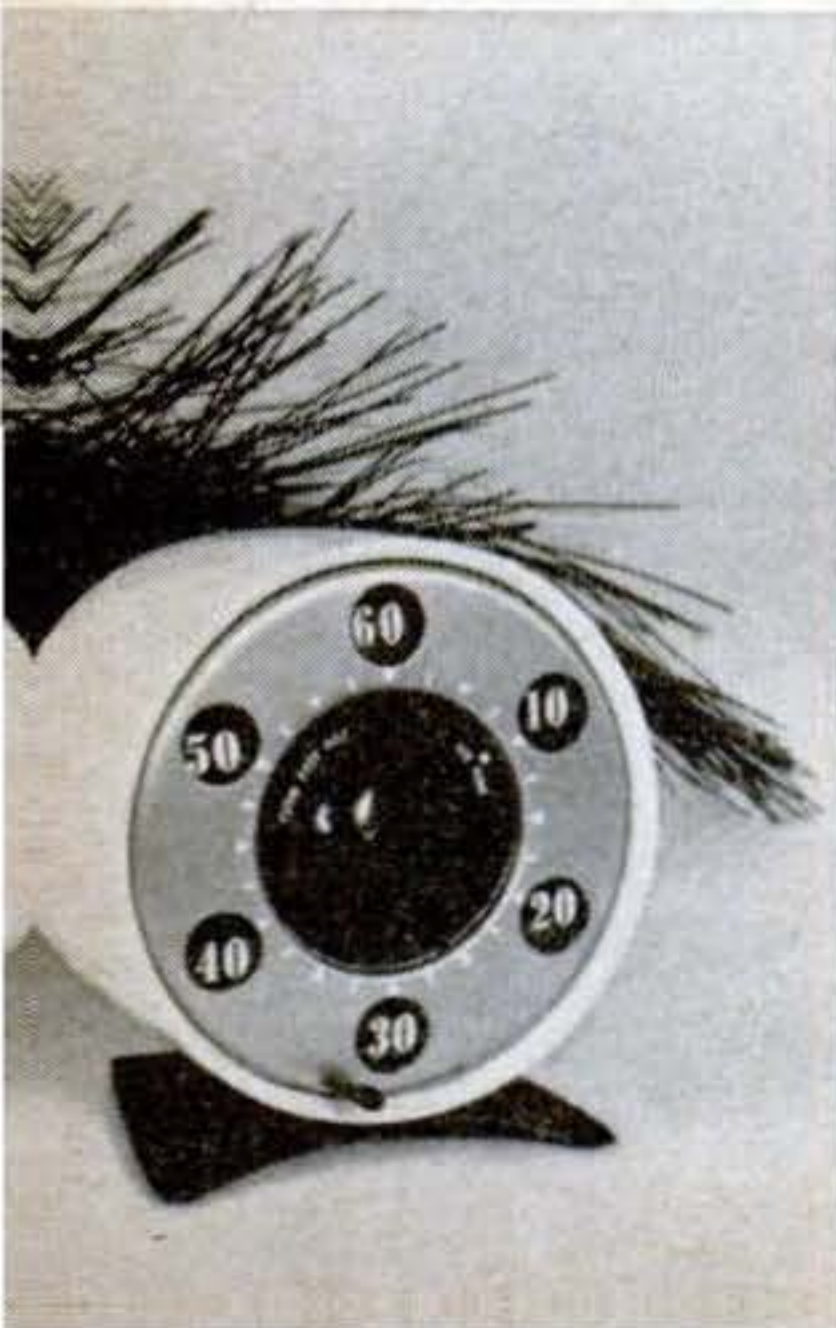
Outdoor speaker. The J. B. L. Festival is handsome enough to be used indoors, but its waterproof cones and case make it a rugged outdoor speaker. The unit looks as if it consists of identical units, mounted side by side. Actually, only the left box contains a working speaker. The right contains a "passive radiator" that vibrates in tune with the left speaker. It's made by J. B. L., 3249 Casitas Ave., Los Angeles, costs \$140.



Low-cost stereo receiver kit. Real stereo hi-fi doesn't come any cheaper than this new receiver from Heathkit: The kit costs \$73 (plus \$8 if you want the cabinet shown in the photo at left). Here are the set's specifications in a nutshell: FM tuner sensitivity is three microvolts—that's adequate for all but the deepest fringe areas; amplifier power, a clean five watts for each channel—more than enough for all normal listening levels from moderate- or high-efficiency speakers.

Two timers in one. This device will ring at any minute you choose, up to an hour; when you flip a switch, numbers in the dial change, and the timer shifts to counting seconds, up to six minutes. The double-purpose timer costs \$6.95 from Spiratone, Inc., 135-06 Northern Blvd., Flushing, N.Y. 11354.

Extra-sensitive CdS meter. Expotrol light meter covers from 1/4,000 second to 60 minutes, f/1 to f/64, ASA 3 to 6,400. With attachments, it takes readings off a ground glass or the finder of an SLR camera, or converts to spot meter. Cost: \$39.95. With attachments and case, \$99.95. Spiratone.

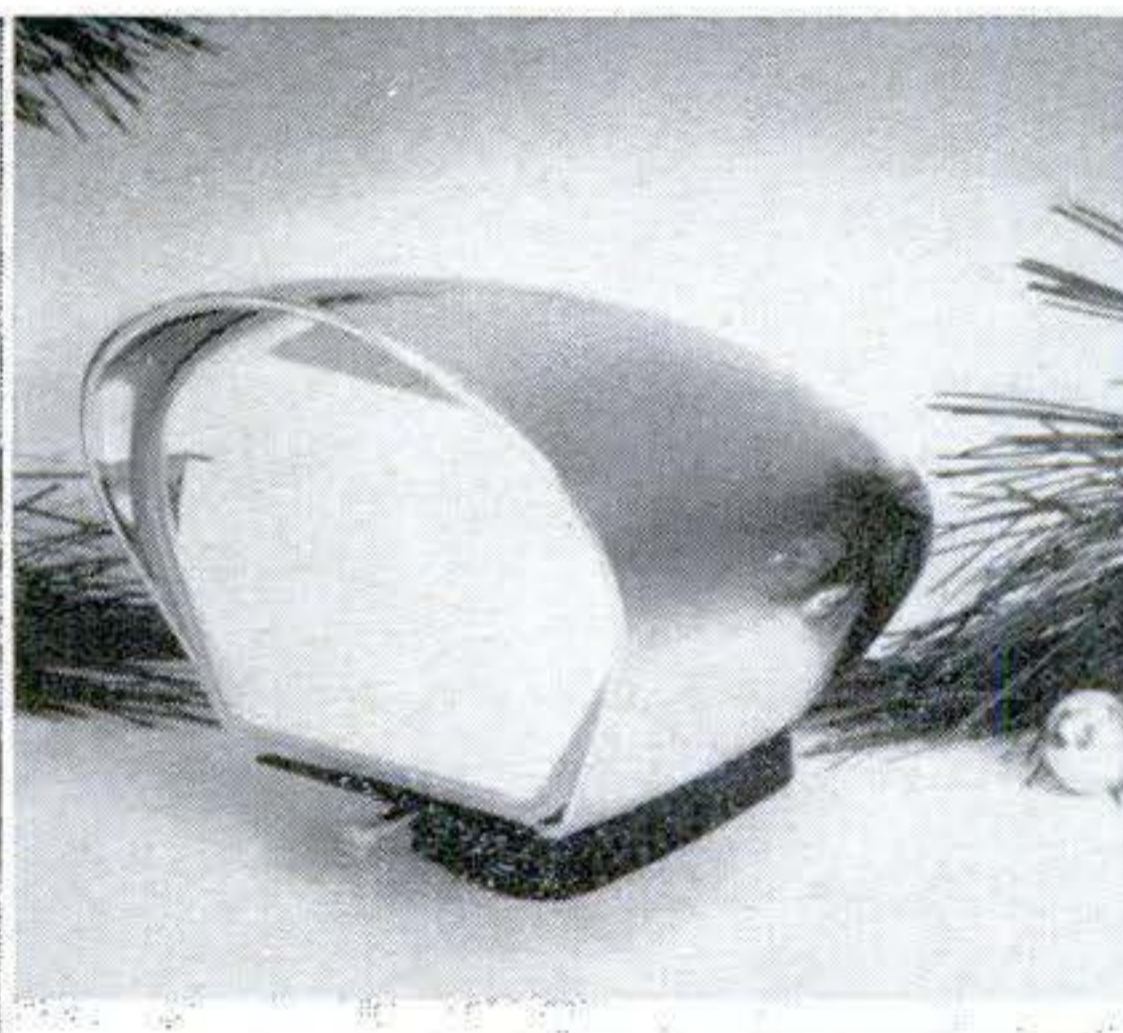




Air horns for your car. Many of today's standard horns have trouble getting heard by drivers up ahead on the highway. Big diesels, sing-song truck tires, wind roar, and radio noise can combine to drown out any plain two-tone electrical horn less than a quarter-mile away. Many drivers feel an air horn is a helpful safety item. These Sparton trumpets with their two-pound Freon cartridge can be installed under the hood (when there's room) or mounted outside on passenger cars, station wagons, pickup trucks, or what have you. The \$38.50 kit includes horn button, solenoid, wiring, tubing, and all necessary hardware for making your own installation. Sparton Mfg. Co., Flora, Ill.



plasticon acrylic coating. Here's a coating that protects your car's paint. The maker claims it replaces cleaning compounds and wax. plexo-7 is the marine counterpart. One can is \$3.60 from Plasticon Chemicals, Inc., 47-38 Fifth St., Long Island City, NYC 11101.



Sebring mirror. Developed in racing, this mirror is adjustable from the driver's seat and has no sharp points to injure pedestrians. Nylon mounting eliminates vibration up to 200 m.p.h. \$9.95 in chrome, silver, red, green, or white. Formula One, 37 W. 57 St., NYC 10019.



Gas-tank lock. Here's one way to keep gas from being stolen from your car. Get a locking gas cap—push down to lock, turn key to unlock. For all U.S. and imported cars; \$2.25 from J. C. Whitney, 1917 Archer, Chicago 60616.

Continued



Long-range CB walkie-talkie. This rechargeable battery-powered Citizens Band transceiver has a full five-watt transmitter. A side-mounted switch lets you choose from among its six crystal-controlled operating frequencies. Called the Dynacom-6, it's sold by Lafayette Radio, Syosset, N. Y. The price is \$200.



Swingline staple-gun kit. Is this your year to ask for a staple gun? If you don't own one, you couldn't make a better request; it's a tremendously useful tool for any home owner. We present a choice of two brands of tackers, each with a selection of staples and other items. The Swingline 800 kit, shown directly above, comes in a neat rustic wood case with a slide-in lid and a carrying handle. Inside, you find the gun, two boxes of staples (1,000 each), and a metal belt holster. Price of the complete kit is \$10.95.

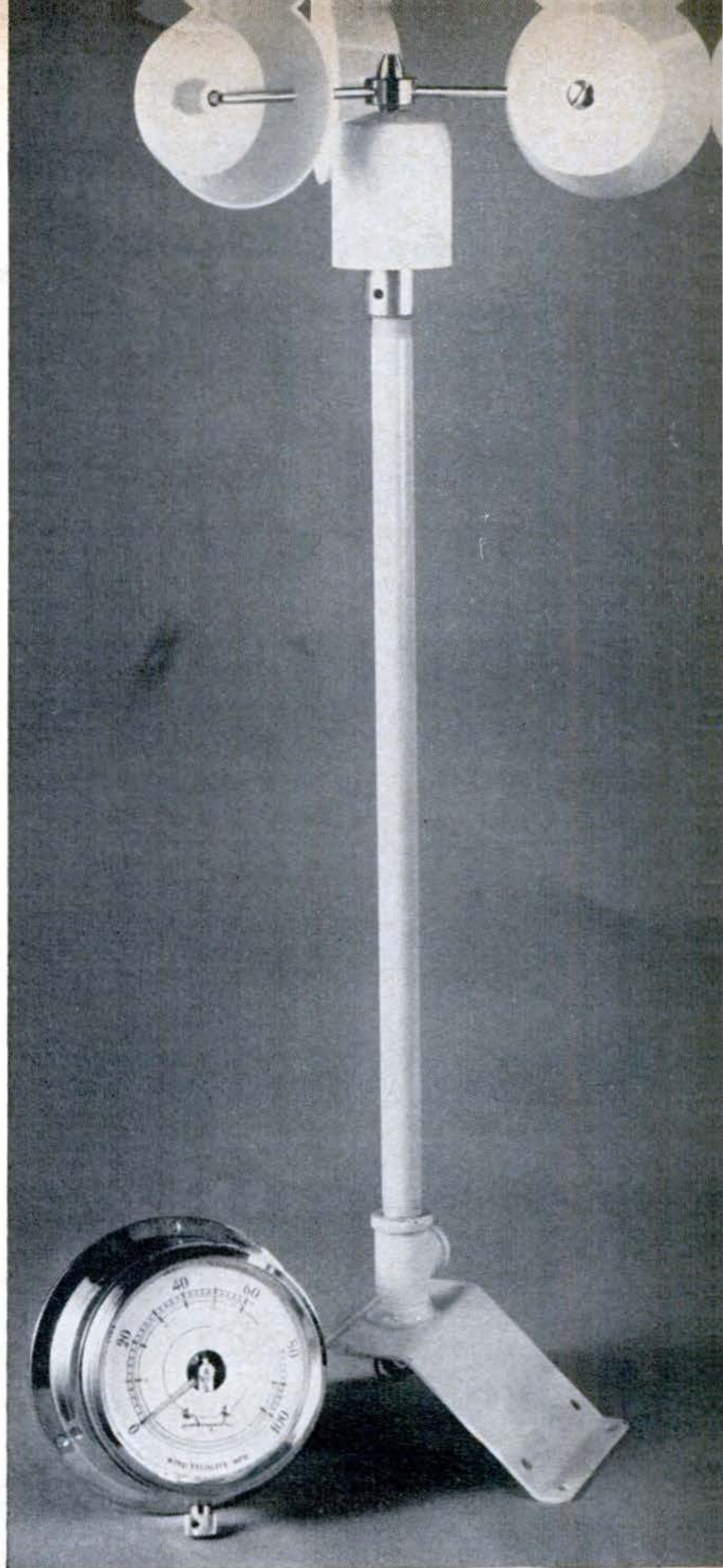
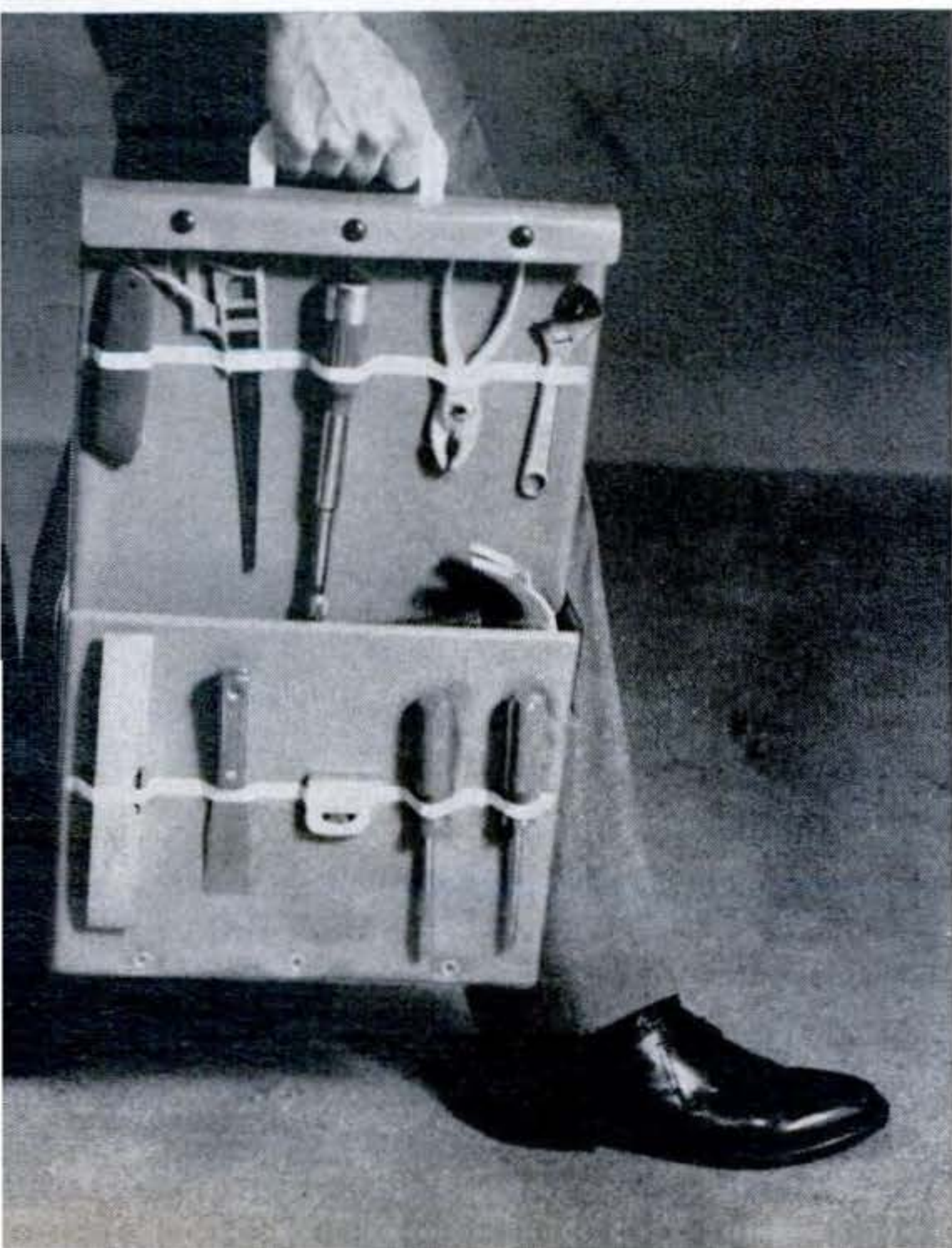
Miniature radio/phonograph. Here's a carry-along AM radio and phonograph combination that is designed to play tiny phonograph records as well as conventional 7- and 12-inch discs. Both the player and the records are made by Philco-Ford. The midget records, only $3\frac{7}{8}$ inch in diameter, are pressed out of wafer-thin plastic and are flexible. They turn at 45 r.p.m. and cost about half as much as ordinary 45 records. The battery-powered phono player converts into a radio at the flip of a switch. It costs \$25.





Arrow multipurpose staple-gun kit. About everything you'd need for any type of home-fastening job is contained in this kit. In addition to a larger, heavy-duty staple gun (Model T-50), you get a package of 5,000 assorted staples (four sizes), accessories for three different types of fastening jobs (wire, shade, and screen attachments), and a staple lifter. In carrying case: \$17.50.

Household tool kit. Packaged in a vinyl case for carrying, the 11 Millers Falls tools below are readily available when you hang up the case. The kit is a good choice as a home-shop starter set, or as a fix-it kit. Included are a hammer, utility knife, saw, hand drill with bits, pliers, wrench, level, putty knife, tape rule, and two screwdrivers. Price is \$28.50.



Wind-speed meter. This three-cup anemometer works just like its professional cousins on duty with the Weather Bureau: As the cups turn, a switch opens and closes repeatedly, feeding current pulses to the indicating meter.

The instrument will indicate over a wide wind range—from still air (0 m.p.h.) to hurricane-force winds (100 m.p.h.). It can be powered either by a dry-cell battery or an AC adapter. Made by Air-guide Instrument Co., 2210 Wabansia Ave., Chicago, it sells for \$70.

Continued



CHRISTMAS GIFT PREVIEW

Kit of accessories for reversible drills. The man who owns a reversible drill needs accessories to get full value from it. Skil has now brought a number of these together into one handy kit. It includes five high-speed bits of varying diameter, six hex-head sockets and an adapter to drive them, three Phillips-head-screw bits, and three slotted-screw bits. The latter have spring-tensioned adapters to grip the head of the screw. Owners of variable-speed drills can also make limited use of the accessories—for simply driving screws and tightening nuts. Price of the set: \$8.50.



Projection stand. This easy-to-store stand folds to a flat 3½ inches. One platform holds the projector; the other, extra reels or slide trays, or, for sound, a tape recorder. Top platform may be angled up or down by a turnbuckle elevation control. Adjustable leg keeps stand steady. Price of Negema Model C: \$39.95. Distributor is Burleigh Brooks, Inc., 420 Grand Ave., Englewood, N. J. 07631.



Close-up camera. A modified Instamatic 104, the Kodak Instatech offers the simplicity of cartridge loading plus the ability to take extreme close-up shots of flowers, tiny models, craft items, and other small objects. Outfit includes attachments for distances of 5-8 inches and 15-24 inches, five flash-cubes, batteries, film. \$49.95. Lester A. Dine, Inc., 2080 Jericho Turnpike, New Hyde Park, N.Y. 11041.



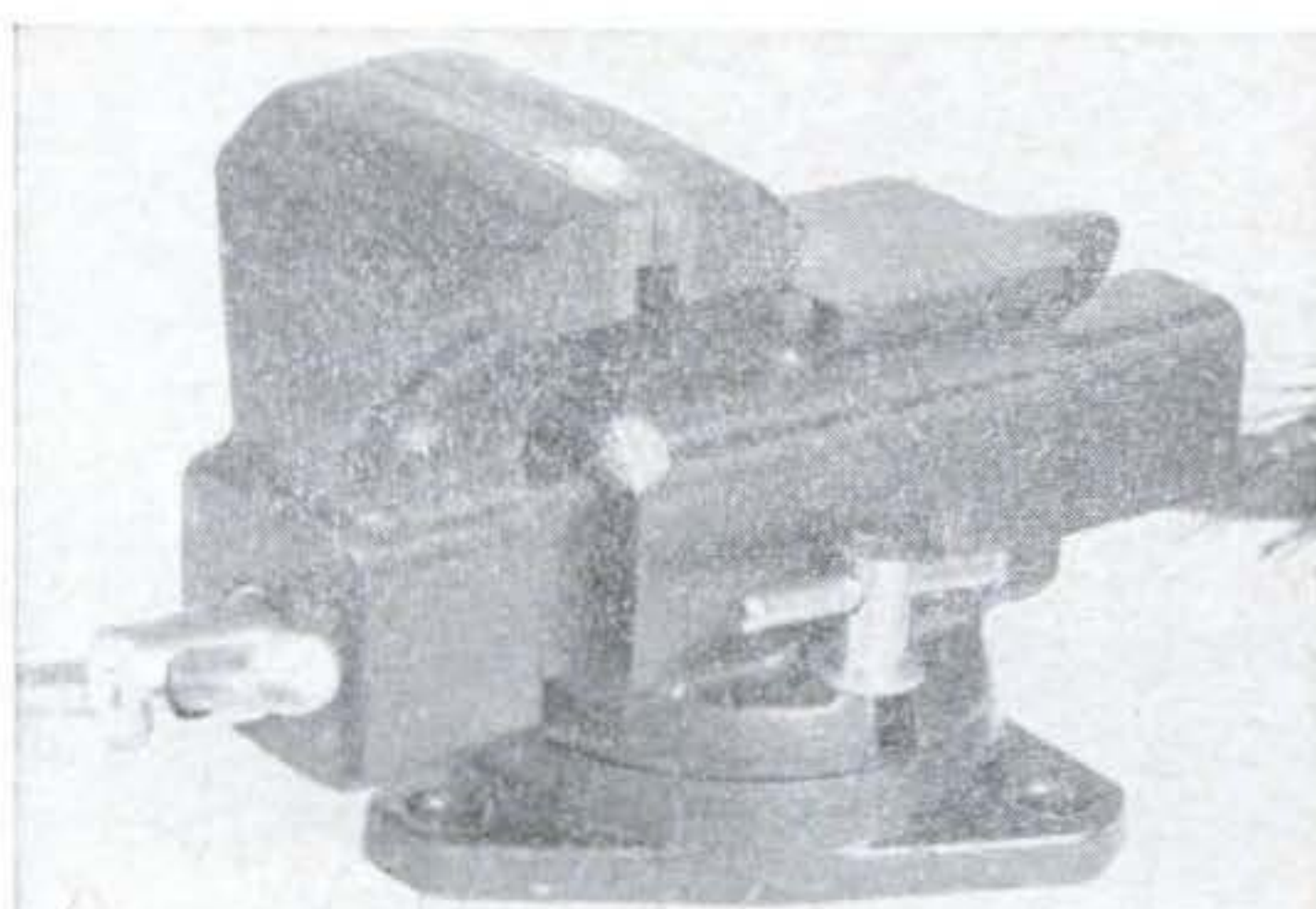
Soldering gun. Any soldering job becomes easier with a handy kit like this one—a dual-heat Weller gun, three soldering tips, tip wrench, soldering aid, and some solder, all packed in a rugged plastic case. The gun has a two-position switch so you can change instantly to high or low heat, a built-in spotlight, and a long reach for tight spots. \$8.85.



Starter socket set. Crescent Tool's LTB10 is a good starting point if you'd like to build a collection of wrenches. The $\frac{3}{8}$ "-drive 10-piece set above includes four six-point sockets ($\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", and $\frac{9}{16}$ "), three 12-point sockets ($\frac{5}{8}$ ", $\frac{11}{16}$ ", and $\frac{3}{4}$ "), a spark-plug socket, 5" extension bar, and ratchet. In a rugged metal storage case: \$13.80.



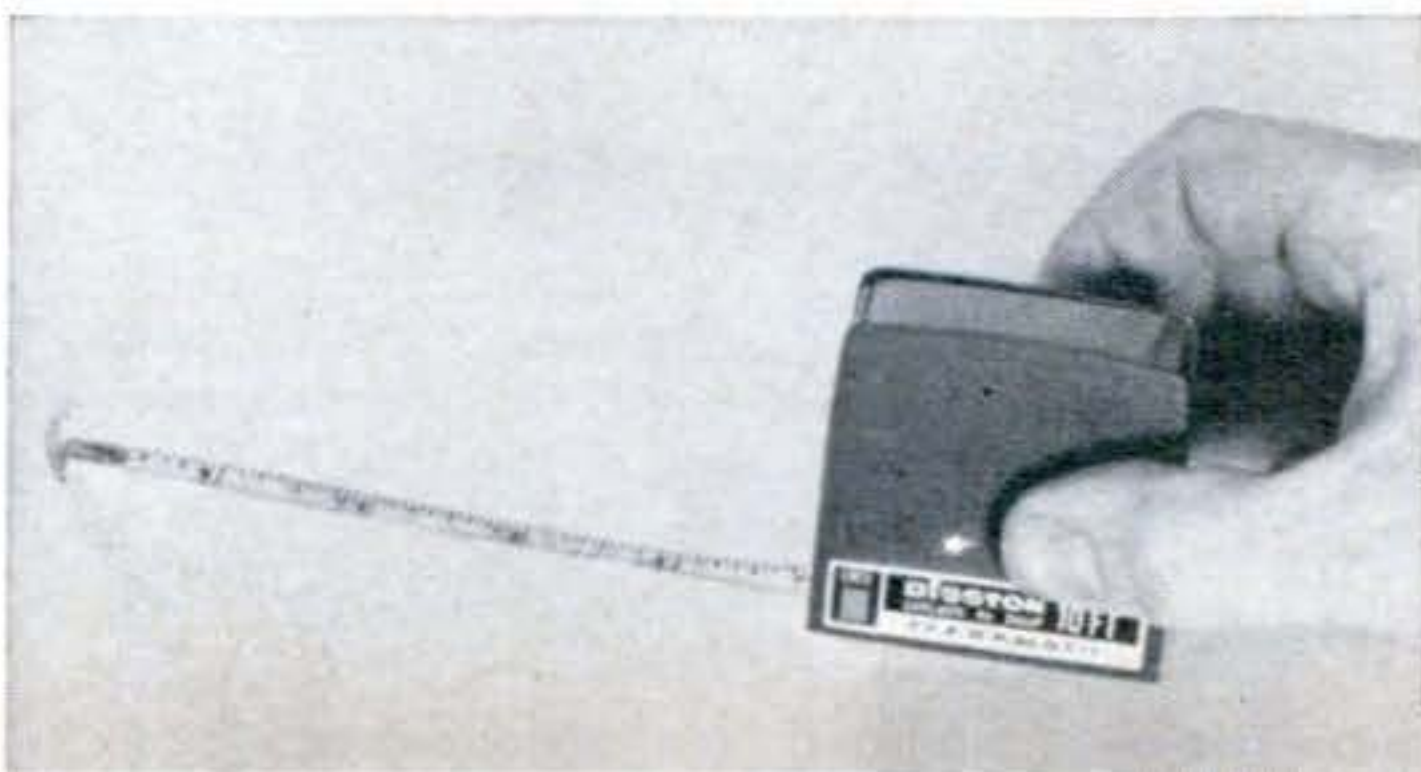
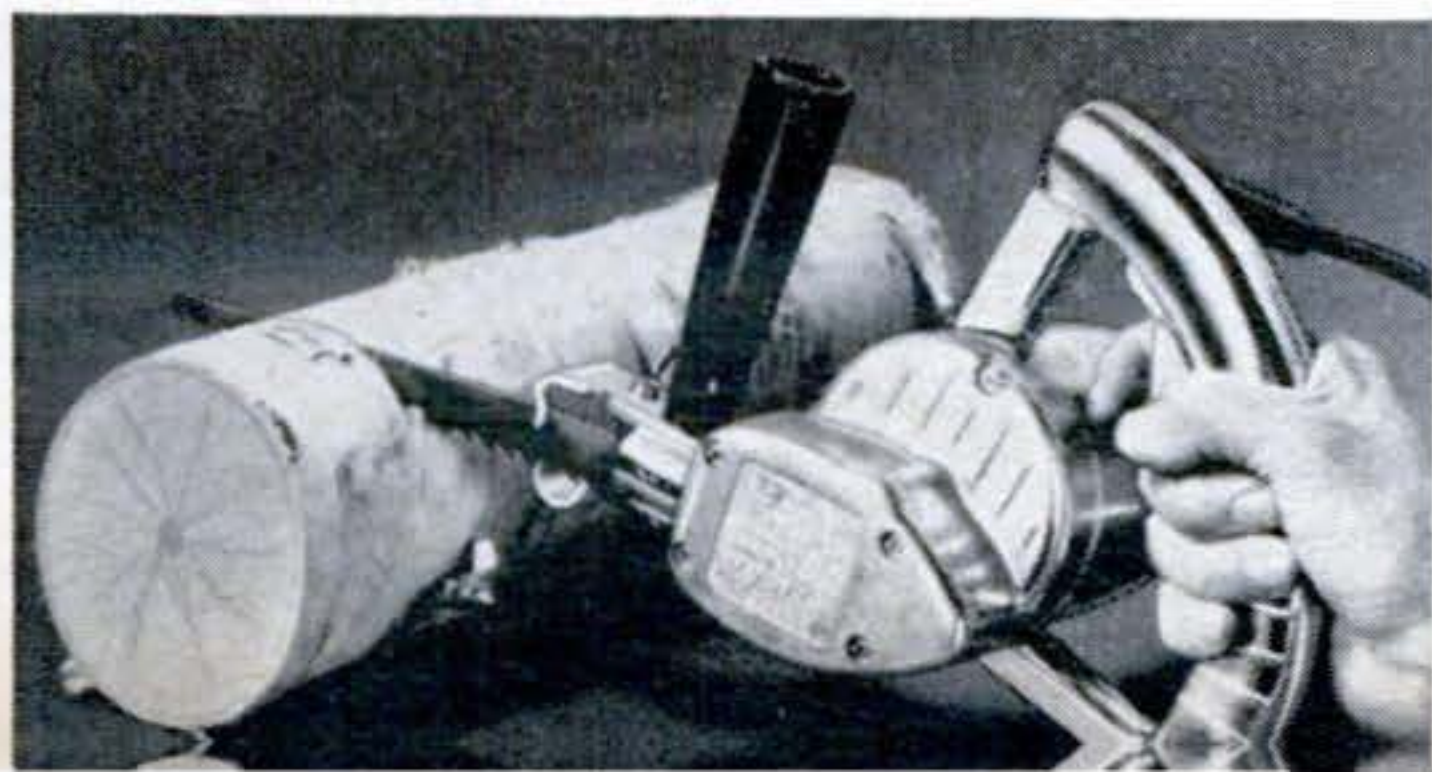
Electric engraver. This is a good bet as a gift for the man who already has everything in the way of tools—almost. The Dremel Electric Engraver engraves names or numbers on metal, glass, wood, or plastic. It weighs seven ounces, comes in a lightweight plastic case. With solid carbide engraving point, it costs \$14.95. Dremel Mfg. Co., Racine, Wis.



Swiveling vise. A vise that swivels is a convenience in any shop. Here's a rugged and economical choice—Montgomery Ward's Power-Kraft vise that swivels 200 degrees, locking securely in any position where you find it most handy to work. It also has a large anvil surface and a handy forming horn. In 4" jaw size, price is \$10.95; in 5" jaw size, \$18.99.

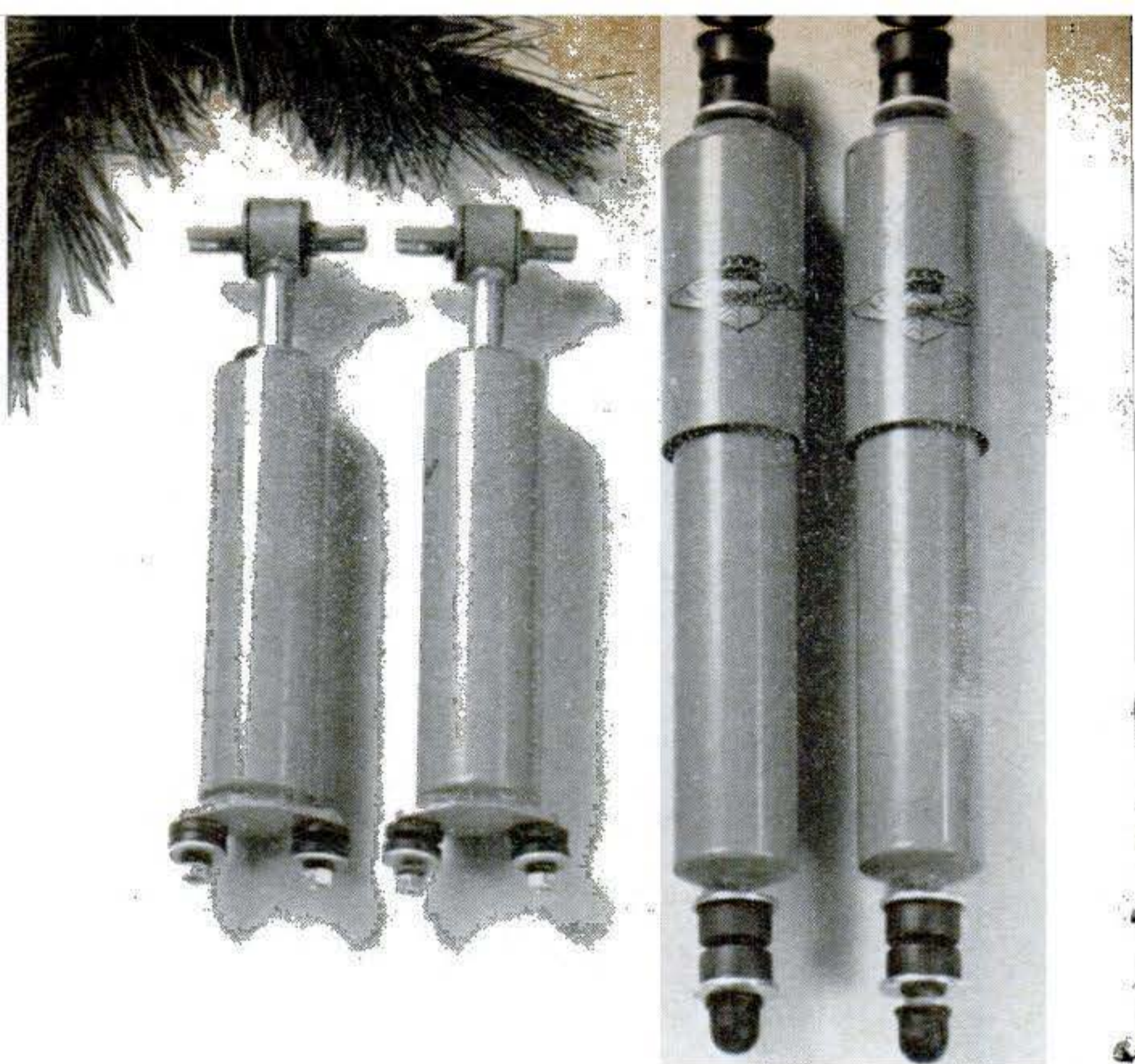
Two-speed freehand saw. A choice of two speeds and seven types of blades enables you to cut anything with Wen's Model 920D Zipp Saw—from a 6" log to a piece of 2" pipe. The curved foot plate enables the saw to start its own inside cut in plywood, paneling, etc. The $\frac{1}{3}$ -hp. motor and handle are offset so your cutting line is always visible. \$44.95.

Squeeze-case rule. When you want to retract this steel rule just squeeze the case. Made of molded nylon on the sides and stainless steel on the edges, the case itself acts as a spring when squeezed. A button locks the blade at any desired point in extended position. Disston makes the rules in 10', 12', and 16' models. Prices: \$2.60 to \$5. *Continued*

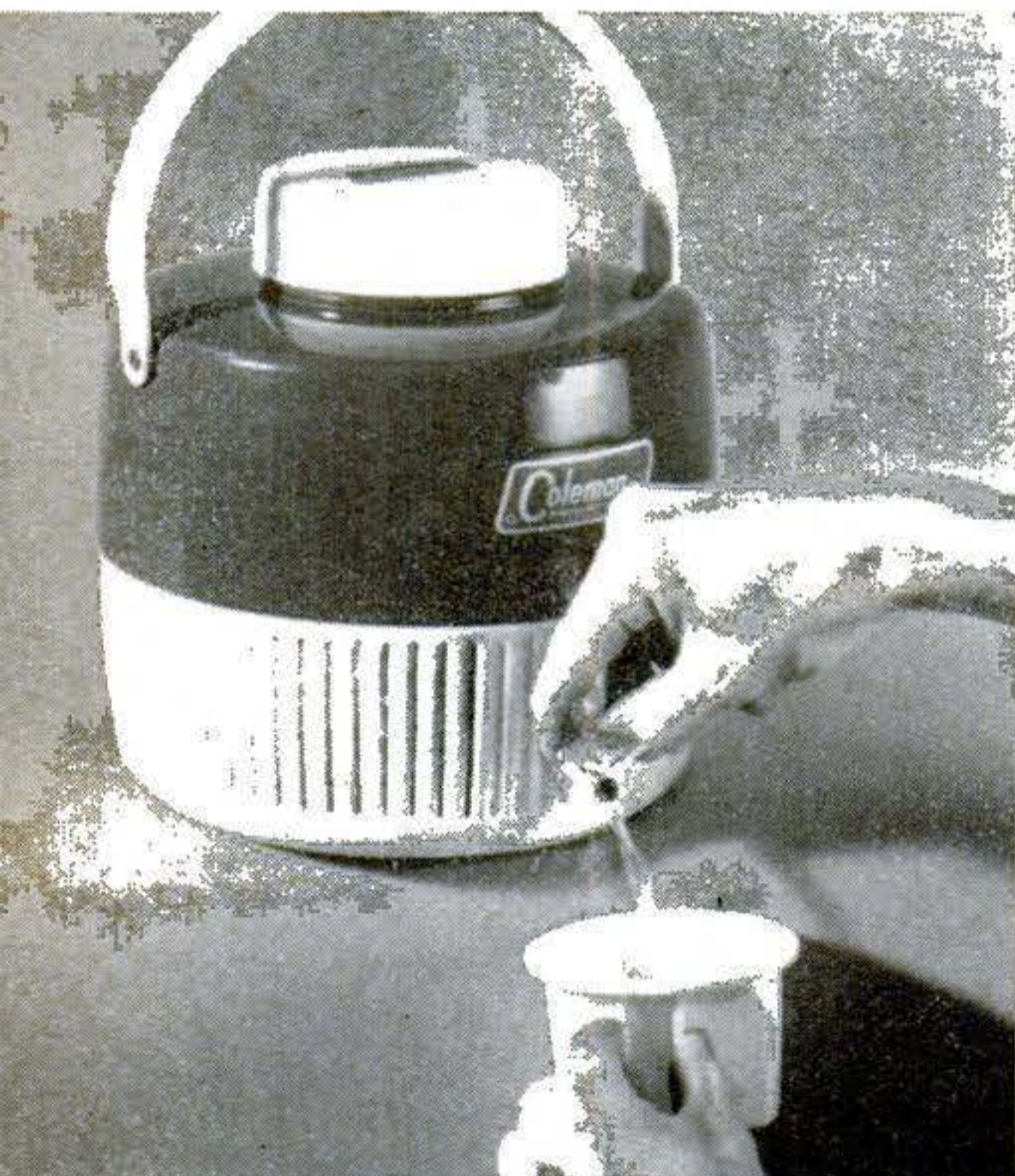




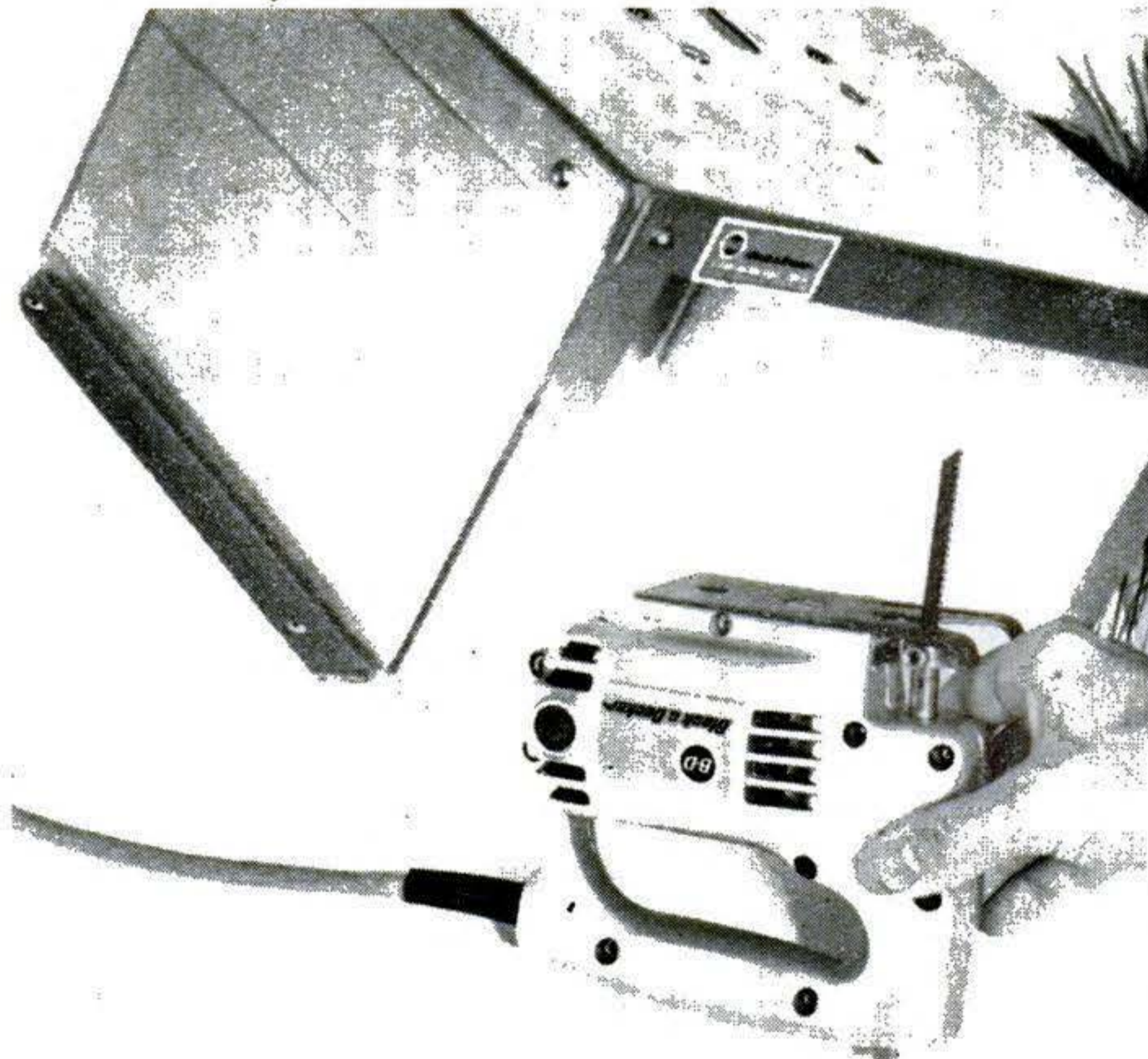
A torch for handy carrying. High style is combined with a practical touch in this Bernzomatic propane-torch kit, assembled specially for holiday giving. Along with the propane cylinder, you get seven accessories—all neatly housed in a handsome red-and-blue attaché case shown above, made of unbreakable plastic with leather graining. You also get the company's new lifetime guarantee. Price: \$11.59.



Adjustable shock absorbers. The softer the springs on your car, the more important is the job of the shock absorbers. Regular shock absorbers are often too small for the cars they're fitted on, and they wear out gradually. Replace them with a set of adjustable Koni shocks that will never wear out (they can be reconditioned). Koni shocks improve road-holding and handling precision, act as a brake on pitch, roll, and bounce. The Mustang set shown above costs \$100 from Kensington Products Corp, 150 Green St., Hackensack, N.J. 07601. Other shock absorber sets are available for most U.S. and imported cars.



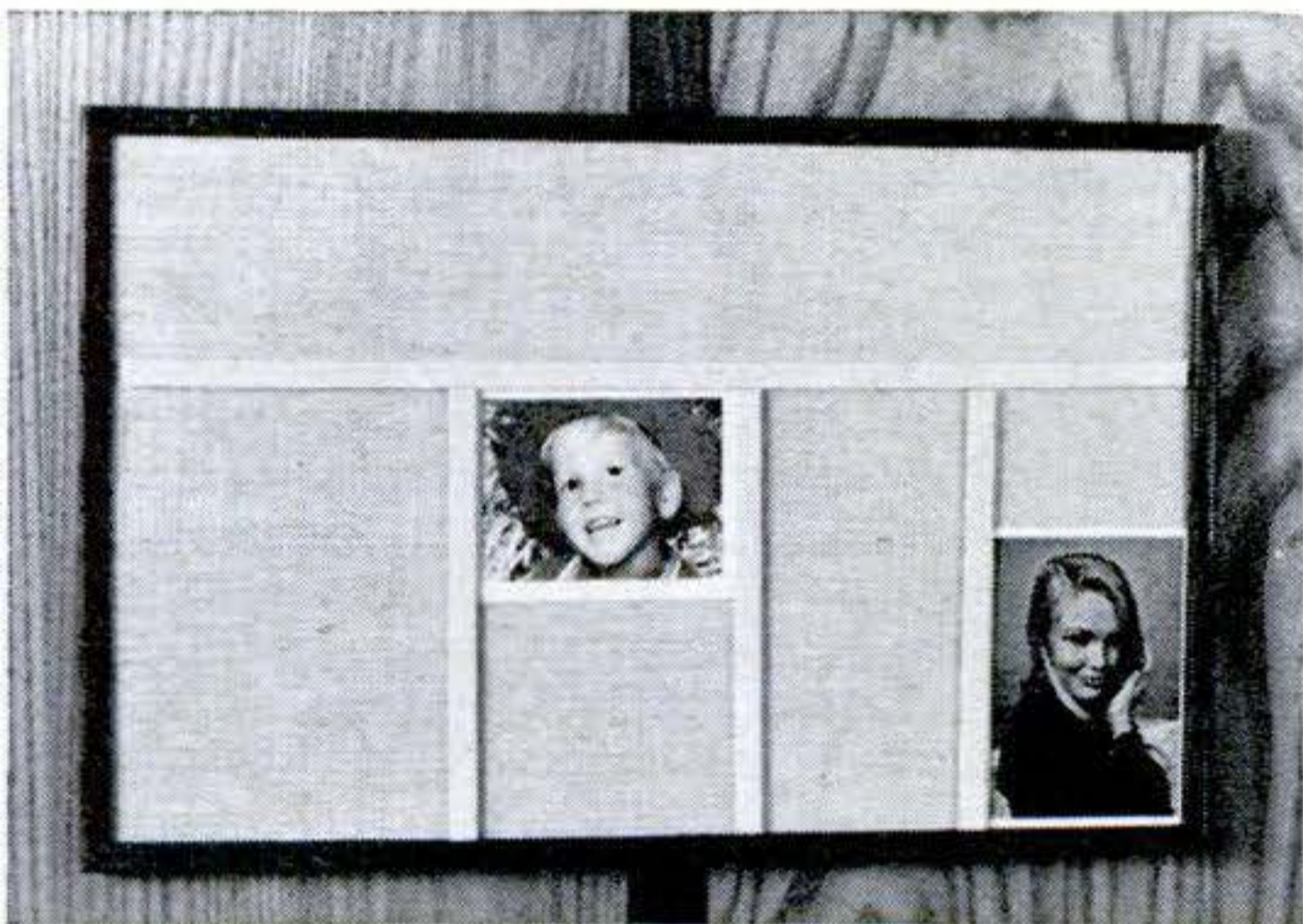
Insulated jug. Liquids are kept either hot or cold in this Coleman insulated jug for picnics or for use in the car while on the road. Insulation is 100 percent urethane. The jug has a husky bail handle, a fast-flowing faucet, and the inner lid is a drinking cup—with a formed-in handle. Price is about \$6.98.



Jigsaw—and table, too. Black & Decker's U-153-1 kit is a money-saver for you. Besides being a jigsaw, it contains a table under which to mount it, a selection of 10 blades, blade pouch, hex wrench, and holder. The price of \$24.99 saves you 14 percent over buying the items individually. The table gives stability for accurate and intricate cuts in wood, metal, plastics, and other modern materials.



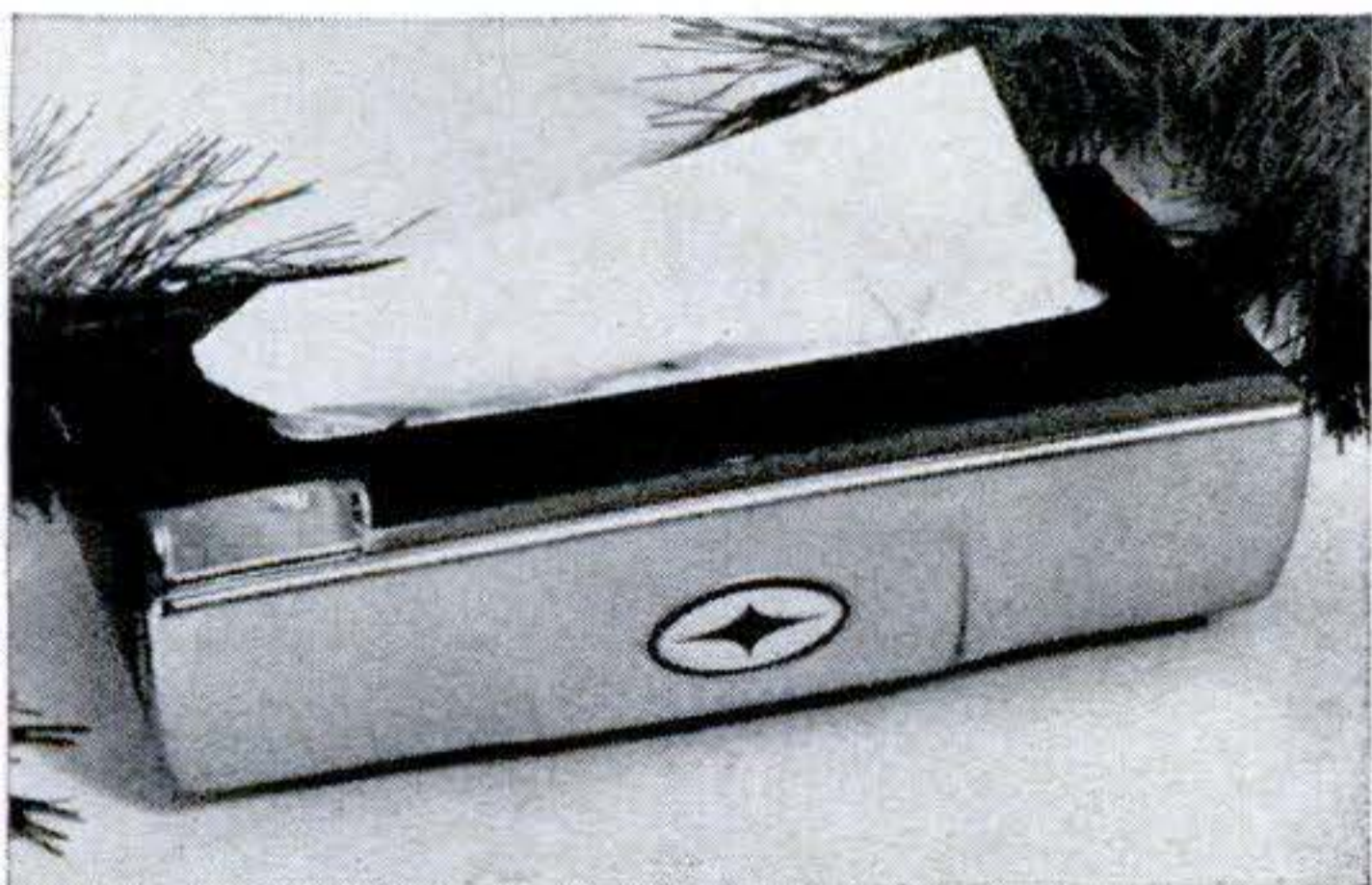
A jewel among tools. Here's a midget ratchet kit that would gladden any man. Who would use it? Auto mechanics, especially for tune-ups; tool-and-die makers; electronics technicians; aircraft mechanics; appliance repairmen, etc. The set includes a 3 $\frac{3}{4}$ " ratchet, 2 $\frac{5}{8}$ " extension, four screwdriver adapters, a square adapter, and 12 socket-screw tools ranging from .050" up to $\frac{5}{16}$ ", stored in foam. Kit 1320 costs \$11 from Chapman Mfg. Co., Durham, Conn. 06422.



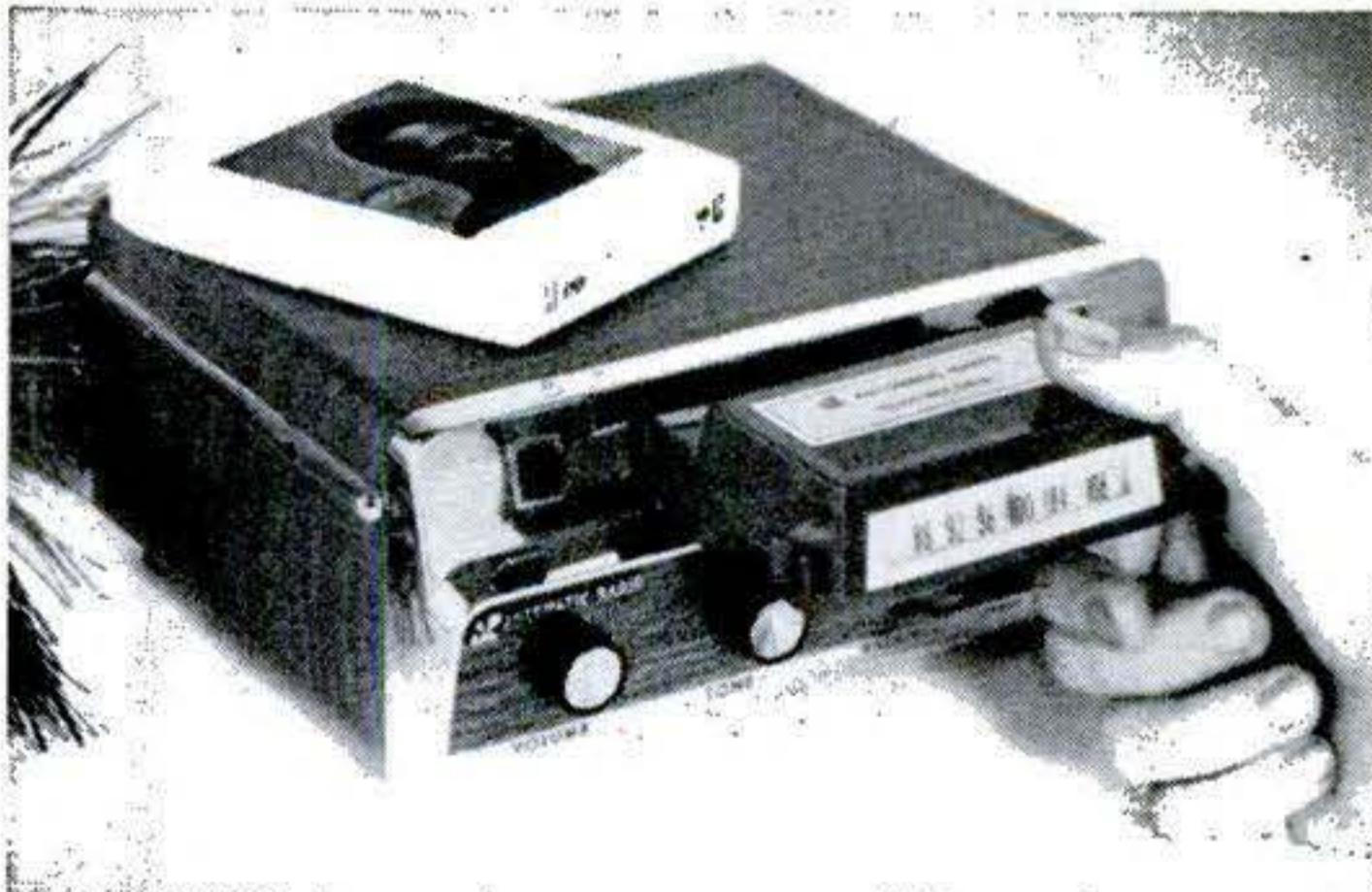
Adjustable frame. Magnetic molding strips, which move to any position for different combinations of pictures, make for easy changes. Magnetic Foto-show comes in two sizes: 10 by 12 (\$4.98) and 12 by 19 (\$6.98). It's made by Hudson Photo Industries, South Buckhout St., Irvington, N.Y. 10533.



Double-duty film editor. Both super 8 movie film and standard 8 go in the Dual-8 editor. (You switch by changing a sprocket wheel.) It has a focusing control, framer, and film notcher, costs \$25. Outfit, including butt splicer, splicing tapes, and four reels, is \$34.95. Hudson Photo Industries (address at left).



Handy tissues. Dirt in the car? Dirt on your hands? Grab a tissue from this dispenser which fits neatly under the instrument panel. A simplified spring- and stem-mounting bracket adjusts for any angle or position. \$3.50, including a box of tissues, from J. C. Whitney, 1917 Archer, Chicago 60616.



Auto tape player. This below-dash tape player for your car has an unusual feature: Besides playing both eight-track and four-track stereo-tape cartridges, it converts to an AM or FM radio when you plug a tuner cartridge into its slot. Automatic Radio, Melrose, Mass., \$120.

Continued



CHRISTMAS GIFT PREVIEW

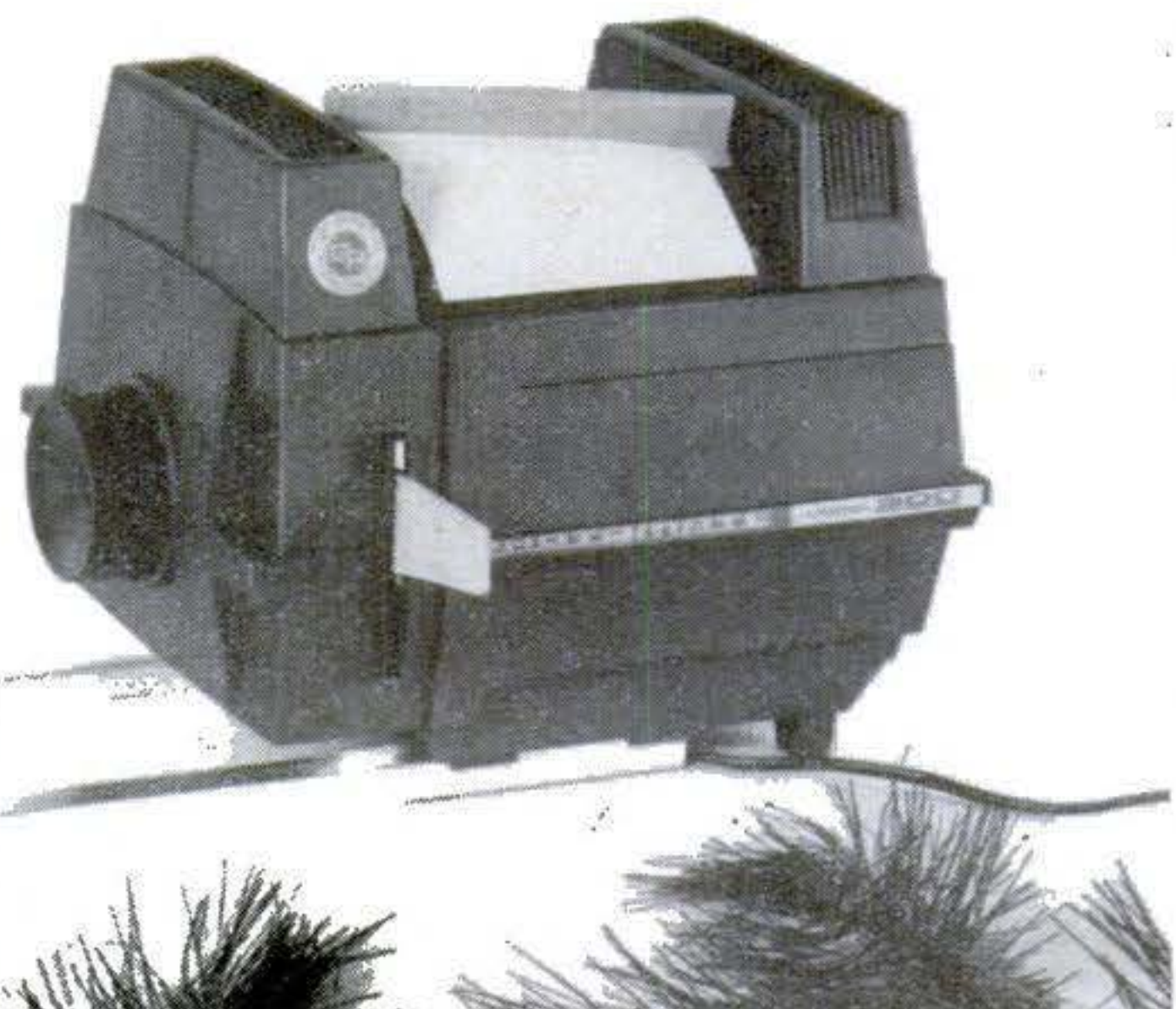


Sealed-beam long-range and fog lamps. Make your night driving safer with Lucas Projector LR6 which throws a 90,000-candlepower pencil beam a tremendous distance. The Pathfinder FT6 fog lamp produces a wide flat-top beam with a hot spot at the top edge to increase penetration. Prices from Lucas, 501 W. 42 St., NYC 10036. Warning: Some states outlaw the use of all auxiliary lights.

Telescoping monopod. Extending to full length for eye-level shooting, it collapses for easy carrying on hand strap. A foot release works it. Brooks-Susis Monpod (\$9.95) is distributed by Burleigh Brooks, Inc., 420 Grand Ave., Englewood, N.J. 07631. **Stabilet tripod** (inset, left) is a five-inch handful that serves a double purpose: Screw it to your camera and it's a grip. Unscrew the cap at the bottom, and out slide legs to make a table-top tripod. It's \$8.95. Distributor is EPOI, Inc., 623 Stewart Ave., Garden City, N.Y. 11533.



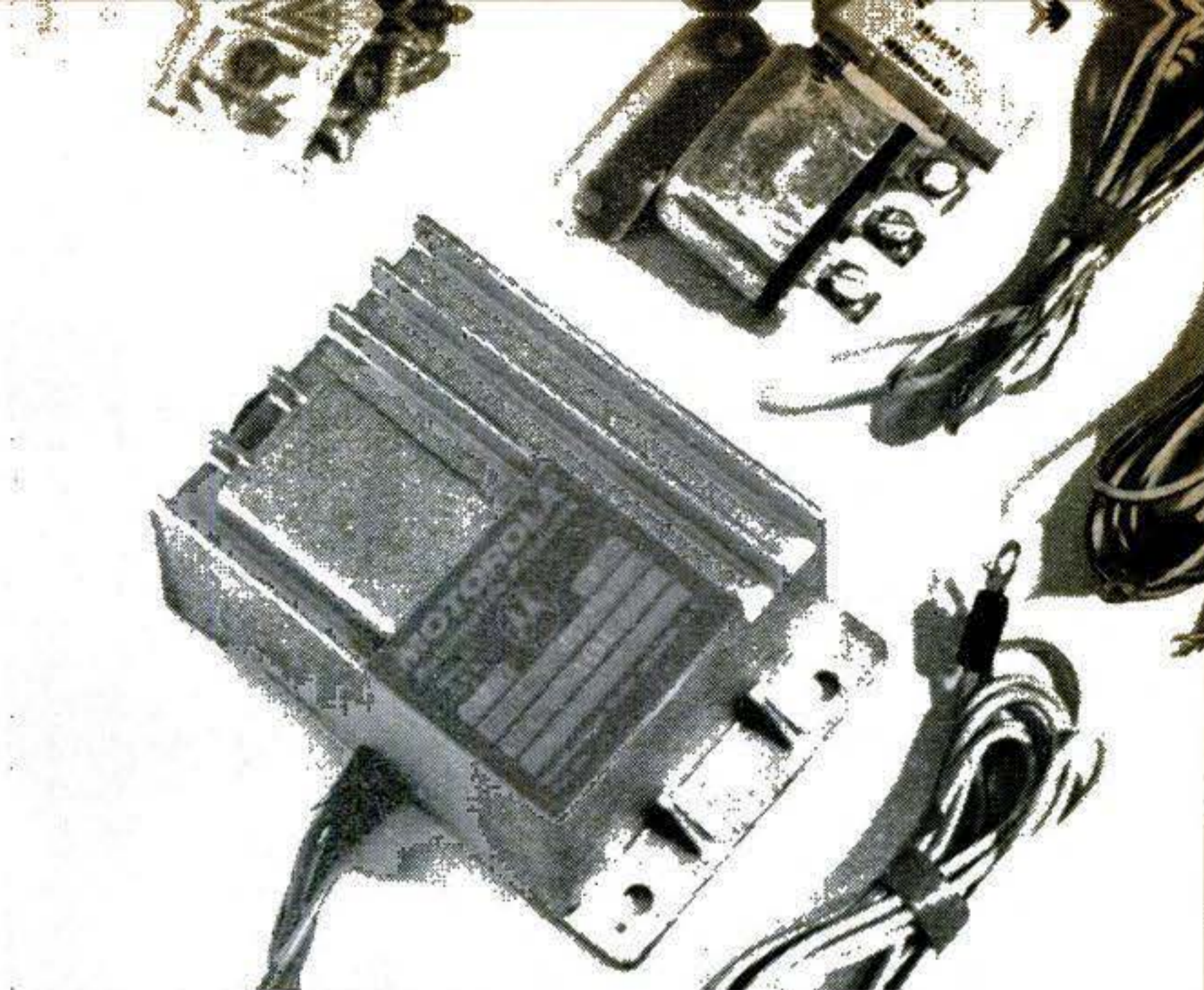
Photo-enlarging toy. You can make enlargements up to five by seven in the living room, with this device, using a dry process developed by 3M Co. There are five steps: 1) Insert negative in holder. 2) Negative is projected on viewer, enabling you to enlarge or



edit. 3) Focus lens. 4) Insert paper. 5) Place paper on developing plate. Print permanence is uncertain. PhotoMate is \$29.95. Paper packets (eight sheets of five-by-seven, or 16 of four-by-five) cost 99 cents. Graphic Products, 200 Fifth Ave., NYC 10010.



Transistorized tachometers. Know your engine speed and you won't over-rev or let the engine lug too far down on the torque curve. Stewart-Warner has a range of pedestal- and panel-mounted tachometers, precision-built with solid-state circuitry and a moving-coil mechanism that has proved its reliability in racing. Available for 12-volt negative-ground cars with four, six, or eight cylinders.

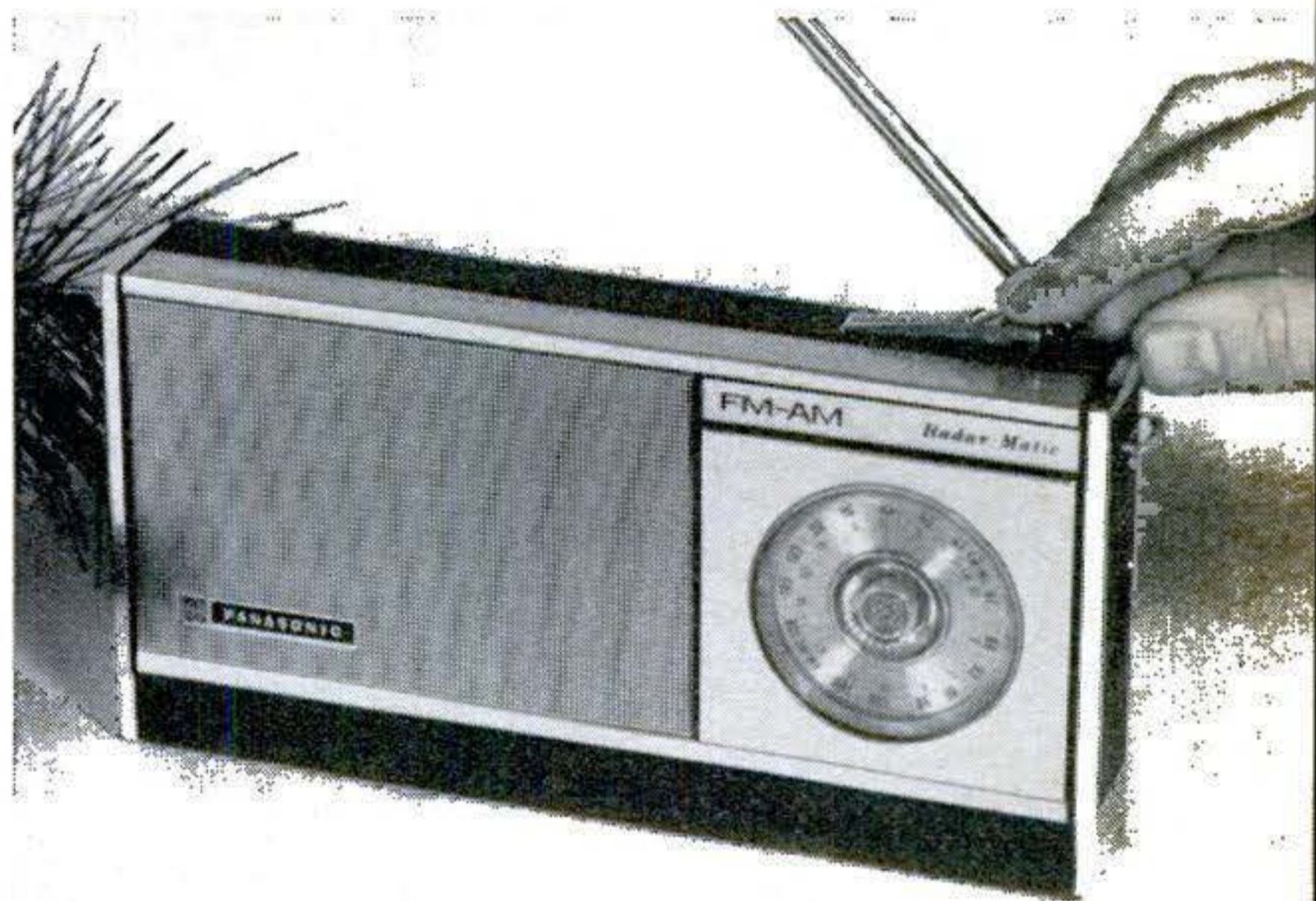


Capacitor-discharge ignition system. Here's a high-performance ignition system you can mount in your car in a single afternoon. It's made by Motorola, and costs \$50. Unlike conventional systems, a C-D ignition doesn't run out of steam at very high r.p.m. or when a cranking starter motor lowers the available voltage; thus it improves both the engine's starting ability and its high-speed characteristics.

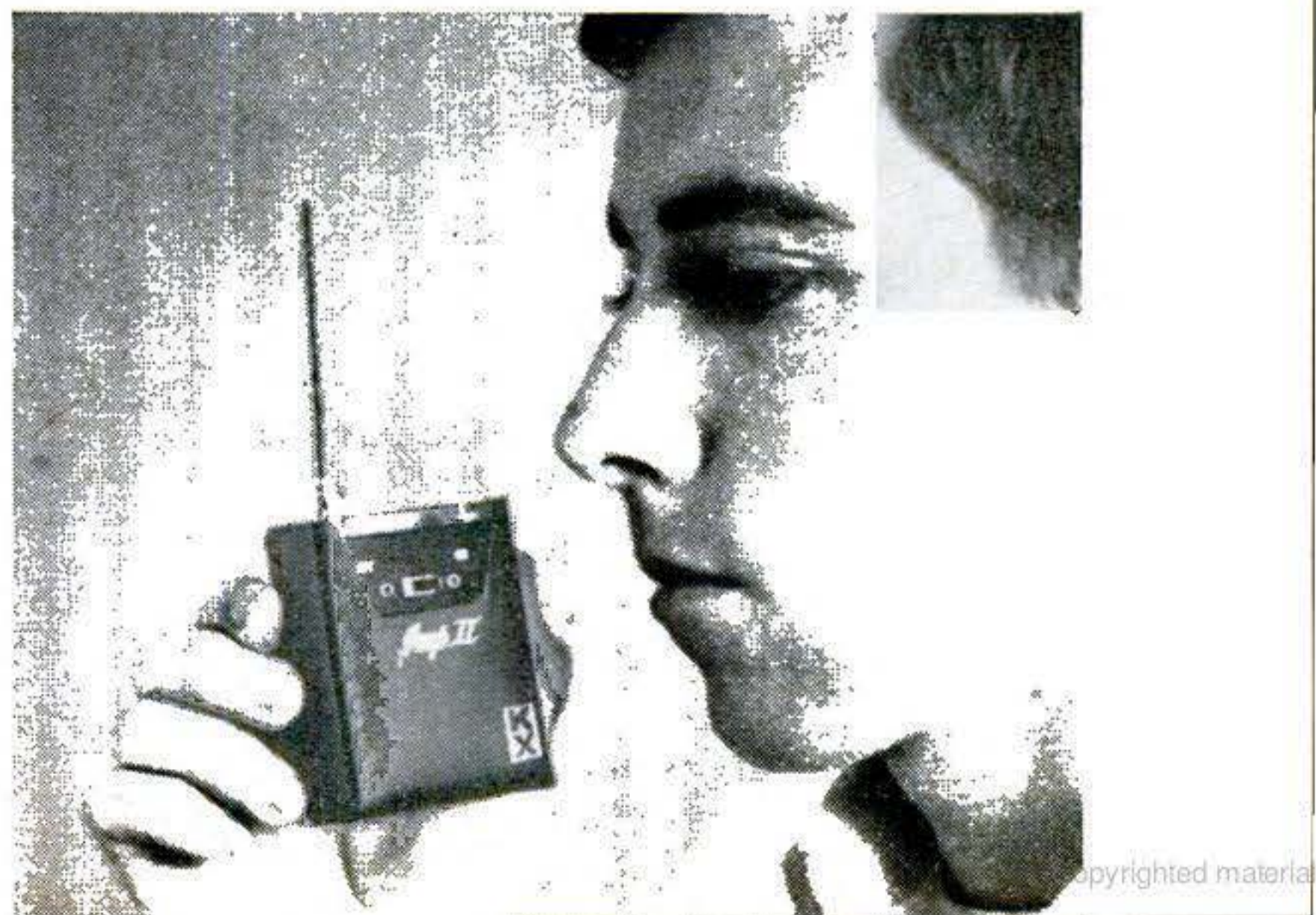


Transistor voltmeter. This battery-powered version of the old-faithful vacuum-tube voltmeter uses a field-effect transistor to produce its 11-megohms input impedance. It measures AC and DC voltages, and resistance. Cost: \$80. It's made by the Triplet Co., 500 Harmon Rd., Bluffton, Ohio.

FM wireless mike. You can broadcast to a nearby FM receiver—on any clear frequency—with this pocket-size battery-powered mike. It's called the IMP II, and is made by the Kinematix Co., 2040 Washington Blvd., Chicago. Two practical uses: As an electronic baby-sitter, or as a wireless mike for performers on a stage. It's \$50. **PS**



Signal-seeking radio. Panasonic AM-FM portable tunes itself perfectly at the touch of a lever: Press it, and the dial turns slowly—it's driven by a wind-up motor—until it reaches a new station. Then it locks on dead center. A side control lets you tune it like a conventional radio, too. Cost: \$70.



Coffee Table That



PS PROJECTS

Table is just the right height for use in front of a sofa. The planter in the center occupies only a

small part of that space. Remainder of the shelf behind it is handy for storing current magazines.

Here's a handy way to store an encyclopedia. The handsome table has other uses, too

By **CARLTON G. BUCHER**

Keeping an encyclopedia set where you and the children can use it freely is only one function of this coffee table. It has two spillproof surfaces for serving beverages, and between them a top big

enough to hold serving trays, ashtrays, and board games. The big open space in the center below could take other books, magazines, records, radio or record player—even planters.

Encyclopedia volumes—or other books—are stored spines up under the glass at each end. Titles are convenient to read, and selection is easy.

Start construction by cutting the parts as shown in the cutting pattern in the blueprint on the following pages. The sides (C and D) are the only pieces that require any further detail. Notch

Solves a Problem



Even young children have no trouble pulling out and replacing volumes of encyclopedia. Books are

stored in the table with the spines up. Titles are easily read through the glass panels at each end.

them as shown for the table top; then groove them for the plate-glass panels. The rest of the job is assembly.

Check the size of your encyclopedia before assembling the end units. Note that the distance of bookshelf below the glass is book width plus $\frac{5}{8}$ ". With this determined, assemble both end units and attach them to the bottom with screws from beneath. Finally, attach the top.

Order the plate glass cut to size for an easy fit in the grooves. The 5" factory-made legs go on last.

If you're going to use an enameled or

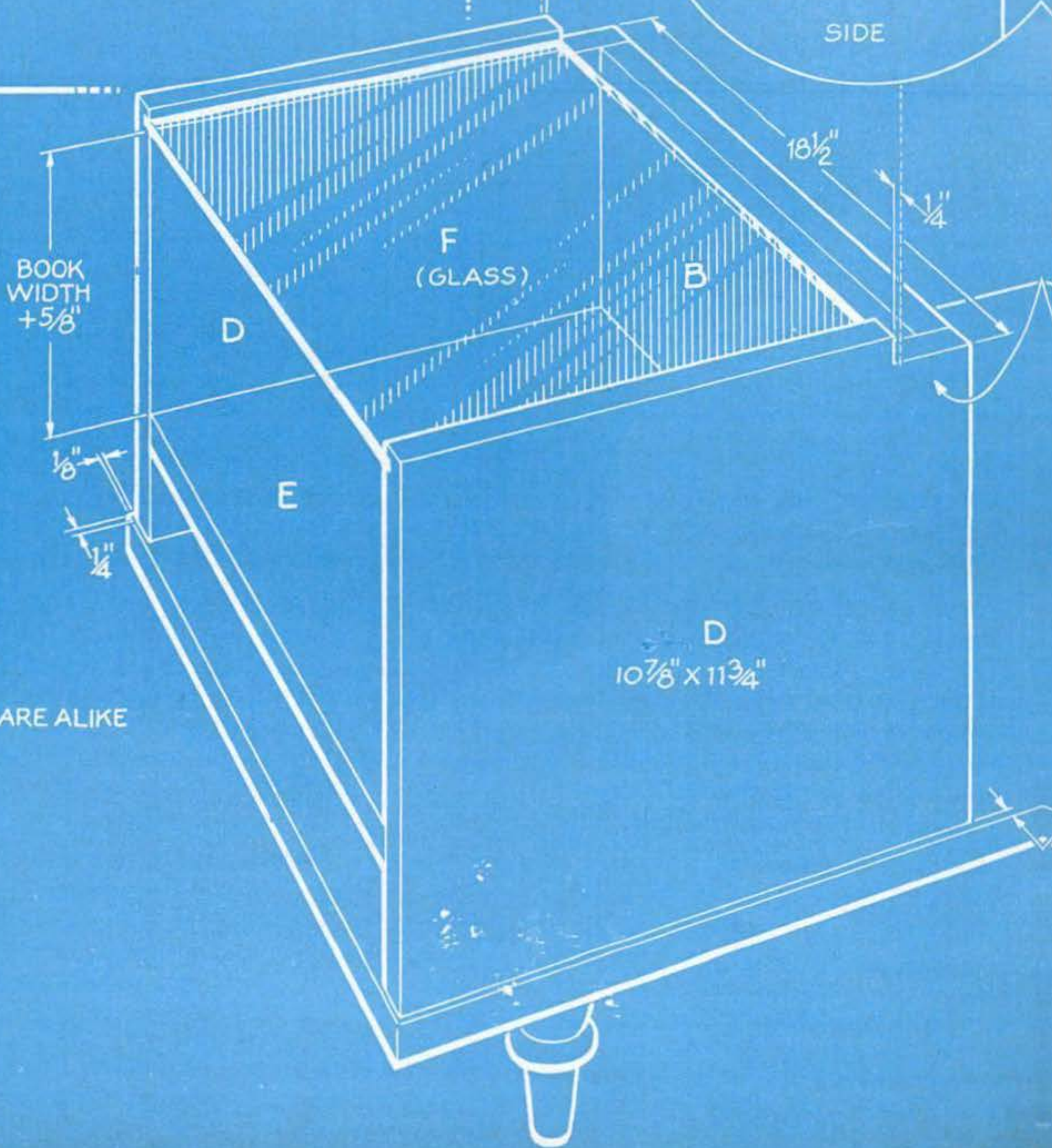
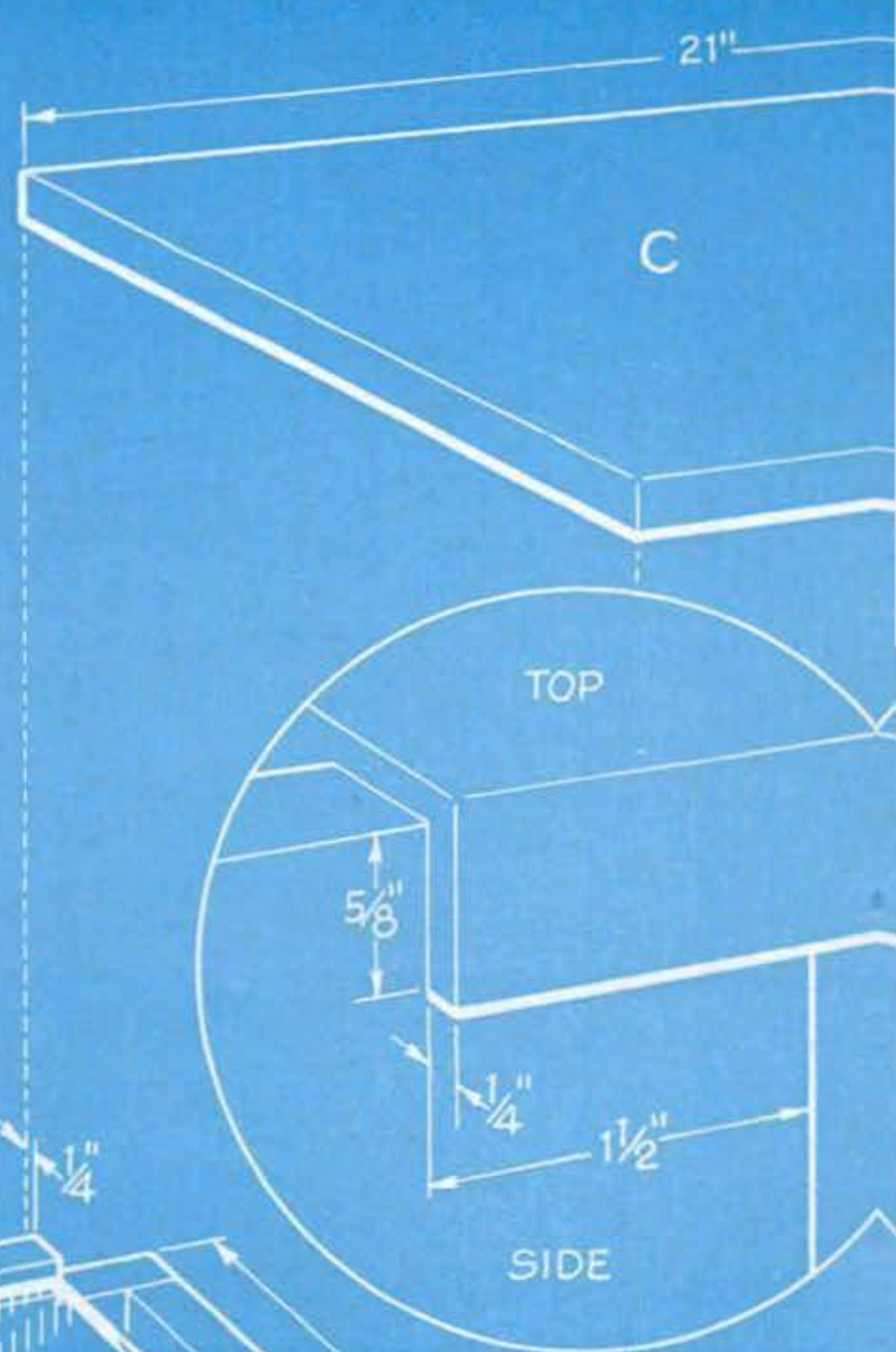
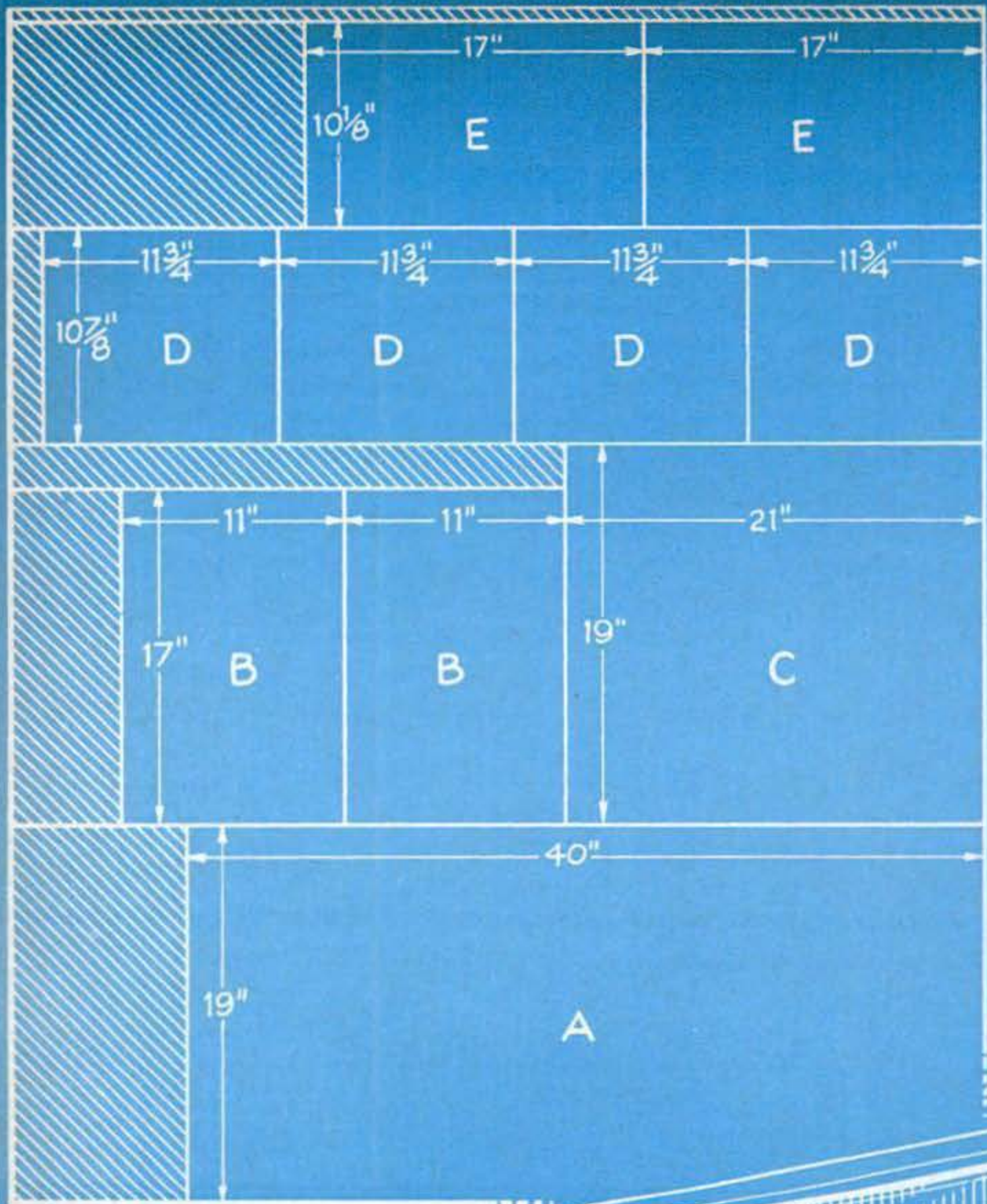
antique finish, you can save money by making the table of fir plywood. And you can assemble it with glue and well-set nails. If the table is to be stained or left natural, birch or walnut cabinet-grade ply is recommended. Use dowels to assemble, and wood-tape the ply edges for a professional-looking job.

The table shown was designed so that each bookshelf holds 10 volumes of a popular set. Measure your set before cutting the stock, and change the shelf width and height if necessary.

Turn the page for lie-flat blueprint

CUTTING PATTERN

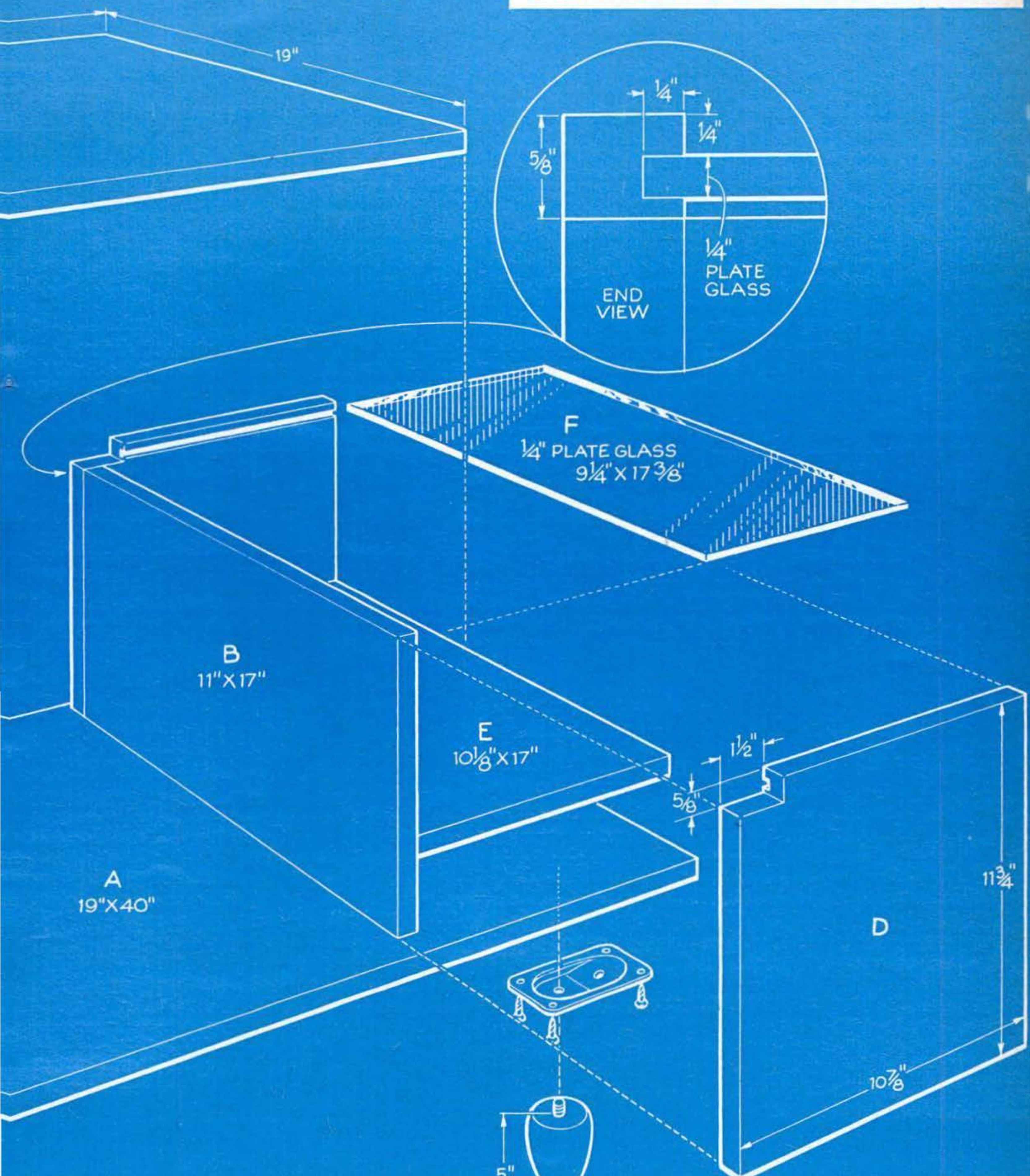
3/4" PLYWOOD 48"x 60"



NOTE -

BOTH END ELEMENTS ARE ALIKE

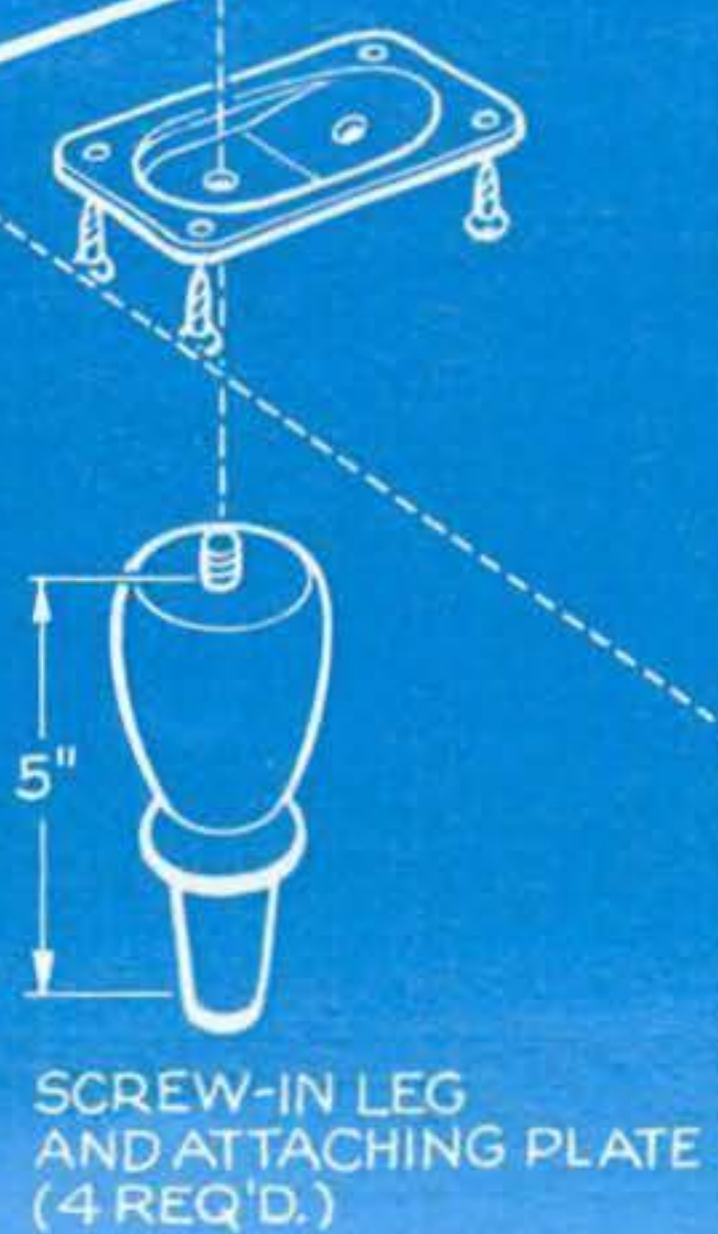
PS LIE-FLAT BLUEPRINT COFFEE-TABLE BOOKSHELF

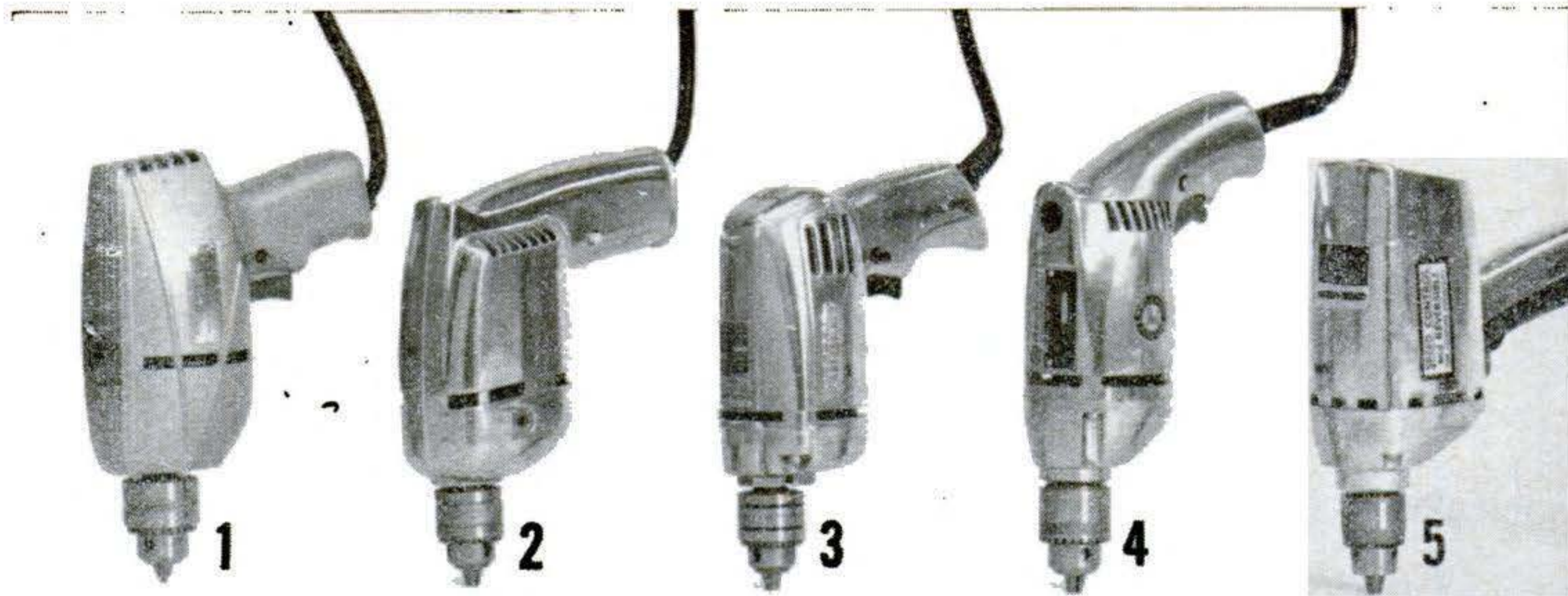


NOTE —

GLUE AND NAIL
OR
GLUE AND DOWEL
ALL JOINTS

GLUE WOOD TAPE
TO ALL EXPOSED EDGES
FOR NATURAL FINISH





Variable speed is the word in $\frac{3}{8}$ " drills these days. All shown (but one) have this feature. Can you spot

the one without it? 1) Thcr 913 VSC; 2) McGraw-Edison 70178; 3) Craftsman 1112; 4) Rockwell 386;

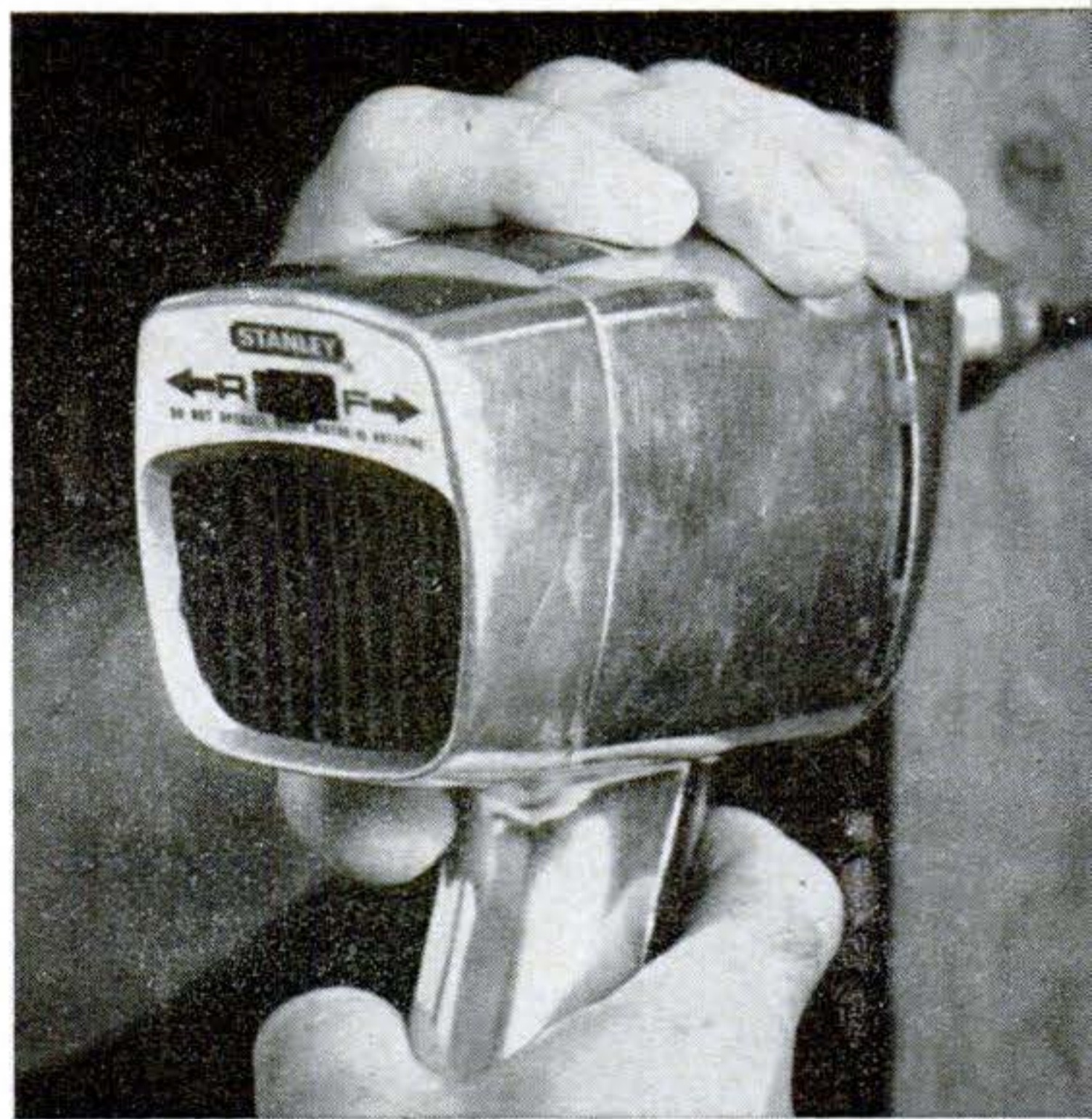
PS TOOLS

YOUR BEST BUY:

Now in the same price range as quarter-inchers, they'll do all the latter will do—and more

Can you get more for your money? If you're shopping for a drill, the answer is yes. Don't pass the $\frac{3}{8}$ " drills by, thinking (as I did) that the cost would be too high for a tool with the latest features. It isn't. Proof? There are now several $\frac{3}{8}$ " drills on the market that have both reversible and variable-speed features. And they sell for about \$40.

Why a $\frac{3}{8}$ " drill, rather than the popular $\frac{1}{4}$ "? First, and obviously, is the larger chuck capacity, which lets it take bits and tackle jobs that are beyond the scope of its little brother. Its slower speeds also offer advantages. You needn't invest in expensive high-speed bits for metal drilling. Low-carbon bits that can't take the higher speeds of $\frac{1}{4}$ " drills can be substituted. Low speeds are best for carbide masonry bits, too. Even when a $\frac{1}{4}$ " drill boasts variable speed, it isn't right for some low-speed jobs. That's why many bits and attachments are equipped with shanks that won't fit a $\frac{1}{4}$ " drill. For example, a large hole saw will



These three new $\frac{3}{8}$ " drills reverse

With reverse added to a variable-speed drill, the tool has greater versatility than ever. Screws and bolts can be removed as well as driven, and bit

fit only the larger drills for a good reason: They've got more torque. This means extra heft and power for the more demanding jobs and slow-speed applications. Because they have more punch per pound, you could reasonably expect



5) Stanley 80744; 6) Millers Falls SP2139; 7) Wen 821VSC; 8) Skil 597-5; 9) Black and Decker U-320;

10) Montgomery Ward 9220. The drill without variable? No. 3. For Sears v/s, see page 132.

a 3/8" Drill?

By HARRY WICKS



t the flick of a switch

withdrawal is far easier. Stanley (left) located the switch at the rear of the motor housing. Millers Falls (center) chose the left side of the handle,

while Skil (right) uses a lever above the trigger switch. Skil has just added an adjustable trigger-speed knob for presetting maximum speed desired.

them to be larger and heavier than the quarter-inchers. That's not always the case. Recent developments—solid-state electronics and plastic housings, for example—let the manufacturers pack 3/8" power into a 1/4"-size package.

What we found out. It's possible to get a 3/8" drill to custom-fit any buyer's needs. They are offered with shockproof cases, in kits, with multiple-speed settings, reversible action, and variable-

Continued

Facts About 3/8" Drills

speed control. And some (not all) come equipped with a multiposition auxiliary handle—a big plus for slow, continuous drilling that calls for steadiness or extra muscle.

Variable-speed control. This just about does away with starting holes and center punching. There's no chance of bit slippage, because you start slow. This feature has been offered for several years on 1/4" drills, and has proved so popular that leading manufacturers have added it to their 3/8" lines. But this doesn't make the 3/8" identical to the 1/4" in r.p.m., just because both start at 0. The range of a 3/8" variable-speed drill is considerably shorter, so as not to lose the torque advantage.

Every manufacturer listed in our chart has at least one variable- or multiple-speed drill on the market. New models have come recently from Black and Decker, Millers Falls, Skil, and Stanley. Black and Decker's Scru-Drill changes to a screwdriver when you rotate a collar behind the chuck.

In many instances, a multiple-speed drill is more desirable than the trigger-operated variable. If your work is basically confined to two or three speeds, multiple speed will suit you perfectly.

The reversibles. Reversible action is being added to more and more rigs. To the man whose projects involve a lot of assembly or dismantling using screws or bolts, this combination is like having an extra arm. It's also a boon if you do much tapping.

If you don't need (or want) any extras, however, you can still buy a plain old-fashioned drill. Ward has a 3/8" model that sells for \$10.95; Sears has an \$11.99 economy special. Most companies market at least one model selling for less than \$20.

MAKE AND MODEL		RETAIL PRICE	LENGTH (in.)	WEIGHT
Black & Decker Towson, Md. 21204	U-124	\$13.99	7 3/4	3
	U-320	\$39.99	8 1/2	3
	681	\$69.00	9 3/4	4
McGraw-Edison Boonville, Mo. 65233	70148	\$12.95	8	3
	70164	\$14.95	8	3
	70178	\$16.95	8	3
Millers Falls Greenfield, Mass. 01301	SP2038	\$18.88	8	2
	SP2038VS	\$28.88	8	2
	1038	\$29.95	9 1/8	3
	2838	\$36.50	9 1/8	3
	SP2139	\$36.88	8	N
	SP1141	\$38.50	10	2
Milwaukee 13135 W. Lisbon Rd., Brookfield, Wis. 53005	0220	\$59.50	10 1/4	4
	0870	\$62.50	12 1/4	6
	1620-1 0222	\$82.50 \$64.50	12 1/4 9 1/2	9 4
Montgomery Ward (Powr-Kraft) 619 W. Chicago Ave. Chicago 60607	9248	\$10.95	8 3/4	3
	9221	\$18.50	8 3/4	3
	9220	\$29.95	9 1/2	4
Rockwell Rockwell Building Pittsburgh 15208	55	\$19.97	10 1/4	3
	56	\$29.97	10 1/4	3
	386	\$53.00	9	4
	366	\$45.00	9	4
	776.5	\$67.00	10	4
	776.7	\$67.00	10	4
	756	\$69.00	13 3/4	7
766	\$75.00	14	9	
Sears 925 So. Homan Ave., Chicago 60607	1108	\$11.99	9 3/4	3
	1112	\$19.99	8 3/4	3
	1115	\$24.99	8 3/4	3
	775	\$24.99	8 1/4	4
	1117	\$32.99	8 1/4	4
	1107	\$32.99	8 1/8	4
	1101	\$39.99	10 1/2	4
1103	\$49.99	9 3/4	4	
Shopmate P.E.T. 1200 E. State St., Geneva, Ill. 60134	1837	\$24.30	10	4
	1836	\$30.50	10	4
	1834	\$34.95	10	4
Skil 5033 Elston Ave., Chicago 60630	597-5	\$42.95	9 3/4	3
	597	\$39.95	9 3/4	3
	569	\$32.95	9 3/4	3
	560	\$28.95	9 3/4	3
	76	\$47.00	9 5/8	4
	90-50 262	\$75.50 \$73.00	9 1/2 13	4 7
Stanley 666 Myrtle St., New Britain, Conn. 06050	80060	\$19.00	9	3
	80743	\$27.00	9	3
	80744	\$38.95	9	3
	90063	\$46.50	9 1/2	4
	238	\$70.00	8 1/2	3
	9079-3 90772	\$63.00 \$72.50	5 3/8 9 1/2	5 5
Thor 175 N. State St., Aurora, Ill. 60507	912	\$16.95	8 1/2	3
	913	\$24.95	8 1/2	4
	912VSC	\$29.25	8 1/2	4
	913VSC	\$34.25	8 1/2	4
	STD-5	\$52.00	8 5/8	4
	UFD-5	\$72.00	9 3/4	4
	STDD-5 VSC	\$62.00 \$77.50	12 7/8 9 3/4	4 4
Wen 5810 N.W. Hwy., Chicago 60631	820	\$24.95	8 3/4	5
	821	\$29.95	8 3/4	5
	830	\$29.95	8 3/4	5
	808D	\$29.95	12 1/2	5

N.A.—Information not available.

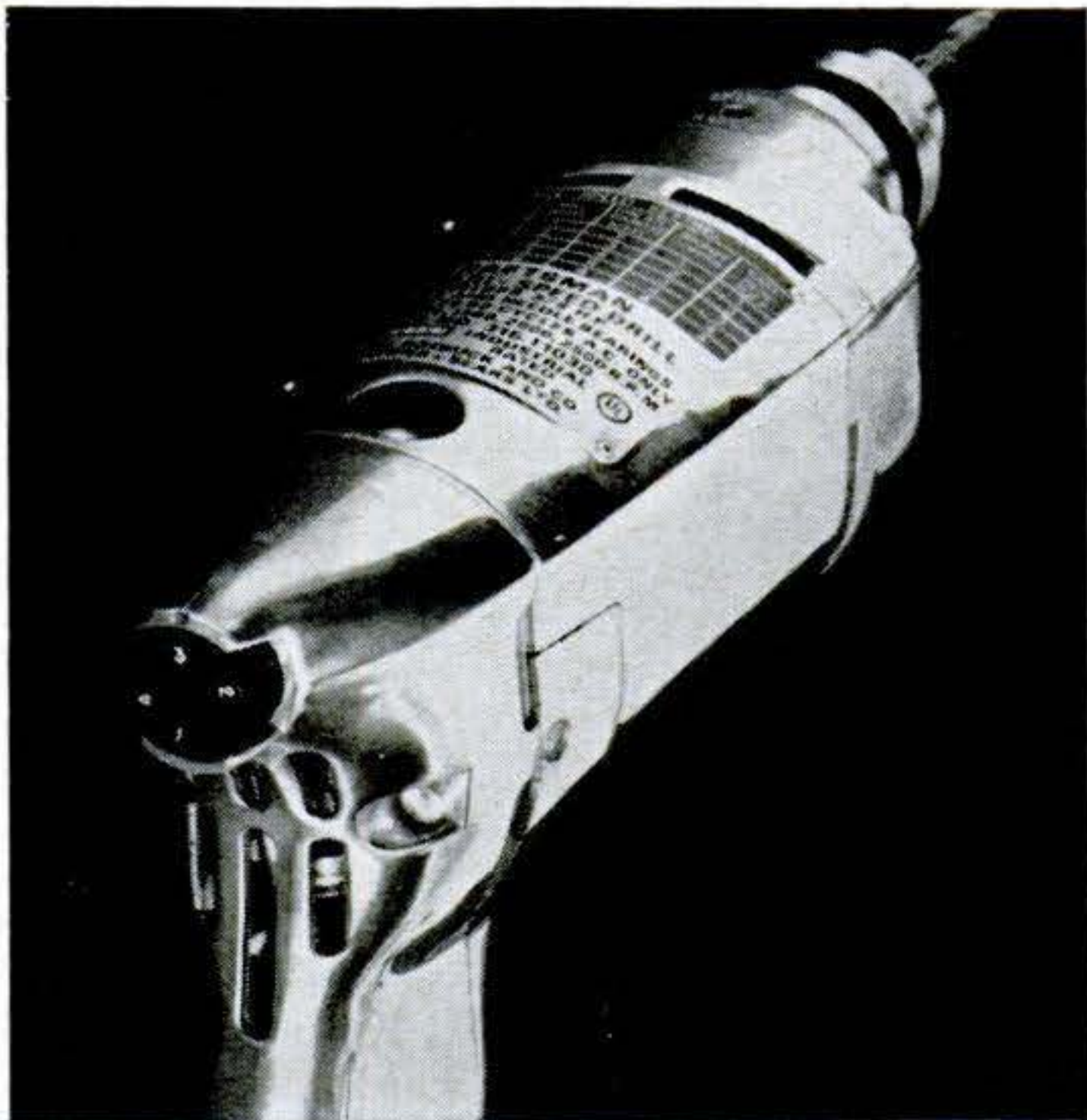
Power-Cord Length (ft.)	Grounded Plug	Double Insulation	CHUCK R.P.M. (no load)	Stages	Overall Reduction	Number	Ball	Other	Multi-speed	Variable	Reversible	Consumer	Industrial (heavy duty)
6	✓		1,000	Double	22.7	6		Sleeve				✓	
6	✓		1,000	Double	22.7	7	1	{ 4 Needle 2 Roller				✓	
6	✓		0-1,000	Double	22.7	6		Oil impreg.		✓	✓		✓
6	✓		1,000	Double	20	4	1	N.A.				✓	
6	✓		800 & 1,000	Double	20	4	1	N.A.	✓	✓		✓	
6	✓		0-1,000	Double	20	4	1	N.A.		✓		✓	
6	✓	✓	1,000	Double	22.3	6	1	Oil impreg.				✓	
6	✓	✓	0-1,000	Double	22.3	6	1	Oil impreg.		✓		✓	
7	✓		1,000	Double	24.7	6	1	Oil impreg.				✓	
7	✓		1,000	Double	24.7	6	1	Oil impreg.				✓	
6	✓	✓	0-1,000	Double	22.3	6	1	Oil impreg.		✓	✓	✓	
6	✓	✓	1,000	Double	24.7	6	1	Oil impreg.				✓	
6	✓	✓	0-1,000	Double	26.2	6	3	{ 1 Needle 2 Oil impreg.		✓		✓	
8	✓		650	Double	31	6	4	Roller					✓
8	✓		1,000	Double	18	6	4	Roller					✓
8	✓		900	Double	22.5	6	6				✓		✓
8	✓		0-1,000	Double	31	6	4	Roller		✓			✓
6	✓		1,000	Double	24.1	6		Bronze				✓	
10	✓		0-1,000	Double	10.1	6		Bronze		✓		✓	
10	✓		0-1,000	Double	23.2	6	1	{ 4 Bronze 1 Needle		✓		✓	
6	✓	✓	1,000	Double	9.8	6		Bronze				✓	
6	✓	✓	0-1,000	Double	9.8	6		Bronze		✓		✓	
6	✓	✓	0-1,000	Double	21	6	3	Needle		✓		✓	
6	✓	✓	1,000	Double	21	6	3	Needle				✓	
6	✓	✓	750	Triple	43.1	8	3	Needle					✓
6	✓	✓	500	Triple	28.4	8	3	Needle					✓
6	✓	✓	1,000	Double	20.1	6	3	Needle					✓
6	✓	✓	1,000	Double	20.1	6	3	Needle					✓
6	✓		1,000	Double	22.4	5		{ 2 Sleeve, 1 Thrust,				✓	
10	✓		1,200	Double	19.6	5		{ 2 Flange, 2 Sleeve		✓		✓	
10	✓		0-1,200	Double	19.6	5		Sleeve		✓		✓	
10	✓		1,150	Double	20.3	4	2	Sleeve		✓		✓	
10	✓		0-1,150	Double	20.3	4	2	Sleeve	✓	✓		✓	
10	✓		800 & 1,750	Double	14.8	4	2	Sleeve				✓	
10	✓		825	Triple	13.5	5	3	Needle		✓		✓	
10	✓		1,000-2,500	Double	10.7	5	3	Needle		✓		✓	
6	✓		800 & 1,000	Double	23.3	7	1	Bronze	✓				✓
6	✓		0-1,000	Double	23.3	7	1	Bronze		✓			✓
6	✓		0-1,000	Double	23.3	7	1	Bronze		✓	✓		✓
6	✓		0-1,000	Double	22.3	6		Oil impreg.		✓	✓	✓	
6	✓		0-1,000	Double	22.3	6		Oil impreg.		✓	✓	✓	
6	✓		0-1,000	Double	22.3	6		Oil impreg.		✓	✓	✓	
6	✓		1,000	Double	22.3	6		Oil impreg.				✓	
10	✓		900	Double	22.6	6	3	Oil impreg.				✓	
10	✓		0-500	Double	56	8	5	Needle		✓		✓	
10	✓		750	Double	28.1	8	4	Needle				✓	
6	✓		1,000	Double	22.8	6		Oil impreg.				✓	
8	✓		1,000	Double	22.8	6	1	Oil impreg.				✓	
8	✓		0-1,000	Double	22.8	6	1	Oil impreg.		✓	✓	✓	
8	✓		1,000	Triple	24.2	8	4	Oil impreg.				✓	
8	✓		600	Triple	43.5	8	7	Needle				✓	
8	✓		900	Triple	25	8	3	Needle				✓	
10	✓	✓	0-1,000	Triple	24.2	8	4	Needle		✓		✓	
6	✓		1,900	Double	N.A.	4	1	Sleeve				✓	
6	✓		900	Triple	N.A.	6	2	Sleeve				✓	
6	✓		0-1,900	Double	N.A.	4	1	Sleeve		✓		✓	
6	✓		0-900	Triple	N.A.	6	2	Sleeve		✓		✓	
6	✓		500	Triple	N.A.	8	3	Needle				✓	
8	✓		500	Triple	N.A.	8	8					✓	
6	✓		500	Triple	N.A.	8	3	Needle		✓		✓	
8	✓		0-1,000	Triple	N.A.	8	8					✓	
6	✓		1,100	Double	17	7	1	{ 1 Needle 5 Bronze		✓		✓	
6	✓		0-1,100	Double	17	7	1	{ 2 Needle 4 Bronze				✓	
6	✓		1,100	Double	17	7	1	Oilite bronze				✓	
6	✓		450-3,000	Double	14	9	1		✓			✓	

Space requirements do not permit listing of every drill by each manufacturer. For information on other models, contact manufacturer.

Multiple-speed rigs feature quick speed change. Here are two



To change speed on Wen's model 808D, the chuck is inserted in one of two speed spindles. The side-mounted switch gives two speeds to each spindle.



Speed can be quickly set on Craftsman 1103. Knob at rear presets four different r.p.m. Reference chart on housing gives speed to use for job at hand.

Consumer or heavy duty? Power tools now receive only one rating—Industrial—from the Underwriters Laboratories (UL). Domestic has been dropped. UL approval relates to tool safety. If a tool doesn't pass the tests—no listing.

Don't confuse UL Industrial approval with the manufacturers' use of the same word. All drills on the chart are UL-approved—hence UL Industrial rated. But most companies have two classifications of power tools—consumer and industrial (heavy duty). Check the chart to find how the drill you're interested in is rated.

It's pretty well known that the $\frac{3}{8}$ "

drill is superior for slow-speed and tough-job operations. But how does it perform with high-speed wood bits? To find out I checked with the Irwin Auger Bit Co. A company spokesman said: "Speedbor '88' spade bits bore well at 1,000 to 1,200 r.p.m. but will not function at peak efficiency at that speed. The best speed is 1,700 to 2,000 r.p.m." In other words, they'll do the job perfectly satisfactorily at the lower speeds of the $\frac{3}{8}$ " drills. The job just takes a little longer.

So if your work is fairly evenly divided—between high- and low-speed use—pick a variable- or multiple-speed $\frac{3}{8}$ " drill with a high r.p.m. rating.

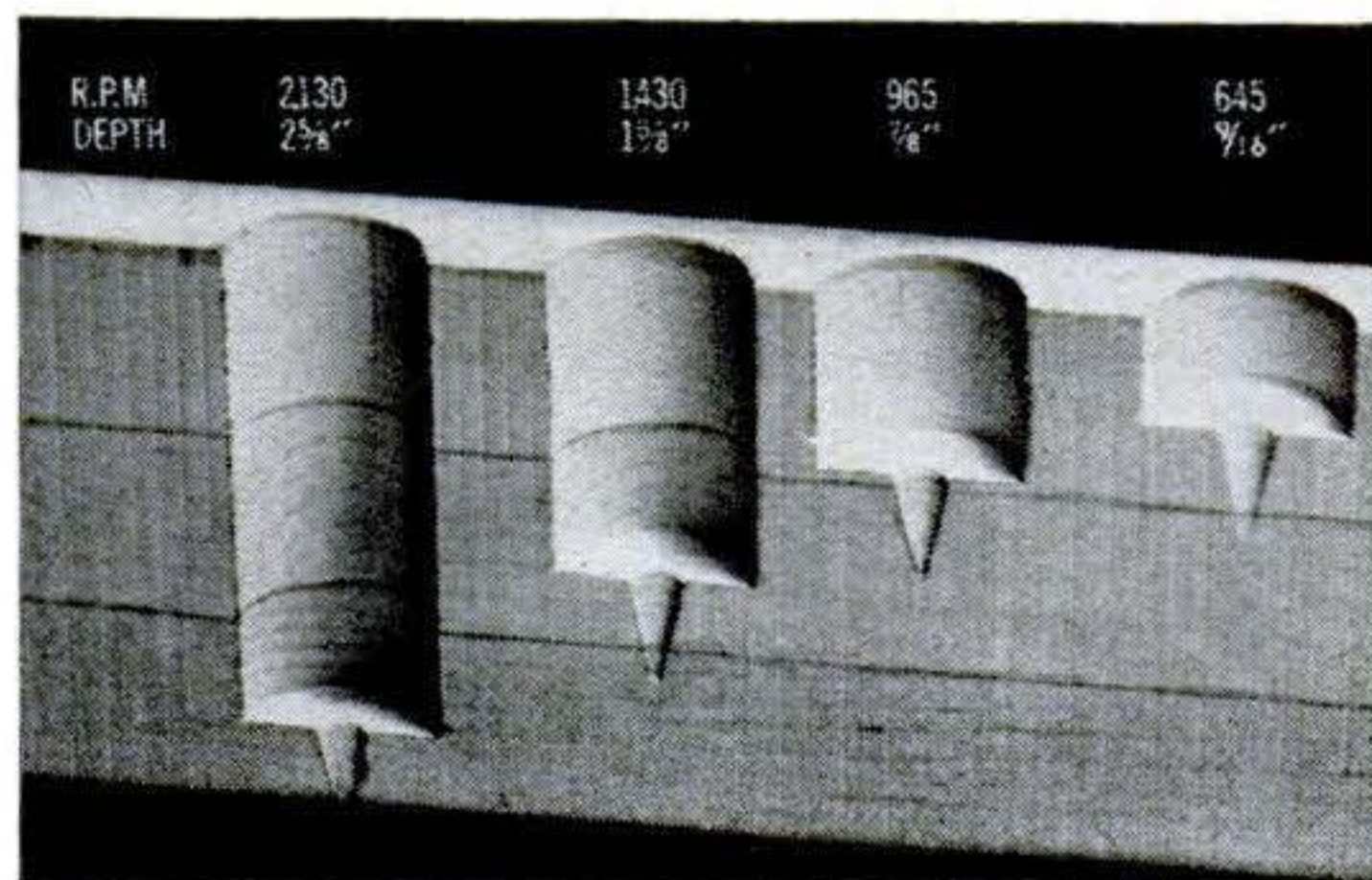
How to buy your drill. Check the specs to find out how it is built. What type of bearings—ball, roller, or sleeve? How many bearings? What's inside the casing determines drill price and the rule for buying is simple: Pick the best-built, most powerful drill your budget allows for your kind of work.

If you do a lot of shop work and are constantly "putting the boots" to a drill—move up to the \$30 to \$40 range. In this bracket you can select from the best all the manufacturers offer. As a rule of thumb you can figure that any drill from \$30 up is in the professional user's class.

For the man who does everything around the house (from making furniture to extension building), the wisest and most economical purchase is a heavy-duty, industrial drill.

A spokesman for one of the manufacturers said, "Be sure to let your readers know where the different class tools can be bought." Good point. Consumer tools

[\[Continued on page 182\]](#)



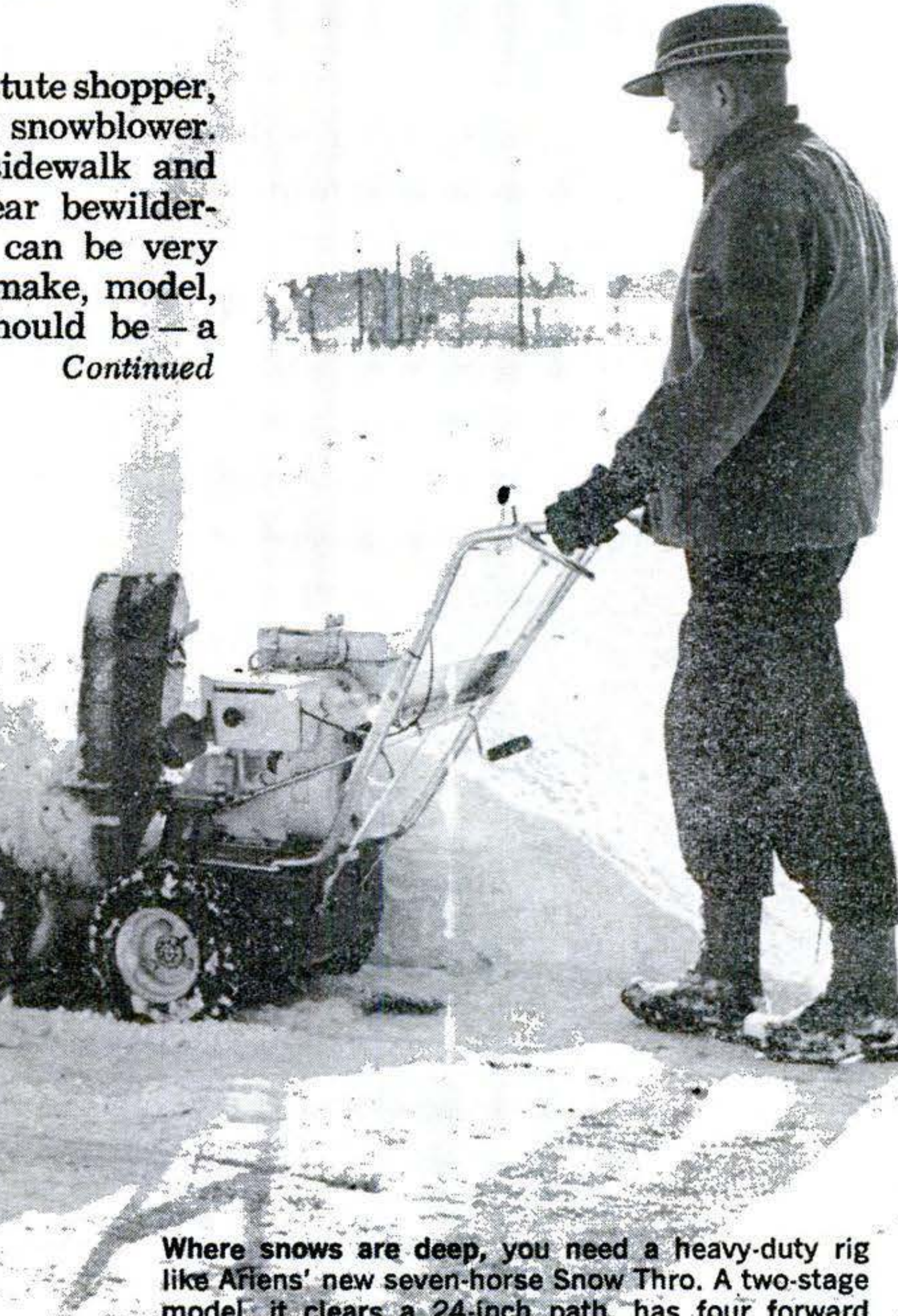
How do high-speed wood bits work at low speeds common to $\frac{3}{8}$ " drills? The job just takes longer. A 1" Irwin Speedbor made these holes at various r.p.m. in 3" maple in 10 seconds at 30-lb. thrust.

How to Buy the Right Snow Thrower

How much snow? How big is the area you must clear? Any slope? Here's how to match a rig to your needs

By E. F. LINDSLEY
PS Outdoor Power Equipment Editor

If you fancy yourself as an astute shopper, slow down before you buy a snowblower. These trim and gleaming sidewalk and driveway cleaners can appear bewilderingly alike. In truth, they can be very different. Getting the right make, model, type, and size is — or it should be — a highly personal thing. *Continued*

A black and white photograph showing a man in profile, wearing a hat and a jacket, operating a snowblower. The snowblower is a walk-behind model with a large auger and a discharge chute. The man is standing in a snowy field, and the snowblower is clearing a path. The background is a bright, snowy landscape.

Where snows are deep, you need a heavy-duty rig like Ariens' new seven-horse Snow Thro. A two-stage model, it clears a 24-inch path, has four forward speeds and reverse. It takes mower and lawn-vacuum attachments for summertime chores.



An electric snow thrower is one of the choices you have in making your selection. Easy starting is a big advantage. Sunbeam's 18-inch models even come equipped with a headlamp, as shown above.

Choosing the wrong machine can cost you extra physical effort. Unlike many shop and garden tools used as a hobby, trundling out the snowblower is seldom a matter of choice. Using the wrong blower for the job is not amusing—and can be exhausting. An example of a bad choice would be a blower that lacks a power reverse when you have to back up a hill.

When you're buying a blower, a bit of logical analysis can widen your choice: If you're new in the area, don't take a neighbor's tale of winter conditions as the last word. Check with the local news-

Dozer blade or thrower—you get your choice in the snow-removal products made by Wheel Horse. At



paper or U.S. Weather Bureau on actual snowfall and its frequency.

One- or two-inch falls are easily removed with light equipment; three to five inches takes medium-powered equipment and makes for rough going if it's frozen or heavy-wet; snow six to 12 inches deep, and drifting, takes plenty of guts and is grounds for a blower or tractor of five hp. and up.

Evaluate your sidewalk and driveway. Got a standard city lot of 60 by 125 feet, with an ordinary sidewalk in front and about 80 feet of driveway to a one-car garage? Light equipment will easily clean off light to moderate snow. If you have real buster storms occasionally, the medium-size blower may be better. This would also apply to a corner lot.

If the small city lot isn't representative, how does your home fit into a typical suburban spread about 200 feet wide and deep, with a two-car garage? Here, medium-power machines are fine for light snow but may show up weak in heavy going. Often, it's wise to be a two-blower family—with a light, shovel type for steps and landings, and a husky higher-powered blower for the big areas. Five-hp. models fit this picture quite well.

For a rural or big suburban snow-cleaning job, your main concern will probably be drives, garage ramps and turnarounds, and maybe a skating rink. The choice is a self-propelled blower of six horses and up, or a front-mounted blower or blade on a garden tractor.

Visualize your job. If any area has a

left is a Wheel Horse six-speed tractor with blade; at right, same company's Reo snow thrower.



perceptible slope, you'll want to back up-hill part of the time. Dragging a blower backwards on slippery footing can be dangerous and exhausting. You'll want a power reverse. And backing out will be necessary if you have tight spots that give you a problem on where to throw the snow. How much room you have for blower storage can also influence what you buy. The larger self-propelled units demand parking room.

The little giants. Check them out by sizes. The lightweight outfits that you use shovel fashion or as a push-along blower have semiflexible plastic paddles or augers, and two handles. These little gems are foolers. Don't sell them short. In addition to being handy on porches, steps, and patios, they'll clean a light snow from an average walk in fast time. Their abilities are not appreciated until you dig one into a frozen drift.

Small and light enough to go in a car trunk, these little giants can be a real ace in the hole in snow country. Even ramming them under the frame of a stuck car doesn't seem to bother the tough plastic paddles. Storage? Hang it on a wall like a broom.

The medium-size jobs. Buying a medium-size blower can lead you into trouble. In really big blowers and really small ones, highly specialized engineering must enter into the design. The cost of such development takes a first-line company with a reputation at stake. A medium-size blower can be assembled from standard parts. Competition is keen in this market range. Items to look for:

- Overall quality. Finish, rustproofing, bearings, drives and clutches, and the name of a manufacturer who will be around for parts and service when needed in the future.

- Is the engine really waterized? Protective housing and shields around spark plugs and controls are standard on good blowers.

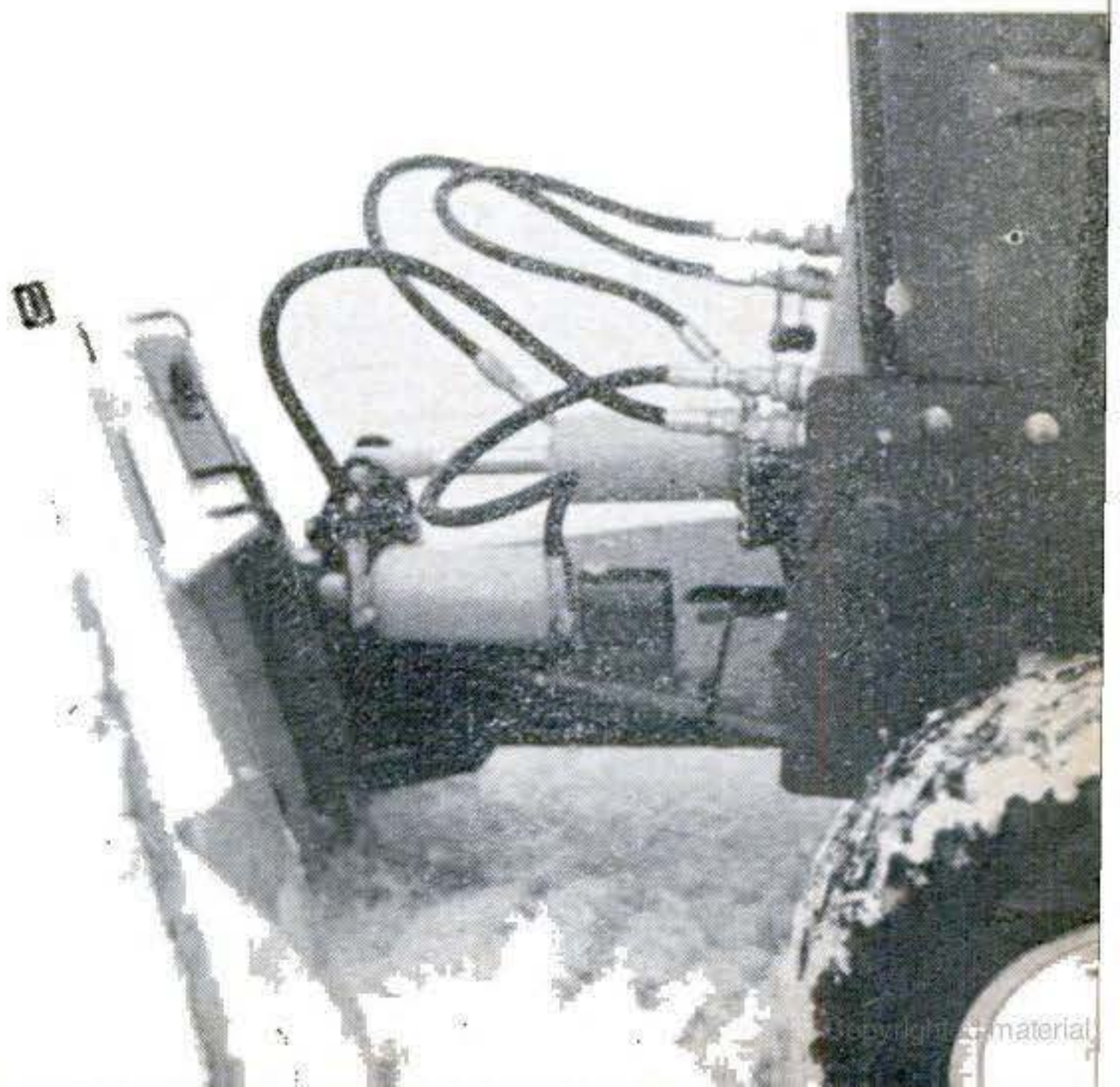
- Is it self-propelled? For areas with light, infrequent snows the hand-pushed blower is perfectly practical; elsewhere, self-propulsion is a big help.

[Continued on page 174]

New hydraulic lift for John Deere tractor gives control of blade height and angle (right) and lets driver position blower (upper right) for high or low cuts.



"Don't sell them short," says the author about lightweight, powered snow shovels that several companies now make, in both gas and electric models. In fringe snow areas, and for walks and steps, they're fine. That's an AMF Husky Junior above.



Popular Science

AWARD

Popular Science Monthly announces another in its series of Awards presented in recognition of companies and individuals making outstanding contributions to American living in fields of interest to PS readers. Previous winners of the Award are: Ford Motor Co., Eastman Kodak, Homelite, General Motors, International Correspondence Schools, Fisher Body Craftsmen's Guild, Dr. Edwin H. Land and Polaroid Corp., Outdoor Power Equipment Institute, and Sheldon Coleman and The Coleman Co. The 10th selection of the Popular Science Editorial Board:

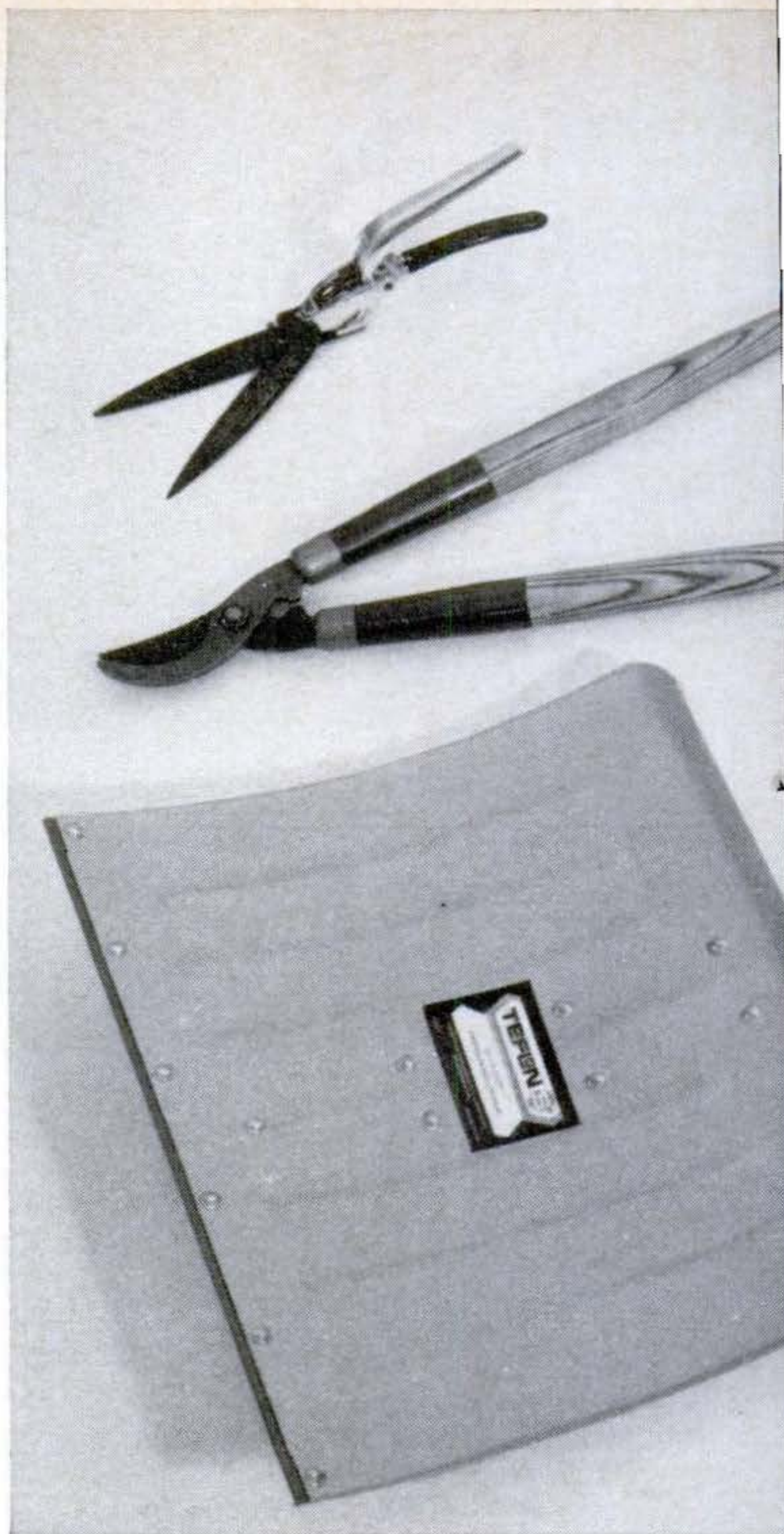
Du Pont's TEFLON-S

This new heavy-duty coating is sparking a revolutionary new line of hardware that takes the fatigue out of do-it-yourself chores for men



the way its chemical cousin, Teflon, took the drudgery out of pot-and-pan cleanups for women. The new Teflon-S seal (above), which can be found on tools from snow shovels to saber-saw blades, is your assurance of unprecedented ease of operation.

EUGENE S. DUFFIELD **ERNEST V. HEYN**
President Editor-in-Chief



Du Pont's

... takes on a

By **HERBERT SHULDINER**

Now men have a friend at Du Pont, too. For years you've seen how easy they've made life for the woman of the house by developing that nonstick Teflon finish that made washing pots and pans such a cinch. Wouldn't it be great if they could find a way to put it on tools



Slick New TEFLON-S

variety of man-size jobs in the tool world

to make your workshop and garden chores easier? Well, you needn't be envious any more. Du Pont has perfected a Teflon coating with muscles—Teflon-S—designed for man-size jobs [PS Apr., Aug. '67].

Indications from the performance of the first Teflon-S-coated tools (like those shown above) are that they are going to revolutionize hardware as they did kitch-

enware. All kinds of handsaws, power-saw blades, paint tools, garden shears, pruners, and even snow shovels work faster and easier when coated with this miracle substance.

Almost any tool with a sliding surface is easier to use when it is slicked over with Teflon-S. That's because it has an exceptionally low coefficient of friction—

Continued

a self-lubricating quality that allows tools to slide more easily on the surface or cut through materials. In addition, things seem not to cling to the coatings. Stephen E. Leighton, Du Pont's sales manager for Teflon finishes says a coated snow shovel will release snow and ice as cleanly as scrambled eggs come off a coated frying pan. That's where the similarity between Teflon and Teflon-S ends, though.

The new tough stuff. Teflon nonstick finishes for cookware first hit the market in 1961 and more than 160 million pots and pans have been coated since then. But kitchenware-type Teflon was not capable of the heavy-duty punishment tools must take. Now Du Pont chemists have produced a new durable finish that has toughness as well. It is a wholly new and different stratified nonstick coating, more suitable for workshop than kitchen.

Teflon-S gets its toughness partly from new ingredients and partly from a layering effect after curing. Even though it's applied in one coat, either by conventional air or electrostatic spraying, it has a microscopically stratified structure when it hardens. In addition, the surface of the tool is first etched so that the Teflon-S completely fills in the tiny crevices in the surfaces of the metal. When the top layer is scratched, Teflon-S has a self-renewing ability. The microscopic valleys have enough of the coating left to retain all the advantages of the finish. Nicks do not affect the performance of the tool.

Red Devil use-tested its new line of Teflon-S-coated putty knives, paint scrapers, and taping knives by giving the tools to professional contractors. After two months of professional use—the equivalent of almost a lifetime of use by a do-it-yourselfer—many of the tools apparently had no visible Teflon-S left. However, according to Otto Sticht, Red Devil's merchandising manager, the microscopic amounts in the etched crevices were enough to give the tools the same drag-free operation and easy clean-up characteristics they had when they were new. What's more, the treated tools require no break-in period. This unique property makes any man with a putty knife an expert glazier.

[Continued on page 164]

How TEFLON-S Improves Power-Saw Blades

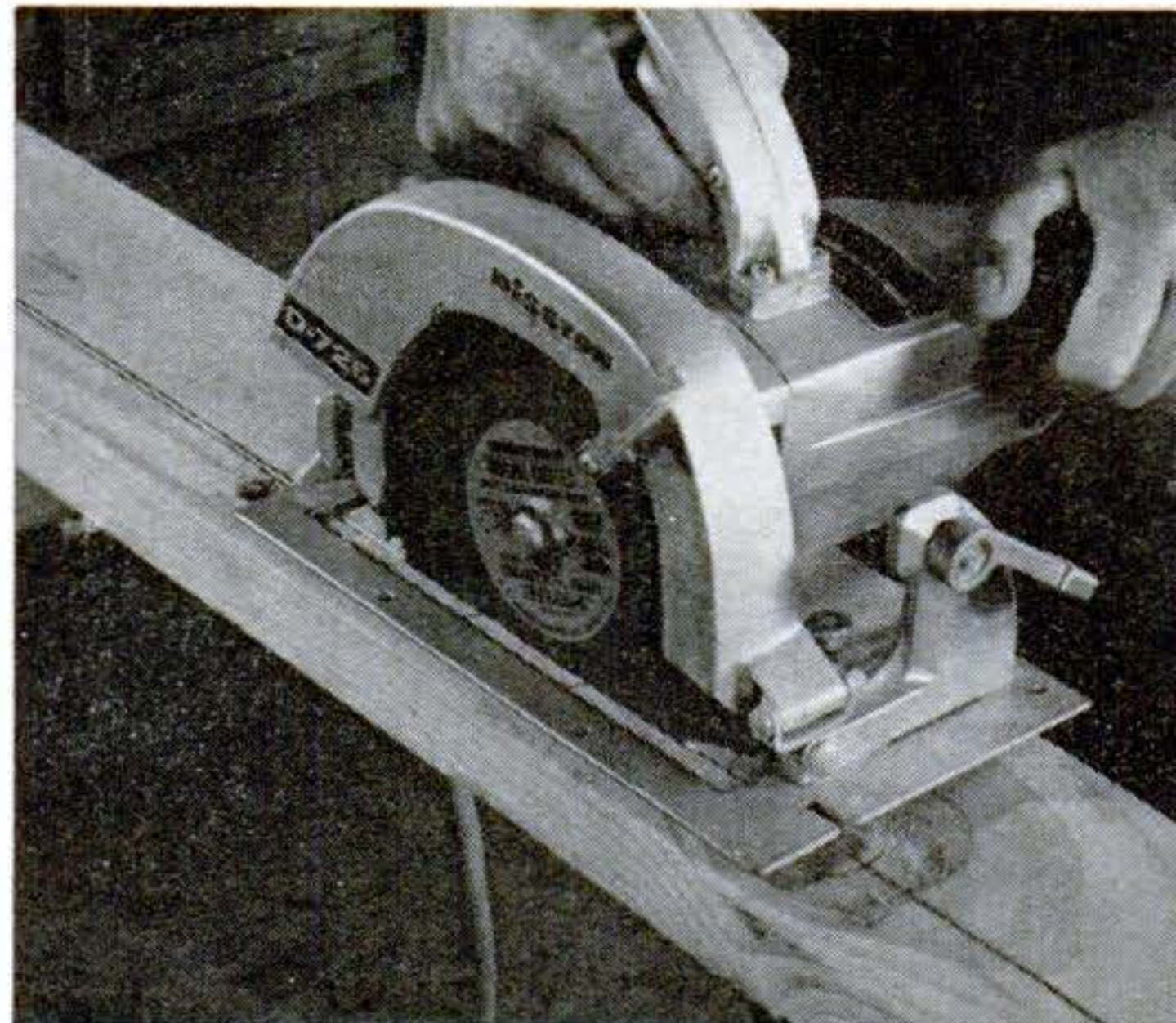
You can clean them in warm water and detergent, then forget about rust—but that's just one advantage

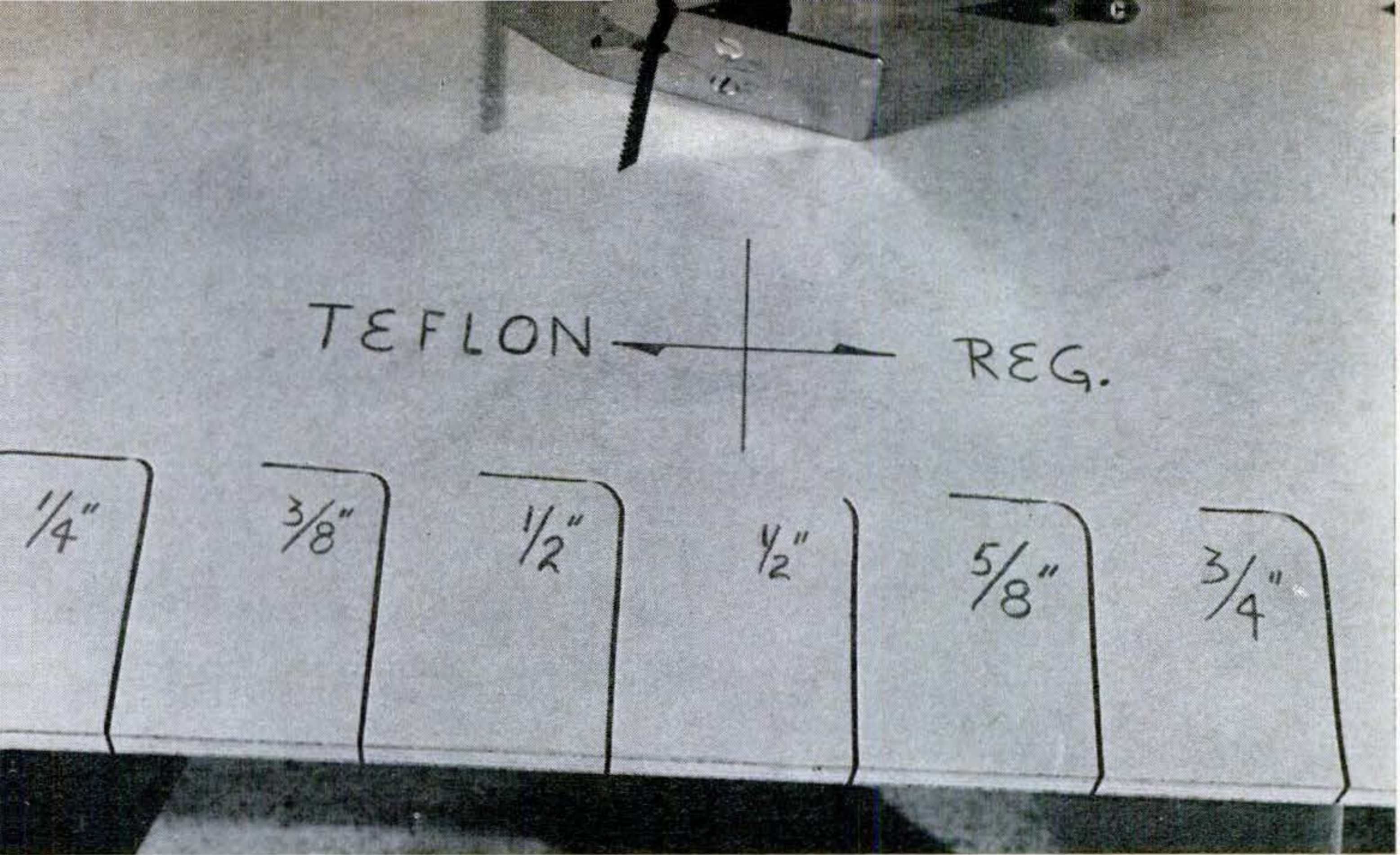
By R. J. DE CRISTOFORO

What advantages can you expect from power-saw blades coated with Teflon-S? To find out, I tested Disston circular-saw and saber-saw blades coated with the new material.

The slippery coating makes it easier to get around tight corners with saber-saw blades. Using blades that were identical except that one was coated and one was not, I first cut turns of $\frac{3}{4}$ " radius.

Less sharpening is needed. In a Disston test, a $7\frac{1}{4}$ " blade cut 20,000 linear feet of two-by-fours before sharpening was needed. Same blade with Teflon-S gave good performance to almost 30,000'.





Tight turns are easier with saber-saw blades coated with Teflon-S. This is the author's test board. The

uncoated blade quit on the $\frac{1}{2}$ " turn. The Teflon-S blade breezed right along to a neat $\frac{1}{4}$ " turn.

No problem. On the $\frac{1}{2}$ " turn, the uncoated blade got only about halfway around before it began to fight back. The Teflon-S-coated blade made it all the way down to $\frac{1}{4}$ ".

On a circular-saw blade, Teflon-S reduces friction, and the blade turns more freely. This is a step toward the ideal condition, where the motor can reach its free-running design speed under load.

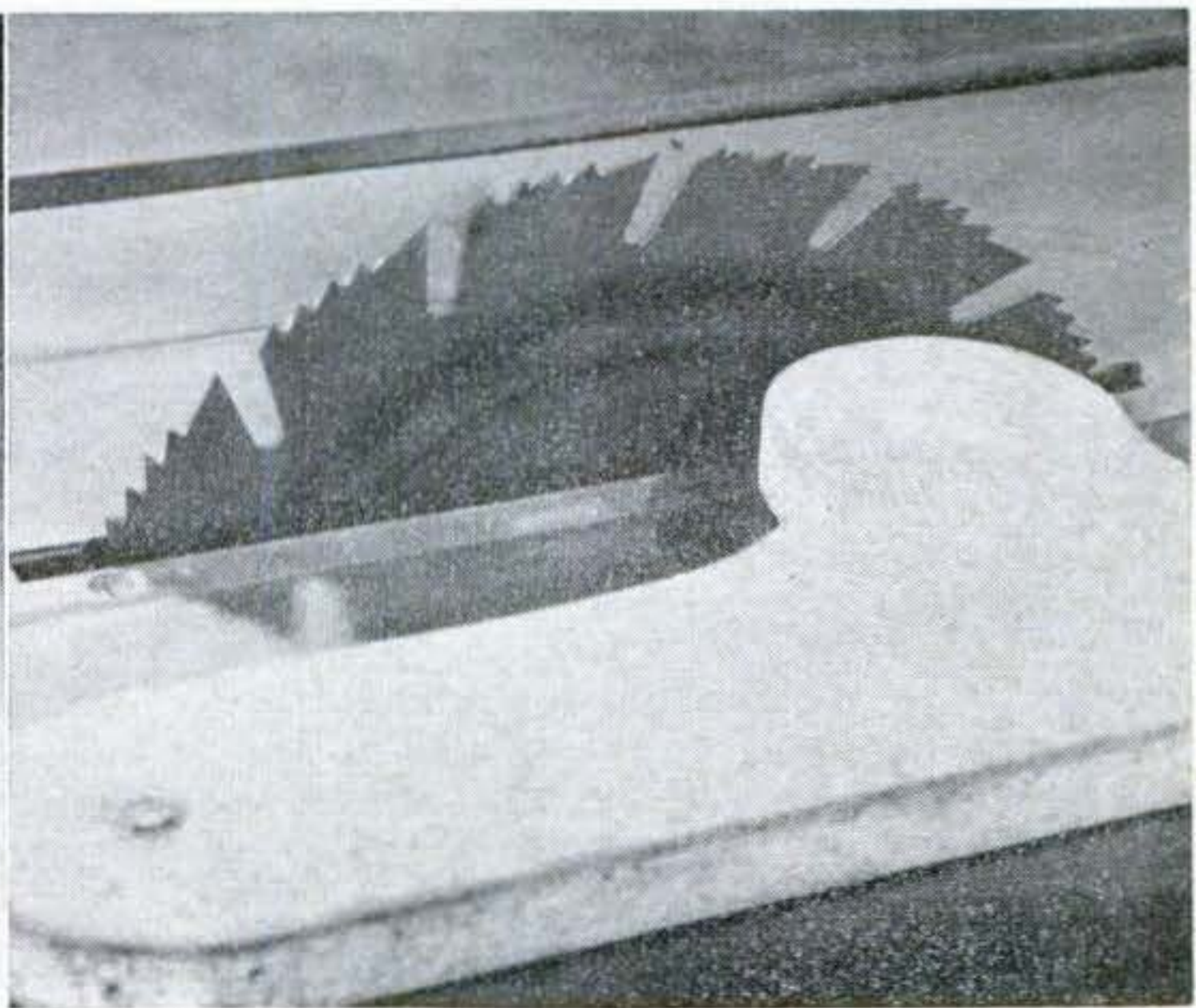
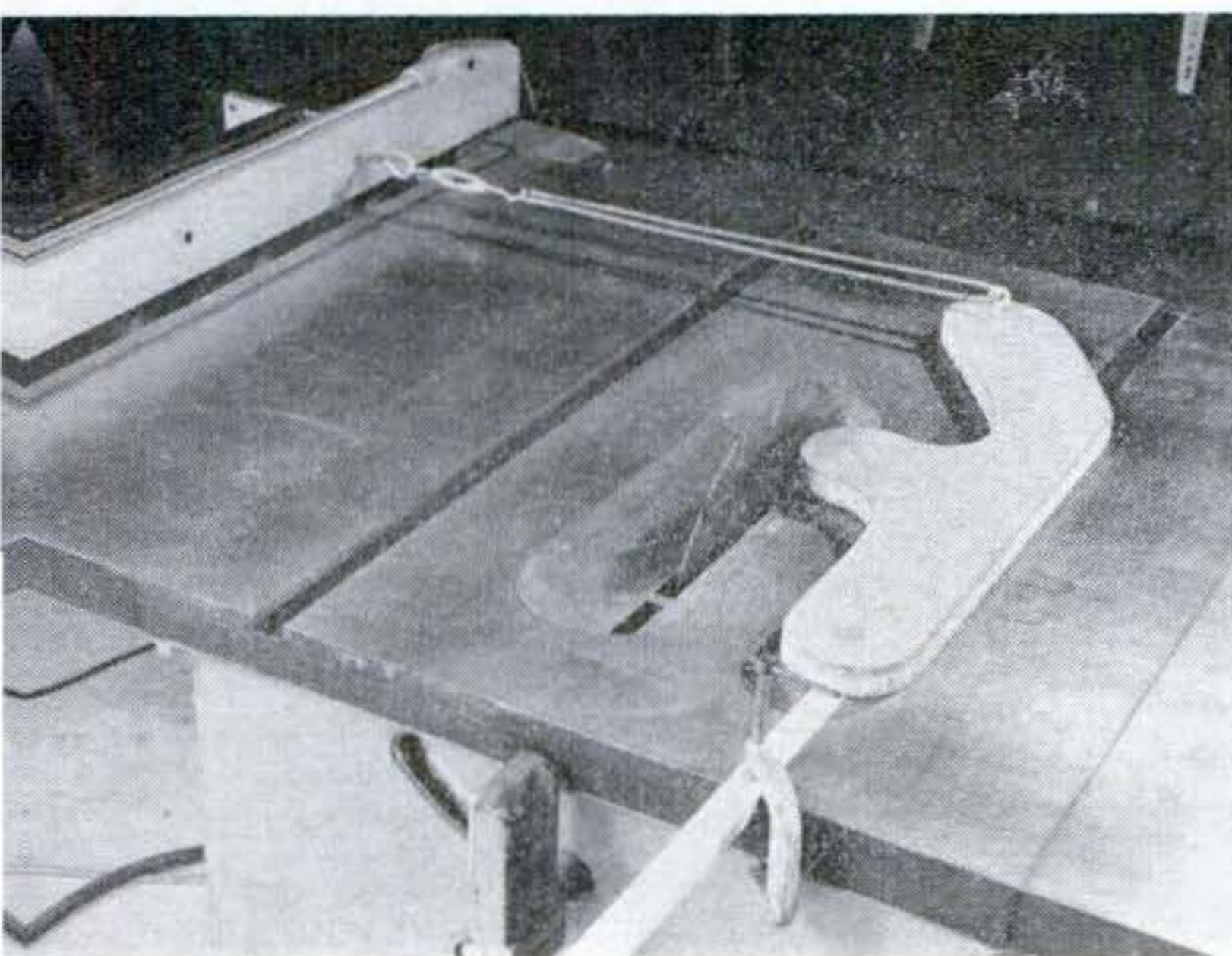
With all other factors being equal, you should get more r.p.m. from a coated blade.

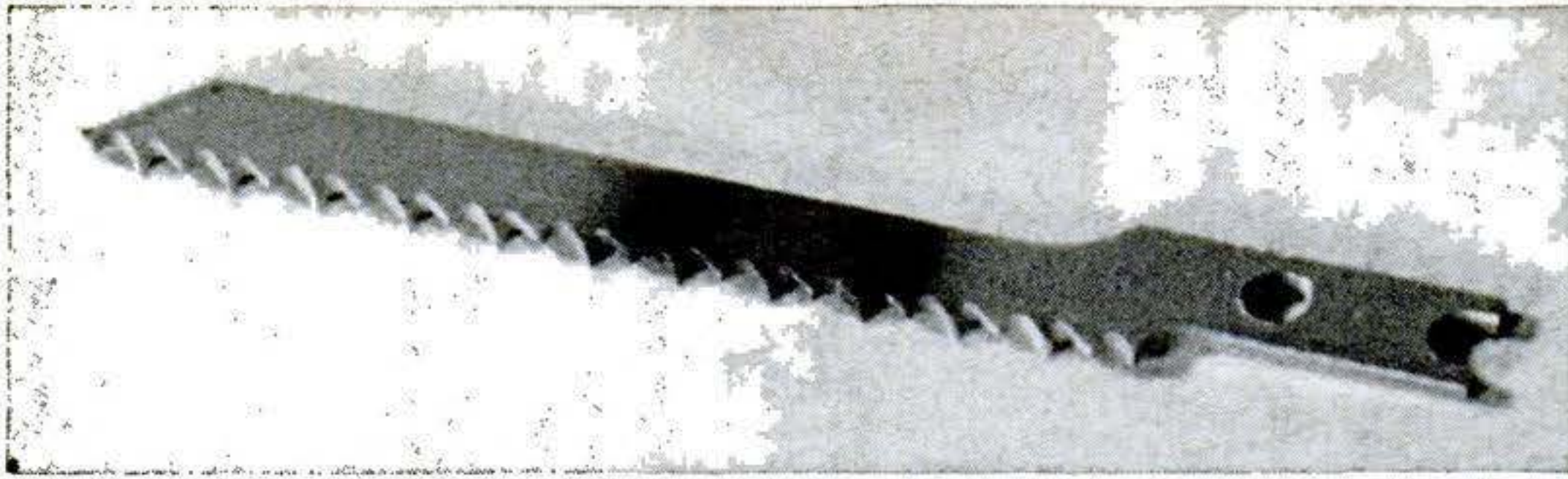
Assuming no increase in rate of speed, this should improve cut quality to some degree since greater r.p.m. let more teeth pass over a given area.

Right now this improvement is so subtle that you may not notice it. But it might lead to general cut-quality im-

Continued

One-hour abuse test was run on the side of the blade. Material used was hard-board-surfaced particle board which was mounted to rub against the blade. Tension was increased every 10 minutes by moving the rip fence. Result was only a burnished side and a wearing down of the test block.





Saber-saw blade without Teflon-S coating was burned as shown here when the author tried to force it through a $\frac{1}{2}$ " turn as shown on preceding page.

provement through blade-design changes.

For instance, we now depend on tooth set to provide clearance in the cut for the body of the blade. If the lubricity of Teflon-S makes it possible to minimize, or perhaps even eliminate, the clearance provided by tooth set, is it too farfetched to think of doing all cutting with something resembling a hollow-ground blade?

Fewer deposits build up on a circular-saw blade. To check this out, I ripped through several hundred feet of resinous pine, using a standard 10" combination Disston blade with an industrial-hard Teflon-S coating.

What the coating picked up was a snap to remove. Buildup on tooth faces and in gullets flicked off with a fingernail.

After cutting through all the pine, I put the blade aside for some hours until

the resin was fully dry. I then soaked the blade in warm water and detergent for a few minutes. All deposits wiped off easily.

What about rust? I took a blade that I'd used for a good amount of cutting in various materials, one that I had also abused in a side-abrasion test, and put it out in the sun to dry after immersing it in water. I repeated this immersing-drying several times and finally left the blade for several days on the lawn, where it was subject to sprinkling, night moisture, and hot sun.

No rust showed up. This means you can maintain a blade in good condition without having to baby it. My personal reaction is that if Teflon-S gave us no other advantage than this, it would be a happy improvement. PS



These tests involved ripping through about 1,100' of 2" construction-grade fir, $\frac{3}{4}$ " hardboard-surfaced particle board, $\frac{3}{4}$ " DF plywood, and redwood. Final

ripping was through some 200' of resinous pine. Above, Junior helps get rid of some of the accumulated sawdust, which is tilled into the soil.

TO REMOVE SECTION, open magazine wide at this page, rest it on table, run your thumb firmly along center fold. Then pull out the sheets gently, one at a time.

Facts About All Kinds of Faucets

By **GEORGE DANIELS**

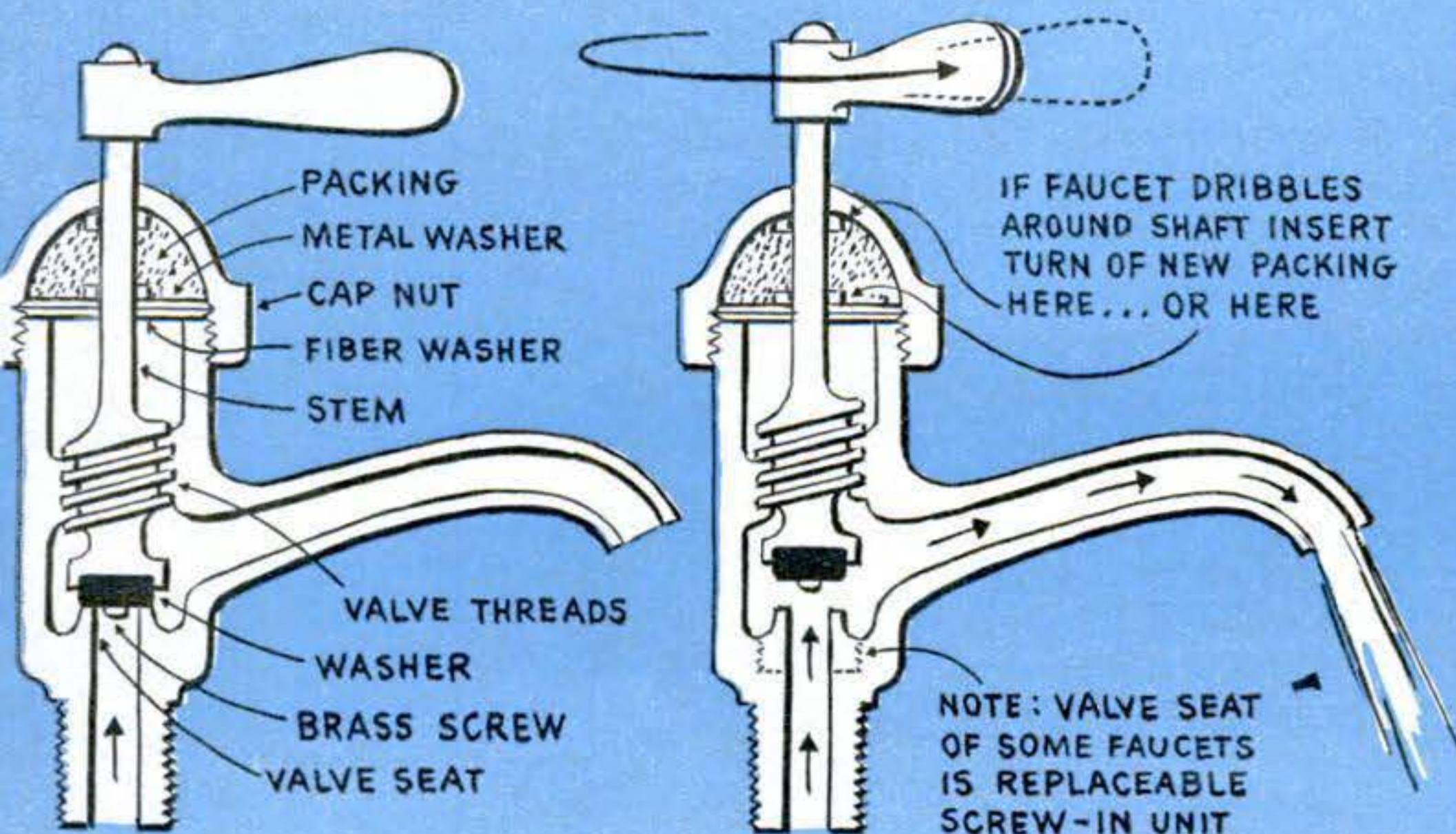
Today's variations of the faucet could fill a book. Spare parts for the many makes and models cover a sizable display rack at many plumbing-supply houses. But the old familiar washer-valve type still leads the field. And it's the easiest to fix.

If it drips, you start repairs by buying a package of assorted faucet washers. With these at hand, you shut off the water, under the fixture or at the main valve. You then wrap tape or cloth around the hexagonal nut on the faucet body to prevent scratches while you're removing the cap with an adjustable wrench. If the cap sticks, squirt penetrating oil into the threads. Unscrew the cap completely and turn the faucet handle in the "on" direction until the valve-shaft threads are unscrewed and you can lift the stem out.

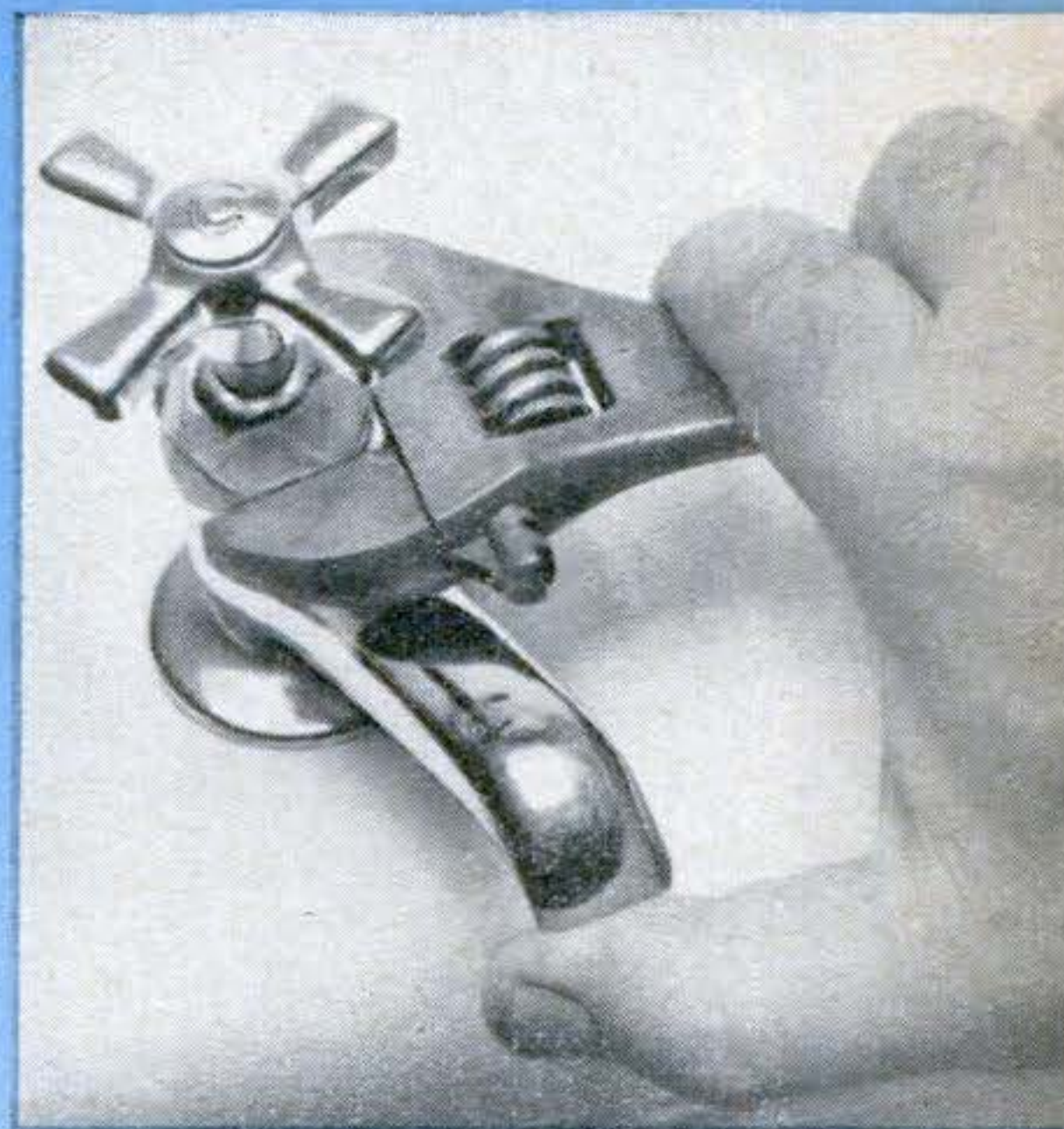
Remove the brass screw that holds the washer in place. If it's frozen or the screwdriver slot is chewed away, use

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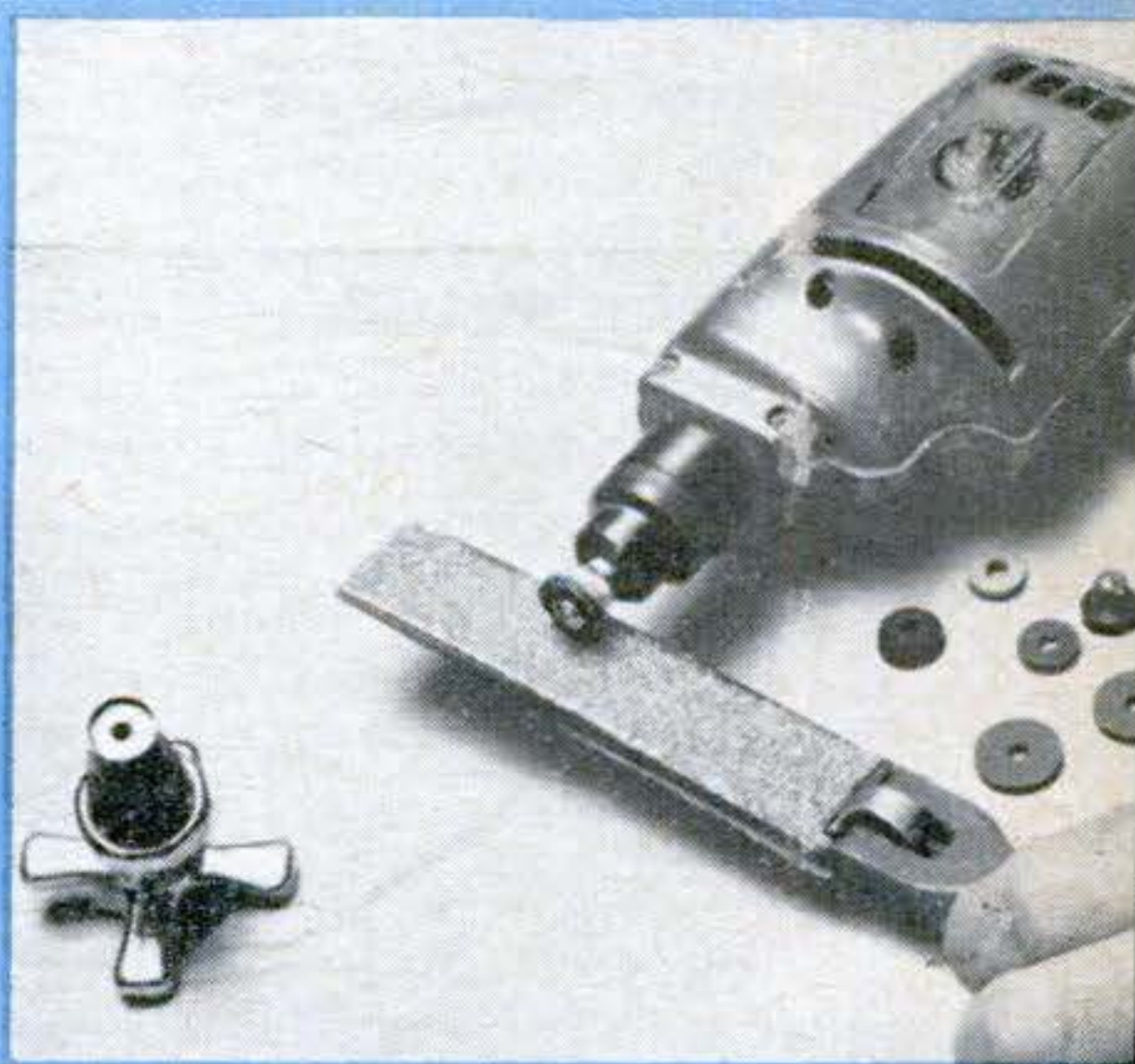
How to repair faucets of the common washer type



Familiar washer-valve faucet shuts off water by forcing a fiber or rubber washer down on the valve seat. Water flows when handle is turned, lifting washer off seat. Many kinds of handles are used.



Pull the wrench against the faucet spout like this and you won't turn the faucet around in the fixture, possibly loosening connections under it. Use a smooth-jaw wrench to avoid damage to hexagonal nut.



New washer must fit valve-shaft recess exactly. If you don't find exact match in your washer assortment, you can sand down an over-size washer with an electric drill and medium-grit abrasive as shown.

cam-lock pliers to loosen its head. Pry out the washer with the tip of a penknife blade, being careful to avoid bending the brass rim of the recess. Select a new washer of the same size. It's best to install it with a new screw.

Twist the stem into the faucet, and tighten the bonnet nut until the packing compresses on the stem, causing the stem to drag slightly when it's turned. Try the faucet several times.

The valve seat. Faucet reamers are little hand tools that smooth the faucet's valve seat by shaving off a little surface metal. Use one if the valve seat is distinctly rough or pitted, but use it sparingly. If the seat is merely dull, smooth it to a polish with wet-or-dry auto-body abrasive cloth (about 400 grit). You can work it with your fingertip in some faucets. Pull a strip taut over the end of a dowel if your finger won't fit. A few back-and-forth turns on the valve seat usually do the trick. A smooth valve seat minimizes washer wear.

Dribbles around the faucet shaft when the faucet is turned on are caused by packing failure. With the faucet dismantled, remove the handle from the stem, slide the cap nut off, and pull the packing down out of the cap. Push in a new gum-drop-shaped packing washer of the proper size—or apply one turn of graphited faucet packing (looks like silvery black spaghetti) around the shaft above the old packing, and push the whole business back into the cap. If the old packing won't come free, apply the turn of new packing under it, but above the metal packing washer. This usually works out almost as well.

Skewed faucet handles. If you have single-handle twin faucets (usual on sinks) that don't point in symmetry when turned off, the trouble is easy to correct. (It often occurs after just one of the faucets gets a new washer.) If the handle is held on by an exposed screw, remove the screw and tap the handle upward off the splined shaft. Replace it pointing in the right direction, and tighten the screw. You need not turn the water off for this job.

If there's an H or C escutcheon (for hot or cold) atop the handle instead of a screw, it usually will unscrew or pry off. If it does neither, look at the hub

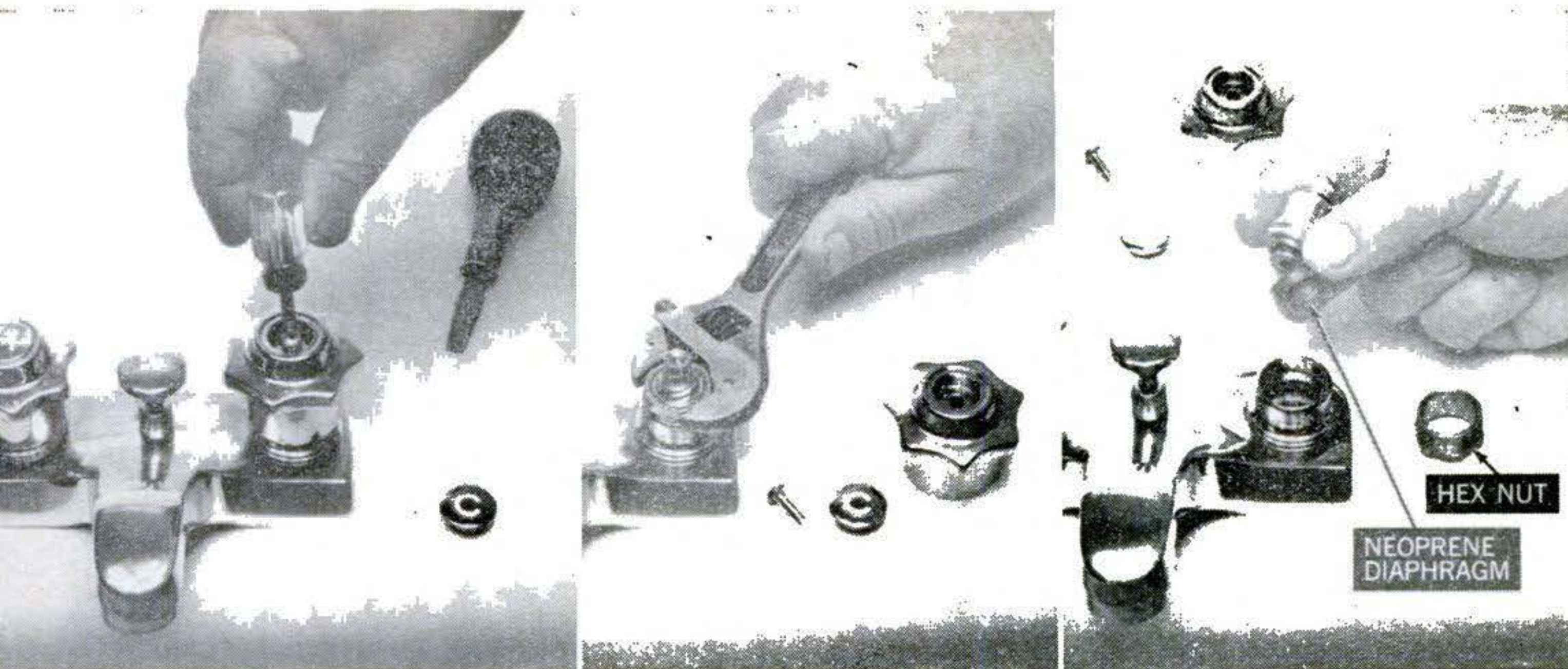
under the handle. Some handles are held on by concealed setscrews that call for an Allen wrench. If you're faced with a puzzler, don't use force. Look carefully and you'll find the answer. (Some plumbing designers apparently like to baffle you.)

The diaphragm valve. This is one of several types of washerless faucets now in use. An example is American Standard's Aquaseal. In this a neoprene diaphragm is raised and lowered by a threaded shaft. The end of the shaft is pivoted so that the diaphragm is subject to compression only—not to the rotating friction and wear of the washer. Consequently, it lasts many times longer. Another advantage is that the diaphragm seals off the threaded shaft from the faucet's water chambers. This permits lubrication of the threads for easy action, and eliminates the need for water-stop packing around the shaft. No shaft dribbles are possible if the diaphragm is intact.

To replace the diaphragm, remove the faucet handle by snapping off the escutcheon cap and removing the handle-holding screw beneath it. Then lift the handle off. This exposes the hex-top bushing that holds the diaphragm assembly in place. When the bushing is unscrewed, the cylindrical diaphragm assembly can be pulled up and out, complete with the neoprene diaphragm. In replacing the diaphragm, try not to wipe away the lubricant packed around the pivot. If any dribbling showed around the shaft before

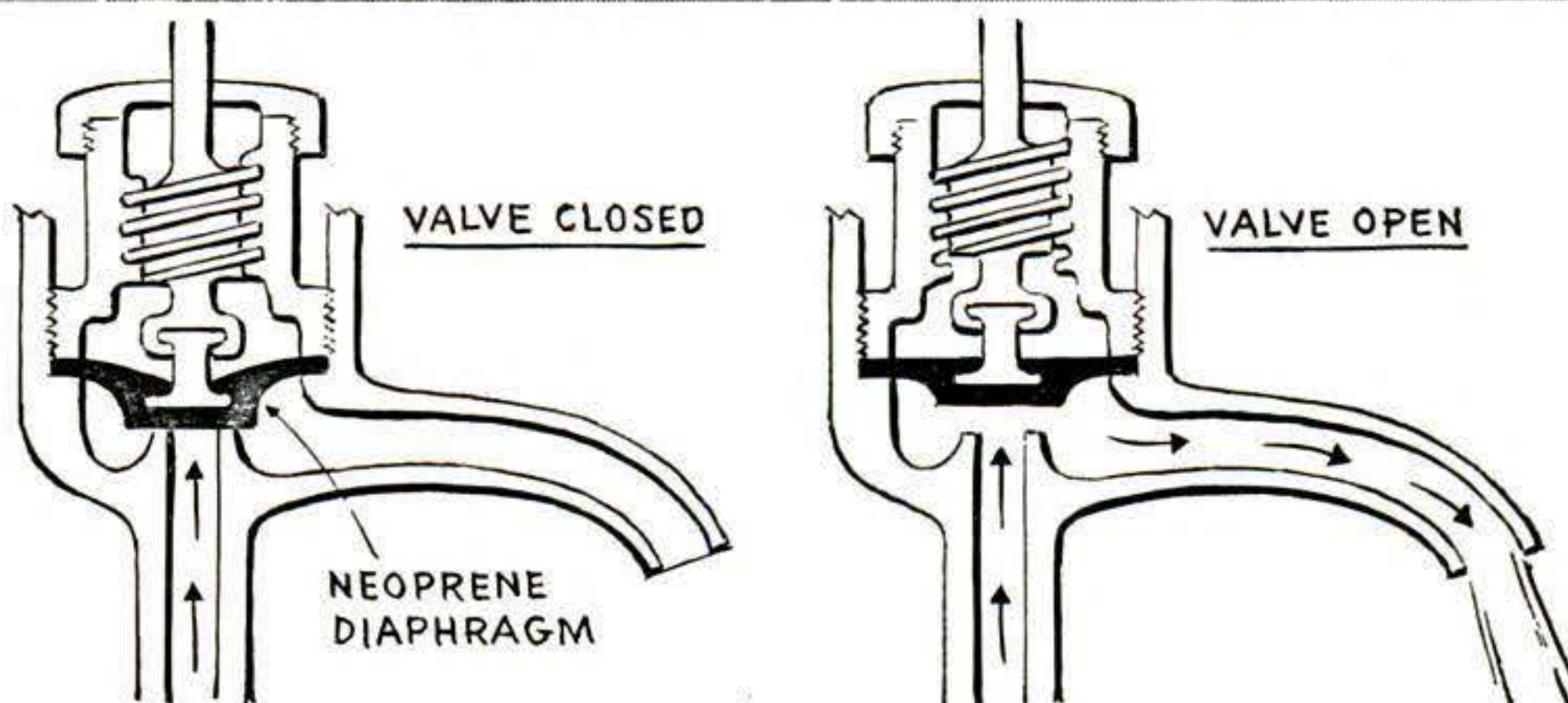


Problem of nonstandard faucet spacing found on some old fixtures or new marble or glass counter tops is solved by using new Price-Pfister flexible-pipe setup. By bending pipe, you can locate the faucets anywhere within a range of 8" to 15" on centers.



Repairing faucets of the diaphragm type

Removing screw that holds handle is first step in repairing many faucets, including this American Standard diaphragm type. Screw is often found under snap-on or screw-on escutcheon carrying H or C label. With handle removed, unscrew hex nut and pull out assembly. Then replace the diaphragm.



the repair, it will be cured by the diaphragm replacement.

Single-lever and push-pull faucets. These are shut off by spring pressure plus water pressure. Unlike the usual washer-valve faucet, the Hyseal type actually closes more tightly as the pressure increases. Since pipe sediment or rust could interfere with valve closure, removable strainers are built into the faucets on the supply-line side of the valve. Cleaning these strainers is the only servicing work you're likely to do on these faucets for quite a few years. You can tell when cleaning is necessary, as the clogged strainers slow the flow from the faucet.

The trick is in gaining access to the strainers. If the faucet is in a new house, and if the builder hasn't supplied you with a faucet-repair instruction sheet, you may have to play the job by ear. Before you try it, however, look for a trademark on the faucet and check your phone book's Yellow Pages for a dealer who handles the make. He can either give you an instruction sheet (usually with a pull-apart drawing showing part locations and

names) or tell you how to get one direct from the manufacturer.

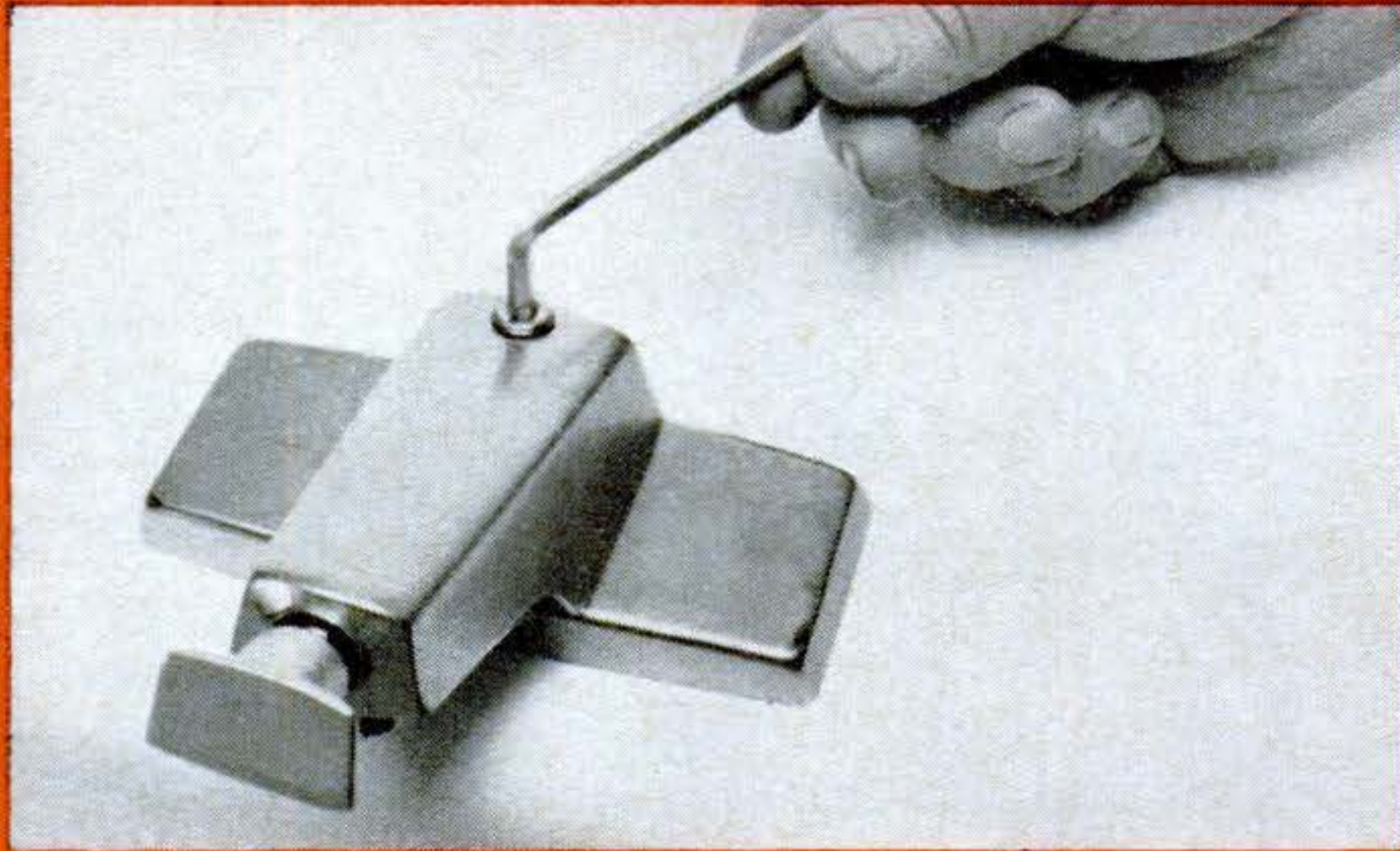
Metal-to-metal faucet valves. Like the valves in the gold-plated Sears faucets shown in the photos, these are made of special abrasion- and corrosion-resistant alloys. They permit no-drip guarantees up to 10 years. The entire valve assembly is sealed in the faucet body with an O ring so no water can reach the upper portion of the faucet (above the valve assembly) and no packing is required.

In the faucet shown, there is no hex portion to the cap nut since it need be turned on the threads only finger-tight. If it sticks when removal is necessary (maybe after 10 years), a rubber friction-grip disk (sold in housewares departments for unscrewing jar tops) makes a good removal tool. The same disk is handy on many other modern faucets that lock major parts with serrated or knurled nuts rather than hex nuts.

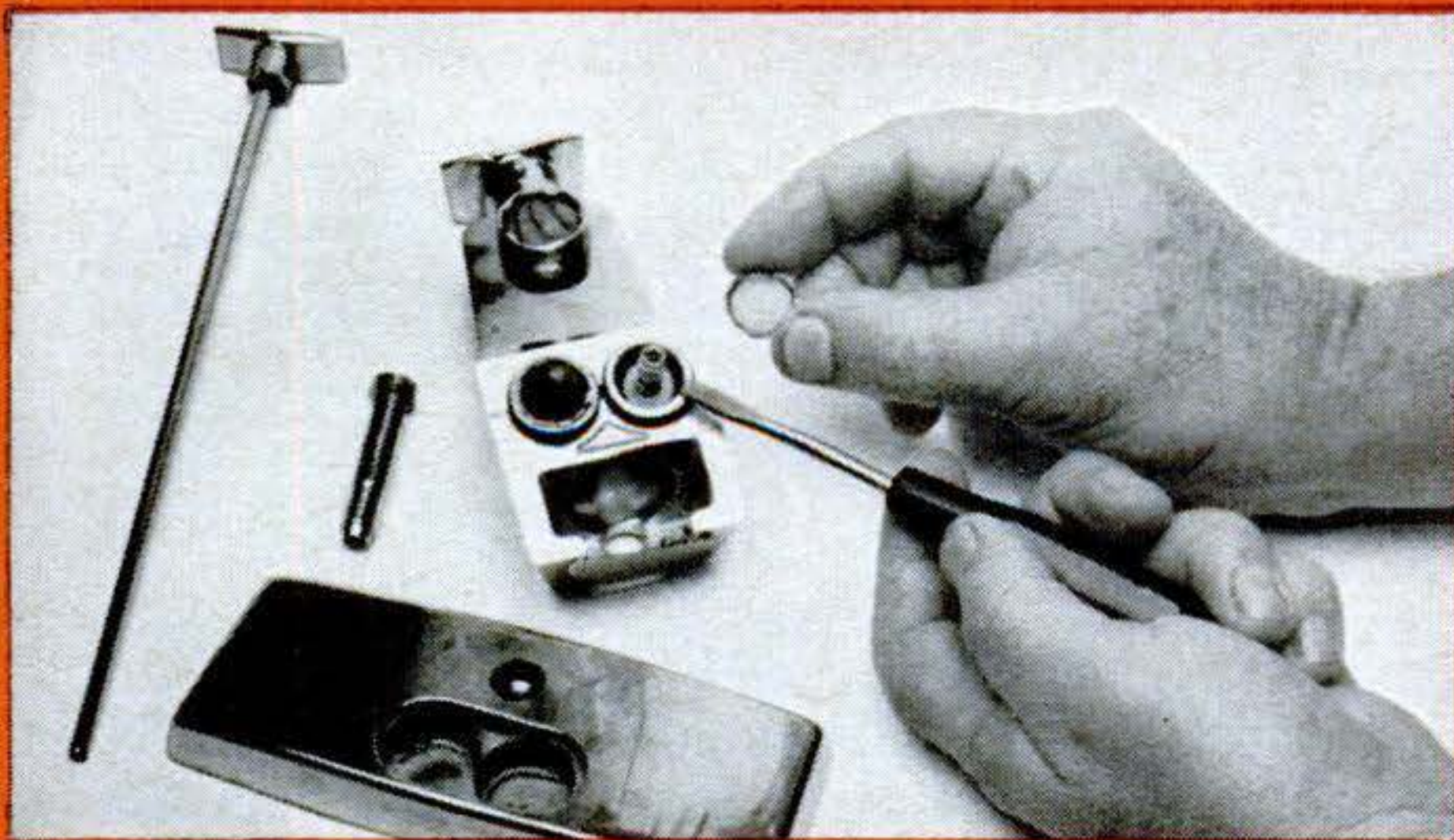
Once the cap is removed, a serrated-rim nut below it is removed to free the valve assembly. You have to pull the unit out

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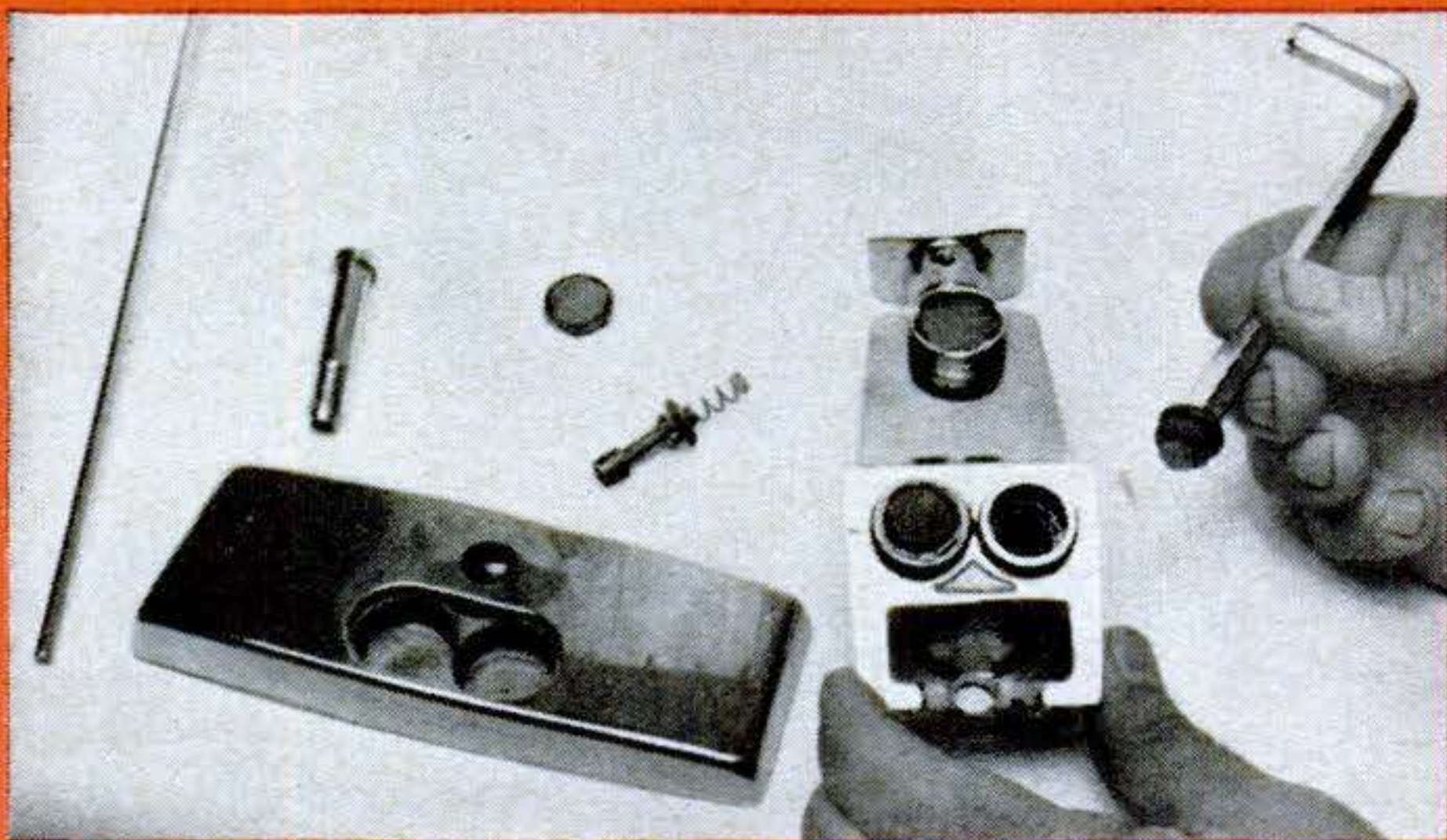
How to dismantle and clean push-pull single-lever faucets



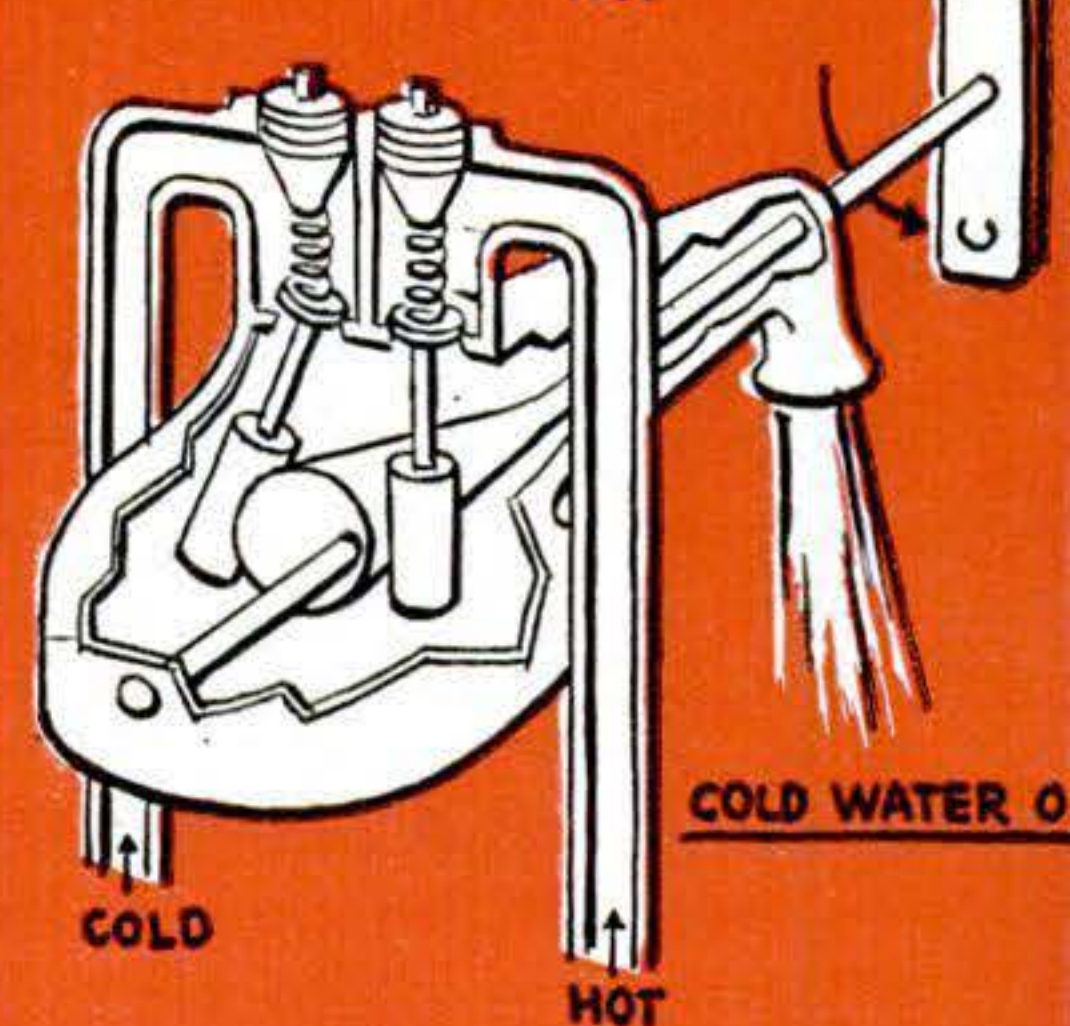
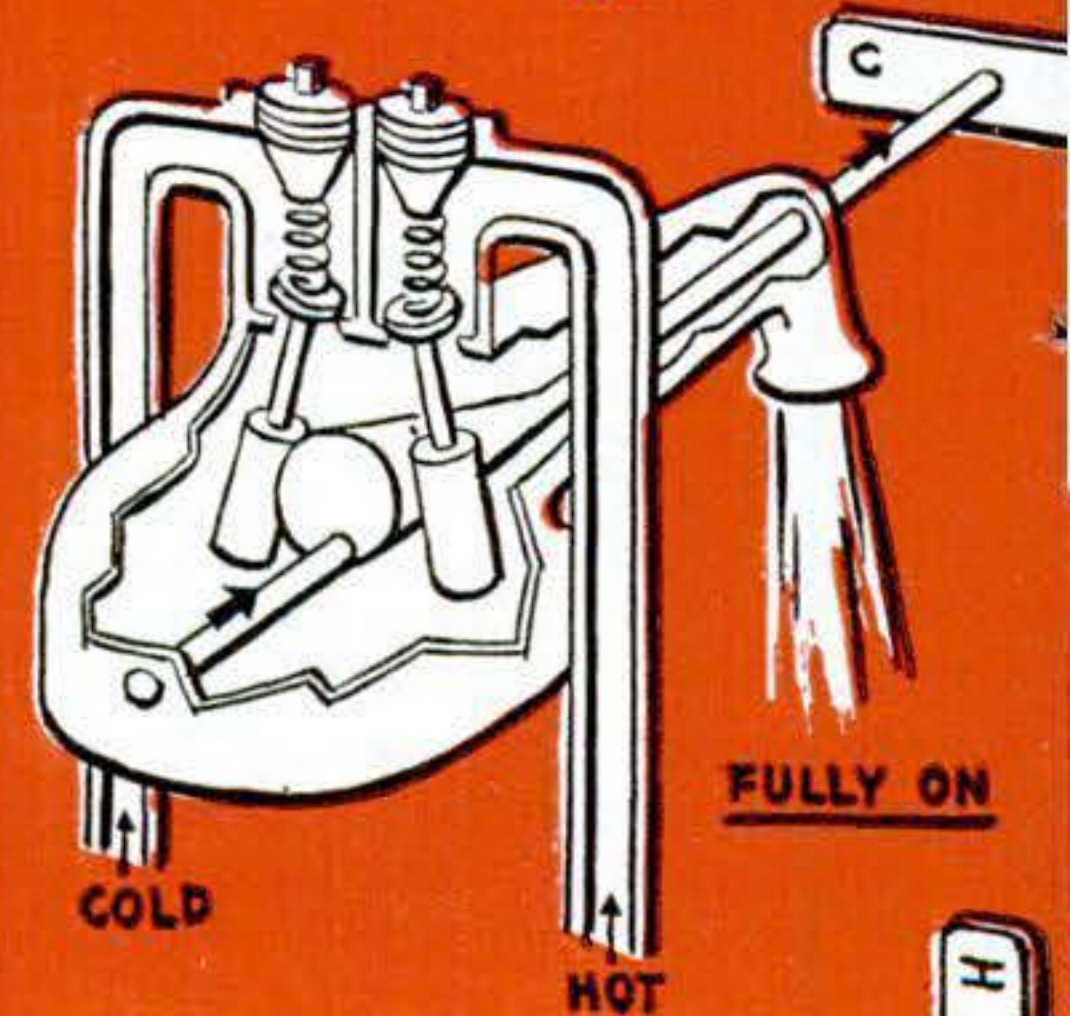
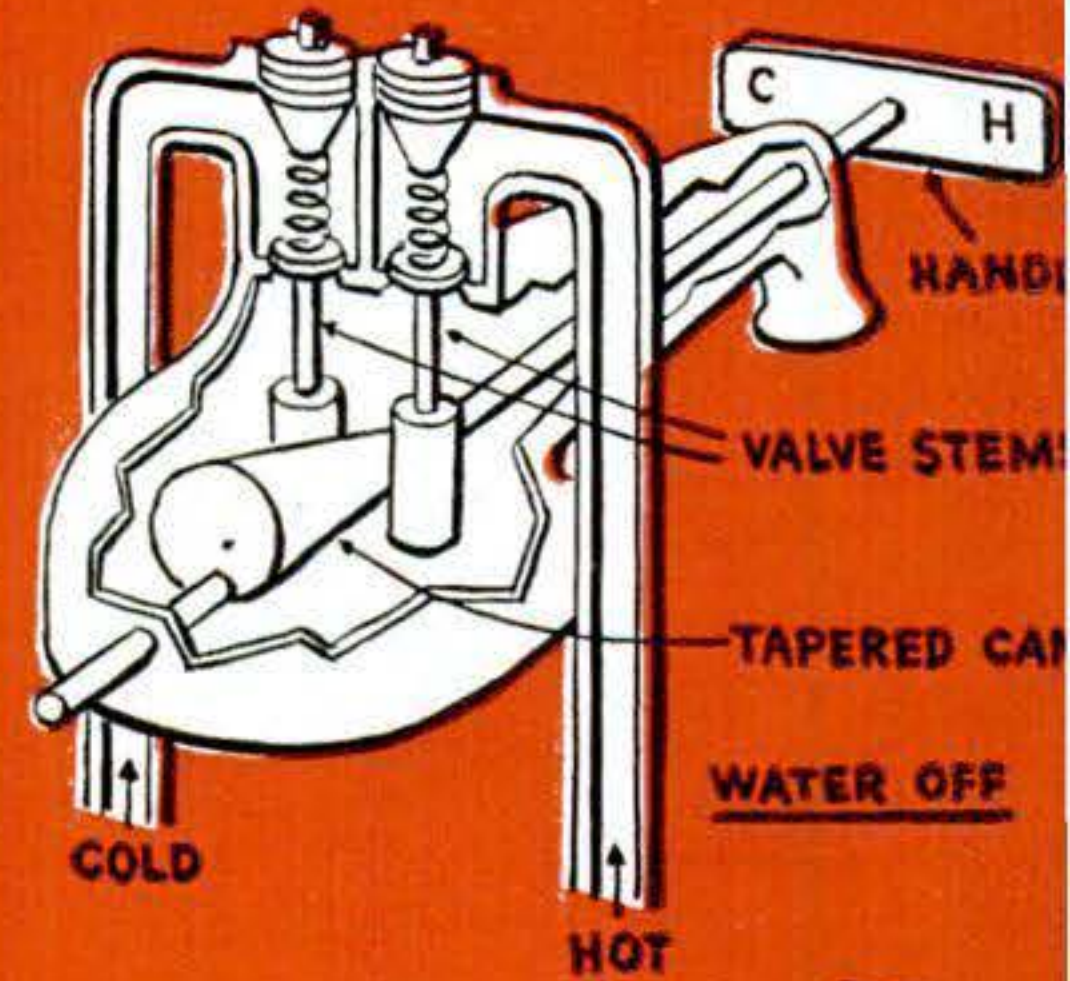
To clean the strainers of a push-pull Hyseal lavatory faucet, you should first remove the part shown here with an Allen wrench. Then tap the spout upward and off the base with a block of wood.



Turned upside down, the spout reveals the strainers in the valve openings. Pry the strainers off for cleaning, holding a finger on each of them to keep the spring from popping it across the room.



If the faucet drips when it has been shut off, check the valve seats after removing the spring-stem assemblies. Unscrew the seat with an Allen wrench if you find it needs replacement.



How push-pull faucet works is shown in the drawings above. A tapered cam between two cam followers does the trick. When the narrow end of the cam is between the followers, no water flows. When you pull out the handle, both hot- and cold-water valves are tilted open. When you twist the handle, you can mix hot and cold water as desired. Turn the handle 90 degrees and you get either hot or cold. The same principle is found in the American-Standard swing-arm shown in photos on facing page.

with a firm grip, as the O ring holds it snugly in the faucet body. Replace the unit by pushing it down with enough pressure to force the O rings into place. Then screw on the retaining cap and tighten it down.

A loose faucet in the fixture. This is more likely with single than double faucets. Check the jam nut on the threaded faucet shank under the fixture top. Tightening with an adjustable wrench may cure the trouble. If a rubber or spring-type metal washer between the nut and the underside of the fixture has broken apart, however, you'll need a replacement.

Disconnecting an old supply pipe often calls for additional replacement of parts, rubber washers, etc. To avoid such extra work, remove the pieces of the old washer above the jam nut, and turn the jam nut farther down on the threaded faucet shank. Then wipe clean the undersurface of the fixture around the shank. Follow up by sticking on two layers of rubber electrician's tape to form a substitute washer around the shank. A washer, cut from copper or aluminum flashing and slit through the rim, goes on below the rubber tape. Then the jam nut can be tightened back in place without chewing into the rubber tape. This holds the faucet firmly in the fixture.

Leaky connections. If this happens at either end of the faucet supply pipe (directly under the faucet or at the stop valve below the fixture) you can often cure the trouble merely by tightening the hex nut at the trouble point. If this doesn't do the trick, the chances are a rubber slip-

joint washer has reached the crumbling stage. To fix it, shut off the water at the stop valve (or main valve if there's no stop valve) and unscrew the hex nuts at both ends of the supply pipe to remove it. Replace washer, reconnect the ends.

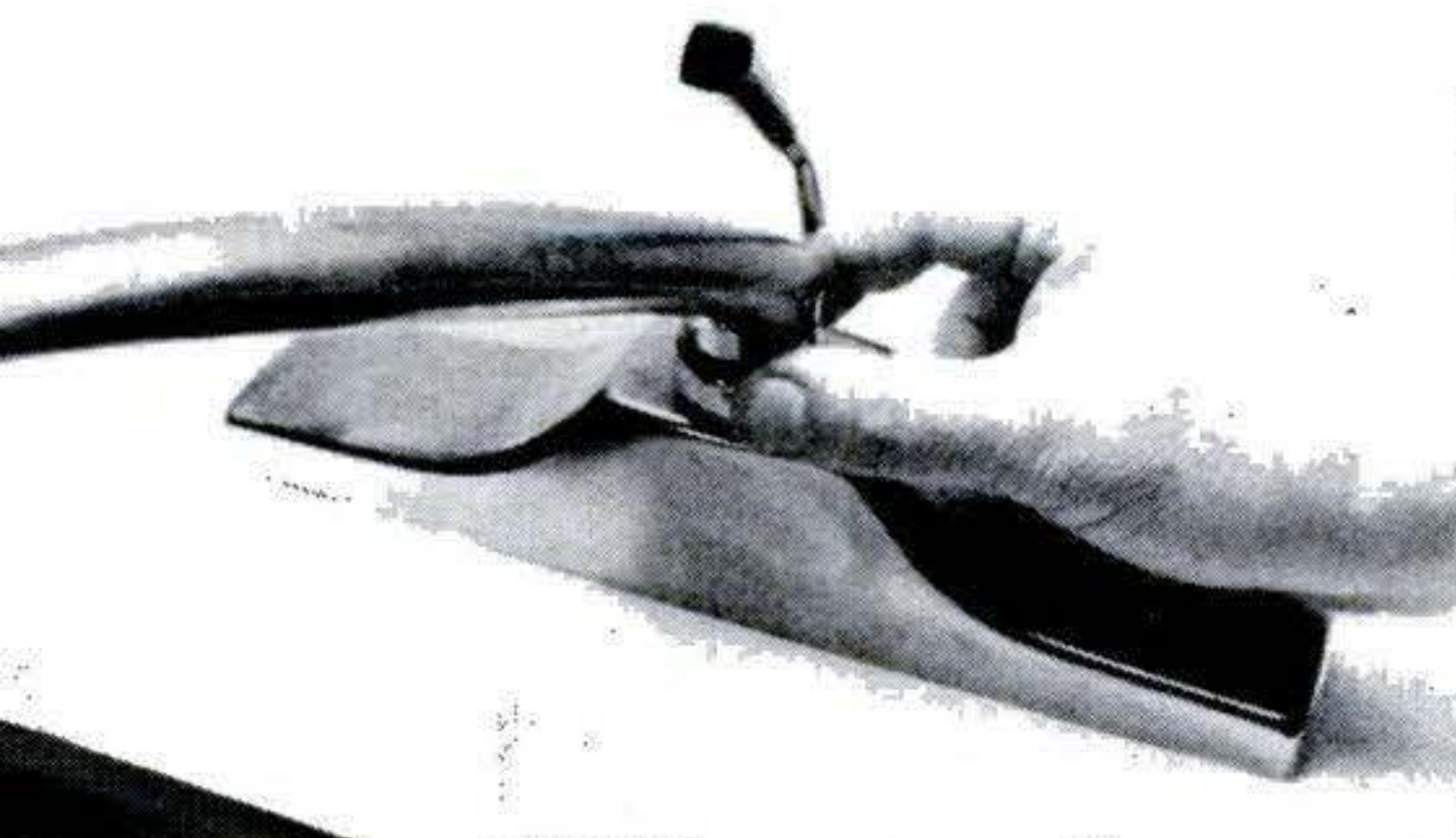
To make the job permanently trouble-free, however, you'll be wise to replace the complete supply pipe with one that has positive metal connections at both ends. This type, in its commonest form, has an integral metal flange at the faucet end and a "compression fitting" at the other. Simply cut the supply line (usually chromed soft copper) to the required length, slip the compression ring onto the cut end (after sliding the compression nut on ahead of it), and connect the new line. Adapter fittings are available for connecting to pipe threads. The compression fitting won't "blow out" as rubber slip-joint washers sometimes do.

When you can't match pipe spacing of an old faucet set, use a flexible-pipe faucet assembly like the Price-Pfister unit shown in the photos. This provides a range of 8" to 15" between centers of faucet shanks, with the spout and stopper handle centered. The flexible connecting pipes are bent to fit the hole spacing. The faucets are pushed up through the holes from beneath and tightened in place with trim nuts from above. The drain fitting and faucet spout are mounted from the top and tightened in the connecting unit under the fixture.

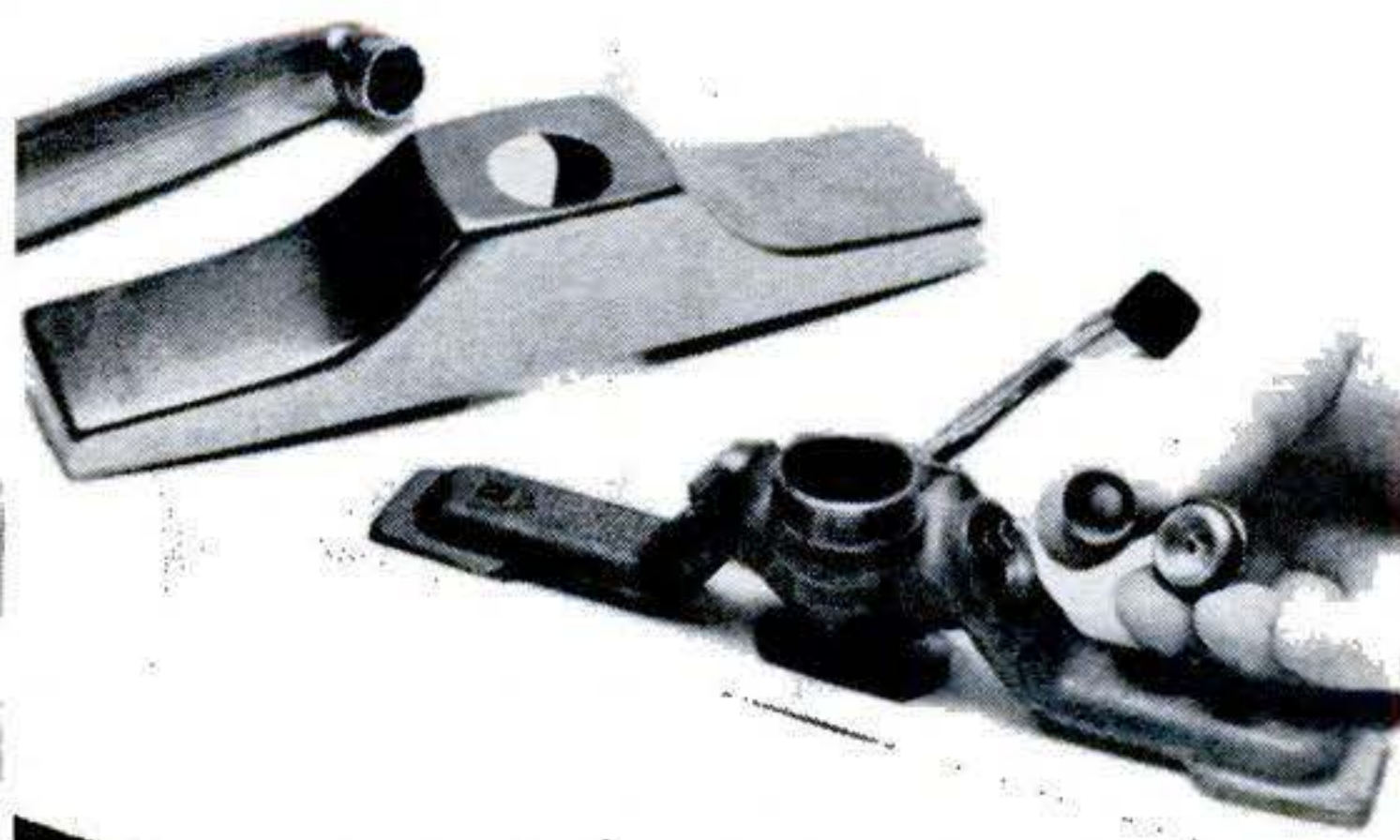
When replacing broken handles, take one of the old handles with you to the hardware store. To be sure your replace-

Continued

How to dismantle a swing-arm single-lever type of faucet



Serrated-rim nut on spout is secret of taking apart this American-Standard unit. If your fingers won't turn it, tape it and use pump pliers with care.



Loosen valve covers with adjustable wrench, but use fingers for final turns. After cleaning strainers, turn in caps just enough to prevent any dripping.

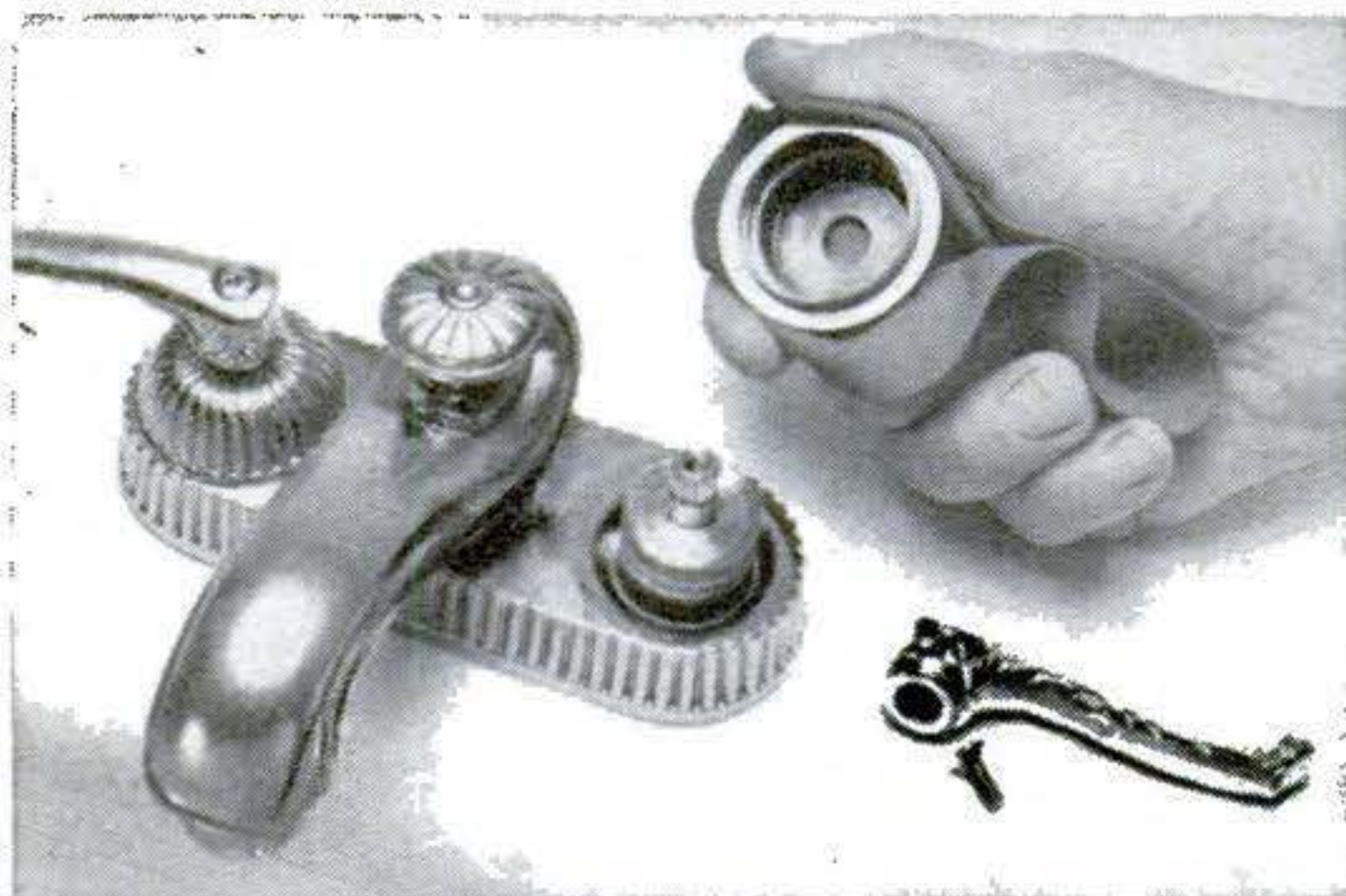
ment handles will fit, try both old and new ones on a faucet shaft.

About spray hoses. With faucets turned on to the desired hot-cold mix, water should flow from the spray hose only when you press the valve lever on the spray

How to work on metal-to-metal faucet valves



You must remove handle to service Sears gold-plated metal-to-metal valves. This enables you to turn the cap off the top of the valve shaft. Same procedure applies to many old faucets with china bases.



No wrench, please! Piece of cloth or sheet rubber will improve your grip on the ornamental cap if you can't turn it with your bare hand. Then remove the knurled cap that holds in the valve assembly.

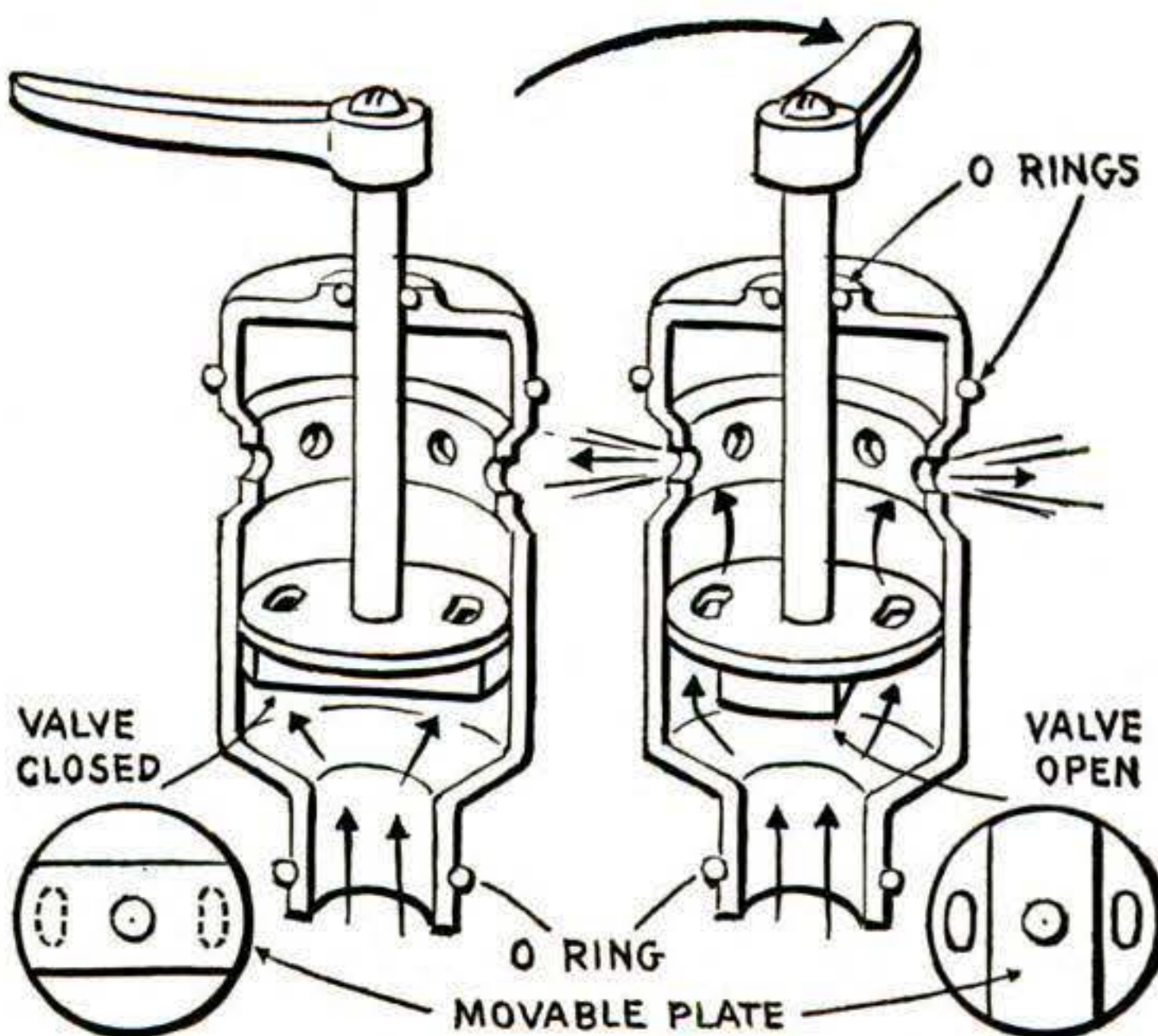


Return handle to the shaft if necessary to pull out the valve assembly. Sealing O rings require substantial pull. In this type you replace the entire valve assembly if it ever begins to give you trouble.

head of the hose. A slight continuing flow from the faucets is normal in some types. The automatic switchover is accomplished by a diverter valve inside the faucet at the base of the spout.

If faucet flow is slight, clean the strainer or aerator on the spout. If hose flow is meager, check and clean the same part on the spray head. If this doesn't increase the flow from the hose, look for a kink under the sink. If the hose is old and shabby, the flow may also be blocked by crumbling lining. To remove the hose, shut off faucets and remove the hex-nut connection closest to the hose. Some hose connections have several hex nuts. Take the old hose with you to the plumbing supplier so you can be sure the replacement you buy will match.

If these measures don't correct the trouble (or if there's no fault in the hose) check the diverter valve. You remove the faucet spout to get at it. Lift out, or screw out, the valve parts. As with the hose, take the old valve along when you buy a replacement. (Replacements for many older all-brass valves are now made of plastic or brass-plastic combinations.) If your sink faucet is relatively new, the diverter-valve parts may be completely enclosed in a stainless-steel cylinder. You replace the entire unit. A threaded tube extending from the base of the cylinder screws into the faucet for mounting. And again: Be sure your replacement matches the old assembly. **PS**



How they work: Water is turned on and shut off by rotating a special alloy plate that uncovers and covers two valve holes in a stationary plate. Three or more O rings are used to seal the assembly.



Shop Talk

By ROBERT P. STEVENSON

Ready-made furniture legs are getting better and better

Want to pass yourself off as an even better craftsman than you are? I don't know of a surer way of doing so than by correct use of some of the variety of ready-made furniture legs now available. Just as an example of what's around, I had word that the Stanley-Judd Division of Stanley offers wooden legs in modern, colonial, traditional, and provincial styles in a range of seven sizes from 4" to 28". Two big mail-order houses, Montgomery Ward and Sears, Roebuck, go a step further; they offer fancy tops under which to fasten an amazing variety of legs, wood and metal. When you order legs, Sears will also send you a free 15-page pamphlet crammed with useful ways to use them. The legs are most often used for tables, but they're also adaptable to chests and cabinets. You can get pedestals, too, in several forms. You might prefer one of these—under the center of an oval, circular, or square table top. It's the fast and easy way to make a handsome table at a surprisingly low cost.

You can now buy our "Wordless Workshop" in book form

Solve a household problem by building a project? That happens each month in this magazine's popular "Wordless Workshop." Roy Doty's cartoon characters, Momma, Poppa, and little Moppet, have been solving such problems for nearly 15 years, and it's time some of their adventures were collected in book form. This has now been done. In making the selections, the editor, Harry Walton, added an extra—a list of materials needed for each of the more than 50 projects included. The paper-bound book is issued at \$2.45 by Taplinger Publishing Co., 29 E. 10 St., NYC 10003.

This year, spray on those Christmas-tree decorations

When I received information about a product called Frosty Spray Angel Hair, my first impression was that the package should have been addressed to a magazine catering to ladies. But the stuff turned out to be canned Christmas decoration packaged by Aerosol Specialties, Inc., 1010 Atlantic St., Bridgeport, Conn. 06605. Press a button and spray the silky stuff all over your Christmas tree.

Odds and ends of interesting things from here and there

Mankind's first kite probably soared up in the breezes of China some 2,500 years ago. That bit of history comes from a new book, *Kites, an Historical Survey* by Clive Hart, a university English teacher in Australia. Dr. Alexander Graham Bell, inventor of the telephone, was one of many historical figures who were serious kite fliers in the interests of science. Hart's book is published by Frederick A. Praeger, New York. Price: \$12.50 . . . Like to build a sauna? Write for information to MacLevy Products Corp., 316 Fifth Ave., NYC 10001 . . . You can tailor-make your own set of screwdrivers (both regular and Phillips) and nut drivers with kits available from Vaco Products, 317 E. Ontario St., Chicago 60611. A clutch handle permits snap-in, snap-out blade changing . . . For holes and breaks in concrete walks, drives, or steps, use Tamms Dry Latex Concrete Patch. It comes in five- and 10-pound cartons, is a product of Tamms Industries, 8000 Joliet Rd., Lyons, Ill. 06534.

Snowmobiles Start a

Winter camping is catching fire as thousands of sportsmen

By HERBERT SHULDINER

Camping used to be something to dream about during the winter while you got your gear in shape for the coming season.

Well, you can stop wintertime dreaming now. Improvements in equipment and transportation have put camping in season the year round. Sparked by the remarkable spread of snowmobiling, outdoorsmen are traveling conveniently into areas that used to be closed from first

snowfall until spring thaw. Snowmobiles take you into previously impenetrable forests and wilderness for camping, hunting, and ice fishing.

With the right kind of equipment and supplies you can have as much fun outdoors in winter as you do in summer. And there are some advantages to cold-weather camping, too: no crowds or insects, for instance.

Admittedly there are some added precautions to take in winter camping, but by cooperating with nature, rather than

Winter campers prepare breakfast outside shelter—a Thermos Pop-Tent that sets up in two minutes.



New Camping Craze

Rediscover the exhilarating joys of the frigid outdoors

fighting it, your trip can be safe and comfortable. Here are a few pointers that can help make your snowmobile camping trip easier:

It's wise to travel in pairs. You can ride far enough on a snowmobile in 15 minutes so that you can't walk out.

Carry extra drive belts, spark plugs, a few simple tools like a screwdriver and an adjustable wrench, and enough fuel to get you back. Take along snowshoes or skis to help you walk out if your snowmobile becomes disabled.

Leave word with a park superintendent or forest ranger when you go into the woods. Tell him the route you are taking, your destination, and date of return. If you don't show up on schedule, he'll know where to search for you.

Don't travel light. Many a camping trip has been spoiled by the notion that carrying the least equipment is best. You don't have to be miserable to enjoy camping. So take along enough to ensure your warmth and food needs. A good bet is to tow a toboggan behind your snowmobile for carrying gear, which should include a good small tent, sleeping bags, matches, a three-pound axe—not a hatchet—a skillet and pot, and a generous supply of food.

Tents. The best tent for winter camping is one that you can set up quickly. There are several good ones to consider: The Thermos Pop-Tent (below, left) lit-

Continued



Ice fishing is luring increasing numbers of sportsmen out-of-doors in winter. Ski-boat (in background), manufactured by Bombardier, is a handy snowmobile trailer for carrying all your gear.

erally pops into position for you in just two minutes. You can set it right on the snow. This two-man tent is draft-proof and can withstand 60-m.p.h. winds.



Gloy's Heat Pal safety heater is adjustable so you can set it for any temperature, from 1,000 to 5,000 BTU. It burns up to 30 hours on a three-pint supply of denatured alcohol. The price is \$27.95.

New Coleman catalytic heater has an 8,000-BTU capacity—largest of any tent heater on the market. It has a bigger head and wick than previous models to provide larger heat output. It's about \$50.

Adams windproof radiant heater operates on propane gas, which remains efficient down to 46 degrees below zero. The compact heater doubles as a handy stove for cooking. It costs about \$27.

Porta-Heat is a versatile tent warmer. It burns canned-heat fuel and can also be used as a cook stove. One seven-ounce can of fuel gives 1½ hours of warmth. It's \$5.95.

The Coleman Lodestar is another easy-to-rig tent. It weighs just 26 pounds and can sleep three. The 13-pound Avis Mountain Tent, made by Avis Products of Troy, Mich., is ideally suited for extreme temperatures. For milder weather, the Whelan Lean-To made by Camp and Trail Outfitters, 112 Chambers St., NYC 10007, gives adequate shelter, but it needs a big fire outside to be comfortable.

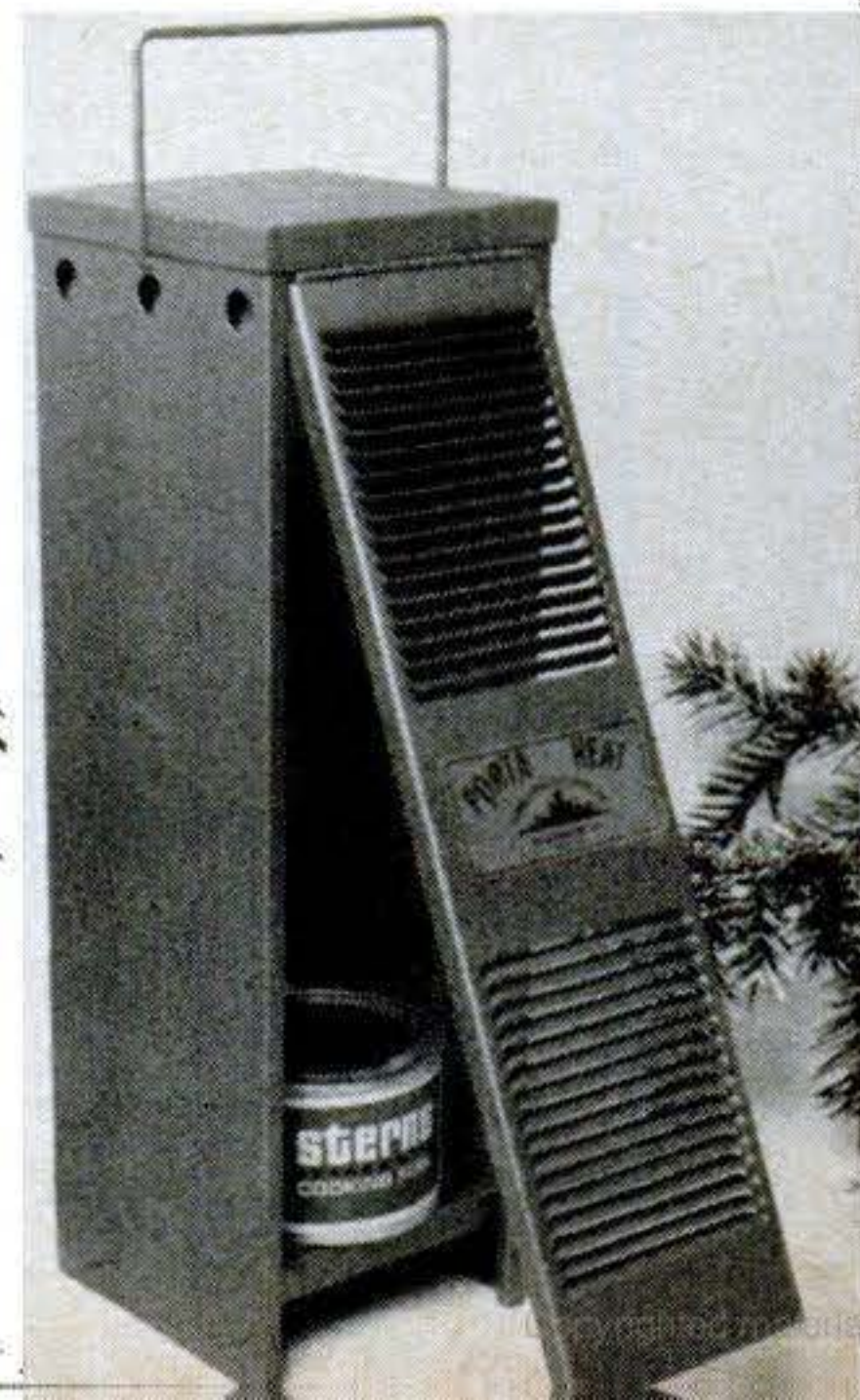
You should pitch your tent over a tarpaulin for added insulation. This is especially important when you use a tent heater.

Sleeping bags. When temperatures stay above zero, you can use bags filled with man-made fibers. But for below-zero weather, you need at least a four-pound down bag. A down mummy bag is the best bet. If you use your sleeping bag on a cot, a layer of newspaper between the cot and bag will provide extra insulation. If you're sleeping right on the floor, a good air mattress under the bag will keep you warmer.

Heaters. Radiant or space heaters can be easily set up without fear of fire—with a few simple precautions. The biggest heat output you can get in a single tent heater is offered by the new Coleman 8,000-BTU catalytic heater. Equipped with bigger head and wick than previous models, it can warm a small tent in the coldest temperatures.

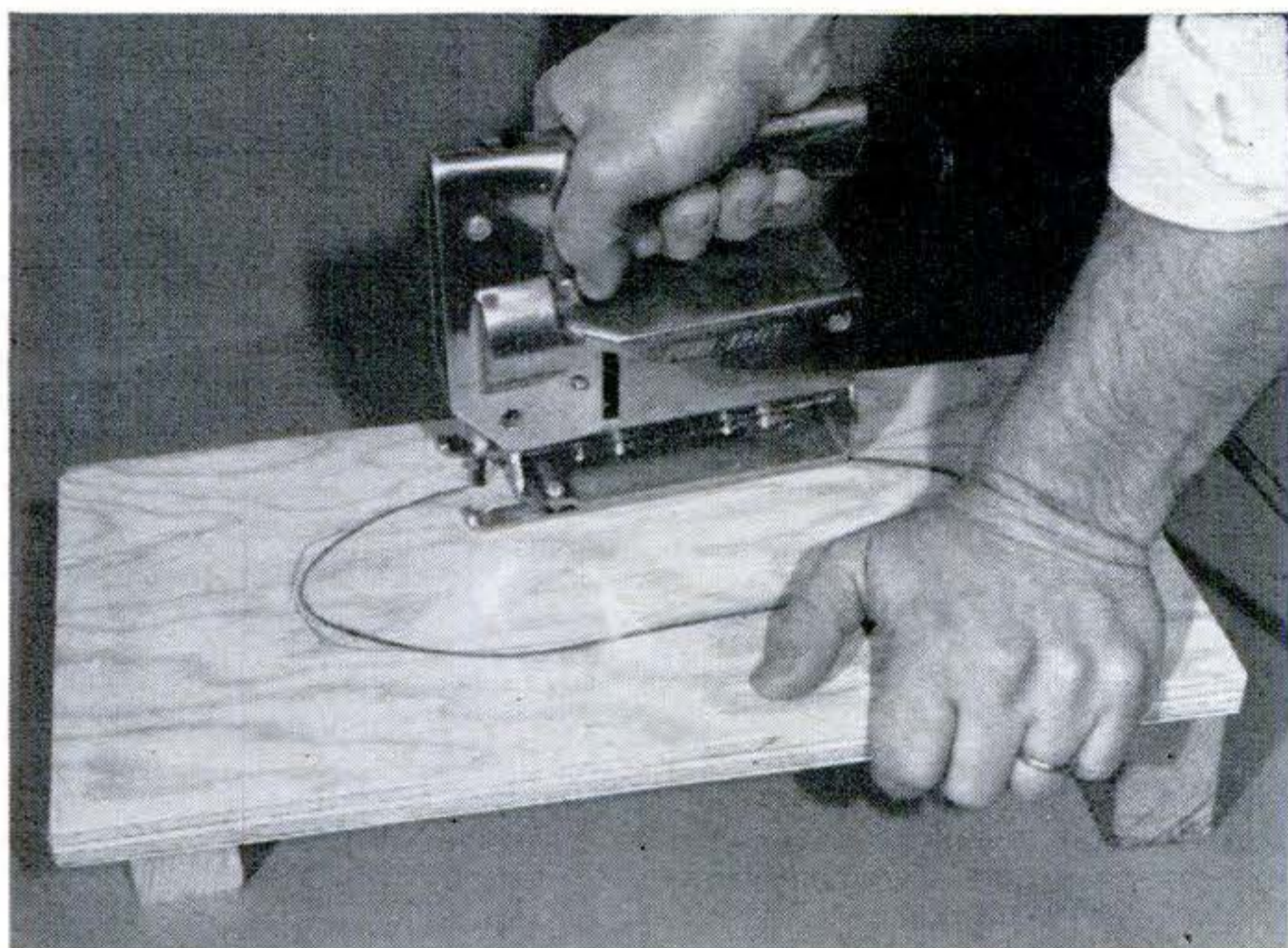
The Porta-Heat stove, which burns canned heat, is another convenient de-

[\[Continued on page 184\]](#)



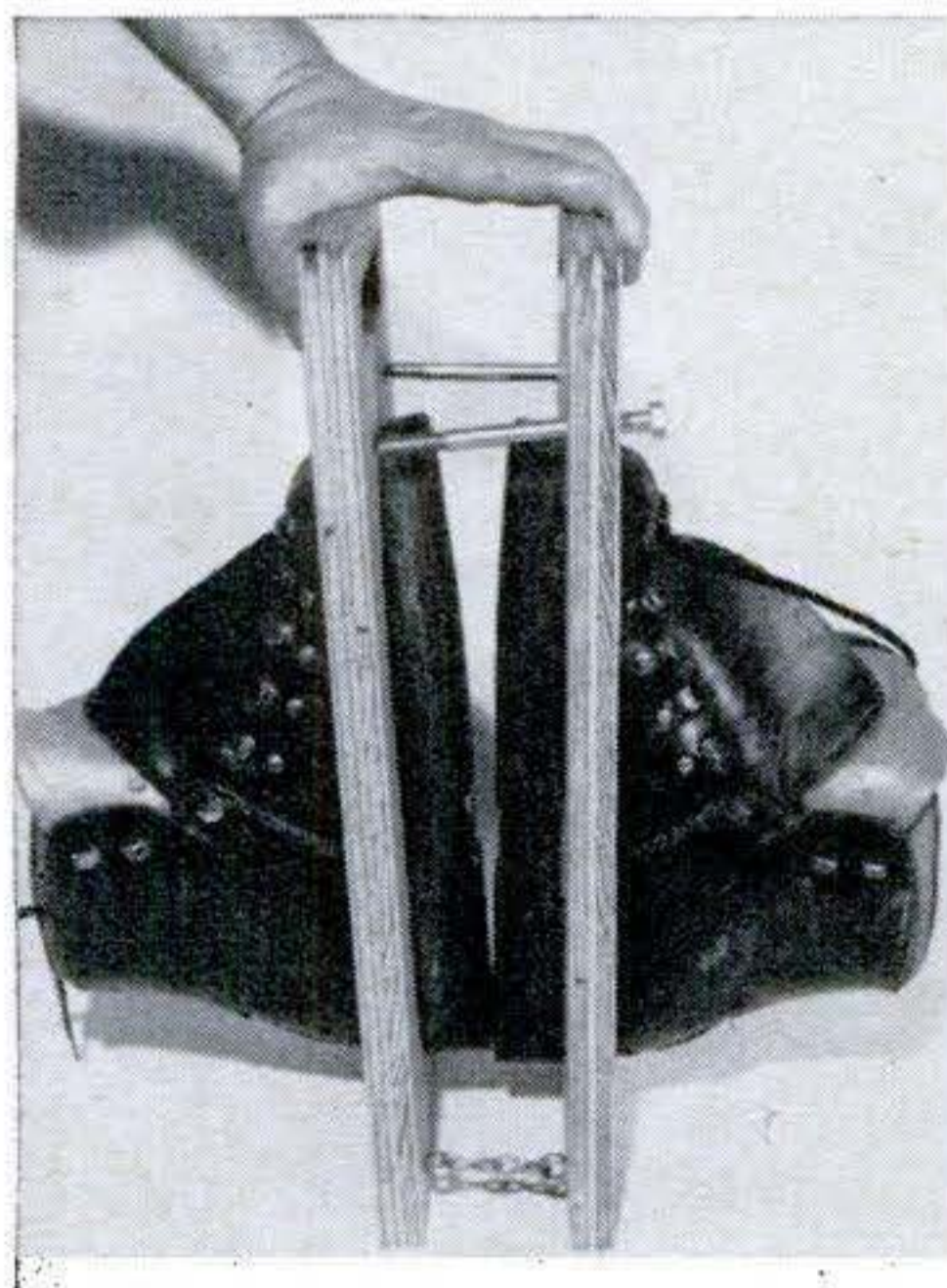


1 As every skier knows, boots tend to take on a permanent curl. To make a frame that will keep them flat while not in use, trace the sole on a piece of plywood. Then, within the first tracing, make a freehand drawing of line where sole and upper meet.

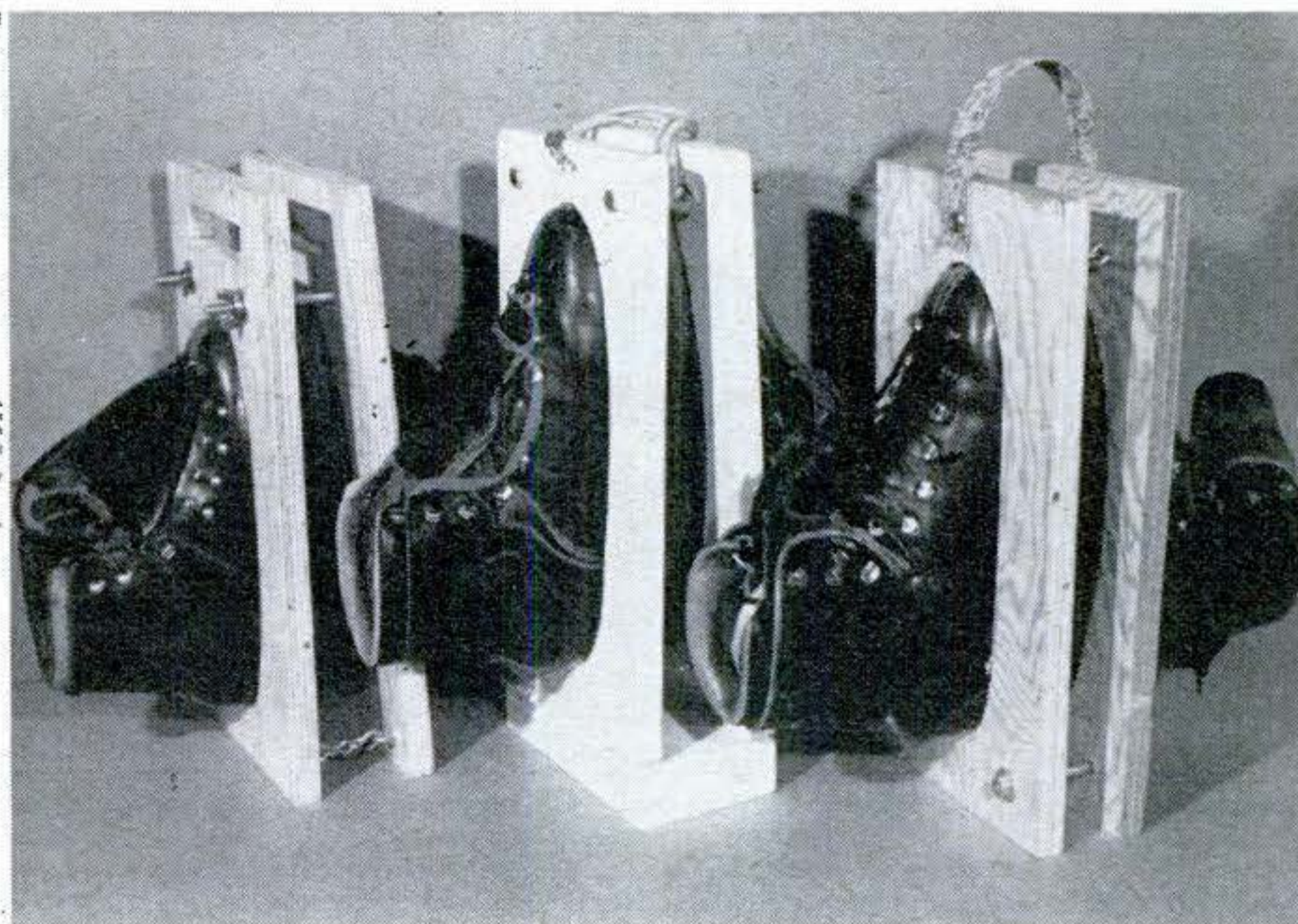


Simple Holder Flattens Ski Boots

2 Cut on second line with a saber saw (as at left). The opening should fit over the body of the boot, but not the sole. Trim if necessary. Cut board for other boot. Clamp two frames together and drill bolt holes.



3 Determine length of chain between the frames with boots in the holder. Line heels up, then measure. Use bolts and wingnuts on the other end.

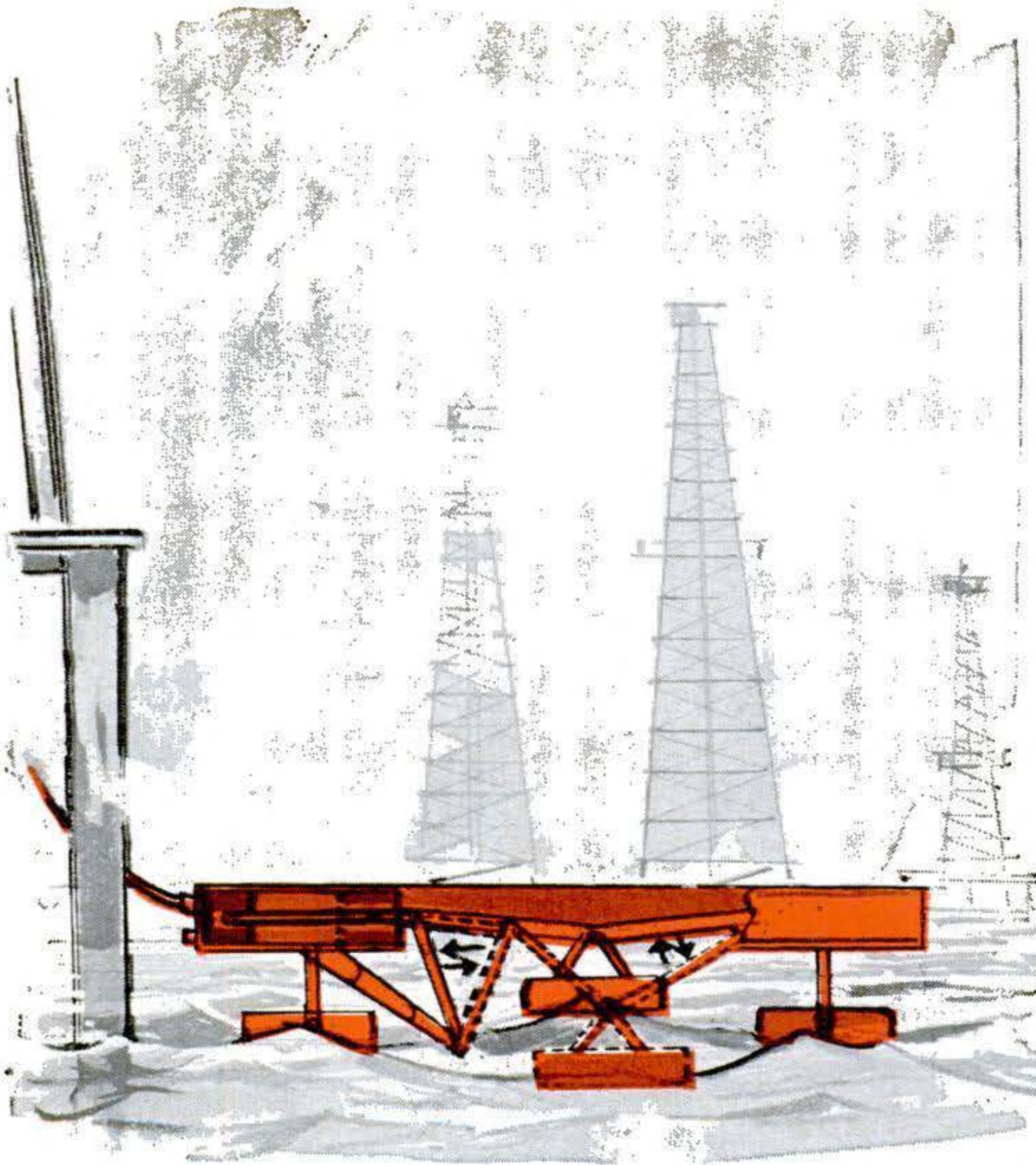


4 Construction can vary from one frame to the next to use up any fasteners you have in your junk box. Carrying handles can be made of any material, or cut into the frame if the boots are small. Paint, or don't paint, as you choose.

New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMO

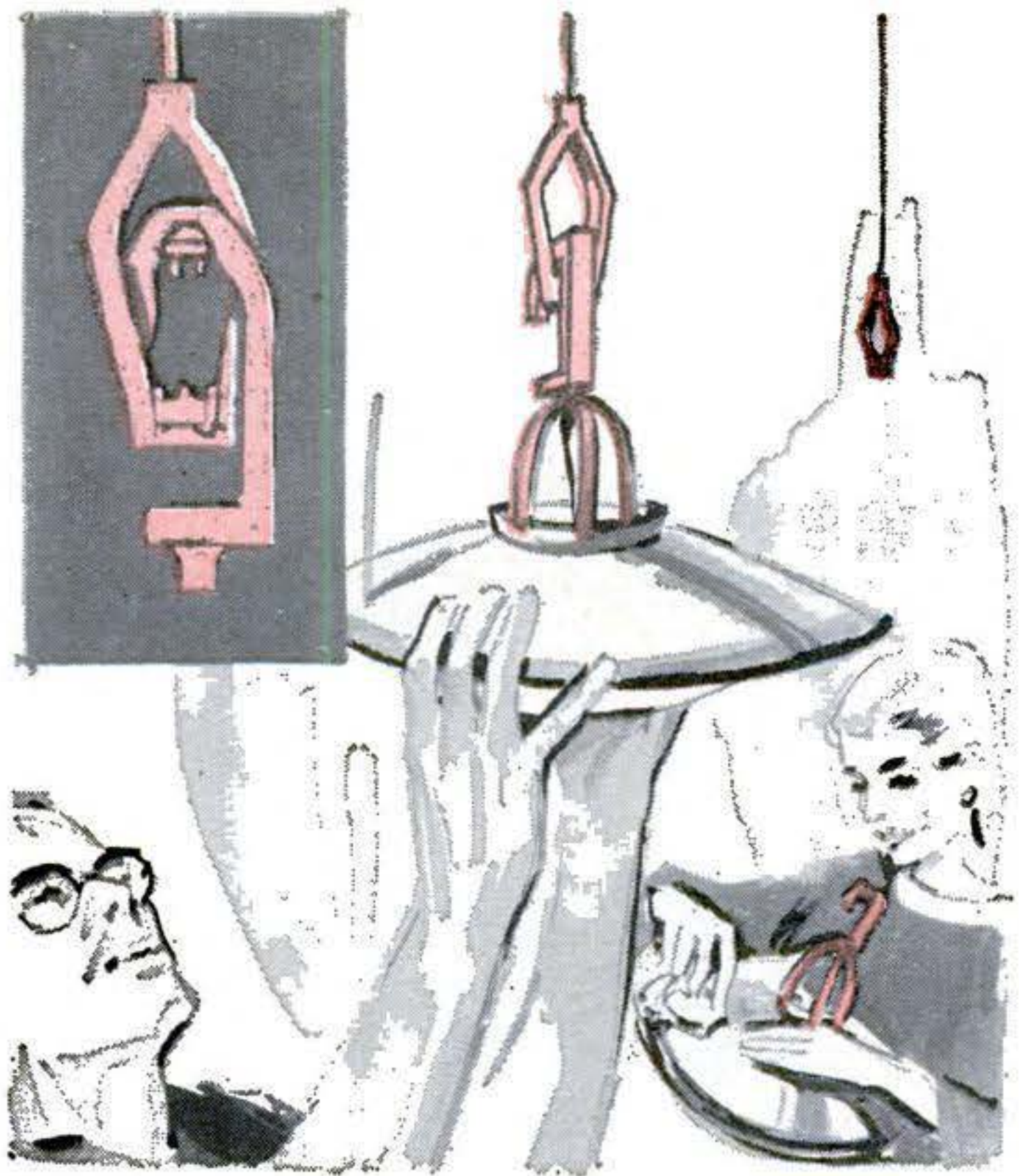
Ocean powers pump. Movement of the ocean, says a recent patent, could be put to use as a power source for off- or near-shore installations. Two linked floats, spaced between the swells, would rise and fall in unison. A third, between, and moving oppositely to them, would be linked to a piston in a pump cylinder, in which up and down wave movement would compress air. The cylinder's output could be drawn off for useful work on shore or at sea.



Airless tire defies punctures. To get the springiness and road-holding qualities of standard air-cushion tires (even on terrain where such tires quickly fail), this inventor would bolt airless, steel-plied rubber shells to wheels, using spring-loaded pins. Locked on during wheel assembly, the flexible struts would hold the tires in shape and keep them from slipping off like other airless tires.



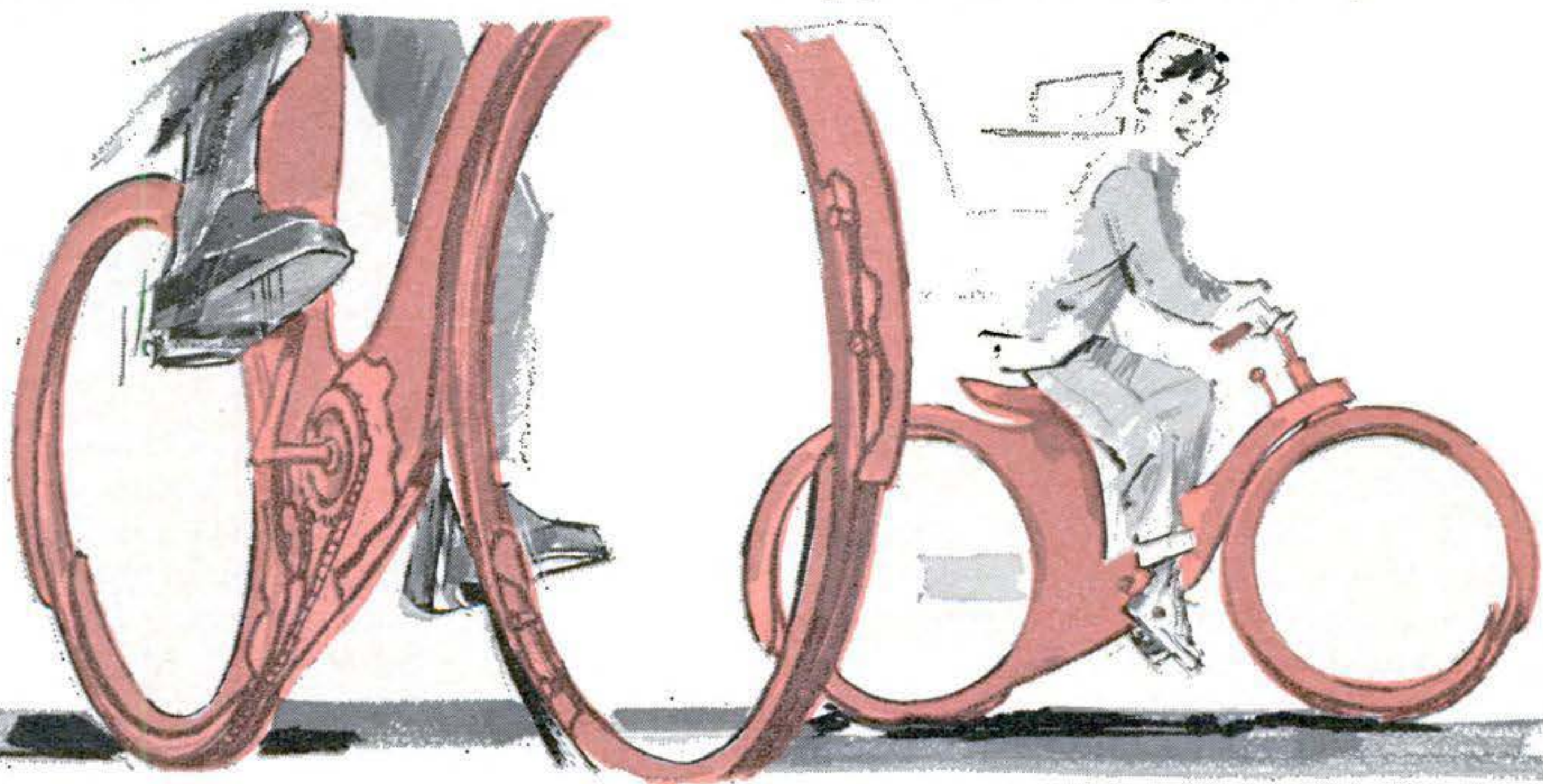
Hammer cam pulls nails. You wouldn't have to block a hammer to pull long nails if it had the gripping leverage provided by this slot and cam. The opening extending through the neck of the hammer head would slip over a partly pulled nail, and a toothed, spring-returned cam would lock onto its shank. It would be especially suitable for headless nails. It would tighten fence wire, too.



Light fixture unplugs for cleaning. Ceiling fixtures could be lifted off completely for cleaning or relamping if suspended from these hangers. Contacts in a permanently mounted bracket would mate with plug-in contacts on the removable assembly. Lifting the fixture would disconnect it; rehangng it—or a replacement—would restore the contact.



Pumped stopper seals pipe. This inflatable plug might make it easier to make repairs or check the flow in pipe lines. Instead of hammering in a wedge, you'd insert a plastic bladder and inflate it with a bicycle pump until the flow stopped. The plug would accommodate to roughness or irregularity in the pipe and, deflated, would slip out.



Rim drives spokeless bike wheel. Rubber rollers in the fenders of this bike would serve to guide spokeless wheels and cushion them against road shocks. The inventor says the

solid, wear-resistant plastic rims would ride as smoothly as rubber-tired ones but couldn't go flat. An endless belt through the pedal gear would drive the grooved rear wheel.

The following patents have been issued on these inventions: **Ocean wave pump**—No. 3,274,941 to E. L. Parr, El Cajon, Calif.; **Airless tire**—No. 3,329,192 to Alfredo Roque, Managua, Nicaragua; **Nail puller**—No. 3,281,117 to R. C. Ahearn, Wellington, N.Z.; **Lamp hanger**—No. 3,225,154 to F. M. Henne, Cincinnati; **Inflatable pipe plug**—No. 3,276,481 to Carrell S. McNulty, New Britain,

Pa.; **Bicycle with spokeless wheel**—No. 3,329,444 to Arthur Lidov, NYC.

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.

Gus Meets a Suspicious

The bearded stranger not only looked like an oddball—he acted kind of funny and even his car troubles were peculiar. But the explanation was really quite simple

By MARTIN BUNN

ILLUSTRATION BY RAY QUIGLEY

It was the eyes—small, bright blue, and suspicious—that first made Gus Wilson uneasy. Besides a slim mustache, the man had a goatee that accentuated a jutting chin. He spoke slowly, hesitantly.

“I think it’s a miss,” he said, gloved fingers tapping the wheel of the Mustang he had driven into the Model Garage. It bore city plates. “The engine shakes running slow, and doesn’t accelerate well.”

Gus’s ear had already told him there was a miss. He brought out his plug scope and connected it. One short trace among seven normal ones promptly identified the culprit as cylinder number five. Gus killed the engine. Carefully detaching the resistor cable from cylinder five, he removed the plug. Apparently it had been dropped, for the side electrode was bent, closing the gap.

“Whoever cleaned your plugs last must have dropped this,” Gus remarked. “There’s no gap for the spark to jump.”

The man licked his lips, nodded.

“You just passing through?” asked Gus as he regapped the plug.

“I’ll be around a couple of days. The name’s Gabriel West.”

Gus tightened in the plug, replaced the cable, and started the engine. It ticked over smoothly.

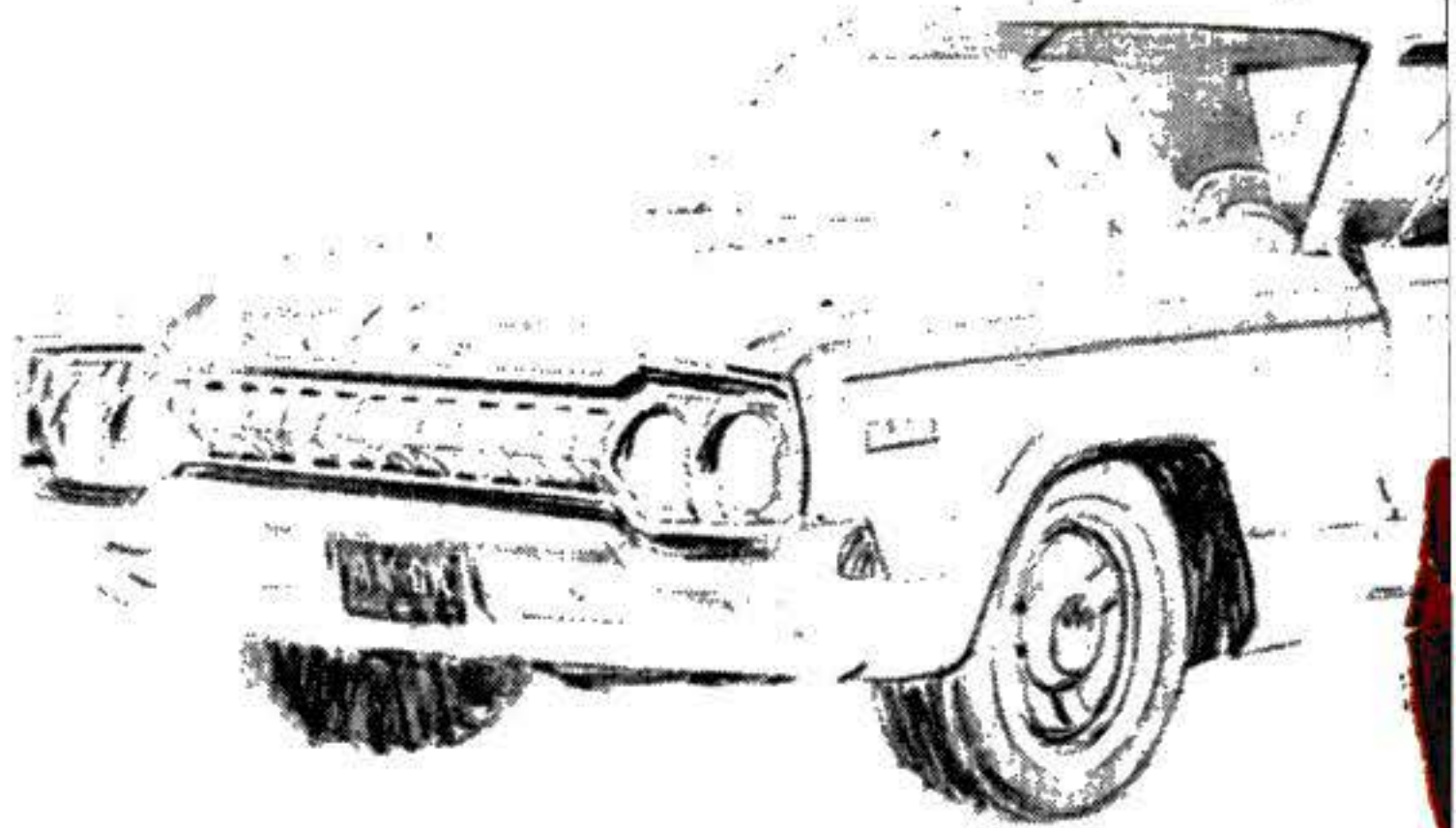
“That’s fine,” said West, who had stepped out to watch. “What do I owe...”

A loud brake squeal interrupted him as a Dodge nose-dived to a stop outside the shop. From it tumbled Kenneth Marcy, his 17-year-old face a cloud of doom.

“Hey, am I glad you’re in, Mr. Wilson. Can I talk to you right away?”

“Sure, Ken. In about a minute.”

“Go ahead,” said West, his piercing



eyes flicking from the boy to Gus. “I’m glad to stay out of the cold a while.”

“Thanks, Mister.” Ken swung back to Gus. “Dad said I could use the car while he’s away on business. Ma doesn’t drive, so I take her around. But I had the car last night and I—I think maybe I damaged the automatic transmission.”

“Why?” asked Gus.

“The engine winds up hard in low,” answered the boy, “then jerks into second, but right away upshifts again into high. Maybe the bands are shot.”

“What were you doing last night?”

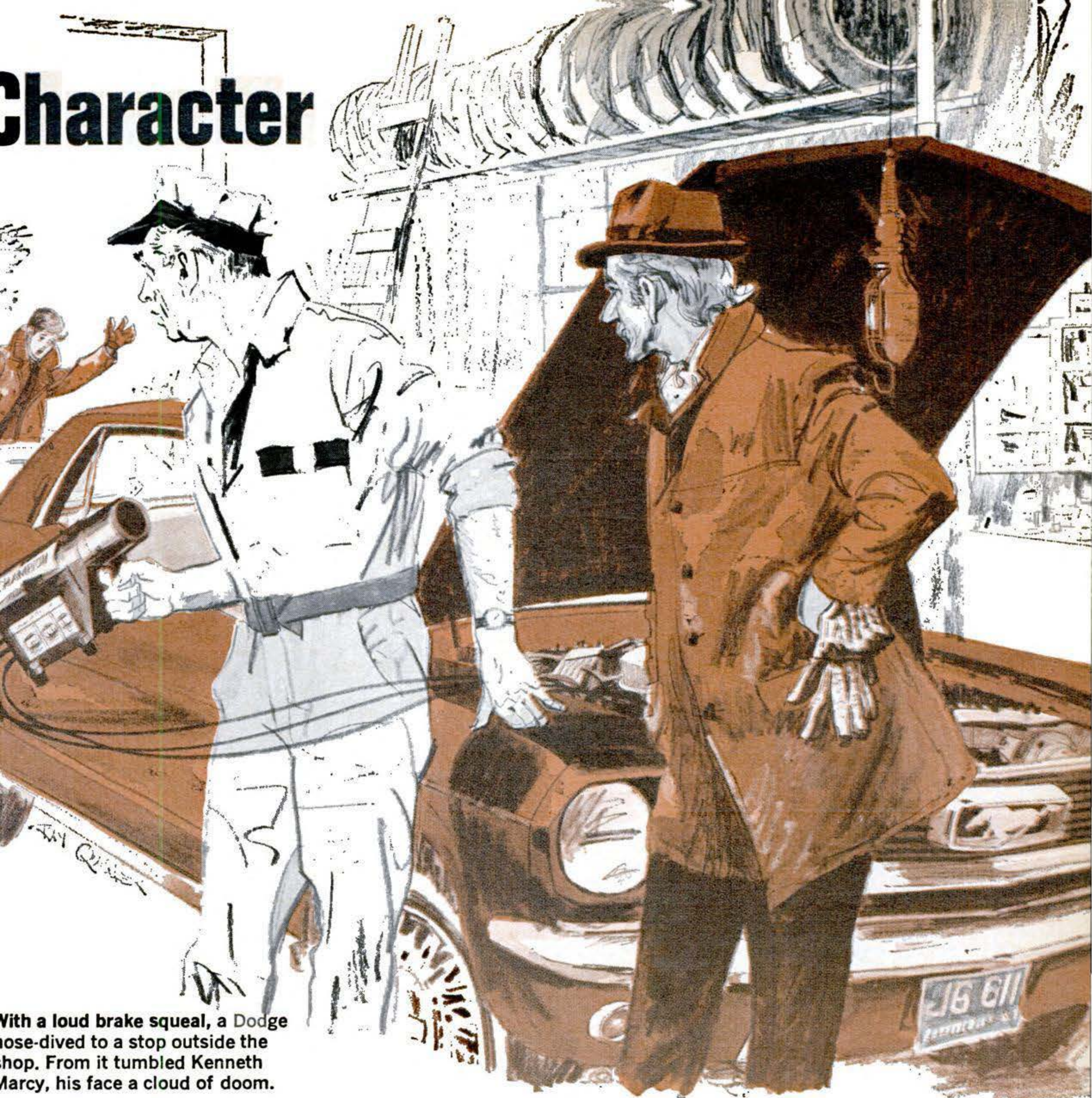
Ken flushed. “Draggin’. On Main Street—but there wasn’t any traffic that late. Course, I was floorin’ the gas in ‘drive’, but it ran fine. This morning, though, even Ma could tell something was wrong. She said bring it here. You think I really wrecked the box?”

Gus raised the hood. After one quick glance, he pulled out the transmission dipstick, sniffed it, shook his head as he put it back, and closed the hood.

“Too soon to tell, Ken. You know overhauling any automatic transmission comes high. I thought that ticket you got last fall cured you of drag racing.”

The boy groaned. “I wish it had. Dad will kill me if this is going to cost. Could I pay it out of my allowance?”

Character



With a loud brake squeal, a Dodge nose-dived to a stop outside the shop. From it tumbled Kenneth Marcy, his face a cloud of doom.

"Not if it's a two-, three-hundred-dollar job, Ken. Will your mother be needing the car today?"

"Not this late. We were out already."

"Then you better leave it overnight, to give me time to figure the cheapest job I can do. See me at 8:30 tomorrow."

"Gee! Well, okay. Thanks, Mr. Wilson."

The boy walked out glumly. Paying Gus the small amount he asked, West got into his Mustang.

"One worried kid you got there."

Gus nodded. "It may do him good. Hope it cures him of stop-light racing."

"Think he ruined the transmission? I

don't know much about auto mechanics."

Again Gus had a flash of intuitive distrust. He shook his head.

"I could have fixed it right away. But it won't hurt him to sweat it out."

West nodded, his eyes more suspicious than ever, and drove out.

Gus wasn't surprised when, just before 8:30 next morning, the Mustang once more rolled into the Model Garage.

"She's missing again," began West. "Sort of galloped when I started up. I know you fixed a bad plug, but there must be something else wrong now." *Continued*

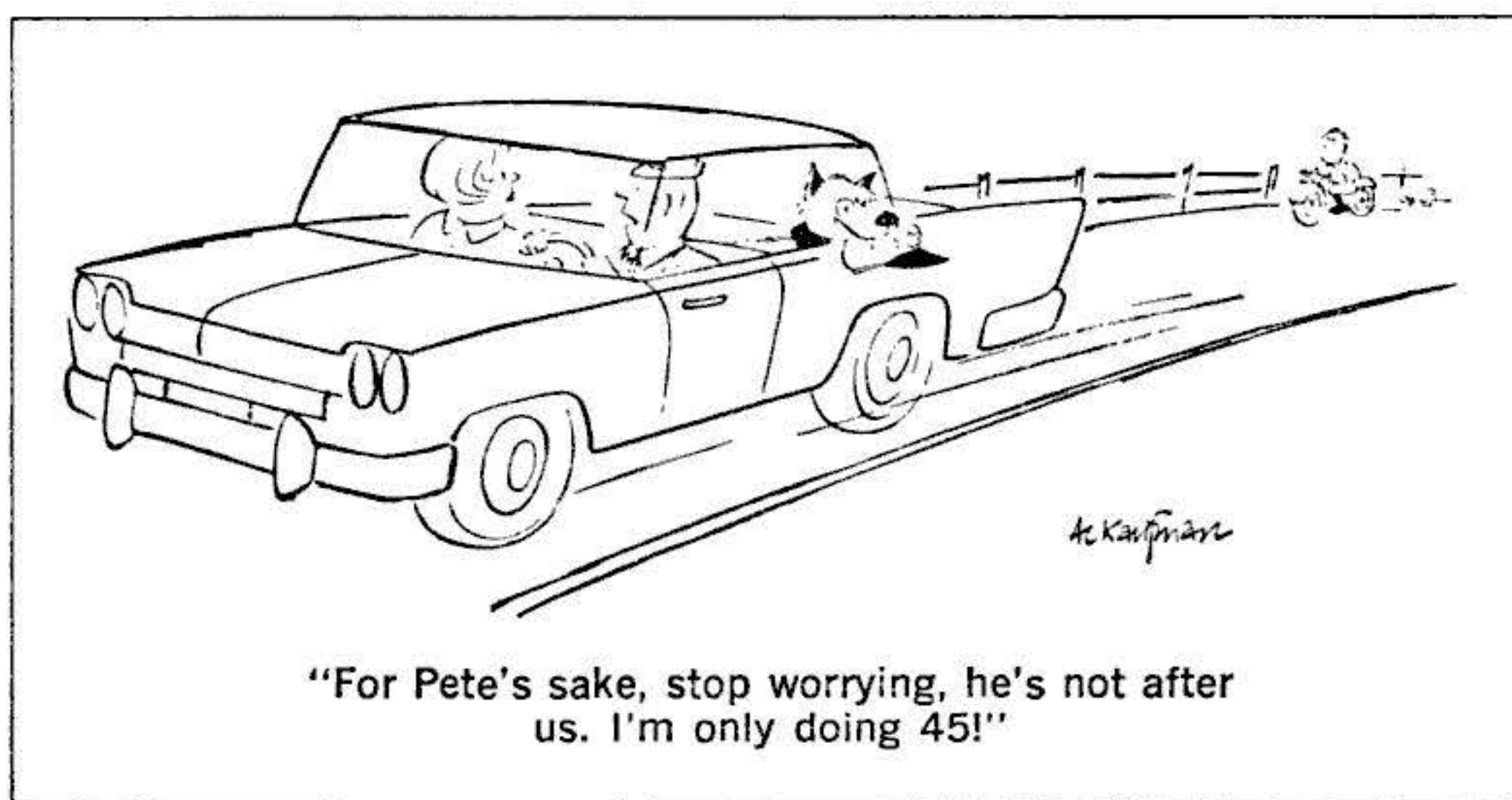
Gus hooked his plug scope to the ignition wiring. As the engine caught, eight traces welled up on the fluorescent screen, all below the red line, yet none so short as to indicate a fouled plug.

"It's idling nicely now," said Gus.

"It wasn't five minutes ago," insisted West. "It even died at a stop sign."

"Hey, Mr. Wilson. How about it? Will it cost much to—" Ken Marcy, face glistening with sweat despite the cold, stared at West in surprise before going on. "Sorry to butt in."

West waved a hand. "I've got time."



"I got to know, Mr. Wilson. Is it bad news?" the boy asked pleadingly.

Gus raised the hood of the Dodge.

"This time you're in luck, Ken. There's your trouble." He pointed to a link rod, its loose end lying atop the manifold. "When you lead-footed the gas, that ball joint on the throttle plate hopped out of this end of the rod, which was set a bit too long. With this disconnected, the shift points are controlled only by transmission-oil pressure, instead of by the throttle *and* oil pressure, so they went hay-wire."

Screwing the adjustable end of the rod down a trifle, Gus put the ball in its socket, squeezed the retaining clip to increase its tension, and slid it on.

"No harm done," said Gus. "But drag racing on a public road could have cost you much more than a big repair bill. My charge for this is a promise from you."

"You've got it, Mr. Wilson," declared the boy. "Never, never again. And thanks. Can I take the car to school?"

"Get it out of here," ordered Gus sternly, "before I charge you storage."

"Good as a TV show!" chuckled West after Ken had gone. "Only you passed up a chance to make a few bucks, didn't you?"

"Don't need 'em that badly," retorted Gus.

Turning back to the Mustang, he inspected the points, cap, and timing advance, and checked the shaft for excess play. Closing up the distributor, he hooked a tachometer in place of the scope and restarted the engine.

Noting the idling r.p.m., Gus shorted out one plug at a time and read the drop in revs as each cylinder cut out. The differences were so alike as to rule out a weak cylinder, whether due to poor compression, a bad valve, or broken rings.

Detaching the tach, he inspected all the spark-plug cables for breaks or chafed spots. There were none.

"The engine's running perfectly. If there's any trouble,

it's certainly intermittent."

"Okay. If it happens again, I'll be back," said West, and drove off.

"One thing about him," remarked Stan, Gus's helper. "He's never in a hurry, like everybody else is. You'd think it's his business to hang around."

"No, we won't be likely to see him again. He's strictly a transient," said Gus.

He couldn't have been more wrong.

About the same time next morning, the Marcy Dodge stopped outside, and Ken ran into the Model Garage.

"Mr. Wilson, I—I had to come to see you right off," he blurted breathlessly.

"The car's okay, isn't it?"

"Yeah, it's fine. Thanks for getting me out of that spot. But listen—I—I just remembered who that guy is. The one with the beard. Dad took me to lunch in the city some time back, and there was this same guy, and Dad told me he's a newspaper columnist—Dan Presley!"

The name meant nothing to Gus.

"Don't you read his column, *Pointers*?" Ken went on. "It's in lots of papers. He

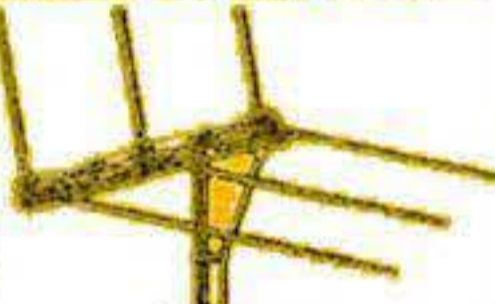
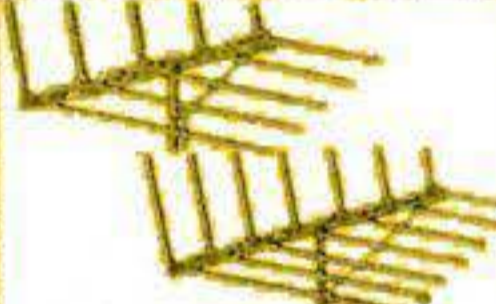
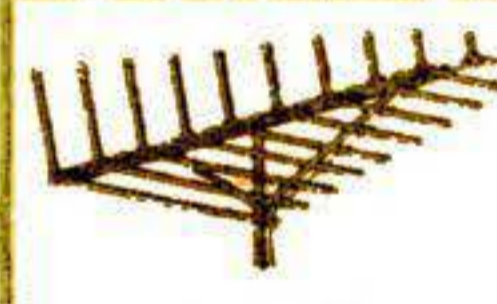
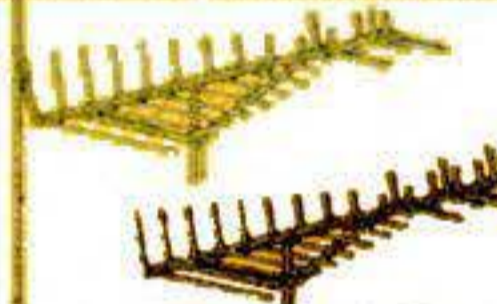















Continued

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FINCO has developed the Color Spectrum Series of antennas—"Signal Customized"—to exactly fit the requirements of any given area. There is a model scientifically designed and engineered for your area.

Check this chart for the FINCO "Signal Customized" Antenna best suited for your area.

STRENGTH OF UHF SIGNAL AT RECEIVING ANTENNA LOCATION	Strength of VHF Signal at Receiving Antenna Location				
	NO VHF	VHF SIGNAL STRONG	VHF SIGNAL MODERATE	VHF SIGNAL WEAK	VHF SIGNAL VERY WEAK
NO UHF →		 CS-V3 \$10.95	 CS-V5 \$17.50 CS-V7 \$24.95	 CS-V10 \$35.95	 CS-V15 \$48.50 CS-V18 \$56.50
UHF SIGNAL STRONG →	 CS-U1 \$9.95	 CS-A1 \$18.95	 CS-B1 \$29.95	 CS-C1 \$43.95	 CS-D1 \$43.95
UHF SIGNAL WEAK →	 CS-U2 \$14.95	 CS-A2 \$22.95	 CS-B2 \$48.95	 CS-C2 \$58.95	 CS-D2 \$68.95
UHF SIGNAL VERY WEAK →	 CS-U3 \$21.95	 CS-A3 \$30.95	 CS-B3 \$48.95	 CS-C3 \$58.95	 CS-D3 \$68.95

NOTE: In addition to the regular 300 ohm models (above), each model is available in a 75 ohm coaxial cable downlead where this type of installation is preferable. These models, designated "XCS", each come complete with a compact behind-the-set 75 ohm to 300 ohm balun-splitter to match the antenna system to the proper set terminals.



THE FINNEY COMPANY
34 West Interstate Street
Dept. P3 • Bedford, Ohio 44146

Send for free brochure

Name _____

Address _____

City _____ State _____ Zip _____

fingers rackets, bunco schemes, crooked businesses. For two months he's exposed garage gyps who pull off a wire and tell a customer he needs a big repair job. He doesn't name names, but writes so local people can spot the crook every time. And he's been in here twice!"

"Mmm. That figures," mused Gus.

"I don't mean you're crooked," added Ken quickly, "or that he can get anything on you. But you've been pretty good to me and—I wanted you to know."

"I appreciate it, Ken. Thanks."

"I read that column," remarked Stan. "Presley is tough on bum mechanics, as well as on crooked ones."

"Well, if he's rigged his car this time," said Gus, "he's done a good job. I can't find the symptoms he's beefing about!"

An hour later, with two cars blocking the shop door inside, a horn sounded. It was Presley's Mustang out front.

"Happened again," said the bearded man. "When I started up at the motel, the engine almost shook me out of the car. It stalled three times getting here."

"It's smooth enough now," said Gus. "Look, I haven't time for games," he declared. "I just heard who you are, Mr. Presley. So you won't find out much more about me than you already know."

The smile that suddenly spread over Presley's face reached even his eyes.

"Okay. But I already know all I need to know about you, seeing you handle that kid with the Dodge. I jimmed that spark plug you fixed, but this car really does run rough mornings. I wish you'd check it again."

"The door's blocked," said Gus after a moment. "Move the car over there."

Getting tools and instruments from the

shop, Gus tried the plug scope with the same result as before, then checked the automatic choke. Fingers numb with cold, he put the ohmmeter prods across each of the plug cables in turn. Their resistance ran from 8,000 to 20,000 ohms. But the last one—number five—was 200,000 ohms.

Gus twisted the cable, seeking a break that might cause intermittent high resistance. The reading stayed the same.

Putting the cable on a fender, Gus rechecked the others, then replaced them. Finally he checked number five again.

The meter didn't budge. Repeated tries showed the cable nonconductive.

"The main trouble with resistor cable, which has carbon instead of metal wire inside," Gus told Presley as he replaced the defective one inside the shop, "is people. Grab a cable too far from the boot, and you can break that carbon string. Bet that's what you did when you yanked it off to take out that plug so you could mash the points together."

"I'll buy that," said Presley. "I didn't know you have to treat resistor cables gently. But why did it miss only mornings, and how come you got that open reading only the second time you tried?"

"The cold," replied Gus. "Overnight, and after I left it on the fender, the conductor contracted, pulling the broken ends so far apart the spark couldn't jump them. When the engine warmed it, the carbon expanded, shoving the ends together enough to let a spark jump."

"Congratulations," said Presley.

"You going to mention the Model Garage in your column?" asked Stan.

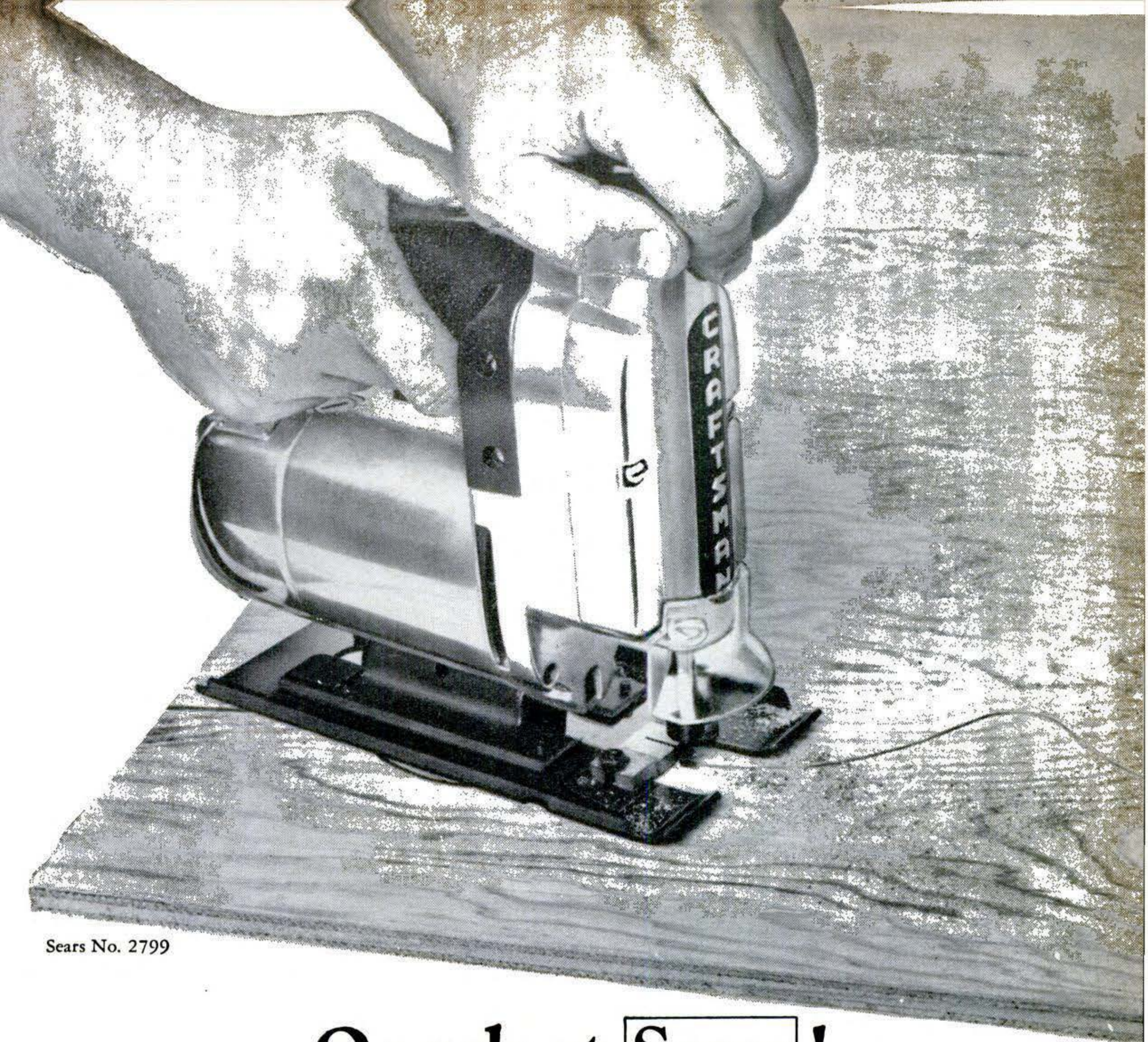
Presley answered with a satanic grin.

"Negative! Staying out of *Pointers* ought to make you happy. I've got no space to waste on an *honest* garageman!"



Sporty experimental car: How low can you get?

An experimental car that traces its lineage back to the Mustang is being displayed by the Ford Motor Co. It's the Allegro II, with an overall height of only 41¼ inches. To disembark, the driver swings the steering wheel up. On reentry, a "memory" button returns the wheel to the driving position.



Sears No. 2799

On sale at **Sears**! Craftsman Multi-speed Sabre Saw

For heavy-duty commercial use. On sale
at a homeowner's price! Regularly \$54.99. Now only \$39.99!

Save \$15.00! The Craftsman[®] sabre saw cuts wood 4 in. thick, delicate veneer, brass, copper, steel, leather and plastic.

The baseplate adjusts 0°-45° left or right for bevel cuts. There's even a sawdust blower that keeps dust away from the cutting line, so you can *see* what you're doing.

A special counterbalance reduces vibration, so there's *less fatigue*. An auxiliary knob for two-hand use assures *full control*.

And listen to this exciting feature: an electronic "reserve power circuit" automatically adds power when the going gets rough, so the

pre-set speed is constantly maintained. And there's a choice of 11 speeds to suit every job perfectly. Comes with 8 blades and blade holder, edge guide, circle-cutting attachment, chip shield and anti-splinter attachment.

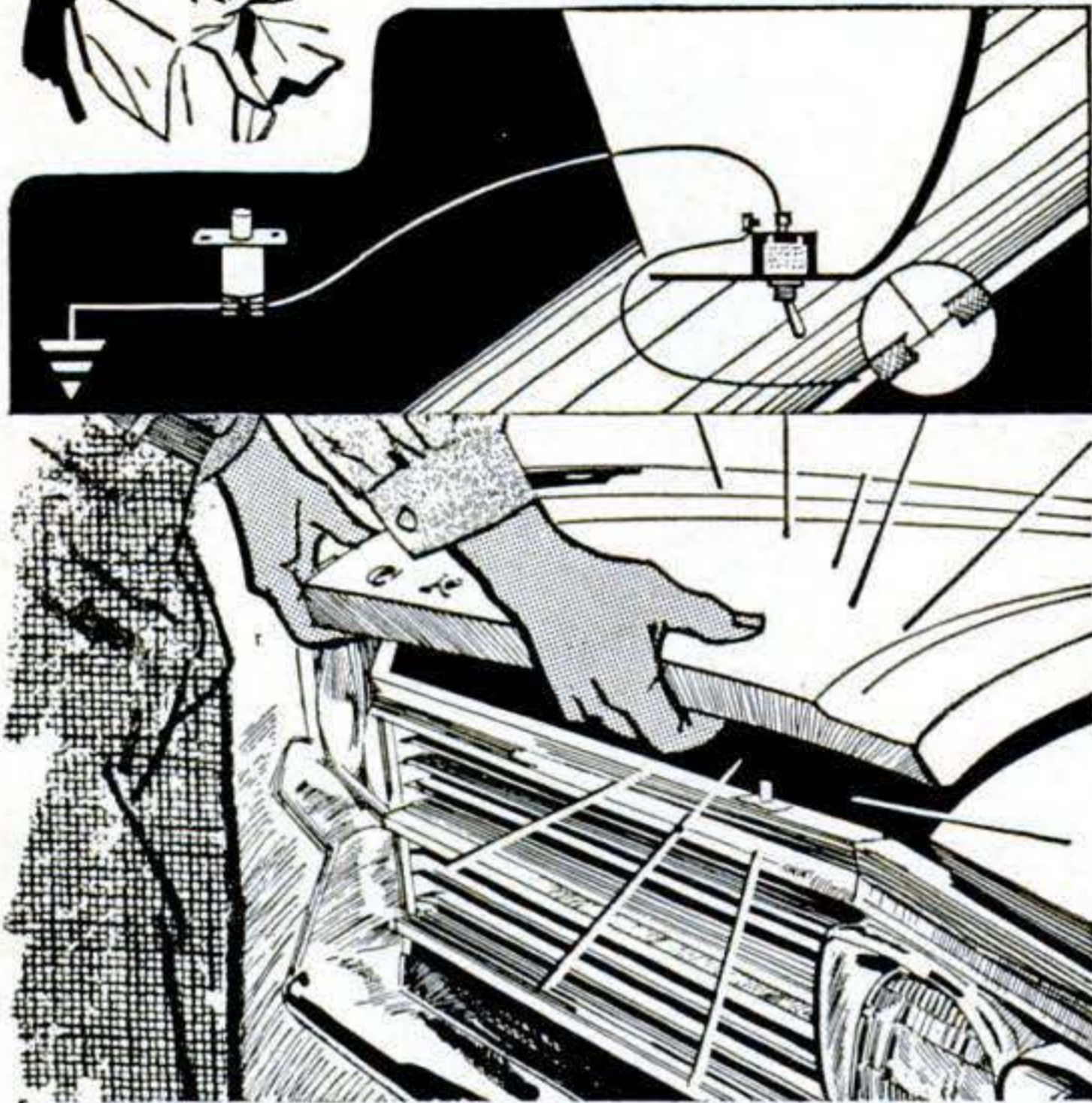
Sale ends December 23, 1967. Remember, there's No Money Down on Sears Easy Payment Plan. **You can't do better than Sears.**

Free service and parts upon return if any part proves defective within one year of sale. This guarantee does not apply to electric tools used in rental service.

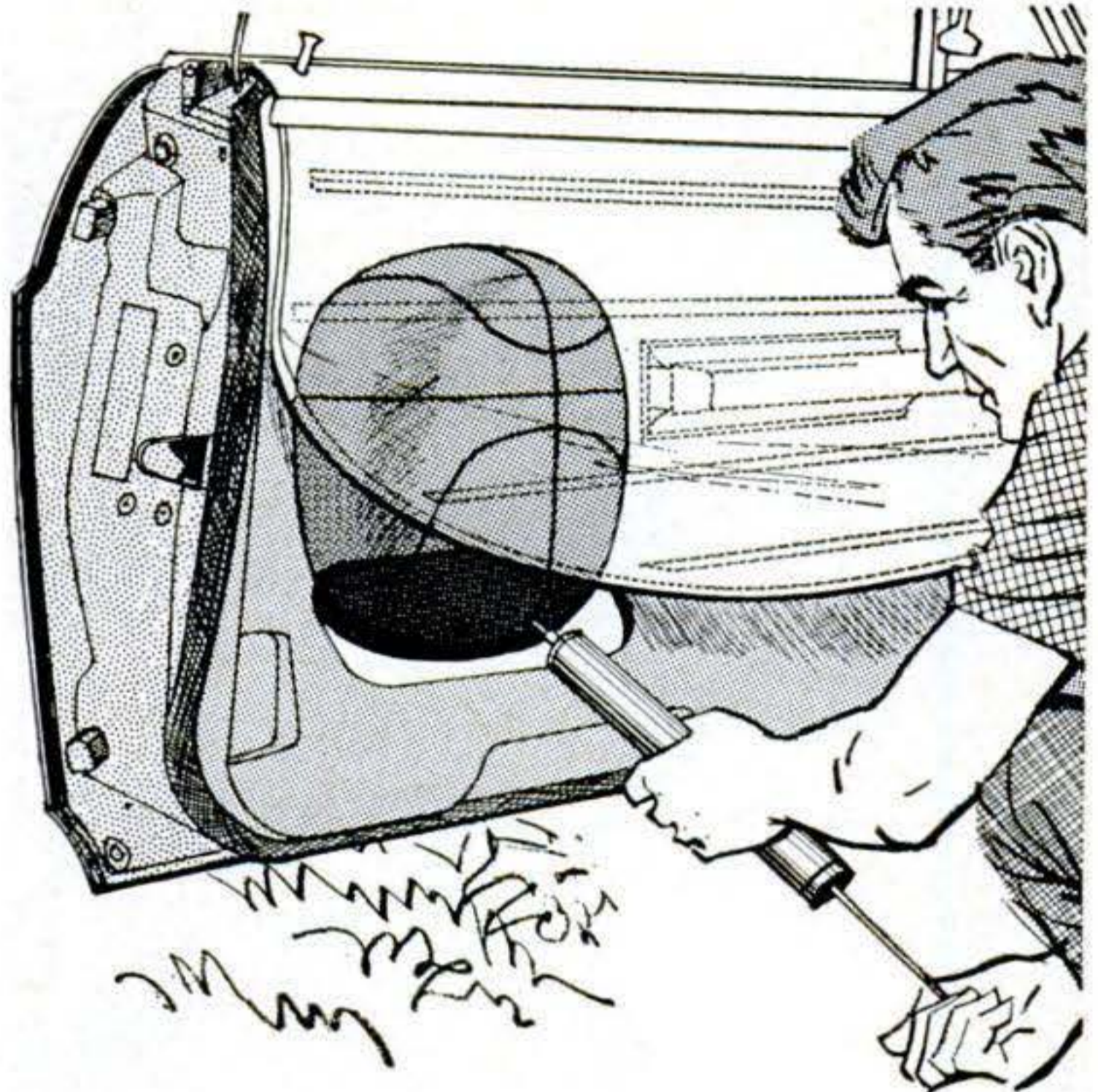


Hints from the Model Garage

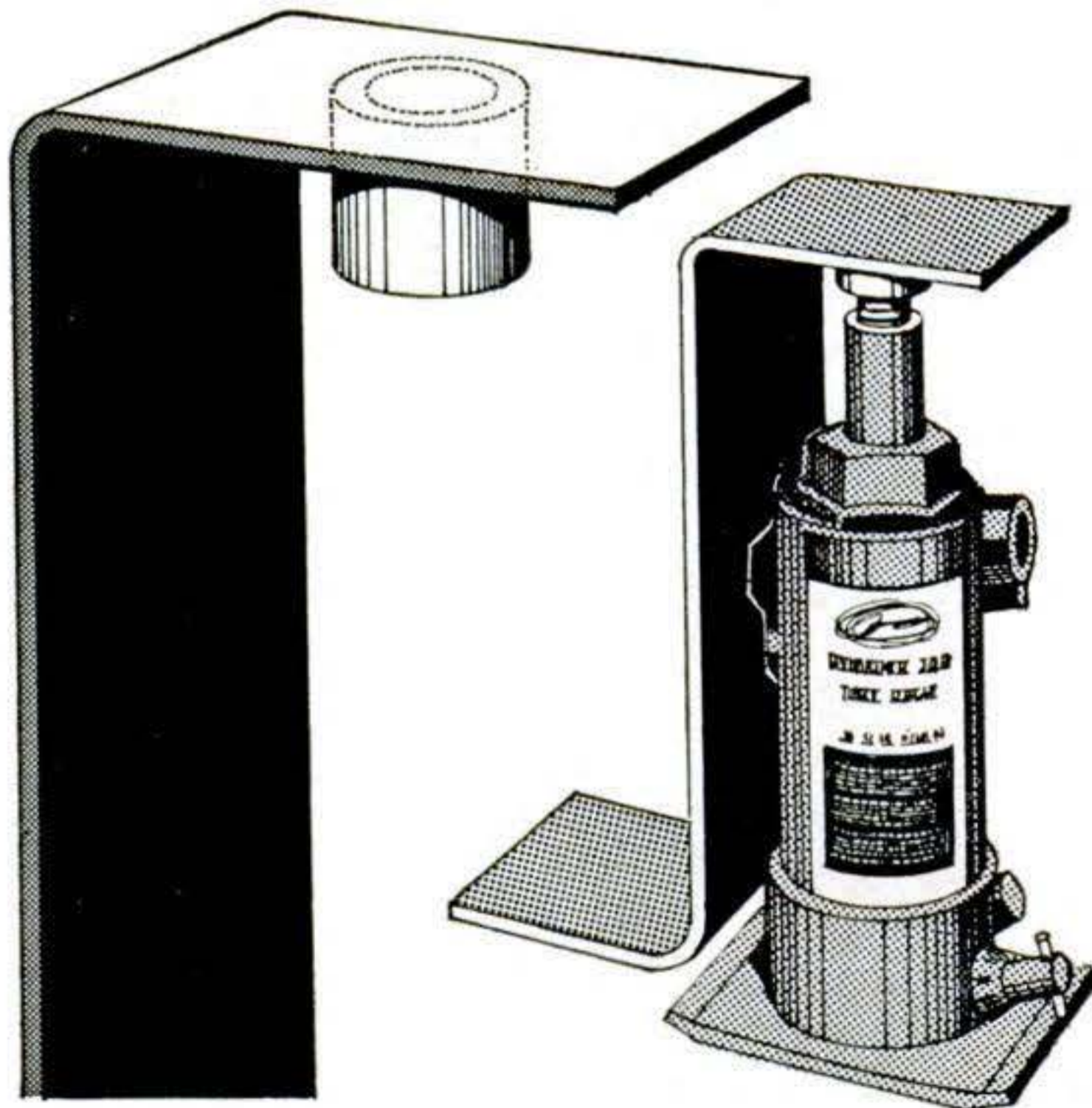
DRAWINGS BY RAY QUIGLEY



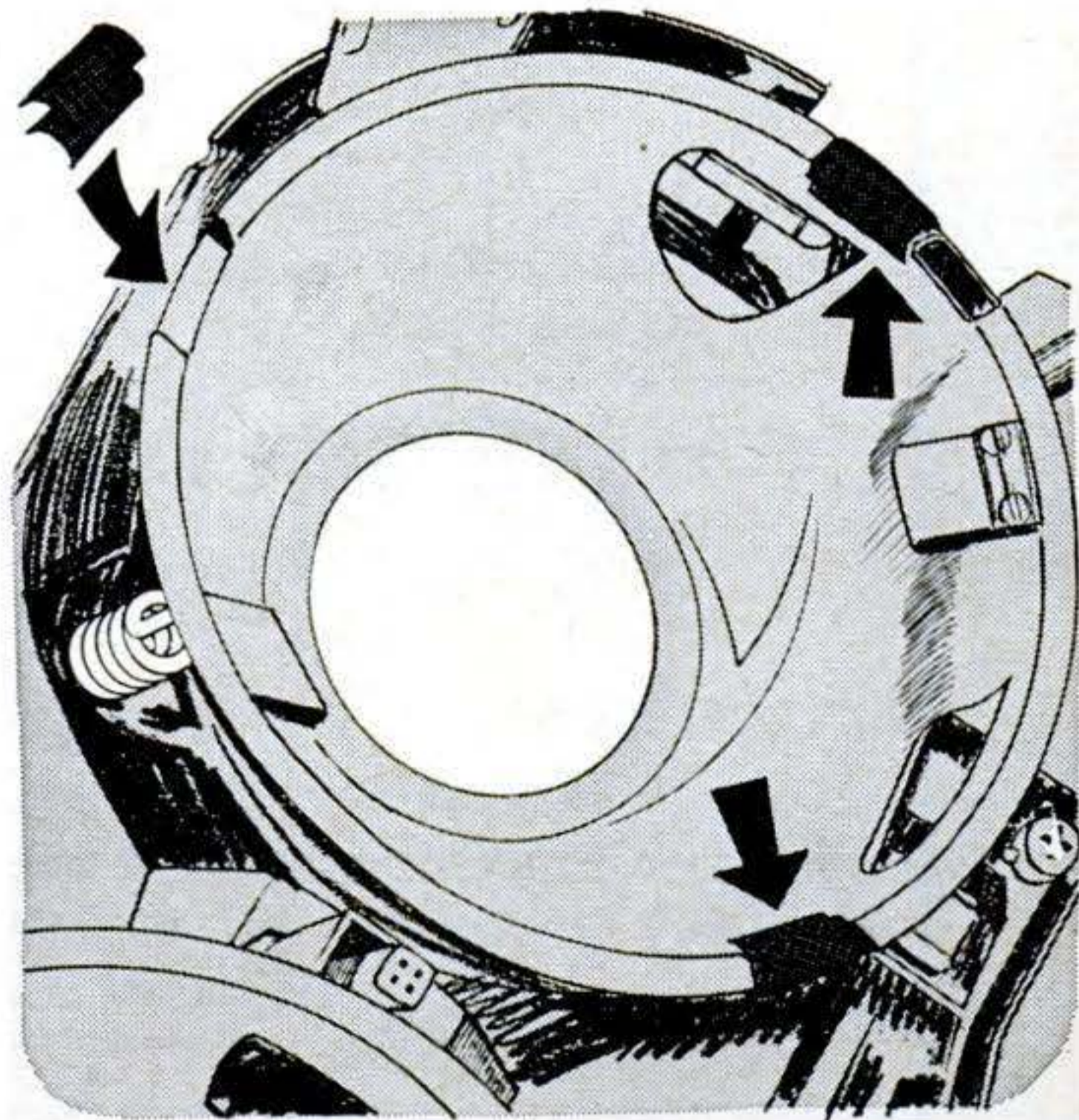
This theft guard sounds your horn when the hood is opened. Fasten a door light switch under the hood and run a wire to a toggle switch under the dash. Connect it to the horn-relay ground terminal. Ground the hood switch. Flip the toggle to open the hood.



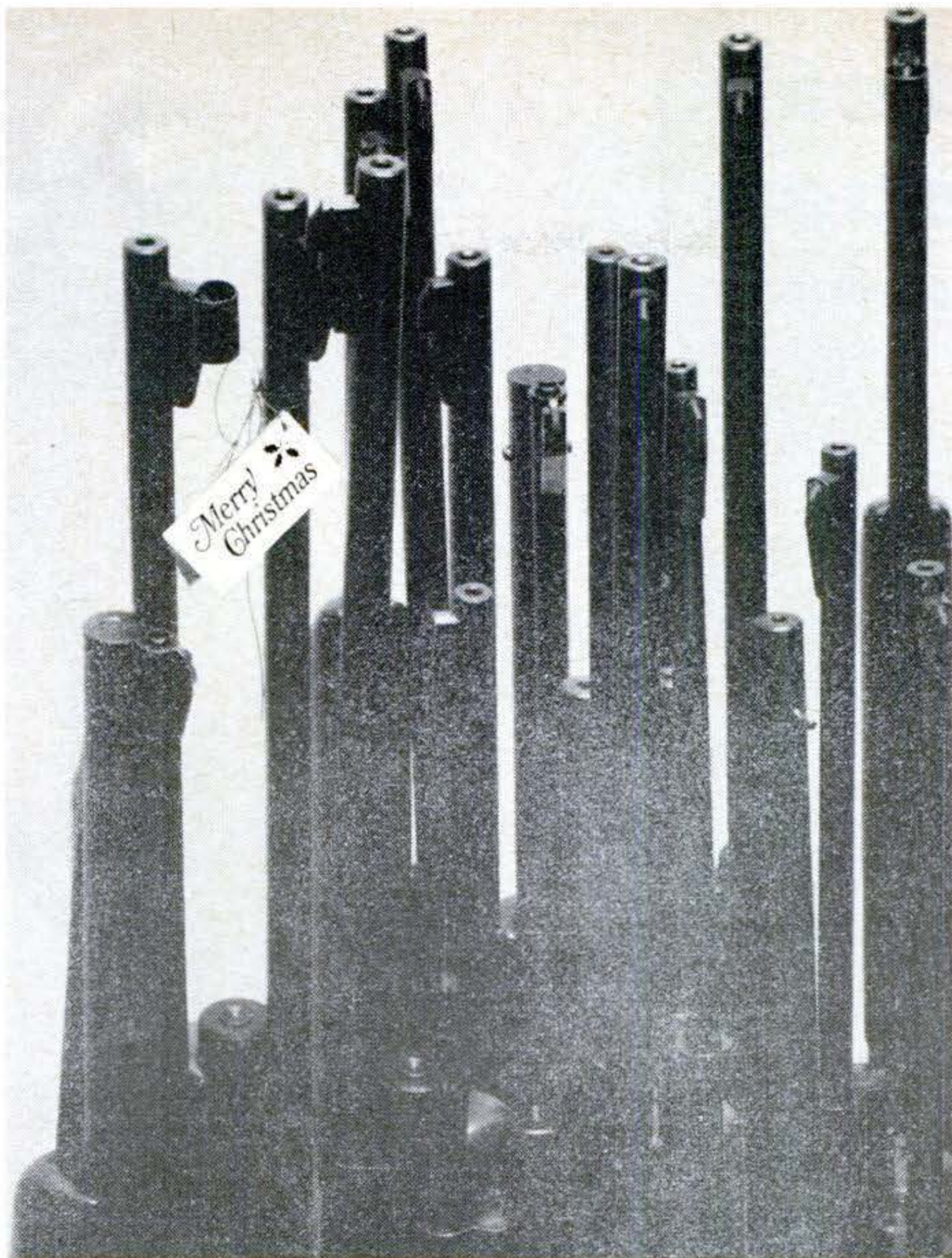
Some dents in door panels can be straightened from inside without dismantling the whole door. Ease the panel open and slip a deflated basketball inside; inflate the ball with a pump. This will usually push the dent out, restoring the door to its original shape.



To use a jack at points so low you can't get it underneath, make this adapter: It's a piece of steel bent at right angles at both ends, with a short piece of pipe welded to the underside of the top section. The pipe holds the bracket securely on the jack plate.



Sealed-beam headlights on '66 Fords sometimes come loose because the retaining springs lose tension. Cure: Put two layers of friction tape over the alignment notches in the housing ring, and be careful not to overstretch the springs when reassembling.



BARRELS OF FUN!

Barrels of fun for years to come! The most fun-packed gift anyone could give (or receive) . . . from the world's largest manufacturer of CO₂ and air-powered fun guns! Here are some of our most popular rifle and pistol models. Which one do you want most?



POWERMASTER 760. BB and .177 cal. Pellet Air Rifle. Power ranges from low for indoors to high velocity of over 500 feet per second for field shooting. Genuine hardwood stock, solid steel barrel. Short-stroke, high-compression pump. Holds over 180 BB's. Carries the symbol of fine gun craftsmanship . . . the gold-finished trigger. Less than \$22.



MODEL 140. Air-powered Pelgun Rifle, .22 Cal. Crosman quality and performance is built into this economical, high powered, single shot pump gun. All steel button-rifled barrel, polished hardwood stock, self-cocking mechanism, selective power, adjustable sights. Less than \$33.



MODEL 99. CO₂ Powered Pelgun, Lever Action Repeater. Looks, feels, handles like a big-game rifle. Lifetime valve for increased power and efficiency. Power selection gives choice of normal or high power. Self-feeding magazine holds 10 Super Pells. .22 Cal. About \$36.

You can add a Master mount and scope to any of these rifles; optional \$9.98. See these and all the fine models at your Crosman dealer. Send for free "More Shooting Fun" brochure. Write Dept. PS-127.



MARK I AND MARK II. Target pistols for .22 Pellet, or .177 Pellet and BB. They feel, look, handle like—and are—fine match target pistols. The most accurate Crosman has ever designed for Pellet and BB shooting. Fully adjustable sights, trigger adjustment for conventional or fine shooting. Up to 120 shots per single CO₂ Powerlet. Single shot action for accuracy. Under \$25.



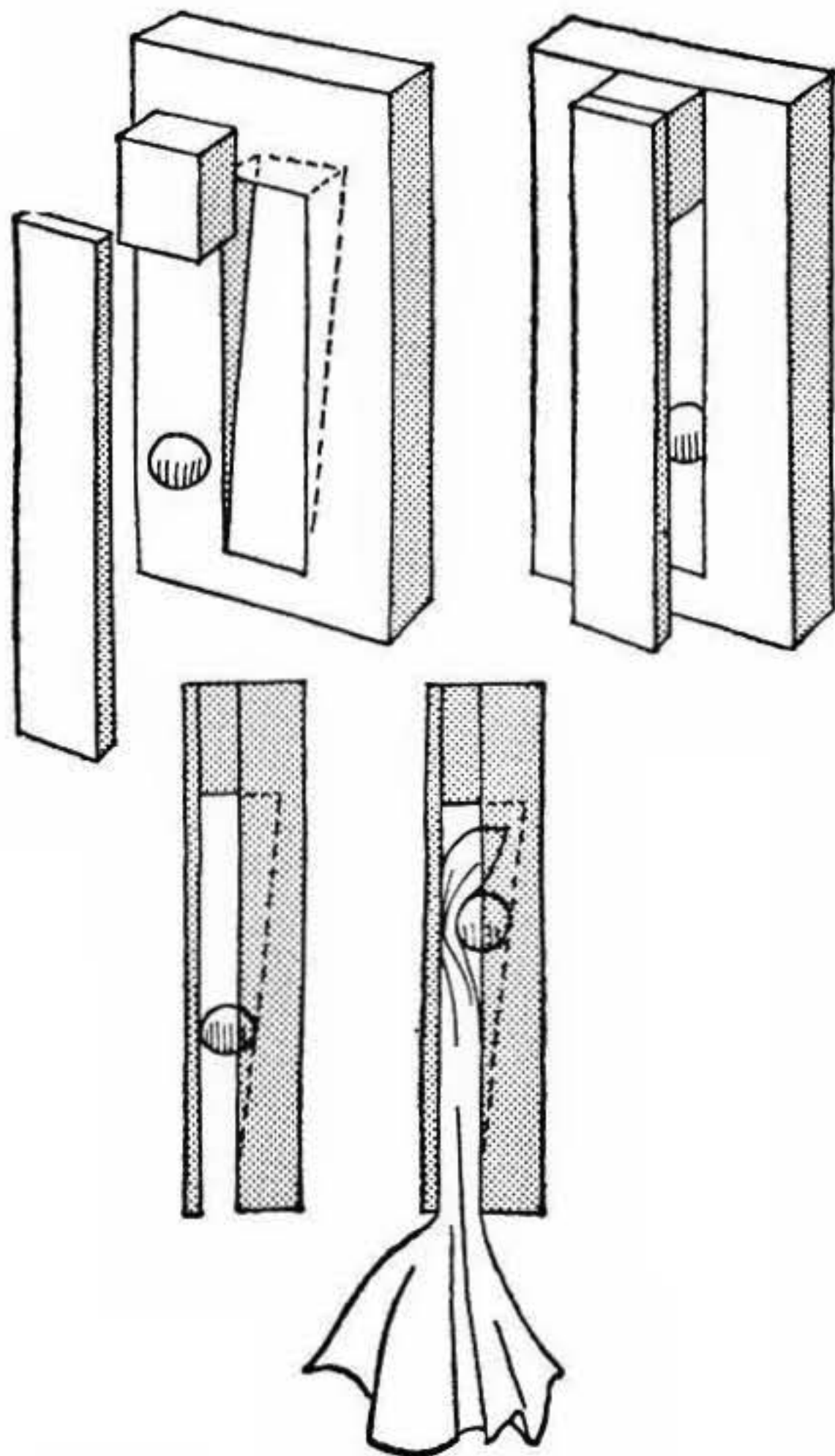
MODEL 38-C. Combat "38", CO₂ Pelgun Revolver. Here's a pistol that's easily mistaken for a .38 caliber firearm. It offers single and double action and revolving cylinder which holds six .22 caliber Crosman Super Pells for slow or rapid firing; (38-T target model with 6" barrel), either model, less than \$33.

Prices slightly higher in Canada

Crosman/Going Great Guns
Crosman Arms Co., Inc., Fairport, N. Y. 14450
Crosman Arms (Canada) Ltd., Dunnville, Ont.

Wordless Workshop

By ROY DOTY



When a man gets a Stanley tool on Christmas he's like a kid with a new toy.



"Jobmaster" Hammer. Perfectly balanced, built strong for tough jobs.

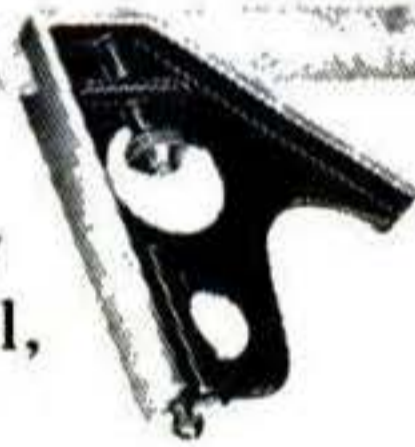


Torpedo Level. Versatile, rugged — bottom grooved for use on shafts, pipes, other round surfaces. 3 easy-to-read dials.



"Hex-A-Matic"™ Nutdriver. Handier than wrench, or conventional nutdriver. Automatically adjusts to fit 15 sizes of nuts and screws.

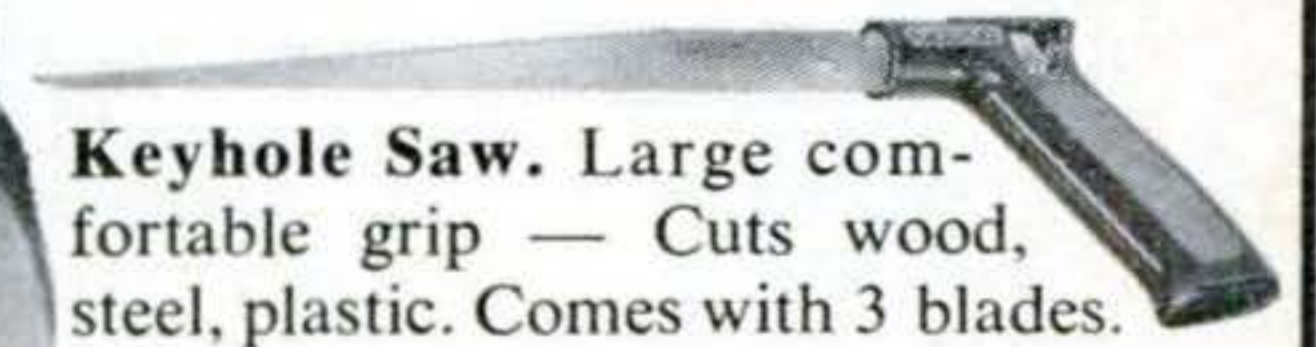
Combination Square. Handy shop tool . . . try and mitre square, level, plumb, depth gauge.



Tape. New chrome car-
tour de easily
tride



Keyhole Saw. Large comfortable grip — Cuts wood, steel, plastic. Comes with 3 blades.



All tools come in attractive gift-packages for Christmas.



Another gift problem solved by Stanley Tools, Division of The Stanley Works, New Britain, Connecticut.

STANLEY®



Du Pont's Slick New Teflon-S

[Continued from page 138]

In another test, reported by J. T. Loechner, marketing manager of the H. K. Porter Co., a coated pruning saw was stroked through highly abrasive lumber two million times. Results showed no significant wear or marring of the Teflon-S coating.

Porter also tested a coated saw by cutting part way through a yellow-pine beam that had been saturated with water and ammonium phosphate. While the cut was incomplete, the handle of the saw was bent perpendicular to the cut and the sawing continued—without any noticeable binding.

An invisible oil slick. "It's almost as if the blades were continually being lubricated by an invisible oil slick," says James Pyle, manager of the Haymore Corp., a Chadds Ford, Pa., tree-surgery firm that field-tested a variety of Teflon-S-coated tools. He estimated they eased sawing effort by 25 percent when pruning branches. The coatings virtually eliminate adhesion of sap and sawdust. "Normally we have to clean blades every two weeks to remove rust and gummy deposits," Pyle says. The test blades didn't need cleaning after more than three months of constant use, he reports.

The Wiss Company tested its new anvil pruner coated with Teflon-S on many green woods, including forsythia, oak, maple, willow, cherry, and hydrangea, ranging from 1/4 to 3/4 inches in diameter. The coated blade cut with less effort, did less bark damage, and showed considerably less face marring. This means faster healing and less likelihood of plant disease.

True Temper and O. Ames Co. have a line of tools with Teflon-S coatings including a hand pruner, lopping shears, snow shovels, grass and hedge shears. Wallace F. Reid of True Temper told POPULAR SCIENCE that the hedge shears had shown a remarkable ability to minimize sap buildup on blades. Nurserymen who tested the shears normally carry a can of solvent and steel wool to clean the blades of resin buildup as they prune, shape, and shear evergreens. The solvent and steel wool are unnecessary with the Teflon-S shears, Reid says.

These work-saving features have set

off a rush in the hardware industry to get the benefits on more tools.

This means that the do-it-yourselfer can find most of the commonly used tools with Teflon-S coatings—handsaws, for instance, normally tricky tools to handle for the infrequent user. But with a handsaw that has a Teflon-S coating, there's less binding, smoother cutting. Edges don't get damaged. Most of all, less physical effort is needed.

These benefits are already available on handsaws made by Disston and Great Neck Saw Manufacturers. Great Neck also makes back and compass saws with the coating.

Teflon-S-coated circular- and saber-saw blades are being produced by Simonds, Skil, and Disston.

You may recall coated pots and pans were many women with some of them. There were no rigid rules but they quickly changed by the giant chemical companies.

All tools are tested. Any manufacturer who's licensed to use Teflon-S products, either must conform to use Teflon-S coatings standards before he can put a certified product. Manufactured samples of every lot for Du Pont will permit Du Pont technicians to submit sam-

ple with microscopes and adequate coverage. The tools must pass the same tests to insure that the coating adheres to the surface. Ancient continuing. Du Pont doing the first batch, so you can get a properly coated tool you buy one with the official label.

You'll pay a slightly higher price for tools that are coated with Teflon-S—about 10 percent more on small tools and up to 30 percent more for large tools.

But slightly higher prices seem a bargain for the added ease and comfort you'll get from the tough slick new Teflon coating that has come out of the kitchen to do he-man jobs.

Du Pont's Slick New Teflon-S

[Continued from page 138]

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All tools are tested. Any manufacturer who's licensed to use Teflon-S coatings must conform to extremely high quality standards before Du Pont will permit him to put a certifying label on the product. Manufacturers must submit samples of every lot for testing.

Du Pont technicians inspect the samples with microscopes for imperfections, and adequate coverage and baking. Finally, the tools must pass tough destruction tests to insure that the coating film adheres to the surface. And these tests are continuing. Du Pont doesn't just test the first batch, so you can be sure you're getting a properly coated tool any time you buy one with the official Du Pont label.

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When a man gets a Stanley tool on Christmas he's like a kid with a new toy.



"Jobmaster"tm Hammer. Perfectly balanced, built strong for tough jobs.



Torpedo Level. Versatile, rugged — bottom grooved for use on shafts, pipes, other round surfaces. 3 easy-to-read dials.

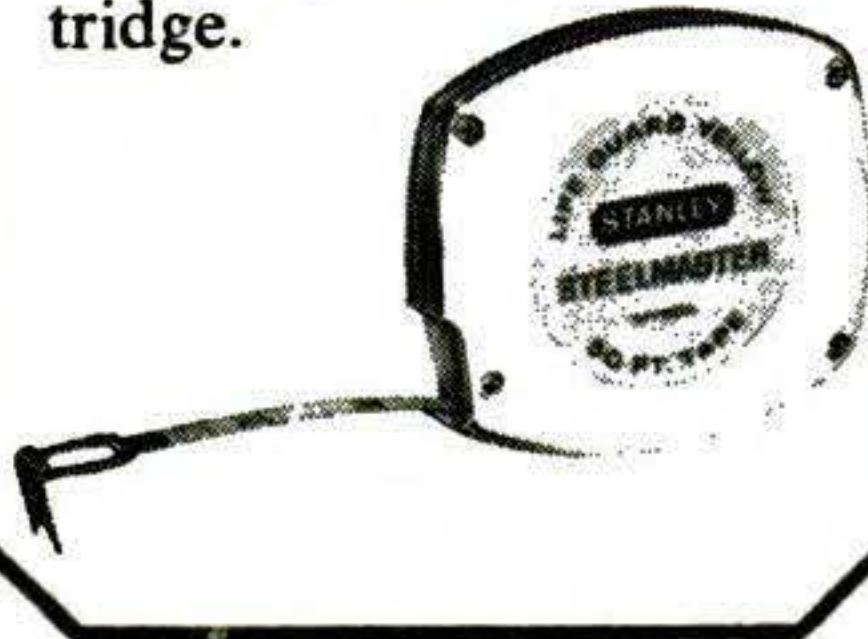


"Hex-A-Matic"tm Nutdriver. Handier than wrench, or conventional nutdriver. Automatically adjusts to fit 15 sizes of nuts and screws.

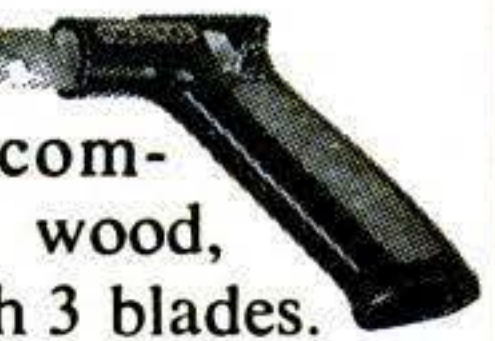


Combination Square. Handy shop tool . . . try and mitre square, level, plumb, depth gauge.

"Steelmaster"tm 50' Tape. New chrome-plated contour designed case with easily replaced blade cartridge.



Keyhole Saw. Large comfortable grip — Cuts wood, steel, plastic. Comes with 3 blades.

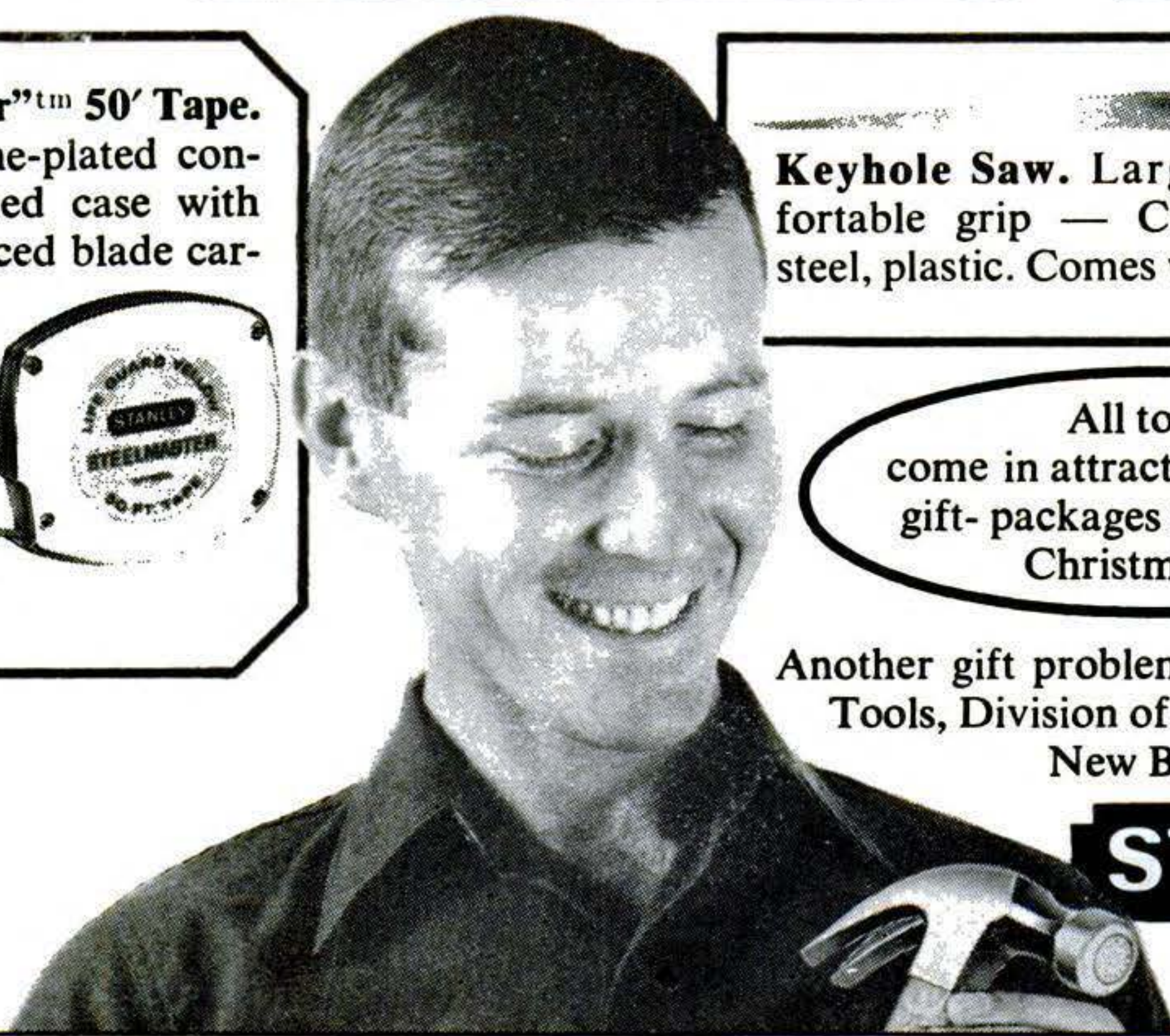


All tools come in attractive gift-packages for Christmas.

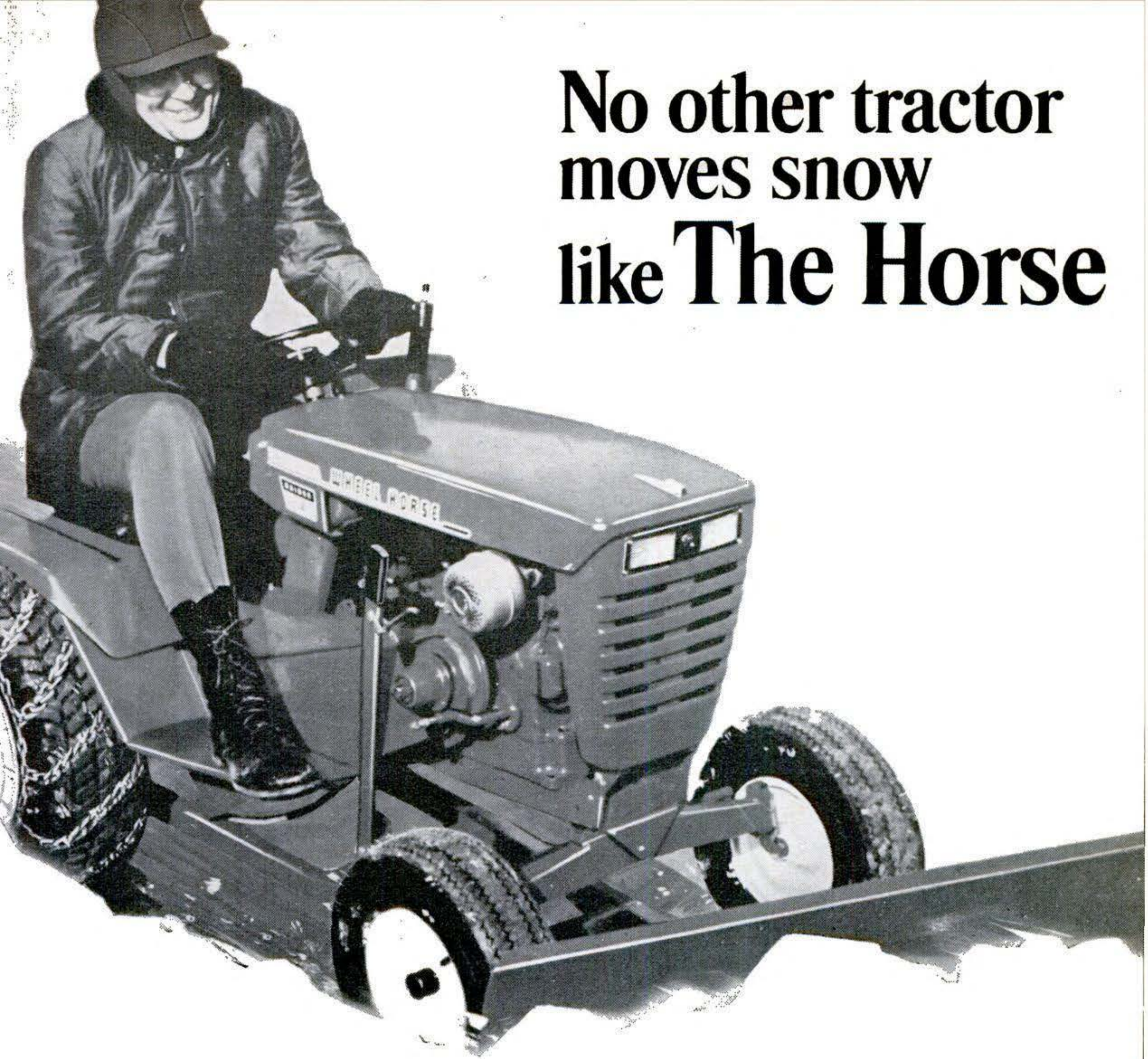


Another gift problem solved by Stanley Tools, Division of The Stanley Works, New Britain, Connecticut.

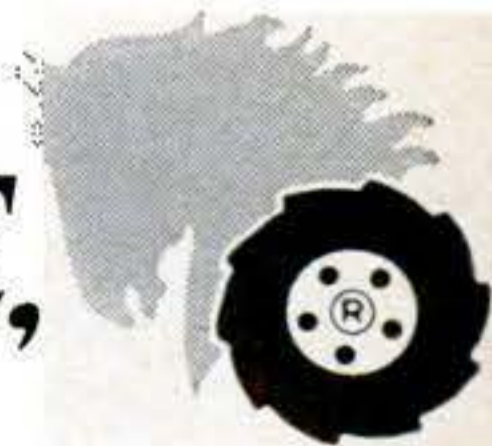
STANLEY[®]



No other tractor moves snow like **The Horse**



Get a Horse!
WHEEL HORSE,
of course!



HERE'S WHY: Wheel Horse packs the big power to move big snow in a jiffy. Gets life moving again. Plenty of selection, too! Eight Wheel Horses from 6 to 12 hp. Many with Transpower Differential to help take The Horse through slick spots. Less chance of bogging down. New safety headlights and taillights for before-daylight, after-dark snow removal. New winterized engine power—solid state ignition—plus a new quick response starting system built especially for subzero dependability. Choose blizzard-busting 37" snow thrower or 42" dozer blade. Wheel Horse attaching snow equipment takes charge of any snowfall. See your Wheel Horse Dealer. He's in the Yellow Pages. No other tractor dealer has a better deal. Write for free literature.

WHEEL HORSE PRODUCTS, INC., 502 W. Ireland Road, South Bend, Indiana 46614.

Amazing New Two-Stroke Radial Engine

[Continued from page 46]

these critical areas. The cylinder bores will live longer and the rings will seal better. The engine is quieter because combustion noise is lessened by the liquid jackets.

Injected fuel—without oil. The next obvious feature is that this is no ordinary two-stroke. Instead of mixing oil with gasoline, it uses a full-pressure, dry-sump crankcase. The timed, solid, direct gasoline injection into the combustion chamber does not foul spark plugs. It does allow positive starting along with economical fuel consumption.

Why radial? Conventional engines with overhead valves have abandoned radial types as having too much frontal area. But radials do offer the advantage of the very least hardware between the piston (where the power is generated) and the prop shaft—an obvious saving.

Since two-strokers require less displacement and have no valves in the cylinder head, their overall diameter can be kept small enough to take advantage of radial construction. With no cooling fins, the size is further reduced.

Two-stroke radial construction permits another important feature. As can be seen from the cutaway drawing, there is no master rod as in conventional four-stroke radials. All cylinders are in one plane for good balance. The slipper connecting-rod design can be used because there is no tension under normal operating conditions—and because it is a two-stroke. The forged aluminum-alloy rod is in compression at all times, except when standing or during the first half-revolution during initial cranking. To handle these conditions, a lip around the crankpin is used, but it does not contact during normal operation.

The single-throw crankshaft is of three-piece construction with the hollow, hardened crankpin shrunk into the two crank cheeks. The con-rod retaining lips are integral on each cheek, and a gate section is removed from the inside portion of the lip to insert the five rods. Even with the considerable counterweight required by the radial arrangement, the shaft weighs only 25 pounds.

Since this engine has an oil-lubricated crankcase and is a radial, scavenge air

cannot be pumped in the conventional two-stroke manner—that is, by using the underside of the piston and pressurizing the crankcase. In the McCulloch engine scavenge air is supplied by an exhaust-driven turbo-supercharger.

The turbocharger pumps adequate air under load, but for starting, light load, and rapid acceleration, an additional air pump is needed. This compressor is mounted directly on the crankshaft. It unloads above $\frac{3}{4}$ power, and by use of a four-way valve can supply clean, cabin-pressurization air. Exhaust gases drive the turbocharger at a maximum continuous speed of 75,000 r.p.m.

The accessories. An accessory-drive gear case is located on the front of the engine and each accessory can be removed separately.

Accessories in this case include: two magnetos with impulse couplings; electric starter with solenoid; high-output alternator with rectifier and voltage control; coolant pump; lubrication system with full-flow filter and scavenging capacity for the turbo; fuel system with primary pump, filter, high-pressure and timed injection pump, relief valve, and injection nozzles; vacuum-pump drive; tachometer drive; propeller-governor drive; and propeller-speed reduction.

This last feature is unique. Conventional gearing has been discarded in favor of multi-V belts (seven) and grooved pulleys. The belts are a new development of Gates Rubber, and to date McCulloch has experienced no trouble with them.

The TSIR-5190 has undergone several thousand hours of testing. This includes both bench and in-the-air time as the pusher engine in a Cessna 337 Sky-master.

That McCulloch believes in the future of the engine is amply proven by another imaginative project recently undertaken by the company's founder and president, Robert P. McCulloch. He's now busy building from the ground up an entire community, Lake Havasu City, located on the Arizona side of Lake Havasu. In time it will be the home of all the various McCulloch manufacturing facilities, including the plant where the TSIR-5190 will be built. PS



Give your wife a Bernzomatic Propane Torch for Christmas.
 (just to be sure of getting one)

Frankly, your wife may not appreciate a new Bernzomatic Propane Torch Attache kit. Even though she can use it to make jewelry, antique furniture, and brown the meringue on her pies. So promise her something else. A filmy negligee. Exotic perfume. Then, start hinting. Explain how a torch will help you

sweat and thaw pipes, lay tile, peel paint, and do a hundred money-saving jobs around the house. Mention how prices start at \$7.50 (pretty good when you figure every Bernzomatic Propane Torch is guaranteed for life). If she doesn't take the hint, threaten to buy her one. That always brings them around.

Lifetime Guarantee: The Bernzomatic torch burner is guaranteed for the life of the owner. When returned to our factory, it will be put in first class mechanical condition. It doesn't matter how the burner was damaged. We will either fix it or send you a new one free of charge.



BERNZOMATIC

My LSD Trip

[Continued from page 64]

come rational. But I'm slipping away, swinging up, up in a crazy-colored paisley spiral.

Before I came to Philadelphia Dr. Leary gave me another bit of advice. "Do you wear a wedding ring?" he asked. I do. "Why don't you prepare by spending 15 minutes thinking about that ring. It may mean nothing to you now, but *make it mean something*. Practice squeezing it between your thumb and finger, and as you hold it think of what it symbolizes—your wife and love and union and harmony—all good feelings. During your experience, when you get confused and feel flipped out, hold the ring and think. And remember, everything's on autopilot, and it's going to be all right."

I grab the ring and think of home—and I simmer down. It helps pull me to the calm center. The ring is alive, part of my finger, like the sun—also part of me.

12:15—*Subject bites arm (probably for recognizable sensory input). Drinks more OJ. (Altogether I downed a quart.)*

12:30—*Nauseated. Tries to explain things, but gives up. Continues to say "Wow." Very agitated.*

I feel I can see inside my brain. I think I can watch the LSD move into it, releasing enzymes, and the enzymes seep through the tissues.

1:00—*Indicates I am menacing. Sweating profusely.*

I think I'm in a padded cell, a free-form compartment with wobbly walls and doors with slits in them through which the staff is watching me writhe. Dr. Ray is in on it, and he knows I'll not come back. He'd abort the trip, but he's lost the chlorpromazine.

1:30—*Wants reassurances I'm real.*

I swing around again and Dr. Ray has turned to celluloid. I know because I can see behind him and he's just a shell. I reach out and poke him. Miraculously he jumps.

2:00—*Continues restless. Humming.*

Anything to hold onto what's real. I sing, and the song slows the pendulum. The song is Arabic, and very interesting. I'll try to remember. (I couldn't.)

2:30—*Up in chair for few minutes. Very unsteady. Back to bed. Appears*

nauseated, drunk. (Later, Dr. Ray said I looked so bad *he* got nauseated.)

If I can get up, get off this cot, maybe I'll stay conscious. I struggle up, helped by Dr. Ray, but my body won't work—too weak. I'm sick, so sick, so, so sick. Back to bed.

2:45—*Sitting up again and fighting. Seems to be coming out of it. Nurse enters; he's glad.*

I must stay conscious. I sit on the side of the cot jerking like I'm trying to keep awake at night while driving on an expressway.

Suddenly a nurse appears. She's a cute little girl I recognize from my ward. I'm delighted. "Where were needed you I when?" I ask cleverly, then realize it makes no sense. So I say, "There are the words; put them together as you like."

"Climb into my gondola," I continue. "Take off the uniform and we'll roll around on the padded floor of the cell." But she doesn't understand. She's one of the others, too.

3:00—*Up and walking about. Bathroom. Beginning to enjoy again and make wisecracks.*

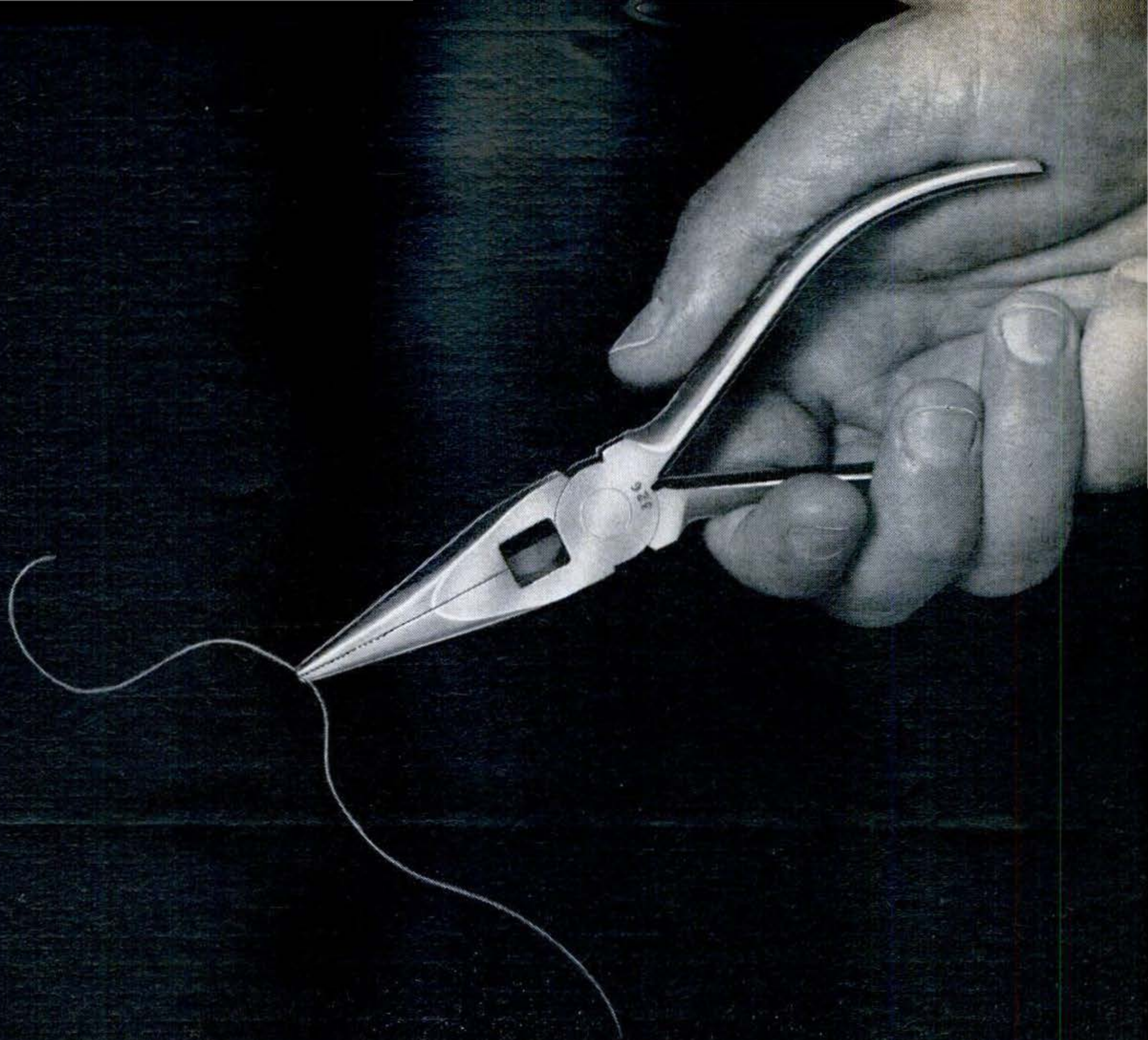
I think the nurse did it. I'm thinking outward again, and I have some control—at least enough to use the bathroom, as I've wanted to for the last two hours.

I make my way back again and sit on a chair, balancing. Dr. Shagass enters and I giggle at the way his pipe distorts his lower lip. "It's pretty spooky down in the recesses of the mind," I say. "There are monsters down there. But everyone is allowed a monster or two.

"Okay, you're dismissed," I say abruptly, and turn away to my own thoughts. But I have to be very patient with him, because he hasn't been here, either.

(Later, Shagass explained that he allows none of his doctors to experience LSD. "They lose all objectivity," he says. "Either they become violently opposed, or start to proselytize." When he first began the work, one of his resident psychiatrists did try the drug, but "then he and another staff member who had taken it promptly formed a club.")

The drug began to wear off quickly then, I felt. I paced back and forth, doing little dance steps, even though I was



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MEADVILLE, PA.

My LSD Trip

exhausted. I felt it must be early the next day. But it was only 5:00. Dr. Ray put me in the hands of the nurse and went home. He, too, had had a tough day.

In the ward dining room, the thought of eating was too foolish. I did have a cup of coffee, though, and it was the greatest of my life. As I held the cup the heat seeped deliciously down into my arms and up to my shoulders. I sat luxuriating in it while I watched the astonishing fluorescent yellow cup and the rich brown of the coffee. Then I tasted it—almost too good to stand.

I couldn't stay seated. I got up and did a few delightful pirouettes—who cares about people watching?—then noticed that the chair I was waltzing by was gently rising from the ground. I delicately pushed it back down. It rose again. I had to sit on it to keep it still. But no one else noticed, which explains the fact that I was the only one giggling.

Stage III—CONTEMPLATIVE

I'm not an introspective person. If I haven't something to read in idle moments, I'm pretty unhappy. But as the seventh hour of my flight approached I went outside (and realized that outside was where I wanted to be the whole time) and lay on the grass (unbelievably green, amazingly fragrant) and watched the sky for two hours without moving. This is the mystical time, the period during which people have religious experiences. I didn't, but as the clouds passed I felt I was a part of them, and I knew that I and they and the earth and grass were one. I looked into infinity and my ego dissolved into—and became an integral part of—a whole. And suddenly I knew what paleontologist David Techter meant when he wrote, "How many persons will be willing to go to church to *hear* about God when they can *experience* God through a psychedelic drug?"

My time sense was still haywire. I saw a guy walking away, then turned my attention to the sky for 20 minutes or so. When I looked back he had traveled only 10 feet.

The sunset, by conventional standards, was probably dull—varying shades of gray. But to my new eyes it was gor-

geous. I think I'll never again see sunsets the same.

This period wasn't all pleasant. Once I rolled over and looked at the back of my hand. I was horrified to see it was an old man's hand, my father's hand wearing my ring. That day I aged.

Back in the ward later (in my 10th hour) I sat quietly detached in a corner watching my fellow patients. They were in varying stages of mental illness—some appearing almost normal, others in near catatonia—but all deeply troubled. I looked at them and suddenly realized that I knew what they were going through, because earlier that day *I was there*. My reality returned, but theirs continues to rush past, too fast to clutch. The knowledge was almost too much to bear. I left the room.

Stage IV—REASSESSMENT

I was worried. As I ended my 11th hour, the psychedelic cliché "It doesn't matter" kept swimming in my head. I thought I should be making notes or outlining or reading. But then I thought, "But why? It doesn't *matter*."

I became aware of a deep, newly revealed disenchantment with the values of my generation, an awareness that the principal drive is that of greed, and that our affluence comes from the mass cult of selfishness and bigotry and duplicity. Is this what the flower children see, I wondered; is this why they switch to open, simple, idealistic ways? Is theirs a revolution against the fast buck, the tyranny of company-think, the demands of status, the immoral killing in wars?

That night, even though I was exhausted, and even though Dr. Ray had given me two sleeping pills, I lay staring for hours at the darkened ceiling, my thoughts tumbling too fast for sleep.

What about tomorrow? Will things again matter?

They did, and do. In the morning I continued to feel strange and contemplative. But I began to make notes.

And yet a phrase continued to run through my brain—something I had thought the night before: "They've taken me all apart and now I have to put myself back together again." Some of the pieces still don't quite fit. PS



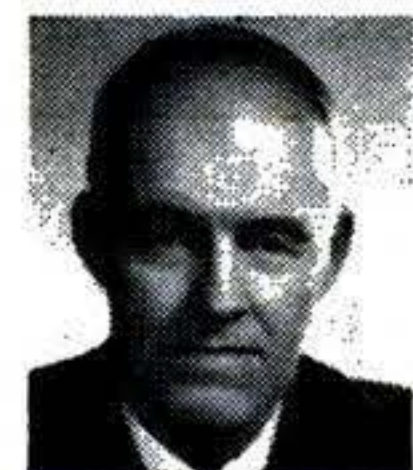
As a Broadcast Engineer, you earn a man's pay putting glamorous TV and radio entertainers on the air, covering sports and news events.

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tions will be started, with unlimited opportunities for Broadcast Engineers.

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How to Buy the Right Snow Thrower

[Continued from page 135]

- Can you change chute-discharge direction easily? A handle-mounted control helps the turnaround.

- Independent wheel and blower drives. With the limited speed range of typical medium rigs, you'll sometimes want to run the auger at full throttle while hand-controlling forward travel.

- Safety. Pass up blowers with exposed gears, sprockets, belts, and chains. With snow in your face, it's easy to get a mitten caught in the machinery.

- How big are the drive wheels? The bigger and fatter the better.

- Are chains provided? They're standard on many self-propelled blowers.

- Take a long, hard look at throttle and control linkages, handles and grips. Lightly built and poorly rust-protected parts suffer much more than on summer equipment. While someone stands on the front edge of the scoop, bear down on the handles. You'll apply the same loading when hogging into a frozen drift.

From five horsepower up. In this lineup, you'll be looking at fairly sophisticated equipment. Keep an eye out for:

- Choice of gears or forward speed ratios independent of throttle. For fast routine snow removal, you'll want a good brisk walking speed, about 2½-3 m.p.h.; for harder going, a slower pace and more push; and for real drift chewing, a low-low range. Top blowers have three or four forward ratios, one reverse speed. In my experience the greatest single secret to a quality blower is the proper speed ratios of auger, blower (if two-stage), and forward motion coupled with proper machine balance.

- Handle-mounted, constant clutch control for instant speed shift, for quick reverse, for safety in parking and handling, and for inching into a tough cut.

- Clutch lockout of "deadman" type or a positive lock.

- Fast, rugged chute control.

- Differential action on drive wheels while turning. An Ariens option: a differential lockout that functions much like a nonslip rear end in a car.

- Electric starting—at least as an option. You may want it later.

Some buyers feel that the cost of a big blower warrants summer as well as

winter use. They have engine and drive train—why not use it? Ariens offers ready conversion. Or you may prefer a single-stage over a two-stage blower. The makers cite advantages on both sides.

Tractor-mounted accessories. Both blowers and scrapers are highly practical. Swath widths for blowers range from 32 to 42 inches; for trip-mounted blades, from about 42 to 54 inches. Normally, you're confined to units made specifically for your tractor. When buying a blower or a blade, it's a good idea to get wheel weights and chains.

If you're buying a tractor and the snow-removal function is important, be sure to try it with the blower or blade in place. And look for:

- Convenient attachment and removal of blower or blade. A bag of nuts, bolts, spacers, and lock pins is difficult to keep track of from year to year.

- A well-engineered power drive to the auger. Look for splined drive shafts, chain and sprocket, or other mechanical solidity. Avoid open and exposed belts.

- Easy raising and lowering of the blower or blade. A good control takes little effort and is precise. It should allow any position from down pressure from tractor weight to free float or high lift for transport.

- Availability of a shelter cab. When you're riding in a chill wind laden with ice crystals, a cab is worth having.

An outstanding development for tractor-mounted snow movers is John Deere's hydraulic control: With the flick of the finger, a blower or a blade is raised or lowered to just the right height.

The electrics. These make sense to a lot of people. All fall into the small and medium lower range. Some are two-handle blowers for alternate shovel or push use. They weigh in at a trifle over 25 pounds. In the single-handed type, at least one make offers such items as headlights, the equivalent torque of a three-hp. engine, and self-propulsion. For safety, electrics require proper grounding. The circuit and fuse must be able to handle the 15-amp requirement comfortably. If you're buying an electric, arrange for such a circuit—and an outdoor outlet at a convenient location. PS

The how-to-glue chart.

Type of Material	Glue For General Usage (In Order of Preference)	Glue For Maximum Waterproof Durability (Boats, Exterior Construction, etc.)
All general gluing of hard and softwoods	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All	Elmer's Waterproof Glue
Particle and chip boards to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement Elmer's Glue-All	Elmer's Waterproof Glue
Plywood to decorative plastic laminates	Elmer's Casein Glue Elmer's Contact Cement Elmer's Plastic Resin Glue	Elmer's Waterproof Glue
Laminating heavy framing members	Elmer's Casein Glue	Elmer's Waterproof Glue
Veneering, inlays, cabinetwork	Elmer's Plastic Resin Glue (extended) Elmer's Glue-All (small jobs)	Elmer's Plastic Resin Glue
Bonding oily woods (teak, pitch pine, osage, yew, etc.)	Elmer's Casein Glue—sponge surface with dilute caustic soda one hour before gluing	Elmer's Waterproof Glue
End-wood joints, mitered joints, scarf joints	Elmer's Glue-All Elmer's Plastic Resin Glue (heavy mix)	Elmer's Waterproof Glue
Loose-fitting joints, relatively rough surfaces	Elmer's Glue-All Elmer's Casein Glue (heavy mix)	Elmer's Waterproof Glue
Doweling	Elmer's Plastic Resin Glue Elmer's Glue-All	Elmer's Waterproof Glue
Hardboard to ply- wood, wood or itself	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing porous mate- rials—linoleum, can- vas, etc. to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing plastics, metal foil, etc. to wood	Elmer's Casein Glue (sand both surfaces)	Elmer's Contact Cement
Gluing non-porous materials— glass, metal, iron, aluminum, bronze, brass, etc.	Elmer's Epoxy Glue	Elmer's Epoxy Glue

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**BORDEN
CHEMICAL**

"I'll Cheat You If You Don't Watch Out"

[Continued from page 79]

high number—above five—so the number you want to show will very rarely be scratched. However, it does happen, especially on cars to be reset only 10,000 to 20,000 miles. But since you're only turning the first number, it will be at least a year before a scratched one appears.

You'll find scratched numbers turning up more commonly as more artists appear. Most dealers will accept sloppy work since few individuals recognize the reason for the scratches. Their attitude is almost one of defiance—as if they believe the public will not want to be involved in any legal action. Of course, the vagueness of the laws in most states gives them a great advantage.

Signs that clue you in. The first sign to look for in a used car is scratches on a number or spacer. Any scratches were put there by a pick. There's nothing in a speedometer that could mar the numbers. If you find scratches, you can usually find other signs of high mileage. Even if no scratches are evident, they may appear later. If you can get no information on the car's background, it is wise to have the entire unit removed for an examination of the complete odometer drum.

There are also signs you may find on particular models. The most common way of gaining access to the odometer is through the tube behind the high-beam indicator. Remove the bulb and, using a match or one finger, check for holes or other damage to the tube. Damage indicates only one thing—a pick was introduced to reset the mileage. It sometimes happens that the entire tube gets pushed down into the speedometer unit. This will allow the bulb to shine directly through the instrument panel—so try the instrument light in a dark or shady place. If the tube is properly in place, you should get a red glow from the indicator, not a yellow glow. Access through the tube is used by all artists on the following cars:

- Buick Special1961-62
- Chevelleto 1964
- Chevrolet1957-58
- Chevrolet trucks1960-64
- Chrysler1960-62
- Comet1965-66
- Corvairto 1965
- Corvetteto 1962

- Fairlane1965-66
- Falcon1964-65
- Ford1963-64
- Mercury1962-64
- Mustangall years
- Olds F-851961-62
- Oldsmobile1957-58
- Pontiacall years

On some late-model cars, the tube was replaced with a plastic bubble or tube. The odometer is reached in the same way, but the pick is heated with a small propane torch to burn its way through the plastic. You'll find this damage on 1965-66 Fords, 1963 Olds, and late-model International trucks. A variation of this method is used on 1959-60 Chevrolets. The pick is introduced through the left-turn-signal tubes on these models.

On other models, it's necessary to punch a hole in the speedometer case behind the numbers. The hole will be to the right and above the speedometer cables. Using a flashlight, examine these cars for an entry hole:

- Chevelle1965-66
- Chevrolet1964
- Chevrolet trucks1965-67
- Chevy IIall years
- Chrysler1963-64
- Corvair1965-67
- Corvette1965-67
- Falcon1962-64
- Oldsmobile (except '62)1960-66
- Plymouth1962-64
- Pontiac Tempestall years

On printed circuit:

- Buick Special1963-66
- Oldsmobile1962, 65-66
- Olds F-851963-65

Below printed circuit:

- Chevrolet1965-67

Under left corner of unit:

- Dartall years
- Valiantall years

Behind odometer:

- Buick1966

On Cadillacs for 1961-62 look for a hole on top of the unit directly above the odometer. The dash pad must be removed to see it. This can also be found on some 1965-66 Plymouths. Usually the holes are left uncovered, but sometimes electrical tape or fake inspection stickers are slapped over them.

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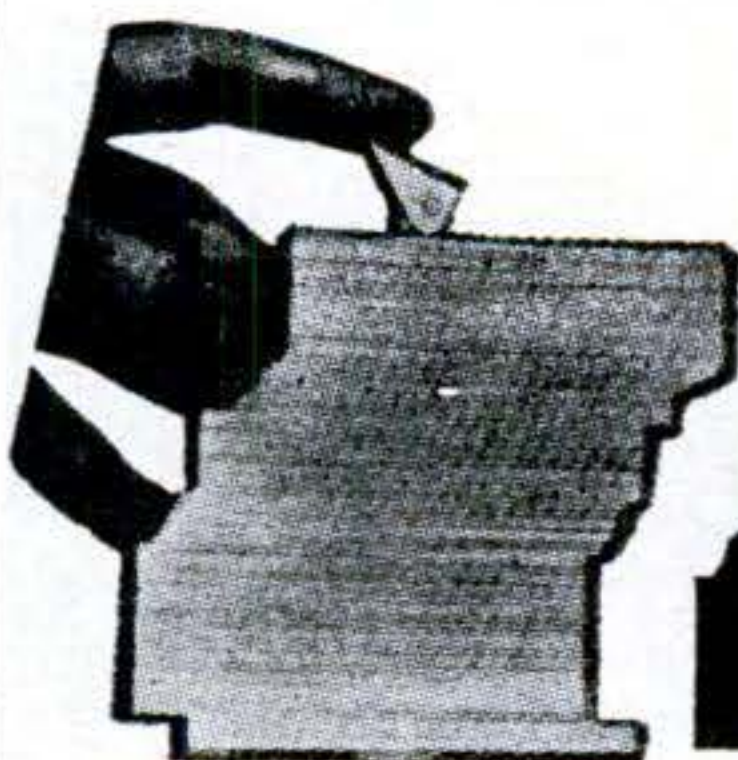
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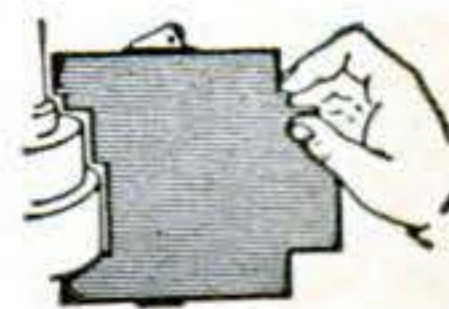
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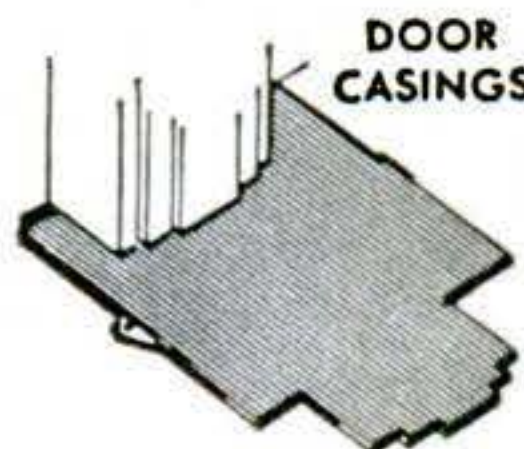
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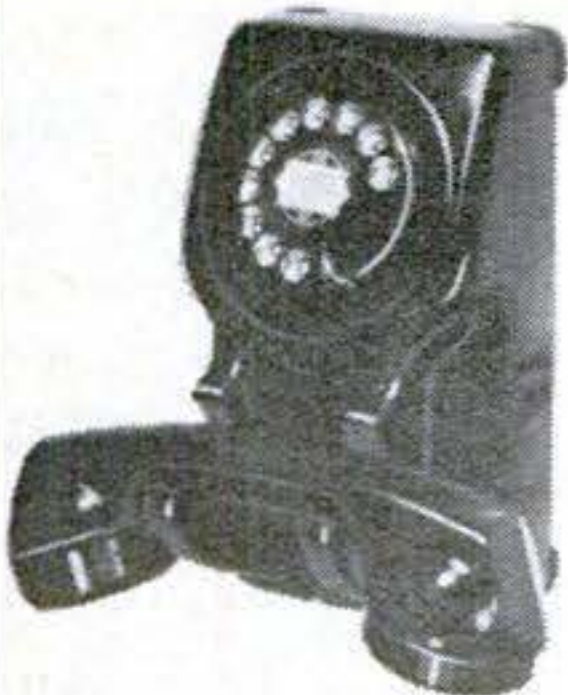
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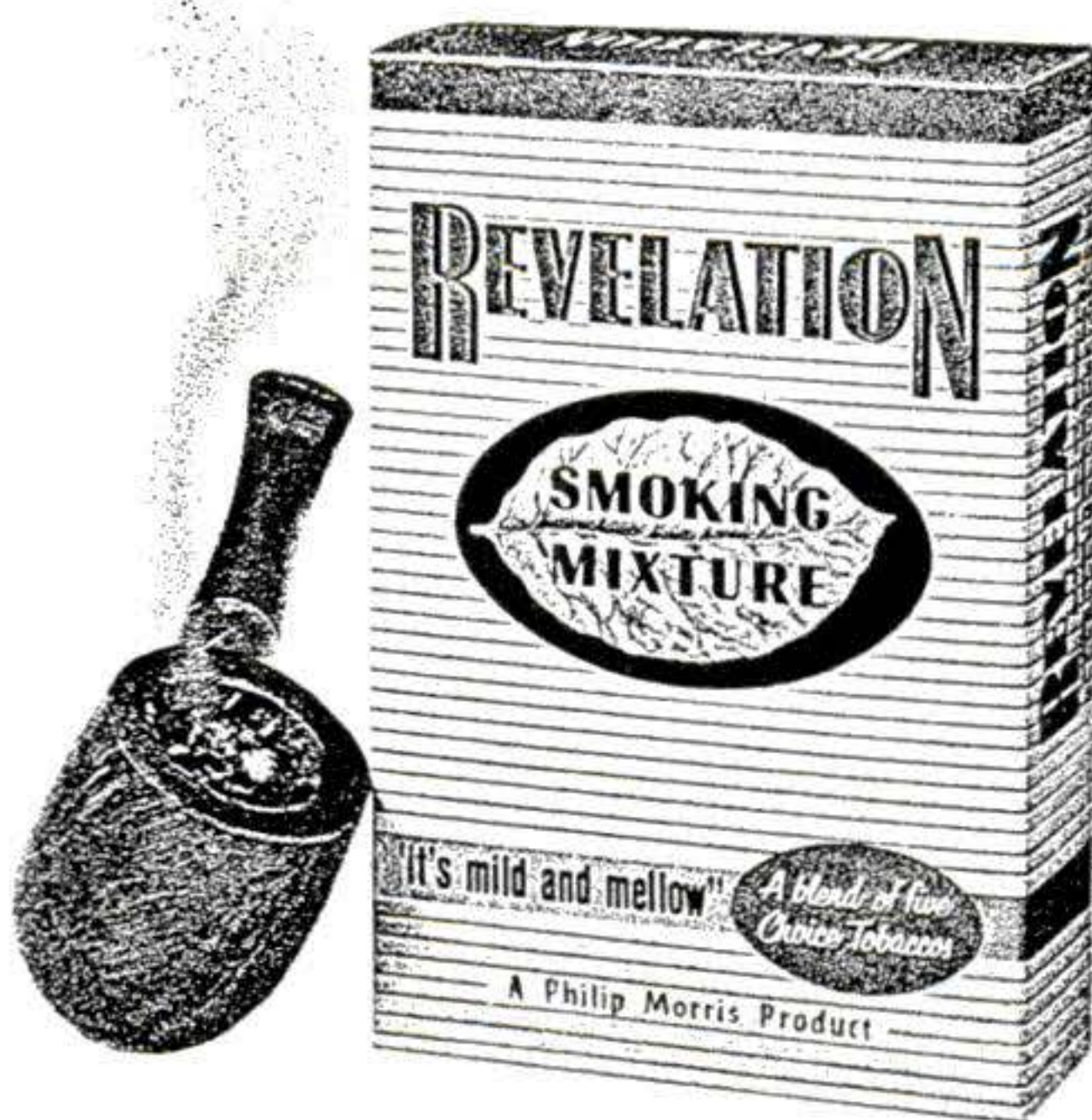
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"I'll Cheat You If You Don't Watch Out"

There are numerous models with illumination lights that give accessibility to the odometer, and have no tubes. On these, you'll have to rely on scratched numbers or spacers as evidence of resetting. In this same group are numerous cars with a speedometer face that lifts off, or an entire unit that can be removed easily (look also for missing screws and other fasteners on these). Modes of access line up like this:

Through odometer-bulb socket:

Buick1962
Chevrolet1961-63
Oldsmobile1959-62

Through face:

Buick1963-65
Comet1960-63
Falcon1960-63
Lincoln1961-63
Olds F-851965-66
Rivierato 1966
Thunderbird1958-63

Removal of unit (5 min.):

Dodge1965-66
MGall years
Triumphall years
Volkswagenall years

The 1961-62 Plymouths are reset by spreading the case (held by four screws) and picking from directly above.

Although the use of the ice pick is a new twist, you'll still find one venerable and common sign—the absence of oil stickers. The price for resetting includes removal of oil, air-filter, and spark-plug stickers, and any other signs of high mileage. If you've already bought a car and you now find these signs, I would suggest an effort to locate the original owner.

What you can do. This will depend largely on the state where you purchased. And you'll need all the proof you can get. If you can establish substantial proof, go to your district attorney. In some states you can file criminal charges on one definition of theft—obtaining money by fraudulent misrepresentation. You can also check with your Motor Vehicle Commission. In any case you'll need legal help.

You have one advantage—most dealers absolutely do not want the publicity. If you haven't bought yet, point out suspicious signs to the car dealer. You might even recommend this article to him—he should find it interesting reading. **PS**



Take-apart bike assembles in seconds

You can adjust this portable bike to fit precisely a six-foot man or an undersize eight-year-old. Push a button and flip a couple of levers and it comes apart for easy stowing in a car trunk, boat, or hall closet. The Commuter II is imported from Holland by Columbia. A single-speed version sells for about \$80 and a luxury, three-speed model for around \$90. Overall length assembled is 58 inches, wheelbase 37½ inches, and weight 37 pounds. The bike has a rigid, press-formed square frame and tubular forks.



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Short-EE Skis . . . Short Cut to Fun

[Continued from page 110]

head across the slope, and then turn once more so that you're heading down again. There's a dual purpose behind this fun gambit. You learn turns at the same time that you learn to control speed.

There's another nifty called the Cha-Cha-Cha. For this you make two big hip turns followed by three ankle turns. To a standard cha-cha-cha dance beat you build up a sense of rhythm and develop maneuverability. Lots more fun than the standard variety of ski exercise—and you don't even need bongo drums.

There are some things you can't do on Short-EEs. If you want to race, for example, put your money on the other guy.

Deep snow. I found out the hard way that deep snow can give you trouble. Coming down a hill, I picked up a little more speed than I intended. Thinking it would slow me down, I headed for the deep snow at the side of the trail. The tips of the skis caught and—*ka-voohm!*—I went right over the front ends and landed face down in the snow. If I'd been on long skis, I'd probably have broken an assortment of bones. As it was, I just had the wind knocked out of me.

There isn't enough ski to rack and twist usually vulnerable leg bones. Research by Dr. John Outwater Jr. at the University of Vermont confirmed this.

To cap the day, a group of us decided to ski—not ride—back down the mountain. The terrain had the mild slope of an open-air elevator shaft. I screamed for Clif. He took me by the hand, held me upright, and talked me down that cavern, zig-zagging with me across the face of the slope. That's another advantage of Short-EEs. With no poles to fuss with, the instructor can hold your hand and help you through the rough spots.

The trail was about two miles long, but I got the distinct impression that somebody was continually piling more mountain in front of me. Later, while we trudged the last few steps to the lodge, Clif tossed in his little surprise: The trail we'd just come down had been built for the 1960 Olympics! After only two days on skis, a thing like that can set a man up for weeks. I felt like a modern-day Hannibal on the down side of the Alps. [PS]

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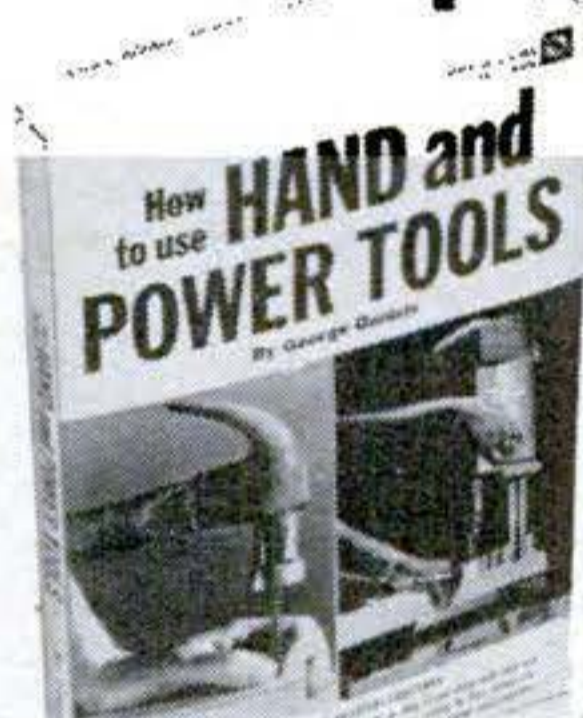
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Your Best Buy: a 3/8" Drill?

[Continued from page 132]

can be found at the nearest hardware or building-supply retailer. But to buy an industrial tool, go straight to a mill-supply outlet. One exception: Stores with their own line (Sears, Ward) keep both categories in stock.

Still undecided? Check the chart for other considerations: safety features, gear reduction, even cord length. That can be important in a shop with limited outlets, where a skimpy cord means dragging out an extension every time there's a hole to be drilled.

Note the size-weight ratio and mentally measure each tool against the jobs you're likely to do with it. If you anticipate a lot of limited-clearance drilling, you won't want a casing that's a foot long or has a D handle; and if your work is mostly overhead, check the weight. Go out and test the heft of the tools you're considering. Different casing designs and handles appeal to different hands, and proper balance can make any job go faster and easier.



Some drills come equipped with an auxiliary handle; some don't. Ward's model 9220 has an extra position at the rear of the drill. Look for this feature if you plan on a lot of heavy drilling.

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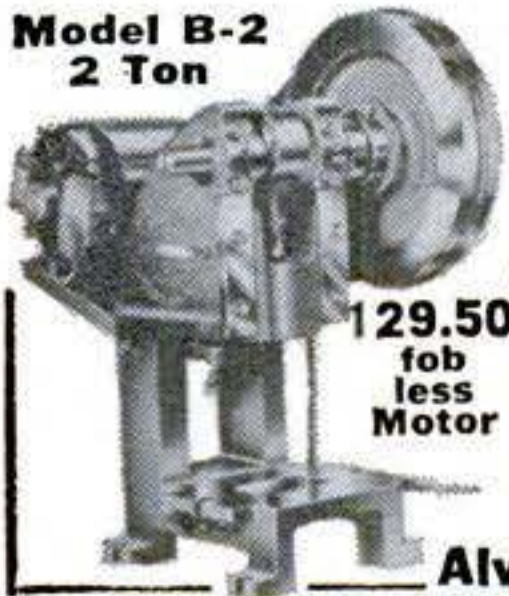


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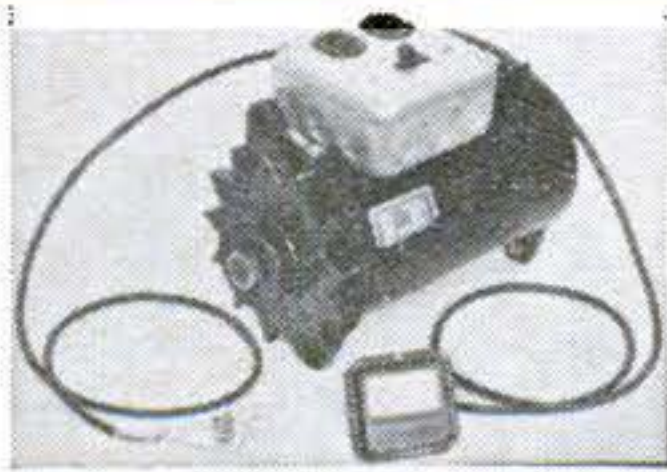
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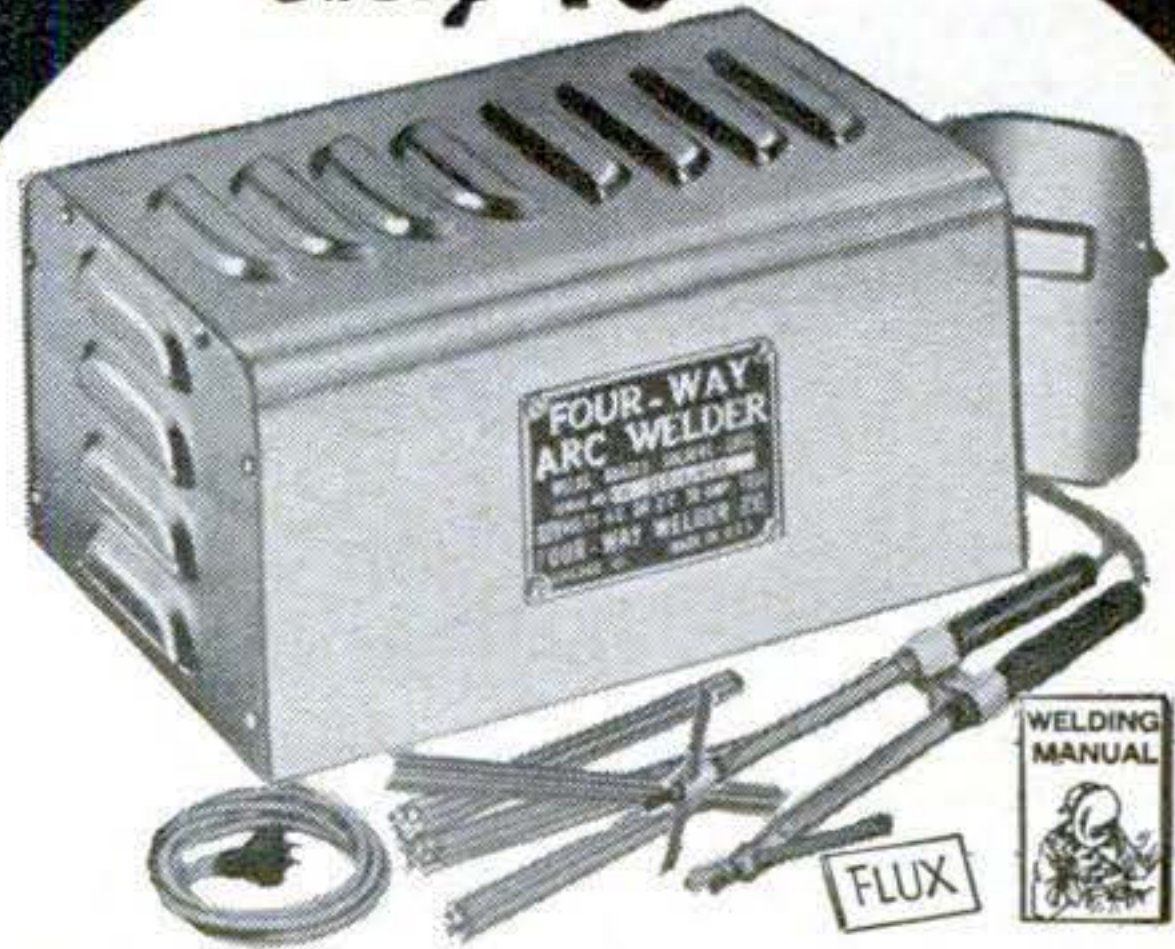
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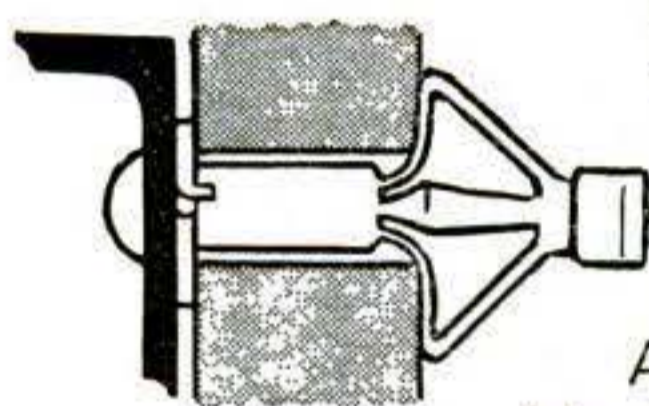
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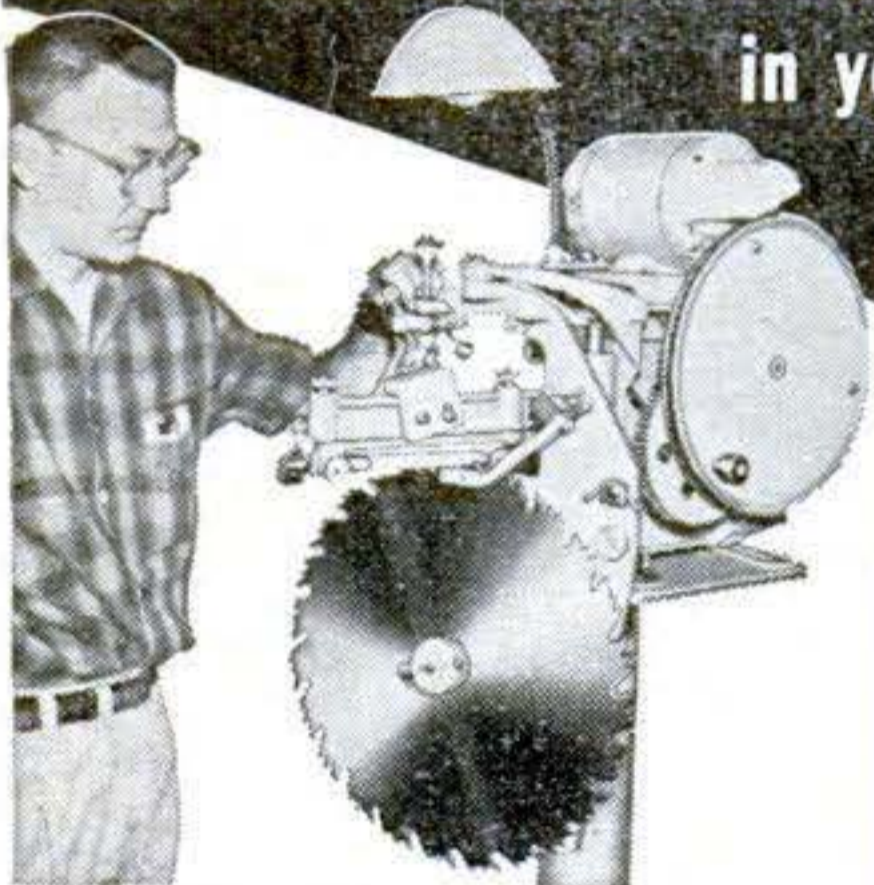


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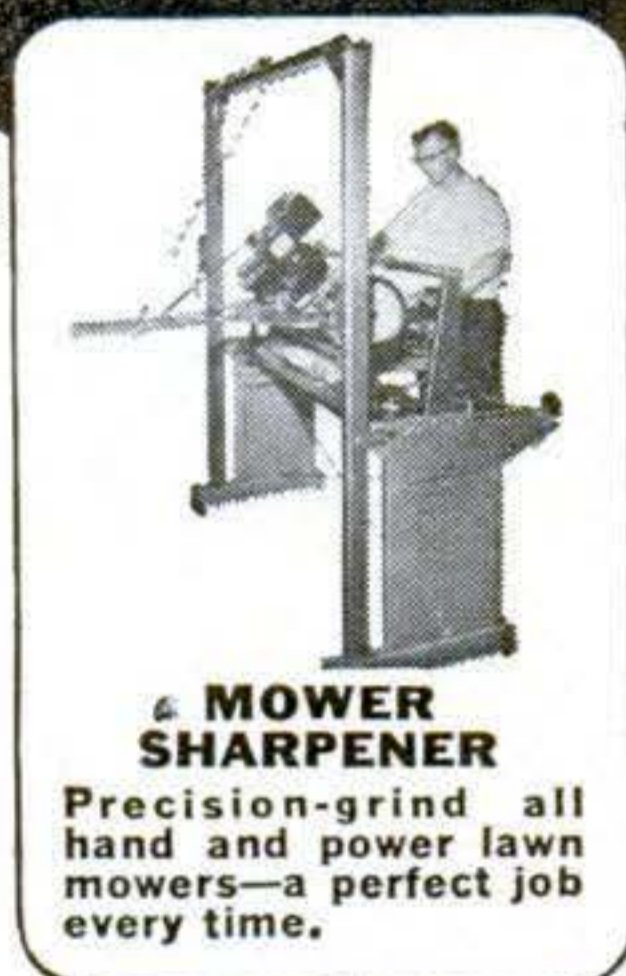
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Snowmobiles Start New Camping Craze

[Continued from page 150]

vice. It produces 4,300 BTU on seven ounces of Sterno, and when you put it on its back, it becomes a two-burner cook stove. Whatever type of heater you use, remember it burns oxygen. Even though the tent fabric "breathes," it's a good idea to leave one flap open a slit for an adequate air supply.

Lighting. Winter days are short, so it's handy to have a lantern in your tent if you want to see what you're doing after dark. Choose a lantern that uses the same fuel as your stove or heater.

Stoves. One of the roughest parts of any camping trip is starting a fire in the morning to make coffee. A small gasoline or propane sports stove lets you reach over and light up while you're still in your sleeping bag.

Clothing. Most important are good boots and gloves; if you can keep your hands and feet warm, you'll generally be comfortable. Face covering is another must item. A ski mask or a 3M facial protector will keep your face warm and protect your lips from wind.

All this equipment can help make things comfortable after you've pitched camp. But picking your site is just as important. Select a site that is sheltered (like a thicket of evergreens) and that will screen you from the wind.

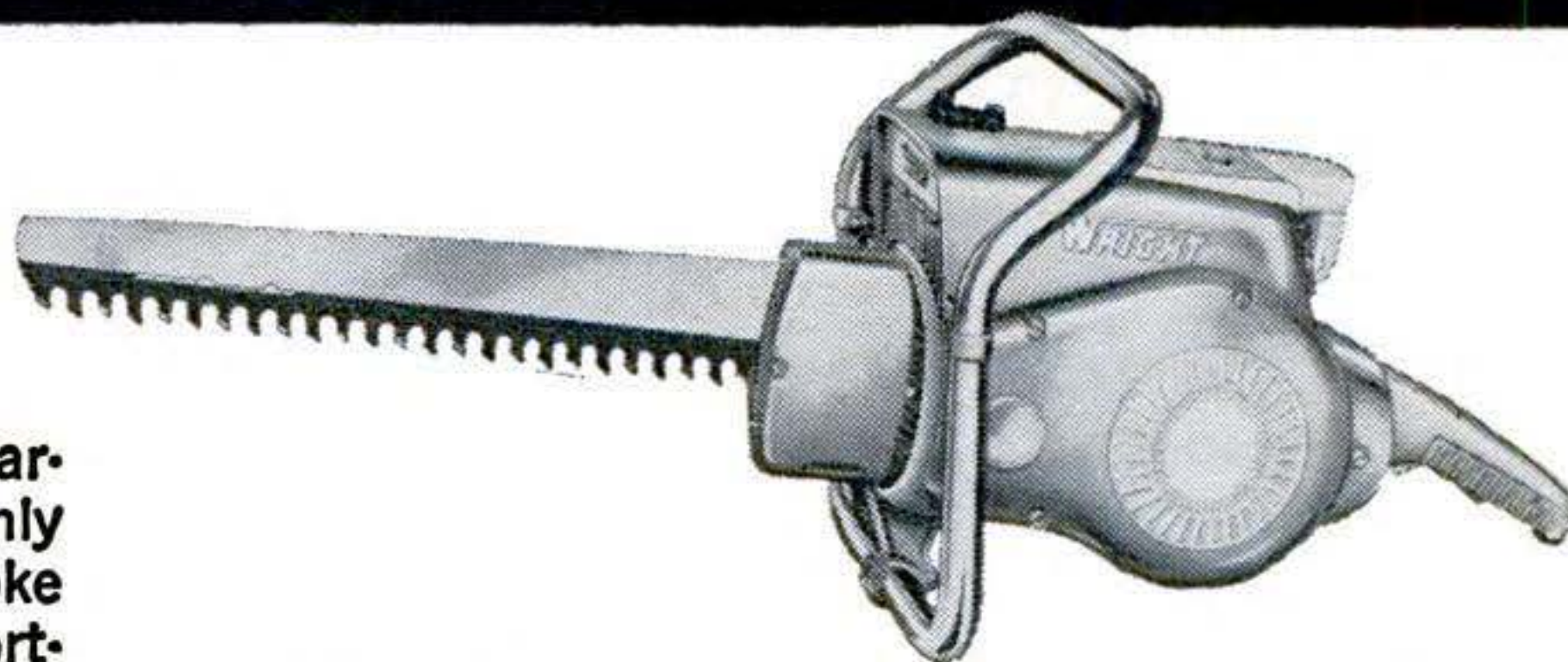
Be prepared. Even if you're not going into the wilderness, but contemplate traveling in a park, remember that facilities will be shut down. So carry everything you'll need, including some water.

Don't travel into areas you're not fully equipped to handle. Camping in the wilderness is rough at any time, but it's especially tricky in the winter. Even so, the number of winter campers is growing steadily. To accommodate this growing army of sportsmen, thousands of miles of new camping trails have been opened for winter use in the Northeast, across northern Wisconsin, Minnesota, Michigan, and Montana, and in several national parks, particularly Yellowstone and the Tetons.

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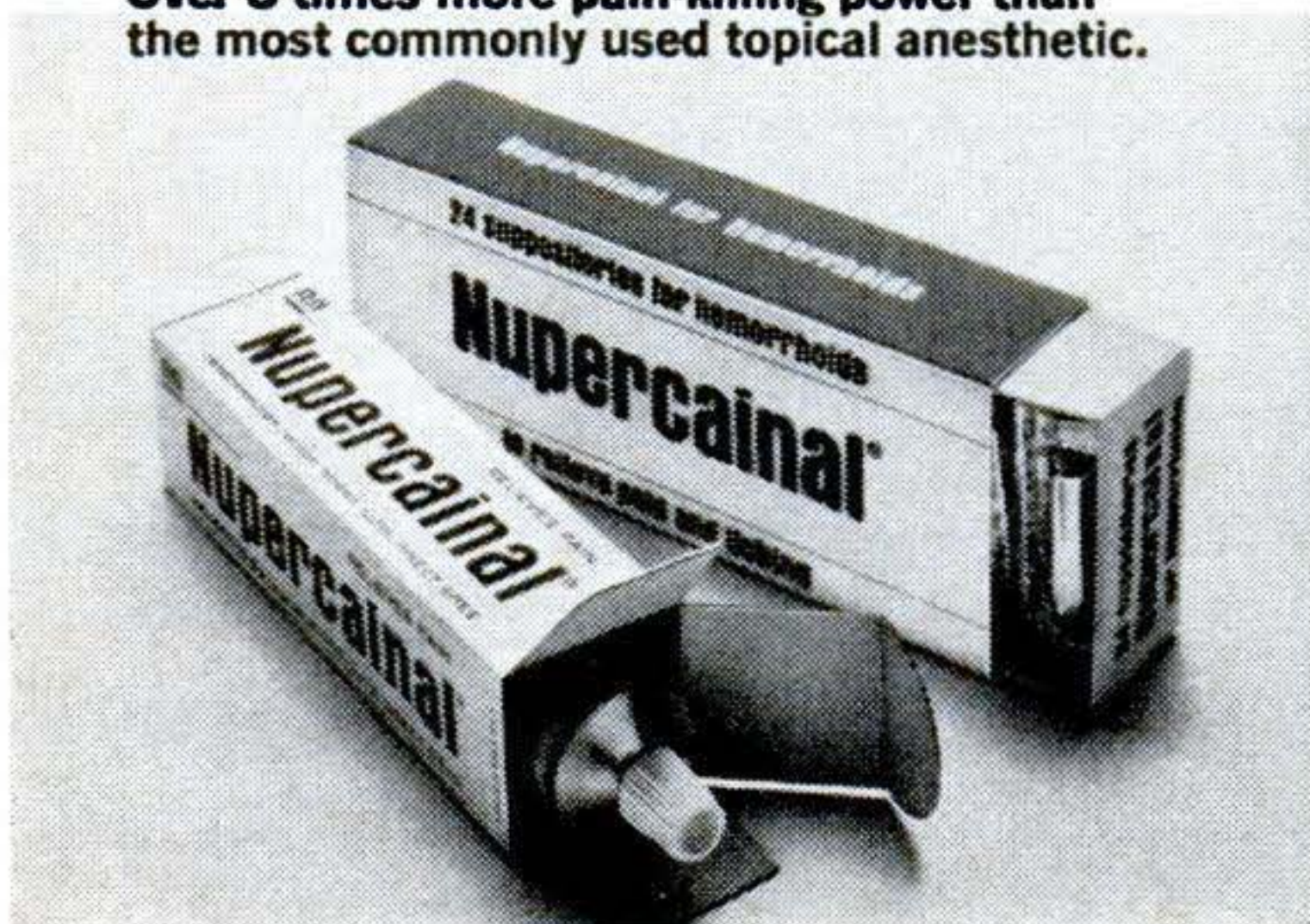


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Smart Way to Check a Camera Shutter

[Continued from page 107]

its scanning to the bottom, the other where it has begun its next scanning pattern at the top. To insure one complete top-to-bottom diagonal, you should take at least four pictures of the screen. For those cameras with focal-plane shutters that move vertically instead of horizontally, it is necessary to rotate the camera 90 degrees when making the exposure.

Now, here's the procedure:

- 1) Load the camera with Tri-X.
- 2) Set the aperture to $f/4$.
- 3) Turn on the TV set and let it warm up for a few minutes.
- 4) Tune in the channel that gives you the clearest picture.
- 5) Turn up the brightness control and turn down the contrast to give the sharpest scan lines.
- 6) Use a tripod for sharpness, and move in close to get the largest image possible.
- 7) Shoot at least four shots at each shutter speed you wish to check.
- 8) Keep a record of the shots.

I chose five speeds for checking: 1/1,000, 1/500, 1/250, 1/125, and 1/60.

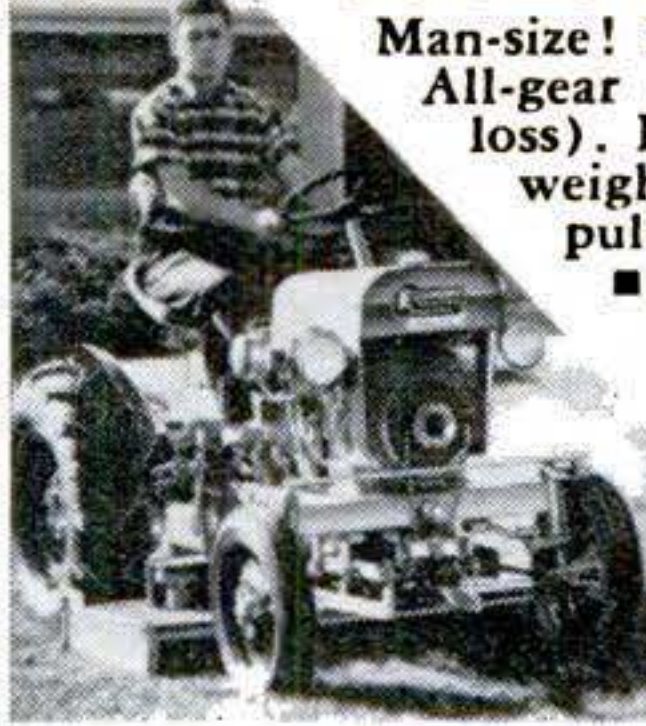
No prints needed. It is not necessary to make prints in order to count the lines. You can project the negative with an enlarger; or, if you don't have a dark-room, you can have your negs bound in ready-mounts and project them with a slide projector. Counting the lines is usually easy—although you'll need a magnifying glass on your contact prints.

To find your shutter speed, multiply the number of lines by 1/15,750 and convert the resulting fraction to thousandths of a second—or use the table at the beginning of this article.

What about speeds between 1/30 and 1/60, where one pattern of scan lines has already been filled in, and the next beginning pattern appears as a white diagonal on it? Just measure the height of the stripe at one point, move over to the left (or right) in a clear area, and count out the corresponding number of lines. To the speed you come up with, of course, you add 1/60 of a second (for the first scan pattern), to get the true speed. Or, if your addition is shaky, just think of that figure as the amount by which your 1/60-second setting is slow.

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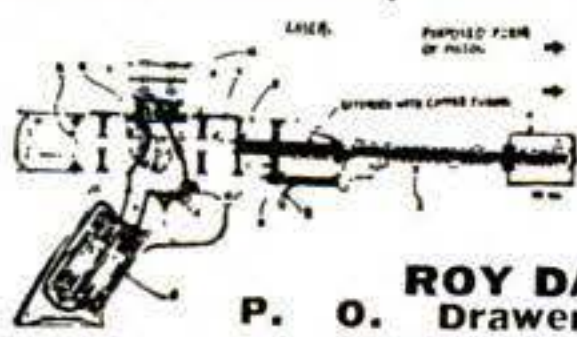
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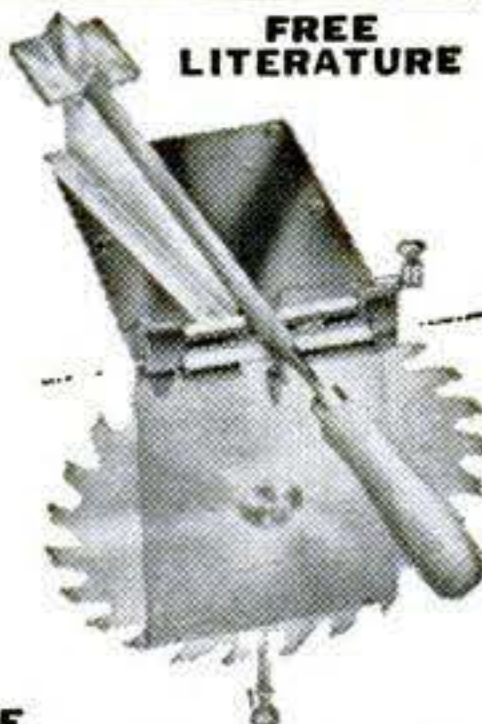
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[Continued from page 71]

been considered the inevitable ravages of time and the elements, mothballing hung upon the Navy's key discovery that the air's humidity was an inactive vessel's worst enemy—and that keeping it below 35 percent was the secret of preserving a ship an unlimited time. The brilliantly successful technique adopted was no static one, but a dynamic method with active machinery.

To mothball the New Jersey, workers sealed every opening to the outside. They divided the interior into zones and equipped each one with an automatic dehumidifying plant. By way of hoses and ducts, blowers kept circulating air dried by passage through canisters of silica gel or activated alumina, which were renewable by heating. Linked to this system were the big-gun turrets. Other outside equipment was encased in weatherproof sheet-metal domes (which had superseded plastic "cocoon" tried earlier) and kept moisture-free by charges of silica gel replaced at six-month intervals. Inside and outside the ship, too, a film of rust-preventing compound was sprayed on all bare-metal surfaces, such as the insides of turbines and boilers.

Now, the unsealing. Reactivating the New Jersey thus began with removing steel plates that had sealed her stacks, ventilators, doorways, and sea connections. Cranes lifted away the domes from topside gun mounts, directors, searchlights—and the air-drying machines below deck. Next steps were to make the ship habitable for the crew coming aboard, and operable, by starting up her own systems for ventilating, plumbing, heating, refrigerating, power-generating, and propulsion.

Currently, too, her hull is being sand-blasted, to remove marine growths and strip the metal bare in preparation for fresh coats of antifouling compound and haze-gray paint. That should be done, and the drydocked ship should be afloat again, when this is read.

By next mid-March the New Jersey may be ready for preliminary sea trials of her propelling machinery. Her later shake-down cruise, when her big guns will be test-fired, will be her coming voyage to Vietnam.

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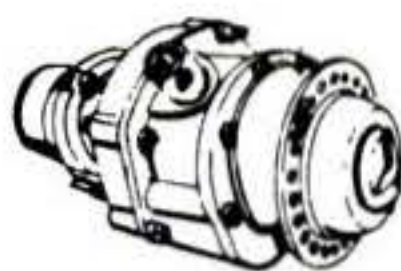
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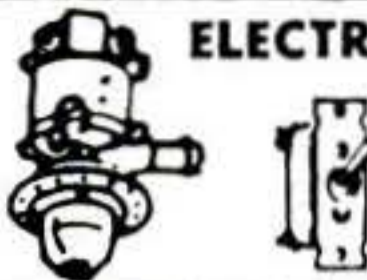
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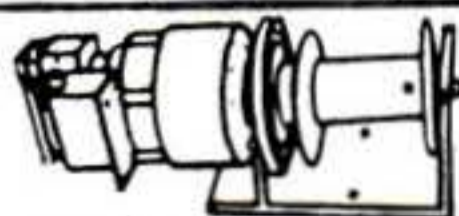
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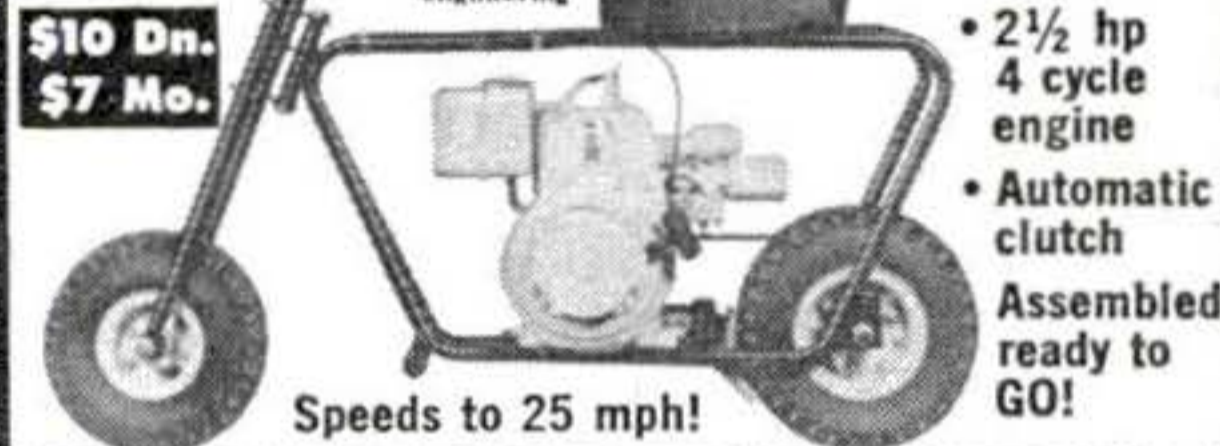
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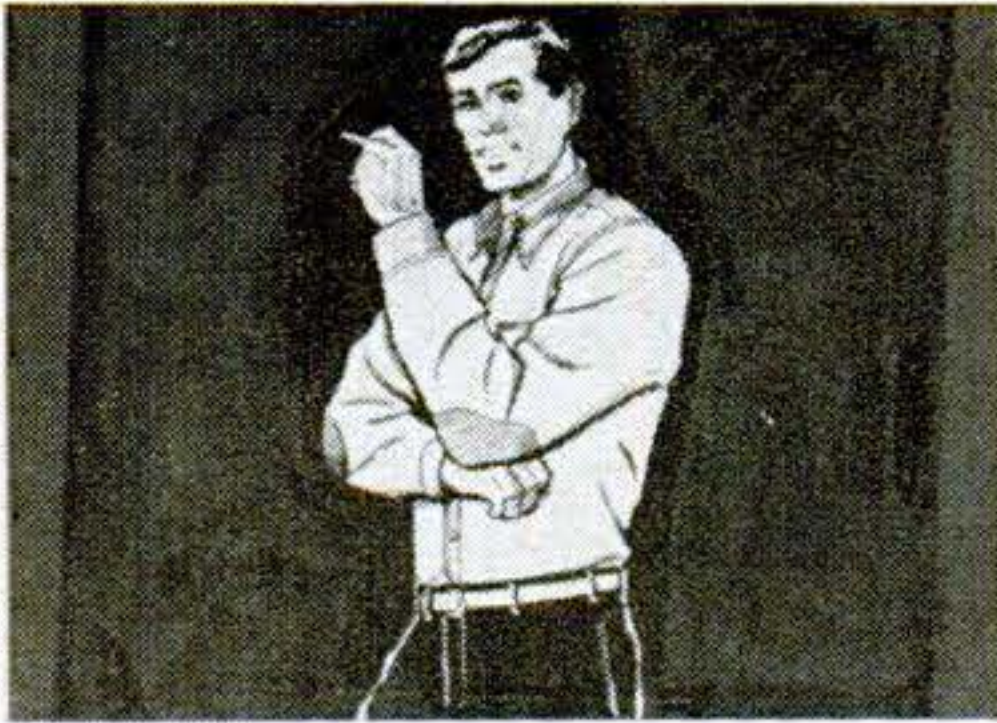
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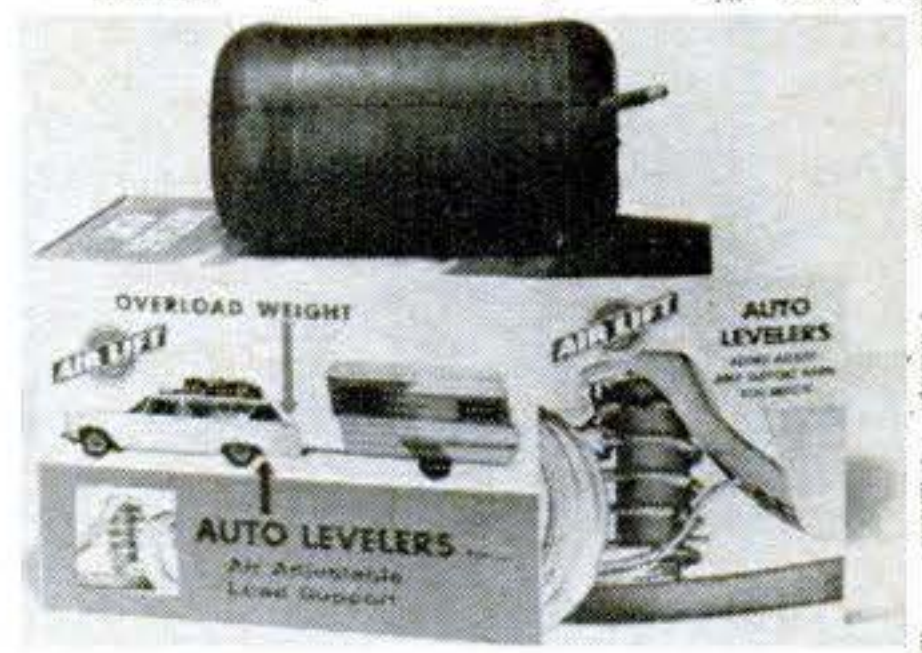
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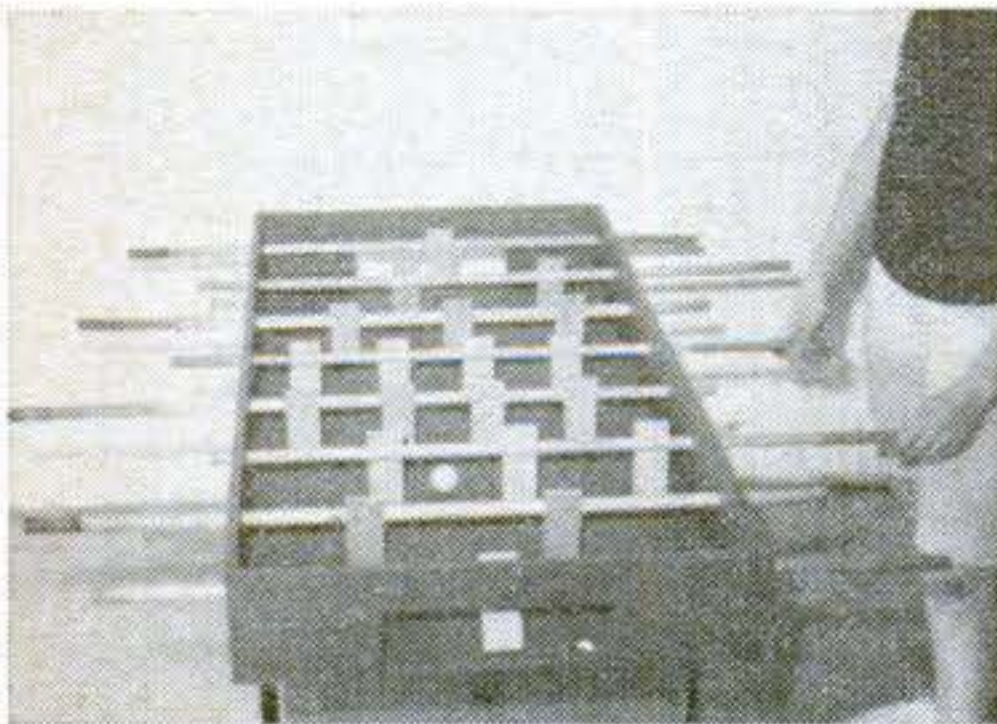
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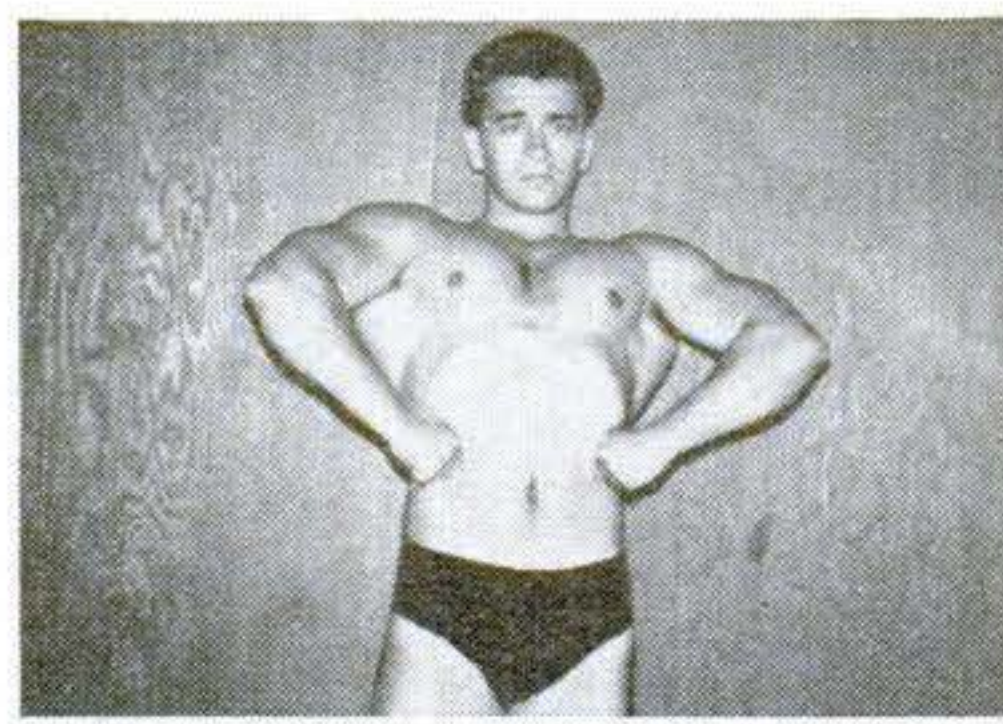
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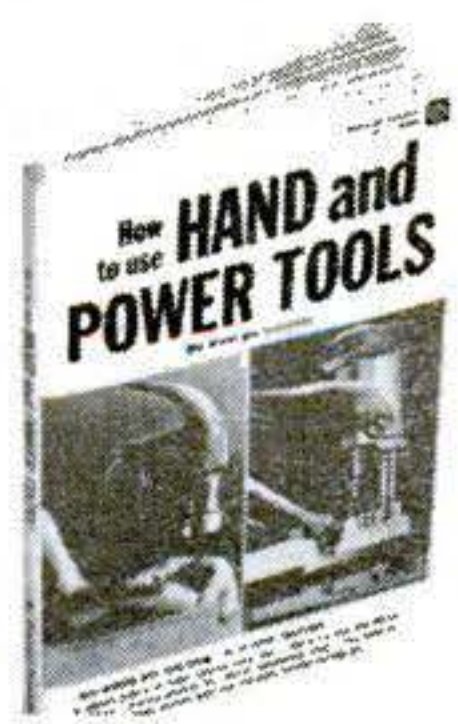
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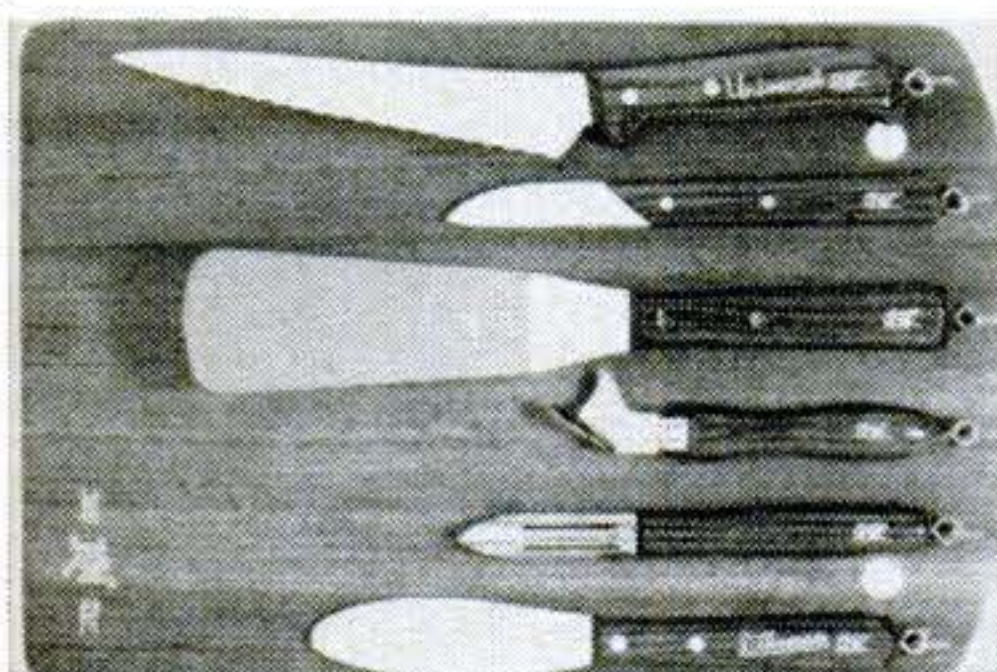
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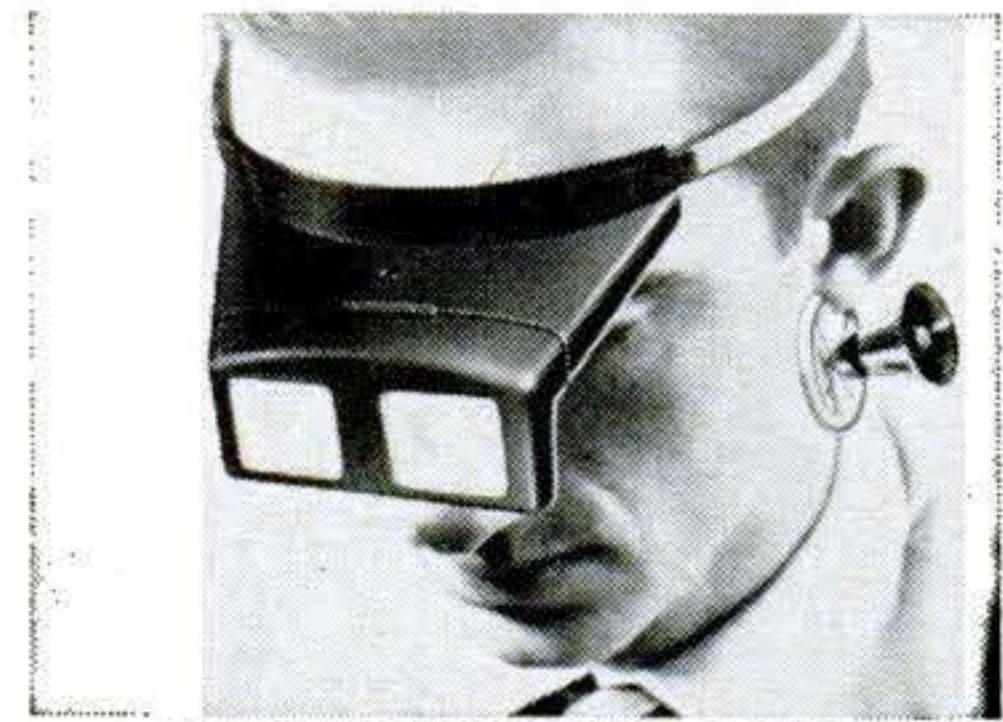
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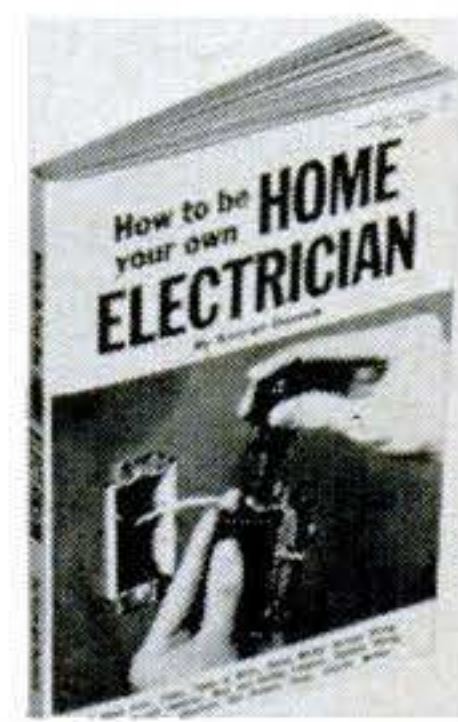
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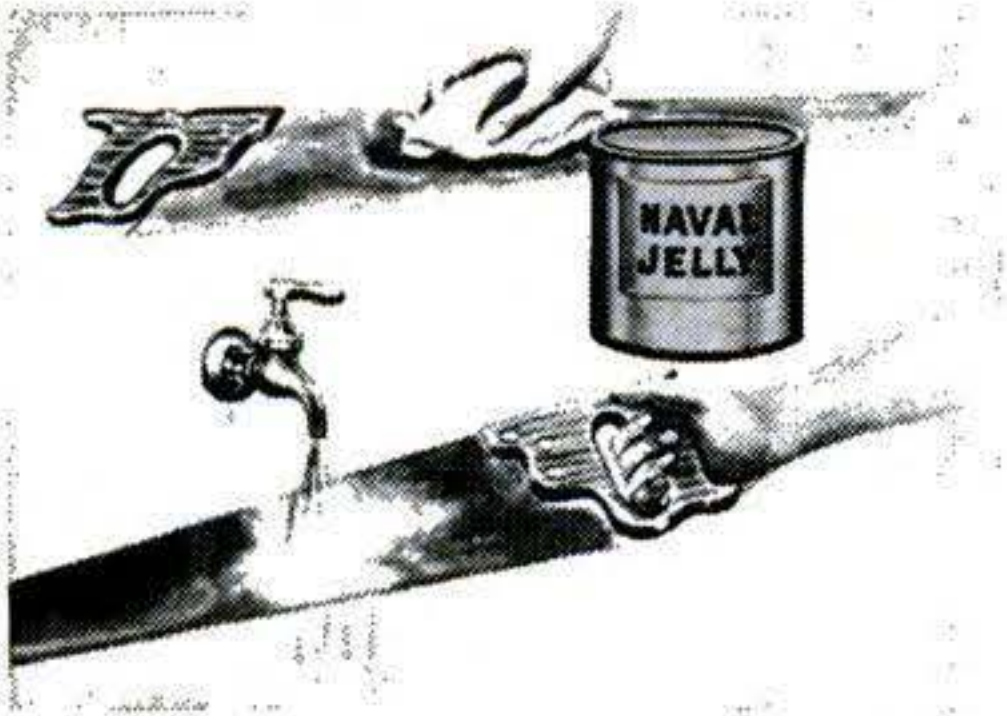
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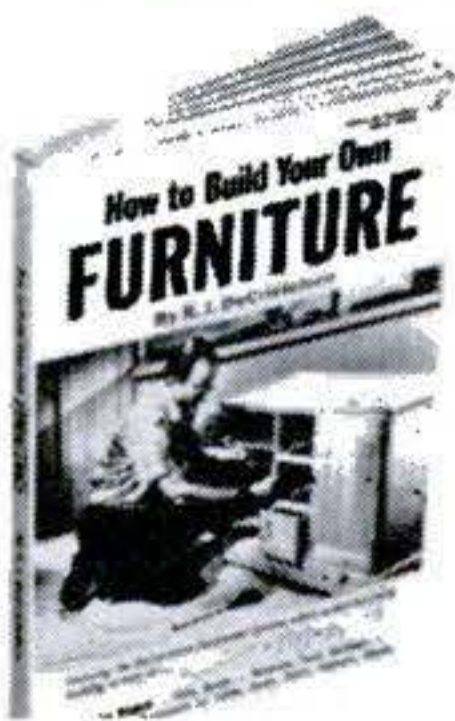
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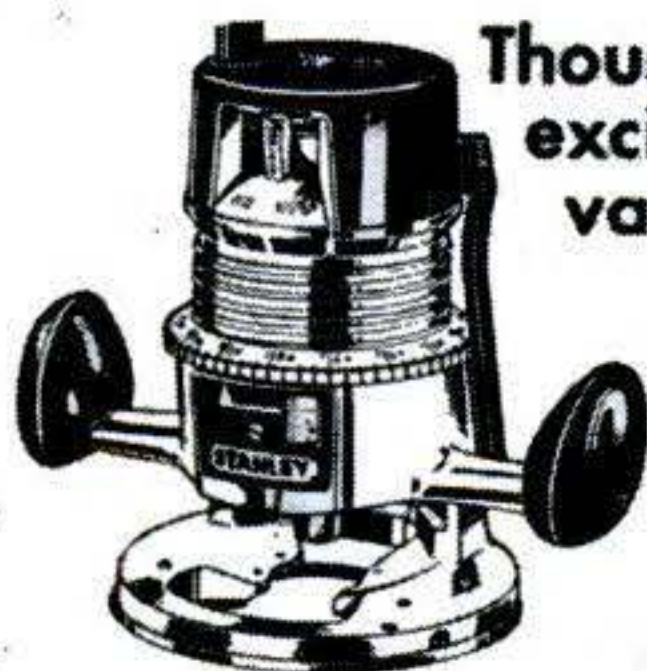
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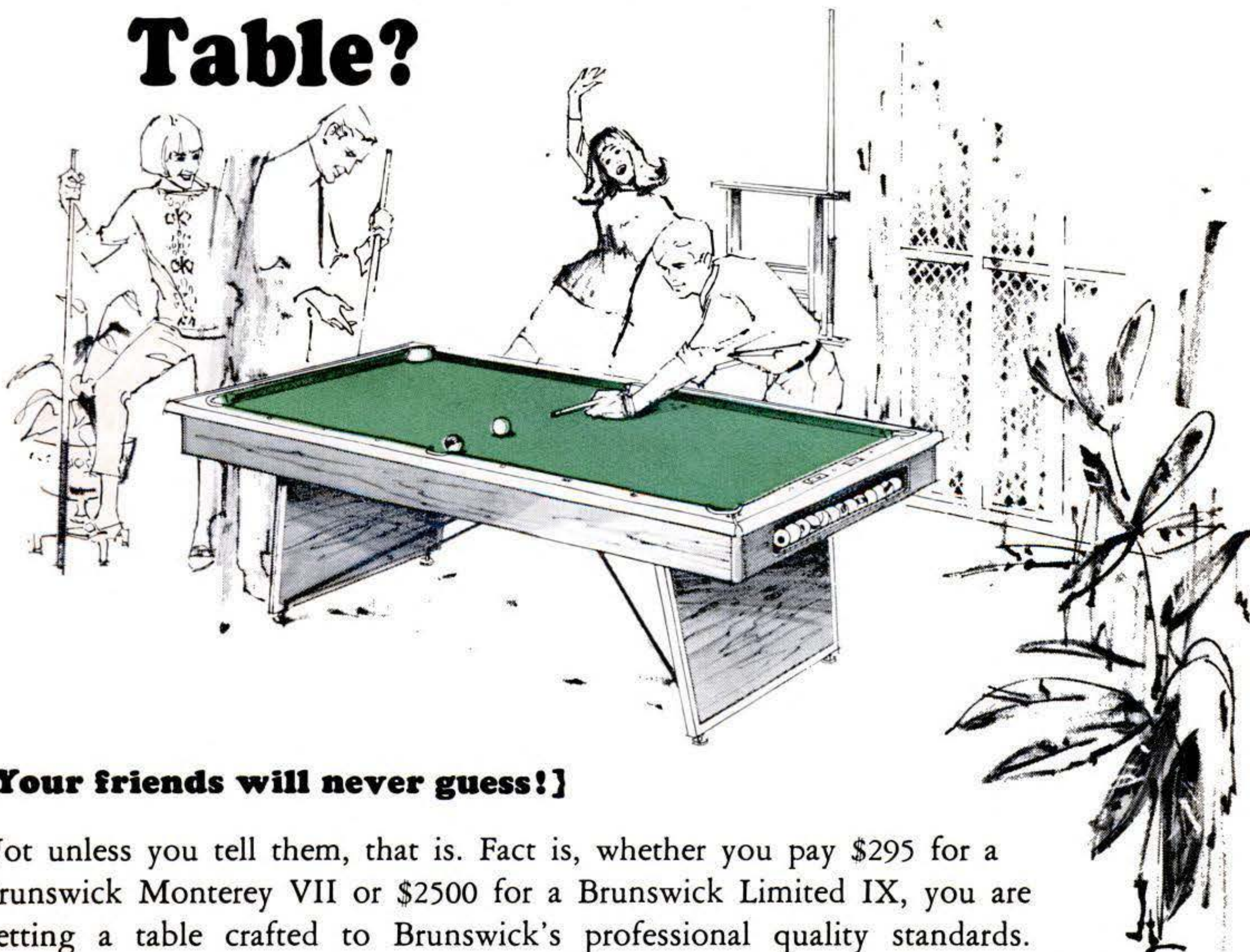
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