

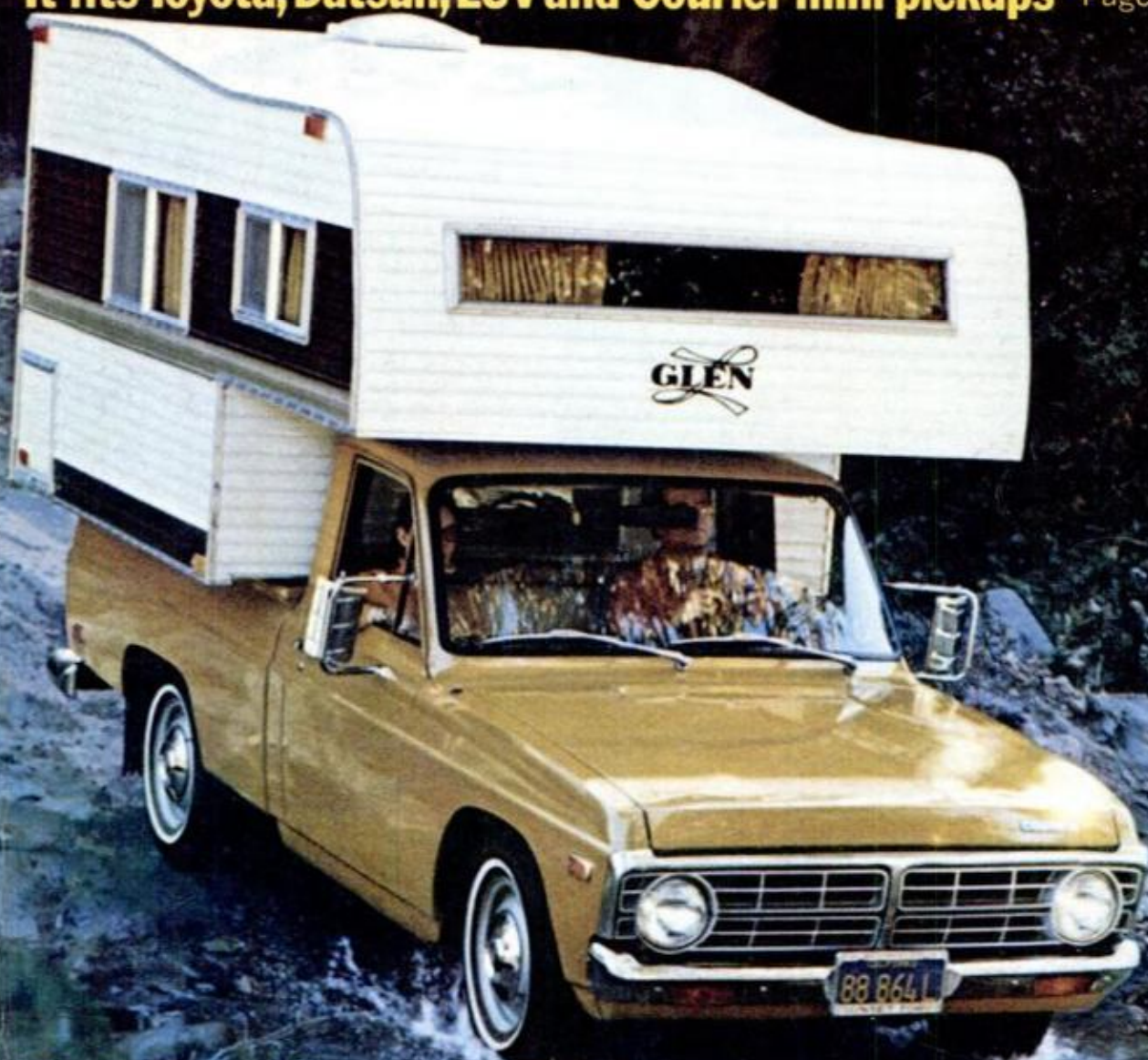
Popular Mechanics

26 pages
New models
New conveniences
New ways to go
MOTOR CAMPING

MARCH 1973
50 CENTS

For \$607 you can build this camper

It fits Toyota, Datsun, LUV and Courier mini pickups Page 178



Sewing centers: the kind women want but can't buy

We offer plans for four — from a wall-hung space-saver to a deluxe freestanding unit.

Build any one of them and you'll be a hero. Page 77

How to: Adjust a Pinto carburetor

Cut, splice and connect wires ■ Build a basement partition

Hang drapery traverse rods ■ Patch a hole in sheet flooring

Meet the new Omega. If you think you can't afford an Olds, think again.

A smaller Olds at a lower price.

Omega is a whole new kind of Olds—a compact. But one with Olds big-car thinking built into three interesting variations: 2-door coupe, 3-door hatchback and 4-door sedan. All of them a lot of Olds for the money.

Omega is not your basic little car.

It's nearly 500 pounds more car than some smaller compacts. The wheelbase is longer—111 inches. And you can feel this extra size and heft working for you on the road. It's solid and steady. Roomy. Comfortable. Agile and maneuverable.

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also things some compacts don't offer at any price! A glove compartment with a door and a lock. Rear windows that roll down. And generous trunk space.

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You can order a vinyl roof for looks. Our famous Rocket 350 V8 for go. Sporty high-back bucket seats and a console for the coupe and hatchback. Even a special tent that converts the hatchback into a camper.

It feels like a bigger car. Get into an Omega and notice the comfort. The way you sit up, how right the steering wheel position seems, how easily the car responds. Sure, you can get a lesser compact for less money—but then, it wouldn't be an Olds Omega. Oldsmobile. Always a step ahead.

'73 Oldsmobile Omega.



Hatchback Coupe

Coupe

Town Sedan



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This One



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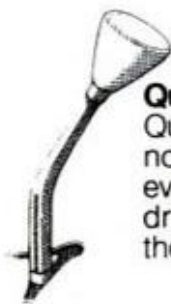
MEADVILLE, PA. 16335

Jeep Introduces Automatic 4-Wheel Drive.

QUADRA-TRAC™—Someday all 4-wheel drive vehicles may have a system like it... Jeep Wagoneer has it now.



Here's how it works and what it does for you:



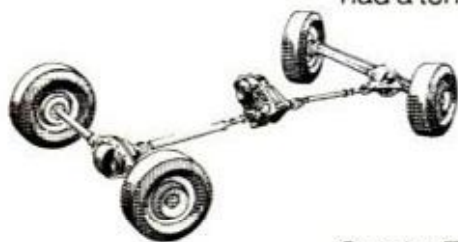
Quadra-Trac eliminates shift lever and front locking hubs.

Quadra-Trac is full-time automatic 4-wheel drive. There's no need to get out and lock in the front wheel hubs or even shift a lever... Quadra-Trac eliminates both. 4-wheel drive is automatically there when you need it—on or off the highway.



Quadra-Trac offers superior traction.

Under test conditions, two Jeep Wagoneers, one Quadra-Trac, one without, were asked to make an accelerating turn on a water-soaked road. The Wagoneer with Quadra-Trac remained in control, while the other vehicle had a tendency to fishtail.



Quadra-Trac works in a new way.

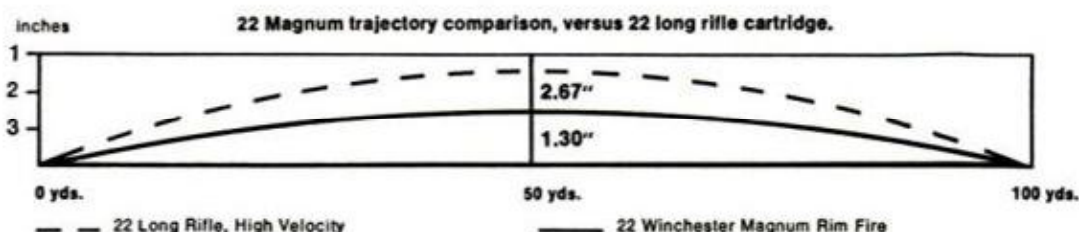
A third differential allows torque to be directed automatically to the wheels that have the best traction. If the wheels on one axle start to slip, as on ice or rough terrain, the wheels on the other axle automatically take over.

Quadra-Trac is one of the most advanced 4-wheel drive systems ever developed and it's available now on Jeep Wagoneer and Jeep Truck. If you want to know more about it, see your Jeep dealer. He's the 4-wheel drive expert.

Jeep
Toughest 4-letter word on wheels.

Winchester 22 Magnum Rim Fire cartridges were pioneered by Winchester-Western to give hunters and shooters the power of a center fire at a price that lets them get plenty of practice.

Check the new low cost of Super-X Magnum Rim Fires in both Winchester and Western brands:



A proven performer that was first in the field. Ten years ago a new era of rim fire power and varmint shooting performance started with the introduction of 22 Winchester Magnum Rim Fires, economical loads that fit between regular 22s and costly center fires. Because of the logical simplicity of the new Magnum load, plus its wind-bucking accuracy, and extra power for shooting varmints, game, and pests, so many manufacturers brought out rifles and pistols for it that the Winchester Magnum quickly became the standard of the industry.



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New Winchester Model 9422M Magnum chambered for 22 Winchester Magnum Rim Fire loads. This new lever action 22 magnum rifle, patterned after the famed Model 94 Winchester was built specifically to handle the Winchester Magnum load, and to bring out the best in Super-X, the original brand of extra power that's never been topped. You get accuracy, reliability, and performance every time. The new Model 9422M is carved from solid steel and rich walnut with no shortcuts or substitutions. Magnum rim fire 22s available in either Winchester or Western brands. **WINCHESTER-Western** 275 Winchester Avenue, New Haven, Conn. 06504.



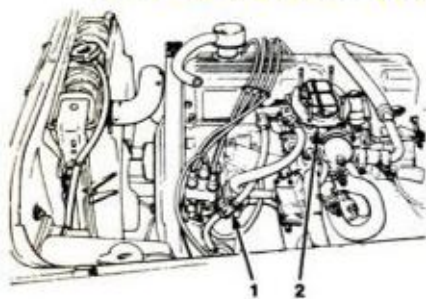
winchester
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want it

HOW TO . . .

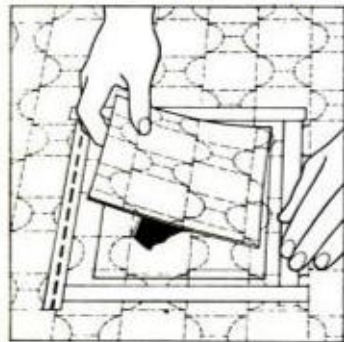
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ON THE COVER: For \$607 you can build this camper to fit mini pickups.
Photo by Mario Romo

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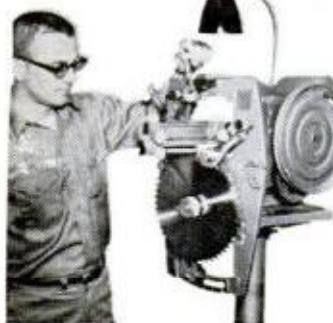
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BUSINESS OF YOUR OWN



Turn your spare hours into extra dollars this proven, practical way—start your own money-making sharpening business! No selling or canvassing, no experience needed . . . you do it all automatically with the Foley Saw Filer or Mower Sharpener.

Earn \$6⁰⁰ to \$8⁰⁰ an hour In Sparetime



Hundreds of people like yourself are making cash like this—\$20 to \$30 a week—right now in spare time. "My spare time saw filing business has made me \$952 these first ten months"—says R. T. Chapman. Many have built a complete sharpening service with year-around profits. You can, too, simply by following, the sure, easy Foley plan.

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You can sharpen combination (rip and crosscut) circular saws, hand saws, band saws, crosscut circular saws—and do a perfect job every time without experience or special training. The precision Foley Filer does it for you automatically! A complete repair shop in one machine! Set up in basement or garage, work your own hours in your own way and earn big sparetime profits.



Husband and Wife Have Going Business

Here's the story from Dick and Jo Ann Koester after being in business 10 months: "We have acquired another Foley Saw Filer and for the past two months we have been in full-time operation. As we live in a small town of 150 population in farm area we use our truck to pick up saws in five nearby towns. With a family to support and plans for building to our house we had to pick up business fast and already sharpen an average of 15-20 saws a day. Business for the future looks even better as good machine filing is our best advertising."

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LETTERS TO THE EDITOR

A moral tale

Very fine article on *How to Fix Your Automatic Washer* (page 66, Jan. PM). But you forgot something.

Four months ago our neighbors had trouble with their washer. It would not agitate properly or empty all the way. A new clutch didn't do any good. The parts man said, "It's gotta be the transmission." Well, Mr. Smith's machine had 18 years under its belt, and he wasn't going to waste that money on a new part and still have an old machine.

Mr. Smith, who's a saver of parts, proceeded to tear the machine apart, top first. He cut all the wires off—maybe he could use the switch on something, and the neon light, and the motor. Then we received a phone call: When he pulled out the agitator, there was an article of clothing wrapped around underneath it.

Moral: Don't cut your wires till you remove the agitator from the machine.
CORNWELLS HEIGHTS, PA. FLO HUNKAPILLER

A matter of degree

In the January issue I noticed two small errors. On page 140 (*Router Know-How, Part 2*) the angle as shown should be 68° from horizontal instead of 22° (which is from vertical). On page 176 (*\$300 Pool Table for \$107*) the same type of error occurs. The table-leg angle as shown should be 14° from vertical instead of 76° (which is from horizontal).

When things like this happen, it makes me feel good—I don't want to be the only one who makes mistakes.

ALLENTOWN, PA. BOB SCHAFFER

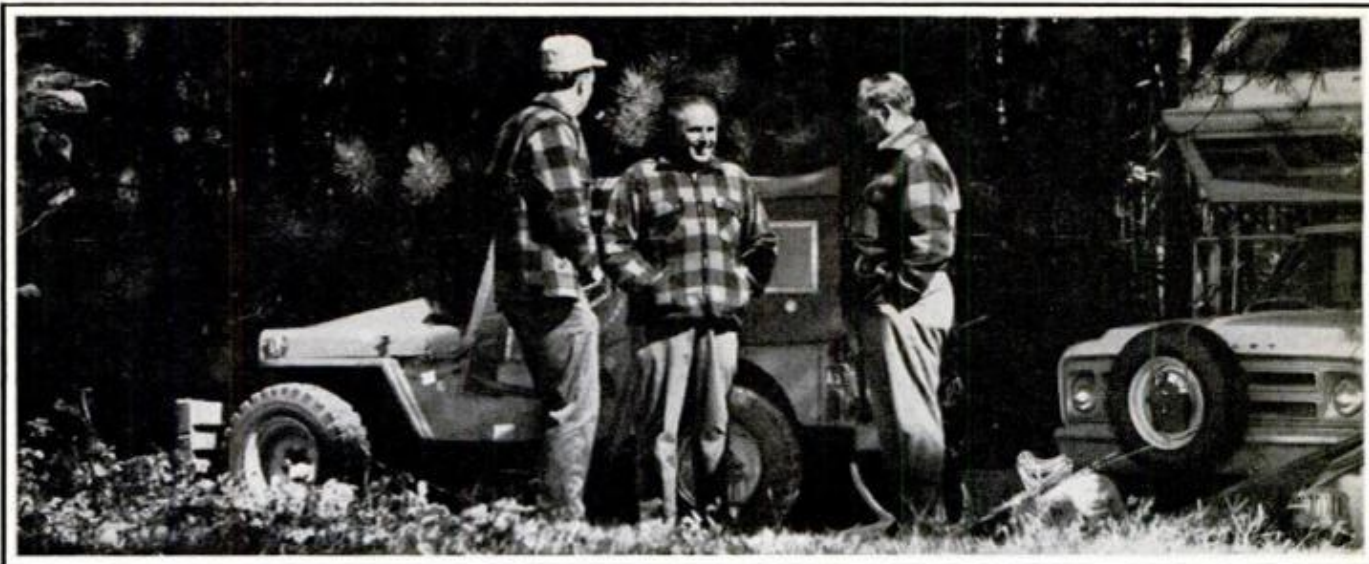
Battery repair

In *How to Stretch the Life of Your Battery* (page 125, Dec. '72 PM), the author describes battery-post repair procedure whereby a torch is used to melt lead into a mold on the battery to reconstruct a new terminal post.

Using an open flame that close to a battery can be dangerous.

Hydrogen gas is a normal by-product of the chemical action within a battery dur-

(Please turn to page 10)



**STEVE PETRASEK IS HEARING
FROM A LOT OF CAMPER OWNERS WITH PROBLEMS...
THAT FIRESTONE'S WIDE OVAL TIRE SYSTEM
CAN SOLVE.**

Tire engineer Steve Petrasek heard from a lot of people after we ran the story about his annual 31 hour run to the wilds of Montana using the Firestone Wide Oval System. One even started out: "Help", and many talked about problems ranging from poor mileage with present tires to a need for more traction, better road control, and load capacity information.

The Wide Oval System may not be the answer to every camper problem, but it solves a lot of them, which is why these tires are Steve's choice for the tough driving he and his buddies do each year with a jeep in tow. Remember, as a Firestone engineer with a racing, farm and truck tire background, Steve can take his choice of tires. And he sticks with The System.

See your Firestone Dealer or Store and find out why.

On the front you put Firestone's Transport 500 Wide Oval® truck tires. They're the steering part of The System, with a wide, wide tread designed



to build stability under that camper and deliver more miles than the Transport Wide Oval tires they replaced in our line.

On the rear go Firestone's Traction All Season™ Wide Oval truck tires, the *drive* part of The System. Their treads are computer-designed to behave nicely at turnpike speeds, and to move your camper through snow, sand and mud when you turn off the mainline.

**The Wide Oval System
for Campers.**

Firestone

LETTERS

(Continued from page 8)

ing the charging process. Hydrogen gas, even in small concentrations, is explosive and when confined within a battery and ignited by spark or flame can violently burst the battery. Sulfuric acid could be splattered into the face and eyes of anyone working on the battery.

I personally know of three battery explosions. One was caused by a person examining electrolyte level with a match. Another happened when a mechanic accidentally short-circuited a battery terminal to ground with a wrench. The third one was caused when a mechanic used a pair of pliers to short from the positive to negative terminal to see if it was "hot."

Undoubtedly, battery posts can be repaired in the manner described in the article, but I would first empty the battery of all electrolyte, flush it with water, then fill it completely with water before attempting repair with a torch.

BROOKINGS, ORE.

ALLEN J. FRANK

You recommend a very dangerous pro-

cedure. The article suggests pouring "pure" sulfuric acid into the battery, 1/2 ounce at a time. Perhaps you did not know that adding such quantities of sulfuric acid which is more than 50-percent "pure" will cause a violent reaction causing a spray of acid to the reader's hands and face. One should use 20 to 25-percent sulfuric acid (which even at that strength is called "fuming") and *one should always wear glasses or goggles.*

We work with 90-percent sulfuric acid every day, and we have learned that even a small amount can burn the skin or even ignite some substances when spilled.

BARBOUR RESEARCH ROBERT G. BARBOUR
LABORATORY DIRECTOR
WEST LOS ANGELES

We received many letters from readers rightly concerned about hydrogen gas in storage battery cells. The gas is generated only during the charging process.

We reported on the technique employed by Sytronic Battery Co. of Plainview, N.Y., operated by Seymour Seligman. He has never had a battery explosion. He re-

(Please turn to page 14)

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YOU GET ALL THIS with new NRI Master Automotive Technician home training. Included is the NRI Achievement Kit we send you the day you enroll . . . ten outstanding kits of automotive testing and repair equipment, plus educator-acclaimed NRI "bite-sized" texts — all yours to keep and use for years to come.



NRI announces a dramatic new way to learn Automotive Repair at home

Top auto experts praise NRI's new training plans

NRI's two new home training programs in Automotive Servicing and Repair have been acclaimed by three of America's foremost automotive experts. Richard Petty, America's winningest stock car racer says, "I especially like the way NRI has programmed essential training equipment they give you into step-by-step instruction." Tom McCahill, car tester and writer, commented, "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." William H. G. France, president of NASCAR reported, "The new NRI courses for mechanics are amazingly complete and seem to cover all major aspects of today's sophisticated cars. If you're at all interested in automotive training, I suggest you investigate NRI."



Professional equipment included at no extra cost

NRI gives you the choice of Master Automotive Technician training or a shorter Automotive Tune-Up and Electrical Systems course for the man seeking greater understanding of basic car repair. The Master course covers every major aspect of auto repair, from changing spark plugs to operating your own garage or car-care center. You not only learn the how and why with NRI's proved-in-use "bite-sized" texts, but you also get professional training equipment you need to actually do the work on your own or other cars as you move along in your home training. Equipment you get—at no extra cost—includes your own ignition-analyzer scope, as well as a dwell-tachometer, timing light, complete set of tools, volt-amp tester and assort-

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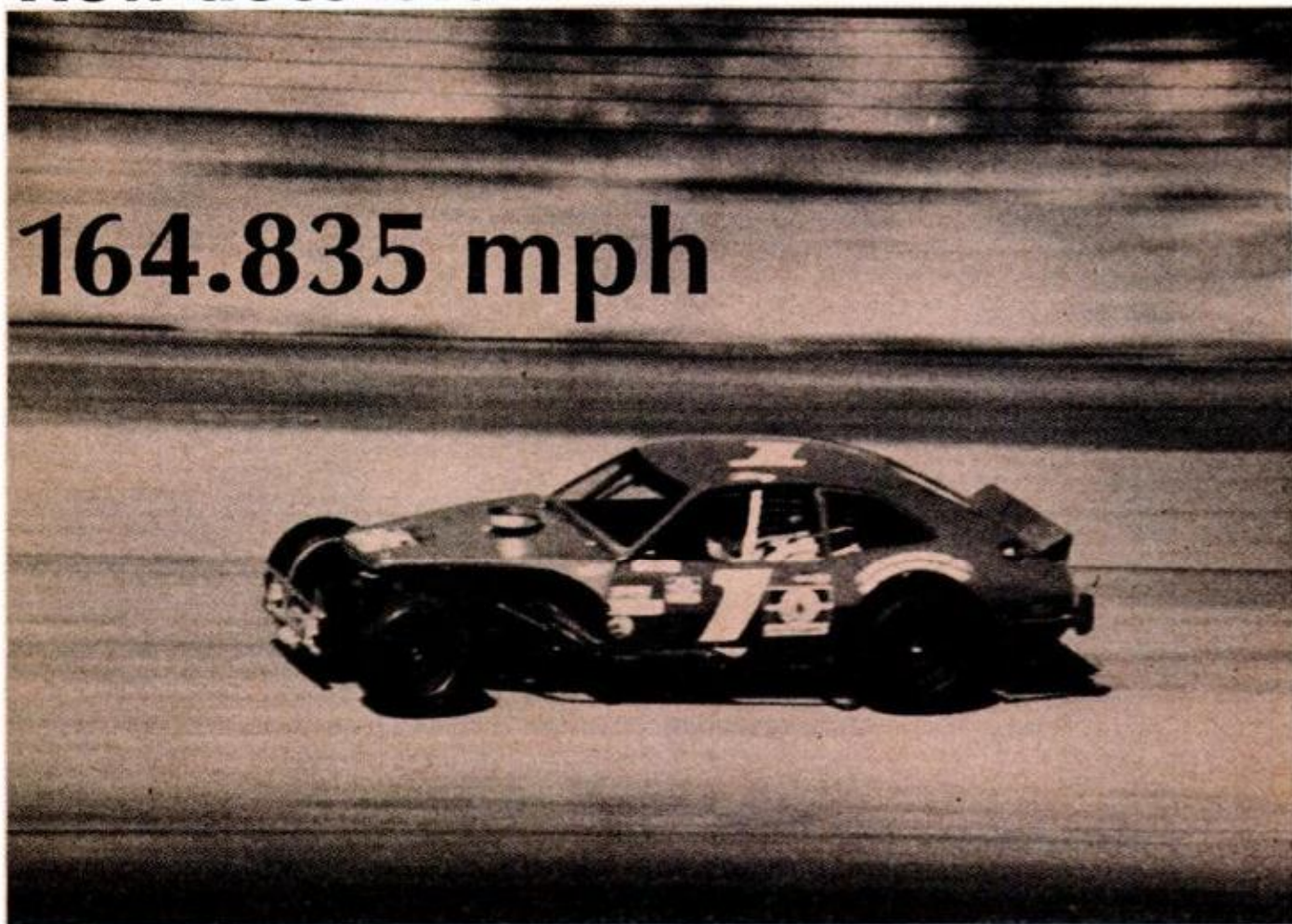
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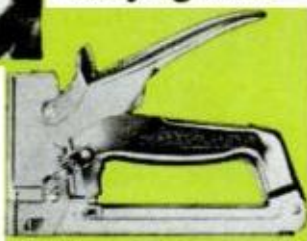
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Swingline
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LETTERS

(Continued from page 10)

moves the caps and allows the battery to air out before the posts are repaired.

Seligman further explains that as long as sulfation of the plates has not gone so far as to short the plates, acid is added to bring up specific gravity of the electrolyte. It should have a specific gravity of 1.265. (Our term, "pure," is regrettably somewhat ambiguous; it means that there are no impurities such as metal in the acid used for etching.) The acid is added to the cells a little at a time.

For complete safety, you will want to wear goggles, a rubber apron and safety gloves.

Celica's better than we said

I don't know who you contacted for opinions on the Toyota Celica ST (*PM Owners Report*, page 86, Jan. *PM*), but I wasn't one of them. So you may have my belated opinion to go with those you published.

The Celica is unquestionably the finest car I have ever owned. It is the first car I ever took delivery on that had zero factory defects. It is the first car I ever bought where the dealer sat down in the car with me for 15 minutes and went over all the dials, knobs and features before sending me off. It is the first car that ever offered me a special key to use in parking lots, that would not open the trunk or glove compartment. It is the first car that gave me a trouble light and toolkit. I could go on and on.

You panned the dealers and servicemen, but the two dealers I have dealt with could not have been better.

PHILADELPHIA

DR. R. ALEXANDER

Mod-24 framing

This Mod-24 building construction method "developed by the American Plywood Assn. and Western Wood Products Assn." (*What the New 24-Inch Framing System Means to You*, page 62, Dec. *PM*) is nothing new to me. My father has been using this type of framing for some 35 or 40 years. It has proven to be very sound construction.

LAFAYETTE, LA.

LYNN J. CURRY

I built my own home and used 24-inch frame spacing in some portions, instead of

the traditional 16 inches. I encountered several problems.

First, my materials costs were higher! The local building code specified 1/2-inch plywood subfloor for 16-inch joist spacing and 3/4-inch for 24-inch spacing. The higher cost of thicker plywood was partially offset by using fewer joists; however, the code required a bigger joist (2x12 instead of 2x10) in order to maintain the required load-carrying capacity of the floor. The net result was an increased cost of about \$150 for subfloor and joists.

There was a saving of \$40 or \$50 for the stud framing lumber.

The roof costs were about \$70 higher with 24-inch rafter spacing. Again, it was a matter of being required by the code to use thicker plywood and heavier rafters to compensate for increased spacing.

Second, the insulation in the walls does not maintain its proper shape. The 24-inch span gives enough play for the fiberglass to expand and eliminate the air space, which decreases the effectiveness of the insulation.

Finally, most 4x8 sheets of paneling have grooves that coincide with 16-inch framing. This hides nail heads. With 24-inch spacing, nailheads ended up in the middle of a simulated plank where they are more visible.

MILLERS, MD.

DAVID W. R. BROWN

Sears service manuals

We were surprised that the local Sears, Roebuck appliance-repair parts department contacted by your writer said it could not supply manuals for washers or dryers more than one year old (*Appliance Clinic*, page 58, Nov. '72 PM).

Kenmore service manuals are available through any of Sears Parts Departments. When ordering, ask for Kenmore Automatic Washer Service Manual (part No. 821462-A) and Kenmore Automatic Dryer Service Manual (part No. 828693).

The washer manual, for example, is designed to provide basic knowledge of the operation of the automatic washer. It does not cover a specific model, but covers in detail the repair of most components used on any model.

SEARS, ROEBUCK AND CO.
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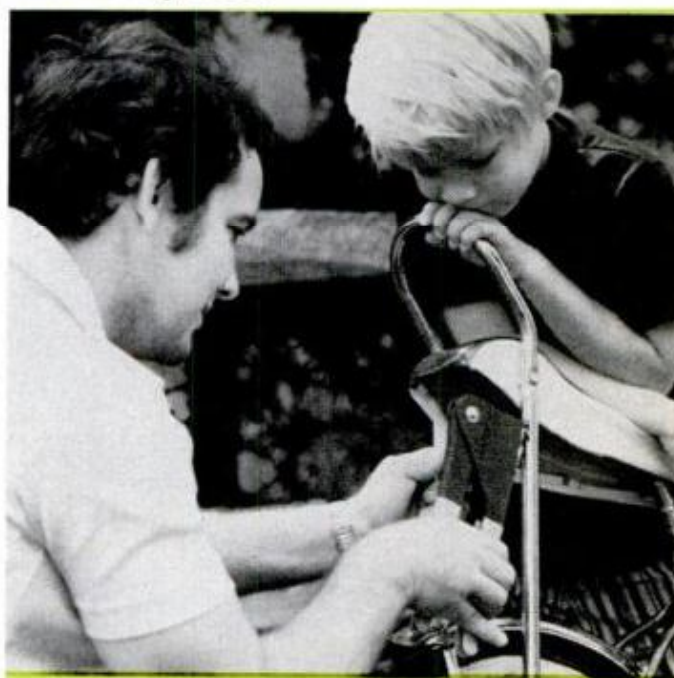
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MARCH 1973

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| <input type="checkbox"/> Auto Body Rebuilding Specialist | | <input type="checkbox"/> Electronics Technician | <input type="checkbox"/> CATV Tech. |
| <input type="checkbox"/> Engineering (Civil, Electrical, Mechanical, Chemical) | <input type="checkbox"/> Check here for special information, if age 16 or under. | | |

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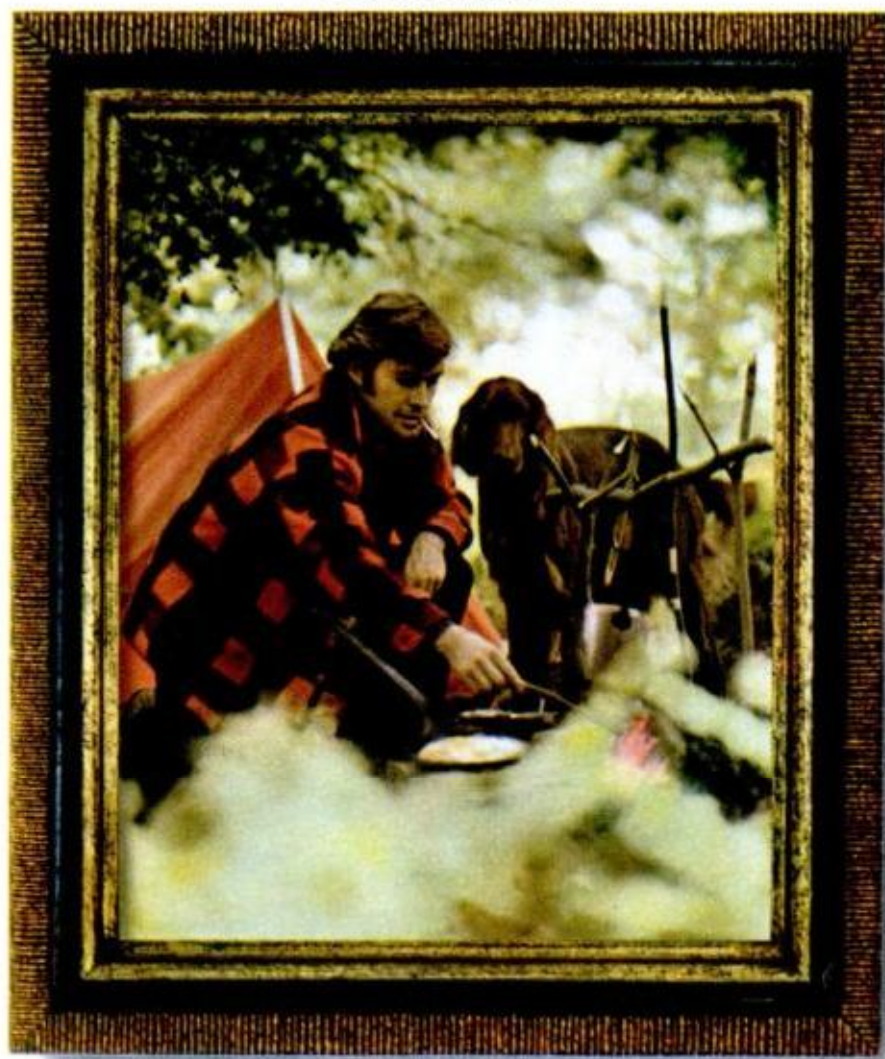
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THE BICYCLE SHOP



By EUGENE A. SLOANE

How to build and lace a bicycle wheel

YOU WILL EVENTUALLY hit a hole in the road hard enough to flatten your rim. Then you'll begin to hear a rhythmic thump, thump, thump coming from the afflicted wheel which seems unrelated to any random rough spots you're riding over. You will very likely then have a flat spot bad enough that no amount of truing and aligning of the rim will remove it. Now you will need a new rim.

Or, you may simply decide to upgrade your bike with better hubs and rims, or switch from clinchers to tubulars but use your old hubs. For these or other reasons, you may want to lace a new rim onto an existing hub, or vice versa.

For some reason, probably because of the maze and complex angles of spokes, lacing and building a wheel has for years been a virtual mystery to even skilled home bike mechanics. I once saw a West Coast math professor busily figuring out spoke angles with compass and protractor, with the idea of computing spoke angles so he could follow an existing wheel as he laced a new one. Wheel building simply isn't that difficult, although even with these simplified steps it might take you an hour to finish lacing your first wheel. You should soon be able to poke all the spokes in rim and hub in 30 minutes, and with practice in 10 minutes. That's not bad, considering a bike shop charges upward of \$6 to \$8 to build a wheel, exclusive of parts.

In this issue I will discuss wheel building only. Truing and aligning the wheel will be the subject of next month's *Bicycle Shop*.

In building a wheel, I assume you will be using a 36-hole rim and hub and 27-inch tubular or clincher tires, since most of the better 10-speeds sold today are so equipped. However, those instructions also

apply to other wheels with "crossed over four" spokes.

First, a few tips:

- *Make sure you have the right-size spoke.* Use an old spoke, or, if you have a wide flange hub and are lacing a 27-inch rim, use 12 or 12 $\frac{1}{16}$ -inch spokes. I prefer Robergel spokes for strength, but Union will do.

- *Remove freewheel gear cluster on rear wheel so you can poke spokes in hub in freewheel side.*

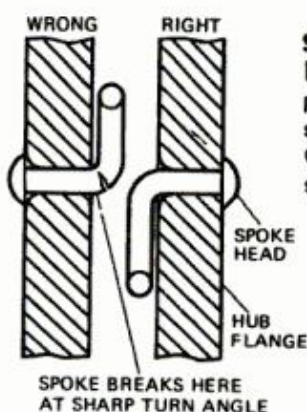
- *If you're lacing a small flange hub (1-inch diameter), you can still use 12-inch spokes if you cross three instead of four (see below).*

- *If spokes do not fit easily into hub holes, or spokes won't bend so spoke head seats easily into hub hole, ream hub holes out with a $\frac{3}{32}$ -inch drill; if still too tight, with a $\frac{7}{64}$ -inch drill.*

- *Definitions: Rim is the part the tire goes on. Hub contains bearing and axle. Spoke head is the part with the curved section and flat head. Spoke nipple is the short tubular threaded piece that holds the spoke on the rim.*

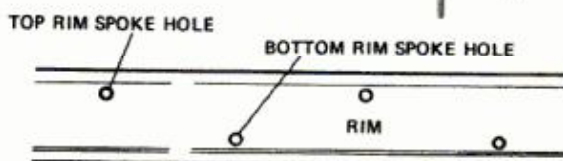
- *A 1-inch hole drilled in your workbench holds the hub upright for easier lacing.*

(Please turn to page 22)



SOME HUBS have every other hole countersunk. Always put spoke head in uncountersunk hole (drawing, left). Countersinking will relieve stress where spoke curves

HUB HOLES in one flange are offset from holes in the other flange. Poke a spoke down through the top flange; it lands between holes in the facing hub flange, as shown in photo

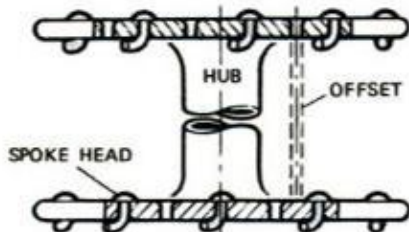


RIM HOLES are also offset. Every other hole is closer to the edge of the rim, as shown. Ignore the rim valve hole throughout these instructions; do not count it as a spoke hole as you lace the wheel

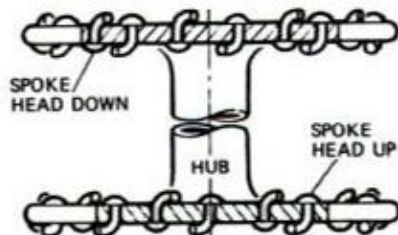
THE BICYCLE SHOP

(Continued from page 21)

Step 1: Hold hub upright in one hand, nine spokes in the other hand, spoke heads up. Poke a spoke down into every other hole in hub top flange (drawing, below). If every other hole is countersunk, poke spokes in noncountersunk holes. Now, using a spoke from top flange as guide, with hub still held as before in one hand, poke spokes down into every other hole in bottom flange, starting with first hole in bottom flange to left of where guide spoke hits flange. Do not put spoke into countersunk hole!

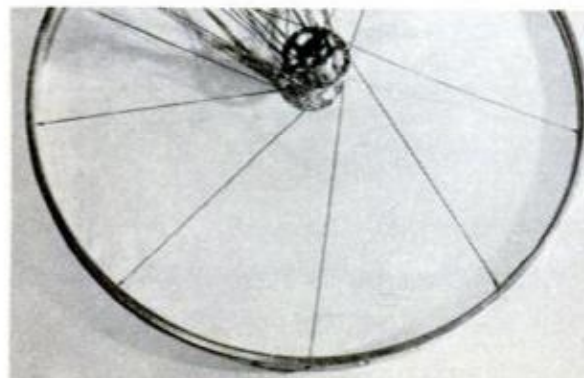


Step 2: With hub in same position as in Step 1, fan out spokes and, holding spokes so they won't fall out, turn hub over. Poke spokes in remaining holes in top and bottom flanges, with spoke heads up (drawing, below). (Relative position of spoke heads depends on which flange faces up.)



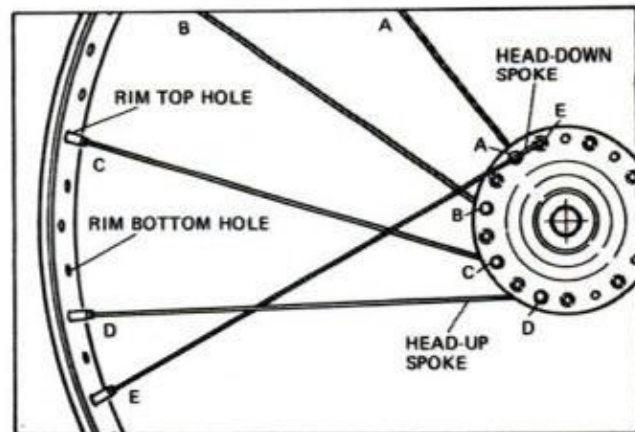
Step 3: Spread all spokes out and lay fully spoked hub on bench. Put rim down so hub is more or less centered. (We will from here on refer to spokes in hub as head-up or head-down. Head-up means spoke head faces upward from top of flange; head-down means spoke head faces downward, so spoke comes through flange hole from underneath. See drawing above.)

Step 4: Put any head-up spoke from top hub flange in any top rim spoke hole. Thread nipple on about six turns. (From here on thread nipple on each spoke as you insert it in rim.) Count off four rim holes to right of first spoke inserted in rim and put next right head-up spoke from top hub flange into that hole, which is a top rim hole. Continue until all top hub flange spokes are in all top rim holes and nipples threaded on. (Ignore the mess of spokes around you; concentrate on spoke involved.) Photo shows first four spokes installed. Note rim is moved



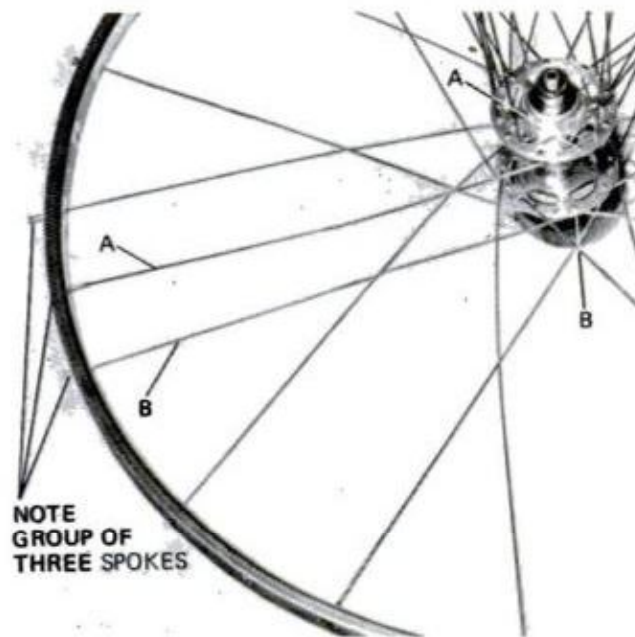
to left so spokes are twisted to clear just out-board of the next left head-down spoke in top hub flange, which is vital to wheel lacing. Note also the three empty rim holes between each spoke, two bottom holes and one top hole. Top holes are for remaining spokes in top hub flange.

Step 5: Take any of the remaining nine head-down spokes from top hub flange and cross over three spokes to right and under the fourth spoke and put in top hole in rim (drawing, below). Note that spoke E, which is the one we are lacing in Step 4, passes over spokes A, B, and C and under spoke D.



Step 6: Lace the remaining eight head-down spokes in hub top flange as per Step 5, crossing over the three spokes to the right and under the fourth spoke. Thread nipples on as you go. You should now have laced groups of two spokes in the rim, with one empty hole between the two, as shown between spokes D and E in the drawing above.

Step 7: Turn the wheel and hub over. Take any head-up spoke in the top flange. Refer to hub photo, page 21, which shows that spoke holes in top and bottom flanges are offset instead of being drilled vertically in line top to bottom. In the photo accompanying this step, letters designate key spokes.



NOTE
GROUP OF
THREE SPOKES

Sight down any head-up spoke (A) in top flange (the flange that's now on top) or use a spoke as a guide, and find the head-up spoke (B) in bottom flange

(Please turn to page 24)



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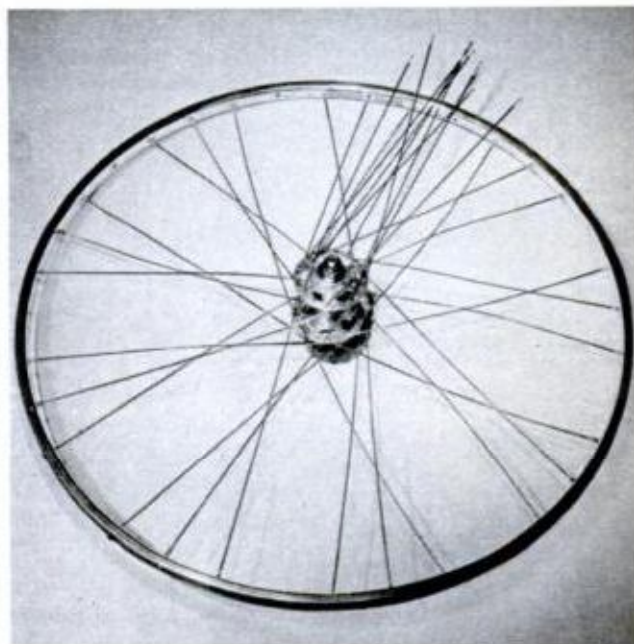
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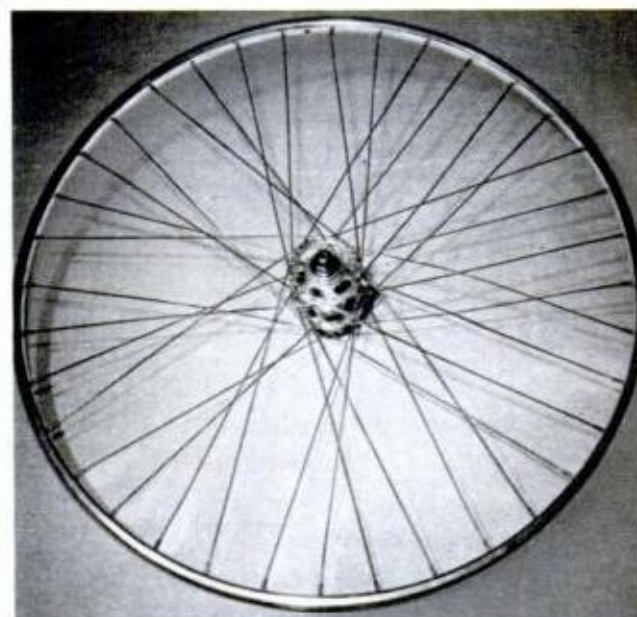
THE BICYCLE SHOP

(Continued from page 22)

just to left of head-up spoke in top flange above. Line head-up spoke in top flange roughly parallel with the head-up bottom flange spoke you have just found (spoke to left below). Insert the head-up spoke from top flange into top rim hole to right of the head-up bottom flange spoke you were using as a guide. (This is the next hole to right of the bottom flange head-up spoke.) Note the relationship of top flange head-up spoke (Spoke A) to its counterpart (spoke B) in bottom flange.



Step 8: Continue lacing head-up holes in top flange into rim as per Step 7. When finished, spokes will be in groups of three, as shown above. Lace spokes to left, as in Step 4.



Step 9: Lace remaining nine head-down spokes in top flange to right, crossing over the first three and under the fourth spoke just as you did in Steps 5 and 6. Take up all nipples (with ratchet screwdriver for speed) so only one or two spoke threads show. You are now ready to align and "true up" the wheel, which will be discussed next month. ★★

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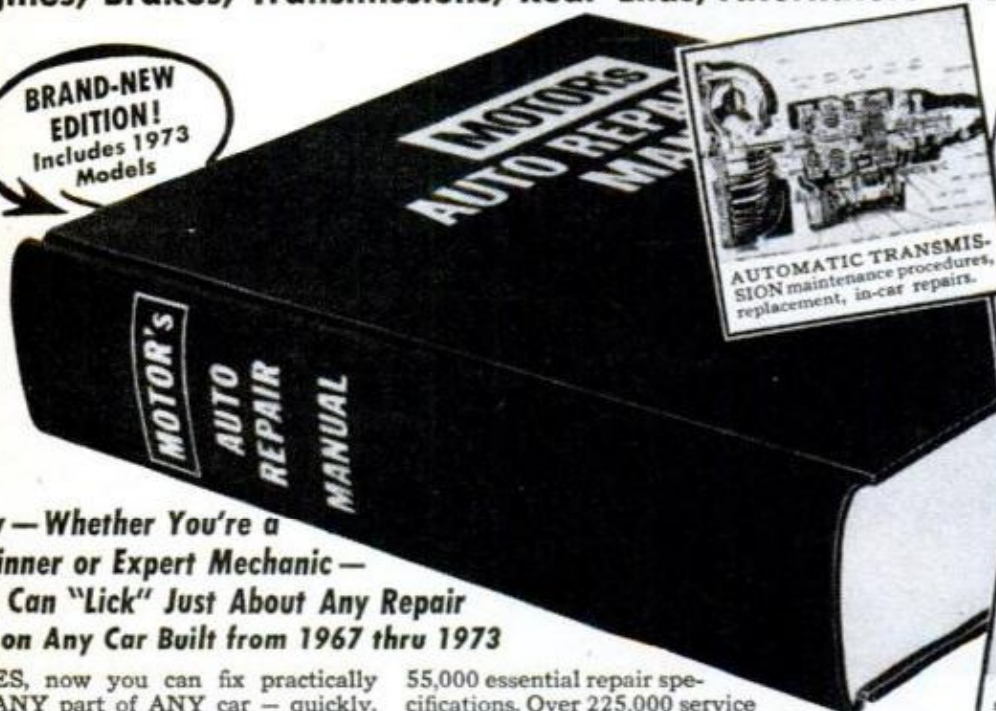
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science worldwide

By JOHN PEARSON



Dr. Feinbloom checks out specs

VISION OF PARTIALLY SIGHTED PERSONS can be improved from 600 to 1000 percent through the use of new "zoom" spectacles, according to the inventor, Dr. William Feinbloom, a New York City optometrist. Each eyepiece has two lenses that are separated by about an inch of airspace. The system is said to greatly increase the amount of light that hits the eye. Dr. Feinbloom claims his invention can help people with less than 10 percent of normal vision, enabling them to read magazines, watch television and, in some cases, drive a car. Dr. Feinbloom makes his spectacles available to all who need them, declaring: "My invention belongs to the world." Still, the glasses are expensive, costing from \$600 to \$800 a pair.



Weigh-in for two-day-old pig

THE SOURCE OF MUCH-NEEDED PROTEIN in developing countries could be the rabbit, long noted for its ability to proliferate. That's the theory of researchers at the Battelle Laboratories, Columbus, Ohio. They say that rabbits offer high nutritional value at low investment cost as well as returns from the sale of pelts and other by-products. Studies indicate that a female can produce five litters a year—about 150 pounds of marketable rabbit.

THE SMALLEST PIGS in the world—averaging about 80 pounds as adults—are bred at the University of Gottingen, West Germany. They stem from a line of miniature American pigs and are used for research. Porkers are good test subjects because they suffer many of man's ailments, have similar circulatory systems and will eat whatever man eats, an aid in carrying out research in human digestive problems. But standard-sized pigs—some top 1000 pounds—are too big and heavy for most lab facilities. They also eat too much.



Plastic pyramids trap the sun

THOUGH APOLLO 17—the last moon mission—is over, scientists on Earth will continue to receive live reports from the moon for at least two years. An extensive network set up by Apollo crews since 1969 and powered by atomic energy allows for direct relay of data from experiments on the moon. Instruments in the network measure such things as tremors beneath the lunar surface, heat radiating from within the moon, gravitational and magnetic forces, and particles in the lunar atmosphere.

A HEATING PROBLEM was solved in the sprawling entertainment center on Britain's Isle of Man by constructing its walls and roof of transparent plastic. When

(Please turn to page 32)

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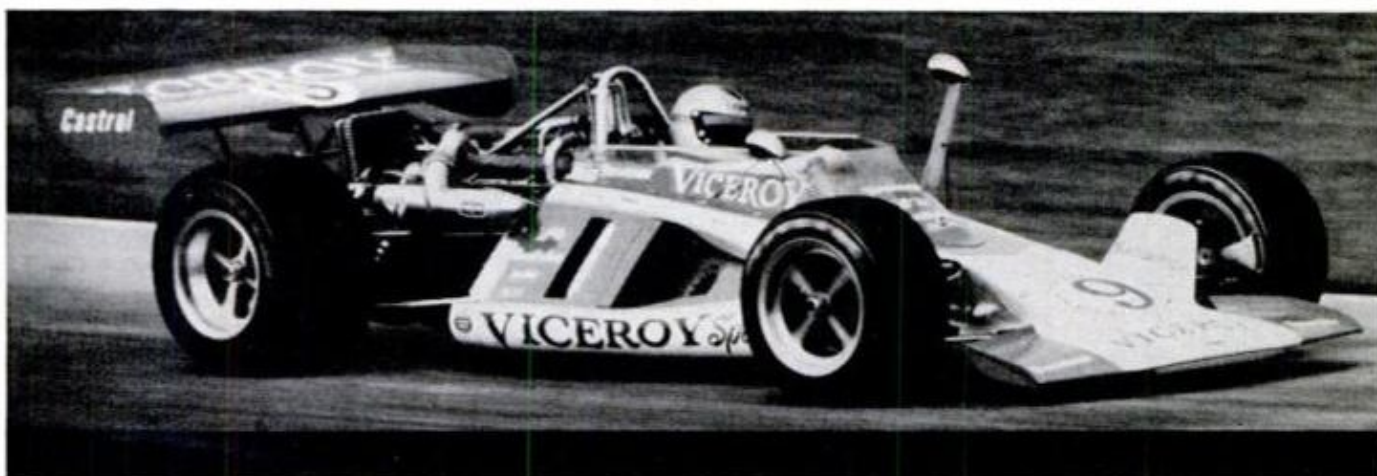
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SCIENCE WORLDWIDE

(Continued from page 30)

the sun shines, the building heats up to 80° F. When it's cloudy, auxiliary boilers take over. The plastic is shaped into thousands of tiny pyramids, which, engineers say, act as "sun traps." The walls are strong enough to withstand the 120-mph gusts that are generated by storms over the Irish Sea.

The environment

AIR POLLUTION seems to be everywhere, including high in the Swiss Alps. The Rhone glacier, once an almost transparent river



of ice, is covered with a layer of gray dirt that has been formed over the years by waste particles from industrial sources, autos and jetliners.

EFFECTS OF AIR POLLUTION on plant life are illustrated in a series of 35-mm color slides prepared by the Department of Agriculture. They're designed to help identify pollutants that harm vegetables and fruits, field crops, and ornamental plants and trees. A set of 105 frames, for \$18.50, can be ordered from the Photography Div., Office of Information, U.S. Department of Agriculture, Washington, D.C.

A TECHNIQUE for "marking" seagoing oil shipments with invisible magnetic tags has been developed by General Electric scientists. Every time a tanker takes on petroleum, its cargo could be tagged with a batch of magnetic dust. Each batch would have slightly different magnetic properties from all others used, and the properties would be registered as a code. In the event of an oil spill, the tag could quickly be analyzed and the culprit identified. ★ ★ ★



only you can save hunting...

Today hunting is safer than ever. The National Safety Council reports a 7.4% decrease in hunting accidents in the past decade. The Metropolitan Life Insurance Company points out hunting is safer than swimming or fishing.

BUT... Some people aren't interested in facts. They want hunting stopped forever. Here's what they're repeating often enough so the public is starting to believe them. (Write NRA for list of sources.)

"The yearly death and accident rate among hunters and innocent civilians indicates that hunting should be outlawed."

"The only herd that needs trimming is the herd of hunters."

"Hunters are generally a destructive, dangerous lot who have made a mess of our wildlife resources."

HOW can you, as a sportsman, fight this kind of talk? Best way is by joining NRA now. Become an NRA member and give us more muscle in our continuing efforts to tell and sell the truth about hunting and firearms. It's time you stood up for the hunting and shooting heritage you, as an American, believe in. Fill in and mail your application for NRA membership today. Tomorrow will be too late.



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IMPORTS AND MOTORSPORTS

BY BILL HARTFORD



OFF-ROAD RACING is a bouncy sport. The front end of your vehicle is airborne half the time, and your rear end the other! There are lots of dropouts—and rollovers as teams battle the ruts and rocks along the way. During the last Baja 1000 from Mexicali to La Paz the International Scout II, pictured above, winner of category II, rolled twice before blasting into La Paz two hours before the nearest competition. The Baja 1000 is sanctioned by the National Off Road Racing Assn. (NORRA) and divided into 10 classes for 10 types of vehicles. The Scout II took honors in the factory-production, two-wheel-drive class. The only modifications made by driver Jimmy Jones and navigator Cass Cassinelli were the allowable ones of chaining the engine to the frame and changes in exhaust system, manifold and carburetor. You can get more information about off-road racing by writing to NORRA at 1616 Victory Blvd., Suite 200, Glendale, Calif. 91201.

BACK ON THE ROAD and paved ovals this month is the smooth and fast kind of auto racing in which cars have a ground clearance of one pebble and the tracks are vacuumed before the machines line up on the grid. Championship (Indy-car) racing starts March 17 at Phoenix. Trenton's next on April 15 and then Indy on May 28. The rest of the season stacks up: July 1, Pocono; July 15, Cambridge Junction, Mich.; Aug. 12, Milwaukee; Sept. 2, Ontario; Sept. 23, Trenton again and Nov. 3, back at Phoenix for the traditional finale. The fastest cars on the track last year were Dan Gurney's Eagles, but they

might not have top speed in the bag this year: The new Mark II Parnelli car (owners, Vel Miletich and Parnelli Jones; designer, Maurice Philione; drivers, Al Unser and Mario Andretti) turned 197.8 mph in testing at Ontario Motor Speedway—and that was in the very first days of testing.

MINIBIKES! WHAT'S A PARENT TO DO? It seems that minibikes are often more of a problem than a pastime. Certainly for responsible parents who participate in the purchase of the machine and set up rules for their use. There's some good advice in a new pamphlet published by the National Highway Traffic Safety Administration of the U.S. Department of Transportation. You can get a single copy free by writing the Consumer Product Information Center, General Services Administration, Seventh and D Sts., S.W., Washington, D.C. 20407.

NEW TO THE TOYOTA LINE for 1973 is a four-door Corona station wagon. It has a top-hinged tailgate and shares with the sedan and hardtop all their features as well as running gear, differing only in dimensions and weight: wheelbase, 96.9 in.; overall length, 171.3 in.; height, 55.9 in.; and curb weight, 2490 pounds. Also new is a three-speed automatic transmission for the Celica ST (See Owners Report: Toyota Celica, page

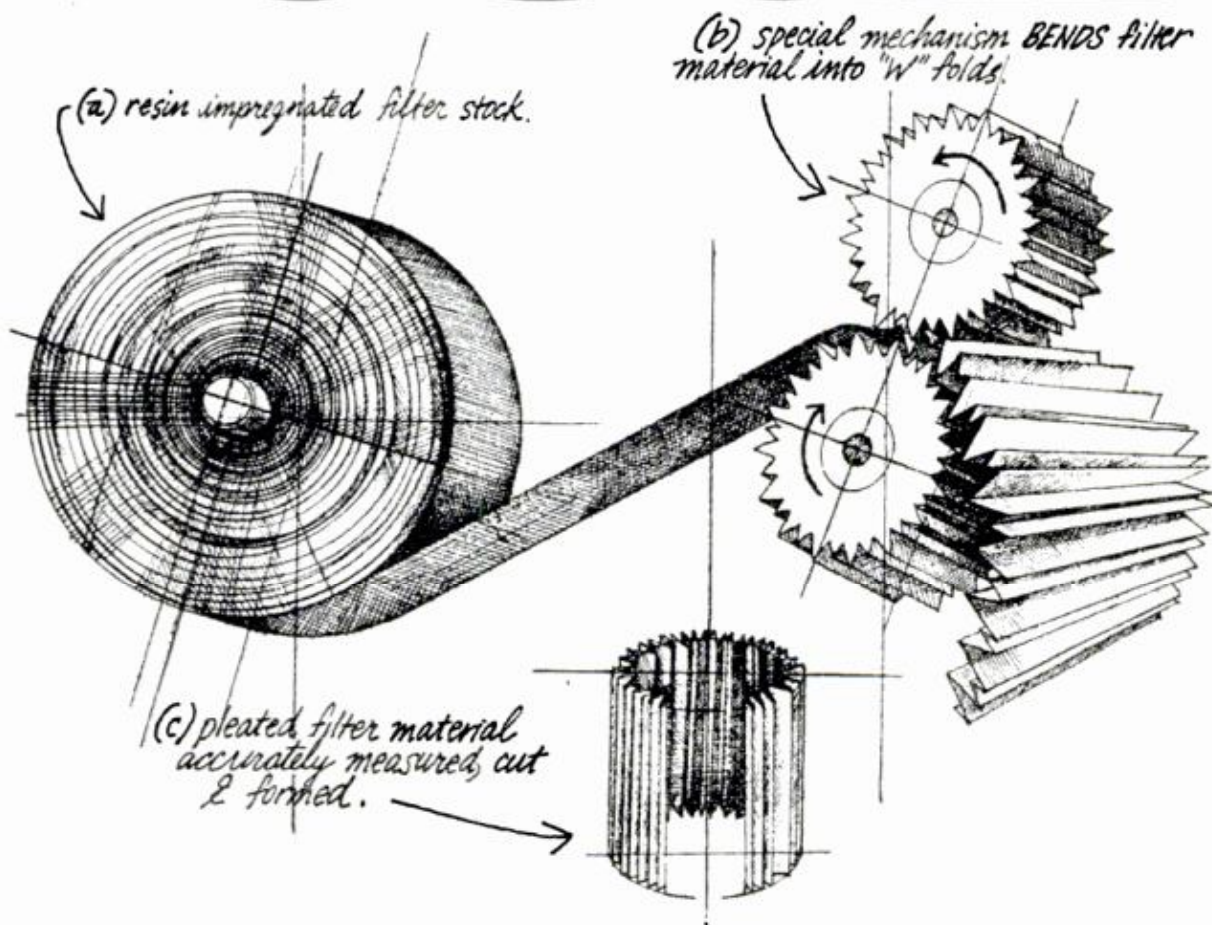


86, Jan. '73 PM), and a performance boost for the Mark II's ohc Six: The 156.4-cu.-in. engine puts out 122 net hp, up 12 percent over '72 versions.

BEST FIRST SPORTS CAR for my money and for people who really love to drive is the Triumph Spitfire—and it's better for '73. Overall styling is the same as it has been but the engineering changes are many. It's now called the Spitfire 1500 because engine displacement is up to 1493

(Please turn to page 36)

TOUGH!



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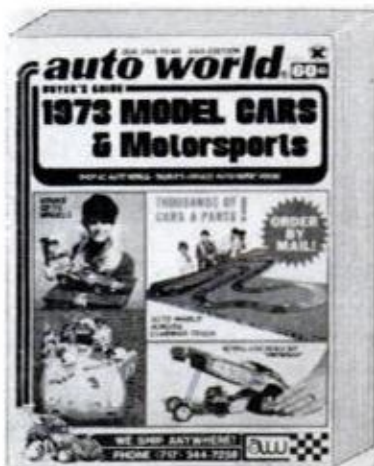
(Continued from page 34)



cc (from 1296) with attendant increases in horsepower and torque. A larger clutch has been fitted for the additional torque, and rear-axle ratio is taller (3.89:1) for less noise and better fuel mileage at speed. Interior changes include new seats, dash, steering wheel and excellent, inertia reel, lap/shoulder belts of the three-point type for quick, convenient one-hand connection to the center anchor. What else is new? Base price. It's up to \$2895.

P.S. If you're really into Triumphs (even if you don't own one) you can join the Triumph Sports Owners Assn., 600 Willow Tree Rd., Leonia, N.J. 07605. It's \$5 a year which puts you on the list for the very informative TSOA Newsletter.

CATALOGOMANIA. Homeowners have their Sears and Wards. Outdoorsmen have their L.L. Bean and Eddie Bauer. Electronics experimenters have their Lafayette and Heath. And auto parts and add-on nuts have their J.C. Whitney. The full-fledged catalog for motor-sports fans is the latest Auto World whopper. Officially called the 1973 Model Cars & Motorsports catalog, the 150-pager is full of all kinds of model cars and racing cars as well as real racing equipment for full-size



cars. The guy who gets it together is Oscar Koveleski—a name you know if you follow auto racing. If you can't find the catalog on newsstands for 60 cents, you can send 50 cents to Auto World, 701 North Keyser Ave., Scranton, Pa. 18508.

DO-IT-YOURSELF GUIDE: The U.S. Bureau of Customs has all the rules for importing a car. Send a dime to the U.S. Government Printing Office, Washington, D.C. 20402. The publication is Stock No. 4802-0027. ★ ★ ★



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Read about the big demand for on-location cleaning, see why Von Schrader Detergers are the finest of their kind, how easy they are to operate. Learn how other men have become financially independent, how Von Schrader helps you every step of the way. Fill in the coupon and send for free booklet.

Extra! Special Recorded Message included with booklet. Listen as Francis von Schrader talks to you personally about your growing future with Von Schrader Detergers.



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APPLIANCE CLINIC

By PAUL MANN

When hard is too hard

We recently moved into this area where well water prevails. This water leaves whitish deposits on pots and pans after water has been boiled in them, and the only way to remove them is with steel wool. Is this indicative of excessive iron in the water? What can be done about it?—Mary Cruden, Omer, Mich.

It sounds as if you have a typical hard-water condition; that is, water contains calcium (lime) and magnesium rather than iron. Iron in the water would be indicated by brown to black stains on fabrics and porcelain.

If a hardness condition is at a critical stage, it will not only leave deposits, but can plug water pipes, and leave scale in water heaters and steam irons. The solution is to install a water softener, but you probably won't want to purchase this rather expensive unit unless it turns out that your situation is critical. How can you find out?

Water hardness is measured in grains per gallon. Water in a home usually falls between 3 and 30 grains per gallon. When hardness exceeds a 10-grain concentrate, the installation of a water softener is recommended.

Take a clean plastic vial of water to a well driller in your area. Most of them have equipment to test the hardness of water.

Powerless power cord

Our General Electric portable dishwasher has a retractable power cord. Our problem is that retraction now is so sluggish that the entire power cord isn't retracted. Can I do something about this?—Walter Lawrence, Orlando, Fla.

Of course. The probable cause of your trouble is a need for lubrication. There are two points that require lubricant. Take the reel apart, clean it thoroughly and lubricate these points with Vaseline or a silicone.

Another cause for sluggish retraction is a weak spring. If the condition continues, remove the spring and get a replacement at a GE dealer or hardware store.

Washer 'tears' clothes

We are having a problem with clothes tearing in our washing machine. What causes this and what can be done to prevent it?—Mitchell Berry, Winston-Salem, N.C.

When a washing machine "tears" clothes, the trouble is usually chemically or mechanically induced.

Chemical damage is most often caused by improper use of bleach. Pouring bleach on clothes without proper dilution or measuring can cause small round holes in fabrics or will weaken the strength of the fabric so it tears easily. Chemical damage can also result from using soaps having a high lye content.

To determine if tears are being caused by bleach, have a druggist mix a two-part Fehling solution as follows:

Solution A: Dissolve 70 grams of sodium hydroxide and 175 grams of potassium sodium tartrate in 400 cc of distilled water. Dilute to make 500 cc.

Solution B: Dissolve 30.64 grams of copper sulfate in distilled water. Dilute to make 500 cc.

Don't mix the solutions until you are ready to use them. Then mix equal parts in a heatproof glass container and completely immerse a damaged item of clothing. Slowly bring the solution to a boil and continue to boil it for three minutes. Then remove the item of clothing for examination.

If tears are being caused by improper use of bleach, the damaged area will look pink and its tensile strength will be very weak. Conversely, areas that haven't been affected by bleach will be light blue in color and strong.

Mechanical damage can be caused by a problem with the machine itself or by a sharp foreign object introduced into the machine. Since the agitator is the one part that comes in contact with clothing most often, start your search here.

Is the agitator cap tight so that clothing isn't getting snagged? Is the agitator surface smooth? Is its bottom edge no more than $\frac{7}{16}$ inch off the bottom of the tub?

If there are any rough projections on

(Please turn to page 40)



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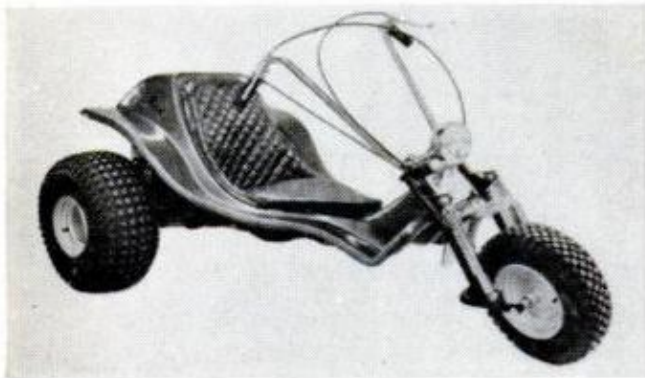
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APPLIANCE CLINIC

(Continued from page 38)

the agitator, try to smooth them down with sandpaper or a file. If the agitator is broken, have it replaced.

Check the basket by rubbing an old nylon stocking over its entire surface. If the stocking gets caught, you have encountered a projection that should be smoothed down.

If the agitator and basket aren't damaged, then clothing is probably being torn by foreign matter which is being introduced into the wash water. For example, watch out for particles of gravel that get hung up in pockets and cuffs.

Finally, keep in mind that clothing wears and certain spots will become weaker than others. This makes them more susceptible to tearing. These weak spots can be detected easily by holding the clothing up to a light.

Waste water worries

I recently installed a waste disposer and am experiencing leaks between the sink and sink flange. I've removed and reinstalled the unit a couple of times, each time using a generous amount of plumber's putty under the sink flange. What can be done to stop these annoying leaks?—Robert Buchanan, Woodland, Calif.

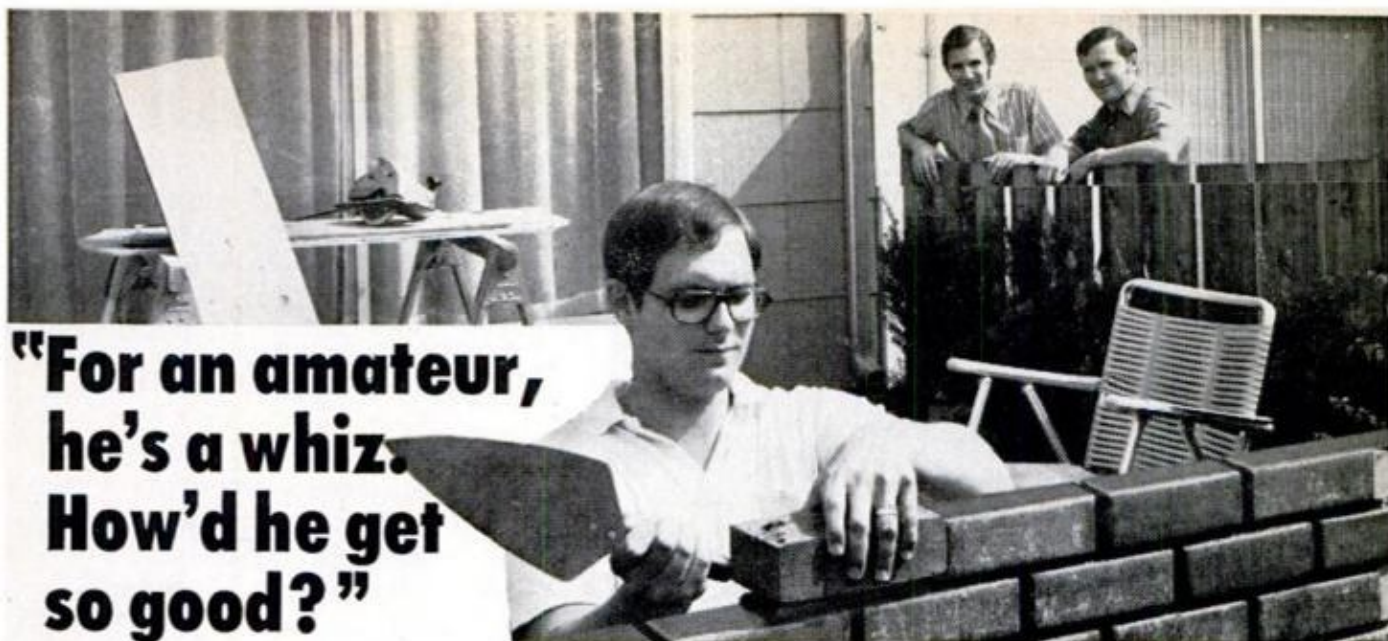
You may have gotten something fouled up in locating the position of the sink flange and allied parts.

In tightening the mounting studs, apply firm even pressure. Make sure that the snap ring is in the groove on the sink flange. If gaskets and seals are not properly set and tight, the leakage will continue regardless of how much putty you have used.

Supplier of service manuals

Parts Distributors Corp. of 932 Old York Rd., Abington, Pa. 19001, informs us it has available service manuals of many major appliance manufacturers. You can obtain a free listing of these manuals by mailing the company a stamped self-addressed envelope. ★★★

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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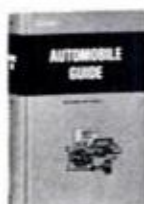
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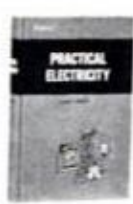
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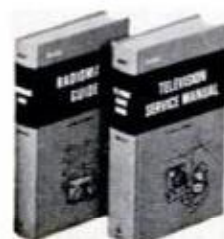
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Photo Hints

Darkroom table sink

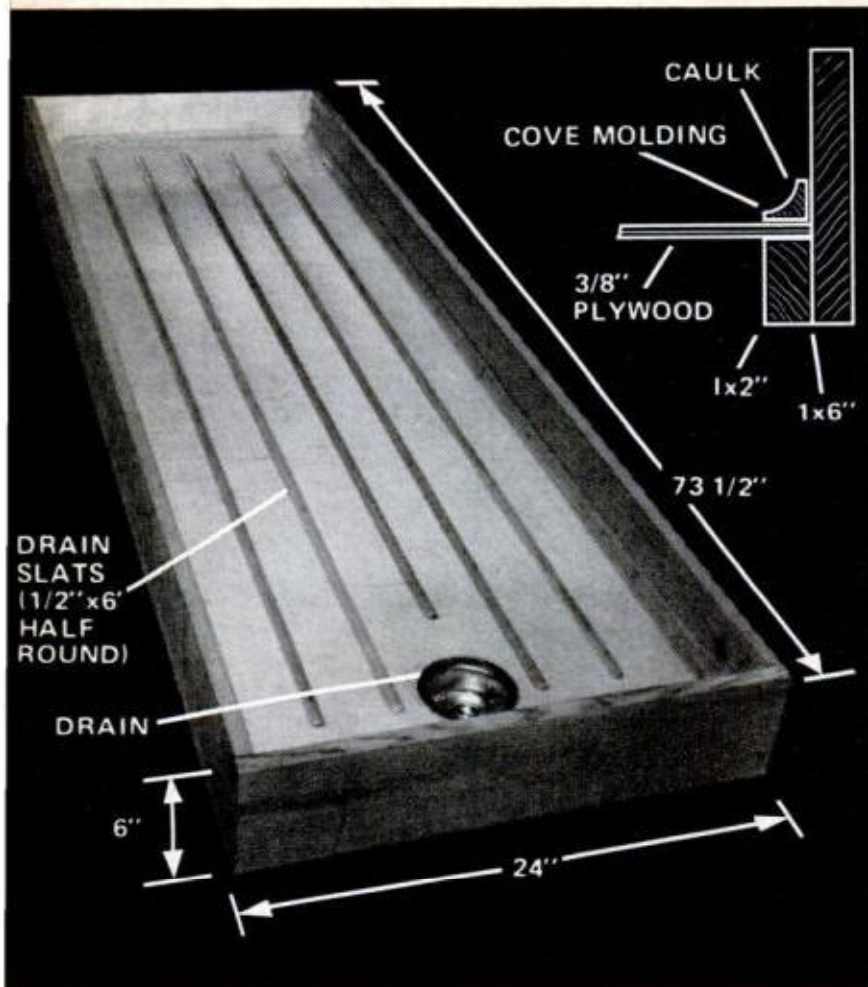
YOUR DARKROOM SINK—if you have one—is probably too deep to hold your trays at a convenient working height and too narrow to hold all of them at once. And normal spills and splashes mess up the floor if you just set your trays on a table.

I decided to build a tabletop just big enough to hold my trays, put a high lip around it, and made it into a darkroom sink.

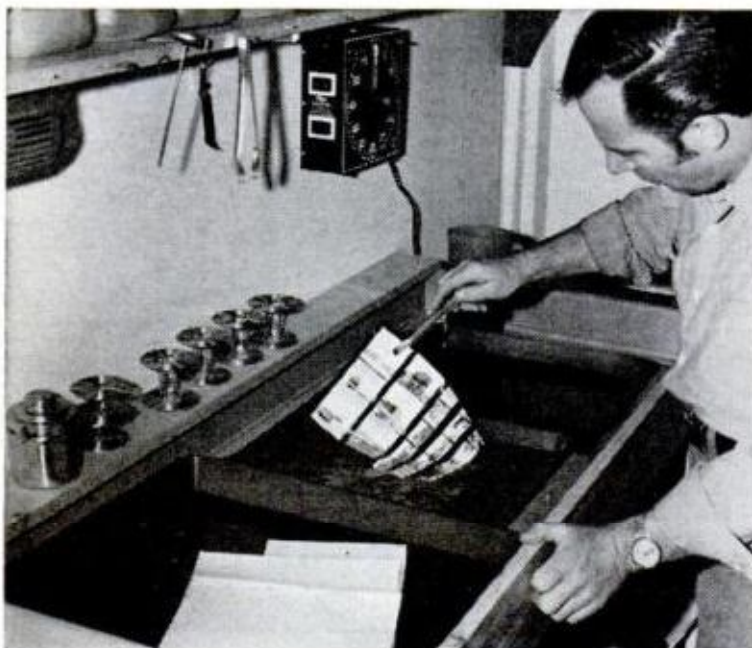
The bottom is $\frac{3}{8}$ -inch exterior plywood (2x6 feet, in my case), boxed in with 1x6 stock and supported on a lip of a 1x2 lumber. For sealing (and to make round corners easy to wipe clean), I put stock 1-inch cove molding around the inside edges of the bottom, caulked the molding, then covered it with a coat of fiberglass boat resin and molded 6-in. fiberglass tape over that. I installed drain rails (stock, $\frac{1}{2}$ -in. half-round molding) to allow spills and wash water to drain under the trays and print washer and I put a sink drain and strainer at one end. Finally, I gave the entire sink a coat of the resin. You can use epoxy or polyester resin—but if you choose epoxy, do the job in a well-ventilated space and beware of fumes.

You can mount the finished sink on homemade legs or ready-made ones, build it into a counter top, or even lay it on top of two tables, cabinets or saw-horses of convenient (and matching) height. If you have to put your sink away between darkroom sessions, you may want to put the drain in a corner of the sink for easier emptying when you're through.—*Victor W. Kondra, Goleta, Calif.*

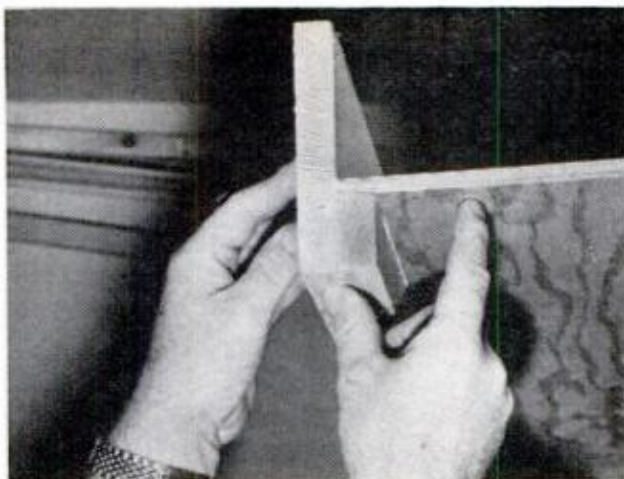
POPULAR MECHANICS



SINK DIMENSIONS were chosen to match my trays and fit the space I had available—you can vary length and width to match your space and trays. Six-inch height keeps sink shallow enough for easy print agitation, allows use of standard 1x6 lumber (actually smaller than nominal size, but exact dimensions aren't critical). Drain rails, (stock half-inch, half-round molding) raise trays above sink floor, allowing liquids to drain easily. For temporary setups, place bucket under drain



FINISHED SINK holds three large print trays. Shallow design is ideal for temporary darkrooms, since it's easy to store



END VIEW (above) shows side rail, sealing lip and plywood bottom. Glue and nail sealing lip to the side, then glue and nail the bottom to the inside edge of the sealing lip. End sections are butt-nailed into position before cove moldings are installed

COVE MOLDINGS (top right) form added seal, make smoothly curved base for fiberglass tape overlay; curves make spills easier to wipe up, too. Coat both flat sides of the cove moldings thoroughly with a caulking compound before nailing them in place

FIBERGLASS CLOTH TAPE, applied over cove molding, provides an extra seal against leakage, smoother corners. After installing tape, drain and drainage rails, seal the entire sink with fiberglass boat resin (polyester or epoxy—but beware of epoxy fumes)



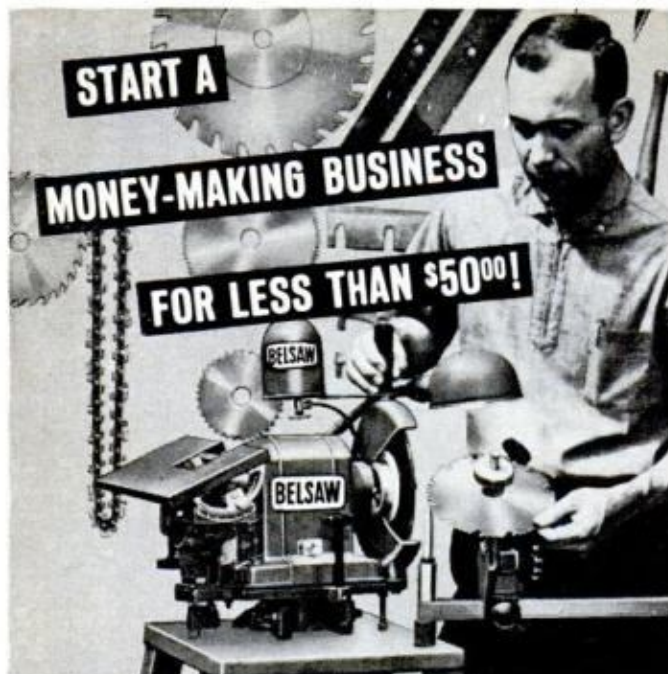
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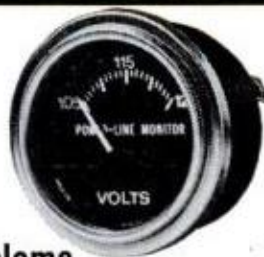
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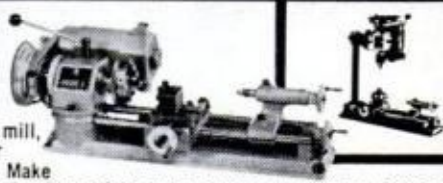
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NEWS Need for thousands of new technicians in booming field brings action! Now, for the first time, you can train at home with this **OFFICIAL** industry association course. It's "insider" training. The **ONLY** course Approved and Endorsed by



It's the course you couldn't get before because it has always been reserved for "insiders" — association members and their dealers.

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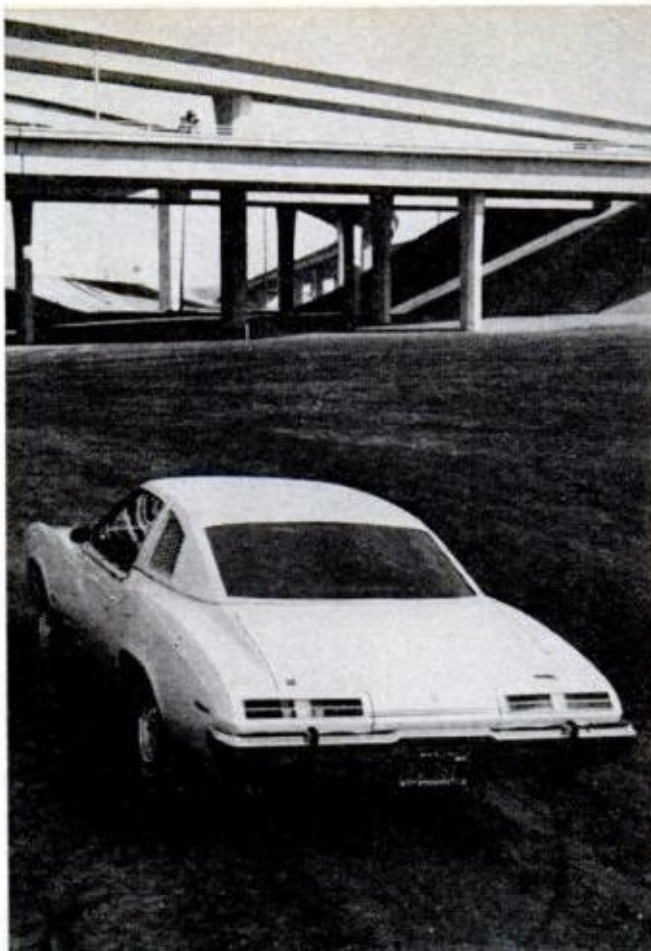
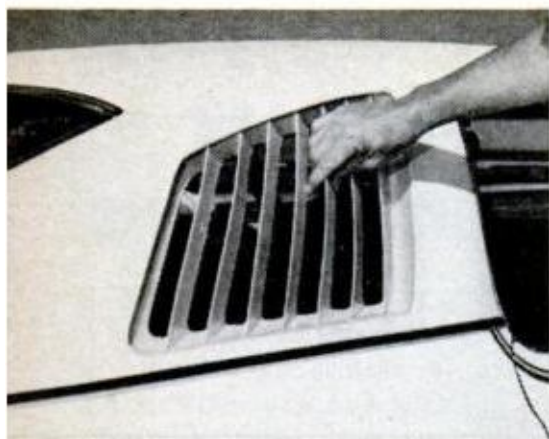
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BOPPABLE NOSE pops back, but vinyl racing stripe cracks if wrinkled too often. Louvered side windows don't go down, are hard to clean. Driver can see out of them but rear riders can't

PM OWNERS REPORT: PONTIAC GRAND AM

To Pontiac, it's a 'European

By **MICHAEL LAMM**, West Coast Editor

Photos by the author

DOESN'T LOOK like the average car —looks more foreign," says a Massachusetts welder. What he apparently doesn't realize is that Pontiac went to an awful lot of trouble to give that impression.

Neither this owner nor (judging from responses to our survey) most other Grand Am owners realize that Pontiac has spent considerable time and money to make this a genuine American grand touring car in the European tradition (see *What makes this American gran turismo car European?* page 52). Pontiac's effort has apparently been lost on all but a handful of Grand Am owners.

Too few buyers understand that General Motors "went European" this year

with four of its A-bodied intermediates: the Grand Am, Chevy's Monte Carlo, Buick's Regal and the Olds Cutlass Salon. All four try to capture the Continental *gran turismo* flavor. They offer the nearest thing to sports-car handling ever put into American cars of this size. Handling in each case comes via finely tuned suspensions and chassis set up for steel-belted radial tires (standard equipment), good disc braking, quick steering, plus stabilizer bars front and rear.

The car magazines have all called the Grand Am "Detroit's Mercedes." Despite stiffer-than-normal suspension, Pontiac engineers have given the Grand Am a comfortable long-distance ride. Its stylists reached for European verve inside and out, with luxury touches and tidbits not normally found in U.S. cars—adjustable lumbar supports inside the front seat—



HANDLING AND MANEUVERABILITY are two qualities Pontiac engineers very successfully put into Grand Am. Many owners bought the car for other reasons, but they soon discovered its European *gran turismo* virtues

A nationwide survey based on 700,000 owner-driven miles **GT,' but do owners agree?**

backs, for instance, or the dimmer switch in the turn signal stalk, plus a very British-looking instrument panel with instruments set in real mahogany.

Has Pontiac succeeded? Or is all this *gran turismo* sophistication lost on buyers who don't appreciate it?

One of the first questions we asked was, "Why did you buy your Grand Am—what tipped the scale in its favor?" Here are typical answers: "Many features available at thousands of dollars less than other luxury cars." "Styling." "Because I didn't know what make it was the first time I saw it; I thought it was a foreign car." "Wanted a smaller car and was impressed with the Grand Am's appearance."

The majority of reasons ran in that general vein. Most owners couldn't have cared less about touring in the grand European manner. They weren't swayed by han-

dling, responsiveness, braking, maneuverability, or any of the rest of it.

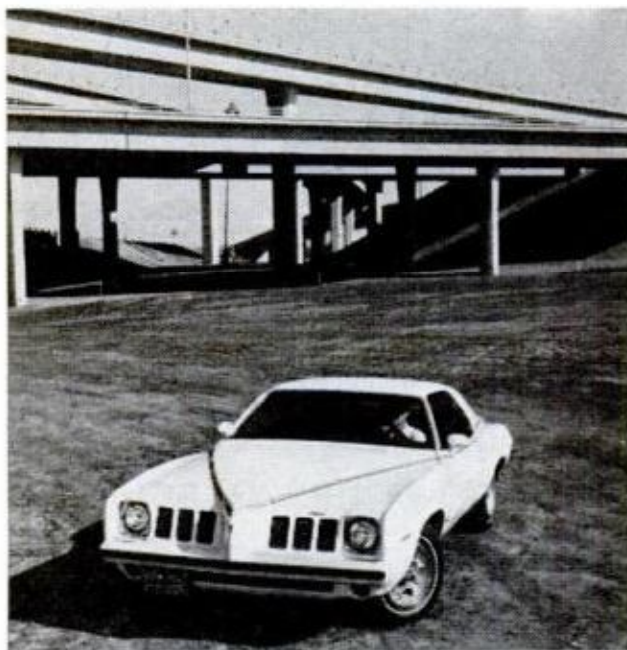
But then, about every 15 questionnaires we'd get another type of response. This was from people who understood what the Grand Am was all about. To wit: "I bought my Grand Am because it's a radical departure from GM's norm—suspension and handling foremost."—Ohio rubber worker. "Because of its European-like handling and comfort plus Detroit's luxuries."—New Jersey bank examiner. "Where else for the price can you get a car that has been engineered so soundly?"—Ohio shipping clerk. "The chassis tuned to the radial tires, lumbar-adjustable bucket seats in a four-door, and gauges on the instrument panel—wow!"—Indiana technical writer.

So while most people fell for the Grand Am's looks, which did play an important

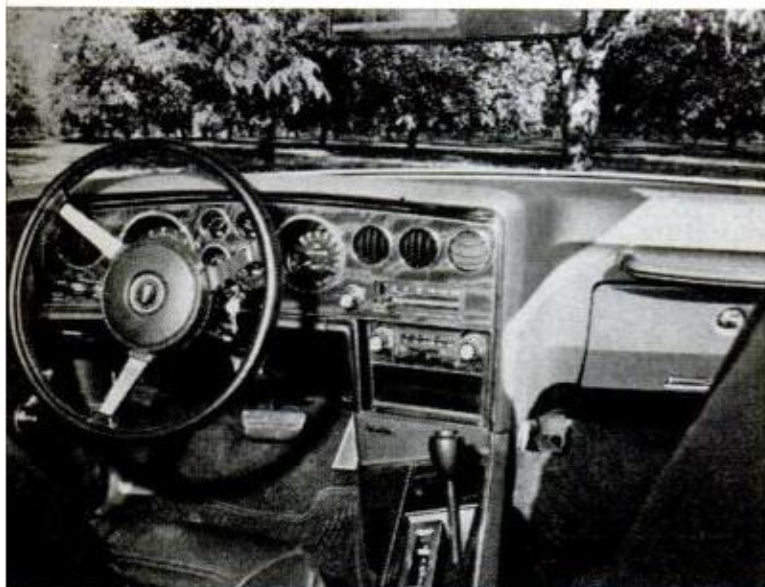
role in all buying decisions, about one out of 15 buyers had deeper reasons.

Once purchased, owners began to discover what they'd gotten. "Very comfortable, especially on trips." "Cruises effortlessly, rides surprisingly well on *silent* radial tires." "I like the standard features such as disc brakes, steel-belted radial tires, reclining bucket seats, the smooth handling and quick response." "I drive an average of 60,000 miles a year, and this is the best road car I've ever had." "Corners best of any car I've ever driven."

An Albuquerque jeweler compared his Grand Am to the 1968 Mercedes 280SE sedan he'd traded in on it. "I'll never un-



DISTINCTIVE FRONT sets Gran Am apart from other Pontiac intermediates, but rear looks like Le Mans



DRIVER-ORIENTED COCKPIT sets full gauges in real mahogany dash. Turbo Hydra-Matic trans is standard

derstand the Mercedes' shortcomings. It's superbly designed and the engineering is faultless. But it was always noisy (engine and wind) and too expensive to maintain. When we traded it at 42,000 miles, it needed an engine overhaul, used a quart of oil every 300 miles, and chugged at idle (cure:

(Please turn to page 52B)

What makes this American gran turismo car European?

THE AUTOMAKERS' DREAM is sports-car handling in a family sedan. The Europeans got there first: Jaguar, Mercedes, Citroen, BMW and so on.

Not to be outdone, GM decided that if the Europeans can do it, so can we. GM set out to build—and did build—four cars that embody true gran turismo handling, maneuverability, braking and performance, combined with a good long-distance ride, roominess, general comfort and luxury.

For 1973, all four of GM's A-bodied intermediates—Pontiac Grand Am, Chevy Monte Carlo, Olds Cutlass Salon and Buick Regal—offer true GT models. These cars really handle. Let's see what makes Grand Am that way.

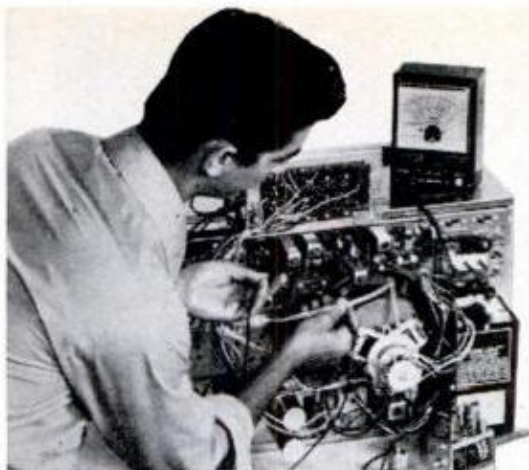
The Grand Am's chassis was set up specifically for steel-belted radial tires. (See *How Detroit is "tuning" its new cars for radials*, which begins on page 130.) Suspension uses heavy-duty everything, including harder rubber bushings, a thicker front stabilizer (1.12 in. o.d.), a standard rear stabilizer and a bit more suspension travel than found in normal Pontiac intermediates.

Shock absorbers, called Pliacell, have internal plastic membranes that separate the hydraulic fluid from the gas. At high speeds on rough roads, most shocks tend to aerate (gas and fluid mix, causing bubbles). This kills a shock's effectiveness. But Pliacell shocks can't aerate.

Despite a much stiffer-than-normal suspension, the Grand Am's ride is very smooth and silent—surprisingly so. At 80 mph, the car feels like most others doing 60.

Two V8s in four horsepower ratings lend impressive performance. Hottest is the LS2 Super Duty 455-cu.-in. V8 at 310 hp net. This engine has fittings at the back of the block for quick conversion to dry-sump lubrication (for racing). Transmission choices include the Muncie M21 wide-ratio four-speed or GM's Turbo Hydra-Matic (standard).

Conclusion: If you want a car that handles—and one that handles the family as well—the Grand Am and its three A-bodied cousins will give you more grand touring for your money than anything from Europe.—M.L.



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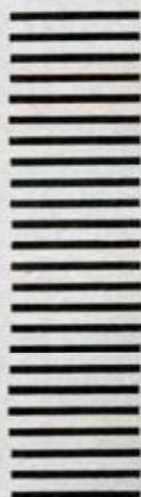
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SEATBACKS ADJUST not only for rake, but also have back supports inside that can be dialed firm, soft

PONTIAC GRAND AM

(Continued from page 52)

a \$400 injector pump). That's why we began to look for a car with Mercedes virtues but for less money and upkeep. The Grand Am has common domestic faults, but the ride is true and precise, it doesn't float at highway speeds, it turns in a reasonable circle, it doesn't stick out yards beyond the axles, it fits into my garage, it carries five people at 70 mph, and you can carry on a normal conversation at that speed."

What are some of those "domestic faults"? Owners rated workmanship good/excellent by a two-thirds majority—terrific for a Detroit car. When asked for specific complaints, 23.3 percent had none—a remarkable showing. But there are gripes.

"Alloy wheels are too soft—a brick will total one, and did!" "It's extremely difficult to find steel-belted radial snow tires to fit this car." "No rear legroom in the coupe, no light in the heater control or trunk." [*They're optional.*] "The tuck-under of the body makes it impossible to keep clean." "Louvered rear side windows look nice, but the glass is hard to clean, and nobody sitting in the back seat can see out." "Gas mileage is less than I expected with the two-barrel carburetor." [*Lots of owners complained of poor gas mileage.*] "Not enough headroom, legroom, nor trunk space." "Lousy workmanship."

We asked owners, "If you were willing to spend \$1000-\$2000 more for a car, would you have bought a different one?" An amazing three out of every four said no. Of those who said yes, 31.3 percent wanted a Pontiac—probably the Grand Prix or Grand Ville with more luxury and comfort options than they ordered with the Grand Am. Next came Mercedes-Benz, then Toronado and finally Cadillac. We also got a smattering of BMW, Pantera, Triumph Stag, Corvette, etc.

Several owners mentioned that passers-by would punch the Grand Am's pliable nose just to see it spring back. This caused the pinstriping decal to crack and peel. But the ultimate testimonial in favor of the plastic schnozzola came from an Indiana postmaster. He says, "I am adding this little note to tell you just how effective the new bumper really is. My wife was struck across the front of our Grand Am while waiting at an intersection. The car that swiped her was doing more than 40 mph, according to the police report, when he brushed his side against the Pontiac's nose. The other car's doors and fenders were torn, and damage was estimated at \$700. Damage to our Grand Am: \$30. The investigating officer said that if he hadn't seen it with his own eyes, he'd never have believed it."

What are some suggestions owners have for improving the Grand Am?

"Swivel bucket seats and the door straps moved back so they're not such a long

(Please turn to page 52D)

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Summary of 1973 Pontiac Grand Am Owners Reports*

Total miles driven	715,402
Body styles:	
2-door coupe	77.4%
4-door sedan	22.6
Engines:	
400-cu.-in. V8, 2-bbl.	65.4%
400-cu.-in. V8, 4-bbl.	26.8
455-cu.-in. V8, 4-bbl.	7.7
455-cu.-in. V8, 4-bbl. SD ..	0.0
Average mpg by engines:	
400-cu.-in. V8, 2-bbl.	
local driving	11.1
long trips	13.7
400-cu.-in. V8, 4-bbl.	
local driving	10.9
long trips	13.3
455-cu.-in. V8, 4-bbl.	
local driving	10.4
long trips	12.5
Transmissions:	
Automatic	98.4%
4-speed manual	1.6
Why did you buy a Grand Am?	
Styling	78.5%
Handling	31.0
Size	10.3
Would you have bought a different car if you'd had \$1000 to \$2000 more to spend?	
No	74.1%
Yes	25.9
If "yes," what car?	
Pontiac (with more options) ..	31.3%

Mercedes-Benz	25.0
Olds (mostly Toronado)	12.5
Cadillac	7.8
Specific likes:	
Handling	79.1%
Design—appearance	68.3
Comfort	36.1
Riding qualities	32.1
Performance	13.3
Roadability	12.4
Specific dislikes:	
Poor gas mileage	22.1%
Poor workmanship	16.7
Trunk too small/unusable	6.3
Thin or cracking paint	6.3
No rear legroom	5.4
Lack of power	5.4
What changes would you like?	
More front, rear legroom	14.7%
Different styling	10.9
Better workmanship	7.6
Better materials	6.2
More headroom	6.2
Had any mechanical trouble?	
No	55.6%
Yes	44.4
What type of trouble?	
Carburetor	15.3%
Electrical	9.0
Windshield wipers skip	9.0
Speedometer cable	8.1

Steering	7.2
Engine diesels	7.2
Did you repair it yourself?	
No	97.2%
Yes	2.8
Dealer repairs satisfactory?	
Yes	70.5%
No	29.5
Is the Grand Am your only car?	
No	61.2%
Yes	38.8
Other cars owned:	
Pontiac	34.6%
Chevrolet	16.3
Ford	10.5
Volkswagen	7.2
Oldsmobile	5.9
Cadillac	5.9
Workmanship opinion:	
Good to excellent	67.8%
Average to poor	32.2
Dealer service opinion:	
Good to excellent	65.1%
Average to poor	34.9
Age distribution of owners:	
15-29 years	41.6%
30-49 years	39.7
50-plus	18.7
Would you buy another Grand Am	
Yes	87.2%
No	12.8

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

PONTIAC GRAND AM

(Continued from page 52B)

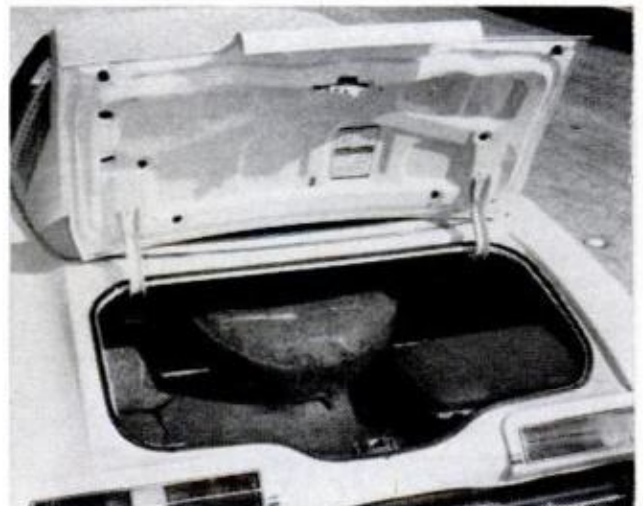
reach." "Rear windows should roll down and also be easier to clean." "Better seals on doors and windows so they don't leak air and water." "Individual rear-end styling—now it's the same as on the regular Le Mans." "Seatback releases are in a terrible location. These should all be standardized." "Heavier front shocks with the 455 V8—my car bottoms."

The last word comes from a New Mex-

ico property administrator who writes, "It is the best overall car I have ever purchased, due to its outstanding handling, roadability, comfort, safety, and roominess. I have been a GTO buyer for 10 years, but I am convinced that Pontiac has come up with a car that is a GTO-plus with all its features greatly improved at the same time. And it is one of the most looked-at cars I have ever owned, including the first 1964 GTO and a 1955 Buick Century (doozies in their day). The mildest reaction I get is 'TERRIFIC!'" ★ ★ ★



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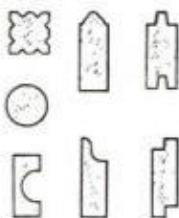
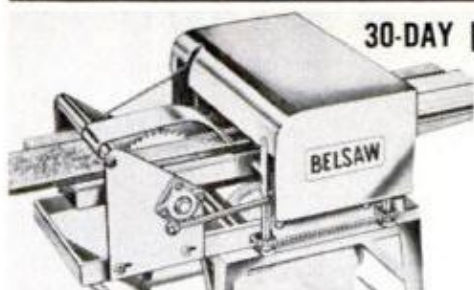


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For most of us, these are just dreams. But have you ever stopped to think that there is a way to get rich—possibly only one sure way? Most fortunes, as you know, are made by people who own their own business.

Perhaps you've thought of starting a small business of your own . . . a franchised drive-in, or maybe a service business. Trouble is, you need \$10,000 to \$15,000 to get started and even then it's a gamble—with slim chances of ever making really big money.

But there is *one* business which could make you rich—almost overnight! And the beauty of it is, you can start on a shoestring during your spare time, even while holding your regular job.

Cash by Mail

The business is Mail Order—and it's fabulous! Come up with a 'hot' new item . . . and WHAM!

It strikes like a bolt of lightning! Suddenly, you are deluged with cash orders from all over the country . . . MORE MONEY than you could ever make in a lifetime!

Like the Vermont dealer who ran one ad in Sports Afield Magazine. His ad pulled 22,000 orders—over A HALF MILLION DOLLARS IN CASH!

There is no other business where you can make a fortune so quickly!

● A beginner from Newark, N.J. ran his first small ad in House Beautiful—offering an auto clothes rack. Business Week reported that his ad brought in \$5,000 in orders. By the end of his first year in Mail Order, he had grossed over \$100,000!

● Another beginner—a lawyer from the midwest, sold an idea by mail to fishermen. Specialty Salesman Magazine reveals, "he made \$70,000 the first three months!"

Proof

It's a fascinating business! Running ads in newspapers and magazines . . . mailing gift catalogs . . . getting cash orders in your daily mail—steady as clockwork.

There is no other business where you can start on a shoestring and pyramid your profits—without investing in merchandise! One husband and wife mail order team took in \$40,000 selling one item. They obtained FREE ads in national magazines . . . didn't invest a cent in merchandise, and even got the supplier to ship all orders for them!

These exceptional cases are absolute proof that you can get rich in your own Mail Order business. Very rich. Even a U.S. Gov. Report stated: "A number of

one-man Mail Order enterprises make up to \$50,000!"

Pick up any magazine. Notice how the same mail order ads are repeated . . . month after month? That's concrete proof! You know those ads wouldn't be repeated over and over again—unless they were bringing in big cash profits to their owners.

The Secret

The secret of getting rich in Mail Order lies in *financial leverage*. It's a little-known, almost secret method—using other people's capital to make money for you!

You can get thousands of dollars worth of advertising in big national magazines—without investing your own money! And you don't have to write a single ad. Tested and proven ads are prepared for you by experts. Reinvest the profits from your first successful ad—to get more, larger ads, and the profits begin to snowball! It's like building a chain of stores . . . each new store puts more money in your pocket.

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We supply you with beautiful gift catalogs throughout the year. All products are dropshipped for you, with up to 100% mark-up! You get free samples of top-selling mail order items, plus monthly trade reports on 'hot' new products . . . tested, successful ads are sent to you monthly. You get advertising directories, postal laws, complete courses, expert guidance—EVERYTHING you need to practically guarantee YOUR SUCCESS. Why? Because *our* business depends upon your success. It's mutually profitable!

A recent feature article in Income Opportunities Magazine stated, "Mail Order Associates Inc., offers the most comprehensive Mail Order program ever offered to beginners." They go on to say, "This could be the opportunity you've been looking for. A chance to get in on the ground floor in a little-known business which we believe is on the verge of a new boom."

Free

We are now accepting a limited number of charter members in our new Mail Order Program. No previous experience is required but you must be over 21.

If you are sincerely interested in starting a profitable business of your own . . . if you can see the tremendous advantages which Mail Order offers . . . then ACT NOW!

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will send you a free book—gift catalog, reprints of feature articles, plus complete facts about our program. Write to:

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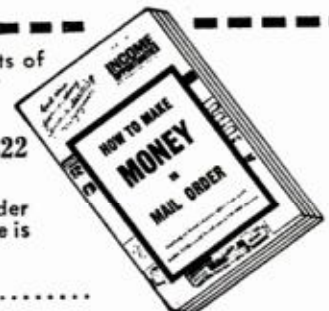
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Recreational

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Higher

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*President's Message to Congress
Jan. 30, 1967

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Fresh, clean air to breathe. You will see neighboring mountain peaks which reach for the clear blue sky. Roam the Pinon and Ponderosa woodlands, ride the wild horse trails and see the wild horse herds which still roam the mesa top. The Mesa overlooks one of the San Luis Valley's largest lakes . . . Lake Sanchez, where your family can swim, sail, water ski and fish for flashing Northerns and Rainbow Trout.

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These are but a few reasons why property at this price and these terms is going fast. It will never be any easier to buy your own 2½ acre retreat in Wild Horse Mesa. Just \$24.50 total monthly payment. No down payment, no sales commissions. Every dollar is applied to the purchase of your land.

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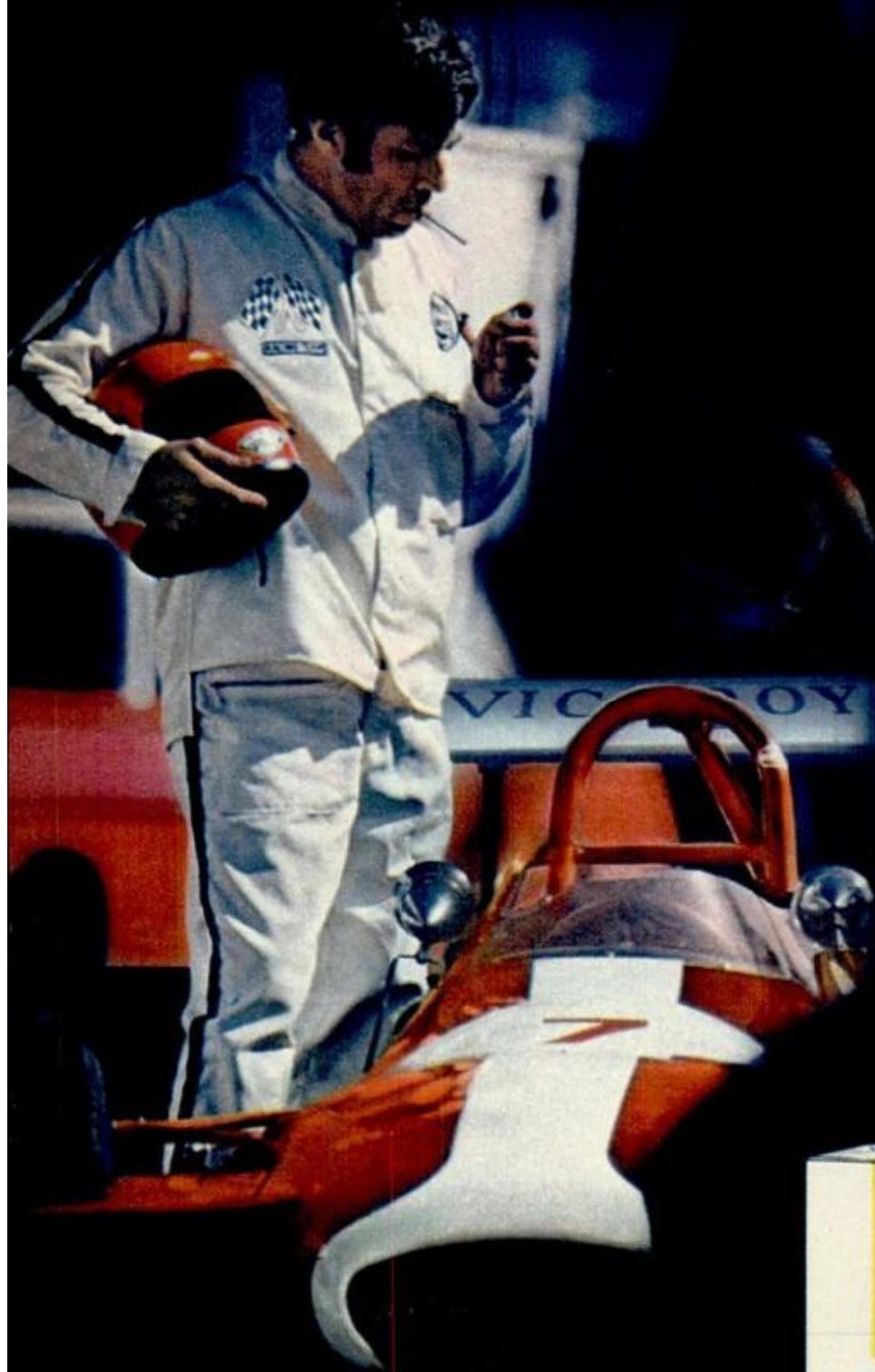


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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Gasketless

Should there be gaskets under the sparkplugs of a 1970 Dodge Dart slant Six engine? My car never had any, and opinions are divided as to whether they are required.—N.K. Flynn, San Juan, P.R.

Gaskets are not required if sparkplugs have tapered seats, which make a gas-tight seal when firmly tightened. The seat is the part of the plug immediately above the thread that sets itself against the sides of the cylinder hole. All plugs with square seats require gaskets.

Keeping a Chevy going

Several owners of 1972 Chevrolets, myself included, are having trouble keeping a cold engine running. It starts quickly, but stalls if you take your foot off the gas pedal. Once warm, the engine runs great. What can be done to get rid of this problem?—Donald Tymn, Sterling Heights, Mich.

The problem may occur because vacuum is pulling the choke butterfly plate open too soon. This can be corrected by adjusting the choke vacuum break as spelled out in the 1972 Chevrolet service manual. Another reason may be a poorly adjusted idle-stop solenoid, which should be adjusted according to instructions in the manual.

Finally, some modifications have been made by Chevrolet to the choke closing assist spring and thermostatic choke coil, both of which have a bearing on your problem. Ask your dealer to apply the instructions given in technical service bulletins 72-T-1 and 72-T-3.

Toyota's brake problem

I own a 1971 Toyota Corona which at 4500 miles wore out its front-disc rotors and pads. The same thing happened at 9200 miles. The dealer has made repairs, but doesn't seem to have a lasting solution to the problem. Can you help?—F. Neal Sever, Pittsburgh.

According to Toyota, the procedure outlined in service bulletin Y-7 (10-27-71)

"will accomplish outstanding results" if brakes are squealing or short life is encountered. Toyota contends the trouble is caused by disc-brake calipers which aren't returning to full release position and suggests you remove all four caliper guides, clean all contact surfaces and lubricate these surfaces with Loc-tite or a comparable antiseize lubricant.

More on towing

In the Sept. 1972 Auto Clinic you described for Owen T. Reeves how to tow an automatic-transmission car for a long distance with another car having an automatic transmission. You failed to mention that unless the drive wheels are raised off the ground the driveshaft should be disconnected. When a car with automatic transmission is towed, the front pump in the transmission is inoperative and serious transmission damage can result from insufficient lubrication.—Ewing Kelly Hill, Huntsville, Ala.

Right you are, Mr. Hill. Thank you for clarifying this omission.

Filter follies

Can you tell me if Chrysler Corp. has issued instructions regarding a 1972 Plymouth Valiant with 318-cu.-in. engine? The oil filter which the dealer sells doesn't fit, because it is too long and hits against the torsion bar. Is this common?—Angelo Lorenzo, Stony Point, N.Y.

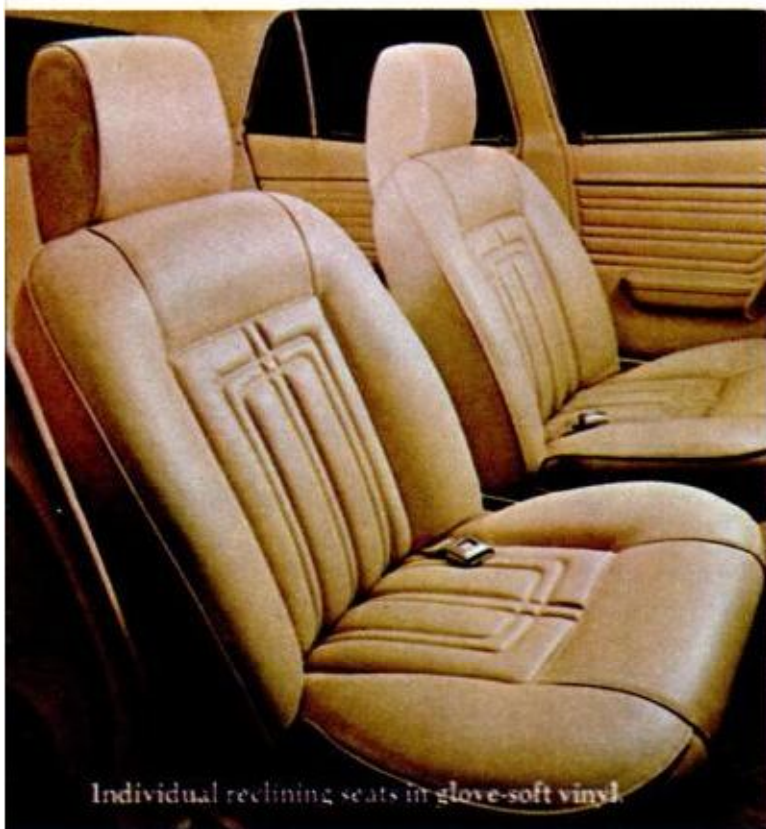
All 318-cu.-in. engines manufactured after March 1, 1972, for Valiants and Dodge Darts no longer have a right-angle adapter that allows the long oil filter to clear the torsion bar. The "shorty" oil filter (Chrysler part No. 3549957) should be used in these models. If your dealer wants proof, refer him to Chrysler-Plymouth service bulletin 10-04-72C (2-23-72).

Hope for Opel

I can't get my 1972 Opel 1.9-liter engine to idle although I adjust the carburetor

(Please turn to page 58)

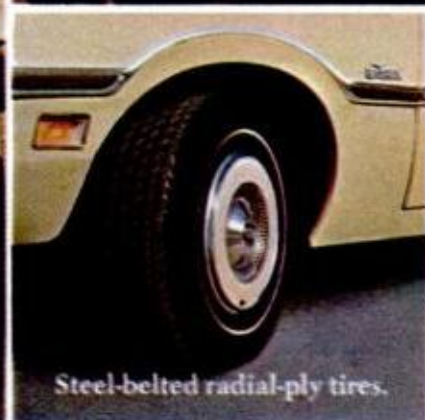
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AUTOMOBILE CLINIC

(Continued from page 57)

just as the book says. What now?—Charles Walsh, Duluth, Minn.

Check the idle jet for contamination. The idle jet is above the mixture screw and the idle-bleed screw near the top of the carburetor. It has a very small orifice in its end. Any contamination at this point will cut off all fuel to the idle circuit. Blow it out with compressed air. Also check the four carburetor hold-down studs and the six bolts that hold the intake manifold to the cylinder head. An air leak between the carburetor and intake manifold or between the intake manifold and cylinder head will upset the idle.

Stumbling Pinto

I am the owner of a 1972 Ford Pinto Runabout which occasionally experiences engine cut-out on right turns only. The dealer replaced the carburetor, but to no avail. Any ideas?—Mrs. F. Sykes, Key West, Fla.

Replacing the carburetor and not setting the float level to specification is a fre-

quent oversight. Your engine may be starving for gas on right turns, because the float has been set too low. Have the dealer adjust the level to spec. If the problem persists, then the cause is probably a short in the ignition's primary circuit.

Frozen transmission

Because of our severely cold winters—as cold as minus 50° F.—the standard transmission of my 1963 Chevrolet pickup truck becomes unbearably hard to shift. Last winter I broke two gearshift levers from the steering column. The grease gets too hard. Any solution?—Tim Jollymore, Duluth, Minn.

When winter approaches, drain the transmission and put in gear lubricant SAE 75 (GL-5), which is equivalent to an SAE 10 engine oil. When warm weather returns, drain the transmission once again and switch back to multipurpose gear lubricant SAE 90.

Taking the rap

Lately, on first starting my 1968 Chrysler Newport with 383-cu.-in. engine in the

But not in an American compact at \$2,809.*



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*Car shown: \$2,809 sticker price, including 302 V-8 engine. Dealer preparation, destination charges, title fees and taxes extra.

morning I hear a distinct rap in the engine that lasts until the oil-pressure light goes out. This takes almost 10 seconds. Is this a warning of some major headache?—Peter Pianta, Bayside, N.Y.

The fact that the rap disappears indicates oil-starved bearings during the period of time that the oil-pressure light is on. It could be a forewarning of major trouble. Lack of oil pressure can be caused by a low oil level, diluted oil, a stuck oil-pump relief valve, a damaged oil-pump suction tube, or a weak oil pump. Have the problem fixed before serious damage is done.

Service tips

● **Car owners** have been doing a double-take at the windows of their cars for some time, not certain whether the eerie patterns they've been seeing mean that the glass is defective or their eyes are going bad. Under certain climatic conditions—on a clear fall day, for

example—polarized color patterns appear. This will also happen when you're wearing polarized sunglasses. It's normal and can't be removed by washing, polishing, replacing the glass or closing your eyes.

● **Cricket owners**—chirp, chirp—take it from Plymouth: The heat range sparkplug the company says you should use (page 51 of your owner's manual) is not the one you should be using. The right one for all Cricket engines is the N7Y.

● **Three cheers for 3M.** It has a simple, inexpensive way of repairing instrument-panel chrome plastic strips that have had the chrome rubbed off. Get a roll of Pressure Sensitive Tape No. 426 (3M's, of course) from an auto-supply dealer and cut a length of the desired size. Press the tape on firmly and carefully to remove wrinkles—who wants a plastic strip that looks like a prune?—and trim it with a sharp razor blade or X-Acto knife. You won't be able to tell it from the original. ★★★

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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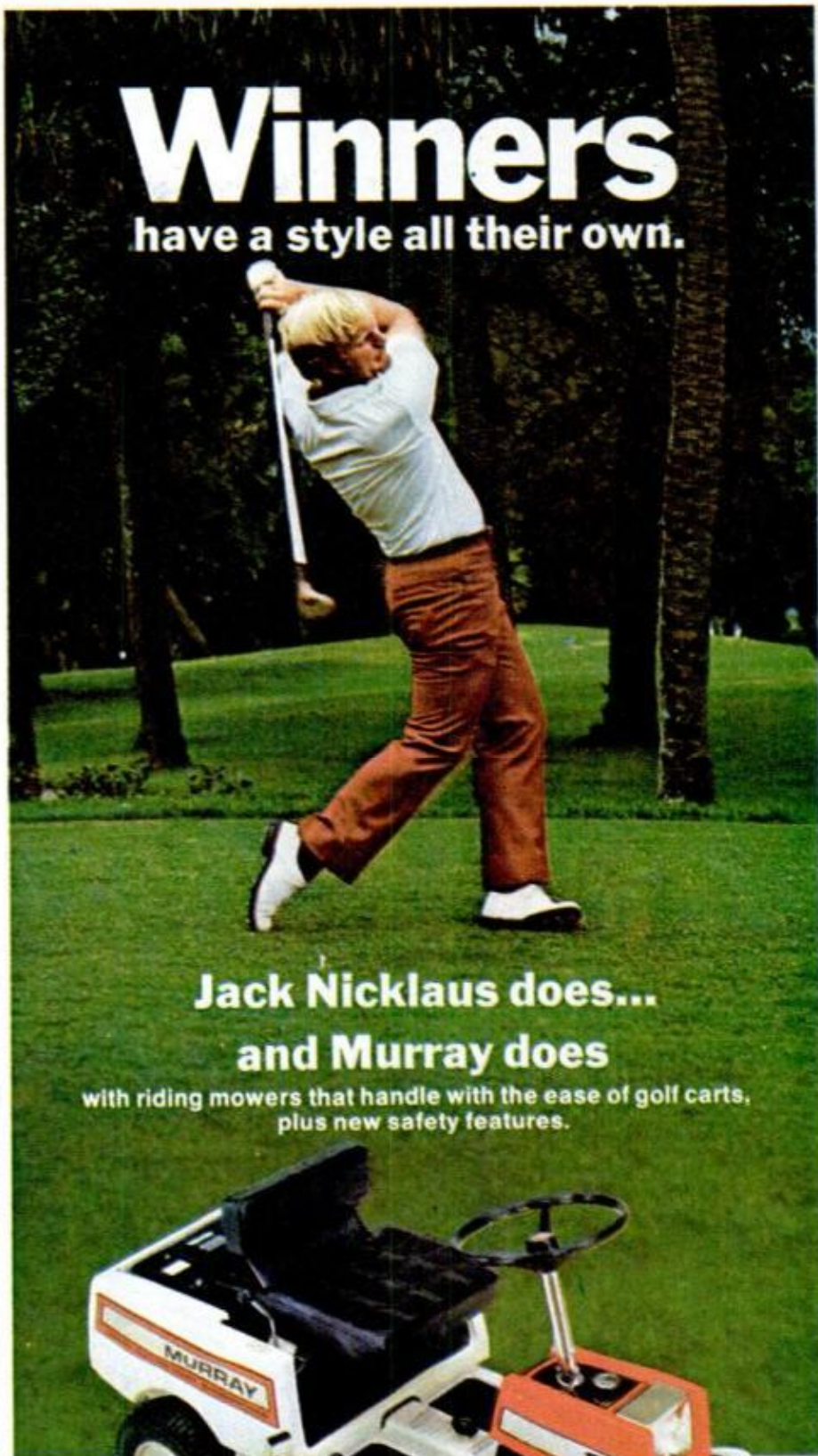
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MARCH 1973

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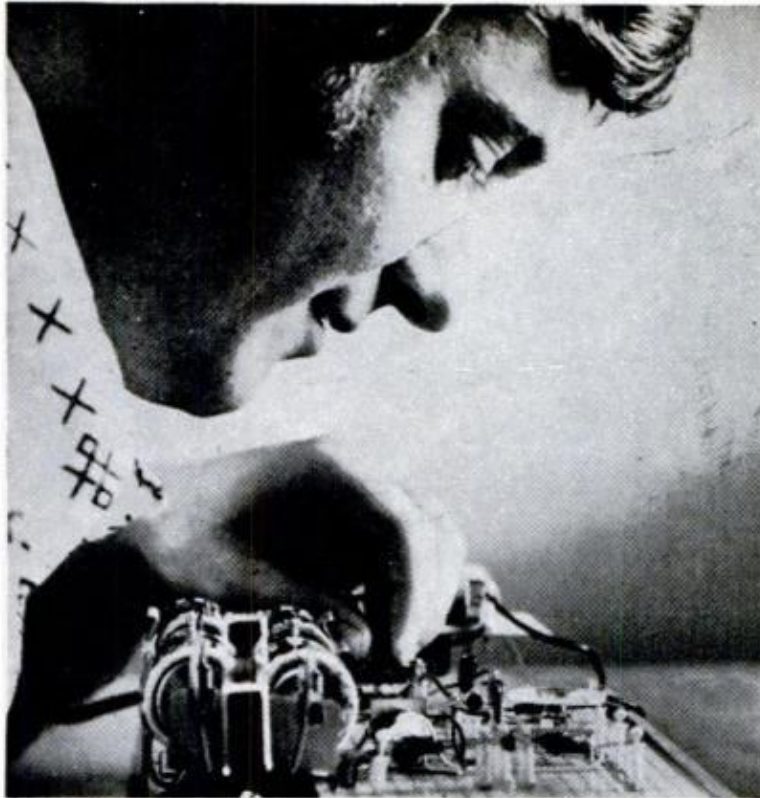
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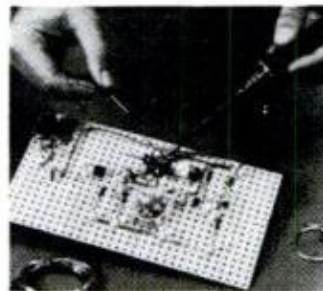
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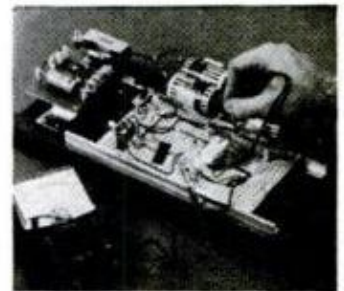
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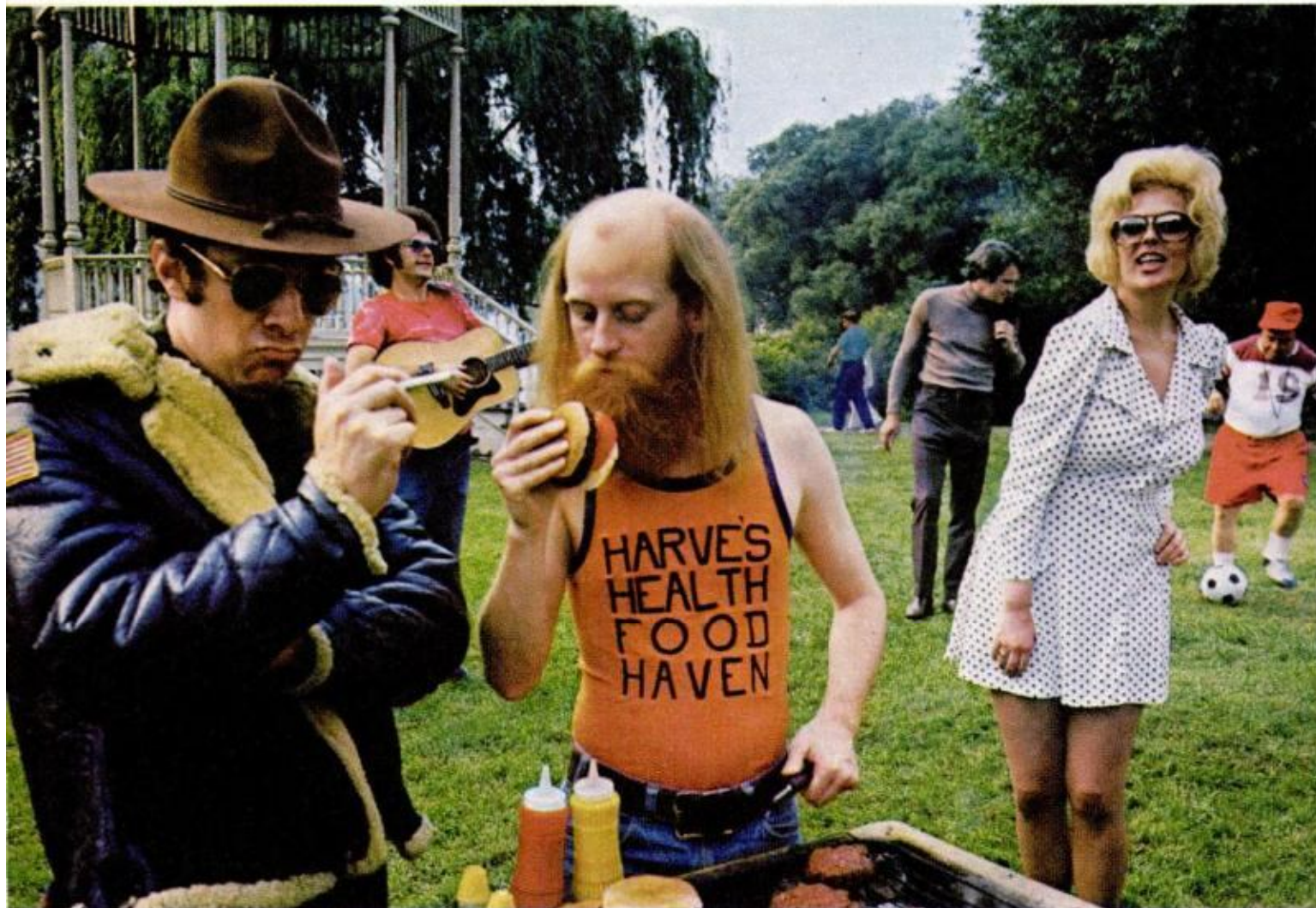
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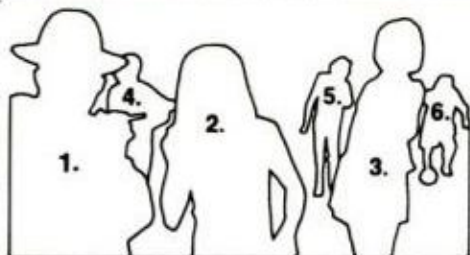
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PM-77

Can you spot the Camel Filters smoker?



©1972 R. J. Reynolds Tobacco Company, Winston-Salem, N. C.



In this picture everybody has a gimmick... almost everybody. Try picking the one who doesn't go along. **1.** Nope. He's Lance Boyle. Gimmick: brags about wars he was never in. Yells "bombs away" as

he flicks his French cigarette. **2.** Sorry. He's Harvey Dibble. His restaurant specializes in dried prunes. Gimmick: smokes wheat germ cigarettes. **3.** Eunice Trace, Starlet. Gimmick: restoring wholesomeness to movies. (Last film review: "At last, a movie the entire family can walk out on.") **4.** Smokey Stanhope, accountant. Gimmick: a guitar. Unfortunately makes the mistake of playing it. **5.** Right. He's just himself. And he sees through all the gimmicks. That's why he wants an honest, no-nonsense cigarette. Camel Filters. Easy and good tasting. Made from fine tobacco. **6.** Calls himself "Killer." Gimmick: thinks soccer uniform enhances his image. When he puffs out his chest, his pants fall down.

Camel Filters.
They're not for everybody
 (but they could be for you).



Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

20 mg. "tar"; 1.4 mg. nicotine av. per cigarette, FTC Report AUG.'72.

ALL By BILL McKEOWN OUTDOORS

THE OUTDOORSMAN'S special recognition event this year will be the second annual National Hunting and Fishing Day.—Sept. 22.

BACKPACKING has inspired improvements recently for several items of expensive outdoor gear. Some small tents now are lighter and better, and warm down sleeping bags are more compact and comfortable.

An interesting switch on the outer fly over a tent is the Filmgap insulating liner for inside Warmlite tents. Suspended inside the tent, its 10 layers of aluminized plastic film are claimed to provide enough warmth so that sleeping bags often are not needed. Warmlite down bags, available in single and triple-layer models, come with built-in foam bottom pads for soft sleeping while keeping out cold from beneath. Both items, developed by Stephenson's, 23206 Hatteras St., Woodland Hills, Calif. 91364, are described in an informative and cheerful catalog.

Alpine Designs is also introducing improved sleeping bags. Its High Loft down models have new over-the-shoulder and high-arc foot design to insure adequate bag warmth top and bottom as well as in between.

CANOE CAMPERS have several new sources for tips concerning waterways to explore. Florida Canoe Trail Guide describes 16 river trips that now make up the state's canoe trail system. Campsites, boat ramps and wayside parks are indicated as well as information about fish to be caught and nature sights to see. The 40-page booklet is available from the Florida Dept. of Natural Resources, Div. of Recreation and Parks, Larson Building, Tallahassee, Fla. 32304. It's free.

In magazine form and for \$3 from Box 673, Humble, Tex. 77338, is Texas Rivers and Rapids. Eight notable rivers in this big state are covered in detail with photographs, drawings and recommendations about suitable seasons and water levels, as well as topographical maps needed. Even checklists of clothing, first aid equipment, personal gear and hints for canoe camp cooking are provided.

Helpful tips for planning a group canoe trip have been collected by a troop of Girl Scout Mariners into a booklet available from Ed Nelson, Grumman Boats, Marathon, N.Y. Nelson also can provide a free Rent-A-Canoe directory

giving sources of canoes for hire in 34 states plus canoe-trip information in Illinois, Ohio, New Jersey, Maine's Allagash River, Indiana, Tennessee, Delaware, New York's Adirondacks, Wisconsin, Crow Wing region in Minnesota, Michigan, and the upper Connecticut River in New Hampshire.

A RAY OF LIGHT may be replacing mechanical weed harvesters, Argentine flea beetles and chemicals potentially dangerous to the environment. All had been previously used in attempts to control water hyacinths and other plants and weeds that have been practically choking some southern rivers and streams. Dr. Ralph Scott, a former Army Corps of Engineers scientist, has patented a laser beam application which directs the beam by mirrors to irradiate aquatic plant life, and the device is now undergoing testing by the Corps of Engineers. It may also have a weed-control application along highway and railroad rights-of-way, while avoiding any air or ground contamination.

THAT READY-TO-LIVE-IN summer-camp cottage, the mobile home, is being improved. All units built by Mobile Home Manufacturers Assn. members since the first of this year have had to have provisions for tie-downs as standard equipment. The organization has also recommended tie-down requirements as a part of the safety standards for all mobile home construction. Occasional wind-storm damage indicates that summer home camps of any type should be properly secured.

RECREATIONAL VEHICLE owners can travel inexpensively if they want to, but often they don't, according to a recent study by the Recreational Vehicle Institute. The average family spends an average of \$62 a day, according to industry spokesman Paul DuPre. What he calls RVcationers apparently like to eat in restaurants and stop in hotels and motels on occasion. This change of pace may help keep the pastime popular.

THE HUNTER'S RED JACKET may not make him a target, but it is also not as visible as he likes to think, according to recent studies. As the sun sets and light level goes down, so does the attention value of red, it seems. Bright fluorescent orange is likely to replace it. The new shade never appears naturally in nature, is easily spotted by people with defective color vision, but does not appear to be noticed by color-blind big game. Tests by the Massachusetts Division of Fisheries

(Please turn to page 68)

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ALL OUTDOORS

(Continued from page 67)

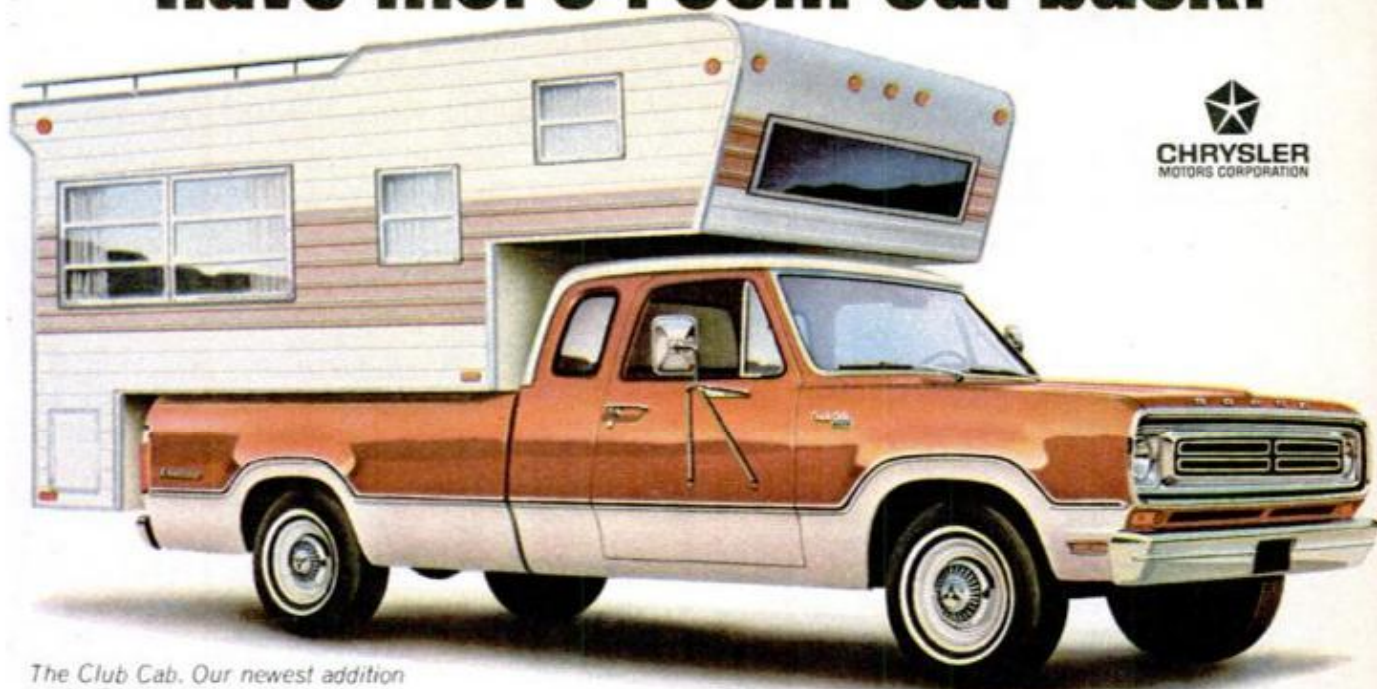
and Game indicate that fluorescent hunter orange stands out best under the widest range of light conditions and terrain. A drop in hunter mishaps in Maine is credited to use of the brilliant color, and six states have now made wearing hunter orange mandatory. It sounds like a good investment for any outdoorsman shopping for new clothes.

DRIVERS' LICENSES FOR BOATMEN is an unpopular subject, and the alternative seems to be proper education. The industry's Let's Go Boating Committee has recently compiled sources for a number of free courses around the country, with addresses for more information about them. For U.S. Power Squadron class locations and dates, write USPS, 50 Craig Road, Montvale, N.J. 07645. It has more than 490 branches. Main offices of the Coast Guard Auxiliary are located in Boston, St. Louis, New York, Norfolk (Va.), Miami, Cleveland, Long Beach (Calif.), San Francisco, Seattle and Honolulu. Boating class information is also available from the American Sailing Council of the National Assn. of Engine & Boat Manufacturers, Box 583, Greenwich, Conn. 06830; the Boating Industry Assn., 401 North Michigan Ave., Chicago, Ill. 60611, and the American Water Ski Assn., Seventh St. and Ave. G, S.W., Winter Haven, Fla. 33881. Many gasoline companies also have booklets covering boating areas for cruising, camping and shoreside facilities.

FOR STICK-IN-THE-MUDS, we came across a fine off-the-road item in a 1912 PM that could come back in style for snow, sand and rutted trail driving today. Take a metal plate with bent-down, saw-toothed sides or a heavy square plank with long spikes driven through to stick out of the bottom. Pound it into the ground with a rock or mallet and hook to it a heavy-duty ratchet hoist, the kind recommended for anchoring to the tree that's never there when you want to winch your 4-W-D out of a ditch. We tried our simple block-and-tackle accessory with a two-ton ratchet hoist. You stand on your block to keep it in place while the tackle does the work. It turns out to be as good a back-country accessory gadget as it was along the rutted roads of 60 years ago.

A 90-MPH BOAT is claimed for Broadbill XXIV, a 24-foot offshore fisherman from Broadbill Marine, Fort Lauderdale, Fla. We don't believe it, but we're willing to be shown. She's ruggedly built in a deep-V design of Hetron fire-retardant resin and fiberglass. But 90 mph? ★★ ★

The new Dodge Club Cab gives you more room up front so you can have more room out back.



The Club Cab. Our newest addition to the Dodge pickup line.

Campers. Only Dodge gives you 34 cubic feet of extra storage space up front for things you don't want to jam in the back!



Handy's the word for it—the easy-to-reach storage space Dodge gives you right behind the seats of every Club Cab. Think about things you could use that space for. Lounge chairs. Grilles. Lots more. Got the list? Okay, the Dodge Club Cab has the extra storage room you need, and there's even room for auxiliary jump seats, if you like. Dodge gives you all this room and convenience in a pickup that will fit in any standard 20-foot garage.

When you buy a Club Cab, you're not just buying room. You're buying one of the most advanced pickups on the road today. You're getting an Electronic Ignition System for surer starts in any weather. And this system is virtually maintenance-free. The Club Cab comes in the famous Dodge Camper Special versions with all the heavy-duty equipment you need for taking a camper across the country. All Sweptline pickups feature front disc brakes, double-wall construction all around, and independent front suspension for a smooth Dodge ride. It's this kind of extra care in engineering that makes a difference in Dodge... depend on it.



AGAIN THIS YEAR,

WHAT'S NEW IN PICKUPS COMES FROM DODGE...DEPEND ON IT.

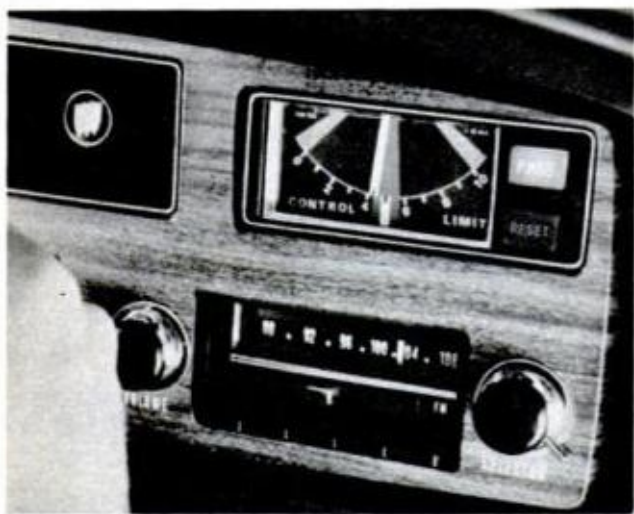
DETROIT LISTENING POST

BY ROBERT LUND

GOLD FEVER AT FORD. If you go for the gee-whiz stuff, Ford's got a trick windshield coming on two of its '74 cars—Mark IV and T-bird—that should interest you. Especially if you live in a part of the country hit by a fair amount of snow and ice.

The glass is called Sierrcin, after the company that developed it. The windshield is of conventional construction, a sandwich consisting of two thin layers of glass separated by a sheet of plastic. The plastic Ford will use is impregnated with gold. Yep, real gold. The gold carries current through the window, warming it up to melt ice and snow. The window will work off an alternator—90 volts, 10 amps—and cars equipped with the glass will come with a second alternator as standard equipment. Ford has worked out all the safety angles so if you're standing in a puddle or water has accumulated on the floor of the car, you can't electrocute yourself.

Window warmers and ice melters aren't new, but don't confuse this with anything you've heard of before. The best ice melter you can buy now takes a minimum of 20 minutes to clear one thickness of ice. Sierrcin glass will clear two thicknesses of ice in less than five minutes. It also tints the glass to keep the sun out of your eyes.



GM LEADS IN RESEARCH to keep drunk drivers off the road. Its latest driver-reaction measuring device installed in an experimental car uses a dashboard meter. When a key is inserted in the ignition, the needle starts to fluctuate, and the driver must steer well enough to keep needle in the narrow center sector. The car won't start unless he passes the test

Ford will install the item in both the windshield and backlight, but not in the sideglass. It'll be an option and the price will be fairly steep. Around \$175.

ALUMINUM BUMPERS. GM and Ford are expected to experiment with all-aluminum bumpers on a limited number of '74 cars. Odd angle is that the light metal will apparently be used on low-price, low-weight cars. Aluminum's advantage is, of course, its light weight. But it's on the big and mid-size cars, not the small jobs, where weight's becoming a problem. So what's the point of putting aluminum bumpers on small cars? Could be that carmakers want to acquire some back-up experience with aluminum—both from a production standpoint and how aluminum bumpers hold up in the hands of customers—before going to aluminum on heavier, higher price cars.

SOFT CARS VS. HARD CARS. The National Highway Traffic Safety Administration is working on an idea that could cause most engineers in Detroit to take early retirement. The government agency thinks automakers should build two types of cars—soft and hard. Soft cars would be the big jobs, hard cars the small ones. Thus occupants of small cars would have more of a chance of surviving when involved in an accident with a big car. And you think you've got problems.

SPORTIVA'S NO MUSTANG. A Ford source denies that the dolled-up Pinto (Sportiva) making the rounds of auto shows is a disguised version of the new Mustang coming this fall. Sportiva has the same general dimensions as the new-generation Mustang, but the real thing will be a sharper, more rakish-looking car than the show Pinto.

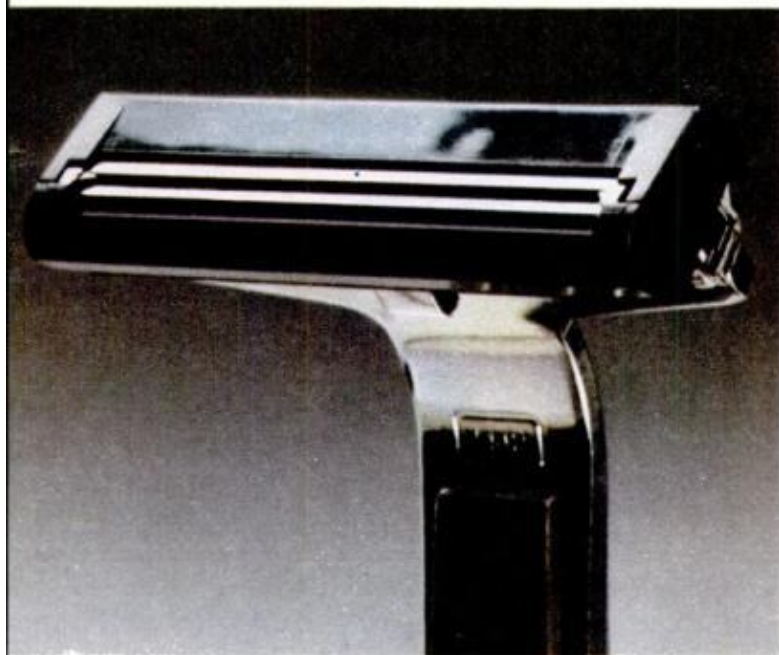
ENGINEERS ARE DOWNCAST over mileage reports coming in on the '73 cars—standard-size cars in particular. Cars that realized a fair 12 to 15 miles to the gallon in proving-ground tests before the '73s went on sale are averaging a skinny 8 to 11 mpg in the hands of owners. This doesn't apply to all makes, but all companies have their share of gas hogs.

What about next year? Engineers say they

(Please turn to page 72)

Schick Super II

against I.



How double is a double edge razor, really?
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Now compare with the Schick Super II:
Both edges are on your side. Always working together.

The first edge shaves you close like your double edge now. The second edge shaves you closer.

There's really no comparison.
It's two against one.
Unfair maybe. But that's life.

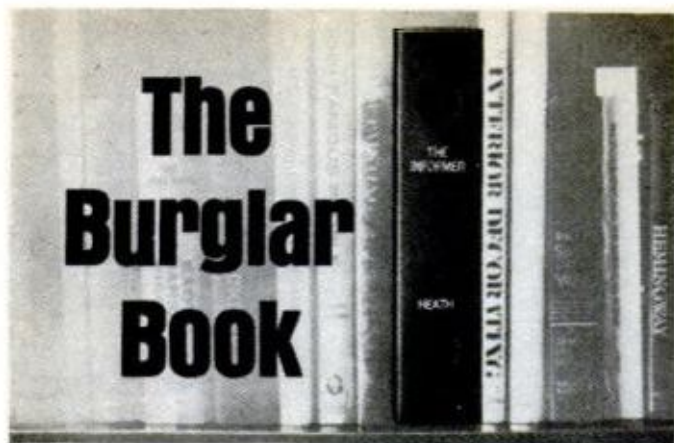
Schick-II
Two Bladed Razor



The Schick Super II. Put both edges on your side.

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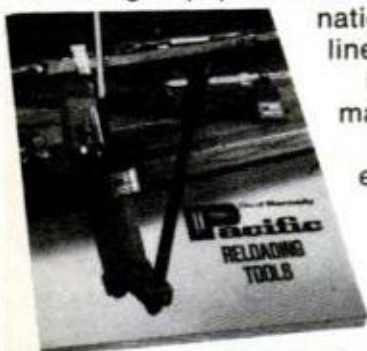
"The Informer", by Heath, disguises the new GD-39 Ultra-sonic Intrusion Kit Sensor and it can stop a burglar cold. To install, you simply plug it into a 120 VAC wall outlet, then plug an external alarm, light, or both into the receptacles provided. Place it on a bookcase or table to survey an entire room or an entranceway. Features include adjustable sensitivity, automatic or manual reset, built-in 30-second delay on alarm. You can build this money-saving kit in about two evenings, even if you're a beginner. Order your Heathkit Burglar Book now.

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DETROIT LISTENING POST

(Continued from page 70)

can't promise improvement, but they think mileage has bottomed out.

SERVICE CHECK BY COMPUTER. Want to put your car through a computer to find out what service it will need for the next 40,000 to 50,000 miles? You can do it for two bucks. The idea was conceived by a parts company, Fram. Here's how it works:

You have to fill out a questionnaire supplying a detailed rundown on your car and how to use it. You can get the form at dealers handling Fram products or write Fram Plan, Fram Automotive Div., East Providence, R.I. 02916. (Don't send the \$2 until after you've filled it out.) Fram will run the information through a computer and send back a personalized reading on service work you should have done as the car ages. Some duplication of information appears in the owner's manual, but Fram factors in a lot of things that aren't there—personal driving habits, geographic location and type of roads you drive on, for example. For your \$2, you also get a book of service tips on what to look for if your car conks out.

This isn't a pitch to sell parts, because the computer printout doesn't mention products or dealers by name. And the company promises not to turn your name and address over to a sharpie who's going to hustle you to buy something. It's a pretty good deal for the money, especially if you're buying a used car and want to know what service bills you might be getting into. The \$2 fee entitles you to only one crack at the computer. If you want another reading later on, you have to pay again.

PREWRINKLED CARS NEXT? Carmakers are looking at a process that permits designs to be worked into the sheet metal when the part is stamped out. This isn't exactly a new idea, but there's a new wrinkle—the design can be changed, giving the appearance of a new model, without reworking the entire panel. The precrinkling is said to increase the strength of the metal, just as corrugated tin is stronger than a flat sheet. The idea is credited to the steel industry. Companies supplying Detroit with raw materials are coming up with all kinds of offbeat ideas in an effort to get automakers to use more of one material, less of another. Steel, copper, aluminum, powdered metals, plastics, glass, rubber, you name it—it's a real battle royal. It's a good shake for car buyers because it gets everybody innovating and improving. ★ ★ ★



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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Extra insulation in attic

I need more insulation in my attic to keep out both heat and cold. At present there are 3-in. batts between 2x6 joists. Should I add more batts or use a pour-type insulation?—Ross Ihler, Cincinnati.

It might be permissible to use batts over batts but I think I would prefer the pour-type, especially if you are now experiencing no problems with moisture in the attic.

The pour-type insulation is somewhat easier to handle in cramped quarters, is quite as effective, and may be a bit cheaper in the end. The fill should be at least flush with tops of joists, or perhaps a little over.

Stubborn leak in ceiling

I live in an old home with a big bay window in the living room. During a driving rain a leak develops near this window, wetting the ceiling plaster. I've patched the roof of the bay, but the leak persists. There's no sign of a leak upstairs. Can you figure this out for me?—Stanley Charter, Utica, N.Y.

I suspect that the flashing over the bay is faulty. Rainwater runs down the siding and enters a small opening you've failed to stop with the patch. From here it courses along a joist, then creeps over the plaster and eventually shows as a wet spot in the ceiling.

I'd try again; you may have to remove some shingles to locate the point where the water gains entry. Either reflash or close the opening with roofing cement. I'm assuming, of course, that the rainwater is not coming from above and coursing down a stud from the plate.

Regluing oval picture frame

I have an antique oval picture frame measuring 20x25 in. Apparently it's made of four curved pieces joined with a peculiar dovetail-like joint. One piece is loose and needs regluing. How do I clamp the frame until the glue dries?—Mrs. R. Peabody, Bangor, Me.

Such frames are usually joined before machine-shaping with a modified "box" dovetail or box joint. Clean the open joint of all old hardened glue, taking care not to alter its shape.

Clamping of the frame probably will be a little tricky but can be done with a band clamp, or "web" clamp available from Albert Constantine & Son, 2050 Eastchester Rd., Bronx, N.Y. 10461. Or a rubber gluing clamp (a heavy rubber band) can be obtained from Brookstone Co., Dept. C-12, Brookstone Building, Peterborough, N.H. 03458.

Loose marble top

I've bought a nightstand with a marble top about 15 in. square. It is not attached. What adhesive or glue should I use to fasten it in place?—Roy Wilkins, Rochester, N.Y.

Although it may have been done, I've never seen a marble top of any size attached with adhesive. Usually it is held in place with some form of cleating that's made a part of the original construction and finished to match the wood. One marble top I've seen had shallow holes drilled near the four corners on the bottom face. Short locating dowels were fitted loosely in these holes to hold the top in place. I saw a small top recently that had a single cleat, or stop, cemented to the underside, but I suspect that this may not have been done originally.

As for your particular case, you might well find that a tape having adhesive on both sides will do an adequate job in holding the top in place.

Flooded asphalt-tile floor

The tiled floor (asphalt tile) in part of my basement was flooded recently. Water remained on the floor about three days and drained away slowly. Will the tile loosen?—Ruben Asp, Racine, Wis.

I don't know. But if tiles have not loosened at joints or corners by now, they are not likely to do so in the future, especially if they were properly installed originally. I wouldn't lose any sleep over this situation. ★★

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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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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Filter Kings, 17 mg. "tar," 1.3 mg. nicotine; Longs, 19 mg. "tar," 1.5 mg. nicotine, av. per cigarette, FTC Report August '72

Explorer Special Sale!

Limited time only! Special Ford Pickups with special discounts on a choice of popular options...including Cruise-O-Matic, power steering, air conditioning.

The '73 Ford Pickup starts out a great buy. Its better ideas include behind-seat storage, full-foam seating, front disc brakes, the roomiest Ford pickup cab ever.

And now you can get an even better buy: A specially equipped Explorer Special. It comes in F-100 or F-250 models... 6¾' or 8' bodies... 2- or 4-wheel drive. And offers three special packages at big savings.

Special Package A: Choice of special exterior paints: Bright Lime, Grabber Blue, Burnt Orange • Special interior trim in Blue,

Avocado or Orange • Color-keyed floor mats • Bright front bumper guards with rubber strips • Bright windshield and drip mouldings • Explorer name plate • Mag-style wheel covers (F-100 4 x 2) • Bright wheel covers (F-250 4 x 2) • Unique lower body side tape stripe • Bright, low-mount Swing-Lok mirrors (long-arm western mirrors on Camper Specials) • Bright rope tie-down hooks on 6¾' models • Bright box side rails on 8' models.

Special Package B: Package A plus... Power steering • Cruise-O-Matic.

Special Package C: Package B plus... Air conditioning • Tinted glass.

Special money-saving discounts now at your Ford Dealer's. Limited time only!



A better idea for safety: Buckle up.

F-100 Explorer Special, shown with optional whitewall tires, tool storage box and rear bumper.

FORD PICKUPS

FORD DIVISION





THIS COMPACT SEWING CENTER becomes a decorative wall plaque when swung up out of way. Open, it extends to a king-size, 20x65-in. work counter



Sewing centers — the kind women want but can't buy

By **WAYNE C. LECKEY**
Home and Shop Editor

*Color photos by
Robert D. Borst*

*Technical art by
Fred L. Wolff*

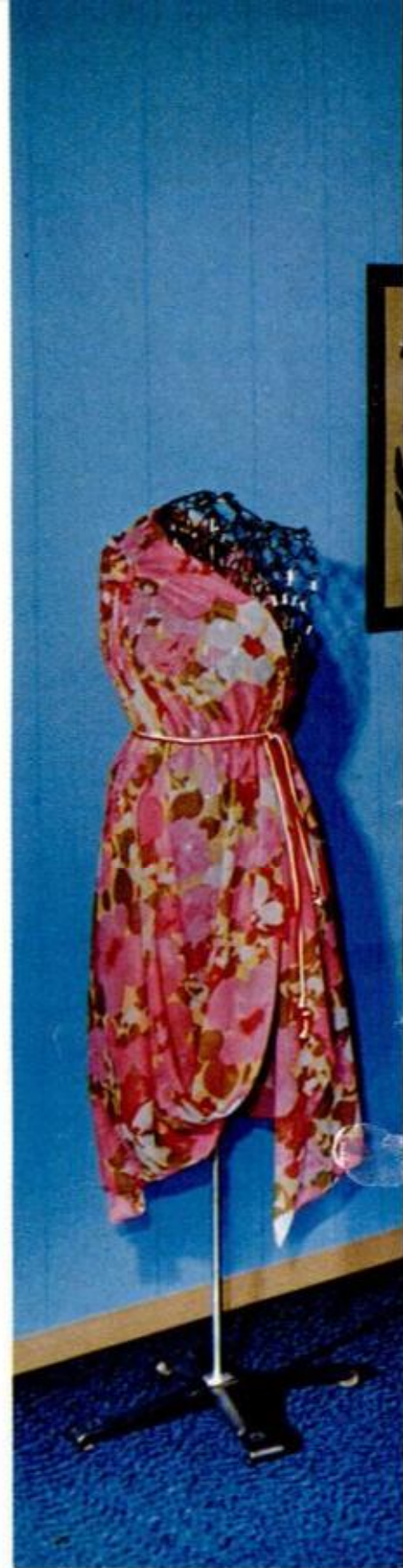
LIKE ANY HOBBY, sewing becomes more enjoyable and creates a lot less clutter when you have a work center where there's a place for everything and everything is in one convenient place.

We kept this thought in mind in designing these four highly functional sewing centers. Incorporated in each design you'll find a work counter for pattern cutting, shelves and roomy drawers for keeping fabrics, yarns and patterns handy and trays for pins, needles and threads. Two of the centers are designed to attach to a wall; all fold up in a minimum of space.

Most sewing-machine stands we've seen are just that—stands for sewing machines. They provide a

place to store the machine when it's not in use and that's about all. Few, if any, offer a good-size worktable to spread out a pattern. There's little space to keep dress patterns handy. There's no space to stow your sewing and often a lack of tray space to hold countless little items. We've tried to give you these features that most stands lack.

Any portable-type sewing machine is adaptable to any of the four centers shown here. The machine shown in the photos is Singer's *Golden Touch & Sew*, and the counter cutouts were made to fit its particular base. While a cutout allows the machine to sit flush, this can be optional: the machine can simply sit on top of the counter. Plans and instructions for building all four of PM's sewing centers begin on page 80.



DROP LEAVES on sewing center at left swing up to provide a whopping work surface nearly 84 in. long. Five center drawers offer storage space galore. Sewing machine fits in cutout, stores in compartment under hinged lid. Closed, unit takes but 24-in. floor space

POPULAR MECHANICS



THE ULTIMATE in sewing centers, this one opens up to offer maximum convenience. Standing 7 ft. tall, it features a closet for storing an iron and ironing board, a swing-down 28x64½-in. cutting board, a leg-free, pull-down sewing machine, a mirror door and more storage space than you'll ever need. Three common interior doors are used for the front; the rest is chiefly plywood. When tipped on side, cabinet will easily pass through any standard-height doorway

1. The island unit

KING-SIZE WORK CENTER accessible from all sides is provided by this cabinet when it's opened and brought out from the wall. We built it entirely of plywood and limited the lamination to certain surfaces to save cost. With surfaces covered as shown below, all exposed parts (leaves, top, drawer fronts) that show when the cabinet is closed have a beautiful ready-made finish.

Decorative plastic laminate offers a durable, slick counter surface ideal for cutting fabrics. However, you can stain or paint the cabinet if you prefer.

In checking the construction details and sections A-A (page 82), you'll see that you can make the sides with $\frac{1}{4}$ or $\frac{3}{4}$ -in. plywood. The $\frac{1}{4}$ -in. thickness cuts down on cost and weight but requires a bit more work; $\frac{1}{4}$ -in. dados (grooves) are required in the back, top and front members.

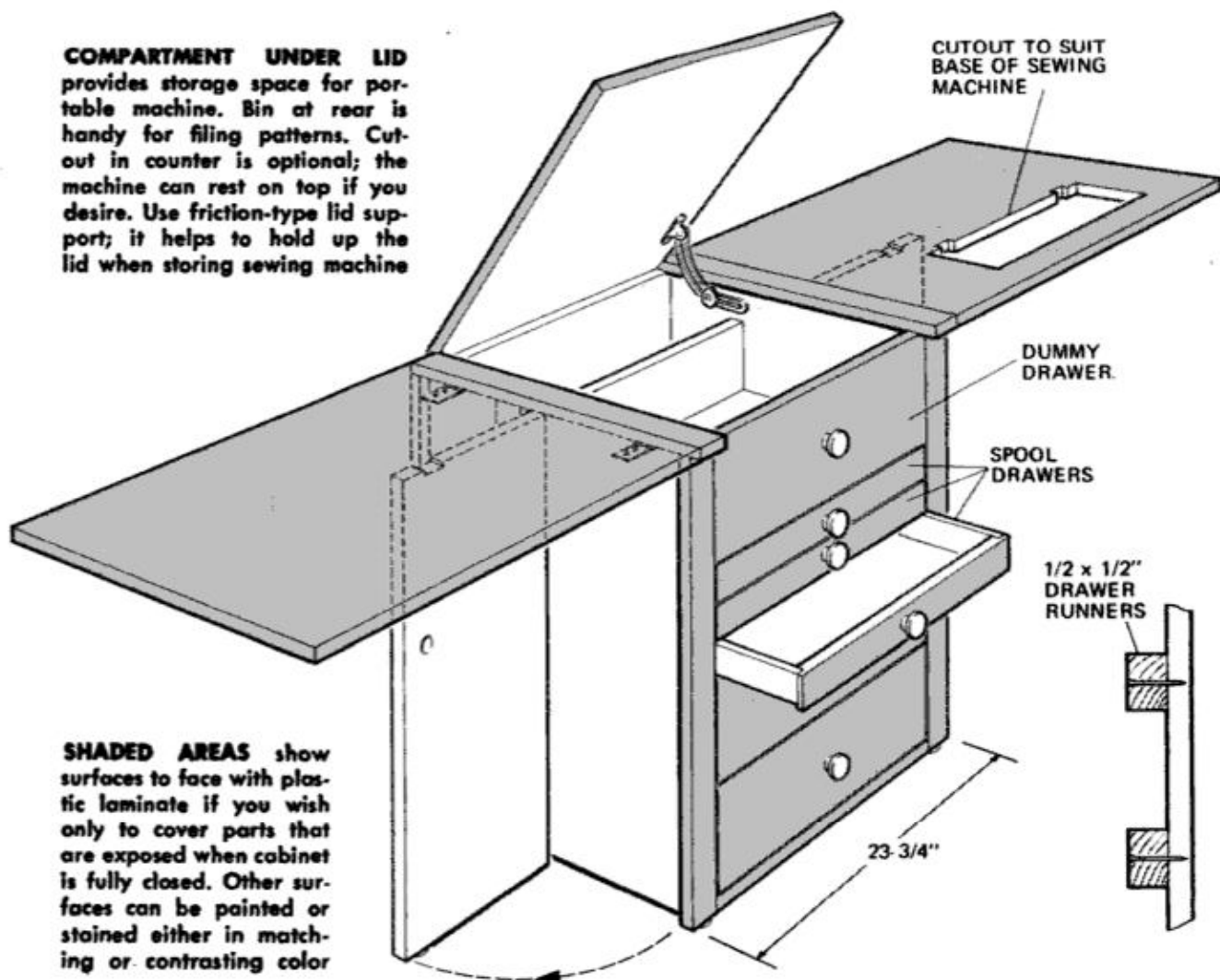
Begin by cutting the $\frac{3}{4}$ -in. back panel.

It will be $22\frac{3}{4}$ in. or $23\frac{1}{4}$ in. wide, depending on the plywood thickness used for the sides. Where $\frac{1}{4}$ -in. plywood is used, run $\frac{3}{8}$ -in.-deep grooves along the two outer edges of the back $\frac{7}{8}$ in. in from the edge. Next cut the two top rails and front pilasters— $1\frac{3}{8}$ or $1\frac{5}{8}$ in., as the case may be—and run similar grooves in them $\frac{7}{8}$ in. in from the edge. Study section A-A and its alternate.

A $\frac{3}{4}$ -in.-thick bottom nails to the back panel even with the bottom edge, and a second panel ($\frac{1}{2}$ in. thick) is installed $8\frac{1}{4}$ in. down from the top. The latter is $\frac{3}{4}$ in. shorter, front to back, than the bottom one. If the sides are $\frac{1}{4}$ in. thick, the bottom member has to be notched at the front corners to fit around the pilasters and be even with them. You'll notice the two top rails project $\frac{1}{2}$ in. beyond the faces of the pilasters so the hinged cover has a lip across the front.

Start assembling the parts you have cut,

COMPARTMENT UNDER LID provides storage space for portable machine. Bin at rear is handy for filing patterns. Cut-out in counter is optional; the machine can rest on top if you desire. Use friction-type lid support; it helps to hold up the lid when storing sewing machine



nailing the bottom to the back first, then the 1/2-in. bottom, followed in order by the sides, top rails and pilasters. If you plan to cover the parts with plastic laminate, you won't have to worry about nailheads showing. If not, you'll have to set and putty the nails that show in the top rails and pilasters.

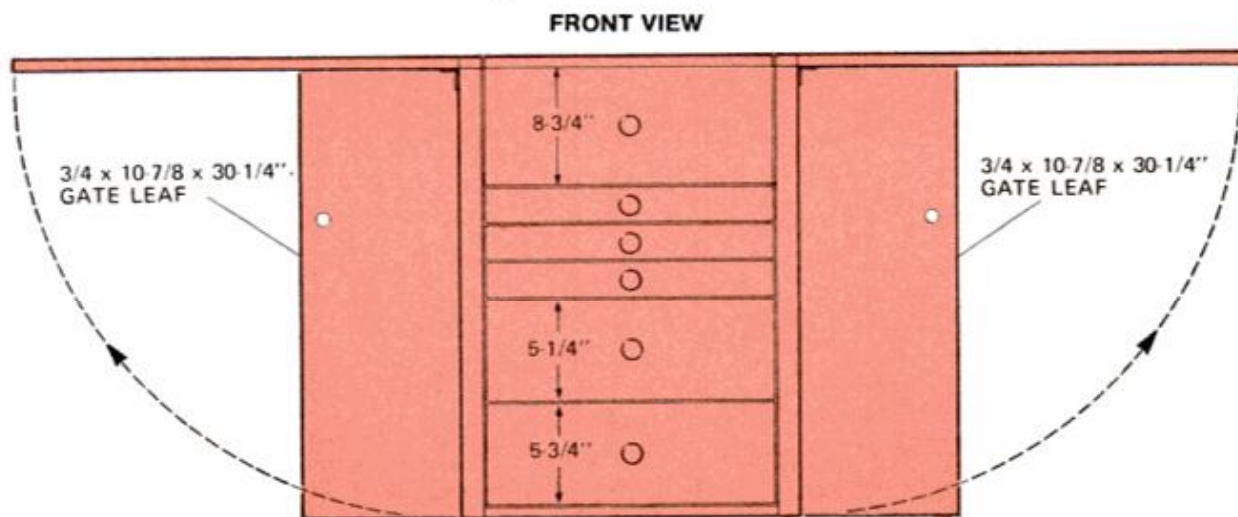
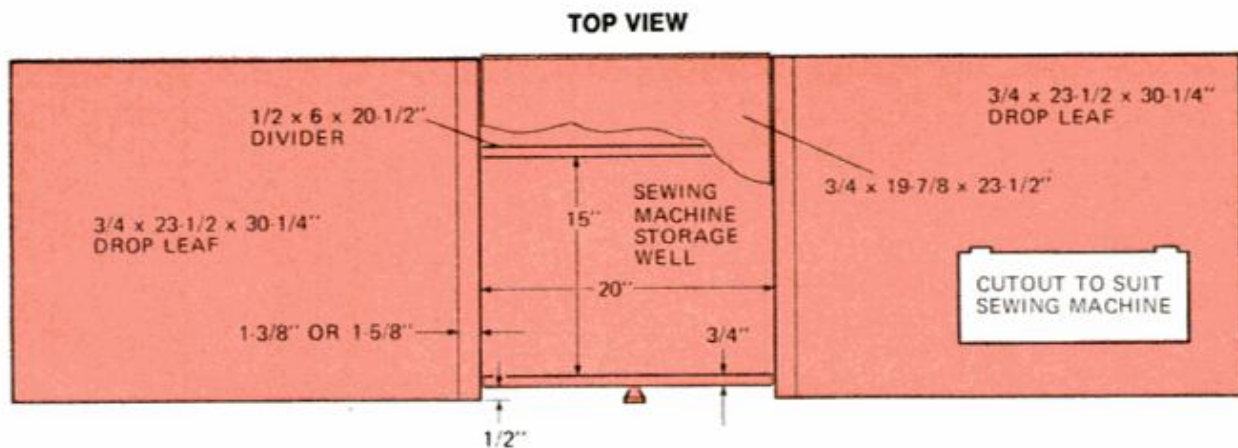
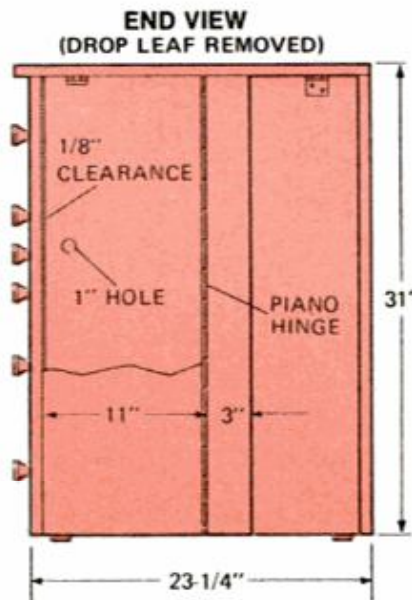
The 8 3/4-in. dummy drawer front is cut and fitted next. Notice that it is held in place with glue blocks on the inside, and that it fits even with the bottom member. We found it easier to apply the plastic laminate to the face of it before gluing it in place. Notice how the laminate (see section B-B) is cut back 1/16 in. at each end to simulate normal drawer clearance. A 6-in.-wide partition, either 20 or 20 1/2 in. long, as the case may be, is installed in the machine compartment 15 in. from the front and nailed in through the sides.

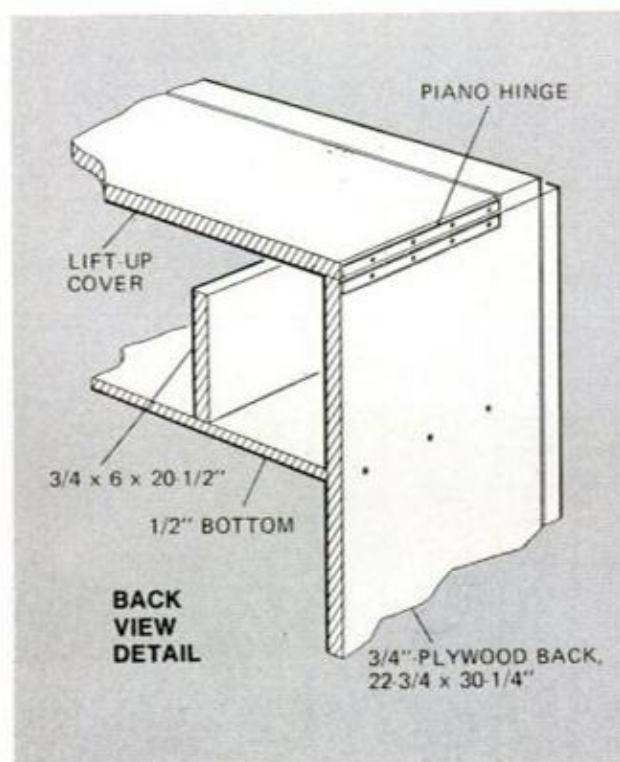
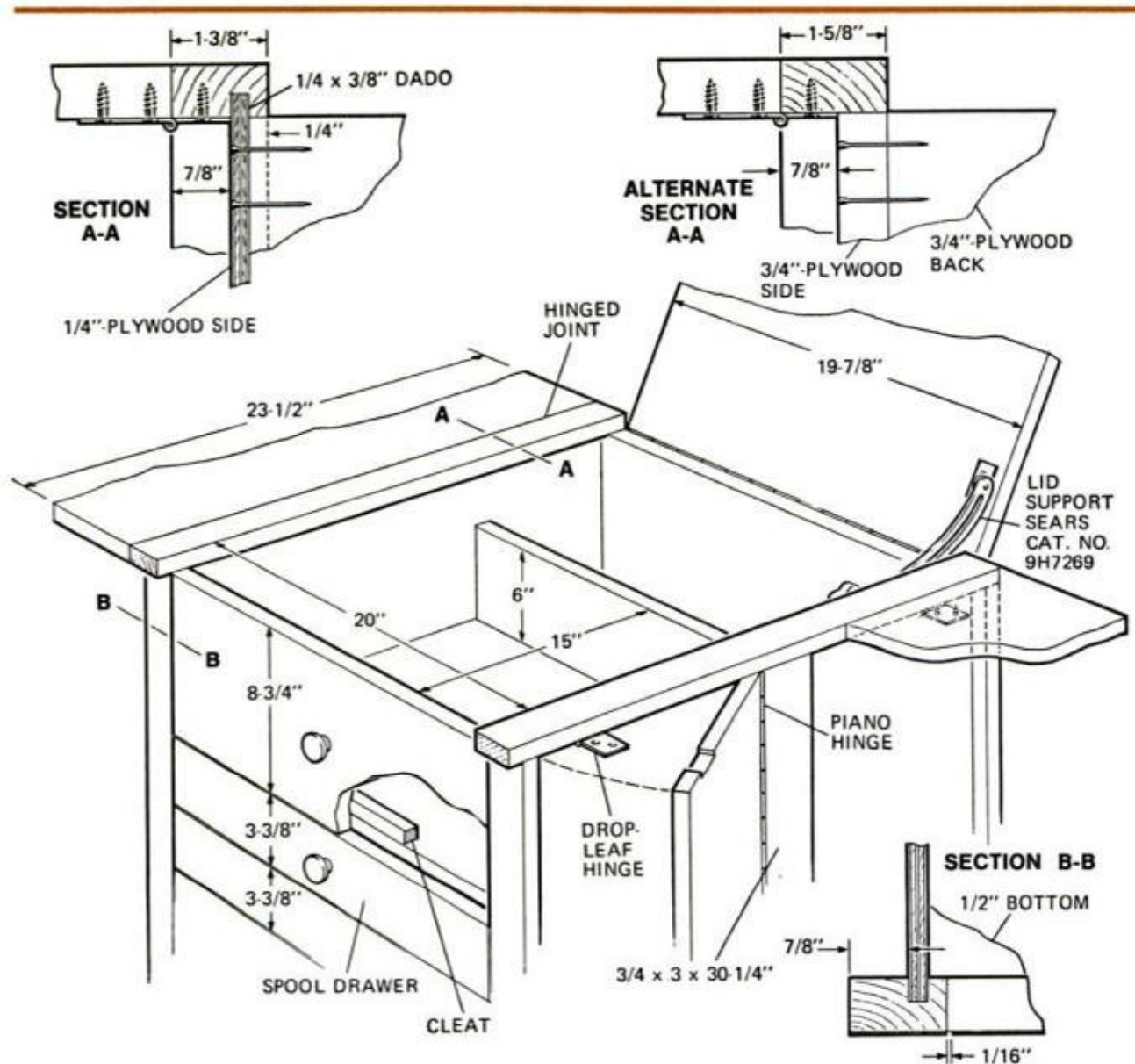
Supporting wings for drop leaves are hinged to 3/4 x 3-

in. vertical members, added to recessed sides of the cabinet 11 in. back from the front. Finger holes are made an inch or so in from the front edges of the wings, and a notch is made in the top of each one so that it will clear the front hinges. Allow a 1/8-in. space for clearance at the cabinet front so that the wings will swing out easily.

Follow typical drawer construction in making the five drawers. With the exception of the bottom drawer, the sides and backs are cut 1/2 in. narrower than the fronts to allow for 1/2 in. runners on which the drawers slide.

Cut the hinged top 19 7/8 in. wide and use a piano hinge to attach it securely across the back. Complete it with a friction-lid support. Hinge the two drop leaves, then place the cabinet on its back and drive rubber-cushion furniture glides into the four corners and outer ends of the wings. ★★★





Cementing plastic laminate

1. Cut your laminate $\frac{1}{8}$ in. oversize all around.
 2. Surfaces to be bonded must be dry and clean.
 3. Apply even coat of contact cement to both laminate and wood, using brush or spreader.
 4. Let both surfaces dry before bonding (10-20 minutes normally). Surfaces will bond when adhesive will adhere but not transfer to brown wrapping paper if touched lightly. If cement becomes too dry (over 3 hours), apply another coat.
 5. Bring surfaces in contact exactly where desired (cement bonds instantly on contact, so you can't shift the work later). Two overlapping pieces of kraft paper placed over cement will let you position the laminate without sticking. When laminate is where you want it, pull out one paper, press down the plastic, then pull out second paper.
 6. Using rubber mallet or hammer and wood block, apply pressure all over surface for positive contact.
 7. Trim laminate flush with work; use block plane and flat file or router and special laminate cutter.
 8. Clean tools, brushes with contact-cement solvent.
- For more detailed information, refer to *How to Work With Plastic Laminates*, page 154, March '70 PM.

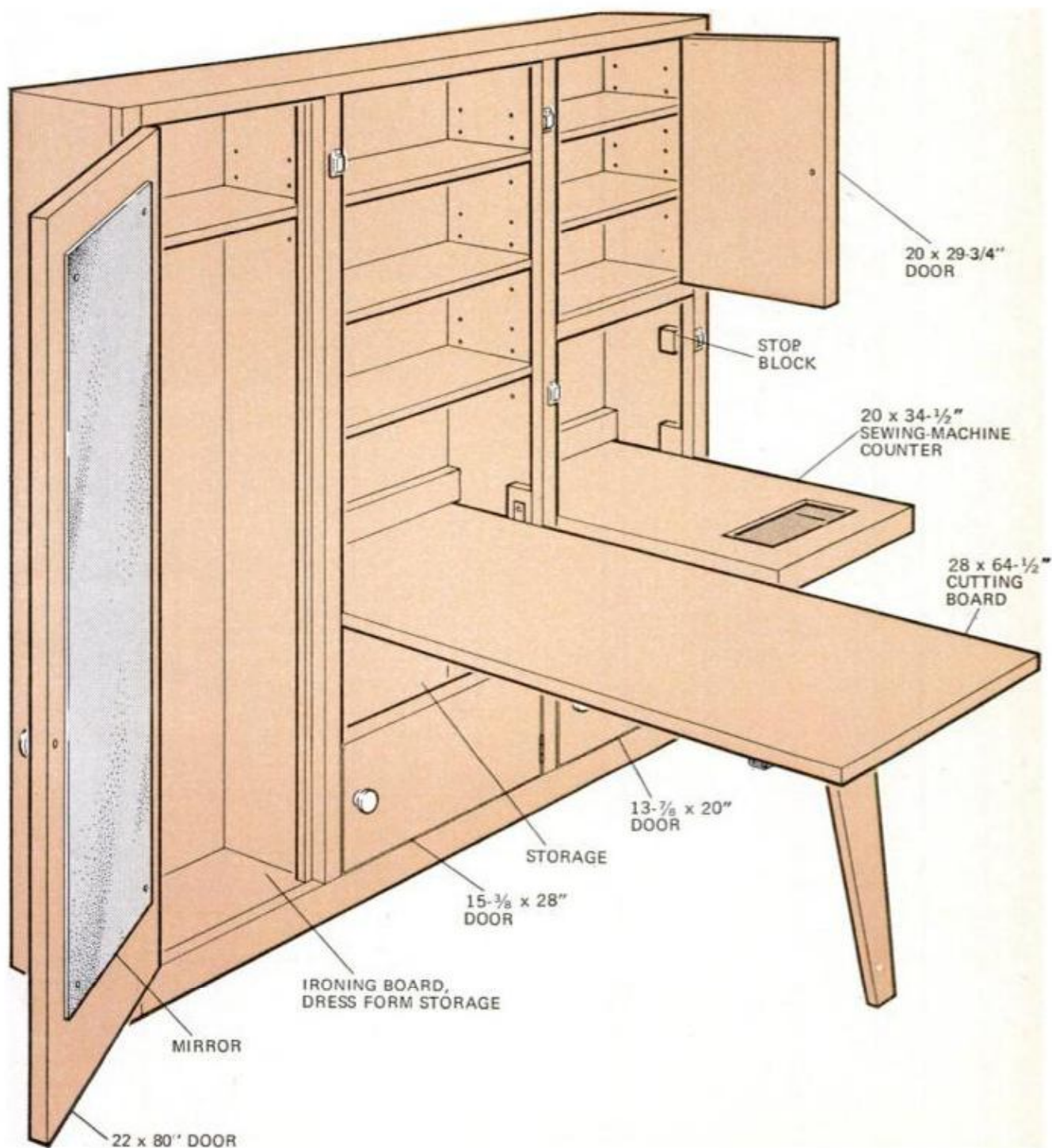
2. The high-rise unit

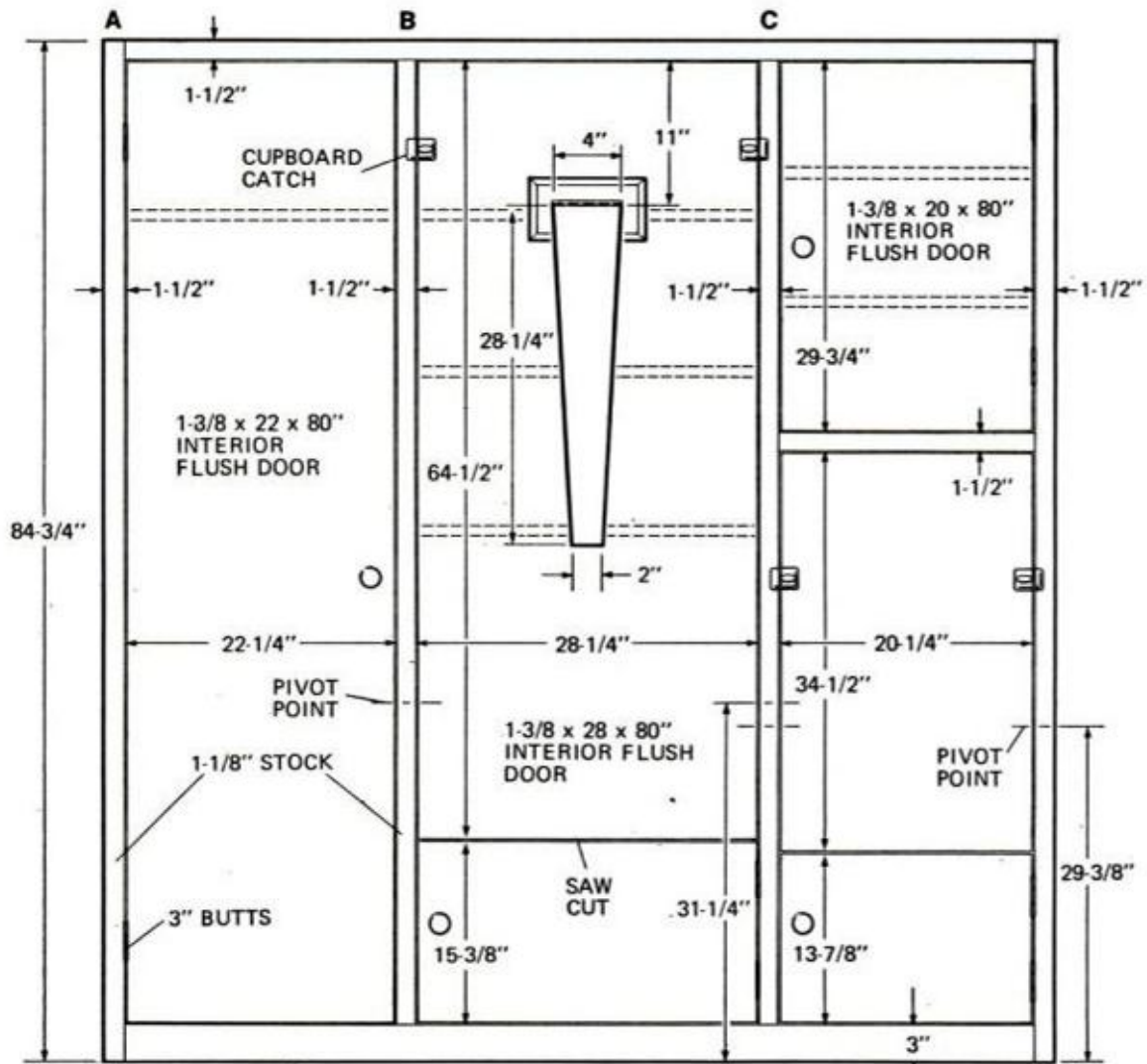
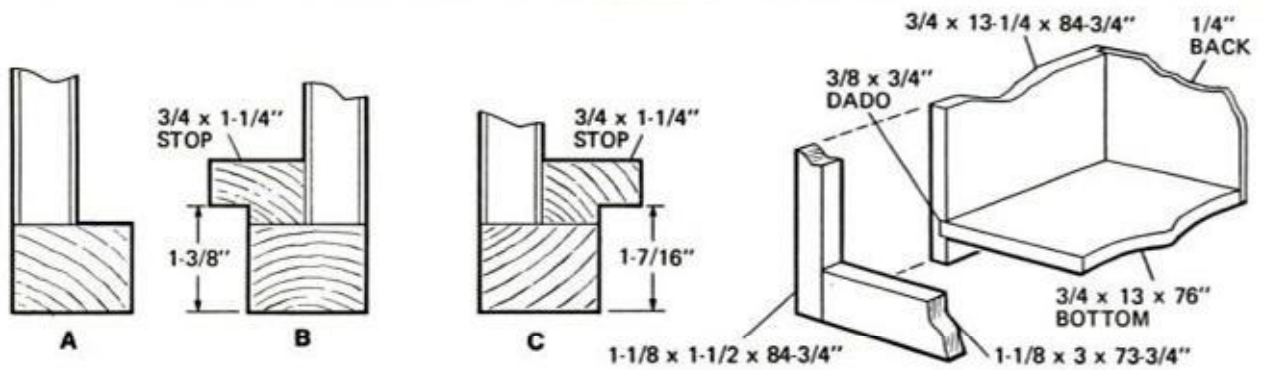
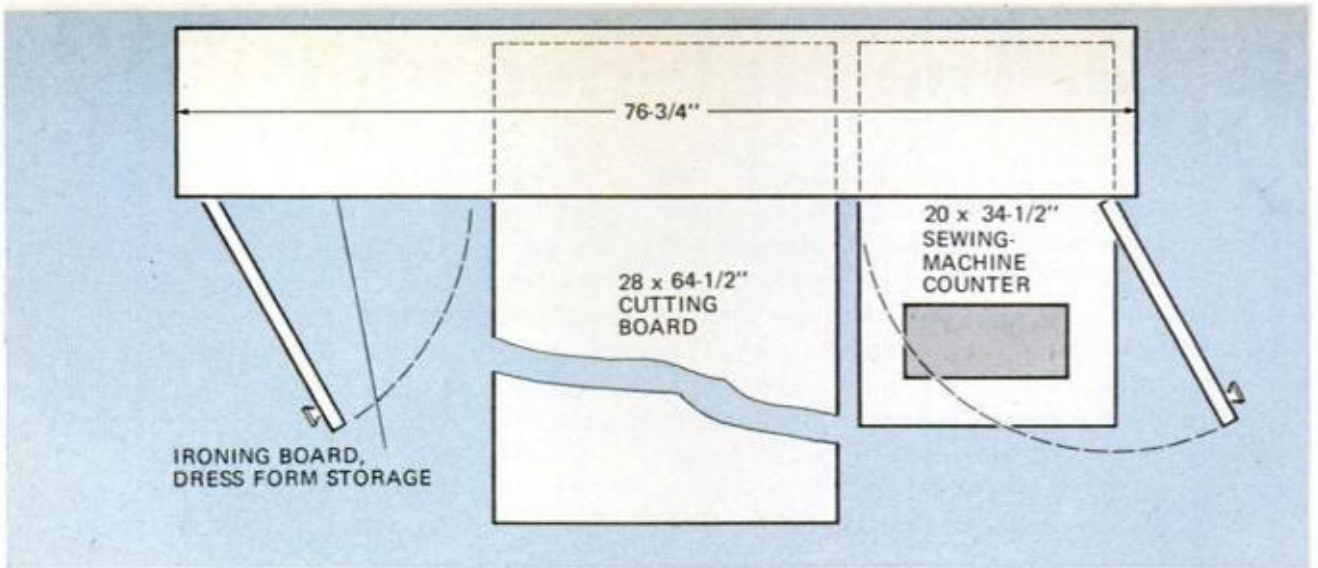
EMPHASIZING CONVENIENCE, this sewing center is built around three $1\frac{3}{8}$ -in. flush doors, one left intact and the others cut into sections. The boxlike case to which they are hinged and pivoted is divided into three compartments by two vertical partitions.

To make the case, cut two side members $13\frac{1}{4} \times 84\frac{3}{4}$ in., then cut a $\frac{3}{8} \times \frac{3}{4}$ -in. rabbet in the top edges and $\frac{3}{8} \times \frac{3}{4}$ -in. dadoes $2\frac{1}{4}$ in. up from the bottom. The rabbets are for a 13×76 -in. top mem-

ber; the dadoes for a 13×76 -in. bottom member. A $\frac{1}{4}$ -in. plywood back laps the edges of top and bottom members, but fits in rabbets cut in the edges of the two side members. The two partitions, 13×81 in., are nailed in place through top and bottom members. The left partition is positioned $25\frac{1}{4}$ in. from the outside; the right one, $23\frac{1}{4}$ in.

Front edges of the case are faced with $1\frac{1}{8} \times 1\frac{1}{2}$ -in. trim pieces of pine, with a 3-in.-wide piece across the bottom. De-





tails B and C, page 84, show how the trim is kept flush with inner faces of the two partitions. Casing nails are used to attach the trim, and the heads are set and puttied.

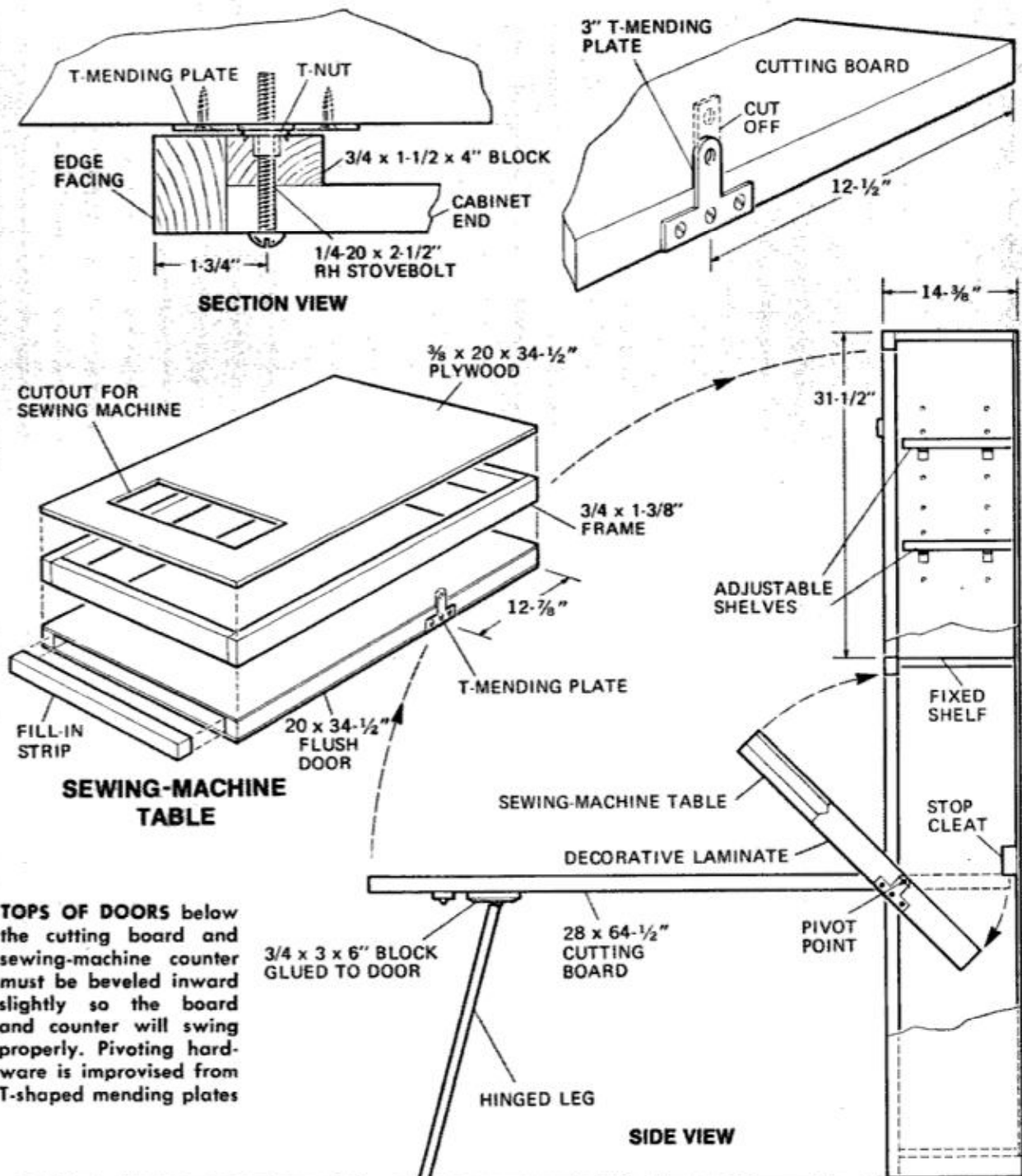
The left-hand compartment is fitted with a stock 22x80-in. flush door hinged with regular 3-in. door butts. The opening as dimensioned provides $\frac{1}{8}$ -in. door clearance all around. A rabbeted stop is on the full length of the door (see detail B); similar stops are on both right-hand doors; the upper stop being $29\frac{3}{4}$ in. long, the lower one $13\frac{7}{8}$ in. The upper right compartment has a $\frac{3}{4}$ -in. bottom $31\frac{1}{2}$ in.

down from the top, and a $1\frac{1}{2}$ -in. trim piece covers the edge.

The 28-in. center door is cut in two sections at a point $64\frac{1}{2}$ in. from one end. Since interior doors are hollow, filler strips of solid wood must be inserted and glued in the cut ends. The $64\frac{1}{2}$ -in. section is the cutting board and is covered on the back with plastic laminate before being pivoted to the cabinet.

The 20-in. right-hand door is cut in three sections: $29\frac{3}{4}$, $34\frac{1}{2}$ and $13\frac{7}{8}$ in. The $34\frac{1}{2}$ -in. section is a swing-up sewing-machine counter. To provide a well for

(Please turn to page 201)



TOPS OF DOORS below the cutting board and sewing-machine counter must be beveled inward slightly so the board and counter will swing properly. Pivoting hardware is improvised from T-shaped mending plates

3. The dual unit

SIMPLEST TO MAKE of the four sewing centers created in the *PM* shop is a dual-unit sewing center that appeals to the builder who wants to spend a minimum of time and money. Of its two individual units, one is attached to the wall to accommodate a portable sewing machine and the other is placed alongside. Together they offer the sewer convenience and storage galore.

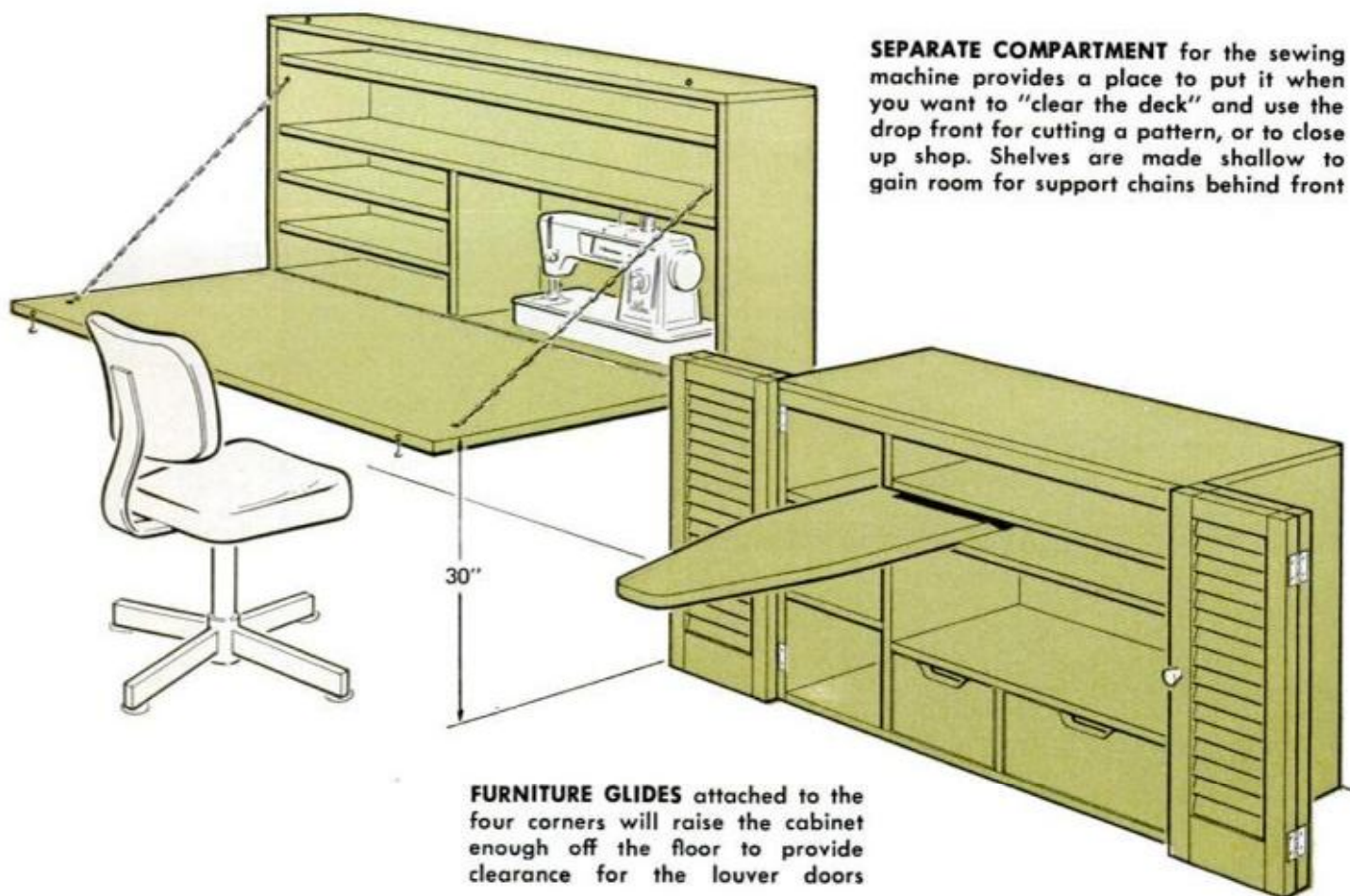
Little more than a box fitted with a back and shelves, the drop-counter wall unit is practically a hammer and saw project. The ends and the top and bottom members are cut in pairs as are the four shelves. The top and bottom boards lap the end members, and the two long shelves butt between. To gain "headroom" for nailing the short divider in place, you should install the lower long shelf first, then the two short shelves and finally the upper one. Chains support the drop front; hooks and eyes hold it shut. Two 3-in.

angle brackets across the top and bottom anchor the unit solidly to wall studs.

Although the base unit is twice as deep as the wall unit, construction is much the same. The top and bottom members lap the end members, and a divider forms compartments. One difference you'll notice in basic construction is the 1½-in. apron that's let in across the front at the top. This requires ¾ x 1½-in. notches cut before assembly.

The sit-down ironing board pivots on a single carriage bolt that passes through a hole in the second shelf and swings clear of the end when not in use. Two drawers with handholds are made to slide easily in the 12 and 22½-in. openings. Stock cabinet louvers are used for doors and trimmed to fit. They're hinged to fold, and held shut by magnetic catches.

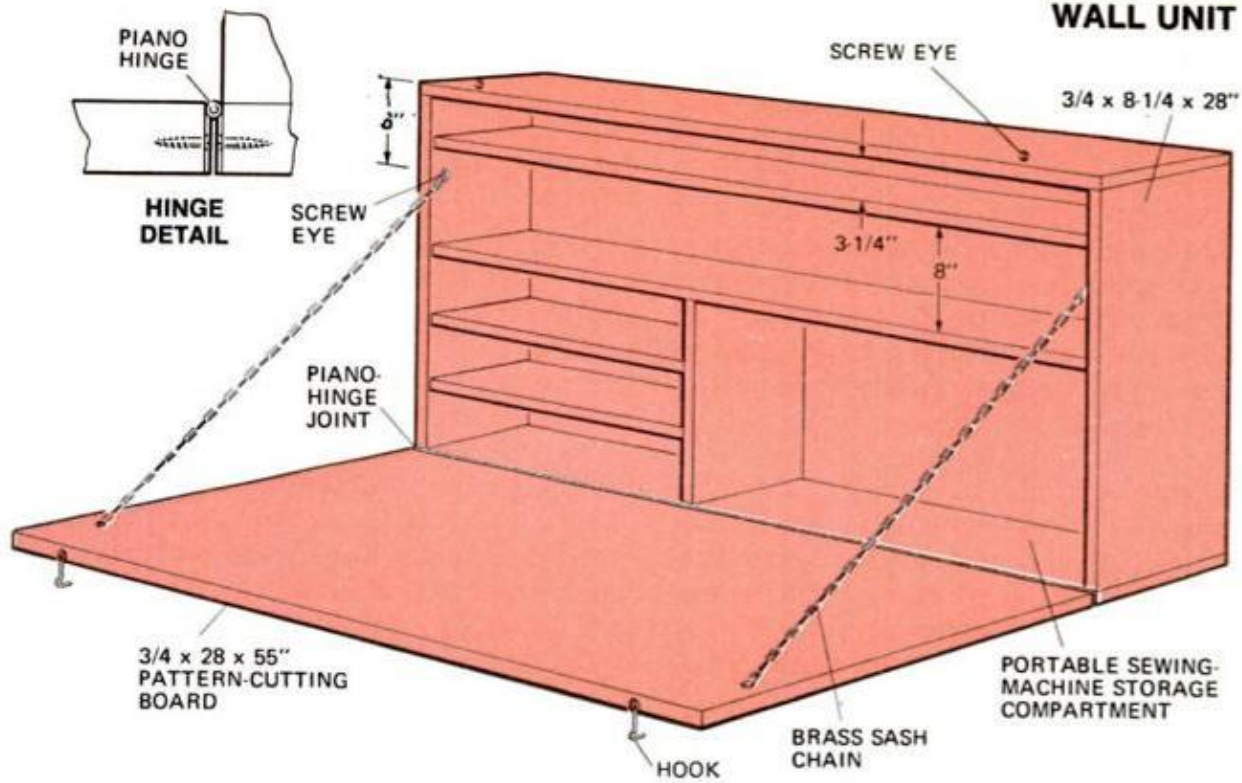
The wall unit should be hung so that the drop front will level at about table height (30 in.) when open. ★★★



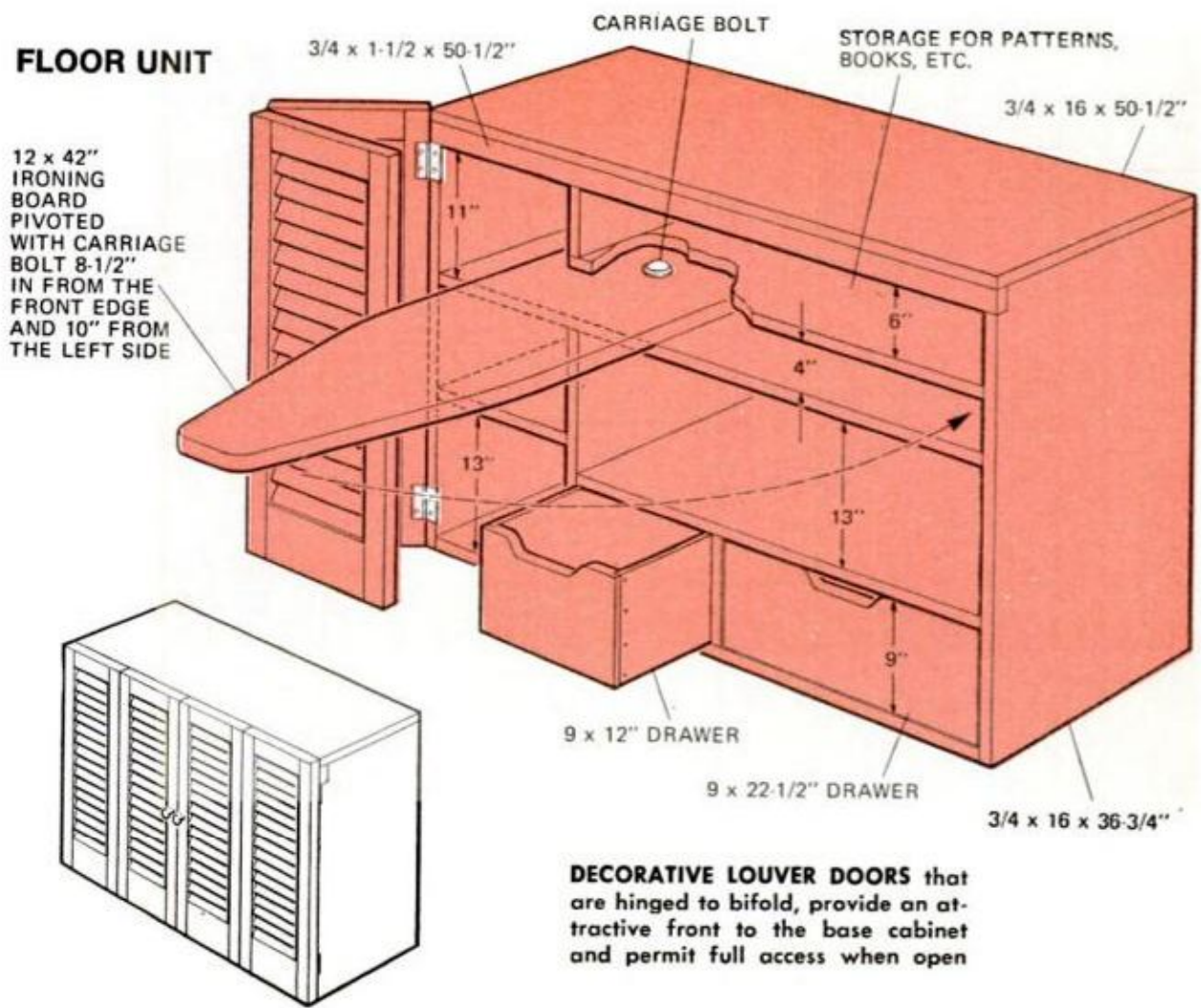
SEPARATE COMPARTMENT for the sewing machine provides a place to put it when you want to "clear the deck" and use the drop front for cutting a pattern, or to close up shop. Shelves are made shallow to gain room for support chains behind front

FURNITURE GLIDES attached to the four corners will raise the cabinet enough off the floor to provide clearance for the louver doors

WALL UNIT



FLOOR UNIT



4. The dual-role unit

WHERE SPACE IS LIMITED and there just isn't room to have a sewing center in the way all the time, this one retracts against the wall to serve as a decorative plaque. When stored, it projects only 14 in. from the wall, leaving free floor space under it.

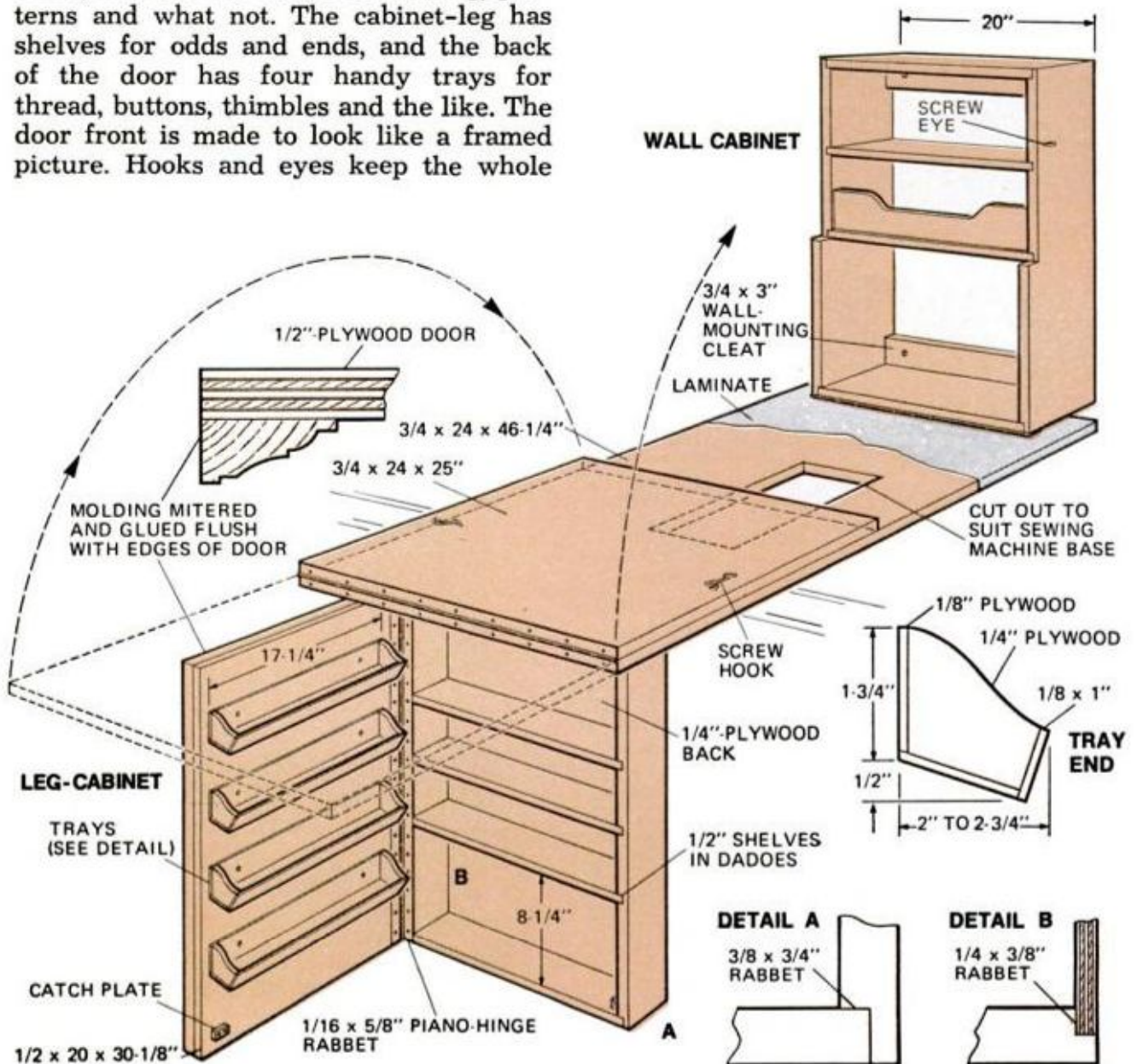
There are three parts: a cabinet bolted securely to a wall, a counter and cutting board hinged to the cabinet, and a swing-down cabinet-leg hinged to the outboard end of the cutting board for support. The leg has a picture-frame door that swings open to support a flip-over extension. When fully open, the cutting board measures some 65 in. long and 24 in. wide. The wall cabinet provides storage for the machine, and shelves above for sewing, patterns and what not. The cabinet-leg has shelves for odds and ends, and the back of the door has four handy trays for thread, buttons, thimbles and the like. The door front is made to look like a framed picture. Hooks and eyes keep the whole

thing stored against the wall. When in use, the sewing machine is flush in a cutout in the cutting board.

Except for the two mounting cleats, the back of the wall cabinet is open. Each side is 9 x 32½ in. and is rabbeted top and bottom for 8 and 9-in.-wide members 19¼ in. long. Two 8-in.-wide shelves fit between in dadoes, the bottom one being placed 17 in. down from the top and even with the notched cutback.

The cabinet-leg, 20 in. wide and 30¼ in. high, is made from 1x4 pine. Edges are rabbeted for a ¼-in. plywood back, side members are dadoed for ½-in. shelves, and 19¼-in. top and bottom members

(Please turn to page 198)





SHIP IS SMALL but amazingly light, strong and maneuverable, with a healthy top speed of 170 mph. Removable wing sections weigh only 22 pounds each, are easily handled by one man (top photo below). Attaching wing requires only four main bolts, plus one for aileron control; can be done in 15 minutes

Homebuilt 'model' plane you can really fly

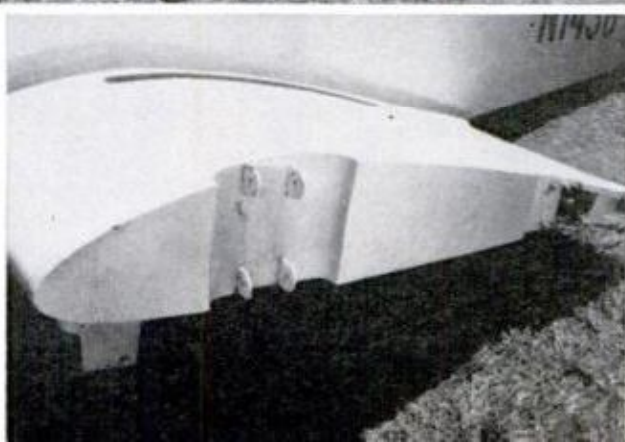
Patterned after modelmaking techniques, this all-wood-and-plastic single-seater is light, low in cost and really fun to build

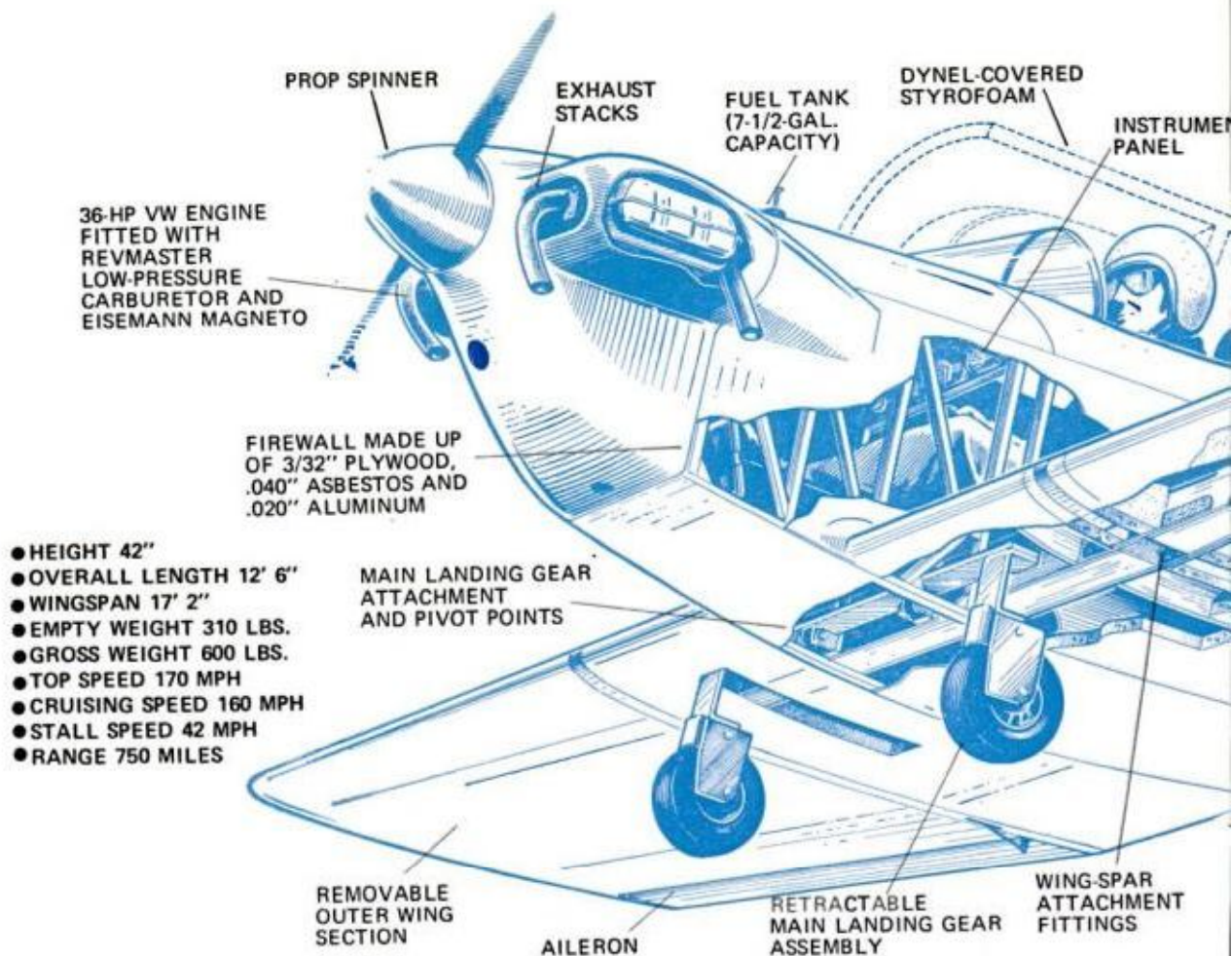
By **SHELDON M. GALLAGER** and
HOWARD LEVY / Photos by Howard Levy

IF THIS TRIM little low-wing single-seater looks something like an overgrown model, the resemblance isn't just a coincidence. Its designer, Ken Rand, has been building model planes as a hobby for years in between his professional duties as a flight test engineer for Douglas Aircraft in California. When he decided to build his own plane—one he could actually fly in instead of control from the ground—it was only natural that his vast modelmaking experience should play a part in the craft's construction. Except for engine and fittings, the ship is fabricated almost entirely from wood and plastics. Called the KR-1 after Rand's initials, it's fully approved for flight in the amateur-built category and

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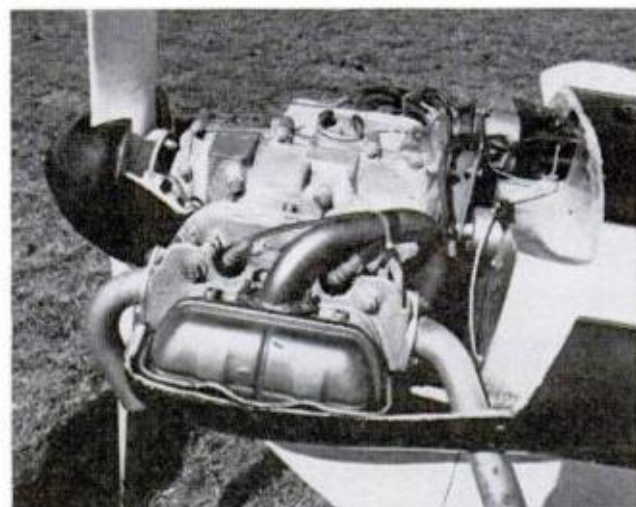
- HEIGHT 42"
- OVERALL LENGTH 12' 6"
- WINGSPAN 17' 2"
- EMPTY WEIGHT 310 LBS.
- GROSS WEIGHT 600 LBS.
- TOP SPEED 170 MPH
- CRUISING SPEED 160 MPH
- STALL SPEED 42 MPH
- RANGE 750 MILES

has been copied by other homebuilders from Ken's plans.

In addition to basic modelmaking techniques, Ken has added some novel features of his own. Most wing ribs are shaped from Styrofoam plastic with the spaces in between filled with Styrofoam slabs. This assembly is covered with a smooth, taut reinforcing skin of Dynel epoxy, producing a strong, light wing weighing a mere 22 pounds per section. In a similar way, contoured areas such as engine fairings, nose cowling, tail surfaces and the curved top portion of the fuselage are all carved from Styrofoam—like shaping balsa-wood in a model. The main air-frame is merely a boxlike structure sheathed with plywood to simplify construction.

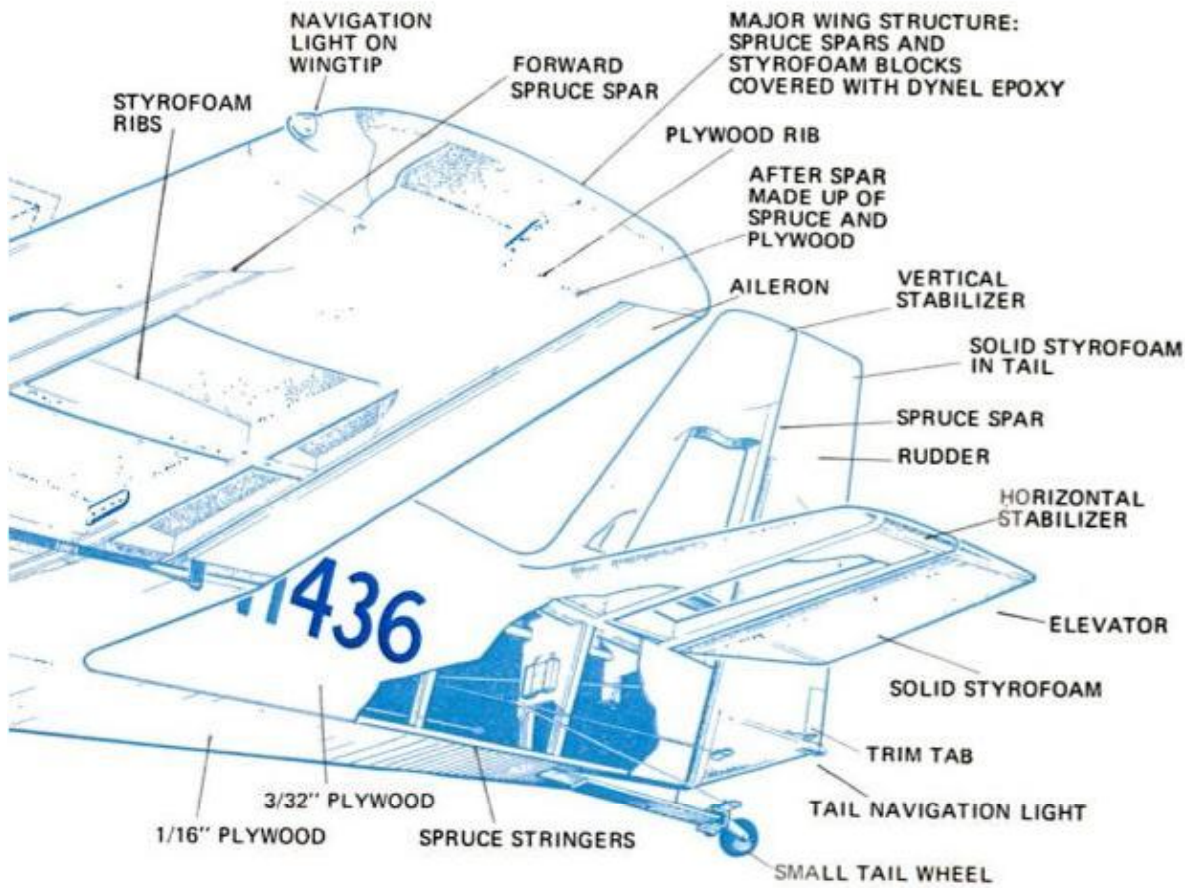
The landing gear is seemingly primitive, yet ingeniously simple, too. The wheel struts are attached to a hinged crossbar. Pulling up on a handle swings the wheels back and upward into wing pockets to re-

UNUSUAL "CANOPY" swings up sideways on piano hinge for easy access to small cockpit. Even when closed, cockpit is still open type with windshield but can be fitted with a plastic bubble for full enclosure if desired. Behind cockpit is cargo space



MINI POWERPLANT is 36-hp VW engine fitted with Eisemann magneto and Revmaster low-pressure injector carburetor. Exhaust stacks are curved downward





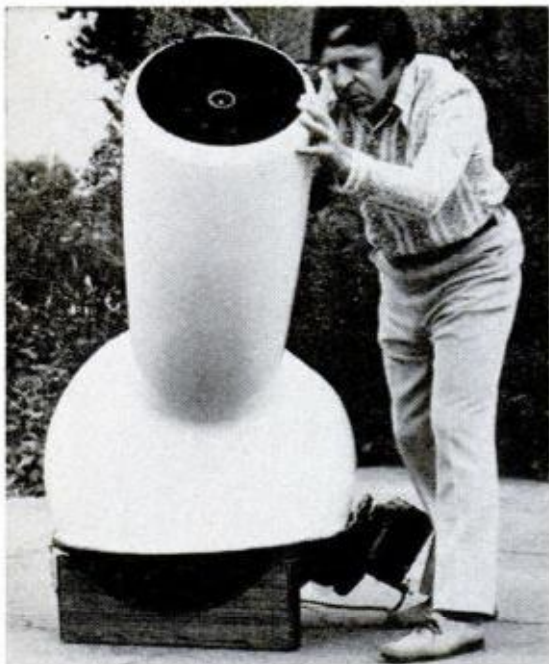
RUDDER AND ELEVATOR control surfaces are shaped from solid Styrofoam blocks (top photo at left). Simply made landing-gear struts (bottom) fold upward into wing pockets to retract wheels in flight

tract them for flight. The crossbar is spring-loaded to cushion shocks.

What's so surprising is the ship's impressive performance on modest power. Out of a junked 36-hp VW engine of 1957 vintage, the KR-1 squeezes a top speed of 170 mph and cruises at a brisk 160. Rate of climb is 600 feet per minute, with a service ceiling of 12,000 feet and a range of 750 miles on a 7½-gallon fuel supply. The plane can land at a leisurely 50 mph and gets off the ground in 500 feet.

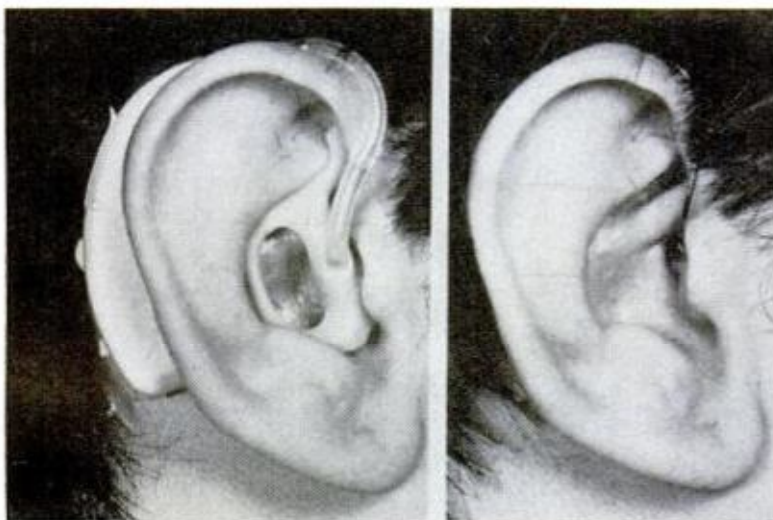
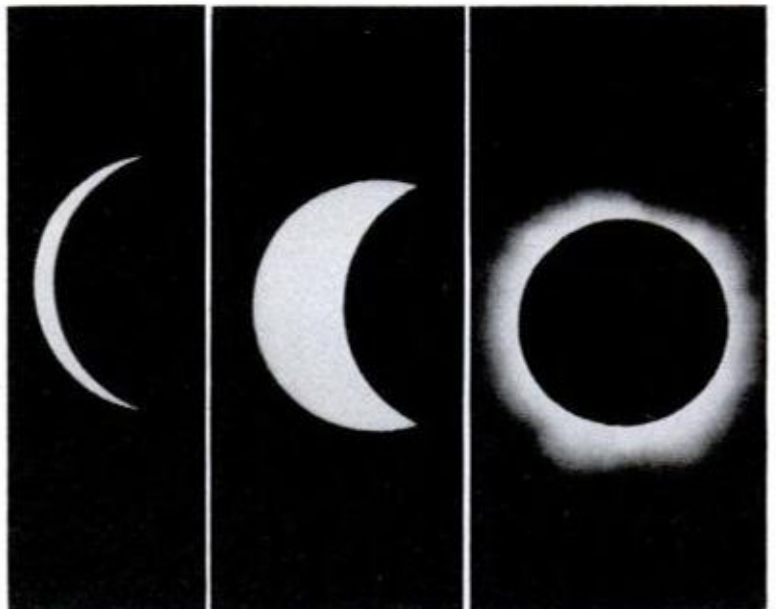
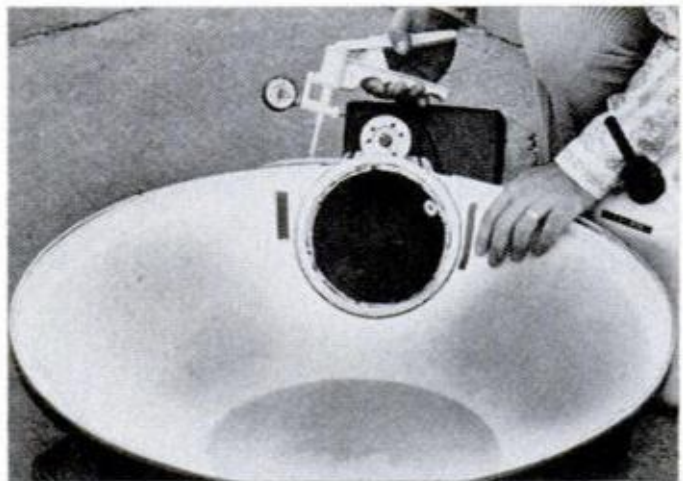
Much of the KR-1's performance can be attributed to its light weight—only 310 pounds empty and 600 pounds gross. Overall length is a scant 12½ feet—less than many cars—with a wingspan of 17 feet, 2 inches. To make the plane readily stowable in a garage, its wings are removable. Another feature is a side-hinged partial canopy that swings up for easy access to the tiny cockpit. KR-1 plans are \$20 from Ken Rand, 6171 Cornell Drive, Huntington Beach, Calif. 92647. ★★★

IT'S NEW **NOW**



Big scope floats in small 'pond'

When amateur astronomer Norm James designs a telescope to be stable, it's really stable. For the one above he built a floating mount—a ball-ended base that rests in a water-filled basin. The scope is turned by a suction-cup drive (upper right), enabling it to track smoothly and accurately without vibrations from passing cars or other shocks. Photos at right are of 1968 solar eclipse taken through the homemade scope. Plans are 50 cents from Norman F. James, 10513 Vall Dr., Sunland, Calif.



Invisible hearing aid wears a tiny 'wig' so you can't tell it from your own hair

A virtually invisible hearing aid is made possible by inserting a tiny speaker directly into the ear canal and running a fine wire to a small amplifier behind the ear. The amplifier is covered with synthetic hair to match the wearer's own (near left compared to conventional hearing aid at far left). Medacoustics, Inc., 609 Fifth Ave., New York, N.Y., sells the device, said to compare in price with standard models.

THE LATEST PRODUCTS AND DEVELOPMENTS



Concrete 'highways' to help speed fast trains of the future

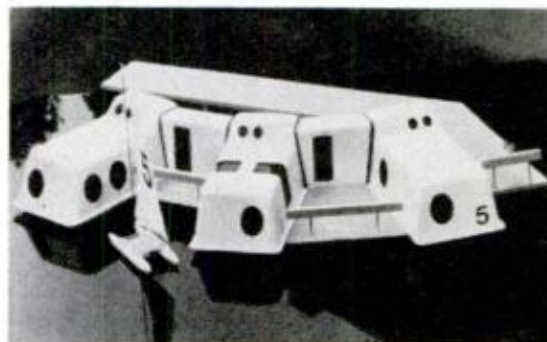
Concrete railroad ties, long thought to be too brittle and unresilient for practical use, are now being tested in England. The trick, engineers found, is to cast the ties as part of a continuous concrete roadbed, much like a concrete highway. The system, if successful, could provide safe, maintenance-free track, especially important for Britain's planned high-speed trains.



Latest in kits: Now you can build your own tough, three-wheeler ATV

This kit-built ATV not only gives you a lot of wild, bouncy fun riding it, but also provides the money-saving satisfaction of putting it together yourself. The rugged three-wheeler, powered by an 8-hp Tecumseh engine, has hefty foot-wide, 21-inch tires for good traction on soft ground or sand. Super Tryke kit is \$369.95. Heald, Inc., Box 1148, Benton Harbor, Mich.

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Home may be in a houseboat city

A floating "city" of houseboats may be one answer to finding housing space in highly populated areas. It consists of modular-shaped houseboats that couple together with interconnecting passageways, docks and shopping facilities. If you want to take a trip, you just detach your floating home and sail away. Conceived by Danny Chan of Hong Kong, idea was one of winning designs in a contest sponsored by Alcoa.



Unsticker for stuck wheel nuts

Unsticking stubborn wheel nuts is easy with this clever torque-multiplying lug wrench. One end fits over the nut to be removed; the other end is anchored on another nut. A ratchet handle turns a crank wheel to increase leverage, quickly loosening the nut. Made by Firma Fritz Wegner, Stormsweg 12 Hamburg, Germany.

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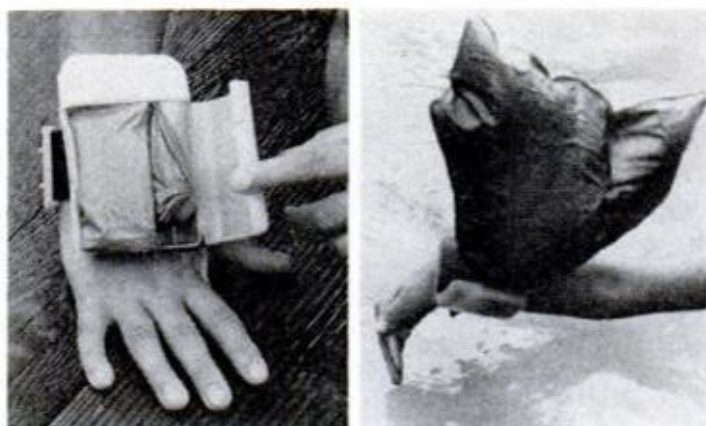
Hello, Mom, we just sank!

Hawaiian beaches not only abound in bikini-clad bathing beauties, but now boast a network of shore-side emergency telephones similar to those along U.S. highways to aid motorists in distress. The phones, located at spaced intervals around the tourist-popular island of Oahu, are designed to speed help to injured surfers, victims of boating accidents, even stranded sunbathers who leave keys locked in their cars.



Double-ender fire engine comes and goes either way

Said to be the biggest firefighting vehicle in Europe, this mammoth German pumper hurls streams of water or foam from twin turret-mounted "cannons" on top. Giant tanks inside hold 5000 gallons of water and more than 300 gallons of foam. Used in Frankfurt, the 50-ton truck has two 500-hp engines and control cab at each end to steer in either direction for quick maneuvering in close quarters.



'Wristwatch' life preserver

Worn like a wristwatch, this tiny cigaret-pack-sized inflatable life preserver is designed to save the bulk of conventional life jackets and also be with you at all times when you're not wearing a jacket. Pressing a button instantly inflates a plastic flotation bag from a built-in CO₂ cartridge. The Aqua-Aid is \$4.45 from New Era Products Corp., 2670 Meadow Rd., Lumberton, N.C.



'Flying saucer' sofa doesn't really fly—but oh what fun you can have on the ground

If you cross a flying saucer with a sofa, you get this circular party seat—sort of a raised version of the popular "conversation pit." It won't get off the ground, but it does save cutting a hole in your floor. The novel whatever-it-is is sold in England by Oscar Woollens, 423 Finchley Rd., London, for—guess—about \$1200.



Pedal-powered car saves on gas, cuts pollution, but you provide the go

If you pedal fast enough, you can keep up with traffic in this foot-powered mini-car designed for low-cost, short-run shopping and commuting trips. The Pedicar has five forward speeds, reverse and 8 cu. ft. of cargo space; even headlight, windshield wiper and rear-view mirror. Most states permit its use on local roads but not highways, says its maker, Environmental Trans-Sport Corp., Box 566, Windsor, Conn. 06095.



Space date: U.S. and Russian astronauts to meet in orbit

How the U.S. Apollo and Soviet Soyuz spacecraft will link up in orbit is demonstrated above by NASA-built models. The rendezvous, scheduled for 1975, will be the first between two nations and will also test out the feasibility of using one space vehicle to rescue another in distress. The Apollo is shown in the foreground with its docking and crew-transfer module connecting it with the Soyuz ship in the background.

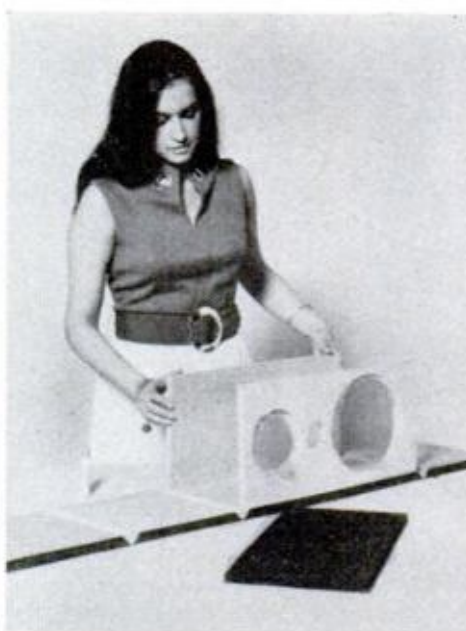
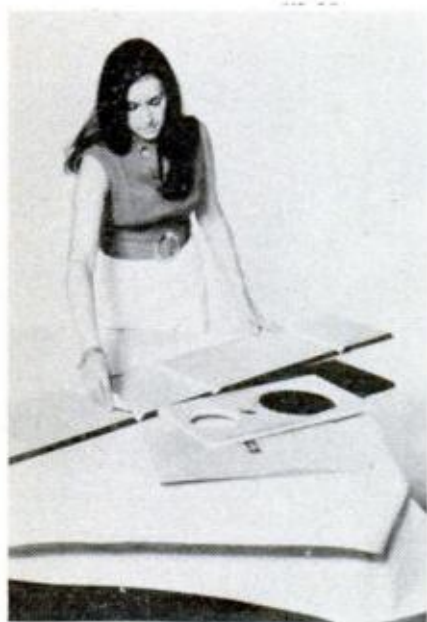
MARCH 1973



This giant hydraulic 'can opener' frees trapped crash victims in seconds

Getting trapped accident victims out of badly smashed cars or other wreckage is quick work with these powerful hydraulic "jaws." The spreading jaws exert five tons of force and can strip off a jammed door or raise a crushed roof in 20 seconds. The portable rescue rig is powered by a 5-hp engine and, for special jobs, can be fitted with grab hooks, cutting blades or chains. It was developed by Hurst Performance, Inc., Warminster, Pa.

NOW



Speakerless speaker kit saves you money by letting you use your own speakers in an easy-to-assemble prefinished enclosure



This kit-built speaker enclosure has a novel feature—it not only saves some of the cost of ready-made models, but lets you use speakers you may already have or wish to buy separately. Parts come knocked down (top photo, far left), but fold together quickly to produce a handsome walnut-finished enclosure of high-quality, acoustic-suspension design (bottom photo, near left). Kit includes a speaker baffle with pre-cut openings for standard speaker diameters of 2½, 5 and 8 inches. Two models—a two-way for tweeter and woofer, and a three-way for tweeter, mid-range and woofer—are available. Speakers are not included, but can be supplied. For prices and additional information, write to National Tel Tronics, 98 Cutter Mill Rd., Great Neck, N.Y. 11021.

Pocket-sized Minolta mini camera now comes with strobe flash adapter packaged in handy all-in-one kit

Electronic flash is now available for Minolta's popular 16-Qt sub-miniature pocket camera, eliminating the need for flashbulbs. Camera and strobe come in a boxed kit (right) that includes carrying case, strobe adapter and film for \$110. Camera takes 16-mm film in easy-load, drop-in cartridges for color slides and color or black-and-white prints.





Add-on video player attaches to any TV

You can play video tape cartridges through your own TV set with this add-on unit, said to be the first for use with any existing TV. The Cartrivision player, previously available only in TV consoles, will be sold separately for about \$700 at department and appliance stores.



Two famous SLR cameras go completely automatic

Automatic exposure is now available on two well-known 35-mm SLR cameras—the Canon EX Auto (top, above) and Nikonmat EL (bottom). You just set desired shutter speed—diaphragm openings are automatically adjusted. Cameras have center-weighted through-the-lens light meters, can be switched to manual operation. Canon EX Auto, with 1/500-second speed and 50-mm f/1.8 lens, is \$229.50, Bell & Howell, 7235 North Linder Ave., Skokie, Ill. Nikonmat EL, with 1/1000-second speed and 50-mm f/2 lens, is \$450, Ehrenreich Photo-Optical Ind., 623 Stewart Ave., Garden City, N.Y.



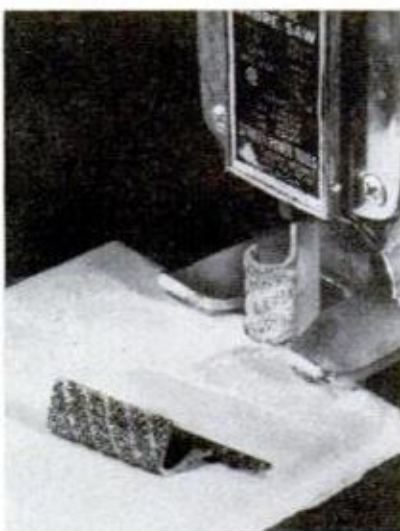
First pollution-free all-electric bus

Proving that pollution-free electric buses may be practical for the future is this compact battery-powered Electrobus already available for short-run urban uses. It seats 20 passengers, hits up to 35 mph, runs three to five hours on a single battery charge and can also be converted to a cargo van. Priced at \$28,000, it's made by Tork-Link, 12457 Ventura Blvd., Studio City, Calif.



Two-way cooking top

This one-piece, glass ceramic top developed for kitchen ranges by PPG Industries, One Safeway Center, Pittsburgh, Pa. 15222, combines a cooking surface with counter space. Usable with ordinary cookware, surface becomes hot only directly over heat source, leaving remaining space for storage. The top, now used for electric ranges, is being considered for gas models. Write PPG for nearest dealer.



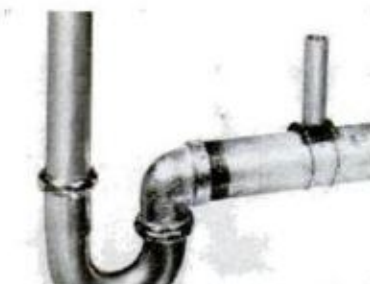
Converts sabre saw into a power file

A new saw attachment called Saber-File converts your sabre saw to a power file. The file has tiny particles of tough tungsten carbide fused to the working faces, which are claimed to file with ease ceramic tile, fiberglass, asbestos and plastic laminates, as well as wood. The packed set of two, consisting of one flat file and one half-round file, sells for \$3.25 postpaid (plus tax where applicable). The manufacturer is New Concepts Co., Inc., Box 182, 1945 Cary Rd., Algonquin, Ill. 60102.



It's the age of aquariums

Newest look in aquariums is this freestanding contemporary bubble tank. The 21-inch-diameter globe of clear plastic provides good viewing, and a concealed filtration system operates through a center service channel to supply fish needs. Standing 36 inches high overall, the aquarium rests on a molded rigid-urethane pedestal. \$139 from Vaungarde, Inc., Dept. PM, 1210 West Oliver St., Owosso, Mich. 48867.



Here's a way to stop drain 'gargle'

Gargling noises in a drain can be stopped by an Automatic Vacuum Breaker. Said to let water rush faster for scouring action, it's mounted in a hole near the trap and secured with wires. \$8; Al Steiner Co., 408 43 St., Union City, N.J.



Socket-wrench kit in a carrying case

Socket wrench kit has nine 1/4-inch drive sockets, nine 3/8-inchers, plus sparkplug socket, two extensions, 3/8 to 1/4-inch adaptor, spinner handle, reversible ratchet, carrying case. \$23.65, Crescent Div., The Cooper Group, Box 728, Apex, N.C.



Easy cleaning with a huff and a puff

Though in use for years in technical laboratories, professional dusting instrument called Dust-Off is now available to the consumer for reaching those hard-to-dust areas and for photography buffs. The tool uses Freon gas, which can be controlled from a delicate puff to a powerful blast. The larger shop version, comes with 15-oz. canister complete with reusable chrome trigger valve and nozzle, sells for \$9.95 (refills are \$1.95.) The disposable-when-empty Dust-Off Jr. is priced at \$2.75, comes with flexible extension rod for precision dusting. Available at local photography and hi-fi outlets. Falcon Safety Products, Inc., Mountainside, N.J. 07092.

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Intermittent blending—automatically

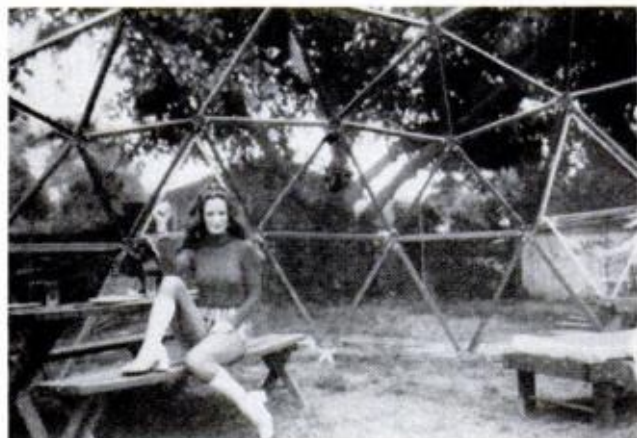
Latest pushbutton blender from Waring features a switch labeled Dynablend that automatically gives the unit on/off intermittent blending. The handy control permits user to do any necessary dry blending such as nuts, dry cheeses or to make bread crumbs. Available in white, avocado and gold at appliance and department stores, it's priced under \$30.



Stops rug raveling

Put a bead of Mr. Quick Liquid Carpet-Binding along the edges of your rugs and carpets, and annoying rug raveling will stop. Vinyl-base liquid forms an invisible coating when dry, is claimed to give long-lasting effectiveness. Four-ounce applicator bottle \$1.50 ppd. from Carpet Products Co., Box S, Central Square, N.Y. 13036.

99



Do-it-yourself dome: Portable fun house for all-weather, anywhere use

It's a back-yard party and picnic shelter, an all-weather pool or patio cover, a portable beach, vacation or hunting cabin—you name it—it's anything you want to make it. The kit-built dome is 18 feet in diameter and goes together like an Erector set in about three hours with two working. Knocked down (upper left), the parts fit easily in a car trunk and consist of redwood struts and pre-drilled aluminum hubs that bolt together for quick assembly. Geodesic design provides a sturdy, self-supporting structure with 255 square feet of unobstructed floor space and more than 11 feet of headroom at the top. Basic frame price is \$750, with clear or opaque skin coverings extra. Portasphere Industries, 16616A Ventura Blvd., Encino, Calif. 91316.



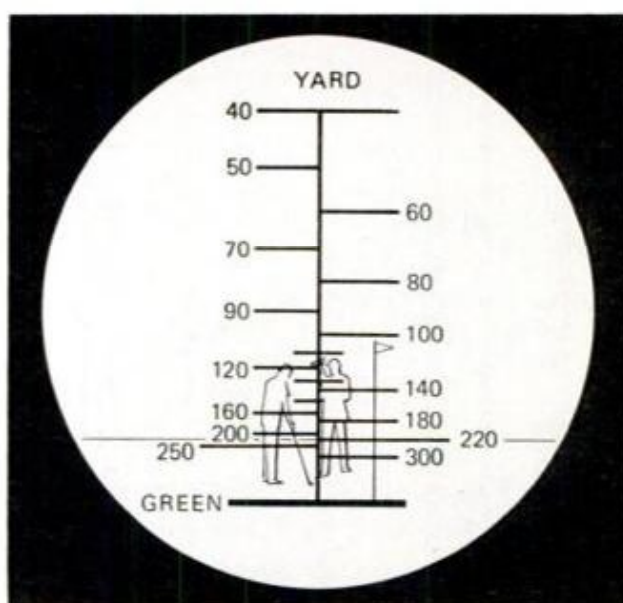
In any language, it's 'out of gas'

Motorists in distress can let passing drivers know their needs with this emergency handbook by the German firm of Bleicher Verlags in Stuttgart. It contains pictures that can be understood in any language like the gas can above (out of fuel) and the wrench across the page (need tools).



Now handicapped persons can drive a car right from their own wheelchair

Wheelchair-bound handicapped persons can drive as easily as anyone else with this German designed hydraulic lift that swings the chair up and into the car. Special controls enable the occupant to drive the car from the chair. In this country, similar lifts and control conversions can be obtained for Chevy vans; may eventually be available for other vehicles. Estimated cost is \$1500. For information, consult Helper Van-Lift, 832 N.W. 1st St., Fort Lauderdale, Fla.



Scope sights golf shots for you

You can improve your golf shots with this handy pocket rangefinder that eliminates the need for judging distances by eye. The principle is based on the fact that the standard 8-foot-high green flag appears taller or shorter, depending on how far you are from it. You aim the scope at the flag, and a scale indicates the yardage needed to reach the green according to the pole's height, as in diagram above. Golf-Scope is \$19.95. Tasco, 1075 N.W. 71st St., Miami, Fla. 33138.



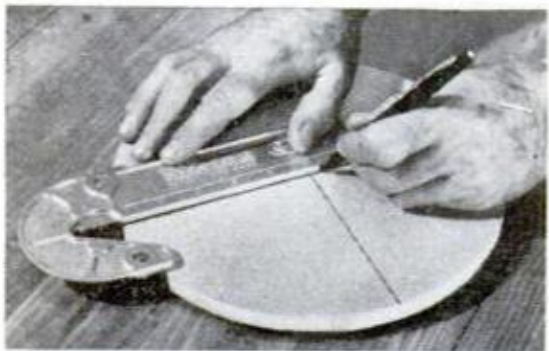
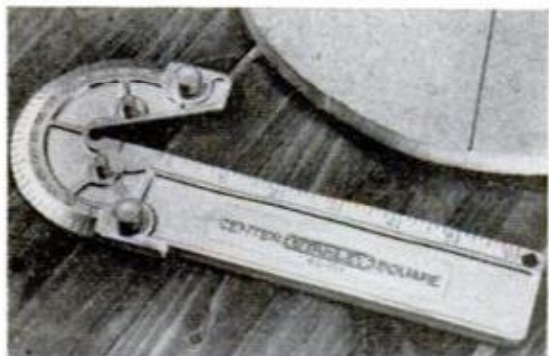
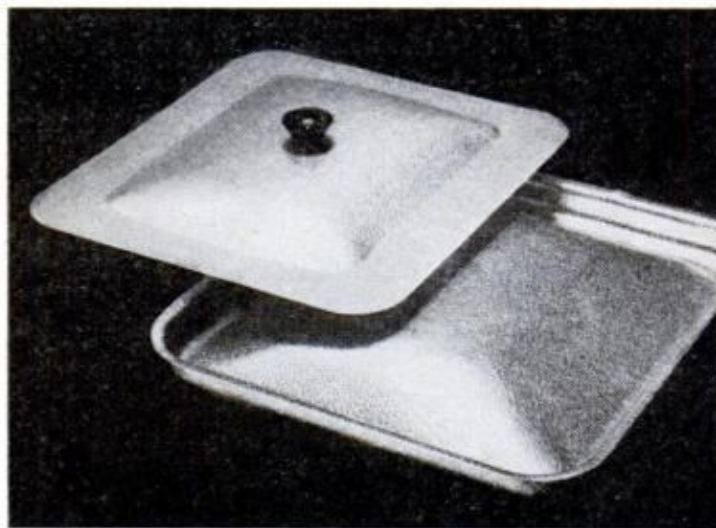
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NOW

Two new cooking aids for your kitchen

Claimed to cook "the world's finest bacon," Mr. Bacon Pan is an oven broiler designed for those who want to avoid saturated fats and greases. Meat is sandwiched between crown and lid, for cooking from both sides simultaneously. \$5.95 at department stores. Nation Wide Products Co., Box 14334, Fort Worth, Tex. 76117. Lectro-Frank (far right) cooks juicier, tastier hot dogs in less time than it takes to boil water because dogs are cooked by current passing through them. UL-approved, cooker is machine-washable. \$7.95 post-paid. Star Mart, Box 28133, San Diego, Calif. 92128.



Versatile square locates circle centers, too

Latest tool from Stanley Tools, Div. of The Stanley Works, Dept. PID, New Britain, Conn. 06050, can handle a number of common, yet tricky, tasks encountered by professional and do-it-yourself woodworkers alike. It can be used as a square, a protractor to mark off any desired angle at any point on a workpiece, or for finding centers of circles from as large as a tabletop to as small as a chair leg or dowel. Center Square No. 46-101 is about \$2 at hardware suppliers.

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Put an end to fumble-finger frustration

The Screwstart, firmly holding a screw against its tip, is used to locate and start a screw to a point where a standard screwdriver takes over. And for dropped screws, the tool has a magnet mounted on the back for easy retrieval. No. 65-155 above, \$2.69; Stanley Tools, Div. of The Stanley Works, New Britain, Conn. 06050.

POPULAR MECHANICS



**Snoopy electric brush
for your 'Peanuts'
operates on a
couple of batteries**

Novel aid to a youngster's oral health is the Snoopy Power Toothbrush by Kenner. The action brushes teeth clean (just like grown-ups' electric toothbrushes), but because it is powered by two D-batteries in the doghouse, there's no cord to plug in. Two toothbrushes are included, and the doghouse has neat compartments for storing them. With wall-mounting bracket, about \$7.

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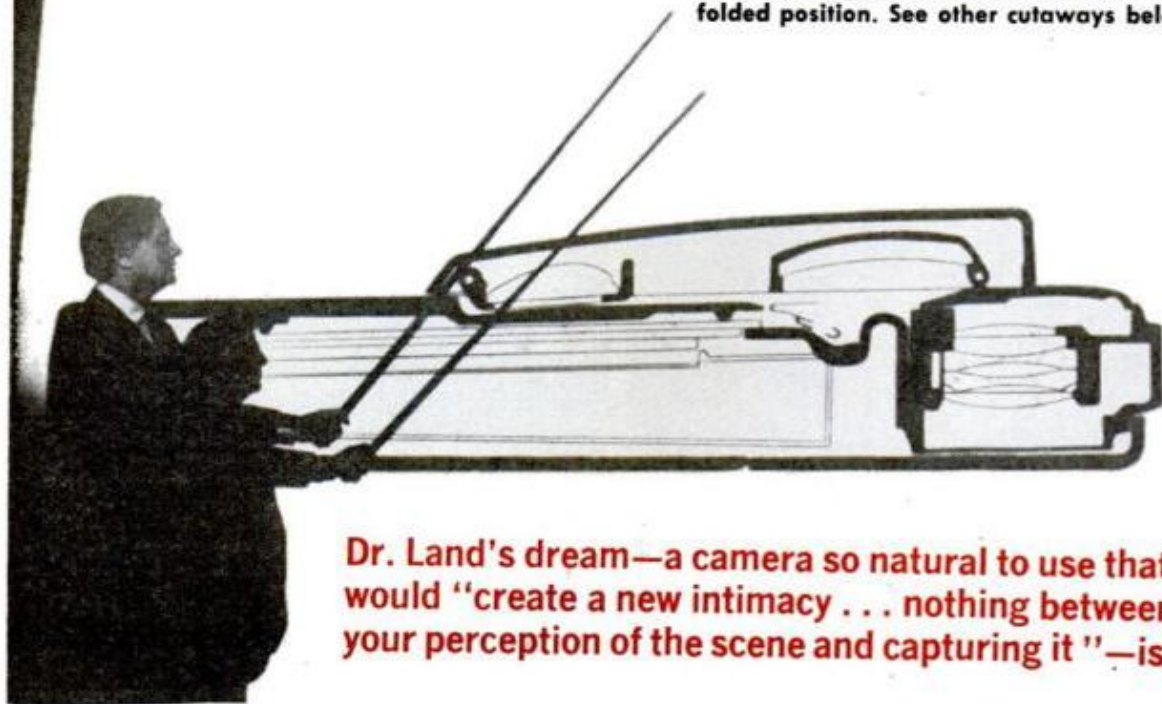


**Rechargeable home
burglar alarm
can be heard
for a quarter mile**

Powered by nickel cadmium batteries, this easy-to-attach Garland Burglar Alarm can be recharged hundreds of times in any 110-volt wall outlet. It hangs on a doorknob, and if the door is opened, sounds an alarm for over an hour that can be heard up to a quarter mile away, says the maker. Compact 7½-ounce alarm is \$14.95 ppd.; Dynatron, Inc., Dept. PM, 26 Fahey St., Stamford, Conn.

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DR. EDWIN LAND, head of Polaroid, shows cutaway diagram of new SX-70 camera in folded position. See other cutaways below



Dr. Land's dream—a camera so natural to use that it would “create a new intimacy . . . nothing between your perception of the scene and capturing it”—is here.

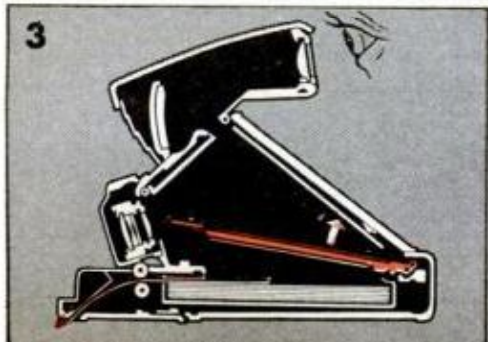
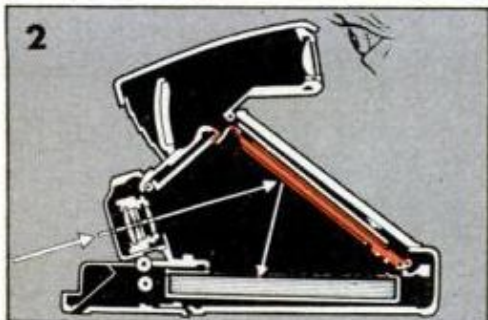
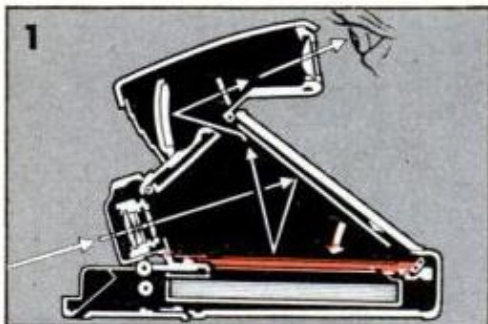
POLAROID'S NEW SX-70 COLOR CAMERA:

‘Our dream was to change photography’

By IVAN BERGER, Photography Editor

TO DR. EDWIN LAND, inventor of the Polaroid Land camera, the revolutionary new Polaroid Land SX70 and its equally revolutionary new film are more than new inventions. To him, they represent a personal dream fulfilled—or at least progressing rapidly toward fulfillment from the original instant-picture Polaroid of 1947.

Dr. Land began the SX-70 as a dream, “. . . a dream that some day we would be able to take a wallet from a pocket . . . open it and close it . . .



REFLEX DESIGN uses double-sided, hinged mirror (color). In the viewing position (1), light rays bounce from fixed mirror to hinged mirror's upper surface, thence to another portion of fixed mirror and through small pupil into viewfinder section. Curved mirror projects aerial image (dashed line) which is viewed through eyepiece. In the taking position (2), hinged mirror rises, and light rays bounce from its underside directly to the film. In the processing stage (3) motor (not shown) pushes film out between rollers; roller pressure ruptures chemical pod, spreading chemicals inside the film unit

and that would be all you'd have to do to get a picture." After 10 years and \$250 million spent in its development, "The camera grew from a wallet to a cigaret case to a cigar case—22 ounces—and will go into a side pocket or an overcoat pocket.

"That meant an entirely new concept in the chemistry of the film, in the structure of the film . . . utterly new concepts in electronics, in shutters and viewers. It meant having the courage to start all of those things at once, to build factories. . . . All taking the chance that if the dream was worthwhile, nothing could stop the convergence and coincidence of all those efforts to achieve the fulfillment of the dream."

Dr. Land saw it not just as a camera, but as a philosophy—the same that had spurred the development of the first Polaroid Land process: ". . . to generate a new intimacy between the human being and the world around him, a domain in which you would see something—a person, a flower, an arrangement of buildings against the sky—

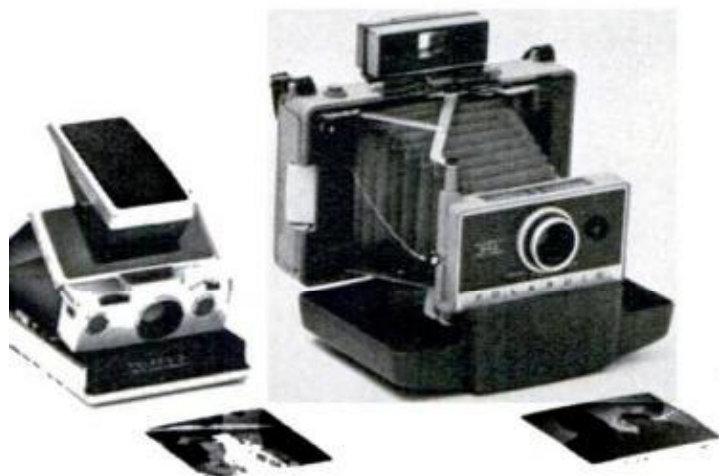


PICTURE COMES OUT less than two seconds after you push red shutter button and develops in front of your eyes. Knurled wheel above shutter button focuses lens from 10 inches to infinity. Black and white knurled wheel at other side of camera is lighten/darken control, just above electric-eye cell

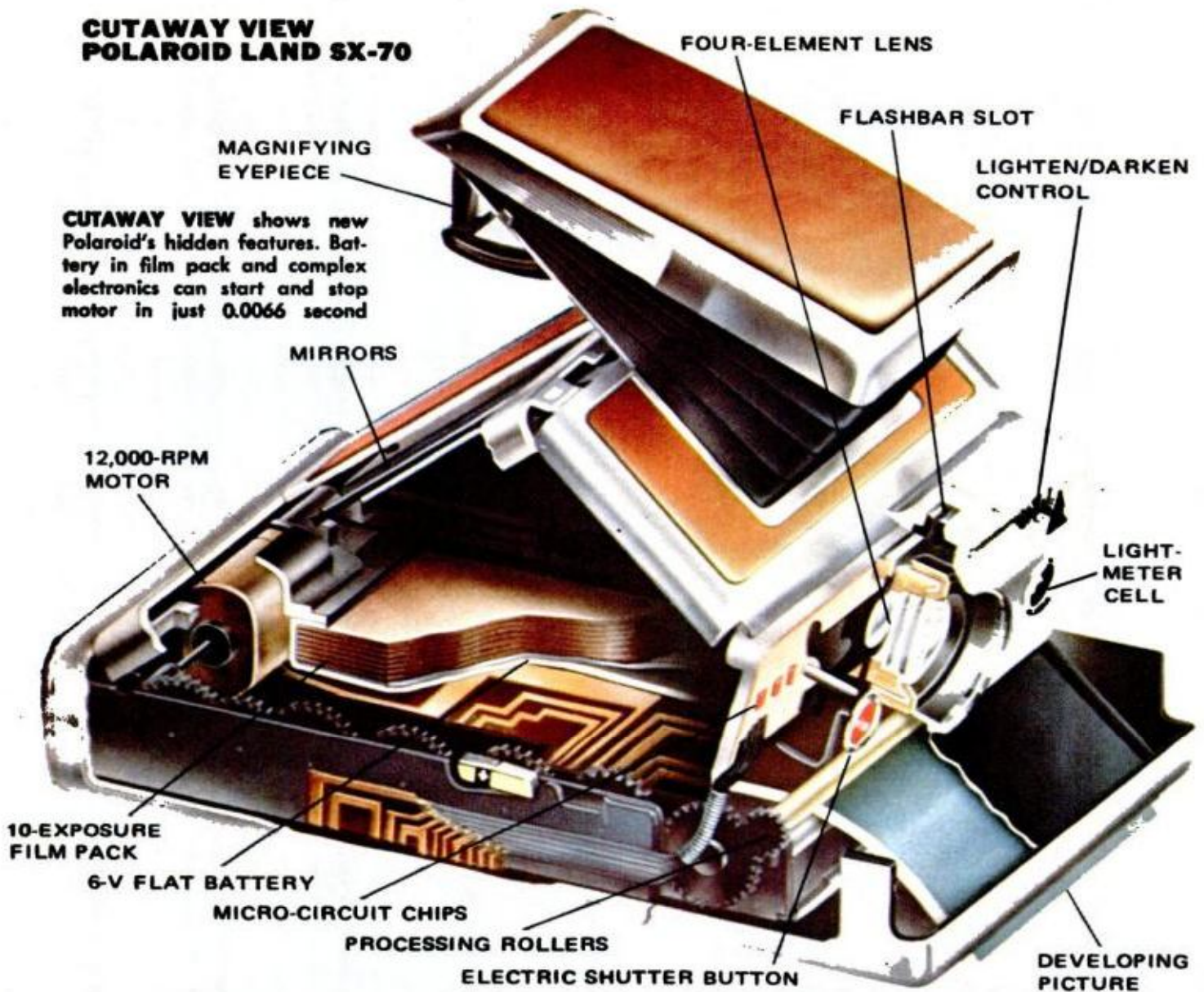


SIZE COMPARISON between the old and new Polaroids shows how compact SX-70 is, whether folded (above) or unfolded (below). Camera is lighter, too—just 22 ounces vs. 2½ lbs for the older version. New print, 3½ x 3¼ inches in picture area, is a little smaller (13 percent) than 2¾ x 3¼-inch print from old camera

GE FLASHBAR makes ten flashes—after the first five have been fired, you turn it around to use the second five. Flash won't fire if you're out of film (but film will be exposed if you should forget to flip Flashbar). The flash exposures are automatically correct from 10 inches to 20 feet



**CUTAWAY VIEW
POLAROID LAND SX-70**



and then, looking through the camera, go quickly from focusing to touching the button . . . and capture the feeling that you had."

But the result of the dream is more than a philosophy—it's the most innovative new

camera design since the original Polaroid, and probably the first Polaroid camera that will influence conventional camera design.

For one thing, it's the first single-lens reflex that folds. That alone involved sur-



POPULAR MECHANICS

prising developments in lenses, focusing systems, even in mirrors. And its new film system required new developments in motor and motor control technology, as well as in the film itself.

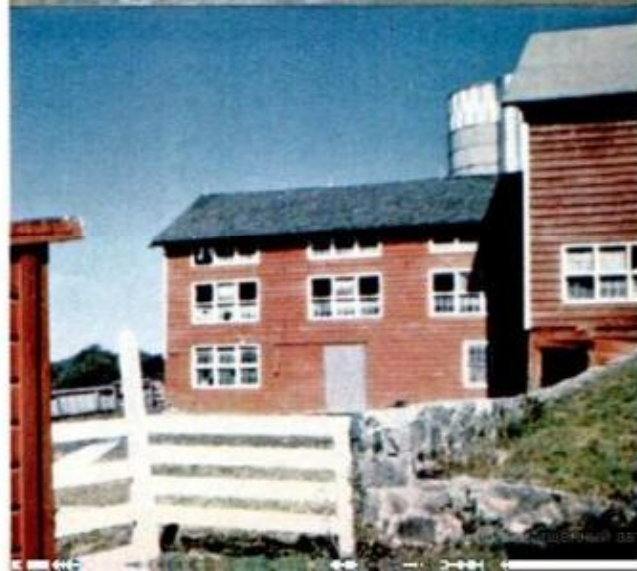
And it's a beauty to use. Tug on the viewfinder, and the camera snaps open. Lift it to your eye and roll the knurled wheel beneath your right index finger, and the image snaps into focus as fast as on most 35-mm single-lens reflexes—only this sharp-focusing image is coming through an f/8 lens, instead of the faster ones required for good focusing in conventional reflex designs.

The shutter button goes off with a gentle touch that causes no camera shake (it's an electrical switch, not the usual mechanical actuator). The motor blips so quickly it's more like a hiccup than a

(Please turn to page 202)



NEW FILM'S COLORS ARE VIVID, even on cloudy days (above). A picture begins to emerge from the green-gray chemical protective coat in less than a minute (upper right) and continues to improve until it's fairly good in 3 or 4 minutes or fully developed, with rich, saturated colors in about 10. Close-ups (left) are easy to take; the newly designed lens focuses easily down to 10 inches, yielding images about one-half life size. (An accessory close-up lens is coming that will let you focus down to 5 inches for life-size images). With flash, the lens closes down as you focus closer to compensate for greater brightness as the flash gets nearer to the subject. At 10 inches, the aperture has decreased from its full f/8 to a tiny f/90, yielding tremendous depth of field—from 7½ to 12½ inches. The black and white studio shot at far left illustrates the camera's unique close-up capability and gives cross section of props used for color shot at near left; focus extends from far flowers almost to nearest grapes





Photos by
Les Turnau

Data by
Annette Sukov

A pool for all seasons

IN NEED OF MORE SPACE, especially for family recreation, the owners of this home decided to create an addition that would give them year-round access to their favorite activity, swimming. They live in Minnesota, where winters are prolonged and frigid, so an outdoor pool really would not have been the answer.

The job was neither simple nor inexpensive. In order to convert an existing bedroom into the new concept, an extra 640 square feet had to be added. To do it, a 20-foot portion of the existing foundation wall was torn out and a supporting

beam-and-post system—that would adequately handle the newly imposed load—was designed and installed.

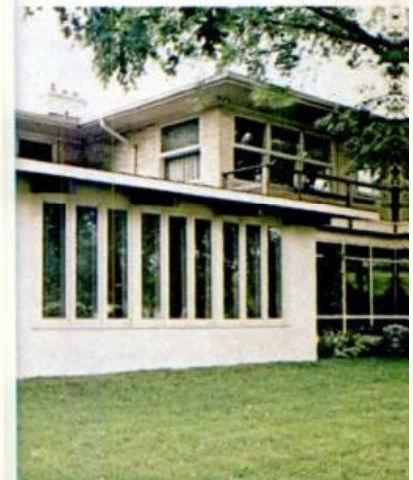
The face of the pool is brick. This brick extends upward about 18 inches above floor level (as can be seen in the photos). A spokesman for the designing architectural firm, Arthur Dickey Associates, Inc., AIA, noted that ceramic tile and slate were also used in constructing the pool. He added, though, that the ceramic tile was rather difficult to apply in the free-form shape.

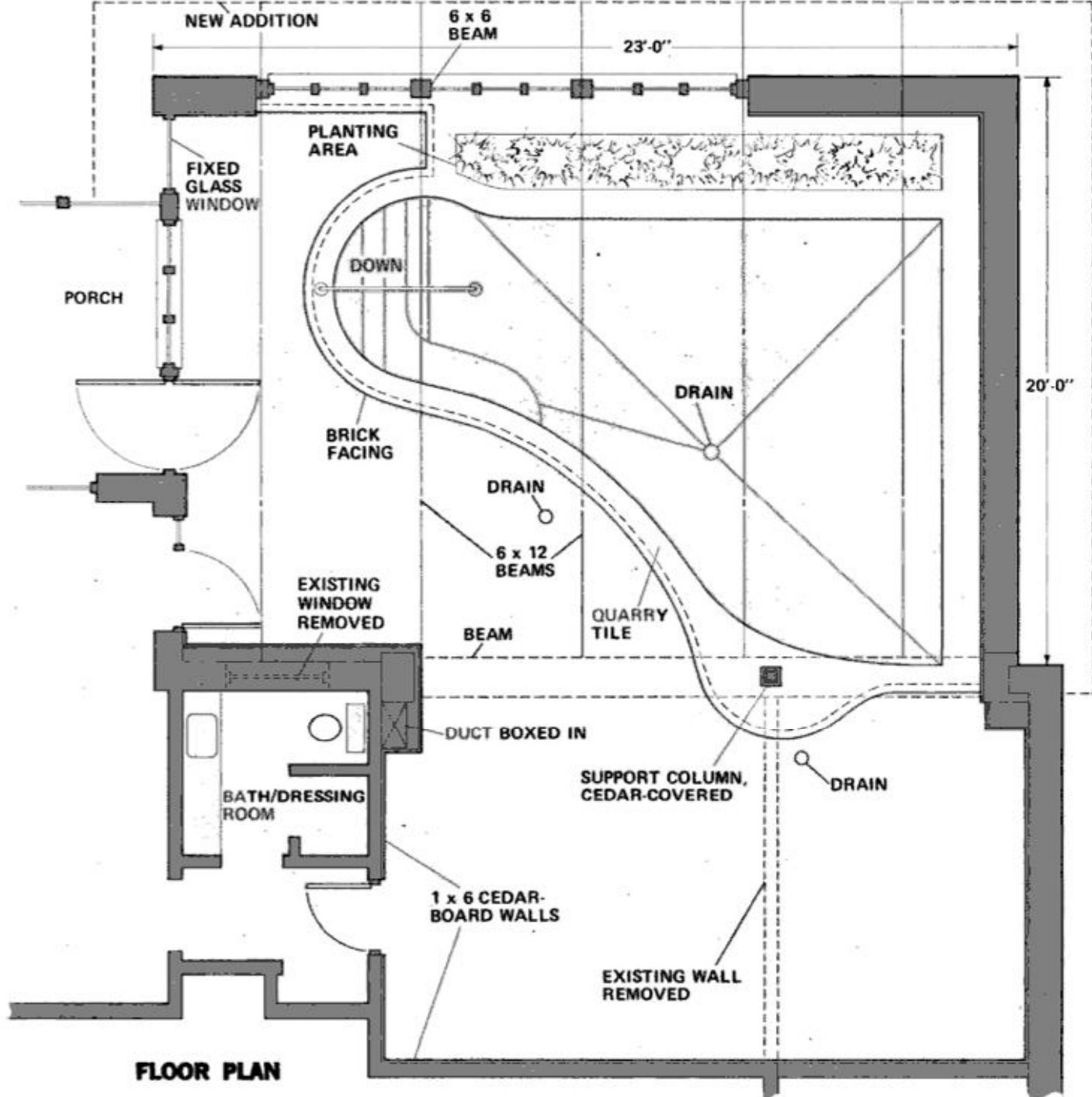
Since removal of the tremendous amount



THE ADDITION of a new room, complete with a heated swimming pool, has provided more recreational dining, entertainment and storage facilities for the home pictured on these pages. The luxurious 880-sq.-ft. room is finished with cedar boards on the inside walls, while indoor-outdoor carpeting is on the floor. The free-form pool measures 24 ft. diagonally. Since the greatest depth is only 68 in., there is no diving board

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FLOOR PLAN

of humidity (present in a room such as this) is of paramount concern, a humidistat is located in the game room. And, because the existing heating plant could not take on the task of warming the new structure, a new forced-air system was installed. Exhausting—to handle that moisture mentioned above—is an integral role of the new system.

Pool lighting is located between the beams overhead; all lights are incandescent for a warm look. Top-quality Pella casement windows reveal the view to the rear grounds. As can be seen in the floor plan, two wood doors were also installed, leading to an existing porch and the recreation area. Cost of all this elegance came high: Remodeling ran \$27,000, the pool another \$7000. ★★★

A NEW FORCED-AIR heating system was installed in the room (but not airconditioning). The critical point to be kept in mind when installing an indoor, heated pool is the proper venting necessary for removal of excessive moisture created. Improper, or underdesigned, vent system could result in condensation pouring off those clerestory windows in rainstorm proportions. Since this isn't a job to economize in, make certain your system is designed and installed by a qualified mechanical engineer

New irons for better soldering

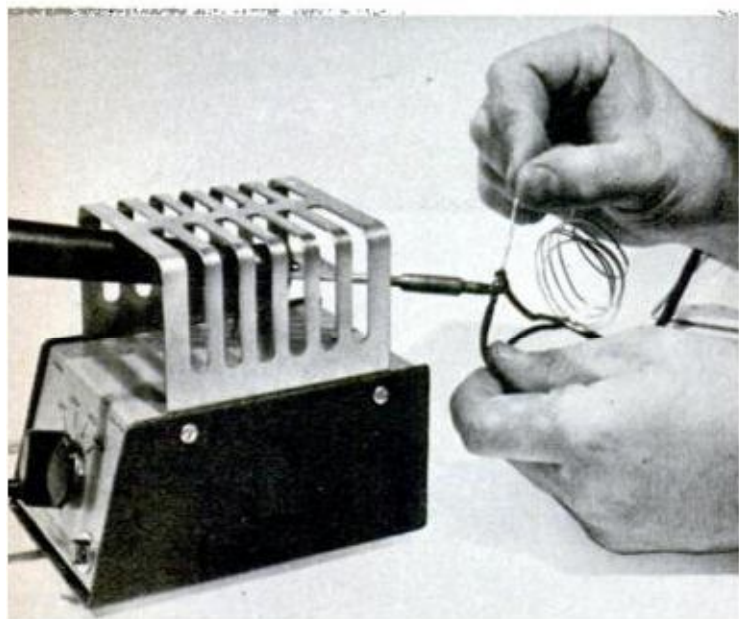


By JOHN BURROUGHS

A SOLDERING SAMPLER: (A) Heathkit, \$15.95; tips, \$5.75. (B) 200-watt American Beauty, \$23.80. (C) Ungar Solder-Off, \$1.50. (D) Solder-Wick, \$1.49. (E) Soldavac, \$3.95. (F) Weller Tempmatic, \$14.75; powerhead, \$10.25. (G) Ungar dual-heat gun, \$10.95. (H) Ungar Imperial iron, three tips, \$10.50; heat cartridge, \$5.35; tips, \$1.40. (I) Weller Marksman, \$3.50; two tips, 85 cents. (J) Ungar Princess, three tips, \$10.75. (K) Ungar pencil, three tips, \$6.25; heat elements, about \$2; tips, 50 cents. (L) Wahl Iso-tip cordless with recharger stand, \$19.95; tip, \$2.25

NOT LONG AGO, you had three choices when you went to buy a soldering iron: big, bologna-sized irons built for heavy soldering on pipes and sheet metal; hefty, high-powered, induction-loop guns, and stubby little pencil irons with one or two low-powered tips for electronic work.

These irons are still around, but now they have a lot of company: single-post guns, thermostatically-controlled guns and irons, irons powered by rechargeable batteries and low-voltage irons with variable-transformer power supplies. The old, original pencil irons now have more tips and elements than ever before. And there are even many new



HEATHKIT IRON goes together in an hour or so. Transformer in base gives three switch-selected heat ranges and electrically isolates soldering tip. Cage stand shields iron tip in rest position, preventing accidental burns—but it can also work as a "third hand," holding iron extended as shown here

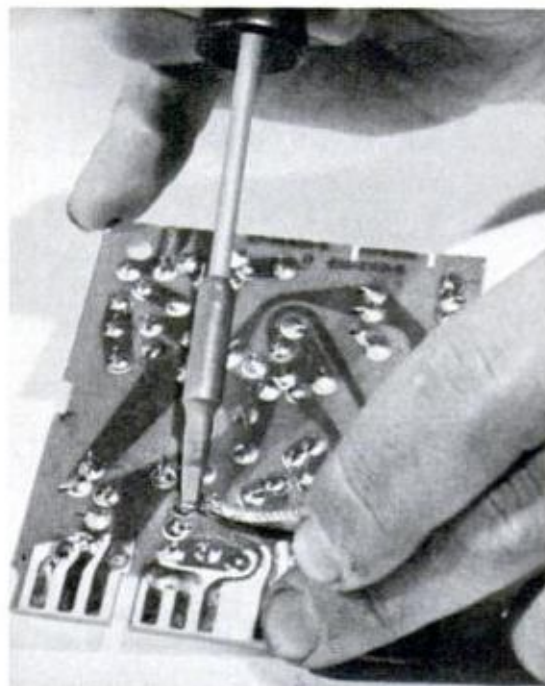
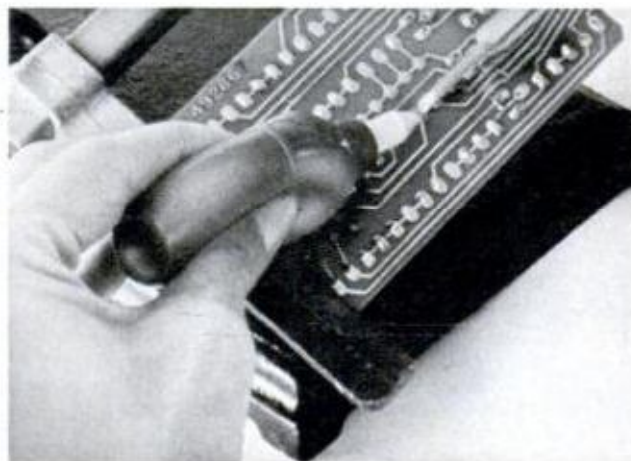
tools for desoldering—a necessity in today's printed-circuit era.

Pencil irons have long been the most popular tools for kit-building, electronic construction and other jobs involving repeated use, since they stay warm as long as they're plugged in. They're also the least expensive irons, with many models costing less than \$5.

The first small pencil irons were simple handles, with interchangeable, ceramic-encased heating elements that screwed in like Christmas-tree bulbs. Some of these elements had built-in tips; others (usually those with fine tips which could be quickly eaten away by chemical interaction with the solder) had screw-in or screw-on tip-lets (see photo, page 114) which cost less

to replace than entire heating elements. Today, many tip-lets are also available with solder-resistant plating, which about doubles their cost but lengthens their lives up to 10 times. Other tips have different household uses, including plastic cutting and sealing and decorative wood burning.

Newer pencil irons have cooler, slimmer, better-balanced handles, which make them easier to hold, and come with more fine tip-lets and fewer heavy ones in keeping with today's emphasis on delicate, heat-sensitive electronic components. Some, such as the Ungar Princess, have elements delivering as little as 10 watts. Other irons, such as the Oryx (not shown here) have thermostatic controls that keep the tip within $\pm 4^\circ$ F. of any preset tem-

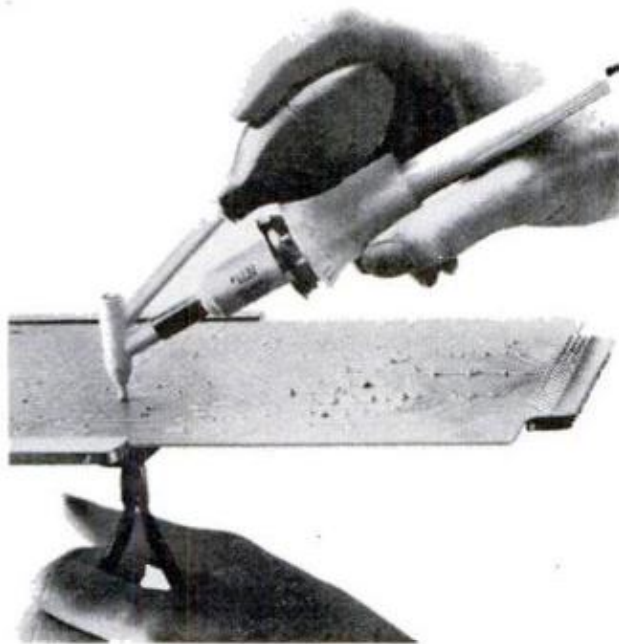
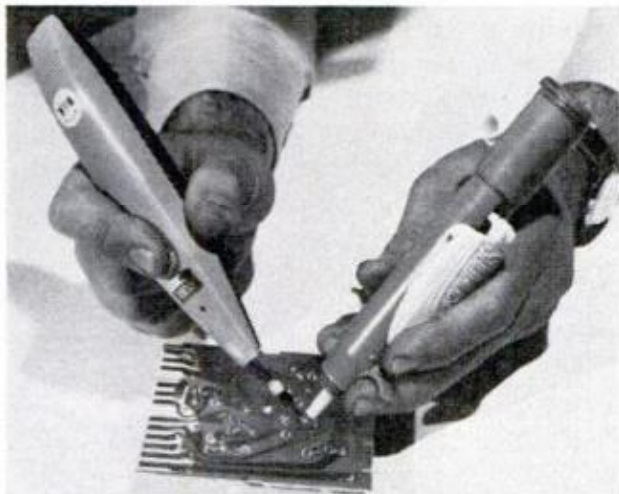


DESOLDERING is eased by a variety of tools: Ungar Solder-Off (upper left) sucks away molten solder; its Teflon tip resists melting. Solder-wick (lower left) blots up solder by capillary action, comes in four widths, costs \$1.49 per five-foot roll. Solda-vac (upper right, shown with Wahl cordless iron) is

perature from 400° to 750° F. Still others, such as the Heathkit, operate on low voltages from transformer power supplies (usually built into soldering iron stands), with switch-controlled tip temperatures.

The transformer-powered irons also prevent damage to integrated circuits and field-effect transistors caused by current leakage or induction during soldering: some regular pencil irons have three-wire grounded cords for the same reason.

Another new kink is the instant-heat soldering pencil from Wall. It's a slim three-ounce design with dual elements. Pushing a switch on the handle turns on the high-wattage element, which brings the tip up to operating temperature in seconds. Then a thermal relay cuts out that



fast, powerful, trigger-operated vacuum, not recommended for ultrafine printed circuits. Ungar Hot-Vac costs \$14.25, combines a soldering pencil and Solder-Off in one handful. Ungar tools are at most electronic parts stores; others shown are from Jensen Tools, 4117 North 44th St., Phoenix, Ariz. 85018

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element and cuts in a low-wattage element to maintain proper heat with no chance of overheating. When a higher heat is required, the relay cuts in again for as long as necessary.

Because pencil irons are continuously hot, they should be cradled in a safety stand whenever you're not actually using them, so they won't accidentally burn you, your bench or their own power cords. Stands are available to match most pencil irons, including an ingenious, \$4.70 American Beauty model that closes like a clamshell over an iron as soon as the iron is laid in place. Continuously-heated irons tend to "dry out," losing their "tinning"—the thin coat of solder that promotes good heat transfer between iron and joint. American Beauty has two answers to that, too: a \$4.70 stand that keeps the iron tip in a pool of molten solder, and temperature-regulating stands (about \$20-\$25) that reduce the current to the iron when it's in its cradle.

Tip temperatures on pencil irons vary with both tip size and wattage. Among regular pencil irons, 25-watt models with tip temperatures from about 600°-800° (600°-650° with fine tips) are best for general electronic soldering; 35-watt irons (650°-850°) are best for general-purpose household electrical and shop work, and still more powerful tips are best for moderately heavy work, such as soldering jewelry. For fine electronic work on transistorized equipment, 10-25 watt irons should be used: a 10-watt iron, with a tip temperature from 575°-650°, is especially recommended. More powerful irons are okay if they're thermostatically controlled.

Soldering guns are widely used for heavy soldering (except for very heavy pumbing or sheet-metal work, for which big pencil irons are preferred) and for intermittent soldering, where their quick heating times allow switching on for each connection to be soldered, then switching off again to conserve electricity and prevent tip drying or charring. The first such guns were loop-induction types pioneered by Weller around World War II. In these guns, a very-low-voltage, very-high-ampere current from a step-down transformer flows through a copper-loop tip, heating it to soldering temperature in a few seconds. Heat is controlled by "feathering" the trigger switch, turning it rapidly on and off as the tip cools or warms. But in-

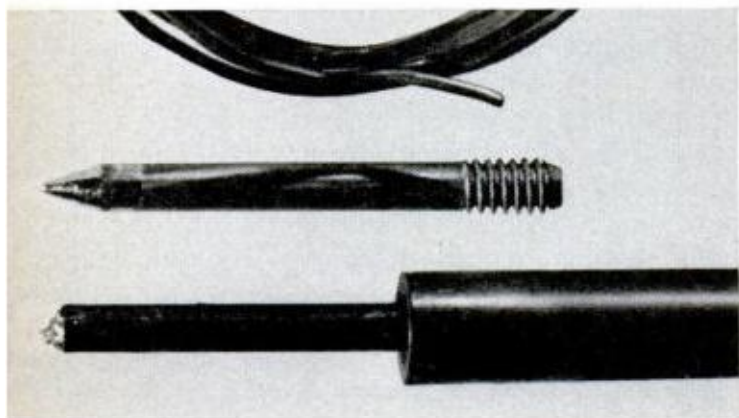
duction guns have disadvantages: They're heavy. Their loop tips are hard to get into tight corners. Feathering the trigger correctly takes some skill. And the heavy tip current can induce destructive currents in some electronic circuits and components.

Newer guns, such as the Wen 450, 222 and 75, and the Weller Tempmatic, eliminate these disadvantages. They're lighter. Their tips are simple posts that can fit almost anywhere. Their tip temperatures are automatically controlled, with no feathering required. And their potential

for induction-current damage is lower. They have one disadvantage, though: single-post guns take about 10 seconds to warm up, four times as long as loop models; that's no problem in most home uses, but it makes them less suitable for production-line work.

Weller's Tempmatic gun (\$14.75) has a ferromagnetic thermostat in its "Powerhead" tip assembly, that switches a fast-heating element on and off to maintain tip temperature, clicking audibly as the gun is used. Powerheads are interchangeable, and two are available, both rated at 150 watts: the 3/16-inch chisel-point head delivers 700° for general soldering, and the 1/8-inch cone-tipped model delivers 600° for electronic work. Extra Powerheads cost \$10.25 each.

Wen's guns use a different regulating system: a transformer in the gun handle supplies low-voltage current to a new kind of heating element in each tip. The element's resistance is higher when hot than when cold; so as heat is drawn from the gun's tip, cooling the element, its lowered



REPLACEABLE TIPS are a necessity (top) since solder erodes copper tips (especially thin ones) quickly, eventually erodes even plated ones. But tip interchangeability also increases an iron's versatility; accessories for Ungar pencil (above) include heating elements from 27 to 50 watts, tips from 0.056 to 0.395-inch diameters, Anti-Seize to keep tips from "freezing" in sockets. Not shown: desoldering tips to contact all pins of an integrated circuit at once. Shiny white tips are plated to give longer life



PENCIL IRONS come in a variety of sizes, from 20 to 600 watts, for jobs from fine wiring to heavy soldering of pipes and sheet-metal joints. Since they stay hot all the time, the pencils are best where joints are made frequently, but should be kept in protective stands (above) between joints. Other stands available include temperature-regulating models that reduce tip heat when the iron is cradled to increase tip life, units that hold tip in molten solder, and those having sponges for tip cleaning

resistance draws more current until the lost heat is restored. Again, changing the tip changes the wattage (Wen doesn't rate its tips by temperature). Wen's \$13.95 Model 450 iron takes 25-100, 100-200 and 200-250-watt tips; its \$7.95 Model 222 Hotrod takes the same 25-100 and 100-200-watt tips, and the \$5.95 Soldering Pistol (shaped like a toy revolver) has a non-interchangeable tip delivering 30-100 watts. Extra tips are \$1.40 for the 222 and 450, \$1.10 for the pistol.

The cordless iron is another new type, operating from built-in, rechargeable batteries. Most widely available is the Wahl Iso-Tip, with 50 watts of output and a tip temperature of over 700° F. It's handy for use wherever cords would get in the way (inside electronic consoles, for example) or where power is unavailable (fixing car electronics, model planes, and the like). Fine and general-purpose tips are available, as are a protective carrier and a recharger that plugs into a car's cigarette lighter socket. A Wen cordless is coming, too, that will be similar in appearance ex-

cept for its longer, right-angled tip.

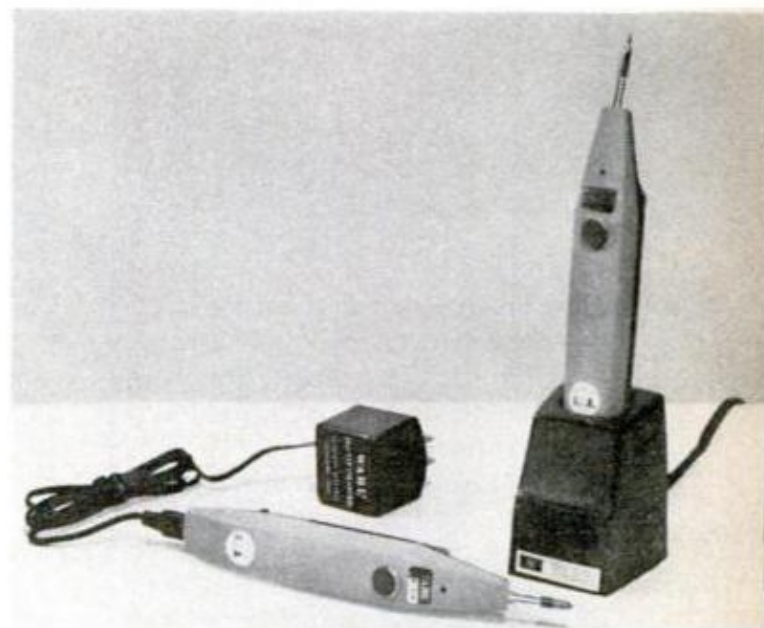
Irons have come a long way from the first heavy, electric ones that were always too hot or too cool—and even farther from the very first, fire-heated ones.

Most of the equipment shown and mentioned here (especially Ungar, Weller and Wen) is available from most electronic parts stores. If you can't find what you want, Jensen Tools & Alloys, at 4117 North 44th St., Phoenix, Ariz. 85018, sells most of this equipment (American Beauty, Oryx, Soldavac, Solder-Wick, Ungar, Wahl Iso-Tip and Weller) by mail. The Heathkit iron is available only from Heath, Benton Harbor, Mich. 49022.

Other manufacturers' addresses include: American Beauty, American Electrical Heater Co., 6110 Cass Ave., Chicago, Ill. 60631; Ungar, 238 East Manville St., Compton, Calif. 90220; Wahl Clipper Co., 2902 North Locust, Sterling, Ill. 61031; Wall Manufacturing Co., Kingston, N.C. 28501; Weller, Box 345, Easton, Pa., and Wen Products, Inc., 5810 Northwest Highway, Chicago, Ill. 60631. ★ ★ ★



CHANGING POWERHEADS on Weller Tempmatic gun changes tip size and temperature, but not wattage. 150-watt tip shown has screwdriver point, automatically regulated 700° tip temperature; 150-watt conical head has 600° temperature. Head costs \$10.25



CORDLESS WAHL Iso-Tip irons store enough power for up to 160 solder joints in built-in, rechargeable nickel-cadmium battery, have "headlights" to illuminate work. Model 7600 (left) costs \$22.95, plugs into recharger (but can't be used while recharging); Model 7550 (\$24.95) drops right into its recharger stand, lifts out instantly and easily for soldering

SINGLE-POST GUNS get in tight spots better than older, inductive-loop types, have regulated tip temperatures. Black gun is Wen: its \$13.95 model takes light, medium and heavy heat-range tips (25-450 watts); \$7.95 model, light and medium tips (25-200 watts). Other gun is a Weller Tempmatic (\$14.75)

Yardpower roundup for '73

If it's time to get a new mower and you're thinking about a rider or tractor, here's a cross section of major makers' offerings, including specs and prices

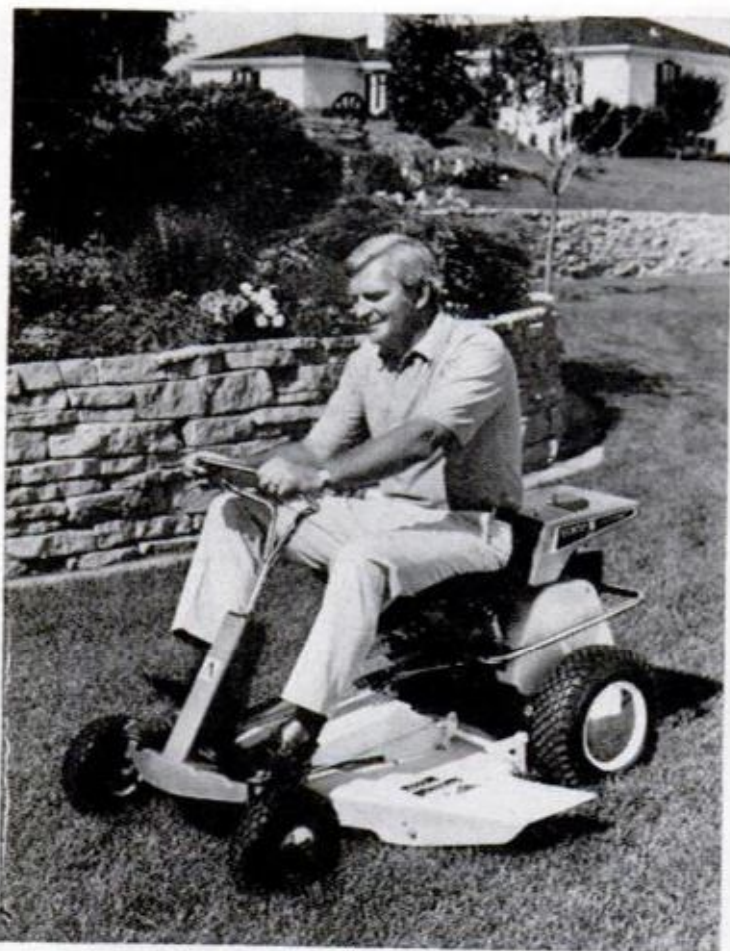
SHOPPING for a riding mower or lawn tractor can be as much fun—or as frustrating—as shopping for a new car. The options are almost as numerous. How much horsepower do you need? Should you go for hydrostatic drive? Is electric starting worth the extra money? And then there are all those attachments—dumpcart, spreader, sweeper—to consider.

Your final choice should be based on the size and topography of your lawn, and the amount of heavy work (hauling, grading) you plan to do. A big, hilly lawn calls for more muscle.

You'll get a good idea of what's available—and for how much—through a few minutes' study of the spec charts on pages 118 and 119. They provide a cross section of the market. Bear in mind that not all makers are included, nor all models of a particular line. The chart had to be condensed because of space limitations.

For the most part, prices are rounded out to the nearest dollar, and are f.o.b. at the factory. Prices for tractors do not necessarily include the rotary mower attachment. Horsepower ratings of electric units are approximate equivalents. ★★★

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THE 5-HP SCAMP is made by Allis-Chalmers and it sells for \$419. It features electric starting, a foot-controlled clutch and a 26-inch rotary mower



THREE 12-VOLT BATTERIES supply power for John Deere's Electric 90. It has 34-inch mower, can cut about an acre of lawn on a charge, and costs \$885

POPULAR MECHANICS



YOU CUT A 28-INCH SWATH with the Bolens 728, a ride powered by 7-hp Tecumseh engine. It has three forward speeds, reverse, shifts "on the go"

POWERED by 8-hp Briggs & Stratton, Murray's model 3-3233 has three forward speeds, cuts 32-inch swath. The slick rider is priced at \$550

By GERALD KRATSCH



INTERNATIONAL'S CADET 75 (right) offers 7-hp engine, optional electric starting and takes 32-inch cut. A variety of attachments is available



DUMPCARTS, TRAILER-SWEEPERS and other attachments are offered for Toro's Whirlwind riding mowers. Shown at left is the 7-hp model that sells for \$500

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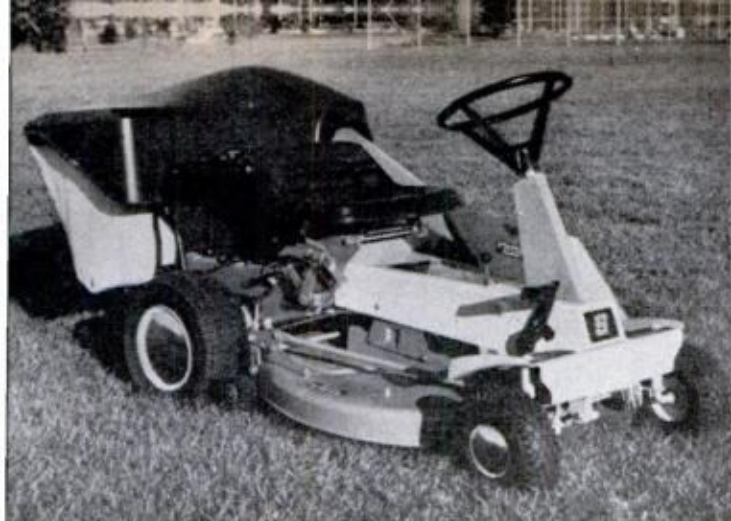


Yardpower '73

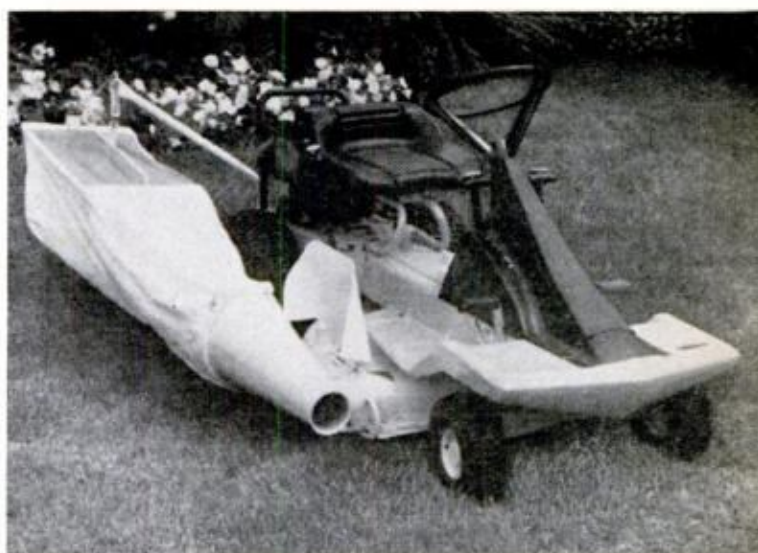
SNAPPER RIDING MOWER series for '73 includes six models with 5 or 8-hp engines. The grass-catcher attachment holds up to six bushels of clippings

Make/Model	Engine/HP	1	2	3	4
AMF 1281 1293	B&S 8	Yes	3	36	NA
	B&S 8	Yes	4	36	NA
Allis-Chalmers Scamp Scamp	B&S 8	Yes	2	30	\$645
	B&S 5	Opt.	2	26	419
Ariens Emperor Emperor Emperor Fairway Fairway Fairway Fairway	B&S 8	Yes	6	38	700
	Tecumseh 8	Yes	6	30	630
	Tecumseh 8	No	6	30	500
	Tecumseh 7	Yes	4	26	570
	Tecumseh 7	No	4	26	450
	Tecumseh 5	Yes	4	26	500
Bolens 728	Tecumseh 5	No	4	26	380
	Tecumseh 7	Opt.	3	28	489
John Deere 90 57	Electric	Yes	3	34	885
	Tecumseh 7	Opt.	3	34	535
Gilson 52040 52039 52038	B&S 8	Yes	3	30	630
	B&S 8	No	3	30	555
	B&S 5	No	3	25	420
Homelite RE-8E RE-5	B&S 8	Yes	2	30	655
	B&S 5	No	2	24	414
Huffman H1543 H1533 H1513	B&S 8	Yes	3	32	585
	B&S 8	Yes	3	26	525
	B&S 5	No	1	26	385
International Harvester Cadet 75 Cadet 55	B&S 7	Opt.	3	32	585
	B&S 5	No	3	28	NA
Jacobsen Mark III Mark III Mark II Mark II 42635	B&S 8	Yes	Inf.	30	640
	B&S 8	No	Inf.	30	560
	B&S 7	Yes	Inf.	30	NA
	B&S 6	No	Inf.	30	NA
	B&S 5	No	Var.	25	NA
Lawn-Boy 9369ES 9329ES 9369 9266	B&S 8	Yes	3	36	700
	B&S 8	Yes	3	32	670
	B&S 8	No	3	36	580
	B&S 5	No	3	26	400
Massey-Ferguson MF 7 MF 6 MF 5	Tecumseh 7	Opt.	3	34	650
	Tecumseh 6	Opt.	3	32	470
	Tecumseh 5	Opt.	2	26	379
McDonough Snapper 3080S 2680S 2680 2650S	B&S 8	Yes	5	30	610
	B&S 8	Yes	5	26	570
	B&S 8	No	5	26	460
	B&S 5	Yes	5	26	510
Murray 3-3633 3-3233 3-3063 3-3013 3-2513 3-2503	B&S 8	Yes	3	36	570
	B&S 8	Yes	3	32	550
	B&S 8	Yes	3	30	500
	B&S 8	No	3	30	390
	B&S 7	No	3	25	370
	B&S 5	No	3	25	330
New Holland R-8 R-8 R-5	B&S 8	Yes		30	646
	B&S 8	No		30	547
	B&S 5	No		26	436
Roper K83233R K83133R K52233R K52133R K51133R	B&S 8	Yes	3	32	580
	B&S 8	No	3	32	500
	B&S 5	Yes	3	26	460
	B&S 5	No	3	26	380
	B&S 5	No	1	26	300
Simplicity Wonder Boy 963 Wonder Boy 900	B&S 8	Yes	2	30	645
	B&S 5	Opt.	2	26	430
Toro Whirlwind Standard 525XE 725XE Sportsman	Tecumseh 12	No	1	25	330
	Tecumseh 17	Yes	4	25	450
	Tecumseh 17	Yes	4	25	500
	B&S 8	Yes	3	32	600
Yard-Man Mustang 3770	B&S 8	Yes	4	36	NA

1973
riding
mowers



THIS 8-HP WONDER BOY cuts a 30-inch swath and provides a five-bushel collection hopper in back. Made by Simplicity Corp., the unit lists for \$645



FOUR MODELS in the Ariens Fairway line are available for '73. They're powered by 5 or 7-hp Tecumseh engines and offer big grass catchers as accessories

MAKE/MODEL	Engine/HP	1	2	3	4
Allis-Chalmers 416H 416S 410S 410 Homesteader	Kohler 16	Yes	Var.	42-48	\$1695
	Kohler 16	Yes	4	42-48	1570
	Kohler 10	Yes	4	42-48	1295
	Kohler 10	Yes	3	42-48	1230
	B&S 8	Yes	3	36	780
Ariens Manorway	B&S 8	Yes	6	38	900
Bolens HT-18 QT-16 H-16 G-14 G-10 G-8	Kohler 18	Yes	Var.	54	2730
	Onan 16	Yes	Var.	48	2195
	Tecumseh 16	Yes	Var.	42	1825
	Tecumseh 14	Yes	6	42	1525
	Tecumseh 10	Yes	3	38	1235
	B&S 8	Yes	3	32	895
John Deere 140H1	Kohler 14	Yes	Var.	47	1765
Ford 145	Kohler 14	Yes	Var.	42-50	1656
GE Elec-Trak E20 E15 E12 E10M E8M	16	Yes	32	42	1750
	14	Yes	28	42	1585
	12	Yes	12	42	1420
	10	Yes	9	36	1090
	8	Yes	3	36	795
Gilson Heavyweight 53015 Heavyweight 53013 Low Profile	B&S 16	Yes	Var.	42	1715
	B&S 10	Yes	4	42	1274
	B&S 8	Yes	Var.	36	NA
Gravelly 814 408	14	Yes	8	50	1634
	Kohler 8	Yes	4	34	923
Homelite T-16H T-10 T-8 T-7	B&S 16	Yes	Var.	42-48	1665
	B&S 10	Yes	6	42-48	1250
	B&S 8	Yes	3	32-36	760
	B&S 7	Yes	3	32-36	675
J.I. Case 446 108	Onan 16	Yes	Inf.	44-48	1717
	B&S 8	Yes	3	34	746
Huffman H-1113 H-1093 H-1078 H-1015	Tecumseh 10	Yes	3	32	699
	B&S 8	Yes	3	32	599
	B&S 8	Yes	3	26	455
	B&S 5	No	1	24	199
International Harvester Cub Cadet 149 Cadet 76	14	Yes	Inf.	38-42-48	1629
	7	Yes	3	36	799
Jacobsen GT-14 GT-12 GT-10 LT-885 LT-750	Kohler 14	Yes	Var.	42	1885
	Kohler 12	Yes	Var.	42	1685
	Kohler 10	Yes	5	42	1390
	B&S 8	Yes	Var.	34	1095
	B&S 7	Yes	3	34	875
Massey-Ferguson MF 14 MF 12G MF 8H	Kohler 14	Yes	Inf.	48	1822
	Tecumseh 12	Yes	4	42	1266
	Tecumseh 8	Opt.	Inf.	34	972
New Holland S-16 S-8G	Kohler 16	Yes	Inf.	48	2055
	B&S 8	Yes	3	36	1008
Roper T63231R T32231R T02231R T82231R	Onan 16	Yes	6	NA	1435
	R&S 13	Yes	6	NA	1135
	Tecumseh 10	Yes	6	NA	935
	B&S 8	Yes	6	NA	835
Simplicity Sovereign 3416H Landlord 3410S Broadmoor 738 Yeoman 648	B&S 16	Yes	Inf.	42-48	1595
	B&S 10	Yes	4	42	1275
	B&S 8	Yes	3	36	935
	B&S 8	Yes	3	32	825
Wheel House 18 Automatic 16 Automatic 14 Automatic 10 Automatic 12 8-Speed 8 4-Speed Ranger 700	Kohler 18	Yes	Inf.	48-60	2167
	Kohler 16	Yes	Inf.	48	1706
	Kohler 14	Yes	Inf.	48	1609
	Kohler 10	Yes	Inf.	36-42	1405
	Kohler 12	Yes	6	36-42-48	1320
	Kohler 8	Yes	3	36	908
	Tecumseh 7	No	3	32	624

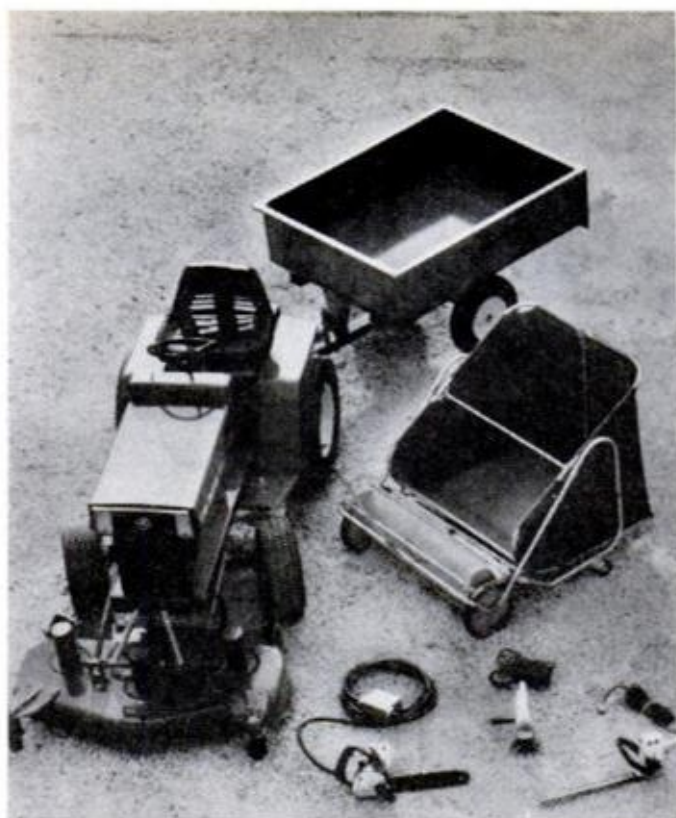
1973 garden tractors

KEY

- 1—Electric start
- 2—Forward speeds
- 3—Cutting width (inches)
- 4—Price
- NA—Not available
- Inf.—Infinite
- Var.—Variable
- B&S—Briggs & Stratton



GILSON 8-HP TRACTOR has low profile and 36-inch, twin-bladed mower. Traction-drive system is said to deliver smooth power in all speeds



ACCESSORIES such as electric chain saw and hedge trimmer run off power unit of GE's Elec-Trak tractors. Standard attachments are also available

Yardpower '73

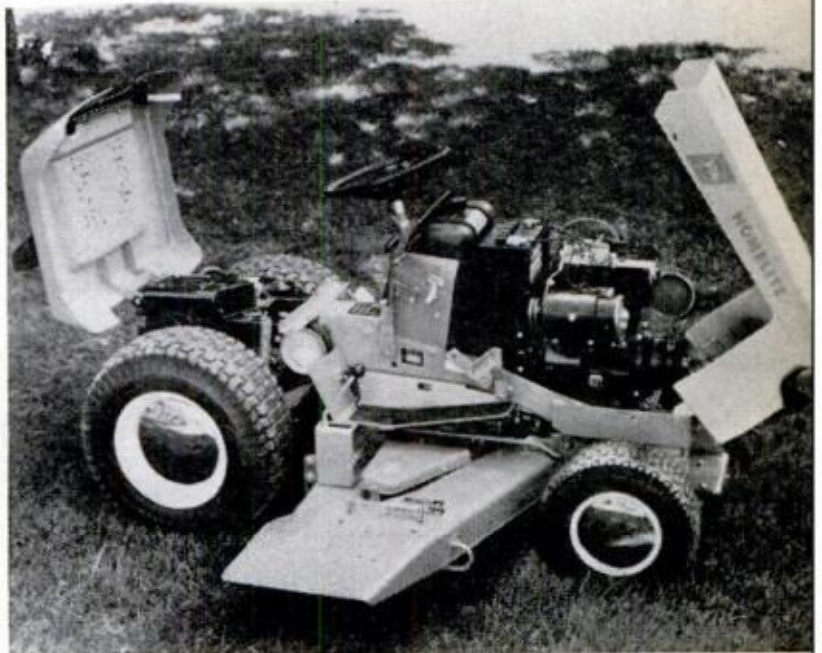
Garden Tractors



AN 8-HP TECUMSEH powers the smallest tractor in the Massey-Ferguson line. It carries a mower that cuts a 34-inch swath, has a hydrostatic transmission offering a variety of speeds. Its price: \$972



GRAVELY 408 LAWN TRACTOR carries a 34-inch rotary mower under its frame. The sleek machine also boasts cast-iron axles and an 8-hp cast-iron engine



FIVE TRACTORS from 7 to 16 hp, make up the Homelite line for 1973. Shown at right is model T-16, a powerful performer. Price: \$1495

WHEEL HORSE couples a 48-inch mower to 16-hp engine in its big Automatic garden tractor (right). Attachments include hefty sweepers, snowblowers



SPERRY NEW HOLLAND has upped lawn tractor line to four units. The S8 is a compact 8-hp machine that offers optional hydrostatic transmission

For fishing offshore and on

ANY BOAT used to be good enough to boat a fish. Not any more. Now special new craft are being created to aid the angler. Small hulls head out into open seas to stalk big gamefish. Bass boats, loaded with new options that increase passenger comfort, speed across more sheltered waters to secret fishing holes, then switch to slow troll by electric motor. The big open utilities can equal the catches of the expensive sports-fishing machines on the Great Lakes or along ocean shorelines if the weather is favorable. The selected models shown here should be seeing a lot of action this summer. ★★★



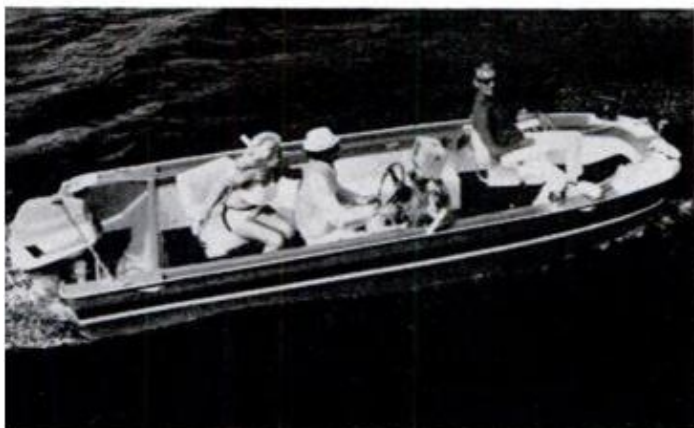
STARCRAFT will offer 14, 16 and 18-foot bass boats, including deluxe models designed by bass champion Bill Dance with locked storage, live wells, trihull



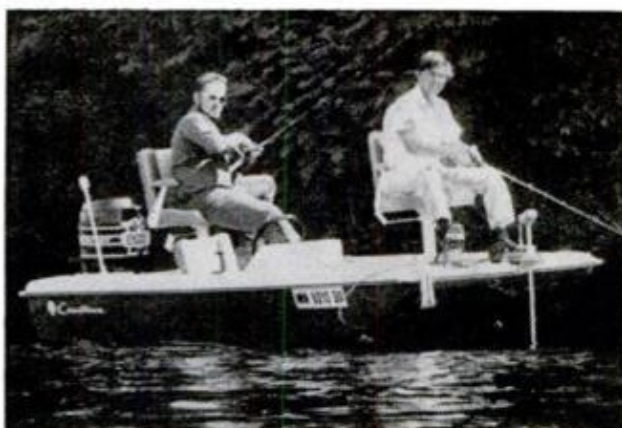
OPEN WATERCRAFT now feature seakindly deep-V hull variations and higher topsides to keep out waves and spray. Boston Whaler's 21-foot Outrage (top) was first tested on rough New England waters. The 19-foot Cobia Fisherman (center) also uses the open cockpit and midships control console. Wellcraft 17 and 20-foot Fisherman outboards have hulls by deep-V pioneer Ray Hunt, can carry 100 and 150 hp. Unobstructed gunnels, casting platforms are standard

BASS RAIDER, new from Cobia, is a 15-footer with tri-V hull, foredeck for electric motor mount, 70-hp rating, seating capacity for five, underseat icebox

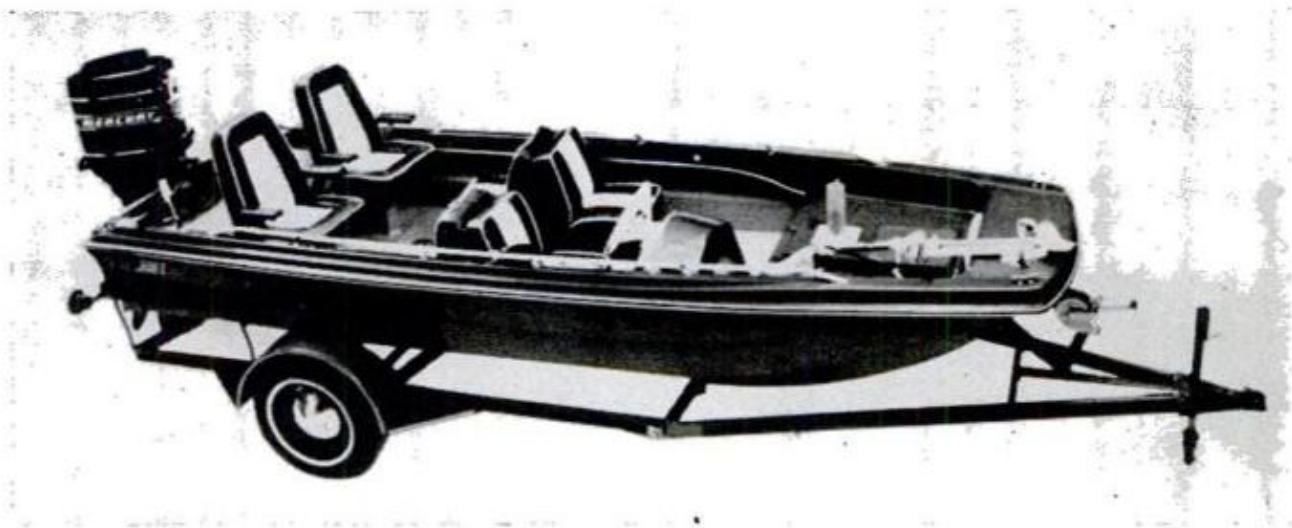
POPULAR MECHANICS



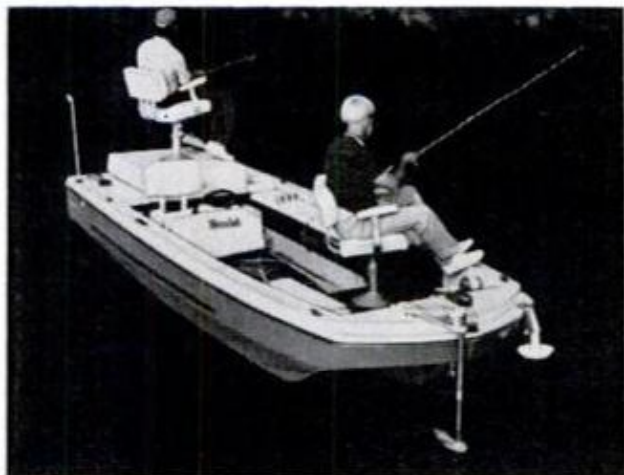
OUACHITA's extensive bass-boat line includes new Convincer UT 16-footer with upright flotation, 95-hp rating, running and interior lights, ballast tank



CRESTLINER calls 15-foot hull of its first bass boat a "Muskie stabilized vee-wing." The fiberglass out-board includes two pedestal swivel fishing chairs



TIDE CRAFT's Miss Pro switches from bass boat to family ski boat in less than five minutes by moving fore and aft platform chairs from pedestals to stern lounge positions shown; 16-footer takes 80-hp motor



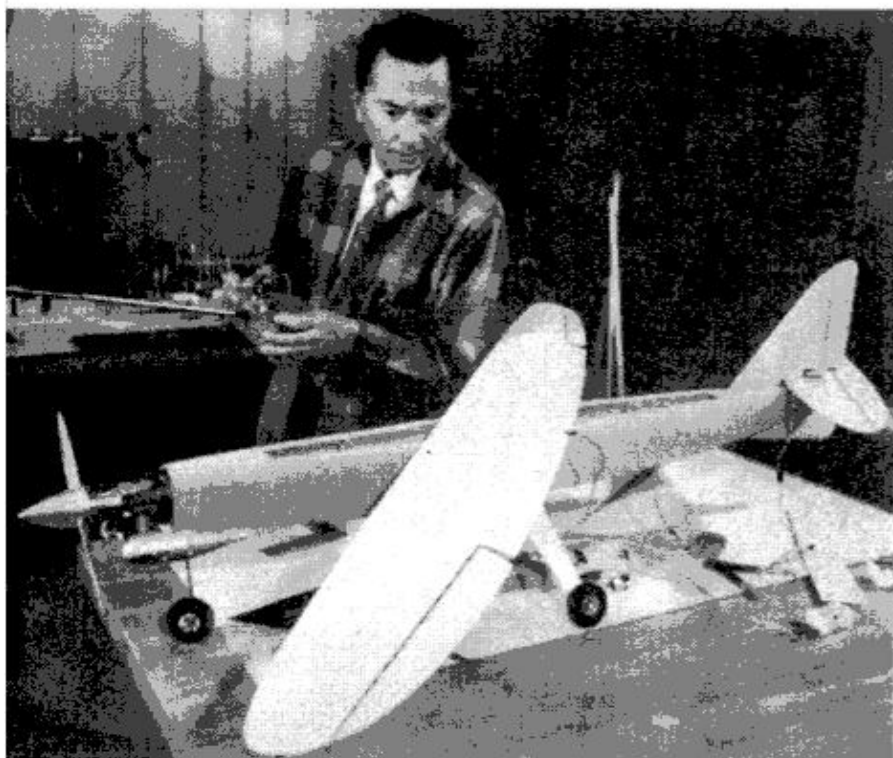
SUPER PRO LTD. from MonArk provides 140-hp stern drive or water jet for power, 10-speed trolling motor, depth finder, matching trailer for this 16-footer
MARCH 1973



TERRY BASS BOSS, built by Delhi (and driven here by Cypress Gardens fisherman Pat Callan), comes in color to match special Johnson Stinger 65-hp motor

Those wild new wings: will they really fly?

Aircraft designers are having a field day trying shapes that look kooky, but may just be crazy enough to revive America's problem-plagued supersonic jet transport



ANTISYMMETRICAL WING pivots sideways in flight, giving the strange-looking craft the appearance of a pair of "flying scissors." Above is five-foot radio-controlled model built by NASA inventor Dr. Robert T. Jones to help test out wing's principle. How idea works is shown on facing page. Because opposing wing and tail surfaces are offset, they don't "fight" each other with their turbulence. This reduces drag, lowers power needs and permits supersonic speeds without producing a dangerous "sonic boom." For low-speed landings and takeoffs, the wing and tail swing back to conventional straight positions

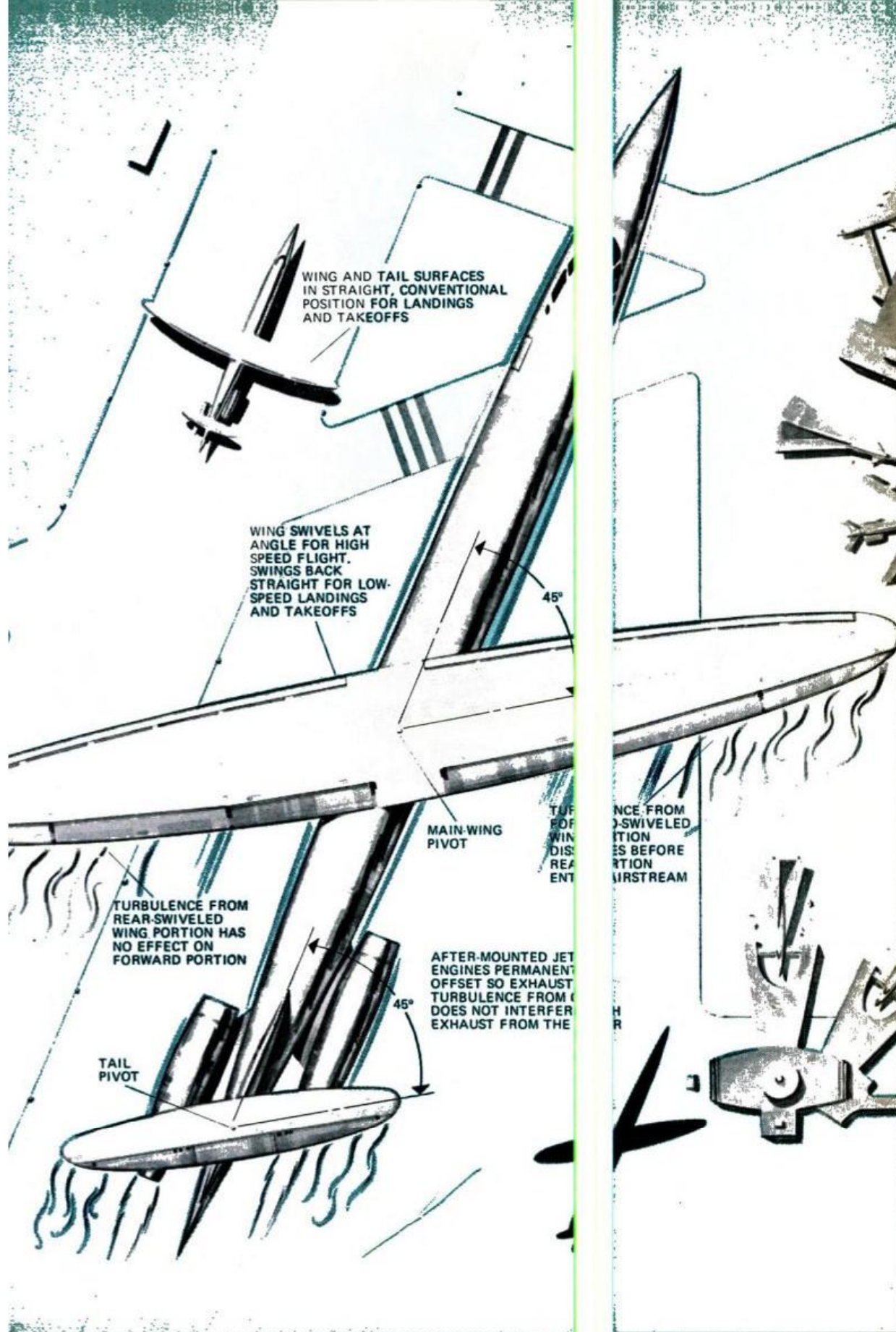
By WALTER B. HENDRICKSON JR.

IT LOOKS LIKE a flying mistake. At high speeds, its centrally pivoted wing and tail surfaces turn sideways at a 45° angle to the fuselage, giving the craft the freakish appearance of a pair of flying scissors. At low speeds, the wing and tail swing back to a straight-across position like those on a conventional airliner.

But the "antisymmetrical" design, as it is called, is no freak. As strange as it may look in flight, this radical new aircraft has proven so successful in tests that it may be just what is needed to revive America's foundering supersonic transport program, officially killed by Congress in 1969 because of strong objections to then-current SST proposals.

Developed by Dr. Robert T. Jones, senior staff scientist at NASA's Ames Research Center in Mountain View, Calif., the weird antisymmetrical concept is designed to provide the high speed of supersonic jet travel, while still maintaining the advantages of low-speed subsonic flight. The problem, says Doctor Jones, is that we've always assumed wings had to be symmetrical because man's flying machine was originally patterned after nature's—the bird. "But there are no supersonic birds," he points out.

Supersonic flight requires a whole new approach because odd things happen at supersonic speeds that don't at lower speeds. At subsonic speeds, advancing shock waves "warn" the air ahead that a plane is approaching, and the air starts to part to let it through. These shock waves travel at exactly the speed of sound. At sonic speeds, the air ahead gets no advance warning since the plane is traveling at the same speed as its own shock waves. The craft thus slams into the unprepared air like a solid wall, generating much more violent shock effects. These shocks cause heavy drag-producing turbulence that saps engine power and triggers



WING AND TAIL SURFACES
IN STRAIGHT, CONVENTIONAL
POSITION FOR LANDINGS
AND TAKEOFFS

WING SWIVELS AT
ANGLE FOR HIGH
SPEED FLIGHT.
SWINGS BACK
STRAIGHT FOR LOW-
SPEED LANDINGS
AND TAKEOFFS

MAIN-WING
PIVOT

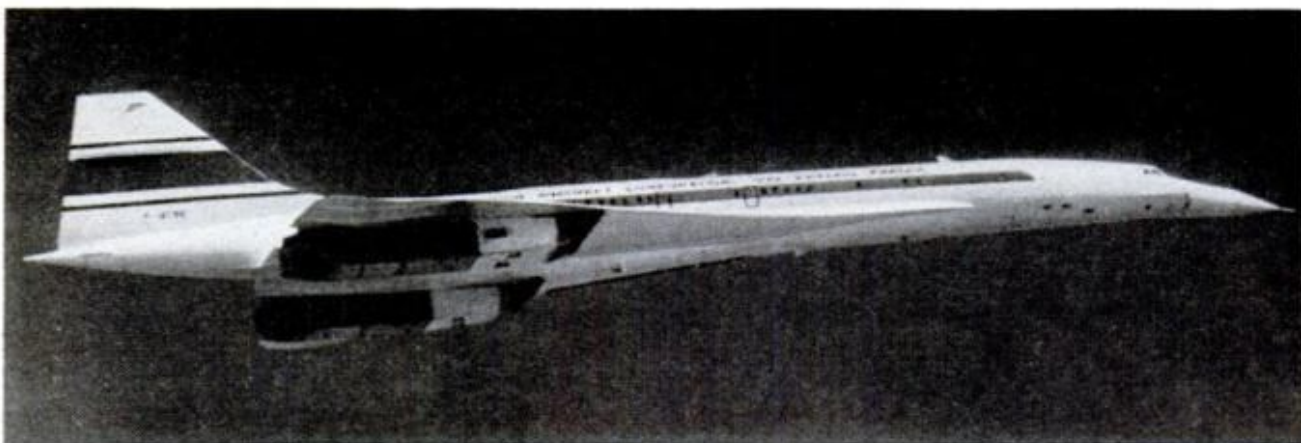
TURBULENCE FROM
REAR-SWIVELED
WING PORTION HAS
NO EFFECT ON
FORWARD PORTION

TAIL
PIVOT

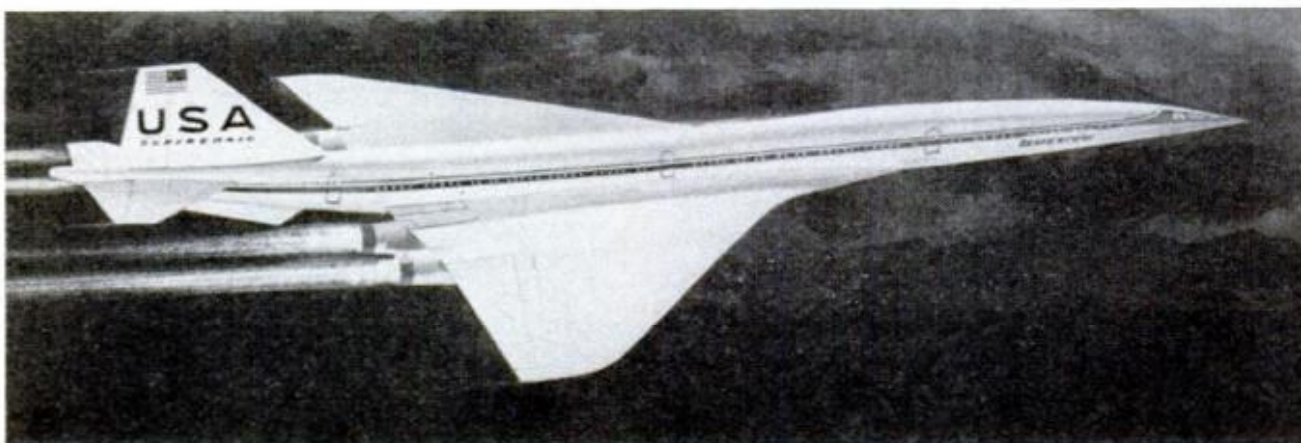
AFTER-MOUNTED JET
ENGINES PERMANENT
LY OFFSET SO EXHAUST
TURBULENCE FROM ONE
DOES NOT INTERFERE
WITH EXHAUST FROM THE
OTHER

TURBULENCE FROM
REAR-SWIVELED
WING PORTION
DOES NOT INTERFERE
WITH EXHAUST FROM
THE FORWARD
PORTION

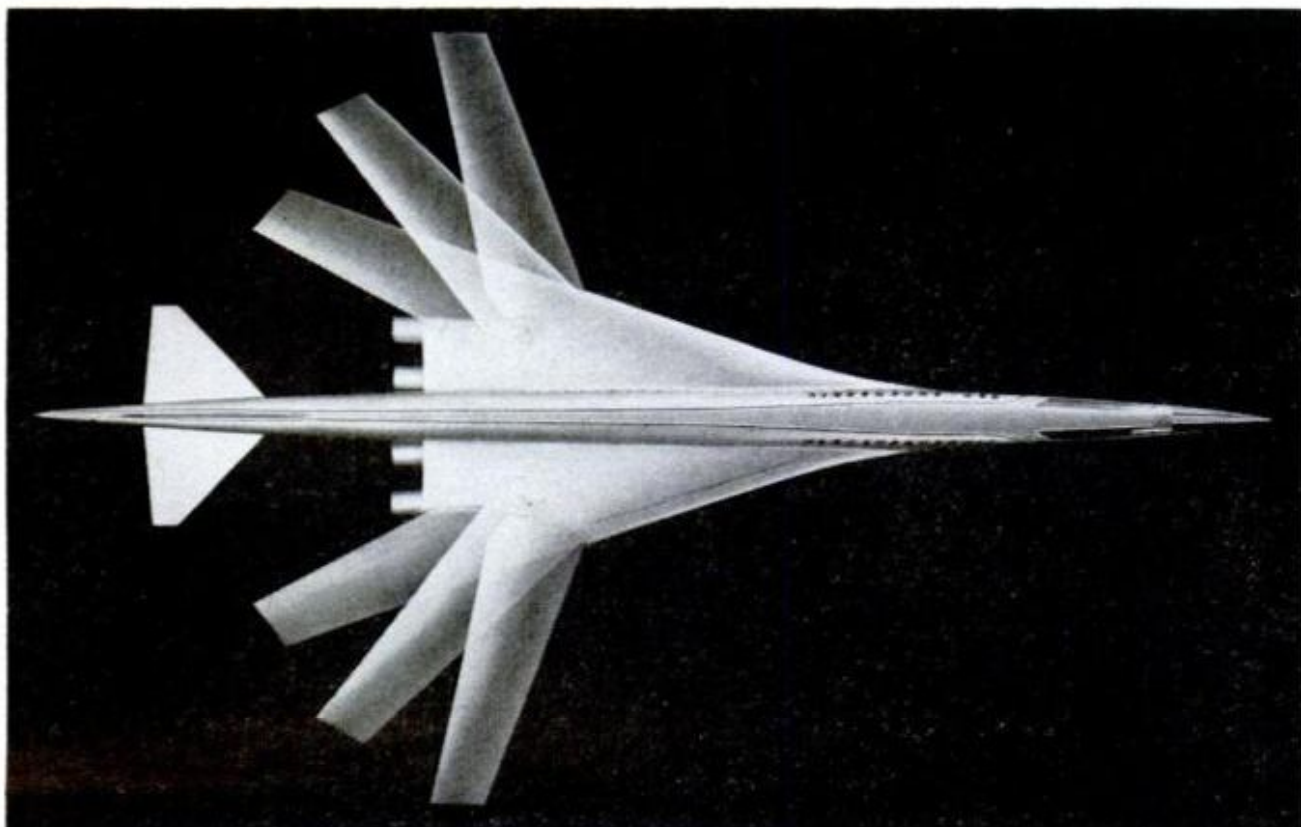
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DELTA-WING CONCORDE, joint British-French venture, is designed to cruise at 1400 mph. The SST prototype has been successfully test-flown, but is still several years away from commercial passenger service



AMERICA'S ENTRY in the supersonic race, Boeing's SST, never got off the drawing board, let alone the ground. High costs, objectionable noise and fears of pollution caused Congress to kill the project in 1969



NEW SWING VERSION represents Boeing's hope for reviving interest in the SST program. Wings extend outward for low-speed landing and takeoff, then fold back for high-speed cruising at up to 1800 mph

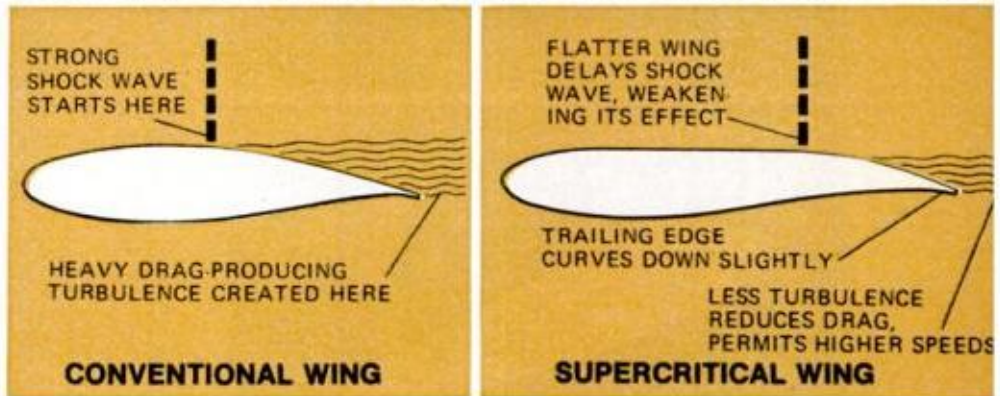
the earth-shattering "sonic boom" that can smash windows and do other serious damage on the ground.

Sweeping back the wings helps to reduce these shock effects, but creates other problems. The narrow, stubby swept wings, while efficient at high speeds, provide little lift at low speeds. For this reason, both swept and delta-winged jetliners must land and take off at high speeds, requiring extra-long runways. The British-French supersonic Concorde, still undergoing tests, needs 9700 feet to take off and up to 7700 feet to land, preventing it from using many of today's world airports restricted to 5000-foot landing and takeoff capacities. In addition, delta-winged craft like the Concorde and the Russian Tupolev-144 SST must land so nose-high for adequate lift that their pilots would be unable to see the ground if it weren't for the addition of the so-called "droop snoot"—a complicated pivoted nose that tilts the cockpit downward for better visibility during landings.

The proposed antisymmetrical configuration would eliminate all these problems. With the pivoted wing and tail turned at an angle to the fuselage, the shock and turbulence created by the forward-swung portions dissipate before the rearward-swung portions enter the same wall of air. Thus the two, being offset, do not have a chance to react against each other and build up increased shock and turbulence. This reduces drag, permits greater speed on less power and significantly lessens the danger of sonic boom damage. Wind-tunnel tests on models of the antisymmetrical design indicate the craft could safely reach speeds up to Mach 1.4—nearly 1½ times the speed of sound or about 945 mph at 35,000 feet (sound travels at approximately 660 mph at jet altitudes). Sonic boom would not be a problem at speeds up to Mach 1.2. Over unpopulated open country or ocean waters, where ground shocks pose no hazards, the antisymmetrical SST could reach Mach 1.5.

MARCH 1973

HOW THE SUPERCRITICAL WING WORKS



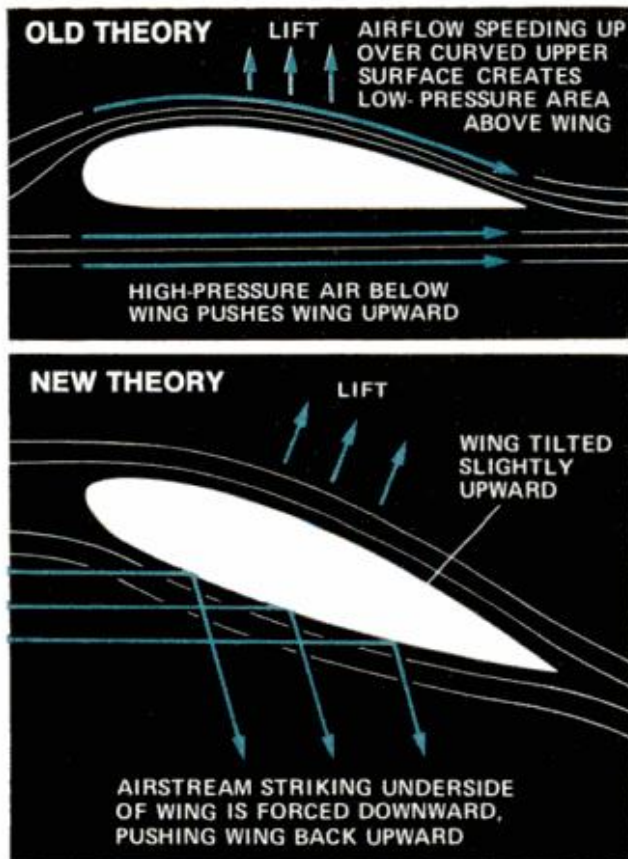
SUPERCRITICAL WING, another NASA development like the antisymmetrical concept, is designed to improve performance at or near sonic speeds. Flatter on top than conventional wing, it delays onset of sonic shock waves, weakening drag-producing turbulence. This increases speed and maneuverability. Wing is seen in Navy F-8 fighter test above

What's more, the antisymmetrical design would not require the high landing and takeoff speeds characteristic of present swept-wing craft. For landings and takeoffs, the pivoted wing and tail surfaces would simply swing horizontally at right angles to the fuselage like those on subsonic jetliners. This would provide increased lift for low-speed, short-run landings and takeoffs, enabling the plane to use existing jetports, even those handling relatively small jetliners like the DC-9.

The added lift gained at low speeds and decreased drag at high speeds would also allow it to use the less powerful but considerably quieter turbofan-type jets employed by subsonic airliners. By contrast, a delta-winged SST like the Concorde requires four times as much power as the antisymmetrical SST.

While the antisymmetrical SST's top speed of around 1000 mph is not as impressive as the Concorde's 1400 mph or the original Boeing's projected 1800 mph, it's still fast enough to get you from New York to San Francisco in 3½ hours—and that's really going some. More than speed alone, the antisymmetrical SST's economical power requirements, reduced noise and pollution effects, short-run land-

MEANWHILE, THE DEBATE CONTINUES: HOW DO WINGS REALLY FLY ANYWAY?



EVERY SCHOOLBOY KNOWS an airplane flies because air flowing over the curved upper surface of wings speeds up, creating a low-pressure "suction" that gives the plane its lift (top diagram). Now this long-accepted theory is being challenged by the belief that it's actually the ram effect of air striking the slightly upturned undersurface of the wings that produces the lift (lower diagram). The wings try to force the air downward, and the air reacts by pushing back upward. Ironically enough, neither theory explains how an airplane flies upside down

ing and takeoff capabilities and lack of sonic boom dangers all add up to big pluses in its favor. It was objectionable noise, fears of pollution and the sonic shock threat that figured prominently in the government's decision to shelve the earlier SST project.

In addition, Dr. Jones points out that the single central pivot arrangement on the antisymmetrical wing is much simpler and safer structurally than the more complicated variable-sweep, swing-wing mechanisms currently used in F-111 and F-14 fighters. Failures in these wing mechanisms, though now supposedly corrected, caused several F-111s to crash. The worst that could happen to the antisymmetrical wing, claims Dr. Jones, is

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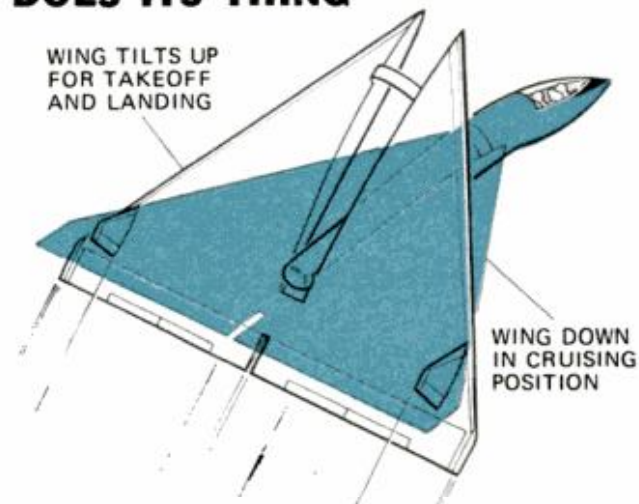
that it might jam in the straight or angled position. Either way, the ship could still fly—an important fail-safe feature. So promising is the concept, in fact, that NASA has granted Boeing a research contract to do further studies on the novel design.

The antisymmetrical wing, while perhaps the most spectacular, is only one of several striking new developments that may help to give the ailing SST program a much-needed shot in the arm. Boeing, on its own, has come up with a revised version of its earlier SST, this one incorporating the variable-sweep, swing-wing principle. Despite the poor showing of the F-111, Boeing is convinced the swing-wing system can be practical if properly designed. The wings are pivoted so they swing back for high-speed supersonic flight, but can be extended straight out for low-speed landings and takeoffs. This, if successful, would solve the runway problem, but other questions of noise, pollution and power requirements still remain.

Interestingly enough, the first Boeing SST was aimed at carrying 300 passengers, while the later version has been revised downward to seat 200. The Concorde holds fewer still—136. Just how many the antisymmetrical SST will tote is not yet known, but there may be a trend in the making toward smaller, more manageable SSTs rather than the

(Please turn to page 206)

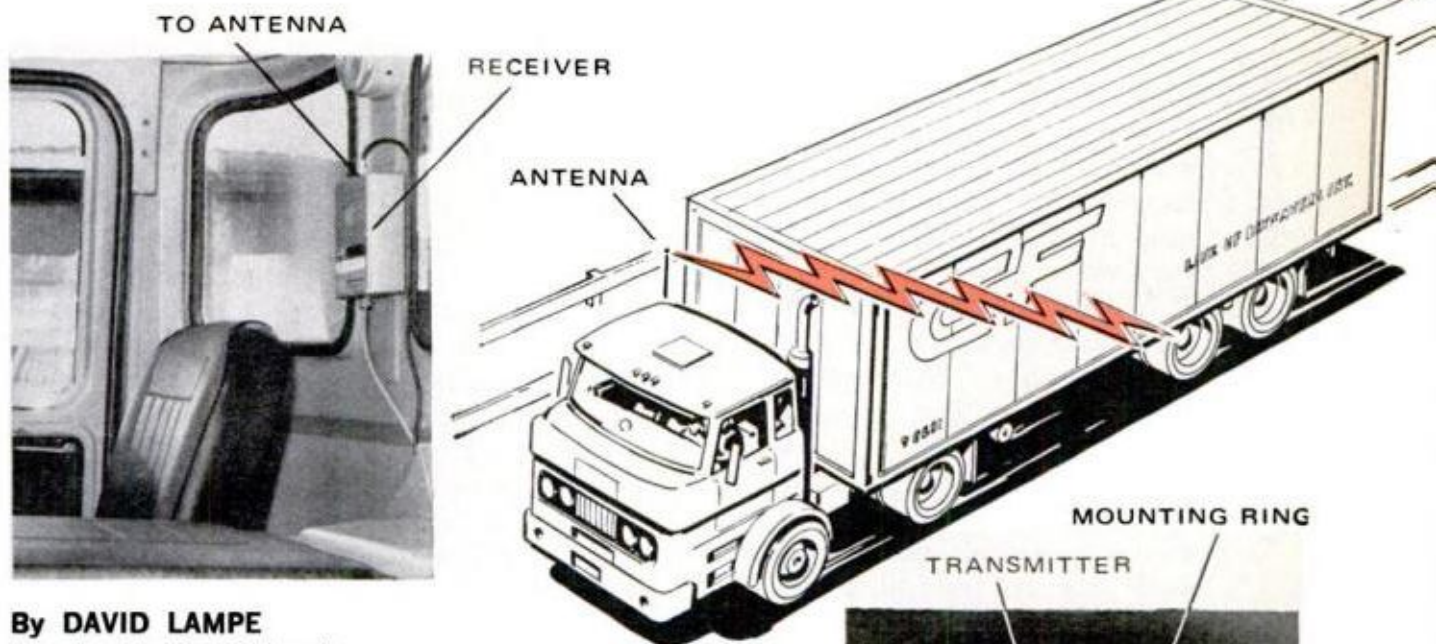
AND NOW A TILT-WING DELTA DOES ITS THING



PIVOTED DELTA WING is designed to tilt up at low speeds to sharpen angle of attack and provide increased lift, making possible short-run landings and takeoffs. At high speeds, the wing would retract to a horizontal position as less lift is required

POPULAR MECHANICS

When tire pressure drops . . . radio sounds the alarm



By **DAVID LAMPE**
Drawing by Roy Grinnell

IN A CAR you feel a sudden drop in tire pressure right away. That's not always true if you're driving a bus or truck. Sudden loss of pressure in a heavy-vehicle tire means weakening and probably losing an expensive tire, and wasting gasoline because of the extra drag of the flat. At worst, it can result in loss of control: the bigger the vehicle, the greater the risk.

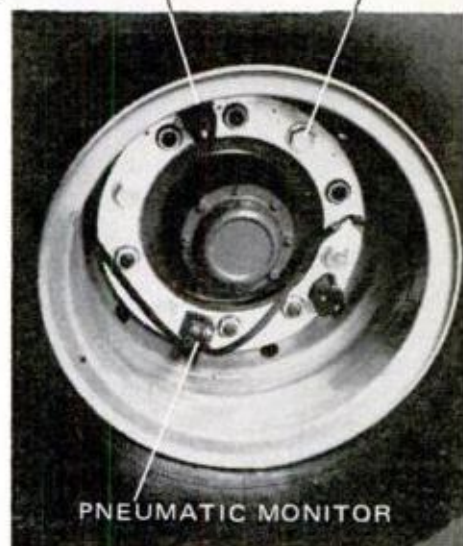
Tire-pressure monitoring is now possible with a new electronic system developed in England by one of the world's leading manufacturers of automotive testing devices. The system is simple, inexpensive and can be mounted on any heavy vehicle in minutes.

All you do is bolt a steel ring to the outside of the truck's wheels (only one ring for a pair of wheels on a single axle), install a special radio receiver in the cab, and connect tire valves to the pneumatic monitor on the ring.

The system is activated by a centrifugal switch when the vehicle reaches a speed of eight mph. After that, if the pressure of any tire drops more than 10 pounds per square inch, the monitor on its hub will trigger the tiny radio transmitter powered by long-life batteries also on the ring. A continuous shrill note is emitted from the receiver until you reduce speed to eight mph.

The tire-pressure monitoring system has been road and laboratory tested under all possible atmospheric conditions. Even steam cleaning doesn't disturb it.

The monitoring system should be available in the United States soon. The manufacturer is Heenan Aspa, Ltd., Shrub Hill Road, Worcester WR4 9EQ, England. ★★★



LOSS OF TIRE PRESSURE is detected by pneumatic monitor which turns on a transmitter. These components and the transmitter batteries are located on tire mounting ring. Signal is broadcast to cab receiver which emits a shrill tone. The volume of the receiver is adjustable but it is designed so that it can't be turned off completely. Driver then won't forget to make the first stop to get air. He locates tire losing air by holding a small magnet near the pneumatic monitors to override the centrifugal switch, and he listens for the tone from the receiver in the cab

How Detroit is 'tuning' its new

Four small, important footprints are your car's only contact with the road—so important that more and more cars are being designed from the ground up to run on radials.

By ROBERT LUND

A BETTER TIRE is forcing Detroit to build better cars. Better in a lot of ways: in ride, handling, steering response and fuel economy. Cars that are safer, quieter and more durable.

All that from a tire? The tail wagging the dog? Not exactly, because the automakers still call the shots, and the tire companies have to go along with whatever Detroit decrees. But after years of obedience to Detroit's bidding, tire companies are beginning to have a subtle influence on the way cars are put together.

Tiremakers owe their new-found clout to the development of the radial tire.

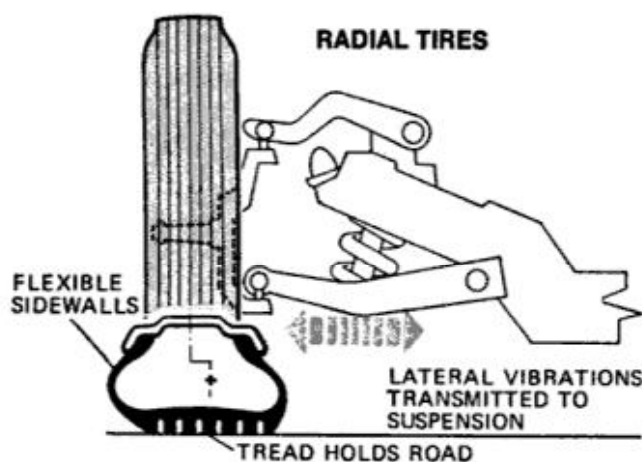
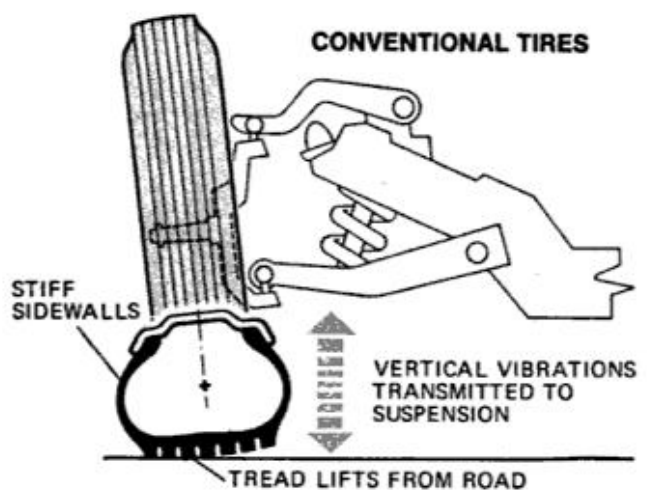
The radial was put into production without blessing from Detroit. This was a gutsy play on the part of the tire industry. The auto companies not only withheld their blessing, they kissed off the tire without giving it a chance.

The president of General Motors spoke for most of the industry when he said American cars couldn't be tuned to radials. The other companies echoed GM's veto. "American car buyers want a soft, plush ride," auto engineers pontificated in chorus, "and U.S. cars don't have suspension systems to accommodate radials." The only outlets the tiremakers could find for radials in the early days were foreign cars and the replacement market.

Ford was the first U.S. automaker to about-face. In 1970, Ford offered radials on Thunderbird and Mark IV. The company installed the tires on a timid six-tenths of one percent of its 1970 model production. Starting with the '73 model run, Ford offered steel-belted radials on everything it makes—standard equipment on Continental Mark IV, Lincoln Continental, Thunderbird and two Mercs—Marquis and Monterey, optional on other Ford products. That speck-in-the-eye 0.6 percent installation rate recorded in 1970 had jumped up to 31 percent as of late last year. Even that figure may be shattered before the model year is out. On Maverick and Comet—cars on which radials cost extra—Ford thinks the installation rate this year could run as high as 45 percent.

Although Ford is taking all the radials it can get from Firestone, General, Goodrich, Goodyear, Michelin (of France) and Uniroyal, it hasn't been able to get enough of the tires to satisfy demand.

At GM, radials are standard on Pontiac Grand Am and Grand Prix SJ, Buick Riviera GS, Oldsmobile Cutlass Supreme Salon, Chevrolet Monte Carlo S coupe and Landau and Corvette. (In the case of Pontiac Grand Prix SJ and Olds Cutlass Salon, the cars themselves are optional models of other cars. But if you order the



IN A HARD TURN and in normal driving, the radial tire transmits more lateral vibrations to your car's suspension than the conventional, bias-ply tire. Result is a different pattern of ball-joint wear, for example, but the new radial tires can still be fitted to your present car

optional car, you get radial tires with it.)

The other car divisions and companies are making radials available, either as standard gear or optional, as fast as they can rig their cars to accommodate the tire and line up a source of supply. The supply situation is improving in a hurry. Firestone has applied for a patent on a process that will permit production of bias-ply, bias-belted and radial tires on the same line using existing equipment. And Good-year has significantly expanded its radial-tire line for domestic cars.

What caused Detroit to change its mind about radials—to go from a thumbs-down attitude to gung-ho enthusiasm?

Automakers didn't like the idea of making changes in the car to match it with the tire. They'd always worked the other way around. The car came first and the tires were hung on later. With the radial, it's a two-way proposition. Car and tire have to be matched to each other.

"I admit we were bullheaded," a chassis engineer for a Big Three division recalls. "Michelin tried to interest us in radial tires in the early '60s. We couldn't see it. The ride was too hard. Then Pirelli came along with refinements. Pirelli made changes in the tire, relating it to specific suspension systems. This was an improvement over the Michelin original, but the Pirelli version still required changes in the suspen-

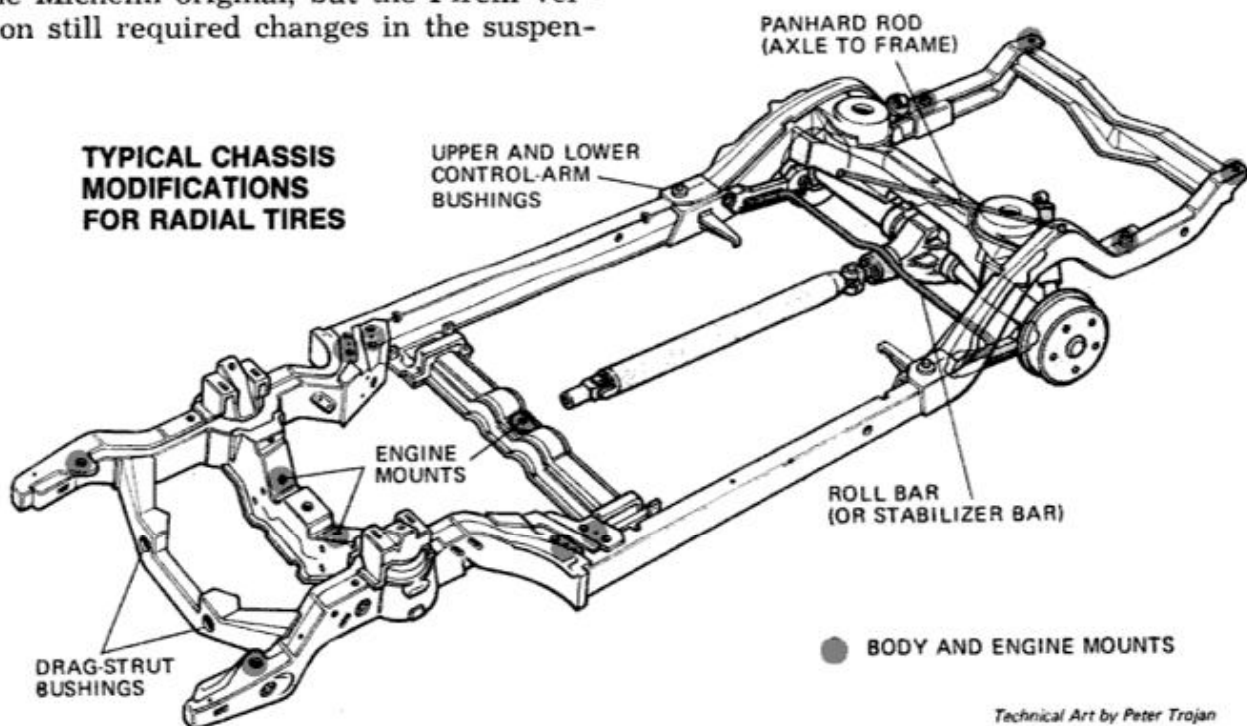
sion system of the vehicle. This was a whole new pitch for us. We were used to calling the tune and having Akron dance to it."

Now Detroit is beginning to see the light. Auto producers have made or are working on structural changes in cars to permit use of radial tires.

Ford is ahead of everybody else in this business—at least in the United States—and the steps it takes to prepare its cars (some of them, but not the entire Ford fleet) for radials indicates the extent of the engineering job that has to be done to bring vehicle and tires in tune with each other. Here's what Ford does to "radialize" its cars:

Radial tires have an inherent harshness that is transferred to the vehicle at low speeds. The car rides rough and noisy. Any imperfections or impacts in the road are transferred to the vehicle. Ford isolates vibrations by the way it tunes the car—

FOR BEST RIDE and handling, a car's suspension, body-to-frame and engine mounts are designed with a choice of tires in mind. In short, the tires should be part of design of any new car. Increased fore and aft and lateral stiffness is required when radials are to be used (see text)



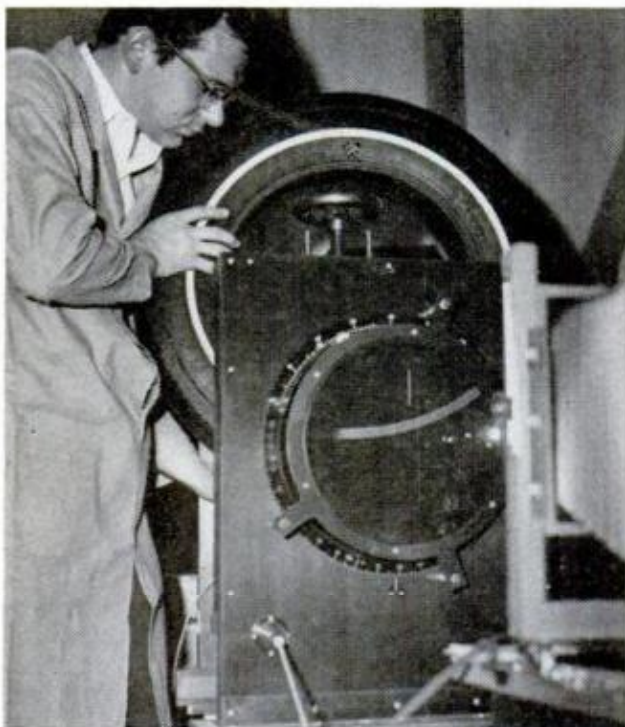
the way the body is floated on the frame through body mounts.

Engine, engine mounts and front suspension are tuned for fore and aft stiffness. Ford does this by using a special drag strut attachment—what body engineers call a puck. This is a rubber bushing that allows the suspension to compensate for impact harshness.

In the rear suspension, Ford uses a panhard rod. This controls lateral stiffness of the suspension. In a car that hasn't been tuned for radials, rear suspension consists of three fore and aft links. There's no lateral control. Thus the car can shift sideways. The panhard rod, which is attached from the suspension—the axle itself—up to the frame, prevents sideway shifting.

Ford found that existing lateral control in its cars was such that it had to install a bayonet-end attachment to get better control of lateral kick caused by disturbances from the rear suspension. This was done to correct a condition called hot-weather burble—a lateral disturbance characteristic of most radial-ply tires under hot-weather, hot-running conditions.

Those are the steps taken to tune a car for radials when the car is built on a body/frame. But not all cars are built on body/frames. All automakers produce some unitized body cars—body and frame are one piece. This rules out changing the way the body floats on the frame.



STRESSES ARE PHOTOGRAPHED by polariscope in check of new Mini-Sport radial tire in Firestone lab

Here are 11 leading questions you

Can I put radials on my old car without suspension set for radials?

Yes. You won't have any trouble handling the car, steering it and maneuvering from lane to lane. You may notice a rougher ride at speeds from the mid-20s to 30-32 miles an hour. The rough ride will be less noticeable after you get above 35 mph. Once you hit 60 to 70, the hard ride will disappear entirely, and you'll get the same smoothness of ride and benefits of wear you'd get with a car tuned for radials.

Can I put conventional tires on my car with suspension set for radials?

Yes. The ride won't be as smooth as you'd get with radials. But there's no danger in switching from radials to nonradials on cars tuned for radials.

If I've got bias-ply or bias-belted tires and have to replace a tire, can I replace it with a radial?

You can't mix one radial with three non-radials. And vice versa—you can't use three radials with one nonradial. Mixing is dangerous because radials and nonradials have different handling characteristics. Under certain conditions, mixed tires will fight each other and you can lose control of the car.

Some tire men say you can get away with putting two radials on the rear of the car—but only on the rear and on both wheels—with conventional tires on front wheels. But you do this at your own risk. The auto and tire companies don't recommend it.

There's no danger in mixing radial tires made by different tire manufacturers.

Unitized body cars have to undergo structural changes to tune them to radials. Each company has a slightly different approach and body engineers are now working on the problem. This doesn't mean you can't buy a unitized body car with radials and get just as good a ride and benefits as with radials on a body/frame car. But tuning is more complicated.

What are the benefits of radials and how are they better than conventional tires for your present car?

● All radials are guaranteed for a minimum of 40,000 miles. The radial is a tougher tire. It can take impacts better than belted-bias and bias-ply tires and is less susceptible to puncturing. But there's a

might ask about radial tires—and straight answers

What do radials cost? How much more than nonradial tires?

Radials will run you anywhere from \$40 to \$90 per tire, against a \$25 to \$40 price range for conventional tires. But you might make a deal for less than that, if your tire dealer's having a sale—tire dealers are always having sales—or if your trade-in tire has a lot of tread left on it. Check the newspaper ads and shop around.

Do the special elements that go into tuning a car for radials require periodic servicing or replacement?

No special service or maintenance. Nothing you wouldn't do to a car without suspension set for radials.

How about the tires themselves? Do they require special attention?

Proper inflation is important, but no more so than with nonradial tires. A radial can handle underinflation better than a bias-ply or bias-belted tire. With overinflation, radials give a harsh ride. "Like a hay wagon, bumpy-bang along," as one engineer described it.

Is tire balancing more or less important with radials than with other tires?

Equally important, but not more or less. If you want a good high-speed ride, the only way to get it is by balancing the wheels on-car.

Do radials have to be rotated?

Rotation will extend the life of the tires and American tiremakers recommend regu-

lar back-to-front, crisscrossing. One foreign company, Pirelli, guarantees its radials for 40,000 miles without rotation. But Goodyear advises that you rotate to realize the full potential of tire life. Keep them on the same side of the car: Left front to left rear; left rear to left front; right front to right rear; right rear to right front. If you use the spare: Left front to left rear; left rear to left front; right front to spare; spare to right rear; right rear to right front.

Can radials be retreaded?

Yes. But if you buy a retread, make sure the job's been done right. Look at the sidewall from *inside* the tire. If there's been severe damage to the sidewall, if it has a big patch on it or series of small patches, demand a guarantee in writing. Or pass it up.

Can I use tire studs in radials?

Sure. The Swiss and Swedes do. Many radial snow tires are made with the holes to accept studs.

Why do radials bulge out at the bottom, so it looks as if you have a flat?

Among the advantages of the radial is that it puts more rubber on the road. It sits on the ground and develops high lateral thrust forces. When you go around a corner, the tire wants to stay on the road, hug the ground, rather than slide or tip up from the road, as with conventional tires. Don't try to take the bulge out by adding air beyond the pressure recommended by the manufacturer. The bulge is natural "fat." Leave it alone.—R.L.

trade-off here. The radial is not as strong in the sidewall as conventional tires. The sidewall is thinner on radials and you have to guard against rupturing the side rubber. Watch out for car washes where the car moves in a groove. If there are jagged edges on the track, don't risk it.

● Because it has a soft sidewall, a radial is cool-running. It doesn't generate heat—there's less chance of a blowout.

Radials purge water better than non-radials. Water is less likely to build up in grooves, reducing risk of hydroplaning.

● There's less rolling resistance with radials, increasing fuel mileage. According to a study by Firestone, the savings in fuel amounts to about six percent.

● The radial is a quieter-running tire. George Brush, manager of tire development for Firestone, says a regular belted-bias tire emits natural frequencies in the range of 160 to 165 cycles per second. The natural frequencies on radials range between 55 to 65 cycles per second. The frequencies flatten out at higher speeds, so that with a radial virtually no vibration is transferred to the vehicle at speeds above 40 to 50 mph.

● When the car has been tuned for radials, it's easier to steer, you use less effort, and steering is more responsive.

● Finally, the radial gives better resistance to side slip in crosswinds and on winding roads. ★ ★ ★

The simple way to ...

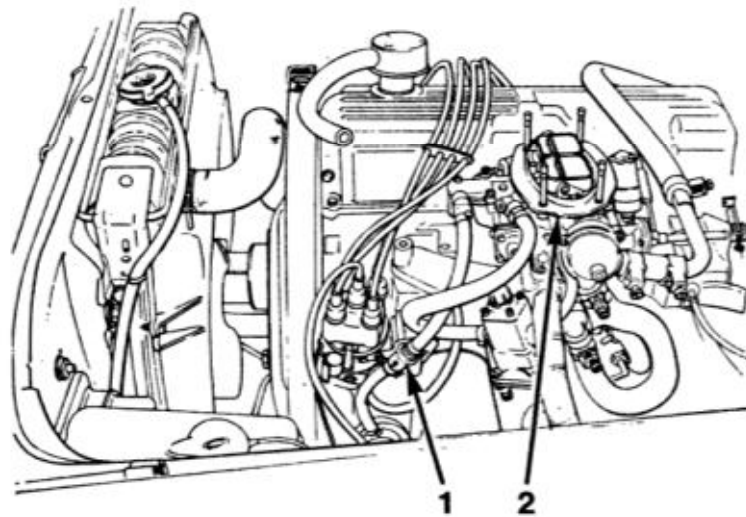
Adjust your Pinto carburetor

THIS PROCEDURE is condensed from a booklet in a new series offered by *Popular Mechanics*. The booklet shows how to do the major maintenance jobs on 1971 and 1972 Ford Pintos with the 2000-cc (two-liter) engine.

To order the booklet, send \$1.99 to Popular Mechanics, Dept. XYZ, Box 1014,

Radio City, N.Y. 10019; include your address and zip code.

Other available books are: VW Beetles 1966 through 1971 (\$1.99 each); a large booklet for all VW Beetles 1965 through 1971 (\$2.95); 1970-71 Toyota Corona (8R-C engine) booklet (\$1.99) and 1971-72 Chevy Vegas (\$1.99).



Instructions in this section show how to replace the fuel filter (1) and adjust the carburetor (2). The fuel filter should not be cleaned, but should be replaced every 12,000 miles.

The carburetor should be adjusted every 6000 miles or whenever a tune-up is performed to obtain maximum engine performance and gas mileage.

Before adjusting the carburetor it is essential that the engine be properly timed and the emission control system be serviced.

WARNING: Be sure to keep area well ventilated when working with fuel. Do not smoke or work with fuel near garage water heaters or electric heaters.

Be sure area is well ventilated before starting engine.

Be sure to keep hands and equipment clear of fan and drive belts when engine is running.

Emergency brake must be on. Transmission must be in park or neutral.



TOOLS, PARTS AND SUPPLIES:

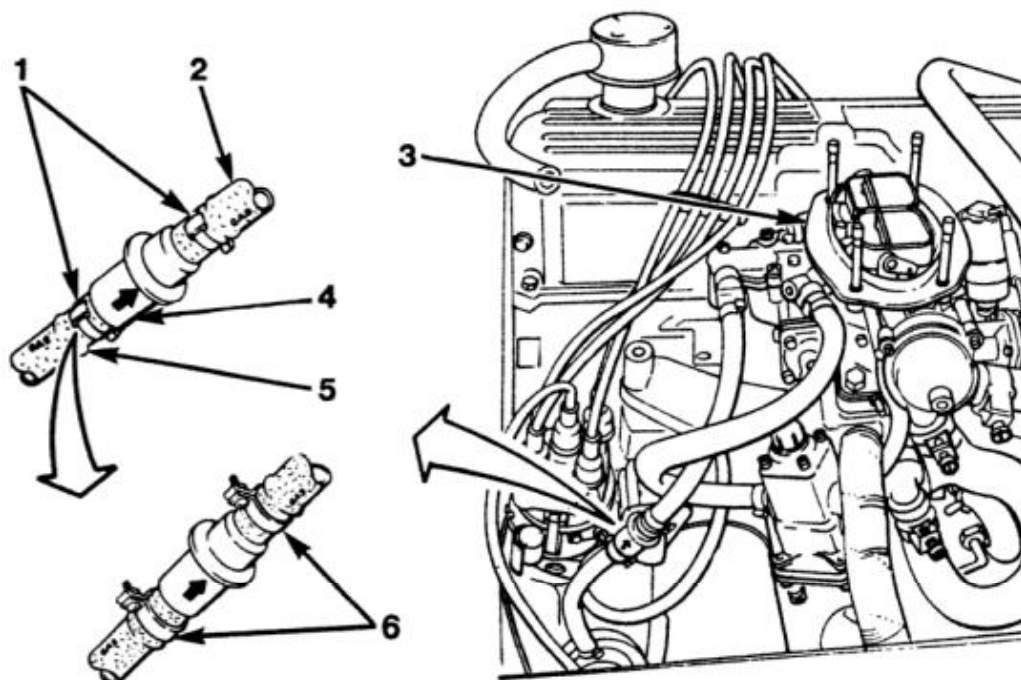
Common screwdriver (1)
3/8-inch open-end wrench (2)
Dwell-tachometer (3)

Diagonal cutting pliers (4), if required
Fuel filter (5)
Clean cloth

Replace Fuel Filter

WARNING: Be sure to keep area well ventilated when working with fuel. If crimp-type clamps (1) are installed, clamps must be removed by cutting.

1. Loosen two clamps (6) or cut two clamps (1).
2. Disconnect fuel lines (2,5) from fuel filter (4). Discard fuel filter.



CAUTION: Be sure fuel filter (4) is installed with arrow on filter pointing toward carburetor (3).

1. Place one clamp (1) on each fuel line (2,5).
2. Connect fuel lines (2,5) to fuel filter (4). Using diagonal cutting pliers, squeeze two clamps (1) until tight. Go to Step 4.
3. Connect fuel lines (2,5) to fuel filter (4). Tighten two clamps (6).

WARNING

Be sure area is well ventilated before starting engine.

Be sure to keep hands and equipment clear of fan and drive belts when engine is running.

4. Start engine.

PART 2

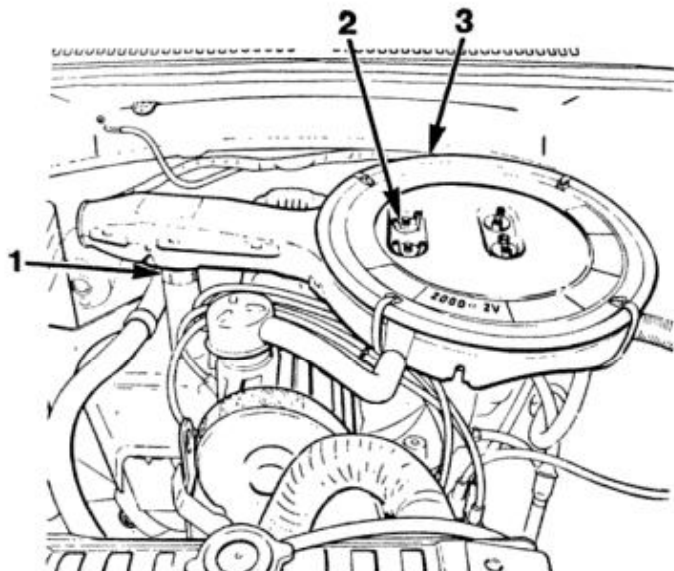
Adjust Carburetor

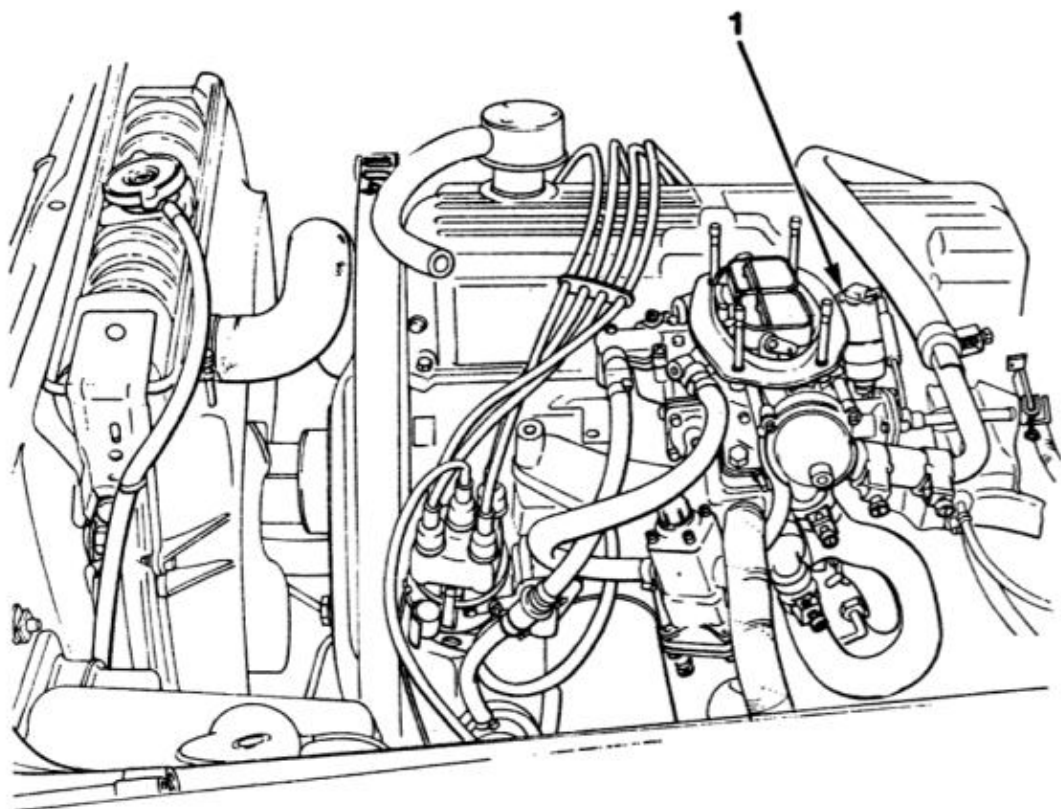
See operator's manual supplied with dwell-tachometer for instructions on use of meter.

1. Connect meter to engine.
2. Remove four wingnuts (2). Loosen clamp screw (1), if installed.

All engine-speed adjustments can be made with air cleaner (3) raised, but not removed, for access to adjusting screws.

After adjustment is made, air cleaner (3) must be lowered to make accurate readings on dwell-tachometer.





WARNING: Be sure area is well ventilated before starting engine. Be sure to keep hands and equipment clear of fan and drive belts when engine is running. Be sure emergency brake is on.

1. Start engine. Allow engine to warm up for at least 15 minutes.
2. Place following accessories, if installed, at positions indicated: air conditioner, ON; automatic transmission, DRIVE.

If your car has an automatic transmission, idle speed is adjusted to 650 rpm.

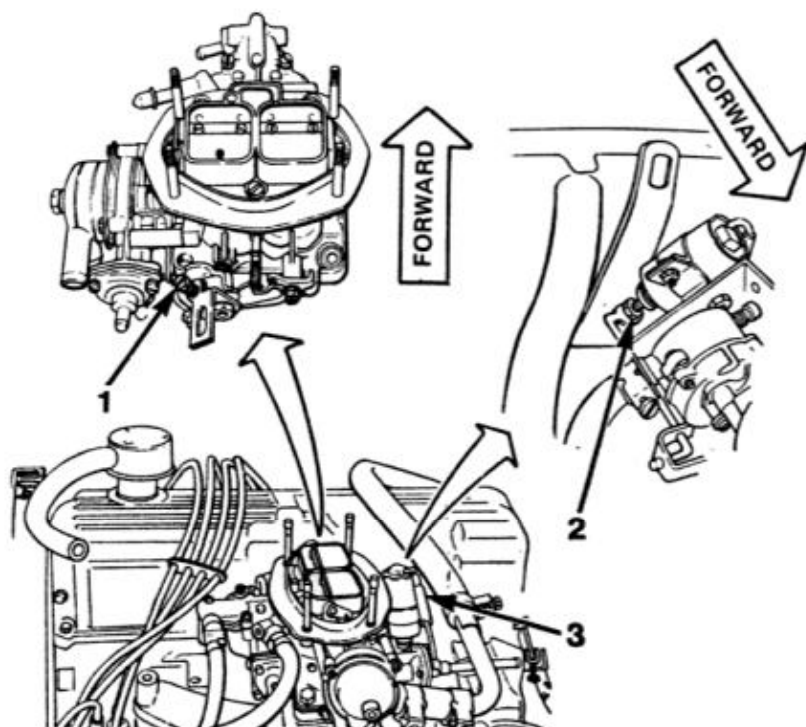
If your car has a standard transmission, idle speed is adjusted to 725 rpm.

If throttle solenoid (1) is not installed, go to Part 4, Step 5.

If throttle solenoid (1) is installed, go to Part 4, Step 1.

PART 4

1. Adjust solenoid nut (2) until reading on meter is at correct rpm.
2. Disconnect solenoid quick disconnect (3) by pulling apart.
3. Adjust curb idle screw (1) until reading on meter is 500 rpm.
4. Connect solenoid quick disconnect (3). Go to Step 6.
5. Adjust curb idle screw (1) until reading on meter is at correct rpm.
6. Place following accessories, if installed, at positions indicated:
Air conditioner—OFF
Automatic transmission—PARK.



PART 5

Read Steps 1 and 2 before continuing.

1. Increase engine speed by lifting up on throttle lever (1) until reading on the meter is 3000 rpm.
2. Release throttle lever (1) suddenly. Check that engine speed decreases below 800 rpm within 1.5 to 5.0 seconds.

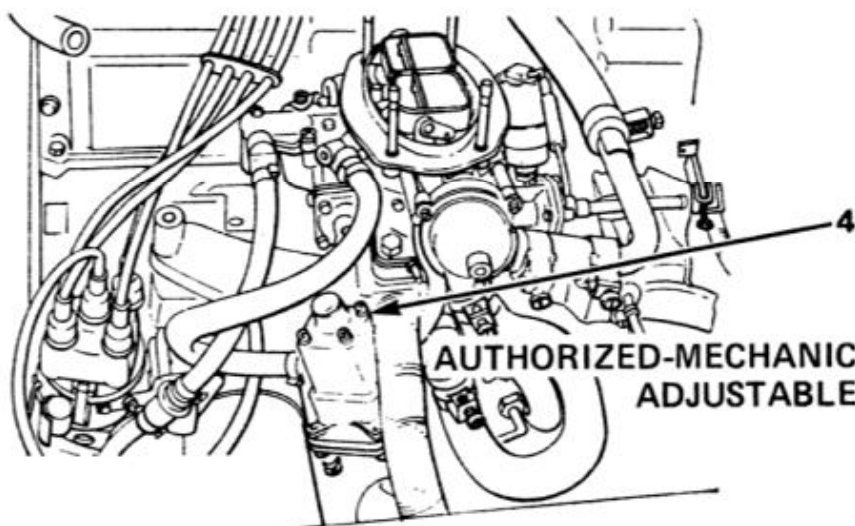
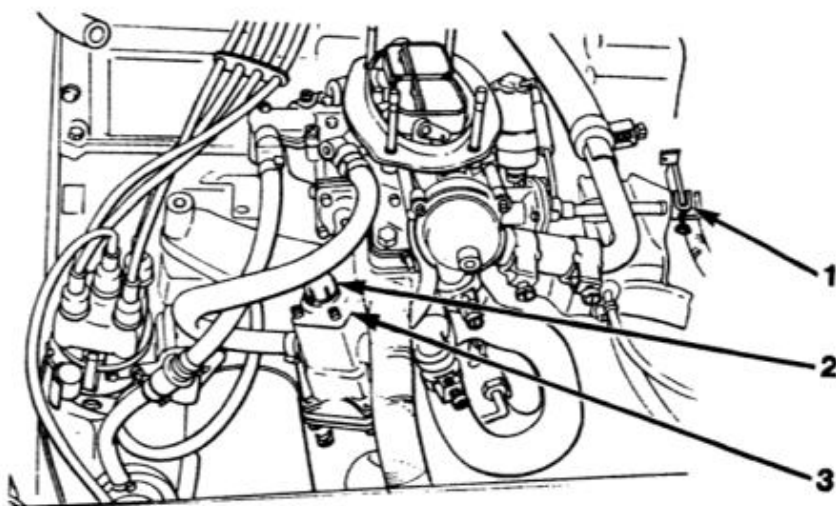
If engine speed decreases below 800 rpm within 1.5 to 5.0 seconds, go to Part 6, Step 1.

If decel valve type (4) is installed, an authorized mechanic must make decel valve adjustment. Go to Part 6, Step 1.

If decel valve type (3) is installed, continue on.

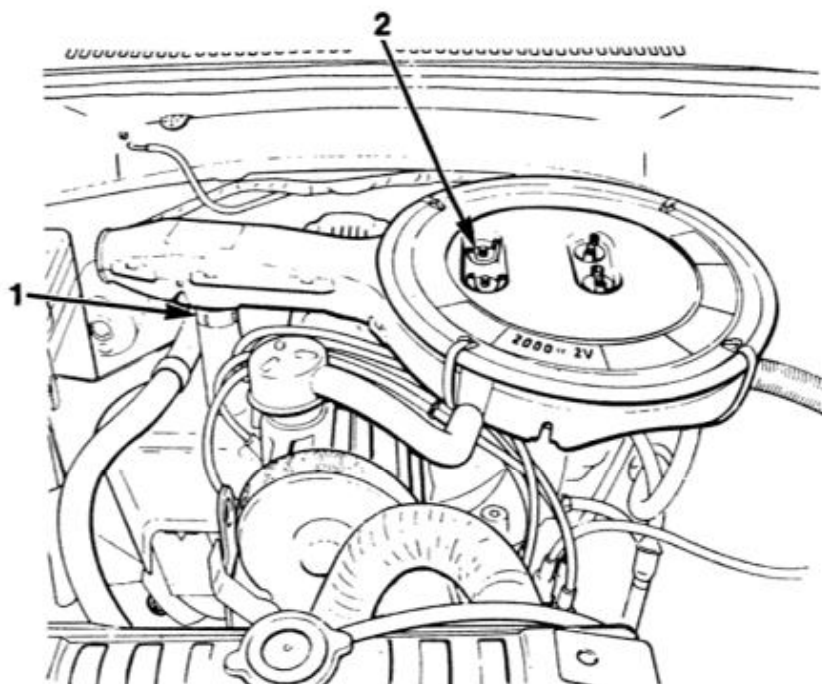
Turn adjuster (2) on decel valve (3) $\frac{1}{2}$ turn clockwise to decrease time, or $\frac{1}{2}$ turn counterclockwise to increase time.

3. Turn adjuster (2) $\frac{1}{2}$ turn. Go to Step 1 to recheck decel valve (3).



PART 6

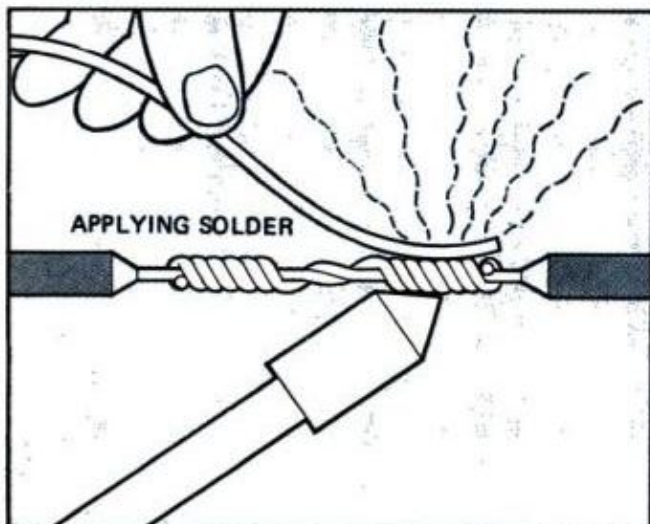
1. Stop engine
2. Disconnect dwell-tachometer.
3. Tighten clamp screw (1), if installed.
4. Install four wingnuts (2).



How to cut, splice and connect wires

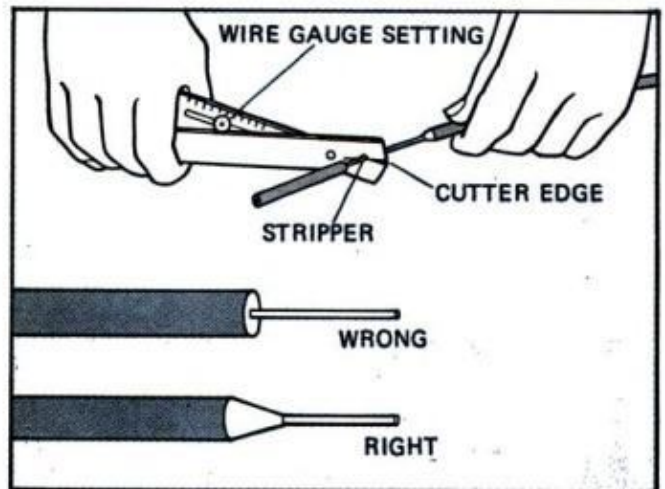
THE WIRING SYSTEMS that may be used in residences usually consist of either flexible-armor type (BX) or non-metallic sheathed cable with ground wire. Local codes may ban the latter system, but, in any event, the systems should not be intermixed. If your home is wired with BX cable and you are adding an outlet, stick with BX armored cable. Regardless of the wiring type you use, the basic techniques for joining (splicing) these wires are the same. That's what this is all about—good techniques for making safe and proper electrical joints.

Basic points you should know: Wiring, stated simply, serves as the conductor carrying electrical current from house service panel to its ultimate use as heat, light or power source (outlet). It is important to use the right size wire; one that complies with local and national codes. (Size will depend on line load.) In any event, wiring must be installed properly. ★★★



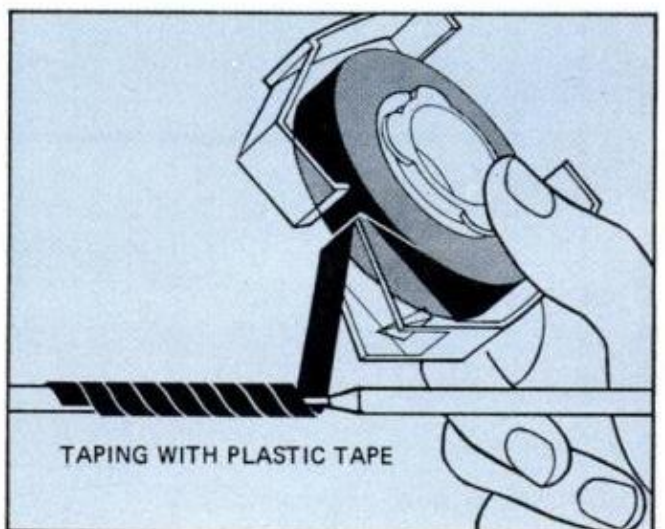
4. Soldering the splice

To assure that solder flows easily, first coat the wires with electric soldering paste. Apply the soldering-iron tip to the wires and heat the wires until solder melts and flows into every crevice (spaces between turnings). Rigidity in an electrical connection cannot be overemphasized; solder should completely cover the exposed joint—and be applied so that it will neither crack nor chip-off when the wires are eventually pushed into the switch or outlet box.



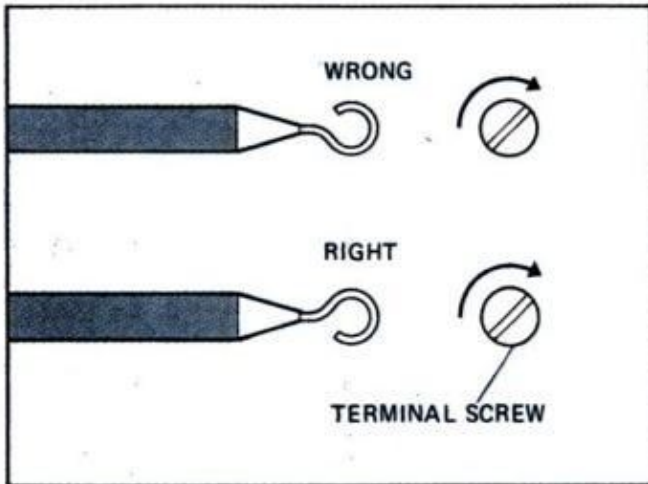
1. Stripping and cutting wire

A combination wire cutter and stripper is a handy pocket tool that cuts and strips clean the most common sizes of stranded and solid wire. A button on the handle lets you set the jaws to desired gauge when stripping so you can remove insulation without breaking the wire. Expose ½ in. of conductor by removing insulation as shown, with insulation shaped like a sharpened pencil rather than a blunt cut. Tool's nose can be used to form the loop on wires for installation under the terminal screws.



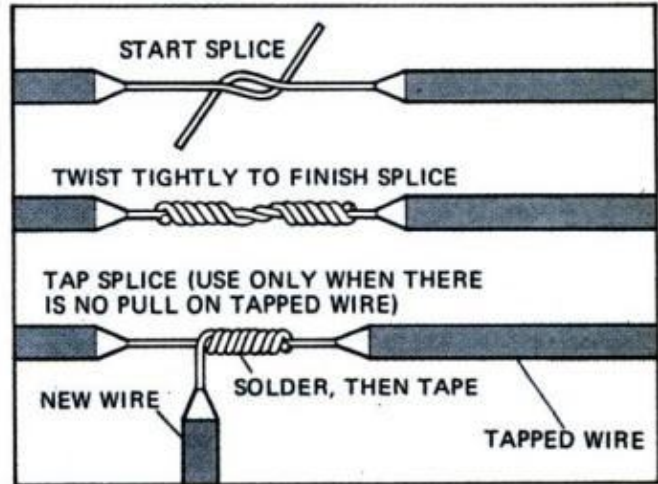
5. Doing a neat taping job

Most professional electricians today prefer to use plastic tape—rather than rubber or friction tape. It lets you do a faster, neater and cleaner job because its dispenser will cut the tape exactly where you want. Since this tape is relatively inexpensive, don't skimp on it. Start at least ½ to 1 in. on the insulation, loop tape around the connection and continue winding tape neatly around until the splice is completely covered. Plastic tape is also known as electrical tape.



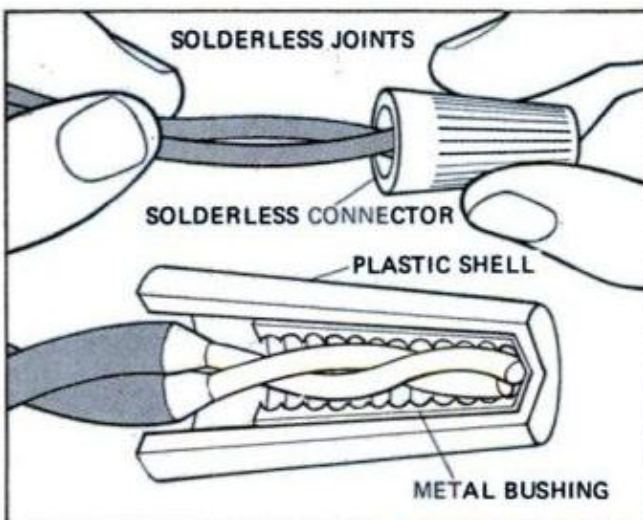
2. Making good connection at screw

The bared wire should be bent to form a loop that will fit tightly under the screwhead. It is important to attach the loop in the direction in which the screw turns as it is tightened. Installed backward, the wire is likely to back out as the screw is turned, resulting in a poor connection with shock-hazard potential. *Good installation hint:* After connecting wires to screw terminals, wrap two turns of electrical tape around the outlet to cover screw-heads completely for added safety.



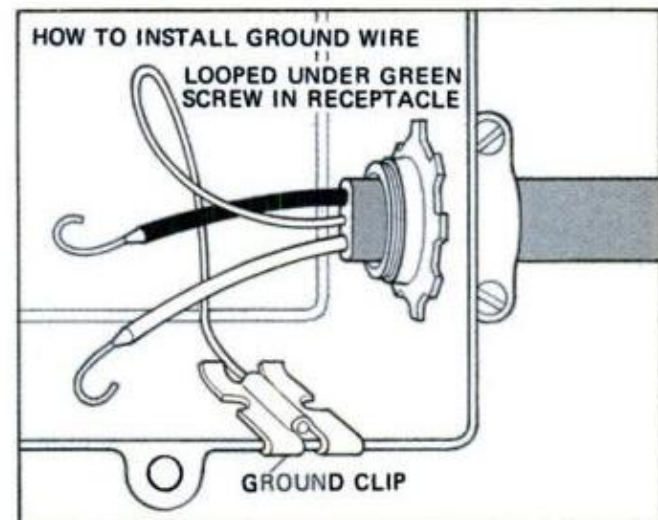
3. Splicing (joining) wire

A permanent connection of two or more wires is called a splice. To make one, remove about 3 in. of insulation from both wires and cross them about 1 in. from the insulation. Then, using your fingers and pliers, make about six to eight turnings to create a neat, tight joint. Joining a wire at right angles to a continuous wire is called a tap splice; use such a connection only if there is no pull on the tapped wire. A splice, done correctly, should be as strong as a continuous wire.



6. Using solderless connectors

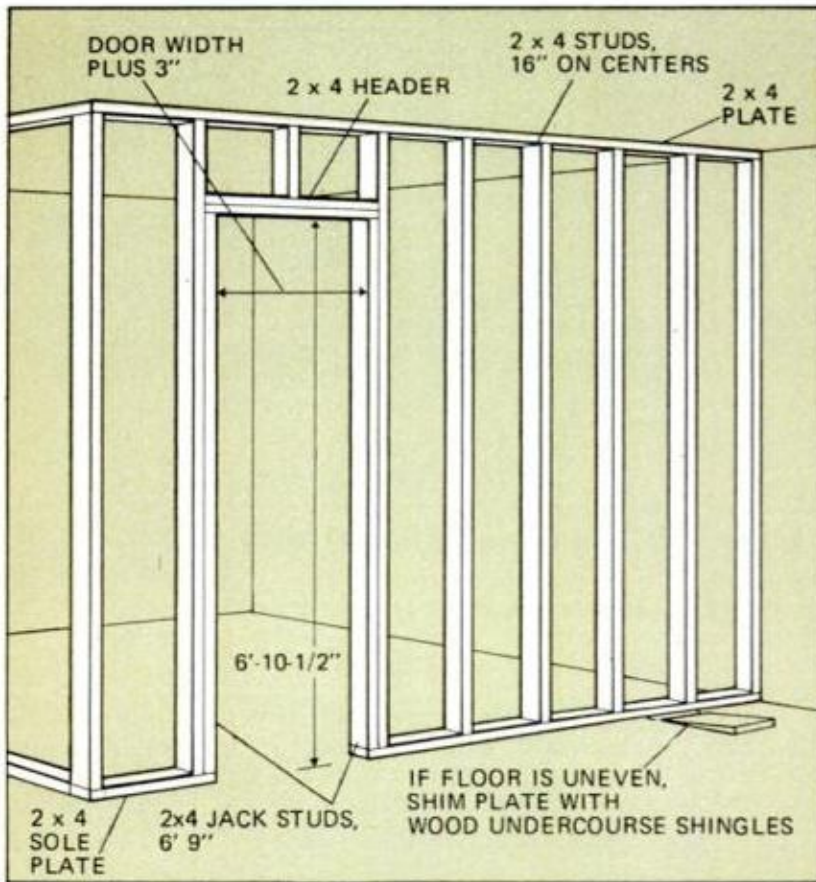
Most do-it-yourselfers today prefer using solderless connectors. These plastic caps—with threaded metal insert—let you do just that. You simply turn the caps onto the wires as shown. For extra safety, when you're sure that a connector is full-on, give a slight tug to make sure it won't slip off when wires are pushed into the box. *Smart tip:* Wrap plastic electrical tape around connector and the wires to prevent any chance that the connector will slip out.



7. Connecting the ground wire

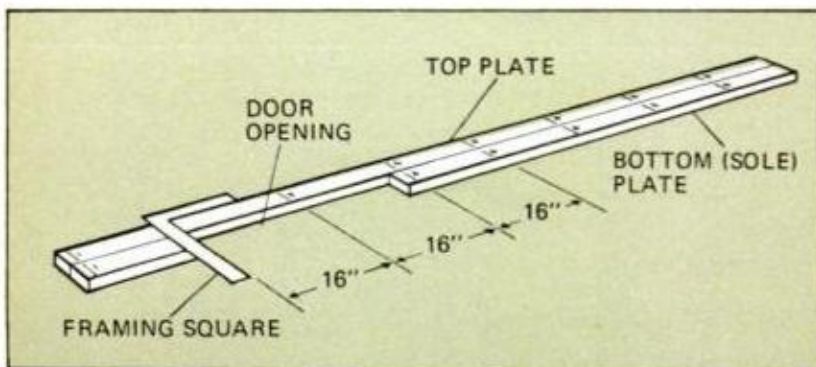
If you are using nonmetallic cable, grounding is required. And, under the NEMA Code effective last January, receptacles must be grounded from green screw to a ground clip mounted on the box. To do it, the ground (bared) wire is looped under the green screw (on receptacle), then pushed through ground clip as shown. Illustration shows a simple installation of ground wire to outlet box to assure a continuous grounded system—reducing shock danger from exposed metal (accidentally livened).

How to frame a basement partition



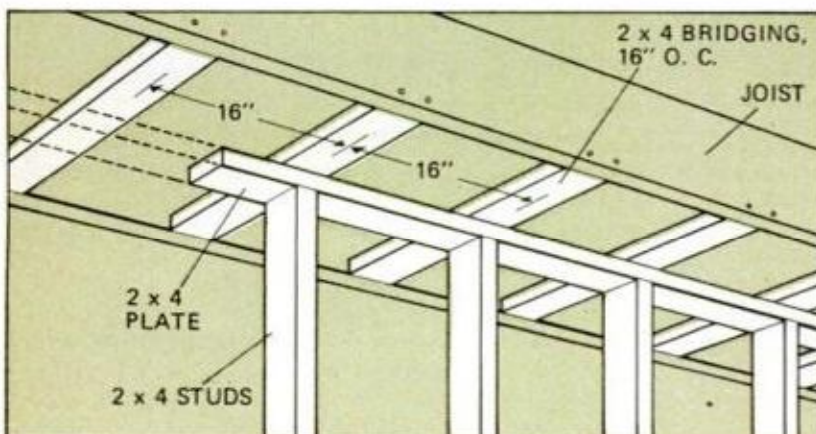
WHETHER you decide to use your basement as a family fun-room or leave the foundation walls bare and lay out the space to provide areas for specific family interests—workshop, sewing center or the like—it's a pretty safe bet that you'll get more efficient use from that room by installing walls.

The basics of such carpentry are shown on these pages. The important point to keep in mind—if this is your first crack at doing it yourself—is to be sure to spend the time that you should in planning and laying out the walls. A typical partition wall (left) is of 2x4 construction, but since these walls are nonload-bearing, you can save a few bucks by using 2x3s. Door opening is standard; you may need a shorter door if ceiling is low. ★★



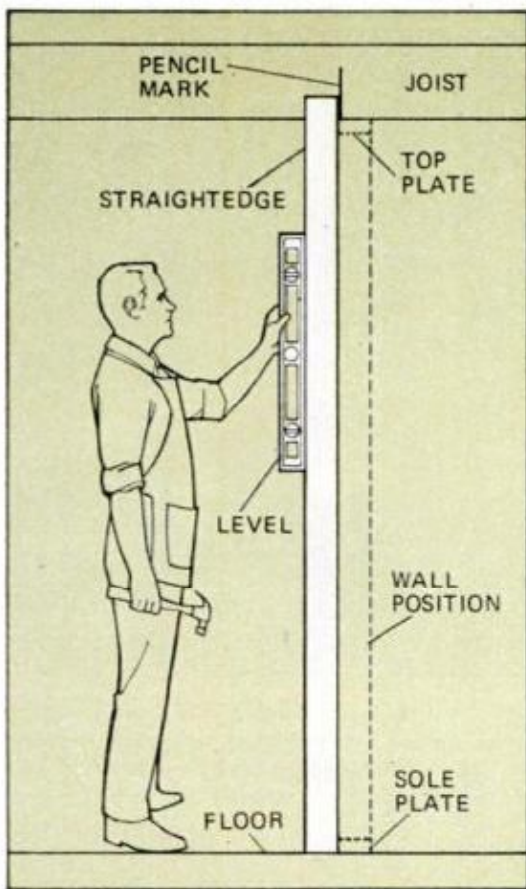
Laying out studs

Partition walls can be erected by using single plates at bottom and top. Use long stock (at least 10-footers) for this chore, making certain that it's free of twist and bow. After cutting the plates to the required length, lay them side by side and mark off the stud locations (16 in. on center). Cut away portions for the door openings on the bottom plates only.



Providing solid nailing

If your partition wall will be parallel with and between joists, you'll have to install nailers (often called cats) between—and flush with bottom of—the joists. The minimum number of nailers should be three in a 10-ft. plate-run—put one near each end and a third at center. (You'll obtain greater wall rigidity if you space nailers 16 in. o.c.) Cut the nailers for a force-fit between joists and install each of them with two 10-penny (10d) common nails spiked through the joists into the ends.

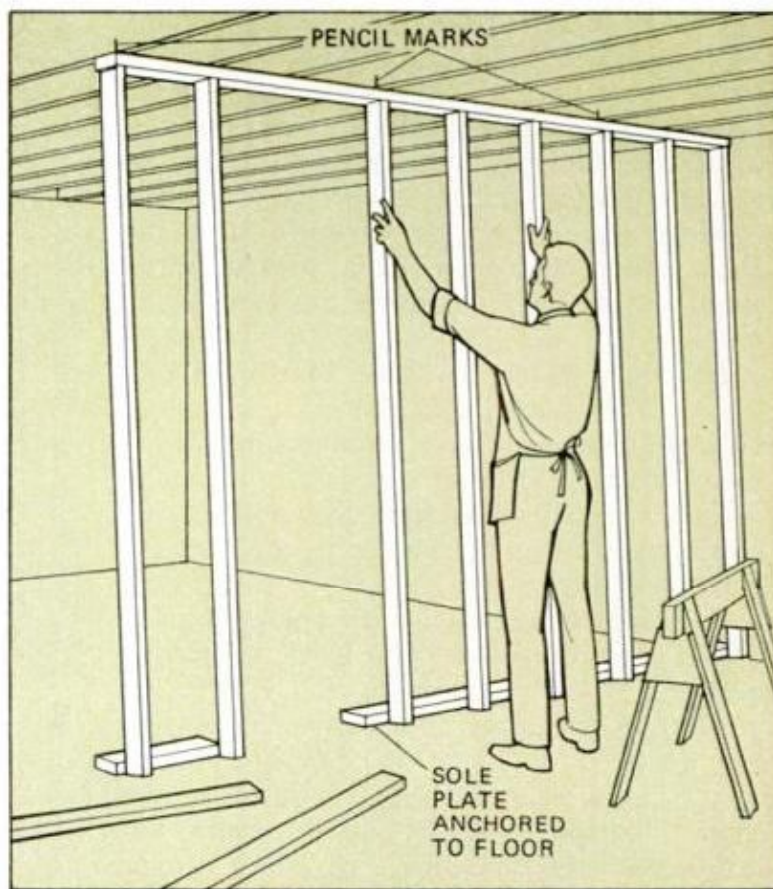


Locating top plate

To set the wall, snap a chalkline on the floor to mark the partition location. Then fasten the bottom plate in position, using either fluted masonry nails (wear safety goggles), lead anchors or masonry pins. To locate the top plate directly over the sole plate, use a straightedge (length of 2x3) and level as shown above. Plumb the straightedge and make several marks on the joists for the top plate at several points along the plate run.

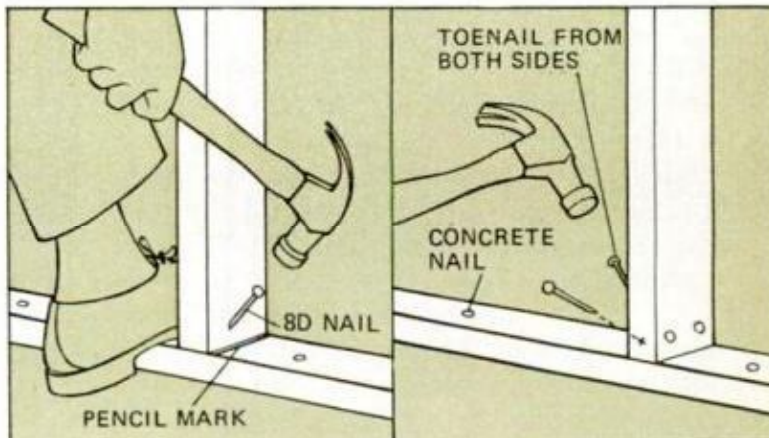
Nailing a stud

To toenail a stud, place the stud on the line on the bottom plate and about an inch or so above the plate, then drive two 8d nails at about a 60° angle. Even though you buck the board (brace it with your shoe) it will move slightly off the line; bring it back to the line by driving a third 8d nail on the opposite side. Finally, to fix the stud, drive in a fourth nail on the face, or narrow, side. Repeat the toenailing at the top if installing the studs individually as mentioned under the heading *Building the wall* in the column at the right.



Building the wall

If your concrete floor is in good shape—that is, relatively level—you can assemble the studs to the top plate on the floor, then tilt the wall up into position as a unit. Check studs with your level (both vertical planes must be plumb) and fasten the top plate to joists with 10d nails spaced 16 in. o.c. But if your floor is not level, fasten the top plate only to those points marked on the joists and cut and install the studs one at a time. Stand on the sole plate to mark a stud for length, then cut the stud full (i.e., leave the line). Such a force-fit bears against the plates for rigidity; when you remove your weight, plate springs up.



How to patch a hole in sheet flooring

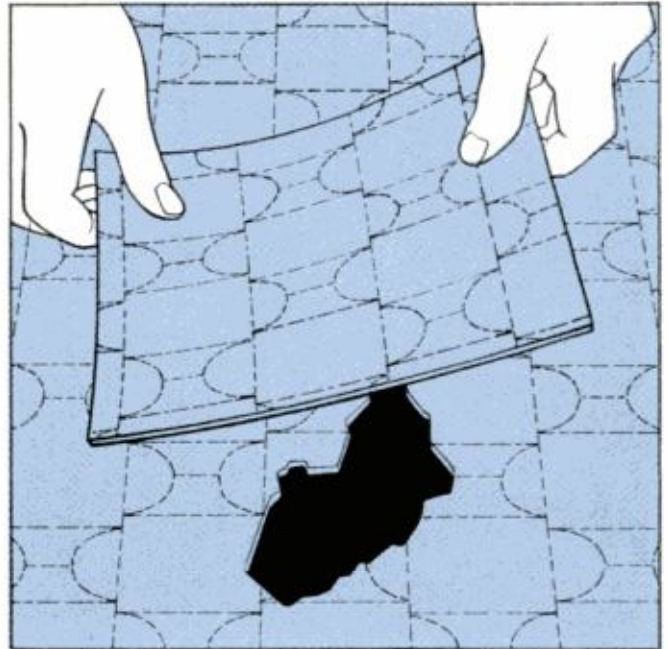
THERE'S AN ADVANTAGE to having a tile floor. When a tile is damaged and must be replaced, there's no need to try making the "patch" invisible—you want it to be seen since it contributes to the overall grid pattern of the floor. Replacing it requires little more than carefully breaking out the bad tile, chiseling away the hardened cement and cementing the new tile in place.

Making a patch in sheet flooring is different. This patch must be as invisible as possible to keep it from standing out like a sore thumb. While it's possible to make such a patch hard to spot, this depends on how carefully and accurately you cut the patch and the recess.

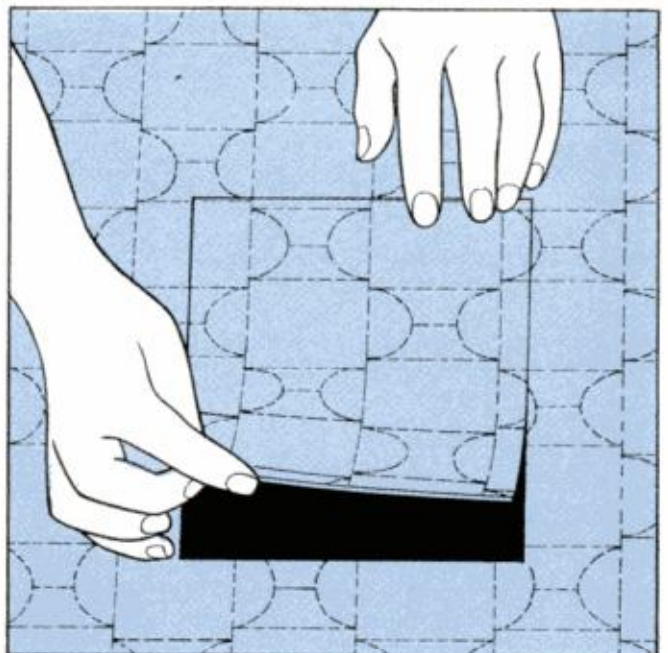
The six steps shown here are similar to those used in marquetry work in which outlines of both the patch and the recess are cut at the same time. Here's how you can do it.

Assuming you can obtain a piece of the same flooring, cut a square somewhat larger than the damaged area. Place it over the worn spot and align the pattern of the patch and the floor precisely. Before it shifts, hold the oversize patch on the floor with masking tape around all four edges. Then, cut through both thicknesses of linoleum. Use a thin-blade knife that's razor sharp and a metal straightedge. Extend the outline of the patch well beyond the damaged section.

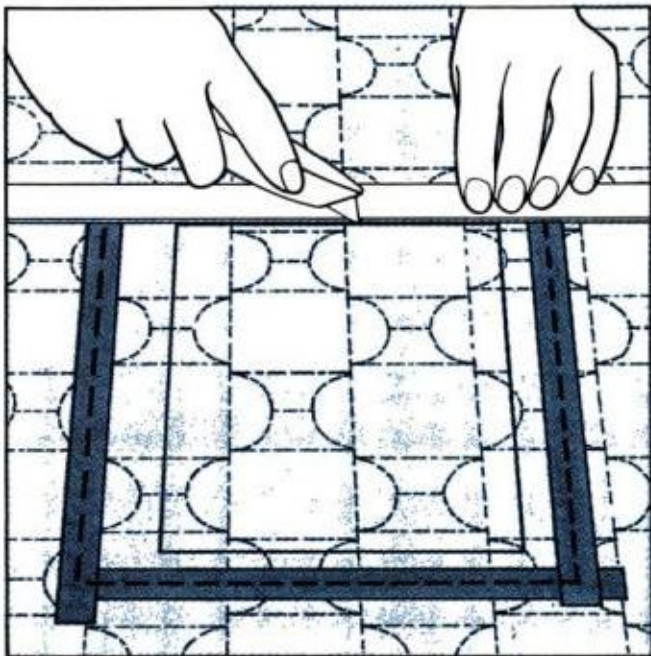
Now peel off the tape and discard the scrap, keeping the square patch. If you find you didn't cut completely through the flooring, retrace the cut with the knife, being careful to stay on the line. Remove the old linoleum within the scored lines, scrape the recess clean of old adhesive, and dust clean. Check that patch fits and that it's flush with the surface. Coat the back of the patch sparingly with linoleum cement. If too much is applied, it will ooze out around the edges. Press patch in place and lay a wax-paper sheet over it. Place a flat board over the paper. Rest a heavy weight on this overnight; then wipe up any cement smears with a damp cloth. ★★★



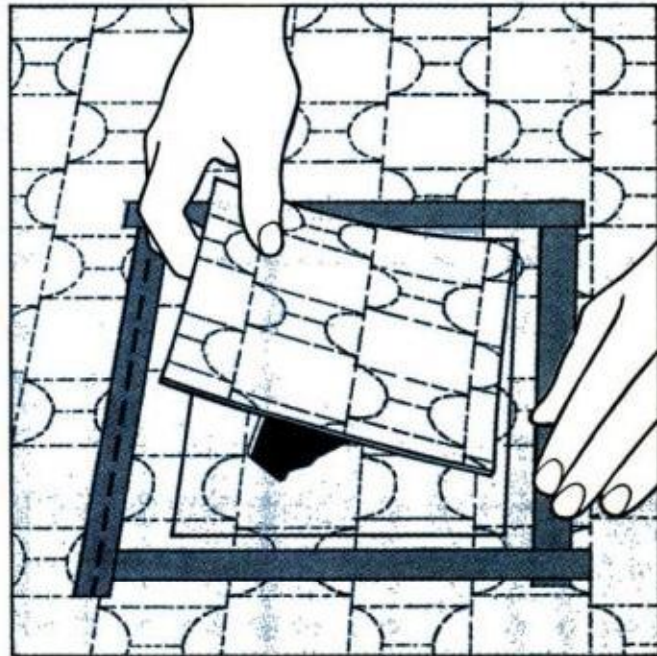
1 OBTAIN A PIECE of identical linoleum and from it cut a square somewhat larger than the damaged area. Then place square over the spot and carefully align the two patterns exactly in both directions



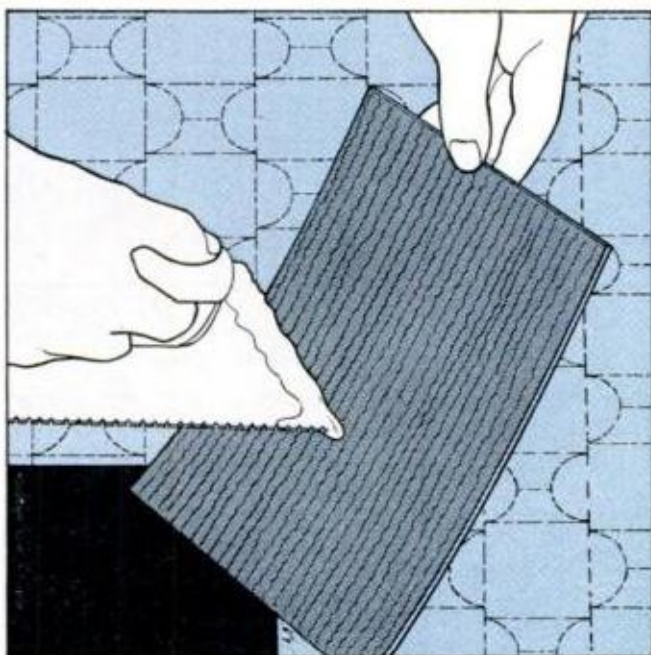
4 IF YOU SCORED LINES CAREFULLY, the patch should fit perfectly. To assure that patch will be level with the surrounding surface, chisel and scrape out any old hardened cement, then brush it clean



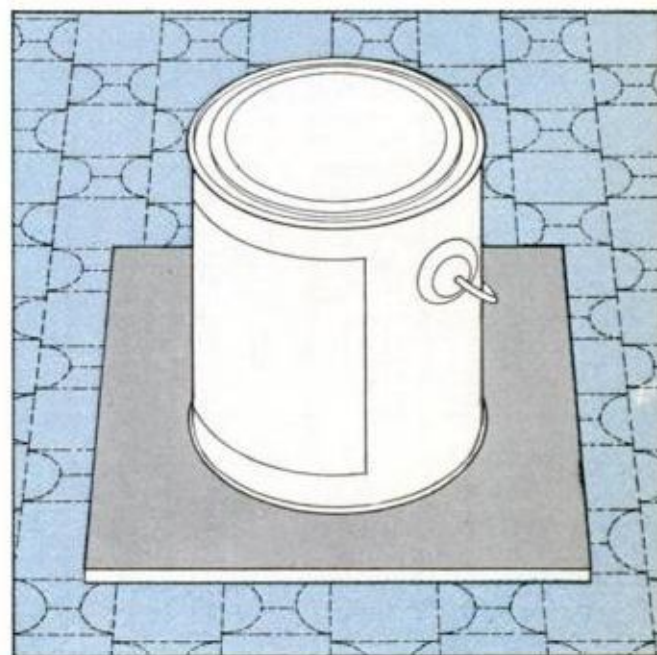
2 WHEN IN POSITION, tape the scrap to floor with strips of masking tape around four edges. Mark a square outline and, with a sharp knife and a straightedge, cut through both thicknesses of linoleum



3 LIFT OUT THE PATCH and peel off the tape. Throw away the leftover scrap. If you find that you didn't cut completely through the second layer, retrace the scored lines with a knife, keeping on the lines



5 APPLY CEMENT SPARINGLY to the back of patch; too much will take longer to dry and continue to ooze out at the joints when you step on patch. Use linoleum cement and apply with a notched trowel



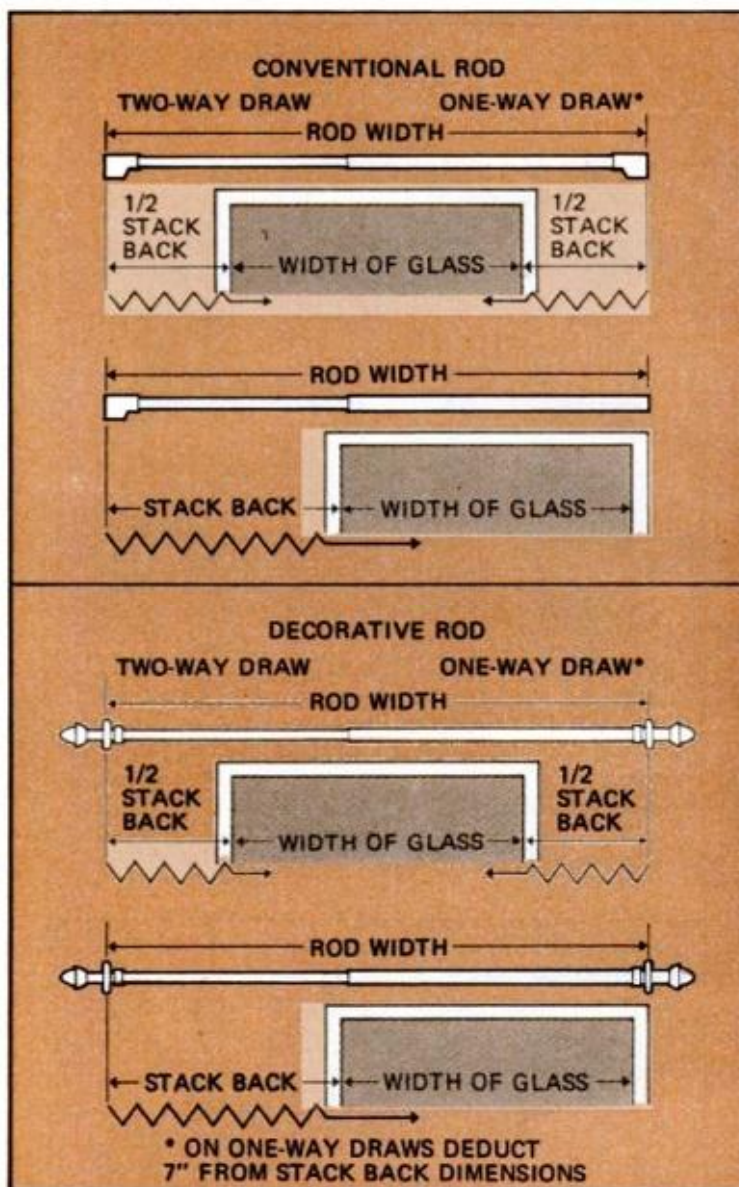
6 PRESS PATCH IN PLACE and keep it flat by weighting it with something heavy. Use board under it to distribute weight evenly. Place wax paper over the patch so board won't stick to the flooring

How to hang drapery traverse rods

PUTTING UP new drapery rods so they stay is a job all homeowners face at times, whether they're moving into a new home or switching over to today's bold, new drapery hardware. Since the popular trend is to stack the draperies back off the glass, you won't always find a stud where you want it. If you do, you're lucky, but chances are you'll be faced with attaching the brackets to a hollow part of the wall. You can't drive plain screws into the plaster; they won't hold. The answer is a Molly fastener which is designed to hold anything securely to a wall when you are unable to drive a screw into a stud.

Plan to place brackets for the rods above the casing, or at least 4 in. above the glass and an equal distance from the ceiling. ★★★

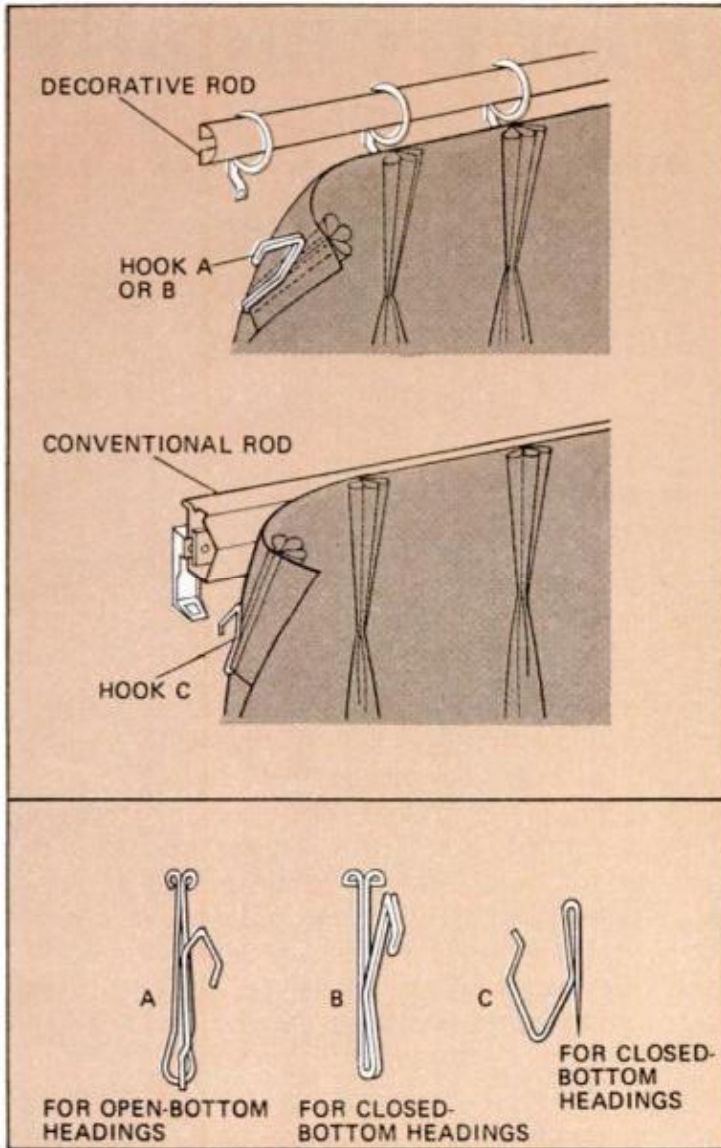
GLASS WIDTH	STACKBACK SPACE	ROD WIDTH
20"	20"	40"
26"	22"	48"
32"	24"	56"
38"	26"	64"
44"	28"	72"
50"	30"	80"
56"	32"	88"
62"	34"	96"
68"	36"	104"
75"	37"	112"
81"	39"	120"
87"	41"	128"
94"	42"	136"
100"	44"	144"
106"	46"	152"
112"	48"	160"
119"	49"	168"



DATA FROM KIRSCH CO.

How to find the right rod length

With a draw treatment, it's best to have the draperies stack back over the window frame and wall, uncovering all the glass. To do this, you must know the amount of wall space needed for the open panels before buying and installing the traverse rods. Use the chart at the left to find the correct rod length. Begin by measuring the glass width of your window. Say it's 38 inches wide. The chart shows you'll need 26 in. of wall for stack-back. So you add 38 and 26 in. and you'll see that you need a rod 64 in. long. The drawings above illustrate where the stack-back will be located. Stack-back is the amount of space occupied by open draw draperies. Space will vary depending on panel width, pleat spacing and fabric bulk. Since windows have two sides, you divide the stack-back distance in half (in this case 13 in.) to see how far the rod should extend on wall, beyond the glass. If using one-way draw draperies, add the full 26 in. to one side.



Selecting proper drapery hooks

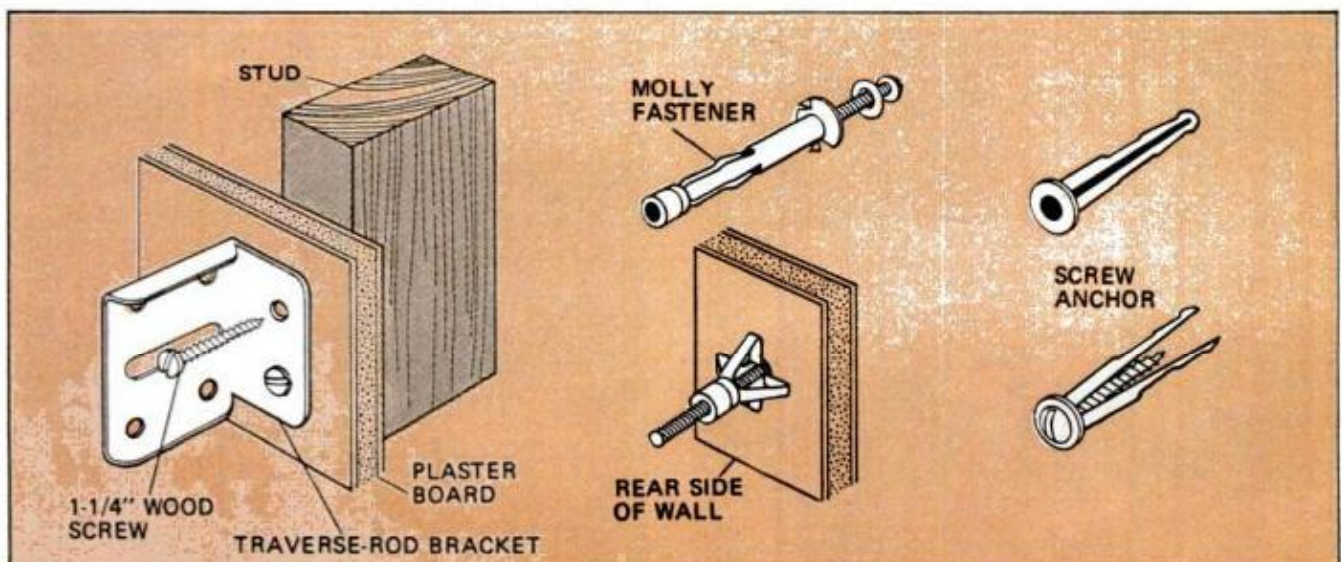
The right drapery hooks can mean the difference between tip-tilt headings and those that stand properly erect. Always important, your choice of hooks is vital to the proper appearance of draperies hung on decorative traverse rods. At each window you will need one hook for each drapery pleat, plus four for returns and overlaps.

On a decorative rod, the heading covers the pendants and falls just below the bottom of the rings. On a conventional rod, the heading extends to cover the rod. Thus hooks for conventional rods must be longer from the top of the hook to the top of the shank than hooks used for decorative rods.

Ways to anchor brackets securely

Correct fastening devices are a "must" for proper installation of drapery hardware. Wood screws 1 1/4 in. long threaded the full length of the shanks are suitable for attaching brackets to studs. If wood studs can't be located or bracket location falls between studs, Mollies (hollow-wall anchors) should be used as shown below. They are inserted in holes drilled through plaster or dry wall, tapped flush with the surface to embed the points and finally pulled up tight on the back by turning the screw that comes with the anchor.

When mounting lightweight drapery rods on the wall, you can use plastic screw anchors. These tapered sleeve-type plugs are tapped in place in undersize holes drilled through the plaster. When a full-thread wood screw is turned into the plug, it spreads the split plastic sleeve and anchors it securely in place.





A 'dust-free' home electronically

Attached to your furnace, an electronic air cleaner will collect 200 times more dust than a fiberglass filter.

By **WAYNE C. LECKEY**,
Home and Shop Editor

Photos by Robert D. Borst

IF YOU THOUGHT you had trapped a lot of dust and dirt the last time you cleaned your fiberglass furnace filter, you'd be surprised at the number of minute particles which passed right through.

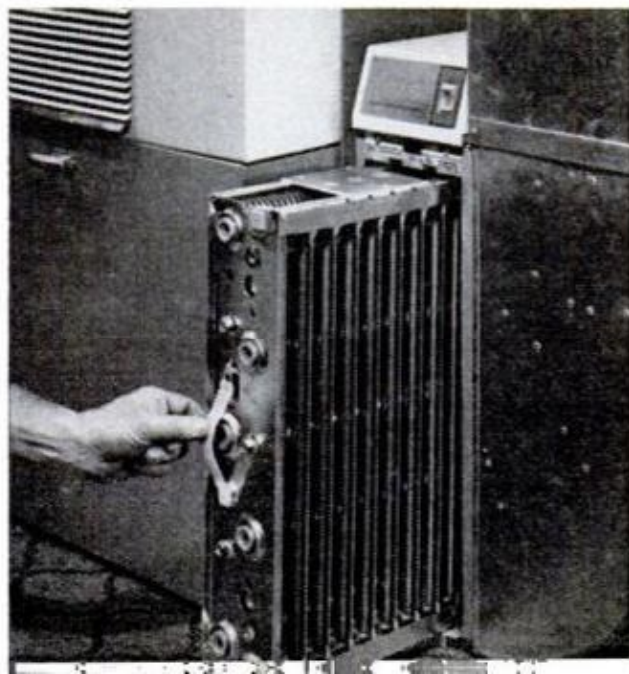
But you shouldn't blame the filter; it's simply impossible for a mechanical-type filter in a forced-air furnace to trap more dust than it does. Only when airborne dust has to pass through the ionizing section of an electronic cell can you hope to

trap and collect the millions of microscopic particles which normally escape back into your house—and lungs.

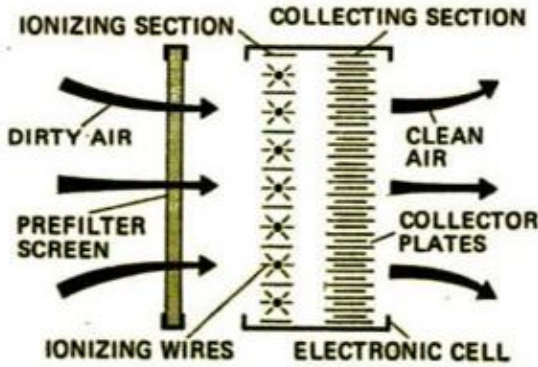
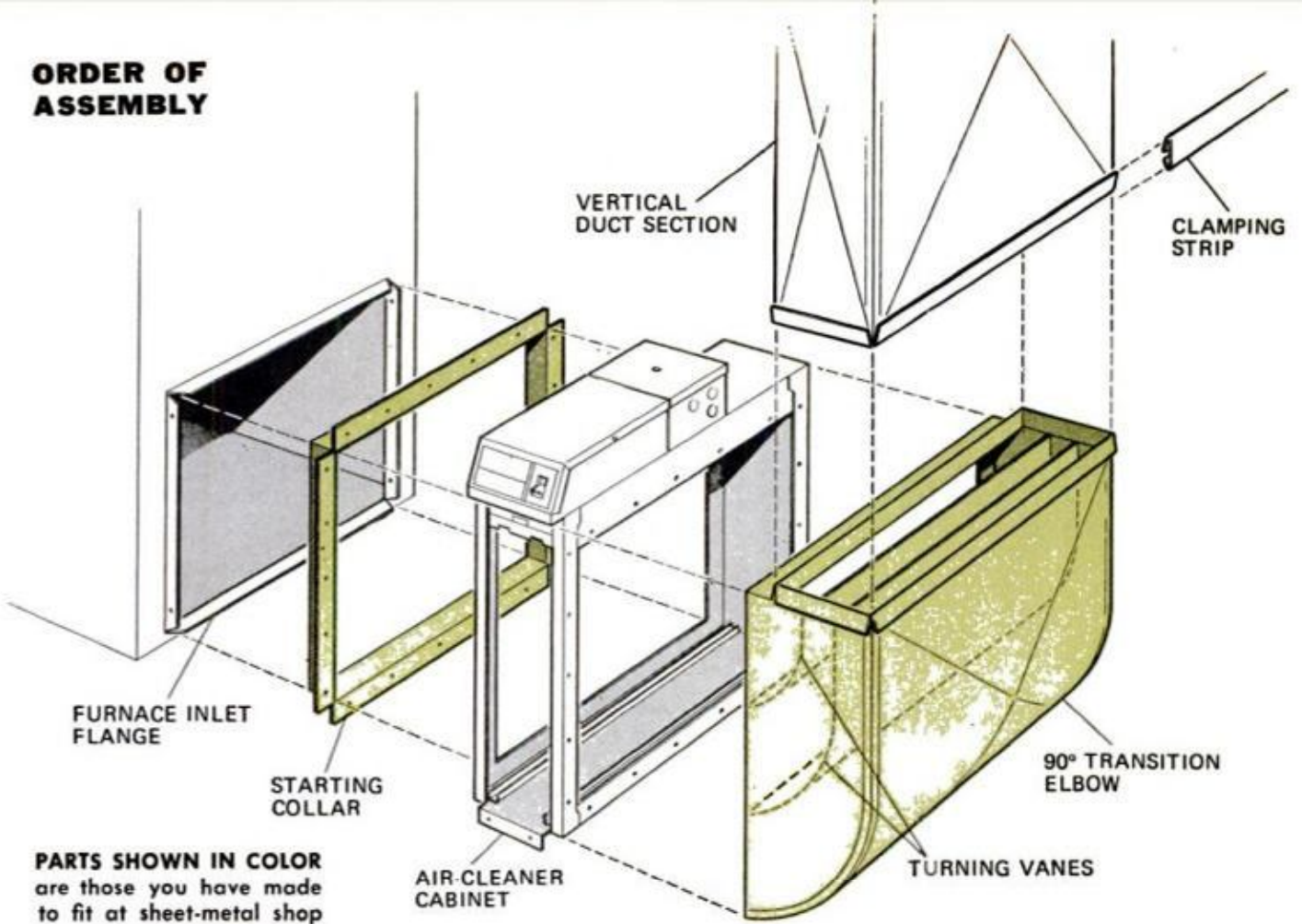
Truly an indoor pollution fighter, an electronic air cleaner takes on the job of removing tiny airborne pollution particles such as dirt, soot, pollen and smoke from the air in your home every time the furnace blower turns on. With these microscopic particles caught, your home and everything in it is bound to stay

CELLS ARE ACCESSIBLE through door at front. Opening of door automatically shorts-out the high voltage

ELECTRONIC CELLS pull out like drawers for periodic washing. Straps provide flat "suitcase" handles



ORDER OF ASSEMBLY

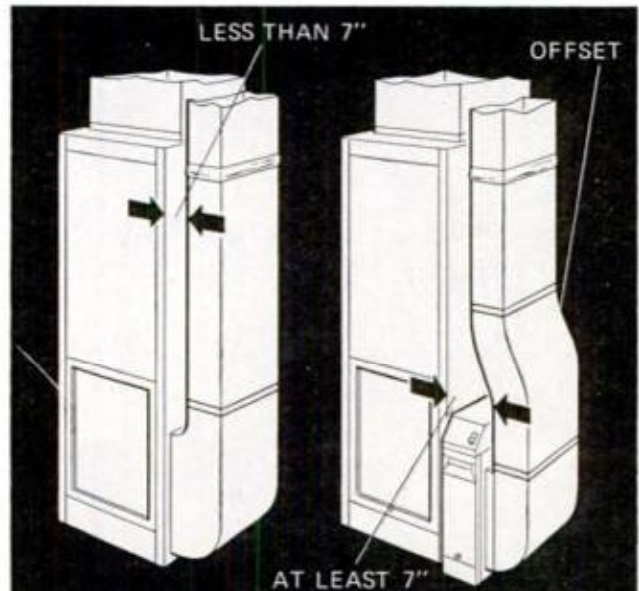
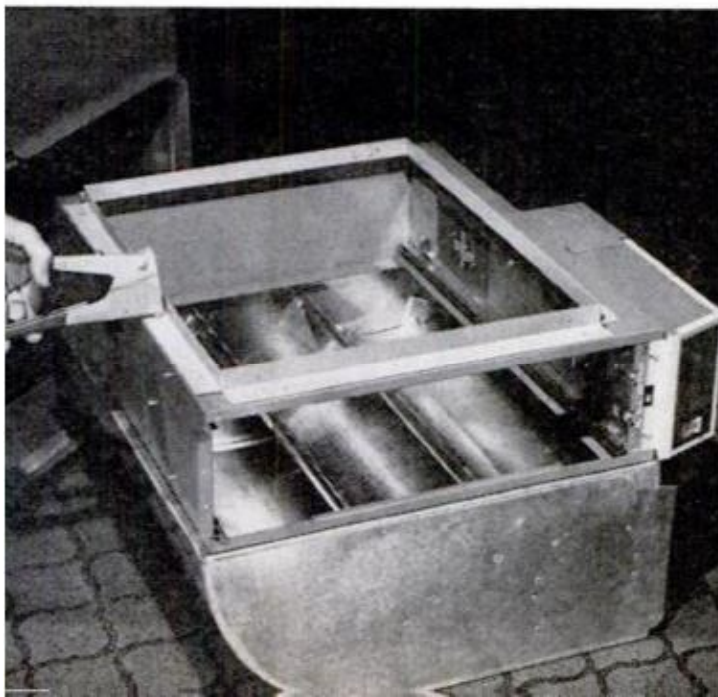


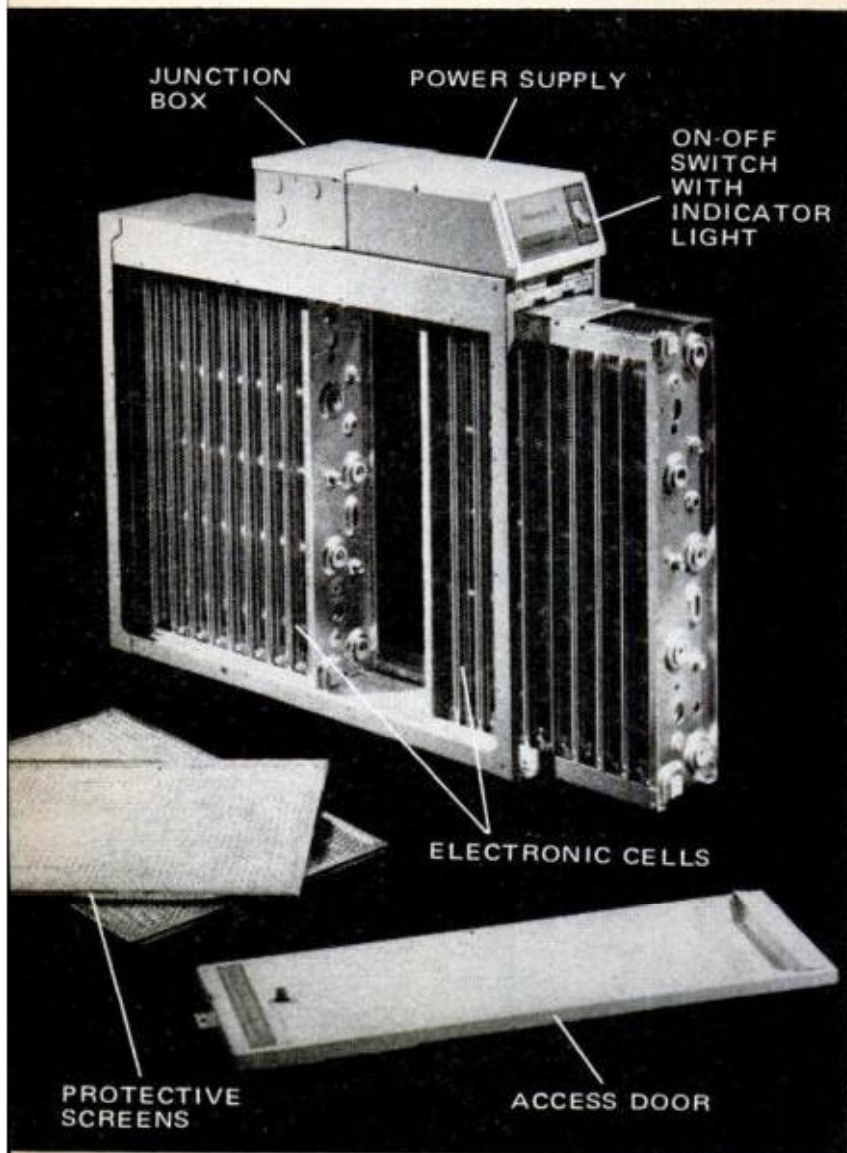
cleaner longer, and you'll be breathing clean, pollen-free air. According to the manufacturer, Honeywell's electronic air cleaner will remove up to 95 percent of airborne dirt and 99 percent of the pollen from the air that is circulated through it, making the cleaner about 20 times more efficient than a mechanical filter.

Here's how it works: The principle is called "electrostatic precipitation." Airborne dust that is carried to the electronic

POP RIVETS ARE USED to attach collar to one side of cleaner cabinet, transition elbow to other side

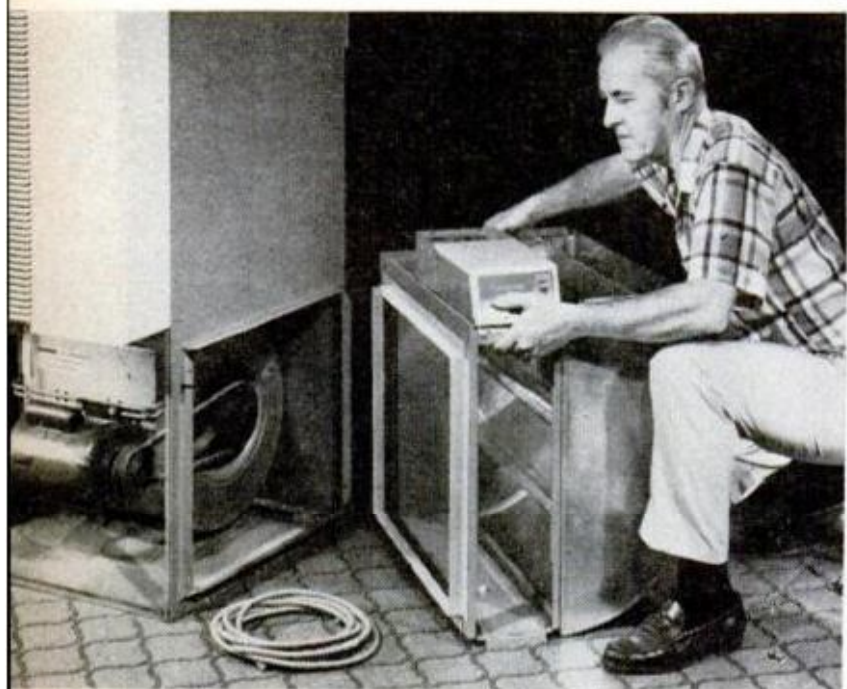
CLEANER REQUIRES 7-IN. SPACE between furnace and vertical duct. If less, an offset section is used





AIR CLEANER includes two electronic cells, high-voltage power supply, junction box, two screens, access door

COLLAR-CLEANER-ELBOW assembly is attached to side of blower compartment with screws through its inlet flange



cleaner and furnace through the return air registers and ducts of your heating and cooling system, first passes through a prefiltering screen which traps the larger particles such as lint, feathers and animal hair. Particles such as smoke and pollen, too small to be stopped by the porous screen, pass on to an ionizing section where they receive an intensive positive electrical charge. The charge makes them cling to a series of oppositely charged electrical plates in much the same way iron filings are attracted by a magnet. Here they collect and remain until the two drawer-like cells are removed and the dirt is washed off in an automatic dishwasher or laundry tub. The cleaned and filtered air, of course, passes on to the blower compartment of your furnace before being recirculated through the house.

Since the air cleaner "runs" when the blower runs, it costs no more to operate than a 50-w. light bulb. An indicator light tells you when the cleaner is operating properly, and as an additional check of the cleaner's performance, a test button is provided at the bottom of the access door. Pushing the button discharges the collecting section of the cell momentarily and produces snapping or arcing sounds. The sounds indicate that the cleaner is working as it should.

You have a choice of a manual-wash unit or a more sophisticated (and expensive) automatic-wash model, in 16x25 in. and 20x25-in. sizes. The smaller units are suitable for forced-air systems with capabilities up to 1400 cubic feet per minute (c.f.m.), representing 3½ tons of cooling; the larger ones are applicable to systems up to 2000 c.f.m.

The air cleaner is adaptable to all forced-air furnace and cooling systems, and adding it to an existing installation is a fairly simple job. Its best location is in the return-air duct right where it enters the blower compartment. To provide an even distribution of airflow across the electronic cells, the existing right-angle elbow in the duct must be re-

(Please turn to page 207)

HINTS FROM READERS

Better break for your sander

If the abrasive paper on your orbital sander has a tendency to break at the ends long before the grit is worn out, try this stunt. Before installing the sandpaper, place two strips of masking tape across the paper at the ends as shown. The tape will strengthen the paper at the points where it normally tears.

—Karl R. Timm, Jacksonville, Fla.

Loose-leaf ring revisited

I've seen several good uses for loose-leaf rings in *Hints from Readers* but not the use that I have for them. I use such a ring to keep my box-end wrenches together and in sequence, as well as keeping metrics from mixing with U.S. sizes. If possible, keep metrics on one ring, U.S. wrenches on a second.

—Gil Longwell, Hagerstown, Md.

Washers save tearing of webbing

When renewing the plastic webbing on folding lawn and patio chairs, you can increase the holding power of the cup screws if you place washers over the holes in the folded ends and insert the screws through them. The washers help prevent raveling and tearing of the webbing at the holes when undue strain is applied.

—J. Carpenter, Williamstown, N.J.

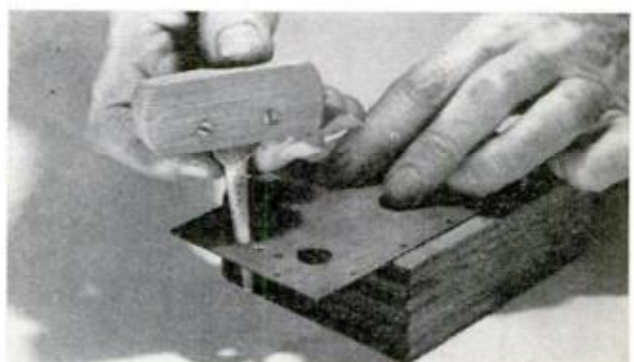
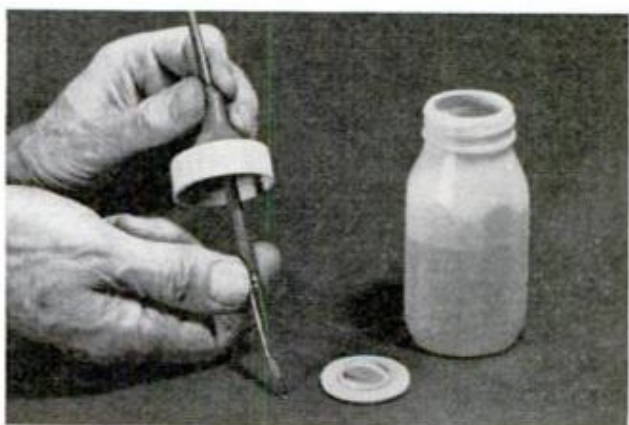
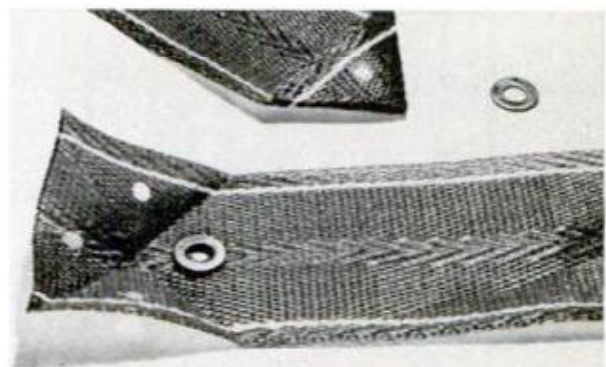
New use for old baby bottles

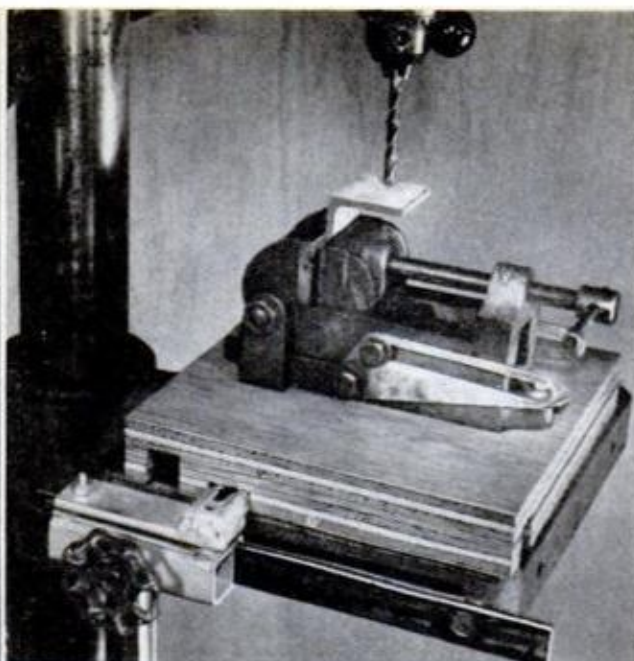
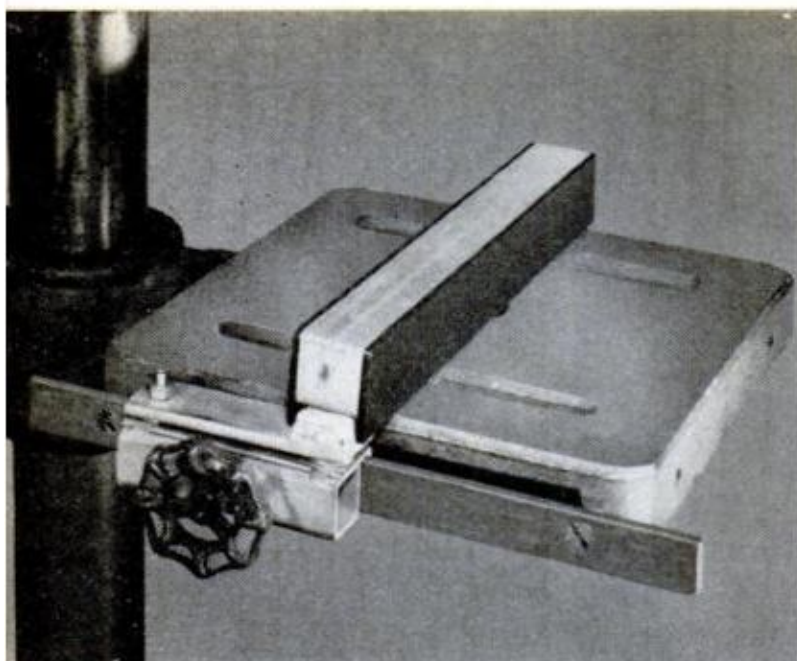
Old nursing bottles make ideal glue or paint-applicator bottles. Simply insert the handle of a small modelmaker's brush through the hole in the nipple until the brush hangs 2 in. below the rim. The nipple provides an airtight seal around the brush, yet allows the brush to be pushed deeper into the bottle as glue level descends.—William Butler, Liverpool, N.Y.

A job for file tangs

A file tang can be used to enlarge holes in sheet metal if it's hardened first. Break off the flat file, heat the tang to cherry red, plunge it into cold water, then clamp it in a wooden slot, as shown. (A round file can be shortened and used in a regular file handle.) For best results, grind the tang's edges sharp.

—Peter Legon, Malden, Mass.





TO USE VISE HOLDER ON DRILL PRESS, the high fence is removed and holder is hooked over the low fence

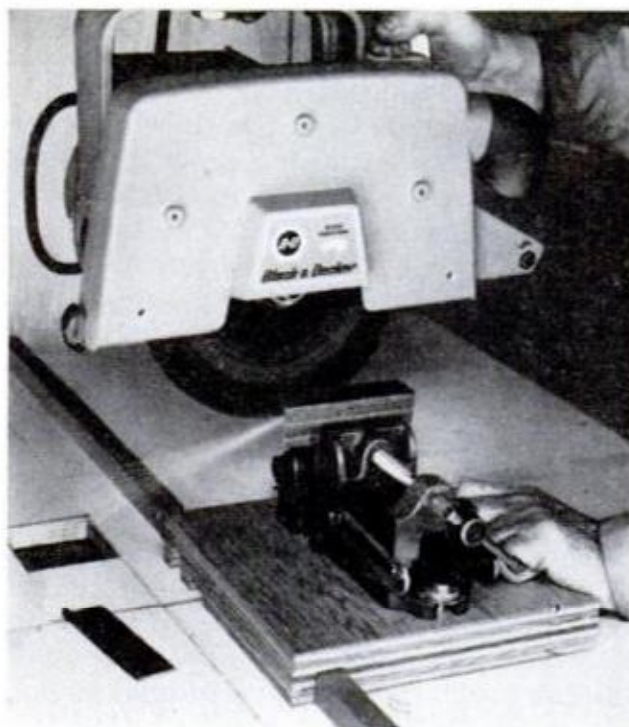
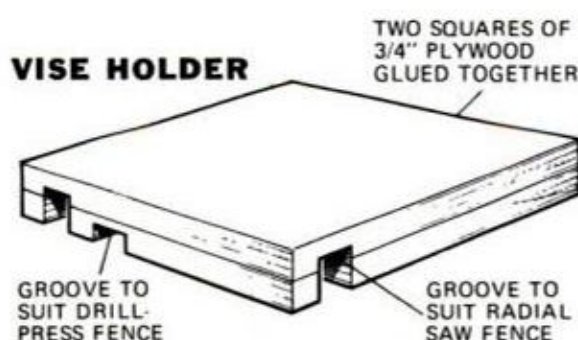
Double-duty drill-press fence

By WILLIAM G. WAGGONER

HIGHLY VERSATILE is this drill-press fence that can be quickly removed and replaced with a handy vise holder you can use on your drill press and radial saw. As a drill-press fixture, it provides a high and low fence that is movable across the full depth of the table. When an extra guide bar is added to your bandsaw table, the same fence can be used for ripping and resawing.

The vise holder consists of two squares of $\frac{3}{4}$ -in. plywood, glued together and dadoed on the underside with deep and shallow grooves. The deep grooves permit the holder to straddle and slide along the fence of a radial saw when metalwork is to be cut off or slotted with an abrasive wheel. The shallow groove lets the holder hook over the low drill-press fence and stay put without clamping. The high fence will be handy for drilling straight rows of holes, routing and precision tapping.

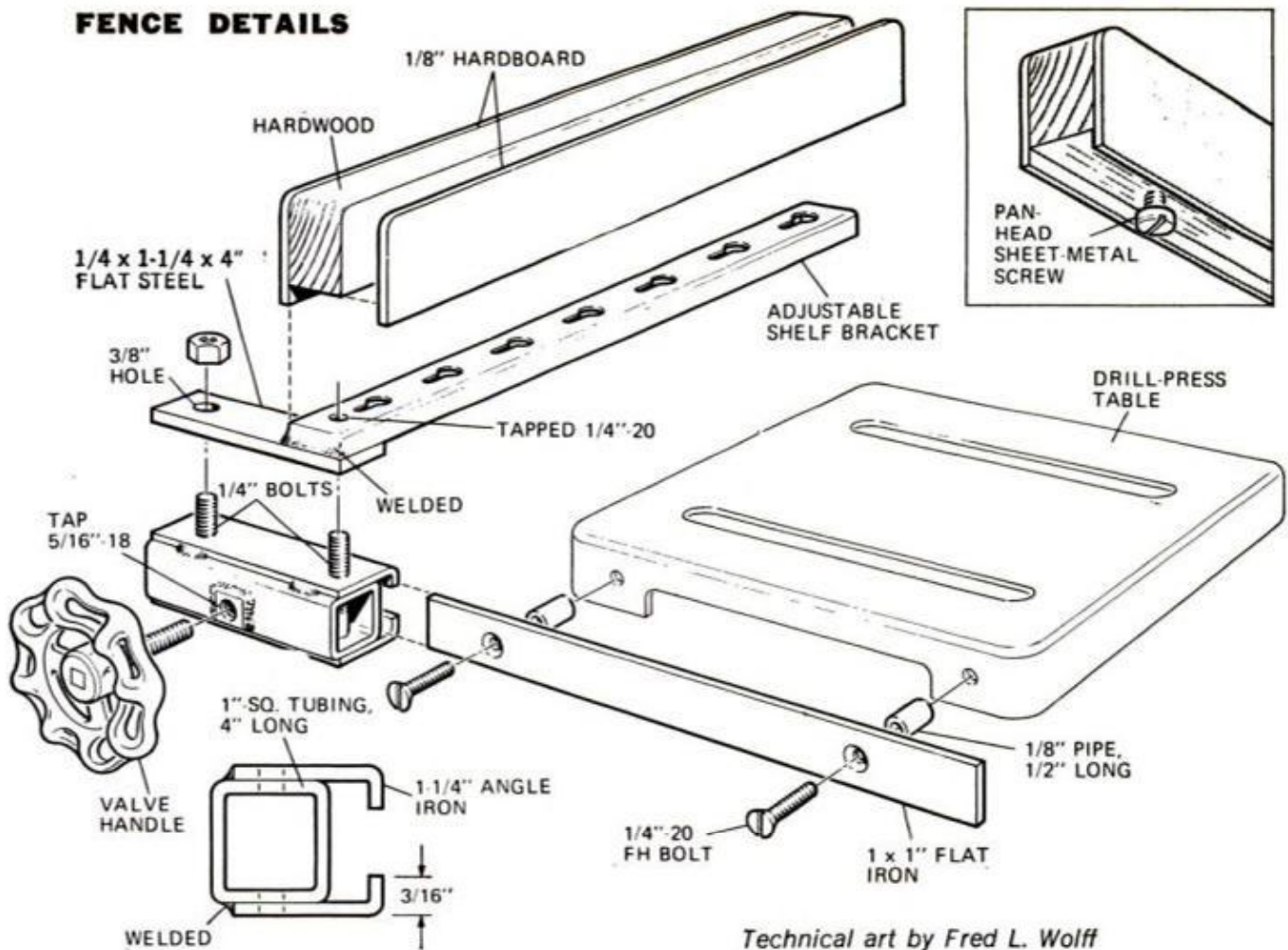
The guide bar on which the fence travels is a $\frac{1}{4}$ x 1-in. length of flat steel and is attached to the left edge of the drill-press table with two $\frac{1}{4}$ -20 fh bolts turned into tapped holes. Sections of $\frac{1}{8}$ -in. pipe hold the bar $\frac{1}{2}$ in. out from the table. It's best to wait and spot the tapped holes after the fence is made so it will lie flat on the drill-press table. The oversize



RIGHT-ANGLE GROOVES in vise holder let you hook it over a radial-saw fence two ways for cutoff work

POPULAR MECHANICS

FENCE DETAILS



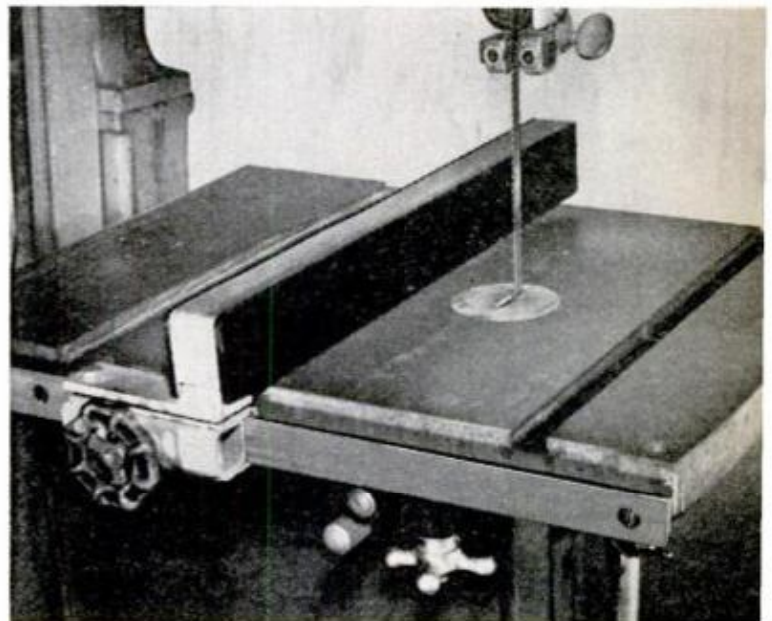
(3/8-in.) hole permits the fence to be squared up with the table.

The low fence is a length of shelf standard welded to a 1/4 x 1 1/4 x 4-in. piece of flat steel. It is drilled for two 1/4-in. bolts, one hole being tapped. The high fence is made by sandwiching a pine or hardwood member between two pieces of 1/8-in. hardboard. The hardboard facings extend below the hardwood core to create a groove along the bottom so the high fence will fit over the low fence. Pan-head, sheet-metal screws in the bottom edge of the high fence lock it firmly to the keyhole slots in the low fence and permit it to be removed quickly.

The clamping fixture is made from a 4-in. section of 1-in.-sq. tubing and has two sections of 1 1/4-in. angle iron welded to it. One leg of each angle is cut back to 3/16 in. to provide a lip, top and bottom, to hook over and ride along the guide bar.

Welding of the angle iron to the square tubing is done by drilling holes through angle iron, touching the torch through the holes and grinding the welds flush. If you use a C-clamp to hold the angle-iron

pieces in place, and insert the guide bar before welding, you'll have an accurately fitting fixture. When a handle from a valve is used for a tightening knob, hack-saw the head from a bolt, file the end to fit the square hole in the valve handle and spot-weld it. ★★★



WITH EXTRA GUIDE BAR ADDED to bandsaw table, the drill-press fence is interchangeable for ripping

HINTS

FROM READERS



No-cost lamp shade

A practical shade/reflector for a bare bulb can be assembled by slipping a foil pie plate over the socket on your drop cord. To be safe, first wrap several turns of electrical tape around the socket.—*Ken Patterson, Regina, Sask.*



No-tangle cord storage

Long extension cords, such as those used for yard tools, can be conveniently stored by wrapping around a length of $\frac{3}{4}$ -in. board. Cut slots at ends for male and female plugs, and for hanging.—*John F. Dinges, Homewood, Ill.*



For driftless drilling

Next time you have to drill a hole on a vertical surface, and want to do it without having to make a punch mark to prevent bit-drift, just notch a rubber plate-scraper to serve as a holder.—*William Swallow, Brooklyn.*

A better way to plant fenceposts rigidly

When you're setting fenceposts, simply tamping the backfilled earth is often insufficient to keep posts plumb. I've found that by dampening and mixing the backfill with about one part Portland cement to five parts soil, posts are kept almost as

rigid as in concrete. Mix on the ground with a shovel. Add enough water to make the mix form a tight ball when squeezed, but without leaving water on your fingers. After placing, tamp backfill with a 2x4. —*Richard Day, Palomar Mountain, Calif.*

NEXT MONTH IN SHOP AND CRAFTS

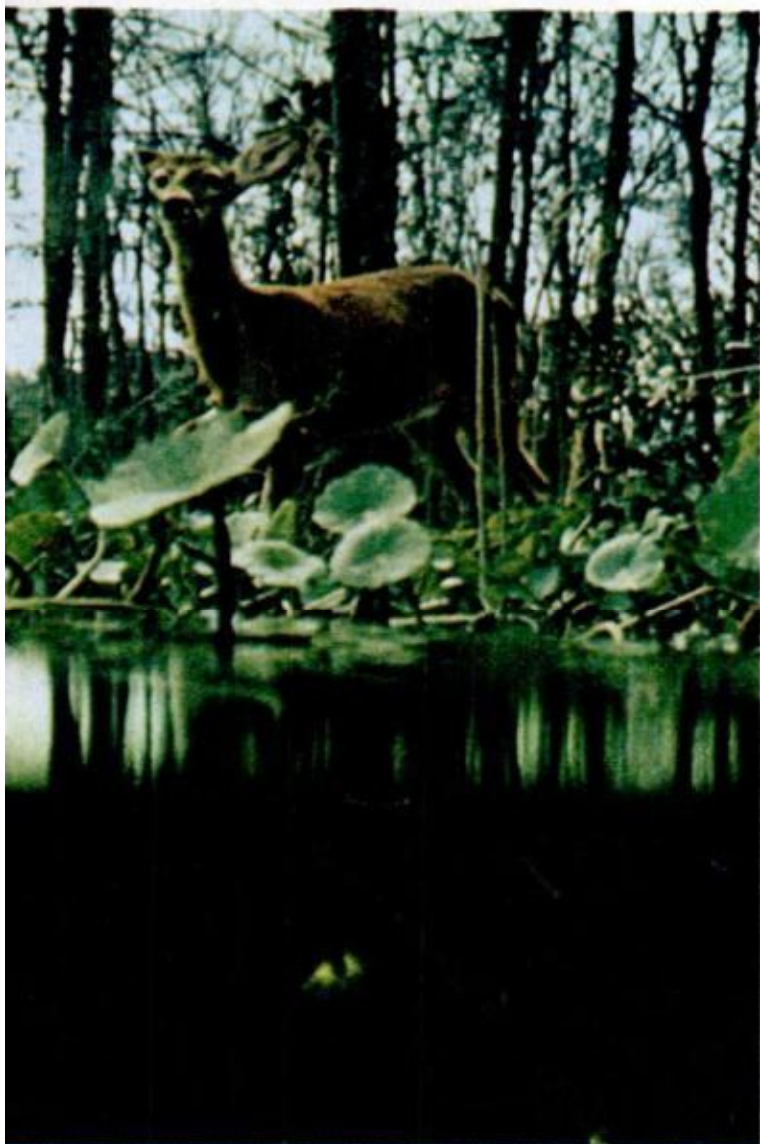
HOME IDEAS GUIDE. Forty pages of attractive, sensible home-improvement and modernization ideas from the people who have the know-how. You'll see many exciting new products that are available now for upgrading your home, plus basement family rooms with ideas galore, exterior remodeling work that will let you do away with that "tract house look," the latest concept in home heating, how to make light fixtures for the kitchen, and much more. It's an exciting issue you can't afford to miss.

HOW TO BUILD A SOIL CONDITIONER. Gardening buffs are sure to want one of these easy-to-build soil tumblers. Constructed of two-by stock and $\frac{3}{4}$ -in. plywood, it can be made on Saturday, used on Sunday.

MAKE THIS HANDY STAND FOR YOUR ORBITAL SANDER. Ordinarily, small parts are just about impossible to sand because you can't get a good finger grip on the workpiece. Build this little bench stand and you're sure to get more from your sander.

PLUS: A sofa from a solid-core door, a self-lubricating oilstone, an easy-to-assemble clock kit, and more.

If this is what you remember best after spending the weekend in the country, your camper was probably built with Starcraftsmanship.



Before you buy a camper, think what you're buying it for.

To see the sunset on the ground instead of on your neighbor's garage.

To show your kids that all wild animals don't live in zoos.

Whatever reason you come up with, one thing is clear. You don't buy a camper for the camper. You buy it for the trip.

At Starcraft we never forget that fact.

That's why we build campers that call more attention to your trip than they do to themselves.

It takes Starcraftsmanship.

Starcraftsmanship is our standard of excellence.

Coming up to that standard has meant

developing the leading research and design center in the industry.

We've designed the telescopic lifter system. So you can spend five minutes setting up camp and a day enjoying it. Not the other way around.

We designed the 35" high kitchen sink so when the sun sets you can watch it without an aching back that you got bending over the supper dishes.

We've designed a lot of features.

But more than our features and the quality materials we build them out of, we put value in craftsmanship.

When we measure a camper for a cabinet, we measure it accurately.

We treat the floors before we lay the linoleum so it won't buckle or deteriorate. We make $\frac{3}{16}$ " holes for $\frac{3}{16}$ " screws. And then we don't forget to screw in the screw after we made the hole.

In short, we build campers that don't end up rattling and jerking like a mass-produced accumulation of nuts, bolts, and metal.

Maybe that's why more people buy Starcraft campers than any other kind.

Think of it this way. If the moment that deer stepped out of the woods you reached for the camper door and the door handle came off in your hand. Which would you remember? The door handle? Or the deer?

Write to us for information about the Galaxy 6 and 8, or any of our 10 camper models and the name of your nearest dealer. Dept. G36-3 Starcraft Company, Goshen, Indiana 46526



The more you live with it, the more you appreciate it.



STARCRAFT

The more you live with it, the more you appreciate it.

By **BILL McKEOWN**, RV Editor

OUTDOORS this year, motor campers will head for highway horizons in a bigger selection of vacation homes that drive and tow. More height, length and even width are being added to larger models. Small ones feature less set-up time and fewer self-containment complications. Trailer trends favor big fifth wheelers, while smaller models of the booming motor homes chop the back off vans and add on all the comforts of a very compact apartment. This year, expect typical inside features to include running water



PICKUP CAMPER BODIES, like Swinger's new 11-foot Sky Lounge with front and rear cab-over windows, are improving livability

Standard travel trailers still sell most, but chopped vans, fifth wheels, motor homes and assorted mini models are growing fastest in popularity now.

New rigs



QUICK SETUP TIME figures less than 60 seconds for the Coleman Minuteman, a tent-camper-type model that hinges from low-tow profile to seven-foot headroom. Under \$700

FIFTH-WHEEL TRAILERS, with the cargo-bed hitch accounting for that fifth, have jumped from three builders three years ago to nearly 100. As in El Dorado below, size is feature



for roll-along recreation



MOTOR HOMES are looking less like moving vans. Seven-sleeper Xplorer, above, has streamlined look



COMPACT II, 13-footer from Hunter Structures, Dallas, pops top for camping, lowers to garage

SLEEPING FOR FOUR is claim of 13½-foot Love Bug with light hitch load for easy small-car towing





OBSERVER is new penthouse motor home from Harvest RVs, South El Monte, Calif. Unit is recommended for spectator sports or for use as a rally control center



system and a galley, wiring to add outside current, options at least for a toilet, and any number of heating, cooling, refrigerating, cooking and lighting appliances as rig size increases. Outside, the new RV may offer more color choice, better streamlining and construction to meet stricter industry standards.

RIDING HIGH, the driver of Shasta's new Motorhome looks out over traffic. Features include aluminum skin and frame, steel roll bars and rubber body mounts

As in other fields, standards are becoming important in this growing industry; a shopper looking at new RVs should first be sure the units have the oval Recreational Vehicle Institute seal certifying that the manufacturer has complied with electrical, plumbing and heating codes.



Electric outlets, for example, must be conveniently and safely located, with wiring leading to properly grounded UL-approved panelboards. Size of water supply piping is specified, drain fixtures must be individually trapped, fresh-water tanks need to be of tested and approved types, and holding tank drain outlets are required to be accessible and have enough clearance to allow a simple drain-hose connection. Stoves and heaters must be of approved types, installed and vented so they aren't near flammable materials and curtains. LP-gas piping and joints cannot

TOYOTA AND CHINOOK Mobilodge team up to provide this camper with push-up top built on a 110-inch half-ton truck chassis, and sleeping a family of four

be enclosed in walls and floors where a leak might cause gas to be trapped. Instead, all tubing must be run in the open, usually under the vehicle, where it is accessible for inspection and repair.

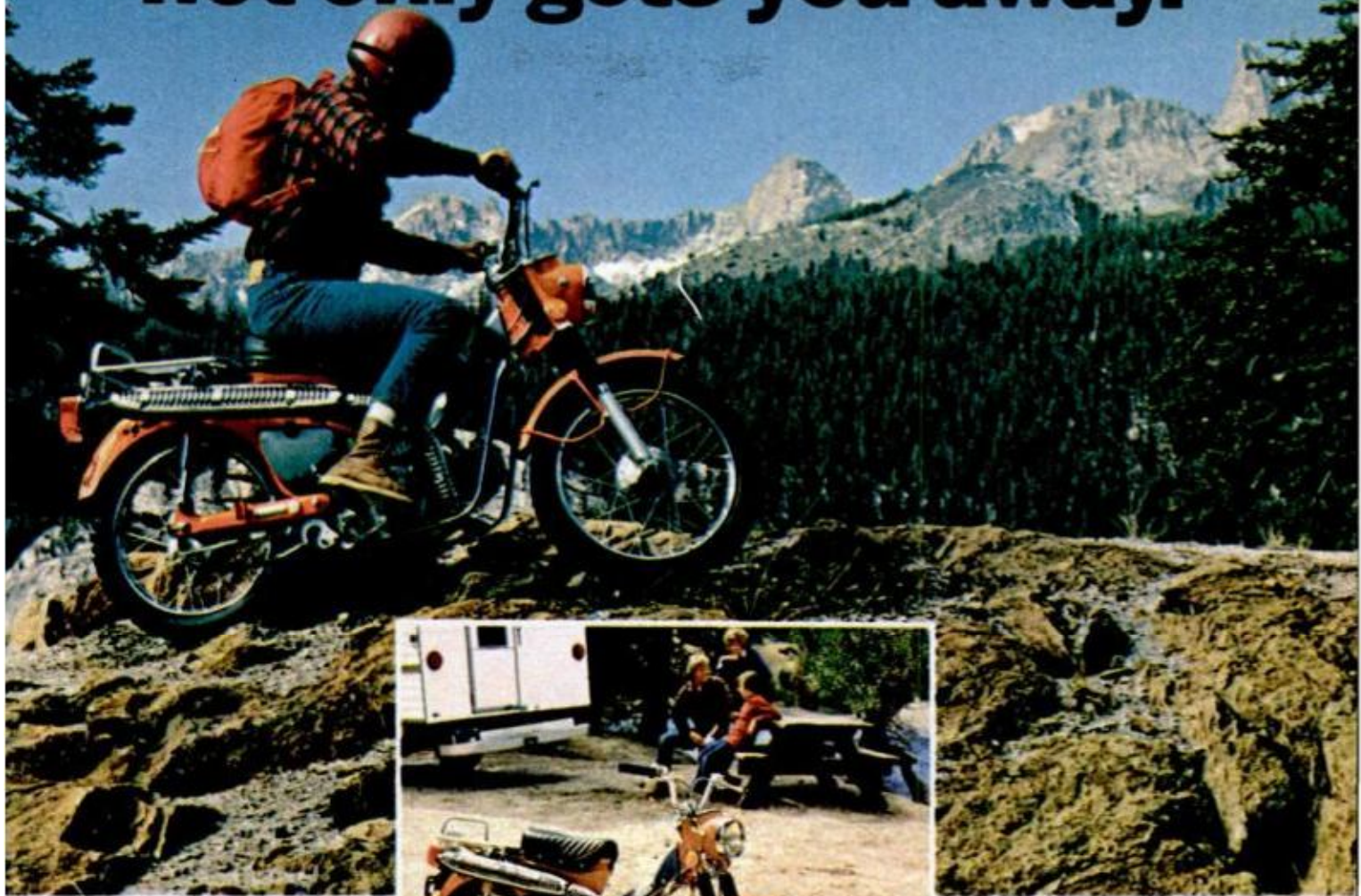
FOLDING TRAVEL TRAILER that hinges down its four Retractable-Walls to camper-trailer height, Rolite 1700 Self-Contained has power-lift top, toilet, shower

RVI standards inspectors visit member firms regularly to insure compliance. During 1972 five members were expelled for failure to correct deviations from the safety standards, and undoubtedly the RVI

(Please turn to page 158)



The Honda Trail 90 not only gets you away.



It gets you back.



A Honda CT-90 is dependable. And when you're riding rugged mountain trails, miles from the nearest road, that's the most important thing of all.

It's a bike designed specifically for the most intrepid outdoorsman. Dependability built-in throughout. Sure-grip knobby tires. Telescopic suspension. Adjustable carburetor. An eight-speed "Posi-Torque" dual-range transmission — high for taking it easy, low for rough riding and climbing.

The Trail 90 has the convenience features to go with its dependability. The handlebars can swivel for easy transport. A handy reserve fuel tank lets you explore further out than ever before. And a tripmeter built into the speedometer lets you know how far you've gone.

The USDA-approved spark arrester/muffler on the CT-90 helps protect the environment. While the wrap-around heat shield on the exhaust pipe helps protect you. And, of course,

for more protection there's the strong Honda warranty. You should become familiar with its provisions.

It all adds up to the trail bike more Americans depend on than any other—the Honda Trail 90. See it along with the many other models at your nearest Honda dealership. Honda has a model there for every different type of riding—trail, dirt, road, on/off road or minibike. And they're all Honda dependable.

HONDA

From Mighty to Mini, Honda has it all.

For safety, we recommend that you always wear a helmet and eye protection, keep your lights on and check the local laws before you ride. For a free color brochure, write: American Honda Motor Co., Inc., Dept. QB, Box 50, Gardena, Calif. 90247. ©1973 American Honda Motor Co., Inc.

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TRI-LEVEL FIFTH-WHEELER from Ardon Mobile, Santa Ana, Calif., adds a double bed over tow-truck cab. Space in the 34-foot unit is said to equal a 42-footer

NEW RV RIGS

(Continued from page 156)

inspection system has improved vehicles available and kept the government from moving in to write RV building directives.

As of the first of this month, however, the National Highway Traffic Safety Administration, Department of Transportation, has issued a consumer information regulation requiring "manufacturers of trucks capable of accommodating slide-in campers to provide information on the cargo weight rating and the longitudinal limits within which the center of gravity for the cargo weight rating should be located." Pictures of where the camper should be placed on the truck and instructions telling how gear should be loaded will also be required.

Camper builders must also put center-of-gravity position labels on their rigs and weight of unit and equipment, with more data in an owner's manual, as of next September. Hopefully the new standard will "reduce overloading and improper load placement in truck-camper combinations, and unsafe truck-camper matching, in order to prevent accidents resulting from the adverse effects of these conditions on vehicle steering and braking."

Present estimates put about 4 million RVs on the road, ranging from \$300 tent trailers to \$50,000 motor coaches. Travel trailers sold last year totaled around 250,000; camping trailers, 108,000; motor homes, 102,000; truck campers, 110,000, and pickup covers, 150,000. Trailers are obviously the most popular RVs, aided by the new boom in fifth-wheel units, and motor homes are growing fast now that less expensive van conversions and chopped vans are swelling the market. Trailer sales increased 30 percent during

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FORD AMERICAN ROAD is name of new luxury pickup camper you haven't seen before. Built by Starcraft for marketing through Ford dealerships, this slick 11½-footer made of 1-piece fiberglass claims full self-containment, two holding tanks plus design innovations



DOUBLE-DUTY TRAILERS, like All Sports Vehicle from Ace Traveler, Alfred, Me., has four swing-up bunks to allow rear loading of snowmobile or motorcycles

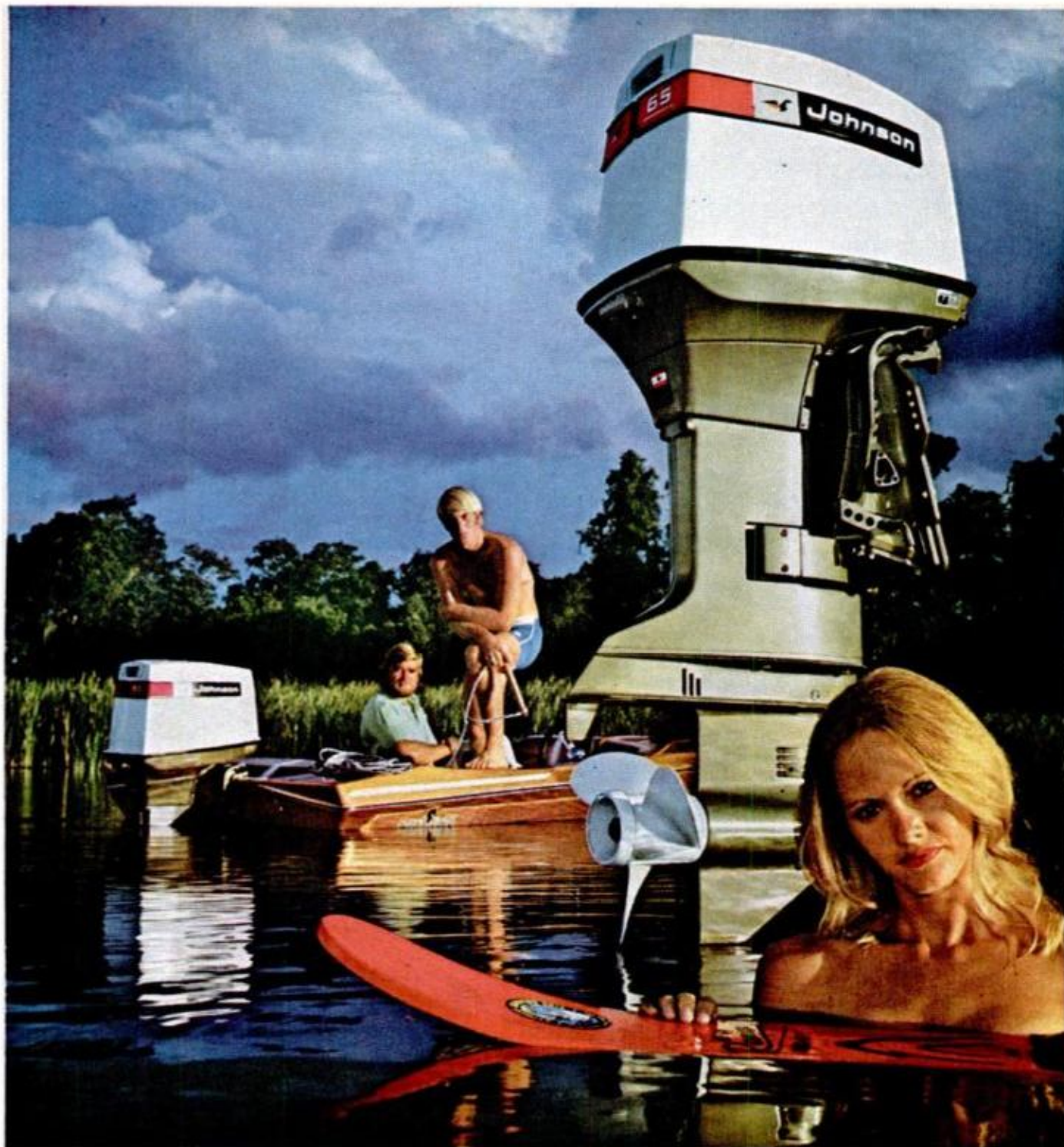


BUNKS FOR SIX, compact car towing, are among the claims for 13½-footer by Playpac Industries, Staten Island, N.Y. Rig even includes enclosed toilet room

the year but motor homes were up nearly 80 percent. Shoppers seem to like the idea of an RV with the motor aboard. The big car companies may sometime build assorted RVs as well. GM is producing a large motor home and Ford is working with Starcraft on a camper for Ford pickups.

Also on the market are tiny trailers for motorcycles and ATVs, rigs that collapse for garaging or open for travel with snowmobiles or trailbikes inside, and rigs to roll-along almost any size family. Americans seem to be rediscovering the out-of-doors. ★★★

POPULAR MECHANICS



Free! Up to five extra miles of water skiing.

Johnson's 65 gives you more skiing, more cruising than comparable competitive outboards.

You get this extra mileage from every six-gallon tank of gas at mid-range speeds because the 65 is exhaust tuned and Loop-Charged.

Exhaust tuning means we use exhaust sound waves to pack more of the new fuel charge into the cylinders. For more power. On less gas.

Loop-Charging brings fuel in and pushes the exhaust out in one continuous power loop. Again, you get more performance without using more gas.

But we didn't stop there. Our MagFlash™ capacitor

discharge ignition system sends up to 37,000 volts of spark to the plugs in less than five millionths of a second. For quicker starts. Smoother running. Long plug life.

So visit your Johnson dealer's and consider a Sea-Horse 65. Or its Loop-Charged brother, the 50 hp.

Not only do you get a lot more skiing. You get a lot more engine. Write for free catalog.

First in dependability.
Johnson
 outboards

Division Outboard Marine Corporation Johnson Outboards, Sea-Horse Drive, Waukegan, Illinois 60085 Dept. PM-373



Chopped vans

Mini motor homes, coach vans—no matter what you call them, they're coming on in popularity



SUPERIOR has widened its van motor home by 14 inches without changing basic Dodge or Chevy chassis



MINNIE WINNIE is Winnebago's new van conversion with optional layouts with a bathtub or six-sleeper



STARCRAFT's Mini has front or rear-door layouts for use on Ford, Chevy, Dodge or Dodge Dual chassis

Fifth-wheel trailers

On the go with two wheels or four

NEWEST of travel trailers and a type unheard of five years ago, these versatile split-level models offer hitch security that makes it possible for passengers to ride aboard in some areas. Fifth-wheelers are

towed by pickups or ranch wagons, with trailer attached to the cargo bed. In sizes now from 18 to 30 feet and more, they are growing rapidly in popularity.

Usually the trailer's upper level over the cargo bed is fitted out with twin bunks or a double bed. Ardon Mobile, in Santa Ana, Calif., has even added an extension over the truck cab for a Tri-Level fifth wheel unit.



QUINSTAR 24-foot model is new addition to line of Coachmen 26 and 28 models. All three fifth-wheelers are mounted on wide-track tandem axles with four-wheel electric brakes. A three-way gas/electric refrigerator, 33-gal. holding tank and 12-volt converter system are standard



MOTOVATOR Mini-Motorhome from Cayo has aircraft look, dual holding tanks, full self-containment

BUILT ONTO THE BACK of vans and panel trucks, this turtle-type invention keeps the front cab and controls but offers walk-through space into a camper body that has standing headroom, bunks for four or more, plus fully self-contained kitchen and bathroom with even a bathtub in new plusher models. Prices rise rapidly from the cost of a luxury car to an average of under \$10,000. Bigger than the big station-wagon vans but smaller than truck-chassis motor homes, the chopped van is a less expensive way for a couple or small family to try touring in an RV that still feels much like a passenger car.



MIDAS MINI 220, new version of the smaller 190, claims special insulation and sleeps six to eight



FRANKLIN Travel Home comes with Dodge, Chevy or Ford chassis, options of eight-cylinder engines, dual rear wheels, full-sized bathtub and forced-air heat



EL DORADO has this new 18-footer for towing by imported mini-pickups and other small light trucks

MIDAS Model 290 Fifth Wheel is newest in an extensive line. Full bath, sleeping for six provided

CONTINENTAL's new Trans-Continental 30-footer has aerodynamic exterior and "stateroom" interior

MARCH 1973

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BIGGER MODELS, like this 28-foot StarCruiser, now can offer optional interior layouts, including one with bathtub. Starcraft also makes 22 and 28-footers, plus a 35-foot Executive model suitable for business meetings

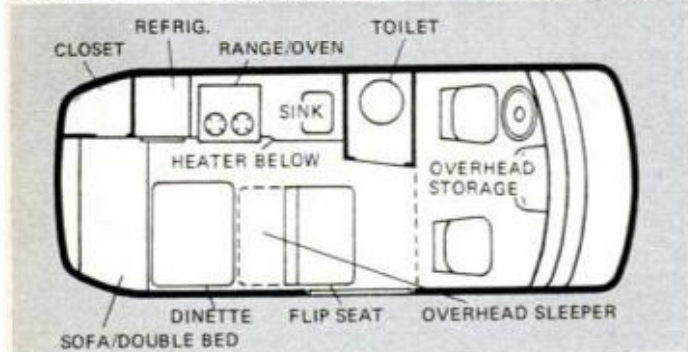


Motor homes

More style, convenience, dollars

ONE OF THE FIRST popular motor homes was the still-popular Volkswagen van camper, but now this booming section of the sport offers everything from minis to motor coaches built from converted interstate buses. Sales were up 88 percent in 1971, the last year for which figures are in, and although they're only 10 percent of RVs on the road, they took 35 percent of dollars spent. Van conversions, chopped vans and conventional motorized models on truck chassis all fit in the category of motor homes.

Domestic rig prices start around \$5000 and go skyward past \$20,000 when you leave stock rolling homes and head into customized vehicles. Self-powered and self-contained, they are big rigs to take from campsite to shopping center, but they offer luxury living anywhere a highway may lead a family of touring campers. ★★★



MINI MOTOR HOMES are increasingly favored by first-time buyers, renters. CamperRent, with 14 branches, offers this Open Road model, sleeping family of five



ADVANTAGES of compactly designed yacht cabin are in Kayot from builder of boats, fifth-wheel trailers

FIRST DIESEL motor home is claim of Monarch from Matoroam, a 25-footer on a Mercedes-Benz chassis





CANVAS or solid-state plastic sides are now options from Apache. Eagle 6 and 8 are six or eight-sleepers

Mini rigs

Compact camping is still thriving

MORE FUN in less space gets a new boost each year from the makers of small trailers. All are particularly suitable for towing with small foreign and domestic cars, and make handy camp cabins for sportsmen who don't mind a little crowding. Besides those shown, there's Playpac, Tri-Fab's Love Bug 13, Combi Camp 500, Trail King with a lifetime guarantee for its tent camper erection system, and Mini Kamper that can be towed by a motorcycle. ★★



MINUTEMAN is Coleman's name for its new flip-top camper. Setup time is said to be just 60 seconds

WILD WORLD from Apeco RVs can come in colors to match small car; has built-in bar, patio, sleeps five

MARCH 1973



SWING-OUT KITCHEN for serving inside or out with top up or down is feature of Starcraft Swinger 6



QUEEN-SIZED BED, claimed to be first in a camper trailer, is provided in Coleman's largest Yorktown



RV Drivers' CAMPING '73 **Report:** **Minihome**

Take a Ford Econoline, raise the roof, slick the interior, and sleep two in comfort—add more only if you must

By **BILL McKEOWN**
Photos by *Lorraine Laredo*

WHAT IS LARGE ENOUGH to be livable, small enough to be maneuverable and cheap enough to be practical? Every RV builder comes up with a different compromise for this cross between a house and a car, but one of the happiest I've driven is Travco's Minihome.

Originally it may have been ahead of its time. VW, Pop Top, Travco Div. of PRF Industries and other companies and individuals had been making camper conversions of station wagon vans and panel trucks for a number of years. But when Motor Homes div. of Travco in 1968 mated a fixed fiberglass top over the cut-out roof of a Ford Econoline, the result was a particularly sleek conversion. Its name, "Minihome," has now become almost the general name for miniature motor homes made this way.

Owners we've talked with immediately point out obvious advantages—and disadvantages. The rig is practically passenger-car size and easy to drive around town or on the highway without feeling you're steering a moving van. Drive it home, however, and the 8-foot height is



COVERED WAGONS used to take weeks, but today's van conversion wagon campers need only hours to cruise through Arizona ponderosas at Flagstaff and along the cliffs of Oak Creek Canyon. Minihome's high roof adds headroom, weight, cost and subtracts miles per gallon. Self-containment and accessories make inside living convenient, but compact. Airconditioning proves its value keeping out dust along back-country trails



too tall for the garage, a car wash or a drive-in movie. It wheels along at turn-pike speeds but may average 12 mpg or less if heavily loaded or bucking strong winds. Aerodynamically, it's remarkably clean, however, and strong gusts cause little more buffeting than in a passenger car, and nothing like the drifting a light imported van can experience.

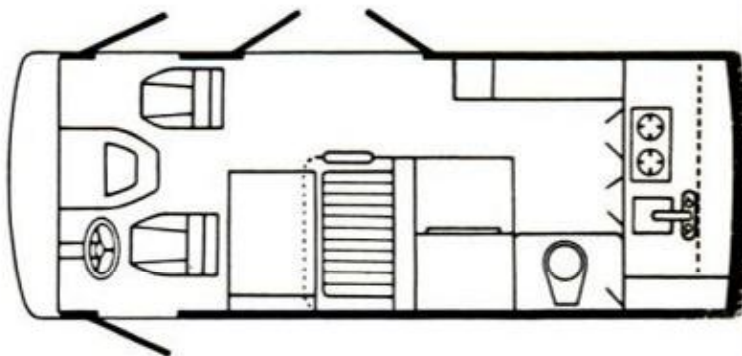
Now the rigs are called Travco Family Wagons, are available on Ford, Dodge or Chevy vans and, along the way, have lost some of the early complaints. Given a rough road, the Minihome could bottom out with teeth-jarring slams. Owners of first models have switched, or should switch, to heavy-duty shocks. Brake fade was another scary trait of the Econoline that is now reported under control.

But old and new complaints, we find, are minor, and often the result of beginner RV-camper experience. An owner in Vermont reported he froze the kitchen plumbing of his rig shortly after buying it for the family for Christmas. He was unhappy, but admits he now drains his water

(Please turn to page 208)



PASTURE PARKING for camping, as above at RKO, Chugwater, Wyo., is easy with layouts such as those shown below. Front seats swivel aft for meals or drop-leaf table folds and rear seat opens into double bed. The rear doors open for a picnic access to stove



HARDLY BEEPING ITS HORN, Winnebago added a 20-foot motor home to its Brave series last summer, but first-time buyers and experienced rec vehicle owners soon discovered this to be one of the best buys on the market.

The 18-foot Brave is the bottom-dollar model at \$6700, but the D-20T offers far more than its additional 2 feet 8 inches for \$705 more. What appeals most to buyers is the straight aisle plan with twin gauchos in a rear lounge area. A table that folds into the rear wall can be extended with leaves to seat six to make a "family size" dinette. The gauchos, with back cushions removed, can be used as twin beds or can be converted to a king-size 7x7-foot bed. Large glass areas give the lounge a wide view.

The D-20T is built on the Dodge 125-

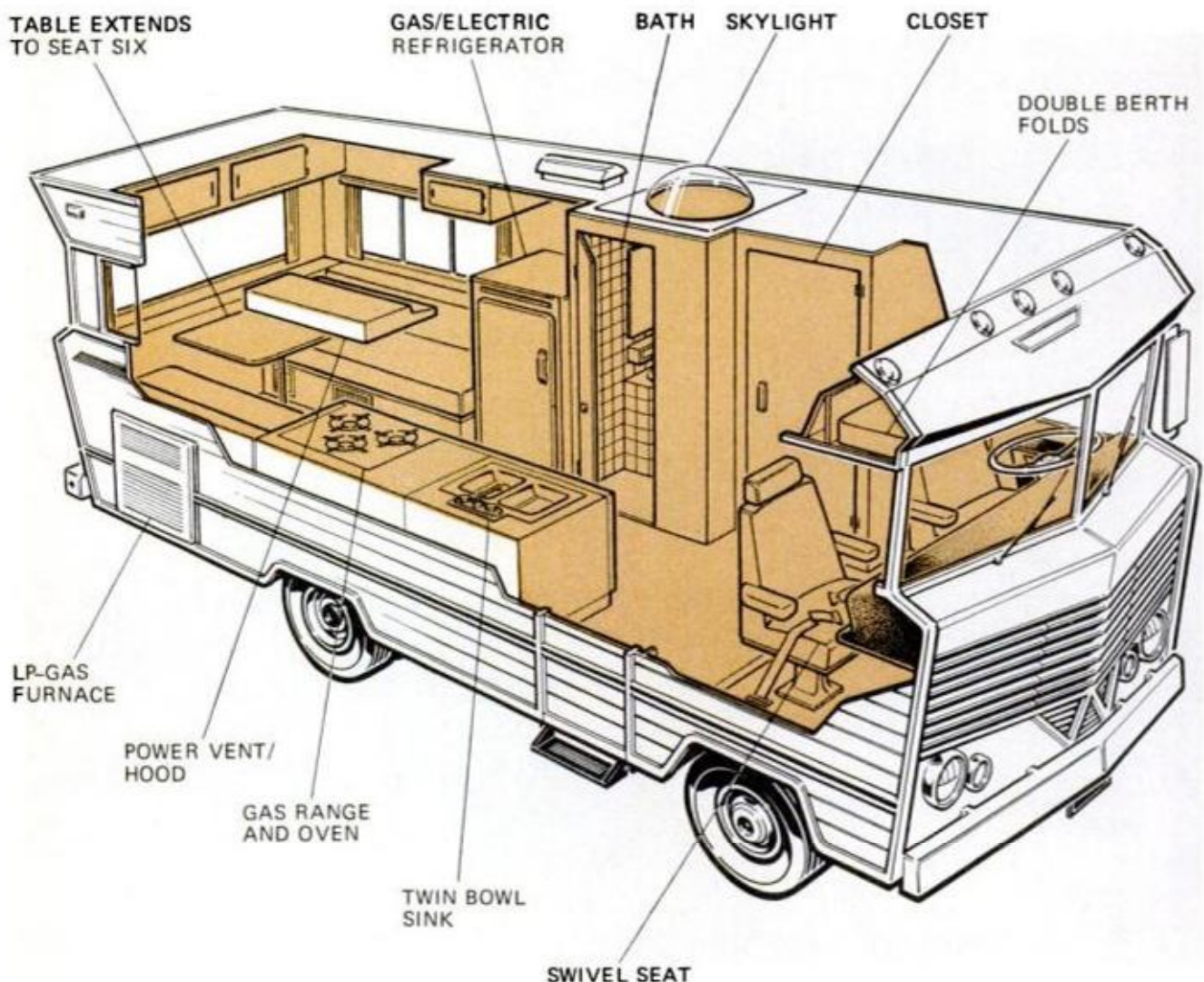
inch wheelbase; the D-18 on the 104. At 20 feet 11 inches overall, this "Winnie" is only slightly longer than a full-size station wagon, yet its 6-foot 4-inch interior height provides more full headroom than mini motor homes of the same length. The front bunk folds up; driver and copilot don't have to crouch to get into their seats.

The galley has double stainless-steel sinks, 4-cu.-ft. gas/electric refrigerator, three-burner range and range hood with exhaust fan. The bath has marine toilet, shower, lavatory and medicine cabinet. The unit has a 46-gallon pressurized water system, 6-gallon water heater, 30-gallon holding tank, and a thermostatically controlled forced air furnace. Plenty of cabinet space helps to keep the vehicle shipshape.

After a six-month test of this model we rate it "Excellent" for livability. It can



Motor home test:



accommodate four adults with ease, or two adults and three or four small children—if the youngsters use the 7x7-foot bed.

We can give only a "Fair" performance rating to this unit which comes with the Dodge 318-cu.-in. engine. The 318 is a troublefree powerplant, but with a GVW of 11000 pounds, the D-20's cruising speed, drops to a maximum of 40 on most long turnpike grades. If downshifting manually to second to maintain rpm doesn't bother you, you'll get your kicks from knowing that you have a durable powerplant. The 413-cu.-in. engine (optional at extra cost) is the answer if you want more power. Gas mileage, as any motor home owner knows, depends on what way the wind is blowing and how hard you want to push. Fully loaded and cruising at 50, the D-20 will get 7 mpg.

The ride—for passengers in the lounge area—is rough. The driver and copilot come off easier but they know they're on a truck chassis. But the stiff suspension has advantages: stability in turns and less buffeting from crosswinds and passing trucks.

D-20T owners we interviewed are generally well pleased with their '73 models.

"Much more stable in crosswinds than my previous motor home (another make)," says a highway engineer. "Well satisfied with the body construction and cabinetry," says a Pennsylvania carpenter, "but the 318 seems to be lugging on hills unless I downshift." "Enough room in the galley so we aren't squeezing past each other." "I'm 5-foot-7," says a retired postal worker,

Please turn to page 208

Winnebago D-20T

By JIM LISTON, Editor



LARGE GLASS AREA gives rear lounge a three-way view. Our test vehicle had 4000-watt powerplant and 10,000 B.T.U. roof air conditioner (both optional). Cooler runs off powerplant on road, does excellent job without need for car air. Forced-air furnace keeps vehicle warm in coldest weather. Luggage rack and ladder proved to be useful options. Tire mount swings left to give access to compartment

WINDSHIELD and all windows are tinted for more efficient airconditioning. Two 70-amp. batteries are accessible on slide-out tray behind left front wheel. Twin 30-lb. LP-gas bottles are carried in left rear compartment. Floor plan (opposite) shows wide middle aisle that gives this model spaciousness found only in larger motor homes. Not shown are additional cabinets over sink and range



Driver's Report: Grumman

PM TEST VEHICLE, here at KOA campground near Montreal, was a 25-foot, rear-bath model on International chassis with 392-cu.-in. International engine. Pilot and copilot (below) sit in comfortable, adjustable pedestal seats. Motorhome sleeps six in two couch/beds (diagram, facing page), two bunks and the dinette's double bed



PM driver agrees with owners who like its solid construction

THE GRUMMAN NAME, which appeared on rugged World War II carrier-based aircraft and on the spectacular Apollo moon lander, connotes durability to those who buy Grumman Motorhomes. In interviews with owners, we found near unanimous praise of the vehicle's "solid construction." Even the strongest critic agreed on that point.

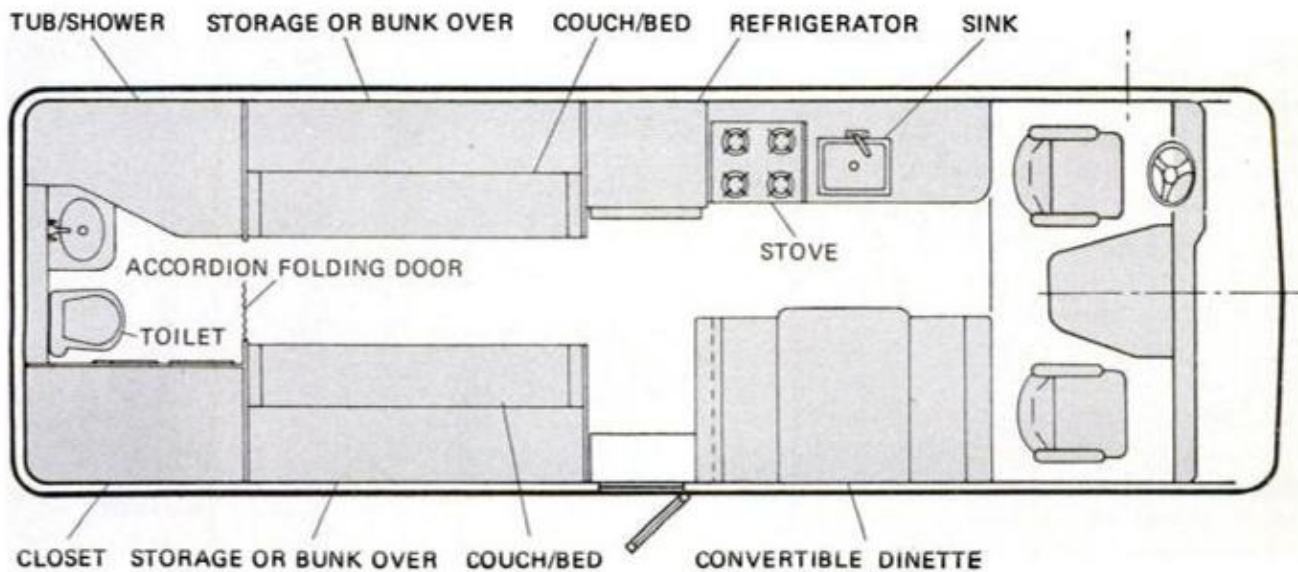
The ".102-inch lifetime aluminum plate body," Grumman literature explains, is so tough that "a .38-calibre bullet fired at close range wouldn't penetrate." We didn't try any wild experiments like that with our test vehicle, but preferred to take the claim on faith.

Neither did we do any slow rolls to prove that its "riveted and welded body plate" is sufficiently supported by "Z-bar and channel-bar aluminum extrusions" and the aluminum flooring by its "I-beam section carlings spaced eight inches on centers." But tooling along the highway, you really do have the comfortable feeling of being surrounded by a solid, pro-

(Please turn to page 210)

Motorhome

By JOHN A. LINKLETTER



How to buy or rent

By **WAYNE HARRIS**

Illustrations by Roy Grinnell

WITH OVER 4 MILLION used recreational vehicles around today, there are plenty to choose from for the camper who wants his fun on the go. Good older models are cheaper now, and if you still can't afford your choice—form a club (as boatmen and pilots do) and buy your dream machine as a joint venture.

Having several people check over your selection is a good idea anyway. Second-hand RVs can have all the problems of a car *and* a home. RV performance and ap-



TEST motorized RV for heat buildup by stopping and accelerating on hills

pliances differ from autos and houses, however. It is well for a newcomer to rent first (see checklist at right) to learn which type of vehicle is best for him, and how all the gadgets work and are maintained.

First, look over the outside of the rig. Any dents, punctures, rust spots on the sides? Loose plumbing underneath? Gouges in the roof? Many owners have driven through the woods where low branches could rip the top, but have never used a ladder to climb up and check the roof condition. Dents won't matter much, but a hole that has let in rain could have caused inner-wall damage that may not show. Small side repairs can often be made inexpensively with epoxy putty. But a smashed corner where roof and two sides meet, or the bottom panel of a rounded metal-riveted coach, where other panels may have to be removed, might take up to a \$500 professional repair. Get estimates and a deduction from your purchase cost.

170

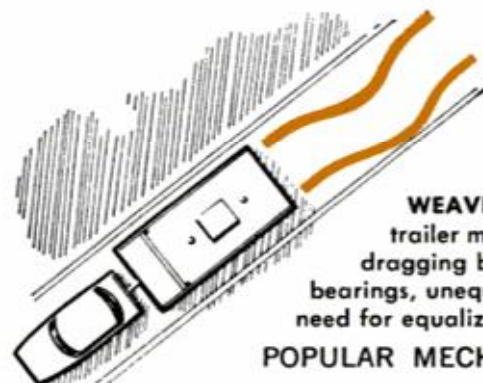
Rips in the canvas of a tent camper can be repaired by an awning shop, or possibly replaced by the manufacturer if you are buying a model from one of the long established companies like Apache, Starcraft, Nimrod. Flat fiberglass punc-



LEAN to side, tongue-heaviness or back droop can indicate bad springs, loading

tures are easy to fix, but slashes or broken curved contours may require a quote from an RV or boat-repair shop. An auto-body shop can give an estimate on steel frame and sheet-metal work. And look at the tires. Replacement could cost under \$20 a pair for a small trailer to several hundred for a set of steel-belted radial wide ovals on a big motor home.

Inside the rig, jump on the floor and push on the walls. If construction seems flimsy, pass it up. Stains around windows and vents may indicate minor leaks that can be inexpensive to seal and fix, or a hatch left open by mistake during a rain squall. But water seepage into inner walls may have started wood rot and structural problems. Fill all water tanks and look, as well, for leakage from plumbing. Accessible joint leaks can be cured, but tearing out walls to find a break could be too expensive.



WEAVING of a trailer may show dragging brakes or bearings, unequal load, need for equalizing hitch
POPULAR MECHANICS

a used RV

All LP-gas and electric appliances—stove, lights, refrigerator, furnace, air-conditioner, water heater, pumps, intercom, plug-in outlets—should be operated long enough to be thoroughly tested. Using a well-tuned TV set, does the picture roll because the generator is off-cycle? At least you know before you buy.

Musty interior? It may be evidence of soggy inner walls. Proceed with caution. Lots of dust around? The rig may have a sprung door or windows that don't quite close. Tap water discolored? Toilet holding tank clogged? Find out why before you buy. An RV dealer can give you replacement costs of a new stove, toilet, furnace or refrigerator. You may arrange to have the expense deducted from the purchase cost.

A road test is essential for a motorized RV and helpful with trailers as well. Does the trailer or mounted pickup



LEAK MARKS around the windows? Sealant should fix this, but check for wall damage

camper lean to one side? Check for broken springs. A rig that sways and fish-tails may require an equalizing hitch. Test brakes and check wheel bearings as well.

A pickup camper body must be removed to check the condition of the cargo bed, camper floor and jacks. Underway, watch for excessive sway, rear sag, fender rub. Try to test a motor home for several hours, stopping and starting on a steep hill to check overheating, transmission slip, ping, brake fade and wheel-bearing squeal.

Bargain orphan RVs are around from companies no longer in business. But you may never locate replacement parts. ★★

MARCH 1973

RV rental checklist

Is this the RV for you? First be sure the rig is big enough for your family, hunting and fishing buddies, or in-laws—whatever the size of the gang that's going along. A cute little "six-sleeper" may be comfortable at night for only four adults.

Enough room and privacy? If you're trying to sell your wife on the sport, be sure to pick a model she feels comfortable in, and won't catch cabin fever if a long, rainy weekend cages you all inside with the dog, cat and kids. Rent one with an enclosed bathroom and more space for longer trips.

Big motor home? Little van conversion? Pickup camper? Travel trailer? Tent-type camper trailer? Look over accommodations and accessories of each. Take a short trial trip near home first.

How does it work? Part of your rental fee should include a complete demonstration of all features and appliances before you leave. Ask lots of questions, even if you think you know the answers. The water pump, toilet, galley or furnace may work differently than others you've seen in use. If the rental dealer can't give you printed instructions, take notes. If he doesn't have time to let you open the tent trailer, start the generator or light the oven while he watches, shop elsewhere.

Can your car tow the rig? Makeshift trailer hitches are unsafe with any trailer. For rigs over 1500 pounds, consider a load-equalizer hitch. Is your car in shape to pull a load behind, stop it, lug it up hills in hot weather? Ask a mechanic who knows. Add extension side mirrors if rear vision is impaired.

Does the refrigerator work? Many new RV renters don't know they may need a bubble level to be sure their LP-gas refrigerator base is absolutely horizontal.

Does galley faucet produce water? Have dealer fill your tank and show how hand, electric or air-pressure water system works. Note if tank makes water smelly or unpalatable.

Electric lights turn on, appliances work? See if heavy-duty extension cord for campground outlet is supplied, if auxiliary battery for lights supplements engine-starter battery.

Generator supplied? Learn how to start and service it. Locate 110-volt outlets.

Toilet aboard? Find how it works, when and how it is emptied.

Water heater? Learn how to light it.



Gear to go

Add-ons and accessories aid convenience, comfort



TOP THAT GOES UP for headroom and down for garaging is offered by Pop Top Co., Mentor, Ohio, for all van models, including VWs, from 1962 on. Original top can be cut out by sabre saw for home installation, or done by a dealer.



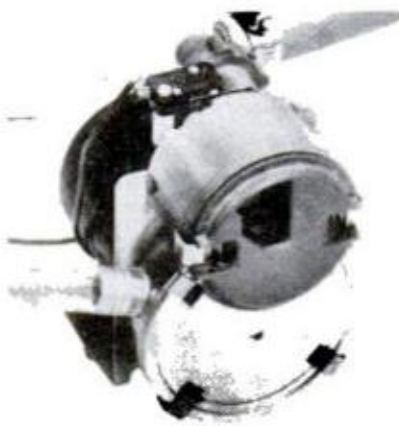
FOR CHOCKING the wheels of a boat, travel or tent trailer parked on a slope or ramp, or for use with any car or RV while you change a tire, the folding Wheel Block from Valley Tow-Rite, Lodi, Calif., is available. It's \$5.26 at marine and RV accessory dealers.



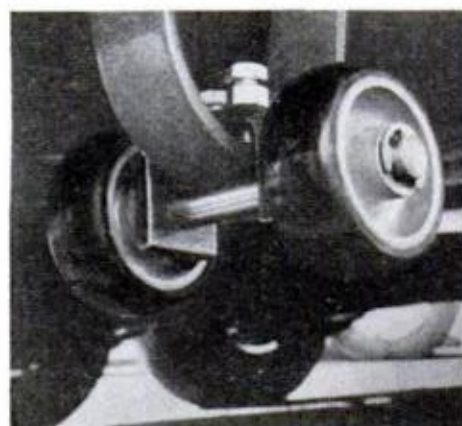
CUSTOM CAB, a four-door seating five, is built on Ford, Dodge and Chevrolet $\frac{3}{4}$ and one-ton chassis by Tri-Van Inc. for fifth-wheeling. Storage box, mid-opening gate are added.



LEVELING a camper can be the trick to make a refrigerator operate, pots stay on the stove and a bed stop sloping. For \$21.95, the Level-It, Box 4097, Fresno, Calif., is an answer.



NO FREEZE-UP in winter, no cycling water spurts, no damage from city pressure are claims for Electra-Flo pump, \$45 from Humphrey Products, Kalamazoo, Mich.

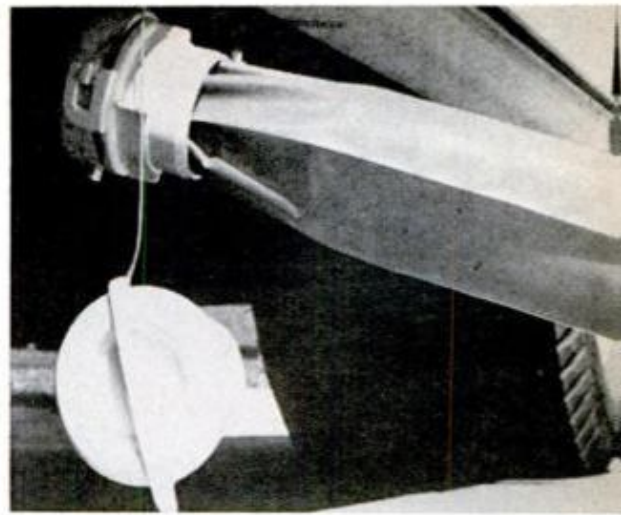


BOTTOMING of trailer tail on rough terrain, driveway curbs is said to be prevented by bolting new Skid-Roll on rear skid bars. Advance Products, Pinole, Calif.

POPULAR MECHANICS



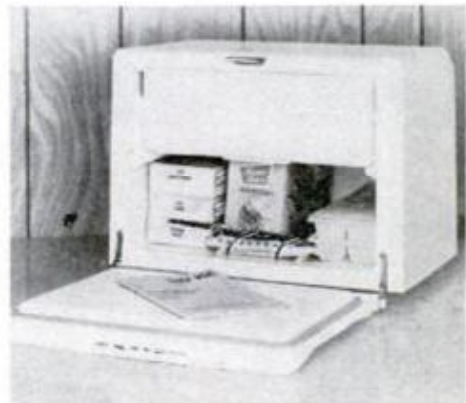
UTILITY BOX BODY is the name for this new option from International trucks. Camper special or vocational pickups with it can offer lockable storage space that also helps keep weight low for good balance with camper insert.



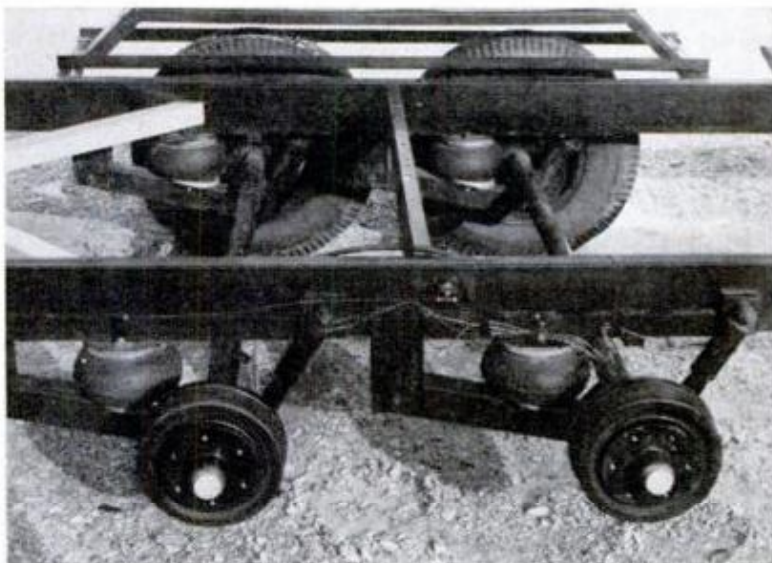
UNPLEASANT CHORE of holding tank dumping is made easier with Dispos-A-Hose, Promotional Engineering, International Falls, Minn.



EVEN A MOTOR HOME, camper or trailer with high roof can carry 300-pound 16-foot hull using Load-A-Boat system of American Recreational Products, Lynnwood, Wash.



QUICK SHIFT from icebox to freezer is possible with BMC Kardel Freezer Insert, by Blackstone Mfg., 4630 West Harrison, Chicago. Ice cubes in 45 minutes.



RIDING ON AIR is reported to ease out the bumps for travel trailers. Hammer Blow Co., Wausau, Wis., provides Air Ride suspension systems for tandem-axle motor homes as well, can offer dashboard-controlled campsite leveling.



VOLTAGE VARIATIONS, a campsite threat to airconditioners and TVs, are checked with \$13 meter of J. F. Ivan, Governor Ave., Cleveland.



Know what it takes to tow

By MORT SCHULTZ

ARE YOU going to buy a 1973 car that will be used to tow a trailer weighing over 1000 pounds?

Even if you aren't sure, it would pay to order the car from the factory with trailer-towing equipment. Having to outfit the car later after you've taken delivery

- NOTES:**
- (1) No changes required for 1000-2000-lb. trailers
 - (2) Except Eldorado
 - (3) Standard on Caprice, Impala, Bel Air sedan, wagons
 - (4) Standard on Laguna, Malibu, Deluxe wagons
 - (5) Standard on Caprice, Impala, Bel Air, Monte Carlo Sedans and all wagons
 - (6) Standard on Caprice, Impala, Bel Air sedans and wagons and on Monte Carlo
 - (7) Can tow up to 7000 lbs. with more powerful engine
 - (8) No changes required for up to 1500-lb. trailer
 - (9) Standard on Coronet and Satellite wagons
 - (10) Can tow up to 4000-lb. trailer with standard V8 engine; up to 6000 lbs. with more powerful engine
 - (11) No changes required for up to 2000-lb. trailer
 - (12) Can tow up to 5000-lb. trailer with standard V8 engine; up to 7000 lbs. with more powerful engine
 - (13) Standard on wagons
 - (14) No changes required for 1000-3500-lb. trailer
 - (15) For high-temperature, heavy-traffic or hilly terrain operation, or if trailer is wider than front of car
 - (16) Optional V8 engine required on Catalina only
 - (17) For cars without airconditioning

Trailer towing equipment for passenger cars

Car Manufacturer and Model	Trailer Weight (lbs.)
American Motors—All Models	1000-2000
American Motors—Ambassador, Matador	2000-5000
American Motors—Jeep Wagoneer (1)	2000-6000
Buick—All Models (1)	2000-3500
Buick—Centurion, Electra, Estate Wagon, LeSabre, Riviera	3500-6000
Cadillac—All Models	1000-2000 2000-6000
Chevrolet—All Models	1000-2000 2000-4000
Chevrolet—All Station Wagons	4000-6000
Chevrolet—Bel Air, Caprice, Impala Sedans	4000-7000
Chrysler—All Models (1)	2000-5000
Dodge—Dart	1000-2500
Dodge—Charger, Coronet (8)	1500-4000
Dodge—Monaco, Polara (11)	2000-5000
Ford—Pinto	1000-2000
Ford—Custom, Galaxie, LTD Brougham, LTD	1000-2000 2000-3500 3500-6000
Ford—Torino	1000-2000 2000-3500 3500-6000
Ford—Thunderbird (1)	2000-6000
International—Travelall (1)	2000-6000
Lincoln (14)	3500-6000
Mercury—Full Size	1000-2000 2000-3500 3500-6000
Mercury—Montego	1000-2000 2000-3500 3500-6000
Oldsmobile—Omega	1000-2000
Oldsmobile—Cutlass	1000-2000 2000-3500
Oldsmobile—Custom Cruiser, Vista Cruiser, Toronado	1000-2000
Oldsmobile—Custom Cruiser	2000-3500 3500-7000
Oldsmobile—Vista Cruiser	2000-3500 3500-6000
Oldsmobile—Toronado	2000-3500 3500-6000
Oldsmobile—Delta, 98	1000-2000
Oldsmobile—Delta	2000-3500 3500-7000
Oldsmobile—98	2000-3500 3500-7000
Plymouth—Valiant	1000-2500
Plymouth Satellite (8)	1500-4000
Plymouth—Fury (11)	2000-5000
Pontiac—Bonneville, Catalina, Grand Safari, Grand Ville, Safari	1000-2000 2000-3500 3500-6000

Know what it takes to tow

from the dealer may vary from costly to almost impossible.

The average price for having trailer-towing equipment installed in a new car at the factory is between \$100 and \$200. Adding this same equipment after the car has been built might boost this cost to nearly \$500.

What you will need will differ from car to car and from trailer weight class to trailer weight class, but generally will include heavy-duty suspension, heavy-duty cooling, heavy-duty charging system, wiring harness and a high gear ratio rear end.

Most cars and RV drivers also benefit from a more powerful engine, automatic transmission, power brakes and power steering.

"Can't I leave the selection of this equipment to the new-car salesman?" people ask.

It isn't wise. Some salesmen don't know

The average price for having towing equipment installed in a new car at the factory is between \$100 and \$200.

beans about trailer-towing equipment, while others will try their best to sell you everything but the automobile agency itself.

It is best to make your own selection. The chart with this article, summing up the necessary changes that should and can be made to 1973 cars that may tow trailers, will help. Use it in conjunction with the manufacturer's list of "tow packages" and trailering equipment, which you can get at a dealer's. Then pick out the exact items you will need.

But be conscious of two terms you will encounter on many manufacturers' lists—"required" and "recommended."

"Required" refers to equipment your car

must positively have to pull a trailer safely.

"Recommended" equipment refers to equipment that is nice to have, but not really necessary. It includes such things as airconditioning, automatic speed control, steel-belted tires and a dual exhaust system.

Give careful consideration to the kind of driving you will be doing. RV trips are not much like the local runs to work, shops or a neighbor's house. Owning a rig that can travel cross-country will mean you'll probably want to go. Towing your first trailer on your first camping trip, in fact, you are likely to plan for higher speed and longer distances than are wise. Fast driving is possible, but it takes more concentration and is more fatiguing. An airconditioner, for example, may more than pay off on long hot runs across a desert or in the muggy traffic of a tropical resort. Even the reduction in road noise which closed windows and an airconditioner can provide will be helpful in delaying that tired feeling and can aid driver safety.

Mountains are often a question mark for the flatlands driver. Every year travelers do trail across mountains without special equipment or problems, in well-tuned cars and with special care and careful driving to prevent overheating of engine and brakes. But hill country is attractive and pleasant to visit, and a trailer owner should move the options of more power and cooling from "recommended" to "required" if much mountain travel is planned.

Off-road running on gravel and woodland trails is also a good argument for larger tires.

Some manufacturers offer trailer-towing equipment as a "package." Ask about this, but note that all necessary items may not be included.

Most carmakers do not offer a hitch. Consult your trailer dealer for proper choice of this essential item. ★★★

The Great Pickup Mystery.



When most people think about buying a pickup they usually think about just two makes—Ford and Chevy.

Which is precisely why we call INTERNATIONAL "The Other Pickup."

But just because we're not exactly a household word doesn't mean we don't make a great pickup truck. We do.

And if we could just get people to look at us they'd make some surprising discoveries.

First, we have a really smooth ride. And we handle beautifully. And you can select an economical six or any one of three powerful V-8's. Or choose between torsion bar or leaf spring suspension. Or have automatic transmission, power steering and power brakes.

And there's important safety features like a collapsible steering column, a fuel tank located outside the cab and an anti-skid system, available on two models.

So before you buy a pickup, try ours.

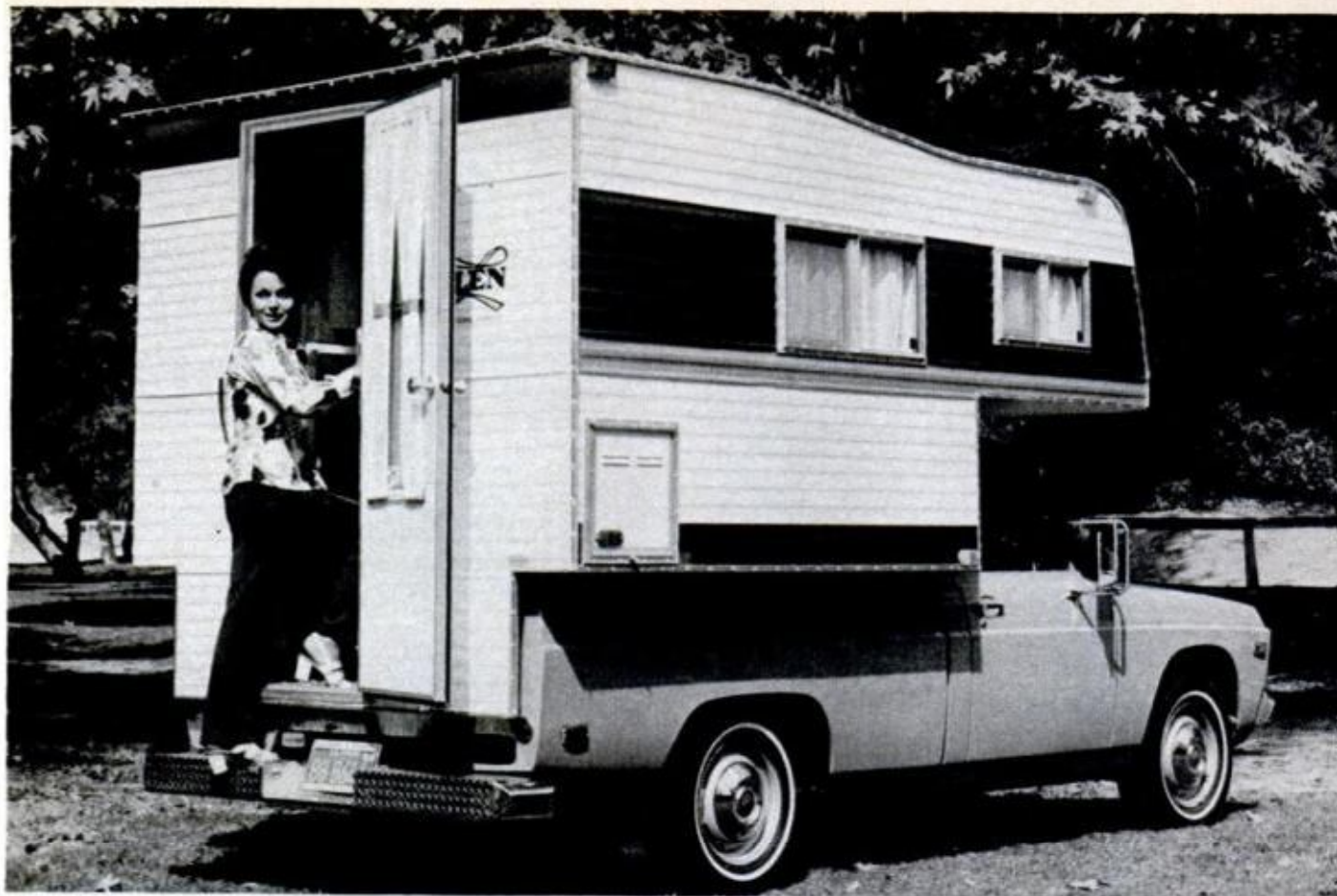
The Other Pickup. At your International dealer.

Some people come away saying it's not The Other Pickup.

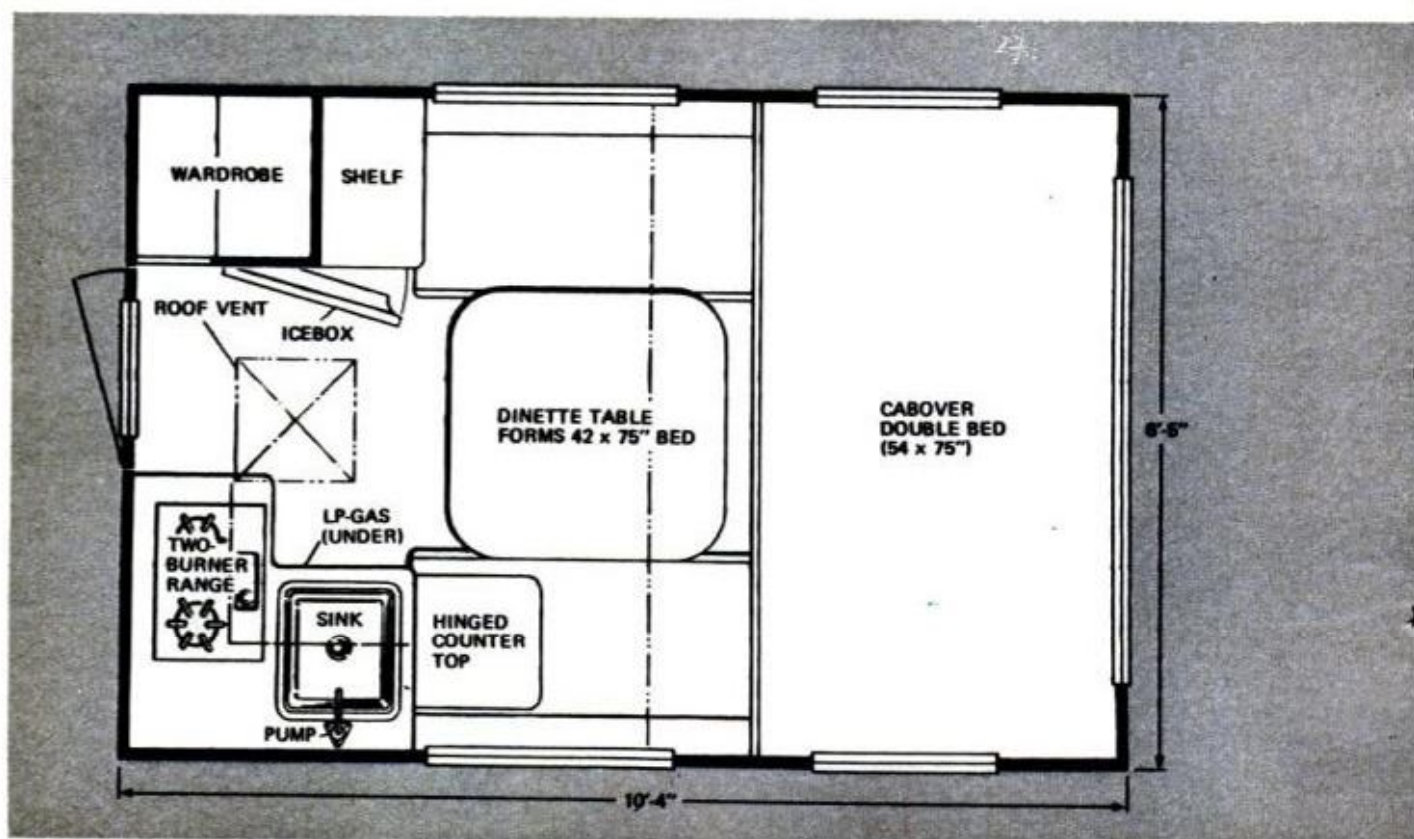
It's the only pickup.



International. The Other Pickup.

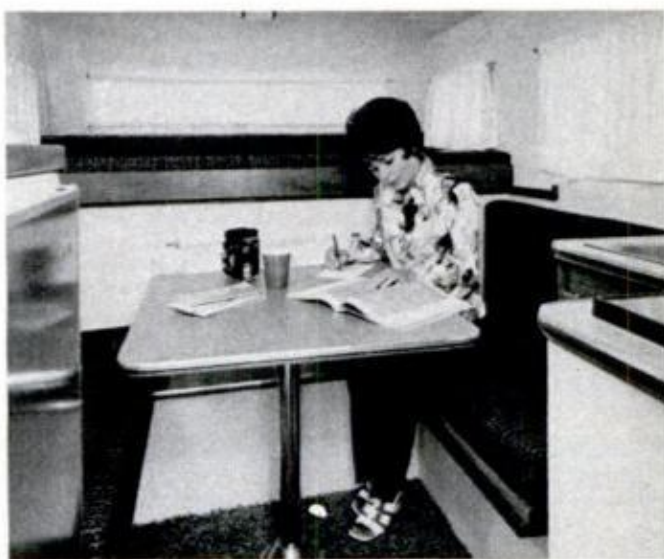


Cabover camper you can





TINY KITCHEN AREA contains two-burner range, sink and self-contained water supply. An icebox is installed on the opposite side of the camper



DINETTE TABLE provides the main work surface. It is made of plywood covered with plastic laminate. Leg is removable to permit lowering of tabletop to form bed

build for a compact pickup

For less than \$2800, you can have a good-looking, practical camper that sleeps four adults. You build the camper unit for \$607 and anchor it to a new—or used—lightweight truck.

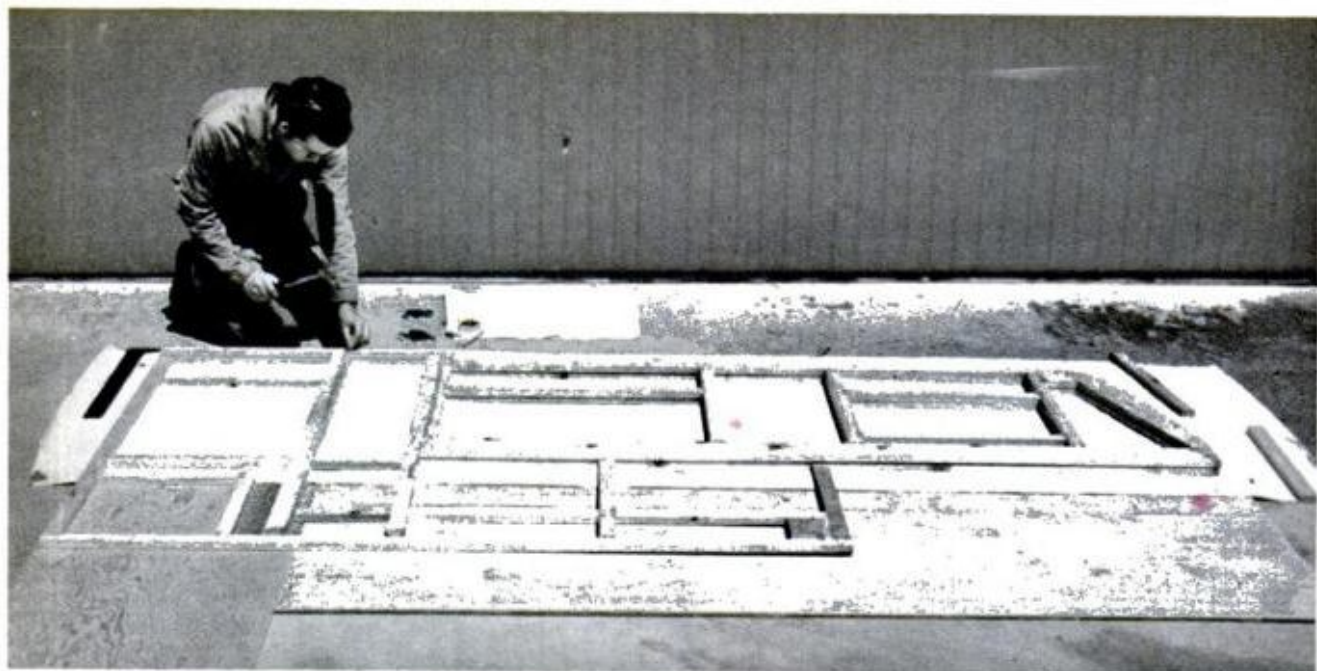
THE "IMPORTER" doesn't provide all home comforts, but for \$607 in materials and equipment—plus your time and know-how—it can convert a typical light pickup into a cozy camper for four adults.

The designer—Glen L Recreational Vehicles of Bellflower, Calif.—says the camper will fit shortbed pickups such as the Datsun, Toyota, Mazda, Chevrolet-LUV or Ford-Courier. Glen L used a Courier—bought in California for \$2150, including taxes—for purposes of this article. Construction photos begin on page 180.

The finished camper reportedly has a "dry" weight of about 850 pounds, a safe load for the small truck. Glen L's Courier-Importer combo averages 17.7 mpg in city and freeway driving. ★★ ★



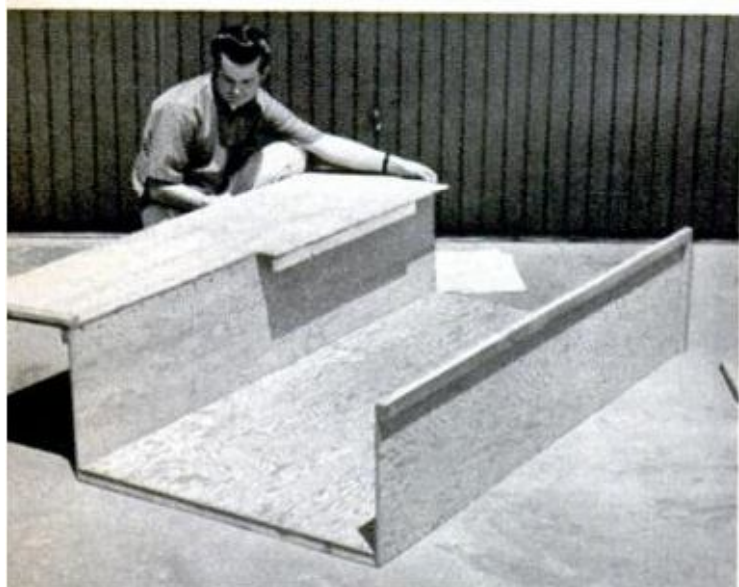
CAMPER SLEEPS FOUR—two on cabover bed and two on bed made by bridging space between benches with tabletop. Cushions double as mattress



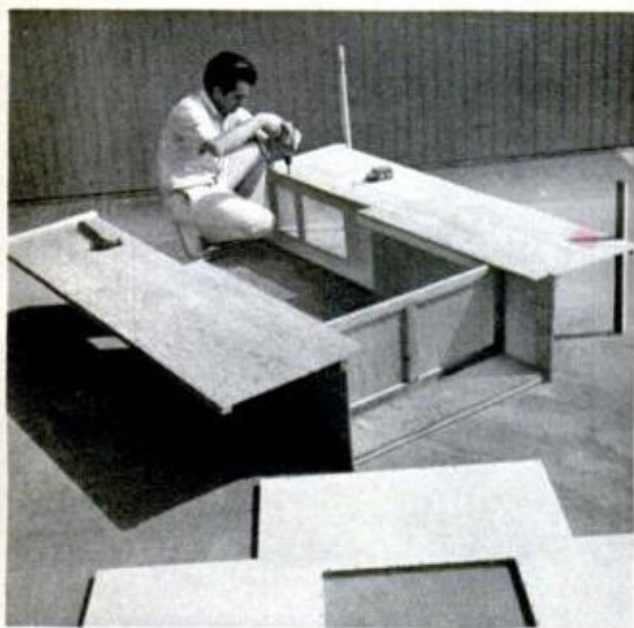
SIDEWALL is fabricated over plywood base covered by full-sized pattern. To assure accuracy, the second sidewall should be assembled directly over the first

FLOOR AND "SIDE WINGS" are glued and screw-fastened. Construction throughout is of $\frac{3}{8}$ -inch plywood. Thicker plywood would add unwanted weight

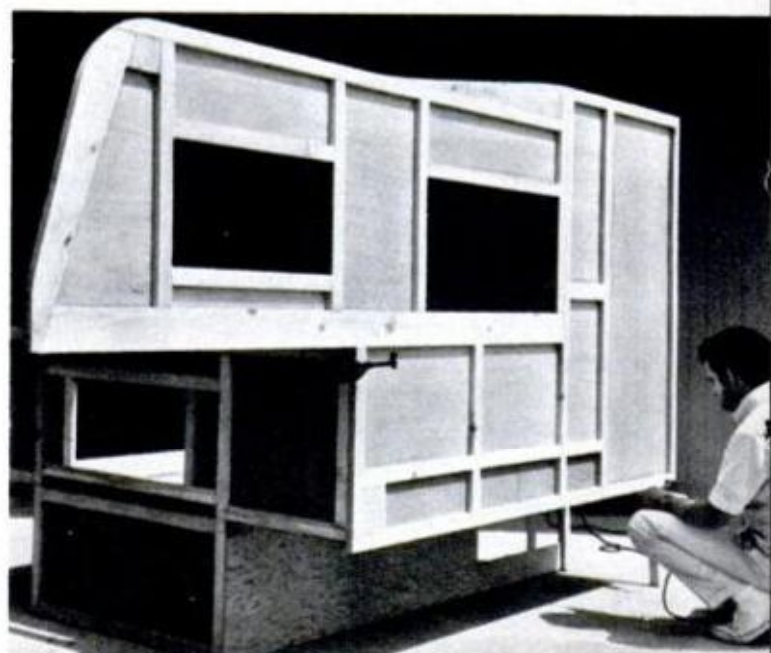
(For more construction photos, see page 182)



SCREWS AND MASTIC are used in joining sidewall to the front wall. Mastic is used where gluing is not practical and where an airtight joint is required



UPRIGHT "LEGS" are used to support the side-wings during assembly. The finished front wall can be seen lying in foreground. Note window cutout



Get away from the crowd.
Get the flavor you want in
Old Gold Filters.

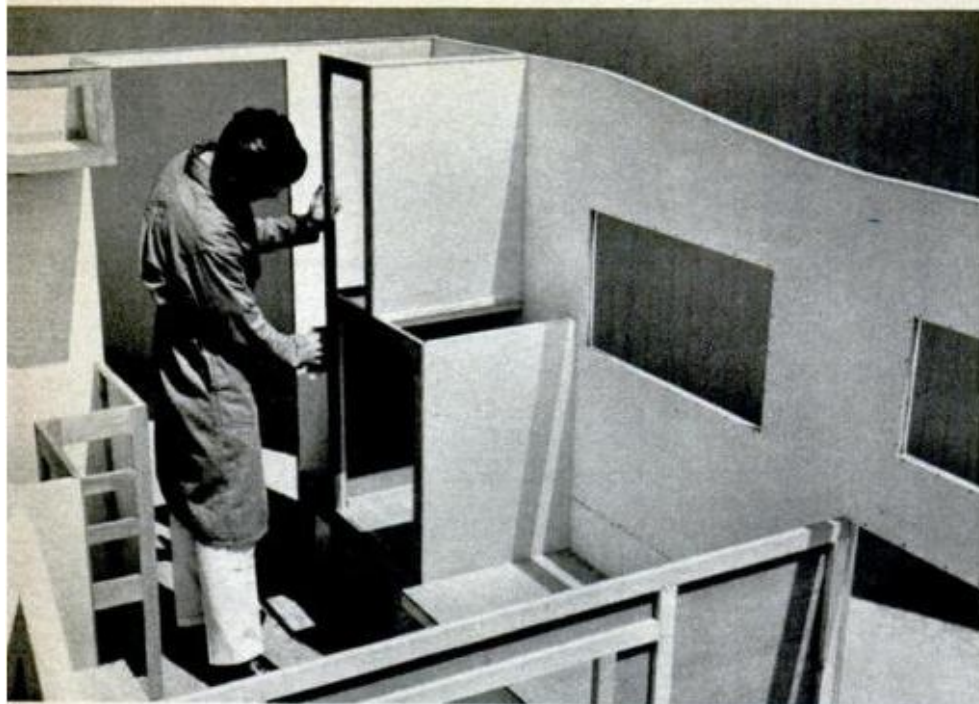


20 mg. "tar," 1.1 mg. nicotine
av. per cigarette. FTC Report Aug. '72

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

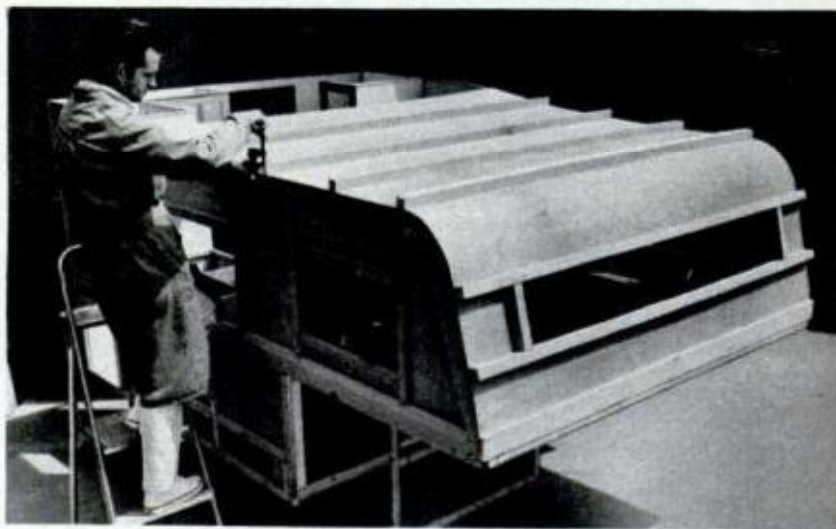
CABOVER CAMPER

(Continued from page 180)

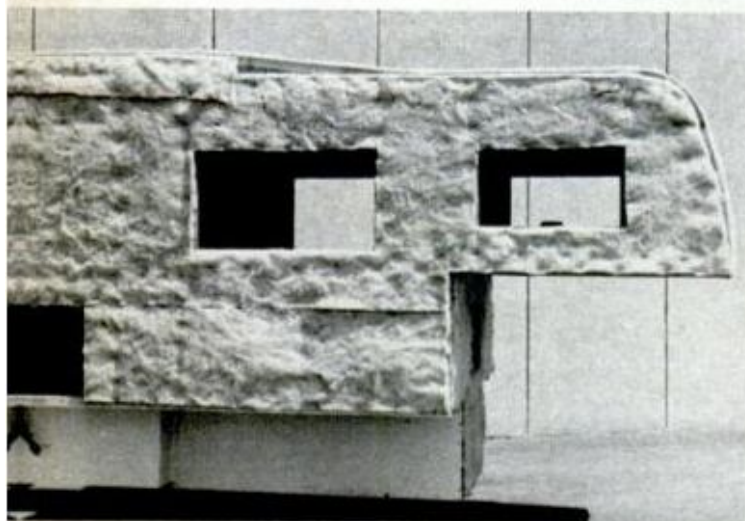


AFTER WALLS are joined, much of the interior can be completed. It's best to put in the cabinets before installation of the roof. The fronts of cabinets can be built of solid wood and doweled at corner joints. Doors should be of the panel type, rather than of the solid variety, to keep the camper's weight down

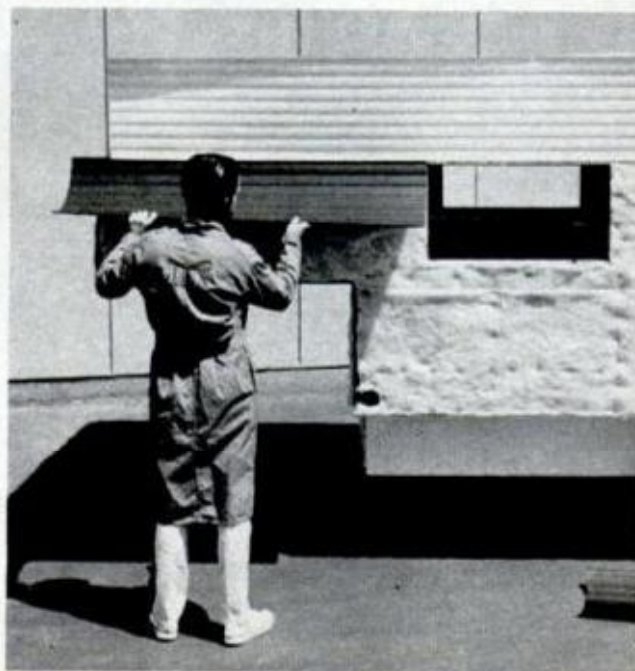
THE ROOF is preassembled in sections. Starting at the front, the first roof panel is progressively bent into place and screw-fastened to the tops of the sidewalls. Successive roof sections are butt-joined at the time they are laid over the roof beams



ALUMINUM SKIN is started at the top. However, before any aluminum is put on, the camper's entire surface is checked for protruding nails or staples



AFTER ELECTRICAL WIRING has been installed, a blanket-type fiberglass insulation of half-inch thickness is stapled or tacked to the walls and the roof



(For more construction photos, see page 184)
182

Plymouth Gold Duster.

**You get a lot for your money.
And a vinyl roof for no money.**



It only happens once a year. A car gets made like this one here. Plymouth Gold Duster. You get all the Duster specialties: room for five, cavernous trunk, electronic ignition. And more.

You get a nice deep carpet to tickle your feet.

It runs door-to-door and wall-to-wall. And it complements one of the plumpest, poshest vinyl-seat interiors you ever saw



on a compact like our Gold Duster. (As if there were a compact like our Gold Duster.)

You get whitewalls, wheel covers, and special trim.

Why not? These are probably the kind of things you'd order on a car, whether or not you were getting a special deal.

Except that with Gold Duster, you're getting a special deal.



You get a canopy vinyl roof that's right in style.

It looks like it came off a gold reptile. You can get it at no extra charge when you buy the car as described. Since the factory doesn't charge the dealer, he doesn't have to charge you.

Gold Duster. It's a Gold Sticker value.

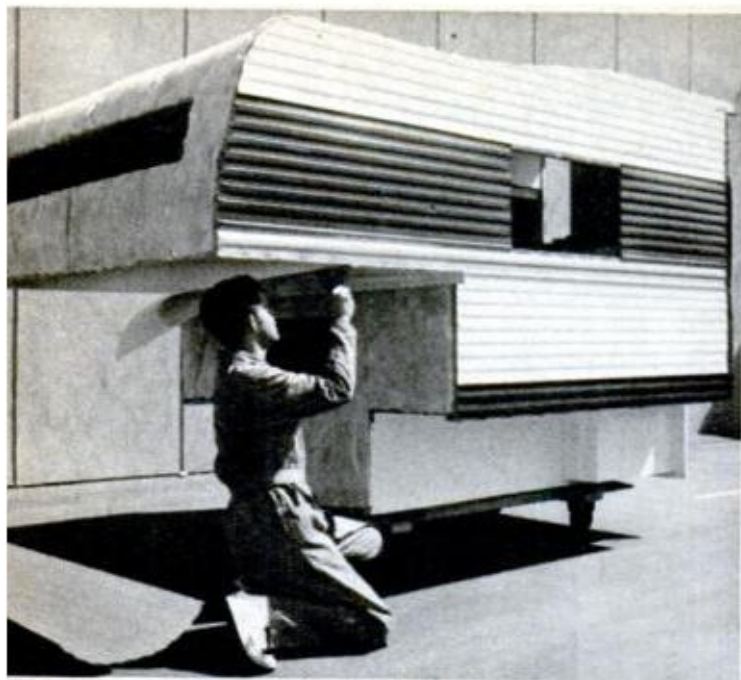


Plymouth Gold Duster. Chrysler Plymouth

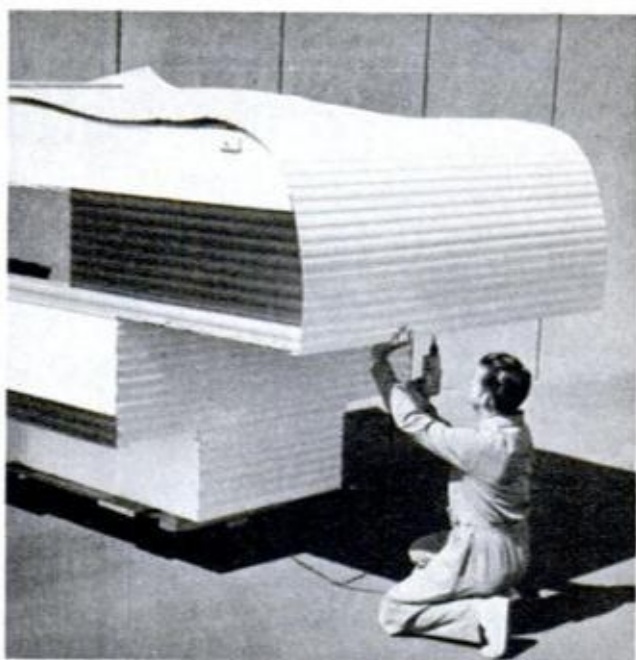
Extra care in engineering... it makes a difference.

CABOVER CAMPER

(Continued from page 182)



ALUMINUM IS INSTALLED under cabover in a prescribed sequence to insure getting a tight seam. An angle strip is used to conceal the front wall joint



ROOF METAL comes in a continuous sheet that is fastened under cabover with hex-head screws. Running lights are installed before the roof is put on

WINDOWS are fitted into wall openings and mastic is used around flanges to prevent leaks. Wiping with a solvent will remove excess mastic from aluminum



HOW TO ORDER PLANS

Plans, pictorial instruction booklet, material listings and full-length patterns of the upper portion of camper sidewalls are available. Price of package is \$10 postpaid. Order from Glen L Recreational Vehicles, Dept. PM, 9152 East Rosecrans, Bellflower, Calif. 90706.

FINAL RESULT is a neat combination of Importer and Ford-Courier. To minimize load on the truck, weight is shaved wherever possible. For instance, plans call for an icebox instead of a heavier refrigerator. In addition to d.c. current from truck's battery, camper can be equipped with a.c. system that is hooked to outside source when the compact camper is parked



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Here are two of the most complete, authoritative books ever written for the man who's handy around the house — and both are yours FREE as a new member of the Popular Science Book Club!

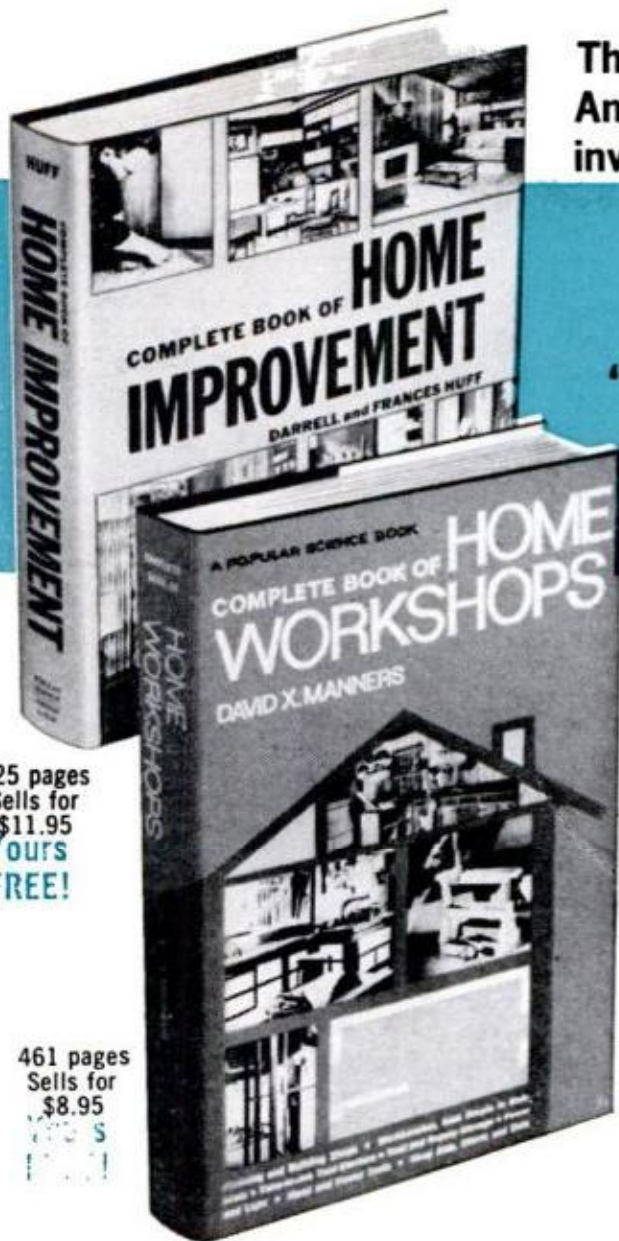
And what a pair they make! *The Complete Book of Home Improvement* will give you all the practical, step-by-step guidance you need to turn your home into a castle — with the best in modern living. Once you learn the right techniques, you'll be amazed at how little it costs (and how easy it is) to improve your floors and walls . . . add a skylight . . . modernize your kitchen and bathroom . . . add a fireplace . . . add living space . . . and lots more!

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Together, these three volumes come to over 1400 pages of specific information . . . covering just about everything the home handyman could want to know or do. They regularly sell for a total of \$29.85 — and they're all yours for less than a \$5.00 bill!

How can you go wrong on an offer like this? Mail the postpaid card now!



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Sells for
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Every four weeks, you'll receive a Club bulletin fully describing the coming Selection and many Alternates. If you want the Selection, do nothing and it will be sent automatically. If you want an Alternate — or no book at all — just indicate your preference on the special form we provide and return it by the date specified. That's all!

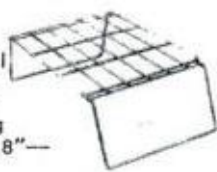
Camping '73 Shopping Guide

Estwing

Campers Grills

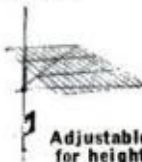
No. EG-20—\$4.90

postpaid
Heavy Duty Folding Grill
Individually Packaged
in Heavy Vinyl Bag for
Easy Packing & Storing
Chrome Plated—12"x18"—
Wt. 3½#



Swingaway Outdoor Grill

Just Drive Grill Post
in Ground for Easy Set-Up
12"x18"—Chrome Plated
Individually Boxed for
Easy Packing & Storing
Wt. 3½#—No. EG-18—
\$4.60 postpaid



Adjustable
for height

Estwing World Famous Sportsman's Axe

Forged One-Piece Solid Steel
Expertly Tempered Hand
Finished Keen, Sharp
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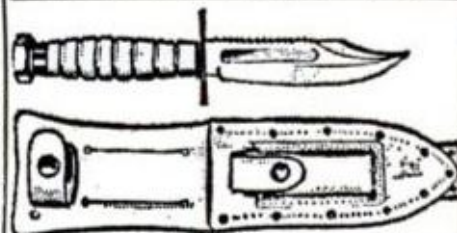
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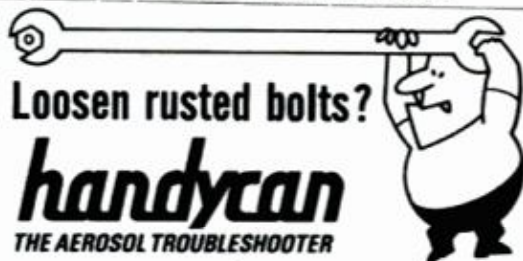
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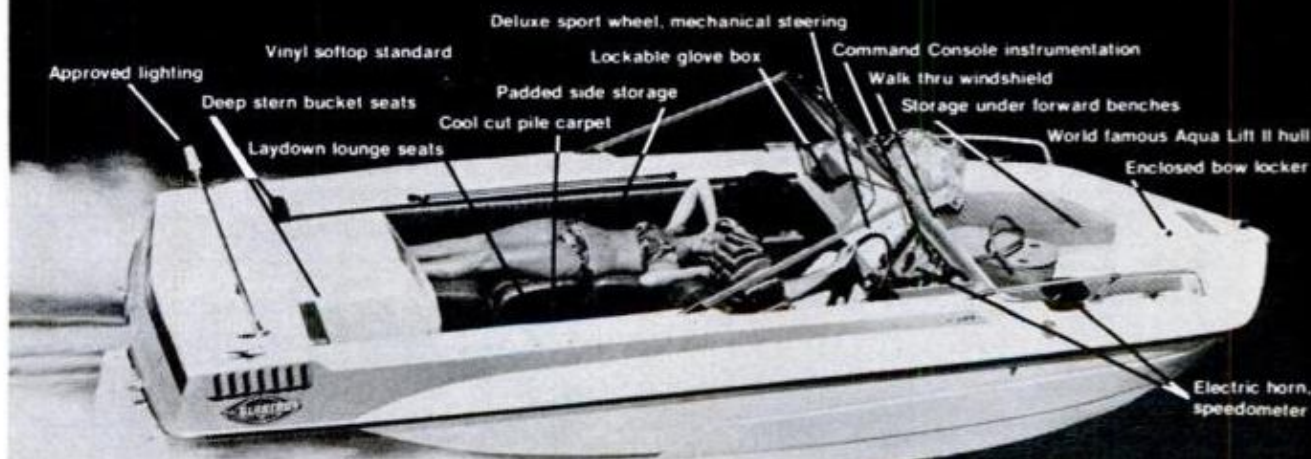
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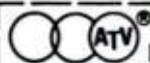
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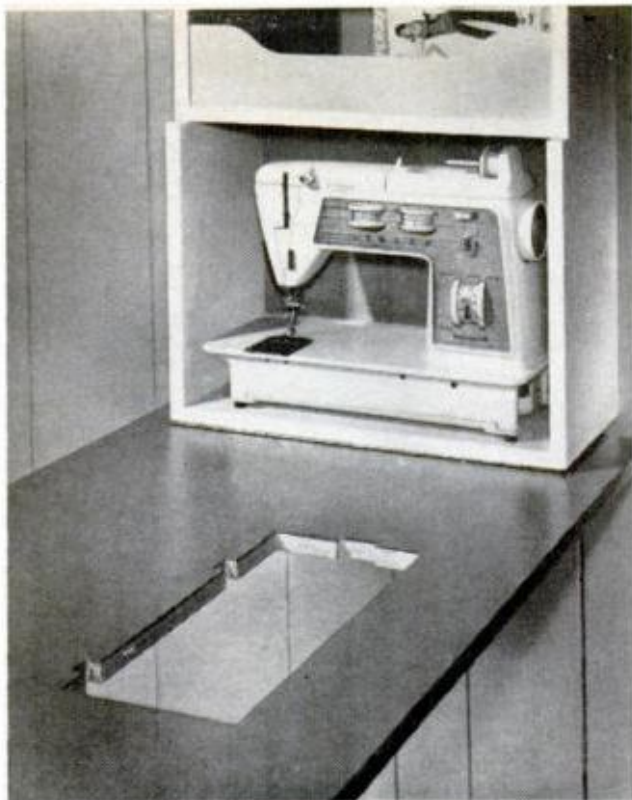
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SEWING MACHINE STOWS in base of open wall-hung cabinet when sewer calls it a day and closes up shop

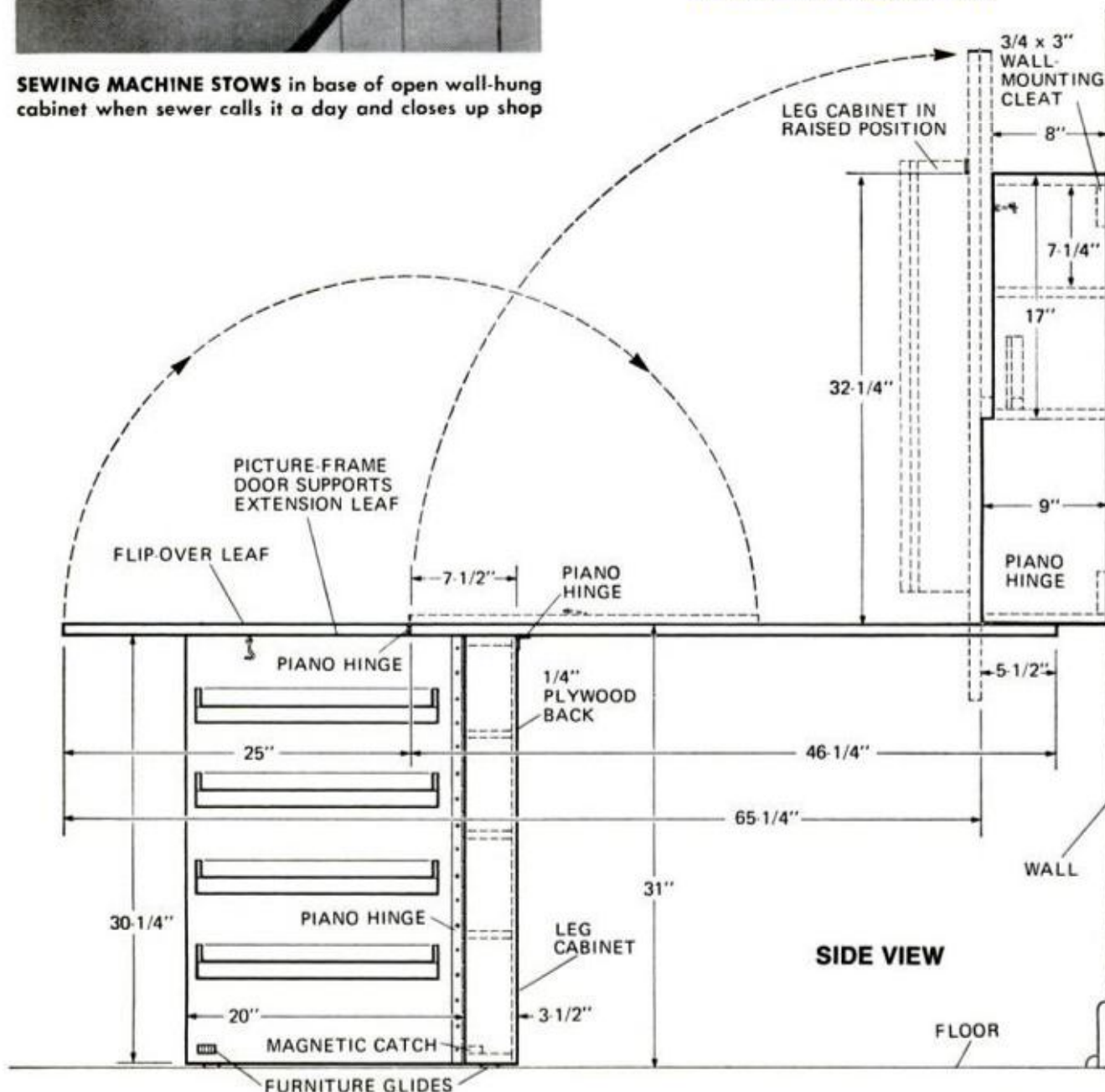
DUAL-ROLE SEWING CENTER

(Continued from page 88)

are housed in $\frac{3}{8}$ -in.-deep rabbets. The $\frac{1}{2}$ -in. plywood-panel door has a mitered frame of lumberyard molding glued to the front. Mat and picture are framed by simply gluing them to the plywood with rubber cement. The picture you see in the prototype is a reproduction of a painting by Johannes Vermeer (1632-1675) called *The Lace Maker*. If you'd like a print, send \$7 to Ostreicher's Prints, Inc., 43 West 46th St., New York, N.Y. 10036.

The framed door is attached with a piano hinge set in $\frac{1}{16}$ -in.-deep rabbets in both door and cabinet so there is no gap between the two when closed. The four spool trays vary in depth from 2 to $2\frac{3}{4}$ in., with bottom tray being the deep-

(Please turn to page 200)



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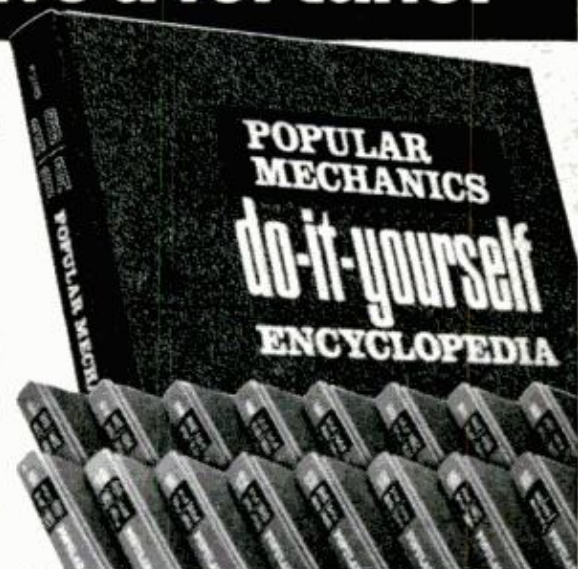
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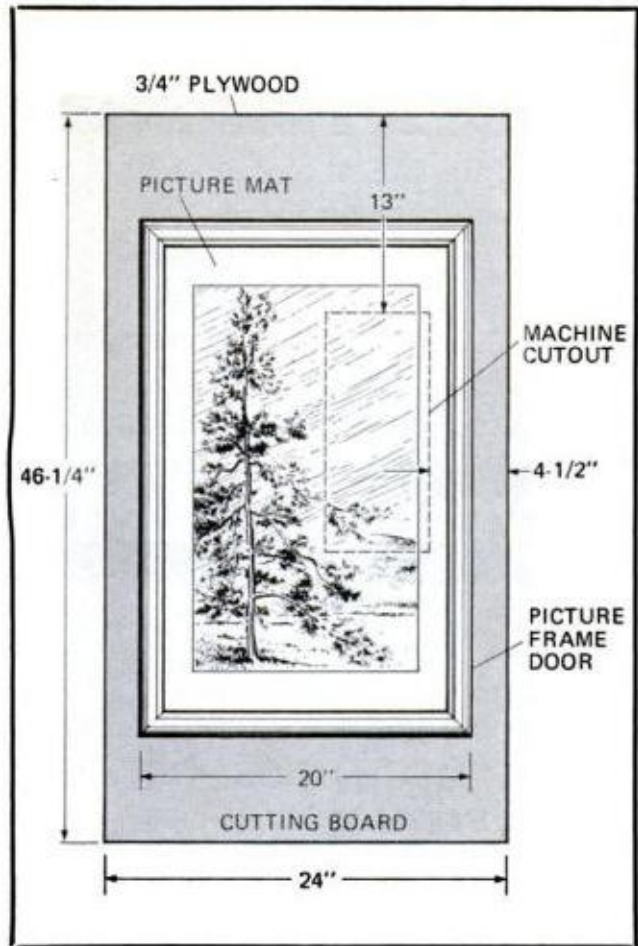
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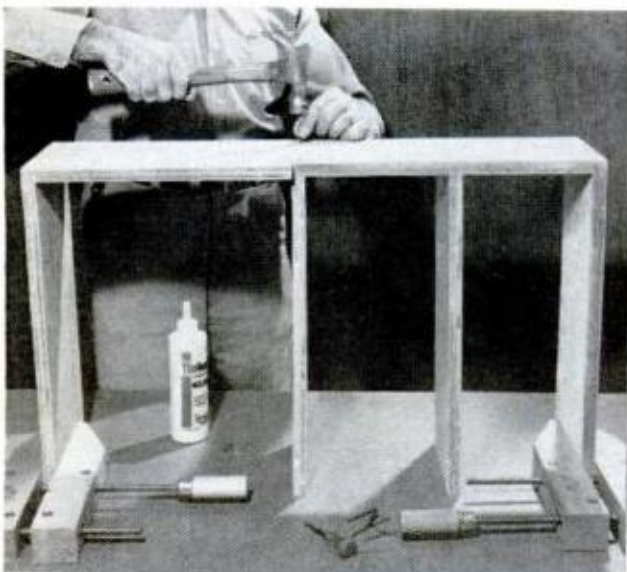
DUAL-ROLE SEWING CENTER

(Continued from page 198)

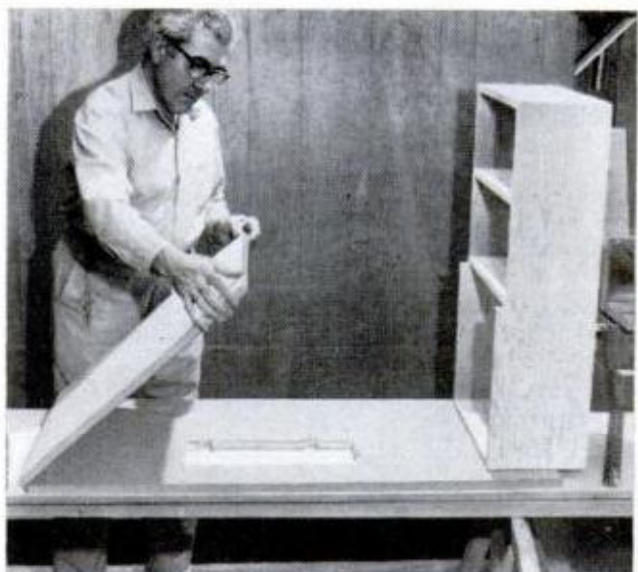
est. Ends are cut from $\frac{1}{4}$ -in. wood, the rest from $\frac{1}{8}$ in. Each tray is fastened to the door, after painting, with small oval-head wood screws.

We banded the edges of the cutting board first with plastic laminate, then covered the top surface, before hinging

the extension to the end with a 20-in. piano hinge. To assure that the extension aligns properly with the cutting board when it lies back on top of it, hold them with two C-clamps while you hinge them together. As shown in side-view drawing, page 198, the hinge point for the cabinet-leg at the outboard end of the cutting board is $7\frac{1}{2}$ in. It's hinged to the wall cabinet $5\frac{1}{2}$ in. from the end. ★★★



PAIR OF WOOD CLAMPS is of great help for holding part of wall cabinet during first phase of assembly



FLIP-OVER EXTENSION should align with edges of cutting board when it lies back on top for storage

HIGH-RISE SEWING CENTER

(Continued from page 85)

the base of the machine, the counter must be double-thick as shown in the detail on page 85, after which the top surface and the three exposed edges of the sandwich are covered with plastic laminate.

Modified mending plates and $\frac{1}{4}$ -20 T-nuts are used to pivot the cutting board and machine counter. As shown, the plates are attached to the edges, $12\frac{1}{2}$ in. from the far end in the case of the cutting board, $12\frac{7}{8}$ in. for the counter. T-nuts are installed in $\frac{3}{16}$ -in. holes in the cabinet at points $29\frac{3}{8}$ in. up from the bottom for the counter and $31\frac{1}{4}$ for the cutting table. Both sets of holes are drilled $1\frac{3}{4}$ in. in from the edge. Roundhead stovebolts are turned through the T-nuts from the outside, through the pivot holes in the mending plates and on into holes in the edges of the counter and cutting board. Bolts $2\frac{1}{2}$ in. long are required for the machine counter, 1 in. long for the cutting board. Study the detail on page 85 to understand more clearly how the T-nuts are used.

A stop block across the back supports

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the counter in a level position when it's down, and regular cupboard catches are used to hold the cutting board and sewing-machine counter when up. Friction catches hold the four doors shut. A swing-down leg hinged to a block glued to the front of the cutting board supports it. All shelves are adjustable; more can be added.

The method used to hold the machine securely in the counter cutout so it can be swung up depends on your particular machine and its base. One way to fasten it would be to drill four small holes through the metal base, countersink them and drive nickel-plated oval-head wood screws into the plywood top. ★★★

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POLAROID'S NEW SX-70

(Continued from page 107)

whir (to raise the two-sided hinged mirror from viewing to taking position, the 12,000-rpm motor turns just seven revolutions in 0.0066 of a second!). The screen darkens and stays dark for the duration of the exposure (anywhere from 1/200 to 20 full seconds, automatically timed) plus the 1½ seconds it takes for the motor to spit the film out of a concealed slot at the front of the camera. Then the image is back, and you're ready to shoot another picture—or even shoot off every film in the pack in sequence, only 1½ seconds apart.

The motor drive is important, since it prevents the biggest single cause of poor Polaroid pictures to date: uneven tugging of the film packet from the camera. And the film packet is important, too: for this film has no paper wrapper and gooey, chemical-laden negatives to peel off and throw away. Instead, the film emerges from the camera with an opaque, grayish-

You no longer have to count seconds . . . the new film times its own development.

turquoise chemical layer protecting its developing image from the light, and with all chemicals sealed inside the plastic film packet.

Gradually, right before your eyes, the image pushes through the opaque layer, showing a recognizable outline in about one minute recognizable colors within four. After five minutes, the colors look good, and they continue to improve subtly until they reach their brilliant, vivid, deeply colored final stage—in about 10 minutes. Then development stops, automatically.

The new SX-70 film has clearer, richer colors than Polaroid Colorpack 108 film, with pinker skin tones, and none of 108's graininess (even under an 8X magnifier, SX-70 looks grainless). But its latitude is still too narrow to capture full details in both light and dark picture areas, and it's still a bit insensitive to green.

SX-70 film also has less grain and richer colors than conventional Kodacolor-X, but Kodacolor still has the edge in latitude and color accuracy.

On the other hand, Polaroid still has the edge in time, the immediacy that was the keystone of Dr. Land's original vision. And though the new film takes far longer than the old one's 60 seconds to develop, you no longer have to stand around counting seconds, since the new film times its own development. You can just slip the exposed films into your pocket and walk on. Or, you can sit and watch since, as Dr. Land points out, the new process gives you "the joy any child knows in the darkroom of seeing the picture come out under the red light. Only this is the first darkroom in which you can see color developing . . . a darkroom which is a light room."

At the other end of the time scale, the new Polaroid film's pictures should outlast those of the old film (and, possibly, those of conventional color films as well). That's quite a trick, considering that the negative and chemicals, sealed within the print packet, can't be stripped away as the old film's could. So making the prints permanent took not only new, fade-resistant metalized dyes (the fruit of 15 years of Polaroid research), but also new film and developer chemistry that would lock those dyes into their proper places, and lock up the other chemicals in harmless form as soon as the development stage was complete.

Even the film packet makes a contribution: Of Mylar plastic, it forms a scratch-resistant, waterproof window over the image. (And since the top and bottom Mylar layers are of equal thickness, the new prints won't curl.)

There are 10 such plastic packets in each SX-70 film pack, plus a unique, flat battery for the motor, photocell and flash. But even with a fresh battery in every pack (which should end battery troubles), the new pack is the most compact in Polaroid's history, and costs two cents less per shot than regular Polacolor 108.

The camera's compactness stems largely from the film's, but the unique, folding reflex design (see illustrations, pages 104-106) accounts for it still more—not only because the camera folds, but because the mirrors lengthen the light path without lengthening the camera. Even the f/8 lens is uniquely compact: though its focal length is 4.6 inches its thickness is only 0.4 inch, a fraction of the thickness of conventional designs, and the front element

(Please turn to page 204)

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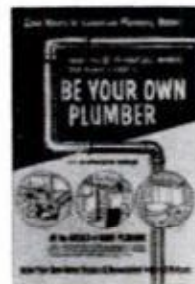
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POLAROID'S NEW SX-70

(Continued from page 202)

moves less than $\frac{1}{4}$ inch to focus from infinity down to 10 inches.

Dr. Land needed such a compact lens to make the camera foldable. But its close-focusing ability (the SX-70 takes half life-size images at 10 inches, life-size ones at 5 inches with an accessory) was important to him, too: "In our dream . . . we didn't want the kind of camera that stops at three feet or even at two. . . . There's endless excitement within your hand's reach—that's your three-dimensional world."

Making the camera easy to focus (and it is) took still more revolutionary thinking. With only an f/8 lens, a conventional ground-glass image would be far too dark to focus on. And Dr. Land didn't want to use split field or microprism, since he felt "the whole beauty of the picture, with nothing to break it up, no little rings or prisms in the middle, was the important part."

So the SX-70's focusing system is as

SX-70's focusing system is as much like a telescope's as a camera's

much like a telescope's as a camera's. The image is formed and viewed in mid-air rather than on a ground glass. The main function of a ground glass—blurring the out-of-focus light rays so you can tell them from the focused ones—is accomplished by a microscopic pattern on the upper (viewing) surface of the moving mirror (see page 104). This pattern is superimposed on a Fresnel pattern that brightens the image as a Fresnel lens under a ground glass does. But this patterned mirror, unlike ordinary ones, reflects asymmetrically—where an ordinary mirror in the film plane would reflect the image right back to the sloping mirror above it, and back out the lens, the SX-70's viewing mirror casts its image at an angle, to pass it on to the viewfinder. All to let you "live in the viewfinder . . . seeing an image in space without seeing the focusing screen, so that you come out with the feeling that there's nothing between you and the image itself."

Exposure is controlled by a two-blade, two-hole shutter assembly that doubles

as the lens diaphragm. Press the electric shutter button (the "cable release" is also an electric switch), and the shutter closes down to darken the film chamber while the mirror rises from viewing to taking position (see page 104), opens to the correct f-stop, then closes again until the mirror falls back into the viewing position.

The shutter's second hole covers the light-meter cell (a photodiode that's far more accurate than conventional light cells), so the light read by the meter during exposure is proportional to that reaching the film.

Plug in one of the new, 10-shot GE Flash-Bars, though, and the exposure system changes. The shutter automatically sets itself to $\frac{1}{30}$ second, while the lens aperture varies with the distances, closing down as you focus closer to compensate for the flash's brighter illumination of nearby objects. From f/8 at 20 feet, the lens closes down to a pinhole f/90 at 10 inches, giving tremendous depth of field for closeups (see page 106). Unlike Polaroid's earlier flash exposure system, which cut off the shutter when enough light had bounced back from the subject, the SX-70's focus-linked system can't be fooled by light or dark backgrounds—but it can't compensate for light or dark subjects, either.

There are five bulbs on each of the Flash-Bar's two sides, each one half the size and twice the light output of those in flashcubes. GE-developed circuitry in the camera automatically skips all used bulbs to fire the next live one. When you're out of film, the Flash-Bars won't fire (but you can waste a film if you've used up your Flash-Bar). One problem, though: red-eye reflections caused by the flash's proximity to the lens, and most troublesome with the middle bulb of the five-flash array; Polaroid is bound to bring out a flash extender, just as Kodak did to solve the same problem on its Pocket Instamatics.

Listen to Dr. Land talk about his dream-child, and the word "remarkable" pops up in every other paragraph. Considering how many revolutionary developments went into its design—new lens, film, chemistry, viewfinder, camera design, flash and motor control circuitry—that's even more remarkable as an understatement. ★★★

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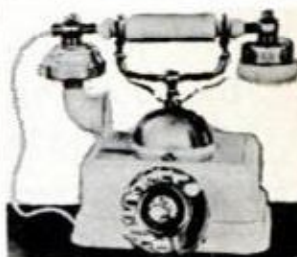


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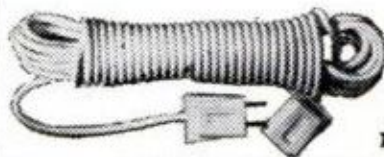
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THOSE WILD NEW WINGS

(Continued from page 128)

giant behemoths envisioned a decade ago.

While Boeing is busy experimenting with its swing wing, the delta wing has not been forgotten, either. In an effort to overcome its basic shortcoming of rapid loss of lift at low landing speeds, two designers are proposing a really wild scheme. It's also a swing wing—but up and down instead of sideways. The delta is hinged at the tail and slotted in the middle to straddle the fuselage. Developed by Mason and Granbyrne Trupp of Tampa, Fla., it can be tilted up or down at will to vary its angle of attack and thus its lift. As the pilot makes his landing approach, he gradually raises the wing. This has the same effect as coming in nose-high, except that the fuselage remains level for good ground visibility without the need for an elaborate droop snoot. Very short landing runs are possible

... the raised wing acts like a giant air brake once the plane touches down.

since the raised wing acts like a giant air brake once the plane touches down.

Short takeoffs are another advantage claimed for the system. Since the engines are attached to the wing and point downward in the raised position, they thrust the ship upward at a steep angle, getting it off the ground quickly. In flight, the wing retracts for high-speed cruising.

Another unconventional design coming along is the so-called "supercritical" wing. Like the antisymmetrical wing, it is also a NASA development, this one the work of Dr. Richard T. Whitcomb at the Langley Research Center in Hampton, Va. Unlike the antisymmetrical wing, however, it is designed primarily for improving performance at near-sonic speeds rather than at high supersonic speeds. Flatter on top than the conventional airfoil, its object is to "delay" or push back the impact of sonic shock waves to a point farther back along the wing. This reduces drag produced by sonic turbulence and results in greater speed and maneuverability. To compensate for some loss of lift caused by the flatter wing, the trailing edge curves down slightly, giving added

upward thrust something like the increased lift an airliner gets with its wing flaps angled downward on landings and takeoffs.

The new wing has already been successfully tested on a modified F-8 Navy fighter and is expected to be especially beneficial to military aircraft where increased speed and maneuverability are vital in aerial combat. The term supercritical, incidentally, is used to indicate a "delayed effect," just as supercooling of liquids delays or lowers the freezing point below normal freezing temperatures.

Meanwhile, back at the drawing board, a heated debate is beginning to develop over just how airplanes fly in the first place. The long-accepted "Bernoulli theory" is now getting its lumps from retired NASA expert Norman F. Smith of Alvin, Tex., who's had 30 years of experience in aerodynamic design. The established schoolbook explanation is based on the assumption that air flowing over the curved upper surface of a wing is forced to speed up to cover the longer distance in the same time as slower-moving air passing along the flatter underside. According to Bernoulli's law that a fluid decreases in pressure as it increases in speed, the faster-moving air above the wing creates a low-pressure "suction" effect that gives a plane its lift.

Not so, claims Smith. Anyone who has ever stuck his hand out the window of a moving car knows that if you turn your palm upward, your hand "flies" upward. If you turn it downward, it's forced downward. This, says Smith, is actually what makes an airplane fly. Air striking the slightly upturned underside of the wing is forced downward and reacts by pushing the wing—and plane—back upward. Thus the credit should go to Newton (for every action, there is an equal and opposite reaction) rather than to Bernoulli, argues Smith. He doesn't deny that the Bernoulli effect may take place; he simply doesn't believe it's the primary source of lift. His theory is at least partially borne out by the fact that most modern high-speed wings are virtually symmetrical in cross section anyway.

But whether it's Newton or Bernoulli, antisymmetrical or supercritical, swing-wing or tilt-wing, a lot of exciting things are happening in aviation today that just may bring about a dramatic new breakthrough in jet-age air travel. ★★★

'DUST-FREE' HOME

(Continued from page 148)

placed with one fitted with turning vanes.

You can have this part made to fit the cleaner at a sheet-metal shop, along with a starting collar sized to slip over the furnace inlet flange. As shown in the drawing on page 147, the collar is attached to one side of the cleaner and the transition elbow to the other. Holes are already in the frame of the cleaner, and I found that Pop rivets were perfect for fastening the three parts together. To attach the assembled unit to the furnace, you simply slip the starting collar over the inlet flange and drive pan-head, sheet-metal screws in from the sides to hold it. Avoid using Pop rivets here since they would make it difficult to detach the cleaner assembly from the blower compartment should you wish to do so at a later date.

The old furnace filter is discarded, of course, and the blower compartment cleaned thoroughly before you start.

If the vertical drop of the return-air duct is less than 7 in. from the side of the furnace, an offset section of duct will have to be used to assure proper alignment. All joints in the return-air system between the air cleaner and furnace should be caulked and sealed to prevent dust from entering the clean airstream.

The electronic cells slide in place with their contacts up and airflow arrows matching the airflow. The ionizer sections and the protective screens must be on the *upstream* side of the cells.

The air cleaner is wired to operate only when the furnace blower is running. Access to the junction box is gained from the top of the unit, and wiring diagrams are provided to suit your particular blower motor.

From time to time, you may hear a snapping noise coming from the air cleaner. Called arcing, this may occur when the cleaner collects an unusually large particle, when the cells are still wet after washing or when they are very dirty.

Caution: The access door of the cleaner is connected to a shorting mechanism that discharges the high-voltage power supply when the door is opened. *Always turn off the blower switch before touching any internal parts of the cleaner.*

For additional information and prices write Honeywell, 2701 Fourth Ave. South, Minneapolis, Minn. 55403. ★ ★ ★

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TRAVCO'S MINIHOME

(Continued from page 165)

tank in the fall, puts antifreeze in his Porta Potti chemical toilet, uses no running water through the faucets aboard until spring and has no more trouble.

Handling heat was a problem for a New Orleans man. He bought his Minihome without the optional Mark IV built-in air conditioner. Shopping around later, he found no company would guarantee effective cooling of the rig unless a bulky rooftop unit was installed up there. Since the good looks of the Ford conversion is one of the pluses mentioned by a number of owners, it would appear wise to order the Travco Family Wagon with built-in air conditioner, no matter what make of chassis, or shop for a used Minihome with the cooling system already installed.

We never experienced insufficient cooling with our model, or excessive engine heat in traffic or mountain driving in tests of over 20,000 miles. A cool feature we especially favored was a 12/110-volt refrigerator that kept cold drinks ready.

Going back to get them could be a skull-snapper, however, if the top pipe berths were left in place. A cross-brace to hold the aft end of the bunks was a bore to duck constantly. Most owners we surveyed dismantle the top bunks every day after one or two scalplings. The agreement, in fact, is that this Family Wagon is comfortably laid out for two with any of the optional interior arrangements, but that camping gets more crowded with even small children along. Perhaps especially with children, although our crew of three is eager for a Minihome trip at any time. With the rear seat folded down into a roomy double bed, they have plenty of space for games or naps.

Rear dinette and gaucho floor plans are offered for the new Royale I and II models. A Busyvan is also available which a camper can fit out himself. Many companies like the walk-around headroom and buy it for their own commercial applications. The latest Travco Family Wagon Lift-top Royale I starts at \$4995 and goes up as more deluxe accessories are substituted or added. Royale II and Maxi Custom have hard tops.

Owners like to describe the many ways they use their rigs. I remember showing TV star Johnny Carson through mine. He was thinking of it as a base of operations

while skiing. Really self-contained? I got into mine in Maine and didn't step out until I reached the Mexican border in Arizona seven days later. Driving alone was lonely, but the Minihome ran like a well-wound watch. Take someone along and, as any owner can tell you, compact camping can be easy—and fun. ★★★

WINNEBAGO'S D-20T

(Continued from page 167)

"and I can't reach the headlight dimmer switch. That will have to be changed. But the windows in the rear bedroom are wonderful. My wife and I lie in bed in the morning in the campground and watch the birds."

For the birds is the front muffler clamp, according to a South Carolina rental agent. All three of his units (and our test vehicle) had loose mufflers. Dodge dealers offer an "improved" clamp, but the permanent cure is welding.

The gauchos—sofa beds—in most motor homes today seem to have been designed for Wilt the Stilt. Those in the D-20T make up into a king-size bed, but they leave a lot to be desired in seating comfort. The sofa seat height is 21 inches; the depth to the bolster cushion 26 inches. (Average chair height is 18 inches, depth 21 inches.) Most adults find their feet dangle above the floor if they want back-cushion support—the gauchos' dimensions were determined by the water tank under one and the furnace under the other.

We couldn't do anything about seat height, but in the test vehicle we cut seat depth to 18 inches by building top-opening wedge-shaped cabinets behind the bolster cushions. These are sloped at a comfortable angle, provide firm support and additional storage space.

Despite minor gripes, the D-20 model seems to be the ideal size for those who want the spaciousness of a full-size motor home in a length most mini motormakers must stretch to reach. It is currently Winnebago's best seller. ★★★

GRUMMAN'S MOTORHOME

(Continued from page 169)

tective cage that doesn't rattle or squeak.

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(Please turn to page 210)

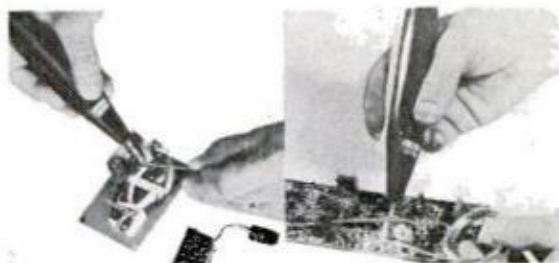
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GRUMMAN'S MOTORHOME

(Continued from page 208)

ahead and to the sides. Double mirrors on each side give him rear visibility. With power brakes, power steering and automatic transmission, the Motorhome seems designed to pamper the driver. The front-access door to the oil filler and radiator does pamper the driver who's accustomed to lifting the engine cover alongside his seat to check oil.

The 392-cu.-in. International engine in the test vehicle pulled the big Motorhome along easily at 60 or 70 mph (getting 8.29 mph overall, we found) and had enough extra push for passing on a hill.

The ride is like any other motor home built on a stiff-suspension chassis—pretty good for the driver and copilot in their pedestal seats, but somewhat rough as you move back over the rear wheels. The suspension has its pluses, though: You don't fight to keep going straight in crosswinds, and there's good control and stability in turns (as we proved in a frantic lane-shift at 60 mph to avoid a car backing up on a throughway).

In a campground, with three kids and a dog along, we experienced a certain amount of stepping on one another's feet, but that seems to be part of motor-home living—with a family, anyway. Otherwise, life is comfortable in a Grumman, with its deep-pile carpeting, four-burner range with oven and fan exhaust, seven-cubic-foot gas/electric refrigerator, hot and cold water, marine toilet and ample storage space. The rear-bath model we tested even has a bathtub. (The side-bath 25-footer trades off the tub for a spacious bedroom in the rear.)

We liked the nicely finished interior and the fact that there's plenty of space between upper and lower bunks so the bottom sleeper doesn't get claustrophobic.

Grumman has been building motor homes nearly four years (with 25 previous years' experience building Olson vans and trucks). A 23-footer, once in the lineup, has been dropped, so present choices are:

- 21-foot Motorhome with side bath (new for 1973). Basic price: \$10,750. It's a four-sleeper, with bunk options for four more. Chassis/engine choices are Dodge, Chevrolet and International, all with 137-inch wheelbase.

- 25-foot Motorhome with side bath. Basic

price: \$14,670. It's a four-sleeper, with bunk options for three more. Chassis/engine choices are Dodge, Chevrolet and International on a 159-inch wheelbase.

- 25-foot Motorhome with rear bath. Basic price: \$14,880. We tested this one. It has sleeping for six, with an optional bunk over the driver's seat for a seventh. Chassis choices are the same as above.

- 28-foot Motorhome with side bath (new for 1973). Basic price: \$17,990. Built for the "adventuresome couple, the retired couple," this model has twin beds in a rear bedroom plus a couch toward the front that converts to a double bed to sleep a total of four. It has Dodge or International chassis with a 178-inch wheelbase.

Owners, who had individually driven 9000 to 22,000 miles, reported getting 7 to 8 mpg with the 25-footer and 7 to 10 mpg with the 23-footer.

The side bath vs. rear bath option of the 25-foot machine had proponents on both sides. "I like the bathtub back there; it makes a kind of utility area that's great for drying ski clothes," said a New Jersey college professor. But lack of a tub in the side bath is no loss, reported a teacher who prefers the big bedroom at the rear.

"There's no comparison with the stability of the Grumman," the teacher continued. "It gives you a feeling of security and quality." A New York electrical engineer likes "its construction and how it looks," and another engineer says simply: "Built solid." Most other owners agreed.

Complaints ranged from "none" to "minor" to a list of 20 grievances from a New York physician who "will never again buy a motor home from a dealer who is unprepared and/or unwilling to give full service." He had "windshields popping out, cracks in the fiberglass roof, fuel line burning through where it lay on the exhaust manifold, transmission selector that slips out of position, air leak around the door" to list some. But, he concedes, "Overall body work is excellent," and it "will be a fine coach" when all is right.

An Indiana real-estate man who's a reserve jet pilot, tried 11 motor homes before he bought a Grumman—and he puts it to a most unusual use: "I take customers and their children to see houses. The kids stay in the Motorhome and watch TV and drink Cokes. Then when we conclude business we may have a martini out of the refrigerator." ★★★



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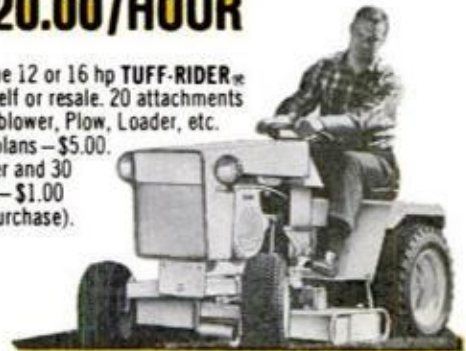
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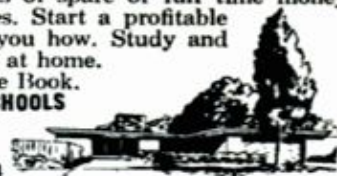
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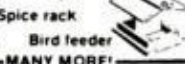
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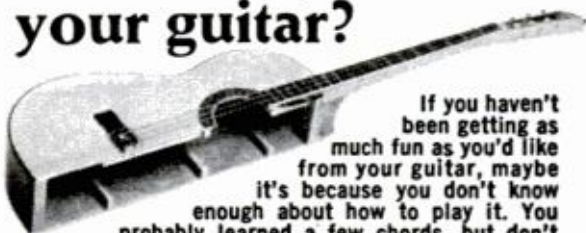
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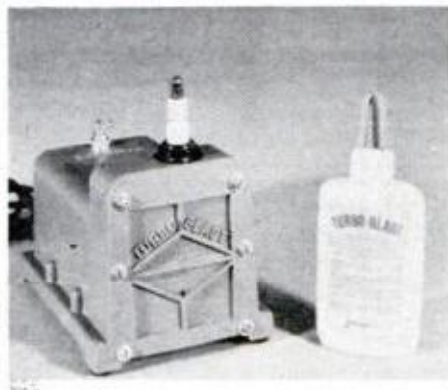
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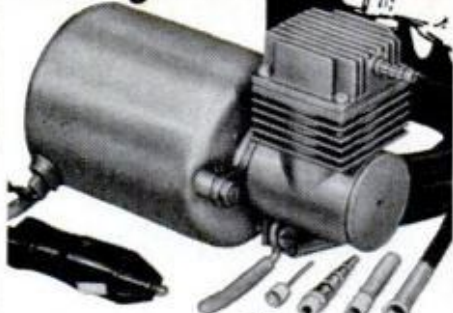
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(Continued from preceding page)

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235

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