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PINTO/VEGA OWNERS Page 74
after 4 million(!) miles:
WOULD THEY BUY AGAIN?

POPULAR MECHANICS

JAN. 1972
50 CENTS

A great PM shop that lets you work like a pro

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Will they ban your snowmobile? It all depends on you Page 62

Biggest bargain since the Beetle: Fiat 128 Page 108

Introducing an old way to enjoy tobacco.

If you're one of the millions who like to smoke, chances are you think that smoking is the only way to really enjoy tobacco.

Well, we have news for you:

There's more than one way to enjoy the pleasures of the tobacco leaf.

As a matter of fact, people have been partaking of these pleasures in ways that have nothing to do with smoking for hundreds of years.

Satisfying the aristocrats:

Take the aristocracy in England.

As far back as the 16th century, they considered it a mark of distinction—as well as a source of great satisfaction—to use finely-cut, finely-ground tobacco with the quaint-sounding name of “snuff”. At first, this “snuff” was, as the name suggests, inhaled through the nose.

Just a pinch:

Later on, the vogue of sniffing gave way to an even more pleasurable form of using tobacco—placing just a pinch in the mouth between cheek and gum and letting it rest there.

Now, hundreds of years later, this form of tobacco is having the biggest growth in popularity since the days of Napoleon.

And what we call “smokeless tobacco” is becoming a favorite way of enjoying tobacco with Americans from all walks of life.

Anything but obvious:

Why is “smokeless tobacco” becoming so popular in America?

There are a number of reasons.

One of the obvious ones is that it is a way of enjoying tobacco that is anything but obvious.

In other words, you can enjoy it any of the times or places where smoking is not permitted.

Thus, lawyers and judges who cannot smoke in the courtroom, scientists who cannot smoke in the



laboratory, and many people who like to smoke on the job, but aren't allowed to, often become enthusiastic users.

In the same way, people who work or play with their hands get the comfort of tobacco—but don't have to strike a match or worry about how to hold (or where to put) their cigarette, cigar, or pipe.

The big four:

The four best-known, best-liked brands of “smokeless tobacco” are “Copenhagen”, “Skoyal” and the two flavors of “Happy Days”.

All four are made by the United States Tobacco Company, but each has a distinctive flavor and personality. (To make sure that distinctive

flavor is as fresh as it should be when you buy it, all cans are dated on the bottom.)

Copenhagen, the biggest-selling brand in the world, has the rich flavor of pure tobacco. Skoyal is wintergreen-flavored. And Happy Days comes in either raspberry or mint flavor—so it's especially popular with beginners.

But if “smokeless tobacco” has many advantages for lovers of tobacco, we must also admit it has one disadvantage.

How to use it:

It takes a little more time and practice to learn exactly how much to use (a “tiny pinch” is the best way to describe it) and exactly how to use it.

To get over that minor problem, we'll be happy to send you a free booklet that explains how to get the full enjoyment of “smokeless tobacco”—as well as a few pinches that you can try for yourself.

(Write to “Smokeless Tobacco”, United States Tobacco Company, Dept. P33, Greenwich, Connecticut 06830.)

Once you get the knack, you'll find you have something else, too: Another great way to enjoy tobacco.



Smokeless Tobacco. A pinch is all it takes.

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This isn't just a new model of an old favorite. This Jeep Commando is a whole new vehicle.

Take its strength. Jeep guts make this Commando the strongest one ever built. With a hefty 232 CID 6-cylinder engine as standard equipment. And a 304 CID V-8 as a mighty option. That's power. They'll take you places you never dared go before.

Take its looks. That new front end makes the Commando more stylish than ever—along with the nine bright, up-to-date colors you have to choose from. This 4-wheel drive vehicle looks at home—at home!



And take the interior. The Commando adds more of everything you want. More leg room. And more knee, hip and elbow room, too. More comfort with full-foam bench seats available in both the front and rear. (Those smart foam-molded bucket seats are still standard.) And more luxury, too, with extra trims and options.



Altogether, it's the new Jeep Commando—the most exciting new 4-wheel drive vehicle in America.

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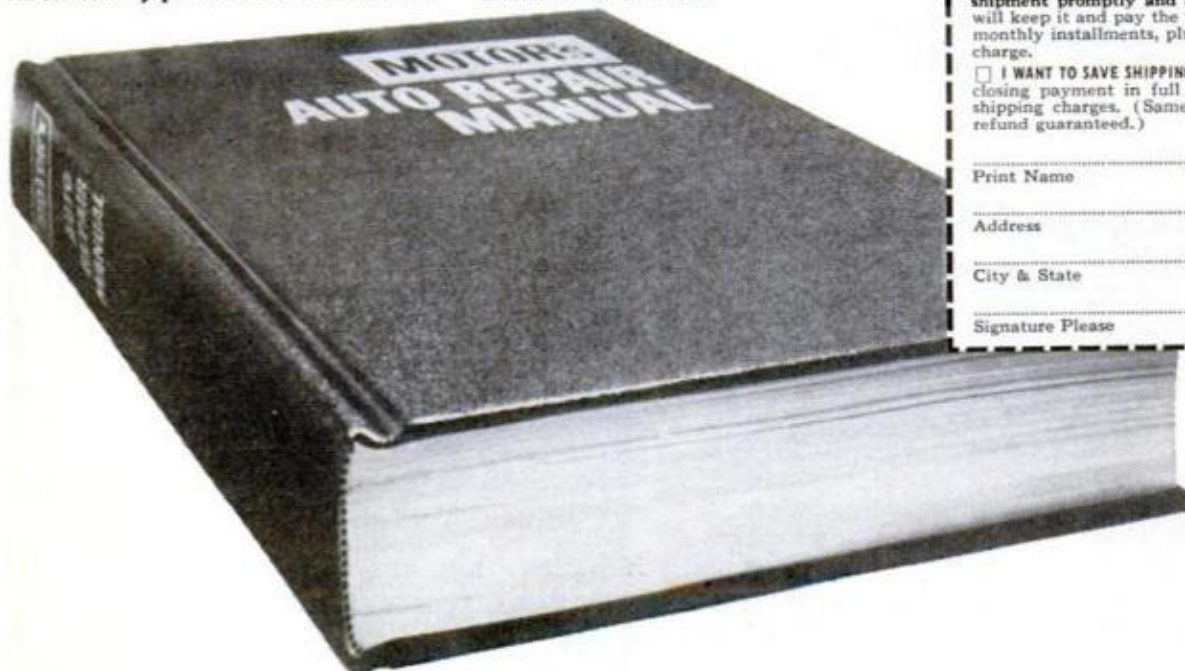
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ON THE COVER: Bombardier Ltd. Photo

Will they ban your snowmobile? It all depends on you. Accidents are the exception—not the rule—but each is fuel for critics who'd ban the machines

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JANUARY 1972

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LETTERS
TO THE EDITOR

Kingfisher on North Carolina

The Vought OS2U-2 Kingfisher that was so magnificently restored by retired Vought Aeronautics employees (*Kingfisher Comes Back*, page 95, Nov. PM) is now permanently displayed on the fantail



of the USS North Carolina Battleship Memorial in Wilmington, N.C. The USS *North Carolina* had three Kingfishers aboard during service in World War II.
BATTLESHIP COMMISSION BOB HIGH
WILMINGTON, N.C. PROMOTION DIRECTOR

Multicolored—10 years ago

In regard to Keith Foley's letter (*Multicolored Taillights?*, page 10, Nov. PM), be advised that 10 or more years ago just such a system was sold at auto-supply houses. The package consisted of what resembled a small traffic signal that was installed in a car's rear window. It was controlled by a switch on the gas pedal. When the pedal was depressed, the green light came on; releasing the pedal switched the light to yellow; stepping on the brake switched the light to red. It was simple, but seldom worked right for any length of time.

CHICAGO

KEN GREENBERG

Not just for racing cars

There's a misleading statement in *Why You Should Hop Up Your Ignition* (page 128, Oct. PM); it reads, "This gives a tremendous boost in high-rpm spark voltage, almost as good as a magneto, which is strictly for racing engines."

On behalf of our client, Vertex Magneto

Please turn to page 8

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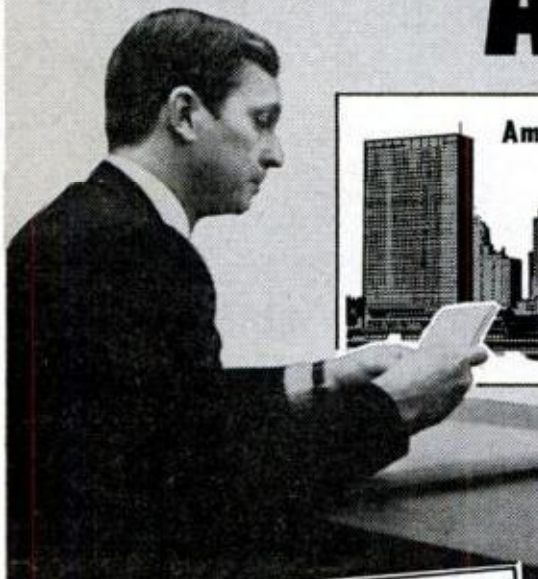


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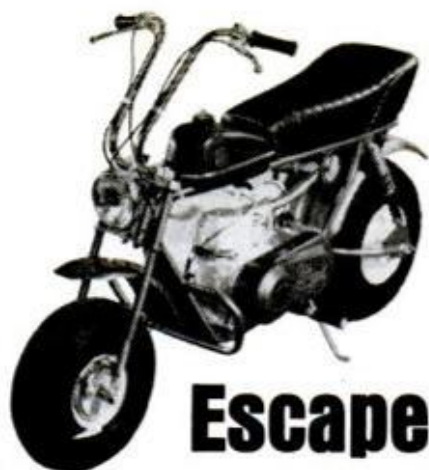
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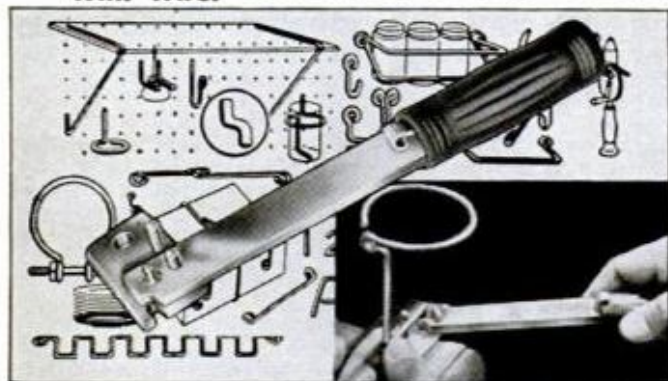


Escape Kit

Heathkit Hilltopper lets you get away from it all in style. This big new trail bike kit is loaded with motorcycle features: telescoping front fork and adjustable rear shocks; 5-h.p. 4-cycle engine with alternator and spark arrester muffler; load-sensing automatic torque converter; giant 18x8.50-8 rear tire and oversize front tire; 2-wheel brakes; folding handlebars and foot pegs for easy hauling; gold metallic finish. Kit GT-101, 177 lbs.; \$299.95*

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LETTERS

(Continued from page 6)

Div. of Ronco Corp., I wish to point out that the same characteristics which suit the magneto for race-car use make this type of ignition superior not only for street-car application, but for use on farm equipment, industrial engines and aircraft and marine powerplants. The magneto further retains its superior characteristics even when used with a diversity of fuels ranging from exotic nitromethane blends to natural gas.

JAMES P. FOLEY, INC. PAUL F. DAEHLING
BALA CYNWYD, PA.

We were a bit too exclusive in that original statement.

I always had hard starting until I put a Delta Mark 10 CD on my 1967 Datsun. Now I get easy starts, better idling, better power on the road, more miles per gallon.
BOISE, IDAHO ROBERT SIMONEAU

I have used a capacitor-discharge ignition for several years on my VW. Last month I installed a homemade one on my 1968 Kawasacki W-1 motorcycle. It has greatly improved performance.
HUNTINGTON STATION, N.Y.

W. M. TRENHOLME

Blue ribbon train

I built this train engine from plans in *Backyard & Birdbath R.R.* (page 118, Aug. '65 PM). It's powered by a gas engine with sufficient power to pull a ca-



oose that will be completed this winter. The train engine won a blue ribbon at the 1970 Minnesota State Fair.

COON RAPIDS, MINN. KENNETH M. KUSIE

Kids don't avoid it

In *The Minicycle—a Whole New Breed of Bike* (page 140, Oct. PM) you said of the
(Please turn to page 10)

POPULAR MECHANICS

You can earn \$5 to \$7 an hour starting soon!

New NRI AUTOMOTIVE MECHANICS HOME TRAINING acclaimed by experts

NRI commissioned one of America's best-qualified automotive writers* to prepare the home training programs, then asked its team of consultants to give it their critical review . . . Here's what they reported:



TOM McCAHILL

"I'm beginning to have some hope about finding good mechanics again."
 "It's a great relief to see a highly qualified school like NRI come up with home training in the automotive mechanics field that should do much to improve the sad state of the car repair industry. The Master Automotive Technician course gives ambitious guys a great start on a top-dollar career. And that Tune-Up and Electrical Systems program can save do-it-yourselfers a bundle, or lead to some lucrative part-time bucks at a going rate of \$5 to \$7 an hour. I'm beginning to have some hope of finding top mechanics again—I'll just look for an NRI diploma on the repair shop wall."

Tom McCahill
 America's foremost automotive editor/critic



RICHARD PETTY

"It's a lot of training for a very few bucks."

"I especially like the way NRI has programmed essential training equipment they give you into step-by-step instruction. There's nothing like learning with your hands, and having exactly what you need to do the job. The fact that the Master Automotive Technician course includes (among other things) an ignition-analyzer scope, dwell tachometer, timing light and exhaust analyzer is an indication that it's a lot of training for a very few bucks. Even the shorter Tune-Up course includes basic tools and equipment at no extra cost. I'm sure Petty Enterprises would give top consideration to a man with an NRI diploma."



America's winningest stock car racing driver



BILL FRANCE

"I've seen a lot of training programs and this one is up there with the best."

"I'm very pleased to find that NRI has developed home training programs in car repair that are right up there with the times. Both the Master Technician and the Tune-Up and Electrical Systems courses are amazingly complete and up-to-date. They employ an easy to learn method that has successfully trained thousands for technical jobs. Subjects are broken down into 'bite-sized' texts and programmed with essential equipment. You get the 'why' as well as the 'how-to' copy; from changing plugs to running your own garage. I've seen a lot of training programs, and this one is up there with the best."

William H. France
 President of NASCAR and International Speedway Corp.

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LETTERS

(Continued from page 8)

Honda: "It's the heaviest of the lot, which made the smaller youngsters avoid it."

But I know three kids who have the CT 70. In fact, for a while I knew more kids with Hondas than any other bike, and most of them were the CT 70.

MAYFIELD, KY.

JOHN BOYD

Five mph is too fast

Eighty-five or 90 . . . hell, there are times when 5 mph is too fast. This morning was so foggy I could not see my mailbox 33 yards away. Five mph under such conditions is fast.

CARSON CITY, MICH. SAMUEL HAGERMAN

War forecast in war galley

The picture of Mr. Aschburner's *Grecian Trireme War Galley* certainly startled me when I saw it in the November *Letters*. My father also built one from your February 1938 issue. In his, he enclosed a letter stating his opinion that war with Japan was inevitable.

STATEN ISLAND, N.Y. ARNE C. EASTMAN

Index that valuable information

Please reserve one *Popular Mechanics Index and Shelf Wrapper*. Your magazine is the best bargain I know for keeping up-to-date on what's new. I can't understand why every family in the country doesn't buy and read PM for all of its valuable information.

TALLAHASSEE, FLA. MRS. ROBERT HIGGINS

We can't either, but we keep trying. That index and wrapper puts all of the information that was published in our 1971 issues at your fingertips. It's \$1.49 when ordered from *Popular Mechanics*, Dept. JL, 224 West 57th St., New York, N.Y. 10019.

Wait a few years and save

I feel that Bill Hartford did not equally represent the future safety standards in '72 *Cars: Why You Should Buy Now* (page 114, Oct. PM). He stressed the point that new safety systems would cost more than the buyer could afford to pay. However, the amount of injury and the cost of auto repairs will decrease. So wait a few years and save.

WESTFIELD, N.J.

BEN OLSON

Auto bumpers have deteriorated to
(Please turn to page 12)

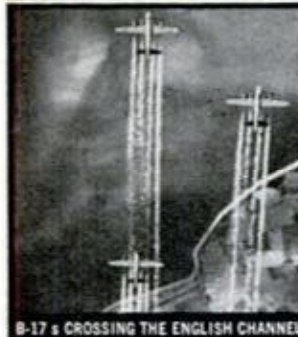
The story of the B-17s and the men who flew them



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LETTERS

(Continued from page 10)

chrome trim and he wants you to buy them instead of waiting for better. Too much cost in safety, he says.

The auto industry forgets cost in its built-in obsolescence and things like curved glass, wings, fins and all sorts of valueless changes. Let's put the money in something worthwhile.

PHILADELPHIA

WILLIAM H. KIRLIN

Mort was right

My father recently bought a 1970 Pontiac and it developed exactly the same problems described by Buford Hall in his letter to *Automobile Clinic* (page 18, Oct. PM). It turned out to be the intake manifold gaskets that were causing hard starting—just as your Mort Schultz diagnosed the problem. Mort was right; my father replaced the gaskets and now he says the car is running great!

ASPEN, COLO.

BART FINN

Great—but wrong price

Everything was great about your listing of Dur-A-Poxy in *New Products for Improving Your Home* (page 132, Sept. PM) except the price. The list price per gallon is \$14.95 (not \$28).

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MITCHELL ANDRESKI
PRESIDENT

Well's too wide

Your diagram in *Anyone Can Build This Coffee Table for \$35* (page 174, Sept. PM) shows the three wells in the middle as 9-13/16 by 13-13/16 in. After building the table, I received the carvings for the wells. They measure only 9-13/16 by 13-5/16 in. This leaves considerable plywood showing. Are the carvings the wrong dimensions—or the drawing?

VANDALIA, OHIO

TERRY L. COLE

Sorry—the drawing is wrong. Anyone else who makes the table should use the correct dimension (23-3/16) or order the carvings before marking the size of the well.

Whoops, says Mort

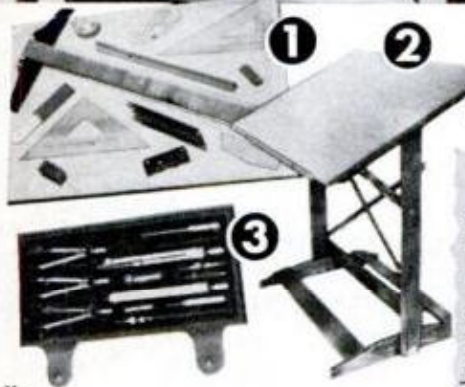
Mort Schultz led Mr. Moen and his son on a wild goose chase in the October issue (*Automobile Clinic*, page 18). The "constant compressor" problem is no problem at all—as Mort stated in his first sentence. It's too bad he didn't stop there.

Old Mort is bound to miss sooner or

(Please turn to page 14)



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LETTERS

(Continued from page 12)

later; maybe he ought to have 30 lashes with a wet noodle. Oh well, we still love you, Mort.

HARTSELLE, ALA.

SAM BOSTER

"Yes, friends, I goofed," says Mort. "Mr. Moen wanted to know why the compressor of his Oldsmobile's air conditioner kept running when he turned the unit off. The story is that, since 1968, Oldsmobile has purposely designed its air conditioner (except Comfortron) with a compressor clutch hold-in relay.

"According to Olds, the air conditioner compressor will continue to operate regardless of the control setting. With the compressor operating, the airflow through the heater-airconditioning system will be dehumidified and will prevent possible fogging of the windshield under certain conditions.

"An easy way to shut it off: While driving along in gear, without shutting off the engine, simply turn the ignition key momentarily to the right as if you were trying to start the engine. This will cause the hold-in relay to cut out. You won't hurt anything."

Mercury vapor needs ballasting

Game Not Called Because of Darkness (page 136, Aug. PM) could lead to serious results. Your readers should be cautioned to never install a mercury vapor lamp in a standard light socket. The least that can happen is a blown fuse; the worst is a violent explosion with a faceful of broken glass. A mercury vapor lamp requires a ballasting circuit to limit the starting current.

Your readers might be interested to know that a dimmer circuit is now available for mercury vapor lighting. With it, a single luminaire can produce anything from a soft glow to a full 1000 watts.

WIDE-LITE CORP.

A. N. HENRY

HOUSTON, TEX.

Nothing new . . .

The "Angle-Dividers" shown in the *New Tools* (page 158, Sept. PM) confirm the adage that there's nothing new under the sun. I have a tool which is identical; it has been in my family for over 40 years. The tool inscription reads: "Nagel's Adj. Sq. Ang. & Bevel, Pat. Aug. 15, '06." I've used the tool many times; it's very useful.

MONROE, MICH.

KENNETH HOYT

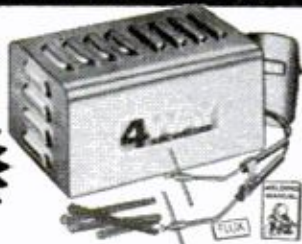
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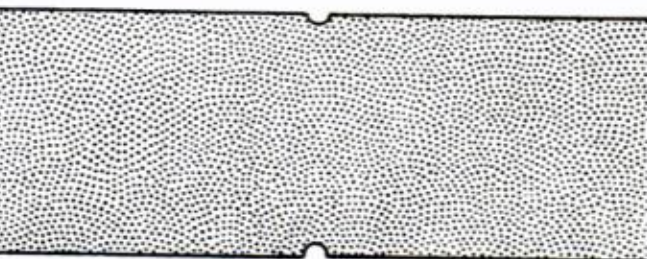
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"What started as a hobby, now pays me \$10 an hour"
 Yes, many MUI graduates make better than \$10 an hour turning old wornout furniture into bright new decorator pieces! **Stack it up against what you're doing now!** Are you making \$150 a week? \$200? \$250? Do you put in long hours of dull work, with small raises? Is that the way you want to spend the rest of your life? Just imagine, you can make \$150, \$200, \$250 upholstering just one chair or sofa these days! And if you're the kind of person who likes to work and earn, you can sometimes finish a job like this in a day. That's pay, ... and it beats what most college graduates make!

AS YOU LEARN, YOU JUST SLIP INTO THE IMMENSE FLOW OF UPHOLSTERY WORK! Think of all there is! . . . Sofas, lounging chairs finished in beautiful fabrics, which MUI tells you how to get at the right price — even leather and all the new vinyls. And then you have built-ins and breakfast nooks, boats, trailers and all the millions of automobiles in America. Yes, you learn all this and more! When we finish teaching you, (in your own home in your spare time) and when you get our California state approved diploma, you **know** this business . . . as a **real professional!** You will then have one of the most fantastic moneymaking skills in America built into your head and hands! No one can ever take this skill away from you . . . and no one can ever fire you, because you're the boss of a business that you can take with you . . . You can make big money from then on . . . any time, anyplace you want to put out your shingle!

When you read the papers you see there's a strike here, a lockout there, Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstering, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.



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POLLUTION FIGHTERS'

NEWSLETTER

By SUSAN MAZUR

'INSTANT OIL' can be made from organic waste in 20 minutes, reports Dr. G. Alex Mills, chief of the U.S. Bureau of Mines Coal Div., referring to the bureau's newly developed process of making crude oil from organic materials, such as manure, sewage, vegetable waste and household rubbish. First, raw material is put into a big kettle along with carbon monoxide, and the mixture is heated to approximately 720° F. Next, a pressure of 1200 pounds per square inch is applied.

In 20 minutes you have crude oil with a heat value of between 14,000 to 16,000 B.T.U. a pound (natural oil has a value of 20,000 B.T.U.) and a sulfur content of less than 0.35 percent—way under the strictest limit on sulfur content allowed for fuel used in powerplants. In addition, weight loss during the conversion is negligible; almost all hydrocarbons are turned into oil. Full commercial operation will take at least two more years, however, says Mills.

ECOLOGY LESSON PLANS have been prepared for teachers of kindergarten through senior high school. Called Environmental Involvement, the package is designed to increase a student's understanding of environmental improvement through his participation in basic experiments on what pollution is all about. Copies (including bibliography) are available to teachers for \$1 each: Environmental Involvement, Inquiry Services, Dow Chemical U.S.A., 2030 Dow Center, Midland, Mich. 48640.

NATURAL-DESTRUCT PLASTIC FOIL may be on the market in another year, according to its developer, Akerlund & Rausing (Lund, Sweden). The product is a result of adding chemicals to polythene, polypropene and polystyrene. ND-plastic, as the foil has been nicknamed, disintegrates in six to eight weeks with normal exposure to the natural elements.

A PORTABLE AUDIO MONITOR has been designed by Du Pont to measure workers' exposure to excessive noise. Pocket-sized, the monitor clips onto a belt or pocket and a

sensitive microphone to the shirt. The monitor—also called a dosimeter since it tallies and records total exposure—is not unlike the radiation counters used by workers handling radioactive materials.

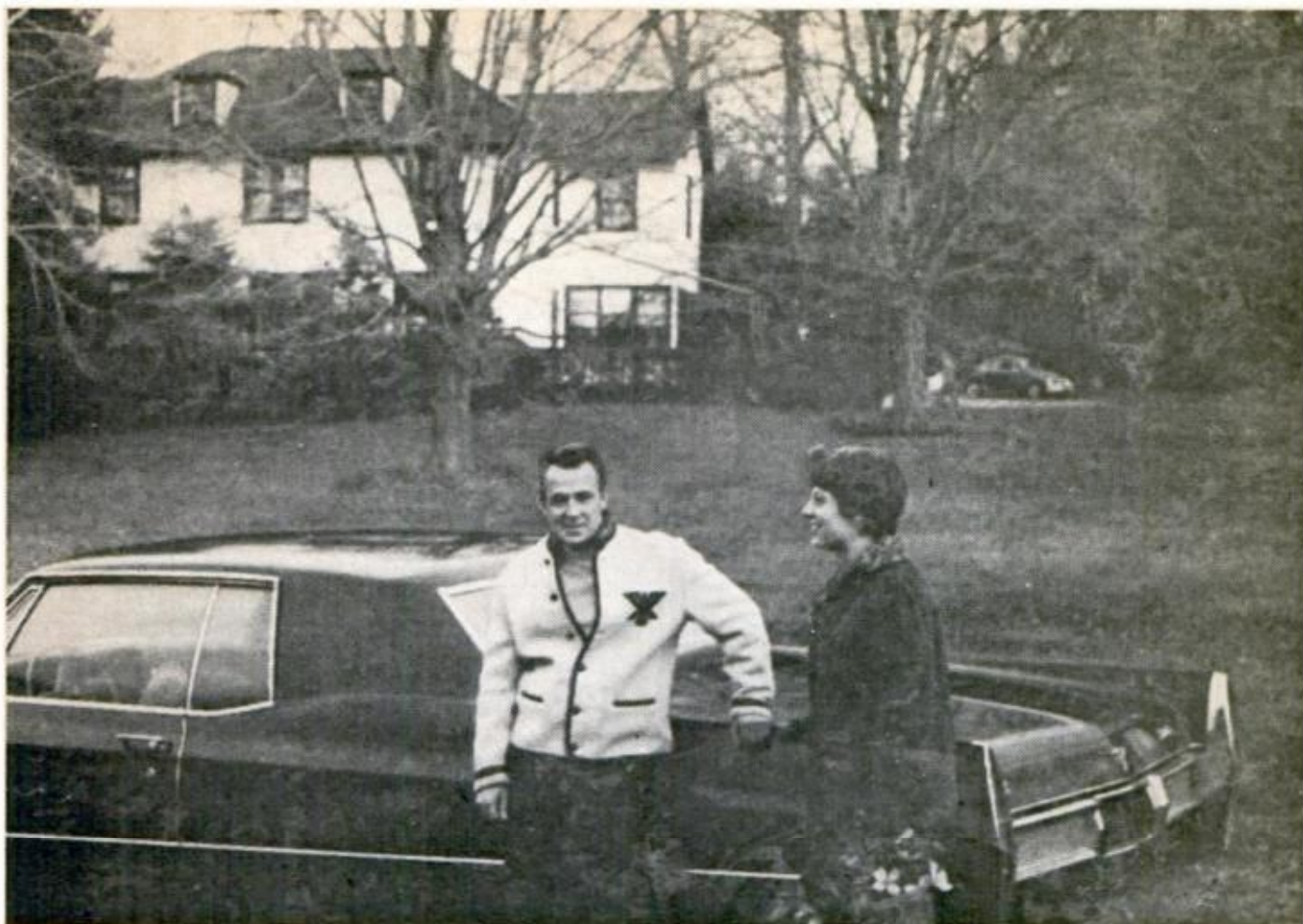
GENETIC DAMAGE in humans resulting from the lead additive in gasoline is being investigated by scientists at the Wallenberg Laboratory in Stockholm. Mutation in plants due to even minute amounts of lead in the atmosphere is certain, according to Assistant Prof. Claes Ramel, director of the team. Tests reveal breakage and abnormal distribution of chromosomes. Ramel says Sweden plans to ban lead additives (used to boost octane rating in gasoline) by 1977. "The reason for not acting more quickly," he says, "is our fear that some new and even more harmful substance, about which we know nothing, will replace the lead."

"WATER TEST KIT" has been designed by Urban Systems, Inc., Cambridge, Mass., for anyone to use to determine the quality of water samples taken in his community. Water quality tests include: dissolved oxygen, hardness, chloride, phosphates and hydrogen sulfide. Priced at \$12, the kit is available at major department stores. Other ecology kits from Urban Systems are "Can I Drink the Water?" and "Can I Breathe the Air?"—each with experiments and discussion and priced at \$6.

RUBBERIZED ROADS—this possibility is being researched by Batelle Laboratories in Columbus, Ohio, under a \$54,000 grant from H.E.W. It is hoped the study will prove that rubber from tires when added to asphalt emulsion and coal tar dressings improves the material's durability, resiliency and resistance to abrasion.

THE "ZERO LEAD" standard for gasoline does not mean the fuel is absolutely lead-free. It has been found that "trace" amounts of lead exist in so-called "pure" compounds and gasoline is no exception. American Oil Co., for example, sets a standard of 0.05 gram of lead per gallon (99.99 percent pure) or less. This figure betters the federal government's standard of 0.07 gram for gasoline used in its vehicles, and is under the .075 limit of the New York City Ordinance.

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



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MODEL 100
Regularly \$77.50

62⁵⁰

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Regularly \$82.50

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Waist and hood doors and dial
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Take advantage of this January sale to save on your own craftsmanship. Learn why Emperor is the world's largest builder of grandfather clock case kits. Both models also available in completely assembled, unfinished cases and as completely finished clocks with movement installed.

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- Full length waist door
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The traditional charm of an elegant, stately grandfather clock increases its value through the years. It is an accurate, functional time-piece as well as a classic addition to any decor. Original designs and movements imported from West Germany make Emperor Clocks both beautiful and dependable.



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72" x 16 3/4" x 10"

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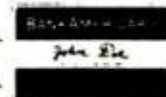
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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Hot stuff

My 1969 Chevrolet Six holds between 190 and 200° on the temperature gauge while the car is moving, but at traffic lights the temperature goes to 210°. To try and correct the problem I have had the radiator boiled and rodded, replaced the 195° thermostat with one of 160°, added fresh coolant and disconnected the heat riser. The temperature is the same. What else should I do?—L. P. Watson, Fairfield, Calif.

First, put the 195° thermostat back into the car. Second, reconnect the heat riser. And third, stop making problems where there aren't any. To quote the Chevrolet service manual, "All passenger-car cooling systems are pressurized with a 15-pound pressure cap which permits safe engine operation at cooling temperatures of up to 252° F."

Big drip

My problem is a water leak in the trunk of a 1970 Plymouth Satellite. Water enters through the lower edge of the back windshield, I've been told. The dealer has worked on the car four times, but it still leaks. What can be done?—Harold W. Barker, Cayuga, Ind.

If the dealer is certain that water is coming into the trunk through the backlight, as the back glass is called, the repair should be simple. There are many effective sealers on the market, such as silicone rubber compound. However, a successful repair can be made only by removing the molding around the backlight and applying the sealer directly to the glass joint. You are doomed before you start if the sealer is simply applied around the molding points. Is this what the dealer has been doing? Be sure also that he checks the top corners by playing a heavy concentration of water on them with a hose. The leak might be there.

Dwell awhile

I own a 1968 Mustang with 289-cu.-in. engine and standard transmission. When I set the distributor breaker points by dwell, the setting by feeler gauge is way off. When points are set by feeler gauge,

the dwell is thrown off. I have had my dwellmeter checked for accuracy, and it's fine. Is my distributor bad?—Richard Smythe, Bowie, Md.

I would say so. Look for trouble in one of two places—either with worn cam lobes or with a worn upper distributor plate.

Sequel to another oddball

In your June column, under the title of "Another Oddball," you recounted the tale of Thomas Nagle of Ardoch, N.D., who has a Dodge that uses a quart of oil every 300 miles for about 1000 miles and then won't use a quart for 2000 miles. Tell Tom that I had a Plymouth with the same habit. I asked a dealer about it and was advised to use a straight number motor oil, such as SAE 20, instead of a multi-viscosity oil, such as SAE 10W-40, which Tom is using. I've had no trouble since.—Max DuCharme, Elkhart, Ind.

Thank you, Max. Tom: It's worth a try.

Lazy Beetle

I recently purchased a 1971 Volkswagen seven-passenger wagon with air-conditioner. It had a "ping" in the engine from the start. I complained about it at the 600-mile service and was told to use premium fuel. At 1800 miles, a can of additive was poured into the gas tank to try to get rid of the noise. At 3000 miles, timing was adjusted. Finally, at 4500 miles, the shop got rid of the ping, but now the car starts very hard, has no power and uses gas. The best mileage I get, and this only occasionally, is 19 miles to the gallon. Can the airconditioner be causing my trouble even when it's turned off?—Spec. 6 Richard N. Pann, Augusta, Ga.

The shop that's been working on this car is causing your trouble, and it's time to turn it off. Tune-up of this engine must be done exactly by the book or you will continue to have trouble (all late model VW owners take heed). Here is the procedure that must be followed:

1. If the designation 27.5° C. is stamped on the intake air thermostat, replace the

(Please turn to page 26)



Her first pair of skis. And he
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AUTOMOBILE CLINIC

(Continued from page 22)

part with one having the designation 45° C. (part No. 113129826).

2. Adjust sparkplug gap to 0.028 in.

3. Adjust the dwell angle of new distributor breaker points to 44°-50°, and that of worn points to 42°-58°.

4. Make sure the carburetor injector fuel stream is passing between the throttle valve and air horn wall just as the throttle valve is opening.

5. Make sure the average amount of fuel being delivered by the carburetor accelerating pump is 1.6 cc for 10 strokes.

6. Be sure that valves are adjusted to 0.004 in. (cold).

7. Check ignition timing. For your particular model, it should be 5° after top dead center with engine speed at 850 rpm (± 50) and with the vacuum hose connected. Since this vehicle has a double vacuum advance unit, the throttle valve must be completely open as timing is being set.

You shouldn't use premium fuel in this car, although it won't hurt anything. Additives are not recommended and shouldn't have been put in. Your gas mileage—19 mpg—is within reason.

Muffling a crack

I have a cracked manifold on my 1964 Cadillac. It is not structurally in danger of separation, because both sides of the crack are being held firmly to the block by bolts. However, I would like to find a way of sealing the crack without having to take the manifold off for welding. Do you know of any treatment that can be applied and will hold until such time as I have to take the engine down for major repairs?—Frank S. Wise, Provo, Utah

One method that I've seen work is to clean off the cracked area and then run the engine until the manifold is hot. Apply several (three should do it) coats of muffler cement as directed on the package. This product may be purchased in an automotive supply store.

What's right is right

What is the correct way to check automatic transmission fluid . . . with the engine running and the transmission in neutral, or with the engine shut off? I've

heard both ways expounded.—Martin Nelson, Waterloo, Iowa

The correct way is the way the manufacturer tells you to do it. All instructions I've ever seen say to drive the car to warm up the transmission and then to check fluid with the engine running and the transmission lever in neutral (Plymouth, for example); other instructions say to keep the transmission lever in park (Pontiac is one). Check the manual.

Service Tips

● Oldsmobile gives us a tip this month about front disc brakes that could come in handy. A good indication of front brake pad wear, the company says, is a low fluid level in the front half of the master cylinder. As a disc brake pad wears, the piston in the caliper moves further out of the caliper bore, which causes the brake fluid to displace more area in the caliper.

● 1971 Plymouth Dusters and Valiants, and Dodge Darts and Demons may show up with a water leak in the trunk after a heavy rain or with an odor of gas inside the car after refueling. Could be a result of three or four holes in the fuel filler tube not having been sealed at the factory. Take the car back to the dealer and he will seal the holes as outlined in Plymouth service bulletin 71-14-11 or Dodge service bulletin D71-14-8.

● Chevrolet has advice for owners of their 1971 models who are being bothered by a body rattle which has escaped detection. It might not be coming from a door as it appears, but from some cage nuts that are positioned at Nos. 3 and 5 body mount locations. If these nuts don't have sufficient caulking compound around them, they may rattle. Have the dealer batten them down as explained in Chevrolet service news 7 (7/71).

● If a mechanic begins to use the specifications outlined in the service manual to align the front end of your 1971 Ford (all models), don't let him. Be sure he refers to revised specifications in service bulletin 16 (7/2/71).

● Oldsmobile goes back to the 1969 models to report that some are now experiencing a clunk because of a dry slip yoke. If you have this trouble, fix it by applying about an ounce of lubricant No. 1050169 directly to the slip yoke splines. ★★★

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

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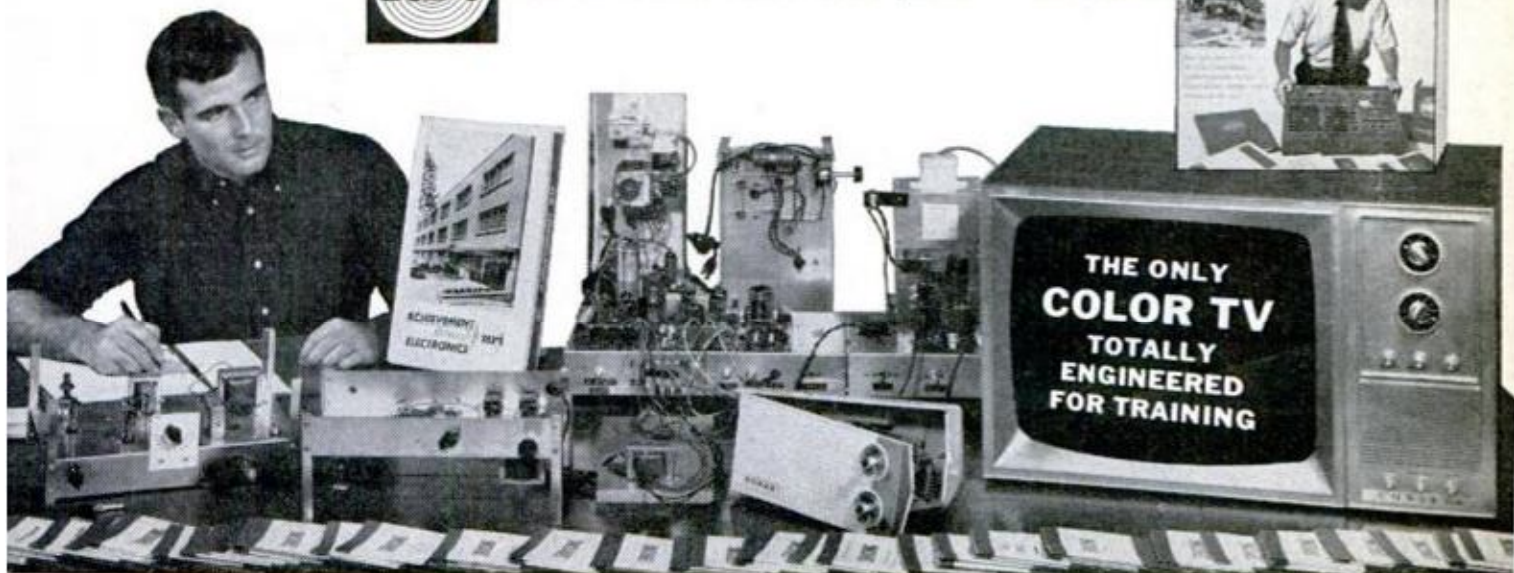
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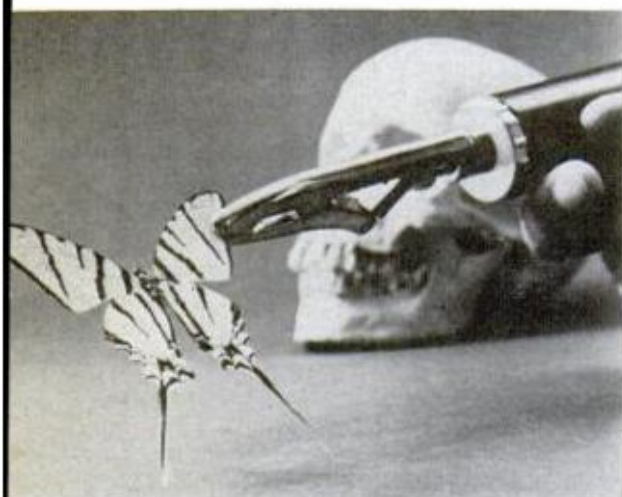
By JOHN PEARSON



Test setup on commercial jet

A NOVEL TEST FOR AN EINSTEIN THEORY was recently carried out by physicist Joseph C. Hafele of Washington University, St. Louis, and astronomer Richard Keating of the U.S. Naval Observatory. The theory: that time passes more slowly for a fast-moving object than for one at rest. The test consisted of flying four atomic clocks around the world. Hafele theorized that the airborne clocks would be moving fast enough to lose about 100 billionths of a second compared to a reference clock back in Washington, D.C. As of now, results of the experiment are undetermined.

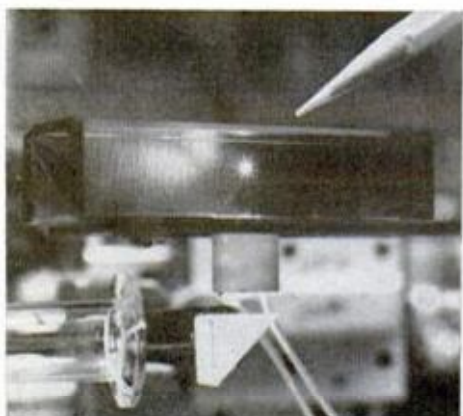
EARTH AND MOON ARE NOT ALONE. There's a third member of the "family," a 1.2-mile-diameter asteroid named Toro, according to scientists at the University of California, San Diego. Attracted by Earth's gravitational force, Toro intersects our planet's path twice every eight years. Discovery of Toro's celestial role was made through computer-aided calculations.



Delicate touch of new cutter

CUTTING THROUGH BONE IS NO SNAP for the surgeon. The standard tool is like a pair of tongs with sharp jaws, designed to "bite" bone away, chunk by chunk. Pressure is applied manually, and cramps in the hand, blisters and fatigue often result. Now a power cutter is available with jaws capable of applying levels of pressure—from a feathery touch to 300 pounds per square inch—on a bone. Power comes from compressed air or nitrogen. Invented by California scientists, the instrument reportedly shortens one common back operation by one and one-half hours.

POLLUTED AIR IN THE OPERATING ROOM appears to be hazardous to physicians and nurses chronically exposed to it. That's the thinking of University of Michigan researchers investigating the occurrence of certain kinds of cancer in doctors who specialize in giving anesthesia and the frequency of spontaneous abortions among pregnant nurses. It's suspected that inhaling and exhaling anesthetic gases over a long period causes changes in the breather's metabolism.



Starlike sparkle from sphere

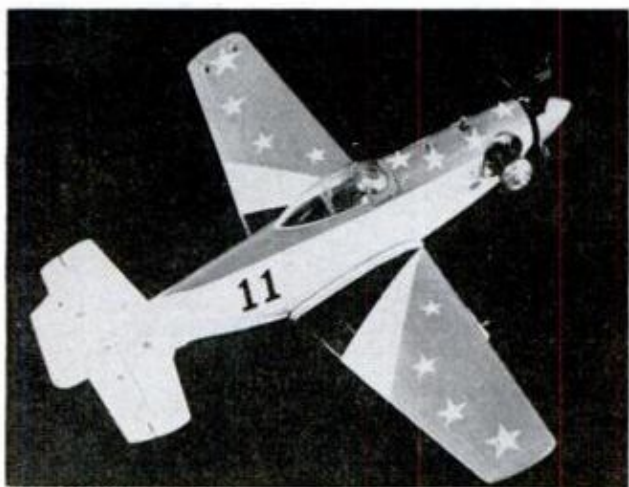
LEVITATION BY LASER. Bell Lab scientists have achieved a reported "first" by using the laser beam to trap a solid particle and hold it suspended in air. The particle, a glass sphere about one-thousandth of an inch in diameter, can be moved up and down or sideways very precisely. Bell researchers say the new technique is expected to provide simple methods for manipulating small particles without mechanical support. This could help in communications research in the measuring of scattering loss caused by particles, either in atmosphere or other transmission media. ★★★

NEWS BRIEFS



Plants thrive in seawater

Researchers have "taught" beets to live in seawater, and they are currently testing other crops. The plants, placed in silica-sand soil, are given fresh water for the first two months, then are accustomed to gradually increased amounts of brine until they thrive in seawater. The purpose of the tests, carried on by Scripps Marine Life Research Group, is to develop ways of irrigating food crops in areas where fresh water is scarce and seawater is readily available.



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Miss America, whose measurements are .049-16-14 (engine, wingspan, length) is a replica of Howie Keefe's P-51D Mustang unlimited racer. Priced at \$13, the control-line flying model is made by L. M. Cox Co.

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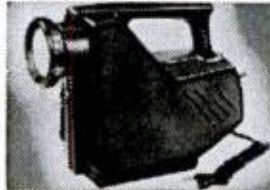
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DETROIT LISTENING POST

BY ROBERT LUND

CAN A BUILT-IN MEMORY be installed in non-mechanical components of cars so that if a part's dinged or dented, it will automatically restore itself to its original shape? Pontiac's already proved the idea's feasible with its "Endura" bumper, which reshapes itself after minor impact.

Suppliers to the auto companies are trying to apply the idea to other items—seats, interior trim, deck lids, steering wheels, lining materials and other nonfunctioning components. Parts aren't going to become indestructible or never require repairing. But there's a good chance some pieces can be made so they'll resume their original shape if damage isn't too extensive.

THUNDERBIRD'S EXPECTED to sport four-wheel disc brakes later this year, on the '73. Chrysler may also offer four-wheel discs on Imperial. The reason you haven't seen four-wheel discs on domestic cars before this is because the auto companies didn't feel they had a safe enough parking brake to team with a four-way unit. But Ford believes it's solved that problem and is ready to go with the item.

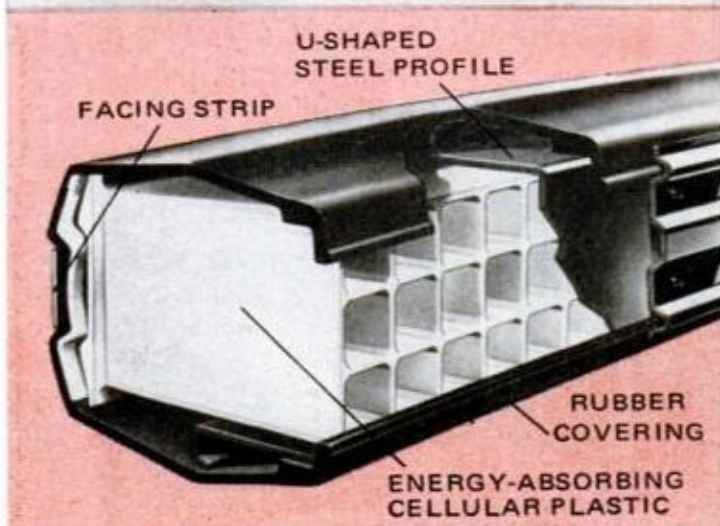
HOW DO YOU KEEP the cargo-carrying capacity cars have now at the same time automobiles are shrinking in size? You don't, obviously. But designers have been challenged to try to provide carry-along space for at least two average-size suitcases, even though overall dimensions of cars are coming down. So you'll see more factory-installed rooftop carriers, attachments to the rear trunk like the ski racks used on VWs and maybe a new idea—traylike compartments that unfold out from under the rear bumper to hold luggage, bikes and big items that can be tied down.

GM EXECUTIVES SCOFF at reports the company will offer a Wankel as an option on all its cars within three years. One of the rules GM lives by in bringing out a new product is to run a test in one car line before extending the item across-the-board. The Wankel's too revolutionary for GM to adopt for all of its cars simultaneously, although the engine may be used in all GM makes at a future

date as the company builds up a bank of experience.

I drove two modified Wankels last month, courtesy of a supplier doing Wankel research for an auto company. (GM or Ford, we'd guess, although the supplier declined to identify the car manufacturer.) The cars handled well, but if you don't have a muffler with a big manifold, you get a sound like a chain saw.

BUMPERS ON THE 1972 SAAB Model 99E are the first to surpass the federal safety standard for 1973. They can take better than a 5-mph impact in the front and 2½-mph in the rear with no damage to the car at all. The 1973 standard



specifies a collision at these speeds with no damage to the safety systems of the car. With the bumpers, which return to original shape after impact, owners of the 99E are given a 15 percent discount on collision insurance by Allstate. The car is now available either as a two or four-door sedan.

Other improvements for '72 include—catch
[\(Please turn to page 34\)](#)



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DETROIT LISTENING POST

(Continued from page 32)

this—an electrically heated driver's seat. On cold mornings the seat quickly heats up to a comfortable temperature when the ignition is turned on. A thermostat turns on when interior temperature is less than 58° F. and turns off when seat temperature reaches 82°. This feature is also on the smaller Model 96 and Model 95 station wagon. Sonnett III sports coupe rounds out the Saab line.—B.H.

PINTO'S A LONG WAY from sounding like a chain saw, but somebody at Ford figures the car doesn't run as quietly as it should and could. So Ford's adding insulation to its mini and making other running changes aimed at reducing noise and transmission of noise into the passenger compartment. The company's making the changes on the q.t., because it doesn't want to advertise the fact that early-off-the-line Pintos didn't get the sound-deadening treatment. Last fall, Chevy made a big thing out of the changes it worked into the '72 Vega to reduce and deflect noise. Ford's catching up.

If you wondered what was going to replace the horsepower race, maybe this is it—a quiet-ride contest.

IT USED TO BE that if you wanted to know what gadgets were coming on next year's cars, you checked the idea cars at the auto shows. They always had a couple of novel hang-ons that would show up on the big-ticket cars in a year or two and then eventually graduate on down to the less expensive makes. But there aren't many show specials coming out of Detroit these days. The guys who thought them up don't have time to work on fun cars. They're too busy on safety and antipollution projects and trying to shape up the here-and-now cars to meet government regulations.

But there's another source you can keep an eye on for a tipoff on new products the auto companies are considering. Keep tabs on the knickknacks put on trucks. Suppliers trying to sell new ideas to Detroit say the motor makers will give a new product a chance on trucks where they won't put it on cars. "They're a lot more willing to experiment with a new development on, say, 15,000 or 20,000 trucks," a venerable name among suppliers explains, "than on 50,000 or 60,000 cars."

So if you want a good lead on the accessories you're likely to see on cars in a few years, keep an eye on big brother. ★★ ★

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Drivin' with Dan

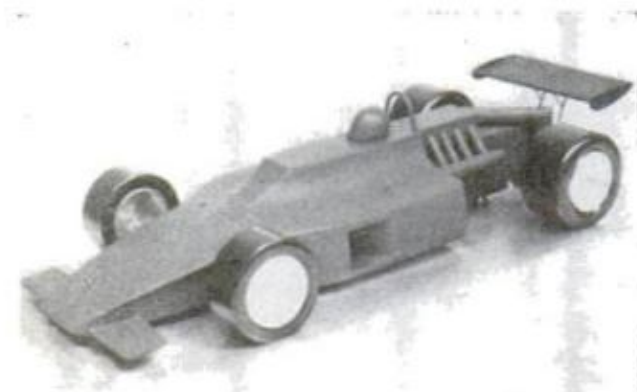
Will raising the back of a car improve performance? What is it like in the driver's seat of your Eagle? Do glass-pack mufflers hurt engine operation? Dan Gurney answers these and other automotive questions

Q. *Could you use a street-type carburetor on a turbocharged race car? And could you turbocharge a street car and have it work reasonably?*
—Ricky Powell, New Orleans, La.

A. Yes, most certainly. In fact, turbochargers are now being tested as a possible means of cleaning up the internal combustion engine. As an emission-control device, the turbocharger would allow use of smaller engines developing the same power as larger engines and on lead-free gasoline.

Q. *Does raising the back end of a car really add anything to its performance? How about the front?*—Kenneth Biggle, Ypsilanti, Mich.

A. Back end up a tiny bit and front down quite a lot seems to be a help. Most of the advantage appears to be aerodynamic (less drag and lift), but some help comes from the lowering of the center of gravity.



1972 INDY EAGLE in the clay looks just like a toy. But when the first of Dan's new Championship cars come out of the All American Racers shops in racing trim they'll be on the track to beat the competition and not to play games. The aerodynamics of this all-new design is the result of wind-tunnel testing, while the suspension geometry was determined by the extensive use of computers. The car is built to accept the turbocharged Offy engine and to meet all specifications for USAC Championship cars. Its construction is monocoque aluminum alloy back to the firewall and a subframe aft of the firewall

Q. *What is it like in the driver's seat of one of your Eagles? What instruments and controls are on the dash?*—James Spencer, Baltimore, Md.

A. Each seat is custom-fitted to an individual driver and it gives good support on both sides as well as back and forward. In addition, there are lap and crotch belts as well as shoulder harnesses. There is very little extra room, but it is very comfortable. We have a tachometer, water temp, oil temp, oil pressure, blower pressure gauge, a fuel pressure gauge, an ignition switch, a fire extinguisher actuator, a chassis handling mechanism, a gear selector, a fuel selector lever and a radio sending button—and there's even an oil pressure warning light to catch our attention!

Q. *In a previous column, you said that the Corvette doesn't meet the Trans-Am rules. Just which requirements doesn't it meet?*—Gene Bennett, Phoenix, Ariz.

A. It's not a sedan. It's only a two-seater.

Q. *If I put glass-pack mufflers on my car, do you think that cutting down the engine's back pressure such as they do would hurt it?*—Ralph Tomlinson, Chicago.

A. No, the glass packs will provide enough back pressure not to hurt engine operation.

Q. *Why are Chrysler engines preferred over Chevy engines in funny cars? What advantage do "Hemis" have?*—Steve Wyland, San Carlos, Calif.

A. The hemispherical cylinder-head design is slightly better for the job.

Q. *I notice race drivers saying their cars ran better after a "chassis adjustment." What are they*

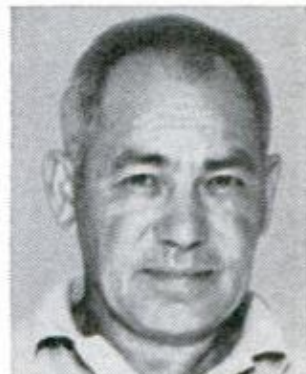
(Please turn to page 38)

when I planned to retire before fifty

this is the business that made it possible

a true story by John B. Haikey

Starting with borrowed money, in just eight years I gained financial security, sold out at a profit and retired.



"Not until I was forty did I make up my mind that I was going to retire before ten years had passed. I knew I couldn't do it on a salary, no matter how good. I knew I couldn't do it working for others. It was perfectly obvious to me that I had to start a business of my own. But that posed a problem. What kind of business? Most of my money was tied up. Temporarily I was broke. But, when I found the business I wanted I was able to start it on a little over a thousand dollars of borrowed money.

"To pyramid this investment into retirement in less than ten years seems like magic, but in my opinion any man in good health who has the same ambition and drive that motivated me, could achieve such a goal. Let me give you a little history.

"I finished high school at the age of 18 and got a job as a shipping clerk. My next job was butchering at a plant that processed boneless beef. Couldn't see much future there. Next, I got a job as a Greyhound Bus Driver. The money was good. The work was pleasant, but I couldn't see it as leading to retirement. Finally I took the plunge and went into business for myself.

"I managed to raise enough money with my savings to invest in a combination motel, restaurant, grocery, and service station. It didn't take long to get my eyes opened. In order to keep that business going my wife and I worked from dawn to dusk, 20 hours a day, seven days a week. Putting in all those hours didn't match my idea of independence and it gave me no time for my favorite sport—golf! Finally we both agreed that I should look for something else.

"I found it. Not right away. I investigated a lot of businesses offered as franchises. I felt that I wanted the guidance of an experienced company—wanted to have the benefit of the plans that had brought success to others, plus the benefit of running my own business under an established name that had national recognition.

"Most of the franchises offered were too costly for me. Temporarily all my capital was frozen in the motel. But I found that the Duraclean franchise

offered me exactly what I had been looking for.

"I could start for a small amount—a little over a thousand dollars—and that amount I could borrow. I could work it as a one-man business while getting a start. No salaries to pay. I could operate from my home. No office or shop rent or other overhead. For transportation I could use the trunk of my family car. (I bought the truck later, out of profits.) But, best of all, there was no ceiling on my earnings. I could build a business as big as my ambition and energy dictated. I could put on as many men as I needed to cover any volume. I could make a profit on every man working for me. And, I could build this little by little, or as fast as I wished.

"So, I started. I took the wonderful training furnished by the company. When I was ready I followed the simple plan outlined in the training. During the first period I did all the service work myself. By doing it myself, I could make much more per hour than I had ever made on a salary. Later, I would hire men, train them, pay them well, and still make an hourly profit on their time that made my idea of retirement possible—I had joined the country club and now I could play golf whenever I wished.

"What is this wonderful business? It's Duraclean. And, what is Duraclean? It's an improved, space-age process for cleaning upholstered furniture, rugs, and tacked down carpets. It not only cleans but it enlivens and sparkles up the colors. It does not wear down the fiber or drive part of the dirt into the base of the rug as machine scrubbing of carpeting does. Instead it *lifts* out the dirt by means of an absorbent dry foam.

"Furniture dealers and department stores refer their customers to the Duraclean Specialist. Insurance men say Duraclean can save them money on fire claims. Hotels, motels, specialty shops and big stores make annual contracts for keeping their carpets and furniture

fresh and clean. One Duraclean Specialist recently signed a contract for over \$40,000 a year for just one hotel.

"Well, that's the business I was able to start for a little over a thousand dollars. That's the business I built up over a period of eight years. And, that's the business I sold out at a substantial profit before I was fifty."

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DRIVIN' WITH DAN

(Continued from page 36)

adjusting, and can you make the same adjustments on a passenger car?—Carl Barnes, Oklahoma City.

A. Modern racing cars usually have many possible "chassis adjustments," which usually consist of things like the brake balance front to rear, shock absorber adjustment, the anti-roll bars front and rear, controlling chassis roll resistance in cornering, ride height front and rear, toe-in adjustments, camber and caster adjustments and, more recently, front and rear-wing adjustments. They still adjust tire pressure also. You can make some of these adjustments on a passenger car, but most would be very difficult. On a race car the chassis is built to be adjusted.

Q. Jim Malloy amazed a lot of people when he qualified your car with very little practice and then placed fourth at Indy. How did you select Malloy from all the other drivers at Indy?—Paul LeClercq, Evergreen, Colo.

A. Jim did do an excellent job at Indy, especially since he had to cope with many many extra problems during the race. Jim impressed me as being the best uncommitted driver there.

Q. On USAC Championship cars, who makes the majority of the turbochargers and how much would one cost? Also, how do you slow the turbocharger?—Les Richardson, New Orleans.

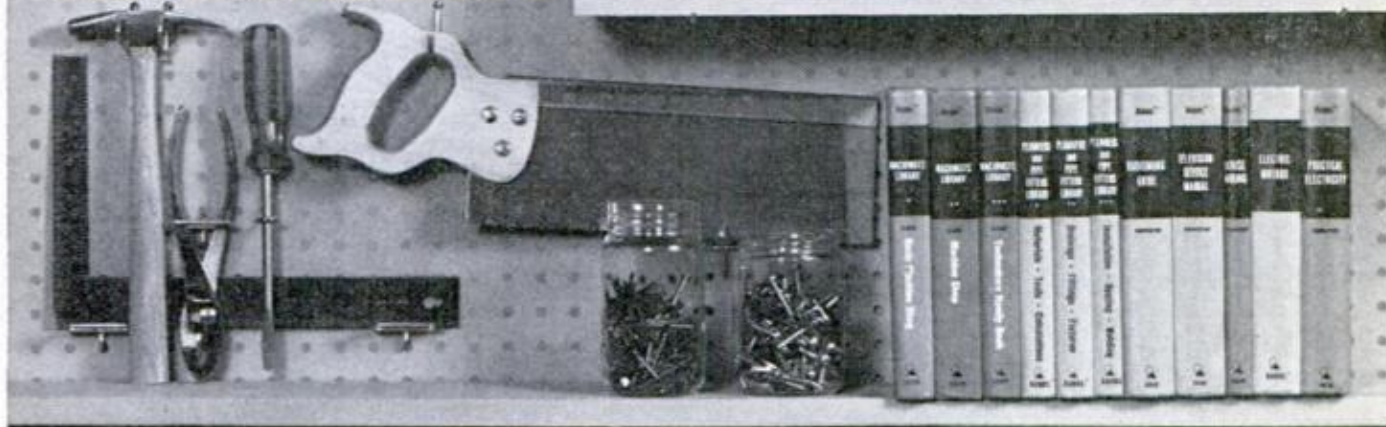
A. Airesearch makes most of them. Cost is \$792. The turbocharger slows down rather quickly once you lift your foot off the accelerator pedal. Butterflies close in the inlet tubes to shut off most of the fuel supply. Therefore there's not much exhaust gas to drive the exhaust impeller.

Q. If you were starting over on your driving career and knew what you know now, would you still start off in sports cars? (Presuming you could start in any type of racing you wanted.) Also, why?—Robert Gunderson, Lincoln, Neb.

A. Wow! Good question, but I don't know how to answer it. I believe I would start in road racing, probably a production car but maybe a Formula V or Ford or possibly a 2.5-liter Trans-Am car. I might also start on oval

(Please turn to page 40)

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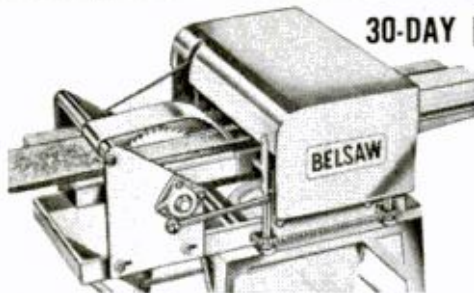
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DRIVIN' WITH DAN

(Continued from page 38)

racing. The point is that in the beginning it doesn't really matter very much. The important thing is to get varied experience and try to start winning.

Q. In the September issue of Popular Mechanics you talked about understeer and oversteer. You stated that understeer means that the car doesn't actually turn as much as the front wheels turn and that oversteer is when the car turns more than the front wheels turn. Isn't this an incorrect statement?—Lowell Thousand Jr., Rochester, Ind.

A. No, it is correct. A case of extreme understeer would be a car which wanted to go straight no matter how much the driver turned the wheels.

Q. How fast could the Datsun pace car go at the California 500? And why did the USAC ban Andy Granatelli's turbine car?—Chris Kotowski, Covina, Calif.

A. The Datsun would go a little over 120 mph and it would lap at over 115 mph. The turbine-car engine was large enough and powerful enough so that it could "loaf" and still be very, very fast. This meant that the engine had a reliability advantage. The USAC didn't ban it, it just cut the size down to where the turbine car was going to have to strain to keep up, just like the piston-engine cars do.

Q. I knew about your young Indianapolis driver, Swede Savage, being hurt last season and I am wondering how he is recovering.—Jaime Campos, Dallas, Tex.

A. At this writing, Swede has not regained his old form completely, but he is back racing!

Q. Is gearshifting required to get around Indy or any of the other big speedways at maximum speed?—Charles Washburn, Oakland, Calif.

A. No. It's as "easy" as you've heard: Foot to the floor and steer left! ★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 22).

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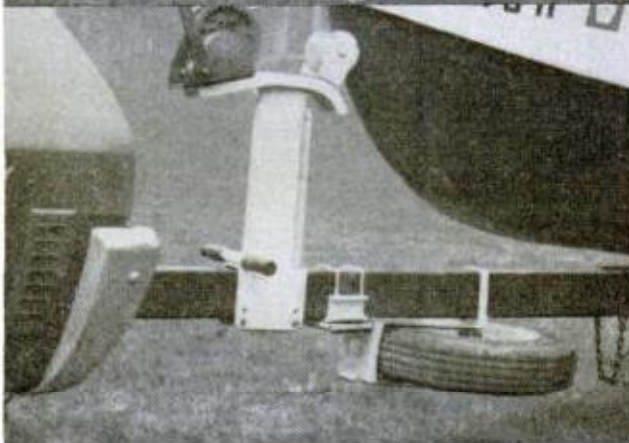
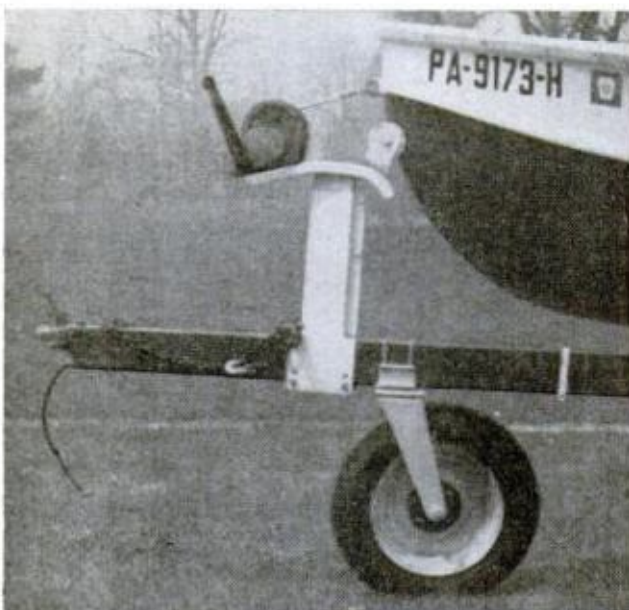
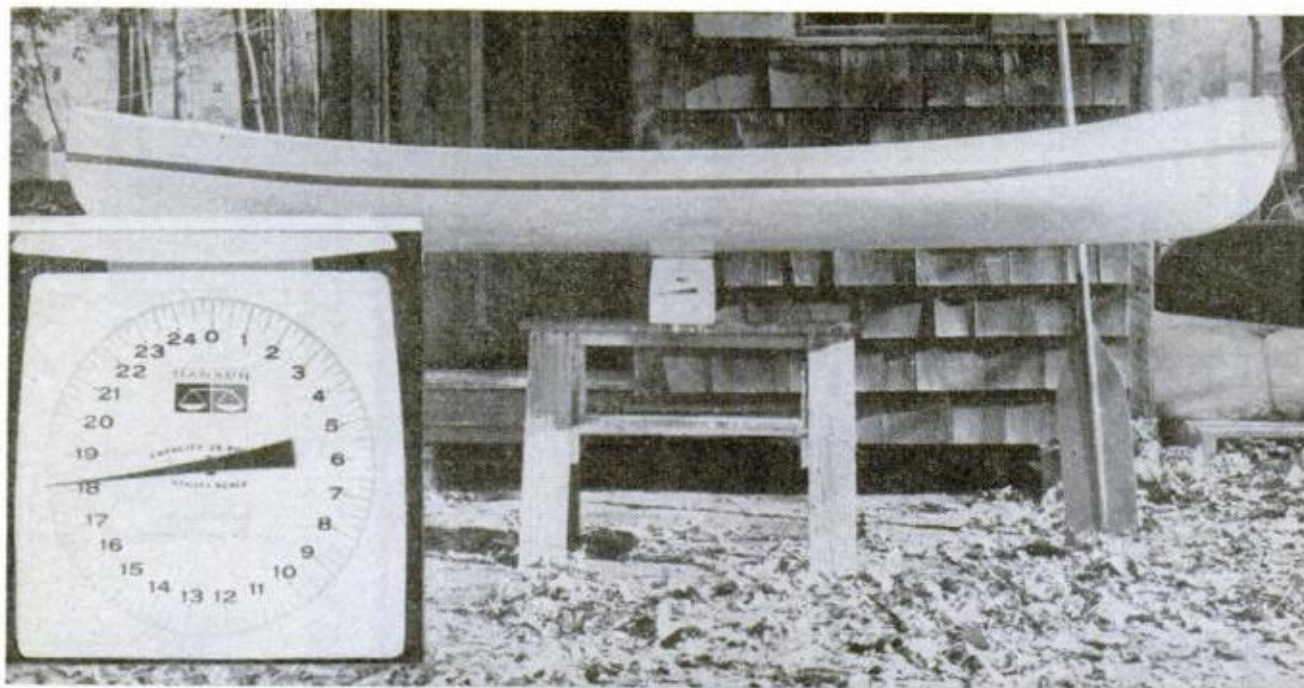
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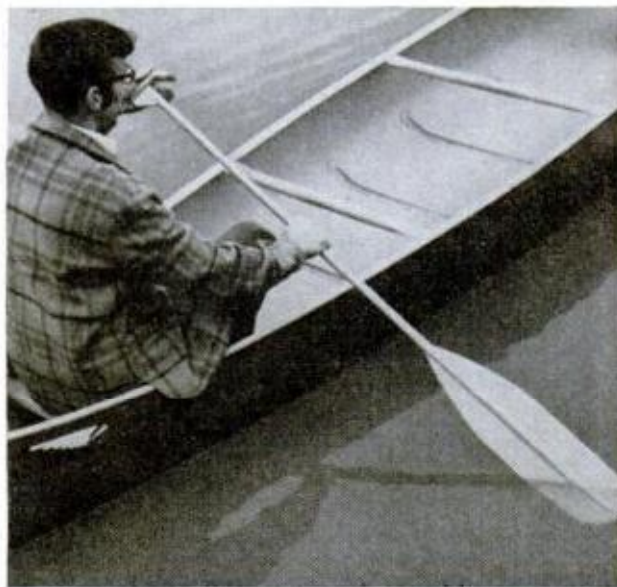
By GEORGE REIGER



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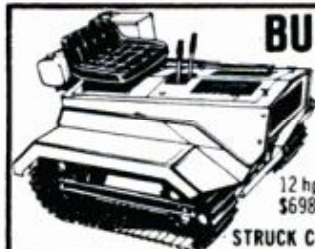
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APPLIANCE CLINIC

By PAUL MANN

Dirty fan rotor shaft

When disassembling a small electric fan for repair, I found the rotor shaft extremely dirty and somewhat scratched. Can anything be done to restore this part so I don't have to buy a new motor?—Edward Rickel, Ann Arbor, Mich.

Wrap a strip of crocus cloth around the shaft and turn the part by hand. Do not use a back and forth motion. When all dirt has been removed, sprinkle some jewelers' rouge on a clean, soft cloth and polish the shaft with the same circular motion you used with the crocus cloth. Keep polishing until the shaft is smooth to the touch.

Better safe than sorry

My Maytag gas dryer is only seven years old. When I turn it on, the flame stays on for about a minute and then shuts off. A local repairman couldn't solve the problem and suggested I buy a new dryer. Do you agree?—Anthony Nardiello, Roselle Park, N. J.

No. The fact that the dryer stays on for a minute or so before shutting down indicates that an internal safety device is kicking the machine off because of a hazard. There are a few systems in a gas dryer that have sensors which will shut the machine down if they malfunction. One is the blower. If it is not working, a safety sensor will sense the build-up of heat and shut the dryer off to keep heat from reaching a critical point. Other systems controlled by safety devices are the pilot assembly and thermostats. Checking each of these parts involves time and effort to be sure, but it's far better to pay a competent serviceman his price to find and fix the trouble than to pay for a new machine which is not needed.

On ice

I have a Kelvinator refrigerator about 10 years old. My brother has one that's fairly new and equipped with an automatic icemaker. I find this is a useful piece of equipment and would like to have one in my refrigerator. Is there a way that I

can equip it with one?—Thomas McKnight, Walton, N.Y.

You can add an automatic icemaker to your refrigerator, but the hardware must be supplied by the manufacturer of the refrigerator. Other makes usually won't fit. I suggest you write the service department of Kelvinator Div., American Motors Corp., 14250 Plymouth Rd., Detroit, Mich. Instructions on installing the icemaker will be provided with the hardware.

Screw problem

I was fooling with an old Westinghouse hair dryer recently, trying to repair it. In attempting to remove the impeller from the motor shaft, I found it fastened with a small setscrew that resembled an Allen screw. On closer examination, I saw that this screw had a splined hole instead of the hexagonal hole of an Allen screw. What kind of screw is this and can I use an Allen wrench to remove it?—Robert Coler, Oakland, Calif.

It's a Bristo screw, and you can't use an Allen wrench. You have to use a Bristo wrench, which has the same L-shaped appearance as an Allen wrench, but is



shaped (see diagram) to fit the splined hole. If your hardware dealer doesn't carry Bristo wrenches, he can get one for you on special order.

Interrupted symphony

If someone is listening to the radio or watching television and I start the vacuum cleaner, static fills the set. Can this be prevented?—Mrs. Paula Freedman, Portland, Ore.

If vacuum-cleaner operation causes radio or television interference, the motor brushes are usually arcing. Brushes are supposed to make good solid contact with the commutator of the appliance motor. If brushes are so worn that they barely touch the commutator surface, electricity arcs (jumps) the gap. However, there could be another reason for your trouble.

The high-frequency alternating current emitted by a vacuum-cleaner motor could be enough to cause radio wave interference. For this reason, some vacuum cleaners are equipped with filter capacitors that suppress this high frequency. If brushes

(Please turn to page 46)



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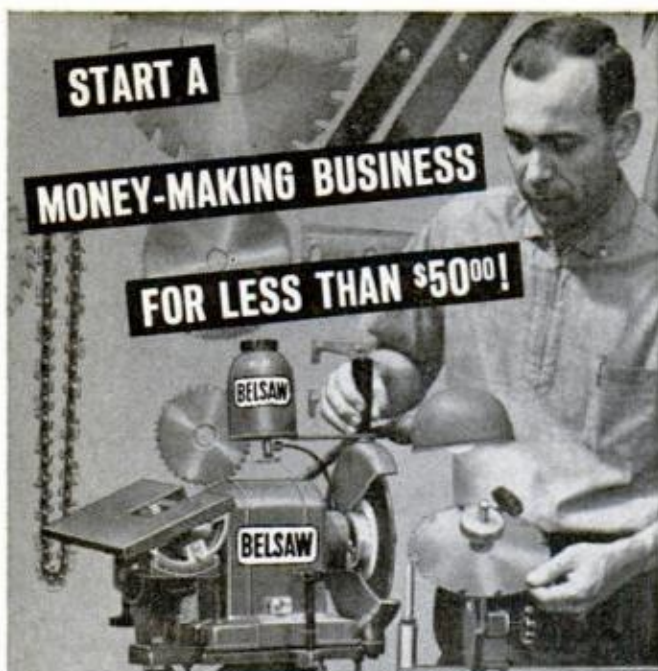
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APPLIANCE CLINIC

(Continued from page 44)

are okay, it's possible that a capacitor is leaking. In any event, the fact that you get radio and TV interference when the vacuum cleaner is operating indicates that the appliance should be checked.

Smokey the oven

What's happened to my self-cleaning electric oven? The second I turn it on to the self-cleaning cycle a great deal of smoke is produced. It never did this before.—George Baumeister, Jacksonville, Fla.

To get rid of smoke produced by the burning-off of food spilled in the oven, self-cleaning ovens are vented through a smoke eliminator. A smoke eliminator is nothing more than a metal tube on top of the oven that is equipped with a catalyst, such as platinum-sponge. As the smoke passes through the catalyst, it breaks down chemically and is eliminated. To assure fast removal of smoke as the self-cleaning cycle is initiated, the catalyst is preheated by a small heating coil that is wound around the outside of the metal tube. It's my guess that this coil has failed.

Maintenance Tips

- **Check switch before motor.** Whenever an appliance equipped with a variable speed universal motor (food blenders and food mixers, for example) refuses to start, the first thing to do is check the selector switch for a bad connection or dirty contacts. A bad switch is more common than a malfunction in the motor; taking the motor apart before inspecting the switch will usually result in unnecessary expense and work.

- **Clothes dryers must breathe.** The greatest enemy is lint that's allowed to build up on the lint trap. For maximum service, get the habit of cleaning that trap before every use.

- **When disassembling an electric iron,** it will be easier to remove parts from the soleplate if you use two 3-in. C-clamps to hold it firmly to the edge of the workbench. Place a thin pad of cloth between the soleplate and the bench top to prevent scratching, and position the clamp handles down to keep them out of the way while you work. ★★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.

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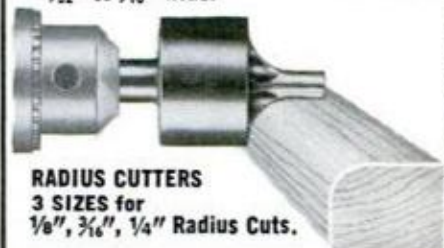
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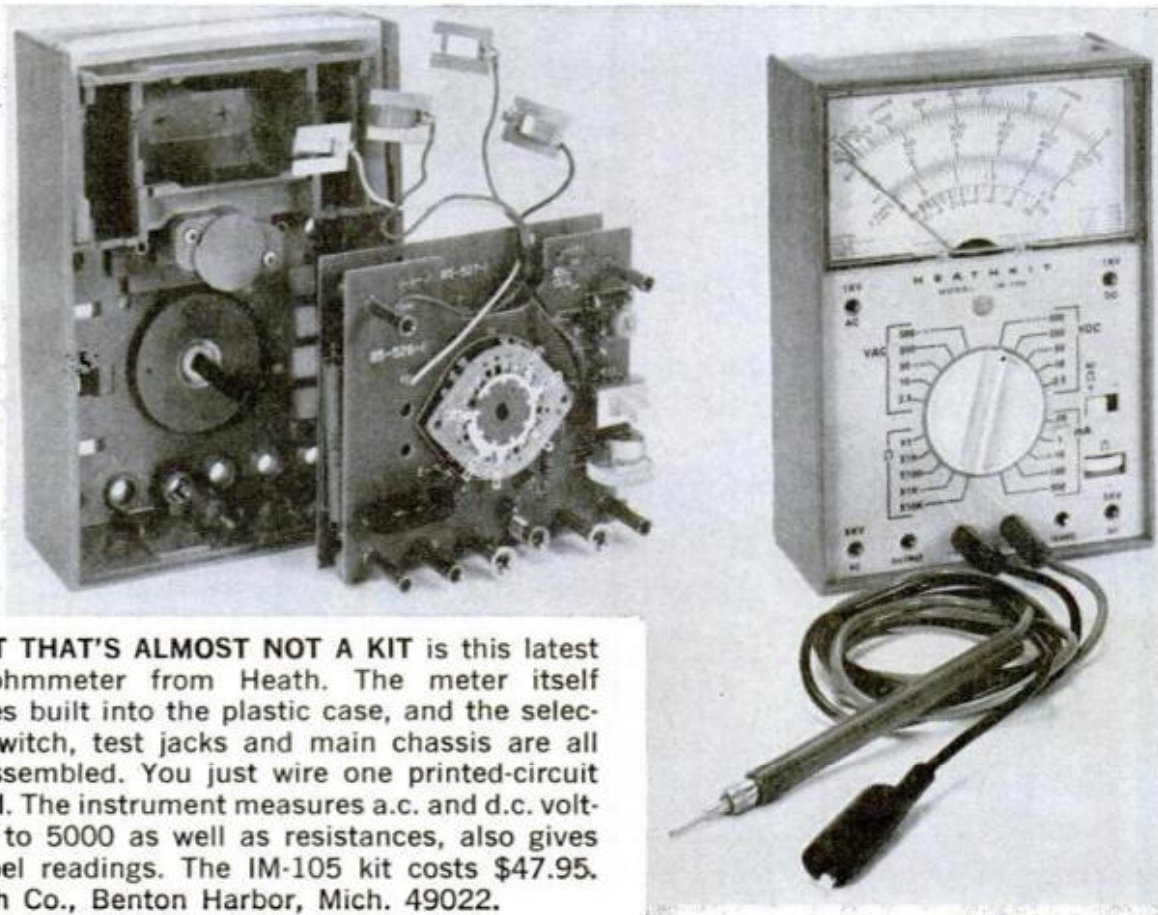
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NEW IN ELECTRONICS



SHOW HOME MOVIES ON TV? That's exactly what you can do with this experimental video film player developed by Kodak. About the size of a hi-fi set (left, above), it takes standard Super-8 film cartridges and displays movies in full color on any color TV set. While Kodak isn't saying how the system works, it's easy to guess that it's similar in principle to that used in Sylvania's Color Slide Theater, which, incidentally, employs a Kodak Carousel projector to show color slides on a built-in

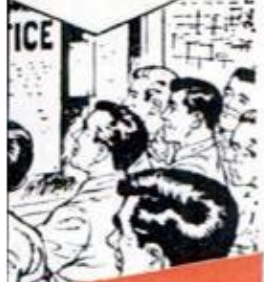
TV screen. In this system, color images are broken into red, blue and green by dichroic filters, then converted to TV signals by a scanner. On the TV screen, signals representing the red, blue and green images are recombined—just as in regular color TV—to produce a full-color duplicate of the original picture. Sound can also be added by sending audio signals to the TV set from the film's sound track. How soon the players will go on sale and their cost are not yet known.



A KIT THAT'S ALMOST NOT A KIT is this latest volt-ohmmeter from Heath. The meter itself comes built into the plastic case, and the selector switch, test jacks and main chassis are all preassembled. You just wire one printed-circuit board. The instrument measures a.c. and d.c. voltages to 5000 as well as resistances, also gives decibel readings. The IM-105 kit costs \$47.95. Heath Co., Benton Harbor, Mich. 49022.

(New in Electronics [continues on page 50](#))

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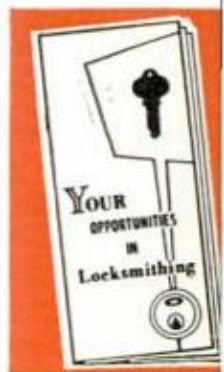


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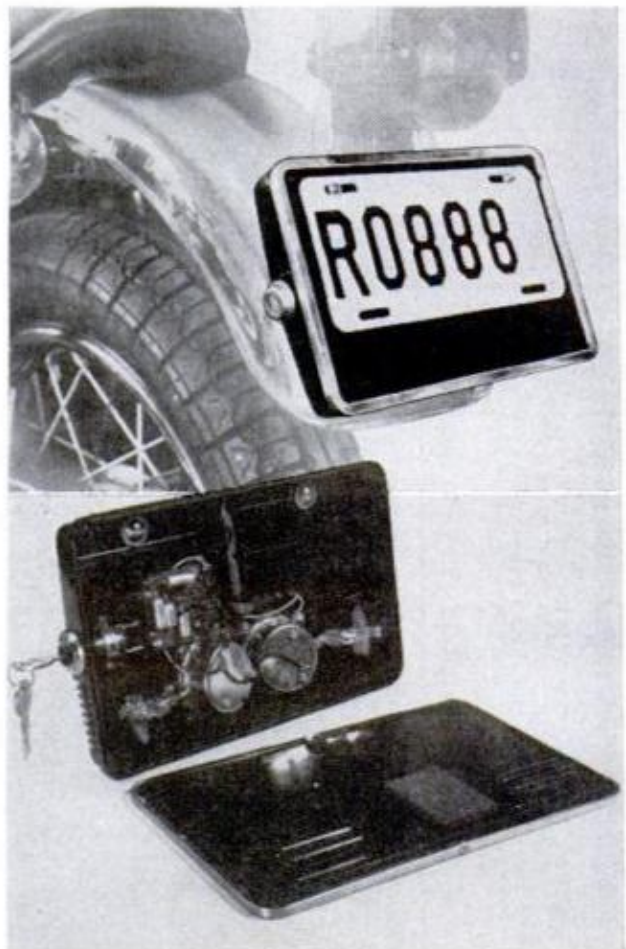
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DO NOT CUT BUT FOLD HERE—Seal.



LOOK, MA, NO WIRES, yet the young lady in the pool above is making a phone call just the same. The cordless phone operates on radio frequencies and is designed to serve as a portable extension in the back yard, at construction sites and other locations where permanent wiring isn't available. Developed by S.U.S. Enterprises in Los Angeles, Portafone can be tied in with the regular telephone system. It's expected to be in use next year.



TWO HANDY PLUG-IN AIDS for car tape players are shown above. At top is a head demagnetizer for eight-track cartridge players. At bottom is a transverter, sold in three models, that provides 6, 7½, or 9 volts d.c. for portable cassette players. Both plug into a car's cigaret-lighter socket for power. A multi-prong adapter plug enables the transverter to fit most machines. Made by Audiotex, the demagnetizer is \$9.90; the transverter, \$6.85.

IT LOOKS LIKE AN ORDINARY license-plate holder, but jiggle it a bit and off goes a loud electronic alarm hidden inside the thin case. The idea is to scare away a would-be motorcycle thief the minute he attempts to make off with a parked machine. When the cycle's rightful owner returns, he deactivates the motion-sensitive battery-powered alarm with a key. Price is \$29.95. Tempo Products Co., 6200 Cochran Rd., Cleveland, Ohio 44139.



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

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

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

By Victor B. Mason

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

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

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

I Have All The Money I Need

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

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

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

A Fascinating and Peculiar Business

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

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

Are You Mechanically Inclined?

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

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

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

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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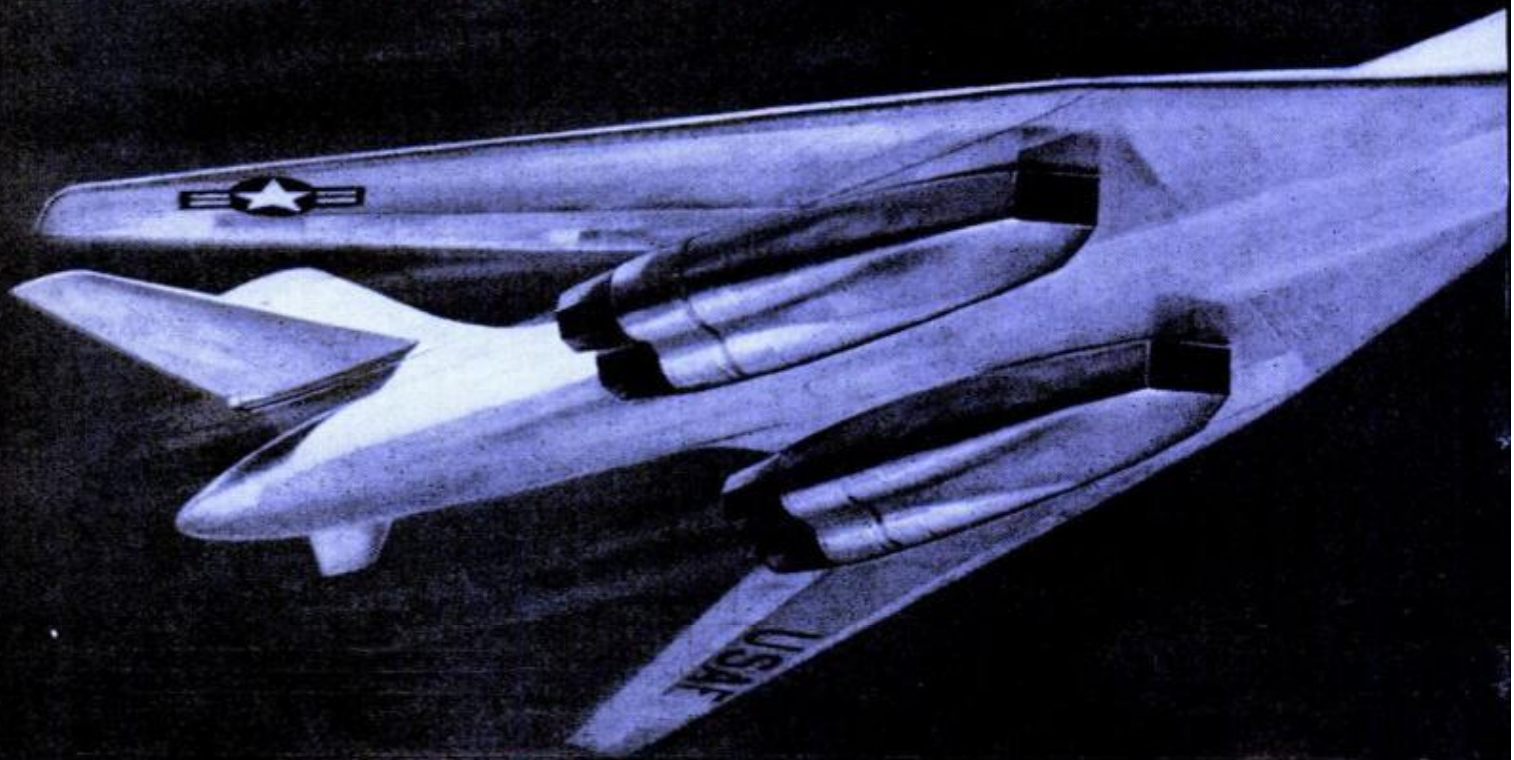
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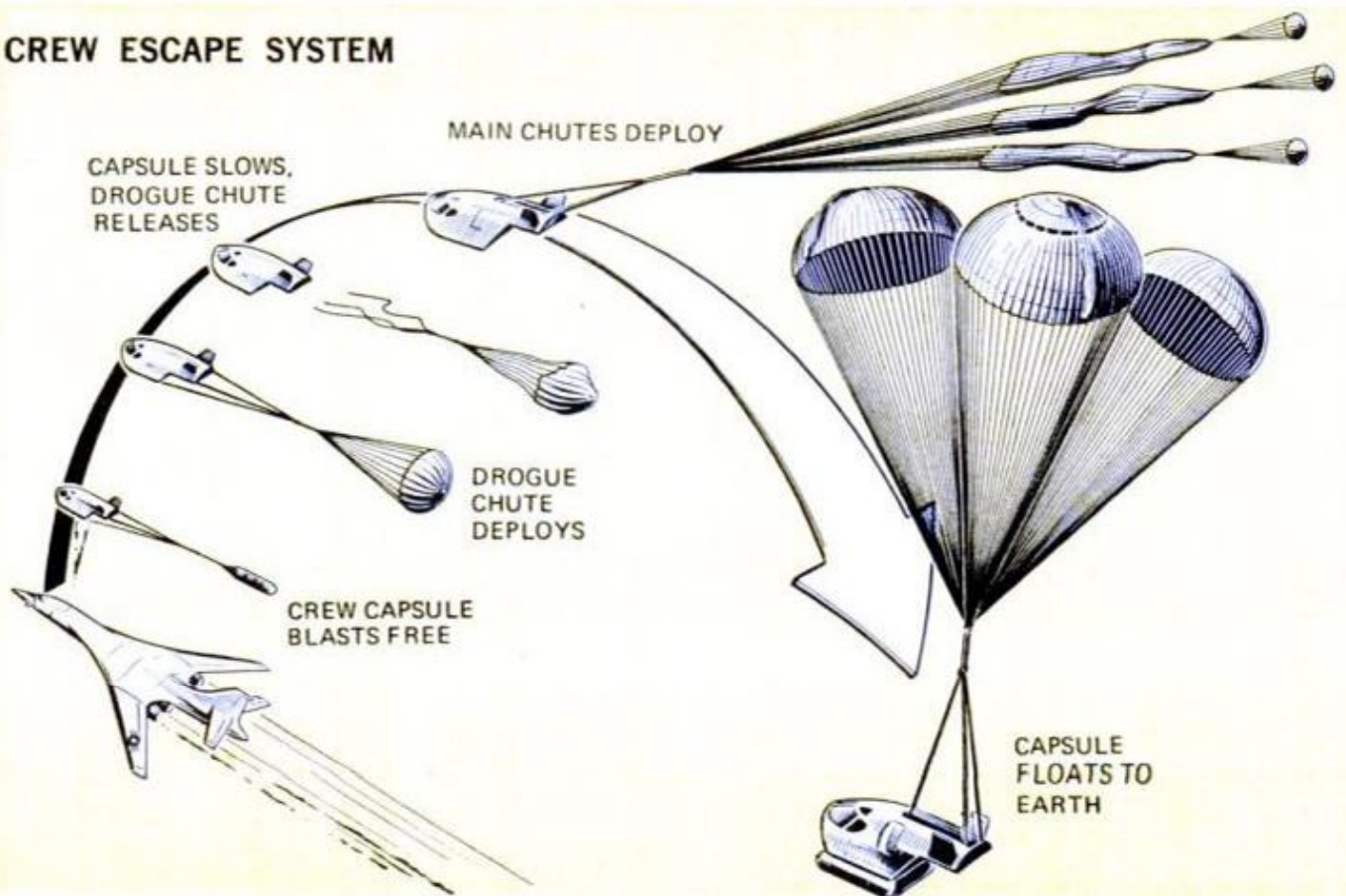
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B-1: a flexible flyer for the '80s

By KEVIN BROWN



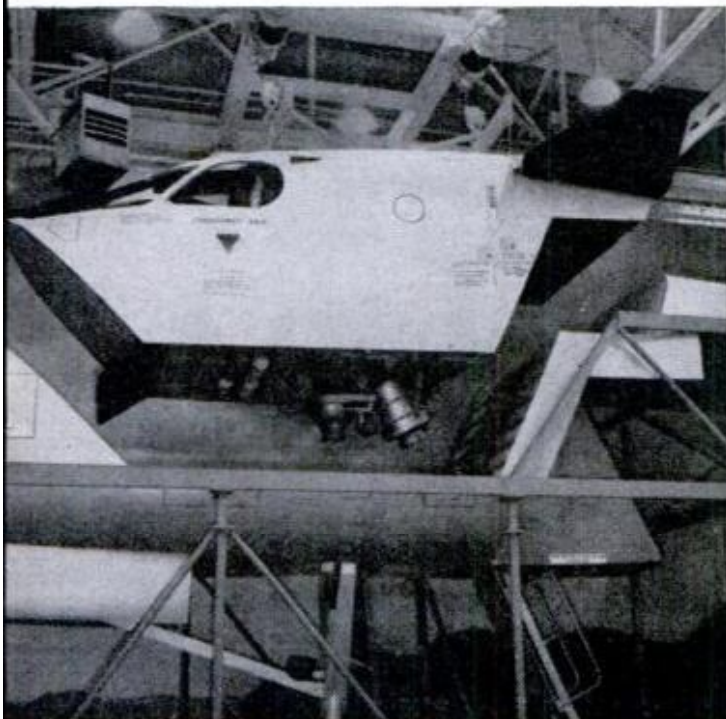
CREW ESCAPE SYSTEM





Designed to replace the aging B-52 bomber, the swingwing B-1 will make high or low-level runs, flying at subsonic or supersonic speeds. Its payload will be almost double that of the B-52

IN EMERGENCY, the crew capsule could be blasted free and its recovery chutes deployed, as shown in drawings at left. Mock-up of capsule appears below. The system is needed because the B-1 would be used at altitudes where usual escape methods would fail



THE B-1 BOMBER has caught a lot of flak—and it has yet to get off the ground.

The flak is of the Congressional variety. Some of our lawmakers contend that the big bird isn't necessary, a waste of money at a time when our economy is in bad shape. A number of their colleagues disagree, claiming that the aging B-52—our lone strategic bomber—won't fill the bill in a supersonic, supermissile era.

One result of the B-1 controversy is that the Department of Defense has settled for an "economy" research and development program reportedly costing a bit over \$1-billion. "We don't buy till we see it fly," is DOD's attitude these days. Thus, a test-model B-1 will be flying for at least a year before a decision on production is made.

Defense officials explain that our country's strategic defense has three main elements: land-based intercontinental missiles, shorter-range missiles carried by atomic submarines and manned bombers.

The combination of bombers and missiles, according to Robert C. Seamans, Secretary of the Air Force, causes an enemy to divide his efforts, making it harder for him to neutralize either of the major elements.

Also, bombers permit a show of strength without the threat of a cataclysmic event. Unlike missiles, aircraft can be called back.

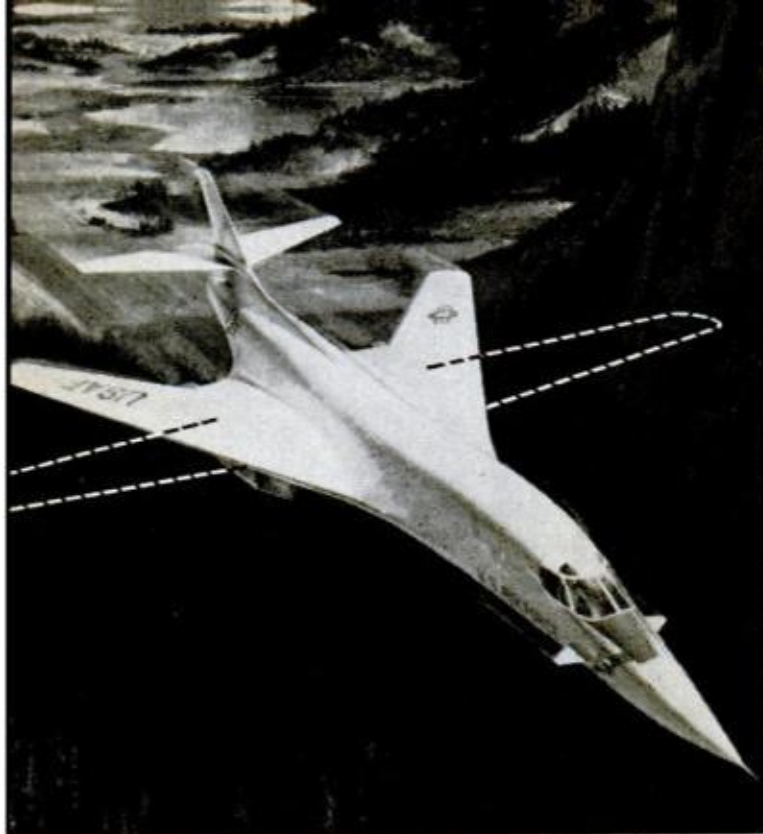
"Another point," says Secretary Seamans, is "we're not always so smart that we can see all the exact uses we will put our forces to. No one foresaw the extensive use of the B-52 and of flying tankers in Southeast Asia—for tactical as well as strategic uses."

Recently, with critical flak still flying, North American Rockwell—prime contractor in the program—unveiled a full-sized mock-up of the B-1 at its Los Angeles plant. Under its contract, the company will build three flight-test B-1s and one fatigue-test airframe. First flight of a B-1 is scheduled for mid-1974. If it measures up, the big bird could be operational by 1978.

Visitors at the unveiling saw a sleek, needle-nosed bird that looks more like a fighter than a bomber. The B-1 is about two-thirds the size of the B-52 and is lighter (350,000-400,000 pounds gross take-off weight), but it can carry about twice the payload of the older plane.

It's loaded with the latest in electronic hardware—jamming equipment, radar, homing and warning devices, and other gear designed to protect the aircraft and

(Please turn to page 50F)



SWINGWING would be almost straight out for take-off and trimmed back for high, supersonic flight

B-1 BOMBER

(Continued from page 50E)

enable it to penetrate the enemy's electronic and weapons defenses.

The big bird can fly high or low, supersonic or subsonic, be dispersed at remote bases for greater protection and quicker reaction, and use almost every weapon in the inventory, including nuclear bombs.

It's designed to handle a variety of missions—from tactical bombing in a brushfire war to intercontinental sorties in an all-out conflict. The B-1 is ear-

marked as our principal, perhaps only, bomber well into the '90s.

The B-1 will be the first American strategic bomber with swingwings. (The FB-111 doesn't count for reasons of limited payload and range.) Relatively short takeoffs will be possible with the wings swung out, more efficient subsonic cruise with the wings part-way back, and speeds of from Mach 2 to Mach 3 with the wings swept all the way back.

Top speed is classified, but best estimates put it between 1700 and 1800 mph. In contrast, the B-52, stemming from the technologies of the late '40s, has a maximum speed of about 600 mph. The B-1 will be powered by four General Electric F-101 turbofan engines, each capable of 30,000 pounds thrust.

In addition to the wing, the B-1 has at least two other unusual features.

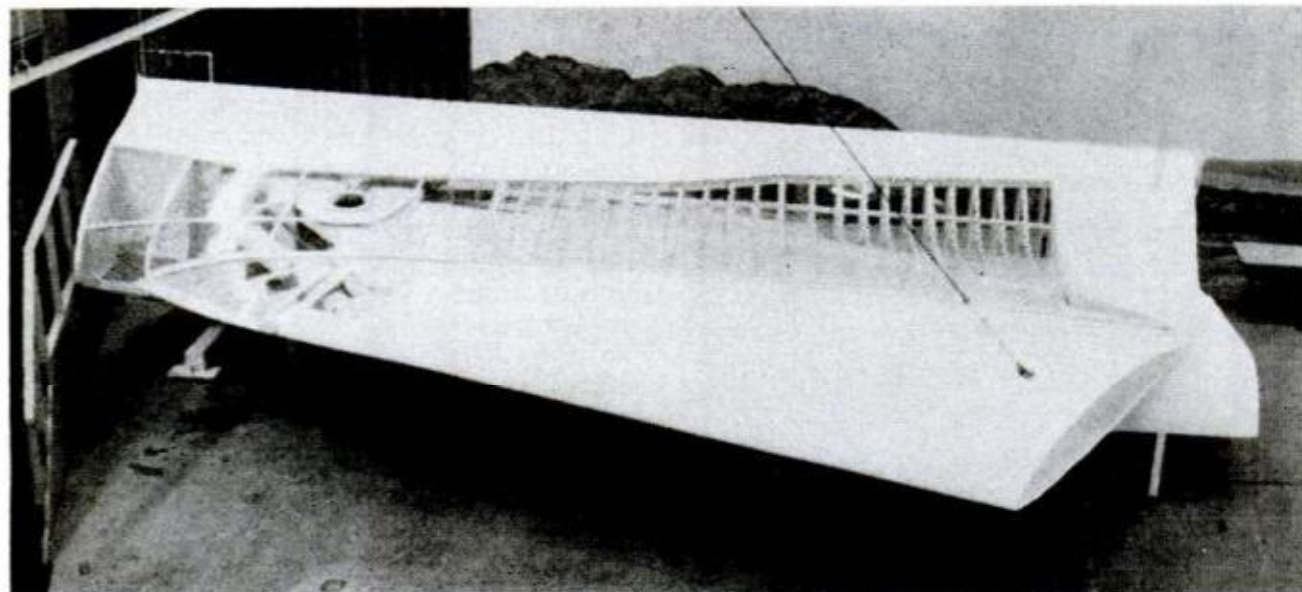
In an emergency, the entire crew compartment will be ejected as a single capsule. Free of the airframe, it will float to earth under three large parachutes. The escape compartment will have built-in flotation bladders for landing in water.

To smooth out the ride at low altitudes—where fast-flying planes really get knocked around—engineers have placed two canards, or vanes, on either side of the fuselage and just behind the nose. The effects of air turbulence on crews at low altitudes can be compared to driving a car with faulty shock absorbers over a washboard road at high speed. The vanes are designed to suppress up-and-down motions of the nose of the plane, making it easier for the crew to function.

The B-1 will have a crew of four: pilot, copilot and two systems operators respon-

(Please turn to page 50H)

MOCK-UP OF THE WING PIVOT was constructed for visual reference by engineers. Areas of particular interest are covered with plexiglass in order to allow for observation while the pivot system is operating





Are you missing half the joy of your guitar?

IF YOU'RE LIKE a lot of people who've taken up the guitar, you went out and bought your guitar with high hopes. You probably bought a little instruction book to go with it, figuring all you had to do was to learn a few chords . . . and that with a bit of practice, you'd sound pretty good.

But maybe now you're finding that what you've learned isn't enough. Being able to strum some chords and sing a few songs is nice, of course — but you get tired of the same few songs after awhile. You'd like to be able to play other, harder songs . . . to play melody along with chords . . . to say things with your guitar that you feel inside, but haven't got the musical skills to express.

If this is the way you feel, we'd like to help you get the skills you need. We'd like to teach you to play the guitar the right way . . . by note as well as by chords, and by notes and chords in combination.

We'd like to teach you to read music, too — so you won't be limited to just a few simple songs that you've memorized. We'd like to help you get the freedom and fulfillment you *should* be getting from your guitar — instead

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of frustration from not being able to play the way you want to.

In short, we'd like to teach you the same kind of things you'd learn if you went to a good, thorough private teacher. The big difference is that we teach you with lessons we send you by mail.

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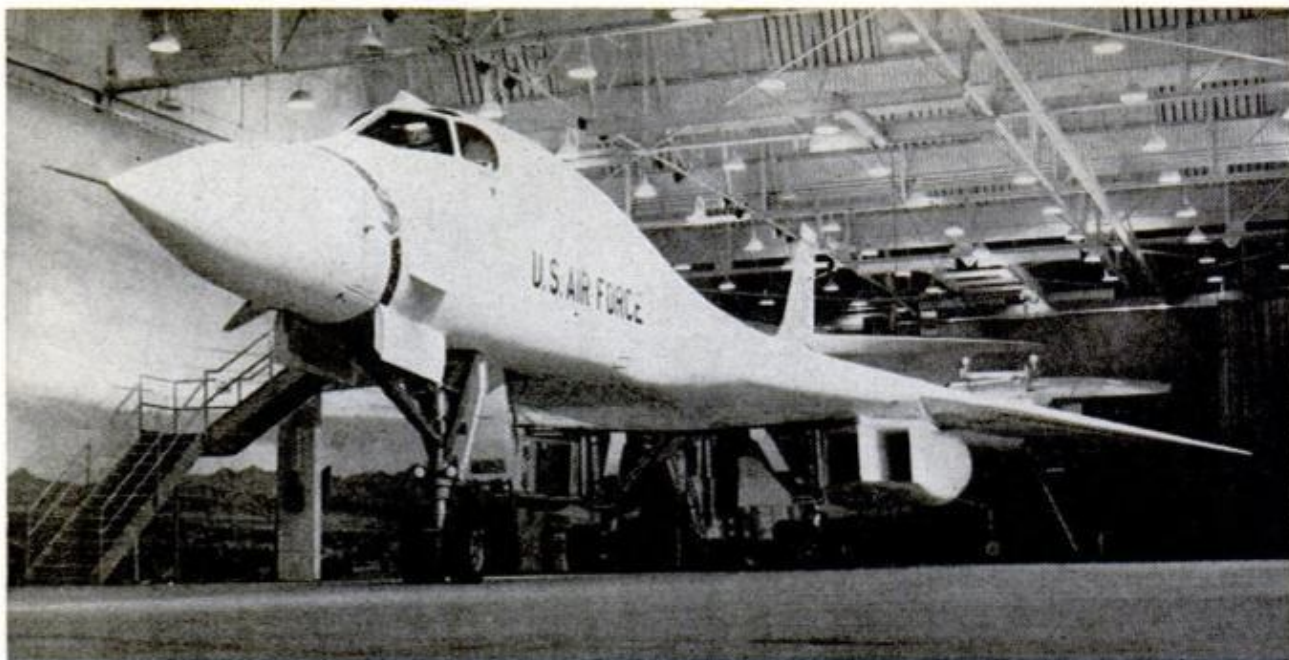
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SLEEK B-1 HAS LINES OF FIGHTER in three-dimensional mock-up. First test plane may be ready in 1974

B-1 BOMBER

(Continued from page 50F)

sible for navigation, radar, defense systems and fire control.

The B-1 can be loaded for a single-purpose mission, or a mix of missions on one flight. In addition to conventional bombs, the plane will have these new weapons:

- A *subsonic cruise armed decoy* (SCAD), the AGM 86, which can be launched from the bomb bay before the B-1 reaches enemy territory. Its 1350-pound-thrust engine can propel it 1000 miles, and its electronic gear can jam enemy radar or create a radar image resembling an aircraft. The decoy also carries a 200-pound warhead for use against enemy patrol planes.

- *Bomber defense missiles* (BDM) that can be directed at enemy interceptors, giving the B-1 a fighter-plane capability and eliminating the need for escorts. The BDMs also can be used to detonate, prematurely, nuclear-armed missiles, rendering them harmless. (The theory behind using nuclear warheads against bombers is that one accurate blast could destroy a whole fleet of incoming planes.)

- A *short-range attack missile* (SRAM) that can be used for air-to-ground attacks. Unlike gravity bombs, a SRAM can be guided to its target, making it a more accurate weapon, especially against radar sites.

The B-1's range is listed as "intercontinental," or in the 10,000-mile category. In other words, it could conceivably take off from an American base and hit a target anywhere on Earth. It will be guided

by an inertial navigation system—the type of system aboard all 747s.

A typical mission would go like this:

The B-1 would take off with its wings spread wide and trim them slightly as it gained altitude. At cruising altitude, normally about 50,000 feet, it would be refueled by a C-135 tanker. Today's jets use such huge amounts of fuel for takeoff and climbout that they suffer a range handicap once they reach cruising altitude. The tanker replenishes what is used up, and returns to base. The B-1, its wings trimmed all the way back, races at supersonic speeds toward its target.

On reaching enemy territory, the B-1 would drop way down, perhaps as low as 400 feet, and sweep toward its target. Within minutes, it's bombs away!

For low-flying capability, the plane will be equipped with a computerized terrain-following radar system that will allow it to follow the "nap of the earth" at near supersonic speeds. This ability would make it extremely difficult for enemy defensive radar systems to track the B-1 because hills, mountains, towers, buildings, and even trees will clutter the screen.

The B-1 may well become the most versatile bomber in the history of the U.S. Air Force. But first it will have to survive critical flak from many sides and the effects of a depressed economy. ★★★

B-1 BOMBER SPECIFICATIONS

Maximum speed: above Mach 2 at high altitudes

Range: Intercontinental

Crew: Four

Wingspan: Wings forward, 137 ft.; wings swept, 78 ft.

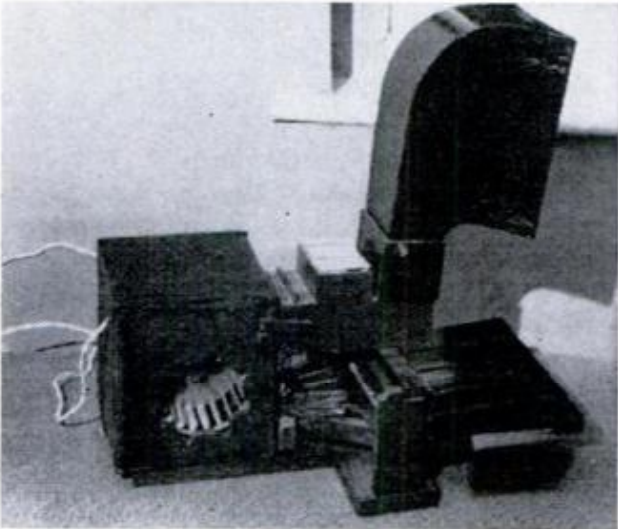
Length: 143.3 ft.

Height: 33.6 ft.

Weight: 350,000-400,000 lbs.

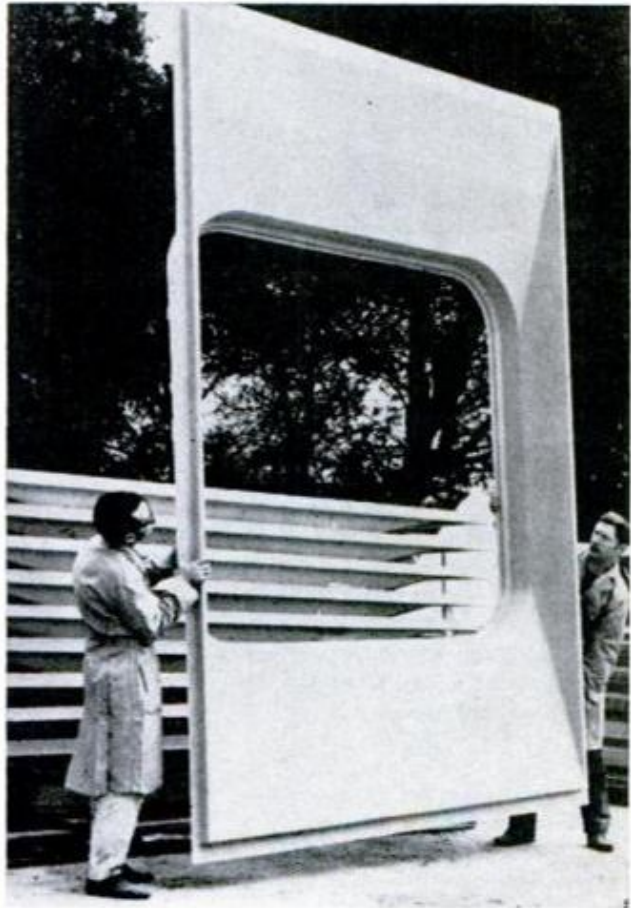
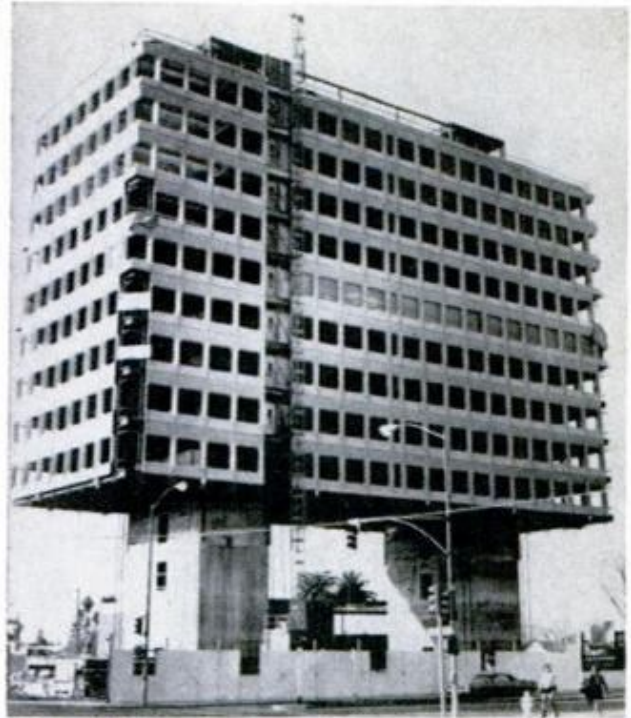
Engines: four able to produce 120,000-lb. thrust

First flight: Spring, 1974.



His 'music' smells

It's played like a piano—but when you press one of the five keys, instead of a musical note, you get a smell. The odor-producers—such as perfume or air freshener—are loaded into cassettes (bottom photo). By pressing a key (top photo), the inventor, Paul John, an art teacher, causes the smell machine to open the cassette; a small fan inside (middle photo) blows the smell toward him.



Plastic panels for high-rise

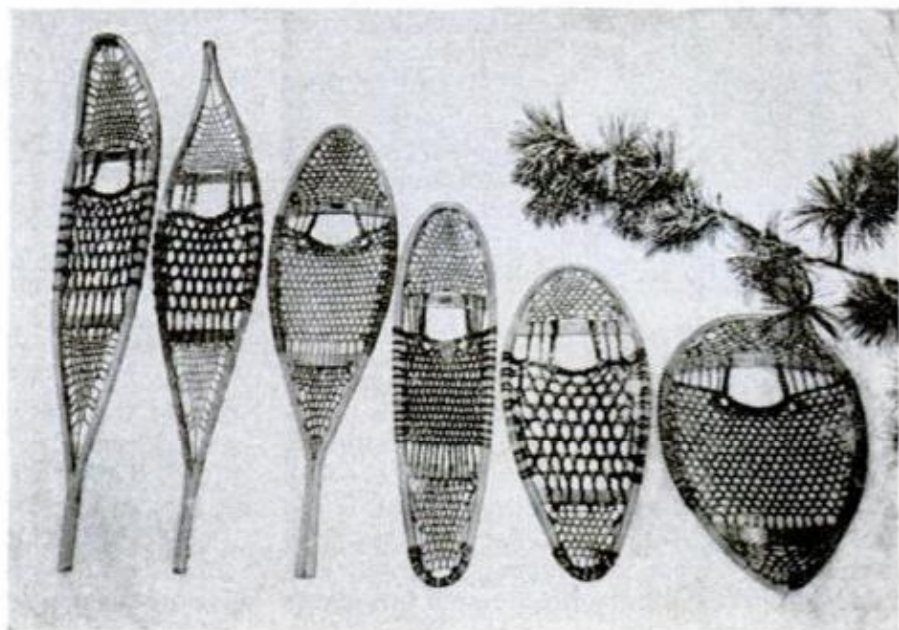
Installation of fiberglass-reinforced plastic panels for exterior walls of a recently completed high-rise office building in Mountain View, Calif., marked the first use of such panels in the United States. The RP panels, molded by Technical Plastics Corp. and incorporating PPB Industries fiberglass, weigh 70 pounds each—light enough to be handled by one or two men.



TAUT COWHIDE WEB keeps hunter afloat on drifts

Snowshoes are bigger than ever

SNOWSHOES come in at least 50 different models, each designed for a particular job or type of snow and terrain. Six of the most popular styles that range in price from \$14 to \$50 per pair are (left to right): U.S. Army, Ojibway, sport, and the tailless otter, bear paw and beavertail. The 10-inch-wide Army and 12-inch-wide Ojibway, each five feet long, are handy for cross-country travel with the tail keeping you going on a straight line. The 14 by 30-inch bear paw is most popular with trappers, followed by the 10 by 36-inch otter, and the 19 by 26-inch beavertail. "Animal shoes" are not for deep snow



By JOHN POWER

YOU'VE GUNNED your snowmobile well back into the woods, smashing a trail through deep snow far from civilization. Suddenly the motor dies, and you're faced with a hike out that would exhaust a moose.

But you reach into the machine for your snowshoes, strap them on, and in minutes you're moving comfortably over five-foot drifts.

That bit of fiction isn't as farfetched as you may think. Some states now require snowmobilers to carry "snow racquets" for such emergencies. Even more persons are taking up snowshoeing just for the fun of it. If you're considering the sport, remember:

Make sure the white ash frames are laced with heavy-duty cowhide. Thin belly leather will sag in wet snow.

Check your weight, local average snow conditions and the terrain before buying. Flat-toed shoes are fine for hard-packed and icy slopes but not very good for deep snow.

Travel across lakes and fields is easier when you wear a long slim shoe with a tail. But trappers and rabbit hunters prefer a tailless type to maneuver over fallen trees and through thick brush.

Best all-around models are the tailed curved-toe "sport" webs. They are available in graduated sizes from the 9 by 29-incher for kids under 50 pounds to a 14 by 48-incher for 200 pounders. A 14 by 42-incher is ideal if you weigh in the 150 to 175-pound range. ★★★

Does your mother-in-law call you a meatball?

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Spot-finishing metal cabinets

Edges of doors and drawers in my metal kitchen cabinets have small checks, or breaks, in the original white-enamel finish. Since I don't want to replace these, I'd like to know the best way to conceal the defects.—W.B., D.C.

Of several methods, I've found the best way is to cut a small opening, slightly larger than the break in the finish, in a piece of thin cardboard and use this as a mask. Buy a pressurized can of appliance enamel, place the mask with the opening directly over the break, hold it firmly and spray through the opening. Usually one full squirt will be sufficient. Remove the mask immediately, being careful not to slide it off. On corners, bend the mask around the corner and hold it firmly while spraying. You may have to make several masks with holes of varying size.

Water on garage floor

After a winter rain, snow or colder weather, water is on my garage floor. There are no leaks in the roof or car radiator, so I've decided water must come up through the concrete floor. But how? And how do I prevent this?—H.E., Mass.

You don't; what you see is condensation of moisture from the air on the floor, which is at a lower temperature than the air with which it is in contact. This happens during a warming trend—any time when the temperature changes from cold to relatively warm. The simple remedy is to open doors and windows to allow air circulation. Even leaving a window open when doors are closed will help. You can also cure the trouble with an automatic-control humidifier operated only when the doors are closed.

There is also the possibility that snow or rain blows in underneath an overhead-type door when it's closed. Rubber strips you can buy at hardware stores will close such an opening.

Spindle scraper

I often clean old finishes off chairs having spindles or turnings. A flat scraper is not good for this purpose as it leaves ridges. Even scrapers with curved edges don't

work well. Isn't there a better way or trick I don't know about?—R.E., Tenn.

Do you have an old pocketknife with a large blade that will hold an edge? Then grind a half-moon, or quarter-moon shape on the edge and hone it sharp. This is the best tool I've ever found for scraping the old finish off chair turnings or any small turnings. You can, of course, do this with any cabinet scraper, but the knife scraper is easier to manipulate and gets into the tight places. However, don't use this method on a valuable antique. Here, it's better to use a wash-off-type varnish remover. This will preserve the natural patina of age.

Insulating plank patcher

A room in my basement is finished with what I suppose are insulating planks of a soft, fibrous material. There are several unsightly digs and gouges. The color is off-white. What can I use as a filler?—L.G., Kans.

You might use a wood filler in powder form that's mixed with water—proportions are given on the container—provided the openings are small or no larger than a thumbprint. Press any extruding fibers back into the recess to be filled and then knife the mixed filler back in place, topping out the filler just slightly above the plank surface. Let the patch dry thoroughly, then sand it lightly until flush and finish with an off-white flat paint. It might help to add a transparent white glue, such as Elmer's, to insure patch adhesion.

Squeak in furnace duct

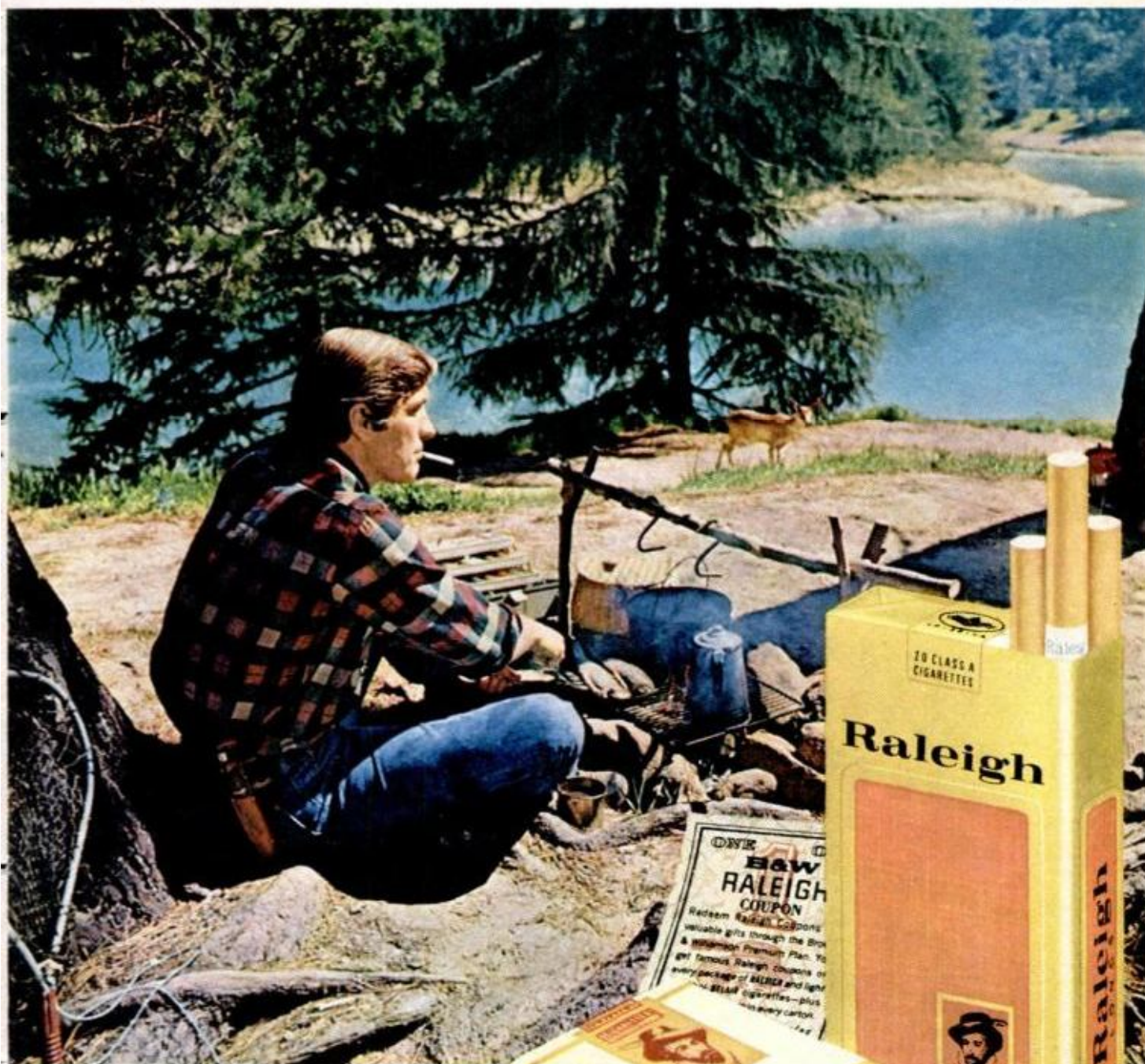
My forced warm-air furnace has developed an annoying squeak that keeps me awake. I just can't locate it, playing by ear. Isn't there some way to turn this trick?—E.W., Me.

You can usually pinpoint any squeak by pressing lightly on the sheet metal in the vicinity of the sound; continuing until, at some point, the squeak stops. Generally, the squeak originates where metal contacts metal and there is slight movement. Once you put the finger on this, a tiny drop of oil placed between meeting surfaces will let you sleep soundly. ★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.

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1.3 mg. nicotine, av. per cigarette, FTC Report Aug. '71

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A craftsman's shop that lets you work like a pro



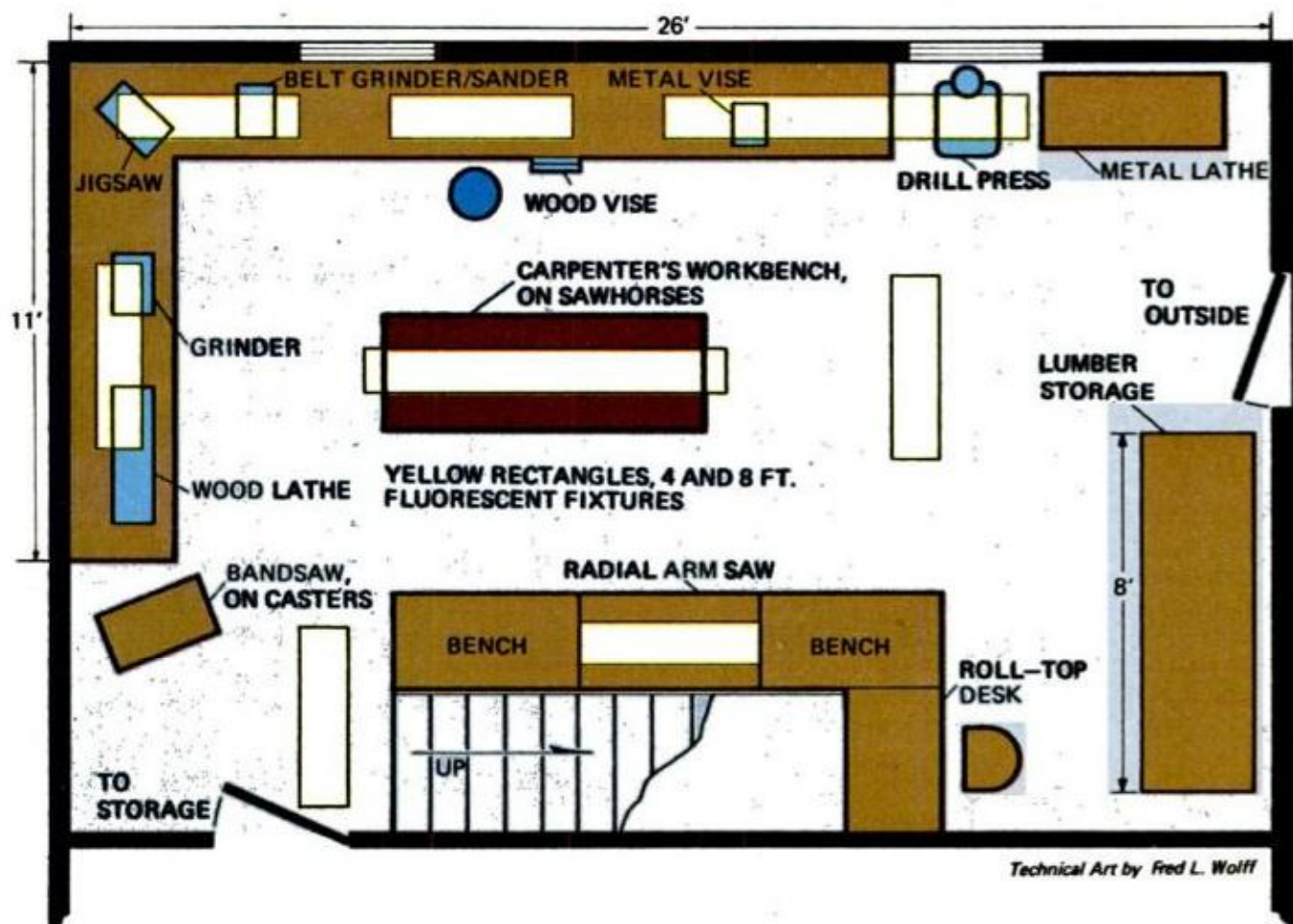
A PM FAN for years, Mel Crosby spends all the time he can in his well laid-out shop. Here, he's finishing handsome table

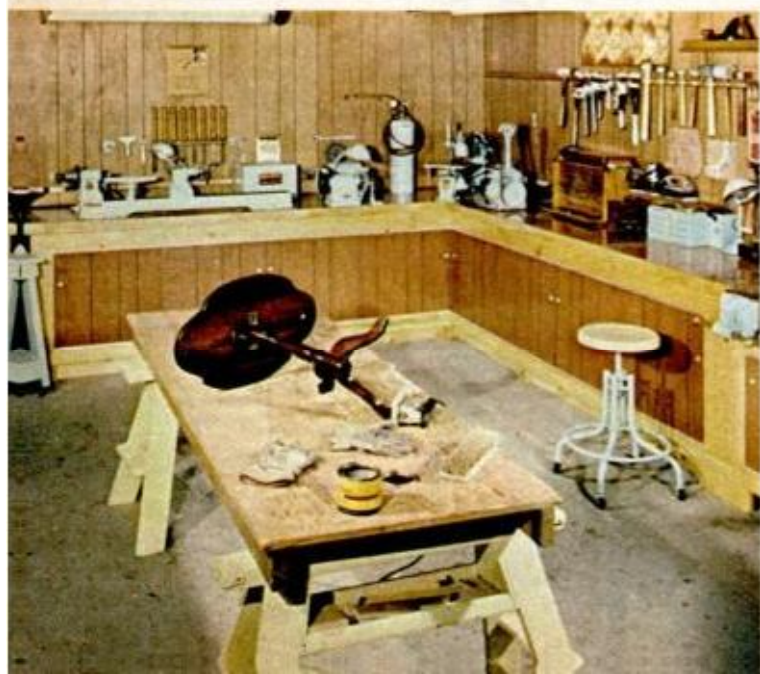
When he moved into his new home, Cape Codder Mel Crosby relied on experience and some ideas featured in PM's Great Shops series to build his dream workshop

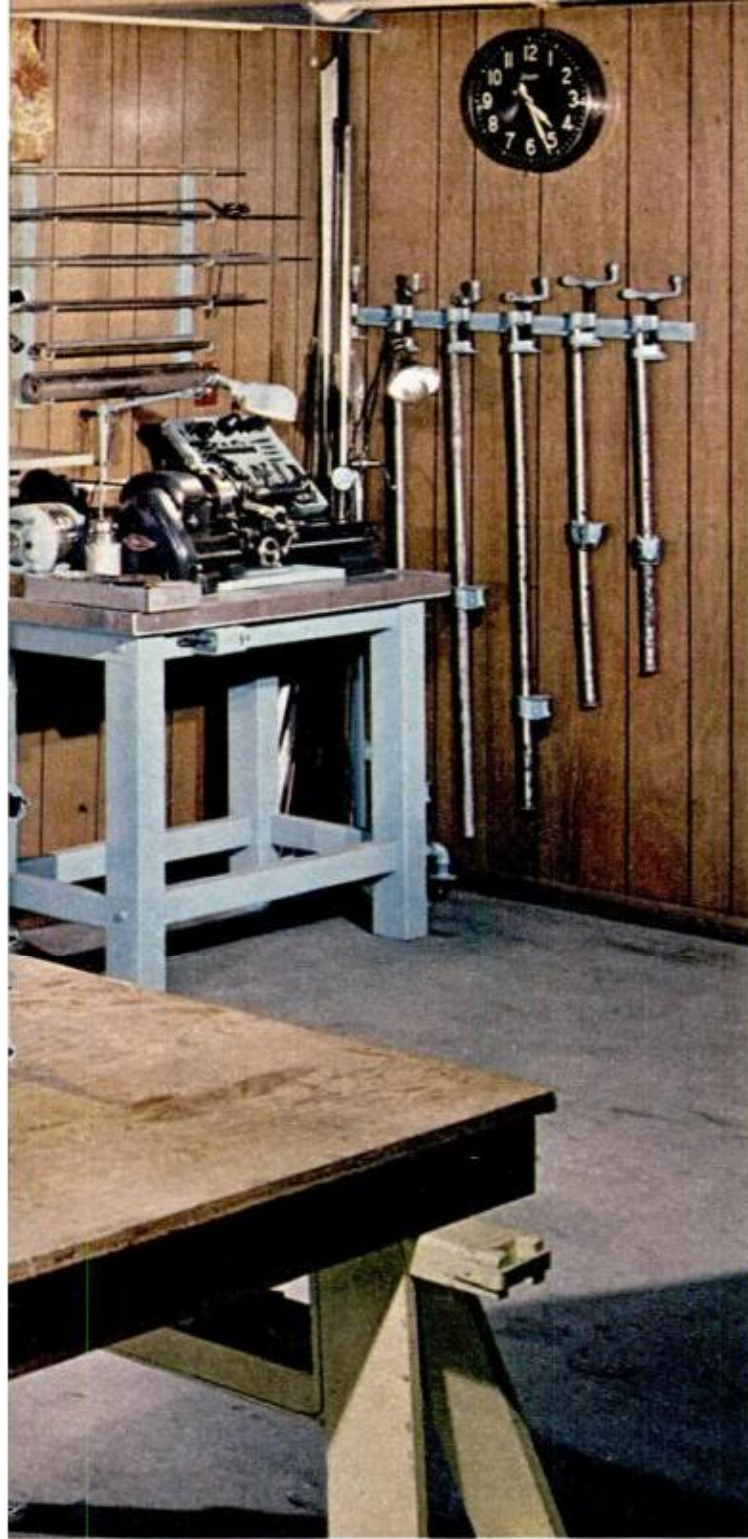
By **HARRY WICKS**
Workshop Editor

Photos by Robert D. Borst

FROM THE MOMENT we walked into Mel Crosby's comfortable home on Cape Cod, Mass., it was obvious to photographer Bob Borst and me that Mel is indeed a serious do-it-yourselfer. There are just too many personal touches around his home that







an average homeowner couldn't have had done by a professional.

We were on Cape Cod to photograph his workshop after having seen a group of pictures he sent us that convinced us his shop was superbly qualified for inclusion in PM's series of "Great Workshops."

With all the examples of Mel's craftsmanship around the house, I found that the questions came easily.

After a quick tour of his home, which houses shop-built projects by the roomful, Mel led us to his basement workshop.

The first thing that struck me (having been in the cabinetmaking business professionally) was that Mel had a worktable set up on sawhorses in the middle of the room. This is a feature you rarely find in a home shop because of limited space. But you will always find a centered "carpenter's workbench" in cabinet shops and good-size mills. The reason is that you can work a project from all four sides, rather than having to heft it and turn it about to get where you want.

Mel taught himself this trick; how long ago even he doesn't remember. He just recalls that at some point "I realized it was a heckuva lot easier to be able to get at any part of a piece of furniture without having to move it."

Mel has an inquisitive, mechanically-oriented mind. As owner of a laundry business in the Boston area, for example, he was constantly coming up with ideas for improving efficiency in his plant. Most of his ideas were worked out at night in his shop and fashioned with his own hands.

His real love is working with wood. And, from the cribbage board pictured

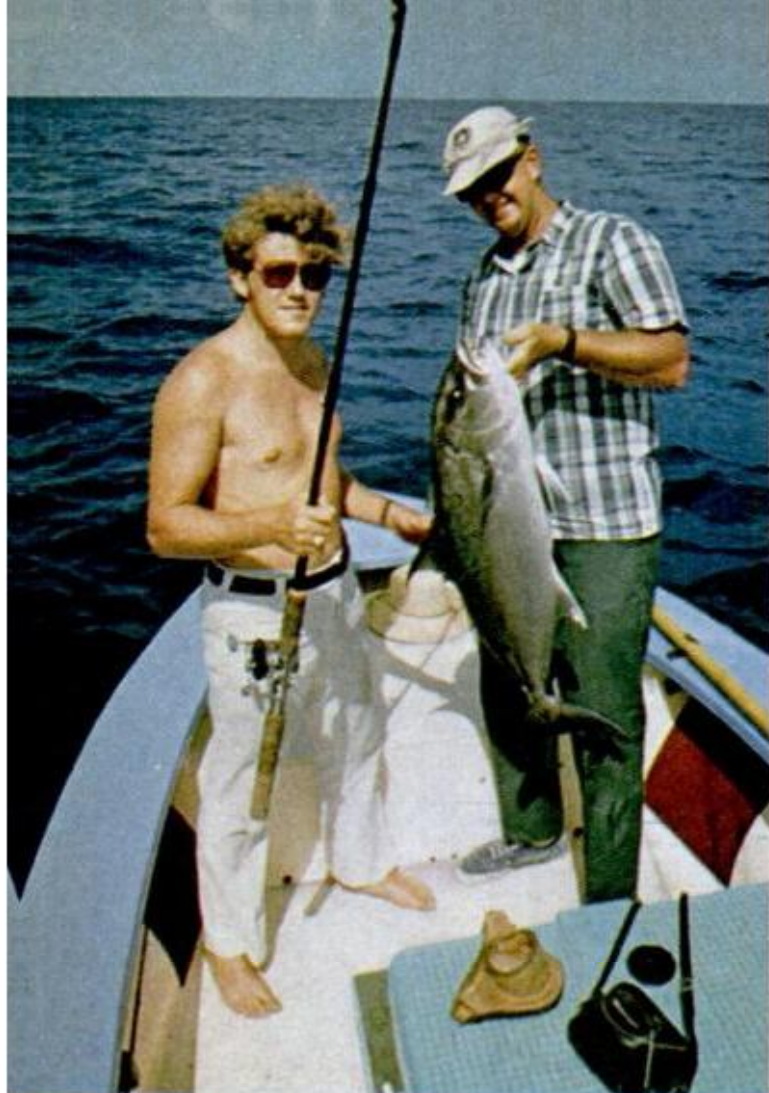
(Please turn to page 162)

CAPE COD SHOP boasts all the tools a do-it-yourselfer could ever want plus layout and space a professional cabinetmaker would envy. At left, above, Crosby is shown at worktable centered in the shop. Photo at bottom, far left, is view of the workshop from the opposite end of the room. Close-up photo at near left, shows well-thought-out planning given to wall tool storage. Crosby's shop layout was inspired by Al Meagher's Minneapolis shop featured in *Popular Mechanics* June 1970 issue.

SIMPLY

More record catches have been made from this hull than from any other in its class. Here's why . . .

By GEORGE REIGER



FIRST REAL TASTE OF OCEAN FISHING for Carter Huber was this amberjack, following initial catch of snapper. Mark Sosin and Bob Stearns (right) discuss angling strategy while riding easily in Hewes hull to likely spot. Mark looks on (below) while Bob rigs up. Note step-up casting platforms fore and aft



GREAT FOR FISHING

IN SOUTH FLORIDA, there's a group of guys who do little else but fish day after day. Some are guides, some professional outdoor writers. This fraternity of some of the world's most savvy anglers holds hundreds of light-tackle records. Their names appear among record holders of the International Game Fish Assn., Salt Water Fly Rodders and Metropolitan Miami Fishing Tournament. And men like Stu Apte, Capt. Cal Cochran, Capt. Bill Curtis, Lefty Kreh and Bob Stearns have something else in common besides a boatload of trophies. All own or use the Hewes Bonefisher.

One day I asked Mark Sosin, CBS Radio's outdoor editor and New York City's resident expert on South Florida fishing, what made the Hewes boats so special.

"Come to Key West," he said, "and I'll show you." So I flew to Florida and met Mark, Bob Stearns and Capt. Nat Ragland of Marathon, along with Carter Huber of Prospect, Ky., who had never been ocean angling before. We piled into two cars pulling a pair of Bonefishers and took off for the Key West Yacht Club.

First, the launching: "A snap," said Bob, unhooking the bow and easily shoving the boats off their trailers at the ramp.

Next, the starting: "Simpler still," said Nat, firing his Johnson 60 to life. Though the hull is rated to carry up to 135 hp, many Florida fishing pros feel 60 horses are all they need.

Finally, the run: "Quicker than a wink—and comfortable all the way," said Mark, as we slalomed among the channel markers leading away from town. In mere minutes we were cruising the shallows and scattered mangrove islands that make up the Keys "back country."

"In flats fishing, you see the boat's



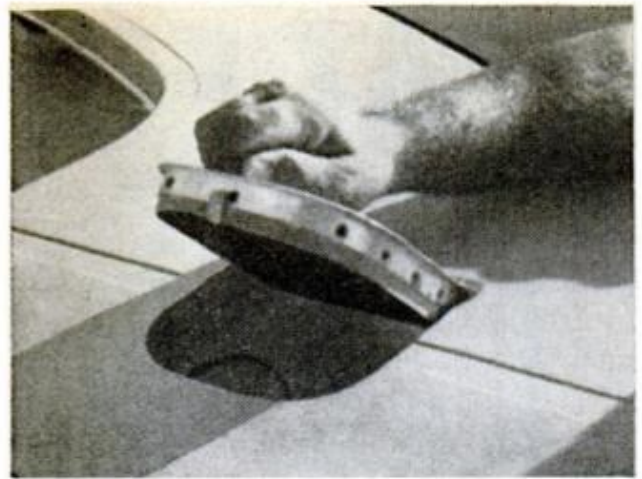
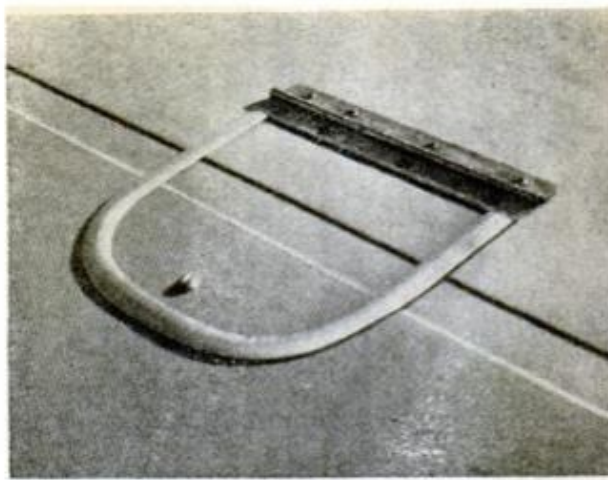
WITH JUST 60 HP, Bonefisher cuts water amidships, using bow to slice through wakes met along the way



LOADED BONEFISHER weighs nearly 1500 pounds, is still a snap for one man to take trailer on or off



PUSHPOLES ARE ESSENTIAL for good flats fishing; one of best woods for forked end or "foot" is guava



MOST BOATS have exposed cleats where toes or fishing lines catch up more often than dock lines. Bob Hewes put bow cleat in recessed space to assure that flat deck up front would always be ready for serious fishing

real capabilities," said Nat, stopping and tilting his engine and picking up his pushpole to work us around an islet. I stood on a natural casting platform formed from the top of the bow storage locker (which held an auxiliary 6-hp outboard) and, with plug rod in hand, looked for fishy targets.

I was impressed with how easily Nat managed the hefty 18½-foot hull in a crosswind. A smaller skiff would doubtless have been easier, but no combination inshore/offshore hull I know of could glide around the flats as handily as Nat's Bonefisher. Of course, most of the skill is in the pushpoler. But Nat had some help in the 10-inch-wide gunwales that make it possible to walk the length of the boat while leaning

into a shove and a spacious stern platform that comes nearly to gunwale height. After hooking a rambunctious barracuda, I found the boat's stability and cleatless surfaces make it possible to move quickly without risking a stubbed toe or broken leg.

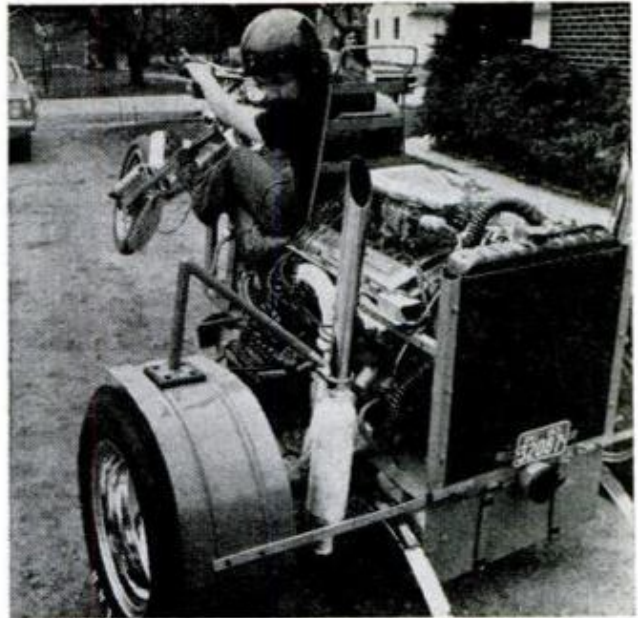
"Flats fishing is slow today," Nat announced. "Let's try the reefs." Off we went, charging 20 miles within an hour to the Gulfstream's edge. Flying fish skittered ahead and in the distance we saw a leaping sailfish.

Using depth recorders, our two boats quickly located a wreck where Carter caught an amberjack while Nat and I lost a lot of lures to toothy king mackerel. Mark and Bob had little luck and

(Please turn to page 169)



THREE ANGLERS, four rods and lots of spare room—even with two more deep-jiggers aboard fishing space would be ample. Note antenna: radio equipment is critical for offshore work



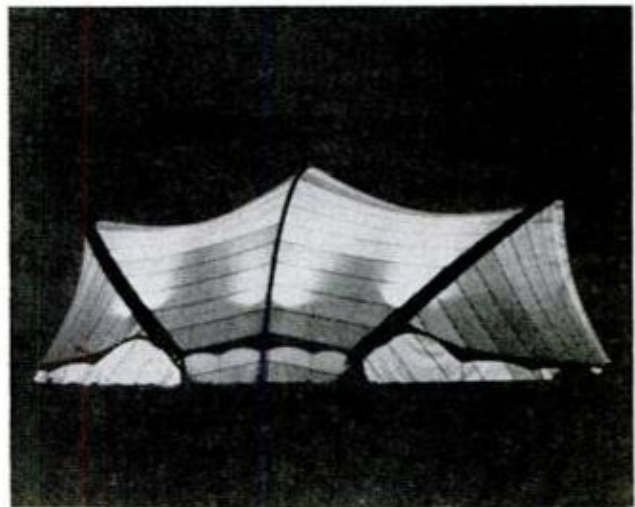
Motorcycle dragster

With a 1958 283-cu.-in. V8 Chevrolet engine mounted behind him, Canadian machinist Peter Carylton can race at 150 mph on his trike, dubbed the *Mind Bender*. The cycle has two Indianapolis racing tires mounted in the rear and a regular motorcycle wheel in the front at the end of a five-foot rake. So far, *Mind Bender* has cost Carylton \$650.



Foul-weather highway

To prevent mud or snow slides from closing a main highway in the Austrian Alps, the government added a bypass covered with a roof. The "tunnel" is used only in bad weather.



Return of the Big Top

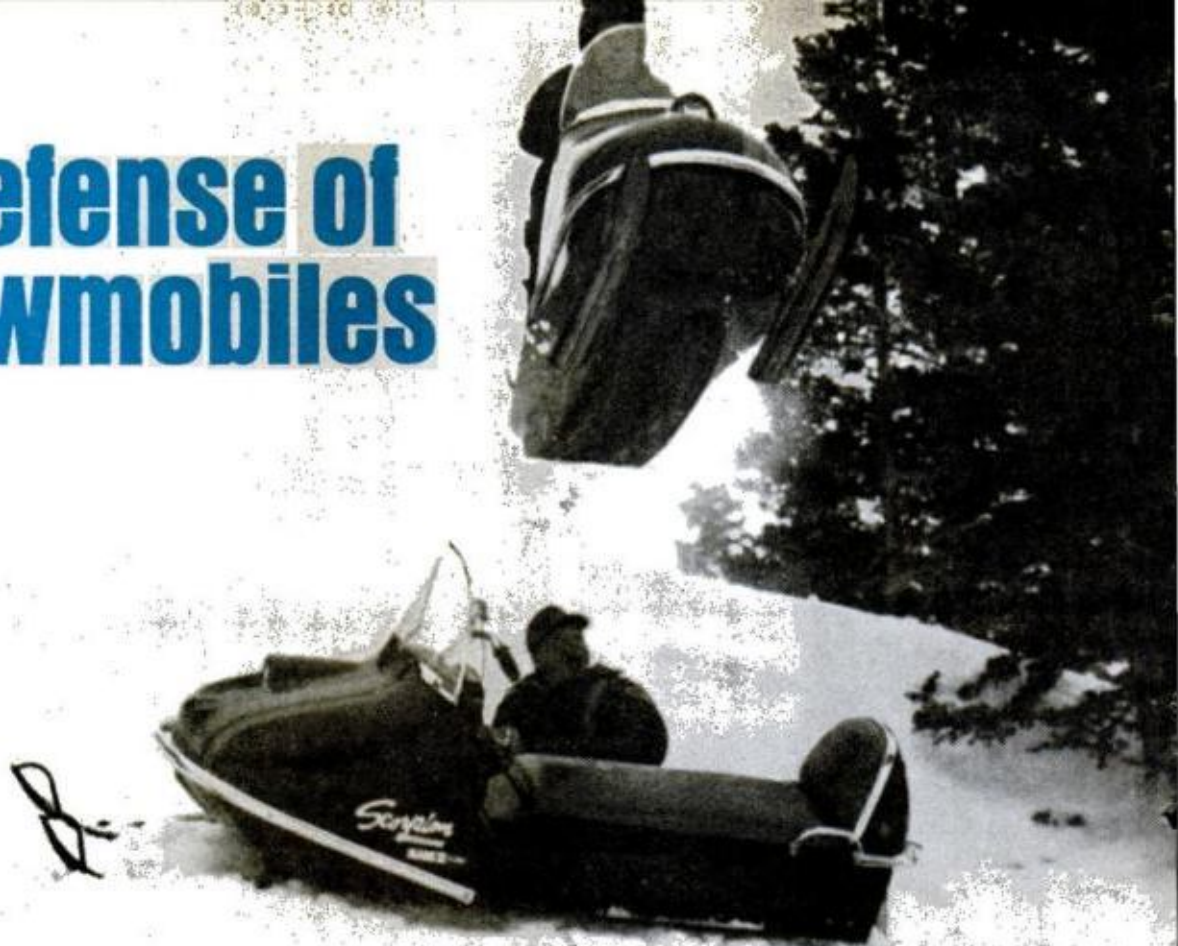
Citizens in Toronto, Canada, covered a neighborhood tennis court with this 60 by 120-foot tent made of high-strength, vinyl-coated beta fiberglass cloth—the same material used in astronauts' spacesuits.



Tiny tug

A nonswimmer, English mechanic Alfred Francis came up with a craft (left) that will tow a person along at 5 mph. The 35-pound vessel runs for an hour on a pint of gasoline and can operate in two feet of water.

In defense of snowmobiles



Accidents are the exception—not the rule—in snowmobiling. But each one is fuel for critics who want to ban the machines

By **GEORGE REIGER**

NO WAY TO WIN FRIENDS for snowmobiling—or even to survive—is wild use of machines by amateurs trying to emulate these skilled drivers. 'Flying' a snowmobile proves its ruggedness—but is for stunt teams only!

NO PHENOMENON since the advent of the horseless carriage has stirred up so much controversy as the snowmobile. Early autos smoked and rattled and frightened horses on country lanes—just as snowmobiles do today. But just as mechanics helped the Model T evolve into our most popular form of transportation, snowmobile engineers are working hard to make snow machines safer and to eliminate excessive noise and exhaust. In the meantime, hysterical criticism has not helped the evolutionary process. Worse, the furor generated by some publications has made reasonable debate increasingly difficult. Friends of snowmobiling who overreact are just as guilty as the sport's enemies.

Take the issue of noise, for example.

With the sound level meter (an instrument that measures sound intensity), critics and defenders alike have waged a statistical war that would be comical if it weren't taken so seriously.

Snowmobiles *are* loud. They do sound a little like mobile chain saws as they wend their way through winter woodlots. Decibel ratings for the average machine at 50 feet range between 80 and 105 on the "A" scale depending on make, horsepower, and whether you're revving the machine by turning it on its side. However, the meaning of these figures is confused by the fact that the dbA scale is a system poorly understood by anyone but an acoustical engineer. And rather than bore people with definitions of microbar, octave band and sone, most experts rely

on "sound equivalencies" to make their figures relevant. For instance, a soft whisper audible at 5 feet is equivalent to 35 decibels on the A scale; a vacuum cleaner at 10 feet is given a rating of 70 dbA, and so forth. But since this equivalency scale is interpreted according to each person's particular memory of the descriptive sound, people's impressions of A scale decibel ratings differ enormously.

At the 1969 International Snowmobile Conference held in Albany, N.Y., the industrial ideal for snowmobile noise levels was established at 50 decibels at 50 feet—this despite the fact that even if the engine of a snowmobile were completely silenced, the sound of the chains and belts in action could hardly be less than 70 dbA at 50 feet!

Even the delegates themselves (some of whom had never even been on a snowmobile) weren't certain what 50 decibels at 50 feet meant. It was a noise variously described as the sound of a sewing machine, or the clatter of a restaurant just before the noon rush!

The 1970 International Snowmobile Congress held in Duluth, Minn., started off toward better understanding of the problem by getting all the representa-



WHETHER THEY SEEK SOLITUDE or the camaraderie of a club on a cross-country trip, rural Americans, because of the snowmobile, now have an option on winter recreation that they've never had before



tives onto snowmobiles the first day of the conference. Fully half the delegates had never before been on a machine, and a goodly number admitted snowmobiles weren't quite so terrible as they'd imagined.

But the conference, primarily concerned with the issue of noise, quickly deteriorated into decibel warfare. Klaus Nowak, vice-president of engineering for ACS, Ltd., a manufacturer of snowmobile mufflers, set up a sound level meter at a bar and discovered that people talking produce a decibel reading between 69 and 76 at 50 feet. When the jukebox went on, the reading rose to 77, and when speech, laughter and jukebox were all combined, the noise level averaged between 80 and 84 decibels. Nowak presented these findings with the thought that people en-



MANY SUMMER ACTIVITIES, from photography to fishing, now are winter hobbies because improved machines take riders to areas never before visited

JANUARY 1972



SNOWMOBILES help ranchers to get ahead of summer schedules by taking them to work areas in the winter

joying themselves at the bar would not have felt that 70 or even 80 decibels for a snowmobile was "too loud."

Immediately, a snowmobile critic countered that *his* sound apparatus had recorded 89 decibels for snowmobiles used by the congress the day before, a level considerably above industry claims and six full decibel levels above Nowak's party.

Decibel quotations flew fast and furious, and some delegates conjectured that the conference room's dbA rating must be close to 85! Unfortunately, most everyone missed the point: that people are willing to put up with some noise in some circumstances—indeed, they seem to relish it—which in different circumstances might trigger a call to the police. A party-goer shouting happily to friends in a room at 84 decibels doesn't want to be disturbed the next morning at 7:00 by the sound of a snowmobile revving up, even if the machine only had a dbA rating of 50.

The question is one of providing sanctuaries for the nonsnowmobiler, and of establishing appropriate areas for the machine's use elsewhere—not for its categorical elimination as some critics want.

With more than two million machines owned in Canada and across the snowbelt of the United States, the snowmobile has become a fact of life in North America. One-sided articles attacking its use are as meaningless as temper tantrums. But then such articles are often intended to be no more

than that. They attack the hazards of the sport without making recommendations for the safe use of snowmobiles. They tell the reader that only he (and the writer, of course) is fit to pass judgment on the wonders of the great outdoors. Yet, ironically, most snowmobilers are country people who live closer to the outdoors than the city folks who come into their areas seeking recreation.

The October issue of *Ski* magazine acknowledges the rural background of most snowmobile enthusiasts and then categorizes them as "... kind of Yankee rednecks..." and "Agnew people" (accident-prone, too). The *Ski* article, however, never hints that there are as many natives who resent the ski lifts, motels and hofbraus established for the weekend enjoyment of skiers as there are skiers who resent the local "Agnews" on their snow machines.

"I have my horse in the summer, my snowmobile in winter. Without one or the other, I'd be on relief," says a Washington State farmer-rancher I know. In other areas, snowmobiles are used to deliver papers, harvest maple sugar, take food to families snowbound by a blizzard, tend power lines and fences—even rescue injured skiers. The snowmobile is a good worker. And debate should be concerned with ways to provide and improve trails for their play—not with banning them out of hand.

Sure, I've seen the tops of plants clipped by thoughtless drivers. But

I've also seen tire tracks across suburban front lawns made by midnight cowboys. But we don't ban cars because of this. We could get into quite a senseless sparring match, with me showing advantages (snowmobile trails facilitate deer getting to winter feed) and you responding with disadvantages (these same trails also enable wild dogs to track down the deer), but the disadvantages balanced with the advantages hardly justify a call for prohibition. Besides, prohibition wouldn't work any better for snowmobiles than it did for liquor—and for precisely the same reason: too many people have developed a taste for the stuff!

Another point is that prohibition talk is often linked with some pretty ill-conceived notions about snowmobiles. Not long ago, one state legislature came close to passing a law requiring all snow vehicles to be equipped with seatbelts. Some representative was obviously eager to show his constituents he was tough on snowmobile safety. And just as obviously he'd never been on one of the machines. Seatbelts would make the roofless, roll-barless snowmobile more dangerous, not safer.

What we need in snowmobiling is less polemic by men who have never used the machine, and more common sense and courtesy by those who do. As accidents and abuses fade, so too will adverse criticism.

Furthermore, ugly statistics don't always have to go up. Last year, for instance, public firearms accidents showed a 10 percent decrease from the year before—and this despite an increase in hunters afield. Education in safe handling was probably the major factor in this improvement, and it can be the same for snowmobiling. Wearing a helmet, knowing your equipment before making a long trip, asking permission before crossing any private land, offering immediate payment for any damage made by your machine, running at reasonable hours, joining or forming clubs to provide community service—these and many more are ways you can help silence the critics.

Finally, do your part to press industry to correct its two great failings of noise and exhaust. Once we have responsible drivers on quieter machines, snowmobiling will come of age as a winter sport. ★★★



INJURED SKIER benefits from snowmobile, which pulls him on sled from ski slope to an emergency station
JANUARY 1972

Queen Mary, Normandie, United States, Mauretania, Europa, Rex—they helped set style for transatlantic travel in an opulent era.

By RICHARD PETROW

NO ONE SANG *Auld Lang Syne*. They didn't even serve champagne to recall the elegant old days. Few bothered to note the *Santa Rosa's* evening departure from New York Harbor on Jan. 8, 1971.

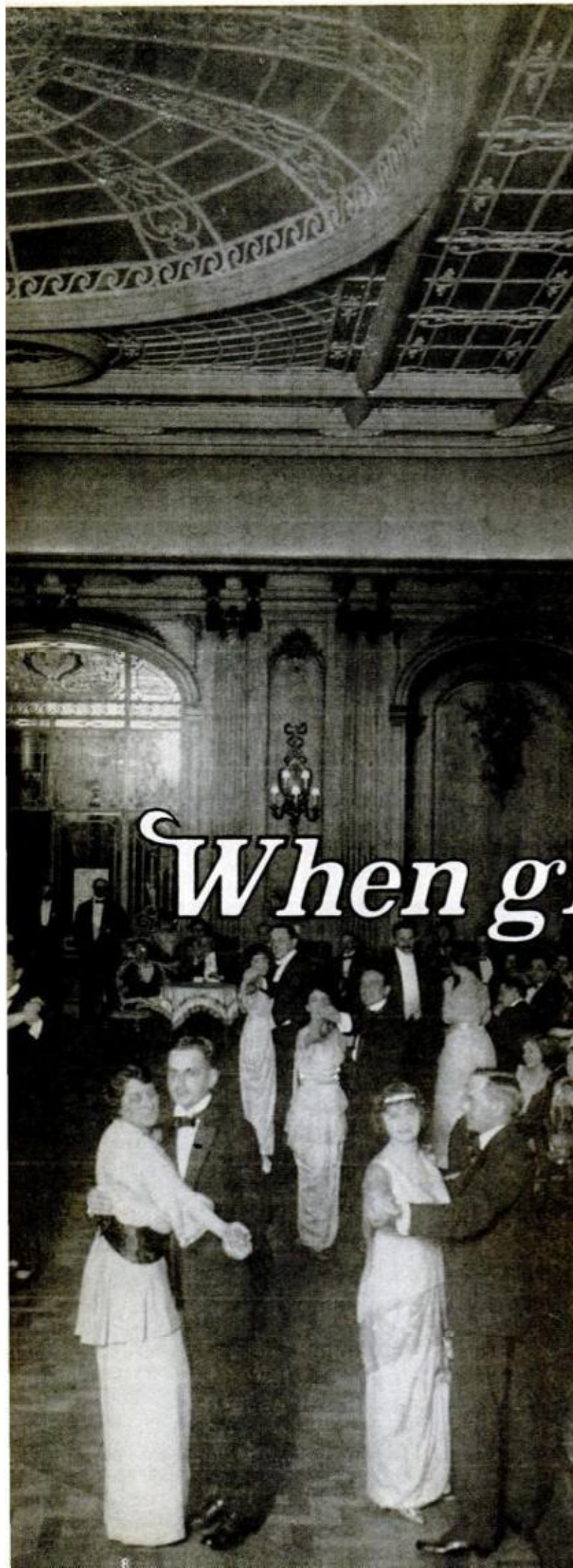
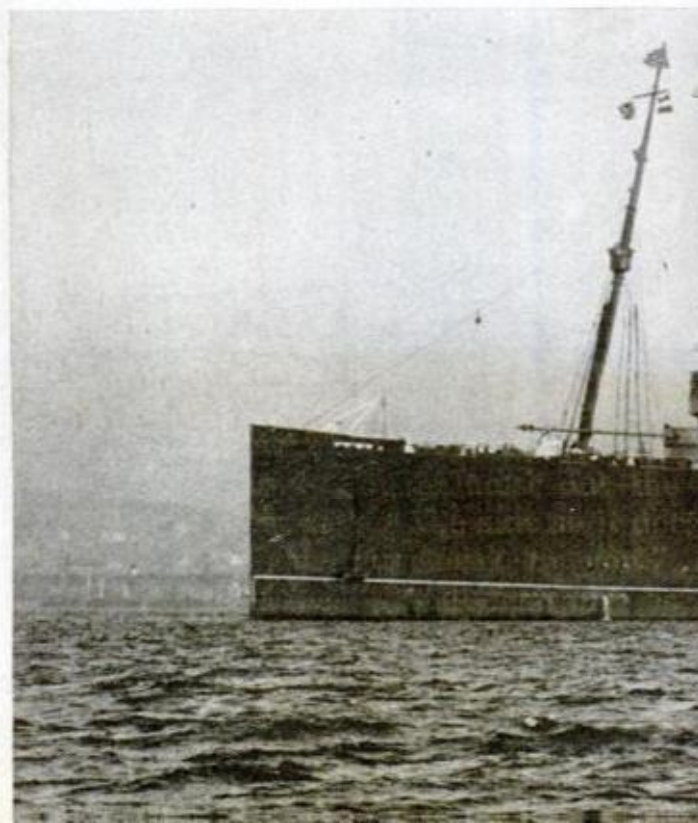
Yet the ship's unlamented sailing marked the end of more than 100 years of American passenger service on the Atlantic. If you want to cross today by luxury liner, you'll have to do it on a foreign vessel, and even that won't be easy.

No longer do streamlined vessels

GETTING THERE in 1914 was more than half the fun on *Vaterland* (left), Germany's magnificent luxury liner. But England's 31,000-ton *Mauretania* (below) outdid her in speed

PHOTO AT LEFT FROM BRAYNARD COLLECTION

When great liners



race year-round across the Atlantic between New York and Europe, competing for the title of the most luxurious and vying for the Blue Ribbon, symbol of the fastest passenger ship afloat. Most of the luxury liners have been "sunk" by a change in public taste that prefers air speed to seagoing style.

Today the supersize passenger ships plying traditional North Atlantic routes cross only during the summer tourist season. Come fall, and *Queen Elizabeth 2*, *France*, *Michelangelo* and *Raffaello* retire to profitable cruising in placid, warm-weather waters.

If you're expecting the grandeur of pre-World-War-II days on these remaining liners, forget it. For example, *Queen Elizabeth 2*, Cunard's newest passenger liner, carries launderettes and ironing boards for passenger use—a far cry from the days when gentlemen sailing the Atlantic first class were routinely accompanied by valets, and a family naturally brought along a governess to mind the children.

Queen Elizabeth 2, launched in 1967, is the latest in a long line of ships

that date from the 19th century. Samuel Cunard began the fleet in 1840 with *Britannia*, the first steamship to maintain a fixed sailing and arrival date on the transatlantic run.

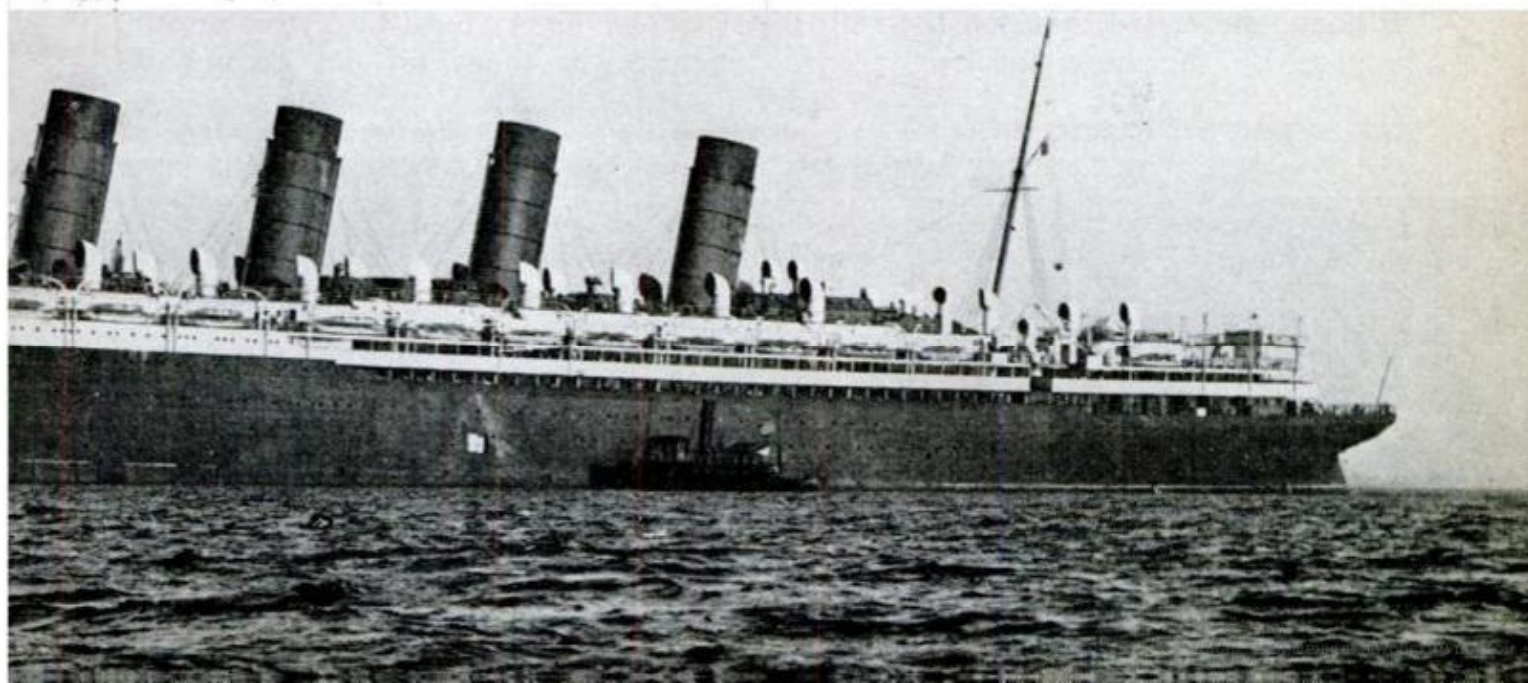
Charles Dickens, a passenger on *Britannia's* first crossing, may have preferred steamship reliability to the vagaries of sail, but he was unimpressed with her accommodations.

The novelist considered his stateroom an "utterly impractical and thoroughly hopeless and profoundly preposterous box," and thought the main lounge a "long, narrow apartment not unlike a gigantic hearse with windows."

Dickens's sour grapes did not deter Cunard, whose line continued to expand. *Bothnia* and *Scythia* came down the ways in 1874, introducing watertight compartments as a safety feature. *Servia*, the first steel passenger ship, delighted her passengers in 1881 with a recent invention—electricity.

England dominated the North Atlantic passenger routes until Germany launched the first in a series of challengers—the *Kaiser Wilhelm der*

ruled the Atlantic



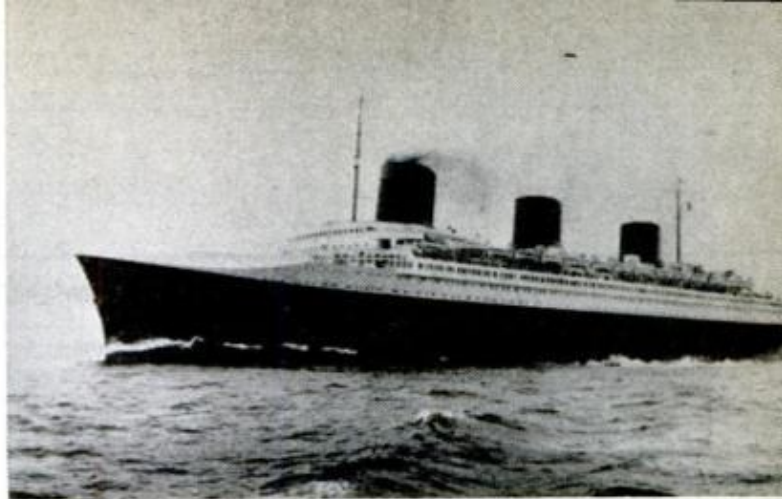
lenged. Germany's Hamburg-America Line put down keels for three huge liners just before World War I began. The three—*Imperator*, *Bismark* and *Vaterland*—were designed to wrest the Blue Ribbon from England.

Bismark was the largest, stretching 958 feet and weighing 56,599 tons. Almost completed when the war began, *Bismark* sat out the conflict in a Hamburg drydock. England won her in the peace settlement, rechristened her *Majestic*, and sailed her on the Atlantic run.

For many passengers, she was the ultimate in lavishness—British posh laid over German plush. Her handsome first-class salon sported hand-carved oak walls and a glass roof 26 feet above the deck, creating a space of ballroom proportions.

A heavy meal—and most were—could be worked off in the Pompeian Bath, a glorified gymnasium and swimming pool decorated with a glimmering combination of marble and mosaics to “conform closely to the architectural and mural decorations of the buried Roman water palace.”

The British sailed her until 1936, then turned her over to the Royal Navy



IN 1935 ENGLAND LOST the transatlantic passenger crown to *Normandie*, the pride of the French fleet

to be used as a training ship. Three years later she was gutted by a mysterious fire while moored at her pier.

Imperator suffered a similar fate. Britain won her as a war prize, changed her name to *Berengaria*, and added her to the North Atlantic passenger fleet. But an unexplained fire left her a charred ruin in the 1930s.

Vaterland had better luck. She entered service before the war, sailing majestically into New York in 1914 to be welcomed as the largest ship (59,000 tons, 907 feet long) ever to enter the harbor. As befitted her size, *Vaterland* was done up in Teutonic splendor passengers described as “nautical Grand Palace Hotel.”

The outbreak of war caught her in New York after her second west-bound passage. Rather than risk capture or destruction, *Vaterland* gathered cobwebs at a Hoboken, N. J., pier until the United States joined the Allies. The government promptly took over the ship, re-named her *Leviathan*,



FROM BRAYNARD COLLECTION

FIRST-CLASS dining salon on the *Vaterland* was a maritime spectacle of carved wood and stained glass. When she sailed into New York in 1914, flying the German flag, the vessel was greeted as the largest ship ever to have entered the harbor

TEN LINERS THAT MADE TRANSATLANTIC HISTORY



MAURETANIA, Britain

31,000 tons;
790 feet long

Launched in 1907 . . . pride of the Cunard fleet . . . held transatlantic speed record until 1929 with an average 26 knots . . . scrapped in 1938.



LEVIATHAN, United States

59,000 tons;
907 feet long

Built by Germany, launched as Vaterland in 1914 . . . seized by U. S. after second voyage . . . used as World War I troopship . . . resumed passenger service as Leviathan sailing under U. S. flag . . . scrapped in 1938.



MAJESTIC, Britain

56,000 tons;
958 feet long

German built but never sailed under that flag or with original name Bismark . . . awarded to Britain after World War I . . . rechristened Majestic . . . burned in 1939.



ILE DE FRANCE, France

43,000 tons;
763 feet long

Entered service in 1926 . . . converted to troop ship during World War II . . . returned to passenger runs after War . . . sold to Japanese moviemaker for prop . . . scrapped in 1958.



EUROPA, Germany

50,000 tons;
890 feet long

She, and sister ship Bremen, led the German merchant fleet in pre-World War II days after launching in 1930 . . . U. S. seized her and converted to troopship . . . Given to France, sailed as Liberte . . . scrapped in 1960.



REX, Italy

51,000 tons;
879 feet long

Entered service in 1932 . . . captured speed record with 29-knot crossing . . . British submarine torpedoed her in 1944 off Trieste.



NORMANDIE, France

83,000 tons
981 feet long

Came down the ways in 1935 . . . U. S. had planned to convert to troopship, but ship burned and sank while still at New York pier . . . scrapped in 1947.



QUEEN MARY, Britain

81,000 tons;
1,019 feet long

Short passenger period after launching in 1936 . . . used speed as successful troopship in World War II . . . liner again until sold to Long Beach, Calif., in 1967 . . . being converted to hotel-convention site.



QUEEN ELIZABETH, Britain

84,000 tons;
1,031 feet long

Designed as world's largest passenger liner . . . but began as troopship . . . her 30-knot speed helped to elude Nazi subs . . . first on the Atlantic as passenger liner after war . . . sold in 1968 as Florida tourist center . . . resold and being refitted in Orient.



UNITED STATES, U. S.

53,000 tons;
990 feet long

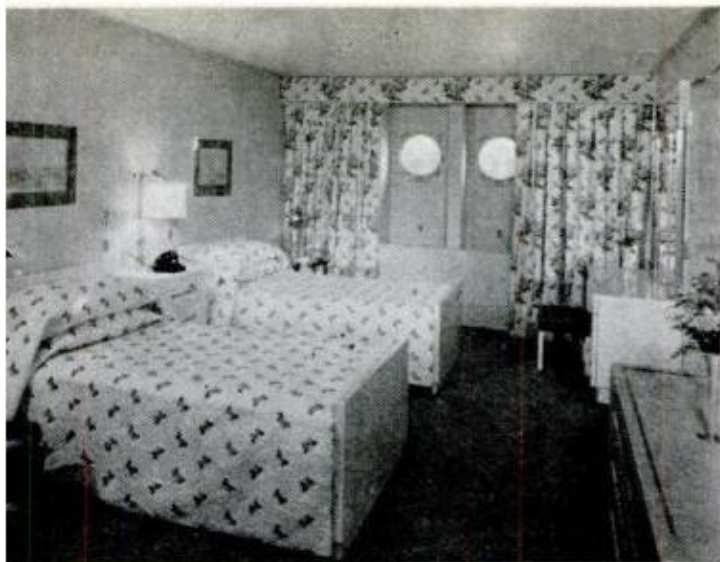
World's fastest liner at 35 knots, retiring the speed trophy . . . extremely light for her size, thanks to aluminum . . . now in Norfolk, Va., drydocked permanently after government refused to subsidize her any more.

and sent her off to transport doughboys to France.

America won *Leviathan* after the armistice and put her on the North Atlantic, but she was a white elephant fi-
70

nancially despite her fine appointments and acknowledged beauty.

Prohibition had taken the good life out of *Leviathan*. Since the government owned her, officials banned liquor at



FIRST-CLASS SUITES on *United States* upheld the tradition of luxury on the Atlantic in the 1960s

sea under the U.S. flag, as they had on land. *Leviathan* took the pledge, and reluctantly sailed "dry" during the 1920s, causing many passengers to shun her for "wet" European ships.

She ended a dismal career in 1938, and was sold for scrap.

Italy's first entry in the prewar-transatlantic sweepstakes was to be the *Principessa Jolanda*.

Everything went smoothly on launching day until the ship hit the water and dropped her anchor. This pulled the vessel up short, causing a list that allowed seawater to pour in through hull openings normally above the water line.

While thousands of spectators gaped in horror, the *Principessa Jolanda* slowly heeled over and sank. She was scrapped on the spot.

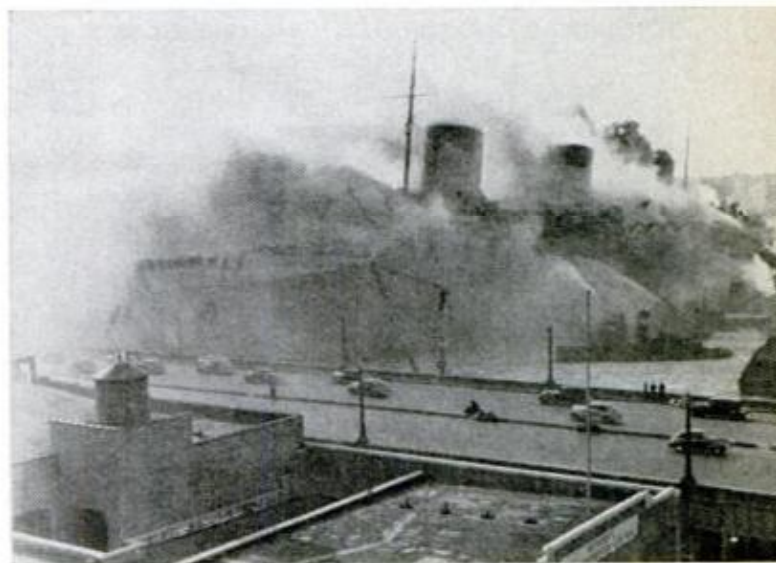
Despite such accidents, enthusiasm for luxury liners continued unabated, reaching a peak during the 20 years between the world wars. France's entry in the 1920s was the *Ile de France*. She did not try to compete in size with *Mauretania* or *Leviathan*; her forte was elegance.

Abandoning the heavy walnut considered a must on other superliners, the builders of *Ile de France* chose light-colored marble and soft-hued mahogany for her public rooms. She boasted the largest first-class dining

room afloat—an airy space with marble walls three decks high entered by a marble encased grand stairway. The centerpiece of the combination smoking room, bar lounge and cabaret was a transparent glass dance floor illuminated from beneath with multicolored lights.

Ile de France never won the Blue Ribbon but her existence helped spur other nations to take up the fashionable rivalry.

Germany's superliner *Bremen* ended *Mauretania's* reign as the Atlantic speed queen in 1929, crossing at 27.83 knots—2 knots better than the old *Mauretania*. *Europa*, her sister ship,



WHILE SHE WAS BEING CONVERTED to a troopship in 1942, *Normandie* caught fire at a New York pier

won the Ribbon in 1933, but *Bremen* retrieved it quickly.

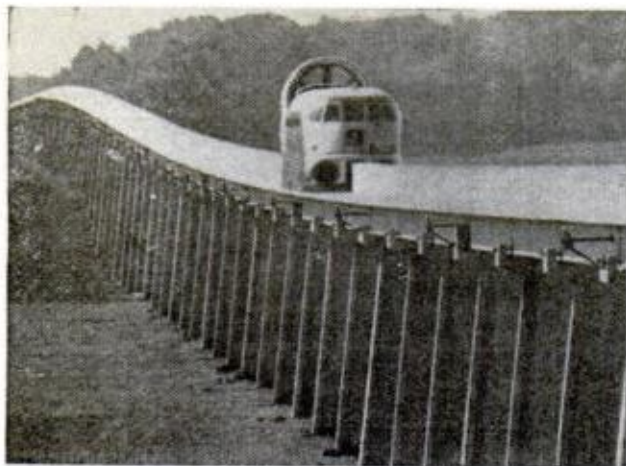
Italy joined the race with *Rex* and *Conte di Savoia*. *Rex* brought Italy Blue Ribbon glory for the first time, but the nation did not have much time to boast about it.

English and French ship builders were putting the finishing touches on vessels that would shatter the records held by *Bremen*, *Europa* and *Rex*. France was first on the Atlantic with *Normandie* in 1935 easily winning the reputation as the most elegant afloat, and the fastest, on her maiden crossing.

But Cunard, the line that started it all, came back with the last of the great

(Please turn to page 178)

NEWS BRIEFS



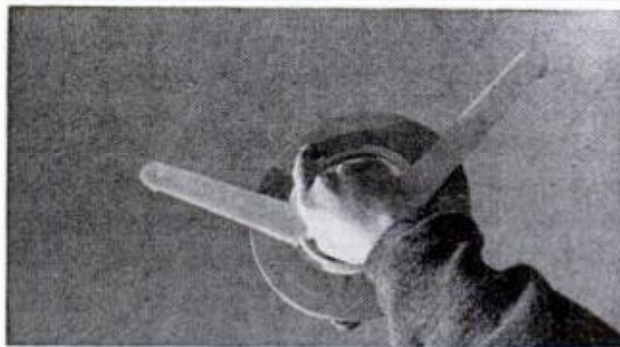
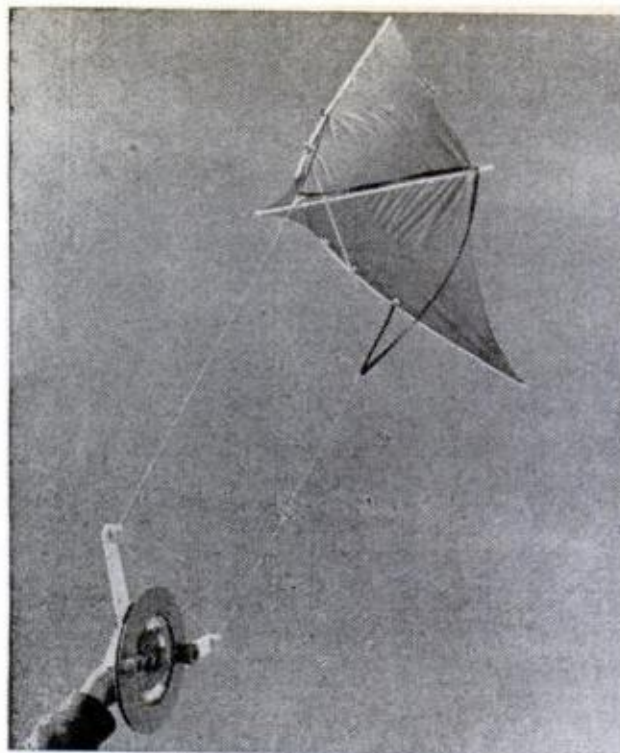
Aerotrain travels 165 mph

Streaking along at 165 mph on a test run is France's turboprop-powered Aerotrain. The vehicle is shown on a section of its 12-mile track near Orleans. The Aerotrain rides the inverted-T track on a cushion of air.



Shield for firemen

To prevent injury to firemen from objects thrown at them, the Baltimore Fire Dept. is experimenting with Plexiglas canopies, such as this one installed on a pumper.

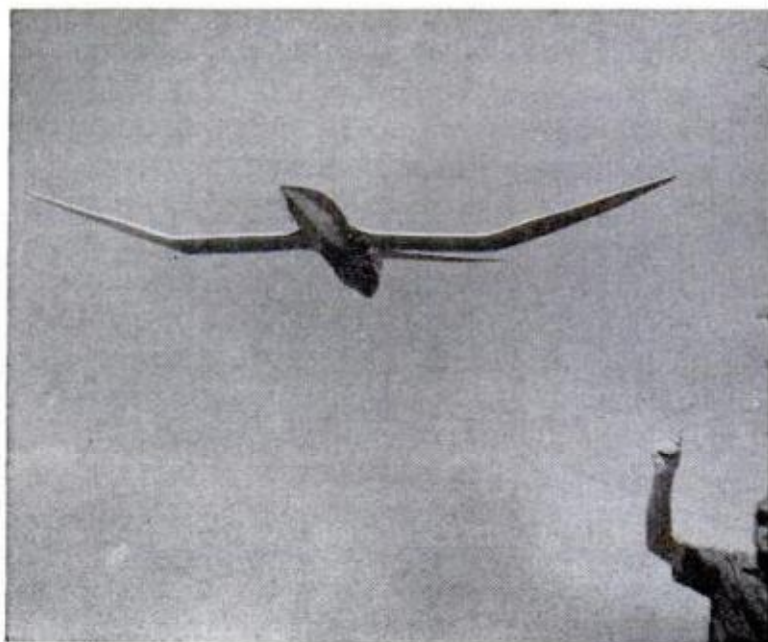


Tricky kite

The Sunbird kite can be made to spin, dive and do horizontal figure eights. The secret is that it's tethered by two strings to a hand control (which is also a reel); twisting the hand grip makes the kite perform its aerobatics. Inventor is Don Gellert.

Prop models look like jets

A ducted propeller and powerplant installed within the tubular sheet balsa fuselage of the radio-controlled planes built by George Richter, Los Angeles, give them the appearance of jets in flight. Richter's most recent model is the Ric-Jet 3 (two photos at right), a powered sailplane with a 76-inch wingspan. It weighs 35 ounces with radio equipment and a Cox .049 Medallion engine. Richter believes that he can build a full-size, single-seat sailplane based on the design. Its wingspan would be about 43 feet and its length, about 25 feet. Other ducted models include (at far right) the Convair Dagger and the Concorde. The Dagger can fly six to ten minutes and as high as 2000 feet. It and the Concorde are powered by an .020 engine.





Rare bird

Of the two genuine, airworthy Bleriot Type 11 monoplanes known to exist, one (shown) was recently put up for auction at Christie's in London. The craft is similar to the plane in which Louis Bleriot flew the Channel in 1909.

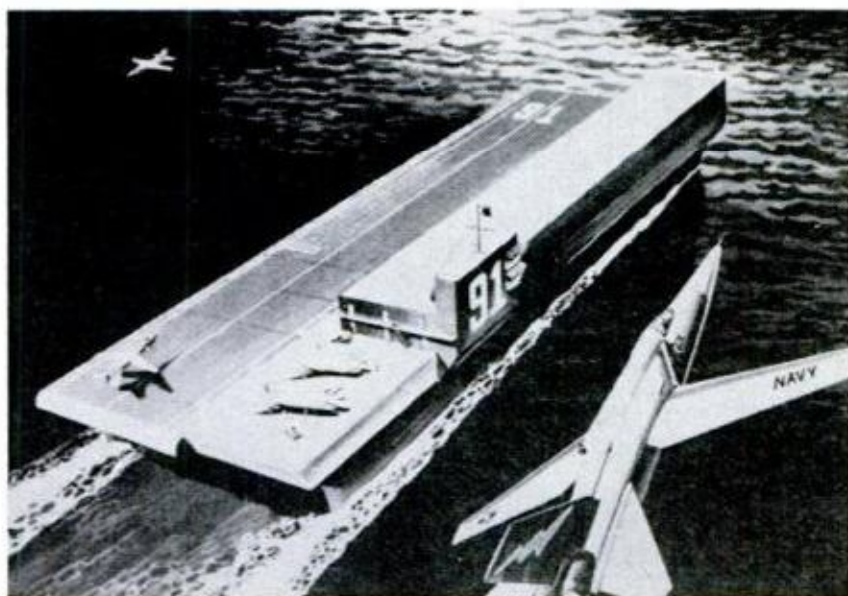


Icebreaker with muscle

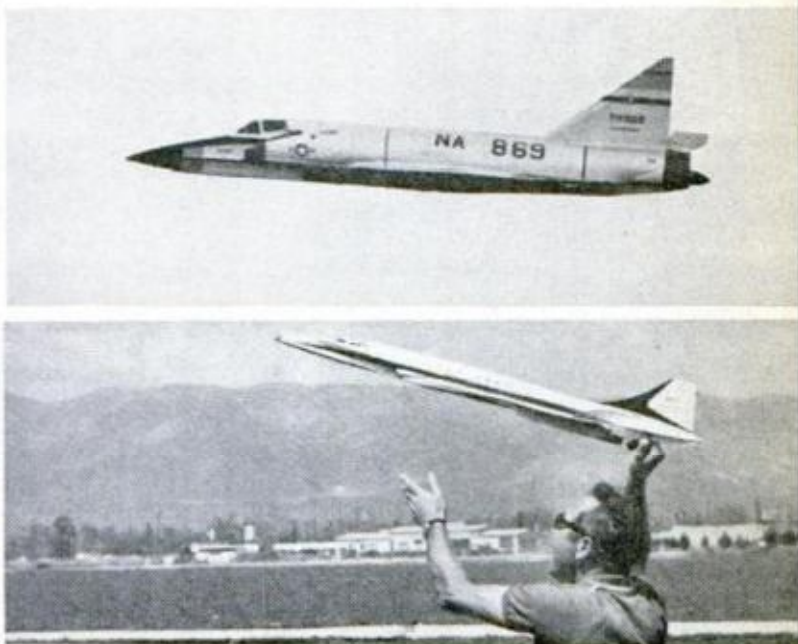
Capable of going through 6-foot ice at a steady 3 knots, the world's most powerful icebreaker is being built for the Coast Guard by Lockheed. The 12,000-ton, 60,000-hp vessel will be operational in 1974.

Sea-control ship

A 12,000-ton, catamaran-hull ship may eventually replace the aircraft carrier in the Navy's fleet. Called a "sea-control ship," the craft would be capable of handling VSTOL aircraft or helicopters, which require no catapults or arresting gear. It would be armed with surface-to-air missiles and its aircraft equipped with sub-detection and killing gear. The new ship, shown here in artist's rendering released by the Navy, would cost under \$100 million.



JANUARY 1972



73

After 4 million miles... **WOULD**

By **MICHAEL LAMM**, West Coast Editor

MANY OF THE IMPROVEMENTS that 1971 Pinto owners suggested have already been made for 1972. But then, lots haven't.

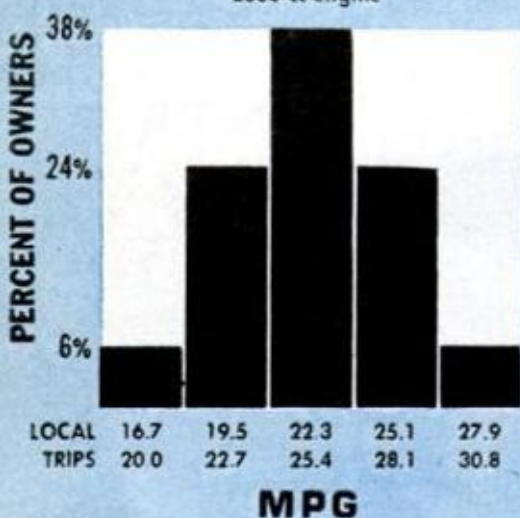
Ford incorporated running changes in the Pinto throughout 1971. For example, first there were gripes about the early Pinto's choppy ride. That brought a mid-year softening of the rear springs and shock absorbers. Next, owners felt the brake pedal was too low, so Ford raised it almost an inch.

Back-seat riders weren't too crazy about the hard rear seats and the center-mounted front seatback releases. So Ford added a bit more padding and moved the releases outboard. The Pinto's controls for air inlet were revamped

(Please turn to page 76)

PINTO FUEL-MILEAGE CHART

2000-cc engine



LOCAL TRIPS	16.7	19.5	22.3	25.1	27.9
TRIPS	20.0	22.7	25.4	28.1	30.8



A Nationwide Survey Based on
2,400,000 Owner-Driven Miles

PM VEGA
OWNERS REPORT...

OWNERS BUY AGAIN?

Photos by the Author

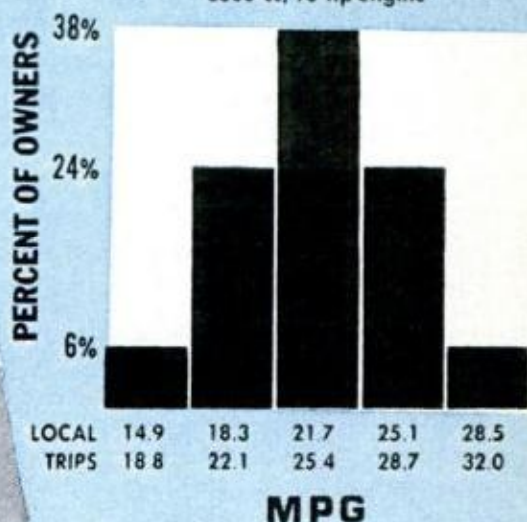
EARLY VEGAS of 1971 weren't put together worth beans. That plus the late 1970 GM strike got Vega off to a slow start. But quality has picked up considerably of late, and the Vega's highly automated assembly lines now turn out the cars better than most, so the mini's early reputation for sloppy assembly no longer appears warranted.

The Vega doesn't actually fit into the Pinto's price class, yet these two cars come in for constant, inevitable comparison. Base Vegas sell for about \$200 more than base Pintos. Chevrolet rationalizes this by saying that customers get more car for the money—better

(Please turn to page 76)

VEGA FUEL-MILEAGE CHART

2300-cc, 90-hp engine



FUEL-CONSUMPTION FIGURES compare closely for the engines most Pinto and Vega owners ordered



PINTO SMALL TRUNK was no complaint. Owners wanting more room ordered the Runabout!

so they didn't take a factory-trained mechanic to work them.

One of the loudest laments concerned the dimmer switch being tucked too far up under the dash. For 1972, Ford brought the dimmer down some 4½ inches to a normal position.

We surveyed only 1971 Pinto owners, because at the time we sent out questionnaires, the '72s hadn't been introduced. Many of our respondents owned early 1971s, so several of their "would-like-to-see's" and general comments don't apply to the 1972s. Yet most do; the car hasn't changed all that much.

Primary reason for buying Pintos isn't hard to guess. Economy wins hands down; 63.1 percent said the lure of low initial price, good gas mileage, and inexpensive upkeep swayed them.

"I needed two small cars instead of one big one," said a college professor



whose sons are learning to drive. And a San Diego Navy ensign confided: "My credit rating did it—no one else would sell me a car."

"To save on insurance and tires," said a Wisconsin millworker. "\$320 cheaper than Vega," opined a California electrician. And another Californian

VEGA

quality, ride, handling, luxury, more power, and so on.

We've tried to avoid a direct confrontation of the Vega and Pinto in these back-to-back *Owners Reports*, and we leave the final comparison to you. It's best made by comparing data tables.



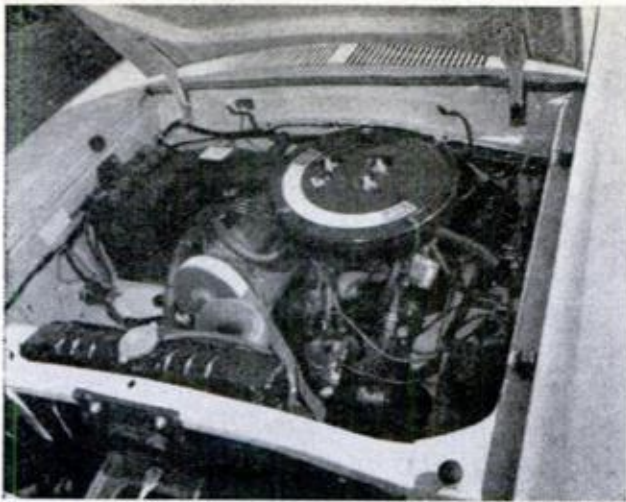
We've also published previous articles about the Vega. These presented cross-country driving impressions (*PM's Coast-to-Coast Test: Pinto vs. Vega*, page 76, March '71 *PM*) and early introduction (*The Minis Are Out to Rule the Road*, page 112, Sept. '70 *PM*).

Chevy's Vega and AMC's Gremlin are America's only truly U.S.-made minis. All the rest are built partly or wholly overseas. Under *reasons for buying*, this statement appeared again and again on our questionnaires: "I wanted an American-made compact." It's a big selling point, the fact that Vegas are built here. Also given any number of times was "economy with prestige." Pure economy, though, headed the list of reasons for buying, with size and styling running a close second and third.

As in the Pinto's case, several oversights noted by early Vega owners have been remedied by the factory, especial-

HATCHBACK VEGA, like Pinto Runabout, has third door in rear giving car station-wagon versatility

POPULAR MECHANICS



TWO-LITER, overhead-cam Four is most popular among Pinto owners. Most have the four-speed box

added, "I drive 50 miles a day round trip to work. My last car got 11 mpg. Gas prices have gone up, so I needed an economy car. Pinto looked the best to me."

Another oft-voiced reason for buying was summed up simply by this Massachusetts schoolteacher: "I fell in love with its looks." An Air Force officer commented: "To change the Pinto's appearance would ruin the sly, sporty look it has."

More than a few owners said they went for the Pinto because it's American-made. What these people didn't realize was that the engine and running gear are imported from England and Germany. (Ford does plan to build Pinto engines here in 1973.)

Most Pinto owners are feeding the German 2000-cc, 82-bhp ohc engine (72.8 percent). One of the reasons this engine is so popular is its greater power. But another reason involves a strike at the British Ford plant. This factory turns out the Pinto's 1600-cc mill. For several months during 1971, the 1600 simply wasn't available. Our mpg figures show an insignificant difference in fuel consumption between the 1600 and the 2000. And since a few owners complained of lack of power, even from the 2000, the 1600 might be on its way out.

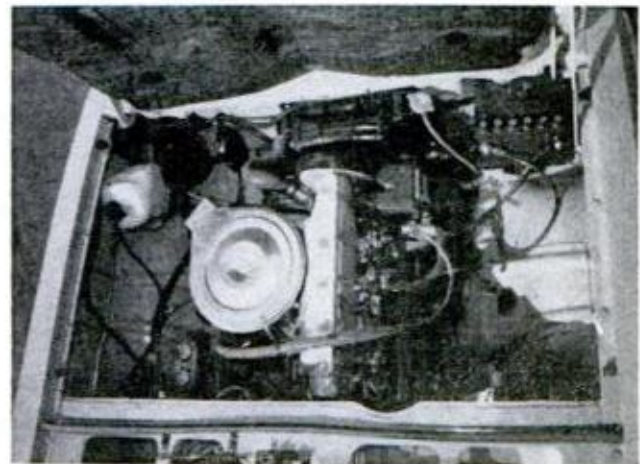
What do Pinto owners think of the

LOWER HORSEPOWER, 2.3-liter Four was overwhelming choice of Vega owners over the higher hp option

ly in 1972 models. Example: First-run Vegas had no real gloveboxes—only a shallow bin on the dash. In answer to the hue and cry, the 1972 Vega now has quite a decent glovebox (but unfortunately it can't be adapted to earlier models).

The Vega has always sold largely on the strength of its good handling and performance. These qualities aren't lost on owners, a disproportionately large percentage of whom (31.5 percent) specified the four-speed manual gearbox. (Par for the industry was about 3 percent last year.)

The Vega's standard disc brakes, wide stance and excellent suspension contribute to statements like: "Bought one, liked the way it handled, so I bought another."—Massachusetts spray painter. "Handles, performs, turns, and stops perfectly."—New Jersey salesman. "Handles like a sports car—really



holds the road—steering is very responsive, especially at higher speeds."—Virginia foreman. "Great-handling car, especially at high speed and on corners. Feels like a sports job."—Colorado teacher. And, "The handling kit gives it real sports car suspension."—California railway employee.

Chevrolet devalued the Vega's horsepower ratings this year, although it's strictly on paper. In 1971, gross bhp was 90 and 110. This year they use a net rating and wind up with 80 and 90



PINTO OWNERS rated economy (75.4 percent) over handling as thing they liked best about their cars

PINTO

quality of their cars? "Cheap," says a Georgia advertising director. "Plastic grille rattles, latches on seats don't catch." And a Bronx timekeeper asks, "Is 'workmanship' still in our dictionary when we speak of cars? No one, I believe, cares about making anything 'quality' anymore."

However that's not the universal view: 58.5 percent of all Pinto owners still feel they're getting better than "good" quality. "Not bad according to purchase price," observes a Utica, N.Y., toll collector.

What do Pinto owners view as specific problem areas? "I am pleased with this car except for stiff suspension and the need for wing window vents."—Brooklyn social worker. "The 2000-cc engine burns too much oil—800 miles per quart."—Boston loan analyst. "Too easy to dent metal."—California farmworker. "Seats too low; I can't see out."—Virginia pressman. "Not enough power for passing; low gear winds out too fast."—Arizona draftsman. "Too light on the road."—Illinois dispatcher. "I love my Pinto, but it certainly has its share of bumps, rattles and squeaks."—Oregon housewife.

Flipping the coin, what are Pinto owners' specific praises? "Handling is superior to most imports. I owned three



VEGA OWNERS found handling (67.3 percent) more impressive than economy (63.0 percent) as best like

VEGA

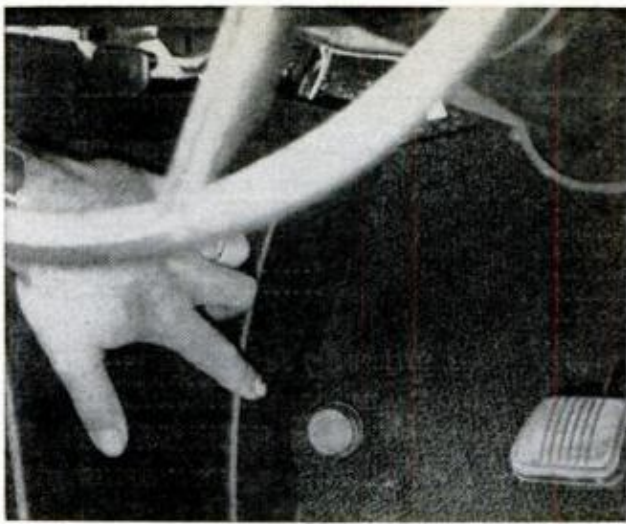
bhp for the same engines. This lowering of power ratings helps keep down insurance premiums and also wards off any consumeristic outcries against a horsepower race in the mini field.

By and large, Vega owners feel that the 110-bhp ohc Four puts out plenty of oomph. But some with the 90 and

automatic aren't too sure. "Needs an ohc Six like the old Pontiac Sprint, about 130-140 hbp," says a North Carolina meatcutter who owns the 90-horse version. "The 90-bhp engine was the only mistake I made with this car; should have gotten the 110."—Maryland government employee.

What do Vega owners think of workmanship and overall quality? "Too much plastic inside, which doesn't seem to fit as it should, but the car does appear to be very solidly constructed."—Illinois draftsman. "Excellent workmanship."—Tennessee student. "Not so good as some foreign models that cost less."—Illinois industrial engineer. "I think quality is really good except for the little silver things on the sides that weren't put on very well and I always have to push them back in place."—Oregon student. "Much too tinny."—Illinois teacher. "Solid; feels like a big, heavy car on the road."—Texas grocer.

In which ways would Vega owners change their cars if they could? Many,



HEADLIGHT DIMMER SWITCH, moved down within reach, is among the Pinto's many running changes

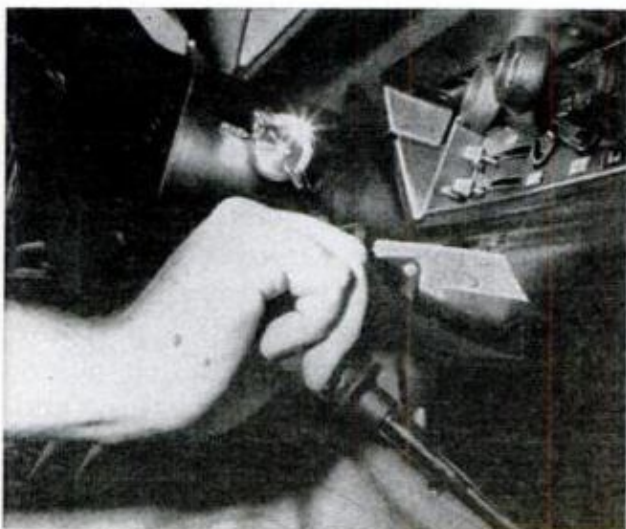
VWs and was dissatisfied with dealer indifference."—Spokane salesman. "I really have fun driving now."—Minnesota banker. "I appreciate the instruction manual for do-it-yourself repairs."—California maintenance supervisor. "Good handling with disc brakes, rack-and-pinion steering, wide tires. She sticks even in high crosswinds."—Cal-



VENT WINDOW is lacking in Pinto and is high on list of things the owners would like to see changed

fornia naval officer. "Good mileage, and no costly repairs."—North Carolina student. "The mileage is as advertised; I really do get 25 mpg."—New York engineer.

The Pinto lists at the lowest base price of any current U.S. car. Which means that Ford dealers don't get much trading margin, a circumstance felt by



ASHTRAY LOCATION was scored by Vega owners. It can be a knuckle-buster when shifting into reverse

many said they'd like the glovebox that Chevrolet just installed for 1972. A New York cocktail waitress suggests, "Route the exhaust out the back instead of out the side so it doesn't smog up the guy next to you." A Texas athlete: "Road clearance is too low, and it won't fit on wash and grease racks." "Legroom in the rear seat is

JANUARY 1972



LOOSE PANELS contribute to many Vega owners' mention of rattles and need for better workmanship

a four-letter word around here, but we expected that." "The roof is so low in the back seat that adults hit their heads even on very little bumps." "Quieter exhaust system." "When the ashtray is open, I hit my hand on it when I shift to reverse gear." "Dimmer switch is in most uncomfortable position—too high." "Needs a larger gas tank." "The

Summary of 1971 Pinto Owners Reports*

Total miles driven2,087,375

Average miles per gallon:

1600-cc Four, local driving ..23.9
 long trips27.1
 2000-cc Four, local driving ..22.3
 long trips25.4

Body styles:

2-door sedan82.4%
 3-door runabout17.6

Engines:

1600-cc Four27.2%
 2000-cc Four72.8

Transmissions:

4-speed manual57.8%
 Automatic41.5
 3-speed manual0.7

Why the Pinto?

Economy63.1%
 Styling26.5
 Size24.6
 Price24.6
 Handling3.4

Specific likes:

Economy75.4%
 Handling56.4
 Styling37.5
 Comfort19.7
 Power10.6
 Performance10.2

Size10.2
 Freedom from maintenance 9.5

Specific dislikes:

Harsh ride11.7%
 Seats too low, hard11.3
 Poor workmanship10.2
 Too lightweight7.5
 Rattles7.5
 Poor quality materials7.1
 Poor dealer service7.1

What changes would you like?

Softer, higher seats20.5%
 Lower dimmer switch11.1
 Add ventipanes7.3
 Better materials7.3
 Better suspension6.0
 More horsepower5.1

Had any mechanical trouble?

No52.9%
 Yes47.1

What kind of trouble?

Carburetor17.5%
 Transmission11.8
 Bearings6.9
 Clutch6.9
 Shift linkage6.2
 Horn5.4
 Alternator5.4

Did you repair it yourself?

No93.8%
 Yes6.3

Dealer repairs satisfactory?

Yes52.6%
 No47.4

Is the Pinto your only car?

No62.1%
 Yes37.9

Other cars owned:

Other Ford products33.1%
 Chevrolet17.4
 Plymouth8.1
 Mercury7.6
 Pontiac6.4
 Oldsmobile5.8

Accessories/power options:

Radio74.9%
 Whitewall tires22.0
 Bumper guards20.5
 Custom trim17.0
 Accent group13.9
 Side-guard molding13.5
 Carpeting10.0

Age distribution of owners:

15-29 years49.5%
 30-49 years38.8
 50-plus11.8

Would you buy another Pinto?

Yes78.0%
 No22.0

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



horn actuator is preposterous!" (The Vega's horn honks by pushing through the rubber padding in the steering wheel hub, and in most Vegas, this takes a fair amount of determination.)

The difference in gas mileage between the 90 and 110-hp engines proved negligible, according to our owners. In city driving, the 90 got an average of 0.9 more mpg than the 110,

VEGA REAR LEGROOM was top criticism; comfort front and rear rated better than Pinto's

while at highway speeds the average difference was only 0.3 mpg.

Under *specific complaints*, rattles and general noisiness ranked first. Other gripes included: "Gets dirty too easily from mud being thrown up past the bottoms of the fenders." "Lack of acceleration with 90-hp engine and automatic." "Gas mileage is only fair." "Car is unusually warm in summer because the back windows don't open out." "Poor service."

Under *specific likes*, handling, economy, and styling topped the bunch. Other items or qualities that pleased Vega owners are: "Ease of upkeep." "Lots more room in my one-car garage." "Disc brakes surely do their job." "Great seats for good driving position." "Hatchback design makes loading easy; a great car for shopping."

A few owners expressed fear that the

(Please turn to page 172)

POPULAR MECHANICS

PINTO SEATS, both front and rear, were a sore point because of shape; rear seat, too low

some owners. "I think he could have offered us more than \$1000 trade on our 1968 Torino GT with 57,000 miles." New Jersey cashier. "The salesman would knock only \$35 off the sticker price, but I bought it anyway."—Maryland printer.

"Dealer's sales policies are fair, and there was no pressure. I believe I got a fair deal," says a Miami nurse. And a Michigan factory worker: "I thought the salesman would try to upgrade me to a more expensive car in the showroom, at least to a Maverick, but for some reason he didn't."

Ford stresses that the Pinto is a "care-free car." Many owners echoed that slogan, and 52.9 percent said their cars have never given them a moment's trouble of any sort—needed no mechanical repairs. The minority who did experience problems listed nothing really serious. Some cited the recall



program early in the 1971 model year to correct a potentially flammable air cleaner. That done, though, typical mechanical complaints were:

"Valves out of adjustment at 8400 miles." "Keeps running after I turn off the key." "Short in horn." "Airconditioner hose had a hole in it." Side win-

(Please turn to page 172)

Summary of 1971 Vega Owners Reports*

Total miles driven2,402,110	Comfort25.6	Dealer repairs satisfactory?
Average miles per gallon:	Ride12.7	Yes53.2%
90-bhp Four, local driving 21.7	Size10.8	No46.8
long trips25.4	Specific dislikes:	Is the Vega your only car?
110-bhp Four, local driving 20.8	Rattles29.7%	No57.9%
long trips25.1	Poor workmanship11.4	Yes42.1
Body styles:	Lack of power10.7	Other cars owned:
Hatchback coupe65.7%	Poor gas mileage9.8	Other Chevrolets35.5%
2-door sedan21.1	Squeaky brakes8.2	Buick10.6
Wagon13.3	What changes would you like?	Oldsmobile10.6
Delivery0.0	Glovebox with door27.8%	Ford10.6
Engines:	Fewer rattles8.1	Volkswagen9.5
90-bhp Four83.0%	Better workmanship7.0	Pontiac7.9
110-bhp Four12.0	Relocate ashtray7.0	Cadillac5.8
Transmissions:	More legroom6.7	Accessories and options:
Powerglide47.3%	More powerful engine6.0	Radio77.9%
4-speed manual31.5	Had any mechanical trouble?	Airconditioning24.3
3-speed manual21.2	No53.3%	Oversized tires16.7
Why the Vega?	Yes46.7	Tinted glass11.4
Economy54.3%	What kind of trouble?	Custom interior15.8
Size30.4	Engine diesels9.7%	Whitewall tires13.9
Style25.6	Carburetor8.4	Age distribution of owners:
Price11.1	Transmission8.4	15-29 years49.0%
Handling6.7	Cold starts7.8	30-47 years33.0
Reputation6.7	Alternator7.1	50-plus18.2
Specific likes:	Oil leaks6.5	Would you buy another Vega?
Handling67.3%	Electrical6.5	Yes75.1%
Economy63.0	Did you repair it yourself?	No24.9
Styling41.4	No91.4%	
	Yes8.6	

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

The blind 'see' with TV

RELAY OPTICS

TV LENS AND CAMERA

INTEGRATED CIRCUITS

FLEXIBLE ELECTRODE MATRIX

BATTERY PACKS

TELEVISION can be more than a boob tube. It can help the blind see, as it does every day in a California laboratory.

The lab TV, however doesn't resemble that set you have in the living room. Rather, it's a scaled-down version with lens, camera and miniature electronic components totaling a mere four pounds. The system is battery-powered.

Blind persons using the prototype at the Smith-Kettlewell Institute in San Francisco can recognize people, distinguish things and perceive light and shadow. Right now, the view is black and white. But Dr. Carter Compton Collins and Paul Bach-y-Rita of the Institute's "seeing eye" project already are looking forward to the day when the TV camera will transmit images in color.

Collins's ingenious system uses a blind person's skin as a substitute for

the eye's retina. Like the retina, the skin contains a two-dimensional sheet of receptors that can transmit pattern information to the brain. Light stimulates the retina receptors; electronic pulses stimulate the skin receptors in the Collins system.

To get sight signals, the lightweight TV camera is mounted on a bow of a pair of glasses worn by the blind person. He directs the camera by pointing his head.

The $\frac{3}{4}$ -inch-square by 3-inch package holding camera drive, lens, light control and focus apparatus weighs only two ounces. Rechargeable nickel-cadmium batteries are used to supply power.

Camera signals are passed to a flexible girdle worn around the waist. Woven into the girdle is a 6-inch-square matrix holding 256 electrodes. These send thousands of tingling electrical pulses to the skin, and the ner-

vous system carries them to the brain. A blind person perceives these pulses as a crude but discernible image of what's up front.

Collins's current electronic prototype evolved from a 400-pound camera mounted on a dentist's chair. That pilot system relied on mechanical vibrations against a person's back to transmit images.

Looking to the future, Collins expects to work out a mass-produced version of the prototype in two to three years with a much sharper picture in color. Although concentrating on the blind, Collins's research team is also experimenting with similar sensing devices that would allow a deaf person to "hear" or an amputee to "feel" with an artificial limb.—*Michael Lamm*

...and a metal hip joint eases arthritis

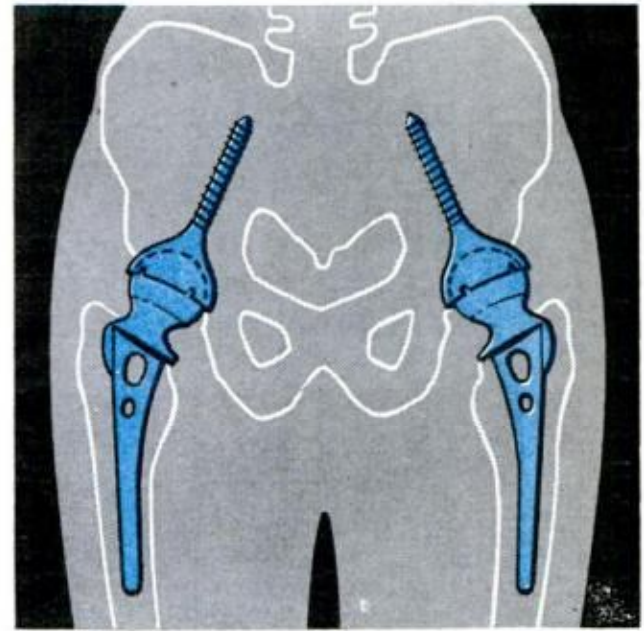
SURGEONS repairing a crippled hip with metal parts are using tools and techniques familiar to anyone who has spent an hour in a workshop.

Small-scale, highly engineered saws, braces, electric drills, mallets and rasps—they're all spread out on an operating table when bone doctors install an artificial joint made from a cobalt-chromium-molybdenum alloy.

Metal joints can be imbedded in a hip to relieve suffering from arthritis or other painful ailments because mechanically the joint is a simple ball and socket—the thigh bone ends in a bony ball that rotates in the cuplike socket of the hip.

The two-step operation begins at the socket end. After slicing open the skin, a surgeon trims off the round head of a thigh-bone ball with a reciprocating saw. A three-inch track is bored out of the pelvis with a power drill, and the bone core eased out with a reamer.

A polished metal cup is countersunk into the pelvis cavity just as a screw is sunk into wood.



SOME 2 MILLION AMERICANS, it's estimated, are potential candidates for artificial hips. Metal replacements are fitted into pelvis and thigh bones

During the operation's second stage, the surgeon rasps out a channel in the core of the thigh bone to hold the artificial joint's ball part. That ball has a head diameter of $1\frac{5}{8}$ inches, and is connected to a stem 6 or $7\frac{1}{2}$ inches long. A mallet raps the ball and stem into the thigh channel.

If the two highly polished units fit perfectly, the cut is sewn up, completing the operation. Patients are up and around within one to two weeks, and in most cases they are ready to be released from the hospital after three weeks.

Doctors using the technique report metal hip wearers can return to strenuous physical activities such as skiing, swimming, bicycling and tennis. But contact sports are out.—*Arthur S. Freese*

Are eight cylinders enough?

The new Jaguar has 12. Here's why

By ROGER HUNTINGTON/Photos by Irv Dolin

THE JAGUAR CARMAKERS in England have shocked the automotive world by bringing out a 12-cylinder engine for large-volume production in the next 5 to 15 years.

It's being used first in their exotic E-type sports coupe, strictly for performance. Within a year it will go into the "bread-and-butter" luxury sedans. Jaguar means business with this new V12—the present two-cam Six has been around more than 20 years. It needed a brand-new engine with 6 to 16 cylinders. It chose 12 and spent millions for new machines to make the engine for years to come.

The whole automotive world is scratching its collective head. What gives? We thought the "right" number of cylinders for passenger cars was settled years ago when engineers at GM research developed the modern short-stroke, overhead-valve V8 after World War II. More than 90 percent of

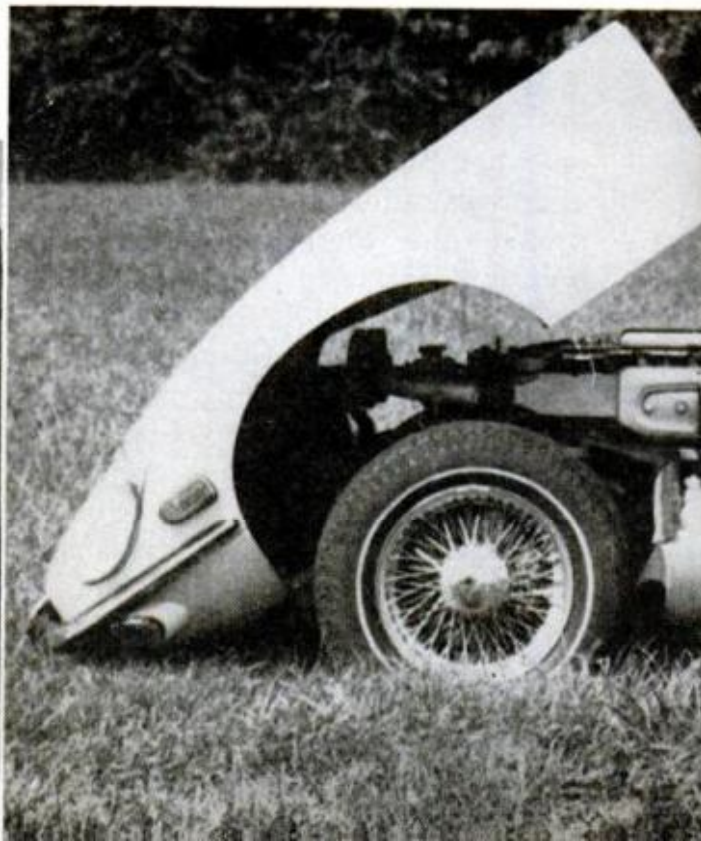
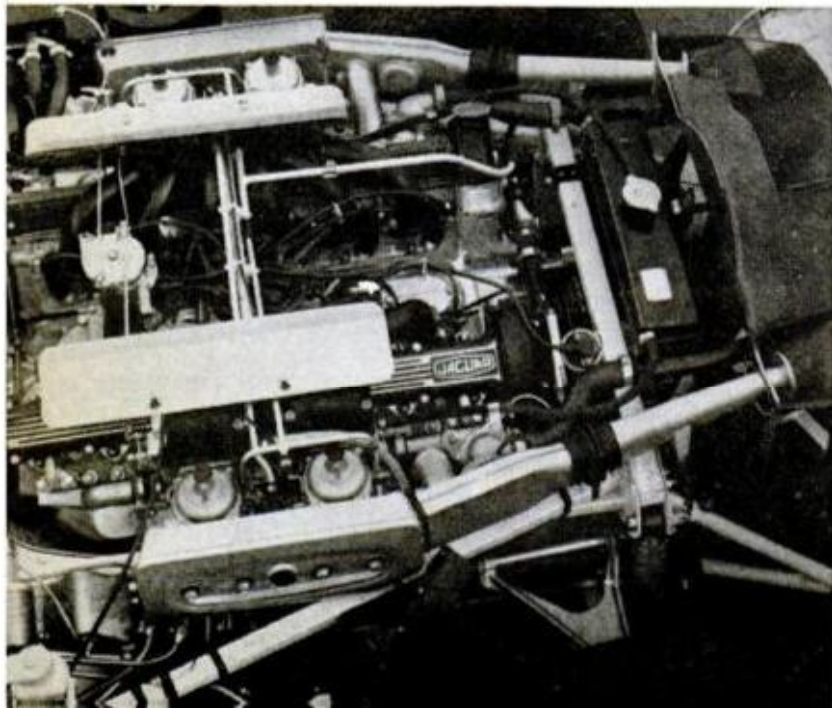
American cars use this layout and it's being adopted by more medium and high-priced European cars: Aston-Martin, Rover, Triumph, Rolls-Royce, Mercedes-Benz. Eight cylinders in a compact V-block seemed the right idea where rock-bottom cost and fuel consumption were not the main considerations.

Now here's Jaguar's new V12—a new concept leading to new questions.

Are eight cylinders really enough?

The thought that maybe they aren't is almost as old as the automobile itself. Certainly the first popular 12-cylinder passenger-car engine anywhere was the famous Packard Twin Six of 1915. This was Packard's answer to the Cadillac V8 that had been introduced the year before and was grabbing a big chunk of the American luxury market. The main idea was more cylinders, cubic inches and power. But the uncanny smoothness and low-speed torque turned out

TWELVE-CYLINDER POWERPLANT has twin banks of six cylinders in a V configuration. Note the position of air-intake nozzles for air cleaners of the four carburetors



to be the big selling points. The car would idle at 3 mph in high gear, and would accelerate from idle to 30 mph in 12 seconds without shifting gears, bucking or coughing. In a day when most cars had four or six cylinders this was pretty special performance. Packard sold 35,000 V12s in the next seven years, and they became some of America's most popular luxury cars.

Copiers appeared quickly. Other American passenger cars using 12-cylinder engines around 1920 included Haynes, National, Pathfinder and Heine-Velox. In Europe, Lancia, Corona (France) and Fiat had the new idea—for very expensive luxury cars. Nobody tried a Twelve for a medium-priced, volume-produced car. The Italian Lancia design, especially sophisticated, had a V angle of only 22° so all cylinders, head sections, valve system and overhead cams could be housed in one huge rectangular block casting!

All these Twelves disappeared by the mid-'20s. The straight-8 engine, and in a few cases the V8, had taken over for luxury cars. Students of automotive history have always questioned why because the Twelves were a lot smoother and more responsive than any Eight. They cost a lot more to build, but that wasn't a factor for expensive cars.

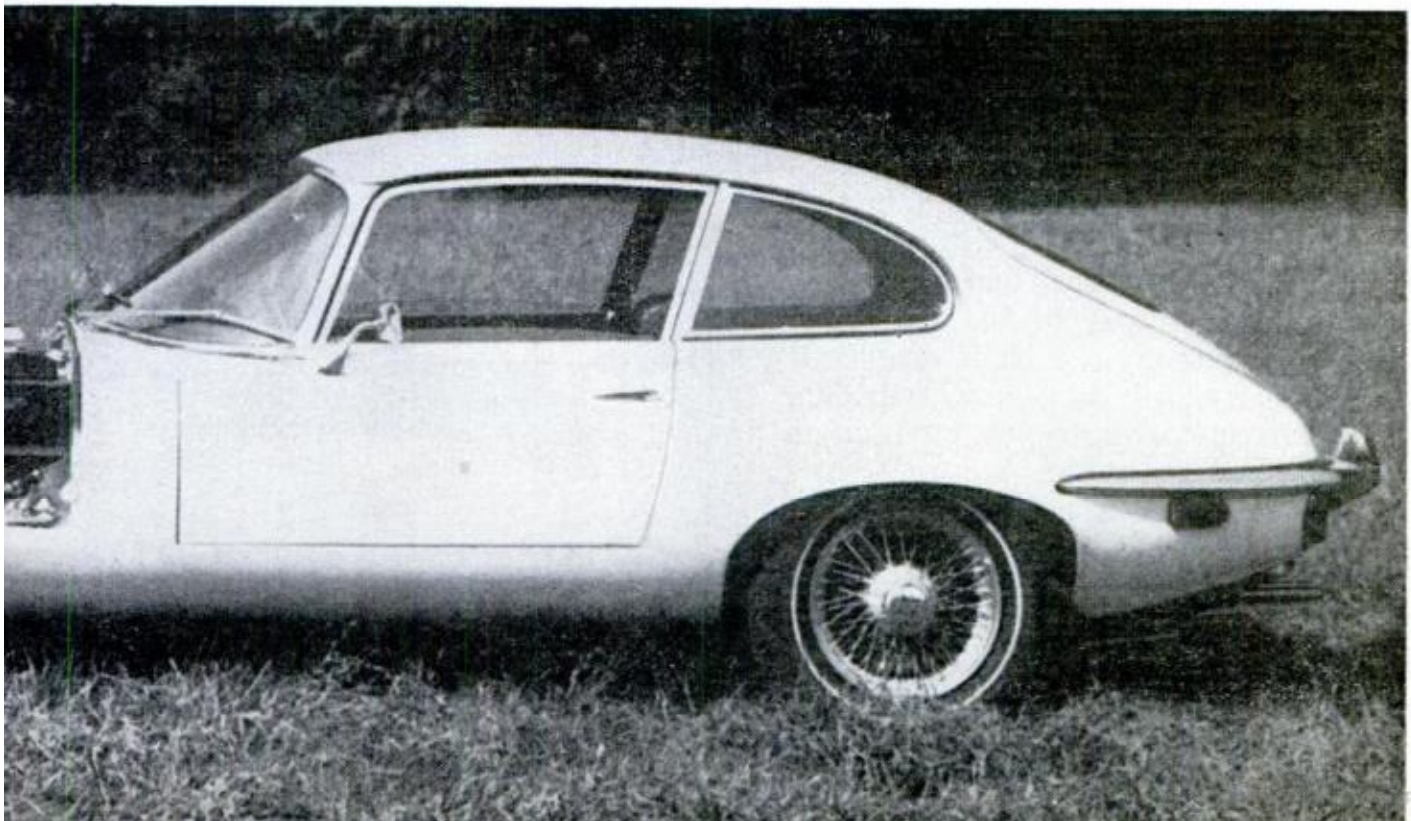
Apparently the straight-8 layout made such an impact on the car world when it first appeared in the early '20s that it started a fad. Practically everybody switched, including Packard.

It wasn't long before everybody was switching back to multicylinders. Soon after the stock market crash, in the early 1930s, luxury-carmakers were suddenly faced with some tough decisions. A lot of poor people couldn't afford even a cheap car, and only a few wealthy people could afford the most exotic. Competition in the luxury market tightened almost overnight.

Detroit's answer was more cylinders. Several companies brought out new V12 designs: Packard, Cadillac, Lincoln, Pierce-Arrow, Auburn. Cadillac and Marmon went a step farther, with 16-cylinder engines. The Marmon V16 was an engineering marvel of its day, with aluminum block heads, intake manifold and oil pan, dual carburetor and positive crankcase ventilation—more than 30 years before Washington required it! The engine had 490-cu-in. displacement and developed 200 hp, enough to propel the sports coupes over 100 mph.

A number of overseas companies also went to Twelves in the '30s, including Rolls-Royce, Daimler and Lagonda in

DROP SNOOT of the E-type, V12 Jaguar 2+2 coupe permits easy access to the engine and front suspension





England, Maybach in Germany and Hispano-Suiza in France.

Multicylinder engines had several very important advantages for passenger cars 40 years ago. We know that the more cylinders there are in an engine, the *smoother* it will run, because there are more power impulses for each revolution of the crankshaft, and these impulses overlap to give a smoother flow of power. Engines weren't mounted on soft rubber pads then; they were bolted solid to the frames. Every vibration came right through to the passengers. The 12-cylinder engine was noticeably smoother than a Six or Eight in that situation—a good selling point.

Another thing, there were no automatic transmissions then. You had to shift gears and pump a clutch pedal. Multicylinder engines had very low idling speeds (down to 200 rpm) and smooth, strong torque from these low speeds. You didn't do as much shifting. Many drivers would start off in high gear most of the time.

Then there was acceleration and highway speed. The big 12s and 16s had a lot more torque and horsepower. Even with the heavier bodies they could out-accelerate and outspeed most small, medium-power cars. Cruising at



TURBINE-LIKE SMOOTHNESS under the hardest acceleration is what you feel in the Jaguar's aircraft-like cockpit. The inertia-reel seat belts provide full freedom of movement. Zero to 60 mph is an easy seven seconds with automatic transmission; handling is improved even more than that in the earlier E-types. Fuel consumption in hard driving is 12 to 14 mpg.—B.H.

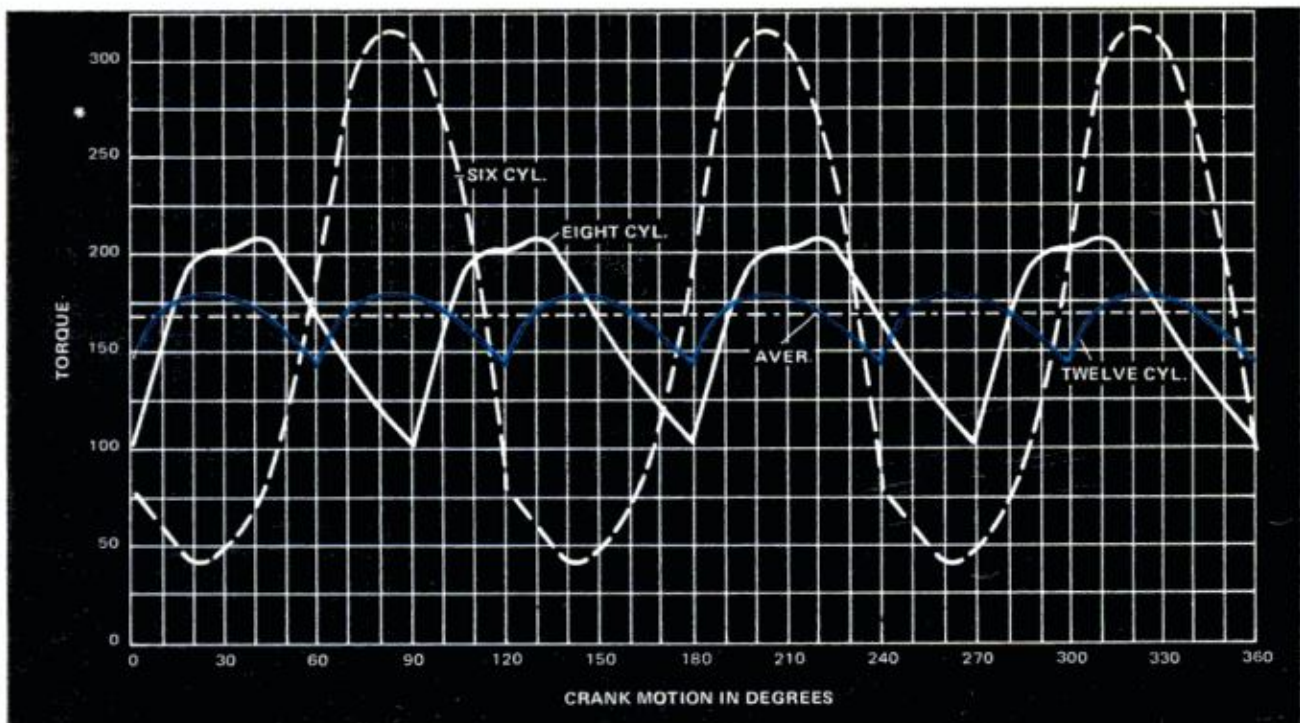
SPECIFICATIONS

Engine: single-overhead-cam V12; displacement, 5343 cc (326 cu. in.); bore and stroke, 3.54 x 2.76 in.; compression ratio, 9.0:1; carburetion, four Zenith-Strombergs; ignition, electronic distributor.

Chassis: Vacuum-assisted disc brakes (front vented, rear solid); rack and pinion steering; four-wheel independent suspension; radial tires.

Curb weight (2+2): 3220 lbs.; wheelbase: 104.7 in.; length: 184.4; width, 66.1; height, 51.4.





SMOOTHEST TORQUE CURVE over complete 360° revolution of crankshaft is that of the 12-cylinder engine

60 or 70 mph wasn't a flat-out deal with a small engine screaming and thrashing. Multicylinder engines of the '30s generally developed between 150 and 200 hp; most bread-and-butter cars were well under 100 hp.

Today, when we talk about multicylinder *racing* engines, we have other design considerations than smoothness and low-speed torque. It's a matter of more brute horsepower. When cubic inches are limited, as they are in most types of racing, you want an engine that will wind up as tight as possible so you can burn the maximum amount of fuel and air each minute, and thus develop the maximum horsepower from each cubic inch of displacement.

The way to get an engine that can turn faster is simply to use smaller cylinders—and more of them. Smaller and lighter pistons, rods and crankshaft can turn faster without developing excessive momentum forces that would overload the bearings. The lighter valves can fly up and down faster without "floating."

For a perfect example of the superior power, compare the latest 12-cylinder European Formula 1 engines (Ferrari, Matra, BRM) with the Cosworth-Ford V8 that has dominated Grand Prix road

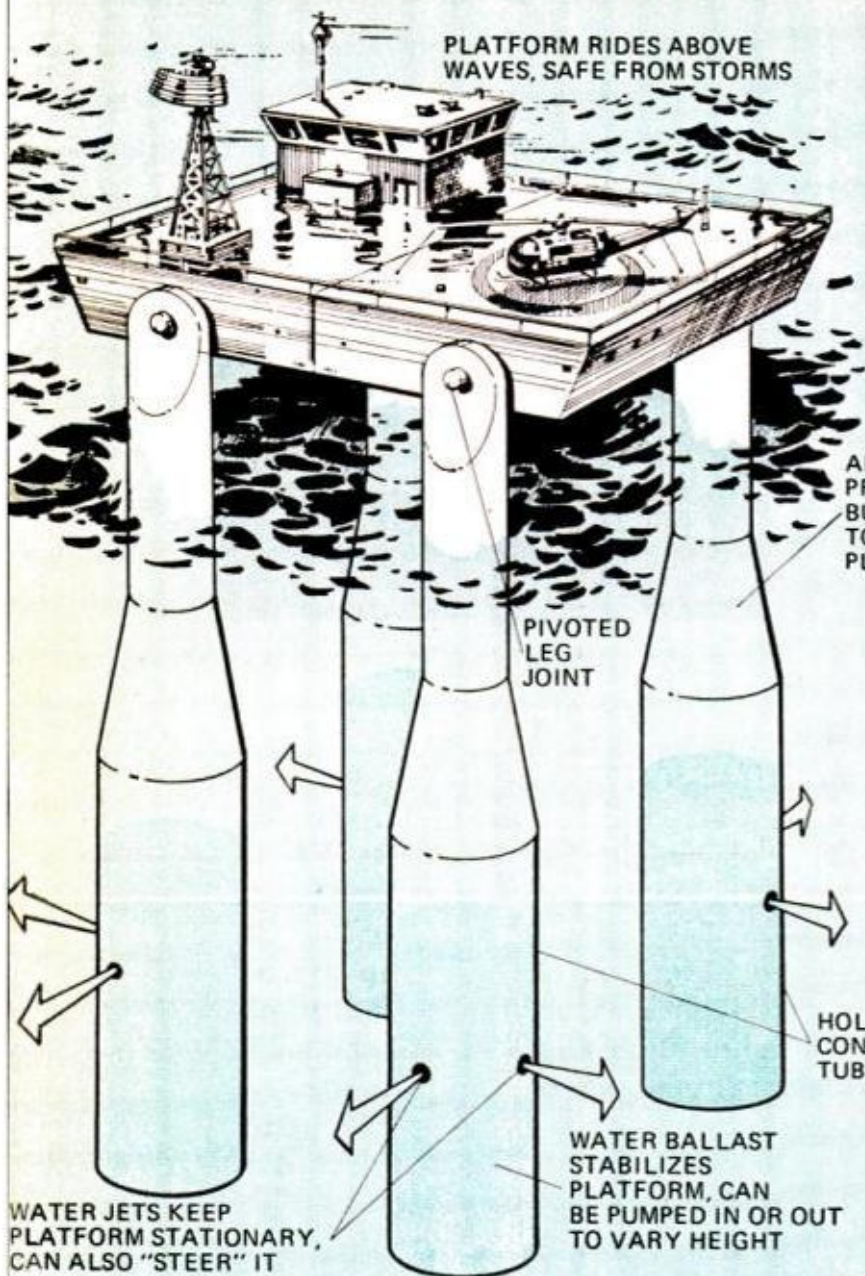
racing for the last few years. All Formula 1 engines have just under three liters (about 183 cu. in.) displacement. The Cosworth V8 has been developed to give around 440 horses at 9500 rpm. But look at the 12s: anywhere from 20 to 40 hp more and at 11,000 rpm or better! The difference is due almost entirely to the number of cylinders, because all engines are quite similar as to combustion chamber design, valve layout, carburetion, cam timing, and so on.

There have been some fantastic 12 and 16-cylinder engines in auto-racing history. As early as 1925 the French Delage Co. was dominating European Grand Prix racing with a little supercharged two-liter V12 that was built like a watch and developed 190 hp. Two years later our Stutz Motor Car Co. sponsored Frank Lockhart in a world speed record attempt with a radical engine that used two straight-8, 91-cu.-in. Millers on a common crankcase and two separate crankshafts geared together to give 385 hp at 7500 rpm!

Multicylinder engines got a boost in the late '30s when the German government became interested in Grand Prix racing for national prestige and

(Please turn to page 176)

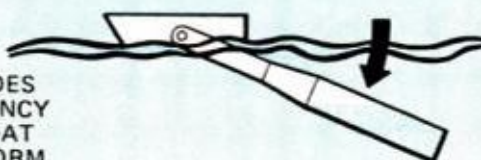
Man-made 'island' floats



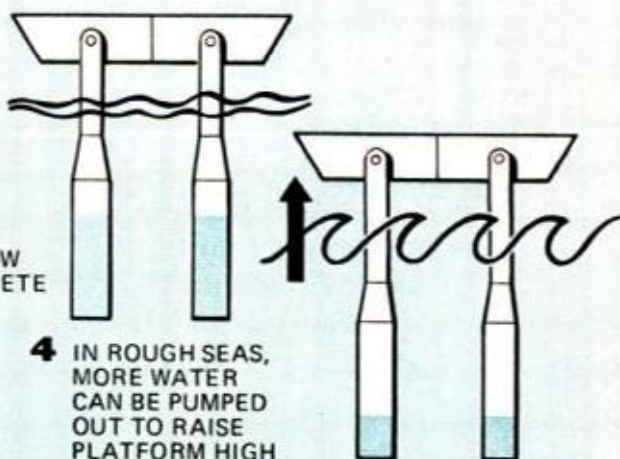
1 PLATFORM SECTIONS ARE TOWED OUT TO SEA WITH PIVOTED LEGS TRAILING OUT BEHIND



2 LEGS ARE FILLED WITH WATER AND SUNK BELOW PLATFORM



3 SECTIONS ARE JOINED TOGETHER AND THE LEGS PARTIALLY PUMPED OUT TO RAISE PLATFORM ABOVE SURFACE



4 IN ROUGH SEAS, MORE WATER CAN BE PUMPED OUT TO RAISE PLATFORM HIGH ABOVE WAVES



No-tilt forklift

Top-heavy forklift trucks often tip over if they tilt on a grade (photo at far left), killing or injuring their operators. To eliminate the hazard, two British inventors, Joe Haley and Ron Grice, have come up with a forklift that pivots. No matter in which direction the truck wheels tilt, the lift itself will remain vertical (near left) so it can't topple over. The hydraulic controlled forklift trucks are made by TFL Crane, Ltd., Great Gransden, Bedfordshire, England.

POPULAR MECHANICS

on stilts!

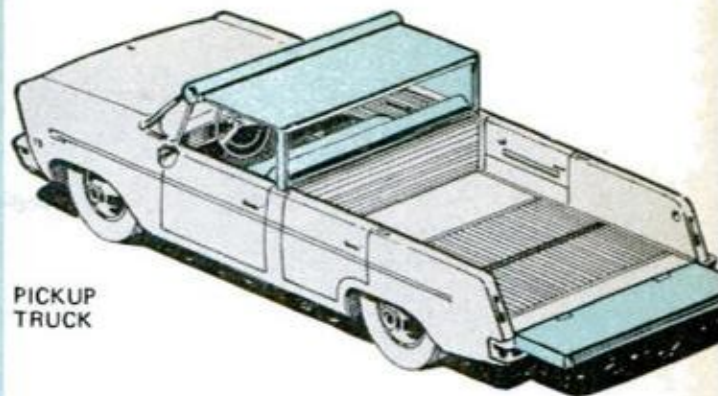
Conventional offshore oil-drilling rigs are limited in size and subject to damage from storms—but not this one. Developed by the Scripps Institution of Oceanography in San Diego, Calif., it's supported on stilt-like legs that can be raised or lowered in the water to keep the platform at any desired height. The legs are huge, hollow concrete tubes filled partially with water. The water acts as ballast, stabilizing the platform so it can't bob up and down. In heavy seas, some water can be pumped out, increasing the buoyancy and raising the platform safely above the waves. The water can also be jetted out in different directions to steer the rig or prevent it from drifting. Computer-controlled pumps would automatically keep it level and in position.

In its present form, the rig is designed to be towed out to sea in two sections, then joined. The pivoted legs float empty until in position, then are submerged to lift the platform clear of the surface. Together, the sections provide an area of 15,000 square feet or about one-third of an acre, but additional sections could be attached to produce a floating island of virtually unlimited size. Uses for the rig, in addition to oil drilling, include midocean weather stations, offshore atomic energy plants, floating airfields and water-borne laboratories for oceanographic research.

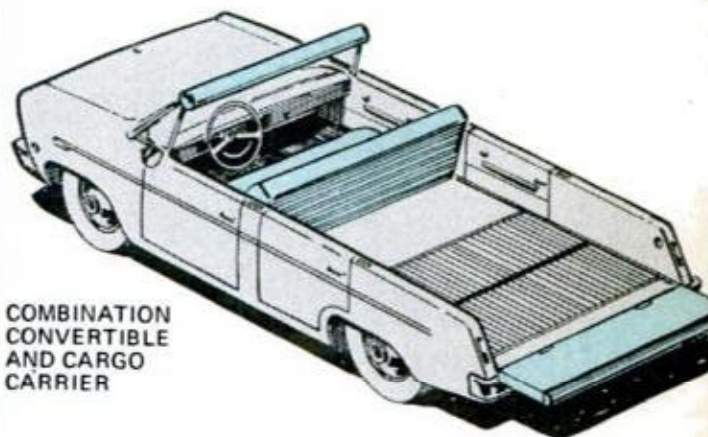
Car for all occasions

Want a pickup truck? A convertible? A station wagon? You could have them all with the ingenious multipurpose vehicle at right, proposed by inventor Vito Sangimino of Brooklyn, N.Y. Interchangeable parts quickly convert it into any of four different vehicles depending on your needs. Seats fold down to provide an open cargo space. A flexible roof stores in a roll on top of the windshield. Pulling it partially out and adding door posts creates a cab. Extend it all the way and you have a fully enclosed station wagon. The idea: Not only could you change your car at will, but manufacturers and dealers would save money on not having to make and stock many different car models.

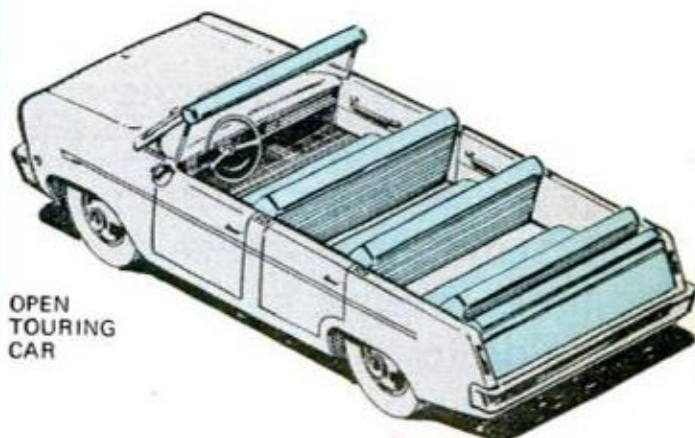
JANUARY 1972



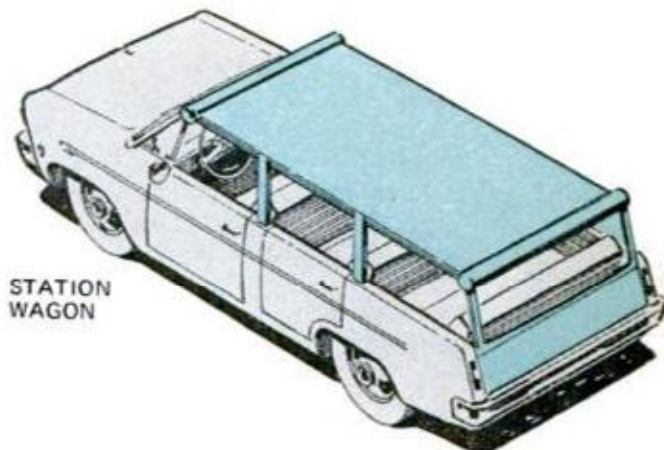
PICKUP TRUCK



COMBINATION CONVERTIBLE AND CARGO CARRIER



OPEN TOURING CAR



STATION WAGON

Tune in the world!



Shortwave listening is a fast-growing hobby that can provide hours of fun and fascination in these exciting times we live in. Here's a guide to choosing the best equipment for the type of broadcasts you want to hear

By FOREST BELT

WHAT in the world's going on? A shortwave receiver will help you find out. Shortwave listening used to be big sport back in the early days of experimental radio. Now it's gaining popularity again—and for good reasons. Today's fast-breaking world events and new advances in low-cost equipment are helping to make shortwave snooping an exciting, fun-filled hobby.

You may tune in on a ham in Alaska chatting with someone in South Amer-



REALISTIC
FIRE-POLICE
MONITOR RADIO,
ABOUT \$100



LAFAYETTE
MOBILE CB TRANSCEIVER,
ABOUT \$85



LONGINES
MULTIBAND PORTABLE,
ABOUT \$40



HEATHKIT
MARINE RECEIVER,
ABOUT \$125

ica, an airline pilot calling a control tower, a ship in distress at sea or a doctor radioing emergency instructions to a disaster area thousands of miles away. You may catch an overseas broadcast from Moscow, London or Vietnam and actually be in on an important global development before you hear about it on regular radio or read it in the papers. Locally, you may listen in on a dramatic police chase or a daring fire rescue.

Early shortwave sets were costly and rather crude-looking. Today, they're trim, compact, smartly styled and relatively inexpensive. Many good models sell for \$50 to under \$200. A few typical examples are shown at the bottom of this and the facing page. The set you choose depends on the kind of shortwave you're most interested in—there are many different types. The term "shortwave," in fact, is just a loose way of describing all the various kinds of radio other than standard AM and FM.

Actually, only a small portion of these broadcasts are in true shortwave. Many are in longwave, medium-wave, VHF (very high frequency) and even UHF (ultra high frequency). These transmissions span a tremendously wide frequency range all the way from about 100 kilohertz (kHz) to 470 megahertz (mHz).

The terms kilohertz and megahertz, incidentally, correspond to the older kilocycle and megacycle designations no longer used. A kilohertz represents 1000 cycles and a megahertz a million cycles—to give you an idea of just how broad the frequency spectrum is. True

shortwave runs only from about 2 to 30 mHz.

Most radio transmissions are organized into "bands." There are ham bands for amateur use, international shortwave bands for foreign broadcasts, marine and aircraft bands, public service bands for fire, police, business and other two-way mobile communi-



TWO LOW-COST RECEIVERS are Heathkit's GR-54 above and Hallicrafters' S-120A below. Heath model tunes three shortwave bands, one aviation and marine band and standard AM band. Kit price is \$89.95



YOU CAN OPERATE this Hallicrafters S-120A on either battery power (above) or on house current. The set, also shown at top of facing page, covers 76 shortwave services plus AM, is priced at \$79.95



HALLICRAFTERS
GENERAL-COVERAGE
TABLE RECEIVER,
ABOUT \$120

HEATHKIT
GENERAL-COVERAGE
PORTABLE RECEIVER,
ABOUT \$130

ALLIED KNIGHT-KIT
SHORTWAVE RECEIVER,
ABOUT \$50



KIT-BUILT RECEIVER offers home or portable use on an ingenious system of rechargeable batteries. A built-in charger automatically keeps the batteries at full power when set is plugged into 117-volt a.c. The Heathkit GR-78 covers 190 kHz to 30 MHz in six bands, including foreign, ham, marine and AM broadcasts. Plug-in circuit boards (left) simplify assembly and servicing. Kit price is \$141.95



VERSATILE MULTIBAND PORTABLE is handy for boat use as it also serves as a radio direction finder for navigation. The five-band Hallicrafters CR-44A covers AM, FM and marine broadcasts, is about \$150

cations, a special weather band, and the CB or Citizens Radio Band. No one shortwave receiver can cover all of these. You must decide which bands you want the most, then look for a set that offers the closest selection. The accompanying charts provide a guide to the types of coverage you'll get on different bands and frequencies. Additional guides are available in shortwave handbooks sold in bookstores.

So-called "communications" receivers are among the most advanced, the most powerful and the most expensive. They're designed for highly sensitive, long-range reception, but are generally limited to the ham bands used by amateurs and/or overseas broadcasts. They receive code (CW) and single-sideband (SSB), a special form of voice radio. Unless you're interested in getting into amateur radio yourself, listening exclusively to ham talk can be a bit dull.

General-coverage receivers and mul-



GENERAL-COVERAGE RECEIVER at left provides both AM and FM for entertainment plus additional bands covering 76 shortwave services. The Hallicrafters S-240 has provision for an external speaker or can be played through your hi-fi system for improved sound quality. It's priced at about \$120

POPULAR MECHANICS

WHEN TO TUNE IN WHERE FOR WHAT

COUNTRY	BROADCAST FREQUENCIES (in kHz)	PROGRAM TIMES (GMT)	COUNTRY	BROADCAST FREQUENCIES (in kHz)	PROGRAM TIMES (GMT)	U.S.A.	BROADCAST FREQUENCIES (in kHz)	PROGRAM TIMES (GMT)
CANADA	6160	0930-0500	JAPAN	15445	2345-0045	Voice of America	3980	0300-0730
	9625 11720 3330 7335 14670	1215-1315 0000-2400		17825			5965 6160 7270 9635 11760 3980 6040 9760 15205 17785	
CHINA (Free) (Taiwan)	11825 15345 17890	0000-0350	JORDAN	7155 9560	0955-1315 1400-1705	American Forces Radio & TV Services	5965	Most times of day
CHINA (Mainland)	7120 9780 15045 15060 17673 17735	0000-0500	LEBANON	11705 11780	1830-2030 0130-0400		9755 11805 15320 15410 15430 21500	
CUBA	9525 11760 11840 15285 17705	0100-0300 0330-0600 0630-0800 2050-2150	NORWAY	9645 21655 25730 25900	0400-0430 2000-2030 1600-1630 1800-1830 1400-1430	KGEI (Calif.)	9695	2200-0430
	EGYPT	9625 11915	0030-0430	SWEDEN	9625 15315 9725 15240 21585		1100-1130 0330-0400 1400-1430	
GERMANY (WEST)	6040 6075 9735 6075 6145 9545	0130-0250 0435-0555	UNITED NATIONS	15410 21670 5955 11840	1800-1805 1830-1835 0845-0900	WNYW (Radio New York Worldwide) -Partly in Spanish	5985+	0015-0230 2230-2345 0130-0245 2000-2300 0115-0230 0000-0230 2030-2215 2145-0115 2315-0100 1900-1945 1700-2400 1700-1945 1700-2130
	GREAT BRITAIN	6110 9580 11780 21610	2115-0415 2130-0330 2115-0030 1500-1515	U.S.S.R.	7290 9865 11830		2200-0530 2200-0530 1730-2130	
INDIA	7215 11620 9912	1745-2230 1945-2230	NORTH VIETNAM	7038 7470	2300-2330 1330-1400 1430-1500 0500-0530 1830-0900 1000-1030 1200-1230 1530-1600 1300-1330	WINB (World International Broadcasters)	11795	2000-2200 1700-2000
	ISRAEL	9009 9625 9725		2045-2130	SOUTH VIETNAM		15018 9755	

multiband portables offer a compromise. While not as sensitive as special-purpose ham receivers, they cover a greater variety of shortwave services. They also include the standard AM commercial broadcast band for news and entertainment, and some even provide FM for fine music listening. General-coverage receivers operate on 117-volt a.c. and are designed for home use. Multiband portables run on batteries and play anywhere. Most portables can also be operated on house current at home with an accessory a.c. adapter.

The number of bands you get on a general-coverage receiver or multiband portable can range from three or four up to 10 or more. In general, the more,

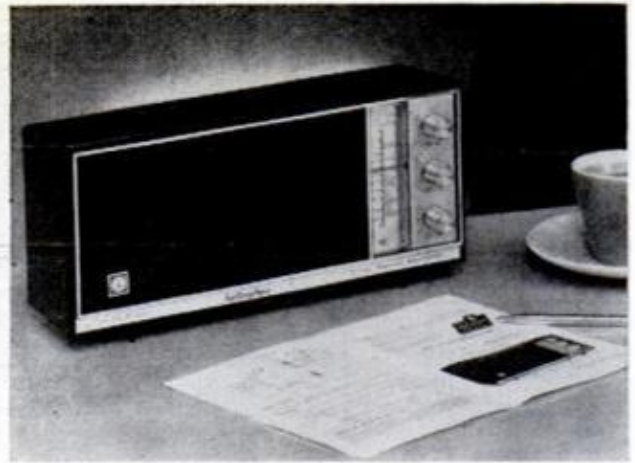
HOW TO CONVERT INTERNATIONAL BROADCAST TIMES TO YOUR OWN LOCALITY

Shortwave program schedules are in Greenwich Mean Time (GMT), sometimes referred to as Z-time, Zebra Time or Zulu Time. It works on the 24-hour clock and is the time at the prime meridian, which intersects Greenwich, England. For the 24-hour time at your listening station, or at typical world points, add or subtract the number of hours shown in the chart below.

Time	Hours	Time	Hours
Eastern Daylight	-4	Berlin	+1
Eastern Standard	-5	Israel	+2
Central Daylight	-5	Moscow	+3
Central Standard	-6	Paris	+1
Mountain Daylight	-6	Philippines	+8
Mountain Standard	-7	Rome	+1
Pacific Daylight	-7	Tokyo	+9
Pacific Standard	-8	Vietnam	+7
Hawaiian Standard	-10		



ONE OF MORE ADVANCED RECEIVERS is this Hallcrafters Model SX-133 priced at \$350. It covers 81 shortwave services plus the standard commercial AM broadcast band. Extra features include signal-strength S meter and antenna trimmer. This type of receiver requires an external speaker and antenna



MONITOR RADIOS let you listen in on exciting fire, police and aircraft calls. This Hallcrafters comes in three models—one for low-band public service coverage (30-50 mHz), one for the high band (152-174 mHz) and one especially for aircraft reception (108-135 mHz). Prices are \$49.95 to \$59.95

the better, although cost naturally goes up as the number increases. The main thing to be sure of is that the bands available are the ones you want. Different sets offer different combinations of choices.

Most general-coverage and portable receivers have several international shortwave bands on which you can tune in broadcasts from foreign countries. Many of these are in English and come on at definite times and frequencies so you can find them easily. Some sets also include one or more ham bands. While these won't cover the full range of amateur frequencies, they'll offer a sampling of some of the most widely used ones and will let you try a little eavesdropping on ham talk without investing in an expensive single-purpose ham receiver.

Foreign and ham bands are designated in meters as well as frequencies. The number of meters represents the approximate actual wavelength of the transmitting frequencies in a given band and is used as a convenient way of identifying this band. Specifications for more advanced shortwave receivers list available bands in meters. Where meter designations are not given, look for the corresponding frequencies. The accompanying chart lists both meters and frequencies for easy comparison.

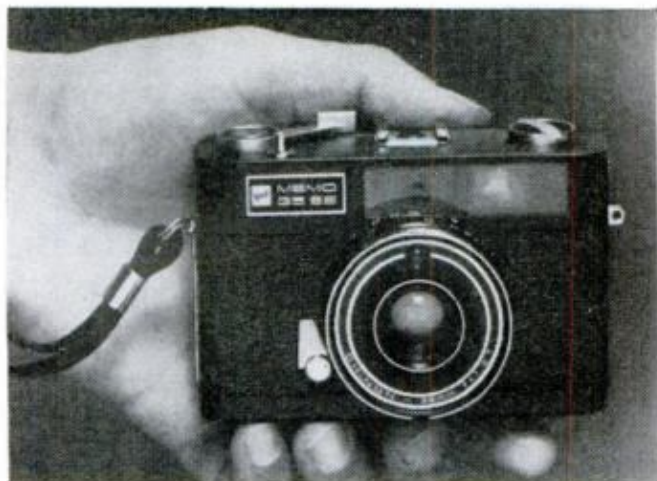
The National Weather Service broadcasts continuous weather reports on 162.55 mHz (in some parts of the country, this varies slightly and may be 162.40 or 162.45 mHz). If you're a boater, skier, camper or engage in other outdoor activities, be sure the set you choose includes this important source of weather information. The forecasts are much more detailed than those on regular newscasts, are updated frequently and can be tuned in any time of the day or

(Please turn to page 170)

WHAT YOU'LL GET ON DIFFERENT SHORTWAVE BANDS

BROADCAST TYPE	BAND (in meters)	FREQUENCIES (in mHz)
Worldwide Shortwave	120	2.3-2.495
	90	3.2-3.4
	75	3.9-4.0
	60	4.75-5.06
	49	5.95-6.2
	41	7.1-7.3
	31	9.5-9.775
	25	11.7-11.975
	19	15.1-15.45
	16	17.7-17.9
	13	21.45-21.75
11	25.6-26.1	
Amateur Radio (Ham)	160	1.8-2.0
	80-75	3.5-4.0
	40	7.0-7.3
	20	14.0-14.35
	15	21.0-21.45
	10	28.0-29.7
	2	50.0-54.0 144.0-148.0
Safety and Commercial 2-Way (FM)	Low Band	30.0-50.0
	High Band	152.0-174.0
	UHF	450.0-470.0
Citizens Radio (CB)	Class D	26.965-27.255
Aircraft	Overseas & Military	2.0-9.0
	Overseas & Military	9.0-18.0
	Navigation	108.0-118.0
	Communications	118.0-136.0
Marine	Coastwise	2.0-2.5
	High Seas	4.0-9.0
	High Seas	12.0-22.0
	Inland	156.0-162.0
	Waterways	

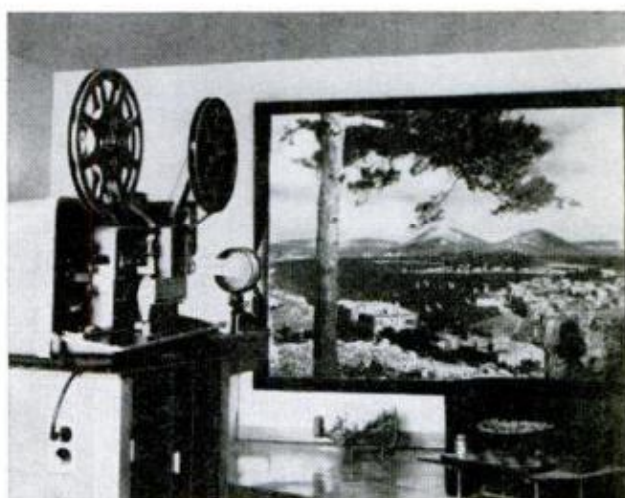
NEW IN PHOTOGRAPHY



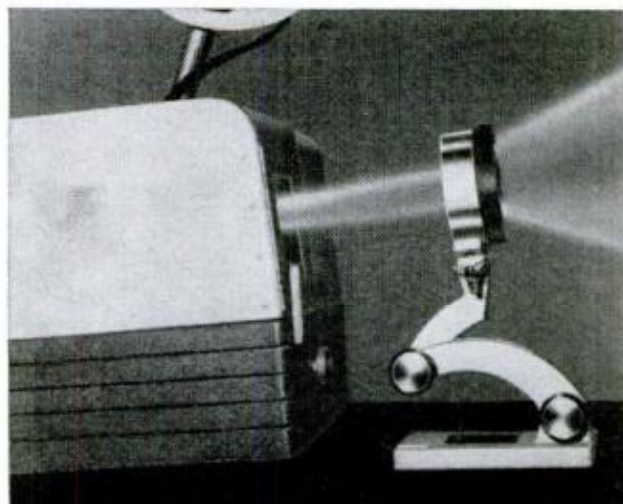
POCKET-SIZED CAMERA is GAF's first entry in the compact 35-mm field. Smaller than most 35s, the fixed-lens, rangefinder-type camera features an automatic electronic exposure control that works in both flash and daylight situations. The exposure system will handle films with ASA speeds from 25 up to 500. Called the Memo 35 EE, the new camera also has a built-in self-timer, a flash shoe on top and a 38-mm, f/2.7 lens. It's \$89.95 from GAF Corp., 140 West 51st St., New York, N. Y. 10020.



FIRST NEW NIKON in 12 years is the F2 above, an updated version of the famous Nikon F. The 35-mm single-lens reflex takes most of the accessories designed for the F model and, in addition, offers an extended-range exposure system covering shutter speeds from 1/2000th to 10 seconds. With motorized drive and magazine back (lower photo), it can make up to 800 exposures at five a second. Basic price with 50-mm, f/1.4 lens is \$465. Ehrenreich Photo-Optical Ind., 623 Stewart Ave., Garden City, N. Y. 11530.



GIANT THEATER-SIZE PICTURES are possible with an accessory lens (above) that can be used with any standard movie or slide projector. The device is simply placed in front of the projector's normal lens, as shown below, and magnifies the image up to 10 feet wide. Moving the lens back and forth varies the amount of magnification to suit available wall or screen area. Price is \$135. Anton Process Co., Box 183, Woodside, N. Y. 11377.

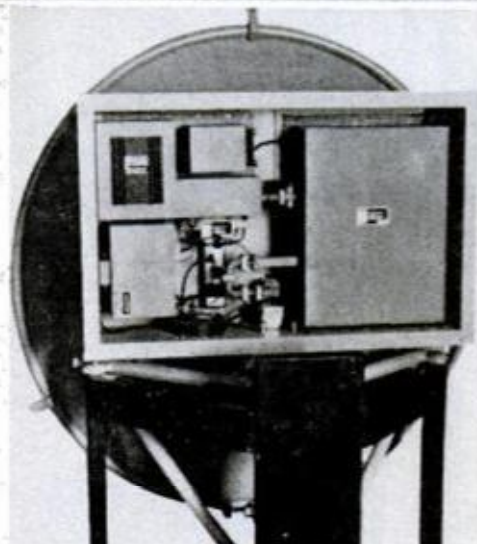


NEWS BRIEFS



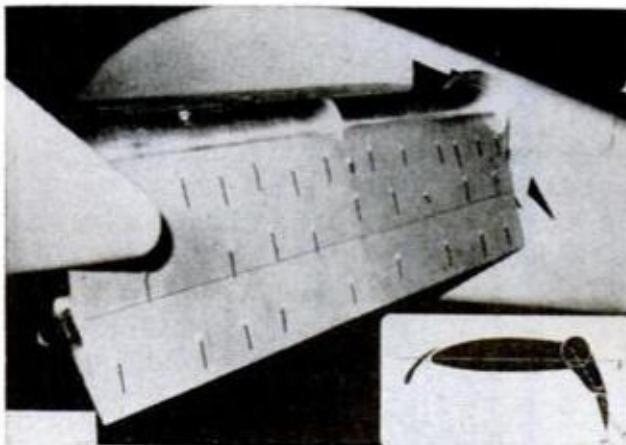
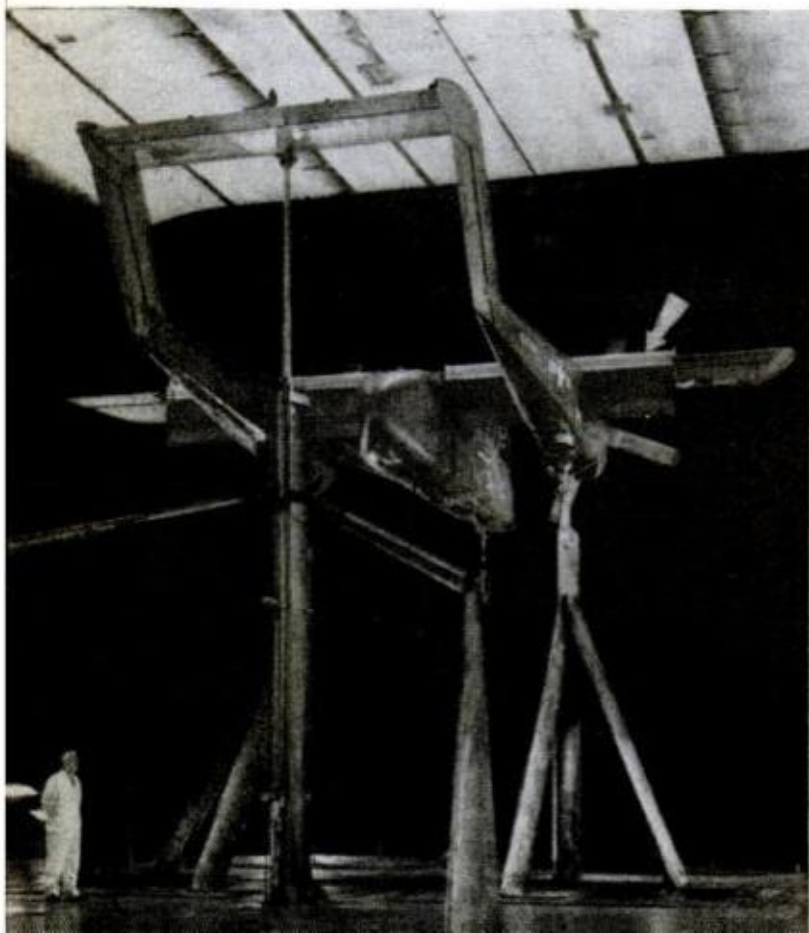
It fell from the E1

This work of art was created by John Curry from hunks of metal that dropped from the elevated train tracks in Astoria, Long Island. He started when a bolt broke his car's windshield. The sculpture appeared in the Hallmark Gallery's "Garbage" exhibit.



A lot to look at

In a demonstration that shows the Laser Link's multichannel transmitting capacity, 12 channels (of a possible 18) are on-screen in the setup at top. The system's wide-band modular/transmitter appears at bottom mounted on the rear of a parabolic antenna.



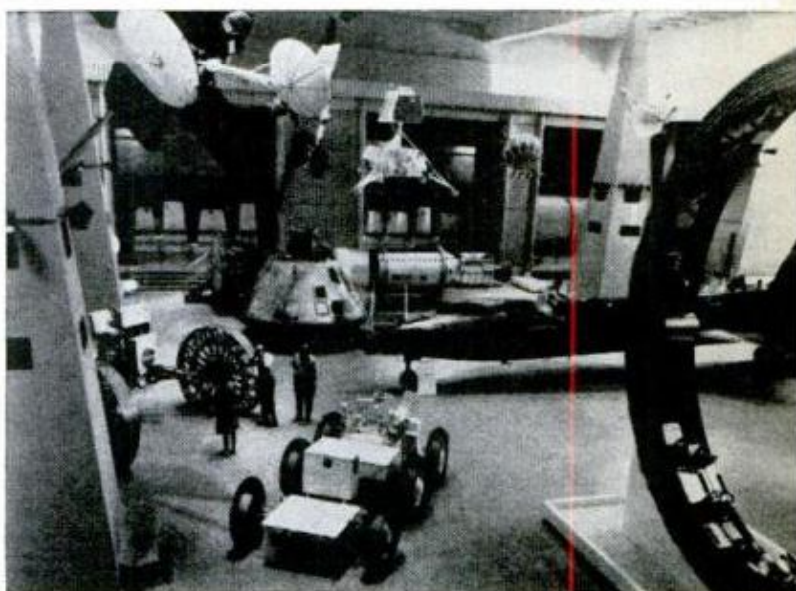
Rotating cylinder aids lift

The rotating cylinder flap is one of a number of devices being tested by NASA to give better lift and propulsion to STOL (short takeoff and landing) aircraft. The new flap is shown on an OV-10 Bronco (left) and in close-up detail (above). The cylinder, located at the leading edge of the flap, rotates rapidly in the direction of airflow; this causes the air to cling to the deflected flap, increasing lift.



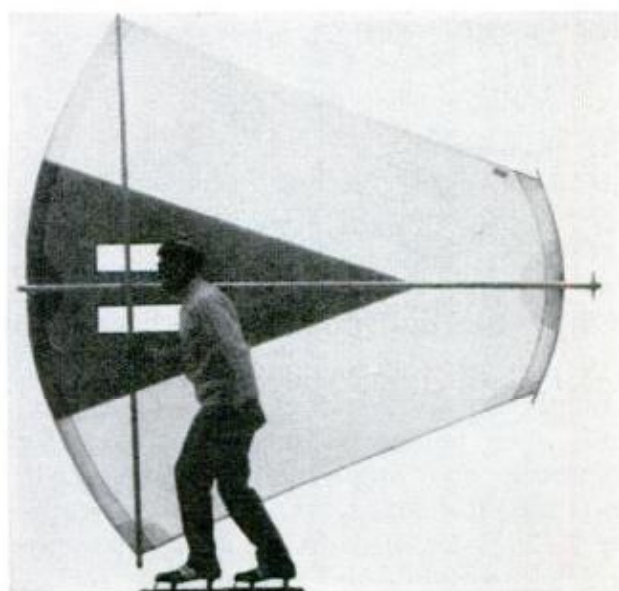
Space and rocket exhibit

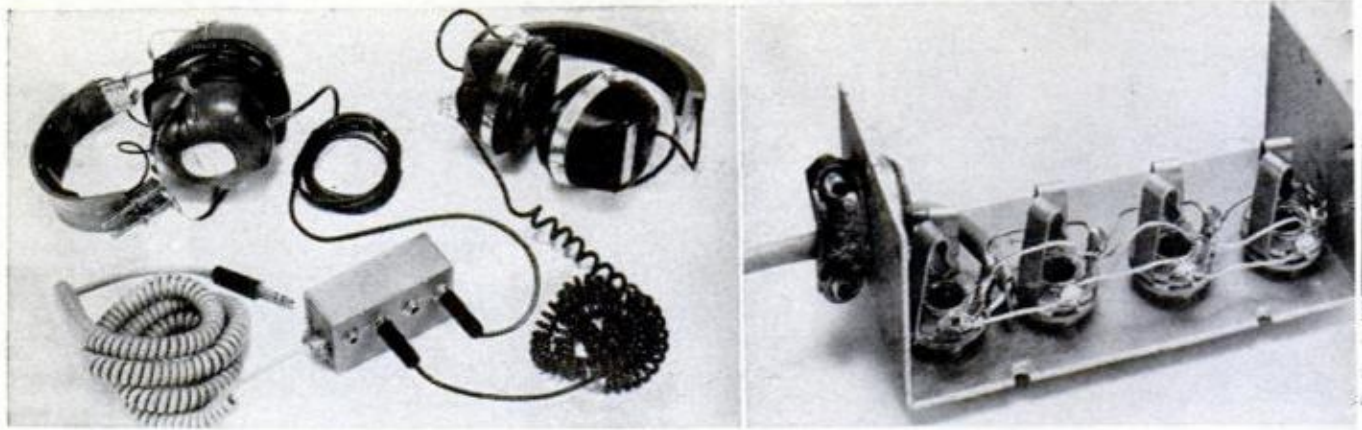
Visitors to the Alabama Space and Rocket Center, Huntsville, can view spaceships, rocket engines, moon buggies and other equipment that U.S. astronauts have used on their space journeys. The multimillion-dollar center, called the largest space exhibit on earth, features equipment that the astronauts have used to explore the moon. One of the outdoor displays (above) is the Apollo/Saturn V moon rocket laid on its side for close-up inspection. Inside (right) are such displays as a moon buggy, space capsules and the X-15. Since its opening in March 1970, the center has been host to nearly half a million visitors. It's located on Highway 20 west of Huntsville and operates seven days a week.



New sail for skaters

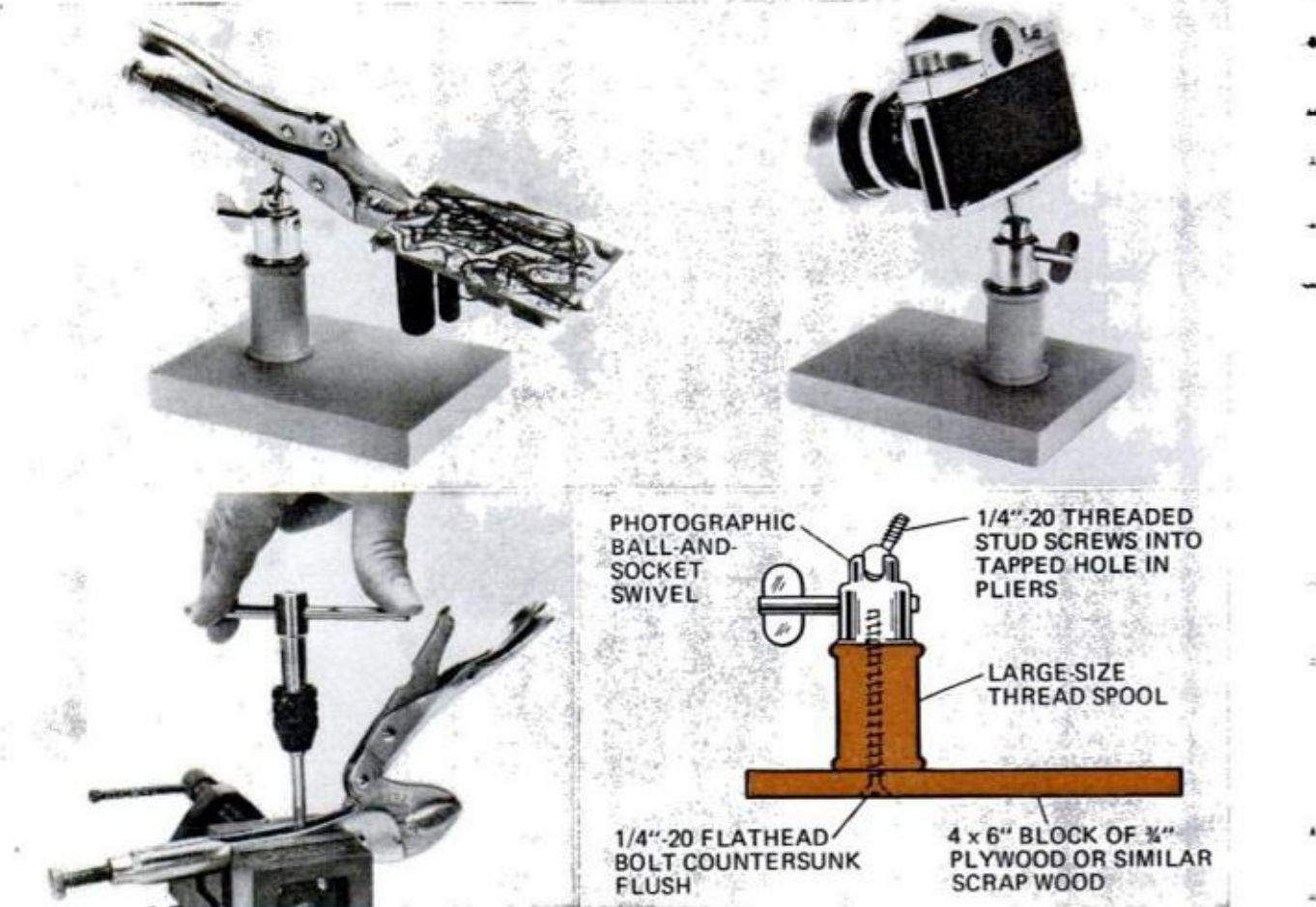
With his hand on the mast and the boom over his shoulder, a skate sailor simply leans against his sail on the leeward side—and, in a good wind, can zip along over ice up to 40 mph. The new Icicle sail, made by Waterfun, Inc., offers large plastic windows for good visibility, a lightweight aluminum frame and fiberglass-reinforced plastic bows. The sails come in three sizes and range in price from \$69 to \$79.





Many ears can hear with this multiple headphone outlet

If several members of your family like to listen to hi-fi with headphones at the same time, this easily made outlet box is the answer. Up to four headsets can be

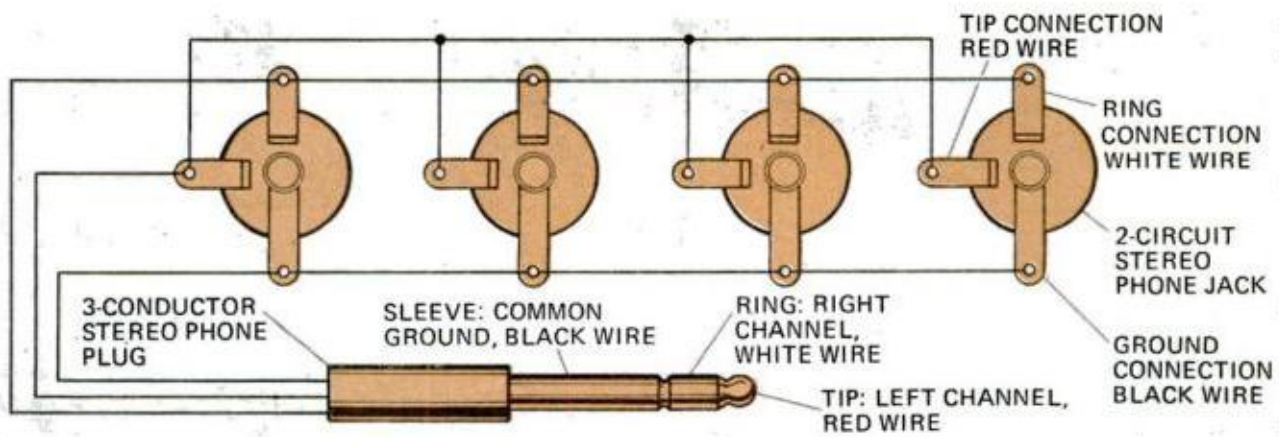


Handy multipurpose work holder or photographic stand

A pair of cam-locking pliers mounted on a photographic swivel makes an adjustable work holder to free your hands for soldering and other delicate jobs. Drill and tap the plier handle to take the swivel's 1/4-20 threaded stud. Release the plier's spring and open the handle so you

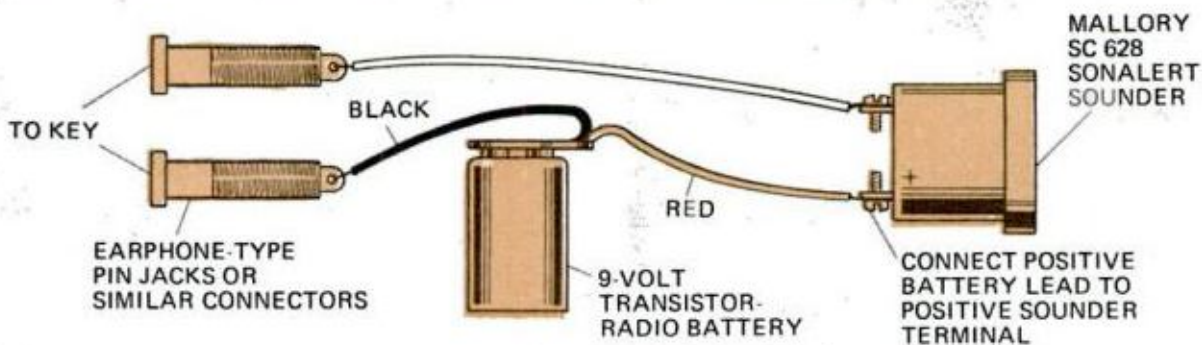
can drill from the inside. This keeps the bit from slipping off the rounded outer surface. Drill size for a 1/4-20 tap is No. 8. Mount the swivel on a small wood block, using a thread spool as a post. With the pliers removed, the stand makes a handy camera support.—Bill Webb, Boston

HINTS



plugged in simultaneously. Use standard two-circuit stereo phone jacks and mount them in a small metal minibox or similar enclosure. The jacks are simply wired in

parallel, as shown above. Use three-conductor cable and solder on a stereo phone plug to fit the headphone jack on your hi-fi set.—Norman Fallon, New York



Like to practice code? Try this inexpensive key sounder

You can make your own code practice oscillator for a few dollars with a Mallory solid-state Sonalert sounder. The sounder realistically reproduces the beep of code signals and also eliminates the need to wear earphones. Wire it in series with a

9-volt battery, being sure to connect the positive battery lead to the positive Sonalert terminal, as shown above. The SC 628 Sonalert sells for about \$5.50 from Lafayette Radio (No. 12 R 74018).—Homer L. Davidson, Fort Dodge, Iowa



How to make Christmas cards from Christmas cards

Don't throw away those colorful holiday greetings. Attractively arranged and photographed, they will make distinctive Christmas cards for your own use next year

By DON LANGER

If you hate to see those cherished Christmas cards go into the trash can every year, here's a way you can salvage their beauty and put them to good use. Attractive arrangements of cards can be photographed and the resulting pictures turned into greeting cards for your own use next season. Photo shops and stationery stores can have such cards printed for you for a few dollars—often for less than you'd pay for ready-made cards.

The pictures shown here were made by

Now: Easier shooting in

Combine a new camera design with special high-speed film and you can now shoot color movies of such dimly lit scenes as candlelight parties, sunsets, streets at night and church and museum interiors. The film, Kodak's new Super-8 Ektachrome 160, has an ASA speed of 160 and, with the camera, provides up to 4½ more stops of exposure over conventional camera-film combinations. The camera (left), also by Kodak, has an unusual "binocular" shape designed for steadier two-hand holding. A fast f/1.2 lens and

POPULAR MECHANICS





TWO TYPES OF LAYOUTS are shown above. One at left plays up few cards prominently with ornaments for added variety, while one at right suggests mass



of cards. Photo on facing page shows part of lighting setup with floods at both front and rear (two additional floods are to the left out of camera's view)

covering a card table with black paper to create a crisp, dark background for the cards. Dark cloth, if handy, could also be used, or you can spray a piece of hardboard with dull-finish black enamel. Try different card arrangements to find the most pleasing ones. Shoot from a fairly high angle so the cards in front don't block those in back. Christmas ornaments and other decorative objects can be combined with the cards to add variety.

Lighting the setup is simple. I used two standard photofloods in back and two small 75-watt reflector bulbs in front. The stronger rear light outlines the cards sharply, helps the background go a deep, dramatic black and avoids washing out foreground detail. Black-and-white prints make the cheapest cards, but you can also have color pictures made into cards. ★ ★ ★



POSING A MEMBER OF THE FAMILY in the picture can help to personalize a card. Or you might try Dad dressed up as Santa Claus for a touch of humor

the dark for both movies and snapshots

longer-opening shutter slit help to increase exposure, making it possible to shoot most indoor and night scenes under existing light without floodlights. Two models, the XL33 with fixed lens and the XL55 with zoom lens, are \$119.50 and \$199.50.

Kodak has also developed an Instamatic still camera for dim-light picture-taking. Its electronic shutter times exposures up to 10 seconds in poor light. The X-30 (right) is \$37.95. An accessory stand with cable release to steady the camera on long exposures is \$4.50. ★ ★ ★

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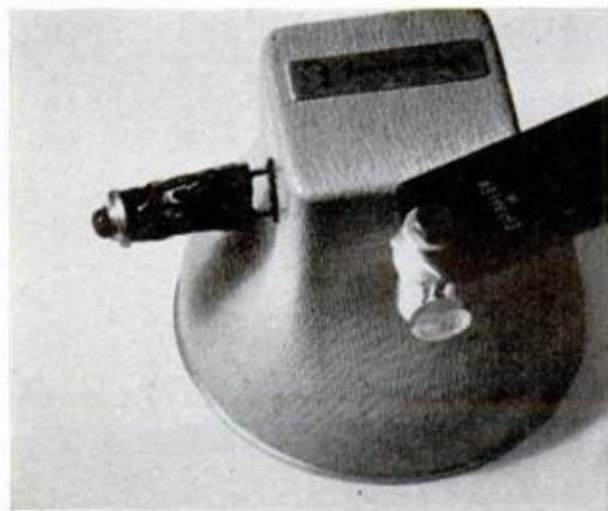
PHOTO HINTS



Shorty 'tripod' from a lampshade

You can make a stable camera support for tabletop photography from a small lampshade. Mount the camera on an accessory swivel, then run a $\frac{1}{4}$ -20 bolt up through the shade's center hole into the swivel. For added height, an empty thread spool can be used as a spacer.

If the shade has a large threaded center hole, buy a screw-in adapter to reduce the opening to a $\frac{1}{4}$ -inch hole for the bolt. —Frank Shore, New York



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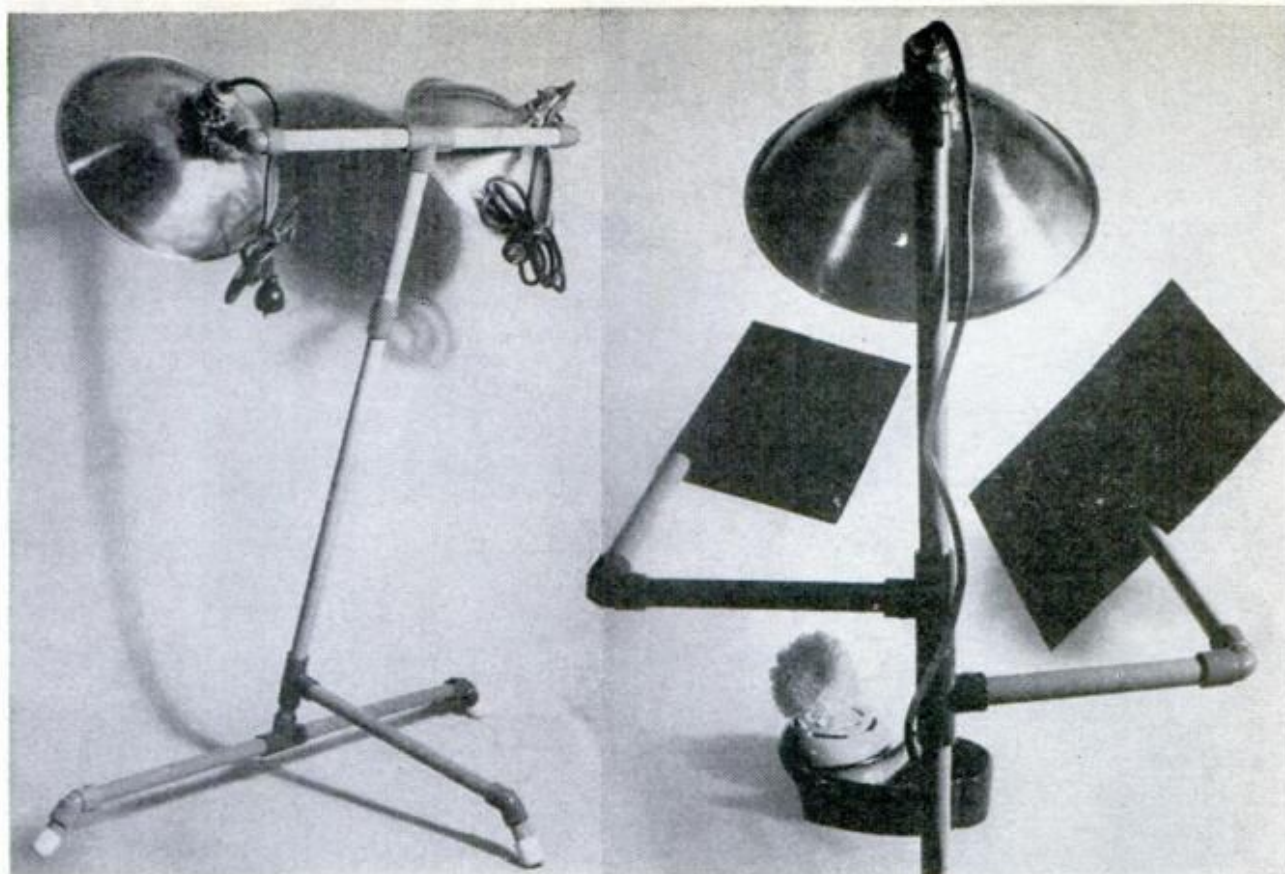
Make your own versatile

Plastic PVC pipe is light, easy to work with and comes in so many versatile fittings you can put together just about any type of light stand or other photographic support you want in a few minutes' time. For short stands, the $\frac{1}{2}$ -inch size is adequate; for taller ones, you may want $\frac{3}{4}$ -inch. Use SS-type fittings that slip together without threading. The pipe can be readily cut to any desired length with a hacksaw. The stands shown here consist of an upright with a crossbar at the bottom and an angled leg at the rear, providing

Plug-in switch fires open flash

Some strobe units aren't equipped with an off-camera flash button, making them difficult to use for open-flash photography. If the unit takes a standard household plug, you can make your own off-camera flash button this way. Wire a plug to a small doorbell-type pushbutton switch, as shown at left, so the switch shorts the terminals across the plug's prongs. Wrap the connections with tape. To fire the flash, just plug in the switch, open the camera lens, push the button, then close the lens. —Rod Moon, Saugus, Calif.

POPULAR MECHANICS



light stands from easy-to-use plastic pipe

a sturdy, slightly backward-slanting base for good stability. The dual-lamp version above has a second crossbar at the top with a floodlight at each end.

The uprights and crossbars are joined by tee fittings with 45° elbows at lower ends. Short sections of pipe serve as connectors and make stubby legs with rubber crutch tips for nonskid feet.

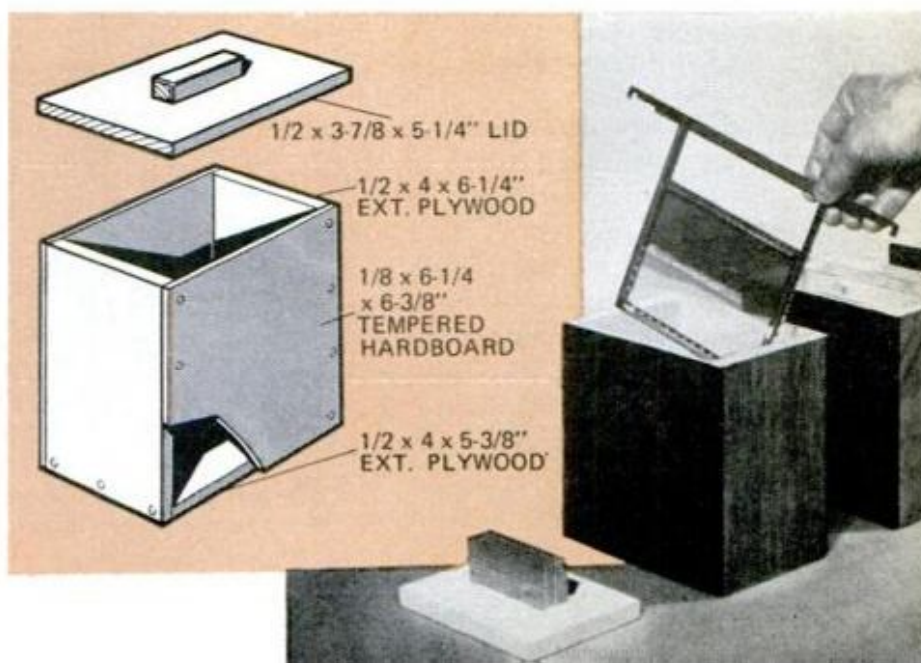
For temporary use, leave joints un cemented so you can take apart the stands for easy storage. For permanent assembly, use PVC cement on the ends before slipping the fittings together.

For attaching floodlights, use standard double-ended ball-type swivel sockets. Cement one ball end into a 90° elbow fittings, as shown on the opposite page, leaving the other ball exposed. The light then clamps to the exposed ball. Use a fast-setting cement such as Por-Rok. Bolts with 1/4-20 threads can also be embedded in fittings to attach other photographic gear.

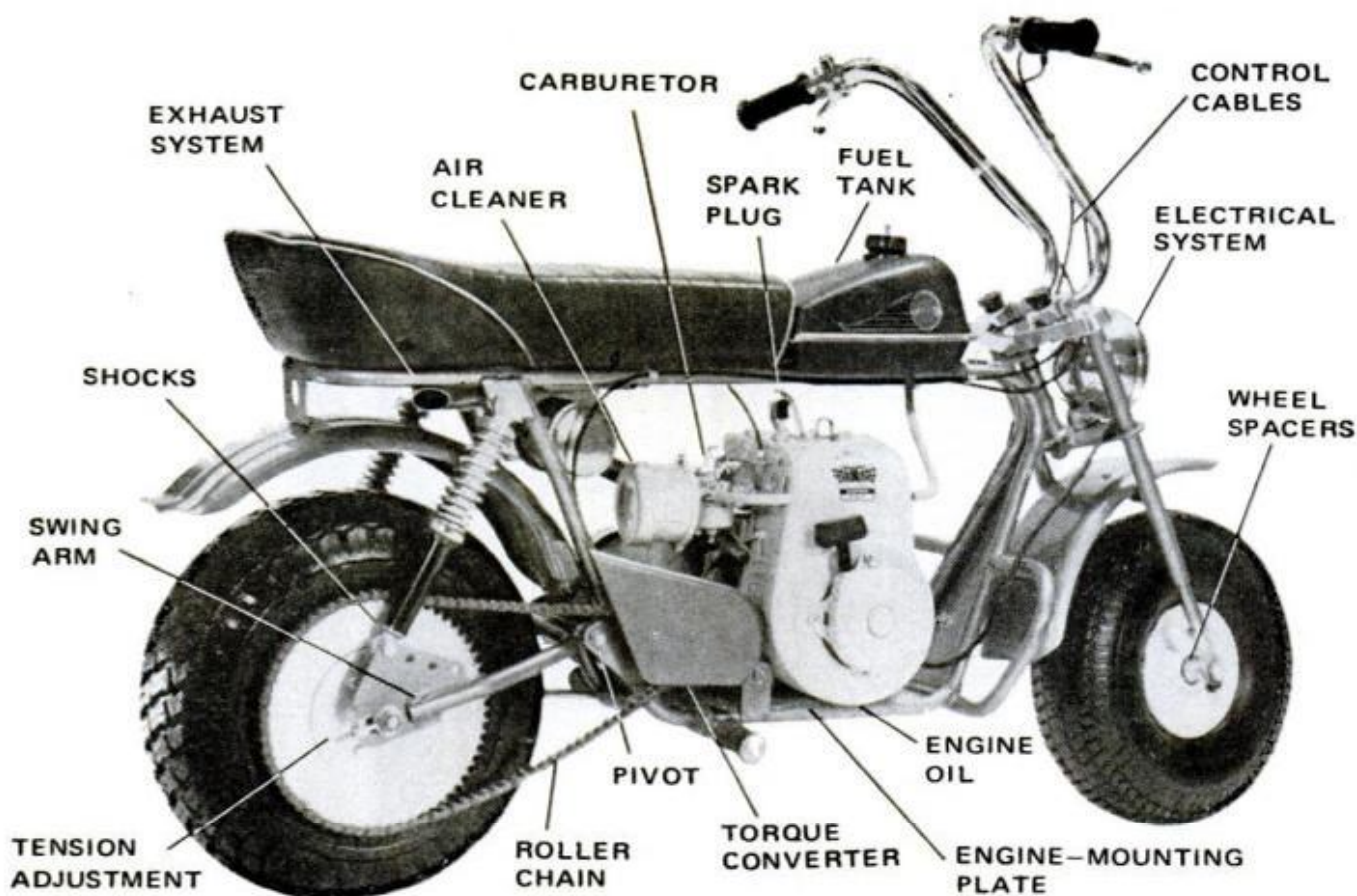
"Barn doors" can be added on the arms by slitting the ends and inserting cardboard deflectors, as at right, above.—Rod Radford, Delray Beach, Fla.

Homemade processing tanks

Leakproof tanks for processing 4x5 film in hangers can be made from exterior-grade plywood and tempered hardboard. Use small nails and waterproof glue in the joints. Face the rough side of the hardboard out. Paint the tanks inside with several coats of epoxy enamel. The lids are designed to float so developer and fixer can be kept sealed from air and fresh for use.—R. S. Hedin, Minneapolis, Minn.



How to BE YOUR OWN



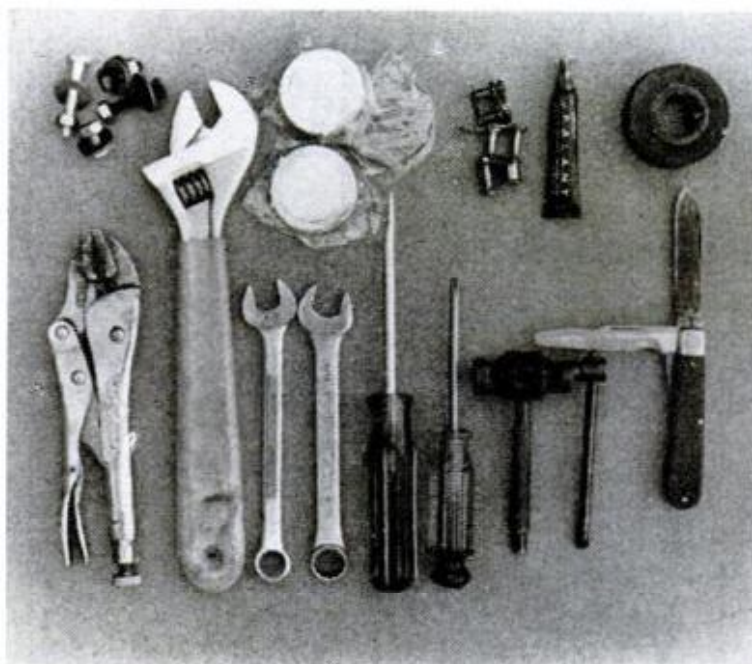
Start by getting the right tools for the job. Then study your own particular machine to identify the various parts illustrated above that need maintenance. Then go to work!

By DOUG RICHMOND

AN EASY WAY to save a pile of money and aggravation is to be your own minibike mechanic. If you don't maintain your bike properly or can't repair it when it needs it, it'll soon be a worthless, broken-down junker.

A common problem with minibikes is engine drift: The engine gradually works itself backwards on its mounting plate until the torque converter fails to operate properly, or, on a chain-driven machine, the chain actually slips over the teeth on the sprocket.

Simply readjusting the engine and tightening the mounting bolts extra hard is not always the answer. No matter how much some bolts are tightened the engine soon works loose and needs re-



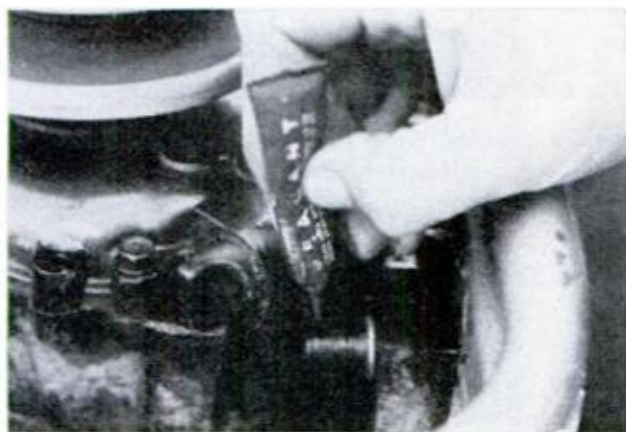
FEW TOOLS are needed for minibike maintenance, but it is important to keep spares of items such as chain links, bolts

POPULAR MECHANICS

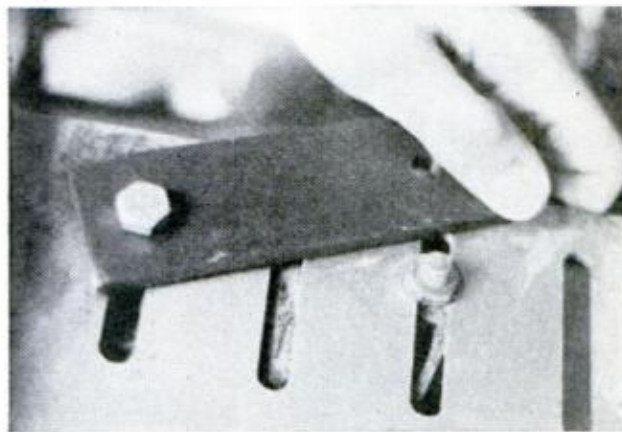
MINIBIKE MECHANIC

adjustment. Part of the problem is that most manufacturers use SAE grade 2 low-carbon steel bolts. Tightening these fastenings really tight is impossible because they will either break, strip their threads or stretch in service.

It's advisable to replace the grade 2 bolts with grade 5 or better. Grade 5 bolts—the ones with 3 "lines" on their heads—are twice as strong. If you can get them you'll find it better yet to go to SAE grade 8, which are alloy bolts



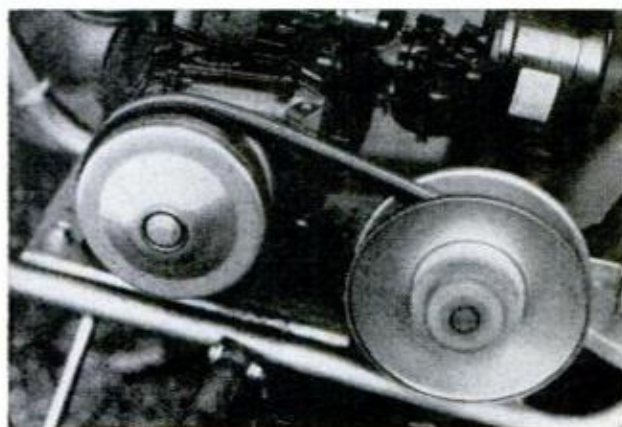
INSTEAD OF LOCKWASHERS to secure bolts on mini-bikes, use Loctite which cements nut to threads



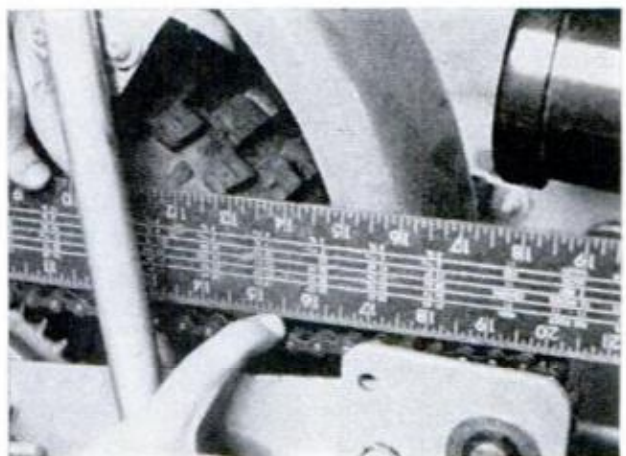
BACKING BAR for engine mounting plate will keep the bolt head from pulling into the adjusting slots



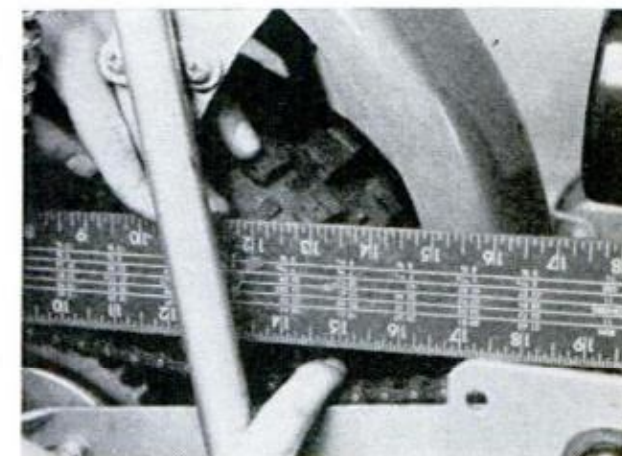
EMERY CLOTH placed between engine and mounting plate will stop engine drift if tightening doesn't



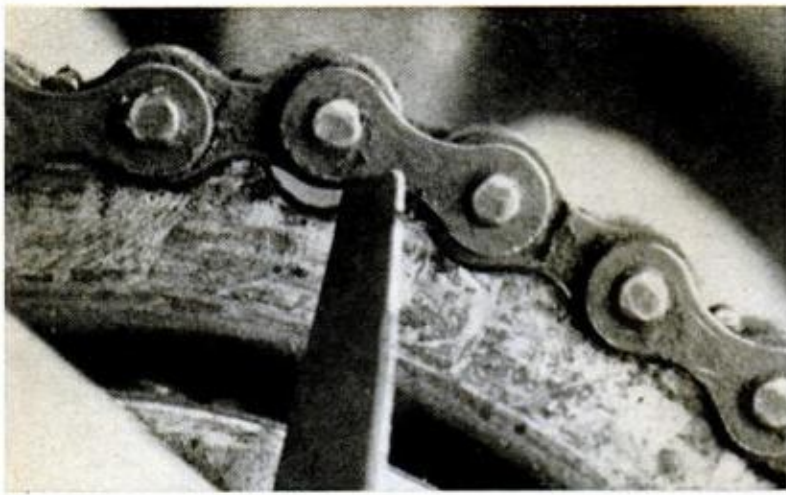
TORQUE CONVERTER ADJUSTMENT is made by blocking bike, opening throttle. Note belt loose on pulley



CHAIN ADJUSTMENT is conveniently checked with a straight edge. This chain has the right tension



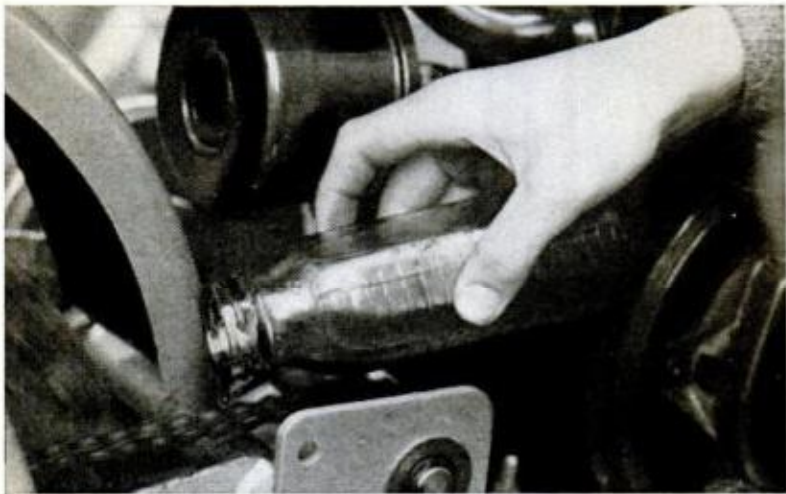
EXCESSIVE SLACK in chain is observed here. Tighten the tension adjustment and check for engine drift



CHECK CHAIN FOR WEAR by lifting it off the sprocket (see text). This chain shows only slight wear



CHAIN BREAKER being used on a chain. Without this tool, disassembling a riveted chain is tough job



LUBRICATING A CHAIN is most easily done while it is moving. Don't run chain so fast that it throws oil

HEAD MARKINGS indicate strength of fastenings from grade 8 at the top to grade 2 at the bottom



with better than $2\frac{1}{2}$ times the tensile strength of grade 2.

Grade 5 bolts are most readily obtainable from auto-parts houses, but the only nation wide suppliers of grade 8 bolts are Caterpillar Tractor dealers. The strong bolts are *not* used with split lock-washers as a general rule because when the fastening is torqued down tight, the washers tend to spread in time and eventually break. "Shakeproof" locking washers give better performance, but modern practice is to use "Loc-tite" to keep the fastenings from unwinding.

Loc-tite, sold by nearly all bearing supply houses, some auto-parts stores and Caterpillar dealers, is a liquid that hardens in the absence of air when applied to metal. A nut installed with Loc-tite will not work its way loose, but may be removed by wrenching. It turns with considerable difficulty for the first turn or two, but then loses most of its resistance and may be removed with relative ease. You can use it, too, on foot peg bolts, control lever screws, axle bolts and handlebars.

Plate-type engine-mounting platforms are equipped with slotted holes to enable the drive to be adjusted, and sometimes even the use of alloy bolts will not anchor the engine because there is so little metal under the bolt heads for them to bear on. Ordinary flat washers aren't the solution because the alloy bolts crush them. Extra-strong flat washers made for heavy-duty applications are some help, but these are extremely hard to locate.

A better answer is to make a backing bar from a piece of scrap bar stock. Size is not critical, but $\frac{1}{4}$ to $\frac{3}{8}$ inch is about



OILING CABLES is most easily done by pouring oil into cable through a funnel taped to the end

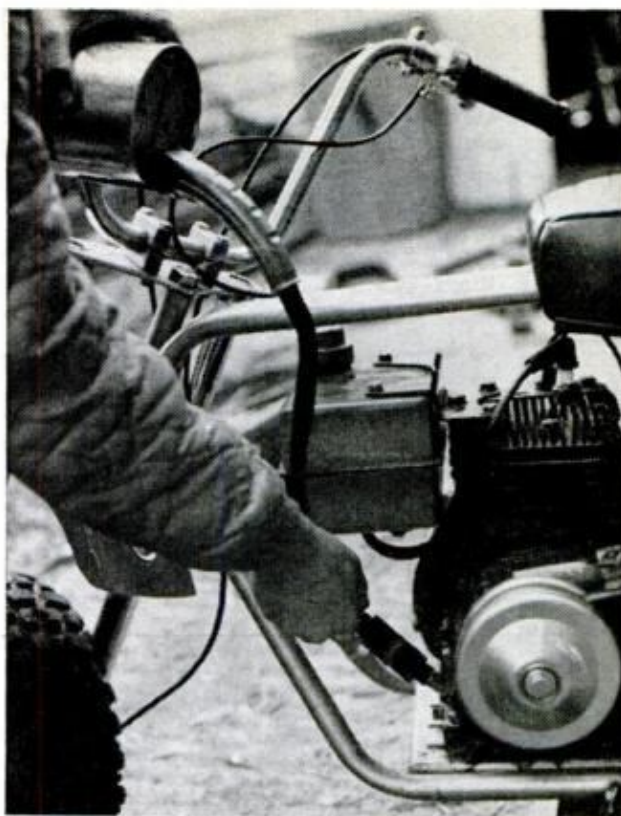
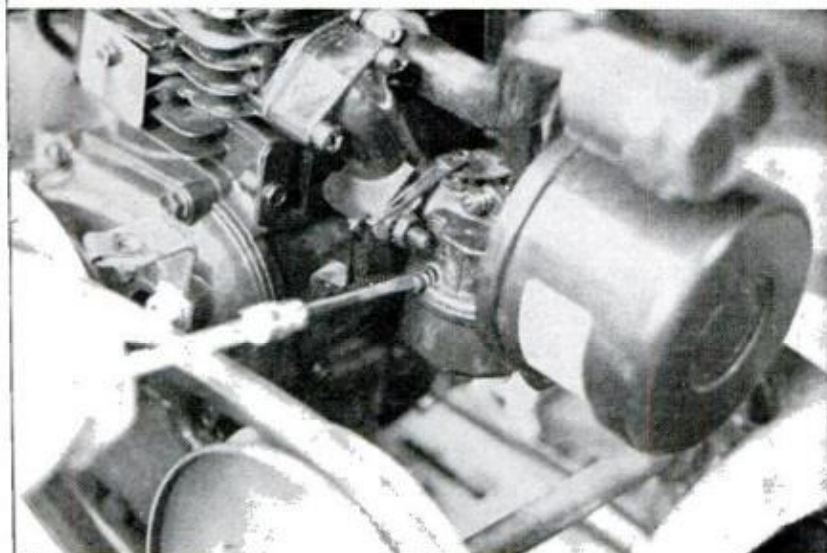
OIL CAN SPOUT meant for car automatic transmissions is best way to get at hard-to-reach fillers

the right thickness and 1 or 1¼ inches wide works out well. Try for 2 inches longer than the distance between mounting bolts if there is room for this under the platform. Holes for the mounting bolts are drilled to size or at most 1/64 inch oversize to provide maximum support for the bolts.

Always install the mounting bolts from the bottom, if possible, to prevent the threads being damaged by rocks and

INSPECT AIR CLEANER regularly as part of your maintenance. Keep it clean to prevent the engine from running rich

IDLE ADJUSTMENT is best done with the minibike blocked up. Adjust for halfway between rich and lean engine falter



gravel thrown up by the spinning front wheel.

When an engine persists in drifting, slide a piece of emery cloth between the motor base and the platform. When using emery cloth, retighten the bolts in a day or two to compensate for torque loss.

Because a minibike carries its drive chain so near dirt and water, it requires more attention than a motorcycle chain,

(Please turn to page 175)



Biggest bargain since the Beetle!



Fiat 128: An amazing front-wheel-drive sedan at an amazing price

By **BILL HARTFORD**, Auto Editor

Photos by Irv Dolin



TRANSVERSELY MOUNTED single-ohc Four is ahead of front wheels, accounts for dipstick location. Spare, jack, battery are under the hood. Long wheelbase (below) is obvious



THE NICKEL FERRY RIDE is not the last bargain in transportation. There are still a few cars that you can buy for less than \$2000 (and the VW Beetle isn't one of them!).

A car outstanding in this price class is Fiat's newest import to these shores, the 128 sedan. With a price tag of \$1880 (as of last November) one might suspect it's being smuggled in from Italy, but it takes the usual route through customs like all other imported cars.

The you-get-what-you-pay-for rule simply doesn't apply to this two-door sedan: You get *more* than you would expect for the price—more room and comfort, more visibility, more fuel economy as well as better handling, ride and brakes. From the ground up, here's a run-down why:

Standard tires are radial-ply Michelins or Pirellis: the best tires for handling and durability. From ground to roofline the car tops off at 55.9 inches—not excessively high, but the boxy shape and waistline location result in lots of

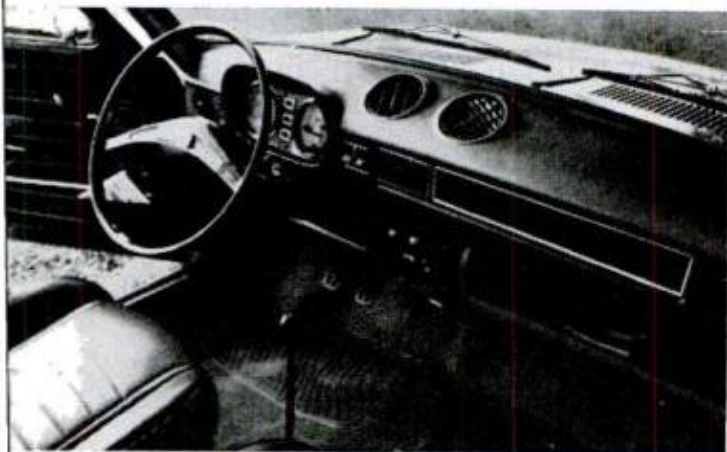
glass to give a greenhouse-like visibility.

Wheelbase is a long 96.4 inches for a car that's 151.8 inches overall. That means less small-car/short-wheelbase choppiness in ride. The short hood up front, which leaves more room behind the wheel, is a result of the front-wheel drive-train that positions the 1116-cc (68.1 cu. in.), overhead-cam, in-line Four transversely and actually slightly ahead of the front wheels. The engine is tilted forward 15°, the front suspension is MacPherson strut-type and the four-speed, all-synchro gearbox is down in line with the engine crankshaft.

With all these working components neatly in place there's still room under the hood for spare tire, battery and jack! That means a super-size trunk for three reasons: no spare, no space intrusion from a rear-wheel-drive differential and no space intrusion from a solid rear axle since the 128 has independent suspension in the rear as well.

Both front seats are nicely adjustable for rake and are fully reclining, and the flat floor adds further to the roominess up front. Rear-seat passengers also fare well with unexpectedly good head and legroom.

INSTRUMENTATION includes speedometer, fuel and temperature gauges. Interior is plain, but pleasing



COMFORT for driver and passengers is good. On trips 10-gallon fuel tank allows over 300-mile range



PREDICTABILITY is characteristic of front-wheel-drive handling. The car understeers (plows) slightly



VISIBILITY is excellent all around. Usual blind spot is practically eliminated with a thin C-pillar

The ohc engine is, Fiat-fashion, free-revving right up to the 6600-rpm redline—fun in the lower gears, but the car reaches its top speed between 85 and 90 mph at a somewhat busy 5600 rpm. The engine demands premium fuel, but milks a gallon for 30-32 mpg—the figure we got in several days of hard driving.

Directional stability at cruising speed is good, as is to be expected with front-wheel drive despite the car's light weight (1800 pounds). Steering is neither light nor excessively heavy, but is quick with only 3.5 turns lock-to-lock. Steering is of the positive rack and pinion type and the car has a 33.5-foot-diameter turning circle.

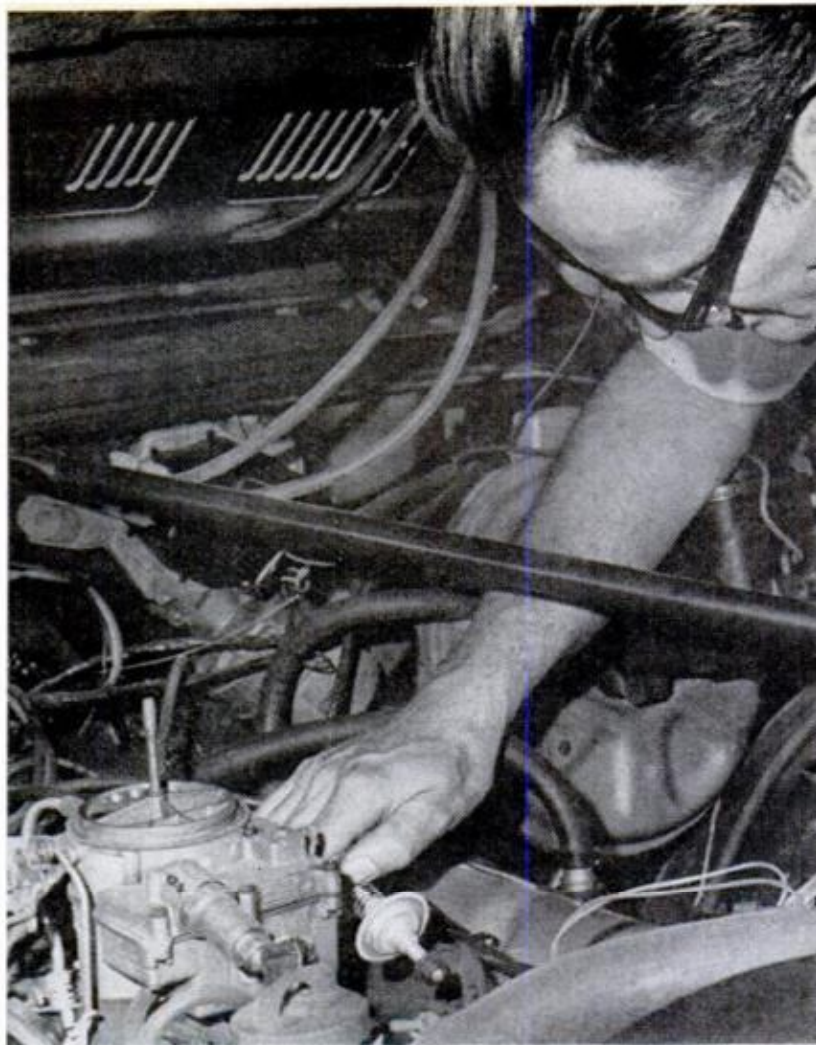
Another bonus feature is front disc brakes; standard equipment, of course. The only option, in fact, is a radio. (Soon to be available, however, is an optional three-speed automatic transmission.) A station wagon model will become available this year and will have a luggage rack as standard equipment.

Even included on 128 models are side vent windows, the best way yet devised by man to exhaust smoke from a moving automobile. Now, if there was only a good five-cent cigar . . .

★★★

Money-saving,
mystery-solving
tips to . . .

Keep the squirt in your carburetor



Don't put any stock in that old saying that carburetor is a French word meaning "leave it alone!" Whoever said this must have been all thumbs

By MORT SCHULTZ

RUSH TO A MECHANIC with a carburetor problem and you'll dent your budget: Mechanics charge about \$25 to overhaul two-barrel carburetors. If they don't want to get involved with overhaul, they'll try to sell a new carburetor, which costs in the neighborhood of \$50. At those prices, you can afford even a whole Saturday learning to repair your own carb.

What are your chances of resolving a problem? Pontiac claims that "when carburetor troubles are encountered they can *usually* be corrected by making adjustments (with the carburetor) on the car."

However, not all adjustments and repairs you can make on a carburetor yourself are needed in every case. To save work, you should first correctly diagnose the symptoms.

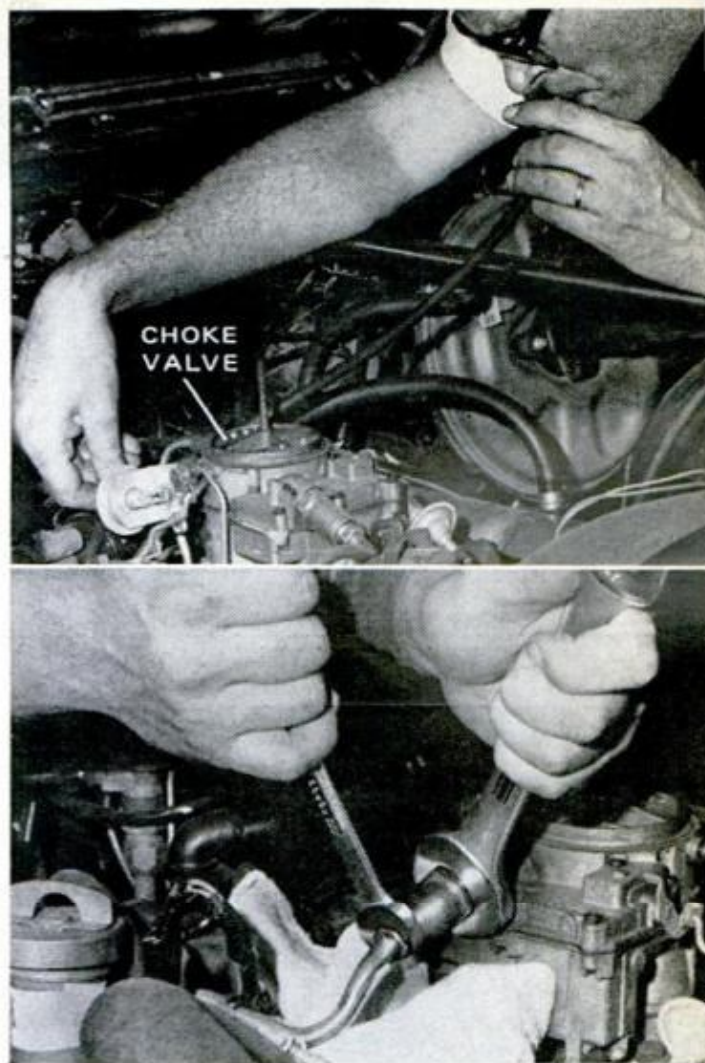
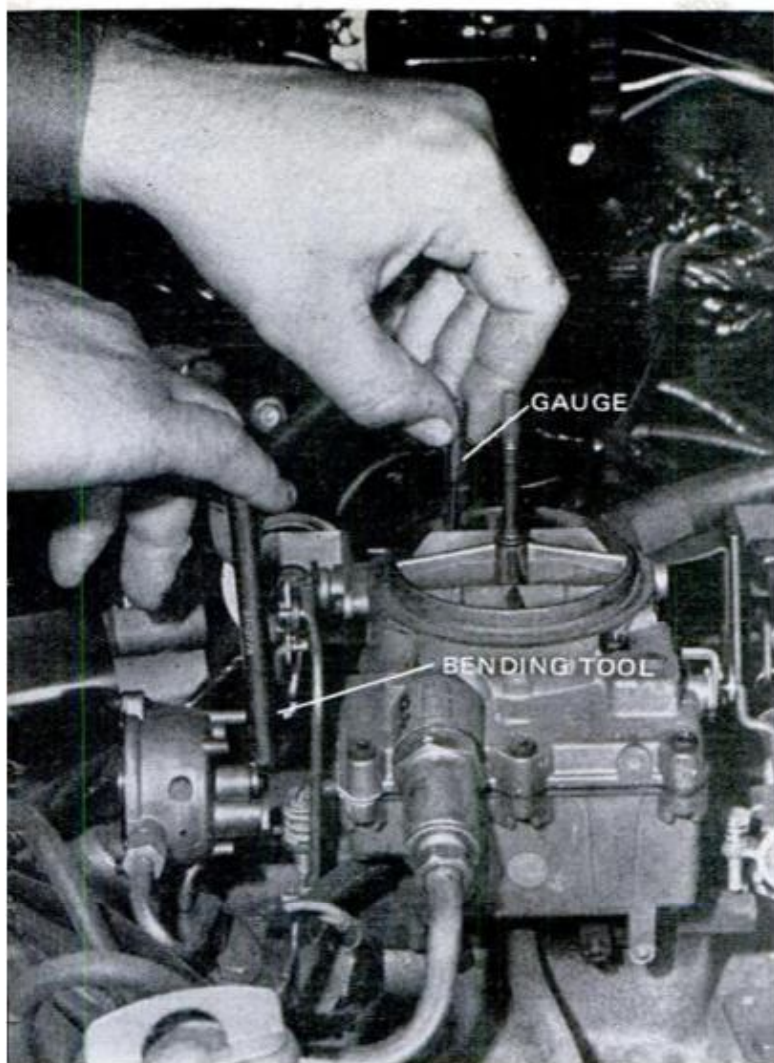
Does the engine fail to start? Does it start and stall? Does it idle rough or lack

power at higher speeds? Is it sluggish or hesitant on acceleration?

Once you have determined how the engine is acting, you can make repairs most likely to solve the problem. However, if repairs don't help, remember that each symptom mentioned above can result from an ignition-system malfunction or from poor engine compression. Before paying for a carburetor overhaul, investigate those possibilities.

Carburetors, though generally the same, differ from maker to maker, particularly as to adjustment specifications. This is a guide for applying specific repairs to specific problems, and can't cover adjustments for every make of carb.

For exact details on adjusting your particular model carburetor see the service manual or a general auto repair reference manual you can get in a library, or write the manufacturer of the carburetor,



CHOKE UNLOADER ADJUSTMENT is made with professional-type bending tool and gauge at left, but you can use pliers and proper size drill bit as gauge. Check choke valve (upper right) by applying vacuum to vacuum break. Filter of this Rochester (lower right) is reached by disconnecting fuel line at filter fitting

giving him the model number (on the nomenclature plate on the carburetor).

The most annoying problem is failure of your engine even to start. Does it flood? Is fuel getting to the carburetor? Are you using the wrong starting procedure (see owner's operating manual)?

A whiff of gas is your best clue the engine has probably flooded. If flooding is no problem, check that fuel is getting to your engine. Remove the carburetor air cleaner and work the throttle lever back and forth by hand while looking down the carburetor throat. You should hear and see gas shooting into the carb.

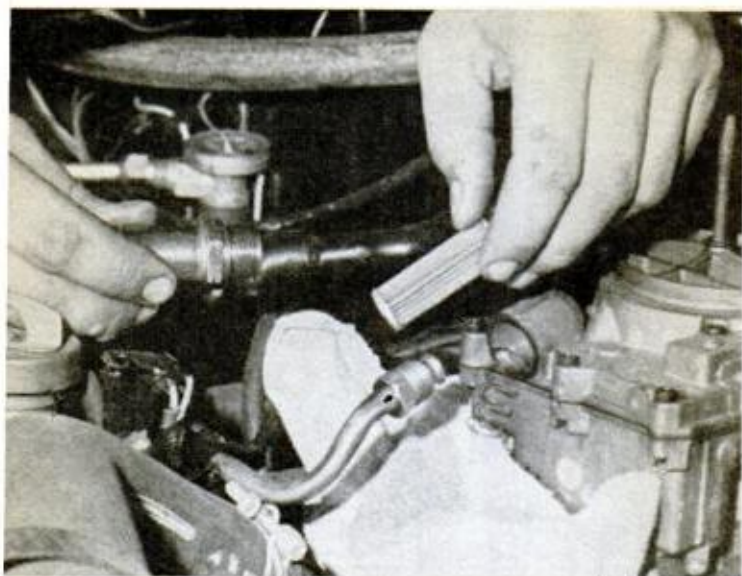
Suppose the engine is flooding. The choke valve may not be unloading. Also, fuel may be leaking past the needle valve in the float bowl because of a damaged needle and seat or an improper float level.

The choke system in most of today's carburetors consists of a choke valve in the air horn, vacuum-break diaphragm, fast-idle cam, thermostatic coil in the

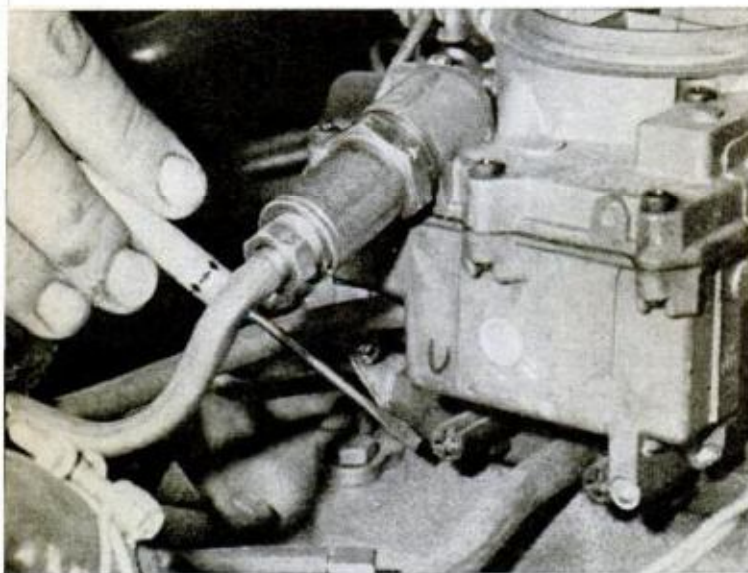
manifold and a rod that connects the coil with the choke valve. Choke-valve operation is controlled by a combination of intake manifold vacuum and temperature acting upon the thermostatic coil.

For instance, when the engine is cold, the coil is tightly wound, pulling the choke valve closed by the coil rod. However, on starting the engine, manifold vacuum is applied to the vacuum diaphragm, causing the choke valve to open slightly so that loading up of the engine with a rich fuel mixture won't take place. If the vacuum diaphragm is inoperative or out of adjustment, flooding will result.

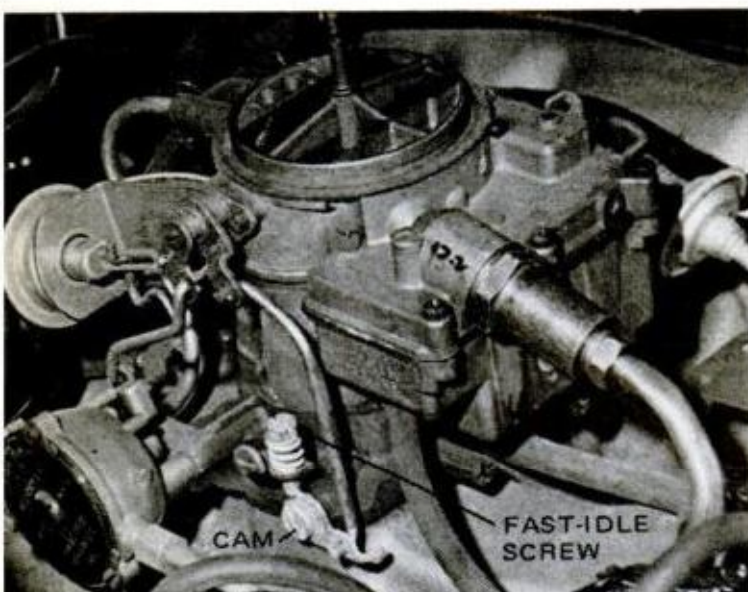
To test the vacuum diaphragm, start with a cold engine. Make sure the choke plate is closed and pull the vacuum break diaphragm hose from the vacuum source. Apply suction by mouth. The choke valve should open slightly. Make sure that the adjustment is correct. The choke unloader adjustment, as it's called, is usually made by bending the throttle lever until



FUEL FILTER should be checked periodically. It can plug up and impede flow of fuel to carburetor



IDLE MIXTURE SCREW(S) on 1968 and later-model cars are capped to prevent adjustments not to spec



FAST-IDLE CAM on carb has several graduated stops on which fast-idle screw rides to prevent stalling

the choke valve opens to allow a specified size gauge to fit between the valve and air horn body.

If engine flooding is caused by a problem in the float assembly, you may be able to repair the trouble with the carburetor on the car by unscrewing the fuel-bowl cover to reveal the float assembly. If you can remove the cover, make certain that gas isn't leaking past the needle and seat, and check float setting.

If the engine isn't starting because it's being starved for fuel, examine fuel lines for kinks. Then see if the fuel filter is plugged. Filters of some carburetors have to be removed from the fuel line inlet. Others are external types on the fuel line between fuel pump and carburetor.

Fuel starvation can also be caused by a sticking float needle (check inside the fuel bowl), a defective fuel pump (run a pressure test) and a binding choke valve or linkage (use choke cleaner).

If stalling occurs when the engine is cold, first adjust carb idle speed to specification with a tachometer.

If the idle mixture screw(s) on your carburetor are capped, as on late-model cars, adjust the carb by the idle speed screw only. Do not tamper with these caps. They are put on carburetors to control exhaust emission levels. It is against the law to remove them.

After setting curb idle speed, let the engine cool down and set the fast-idle speed to specification. To do this, set the fast-idle screw properly on the fast-idle cam, connected by a rod to a lever on the choke shaft.

The fast-idle screw contacts graduated steps on the fast-idle cam to provide a faster idle than normal. This keeps the engine from stalling during warm-up.

With a fully warmed-up engine and a wide-open choke valve, the fast-idle cam rotates so that the idle screw rests on the low step of the fast-idle cam. Here, the engine idles at the curb idle speed.

If the fast idle is set but stalling continues, adjust the choke vacuum break and choke rods. An improperly adjusted choke rod can keep a choke rod opened or closed too much during warm-up. A carburetor usually has two choke rods—one from the fast-idle cam to the choke valve, and one from the thermostatic coil spring to the choke valve. In general, both are adjusted by closing the choke

valve, inserting a specific-size gauge between choke valve and air-horn wall, and bending the rod.

Cold-engine stalling may be caused by a sticky choke valve, defective fuel pump, misaligned float and a dirty or leaking float needle.

A carburetor-related problem that can cause an engine to stall when it's warm is a malfunctioning idle compensator. The job of this thermostatically controlled valve is to offset the enriching effects caused by changes in air density and fuel vapors during extreme hot-engine operation. When extreme engine temperatures prevail, the valve comes off its seat, allowing air into the manifold to offset the richer mixture.

To check the idle compensator, be sure that curb-idle speed is set to specification, warm up the engine, let it idle and plug the idle compensator inlet port (usually inside the air-horn bore) with a pencil. If the idle drops, the compensator valve is damaged and should be replaced.

Other reasons why an engine will stall when hot include an improper float level, a needle valve that's leaking and carburetor gaskets that are not sealing.

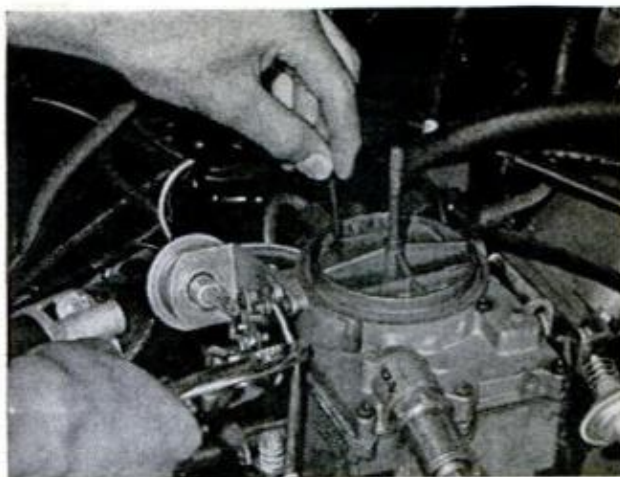
To check for bad gaskets, spread motor oil around the joints of the carburetor and start the engine. If oil is drawn into a carburetor joint as the engine idles, tighten bolts and retest. If the same thing happens, replace the gasket.

Many things that cause stalling produce rough engine idle. Therefore, adjust the curb idle speed first. If rough idle continues, tighten all carburetor screws, carburetor-to-manifold bolts, and manifold-to-engine bolts. Air leaks are a chief cause of rough engine idle.

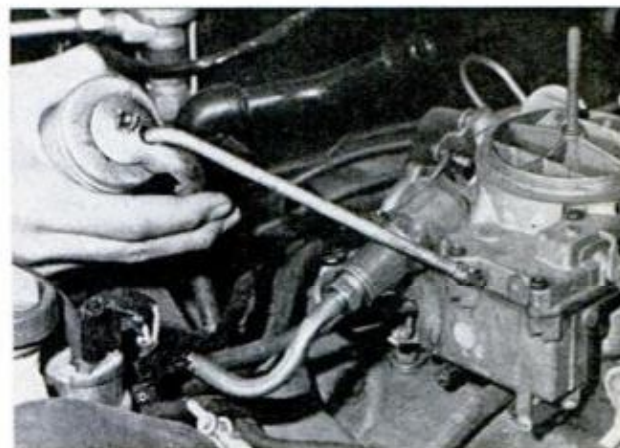
If rough idle still persists, do the following in order: check the idle compensator, make sure that the float needle valve isn't leaking, and see that the float is adjusted correctly. If all this fails, carburetor passages are probably dirty or a part, such as the idle-mixture screw or throttle valve, is damaged. A carburetor overhaul is indicated.

If an engine lacks power at high speed, or is sluggish or hesitant on acceleration, the passages of the carburetor are usually dirty or plugged, or a part, such as the accelerator-pump piston, isn't working right. So roll up your sleeves; the remedy is a tear-down of the carburetor. ★★

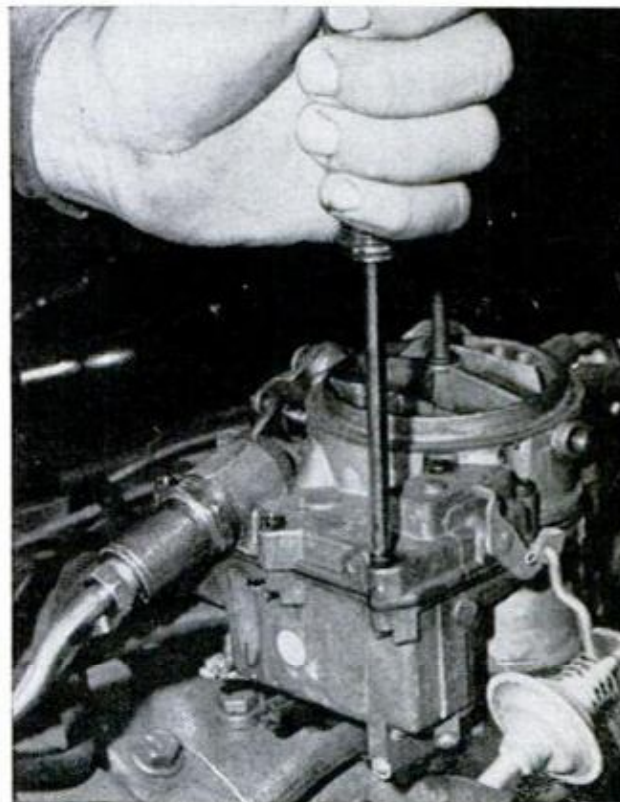
JANUARY 1972



CHOKE ROD is set by inserting proper size of gauge between valve and air-horn wall and bending rod

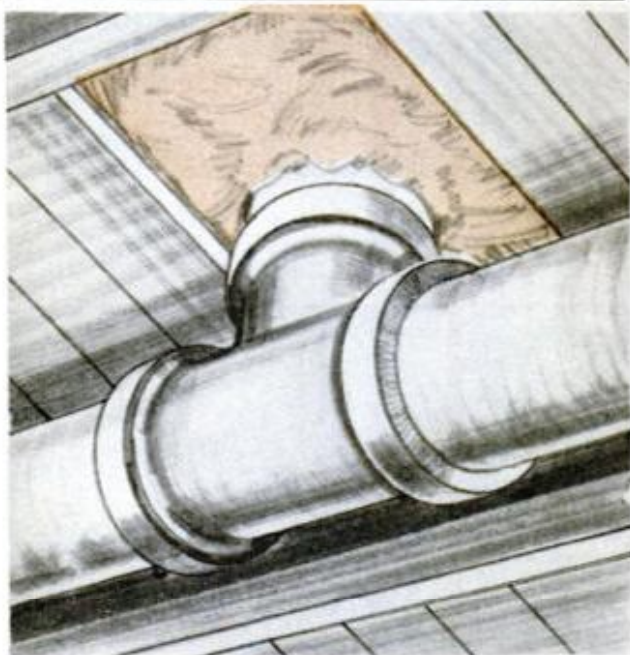


AIR LEAK at carburetor joints can be detected using oil and watching for it to be drawn into carb

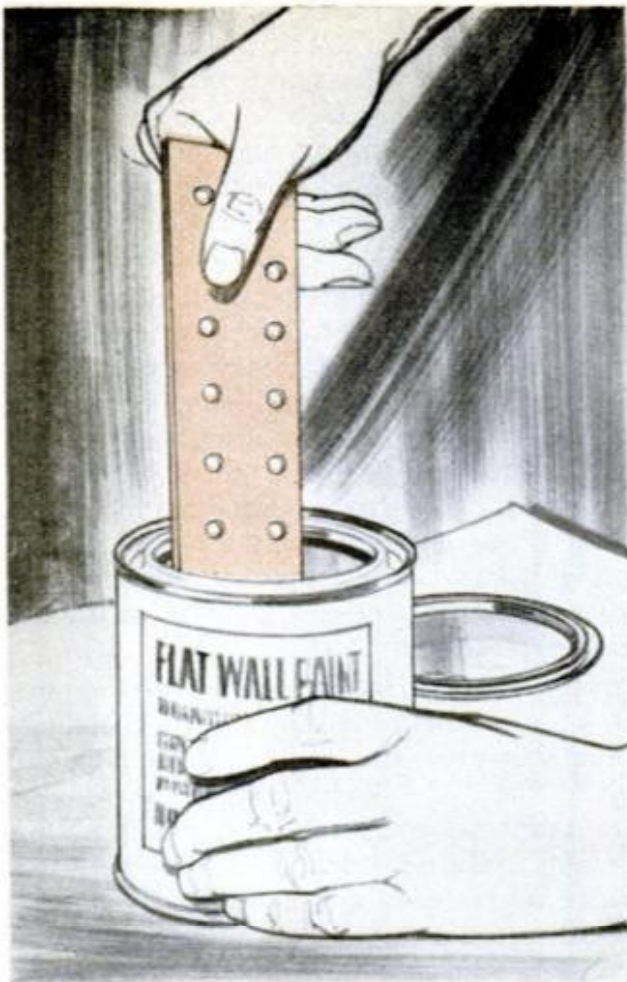


CARBURETOR SCREWS should be tight to prevent air leaks which can cause rough idling and stalling

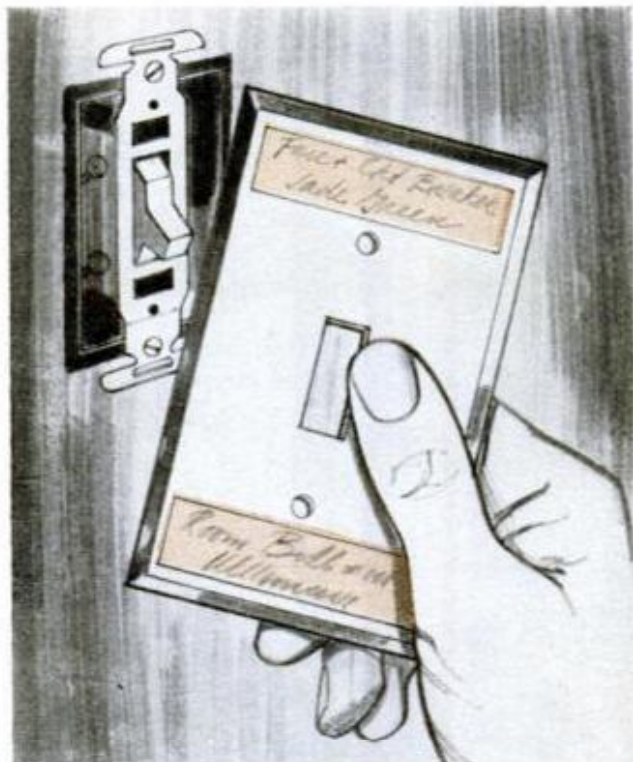
BETTER WAYS TO DO IT!



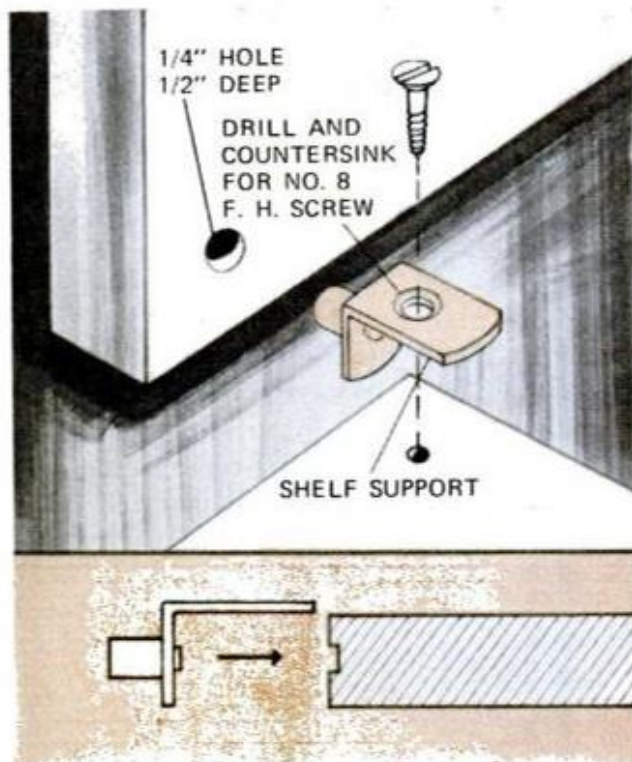
A GOOD MATERIAL for plugging holes around waste and drain pipes through floors of your house is fiberglass insulation. The fiberglass is both fire and verminproof.—Robert Brightman, Great Neck, N.Y.



SAVE THOSE SCRAPS of 1/4-in. perforated hardboard. When ripped into narrow strips, they make perfect paint-stirring sticks. The holes let paint pass through to speed mixing.—Robert Brightman, Great Neck, N.Y.

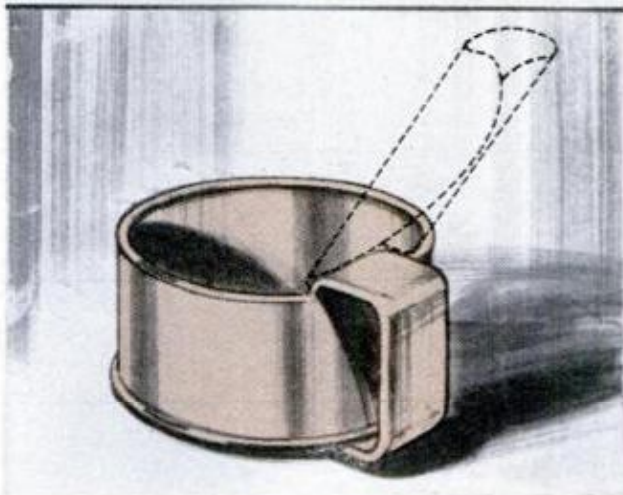
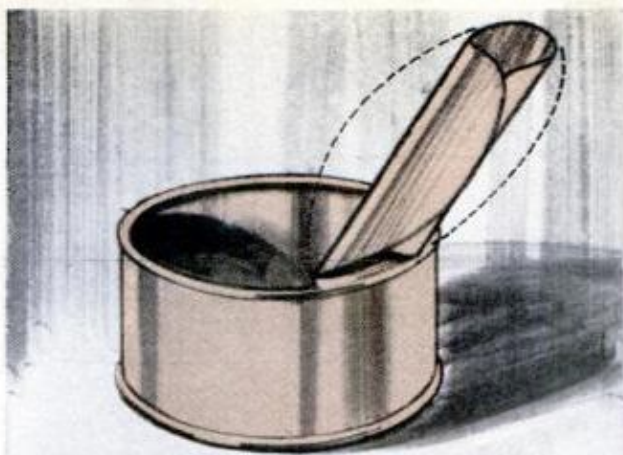


A HANDY PLACE to record such information as the amount of paint or rolls of wallpaper a room takes is on the backs of switch plate covers. Use adhesive tape to write on.—Allen Park, Signal Mountain, Tenn.

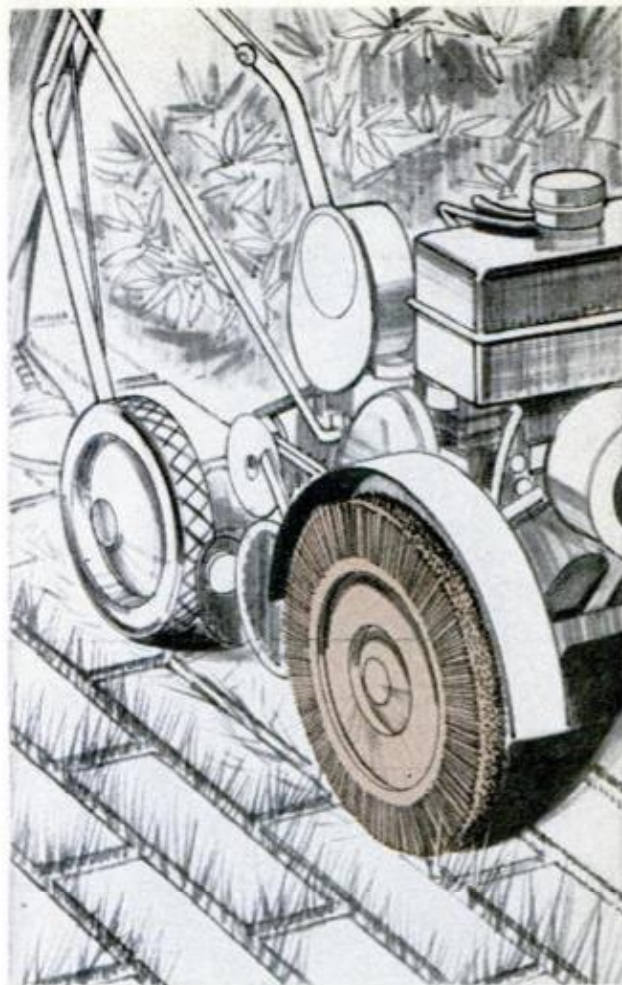


NEAT PIVOT HINGES can be improvised from such common items as shelf supports. All you have to do is drill a hole through the support for a No. 6 flat-head screw.—W. G. Greenwood, Albuquerque, N.M.

POPULAR MECHANICS



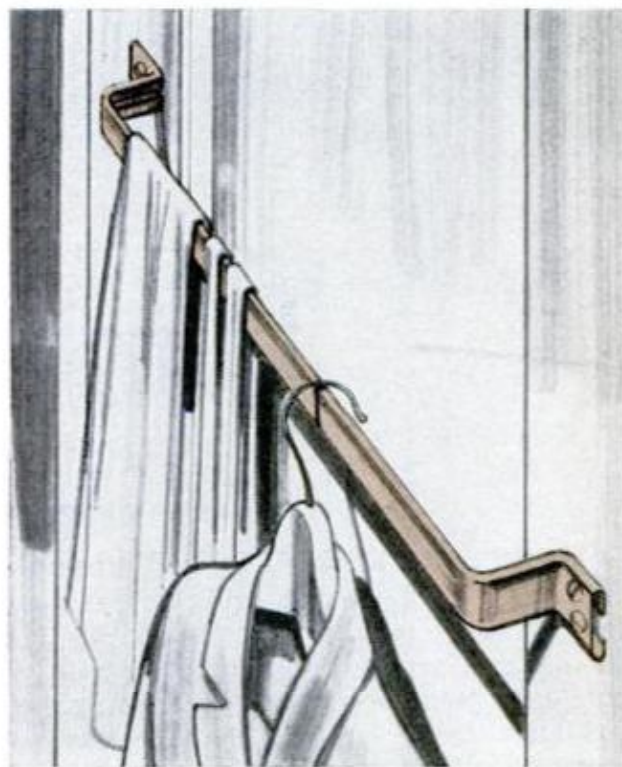
WHEN SHORT OF CUPS at a campsite, empty tin cans filled with hot coffee are easy to hold if they have handles. Pick cans with lids; then fold and bend as shown.—*Barbara Whitaker, Grand Canyon, Ariz.*



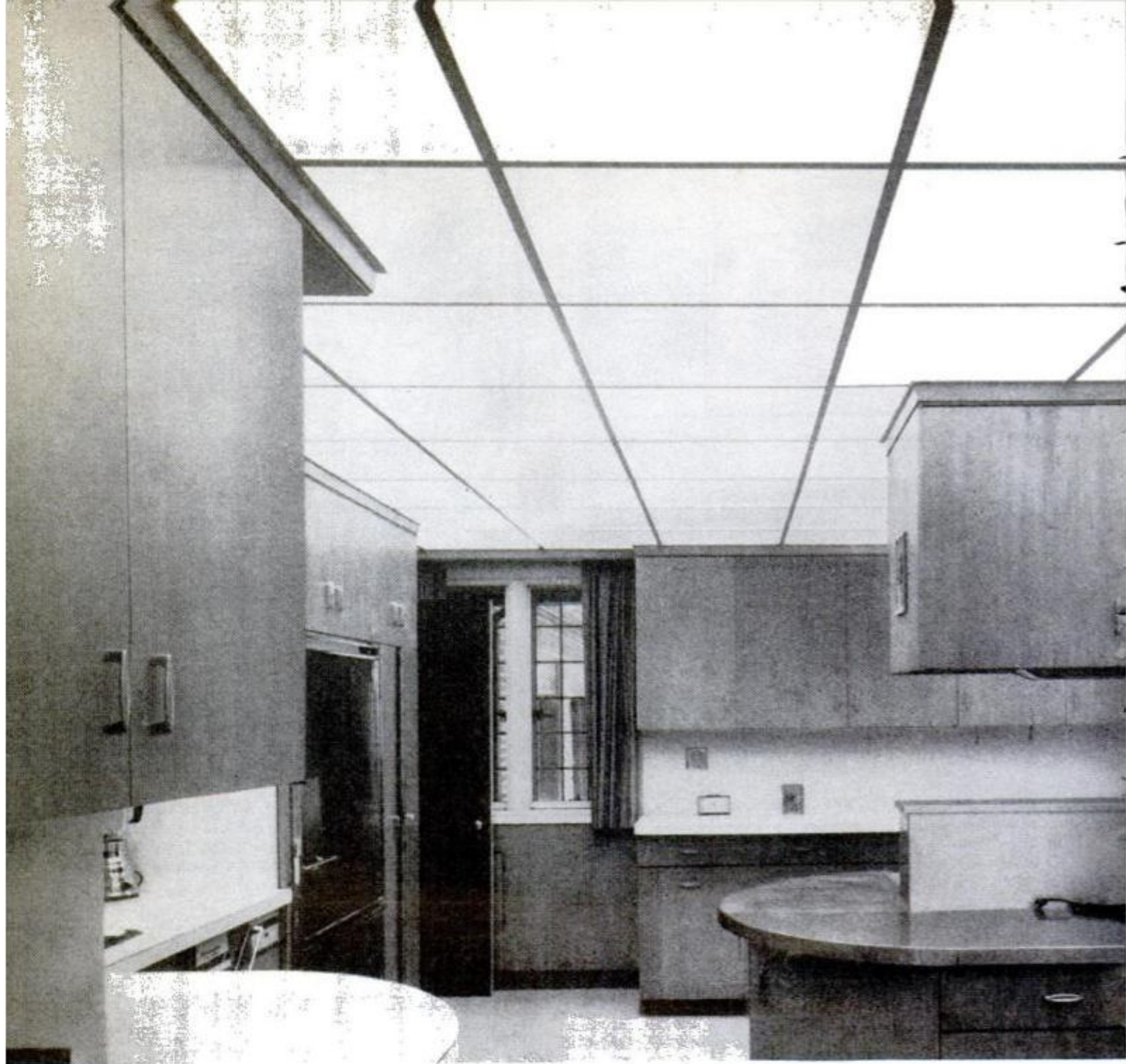
YOUR LAWN EDGER will quickly rid brick and flagstone walks of weeds between cracks if you replace the blade with a wire brush. Beats doing it by hand, but wear goggles.—*Charles H. Hardy, Whittier, Calif.*



WHEN REGULAR CLEANSERS didn't remove unsightly rust stains from our tub and sink, I tried rubbing them with No. 400 wet-or-dry sandpaper. It took them off without a scratch.—*Martha Shantz, New York*
 JANUARY 1972



A FLAT TELESCOPING CURTAIN ROD makes a dandy clothes hanger when attached to the back of a closet door. Simply bend the ends at right angles for attaching with screws.—*Frank Shore, New York*



Luminous ceilings...

The suspended type goes up fast,

By HARRY WICKS, Workshop Editor

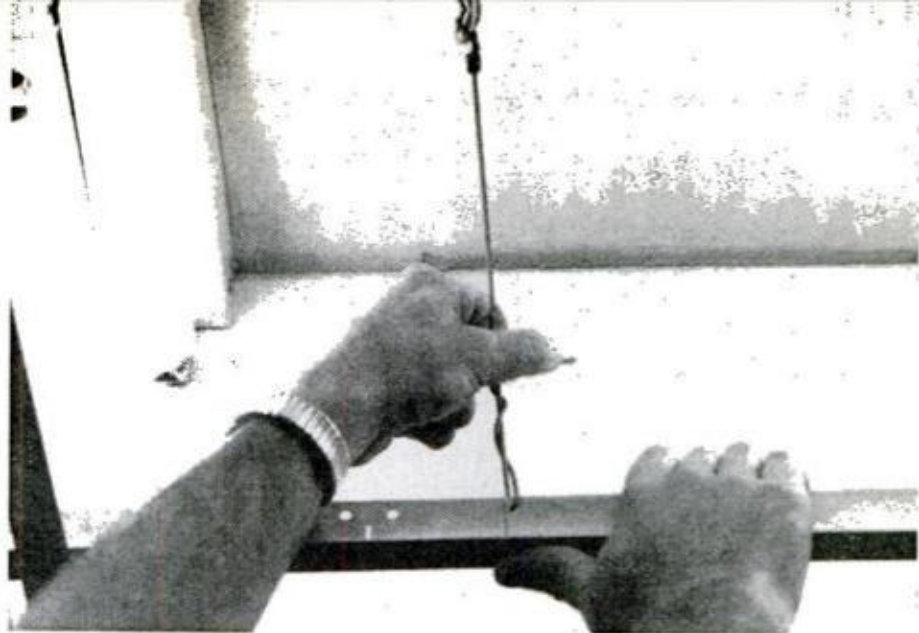
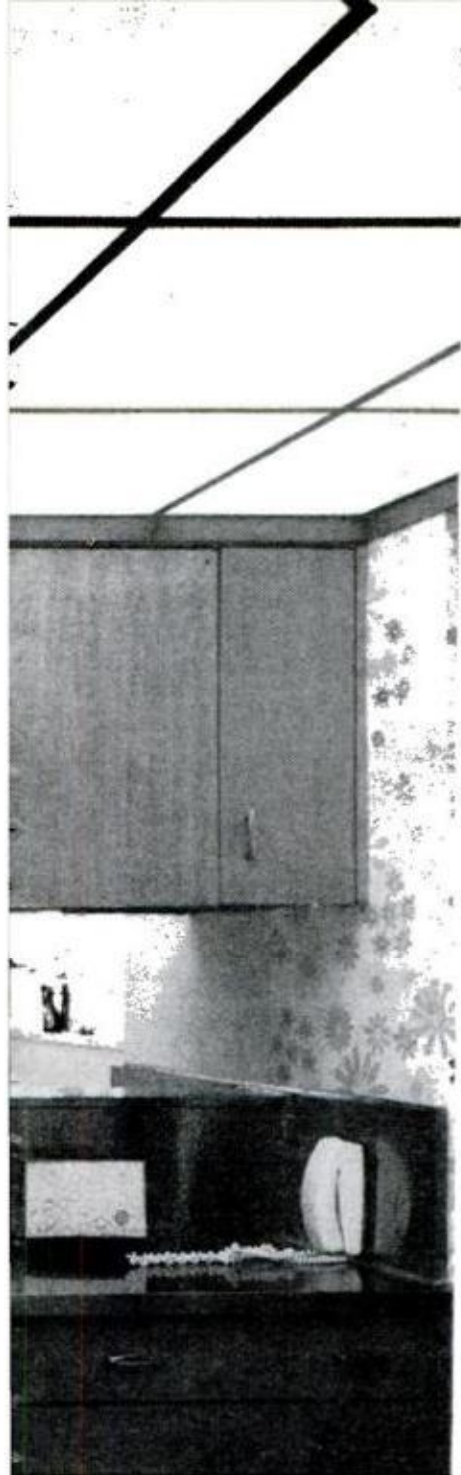
THERE ARE SEVERAL WAYS to update a tired-looking ceiling: You can fur and cover it with plasterboard or 12-in.-sq. tiles, scrape and repaint it with a sand-mix paint or rip off the entire mess and start from scratch. But the easiest method may be to suspend a new ceiling as shown on these pages. Besides being a fairly simple one-man installation, a suspended ceiling offers other advantages.

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First, and perhaps most important, it gives you an opportunity to create a bright, cheerful, evenly lighted room. The big advantage is in a kitchen where materials are exposed to smoke and grease. In place of the backbreaking chore of cleaning them while standing on a stepladder, you merely take down a panel at a time and wipe it with a damp cloth and soap.

Still another advantage is that wiring

POPULAR MECHANICS



SUSPENSION WIRES (above) are cut approximately 1 in. longer than amount of drop desired and tied into tees. Hooks in the old ceiling hold other ends of the wires. Panels (below) are easily slipped into the completed gridwork



shadowless and beautiful

and it can be washed in a sink

or piping concealed by the ceiling can be reached for repair or remodeling without the need to rip out expansive ceiling areas.

Installation. To start, make a scale drawing of the ceiling, laying it out so that border tiles on opposite sides of the room will be of the same size; also at opposite ends.

For a luminous ceiling (such as the Owens-Corning Fiberglas Corp. ceiling system shown), panels should be placed

6 to 10 in. from the light fixtures for best results. The lighting panels come in 2x2 and 2x4-ft. sizes for use with 40-w. warm-white fluorescent tubes spaced 24 in. apart as shown in the drawing.

To prevent any dark, blotchy areas, butt fixtures end to end. For the best lighting effect, put a highly reflective white paint on ceiling areas above the fixtures.

After determining the ceiling height,



WITH GRID UP, the translucent panels are simply slid into place. Border tiles are the last to be cut and placed

mark it with a level line around all four walls. Install the L-shaped metal wall angle, using this line as a guide. On standard walls, drive nails through the vertical leg into each stud. On masonry walls, use concrete nails spaced no more than 24 in. apart.

Suspension wires go up next, at 4-ft. intervals along main tees and on both sides of every splice. If you have a good "hold" for nailing, fasten wires to the ceiling with 8d common nails driven and bent over to act as hooks. Otherwise, use screw anchors and the appropriate size of eyehooks.

Cut suspension wires at least 1 in. longer than the distance between old and new ceilings. For your guide, run a taut line from one wall angle to one on the opposite wall. Wires should be kink-free and bent at a 90° angle at the desired height.

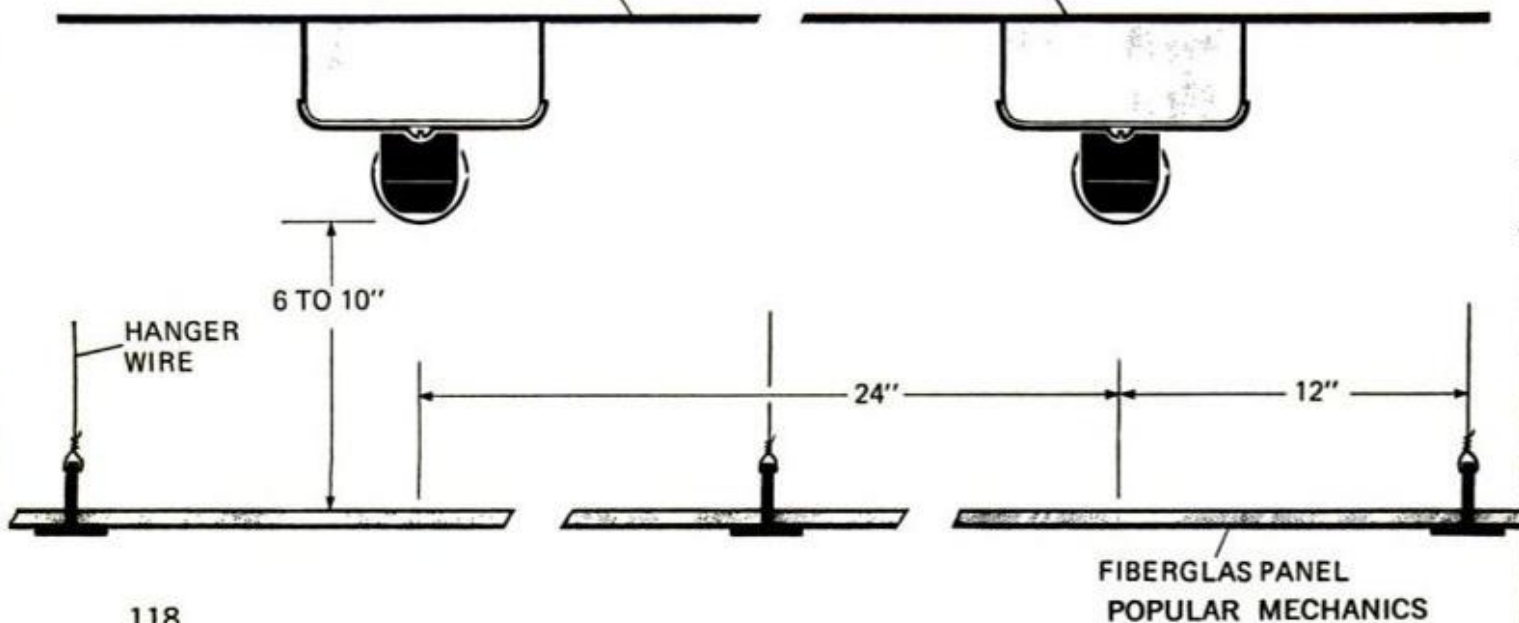
Now, refer to your layout and determine the location of the first main cross tee. To install a tee, rest one end on the wall angle and finish hanging with suspension wire. In rooms longer than 12 ft., tee extensions can be cut as required, making certain that the splice tabs align.

Cross tees (2-footers) are then snapped into place. These are equipped with a lock tab to prevent movement. Cross tees for border tiles must be cut to length before installing. Next, lay in full ceiling panels, including translucent panels beneath light fixtures. Cut and install border tiles last. ★★★

MINIMUM SPACINGS

CEILING

FLUORESCENT LIGHTS
CENTERED OVER EACH PANEL

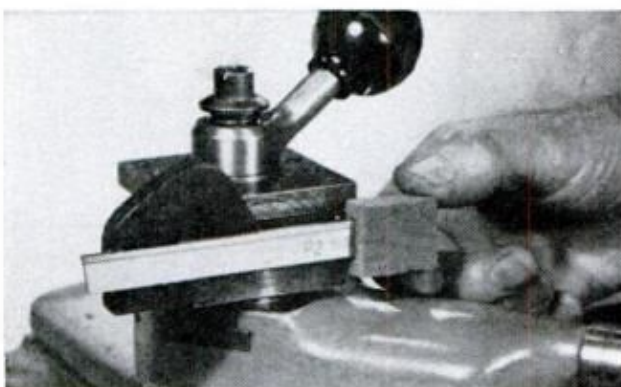




HINTS FROM READERS

Jeweler's saw sands narrow slots

Recently, when I had occasion to smooth the sides of some narrow slots, I discovered this neat way to solve the problem. I just cemented some abrasive paper around a shop-fashioned "blade" that was made from a strip of tin-can metal and then inserted this in a jeweler's hacksaw. —Walter E. Burton, Akron, Ohio



Rigid foam shields lathe bit

To reduce the chance of nicked knuckles, try force-fitting a block of Styrofoam over the tail end of a lathe cutoff tool bit. Simply form a slot that will let the block be pushed on easily, yet afford enough friction to hold it in place. If the foam shield tends to slip, secure it with a hefty rubber band. —W.B. May, Oak Park, Ill.



Silicone serves as nail 'gasket'

If you add some padding under the heads, nails can be useful for holding materials such as plastics that might be damaged by conventional nailing. Here, I used GE's Silicone Seal applied in a ring around the shank just below the head. After curing a day or so, nails can be driven until the silicone ring is compressed. —Walter E. Burton, Akron, Ohio



Improved bed for 40 winks

Next time you are on a camping trip and all hammocks and cots are occupied by fellow campers taking an after-lunch siesta, turn to your rubber boat. Flopped upside down, it becomes a king-size air mattress and will probably make the most comfortable and envied "cot" in camp. It works so well, you don't need a pillow. —John Krill, North Lima, Ohio



Plastic containers serve as caps

You can give ecology a lift by "recycling" plastic containers—such as the type that cheese spreads come in—by using them as covers for laboratory flasks, glass jars or even tin cans. To use one, simply press it in place; its flexibility permits it to grip the rim of the container (provided that the rim is reasonably even). —B. W. Ervin, Kent, Ohio

EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



YOUNGSTERS WILL HAVE HOURS OF FUN, indoors and outdoors, riding and operating the Big Cat. Its forklift, dump shovel, towing hook and crane hook onto a fixed lift assembly that comes completely assembled with battery and recharger. Lever controls allow the Big Cat to raise, lower and rotate equipment and also make it go forward, reverse and stop. Made by Kenner Products Co., 912 Sycamore St., Cincinnati, Ohio 45202, it retails for \$49.

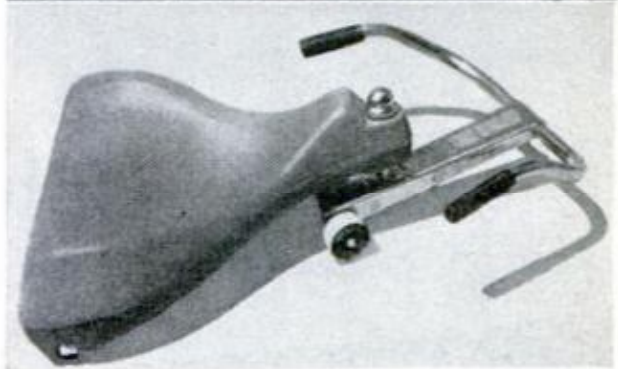


ADD A TOUCH of Early American charm to any decor with this unique one-of-a-kind coffee table. Comes as a kit, including thick cross-section slice of a Tupelo log and three legs, all kiln-dried and sanded, ready to assemble and finish. A 32-inch-diameter table sells for \$39.75 postpaid from Naturlog Originals, Box 826, Dept. PM, Florence, S.C. 29501.

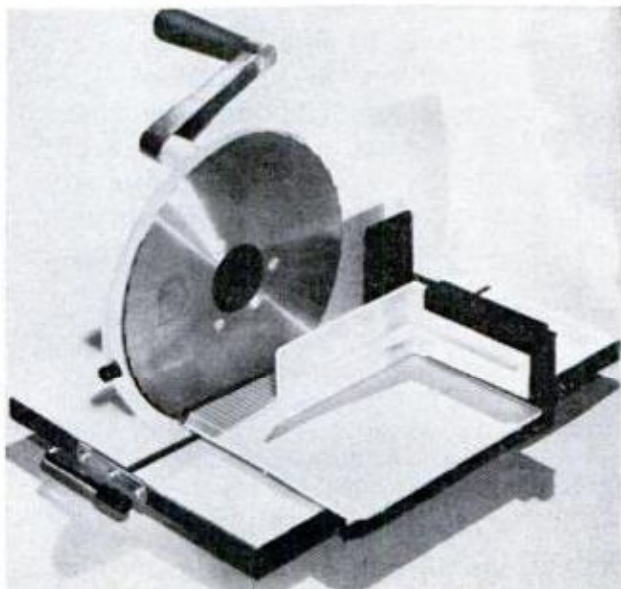
FOR MORE PLEASING flash pictures the Eastman Kodak Co. announces the Magicube Extender. Designed for use with all Instamatic "X" cameras and Magicubes (not regular flashcubes), the extender increases the distance between flash and camera lens approximately three inches. This additional distance helps prevent "red eye" caused by reflections from your subject's eyes when you take pictures in dim or moderately lighted surroundings. \$5.95 at photographic equipment stores.



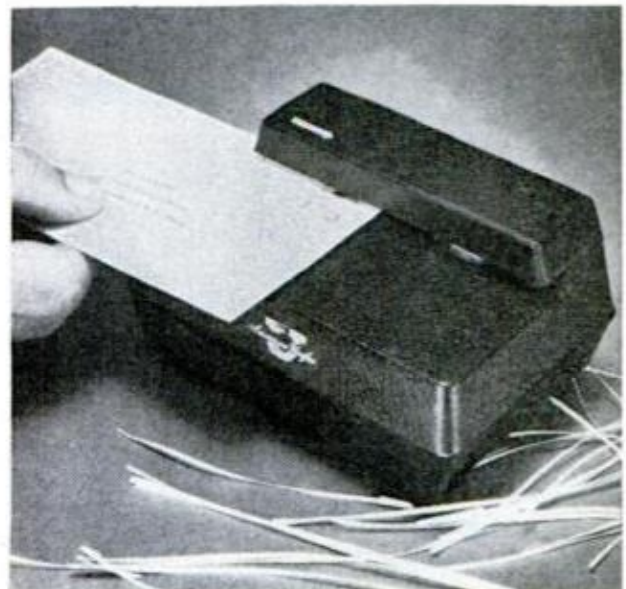
FLYING TURTLE is the name of an exciting plaything (right) that's a cross between roller skates, tricycle and skate board. With an energetic adult or a lively youngster at the helm, it becomes a perpetual motion machine. Rider turning handlebars quickly and swaying his body can get the turtle moving surprisingly fast. It sells for \$24.95; Wichita Manufacturing Co., Inc., 6045 North Broadway, Box 1337, Wichita, Kans. 67201.



THIN-SLICED MEAT can now be prepared at home with the help of a Jupitor Gourmet Food Slicer. All meats are tastier, more tender and go much farther when they are thin-sliced. Vegetables and fruit can also be sliced for slaw, salad and desserts. This ideal gift idea for the chef of the house is priced at \$19.95 postpaid from the E & R Specialty House, 1218 Rawson Ave., Fremont, Ohio 43420.



SWISH, IT'S OPEN. That's how easy it is to open letters with the Unifax Cordless Electronic Letter Opener. Just slide a letter through and off zips a narrow piece of the envelope. Fully automatic with no on/off switch, it requires three D-size flashlight batteries. Great for secretaries, businessmen and at home. Priced at \$15.95, it's made by American Unifax, Inc., 95 Madison Ave., New York, N.Y. 10016.



Built-in learning center

By DAVID WARREN

NOWADAYS, when my son, Dave, gets home from school, like most teen-agers he heads for the telephone. But, unlike most of his pals, he uses a Touch-Tone phone to call his school computer to listen to a lecture that was given earlier in the day. In the near future (I hope), a Picturephone will join the Touch Tone and give *visual* access to the school computer as well.

The whole concept of what is coming in educational techniques prompted the project you see on these pages. Today, schools circulate books from their libraries. In the not-too-distant future, video cassette cartridges for use on home television sets will be the student's homework aid. For example, by adding Motorola's new EVR Teleplayer to your TV, it is just as easy to play an audio-visual program as it is a standard audio recording. The Teleplayer has leads that simply clip onto the TV's UHF antenna.

● *Getting started.* Standard construction techniques were used throughout. To speed up the job, I used Masonite's Cape Cod Maple paneling ($\frac{1}{4}$ -in. hardboard) on the walls and rock maple for the visible structural parts. Instead, you may prefer to use a different wood paneling and wed it to its real wood counterpart. Prefinished Masonite shelving and Marlite Leather

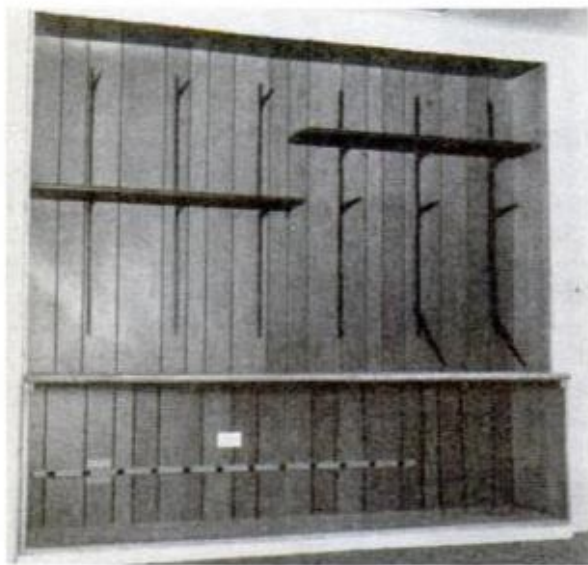
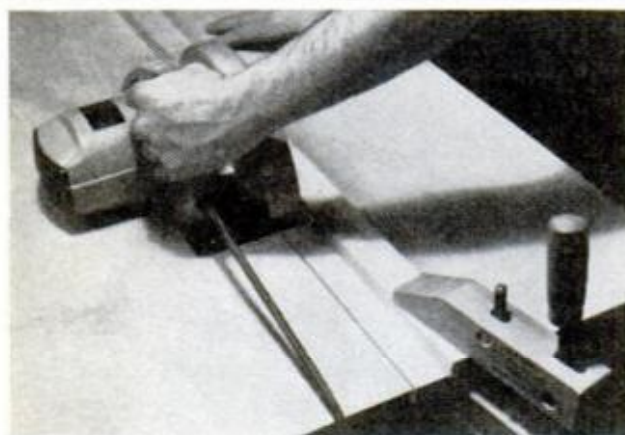
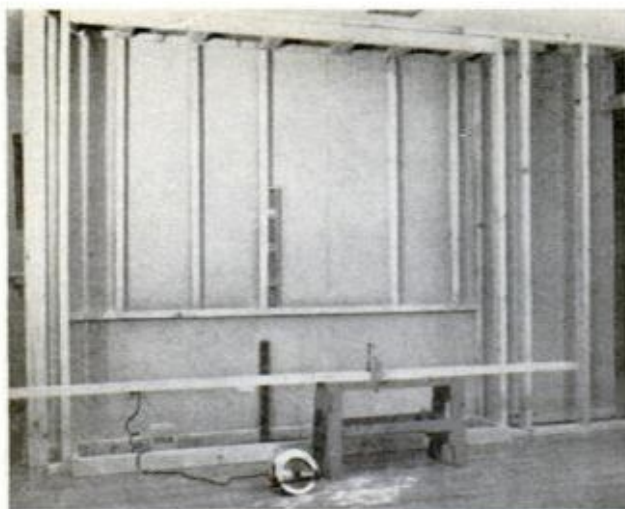
FIRST STEPS (top): determine size of the built-in; rip out the existing wall and install new framing

FOR TRUE PANEL CUTS, clamp a straightedge to the plywood for the circular saw shoe to ride against

AFTER BACK WALL IS paneled, you can install the shelf standards in the upper portion of the cabinet

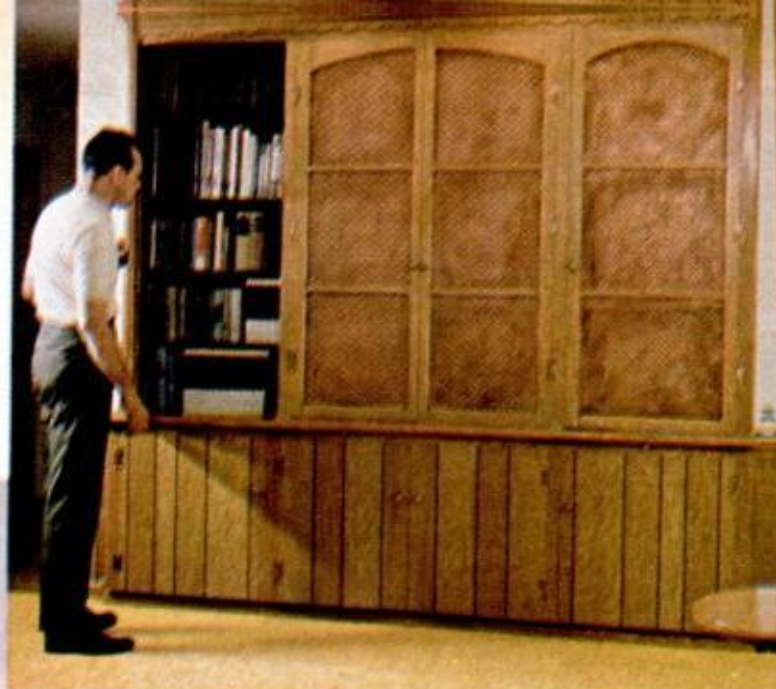
MAKE CUTOUTS for TV, electrical receptacles before placing bottom panel. Plugmold strip is shown here

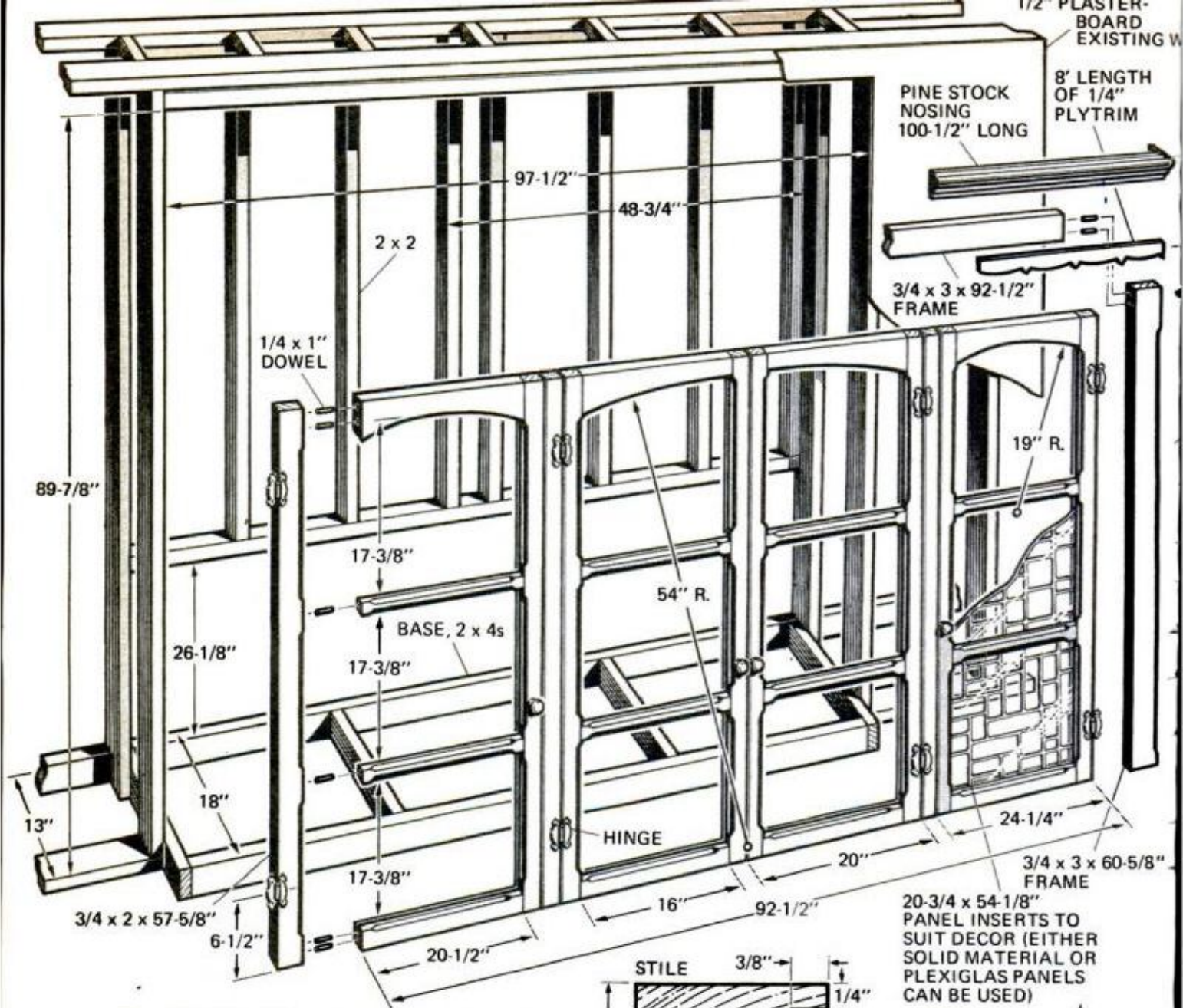
POPULAR MECHANICS



With careful planning, you can provide for in-the-wall storage in addition to your multimedia study.

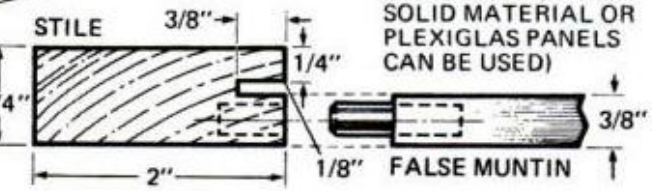
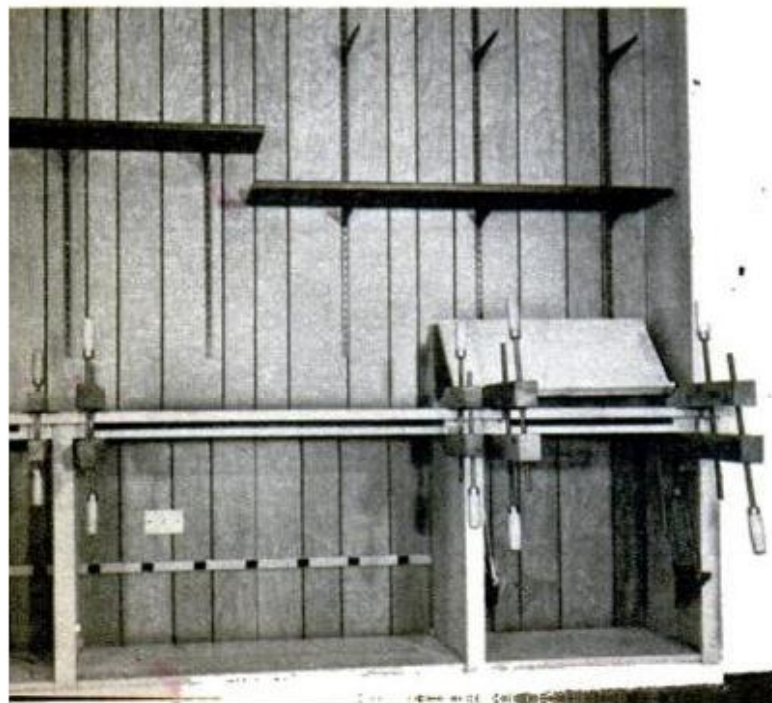
WALL CABINETS can be enclosed with doors (right) or left open (below) for display of modern equipment





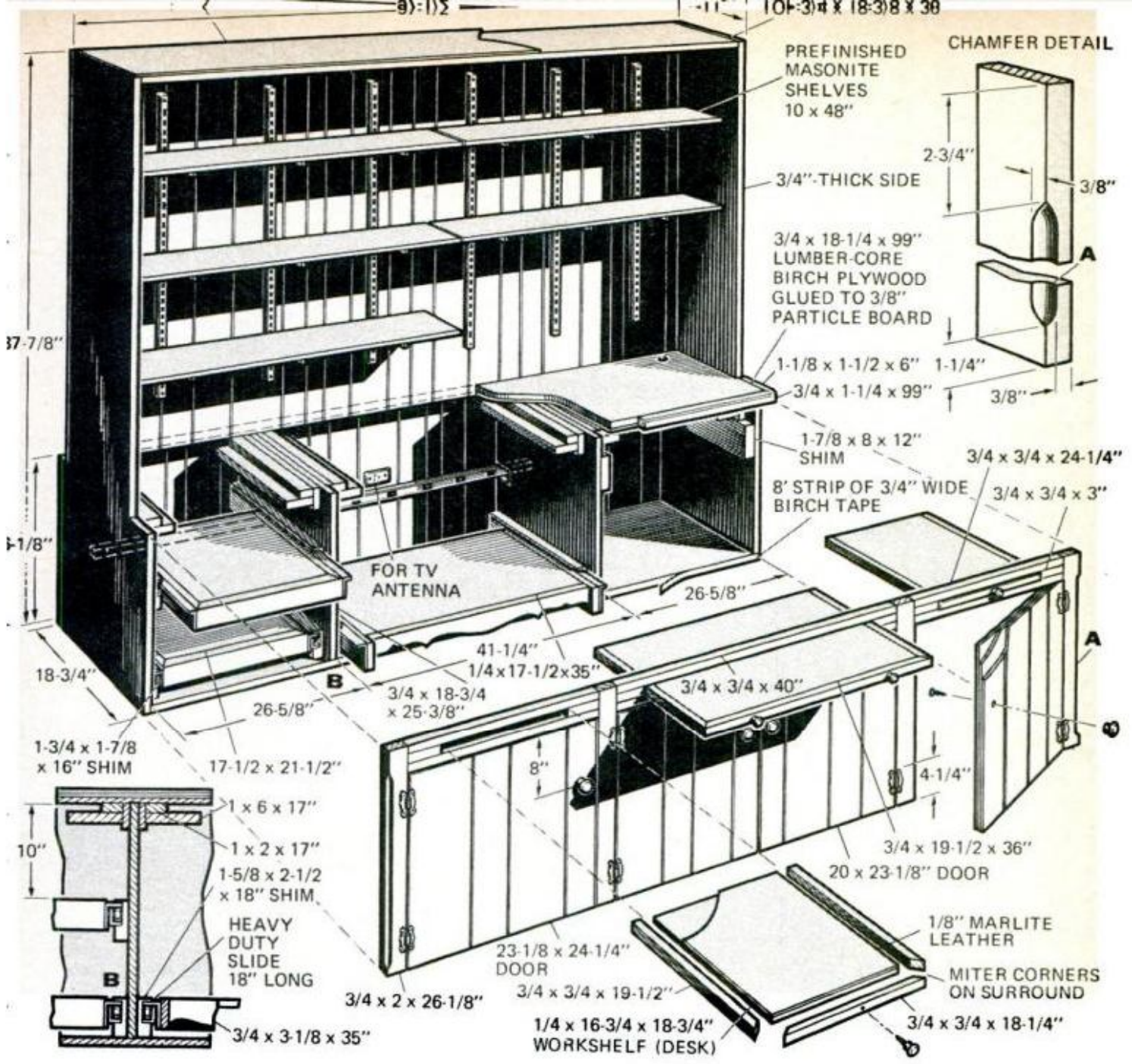
Built-in learning center

WITH COUNTER INSTALLED, cut out the three pieces forming pullout-pocket frame and glue them in place



board on the pullout writing surfaces add richness and durability, while cutting your time and costs further. The drawings above illustrate the learning center exactly as I built it. Dimensions, of course, can be varied to suit the wall space you have available and the amount and size of equipment you plan to install in the unit.

Start construction by removing the existing baseboard. Lay out the lines for the top plate on the ceiling. Then locate the ceiling joists, and fasten the top plate with 16d nails. If the plate doesn't cross the joists at right angles, use some panel adhesive and toggle bolts (spaced 12 in. apart) to fasten the plate. Drop a plumb line to locate the sole plate, then position and fasten it. After the top and bottom plates are placed, locate the wall studs



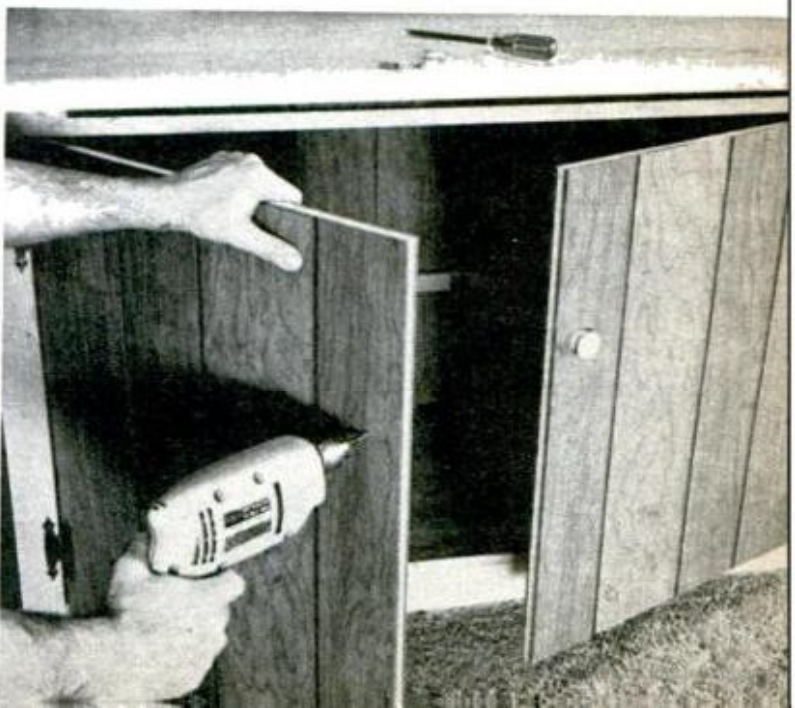
and fit the 2x4 uprights, header and other structural members.

Cover the 2x4s with plasterboard, tape, Spackle and paint it. (Editor's note: For instructions on installing drywall, see the *Popular Mechanics* booklet, *How to Remodel With Drywall*. It's available for 50 cents from *Popular Mechanics*, Dept. HW, 224 West 57th St., New York, N.Y. 10019.) If you wish, panel the false wall to counter height and cap with chair-rail molding stained to match.

● **Case.** Install the 2x4 base and base-board molding. Locate the studs and nail the 2x2 horizontal divider and uprights against the wall. Note that one 2x2 upright is nailed and glued with panel adhesive in the center to insure nailing support. Use

[\(Please turn to page 164\)](#)

AFTER HANGING DOORS, line up knob locations with a level and carefully drill the holes for the screws

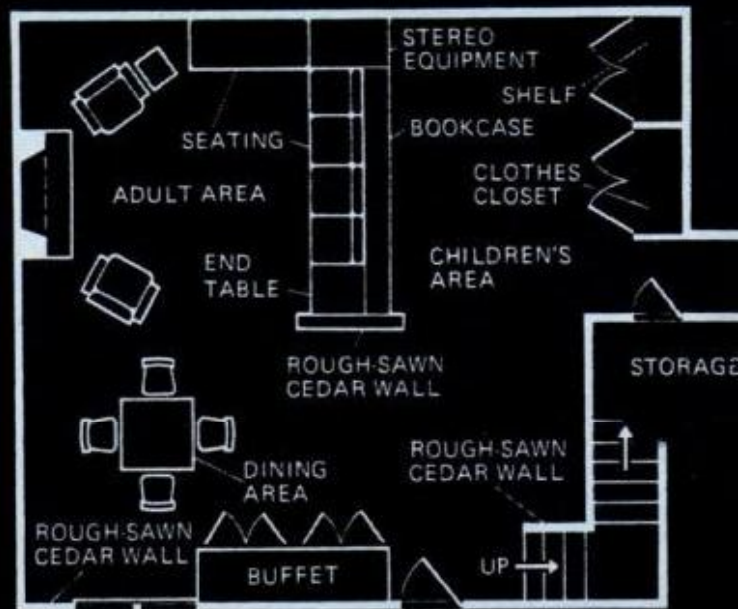




FAMILY ROOM gave the homeowner a playroom with storage space to spare. Bold splashes of color and zebra-striped closet doors add to the visual impact



FLOOR PLAN was laid out carefully to provide three distinct and separate areas for adults, youngsters and dining. Built-in sofa offers additional storage



Bold ideas for basement family rooms

By HARRY WICKS, Workshop Editor

Data: Annette Sukov

Photos by Dean Paris and Les Turnau

There's no rule that says you can't simply frame and panel a basement to convert it into a usable family room. But why let such conventional thinking limit your creative imagination? With some foresight and planning, you can add splashes of color, use "different" materials and design a basement family room with a personality of its own.

The three basement family rooms on these pages, for example, reflect individual family preferences in decorating and room usage. And all ideas shown are valid and easy to duplicate if you want something in your basement family room other than the customary paneled-wall look.

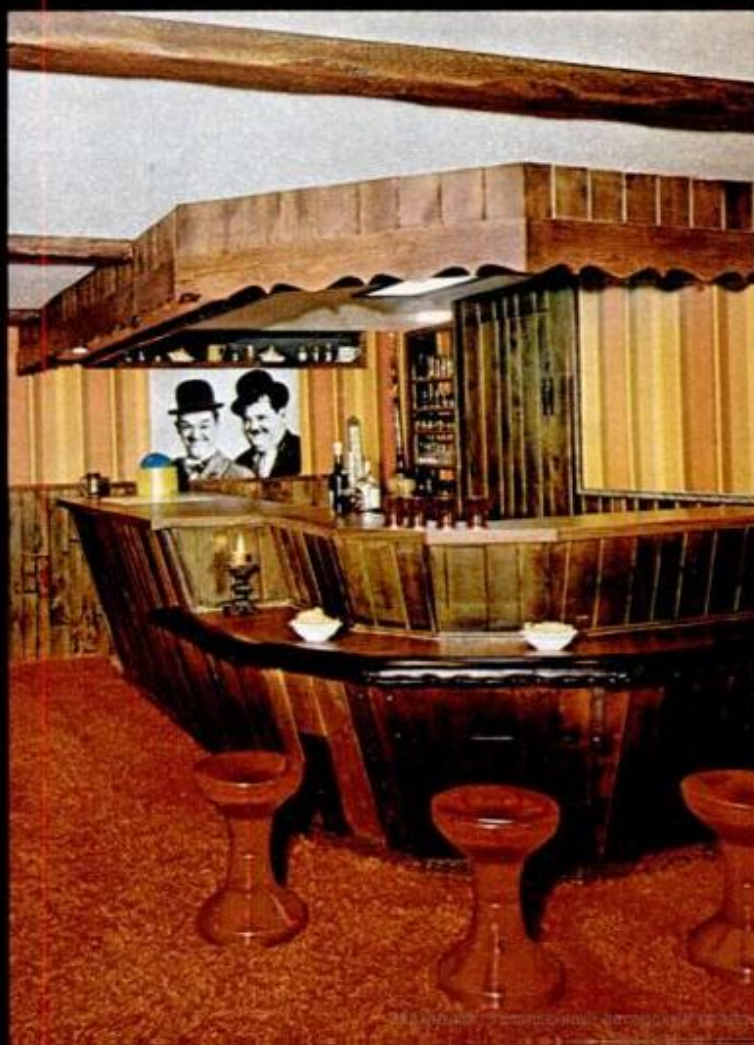
As can be seen in the floor plan on the facing page, the owner wanted to gain three distinct uses from his family room. First, he wanted an area—with adequate storage—for the youngsters to play in; second, an adult room for parties and get-togethers; and finally, a generous-size dining area for family gatherings. Careful planning guaranteed these uses.

A little daring, such as the use of

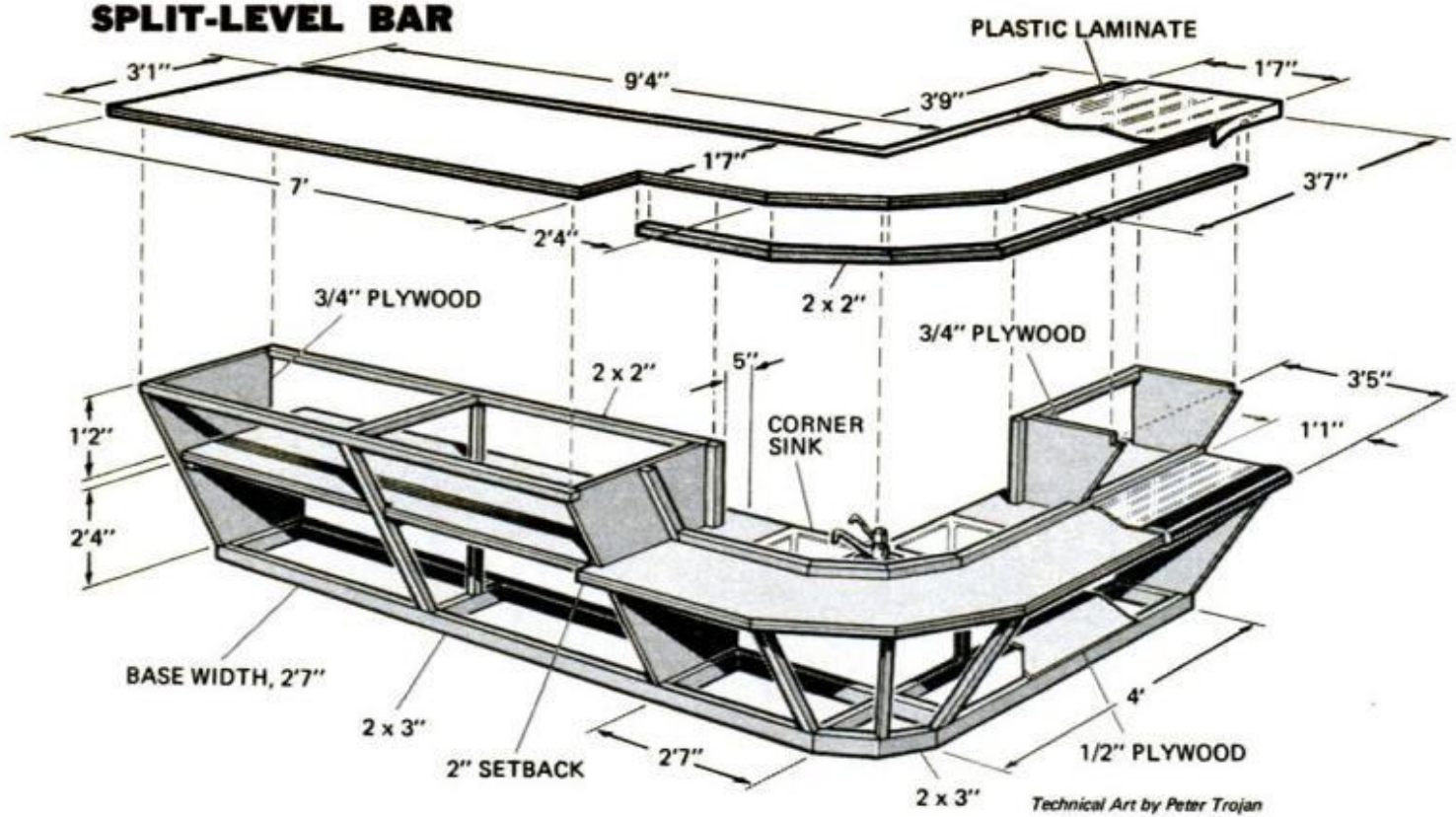


COLONIAL TAVERN LOOK, wanted by owner Ted McLaren, was achieved using weathered siding on walls

CONTEMPORARY MOOD is heightened by the dramatic effect of a split-level bar for standing or sitting



SPLIT-LEVEL BAR



zebra-stripe, "wet-look" wallpaper kept the room's appearance consistent with the rest of the home.

The same approach is true of the split-level bar shown in the drawing above. The clever design is further enhanced by the canopy and decorative valance. Notice that the lower "level" has a bumper along the outside edge. This is simply Naugahyde-covered foam rubber.

The bar and the wall opposite (shown below) are in the Jack Laboe home in Golden Valley, Minn. The remodeling was a do-it-yourself project. Jack simply covered the lower half of the walls with pre-finished birch plywood. Above the dado,

SEATING ARRANGEMENT along wall opposite dual-level bar features built-in storage under seats, durable and plastic-laminated armrests



he applied striped wallpaper over plaster-board for pattern and color.

To achieve the warmth that typical American inns offered weary travelers a century ago, Ted McLaren (Minneapolis) utilized materials salvaged from old farm buildings. Aside from adding great authenticity, the old boards kept overall costs down. The owner claims that by doing the basement himself, total cash outlay was under \$500—including that factory-built fireplace. The stones were gathered by the McLaren clan and Ted was his own mason.

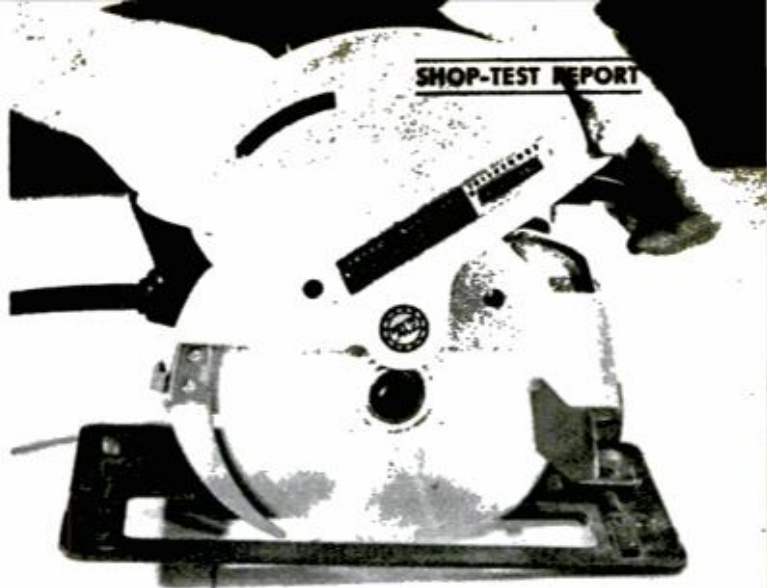
When planning your basement, there are other points to keep in mind besides color and cost. First, it pays to lay out the room in scale on graph paper. Done this way, the room can be designed for maximum efficiency before you ever lift a hammer. Second, after you have decided upon decor, spend several Saturdays visiting well-stocked lumberyards to learn what materials are now available. You'll be surprised to find how much stone, brick weathered siding and "wallpaper" comes in 4x8-ft. panels to make do-it-yourself installations a snap. ★★★

POPULAR MECHANICS

ANYTIME you take a spanking new power tool in hand there is a slight degree of apprehension and extra caution. It's because you are accustomed to your own tool. And, since I have been working with my present saw for about six years, my attitude was no different. So I felt my first task in shop-testing Sears' newest commercial 7½-in. circular saw was to digest thoroughly the contents of the owner's manual, and to familiarize myself with the tool. Once I felt comfortable handling it, I used the saw constantly in the shop. The first thing to get used to was a bright blue flash caused by the electronic brake when the trigger switch is released. After that came the saw's weight (it's heavier than mine) and the feel of the handgrip.

I deliberately made an improper, unsafe cut to test the maker's claim that the brake stops the blade within one second. It does. With ¼-in. hardboard clamped to my worktable so most of its weight was cantilevered, I cut it from the wrong side. When the inevitable binding occurred, the blade stopped spinning before it was out of the ¼-in. material—a comforting feature indeed.

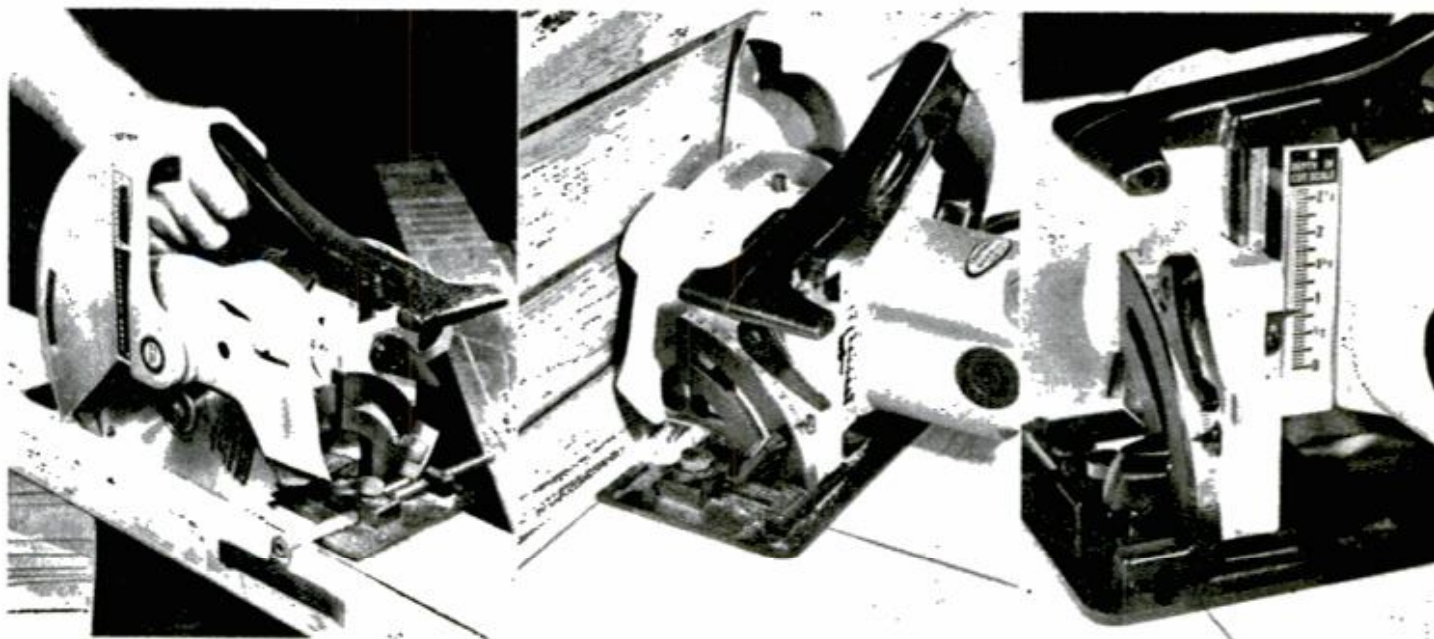
I can report no faults, other than that distracting flash (which you needn't worry about because the tool is double-insulated). Points impressing me much are shown in the photos. For \$80, catalog No. 1188 is a good buy for professionals and serious do-it-yourselfers alike. ★★★



PLUNGE CUTS were a snap with this tool. The riving knife in back of the blade keeps the kerf open

We 'put the boots' to Sears' newest circular saw

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



FEATURES author particularly liked are those shown above (left to right): Ease with which a long rip (using guide) could be made; removable shoe that permits close-to-the-wall cutting, and the easy-to-read depth-of-cut scale. The blade is locked with the lever (over the bevel scale) instead of the usual knob



OAK TEXTURE of staves (above) is obvious. Closed bar (right) serves as table. Potables and glassware (below) are neatly corralled



Roll out the barrel when the gang's all there

With an authentic whiskey barrel—available for \$19—you can duplicate this novel bar for your den or family room

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst
Shop Consultant; John E. Gaynor

A USED WHISKEY BARREL—which a distiller will ship to you for less than \$20—can be converted into a handsome, masculine bar that will be a focal point for your home entertaining.

John Gaynor and I, starting with only a used barrel and some ideas, spent several days in the *PM* shop designing and building this novel bar for den, office or family room. The drawings on the following pages and some tips that we learned along the way make the project an easy and thoroughly enjoyable one. Your barrel bar, like the one shown, is sure to draw admiration from all who see it.

The barrel is readily available and costs about \$19 including delivery. (See the "Manufacturers of Materials" list on page 134.) It comes from distillery to you as shown in the photo on page 133.

Before you put a saw to the barrel, it's a must that you securely fasten the hoops

to the staves with screws. Also, you should drill through each stave into the barrel top and secure the top with 1½-in. screws.

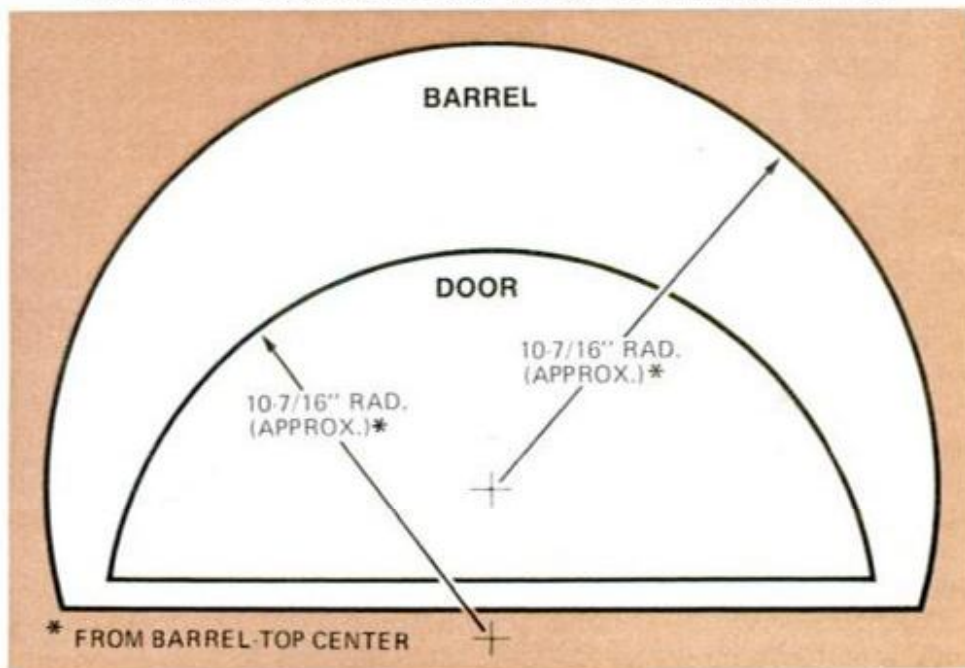
For the door cutout we chose a spot near the bunghole so that this feature would face the room. Make the cutout with a bayonet-type saw; I used a Sawzall fitted with a hacksaw blade. A sabre saw could be used but it will take more time.

Once the barrel is cut open, you'll know it's authentic. Its inside face is charred and literally reeks of bourbon. So, cart it outside and use a hand scraper to remove the char. Then, give it a good sanding with a belt sander and about a No. 40-grit paper.

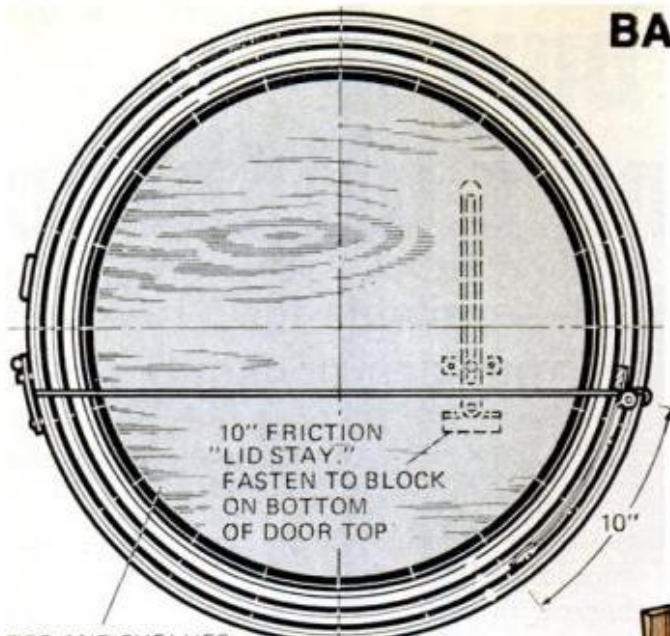
On the bar shown I deliberately left some char in the crevices to retain authenticity. Also, I saved the shipping label, glued it inside the barrel and antiqued it with burnt umber. The only further work

TEMPLATE FOR CUTTING PLASTIC LAMINATE TOP

CUTTING LAMINATE for tops of both barrel and door can be somewhat tricky. To save wasting your costly laminate, make the cardboard templates first, using the approximate radii shown. Then fit the cardboard, using scribes. When satisfied with the fit, transfer marks to laminate, cut out with a sabre saw, test-fit the pieces and, if necessary, file any rough spots. Before you apply any contact cement, make matching position marks on laminate and barrel



BARREL BAR

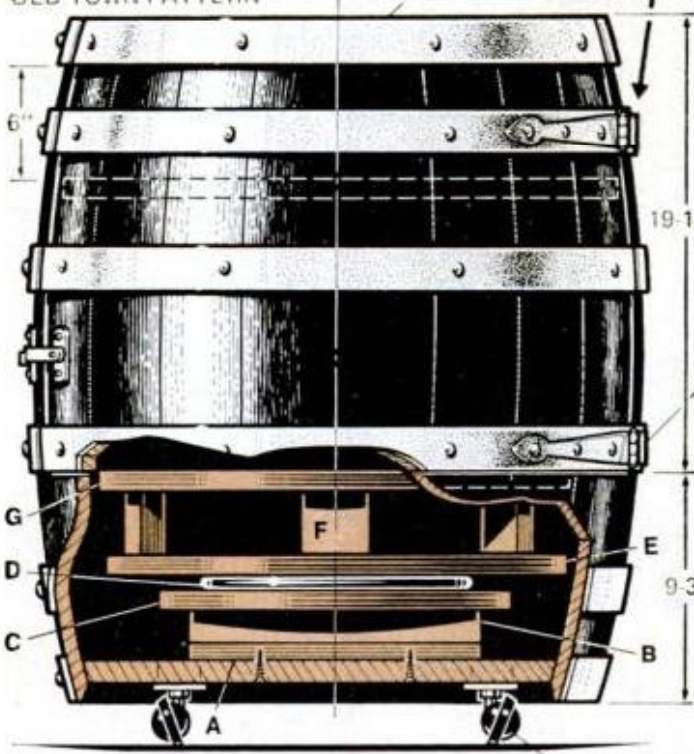


10" FRICTION "LID STAY" FASTEN TO BLOCK ON BOTTOM OF DOOR TOP

TOP AND SHELVES LAMINATED WITH G.E. TEXTOLITE OLD TOWN PATTERN

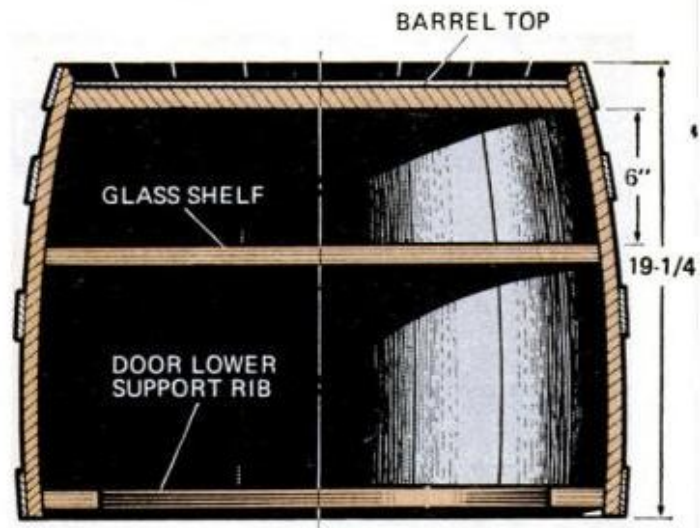
TOP VIEW

1/4 x 1 x 3" SHIM BEHIND HINGE LEAF

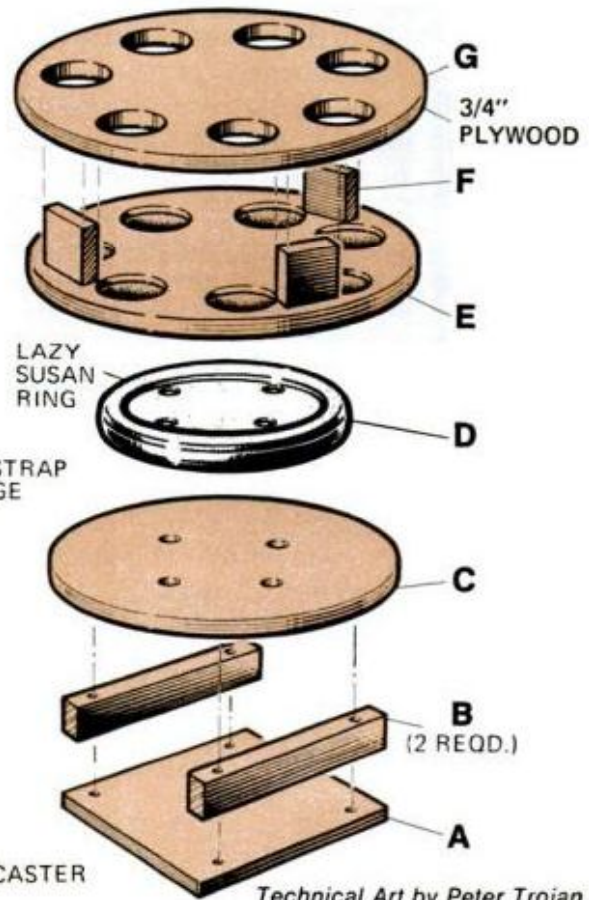


FRONT VIEW

2" SHEPHERD CASTER (4 REQD.)



DOOR-INSIDE VIEW



Technical Art by Peter Trojan

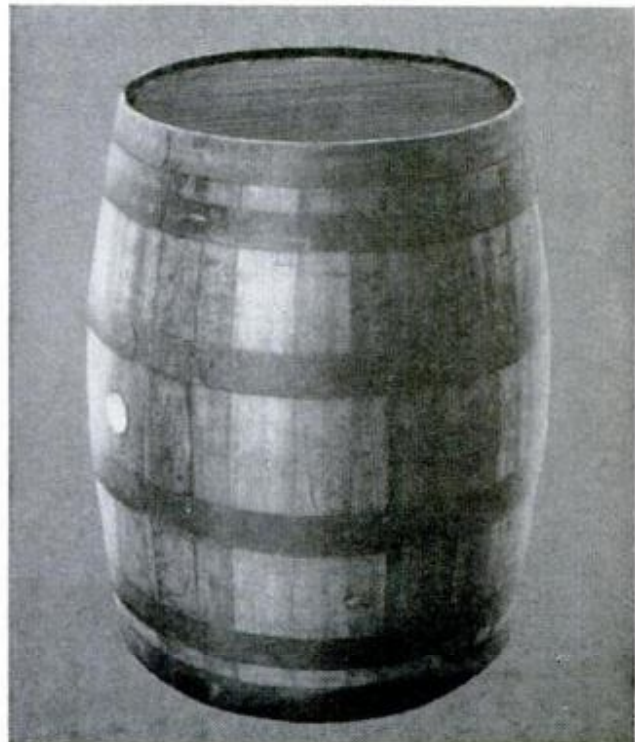
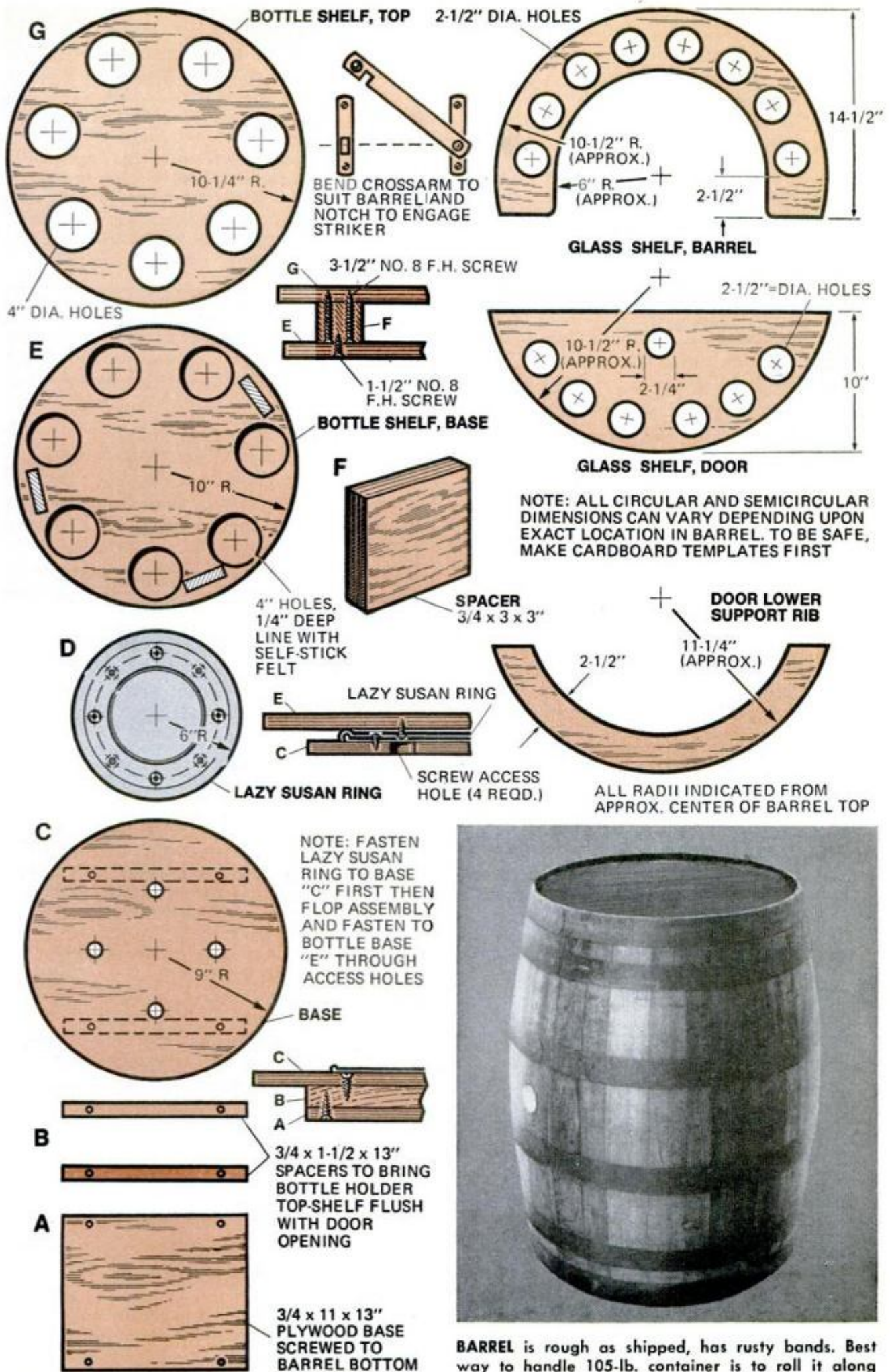
inside the barrel is to varnish it. To seal in that smell, give it at least three or four coats.

The various shelves and support ribs are all cut from 3/4-in. A-D plywood. Their exact radii and dimensions will be determined by where you place them in your barrel. The safest bet is to make either cardboard or 1/4-in. hardboard templates first; then, when satisfied with fit, transcribe outline to the plywood and cut.

The bottle base. Though the bottles could stand in a much easier-to-construct,

fixed stand, we decided to incorporate a rotating base utilizing a lazy Susan ring purchased at the local hardware store. When laying out the bottle shelf, first decide which whiskies will be held by the shelf; then, depending upon the brand, you can conceivably vary the hole diameter if desired. All openings here were cut to a 4-in. diameter, and the shelf holds seven bottles.

The bottle base (E) is painted flat black and the wells which receive the bottles, made with a router, are lined with adhe-



BARREL is rough as shipped, has rusty bands. Best way to handle 105-lb. container is to roll it along

sive-backed green felt. Part G is laminated as are the tops and the shelves.

The glass shelf. Make certain that you place the glass shelf so that when the glasses are suspended in it, the bottles will clear them when the lazy Susan is rotated. Here again, cutouts will be determined by what glasses you wish to keep in the bar. Dimensions shown are for standard highball glasses.

Once the plywood has been fitted where you want it and the glass hole cutouts have been made, the part can be laminated and installed. To fasten it, use counterbored 3-in. screws (one through each stave) and plug the holes with hardwood dowels.

Follow the same procedure for parts that go into the door. Again, cutouts should be determined by the bar accouterments you plan to use. In fact, if desired, the glass shelf on the door can be laid out to provide a cutout for an ice bucket. Swizzle sticks, as shown in the photo, are simply stacked in one of the old-fashioned glasses.

Finishing the outside. Since you'll want to retain an authenticity and that tavern look mentioned earlier, don't oversand the piece. Using a belt sander, start with a No. 40-grit paper, then graduate successively to 60, 80, 100 and 120-grit paper.

MANUFACTURERS OF MATERIALS

Barrel: G.I. Frazier Co., Box 8275, Louisville, Ky. 40208. Price, \$18.75 (add \$5 west of the Mississippi), includes delivery.

Casters: Shepherd Casters, Inc., St. Joseph, Mich. 49085. Model No. 200 (2" dia.).

Plastic laminate: G.E. Textolite, Old Town pattern. Available at lumberyards and building supply houses.

Finish: McCloskey Varnish Co., 7600 State Rd., Philadelphia, Pa. 19136. Walnut oil stain and Heirloom semigloss varnish.

If there is excessive rust on the hoops, chuck a wire brush in your portable drill and remove any rust that is loose or flaking.

The bar shown was given a coat of walnut oil stain followed by walnut filler and three coats of semigloss varnish. You can eliminate the staining and filling if you prefer the weathered-gray look of the oak.

If the bar is to stay in a contemporary playroom, paint the barrel hoops and staves to suit the decor. On this one, hoops were simply painted with flat black before the varnish went on. Another look could be achieved by applying aluminum paint to the hoops and dulling them for a pewter-like finish. ★★★

NEXT MONTH IN SHOPS AND CRAFTS

RADIO-CONTROLLED MODEL PLANE FLIES ON CO₂, the latest fuel to be used by hobbyists. The fuel is nonflammable and odorless, and the little plane emits no more than a buzz when in flight. Pick up *PM* next month to learn how to build this exciting model and use carbon dioxide fuel.

MAKE THIS SHAPER FOR \$60. Starting with a used motor, a *PM* reader built this handy tool for making his own moldings. It really does the job. You'll find complete plans and instructions for making one for *your* shop in the February issue.

MODELMAKER'S WORKSHOP IN A CABINET. So compact it takes only 3½ square feet of floor space, this "workshop" in a cabinet is made to order for the apartment model-maker who owns a miniature lathe and has minimum space to work. Fourteen shallow drawers keep lathe accessories, measuring devices and small hand tools at your fingertips. The base compartment provides a place to store your lathe.

EARLY AMERICAN DRY SINK. A mellow piece in pine to go with the rest of your Early American furniture, it features a removable copper tray, felt-lined drawers for silverware and an adjustable shelf behind raised-panel doors. You'll want to build this little charmer as soon as you see it.

COOK WHERE THE FUN IS. With this elegant grill-in-a-cart you can charbroil steaks, hot dogs, hamburgers, fish or fowl and be where the fun is at the same time when entertaining. You build the cart and equip it with a plug-in electric grill which has a built-in exhaust system to whisk cooking odors outdoors. It's ideal for a family room.

A colonial chair you can build for \$53

Last month we gave construction details for shaping arms and back. Now you can turn spindles and assemble the chair

By RO CAPOTOSTO *Photos by the author*

BY NOW you have all the parts of the chair laid out and are ready for the fun of the project: turning the spindles. If you do not own a lathe attachment for making duplicate turnings (see *Lathe Attachment Duplicates Woodturnings*, page 196, Oct. *PM*), it will take you a little

longer to do the turnings. The job will take some patience and frequent checking.

Start by making a full-size sketch of each of the turnings for reference. Rip the turning blocks for the four legs and the two leading arm spindles out of 8/4-in. stock; the 5/4-in. material will take care



PART 2





SPOKESHAVE will let you do a slick carving job on the armrests. Various contours are shown at the right



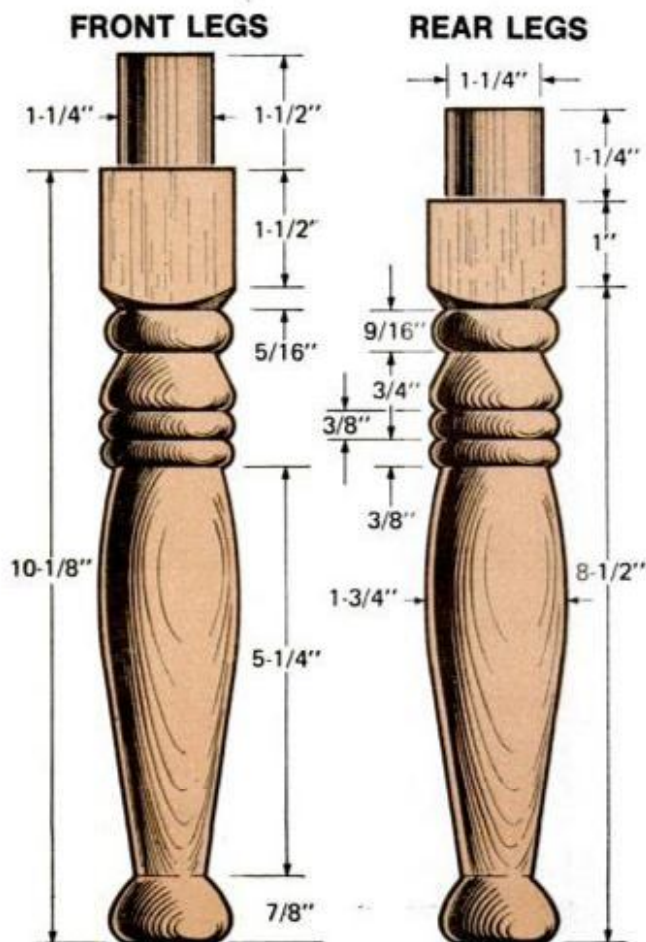
DON'T RUSH SHAPING. Use full-size drawings of contours, plus calipers, to make frequent checks

of the rest of the spindles. Since the legs have squared ends, you'll have to smooth-finish these blocks. Because you will occasionally have to remove the turnings from the lathe, put a reference mark on one facet of the spur center and mark each block accordingly so that the pieces will always go back on the lathe in their original orientation.

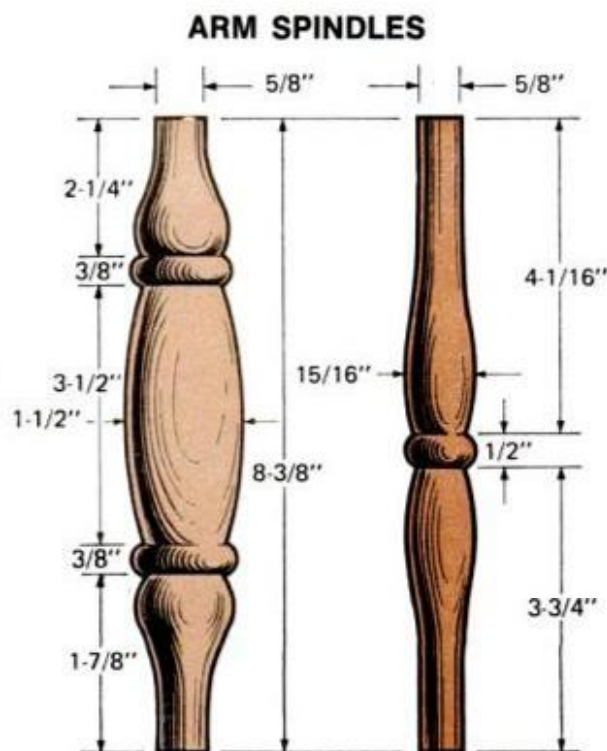
Rough-turn all the blocks into cylinders, except for the leg blocks. These must be turned with squared shoulders not only at the top, but also in the waste area beyond the bottom. This is important because the two flats will later provide the only means of *successfully* drilling the holes for the spindles with *ease* and precision.

To prevent the corners of the square sections from splintering, first make nicking cuts with the toe of the skew. Now you can proceed to make sizing cuts with the parting tool on all of the roughed-in cylinders. It's desirable to keep all diameters a bit oversize to allow for the finishing cuts.

Complete any one of the turnings and then tie it to a shop-made hinging board that's mounted behind the lathe to permit it to serve as a master spindle. Thus you

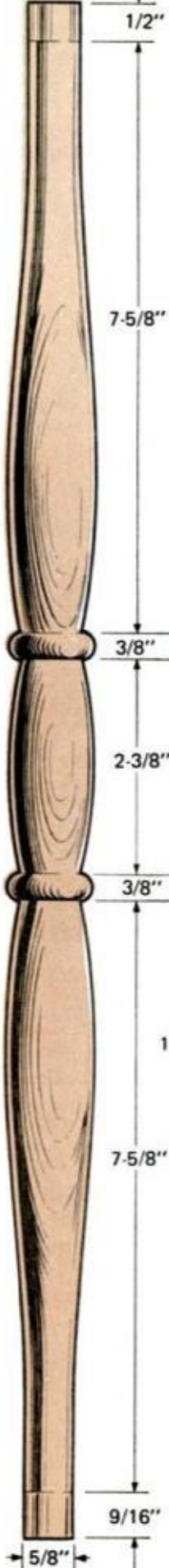


SHOP-TURNED SPINDLES used in the chair test your duplicate-turning skills, a task that is simplified if you make full-size patterns first. The turnings are even easier, and go faster, if you own duplicating attachment mentioned in the text

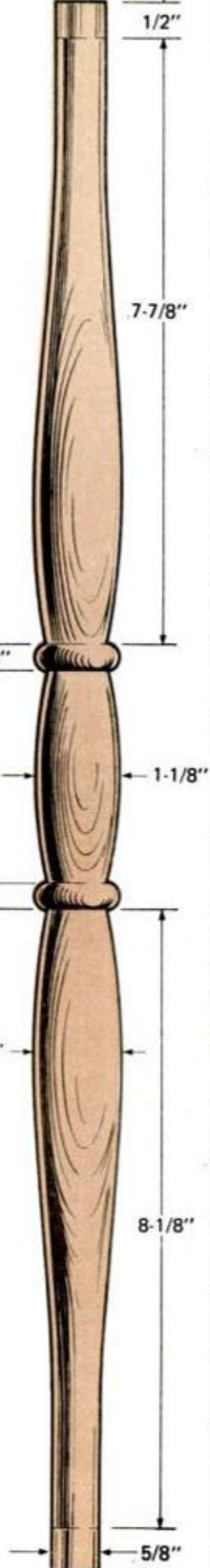


LEG STRETCHERS

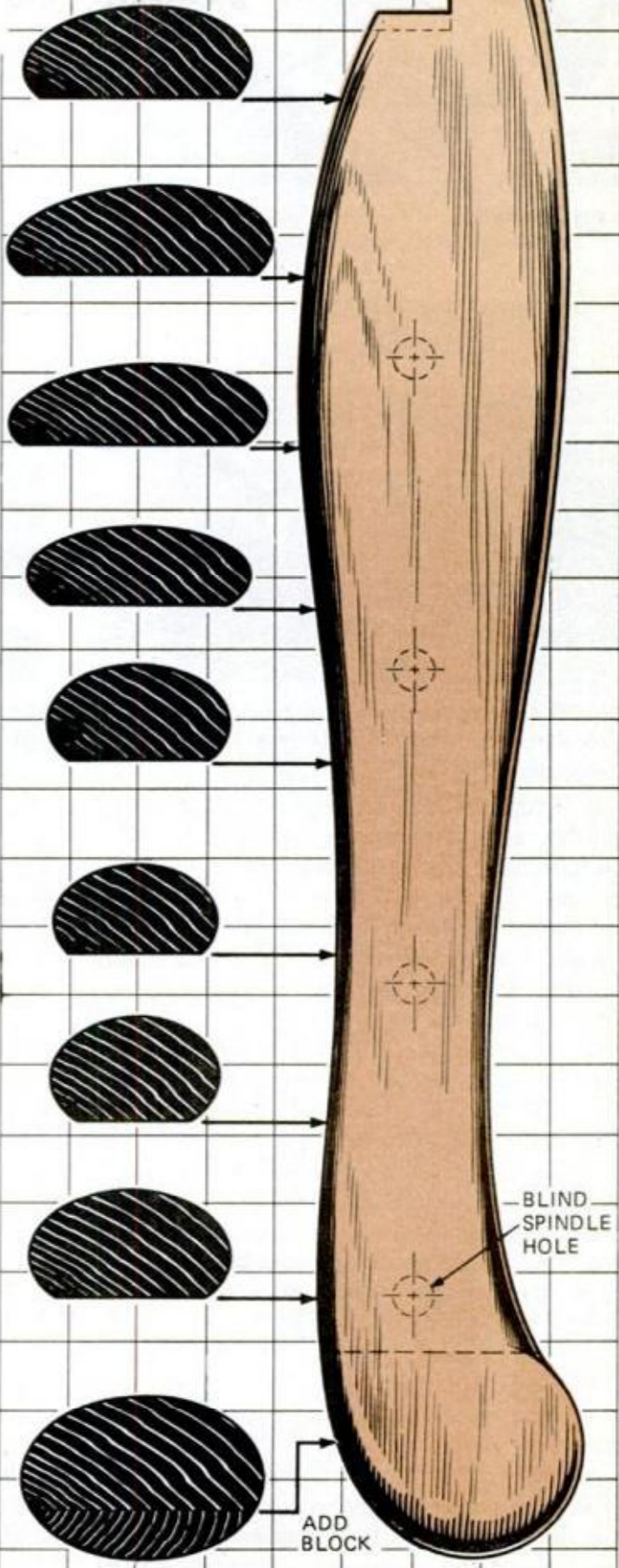
FRONT AND BACK

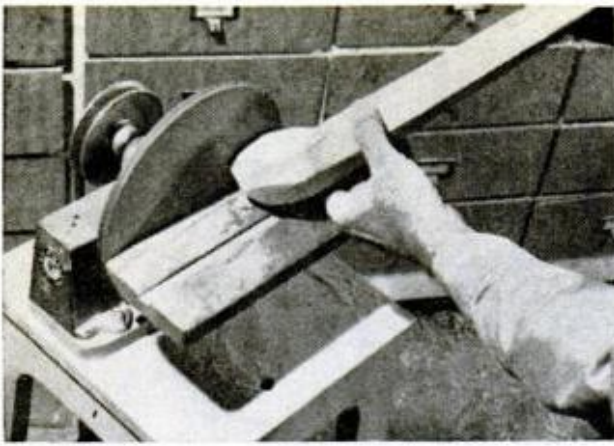


SIDE

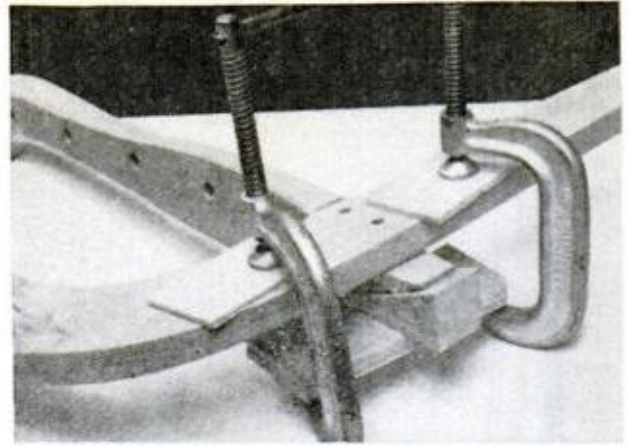


ARM CONTOURS
(FLAT SECTION IS
ARM BOTTOM)

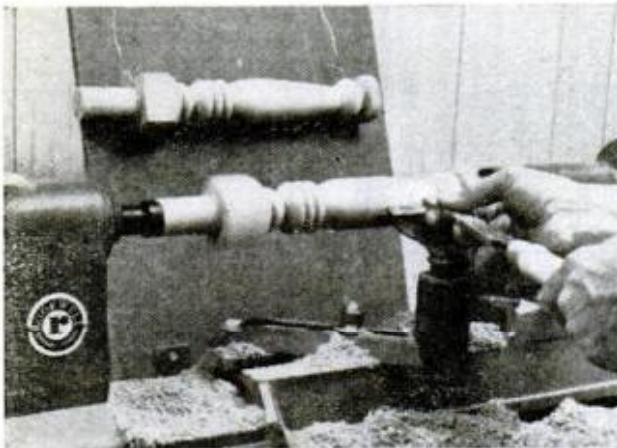




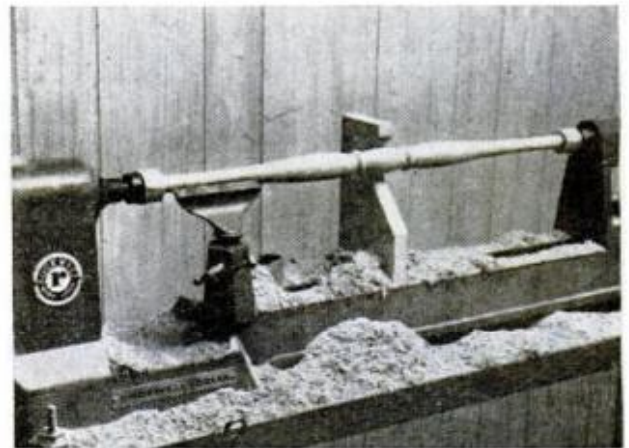
A DISC SANDER is the handiest tool for rounding off ball end of the arm. Added block is required here



SIDE AND ARM must be rigidly clamped precisely in position when you bore the holes for joint-dowels



MASTER SPINDLE can be brought up close to work-piece for comparison to make repeat turning easy



HOMEMADE STEADY-REST is used to cut down vibrations that occur when you turn long, slender spindles

can bring the master forward (up close) to the new workpiece for quick visual matching of the duplicate you are working on.

I also found it advisable to use a steady-rest to eliminate vibrations when turning the slender base spindle. If you don't have such a lathe accessory, you can easily fashion one out of wood. Simply cut a right-angle notch in a piece of wood and clamp it to the lathe bed. The corner of the angle is then set at the height of the lathe center as shown in the lower photo in the adjoining column.

It's a good idea to turn the ends of all legs and spindles just a shade under the drill size for their respective holes to allow a slight amount of play, or wobble, which is necessary to assemble the parts. When satisfied with each turning, sand it to completion before cutting off the waste.

However, don't cut off the bottom waste of the legs until the spindle holes are bored. Each of the legs requires one spindle hole bored at an angle (see drawing).

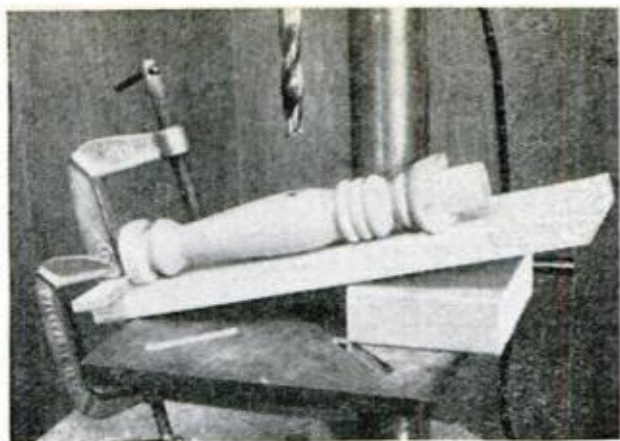
This can be done simply by propping up a flat board on the drill-press table—set at the required angle—and clamping it solidly as shown in the left photo at the top of page 139.

For clean, positive results I strongly recommend the use of spur drill bits for all boring. Rockwell Manufacturing Co., 400 North Lexington Ave., Pittsburgh, Pa., makes them, and they should be available at your local hardware store.

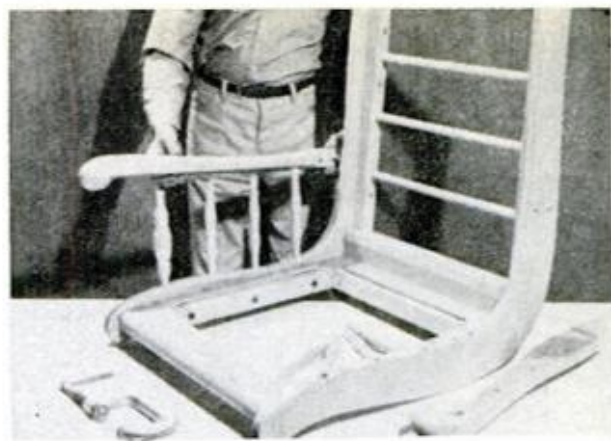
Final assembly is not difficult, but do make a nonglue dry run to permit yourself to make any adjustments if necessary, such as shaving off a bit here and there on tight-fitting spindles.

While you're doing this, don't forget to whittle a couple of flats on all leg and spindle ends so the excess glue can escape. If you don't allow for such glue ooze-out, you'll soon discover that some of the pieces just won't bottom, but they will spring out as soon as you release them.

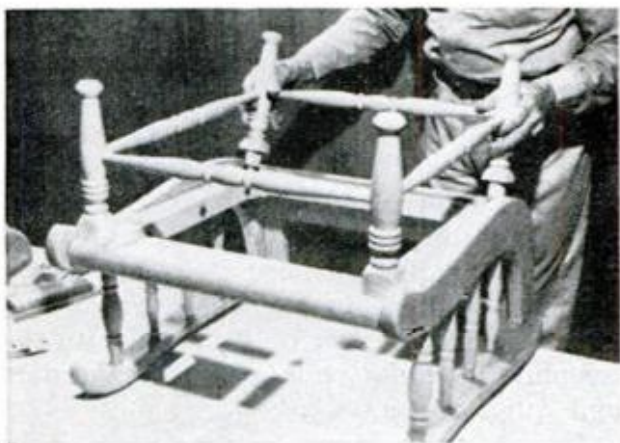
Plastic resin glue is a good type to use. I prefer to make a mixture that's a bit



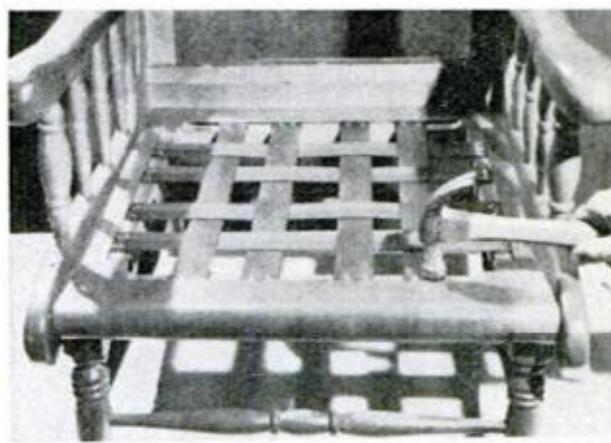
SIMPLE DRILL-PRESS JIG is necessary for boring holes in legs. Flat ends make this trick possible



INSTALLING ARMREST requires a little give and take. Thus, it is best to use thick—not runny—glue



IF SPINDLE ENDS and leg tenons are a bit smaller than holes, angled assembly will fit effortlessly



WEBBING, with the ends doubled over, is nailed into rabbeted recess. Use large-head carpet tacks

on the heavy side so it won't become too watery, thus runny.

Insert the armrest spindles into the sides and then add the rests. The two dowels projecting from the rear of the arms should be sanded to a slight taper to permit some flexing of the arm so it can be worked into place over the spindles. After assembly, wipe off all excess glue: stains and finish can't penetrate a skin of glue (which actually becomes a sealer coat).

Next comes the base. Insert the spindles into the four legs. While the assembly is right-side up, apply glue to the tenons and the shoulders and also to the holes in the frame.

If possible, have a helper give you a hand to turn the assembly upside down and insert the front legs first. Then, while he holds the front legs in the right position, with a bit of twisting you can work the rear legs in place. Use one bar clamp on each leg. Since there is no place for them to go, the spindles will take care of themselves.

JANUARY 1972

The finish on the chair shown consists of a few coats of sanding sealer lightly sanded with 6/0 paper. Next, to a matte-finish lacquer, add a bit of aniline stain (cordovan was used here). Spray on a number of coats. (Editor's note: At least three or four.)

Be mindful that the stain color builds up with each pass, so don't get overzealous when you add the stain. To be sure of getting exactly the shade you want, test it on a scrap of the lumber used for the chair.

After the finish has been applied you can install the seat webbing. Using large-head upholstery tacks, double up on the ends and pull them taut. Weave each strand over and under.

To equip the chair you'll need foam cushions of the following dimensions: Seat, 4½x22x23 in.; back, 4x21x22 in. If you can't get them locally, they are available as stock items through Sears Roebuck. You'll find them listed under "Replacement Cushions for Colonial Style Furniture." ★★★

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Workshop projects you

Early American shaving console

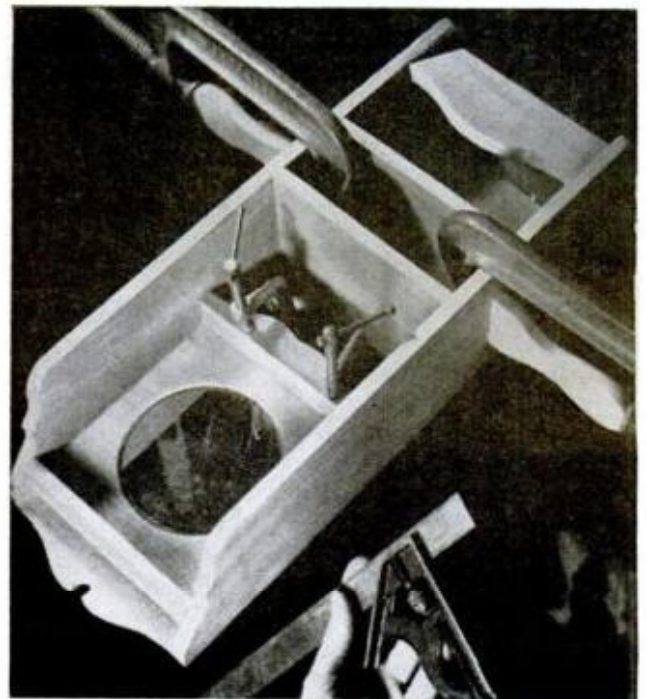
A CHARMING DECORATIVE PIECE for almost any room, this Early American shaving console is also functional. You can use it to hold shaving gear (or other items), and in event of a power blackout, the candles stand ready to provide light. A shelf above the mirror can display an old shaving mug, and the small drawer provides more than adequate storage for the usual assortment of shaving paraphernalia. Additionally, a comb and brush box is located at the base which is fitted with an American eagle hook that serves as a small towel holder.

Even if the console is not used for its original intended purpose, its colonial look fits in well in any room—including the kitchen where it can be hung next to the telephone to hold pads, pencils, calendars and other items.

The shaving console shown is built of cherry; if you prefer, it will still look good in walnut or knotty pine. If you wish, a side-view mirror salvaged from an old car can be used for the looking glass. It would fit flush and be a snug fit in the hole.—*Don Shiner*

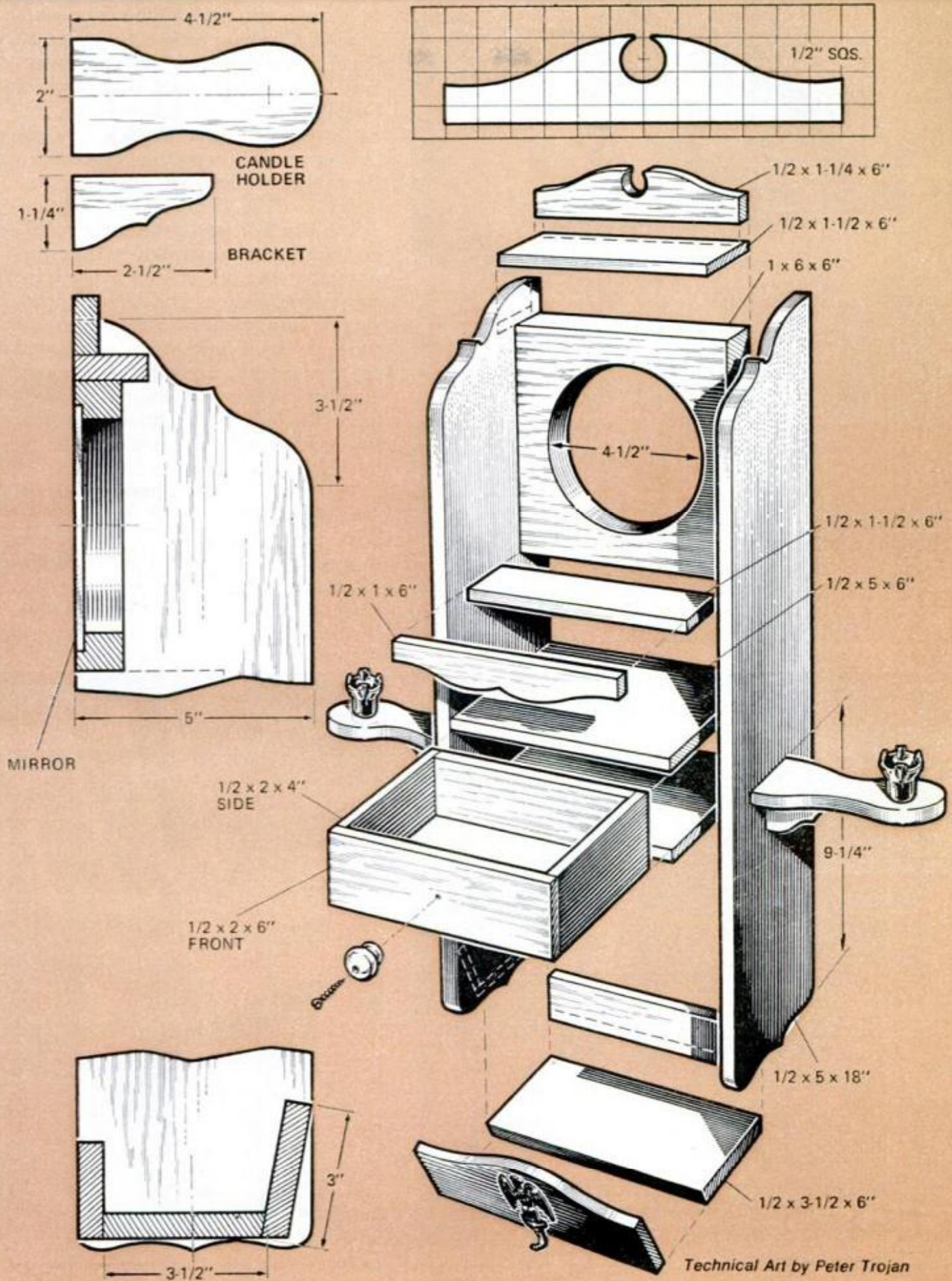


MIRROR CUTOUT in rear panel is made with circle cutter chucked in drill press or with a sabre saw
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BRACKETS for candleholders are glued and clamped to side panels. Drawer is the last construction step
POPULAR MECHANICS

can make in a weekend

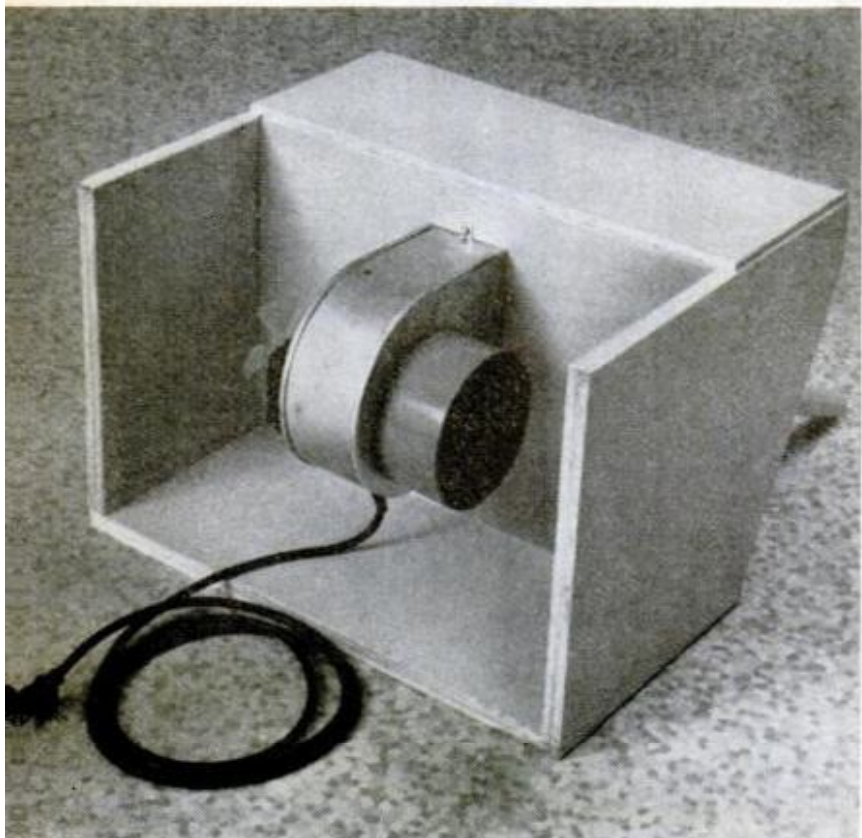


Mitten-and-boot dryer with blower

HERE'S A PROJECT that's certain to bring a smile to Mom's face, particularly during these winter months when snow-covered youngsters return from an outdoor play-session. Soaked mittens and boots can immediately be "hung" to dry, and the blower speeds up the process so they're ready for use again in short order.

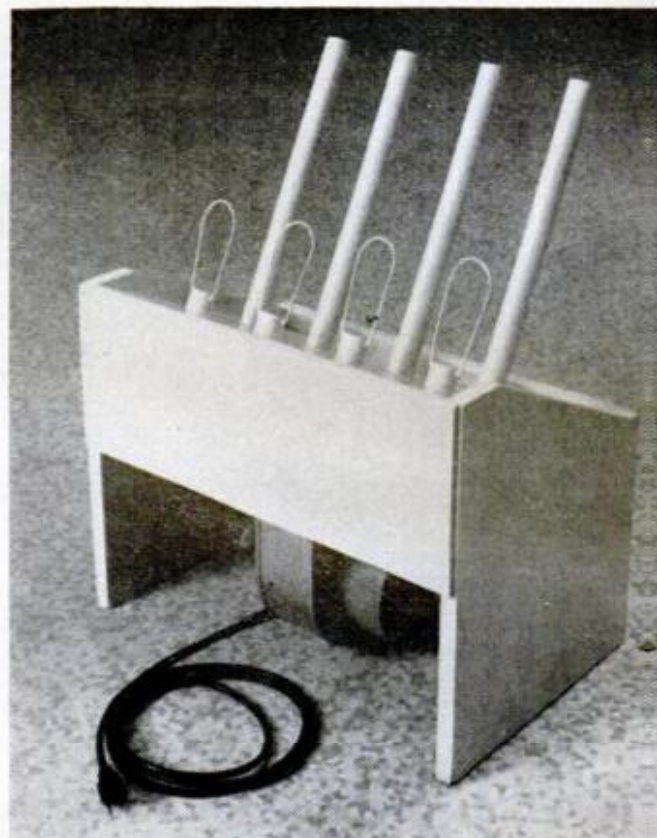
The dryer is built around a wooden box that is separated with a plenum chamber on top and a space for the blower below. The blower pressurizes the plenum and forces air through the tubes. A ledge around the top catches any drops of water. Hang the apparel as shown, particularly the boots. It's important that the conduit ends are not covered by the boot bottoms.

The blower shown here was from a used machine, but if you have to buy one and can't get it locally, one source that I know of is Burstein-Applegate, 3199 Mercier St., Kansas City, Mo. The model is No. 41A4003. Write for price.—R. S. Hedin



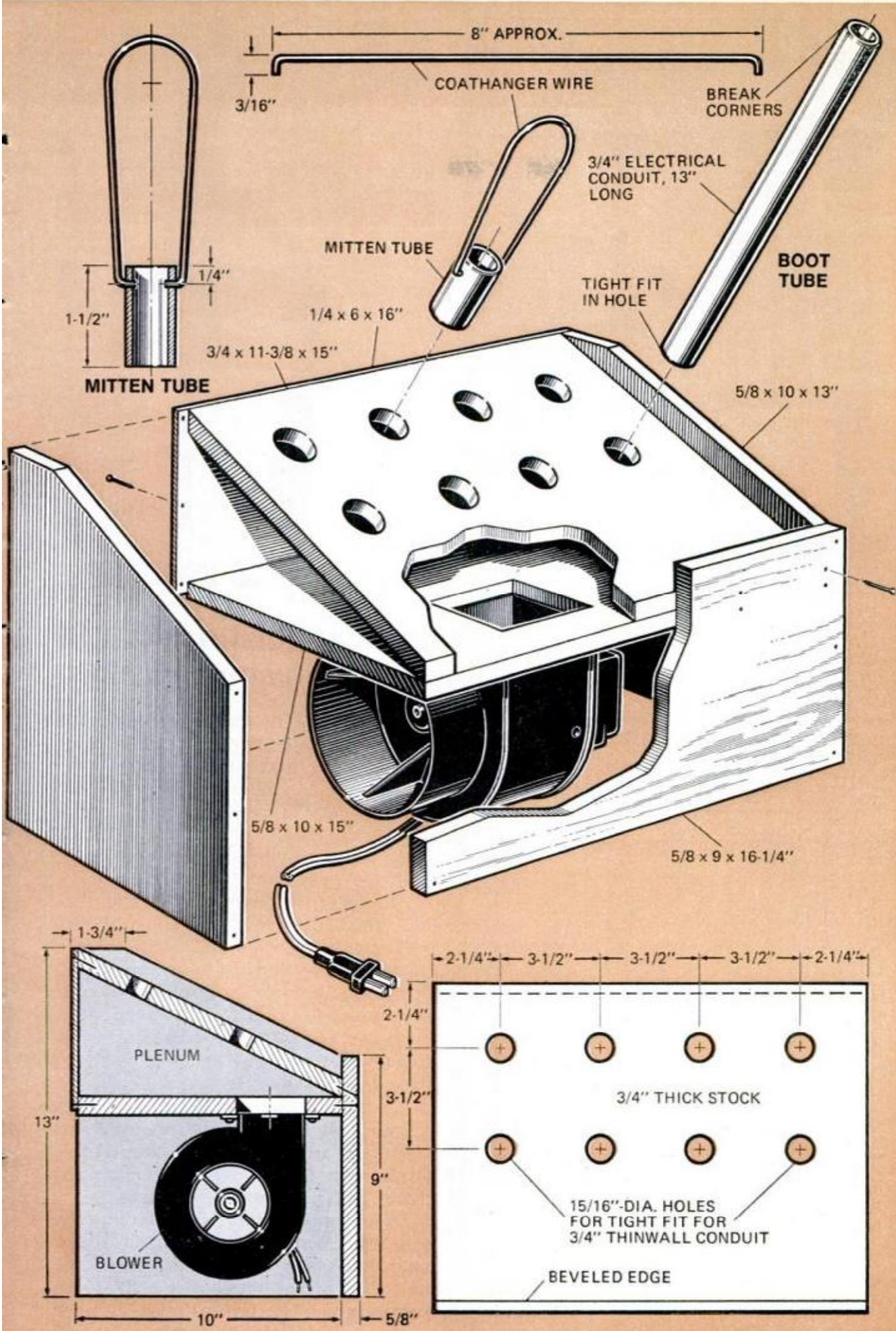
COMPLETED RACK holds two pairs each of mittens and boots. View of the bottom illustrates how the blower is attached

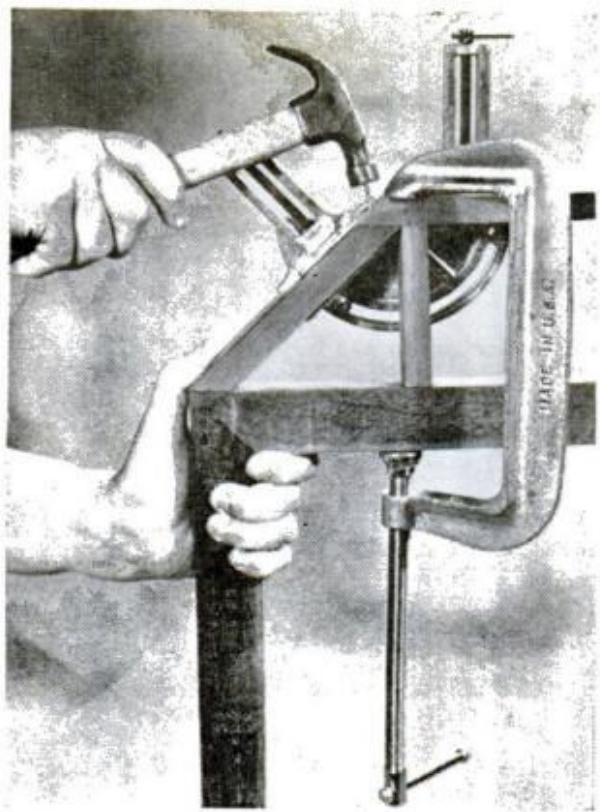
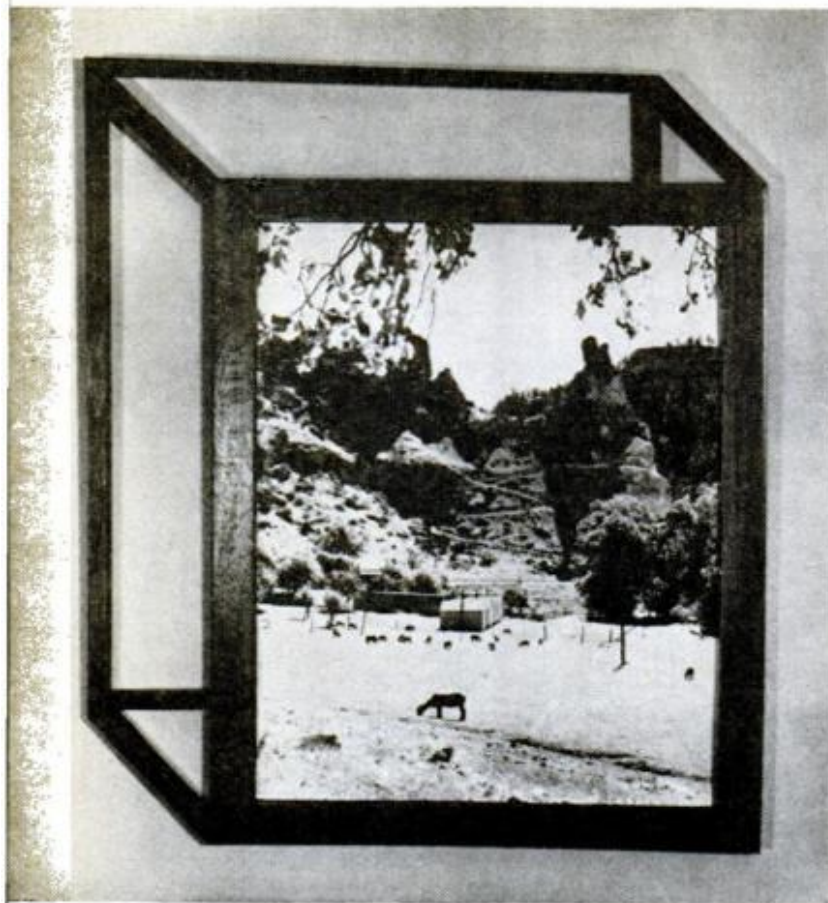
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CADDY utilizes wire for mittens, conduit for boots. Unit can be sized to suit your family

POPULAR MECHANICS





FRAME CLAMP, sold at hardware stores, makes it easy for you to align and join the pieces

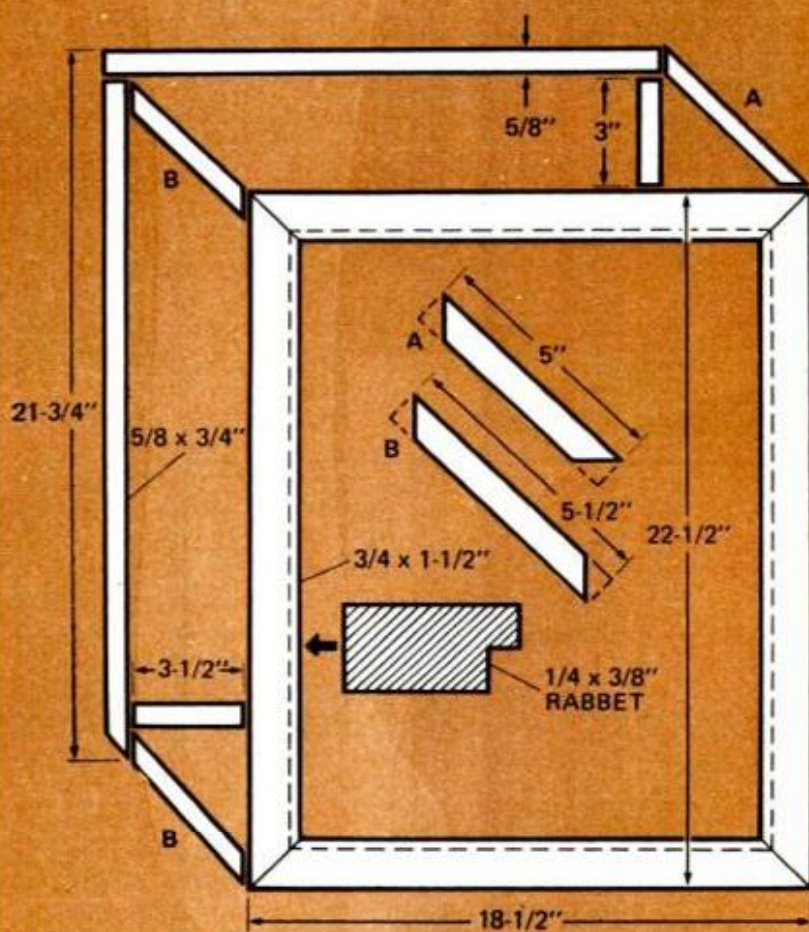
Optical-illusion picture frame

BECAUSE OF its apparent depth, this frame gives a picture a three-dimensional appearance—even though the frame lies flat against the wall. The frame is easy to make, and in all probability the small amount of materials needed can be ripped from scrap stock that you have lying about the shop.

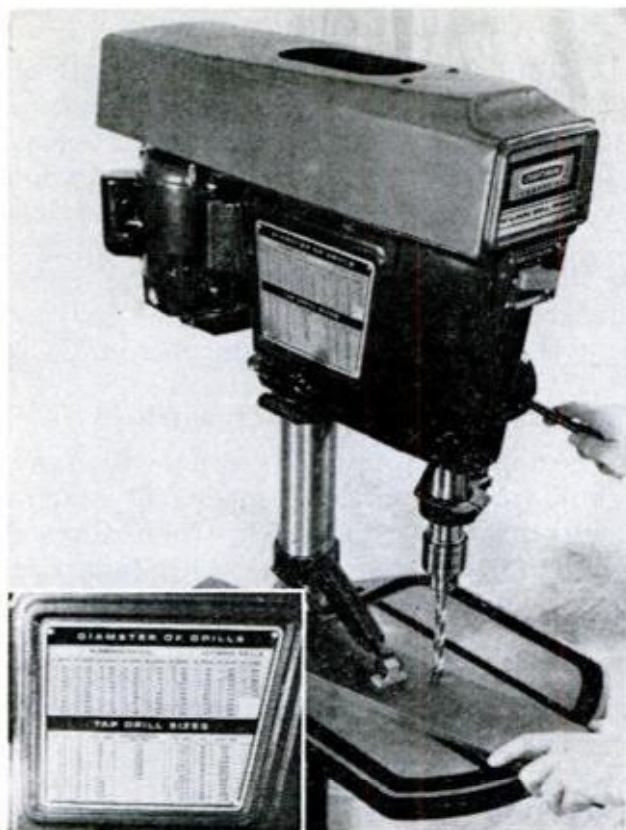
All of the members are cut from $\frac{3}{4}$ -in. stock. The main frame is $1\frac{1}{2}$ in. wide while the "boxing" strips are $\frac{5}{8}$ in. wide. The dimensions given in the drawing at left are for a frame that will accommodate a 16x20-in. picture. Size, of course, can be increased or decreased to suit the picture that you want to hang.

The small picture-frame clamp shown above makes assembling the mitered corners a snap. Most hardware stores stock such clamps. The one shown is made by The Stanley Works.

To assemble, start by fastening the short slant strips to the main frame and then add the boxing strips. The two thin pieces go in last; these are simply glued in. Use a finish of your choice.—*Elma and Willard Waltner*



New tools you should know about



LATEST METAL-WORKING DRILL PRESS offered by Sears features handy drill-bit chart (see inset photo) and quick-reference, spindle-speed chart for selecting speed to suit the material. Model 2463 (commercial) has $\frac{5}{8}$ -in. drilling capacity for cast iron and $\frac{1}{2}$ -in. for steel. About \$240.



PROTECT YOUR TOOLS and other possessions by engraving your initials with a Diamond Marking Pen. This unique tool can be used to etch metal, glass, ceramics, plastics and the like, also for artistic engraving on stemware, vases and ashtrays. The \$5.40 price includes postage and handling. J. W. Holst, Inc., Dept. PM, 1005 East Bay St., East Tawas, Mich. 48730, offers it.

JANUARY 1972



PLIERS/SHEARS, CUTTER/NIPPER combination, 8 in. long, is made of hardened and tempered tool steel (Rockwell hardness "C-56"). Insulated for 10,000 v., the imported tool sells for \$3.95. E. J. Co., Dept. PM, 704 South Fifth Ave., Mount Vernon, N.Y. 10550.



TWO HAMMERS to complete your toolbox are the chipping hammer (\$6) for stone, cement and rock, and heavy-duty framing hammer, \$8. Each has molded nylon grip, forged one-piece construction. At hardware stores. Estwing Manufacturing Co., Rockford, Ill. 61101.



PERFORATED-HARDBOARD HANGERS hold tools and shop supplies within easy reach over your workbench. Designed for use on $\frac{1}{8}$ -in. hardboard, plastic Handy Hangers come in six-piece kit (five shown), \$3.50. Wickliffe Industries, Wickliffe, Ohio 44092.

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HINTS FROM READERS

Cotter pins pinch-hit for hinges

Four or more cotter pins and a length of wire to pass through their eyes will make a serviceable hinge for simple lids on boxes. Pins are driven tightly into predrilled pilot holes, and positioned so their eyes overlap like the knuckles of a regular hinge. Ends of the wire hinge pin are bent at right angles to lock it in place.

—Walter E. Burton, Akron, Ohio

Pliers adapted for punch work

Needing a hand punch stronger than my regular paper punch, I made an attachment that does the trick when slipped over the jaw of my Vise Grip pliers. I sharpened the end of a hollow rivet with a rosehead countersink and inserted it through a metal clip. I placed a pad of sheet lead over the opposite jaw to protect the rivet.—Peter Legon, Malden, Mass.

Leverage from washer 'screwdriver'

Mechanics often make pocket or key-chain screwdrivers from large washers by filling the edges to leave stub blades that fit the screw slots. However, they usually file the stub blade in the center of the washer. A better way is to offset the blades as indicated for greater leverage when you turn the screw. A tool-steel washer is best.—B. W. Ervin, Kent, Ohio

Modification speeds wrench action

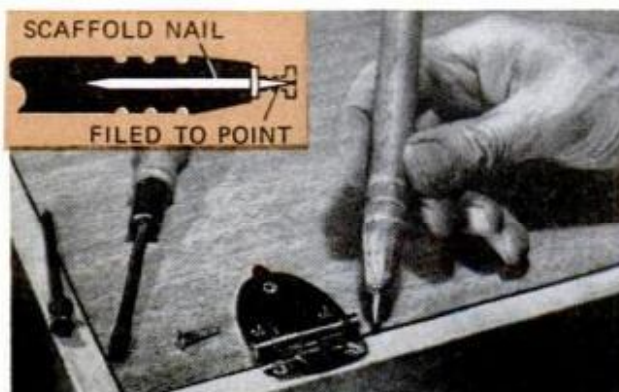
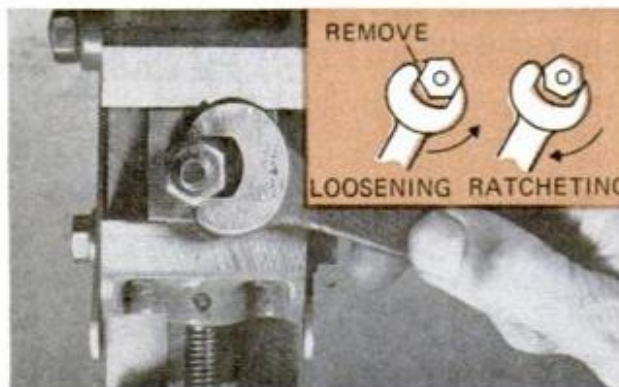
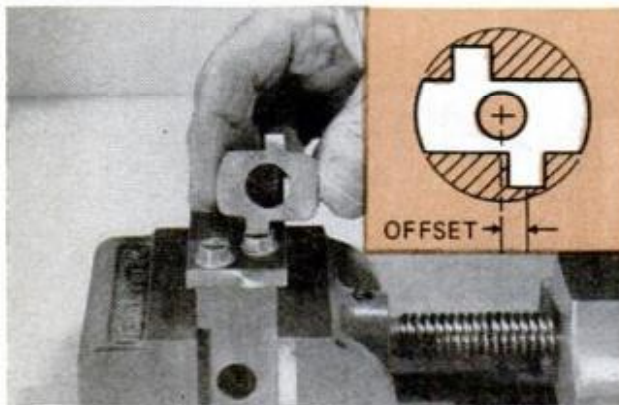
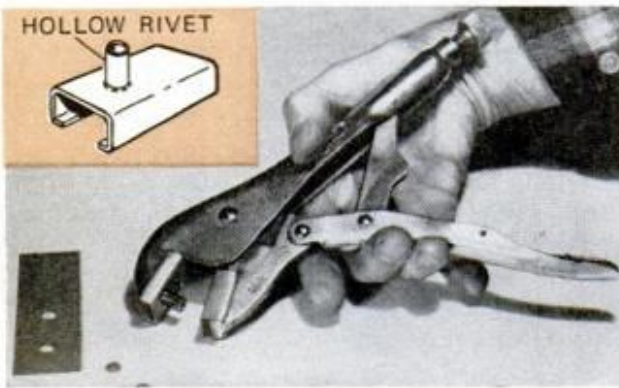
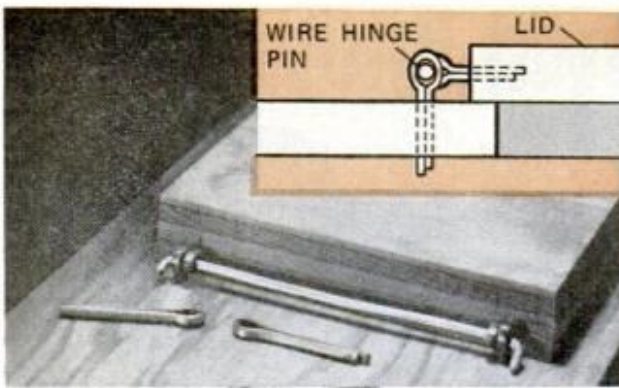
To provide a "ratcheting" movement to an open-end wrench, all you need do is grind off and round one jaw as shown. This lets the wrench slip over corners of the nut until the continued swing of the wrench causes the jaw to grip succeeding flats on the nut as it is tightened. For a loosening action, the wrench is flopped.

—H. Miller, Vallejo, Calif.

Pilot-hole 'awl' for small screws

While drilling makes the best pilot hole for a wood screw in hardwood, screws hold better in softwood when the fibers are merely forced aside. One of the best homemade tools for this can be made from a double-headed scaffold nail; the second head prevents the point from going too deep. The first head is filed to a point.

—Thomas E. Louis, Dobbs Ferry, N.Y.



**Get away from the crowd.
Get the flavor you want in
Old Gold Filters.**



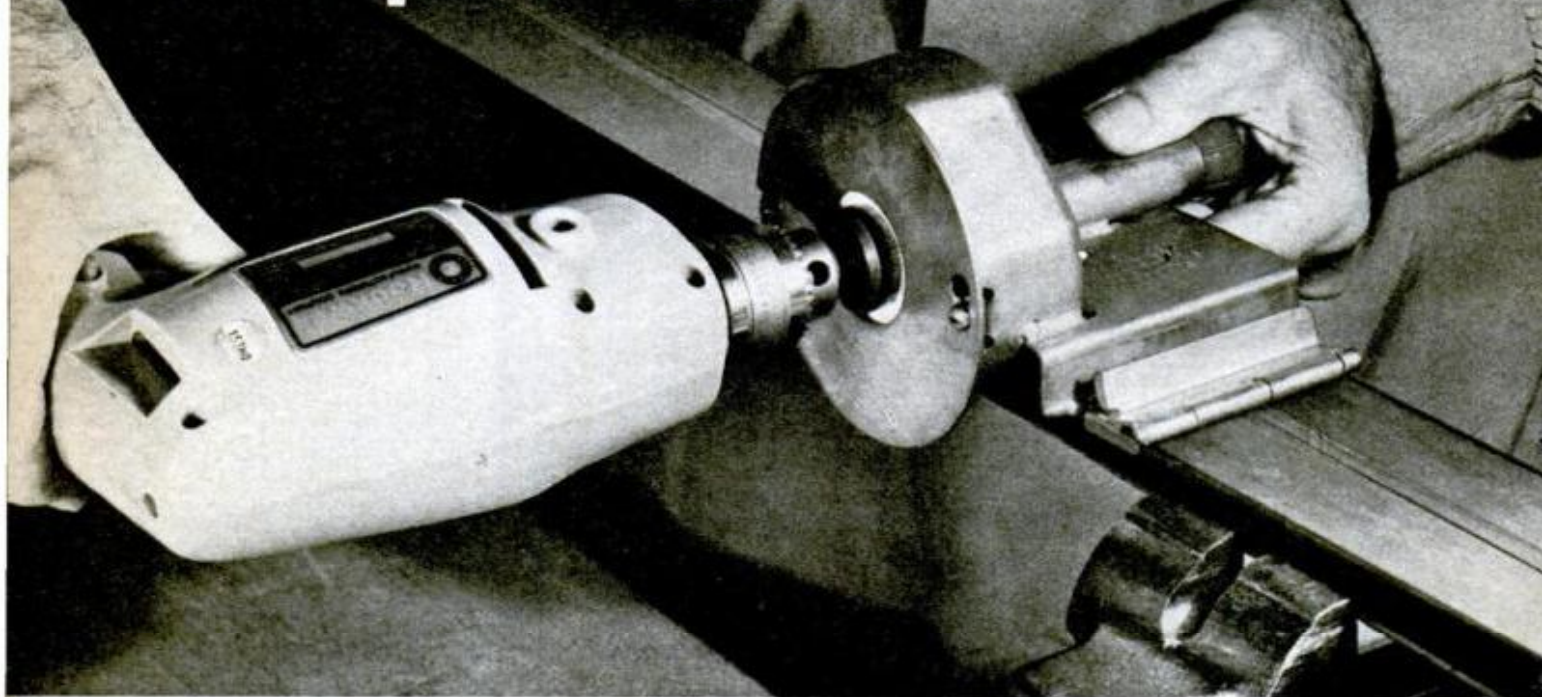
Warning: The Surgeon General Has
Determined That Cigarette Smoking
Is Dangerous to Your Health



20 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Aug. '71

© 1971 Lorillard

This drill attachment sharpens skis



By **WALTER E. BURTON**

Photos by the Author

SKIERS HAVE FOUND that sharp edges along ski bottoms contribute to performance and safety. Such edges help provide holding power on hard-packed snow and are particularly effective in turns. Ski experts explain that, ideally, steel ski edges (which came into use around 1940) should be a sharp 90°, with bottom surfaces in the same plane as the ski bottom.

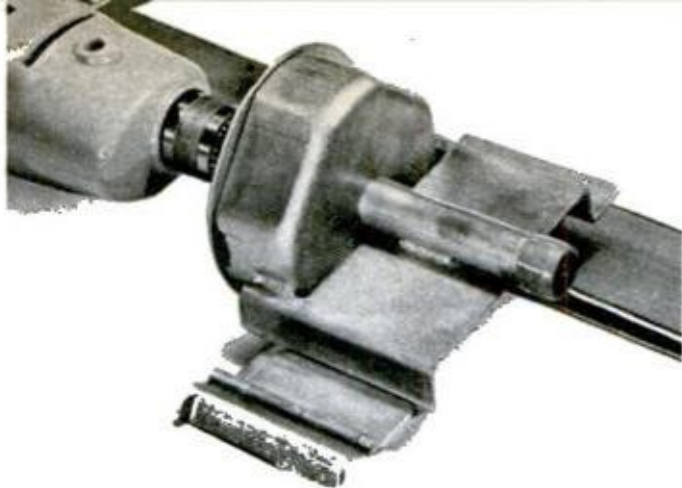
Until now, the file was the usual sharpening tool for the average ski owner or small shop—although considerable care is required to obtain uniform results.

Recently L.J. (Bill) Schell designed a compact portable grinder intended to put sharp edges on skis in minutes. Schell, an engineer with 30 years' skiing experience, reasoned that haphazard methods of sharpening skis were no longer adequate. Hand filing required great pressure, usually resulting in removal of excessive material. Belt sanding had similar problems. If \$30 ice skates were ground regularly for best results, he said, why not devise a method for correctly grinding skis, which are much more expensive?

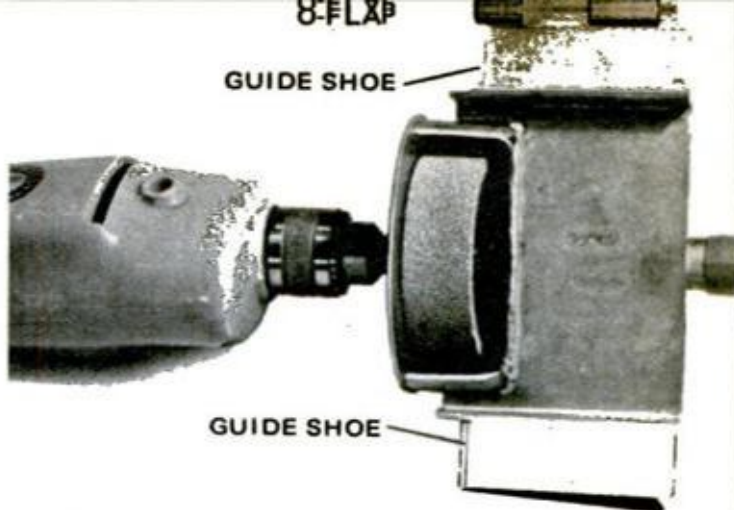
The grinder, called a SharpenEdge, is driven by a ¼-in. portable electric drill and applied while the ski is clamped in a vise. Preferably, ski ends are supported by blocks for added rigidity. The grinder has a specially designed abrasive wheel mounted on a lubricated shaft which has limited endwise movement. The grinder housing is placed on the ski bottom, with guide shoes engaging the edge to be ground. The drill, its chuck clamped to the outer end of the shaft, is started, and pressed toward the ski until the wheel, as a result of shaft endwise movement, contacts the ski edge. Then the sharpener is moved along the ski. Grit is wiped away before the operation is repeated on the other edge.

If necessary, several passes can be made along each edge, taking only light cuts each time. The sharpener manufacturer says that the leading 6 inches and the trailing 3 inches of each ski edge *should not be sharpened*. Ski edges are not precisely straight, but bow inward slightly along the ski's center portion.

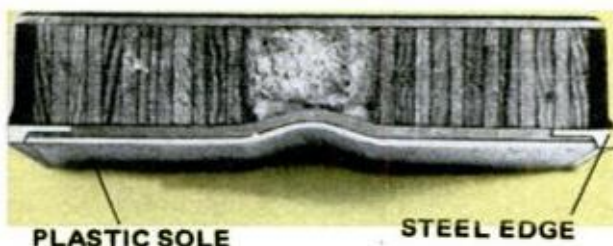
At one end of the sharpener housing is



PERMANENTLY LUBRICATED SHAFT in cylindrical housing moves against spring to feed wheel against work



BOTTOM VIEW of sharpener shows hinged O-flap which is used when wheel rides over obstructions



CROSS SECTION of modern ski reveals steel edge strips at lower corners. These are edges that sharpener restores

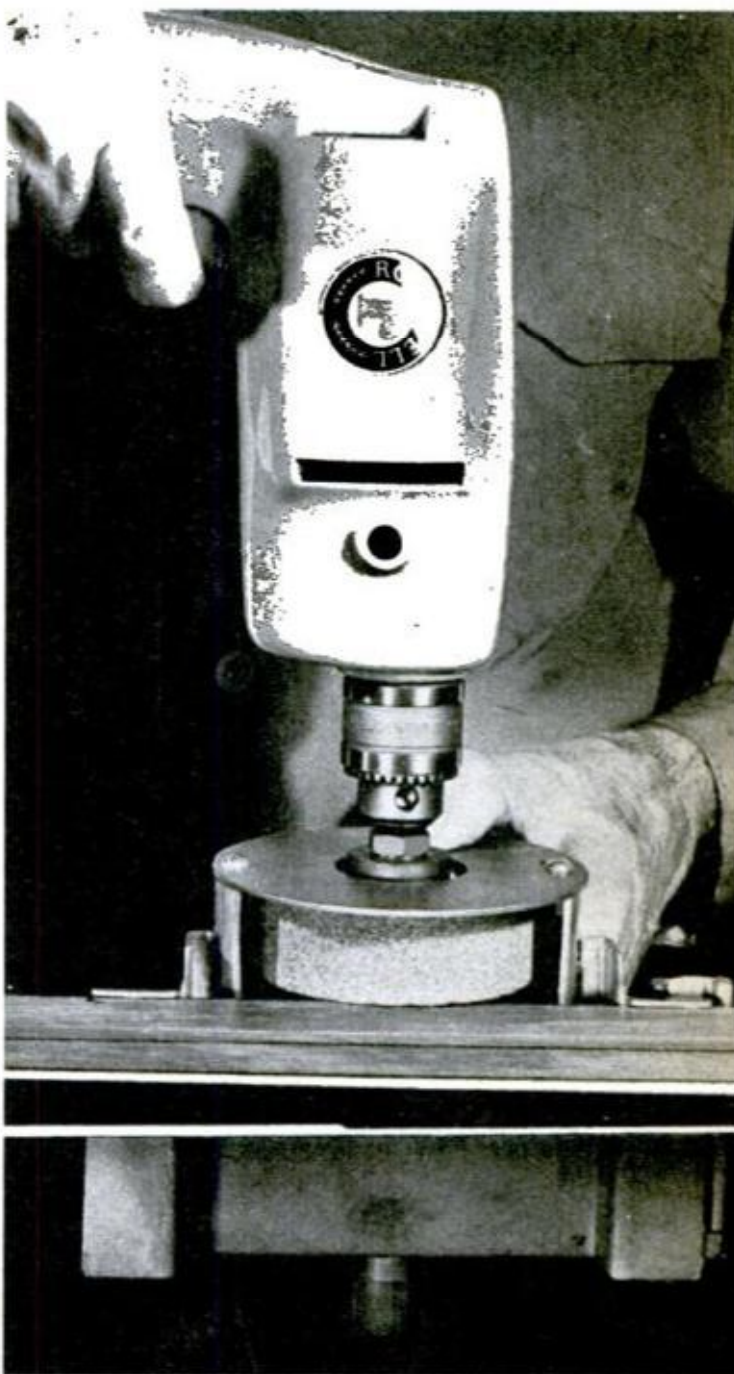
a hinged "O-flap" which, when folded under the grinder base, lifts it so the wheel can pass over obstructions such as cable bindings. When the obstruction has been passed, the O-flap is swung back out of the way. When something (such as a screwhead) is encountered that the O-flap will not assist in clearing, the sharpener is carefully lifted by hand and held up until the wheel passes it.

When the ski is very dull, or when the plastic sole has worn beyond the steel edges, the grinder can be positioned as in the lower right-hand photo to dress the bottoms of the edge strips. Then the sides of the strips can be ground.

The SharpenEdge may have other potential shop uses, such as smoothing edges of metal plates, dressing long cutting blades and smoothing structural sections. To grind uniformly to the ends of a bar or plate, it might be feasible to attach temporary extensions to serve as tracks for the guide shoes.

SharpenEdge is marketed by Schell Ski Equipment Co., 1115 E. 152nd St., Cleveland, Ohio 44110. Price of Model WS-10 (illustrated) is \$19.95. ★★★

JANUARY 1972



SHARPENER can be positioned in the above manner to dress down a steel edge strip sufficiently so that it will be flush with the plastic ski sole

HINTS FROM READERS



Capscrew rotary file

A knurled socket-head capscrew chucked in a drill press or portable drill can be used to deburr and knock sharp edges from soft metal and nonmetal items. Here, one is enlarging a hole in sheet aluminum.—*W. B. May, Oak Park, Ill.*

No nicks from cutter head

A broken section of a cutter head on a rotary electric razor can cause painful scratches and cuts on your face. You can solve the problem by applying a small piece of vinyl electrician's tape to cover the damaged portion of the head. The tape will not impair cutter action, yet offers positive protection from the rough metal.

—*Fred Sanford, Reston, Va.*



Repairing handsaw handles

When I broke the handle on one of my handsaws recently, I wasn't exactly excited about replacing it with one of the newer, less comfortable types. So, I applied contact cement and yellow plastic laminate to both sides of the split handle. After trimming all the edges, the handle is as comfortable as ever and the saw is easy to spot on the job.

—*Joseph Zebrowski, Port Charlotte, Fla.*



Clamp 'muzzles' bit bite

An unprotected tool bit can give a lathe operator a nip if it's left exposed while he changes a chuck or makes some other adjustment. A simple protective measure I use is to snap on a magnetic clamp—like the one shown at left—over its tip. Any clamp can be used but the magnetized kind simplifies parking the clamp on lathe when it's not needed.

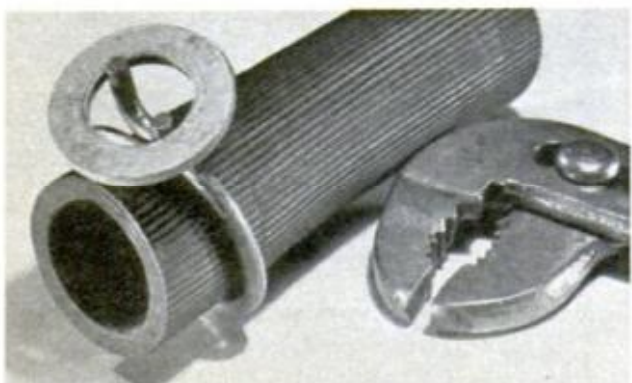
—*B. W. Ervin, Kent, Ohio*



Easier way to clamp radiator hose

A while ago, *PM* published a hint for putting ring clamps on radiator hoses. Though the idea was perfectly valid, I think my method is easier. Simply put the clamp partly in a vise and squeeze the ends together with a thin pliers. Then slip-on an appropriate-size washer over the ends to hold them. After inserting the hose, just remove the washer.

—*Harold A. Miller, Ridley Park, Pa.*





Prepare for a surprise when you first drive a Ford pickup—it rides more like a car than a truck. Steering is precise, almost effortless. Turns are sharp, with little lean or sideways. Hardly any nosedive when braking. Man-size room for head, legs and shoulders. And noise is something you left outside.

The reason for Ford's great ride lies in Ford's better ideas. Ideas like Ford's unique Twin-I-Beam front suspension with big coil springs and two front axles that operate independently to step over bumps and cushion the ride. Or, with heavy-duty springs, an exclusive rear suspension that automatically adjusts to light or heavy loads to keep the ride smooth.

And Fords have the toughness to stand up under big loads, too. Maybe that's why 92 out of every 100 Ford trucks sold in the past 12 years are still on the job. See your Ford Dealer for a fully detailed catalog. Better still, test-drive a Ford pickup. There's a nice surprise in every one.



Works like a truck

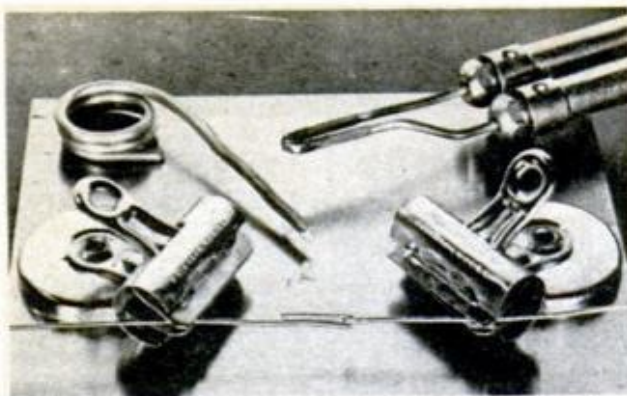
Rides like a car



FORD PICKUPS



A better idea for safety: Buckle up.



HINTS FROM READERS

Magnetic clips hold shopwork

Two or more magnetic spring-type paper clips and a steel plate can be as useful as an extra pair of hands in the shop. The magnets adhere firmly to the steel plate, yet can be shifted around to position the attached clips for holding wires to be soldered, small parts for gluing or tiny items to be painted.

—B. W. Ervin, Kent, Ohio



Squeeze bottle handy for water

An empty plastic spray bottle used for deodorant provides a handy way to carry a small amount of water in a toolbox. Water is often needed to thin brazing flux, moisten an abrasive stone for sharpening a tool or for other on-job uses. Bottle shown has a screw cap covering a spout that I cut off a bit to get a less-scattered squirt.—Jerome Hatfield, Chicago



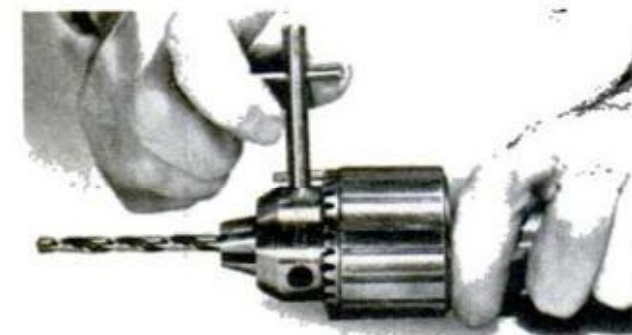
Pipe stand supports drill

If you have an electric drill of the type having a screw-in auxiliary handle, a short pipe nipple and a flange will let you use it as a bench polishing head. The thread of the nipple matches that on the handle, and when the flange is screwed to your benchtop and the nipple turned into the drill, you have a dandy drill stand.—Wilfred Beaver, St. Anne, Ill.



Using sabre blade as small handsaw

A tungsten-carbide blade, primarily made for use in a sabre saw, can be extra handy when fitted with a detachable handle and used as a small handsaw. Made by Remington Arms Co., Inc., Bridgeport, Conn. 06602, these carbide-coated blades cut like a diamond and will saw through such hard-to-cut materials as glass, ceramics, transite, even hardened steel.



Emergency chuck key

When a geared drill-chuck key is lost, an emergency one can be made from a rod that fits the keyholes snugly, and a couple of 1/8-in.-dia. nails. A short piece of nail is driven tightly into a cross hole so the tips will engage the teeth on the chuck shell. A longer piece at the opposite end acts as a handle.

—Walter E. Burton, Akron, Ohio

On his last hunt, Major Hocum smoked a cigarette stamped with his family crest.

Now everybody will be smoking cigarettes stamped with their own family crest

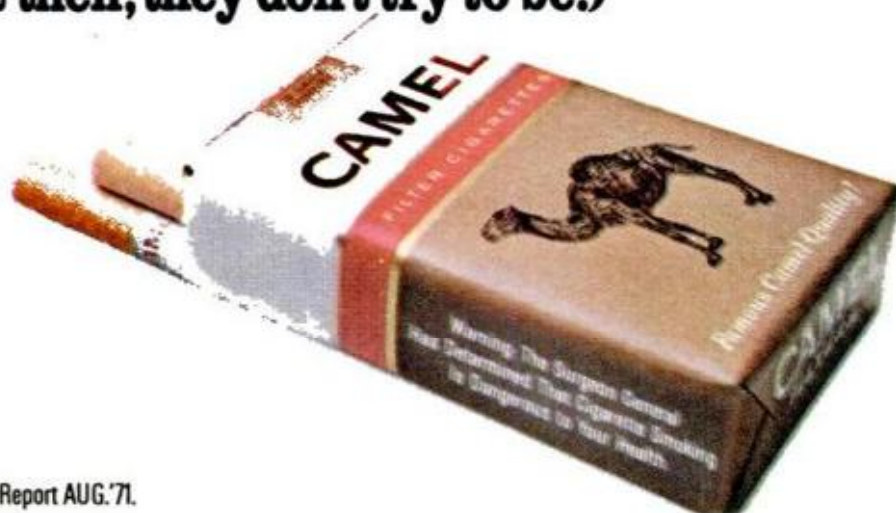


...almost everybody.



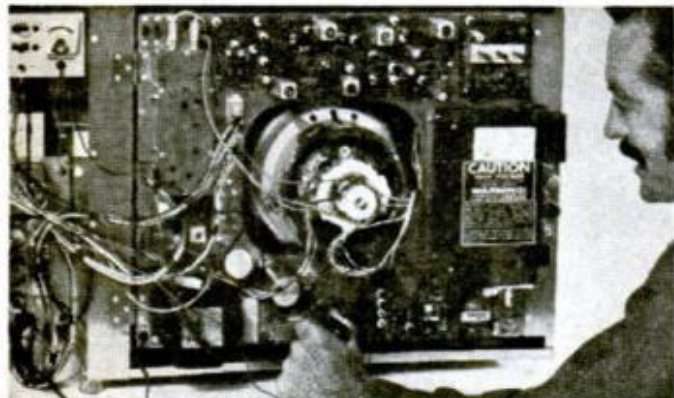
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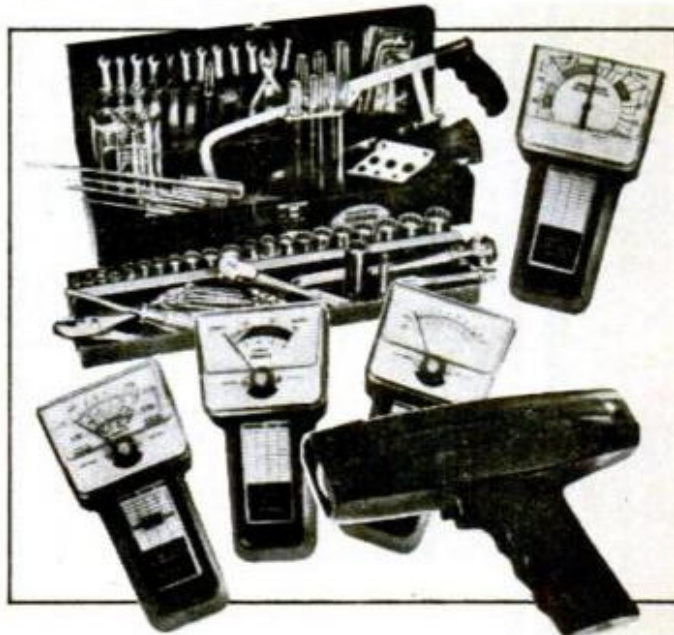
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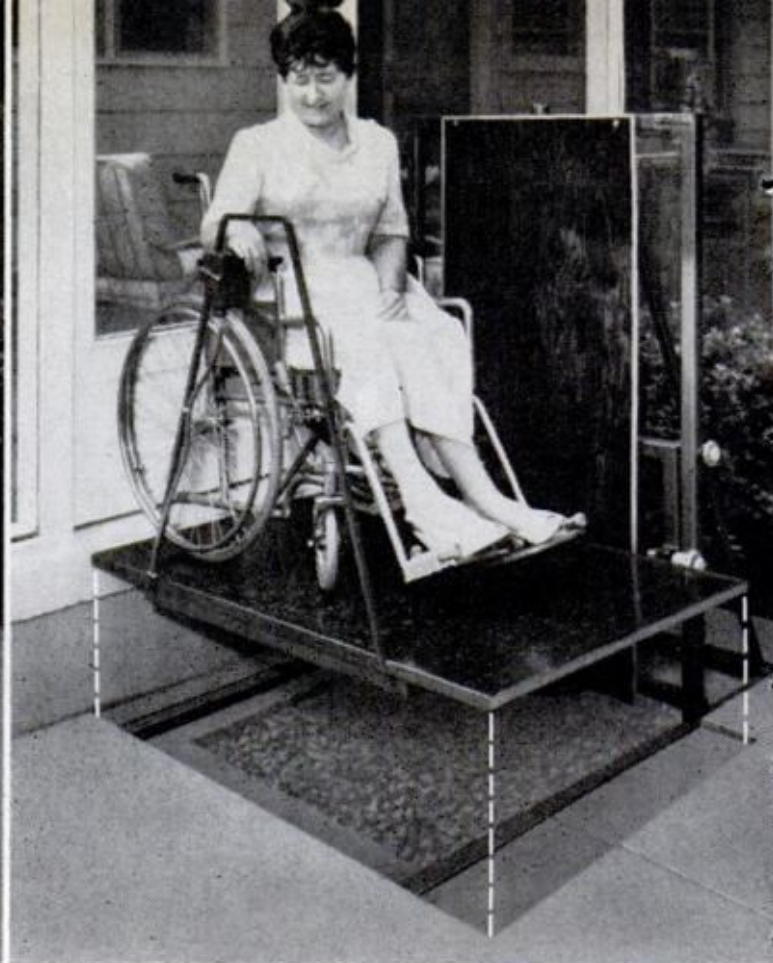
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Photos by Robert D. Borst

Now: an 'instant' outdoor elevator

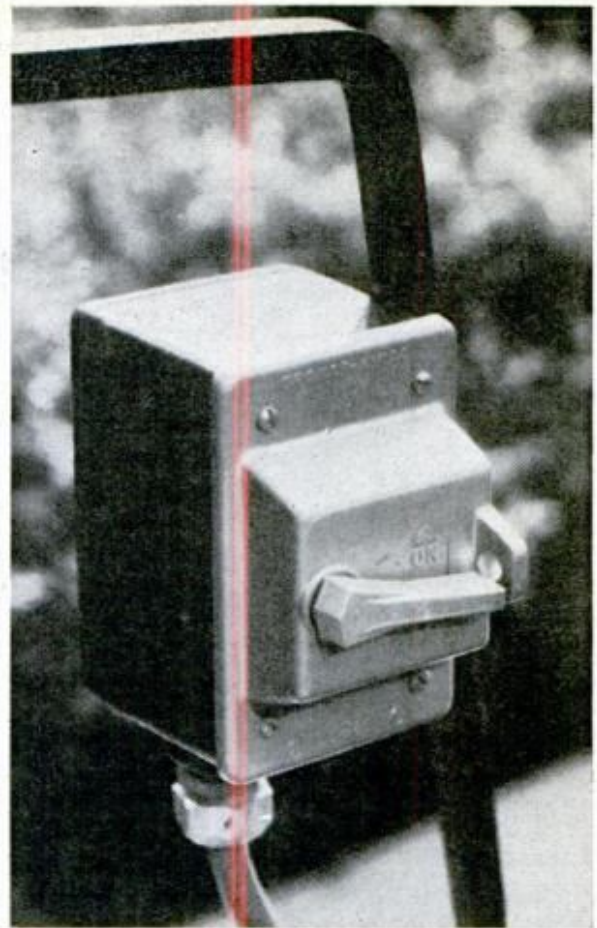
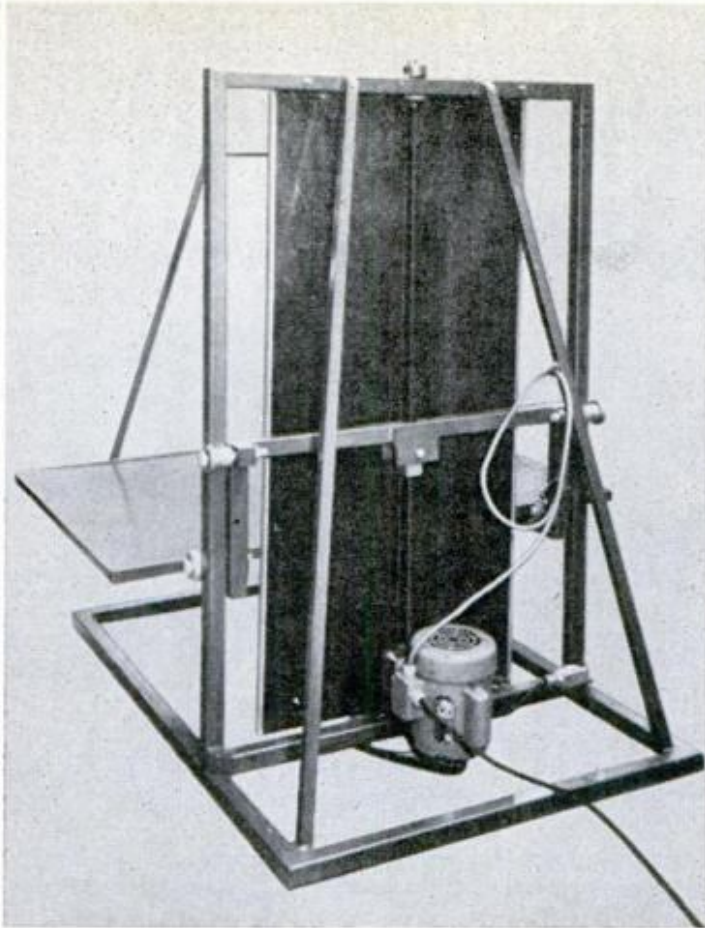
FOR MANY WHEELCHAIR USERS the separation from easy access to the outdoors can be measured in a few feet or, perhaps, in inches. But—without help—those few inches can stop the chairborne as effectively as the sheer wall of a chasm.

The usual solution for bridging the obstacle of a few steps at a front or rear door is a ramp. But the recommended pitch-graduates call for one running foot of ramp for each inch of rise. In other words, to install a ramp to a door or porch that is 45 in. above grade, the ramp would have to be 45 ft. long.

This amount of room is usually not available; thus, the idea is impractical. Additionally, in wet and snowy weather, a ramp can be hazardous for both the user and the person doing the pushing.

John Toce, of Broussard, La., a wheelchair user, has developed a simple, foolproof wheelchair elevator called a Wheel-O-Vator that's ready for use upon delivery. When it's set on level ground alongside a porch or door opening you need only plug it into a 110-v. outlet.

A weatherproof $\frac{1}{3}$ -hp electric motor operates a ball-bearing, screw-lift mechanism through a V-belt drive. The screw-lift is equipped with a friction brake that prevents coasting. A simple



WHAT YOU SEE IS WHAT YOU GET. Elevator framework (left) is exposed to weather, was photographed that way for clarity. Operating switch (right) provides padlock hole so youngsters can't tamper with lift

up-down switch gives the user positive control. *The switch can be fitted with a padlock so that inquisitive youngsters cannot play with the elevator—with possible disastrous results.*

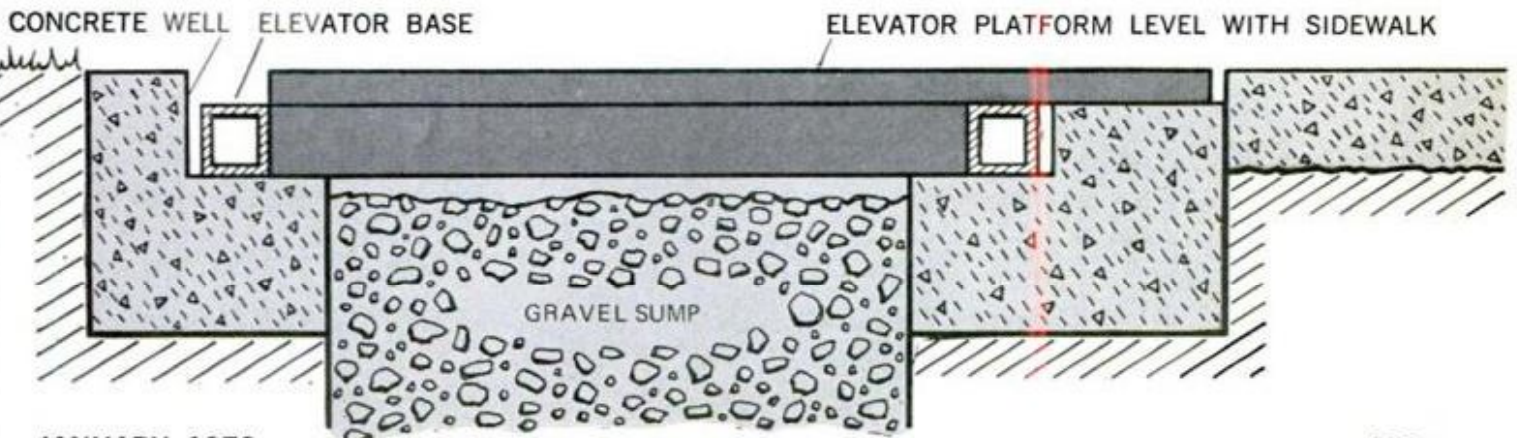
When the elevator is in the down position, the platform is 2 in. above ground level. This can be easily bridged with a raised (and pitched) flagstone, or the tubular frame can be recessed in a concrete base (see drawing below) so that it is flush with the sidewalk when down.

We've illustrated such an installation

and, to provide positive water runoff, we've added a drywell sump. The elevator can be used as is, but for extra weatherproofing in snow country, I plan to install a simple roof and louvered wall around the Wheel-O-Vator shown. That, of course, is a matter of personal taste—not a must.

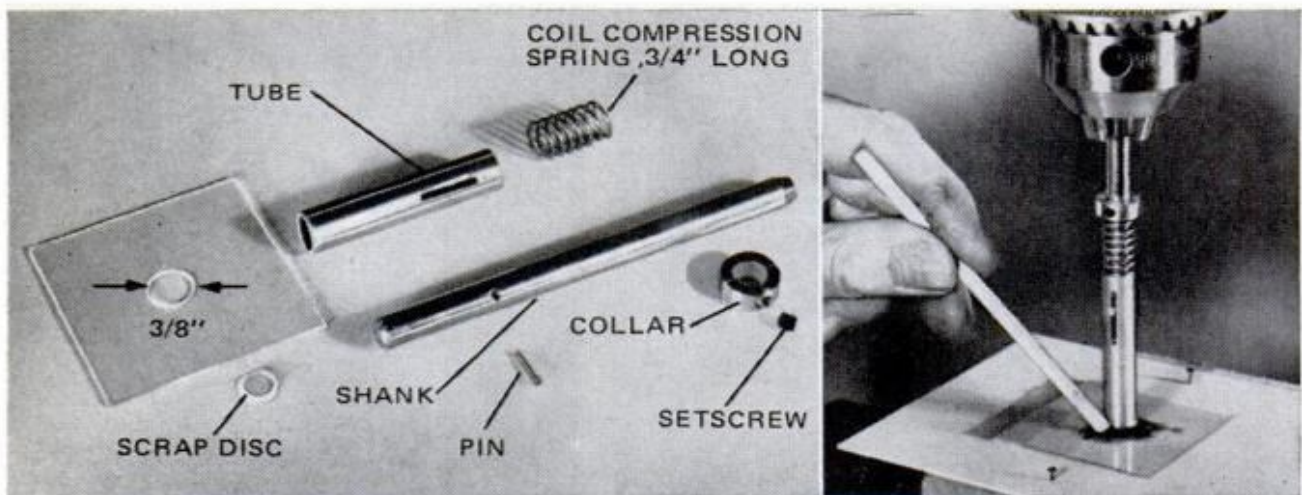
The Wheel-O-Vator is available in lifting heights of 3½, 5 and 6 ft. For information on price, write Wheelchair Elevator Co., Inc., Box 489, Broussard, La. 70518.—James M. Liston

SECTION OF SUBSTRUCTURE



A spring-cushioned 'bit' for drilling glass

By WALTER E. BURTON



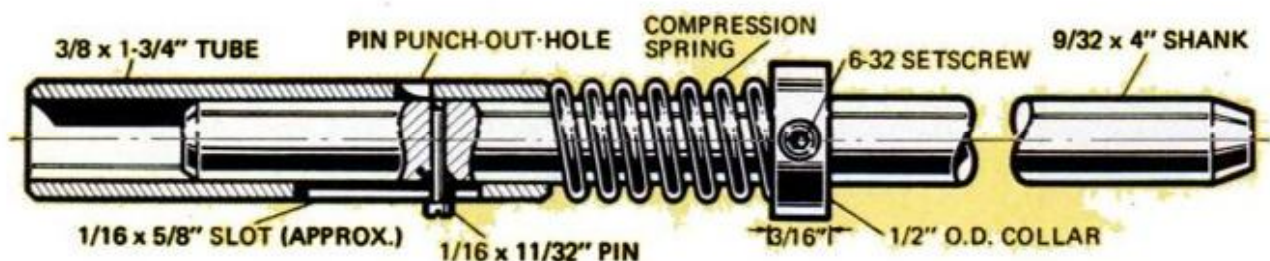
GLASS "BIT" is made from a piece of brass electrical-fixture tubing; No. 80 abrasive grit is the cutting agent. The shop-made tool at right is being used to drill a $\frac{3}{8}$ -in. hole in a color-slide cover glass

A COMMON WAY of making a hole in glass is to use a metal tube as the bit and No. 80 silicone carbide and aluminum oxide grains as the cutting agent. With this method, breakage is not uncommon because it's easy to jam the bit too forcefully against the glass.

To lessen such chance of breakage when using a drill press, I designed and made the spring-cushioned bit shown. Pressure maintained on the bit (by the coil-compression spring) can be regulated simply by moving the drill-press spindle up or down—from a "feather touch" to maximum pressure with the spring completely compressed. I found that the spring pressure could easily be set and maintained (by locking the spindle) for good cutting action of the abrasive grains.

The tube is held on the shank by the $\frac{1}{16}$ -in. crosspin which projects through a $\frac{1}{16} \times \frac{5}{8}$ -in. slot beginning about $\frac{3}{16}$ in.

from the spring-end of the tube. Diametrically opposite the slot is a hole through which a punch can be used, if necessary, to remove the pin. The collar is adjusted so that, with the spring in position and about to be compressed, the crosspin will be at the shank end of the slot. Glass, porcelain, or other material to be abrasive-drilled is positioned on a firm support, such as cardboard on a wooden block, on a drill-press table. Cutting agents mentioned above can be used, separately or mixed with enough water or turpentine to make a soupy mix. To drill, use a moderate speed and bring the tube squarely against the work with the abrasive heaped around it. Adjust pressure (more drill-press spindle up or down) until a satisfactory grinding action results. This can be judged by sound. As the cutting proceeds, some readjustment may be necessary. ★★★



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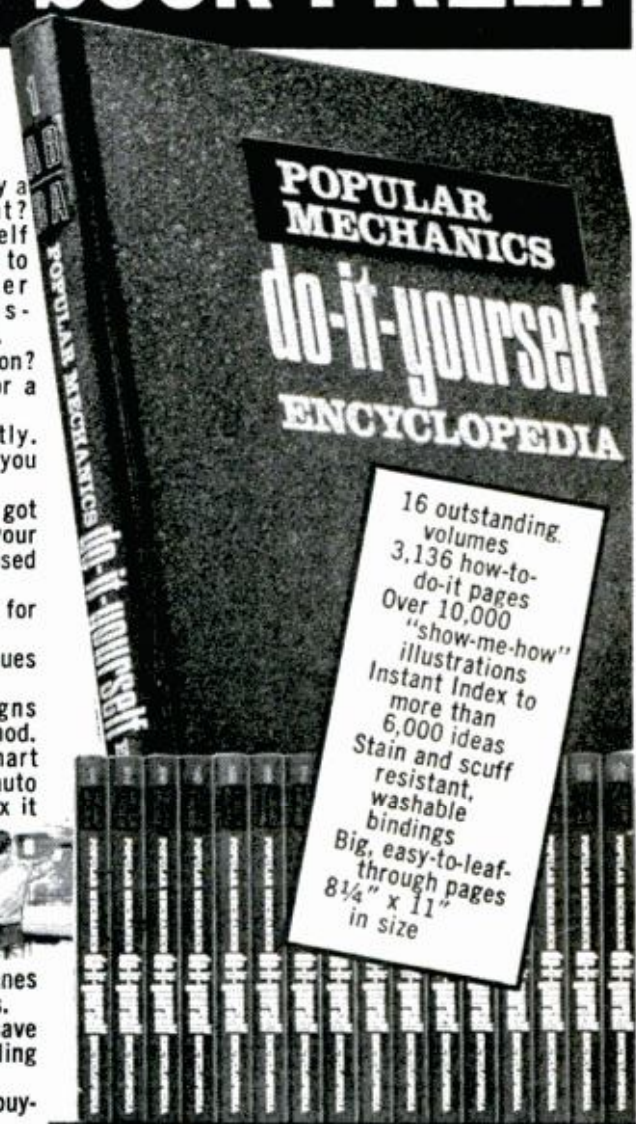
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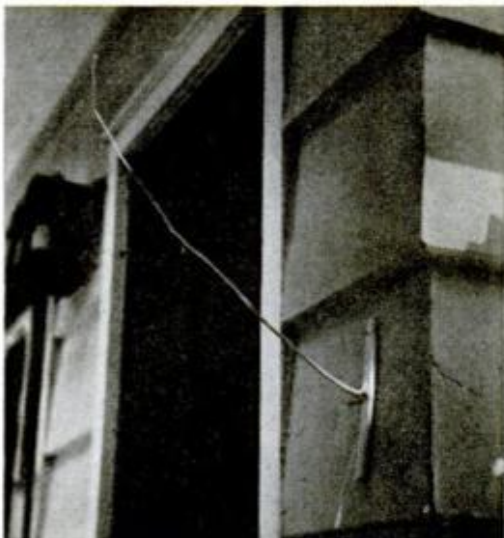
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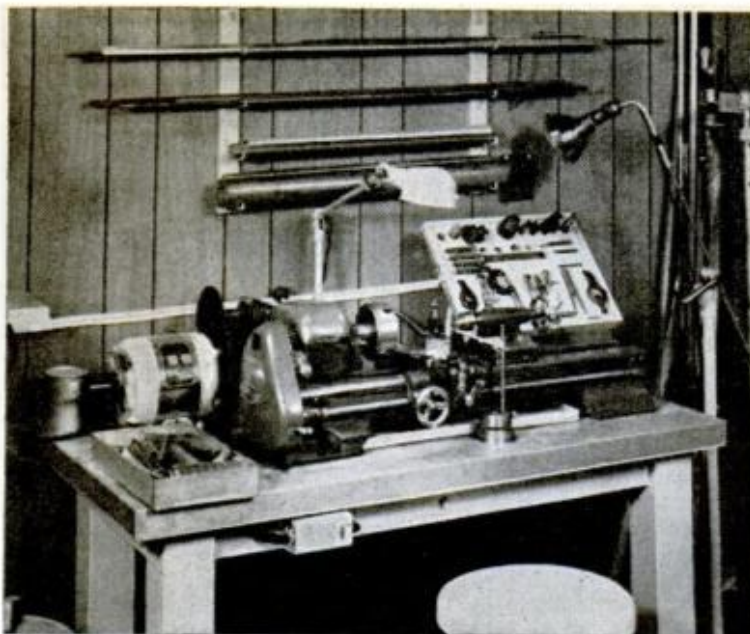
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GREAT WORKSHOPS

(Continued from page 57)



CROSBY whittled "weather stick" above from balsam fir and gave it to the author



METAL LATHE, not used as frequently as woodworking tools, is neatly tucked in corner. Owner-rigged wall lamp is at right

below, left, to fine living-room furniture, he has shown he is indeed a craftsman. Each handcrafted piece I saw—and I saw many—bore his stamp of careful, conscientious workmanship. He doesn't believe in, or take, short cuts, yet he is the first to admit that when some new tool or workshop product comes out he can't wait to get his hands on it.

Interestingly, the Crosbys make an annual trip to the Maine woods where Mel gathers balsam fir when he's out fishing. Out of the wood he cuts, he fashions what he likes to call "weather sticks." He gave me one (shown above installed on my home), and since it's been up, it has been more dependable than the nightly fore-

caster on television. I can't explain why, but as long as it's accurate, I won't question it.

Popular Mechanics is happy to include Mel Crosby's shop in its "Great Workshops" series. His shop and the two featured in previous issues (*Is This the World's Best Workshop?*, page 146, June '70 PM, and *A workshop Crammed With Ideas You Can Use*, page 138, June '71 PM) are the kind of shops we all dream about.

We have another dandy coming up in a few months, and we're looking for more. If you think yours is a winner, drop me a line at *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. If yours is a great shop, we'll publish it. ★★★



PROJECTS by Crosby include several from PM; needlework on stool is by Mrs. Crosby

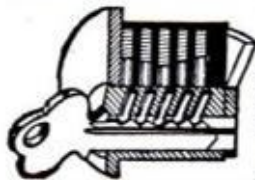


BEAUTIFULLY CRAFTED TOOLBOX stands on workbench, houses small delicate tools. Crosby's projects are just as well built

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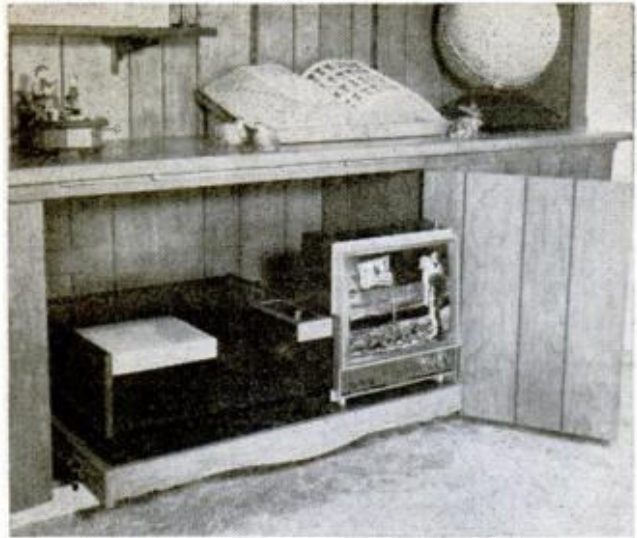
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TO MATCH PANELING, author used a glaze stain to finish desk. If preferred, you could use a laminate



FOR EASY ACCESS, all equipment is on sliding trays. Glazing bright metal parts made them "disappear"

BUILT-IN LEARNING CENTER

(Continued from page 125)

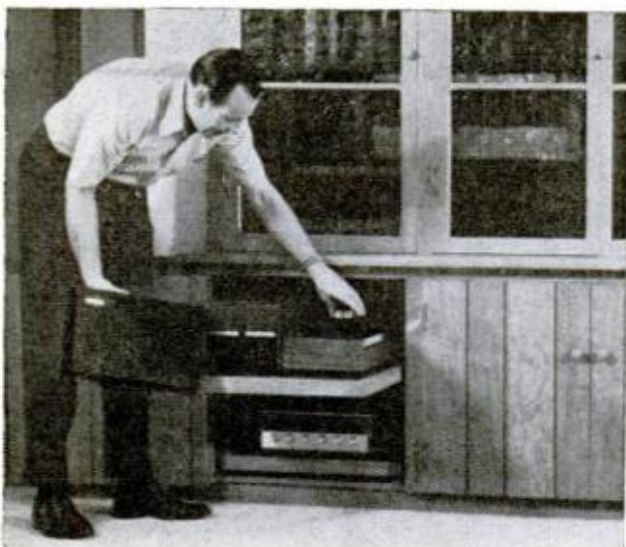
a level to make sure all the 2x2s are plumb.

When finished, the lower cabinet is deep enough to hold most 18-in. color television sets.

Saw the plywood end pieces to size. Nail and glue cleats and shims on each end. Again, verify the height of the equipment you will use and change location of the shims if required. To be sure the ends are plumb, test with a level. Fasten ends in place with panel adhesive and 8d finishing nails. Use adhesive to install the paneling in the top and back of the upper section, then screw the slotted shelf standards through the paneling and into the 2x2s.

● *Lower cabinets.* Provide for a TV antenna jack and electrical outlets in the rear of the lower cabinet. Then glue that paneling into place. Fasten the TV plate.

Install a Plugmold strip using the in-



EQUIPMENT TRAYS and pullout writing surfaces were covered with Marlite's Leather for durability

structions packed with the hardware. Position the 6-ft. strip according to your expected need for outlets. For example, my typewriter filled the right cabinet, so only one outlet was needed there.

Cut and install the plywood base next. Apply birch tape to the front edge of the plywood base. In order for the doors to close properly, be sure the ends extend beyond the base a scant $\frac{1}{8}$ in. Make the counter by cutting the plywood to size and gluing to the particleboard with white glue. When it's dry, cut off the waste particleboard. Glue and dowel the $1\frac{1}{2} \times 6 \times 1\frac{1}{8}$ -in. end pieces. Fasten the $\frac{3}{4} \times 1\frac{1}{8}$ -in. strip to the front edge with plastic resin glue and 6d finishing nails. Counter-sink all nails. Curve the end pieces and front edge with a plane and smooth with 120-grit sandpaper.

Make the partitions next from two remnants of $\frac{3}{4}$ -in. plywood. Edge-glide two pieces and secure by gluing and nailing two cleats at the top. Also, nail and glue the shims for the metal sliding-drawer hardware and typewriter table. Mark and notch the rear edges of the partitions so they fit around the Plugmold strip. Cut these notches oversize so electrical plugs can be passed between cabinets.

Place the counter in its permanent position and level it. Square both partitions and mark their location on the underside of the counter and on the base. Bring the counter to your shop and invert it. Mark the location of the three pullouts. Nail and glue 1x2s that form the pullout pocket sides to the underside. Then nail and glue the six runners for the pullouts. Wipe off any excess glue inside the pockets so the pullouts will slide freely.

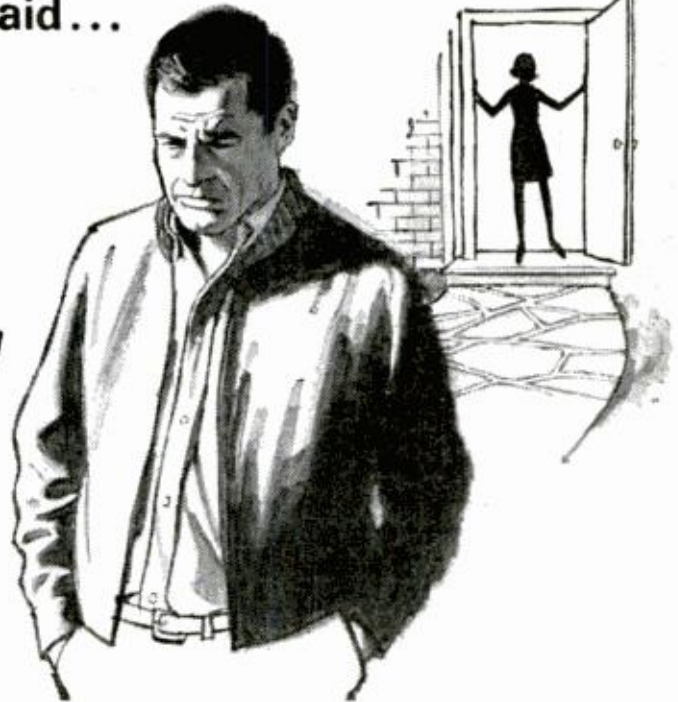
Install the typewriter hardware on the underside of the counter according to the

(Please turn to page 168)

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PM-61

BUILT-IN LEARNING CENTER

(Continued from page 164)

directions provided. Amerock's hardware has stops at typewriter and kitchen-counter heights. The overhang of this counter prevents the hardware from swinging to full height, but it will serve as a typewriter stand at the first stop.

Bore three 1-in. holes along the rear edge of the counter to pass electrical wires between the upper and lower sections. Give the counter a final sanding, put in position, check for level and fasten with glue and 8d finishing nails. Apply glue to the top and bottom of the partitions, and nail through the counter into them. Toenail the top and bottom front edges, making certain the partitions are plumb and protrude $\frac{1}{8}$ in. from the edge of the base.

Cut stopped chamfers in the two end uprights, and nail and glue into place. Next, cut the two middle uprights and nail and glue to the partitions. Cut the three pieces that form the front of each pullout pocket-frame and glue in place.

Glue the door paneling next. To do this, cut each piece of paneling oversize and lay it face down on a flat surface. Spread glue evenly over the surface and lay an oversize piece of particleboard on it. Then spread glue on the particleboard and lay a second piece of paneling on its face to make a sandwich. Weight it and allow to dry overnight.

Install the doors by fastening the hinges to the cabinet first, then prop a door in place and mark the location of the hinge holes. After the doors are hung, snap a level chalkline to mark the horizontal position of the door pulls. After checking the snapped chalkline with a level, install the pulls and magnetic catches.

Screw the typewriter hardware to the shims. Make the pullout writing surfaces, typewriter shelf and equipment trays by glueing the entire 4x8 sheet of Marlite "leather" to a 4x8 sheet of particleboard, similar to the way you glued the door panels. When dry, cut the various panels to size. Cut the framing for the pullouts, equipment trays and typewriter shelf. (Standard typewriter table height is 26 in.) Verify the correct thickness of the frame for the typewriter stand so that it will be the desired height. Glue the maple frames to the Marlite panels. Fit the pullouts into their pockets and attach the brass pulls. After installing the typewriter shelf, fit the sliding drawer hardware on the equipment trays according to the instructions included.

● *Upper cabinet.* Saw the two end rails for the upper cabinet to size, and cut the stop chamfers. Dowel and glue these up-

rights to the top stile. (Also dowel the two middle rails into the stile if you're putting in doors.) Then nail and glue the end rails to the plywood ends, and glue the stile to the top. Glue the nosing to a 2x2 to make the pediment molding. When dry, miter and glue into place. Glue the scallop trim into place next. This trim is 8 ft. long, so it's necessary to fit a $\frac{3}{4}$ -in.-wide piece at each end. I used scrap paneling.

● *Upper doors.* To get the proper curve in the top stiles, and to avoid mistakes when chamfering, draw a full-size pattern of the doors. Cut the rails and stiles for the doors and dado for the inserts you plan to use. To make the muntins, cut the two stop-chamfers on the edge of a board that's at least 2 in. wide; then rip off the $\frac{3}{8}$ -in.-thick muntin with a planer blade. Dowel the rails, stiles and muntins and cut the insert panels to fit.

● *Finish.* Start by giving all maple parts a thorough sanding with 180-grit paper after filling nail holes. I brought scraps of the Royalcote paneling and white maple to my local paint dealer and asked him to prepare a stain to match the Masonite paneling. And I learned something. Maple doesn't take stain—it requires glazing. He started with a pint of glazing liquid and added various colors to achieve a near-perfect match. The glaze is applied with a brush, then spread with a second, dry brush. Keep wiping this dry brush with a rag as you spread the glaze to simulate texture and grain. When the glaze has dried, you can apply burnt sienna in fine wavy lines with an artist's brush. Then blend this out by wiping *once* in a single direction with a rag. Finally, I covered this with two coats of O'Brien's Satin Finish Penchrome varnish.

When the maple has been glazed and varnished and the panels "antiqued" (if you use a filigree), glue the upper doors together with plastic resin glue. ★★★

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Dollar duck decoys

Hunting season is over. But now's the time to repair your old decoys and to make these new ones for less than \$1 apiece.

Up, up and away! Very slowly

Floating majestically in the sky, those Good-year blimps are an enigma in an age of jets. Are there people in them? How do they fly? How fast do they go? These are frequent questions. Here are the answers.

Owners Report: Fiat 124

After driving a total of 1,700,000 miles, owners say it's a car for all seasons—but they yearn for more power.

SIMPLY GREAT FOR FISHING

(Continued from page 60)

soon dashed off to another wreck, while Nat, Carter and I determined to stay on to outwit at least one mackerel.

While fishing in a choppy sea, you soon appreciate the value of a heavy fiberglass hull. Some manufacturers boast of their lightweight boats, saying they're easier to trailer and require less power to plane. But light weight for offshore work is actually a disadvantage. You tend to bounce around too much, and if you do a lot of fast running, you could literally tear a flimsy hull apart!

Roland Berube, Hewes' design-engineer for the Bonefisher, puts *twelve* overlapping layers of fiberglass into his hulls from the keel out. In addition, five stringers are glassed into the hull, three running the length of the boat. Such carefully crafted fiberglassing provides an extra margin of safety when you're far offshore. And the extra weight helps absorb the pain of big brain-jarring waves.

Bob called on the radio/telephone. Mark was into something big. How were we doing? "Not so hot," Nat replied. "Maybe we'll try for jacks and tarpon back at Key West." On the run in, I marveled at how well the Bonefisher gripped the water with no sideslipping on turns. And she threw spray well to one side and aft, being one of the driest center-console offshore fishermen I've ever worked with.

I was also impressed with the use of shock cords to hold fishing rods and storage lids in place. Nat said this was another example in the design where experience had prevailed over conventional ways to do things. Hewes' jobbers had urged him to use conventional hardware. However, he heeded his guide friends, using less expensive, but more practical aviation shock-cord tiedowns rather than rattling, corrodible hooks and latches.

Carter and I caught a few jacks, one small grouper and even jumped a tarpon. But we finally docked without the record promised—or so I teased Nat. Mark greeted us with a Cheshire-cat smile. "Got a good one," was all he said.

I'll say! Mark had taken a 36½-pound grouper on plug-casting tackle. He held an entry for the Key West Tournament.

"It's no record," Nat said, "but it is another biggie for a Bonefisher!"

The boat retails for \$1895, including such niceties as undergunwale teak-rod racks for 12 fishing rods, and twin stern live-bait wells with covers, each reinforced for auxiliary motor use. For further information, write the Hewes Boat Co., 412 N.W.N. River Dr., Miami, Fla. ★ ★ ★

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TUNE IN THE WORLD!

(Continued from page 94)

night. Some sets also offer a marine band on which you can hear Coast Guard weather reports and ship-to-shore communications.

Most good multiband portables include these weather and marine services; general-coverage receivers may not—you have to check. The average general-coverage receiver tunes only up to about 30 MHz, while many special services start at 30 MHz and go on up from there. By contrast, general-coverage receivers may offer more foreign and ham bands than the average portable—so you can take your pick.

Public service communications covering fire, police and other emergency services are divided into two bands—the low band (30-50 MHz) and the high band (152-174 MHz). These are often designated VHF1 and VHF2, or PS1 and PS2, for short. Most general-coverage receivers

Scanning monitor scans across the dial just as if you were turning the knob yourself.

do not offer these services, but a multiband portable may—again you have to check. Such sets also may or may not include an aircraft band from 108 to 136 MHz.

If you're interested solely in fire, police, aircraft and similar communications, you may be better off with a so-called "monitor" receiver. These are designed especially for the public service and aircraft bands. They are so specialized, in fact, that one model may handle only aircraft frequencies and another only fire and police. One may cover only the low public service band and one only the high band. You have to decide which band is the most important to you.

Monitor receivers are inexpensive and perform well on their particular frequencies. Their disadvantage is that they're limited to a narrow range of coverage. Aircraft and emergency calls, while exciting when you can pick them up, tend to be sporadic and indefinite. You may sit up half the night trying to catch a police call only to get a taxi dispatcher talking to his cabs or a bakery truck driver reporting to his boss that he's out of chocolate doughnuts. Another problem with two-way communications is that they are often on different transmitting and receiving frequencies. Thus you're frequently able to hear only one side of a conversation.

One answer is the more expensive "scanning" monitor. This electronically scans across the dial just as if you were turning the tuning knob yourself. If there's nothing on one frequency, it automatically goes on to the next and the next, trying one after another until it hits a transmission. It scans the whole frequency range in a second or so, then repeats the procedure, going around and around. A red light flashes on when it finally spots a broadcast, freeing you from the chore of hunting endlessly across the dial. With a scanning monitor, it's even possible sometimes to pick up both sides of a conversation.

Marine receivers are similar to general-coverage sets except that they include one or more marine bands in addition to other shortwave services. Like general-coverage sets, they also cover the AM band for entertainment and some provide an aircraft band. Many incorporate a radio direction-finding device (RDF) as a navigational aid. If you live near an ocean or other large body of water, a marine receiver can be a lot of fun. Note, though, that coastal transmissions are at the low end of the frequency range at 2 to 2.5 MHz, while those for inland waterways are up in the 156 to 162 MHz range—an important point to consider depending on where you live.

Other special frequencies to look for are 26.620 MHz used by the Civil Air Patrol, 27.980 MHz used by the Coast Guard Auxiliary, and 27.575 and 27.585 MHz used by the U. S. Government. Also in this range are Citizens Band frequencies from 26.965 MHz to 27.255 MHz. While most CB chit-chat is pretty routine, you can occasionally pick up an exciting marine or highway distress call. Now that Channel 9 (27.065 MHz) has officially been designated an emergency broadcast frequency, you should be able to catch some lively activity here. Some marine, general-coverage and portable receivers include a CB band.

You can also purchase a CB transceiver and use it for listening only without a license. If, later, you decide you want to transmit as well, you will, of course, have to apply for a permit.

All in all, however, the general-coverage receiver or multiband portable is probably the best all-around choice for the casual listener and beginner because of its wide selection of bands—if you can't get something on one, you will on another. While most such sets have built-in telescoping antennas for convenience, be sure there are also connections for an external antenna—you'll need one for really long-distance reception.

Another handy feature to look for is

provision for an external speaker. Built-in speakers are, of necessity, small and a larger separate speaker will improve sound quality. Some sets even have a jack that lets you tap off the tuner's signal and pipe it through your hi-fi system.

Additional refinements that vary from set to set are a signal-strength tuning meter, bandspread or fine-tuning control, "squelch" control for reducing unwanted noise, automatic noise limiter (ANL), automatic frequency control (AFC) and automatic volume control (AVC). If you want to receive code, you'll need a BFO switch (beat frequency oscillator) that converts normally inaudible signals into beeps you can hear.

Depending on how your set is marked, you may have to do a little figuring to find the proper spot on the dial for a desired setting. Shortwave broadcasts, while listed in kilohertz (kHz) on program schedules, are usually marked on the dial in megahertz (mHz) as a convenience in keeping the numbers smaller and more manageable. Since one megahertz equals 1000 kilohertz, you can easily convert one to the other by moving the decimal point three places—to the left when going from kilohertz to megahertz; to the right from megahertz to kilohertz. For example, Cuba's broadcasting frequency of 17735 kHz would become 17.7 mHz on most shortwave dials.

You may also have to do some calculating to figure out when a particular shortwave broadcast comes on the air. World-wide program schedules are given in Greenwich Mean Time (GMT)—the time in Greenwich, England—and are also based on the 24-hour clock. Thus 2300 hours is 11:00 o'clock at night Greenwich time (2400 is midnight; 0800 is 8:00 o'clock in the morning; 1200 is noon, and so forth). The table on page 93 shows you how to convert these Greenwich times to your own time, depending on where you live.

One of the most prominent makers of shortwave equipment is Hallicrafters, and you'll find their sets readily available in radio stores, hi-fi shops and discount centers. Prices range from under \$60 to about \$1200. Zenith has long been famous for its fine Trans-Oceanic portable, available in several models. Hi-fi makers like Craig and Panasonic also offer multiband portables with many sophisticated features. For the kit-builder, Heath has a wide variety of ham, general-coverage, marine and portable receivers in kit form for \$34.50 to about \$400. In addition, mail-order houses like Lafayette and Allied-Radio Shack stock a large number of home and portable receivers in both kit and assembled forms. ★ ★ ★

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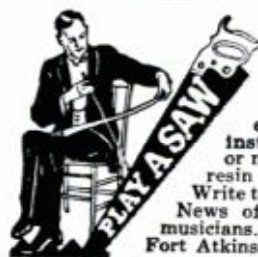
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PINTO OWNERS REPORT

(Continued from page 81)

dow fell out of frame." "It burns oil, and nothing's been done about it yet."

Seating came in for its share of controversy. The Pinto's front seats are very low, and many owners, short ones particularly, say they have trouble seeing out. Others complain that the seatbacks are too high, making checking the rear view over their right shoulder difficult. Still others feel the rear-seat cushion is still too hard to be comfortable—also that there's not much kneeroom. "I am just too old for a sports car seat," says a retired Santa Barbaran.

Asked what changes they'd like to see in their Pintos (and ignoring the ones that have already been incorporated), owners had these suggestions: "I am from Colorado, and the Pinto is underpowered for mountain driving. I think the factory should offer a hotter engine." "Make both front seats adjustable." "The inward curve at the bottom of the fenders lets mud and tar splash all over the sides."

"A deeper glove compartment." "They might put better tires on the car. I wore out my first set in 11,000 miles." "The rear window of the runabout needs to be raised for a better view out the back." "Put an ashtray in the back seat." "I would like swing-out rear windows. There's no through-ventilation when driving in the rain."

Owners more than filled out the questionnaires we sent them. Quite a few wrote little essays on the backs. Unfortunately we don't have space to reprint them here, but as parting shots, we present some of the slogans, mottos, and quickies received:

"Pinto Power to the People!" "P.S., I love this car!" "Pinto Gallops On!" "My Pinto is my sweetheart!" "I love my Pinto!"

A Pennsylvania lady wrote "My husband liked my Pinto so much that he bought one for himself, too." And a gent in Ohio said, "When a guy like me, who knows little about cars, can keep one in top running shape, that car has to be for me. Ford is to be congratulated." ★★

VEGA OWNERS REPORT

(Continued from page 80)

aluminum engine wouldn't hold up so well as a cast-iron one, but they took a wait-and-see attitude. GM research and testing show they needn't worry. We noted no complaints of oil burning or undue mechanical repairs.

Closing out this report, we present some longer owners' statements we consider worthy of passing along.

A Seattle newspaperman added this note to the back of his questionnaire: "I am very pleased with the Vega. This car outperforms, outhandles, gives better gas mileage, and requires less service than the Volvo I used to own. However, Vega lacks the quality of workmanship, materials and durability that Volvos have. What a car this would be if Chevrolet allowed Volvo to build it."

And a California mechanic says, "I bought my Vega in November 1970, and a

month later took a trip to Arkansas. On the way home, I was hit from behind by a semi truck. After rolling and finally getting out without a mark on me, I felt I really had a good car. My insurance totaled it out and paid me off. I went right out and bought another Vega just like the first one. I think I've given the Vega a good test and really should know."

A Pittsburgh housewife comments, "Because Ralph Nader took away my Corvair, which I loved, I bought the next best car to it—the Vega."

Little things mean a lot: "One thing I like about my Vega," says a Massachusetts painter, "is that I can repair it myself with the booklet that came with the owners manual. I change my own oil, filter, will replace my own plugs, can time the engine, lube it myself, change the points, condenser, and transmission fluid. If I had to go to the dealer for all that, it would cost me a bundle, and then it wouldn't be an economy car." ★★

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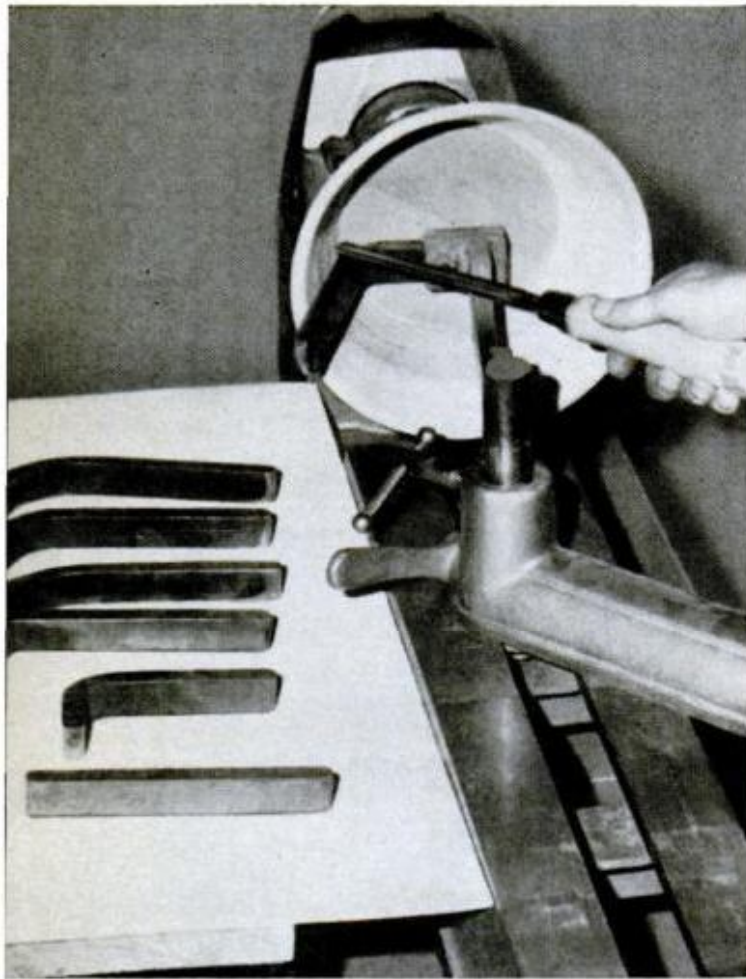
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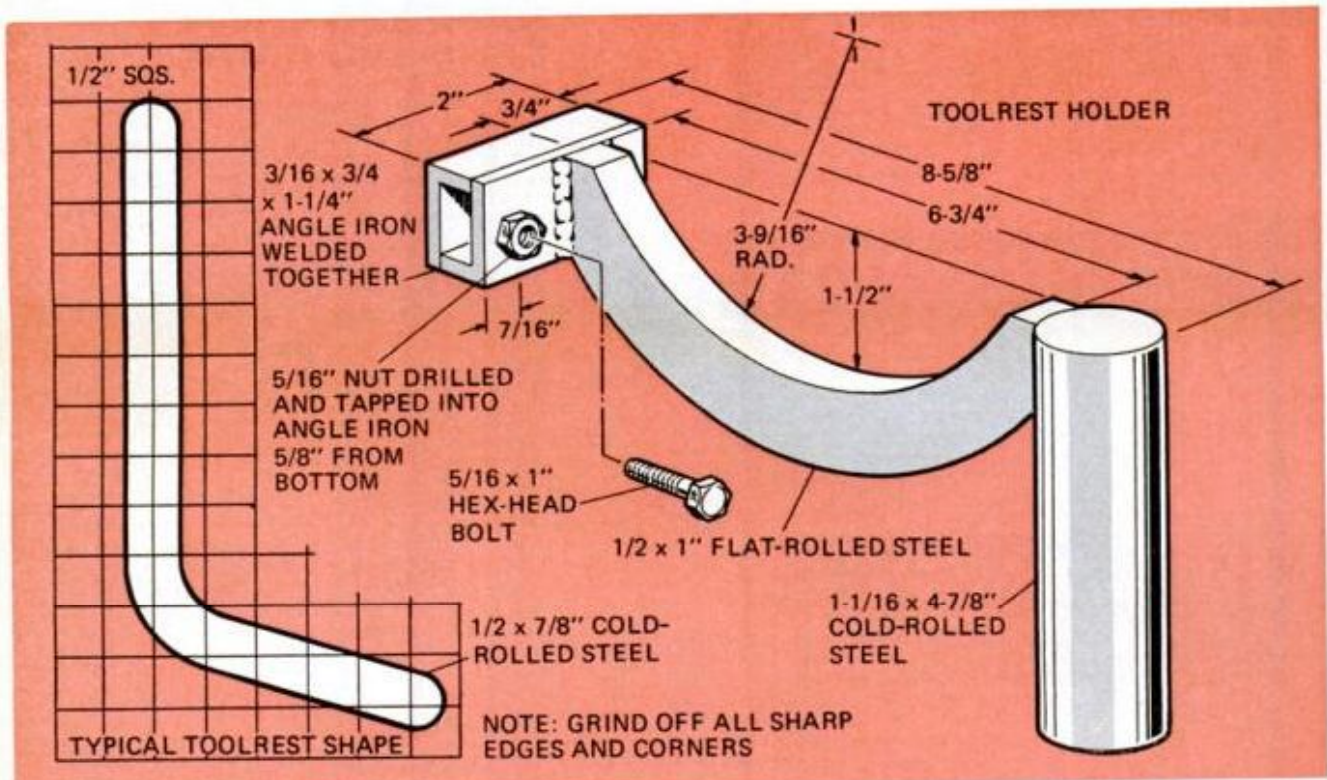
A shop-made toolrest for deep-bowl turnings

By EUGENE PROVO



HERE IS A TOOLREST that makes deep-bowl turning on a lathe faceplate easier and safer than any toolrest that I know of. When used in combination with a regular toolrest base, it can be adjusted to reach practically any inside shape, as you can see in the photo at left. Each of the six rests fits a holder which in turn fits the lathe's toolrest base. The rests themselves can be inserted in their holder from either side, and can be adjusted in or out to suit the size and shape of the work.

Most of the rests can be formed cold. Those with the sharper radii should be heated before forming. The open-end box at the front of the holder, which holds the rest, is simply two pieces of angle iron welded together. In place of the hex-head bolt that locks the rest in place, a wing bolt could be used. The main support bar has an arc to allow for hand and chisel clearance. The rests shown are those that I found most suitable for my use; others may be added to fit your own particular requirements. ★★★



MINIBIKE MECHANIC

(Continued from page 107)

so since I happen to have it on hand and it works well, I lubricate my minibike chains with Bardahl VBA. Some friends have good luck with 90 or 140-weight gear oil they obtain from the corner gas station. But even more important than the type of oil is how it's applied and how often. The ideal way to apply chain oil is with the bike supported on a block and with the engine turning the wheel at a very slow speed. With the torque-converter-equipped Bonanza, for example, this translates to letting the drag of the converter turn the rear wheel. Oil is poured steadily on the moving chain, and the movement of the chain works the oil down inside the rollers and between the side plates where it's needed. Surplus lubricant is tossed off by the action of the chain.

As a chain wears it gets longer. It must be adjusted much more often on a minibike than on a motorcycle. In all cases

A new chain will usually stretch . . . and should be checked after running a half hour

follow the manufacturer's instructions when available. Lacking these, place a straightedge along the drive chain and pull the chain away from the straightedge with the fingers at a point about midway between the two sprockets. Correct play will be from $\frac{1}{8}$ to $\frac{1}{4}$ inch. If it exceeds this, adjust the chain.

If the bike is equipped with swing arm and rear shock absorbers, the amount of slack may differ as the position of the swing arm changes. Measure the slack with shocks compressed and with all weight off the machine, and make the chain adjustment as outlined above with the swing arm in the position that gives the *least* slack in the chain.

A minibike is particularly susceptible to drive-chain breakage because it is so low the chain is continually picking up sticks and rocks and pulling them between sprocket and chain. Generally, the drive chain will part at the master link, and the repair is simply replacing the master link. But once in a while the chain will break elsewhere, and the damaged links will have to be removed before the chain can be rejoined. As the chains are invariably of riveted construction, disassembling them can be quite a problem. A special tool made for that job really works. Called a "chain breaker," it is available

from minibike and motorcycle dealers everywhere.

Check your chain for wear by pulling it away from the back of the larger sprocket. A chain in good condition will pull away from the grooves very slightly. As it wears it will gradually pull farther out toward the tips of the teeth. It is worn out if you can pull it out of the groove so that the inside of the rollers is about half to two-thirds the height of the teeth from the bottom of the grooves. No amount of adjusting will compensate for this wear.

When installing a new chain, the rear wheel should be at the forward end of its adjustment, if possible. A new chain will usually stretch for a few hours, and should be checked after running a half hour and again in a couple of hours or so.

There are other parts to be lubricated—some minibikes have grease fittings on their swing arms. These should have a shot of grease with each oil change. Give pivot points such as levers, foot pegs, brake pedals a drop of oil every so often.

When installing a new control cable, tape a small funnel over the end with plastic electrician's tape and pour in some oil. It is not necessary to allow the oil to remain in the funnel until it drips out of the lower end of the cable—three or four minutes is enough. Engine oil is fine for this. The creeping action of the oil plus the movement of the cable will distribute oil along the housing.

In the absence of specific instructions for adjusting the torque converter belt, stop the engine and loosen the engine mounting bolts. Slide the engine forward until the belt is approximately as tight on the idler bearing at the bottom of the front pulley as if it were being adjusted on a pair of conventional Vee-pulleys. There is nothing critical about this, it just insures that the belt will be gripped by the moving sides of the drive pulley as soon as possible after they begin to close by centrifugal action.

When fixing your own flats it's best to use hot patches. These are usually applied with a special bulky clamp not generally a staple in the amateur mechanic's toolbox. It's only a convenience and not really necessary. The trick in applying a hot patch is to follow manufacturer's directions exactly insofar as the preparation is concerned. Then either clamp the patch with Vise Grip pliers or put the tube and patch on any smooth surface, and place something across the hot patch, such as a wrench, to protect the shoe. Standing on the patch gives the pressure needed. Important: Be sure to allow time enough for the patch to cool—that's the most important part of the operation. ★ ★ ★

ARE 8 CYLINDERS ENOUGH?

(Continued from page 87)

financed the Mercedes-Benz and Auto-Union companies to manufacture world-beating cars. They used mostly 12 and 16-cylinder engines. There was no displacement limit then and some of these wildly expensive engines grew to nearly 400 cu. in. and 700 hp with supercharging! Just before World War II the German V12s were turning up to 8000 rpm, while most racing Sixes and Eights were limited to 6000 rpm.

Probably the most famous 16-cylinder racing engine was the ill-fated British BRM Grand Prix car of the early '50s. The idea was to develop a "national" car with the cooperation of dozens of automotive companies. Too many cooks finally spoiled the brew, but the resulting V16 engine was some kind of peak in engine development. The rules limited displacement to 91 cu. in. so the cylinders were about the size of shot glasses. But this

Twelve-cylinder engines now are dominating Formula 1 and sports-car racing . . .

allowed a safe rev range over 10,000 rpm—and more than 550 hp from the 91 cubes, using 70 pounds per square inch boost pressure from the exotic two-stage supercharger! No other racing engine ever sounded like that BRM when winding up through the gears to ten grand! The project ran out of money before the car was debugged, but this tremendous V16 proved the potential of multicylinders.

Twelve-cylinder engines now are dominating Formula 1 and sports-car racing; Porsche and Ferrari in the sports cars and Ferrari, Matra and BRM on the Grand Prix circuit. This could happen at Indianapolis too, if anybody here had the money to develop a brand-new engine. Theoretically, a V8 can't stay with a V12 when all the other design factors remain equal. The more cylinders there are, the more revs. And that's the name of the game in racing.

Is there any chance we'll see more 12 and possibly 16-cylinder engines in regular passenger cars in the next few years? This brings up the problem of exhaust emissions. Federal emission limits, plenty tight now, will get tighter. It's useless to invest in tooling up a new engine that can't run pretty clean. There's no inherent advantage or disadvantage here in using 12 cylinders instead of 8, but Jaguar is

taking advantage of multicylinders in a special way: a layout of valves, ports and combustion chambers designed more for low emissions than for good breathing and maximum power. Power comes from high revs made possible by the 12 cylinders. This new V12 has very low emissions, only fair breathing, but is red-lined at 6500 rpm. You can wind it up tight with perfect safety. The performance is there, but from revs, not breathing. This is a strong argument in favor of more cylinders for future engines.

Do multicylinder engines take up more space? Certainly they're longer, but the designers have more freedom in arranging engine height and width by juggling the angle of the V. To get even firing impulses a V8 must have a V angle of 90° or be laid flat at 180°. A V12 can have a V angle of 60, 120 or 180°; a V16, 45, 90, 135 or 180°. The late Porsche and Ferrari racing 12s are laid flat to get minimum height for good body streamlining. But the old BRM V16 of the early '50s (and the Cadillac V16 of the late '30s) had a V angle of 135° as a compromise between height and width.

That a 12-cylinder engine is inherently smoother than an Eight is not such an important advantage today because our engines are mounted in soft rubber and pivoted on their gyroscopic centers so that very little vibration is transferred to passengers. Low idling speed and strong, low-speed torque are not as important when you have torque converter transmissions.

Multicylinder engines are not good from the cost standpoint. More parts cost more to make and maintain (sparkplugs are up to \$1.25 now). And these engines tend to use more gas at cruising speeds, because the mixture distribution between cylinders is not quite as even, and there is more friction loss at part throttle.

So the future is really doubtful. There is little question but that Jaguar will do very well with its new V12. It's different, has character, is a good performer and at \$7000 is inexpensive enough for a lot of people to buy. The other two current makers of V12 engines—Ferrari and Lamborghini in Italy—will live and prosper, though they may not be able to meet future U.S. emission limits. But these exotic \$20,000 sports cars don't set patterns.

The Detroit carmakers will be hard pressed to meet future emission limits with any kind of piston engine, regardless of the number of cylinders, so it's a problem of survival, not esthetics. Tomorrow's passenger-car engine may not have any cylinders! ★★★

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GREAT LINERS

(Continued from page 71)

three-stackers—the *Queen Mary*. The *Queen* beat her way from England's Bishop Rock to New York's Ambrose Channel lightship—2907 miles—in 4 days and 27 minutes, with speed averaging 30.14 knots.

Normandie managed to regain the Blue Ribbon once, but *Queen Mary* recaptured it just before World War II put an end to the race.

Queen Elizabeth, *Mary's* twin-stacked sister ship, was still being fitted out when the war began. Her owners decided finishing touches could wait, and sent her down the River Clyde in March 1940 on her maiden voyage, untried and untested. She dashed past Nazi submarines infesting the Atlantic, and slipped safely into New York harbor to begin a wartime career as an Allied troopship.

She, *Queen Mary*, and *Ile de France*, loaded to the gunwales with GIs, used

On her maiden voyage, *United States* lopped 10 hours off *Queen Mary's* record . . .

their speed to elude Nazi torpedoes throughout the war.

Other Atlantic beauties were not as fortunate. *Rex* was sunk off Trieste in 1944 by a British submarine. Mysterious fires gutted *Normandie* at her New York pier soon after the *United States* had seized her. *Bremen* went down in a German port, another fire victim.

Europa spent the war safely moored at a German pier, but was awarded to France in the peace settlement and returned to the Atlantic as *Liberte*. She was scrapped in 1960.

After World War II, Cunard was the first line to resume service. A refurbished *Queen Elizabeth* dressed in prewar plush raised passenger travel at sea to an all time high.

Some statistics tell why: length, 1031 feet (the longest liner ever built); main engine as powerful as 40 locomotives; outdoor deckspace equal to a football field; 36 elevators, six miles of carpeting, and 500,000 pieces of china, glassware and silver.

Queen Elizabeth had little competition for the transatlantic title until the 1950s when *America* became determined to make a splash on the Atlantic prestige run.

Unlike the maritime nations of Europe,

the *United States* had never bothered to build a ship for the Blue Ribbon race. During the 1930s, we were operating two small serviceable vessels, *Manhattan* and *Washington* (each 24,000 tons) plus *Leviathan*.

A third, *America*, was launched in 1939, but was soon converted to a troopship, and rechristened *West Point*. *Manhattan* served as *Wakefield*, and *Washington* became *Mount Vernon*. They resumed civilian service after 1945, but never claimed the passenger loyalty so many travelers gave the two *Queens*.

By 1951, however, *America* was ready to challenge England's passenger supremacy with the launching of *United States*, a streamlined nautical marvel slightly shorter than the two *Queens*, but 30,000 tons lighter.

While older liners relied on wood and marble for elegance, designers of *United States* called for shimmering metal throughout the vessel. They claimed the only wood aboard was in the piano and the butcher's chopping block. Almost everything from the promenade deck up was aluminum—lifeboats, davits, ladders, rails, even her twin red, white and blue stacks.

Heart of the 52,000-ton liner was a power plant that made her the fastest passenger ship ever to be built. On her maiden voyage, *United States* lopped 10 hours off *Queen Mary's* record, bringing the Blue Ribbon to *America* for the first time. That trip, made at an average 35 knots, permanently retired the Ribbon, ending a century of transatlantic competition.

But as a money-maker, *United States* was a bust. Even with a large operating subsidy, she never ran in the black. She continued her sailings for 10 years after the first scheduled transatlantic jet planes began flying, but in 1969 was retired to a shipyard in Virginia where she sits today.

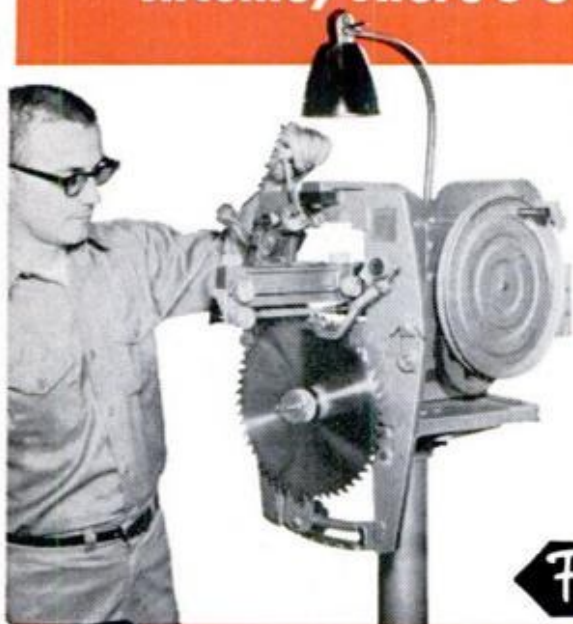
And the other great liners? *Queen Mary* is moored permanently at a California pier, undergoing a refitting job that will turn her into a convention and hotel center. *Queen Elizabeth*, following two unsuccessful years as a Florida tourist attraction, was sold to a Hong Kong company. Whether she will sail again is unknown.

Ile de France was sold to a Japanese moviemaker to be used as a prop, and then was scrapped in 1958.

The few large transatlantic liners still defying the jet age may be nautical dinosaurs to some. But to many others they represent a seagoing tradition of graciousness that will never be replaced. ★★★

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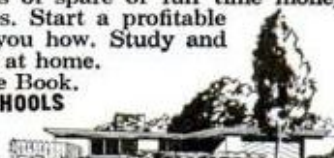
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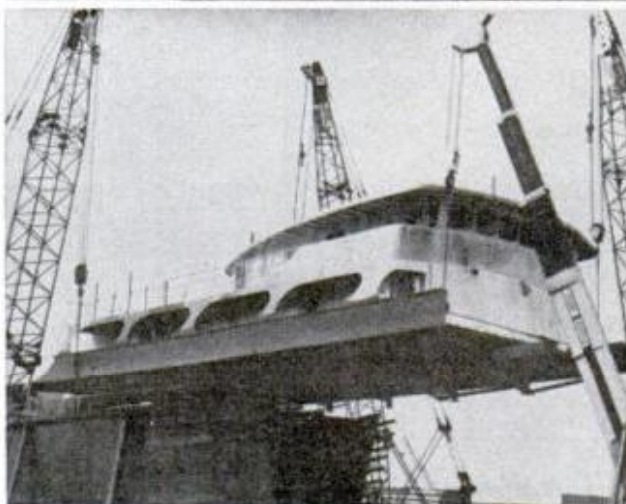
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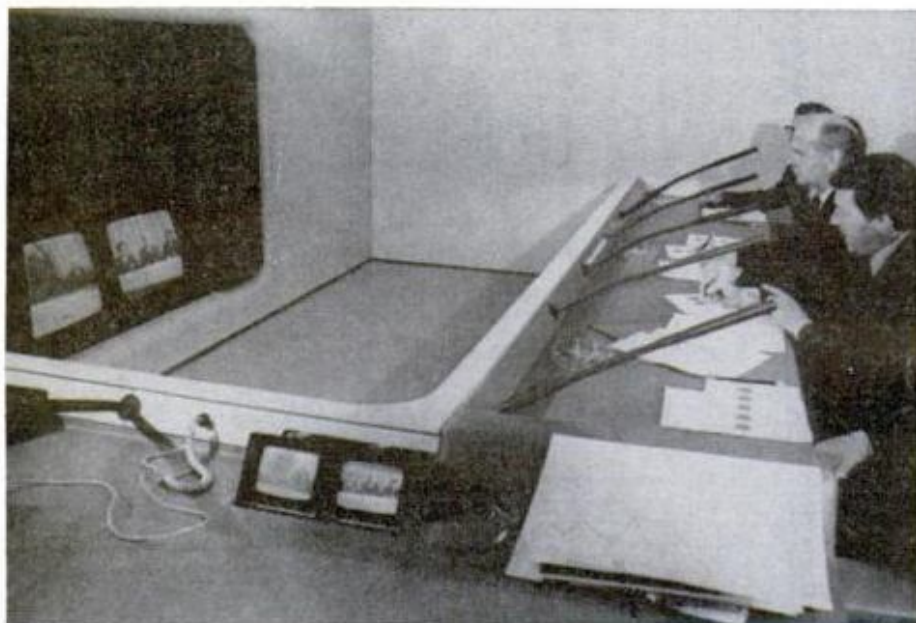
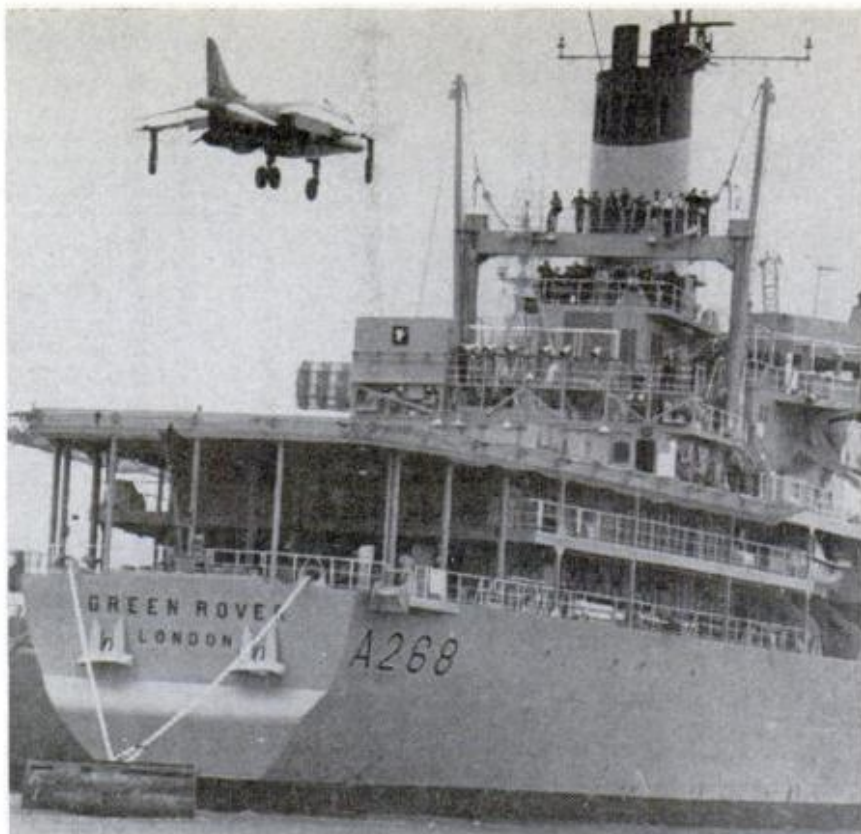
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First for Harrier

Hovering over the deck of the *Green Rover*, an auxiliary ship of the Royal Navy, is a Hawker Siddeley Harrier. The plane performed a vertical takeoff and landing to become the first Harrier to do so on a ship moored in a river. (See *The Plane That Makes Airfields Obsolete*, page 80, June '70 PM.)



TV conferences

British Postal System executives can have a face-to-face conference with personnel in other regions without having to travel out of the office. They use Confravision, a multi-television setup that enables groups of five people to see and talk to similar groups in other cities. The new service went into use in the fall.

Rooftop rider

In a demonstration of the strength and rigidity of a tensioned-fabric structure, a bicyclist rides his machine across a trisail marquee. The display was staged by the manufacturer, Irvin Great Britain, Ltd. The structure has a roof of tensioned fabric suspended between rigid steel masts held in place by steel stress cables.



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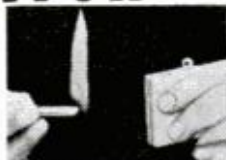
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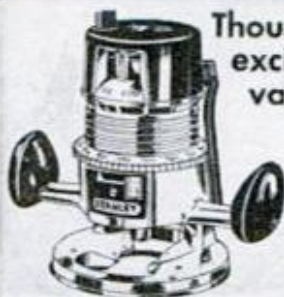
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(Continued from page 184)

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(Continued from preceding page)

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(Continued on next page)

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(Continued from preceding page)

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(Continued on next page)

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(Continued from preceding page)

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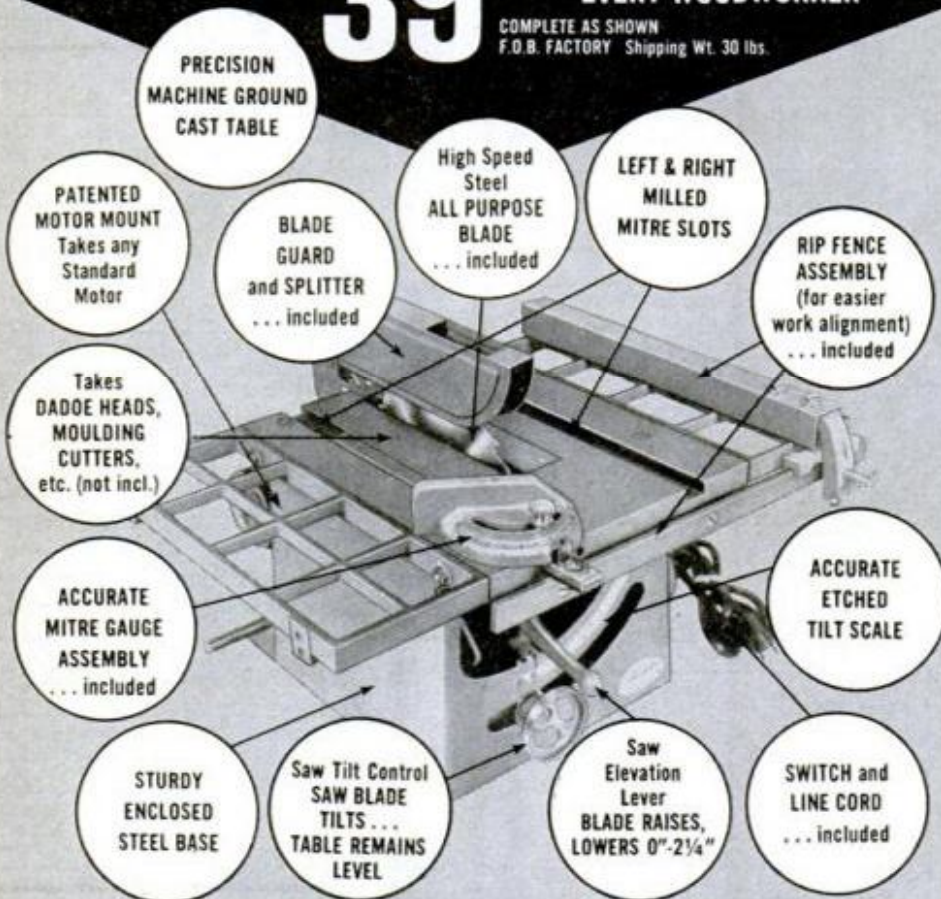
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