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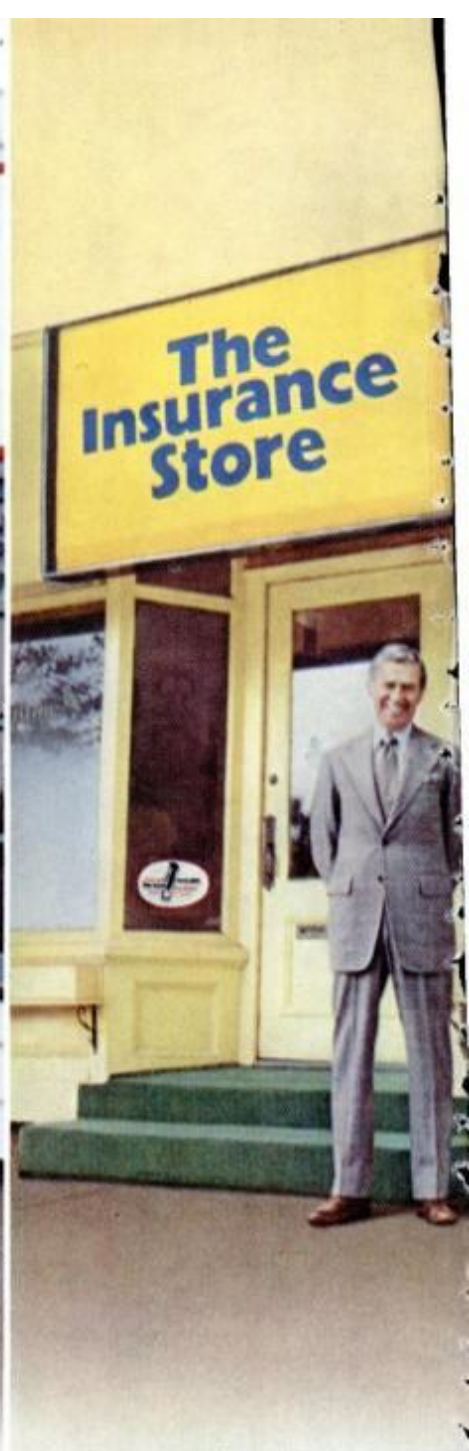




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On the cover

There's no altimeter among the instruments on the dash of the Subaru Brat, but that didn't keep us from seeing how high we could fly the new four-wheel-drive pickup. The unique machine sports bucket seats in the bed for passengers who have no fear of flying—backward! Peter Samerjan shot the picture and West Coast Editor Mike Lamm did the Firsthand Report that begins on page 118.



MARCH 1978

CONTENTS

VOLUME 149 NUMBER 3

INTERNATIONAL EDITIONS: AUSTRALIA, CARIBBEAN, MEXICO, SOUTHERN HEMISPHERE

Special features:

Sneak peek at Nova's front-wheel-drive design for the '80s

Here's a detailed look at GM's radically different compacts.

87

Exclusive: Exotic new weapons for the war against terrorism

How commando groups operate swiftly to save hostages.

90

BONUS section: Gardening and outdoor living

Build our bi-level deck, long-lasting fences, no-care garden.

135

PM dives in a missile sub

Our reporter tells what it's like to ride America's mighty deterrent for war.

94

Sabre saws

A master craftsman's tricks with the most versatile tool!

130

Tire quiz:

PM answers the 20 toughest questions about tires.

100

Automobiles and bikes

- [12 Detroit Listening Post](#)
- [32 Imports and Motorsports](#)
- [42 PM Garage](#)
- [52 Car Clinic](#)
- [64 Your motorcycle: How to control your bike like a pro](#)
- [87 Cars of the '80s](#)
- [98 Firsthand report: Driving Toyota's new Celica](#)
- [100 This tire quiz can save your life](#)
- [118 Firsthand report: Driving the Subaru Brat](#)
- [122 PM Owners Report: Peugeot](#)
- [124 Saturday Mechanic: How to add the luxury of cruise control to your car](#)
- [224 Bike-O-Mania](#)

Boating and outdoors

- [46 All Outdoors](#)
- [70 Orienteering—New sport that can save your life](#)
- [110 Camp/work conversion you can do on a budget](#)
- [112 '78 RV camping: 12 that are great for camping](#)
- [116 First-timers test a motor home](#)
- [120 New add-ons for RVs](#)
- [121 Latest for tenters, packers](#)
- [218 Tantalizing Tents](#)

Science and engineering

- [14 Science Worldwide](#)
- [90 When the terrorists strike](#)
- [94 PM dives with our deadliest missile sub](#)
- [104 Bold new look at a bright new sun](#)

Home and yard

- [16 Appliance Clinic](#)
- [22 Homeowners' Clinic](#)
- [128 Three practical, attractive towel racks to make quickly](#)

Worth writing for

Looking for more ideas and information? See page 175.

PM'S 1978 GARDENING AND OUTDOOR LIVING GUIDE

- [137 Turn your above-ground pool into a backyard resort](#)
- [140 9 great ways to fence your yard](#)
- [144 Gardening with pebbles and rocks](#)
- [148 How to have a greenhouse this spring](#)
- [152 Grow under glass to get a jump on the season](#)
- [156 Lazy man's vegetable garden](#)
- [160 How to get the most from your garden tiller](#)
- [164 How to avoid 13 most common back-yard accidents](#)
- [168 20-step spring tune-up for your garden tools](#)
- [174 New products for lawn and garden](#)
- [178 9 steps to a healthier lawn](#)

Electronics, radio and TV

- [108 Old radios: New turn-on](#)

Shop and crafts

- [28, 38, 58, 62 Hints from readers](#)
- [36 PM Workbench](#)
- [44 PM looks at 3M's press 'n sand](#)
- [56 PM looks at precision drill guide](#)
- [80 Shaker candleholder kit](#)
- [82 PM looks at plastic laminate trimming knife](#)
- [126 Build this movable cabinet for small-tool storage](#)
- [129 2 ways to cut perfect circles](#)
- [130 Basic cutting with a sabre saw](#)

Photography

- [48 Photo Hints](#)

Every month

- [6 Letters](#)
- [18, 25, 26, 97, 108 It's New Now](#)

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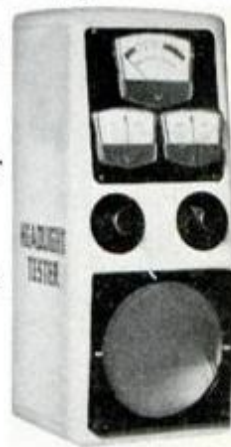
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Special Publications: Clifford B. Hicks

Editorial Offices: 224 West 57th St., New York, N.Y. 10019

Bureau of Information: Sophie Gronowicz, director; 224 West 57th St., New York, N.Y. 10019. (212) 262-4292

Director of Advertising
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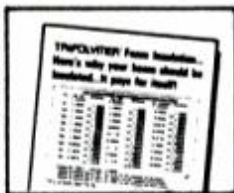
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LETTERS TO THE EDITOR

Likes basic approach

Our U-Mass/Five College Federal Credit Union attempts to provide our members with useful information in assisting their financial management and related activities. We find *Building an Energy-Saving House* (page 124, Nov. '77) an excellent summation of basic principles, written and illustrated in an easily understood manner.

FRANK OLBRIS
SECRETARY, BOARD OF DIRECTORS
AMHERST, MASS.

Immoral to buy big car?

The statement by Mort Schultz in the *Car Clinic* (page 36, Dec. '77) that it's immoral to tell people how to remove an emission control is highly debatable. In view of our country's worsening trade deficit, which results directly from importing too much oil, one could argue that it's immoral to waste gasoline and that to tell the public how to save gasoline is patriotic.

The American public has never been consulted on whether they want these controls on cars. It is time for a national referendum on the issue.

It's amazing that the government still allows the making of big gas-guzzlers, which require the most wasteful controls and which create the greatest temptation to remove those controls. Perhaps it's also immoral to buy a big car.

ROBERT D. SMITH
SWISHER, IOWA

No fuel-line freeze-ups

This is a letter regarding Mort Schultz's article *How to Protect Your Car against the Cold* (page 109, Dec. '77). Mr. Schultz omits mention of the use of gas-line antifreeze, a must during the cold winter months. I hope that you publish this letter as an aid to your readers.

DONALD A. CRISTY
PRESIDENT
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The author replies: "Gas-line antifreeze is a wise precaution in the event that water does get into the fuel system. However, savvy drivers make sure they keep their fuel tank topped off all winter, again cutting down chances of condensation."

Motorizing affects warranty

This is in reference to Bill Hartford's article *How to Motorize Your Bicycle* (page 112, Dec. '77).

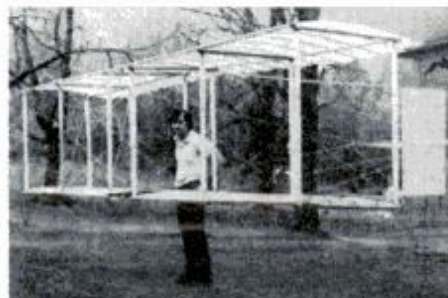
Since the author uses the Schwinn 10-speed Suburban, we think it appropriate that you warn readers that by motorizing their Schwinn bicycles they run the risk of invalidating the Schwinn Bicycle Co. Limited Warranty covering the product. In addition, motorizing takes the bicycle out of compliance with Consumer Product Safety Commission federal regulations applicable to bicycles.

Of course, this is the consumer's choice. Nonetheless, we believe that a word of caution is in the best interest of your readers.

RAY CAPARROS
MANAGER, ADVERTISING
SCHWINN BICYCLE CO.
CHICAGO, ILL.

He built an early bird

I recently read a newspaper story



Douglas Hawley shows his handiwork.

about a man in Oswegatchie, N.Y., who built a glider for \$25 from plans in a 1909 edition of *PM*. To fly it, the pilot stands in a "hole" in the lower wing and runs down a hill until the glider takes off. Can you send me a copy of the plans?

MATT RIGGIN
TULSA, OKLA.

*Though his flight was short, Douglas Hawley made news by demonstrating, from a steep hill in Oswegatchie, that *PM's* vintage glider design works. His bird weighs 50 pounds, has a 20-foot wingspan, is 13 feet long and took him 25 hours to build. He made some changes in the original specs, using plastic film instead of muslin to cover the wings and nylon cord for rigging.*

A photocopy of the plans (No. X315) can be obtained for \$1.00.

*(Please send payment to: *PM*, Dept. X315, 1201 N. 17th St., Tulsa, Okla. 74104.)*

ANOTHER GOOD STEER FROM A TILT-WHEEL USER



I've been sold on tilt-wheel steering ever since I first tried it on my Dad's 1969 Pontiac

*Keith Blixt
Curdew, North Dakota*

ather, like sons. Keith Blixt, at the wheel of his 1977 GMC 4-WD pickup, isn't the only member of his family who is sold on Tilt-Wheel. His son, Gordon, left, enjoys Tilt-Wheel steering in his GMC pickup. And another son, Roy, center, wouldn't be without Tilt & Telescope Steering on his 1977 Cadillac Sedan DeVille. Blixts especially appreciate Tilt-Wheel when wearing bulky cold-weather clothes.

l wheel moves up out of the way to help make getting in and out easier. It adjusts to drivers of all sizes—short or tall, slim or portly. Just select the most comfortable position. You can even change the position of the wheel as you drive, to make long trips more relaxing.



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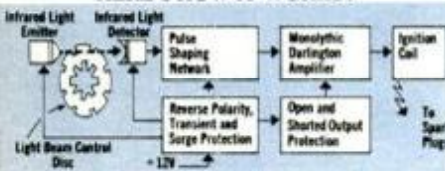
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LETTERS

(Continued from page 6)

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How to go in snow

The article *How to Go in Snow* (page 82, Dec. '77) was quite helpful. Of the 17 tips, however, number 10 should be a last resort. For obvious safety reasons, both hands should remain on the wheel at all times while driving in snow—they shouldn't be engaged in scratching off ice buildup on the windshield.

When the cold snow meets the warm windshield, it melts and the wipers leave a thin layer of water that is quickly turned to ice when you're moving at more than 10 mph. If the window is allowed to remain cool (the nearer the outside temperature, the better), the snowflakes slide off with ease, leaving a clean window (sometimes without even using the wipers). The quickest way to cool the windshield is to put the defroster at its coldest setting and/or to open side windows about an inch.

JOHN A. ZAPARA
PARADISE, CALIF.

I agree wholeheartedly with the third point—"salt your tail." However, from firsthand experience in driving in Newfoundland I would suggest that bagged salt not be used. In a sealed bag it might be okay, but should the seal be broken, the salt would begin to rust the interior of the trunk. I have seen this happen. I would recommend dry sand that does not have road salt in its composition.

The monthly *Saturday Mechanic* feature is a big help to me as I try to maintain my car myself.

REV. DAVID ROBINS
ONTARIO, CANADA

There's no reason why drivers should get stuck—except that they are too light. Empty trucks and cars are the first to stop in heavy snow.

DALE N. TRIPP
ANN ARBOR, MICH.

In addition to the 17 points, I offer these:

1. Old-timers suggest starting on ice in second gear to maximize traction.

2. Salt in the trunk can lead to major corrosion.

3. A lot of Wisconsin farmers carry a 100-pound sack of feed. Recently, I began to carry a sack of cracked corn in the trunk. It provides grit when stuck. An alternative is several 25-pound bags of Kitty Litter, obtainable at most

supermarkets. It provides grit and does not freeze as sand does.

D.G.S. COOK
SHEBOYGAN, WIS.

Your article will definitely help me. But I didn't exactly understand about salt or sandbags. Do you want the weight in front of the back seat, on it, or in the trunk? What's the best place?

CHINMOY RAY
MADISON, WIS.

Author Ed Fales replies: "It depends on the design of the car. In my Omega hatchback I can tuck bags directly over the axle by folding the rear seat. In other cars I have put them behind the seat on the rear cockpit floor. They could even be put on the rear seat, if absolutely necessary. But remember: Weight flies forward in a head-on crash. Bags on the seat should have ripcords.

The idea is to get weight over the working (rear) wheels where it will do most good. (Weighting the rear does no good in front-wheel-drive cars, of course.) Extra trunk weight too far back tends to lift the front wheels, with loss of control. It can off-balance the car in a spin.

I like reader Cook's idea of cracked corn or Kitty Litter. The reason I prefer salt is simple: It comes in tough, waterproof plastic bags with handles. I always lay the bags on a waterproof tarp of some sort, and have never had the slightest trouble with corrosion, although, as the Rev. Robins says, it could happen. I have never had a plastic bag break, however.

If a bag is opened to salt the wheel track, it should never be put back in the car. On one or two occasions I have carried opened bags in plastic buckets.

As to the weight, reader Tripp is quite right. Great weight does do wonders, if sensibly handled. However, as reported, it took over 90 pounds to make my Omega rear stable in terribly slippery snow.

But I have also learned from North Country drivers that too much weight kept too long can cause a permanent set in some springs. It should be removed when needed.

Prices of shower heads

The retail price of the hand Showerburst shower head, the picture of which appeared in the '78 issue, is about \$27. A fixed version sells for about \$9. Inadvertently, PM was given wholesale prices which were in the caption.

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DETROIT LISTENING POST

GM pushing diesels, turbos

GM is looking at diesel, turbo-charged or turbocharged diesel versions of every engine it produces—Fours, Sixes, Eights. Emphasis on "looking." GM is not going all diesel, turbo or turbo-diesel. But all GM divisions will offer one engine or the other by the 1980 model year.

Second round of downsizers

Ford will wrap up the first round of its downsizing program in 1981 and move into stage two in 1984. That's not an educated guess. It comes from a source working on Ford's future cars. This will keep Ford two years behind GM in developing new types of automobiles to meet the objectives and regulations the industry and the government have set for the 1980s. GM will start round two in 1982. Chrysler and American Motors haven't indicated when they will get into the second stage; likely it will be when Ford makes its move or a year later.

Chrysler keeping V8

You can put Chrysler in the column with Ford as disagreeing with those who say the V8 engine is a goner. That makes it two votes for the Eight, one against. The one against is GM, which has indicated it doesn't expect to offer an Eight after 1982. Ford's reply was that it expects the engine to be around at least through the mid-1980s.

Chrysler hasn't pinned a date on how long it will continue to manufacture an Eight, but the company is into a rebuilding program on a Detroit plant that produces Chrysler's 360 c.i.d. Why rebuild if you plan to kill the engine? The 360 is used in vehicles other than cars—vans and light trucks—and will be used in those units. But Chrysler also has plans for keeping the engine in automobiles. Many buyers still want the big Eights and Detroit is going to have to do some clever and hard selling on Sixes and Fours to woo motorists away from the gas gulpers.

More mpg for GM compacts

GM is talking an impressive gain in fuel economy for its new line of compacts—the X-body cars—coming next year. The cars are expected to give 24 to 25 miles to the gal-

lon, a gain of 20 percent over current counterparts. These cars will come out early in calendar 1979, and you can get details of their design in Karl Ludvigsen's story beginning on page 87.

Fresh look for Chrysler minis

American Motors has never had the bucks to spend on styling changes that the other companies have. But they have something almost as good as a big bankroll. His name is Dick Teague and he is v.p. of styling for AMC. Teague can put as many dimples in the metal for a dime as the other guys get with a dollar. But Teague may be in danger of losing his Mr. Resourceful title to his counterparts at Chrysler.

Chrysler is working on two-door versions of Omni and Horizon as followups to the four-door cars. The two-doors will be out in the fall. If you've seen the four-doors, you know they are look-alikes, built-alikes. The two-doors will also be look-alikes. The Teague-like touch is that the two-door models will not look like derivatives of the four-door cars. They will have new sheet metal and a much sportier look than the four-doors. Nothing new under the skin, but they will look like brand-new cars. Chrysler is frequently faulted for playing follow-the-leader in styling, a rap the company is working hard to change.

'Package' service under fire

You can't do much better than the mass merchandisers when it comes to routine service on a car. The big outfits—Sears, Ward's, J.C. Penney, K-mart and others—turn out a quality job at a fair price and stand behind their work—most of the time, if not consistently. The department stores are selective about the type of work they do and they concentrate on the high-volume stuff. There are many jobs they don't handle.

Consumer protection groups have started checking the auto departments of mass merchants and claim to have discovered a catch in the deal. The consumer groups charge that the car owner is frequently sold more service than the car really requires because of the "package" method of pricing used by the stores. Package pricing means the stores quote prices for

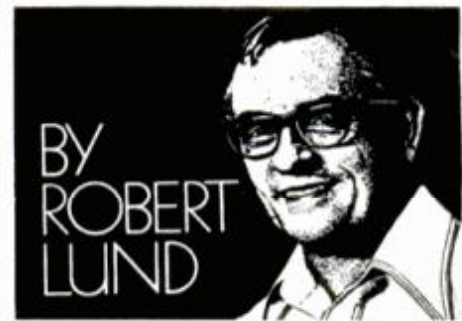
the full job—brakes, tune-up or whatever—whether the car needs the full shot or not. There's no question the customer gets his money's worth, but he may be paying for more parts or labor than he needs because the stores don't sell a partial job.

If the accusation is true, the practice isn't limited to mass merchandisers. There are still gray areas in servicing cars, toss-of-the-coin decisions the mechanic has to make. Clean or fix the old part or install a new one? Use some old parts with some new? If the mechanic guesses wrong, the job bounces back to be done over. The way to prevent that is by selling a complete package. That's the way most mechanics handle the situation, whether they work for a mass merchandiser or Joe's Gas Station.

New do-it-yourself book

GM came out with a repair manual last year that put all the other fix-it books to shame. (DLP, page 34, June '77). Chrysler has now done a similar book, but it's not as extensive as the GM manual. The Chrysler book covers only the engine, where the GM book deals with nine areas of a car. But the Chrysler book, as far as it goes, is every bit as good as the GM book. Most of the info is applicable to cars in general, not just Chrysler makes.

The book consists entirely of drawings explaining how to diagnose a problem and the step-by-step to correct it. A word of caution: Chrysler did the book for professional mechanics and some of the jobs require tools or equipment the average guy isn't likely to have in the car toolbox. The book sells for \$5 from Chrysler Training Center, 26001 Lawrence, Center Line, Mich. 48015. You have to include the publication number, TM711, with the order. **PM**



Announcing the Holiday 88.

Oldsmobile's new idea in sport coupes.



If you still like the idea of a full-sized car but miss the look of sportiness and the feel of driver involvement, then the new Holiday 88 Coupe's for you.

It's a new idea in sport coupes. Holiday 88 comes with front bucket seats. Sports console, T-handle floor shifter, sports steering wheel. Custom wheel discs. Dual sport mirrors. And the special Holiday 88 insignia.



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estimates are 25 mpg highway, 18 mpg city, and 21 mpg combined, with an available 260 V8 and automatic transmission. (Engine not available in California.) Your mileage depends on how and where you drive, your car's condition, and its equipment.

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Holiday 88 Coupe
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There's a lot of News in Olds today.



SCIENCE WORLDWIDE

Asteroid or new planet?

A new object circling the sun has been discovered by astronomer Charles Kowal of the Hale Observatories. It is 100 to 400 miles in diameter and circles the sun between orbits of Uranus and Saturn, according to preliminary calculations. The discovery was made as Kowal examined photographic plates recently taken through the 48-inch Schmidt telescope on Mount Palomar in California.

The new object has an orbit unlike that of any known comet or asteroid, says Kowal. About the size of a large asteroid, it can't be classed among the asteroids because, by definition, they are objects circling the sun between orbits of Mars and Jupiter. While the object is like a planet in terms of orbit, it is far smaller than known planets, so astronomers may have to clarify their definition of a planet.

Heat plenty from the sun

An experimental building now under way on the Massachusetts Institute of Technology campus at



Timothy Johnson with MIT house model.

Cambridge, Mass., is expected to supply over 85 percent of its own heat through "passive" solar-heat systems. Partly funded by ERDA, the 900-square-foot building, believed the first of its kind, will cost \$100,000.

The passive systems include: a new type of window that loses one-fourth the amount of heat of ordinary double-pane glass, with only a 20-percent reduction in transparency; a thin ceiling tile with a chemical core that stores a day's



Sedan "pulls" house trailer underwater in special tank. Bubbles trace the "airflow."

heat at constant temperature (to prevent overheating) and then releases the retained heat at night; reflective Venetian blinds that bounce sunlight at ceilings.

According to Timothy E. Johnson, head of the research team that designed the building, the secret of the newly developed window is a coated plastic material inserted between its double panes.

The ceiling tiles, though only one inch thick, have the heat-holding capacity of 6 to 7 inches of concrete, says Johnson. An inner layer—a chemical core that melts at room temperature—absorbs solar energy during the day, thus keeping a room at constant temperature. At night, as room temperature starts to drop, the core returns to a solid state, giving off heat it stored during the day.

Better health with less heat

If you've kept your home at slightly lower temperatures this winter, you've done more than cut heating costs, according to William Barclay, M.D., editor of the *Journal of the American Medical Assn.* Temperatures in the mid-60s are better for you than those in the mid-70s, he says.

Heating a home during winter removes moisture from interior air—the higher the temperature, the dryer the air. Air with little moisture aggravates bronchial and other respiratory problems, explains Dr. Barclay. It can lead to dry throat and nose, coughs and dry, itchy skin.

An aquadynamic car test

An ingenious and inexpensive method of doing "wind tunnel" tests on cars is being tested at Middlesex Polytechnic, a British technical center. Scale-model cars

are submerged in a transparent tank with the water flowing past the car at a predetermined rate. Hydrogen bubbles are formed by passing an electric current through the water. The bubbles sweep over the models in a manner similar to the flow of air past a full-sized car under normal road conditions.

By fitting miniature spoilers to the models, scientists get a clear indication of how the aerodynamic devices affect the "airflow." Bubbles also show up well in photos, making it easy to record research data.

Laser lightens birthmarks

Plastic surgeons at Boston's Beth Israel Hospital are using an argon laser to treat certain kinds of disfiguring birthmarks. The treatment is done on an outpatient basis and usually results in a significant improvement in the appearance of the birthmark, according to Beth Israel physicians.

The birthmark involved, called a hemangioma, most often appears on the head and neck. Because of its color, it is commonly referred to as a "port wine stain." Usually present from birth, it results from an excess of small blood vessels in the affected area. Heat produced by the laser light causes the blood vessels to close up gradually, reducing the blood flow through them and altering skin color. **PM**





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APPLIANCE CLINIC

QUESTIONS ANSWERED

Cold brew

The coffee-making element of my Mister Coffee still works like new to brew hot coffee in minutes. But the warming element that keeps the coffee hot after it's made isn't working. Can I fix it, and if so, how?—M. Selvedge, Cleveland, Ohio.

Yes, you can fix it. Purchase a heating element with warmer plate and base plate at an appliance service center (about \$4). Undo the small Phillips-head screw in the baseplate on which the bowl sits. **Caution:** Make sure the power cord is disconnected from the wall outlet. Remove the base plate to reveal the warming element—a coil.

Now, unwind the coil and follow its leads upward in the brace. Unsnap the two connections. Unscrew the warming plate and slide it back to attach the leads of the new coil. Position the new coil and screw on the warming plate and base plate. Enjoy your brew.

Sensitive sniffer

Our GE refrigerator developed a strong odor of burning insulation. The repairman has made two calls, but each time the odor has remained. Can anything be done?—H.H. Fritz, Clearwater, Fla.

Let us guess what happened. A relay went bad, causing the odor in the first place. The odor was absorbed by the insulation filling the cabinet walls. The serviceman replaced the relay, but he couldn't do anything about the odor.

If we're right, there is a way to get rid of the odor. Replace the insulation. If you don't want to do this, then you'll have to live with the smell and hope it will dissipate in time. It might.

Lint 'may tag' you

For some time, I've been having a problem with my Maytag washing machine leaving streaks of lint on clothes after the rinse cycle. I have used various brands of soap powder with and without phosphates. I called a serviceman, but he didn't seem to know what to do. Can you help me?—Mrs. Wallace Todd, Edisburg, Ind.

We can give you a list of things that may be causing this condition. Here goes:

- Are you possibly overloading the

unit? And are you using the right water level per load? If you aren't, it can produce the same effects as overloading.

- Is the lint filter present?

■ Is the lint filter in good condition? For example, filters in older models have a rubber gasket around them. This may get very soft, allowing lint to avert filtration. If this applies, get a new filter.

■ Is lint appearing on dark clothing only? This particular problem may be solved by using a fabric softener, which acts as a shedding agent to remove lint so it can be picked up by the filter.

■ Is water in your area particularly hard? This could cause the problem. Solving it may require the installation of a water softener.

Gee, thanks, GE

I'm a General Electric serviceman and would like to add to your answer regarding the GE clothes dryer that shuts off after a couple of loads (Appliance Clinic, page 26, Oct. '77). This problem occurs when the input and output vents in the motor housing become clogged with lint. The motor overheats and the thermal overload switch in the motor opens. The unit will either shut down during the cycle, or it won't start if you do another load until it cools.

To clean lint, disconnect the dryer from the power source and remove the rear access panel after taking off the vent hose if the dryer is vented to the outside. The rear of the motor can now be cleaned easily with a vacuum cleaner and small nozzle, plus a small bottle brush.

Use your fingers and a bottle brush to clean the front of the motor. This area, which is very important to keep clean, can be checked with a pocket mirror and flashlight to make sure all lint has been removed.

I wish to point out that it is also important to see that the venting system is clean, too. Poor airflow can contribute to shortening the life of the heating elements. Personally, I recommend that dryers be cleaned in this manner every four years—every two years if the dryer gets heavy service. Excess lint results in many costly repair bills.—Douglas Stalker, Ballston Spa, N.Y.

Let's hear it for GE serviceman Stalker. He's probably saved many of us a lot of cash with this good advice.

SERVICE TIPS

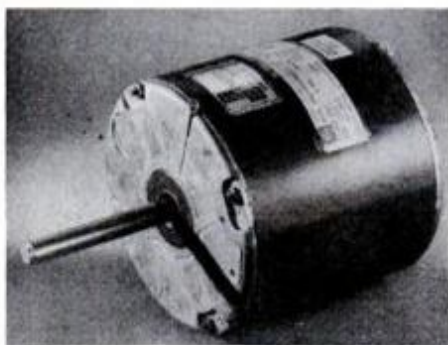
Three new additions to GE's line of Energy Saver Motors were announced this September. The units are:

■ A 44-frame evaporator that results in a maximum 27-percent reduction in energy consumption. The motor is used in refrigerators, freezers, microwave ovens and range hoods.

■ A 39-frame motor that results in an overall 22-percent improvement in efficiency and a savings of 54 watts over the first-generation Energy Saving Motor introduced in 1975. This unit (photo) may be used in heat pumps, solar heating units, central heating and airconditioning units, furnaces, room airconditioners, and ventilating and exhaust fans.

■ A 51-frame condenser fan motor that reduces input power by 15 watts, which represents a 48-percent improvement over standard-model motors. Applications include refrigerators, freezers and space heaters.

Each motor is available in a number of



GE's latest 39-frame Energy Saver motor.

horsepower and voltage ratings. GE hopes, of course, that people who buy new appliances will specify that they want one with an energy-efficient motor. The appliance will be so marked if it does have one.

There is another use for the motors. If an old nonenergy-efficient motor in an appliance burns out, it can be replaced with a new energy-efficient motor. It was difficult to pin GE down on costs and savings, but in general a new motor will cost you about \$5 to \$10 more than a comparable nonenergy-efficient model. It can save you \$4 to \$8 per year in energy costs. **PM**

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. Problems of wide interest will be discussed in this column.

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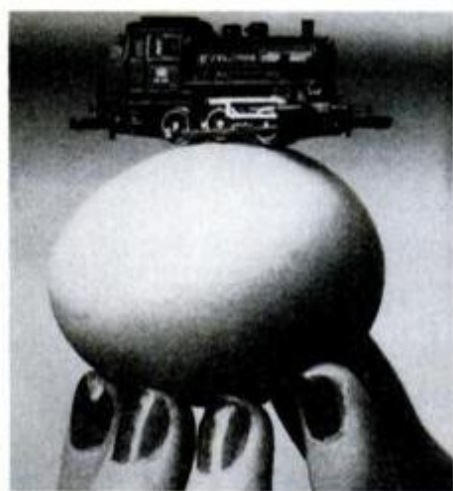


Movies, sports on records

Put a record on, settle back and watch a two-hour full-length movie. That's possible with VISC, a home video disc player developed by Panasonic. Discs are similar to LPs, and signals are picked up with a diamond stylus. In addition to color video, they carry stereo sound. VISC will first be sold in Japan at \$480 up.

Not 'eggzactly' a Metroliner

World's smallest model electric locomotive is dwarfed by an ordinary egg and runs on a track only 1/4-inch wide. German-made, it sells at \$30 in Europe.



People mover on test track

The Dept. of Transportation is spending over \$220 million to develop automated "people movers." Here an Otis Elevator Co. car rounds the bend on new half-mile test track in Denver. The vehicle is electromagnetically propelled and travels smoothly on a thin cushion of air.



Color video tape recorder

The Sylvania Instant Replay permits remote editing of program being taped and has a four-hour taping capacity. Shown on TV set, the unit lists for \$995; optional black-and-white camera, \$320.



Watchband diving gauge

Designed to fit on watchband, a new capillary depth gauge is calibrated in 5 and 10-foot increments. It disassembles for cleaning. \$7.95. Dacor Corp., 161 Northfield Rd., Northfield, Ill. 60093.

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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Open joints in hardwood floor

Two floors in my three-year-old home are oak. During the first heating season joints between boards opened in several places, some as much as 3/16 in. How can I correct this, short of tearing out and re-laying the floor?—C.D. Twiddy, Lynchburg, Va.

It's not entirely unusual to have spaces that wide in your flooring, particularly at points near heating ducts. The wood may not have been properly cured, or the flooring may have been installed long before the heating system was operational.

To fill the larger spaces between boards, you might tap in feathered slices of oak and secure them with white glue. Carefully fill smaller spaces with Plastic Wood, tinted with stain the color of your floor.

Use of a humidifier will also expand the wood somewhat to take up the space between boards.

Blacktop a concrete driveway?

My concrete driveway has wide cracks—some as much as a 1/2-in. wide—and I'm hunting for a more or less permanent repair. What's a material that won't open up if there is further movement?—E.E. Vorce, Sarasota, Fla.

One solution for a cracked concrete driveway is to undercut the cracks slightly, making an inverted "V" of them. Then fill the cracks with a prepared concrete patcher. Tamp the mix in firmly, overfilling the cavity slightly to allow for shrinkage. Keep a piece of damp burlap over the repairs for six days to control hydration.

On the other hand, if the cracks show offsets of more than 1/4 in. or so, then the surest repair is to apply blacktop (asphalt) over the concrete. This will be the most permanent and satisfactory repair.

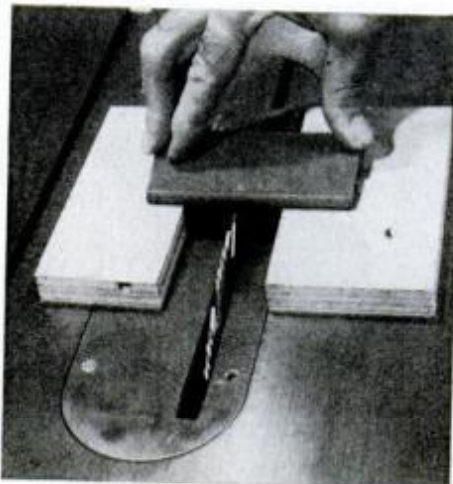
To extend the life of a blacktop driveway, cover it with a tar-emulsion driveway coating and sealer after it has aged one to three months. This protects it from oxidation, seals hairline cracks and keeps it from softening as a result of gasoline and oil puddles.

Sharpen circular saw blades

My table saw is old and I've accumulated a number of dull saw blades. I can easily sharpen the teeth with a file, but how do I get

the blades perfectly round again?
—Frank Harper, Ilion, N.Y.

To sharpen a table-saw blade properly, first put the blade in place on the arbor with the saw unplugged. Begin by jointing the blade—reducing the teeth to uniform size. To do this, place an oilstone on wood blocks so it straddles the blade as shown. Adjust the



Joint circular saw blade by straddling it with oilstone and blocks as shown.

blade so the teeth barely scrape the stone. Then slowly rotate the blade backward by hand until every tooth has contacted the stone.

If you have combination or planer blades with rakers, you must joint those teeth differently. Again with the blade on the arbor and with the saw unplugged, file these teeth individually about 1/64 in. below the cutting teeth. Block the blade so it remains stationary and file squarely across the top of each raker with a 6 or 8-in. mill bastard file. To be sure the blades are filed uniformly, place the file on a wood block and slide the block to the teeth. It's good practice to give each raker the same number of file strokes. This should keep your blades as round as when they were new.

For more saw-sharpening techniques, see page 116, June '77.

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. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

Sweaty windows

Northeast bedroom windows of our home accumulate excessive condensation. There are storm sash caulked and with factory-installed vents. How can this be corrected?—Allan Shriner, Fairfield, Pa.

Condensation collecting on the storm sash is caused by warm, moist air leaking past the inner sash. The inner sash should be weatherstripped to prevent leakage into the space between the two.

Do keep the vents open in winter. In some cases, boring a hole in the storm sash to get more cross ventilation allows moisture to escape rather than collect.

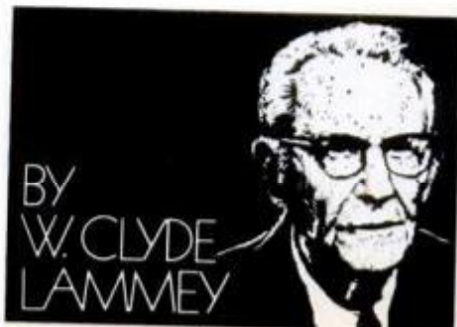
Since the condensation is limited to the windows of one room, you might use a dehumidifier to lower the inside humidity. This will eliminate a lot of moisture.

Vulnerable veneer

I applied birch veneer over 3/4-in. plywood and had to leave the job partially finished. Now, two months later, the veneer has a quite uniform ridged and rippled appearance. Apparently it loosened from the plywood. Am I finished or is there some hope of salvaging it?—Pat Percival, Bay Village, Ohio.

You may have used too much glue. I'm afraid you'll have to do the job over; but first you might try several methods of fixing it. First, place a piece of aluminum foil on the veneer to protect it, then go over it with a medium-hot iron to melt the glue. Next roll the veneer firmly to squeeze out excess glue and weight down the veneer overnight.

If that doesn't work, make slits in the veneer ripples in the direction of the grain, using a sharp modeler's knife. Put glue in slits with a syringe-type glue injector and press the veneer overnight. **PM**





"I saved them 10% on their homeowner's insurance, and they don't even know I exist."

"I'm an actuary for Allstate, and not many people know what I do. My job is to find fair insurance rates for our customers.

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"It's typical of us that whenever we find lower costs like this we want to pass on the savings to our policyholders."

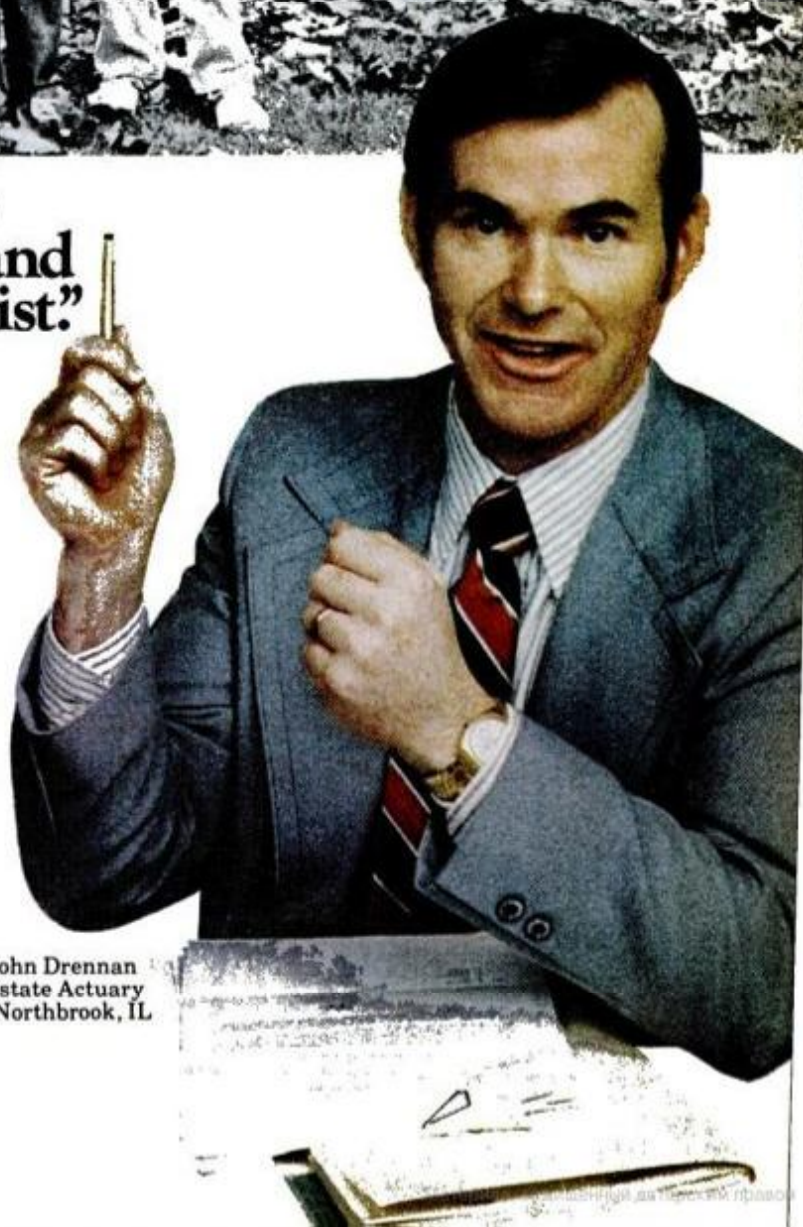


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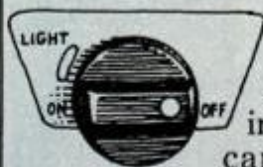
Son of a legend. The Model 275 Coleman® Lantern.

That familiar green Coleman lantern is a tough act to follow. (After all, it's been *the* outdoor lantern for over 50 years.)

But this Dusk Brown off-spring is everything its "daddy" was. And then some.

For one thing, it's even simpler to use.

The Easy-Lite® control has "OFF - LIGHT - ON" positions that you can see.

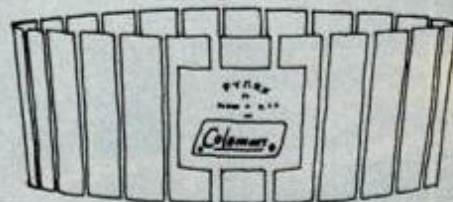


And *feel*, even in the dark. You can dial to full brightness in one turn.

And that same control also cleans the generator tip automatically, every time you light the lantern... to help give you trouble-free performance.

The wide 8¼" ventilator spreads an even circle of light. Down, where you need it. And want it.

There's even a frosted band on the globe so the Model 275 throws a softer no-glare glow that's easy on the eyes.



Sure, that familiar green Coleman lantern will always be around. In stores. And wherever the frogs are croaking. And the crickets chirping.

But the 275 will be there too. Rugged. Dependable. Economical. After all, it is a Coleman.

Remember: Coleman equipment can come in handy in storms, blizzards and power losses too.

**The great outdoors
is too good to miss.**

Coleman 

The Coleman Company, Inc. • Wichita, Kansas

Coleman  **275**

IT'S NEW
NOW

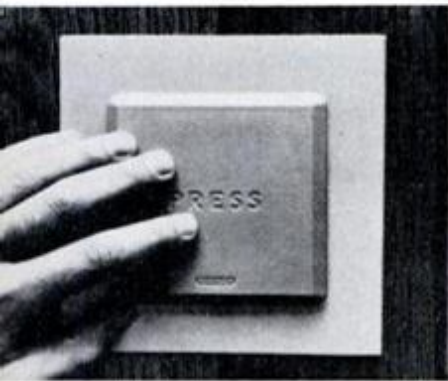


Into the wild blue yonder

You're looking between twin tails of a McDonnell Douglas F-15 Eagle as it climbs virtually straight up after takeoff from Lambert-St. Louis Airport (at top of picture). The takeoff procedure is designed to do more than provide spectacular pictures. It gets the Air Force fighter out of the airport's traffic pattern as quickly as possible. The F-15 is capable of climbing straight up to 10,000 feet in 35 seconds. The St. Louis airport is adjacent to McDonnell Douglas production facilities.

Versatile stick-on switch

Momentary contact switch can be used to activate automatic garage door or for other low-voltage applications. Made by Stanley, switch with adhesive backing for easy mounting on concrete, metal or wood lists for \$30; without adhesive, \$11.



Remote control of appliances

Introl system controls up to 64 remote units—appliances, heaters and the like—via 110-volt house wiring. In kit form, controller board is \$149; remote unit, \$99. Mountain Hardware, Incorporated, Box 1133, Ben Lomond, Calif. 95005.



Bonding cement for quick back-yard projects

Surewall fiberglass reinforced cement is applied to the surface of cement blocks rather than between individual blocks, as is done with mortar. This speeds do-it-yourself projects like this picnic table. A 50-lb. bag retails for \$8.

NEW IDEA

Every Coleman[®] Lantern deserves a bodyguard.

Our new carry case protects 'em for traveling or storage. (Two models fit most Coleman gasoline lanterns.) Molded from tough polyethylene, it helps prevent dents, scratches and



broken glass. There's even storage for funnel, spare generator and mantles.



The Coleman Company, Inc.
Wichita, Kansas



When you turn the switch off but, not the engine.



Carbon deposits in the combustion chamber can cause an engine to continue running after the ignition switch is turned off.

Fuel Mix helps get rid of this carbon and at the same time lubricates and frees sticky valves and thereby increases compression.

Use Fuel Mix every thousand miles and your engine will do what you want it to do.

PENNZOIL COMPANY
GUMOUT DIVISION • CLEVELAND, OHIO 44104

IT'S NEW
NOW

Big hybrid for farm chores

When farmer Steve Boender of Oskaloosa, Iowa, needed a vehicle for routine chores around his place, he saved himself the big cost of a new tractor by building his own "truck-tor." The hybrid muscle machine has a truck's cab and the rear end of a tractor. Boender figures his vehicle cost him only \$600.



Solar-powered weather sentinel

Six solar-powered RAMOS (Remote Automatic Meteorological Observing System) units have been placed in isolated spots across the country as part of a network of 1000 weather-reporting stations. They're made to operate untouched up to 10 years.



Title slides add interest

Introduce your travel slides with transparencies showing a state's name and a thematic scene. Slides are 55 cents each. Catalog from Porter's Camera Store, Box 628, Cedar Falls, Iowa 50613.

Touring in outdoor 'wheelchair'

The Happy Wanderer is powered by a 12-volt battery and dual rear-wheel motors, has single-handed controls, a top speed of 7 mph and is stable even on hilly terrain. Price: \$799. Palmer Industries, Box 707, Endicott, N.Y. 13760.



An effective wind machine

This windmill may represent the world's largest private wind-power venture. Erected on an English manor, it drives generators that can put out 30 kilowatts. Though most of the power is used on manor, 5 kw. is fed into local network.



Oh yes you can!

THE EXPERIENCED PHOTOGRAPHER CAN:

You can concentrate on the creativity of your shot, because our engineers have concentrated on the flawless operation of the OM-1 and OM-2.

For instance, OM cameras offer you the world's fastest continuous view motor drive capability: five frames per second!

Other SLR's have mirrors that can't respond as fast as the OM-1 or OM-2. On many of them you even have to lock up the mirror, so you have to shoot blind.

(Even our less expensive Rapid Winder is faster than many other more costly motor drive systems!)

So that you can journey into the worlds of macro and photomicrography, and more, the OM cameras give you a choice of no less than 13 interchangeable focusing screens. No longer are you limited by a choice of either microprism or split screen.

And while we're talking capability, here's a significant fact: the OM System is the most extensive and versatile in the world, with more compact lenses and components that add to your creativity.

In the OM-2, "OTF": Off-The-Film Light Measurement allows the camera to read the light reflected off the film and sets the exposure while the photograph is actually being taken!

Other automatic SLR's set exposure before the photograph is taken, and the camera locks it in memory. This leaves room for error, due to exposure lag.

The OM-2 also has a totally integrated flash system: the camera automatically controls the flash utilizing the same "OTF" light sensors, assuring perfect exposure with all lenses from telephoto to wide angle at any f-stop.

The OM-2 with "OTF" Light Measurement reads the light, and shuts off the flash at the precise milli-second for perfect exposure.

No wonder more people involved in photography are buying an Olympus camera than any other compact SLR.

So take the time to discuss the advancements of the OM cameras with your Olympus dealer.

Think you can't afford an OM camera? Oh yes you can.

THE WEEKEND PHOTOGRAPHER CAN:

You can take beautiful, creative shots of your family, vacations, or your wildest dreams.

Because our engineers have done all the technical thinking, so you can do all the creating.

The OM cameras let you capture unbelievably creative shots by just focusing and shooting.

You can capture a fast action sequence of your child riding a bike, sliding into home plate, or in a ballet performance.

You can get creative with flash photography. You don't have to set the aperture, shutter speed, or calculate the distance: the OM-2 does it all. You can catch a surprise shot without worrying about under or over exposures.

You can even experiment with lenses, because the OM cameras are part of the most extensive compact SLR system, with lenses that let you fill a shot with a butterfly, or bring a mountain top up close. And interchangeable focusing screens to help make focusing easier and your shots sharper.

Drop by an Olympus dealer and hold one of our cameras in your hands. Let your mind wander. Think about that shot you think you can't get.

Oh yes you can, with an Olympus.

Write for descriptive literature:

OLYMPUS, Woodbury, New York 11797.

OM-1 OM-2

OLYMPUS

The fastest selling compact SLR.
The whole world can't be wrong



Richard Petty says, "If you really want to learn how to repair cars, check out NRI home training."

They give you all the training and equipment you need to get you started in a hurry.

My Dad made auto mechanics out of us long before he'd let us enter a race... so I learned the importance of a good mechanic early... and the opportunities that are out there for well-trained men. That's why I'm sure glad to see training like the two NRI courses come along. With NRI, you learn at home in your spare time, at your own pace. And get solid, hands-on training for practical experience. It's a lot of training for the money.

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NRI's Basic Professional Repair Course covers the basics of auto repair in 30 "bite-size" lessons. From headlight to tail-light, you'll learn all you need to know, quickly. Your training includes important service equipment like an Inductive Pick-Up DC Timing Light, Diagnostic Analysis and Tune-Up Instrument, tune-up tool kit, and more.



Richard Petty, NRI Automotive Consultant and America's Winningest Stock Car Driver

Become a Professional Mechanic.

NRI's 70-lesson Master Automotive Technician Course includes all the equipment, tools, and training you need to be a real pro. In addition to carefully planned, easy-to-digest lessons, you receive all the tools and equipment in the basic course plus a precise Ignition Analyzer Scope, Carburetor Air-Fuel Tester, and a Silent Vacuum Test Pump that helps you detect even the slightest air leakage. You'll learn to service electronic ignitions systems, vacuum controls, pollution control systems, fuel injection systems, auto air conditioning, brakes, and much more.

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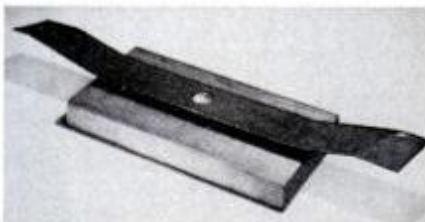
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HINTS FROM READERS

Rebalance a mower blade



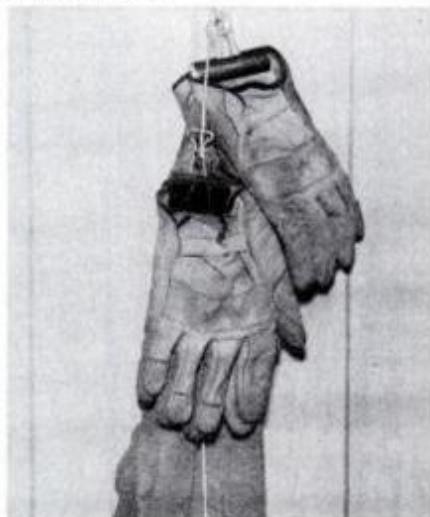
Bore a hole smaller than the marble.



Balance the blade on greased marble.

To maintain proper balance of your rotary lawnmower blade when sharpening it, count file strokes and give each side of the blade an equal number. Double check the blade's balance by placing it on a lightly greased marble that rests in a hole bored in a level board. The board serves as a reference for the blade balance. —G.L. Short

Glove holder



Here's a good way to keep your gloves in pairs—so you won't find yourself on a job with two right-hand ones. Tie two heavy-duty clips to a cord, clip the glove mates together and hang. This arrangement will also allow them to dry better. —Maurice Aase

Consumer Reports thinks you should know:

10 of the best... and 10 of the worst... used car buys

Before you buy a used car, check 10 we rated among those least likely to give you repair problems.

For mechanical reliability we pick:

- 1974 Buick Century V8
- 1975 Chevrolet Chevelle V8
- 1976 Chevrolet Impala
- 1976 Datsun B-210
- 1975 Dodge Colt
- 1973 Dodge Dart 6
- 1975 Ford Maverick 6
- 1975 Mercury Marquis
- 1974 Peugeot 504 (Gasoline)
- 1976 Toyota Corolla

And 10 among those most likely to give you repair problems.

For mechanical unreliability, we pick:

- 1975 AMC Hornet V8
- 1973 Audi 100LS
- 1974 Chevrolet Corvette
- 1974 Fiat 128
- 1974 Ford Mustang II, V6
- 1973 Jeep Wagoneer
- 1974 Oldsmobile Toronado
- 1975 Pontiac Astre
- 1975 Saab 99
- 1974 Volvo 240 Series

Consumer Reports gives you the information you won't hear from car dealers.

Today's used car lot is no place to be on your own.

Without help, you could find a "bargain" that might spend as much time in a repair shop as on the road.

That's why *Consumer Reports* evaluates used cars annually by a rigorous Frequency-of-Repair study of over 165,000 cars. Using the same tough standards we apply to testing new cars, expensive appliances and home products. And evaluating services like banking and insurance.

We also rate the new 1978 cars. Besides predicting their incidence of repair, we unfold techniques that will enable you to make a better deal. And show you how to save on auto loans.

Consumer Reports is the nonprofit, reader-supported magazine of Consumers Union—the nation's leading independent organization for testing and rating consumer products and services.

We don't accept advertising from anyone. We buy what we test at the same stores you do. No "free samples" from manufacturers.



Five facts our readers learned that you could have used:

1. Pepperidge Farm Whole Wheat Bread was rated lower nutritionally than Wonder Enriched White Bread.
2. Pizza Hut's 10" Supreme pie gave us the most nutritional buy out of eight fast-food meals we tested... Arthur Treacher's Fish & Chips the least.
3. Bounty may be a "quicker picker upper" than lower-priced paper towels. But you

may be able to handle most cleanup jobs with the cheapest towel you can find.

4. That much-squeezed-on-TV bathroom tissue that touts its softness whittled 150 sheets off each roll. (Once again, the customer gets squeezed.)

5. Two banks can advertise the same interest rate for your savings account. But one pays only \$44.93 for the same period for which the other pays \$75.30. It's how they *calculate* your interest that counts. A lot of companies may not like what we have to say.

But remember, those same companies spend millions of dollars a year advertising their products and services... so they can give you the facts that serve *their* interests. Shouldn't you spend just \$11 a year on *Consumer Reports*—so you can get the facts that serve *your* interests?

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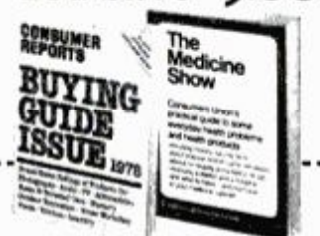
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IMPORTS & MOTORSPORTS



Honda Accord four-door sedan is now available in Japan, will come to U.S.

Four-door Honda Accord

Detroit can't advertise "bigger and better" anymore, not while they're full-bore on developing leaner, lighter, more efficient cars. But Honda can brag that their amazing Accord is bigger and better: A four-door version recently shown in Tokyo is 7.4 inches longer than the hatchback for 170.2 inches overall. It's on the same wheelbase, 93.7 inches; same width, 63.8 in. and a bit higher at 53.5 in. It has improved visibility and cabin comfort. The four-door may be available here later this year.

Meanwhile, demand is still strong for the Accord hatchback, available in two versions for '78: standard and the Accord LX. The LX logo stands for luxury, and while the cars look the same, there's more standard equipment on the LX, like airconditioning, digital clock and all those things that you can possibly think of to turn an economy car into a dream machine.

Penney Pinto

If you're snobbish, you can call the source of your new Pinto, "J.C. Pen-nay," and make believe it's French. Actually, the 49-cc moped is made in Austria for J.C. Penney,



J.C. Penney moped is called the Pinto.

the first national mass merchandiser to offer a moped under its own name. It's a 20 to 30-mph machine (Class B), has a good warranty, comes in yellow or red and lists for \$479. P.S.: Next month we'll survey moped riders for an exclusive PM Owners Report.

1978 Indy pace car

If you read PM you know this is Corvette's 25th year (see *25 Years on the Most-Wanted List!* page 72, Sept. '77). What we didn't mention in that story, with its scoop photos of the '78 Vette, is that the car has been named official pace car for this year's Indianapolis 500. With its 350 V8, the Vette is a natural for leading 33 cars around the parade lap and then diving for the pits at 100 mph plus if the field is neat, tidy and lined up to take the green flag. Corvettes in pace-car dress will be produced for sale in limited numbers and you should see them soon—an eyeful with their two-tone paint, red stripe and supergraphics.



Chevy Corvette in Indy pace-car paint.

Sharpen your reflexes

At the wheel, your split-second reaction time is a matter of life and death. At the controls of this electronic auto race, it's all fun and games. You switch it on, your car comes into play on the LED display, you snap through the gears—complete with sound effects—

and run all four laps in fourth gear. If you're a crackerjack and have no head-on collisions with the blips speeding toward you, you can maneuver along the three lanes to victory in 25 or 26 seconds—the quickest possible time. Auto Race is a Mattel Electronics game. Many stores have it but we got ours from the Auto World catalog, 701 North Keyser Ave., Scranton, Pa. 18508. \$26.95.



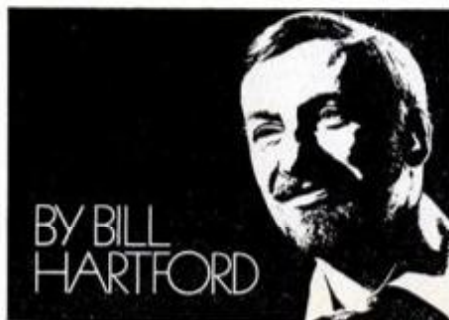
Quick reflexes score 26 on racing game.

Fair shake for machines



New encyclopedia is big on cars.

I needed a one-volume encyclopedia for the ol' homestead, but knew the eggheads were calling the new Random House Encyclopedia a "toy." It's not. The clincher was the coverage the 2856-page book gives to Man and Machines—especially cars and motorcycles. It's full of fine technical diagrams showing the operation of many engines and mechanisms—even 10-speed derailleurs. It's \$50 at many bookstores. Random House, 201 East 50th St., New York, N.Y. **PM**



'78 FORD PICKUPS. TOUGH ALL OVER.

A new Ford Pickup is built tough from the ground up. Ford's exclusive forged steel Twin-I-Beam, extensive corrosion protection, big-cube V-8 options, all-welded cab, and double-wall box are just a few of the reasons.

But what makes a new Ford even tougher to beat are this year's new options like • Synchronesh 4-speed overdrive transmission for highway driving (not available on F-350 models) • Good-looking, comfortable new Lariat interior • 40-channel CB with concealed transceiver, single AM/FM/CB antenna, and all controls in the removable mike • New tilt steering wheel for your most comfortable position.

Take a look at all the new Fords. You'll find them tough all over. And *more* than just tough.



93 out of 100 of all Ford Trucks registered over the last 12 years are still on the job. (Percentage based on cumulative total registrations as of 7/1/78.)

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American Offshore 22. Not just a fishing boat, a fishing experience.

We're as serious about building fishing boats as most fishermen are about fishing. So we designed the new American Offshore as if we were going after bluefish and black bass ourselves.

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Turn on the machine.

This runabout is all class. It's the kind of boat that other people always wish they had. Stylish blue or burgundy metalflake outside. Plush appointments inside. High performance characteristics that will give you a ride you'll never forget.

SuperSport™ 22 V-5.

Fifty m.p.h. and all you feel is the wind in your hair.

We adapted a successful offshore speedboat racing design to bring you the first Deep-V aluminum hull in pleasure boating. It smooths out the rough water and lets a small boat perform in big water with a comfort and grace you never thought possible.



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There are so many ways to have fun with this deck boat that it takes more than one summer to try them all.

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PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

Home fire safety

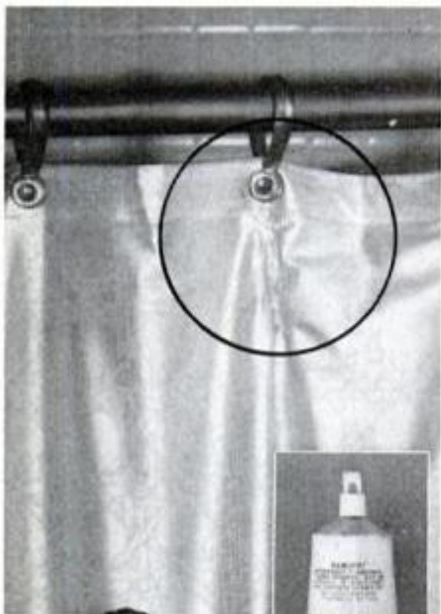
New from the National Fire Protection Assn., 470 Atlantic Ave., Boston, Mass. 02210, is the manual *Firesafety in the Home*. Subtitled "A Security Guide for You and Your Family," the book emphasizes ways you can stop fires before they start by being alert to common and hidden home hazards. Catalog No. SPP-40 is priced at \$6.95.—H.W.

Caster correction

In the November 1977 issue, we reported a new porcelain caster from Minnesota Woodworkers Supply, 21801 Industrial Blvd., Rogers, Minn. 55374. We were quickly reminded that no socket is required—the caster is simply inserted into a predrilled hole. Caster size is 1/2 in. wide by 1 1/8 in. dia.—H.W.

Repairing torn vinyl

Quick tear repair on vinyl upholstery, shower curtains and the

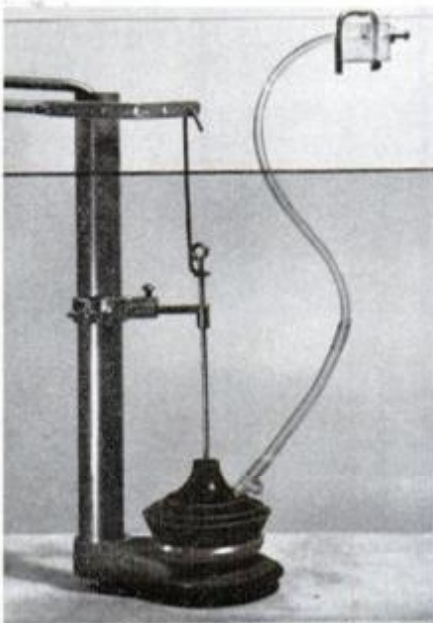


Almost-invisible repair now possible on vinyl.

like is possible with Vinyl Tear Repair kit, SanTek, Inc., 114 North Third St., Minneapolis, Minn. 55401. Torn edges are secured with masking tape, transparent VTR is applied; 30 minutes later, tape is removed and additional VTR is applied. To remove gloss, buff with sandpaper. Four-ounce tube is \$6.95.—P.A.

Save water and money, too

New invention is claimed to convert most toilets to dual-flush system—one for solid wastes, the other for liquid wastes. The result for the average family is a saving of about 1500 gallons of water per month. After installing the device

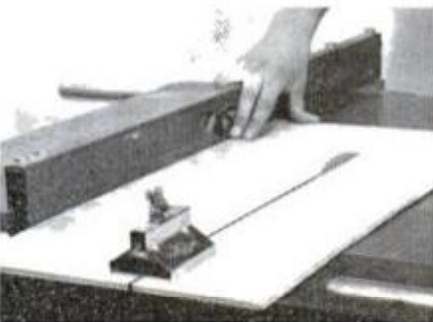


Air valve cube must be above water line.

as shown, simply depress handle for liquid wastes. For solid wastes, handle is held to override the device and flush with a full tank of water. \$4.98 with five-year, unconditional moneyback guarantee. Saveway Co., 930 Clarkston Ave., Brooklyn, N.Y. 11203.—H.W.

Prevent pinched saw blades

Super sawing device from The Adjustable Clamp Co., 417 North Ashland Ave., Chicago, Ill. 60622, called KerfKeeper, is designed for use with portable and stationary



Pony KerfKeeper prevents saw binding.

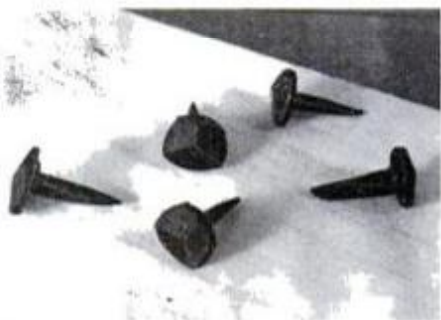


Maximum work thickness is 3/4 in.

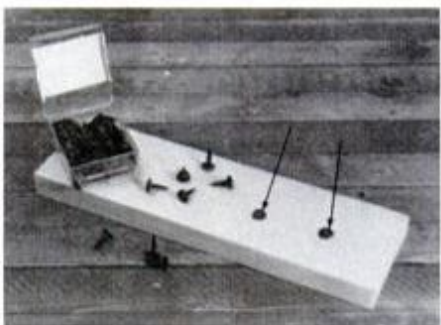
power saws. One or more Keepers are particularly handy on long cuts because design prevents cut section from drooping or sagging—which can cause kickback. At hardware stores, \$2.88.—H.W.

Decorative wrought nails

The latest offering from America's oldest nail manufacturer is wrought-head Decor Nails. They are intended for use when making patterns on doors or paneling—and



Nails: 3/8-in.-dia. head, 1/8-in. shank.



Decor nails (arrows) hide small nails.

for camouflaging small nails. In matte black or brass-plated, \$3.69 per pound, \$1.69 for 4 oz., postpaid. Tremont Nail Co., Box 111, Wareham, Mass. 02571.—H.W.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

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Like the feeling you get when you reel in that first big one.

An old familiar feeling. An excitement that never changes.

Like the feeling you get with every single sip of Smooth as Silk Kessler. So consistently smooth. Unchanging. There's no smoother whiskey at any price.

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**Thank goodness
the best things
in America
never change.**



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KESSLER**



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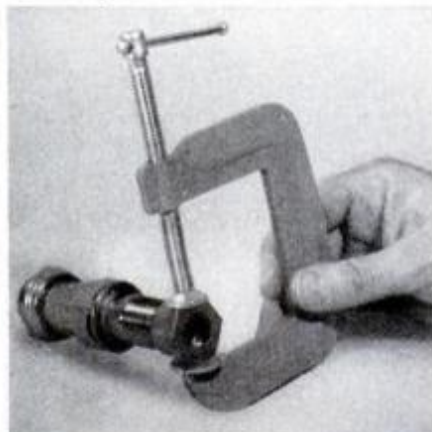
HINTS FROM READERS

Milk cartons shield plants



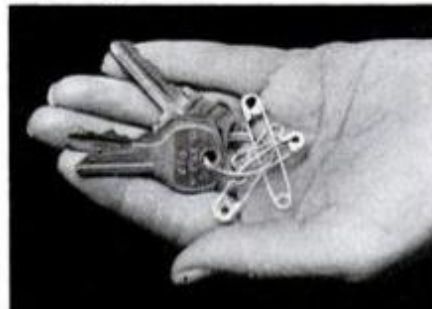
The lower half of a cardboard milk carton with its bottom removed is good for shielding small plants from insects and careless feet.—*Walter E. Burton*

C-clamp serves as wrench



If you have to loosen or tighten a nut or other object that's larger than any of your wrenches, try using a large C-clamp to grip and turn it.—*Ken Patterson*

Key ring carrier



Ever been in a tight situation that demanded a safety pin? Keep several handy for those emergencies on a key ring or snap in a key case.—*John Hosack*

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

Electronic ignition analyzer

Automotive electronics, particularly transistorized ignition, are frustrating for most Saturday mechanics: You can see if points open and close but how can you tell if a transistor is working? In the past, you had to check by substitution or buy expensive test equipment. Now there's an inexpensive



Owatonna electronic ignition analyzer.

(\$60 list) analyzer, about half the size of a cigaret pack, reasonably easy to use, that does the job in minutes. It has four wire leads and three light-emitting diodes. The top diode is labeled "Low Battery" and the others are Nos. 1 and 2.

Just connect two leads to the battery posts, ground a third on the engine and connect the fourth to the ignition coil negative or tach terminal. If "Low Battery" lights, the battery is too weak to test. If No. 1 lights, proceed.

Crank the engine for an instant and either No. 1 or No. 2 will light if anything goes wrong (if neither goes on, the system is good).

If No. 1 is on, the problem is in the pickup or control unit. If No. 2 lights, it's in the ignition coil or control unit. Depending on which diode shines, you proceed to one of two second tests. In some cases, the second test will not completely close in on the problem, but will require you to check the ballast resistor (on Ford, Chrysler and '78 AMC), which means you'll need a multiscale ohmmeter.

The tester, marketed by Owatonna Tool Co., Owatonna, Minn., is designed for General Motors, Ford, Chrysler and 1978 AMC, not pre-'78 AMC cars or many retrofit electronic ignition systems.

While testing, I made various

disconnections to simulate circuit failures on one GM and one Chrysler product. The tester was never fooled.

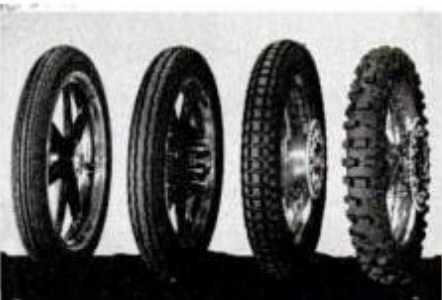
Included with the tester is a calibrated sparkplug with an alligator clip for making that routine check for spark to the plugs. Two problems with that check on late-model cars are high voltage (making it desirable that you don't hold the plug wire while checking) and the recessed terminal (you must force something inside the nipple that will project from it). You just clip the special plug to the engine, attach the coil secondary wire or plug wire, and look for spark. It's possible to clip the plug at a location that lets you crank the engine from the passenger compartment and still see the plug, for a one-person check. Auto parts stores that serve professional mechanics should have this new tester soon. —B.H.



Analyzer has a sparkplug-test accessory.

Attention bikers!

If you've been hauling down too fast and you've flat-spotted your tires, or if you're just low on rubber from having a good time on your motorcycle, you'd better start thinking about replacements. Firestone has just introduced a new Trophy line—16 tires with treads for any kind of riding you want



Firestone's new motorcycle tires.

to do. The Trophy SST street tires (front and rear at left in photo) run from \$27 to \$42 depending on size (there are five sizes available). The Trophy Trials are a universal design for on or off highway (third from left in photo) and are available in five sizes from \$29 to \$36. Trophy MX with knobby tread for motocross (right in photo) comes in six sizes from \$28 to \$43.—B.H.

Memory for mpg



Dash-top computer figures your mpg.

You can throw away your logbook and pencils when you have a Miles-Per-Gallon Multi-Computer from the J.F. Ivan Co. A digital readout displays such info as average mpg since last fill-up, overall mpg since installation of computer, total miles driven since installation and total gallons purchased since installation. A slick gimmick, it's \$70. Company's M-77 catalog shows other electronic measurement devices for vehicles; 10918 Governor Ave., Cleveland, Ohio 44111.—B.H.

Deluxe map light

Here's the Rolls-Royce of map lights. It's a 12-volt, high-intensity



Nifty Zoomlite.

light that can be focused narrow or zoomed to a flood pattern and has full-range dimming control. You get red light to retain your night vision by sliding a pivoted red lens into place. The Zoomlite was designed for aviation use, but it's a natural for RVs, boats, emergency vehicles, even the family car—if \$47.50 can be budgeted for this beauty. Specialty Lighting, 926 Arlee Pl., Anaheim, Calif. 92805.—B.H.

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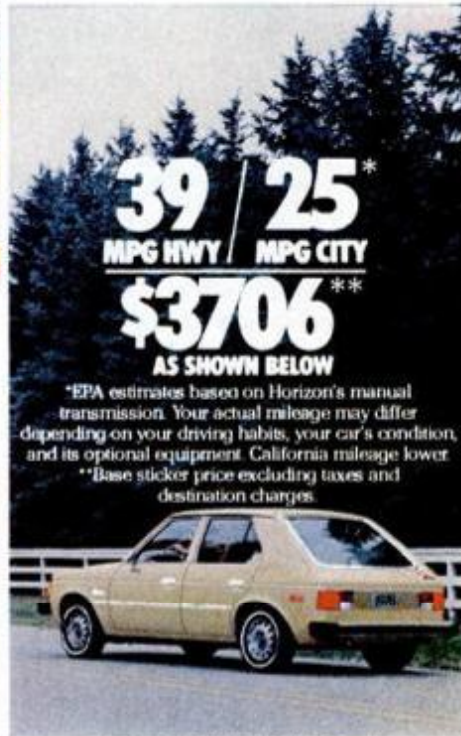
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*EPA estimates based on Horizon's manual transmission. Your actual mileage may differ depending on your driving habits, your car's condition, and its optional equipment. California mileage lower.
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Price includes front bucket seats, AM radio, whitewall radial tires — many things not standard on other cars of its type.



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Horizon is a new answer for a changing America. An America concerned about energy and inflation. Horizon gives you four doors, fold-down rear seat and hatchback to make it easy to pack luggage. Horizon even offers the option of automatic transmission along with stereo, roof rack and sporty trims.

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Horizon is so roomy, four six-footers can relax in comfort front and back. And there's still room for luggage.

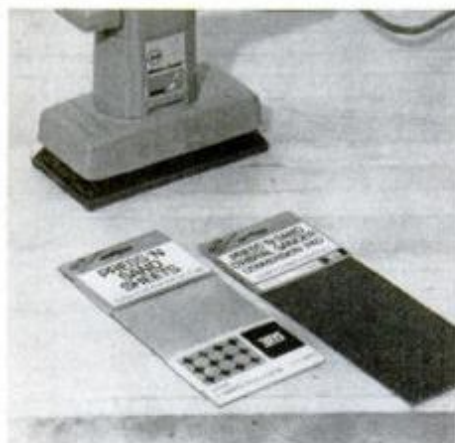
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PM LOOKS AT 3M'S PRESS 'N SAND



Package of six sheets is 84 cents; conversion pad for orbital sander, 99 cents.

A sensible line of adhesive-backed abrasive papers has recently become available. Called Press 'N Sand, the sandpaper sheets need no adhesive or retainers to secure them on your orbital sander. You install a conversion pad on the sander and press on the sheets as



Wipe pad sander clean with dry cloth.



Peel paper from Press 'N Sand sheet.

shown. To remove a sheet, you simply peel it off. On a series of shop projects, I used several sheets with great satisfaction. The finger-saving paper and conversion pads are available at hardware stores. 3M Co., St. Paul, Minn. 55101.—*Harry Wicks, Home and Shop Editor*



Peel liner from pad and install on sander.

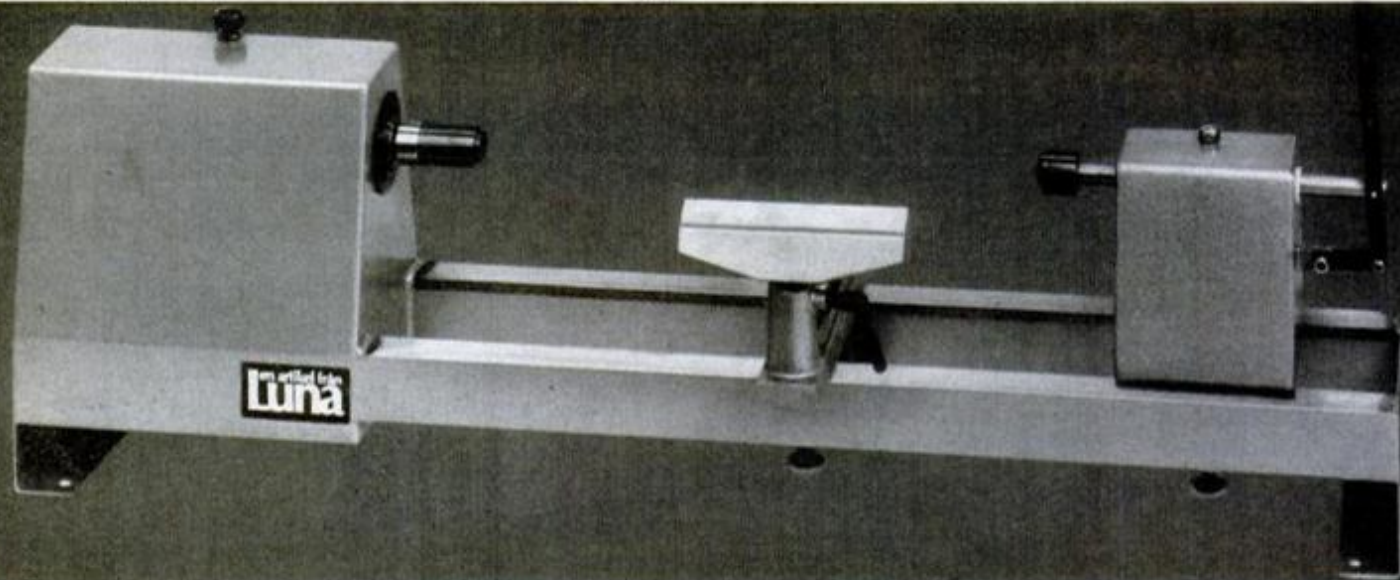


Then press sheet onto conversion pad.



Sandpaper stayed on during sanding.

Our new line of lathes will turn your work smoothly at a price that will turn your head.



Good tools cost good money. When it comes to wood-turning lathes only you know how big an investment you want to make.

Until now, we were reluctant to add this type of woodworking machinery to our line of quality tools. Either they weren't good enough to meet Garrett Wade standards or they were too expensive for the non-professional craftsman. But now, we think we've found a practical alternative—three of them in fact, with bed lengths of 24", 32" and 40" and with a swing over the entire bed of up to 16-1/2".

Made in Sweden by LUNA, our wood lathes are

powerful, smooth-running machines with welded steel frames and sealed ball bearings. They feature three spindle speeds, (750, 1500, and 3000 RPM's), a drilled tailstock spindle (only on the 40" model) and a full range of 15 accessories from a disc sander to a bowl-turning post. We honestly feel there is no better, comparable value to be found anywhere in this country.

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PM-38

ALL OUTDOORS

Mini-bargains

Recently our survey of boat owners and dealers across the country showed that a lot of people are missing the boat because they haven't tried the little ones. The small hulls are safer, more comfortable and durable than they used to be; mini-horsepowers more reliable. You have little worry about being beached by an energy shortage, can have fun on limited water areas, have minimum trouble trailering or cartopping, and can often launch on impoundments and lakes where larger craft are not permitted.

A recent research project by Starcraft indicates that small-craft buyers like the broader assortment of aluminum and plastic materials available in fishing skiffs and canoes. For a first start or a second boat, a small one seems like a bargain bet.

Tempest in a shot-shell

The lead-versus-steel shot controversy had an extensive test this past fall and reports are now in. There has been great resistance to the U.S. Fish and Wildlife Service regulations forbidding the use of lead shot in areas where waterfowl feed and are poisoned by the spent lead pellets, but most hunters seem to be adjusting well.

So far, Atlantic and Mississippi flyways have been affected and this fall Central and Pacific regions will be added to the steel-shot zones. At present the nonpoisonous steel shot shells are available only in 12 gauge. Lead may still be used in other size shotguns.

The complaint has been that steel shot is lighter than lead but harder, so it is more likely to cripple rather than knock down birds at long range (and more likely to deform and scar shotgun barrels). Manufacturers' tests indicate, however, that it would take thousands of rounds more than a waterfowler would ever fire to damage a well-made, modern pump or auto-loader gun. Shooting tests show that steel shot is perfectly effective out to ranges of about 35 to 40 yards, and spray-and-pray "skybusting" is no more excusable with steel shot than it is with lead.

Like it or not, the change may make for more careful, therefore better, gunning.

Best fishing

For an argument almost any time and anywhere, ask a couple of fishermen to name the greatest fish to catch. Basing their ratings on a fish's willingness to hit artificial lures, size, jumping ability, power, endurance, appearance and food value, the Braniff Outdoor Council, which plans flying trips for sportsmen across North and South America, recently took the plunge. Their worldwide list of the top 10 freshwater fighters is: Atlantic salmon, rainbow trout, muskellunge, African tigerfish, mahseer (from India), largemouth bass, smallmouth bass, dorado, payara, and the peacock bass of the South American tropics. They'd call the salmon and muskie the hardest to hook; the dorado, tigerfish and peacock bass the most aggressive; payara, dorado, tigerfish and salmon the best jumpers; and, for its light weight, the smallmouth bass the strongest.

Want to argue?

There is little agreement on where the best fishing waters are situated. Bassing is the most popular activity, and every year the Bass Anglers Sportsman Society (1 Bell Rd., Montgomery, Ala.), comes up with more tournament locations that yield outstanding catch-and-release-alive statistics. The San Diego area still holds the largest bass record, while Toledo Bend, Tex., enjoys the reputation for bass-bonanza country. But our vote would have to go to Rodman Reservoir off the St. Johns River in northern Florida. Bill Martin's Bass Champions guide service agrees, and has established its headquarters there at Box 3200, Route 3, Fort McCoy, Fla. 32637, although they also schedule guides for other parts of the South and worldwide. For a taste of the best in fishing, it's worth contacting them.

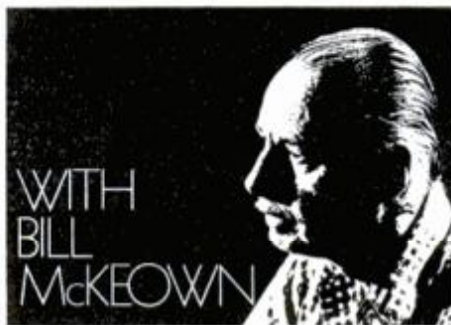
For the do-it-yourself angler, there is a new \$4.25-postpaid book by John Emery, *How to Build Custom Handcrafted Fishing Rods*, from Windward Publishing, Box 371005, Miami, Fla. 33137. Better still, it's subtitled "Repair and customize your favorite rod" if you don't want to go all-out at the beginning. For customized artificials, check *Make Your Own Fishing Lures* by Vlad Evanoff, published by A.S. Barnes at \$9.95. DuPont

Stren dealers now have a new edition of the free *Fishing Knots You Can Depend On* booklet with diagrams of a dozen best knots and their breaking strengths. Some knots slip or tend to break or weaken monofilament, and it is important to learn the latest twists that can prevent more excuses for lost fish. Can you tie a Spider Hitch, Bimini Twist, Improved Clinch or all-purpose Uni-Knot with cold, wet fingers by dawn's first light, and do it neatly enough to maintain 80 to 100 percent of the line's unknotted rated breaking strength? The new Stren booklet shows how.

Camping bonus

Some of last year's camping questionnaires indicate that a majority of campers enjoy the sport because of the money they save, the pleasant people they meet and the sights they see, but that "roughing it" has no special appeal of its own at all. For bonus ways to live outdoors in more comfort and find more things there to enjoy, the best new book we've seen is *Wildlife Country*, published by the National Wildlife Federation, 1412 16th St. N.W., Washington D.C. 20036. Available from them for \$13.80, including postage, it is extensively illustrated in color, and the type of hardcover book that might be expected to cost twice as much.

There are food basics—like how to make "gorp" and "freakies" and 58 other trail recipes. There are chapters on selecting the proper gear for campsite or trail, plus how to repair and maintain it. There are chapters on using map and compass, reading weather signs and using first aid, but also pages on the most spectacular vistas and how to photograph them. It's a truly beautiful all-around guide. **PM**



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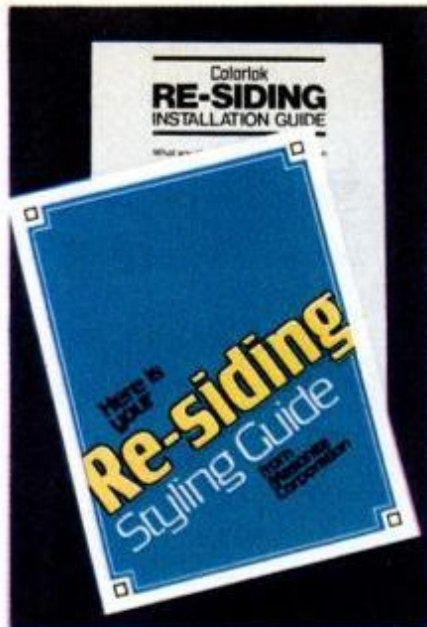
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Here's help in choosing and installing the right siding for your home style

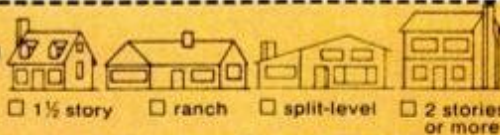
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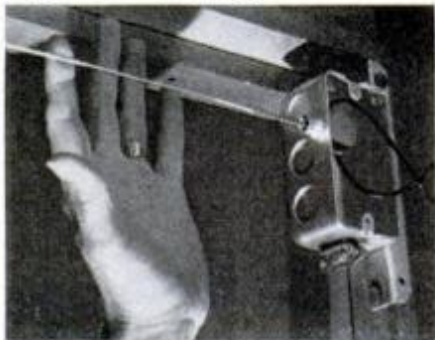
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PM

PHOTO HINTS

Light-control string



Controlling overheads and safe-lights from anywhere in the dark-room is easy this way: Loop a string horizontally between screw eyes and end it at the pull chain of a Leviton Canopy switch. These can be box-mounted, cost less than \$1, and can handle up to 100 w. For multiple lights, use several strings, coded with knots or tied-on washers.—*Dave Bryan*

Camera-case cover anchor



The fold-down front of a standard camera case is easy to lose when detached. You can anchor it with a piece of strong chalkline or fishline. Tie one end as shown to the cover's bottom opening. Loop the other under the head of a short, 1/4-20 truss-head bolt tightened into the case's bottom socket—but file off the bolt head's sharp edge first.—*Walter E. Burton*

Reel dryer



A small electric hair dryer with its variable heat settings helps dry film-tank reels quickly between rolls.—*Ken Patterson*



How can two things that protect so well look so good?

Derusto Barbeque Black Spray makes rusty, weathered barbecue grills and hoods look like new. A special heat-resistant paint, it sprays on to protect and beautify. Dries quickly to a black matte finish. Contains no fluorocarbons.

Derusto Galv-A-Grip™ primes and protects gutters, downspouts and galvanized metal in one sure paint coat. Penetrates and sticks tight. Won't crack or peel like ordinary paint. Comes ready to use. Dries in 3 to 4 hours.

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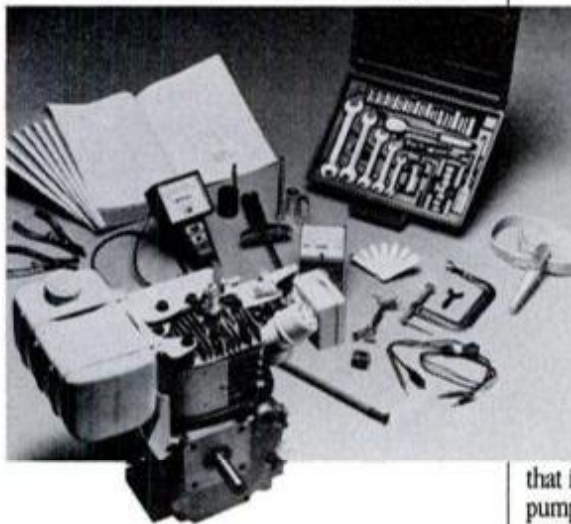
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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Settling an Estate

After two years of good service, my 1974 Buick Estate Wagon (455-cu.-in. engine) is overheating and forcing coolant out the overflow after the engine is stopped. Neither the dealer nor an independent garage can find the trouble. They have rodded-out the radiator; checked for compression leaks into the cooling system; installed a new timing cover and water pump; replaced the head gaskets and magnafluxed the heads; checked the thermo-vacuum switch; replaced the thermostat, transmission oil cooler, radiator pressure cap and vacuum advance; assured engine tune-up to specifications; and adjusted drive-belt tension. What now?—W.R. Jones, Edcouch, Tex.

You haven't missed much. I would also make sure the fan clutch isn't slipping and the radiator filler neck isn't damaged, which could prevent the cap from seating itself. With all this "usual" stuff out of the way, now I'll tell you what you may have overlooked:

1. **A restriction in the exhaust system.** Be aware, especially, that the inside wall of a double-walled exhaust pipe could collapse, restrict exhaust and engine breathing, and cause overheating.

2. **An overcharged airconditioning system.** If the system is "juiced" just one-quarter pound overfull, an overheating problem can be created. More horsepower is needed to drive the airconditioner, which results in higher head pressures, and causes the engine to run hotter.

3. **Brake drag.** Even a relatively light friction of the brakes when combined with high atmospheric temperature (Texas, you say?) can lead to an overheating problem.

Finally, replace the radiator pressure cap with one rated at 18 p.s.i. and increase the percentage of ethylene glycol-to-water to 65:35. This will raise the boiling point a few degrees—maybe enough to stop overheating.

Cooling off a "hot" Toyota

On hot days my 1973 Toyota Mark II develops a vapor lock when I turn off the engine. To start it again, I have to pour cold water over the fuel pump. Is an electric fuel pump a reasonable solution to my problem?—W.A. Haynes, Northridge, Calif.

Even if it is, it's an expensive solution. The fuel line in your Toyota runs across the front of the engine. It is held by a metal clamp that's bolted to the engine near the fuel pump. This clamp acts as a pickup of engine heat. Concentrated heat is radiated to the fuel line at the point where the clamp holds the line. This creates a first-class vapor-lock condition.

Before spending money for an electric fuel pump, I'd remove this clamp and wrap the fuel line with insulation or insulating tape.

Had the same problem

The engine of my 1977 Chevrolet Caprice makes a "hissing" noise, much like the sound made by a jet of water hitting against metal. Mechanics at three different dealerships have offered different versions of what may be wrong, but no so-

lution. I know that one tightened down on the carburetor. Can you help me?—Mrs. M.J. Carrier, Dover, N.H.

It just so happens I created a noise this week in my '75 Pontiac like the one you've described. To replace a top radiator hose, I removed the carburetor air cleaner housing. It was getting dark when I finished the job, and I guess my old eyes weren't up to snuff. Anyway, there was this gosh-awful hissing when I drove the car. I had: (1) failed to replace the air cleaner properly; (2) knocked off the vacuum line to the EGR valve.

What I'm saying is this: Check the air cleaner. Then look for a disconnected or a leaking vacuum hose or component. I'll wager that this is where your snake in the grass is lying.

Sounding off about mechanics

When my 1974 Plymouth Duster with 225-cu.-in. engine was 2½ years old, it became very hard to start and "dieseled" when the ignition was turned off. To "solve" this problem, a Chrysler-Plymouth dealer said that he had to replace the carburetor and tune-up the engine.

A few months later, the engine developed the same symptoms. A different dealer said he had to rebuild the carburetor and tune-up the engine.

Five days ago the very same symptoms appeared. Today I discovered that the hose connecting the PCV valve to the carburetor had worked off the PCV nipple. Reconnecting this hose solved the problem completely.

I am convinced that I have been ripped off by two dealers to the tune of \$180. It's irritating that

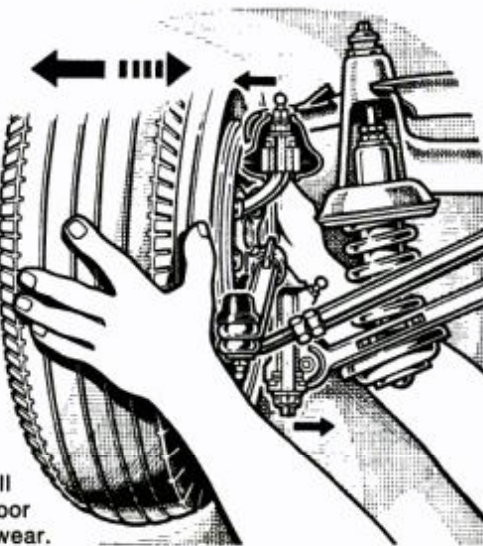
(Please turn to page 54)

Shake things up



A steering system inspection every so often takes but a few minutes and can pay big dividends in safety and roadability. Here's what to shake (front wheels up in the air, of course):

- Front wheels—shake from top-to-bottom to check for wheel-bearing looseness; from side-to-side to test for steering-linkage looseness.
- Idler and pitman arms—shake vertically. Excessive looseness leads to poor steering and tire wear, making it tough to maintain alignment.
- Tie-rod ends—shake with a push-pull motion. Too much looseness leads to poor steering, shimmying and uneven tread wear.



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Lights, 14 mg. "tar", 1.0 mg. nicotine; Filter Kings, 16 mg. "tar", 1.1 mg. nicotine; Longs, 17 mg. "tar", 1.2 mg. nicotine av. per cigarette, FTC Report Aug. '77

This '78 Winnebago gives you two extra feet of comfort. At no extra cost.

Last year, our lowest-priced full size motor home measured 21 feet in length. This year's Brave 23RG is actually two feet longer, several inches wider—but still at the same low price!

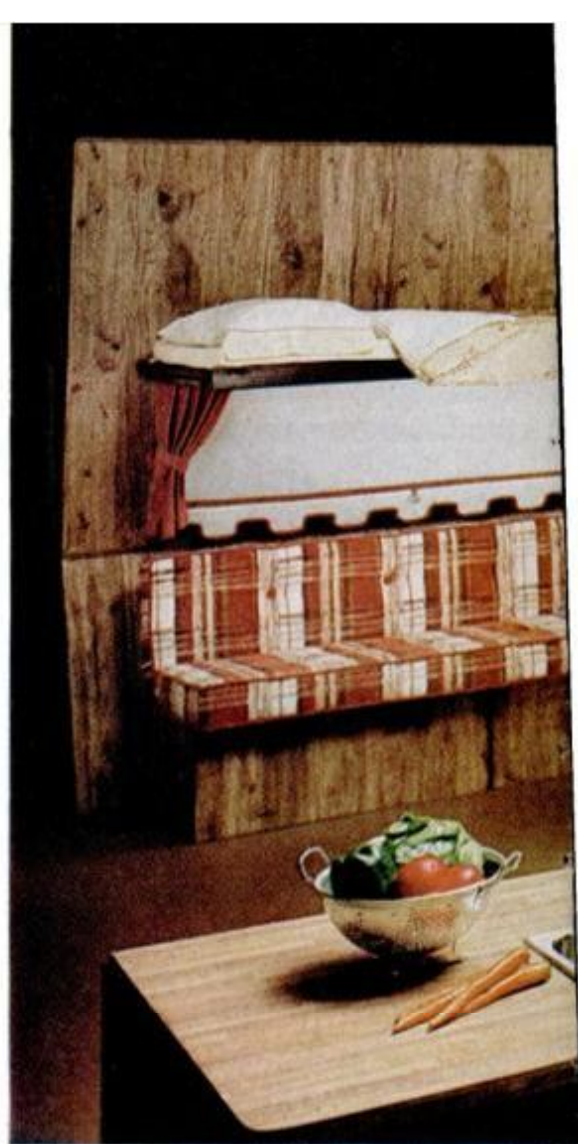
This thrifty new Winnebago isn't just bigger, it's better. We put that extra space to very good use. To give you a bathroom with separate shower compartment. Larger galley with double sink and backsplash plus more cupboard space. A choice of three forward seating arrangements: standard dinette, lounge chairs and table, or couch with pedestal tables.

Other added values include a rear fold-down bunk, AM radio, window screens for driver and passenger, and more. All wrapped up in a sleek new streamlined exterior. And all of it, remember, for no more than last year's list price.

This year, value is the word for every Winnebago from the compact Minnie Winnie to the long, luxurious Eländan II. Look up your nearest Winnebago dealer in the Yellow Pages and go see him now.

You can drive a bargain with us.

There are a lot of reasons why you'll sleep better in a Winnebago.



CAR CLINIC

(Continued from page 52)

there are persons who represent themselves as reputable and qualified mechanics who are charlatans.
—Douglas S. King, Wheaton, Md.

I think people can protect themselves against such things by learning all they can about cars. This means reading—PM, of course.

Old drifter

Is there a solution to the drifting problem I've been having with my 1977 Plymouth Volare (8000 miles)? The car had drifted to the left. The dealer aligned the front end. He also rotated and balanced the radial tires, because one of the front tires was worn. Now, the car pulls to the right. What goes?
—Peter J. McDonough, Carmichael, Calif.

Let's start with this basic premise: If radial tires aren't inflated properly or are uneven in circumference, one to the other, especially on front wheels, the car will wander. Shimmy may also be experienced. A radial tire should not show wear in on'y 8000 miles. The tire on your car that did may be defective. You may have a claim. Also, have

the front end double checked for correct alignment and look for a defective part.

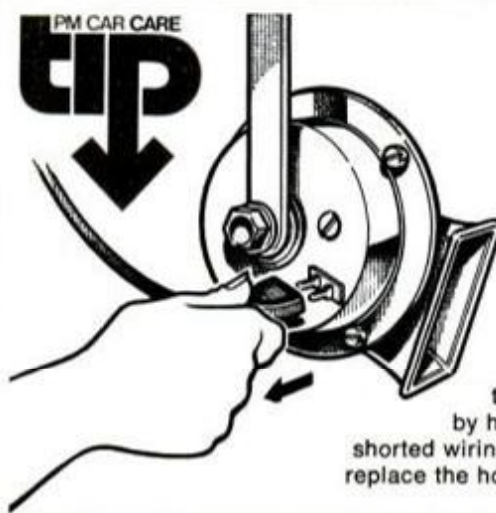
Now, call your dealer's attention to service bulletin 19-03-77 (1/24/77), which discusses ways to correct vehicle wander. The bulletin states that there may be an occasional vehicle which exhibits a tendency to wander as the front suspension moves vertically through its range of travel on long, undu-

lating dips in the road surface. This abnormality is likely to be caused by parts being deformed or mislocated in such a way that the slopes of the tie-rods are not the same on the two sides of the car."

The bulletin proceeds to instruct mechanics how to obtain the correct steering and suspension geometry.

Marquis de Dampo

I own a 1971 Mercury Marquis



Gabriel's it ain't

I saw a pathetically funny sight the other day in the Big Apple, right on Fifth Ave. and 50th St. at lunch time, this car's horn wouldn't stop blowing. Even the cabbies, who aren't a bit bashful about leaning on their horn buttons, were getting annoyed. Ol' easy-solution Mort went to the guy's help. He was in a panic. I lifted the hood, found the horn and yanked the wire. Keep it in mind if you find yourself in this fix. Remember that constant horn blowing can be caused by horn contacts that stick or by grounded or shorted wiring that energizes the horn relay. Don't just replace the horn without checking the latter possibility.



WINNEBAGO
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Want to try before you buy? Call Rent-A-Way Winnebago, 800-447-4700 for information (In Ill. call 800-322-4400)

Brougham that has accumulated 30,000 miles and a baffling problem. In rainy weather, the engine won't start.

Mechanics at several Mercury garages have cleaned the battery terminals. One replaced the starter solenoid and switch. Another put on new battery cables and tested the battery. Nothing has helped. Can you suggest a solution?—Arthur Singer, Stroudsburg, Pa.

Sure. Look for something that impedes starting when it gets damp. Possibilities include a corroded ignition wiring connection point (check terminals at bulkhead connectors), weak ignition switch, weak ignition coil, cracked distributor cap or rotor, or dirty or corroded ground connection at the engine block or frame. Furthermore, if there are loose or dirty connections in the distributor, the engine may be hard to start.

Keyed off

I never owned a car that told me when it wanted to be unlocked until I bought a 1978 Ford Fiesta. Sometimes the key just won't allow

itself to be turned in the ignition switch, and I sit there like a dummy until it gives "permission." My dealer humors me, but I know he thinks I've sent my marbles on vacation. I swear it's happening. Can you tell me why?—Laura Haynes, Falls Church, Va.

Because there's excessive resistance on the lock cylinder, which you are probably overcoming unconsciously when you do get the lock to turn. Resistance may be relieved by turning the steering wheel slightly to the left.

I'll tell you something else about that lock you may not know. If the engine should stall, it won't be possible just to turn the key to restart. Nothing will happen. You'll have to turn the key to the position marked "O" and then restart the engine.

SERVICE TIPS

■ If you keep failing a state inspection for emissions because CO levels are too high with a Chrysler Corp. car, maybe you aren't adjusting idle mixture properly. It is necessary on models

equipped with air pumps to disconnect the air-pump hose and plug the tube leading to the exhaust manifold when adjusting the carburetor mixture for proper CO value.

■ Buick stresses to us, and we, in turn, stress to you this fact about your 1978 Regal or LeSabre with the V6 turbocharged engine: Don't look at the 7500-mile oil change interval for a conventional V6 and think it applies to the turbo. To avert the danger of oil contamination, which is greater with a turbocharged engine, the oil and filter should be changed every 3000 miles.

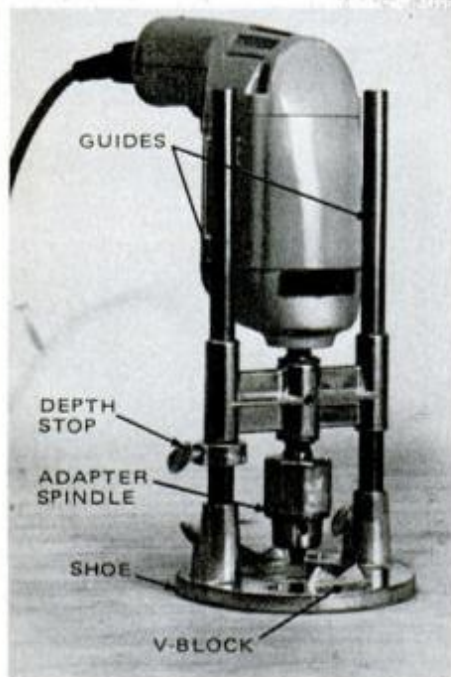
■ Hesitation or stumble of 1977½ Lincoln Versailles with 5.8-liter engines on easy throttle acceleration is preventable according to service bulletin 143. Just install a No. 1 spark delay valve (part No. D3TZ-12A091-C) in the EGR vacuum line between the EGR valve and ported vacuum switch. **PM**

GOT A PROBLEM WITH YOUR CAR?

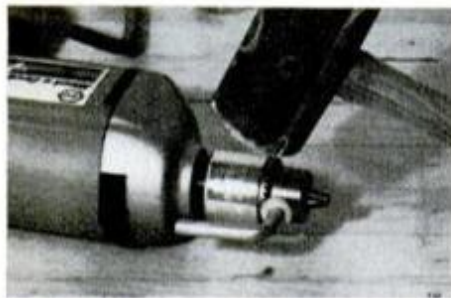
Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

PM LOOKS AT

A PRECISION DRILL GUIDE



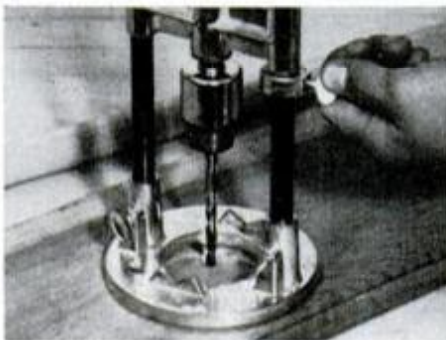
Accurate drilling guide is installed on the drill; chuck goes on the adapter spindle.



To install the drill on Portalign guide, remove the Jacobs chuck, using its key and a wooden mallet as at top and center. Next, you thread the drill shaft into the tapped hole of the adapter spindle and slide the guide over (bottom).

I have to admit that my first reaction to this tool was a negative one—I figured it was just another gimmick that wouldn't be worth the shop space it would occupy. I couldn't have been more wrong. After two work sessions, I realized this was a quality-made guide intended for home craftsmen who want to produce quality work.

Designed for precision use on portable drills, the accessory enables you to do many tasks with relative ease and fine accuracy. The not-so-easy job of boring a true hole in a dowel is now easy because of workholding V-blocks mounted on the guide's shoe. I used the test guide to bore perfect 90° holes, for accurate edge sanding, shaping and freehand routing with highly satisfactory results. I particularly like the accessory for

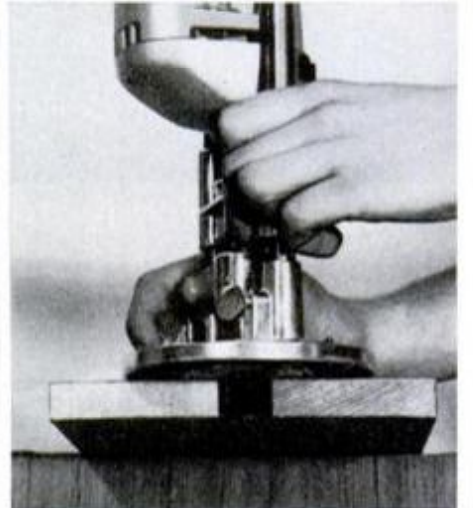


Depth of bore is determined and assured by locking wingnut. V-blocks mounted on Portalign's base make it a snap when you have to bore round stock accurately.



those drilling jobs you would do in a drill press if you could.

Angle drilling can be accurately accomplished by extending the two vertical guides below the shoe—to achieve the desired angle (tilt). For example, if both guides are extended exactly 9/16 in. from the base underside, the angle bored will be 15°. The tool's instruction manual includes settings for the nine most commonly used shop angles—those in between can be determined fairly quickly using the trial and error method and scrap. Though I own a drill press, I plan to keep Portalign in my toolbox for on-job drilling accuracy. The guide is \$19.95 at Sears, Ward's, Penney's and other retailers. The Portalign Co., 4903 Pacific Hwy., San Diego, Calif. 92110.—*Harry Wicks, Home and Shop Editor*



Using a drum sander in the guide, you can quickly sand perfectly square edges.



To remove device from drill, you simply reverse the installation steps as shown.



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HINTS FROM READERS

Staples join cable lengths



Common fence staples are ideal for joining aluminum clothesline cable. Clinch staples around cable ends with pliers.—*D.W. Roberts*

Stepladder lifting



Position a stepladder so you won't pinch your fingers when you lift it. The wrong way (top) is with steps facing you—fingers tend to be inserted between front and rear legs. The right way to handle a stepladder is to grasp it from the rear with a pair of legs in each hand (above).—*John H. Campbell*

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Serving 16 hours a month, and two full weeks a year in the Army Reserve can earn you a good extra income.

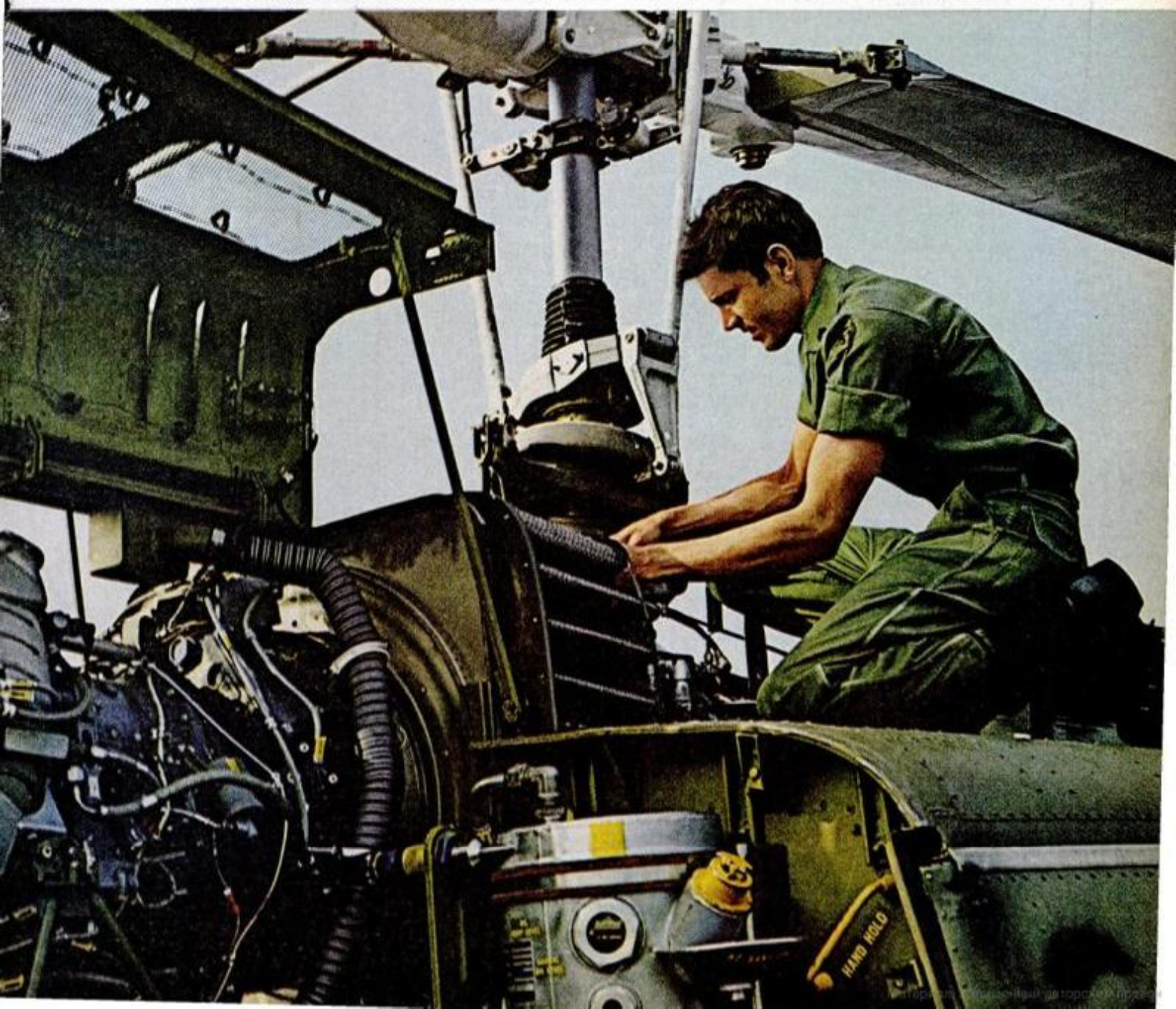
It can earn you an extra good feeling, too. Pride. Because, as an Army Reservist, you'll be working to better your country and community, as well as yourself.

And we have hundreds of jobs to choose from, in many fields. Qualify, and you can learn medical technology, surveying, or automotive mechanics, just to name a few.

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But you'll find it's time well spent. Because, when you come home, you'll have not only a part-time job with full-time pride, but a skill you can use in civilian life, too. For more information, send the attached postcard or call 800-431-1234 toll free. In NY call 800-243-6370.

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HENRY MORGAN SAYS: "Good appliance repairmen are scarcer than doctors who make house calls."



Did you know that there are over a billion appliances in use in the United States today? And three repairmen. At least that's the way it seems when one of mine goes on the blink. With more than two dozen electrical gadgets in my house going snap, crackle and pop, I finally got tired of trying to locate a guy with enough ambition to take my money and I decided to learn how to make the repairs myself.

When a well-aged comic like me decides to go back to school, you can bet the family jewels it won't be back at P.S. 93. I'm going to learn at home, or not at all. So I sent away for NRI's home study course in Appliance Repair . . . and I took the course.

With a mechanical aptitude slightly below that of King Kong, I needed a course that started at the beginning and didn't move ahead too fast. Well, NRI did just that. They started with electricity—what it is and what it does—and went from there. You proceed at your own rate of speed. Whip through it if you want to, or take your time. What counts is the fact that you learn, in a way that it sticks with you.

You learn two things: how to repair appliances—from little one cylinder gas engines to refrigeration and air conditioning equipment; and how to get started in your own appliance business. That can mean money for you either way. If NRI can turn old ten thumbs Morgan into a reasonable facsimile of a repairman, think what they could do for you!

NRI's no fly-by-night outfit. They've been training men for more than sixty years . . . and they've had over a million students. It's the oldest and largest home study school in the field of electronics and electricity, so they know it better than anyone else around.

The NRI course is really easy to understand . . . with lots of pictures to show you what they're talking about. They even send you a professional appliance tester at no extra cost.

With the tester and a few basic tools you probably have already, you're ready to service most electrical appliances. After a few months, you'll be fixing your own appliances like I do, or you can start earning spare time money fixing them for your friends and neighbors. Before you know it, you can have your own full-time business and be independent.

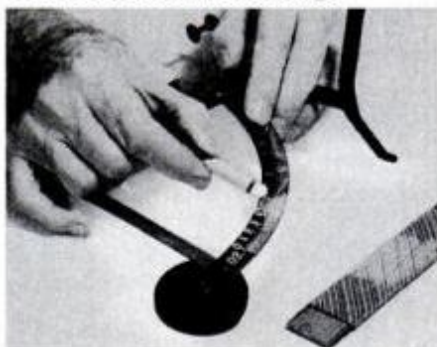
Take my advice and clip the coupon. Even if you don't know which end of a screwdriver is the handle, they can give you real professional training that'll help you break into the appliance repair field. It's one of the few things I've ever sent for that was even better than they said it would be . . . so why not invest a postage stamp to see if it's right for you. The NRI catalog is free and there's no obligation. No one will knock at your door or bug you at home. NRI doesn't use salesmen. They don't need them.

Take it from Henry Morgan, the appliance repair field could sure use some good men. Now.

Henry Morgan
Henry Morgan

HINTS FROM READERS

Renewing metal markings



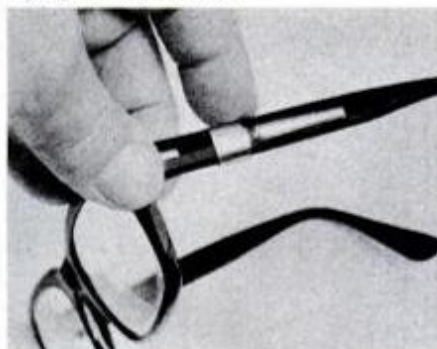
When engraved markings on metal scales and rules become difficult to read, they can be renewed without using commercial fillers. Heat metal slightly; then go over markings with a wax crayon. The wax will flow into depressions when warmed. Wipe off excess wax immediately.—*Walter E. Burton*

Clean sticky calculator keys



When calculator keys become sticky and sluggish from soft drink or other spills, apply TV tuner cleaner and press all buttons several times.—*Jack Drose*

Eyeglasses holder



A clip used to attach pens and pencils to your shirt pocket can be used to secure eyeglasses there too. Attach clip to a bow and glue it in place.—*John Hosack*



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34 MPG HIGHWAY. 24 MPG CITY.

Those impressive figures are EPA estimates with standard 110.8 CID engine and manual transmission. Your mileage will vary depending on how you drive, your truck's condition, where you drive, and your truck's available equipment. California



Regular-size LUV with 6-ft. box and available "Mighty Mike" striping.

EPA estimates are 30 miles per gallon highway and 22 miles per gallon city.

NEW SOFT-RIDE SUSPENSION.

Series 8 LUV features a new soft suspension on regular-size pickup models. Torsion bar independent front suspension and new four-leaf rear springs contribute to

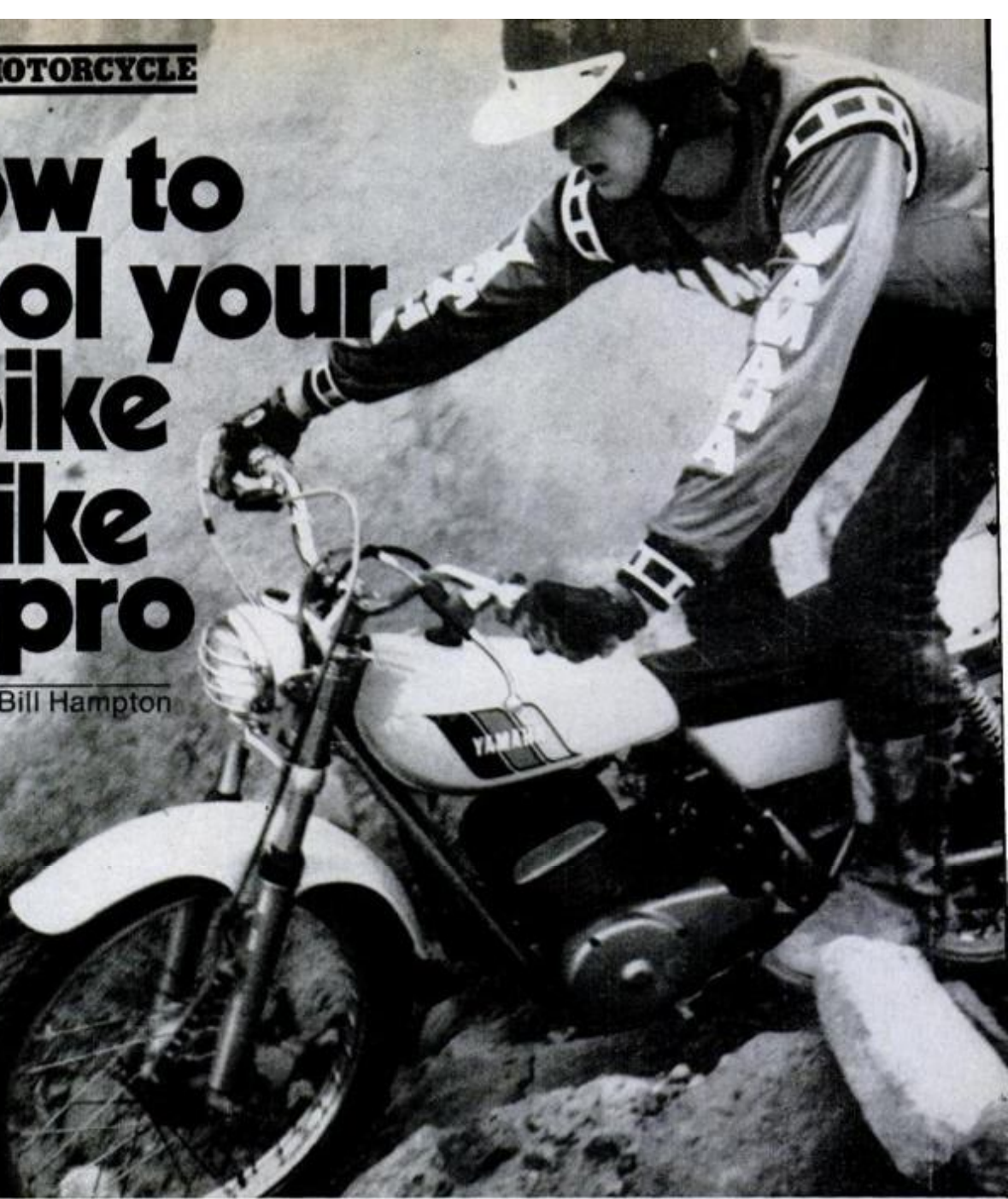
riding smoothness while giving LUV a low road stance.

The new LUV is produced for Chevrolet by Isuzu of Japan.



How to control your bike like a pro

by Bill Hampton



To become a better rider, you have to develop a rapport with your motorcycle. You must move together like a two-wheeled centaur. A motorcycle can move dimensionally much like an airplane. It's inherently sensitive to its operator's actions. Your slightest movement brings some kind of reaction from your bike. So you want to make sure it responds instantly and surely to your commands.

Before you can develop control, you must feel "right" with that mechanical extension of your body. You must establish the proper handlebar/seat/footrest relationship. Assume a normal riding position. Now slide back and forth until you find the most comfortable portion of the seat.

If you sit too far back, your center of gravity will be behind the bike's. The front end will be light and track

improperly. But if you sit too far forward, you'll load the front end and also interfere with the steering. What's more, your hands and feet will have to bend awkwardly to operate the controls. The idea is to keep your center of gravity for normal "sit down" riding.

Most bike seats aren't adjustable. About the only way to improve an uncomfortable seat is to replace it.

Checking the handlebar

Is the handlebar at the right height? Close your eyes and reach out to where your extended arms feel comfortable. But don't feel around for the handgrips. Now look to see where they are in relation to your hands. You may have to reposition the handlebar for proper height.

For road-riding, the handlebar should be of such design that your

Serious dirt riding requires that controls be set up differently than for street riding. Footrests are placed more to the rear to allow for stand-up control. As shown here, arms are kept straight to apply more leverage to the handlebar, which will keep front wheel from being bounced and twisted off course when riding on rough terrain.

forearms are angled slightly to your upper arms, with elbows away from the body. You should be able to move the handlebar through a small side-to-side arc before your upper arms or elbows dig into your sides.

If you can't get comfortable with the handlebar, no matter how you position it, replace it with one of a different "bend." Then turn your attention to the handgrips. If they don't provide a positive, comfortable grip, replace them. They should be just thick enough to permit your fingers to wrap around without digging into your palms. The grips shouldn't

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Self-polishing GAF® linoleum floors or 100% nylon carpets. All designer coordinated in a variety of color choices.



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84. Coachmen is America's best-selling name in RVs. Among other things, that means high trade-in value. **85-555.** Last but not first, our hundreds of happy-to-serve-you dealers throughout North America.



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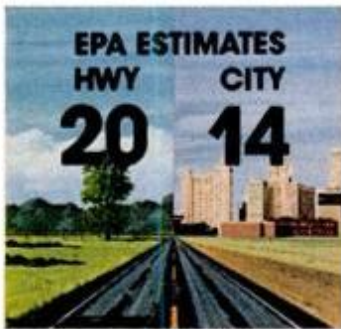
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MORE MILEAGE! Compared to 1976 full-size Chevrolet wagons. EPA estimates with the standard 305 V8 and auto. trans. Power train not available in California.



CONVENIENT DOOR-GATE. Opens out like a door for people. Drops down like a gate for cargo. Counterbalanced. Easy to operate.



ROOMY CARGO COMPARTMENT. Takes loads up to 4 feet wide through a rear opening that's wider at beltline, higher overall than the 1976 model it replaced.



PUSH-BUTTON SEAT CONVERSIONS. A lever releases the folding third seat back. A button high on the side panel lets the second seat fold forward.



LOCKABLE STORAGE UNDER THE FLOOR. 8.0 cubic feet on 2-seat model. Less on 3-seat model (shown).



LOCKABLE STORAGE IN THE SIDE. Over 2 cubic feet. Handy storage trays hold things that usually clutter seats and floor.



MORE MANAGEABLE IN CITY TRAFFIC THAN THE MODEL IT REPLACED. Something to appreciate as you slip into tight parking spaces.



SEATS 8 WITH AVAILABLE THIRD SEAT. Built to take big families with plenty of room for heads, hats, legs, and feet.

1978 Chevrolet Caprice Classic Wagon with available Estate equipment.

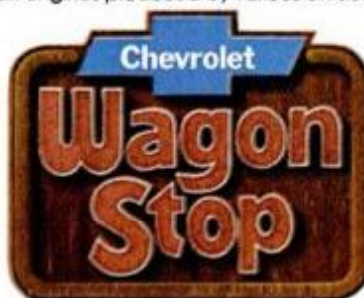


*Your mileage may vary depending on how and where you drive, your car's condition and available equipment. (Chevrolet is equipped with GM-built engines produced by various divisions. See your dealer for details.)

Introduced a little more than a year ago, The New Chevrolet quickly became the best selling full-size wagon in America.*

You can see some of the reasons for its success on this page.

The other reasons will become



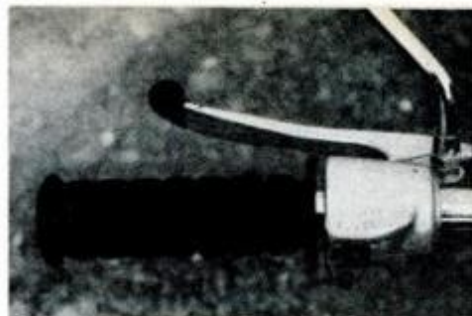
obvious the first time you test drive The New Chevrolet Wagon.

And the best place to do that is at your local Chevrolet dealer's Wagon Stop, your complete shopping center for wagons. *Based on R. L. Polk registrations for 1977 model year.

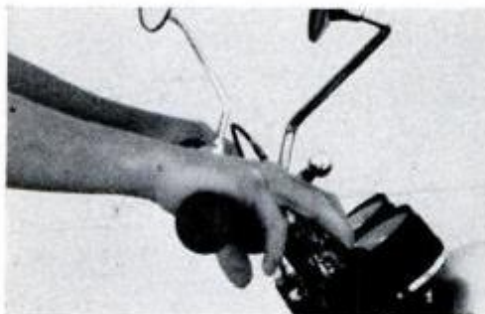


SEE WHAT'S NEW TODAY AT YOUR CHEVROLET WAGON STOP.

Handlebar lever for the front brake (right) and the clutch should be placed so that, in use, they align with forearm, wrist and hand. Handgrips (far right) should be comfortable.



Front-brake lever, on right side of handlebar, should have play adjusted so you don't have to brake with stretched fingers (right); better to use partially clenched fingers (far right).



Adjust levers for right amount of side-play (right) so they don't bind or flop around in use. Position secondary controls like compression release (far right) for easy operation.



Clutch cable should have about 1/16 to 1/8-inch play (arrow, right) before clutch begins to release. Rear-brake pedal (far right) should lie under sole of foot with 1/2 to 3/4-inch play.



CONTROL YOUR BIKE LIKE A PRO

(Continued from page 64)

be so soft you have to squeeze hard to hold on. Neither should they have any hard texture or projections that bite into your hands.

Brake and clutch levers

These left and right-hand levers should slope downward from the handlebar so that when you grasp a lever, forearm and hand are in line. If your wrist has to bend sharply to work a lever, gripping effectiveness is lost. The arm, wrist and hand will fatigue quickly, too. A dirt rider will want the levers to slope downward even more, because most of your riding is done poised on the footrests.

Once you have the levers where you want, tighten their securing clamps just enough to keep them from shifting around when they're operated. Tightened too much, the levers may bend or break—rather

than twist out of the way—should you "drop" your bike.

On some motorcycles, little adjustment is provided for repositioning the levers. Try moving the handlebar for a change in lever position.

Adjusting control cables

The clutch cable should have about 1/8-inch play before it starts to "lift" the clutch. If there's no play in the cable, the clutch plates may not seat properly, causing slippage. Too much cable play, however, may prevent the plates from separating completely when the clutch is operated; a dragging clutch results. This causes creeping at red lights and grinding gear shifts. On the other side of the handlebar, squeeze the front-brake lever. It should move about 1/5 to 1/4 of its total travel before the brake bites. (If you have a small hand, you may want even more play.

With fingers partially clenched, you have more controlled braking effectiveness.

Too much play, however, may allow the lever to bottom against the handlebar when the brake is applied hard. Then you may not be able to take full advantage of the front brake's stopping capacity. Keep both cables well lubed. Check them periodically for broken strands, especially at end fittings.

Check throttle, footrests

Your throttle should turn easily and snap closed when released. And keep it well lubed. It should turn only two degrees or so before it takes hold. Too much play delays engine response to your commands.

In a sense, the footrests are controls, too. By placing your weight on them, you affect the way your

(Please turn to page 68)

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Proper riding position is important for maximum control. Keep feet level on the footpegs, tuck knees in close to the tank and become one with your motorcycle.

CONTROL YOUR BIKE LIKE A PRO

(Continued from page 38E)

bike handles. For street riding, footrests should be forward of your seating position so your legs aren't cramped, yet not too far forward to keep you from posting on them to absorb road shock. And if you ride dirt, you'll want the footrests more to the rear so you can post on them comfortably without loss of balance.

Periodically take a wrench to footrest mountings—keep them tight.

Check the kick start

If your kick starter can be repositioned on its shaft, mount it so it doesn't engage until about 45° from vertical. This way you can quickly restart a stalled engine without having to raise the starting leg very high. In time this leg will become strong enough for you to use a "snapping" action to turn the engine over. This might not work well with a high-compression, large-capacity engine. A lot depends on engine size and your strength.

If necessary, reposition the gearshifter on its splined shaft so that your foot doesn't have to bend awkwardly to operate it.

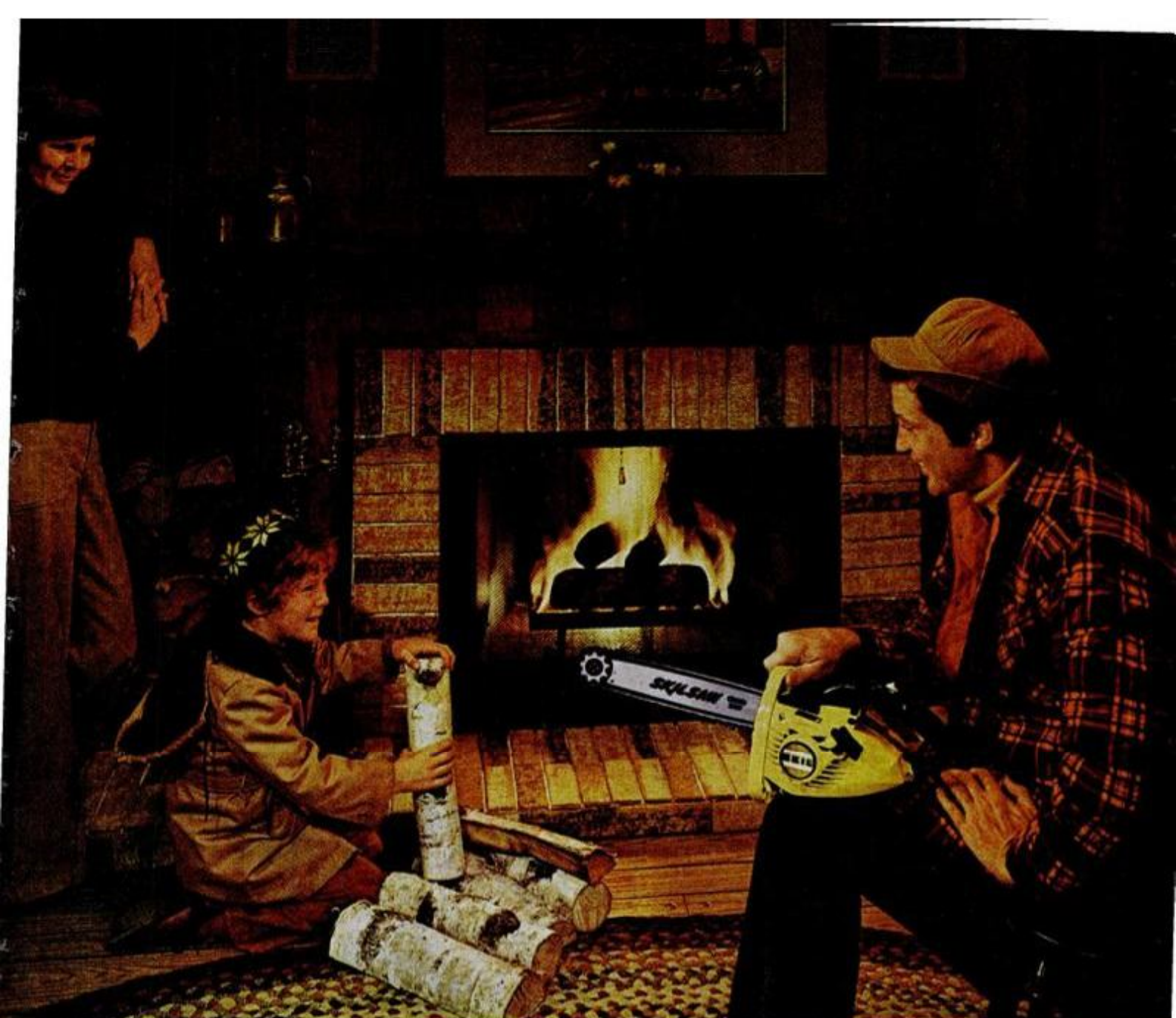
Rear brake pedal

As for the rear-brake pedal, adjust it so that with your foot resting on the footrest in a natural, horizontal position, the pedal is directly under your sole. This cuts down reaction time during emergency braking.

But be careful not to "bend" your foot down and ride the brake when driving in nonbraking situations. To minimize that possibility, adjust the wingnut or knurled adjuster on the brake rod or cable so the pedal has 1/2 to 3/4-inch play.

Once the controls are set up, you'll be amazed at the ways your bike responds to your actions—you'll swear it's reading your mind!

PM



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Orienteering— new sport that can save your life

Now you need only a compass, map and some practice, alone or with friends, to end the fear of ever getting lost.

by Richard Dunlop

Orienteering has become an increasingly popular sport. It's an important outdoor survival skill, with basics that are centuries old.

About 4500 years ago, a sharp-eyed Chinese discovered that a certain mineral ore freely suspended or floated in water on a chip of wood always turned so that it pointed in a direction midway between the place where the sun rose and where



it set. That discovery led to the invention of the compass, an instrument that has accompanied every exploration of land and sea since. Today the compass is used on recreational hikes, trail rides, boating cruises—and in orienteering.

A compass and map are necessary tools of orienteering, a sport with all the zest of a road rally, but it doesn't burn up gasoline, because it depends

PM art: Paul Williams



An outdoorsman's art that is both a survival skill and a competitive sport, orienteering now fosters Olympic-style meets in Europe, North America and Japan.

on a participant's two legs, sense of direction and physical stamina. With map and compass, a person skilled in orienteering can find his way through a settled countryside or a trackless wilderness for the challenge and fun of it.

The sport

Orienteering as a sport has been popular in Europe for several decades, but only in the last few years has it become a major outdoor interest in the United States. Now orienteering meets are common, some under the supervision of the U.S. Orienteering Federation headquartered in Athens, Ohio.

At a meet, judges hand each team a topographic map of the area, upon which several checkpoints have been circled. Flags or other markers are placed around the "course" at the exact spots indicated on the map. The idea is to take off from the starting line and locate the markers (in the fastest possible time, if it is a timed event).

The skill

A person with practice in orienteering can read a topographic map at a glance. There are symbols for roads, rivers, buildings, abandoned mines, fields, swamps, forests and anything else of human or natural origin. Blue means water and brown lines delineate the contours of hills and valleys. The closer together the lines, the steeper the gradient, so there is no possibility an experienced map reader will come upon a cliff when he had been expecting a gentle slope.

An accurate bearing is critical. You may use a conventional compass, perhaps with a lens or prism sighting device or, more likely, you may select a specialized orienteering compass based on the Silva System. This lets you establish directions without having to check degree figures. An orienteering compass also usually has a built-in protractor and ruler for use with a map. With magnetic needle, turnable compass housing and see-through base plate, this orienteering compass makes aligning a map with the terrain much easier.

Orienting

A map can be oriented in different ways. The most popular one is to set the compass at 360°, (magnetic North) and place it on the map with the side edge of the base plate parallel with the magnetic North line indicated on the margin. The direction-of-travel arrow points

(Please turn to page 72)

OMNI'S TOPS.

Motor Trend magazine thinks so. Which is why Dodge Omni became *Motor Trend* Car of the Year.

Veteran car critics and testers have been reporting some very nice things about Omni. Like the confident feel of its front-wheel drive. And the kind of space front-wheel drive gives Omni's occupants. So, the nation's automotive press also thinks so.

We think you're going to

to know Omni prices start at just \$3706*. Which includes such standard items as an AM radio, vinyl body-side moldings, and whitewall radial tires. With a little judicious selection of options and trim packages, you can own an Omni like the one in the picture for just \$4135*.

For that kind of money, you get a lot of versatility. First of all, Omni is built for American-sized folks. There are four wide doors

carryall roof rack. With appropriate attachments, it'll handle bikes, skis, baggage, or other cargo up to 150 pounds. After all, the more you carry outside, the more you can carry inside.

EPA ESTIMATES:

39 MPG HIGHWAY/25 MPG CITY.

Omni is also very obliging on gas mileage. EPA estimates are 39 MPG (highway)/25 MPG (city). That's when your Omni is equipped with its standard

1.7 litre engine and four-speed transmission and 3.3 transaxle ratio. Your mileage may vary. Depends on how you drive, your car's condition, and its equipment.

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ORIENTEERING (Continued from page 70)



Orienteering contests and clubs are easy to start with the variety of new instruction booklets that are available, plus topographic maps from the U. S. Geological Survey.

North. Turn map and compass together until the compass needle points to N on the compass housing. Now map and compass are both pointed North, and the map is oriented.

For this new sport it is also necessary to know the length of your own pace—which consists of one normal step with each foot for a total of two. Once you've measured how long your normal pace is and timed out how fast you normally walk, jog or run, you can figure distances you've covered accurately and project the time it takes to reach each map checkpoint.

First steps

As a competitor, you read your instructions, see where you are going on the map, and then use your compass to determine the correct bearing from where you are to your first objective.

Most people would then draw a beeline on the map, but that is not necessarily the route of a veteran hiker. If a study of the map shows that the orienteer's beeline extends through a swamp or is broken by a cliff, it will scarcely prove to be the quickest route.

The next step then is to establish an optimum course—one that stays, if possible, on relatively level terrain without going too far afield. Careful study of the map may indicate alternate routes, the difficulty

of each, and the trade-off in time for travel over a steep course versus terrain that is easier but longer.

With orienteering experience, you learn not only that the shortest way may not be the fastest, but that the correct heading may not be the best. Suppose you are leaving checkpoint A inland for checkpoint B on a lake-shore. If you arrive at the lake but miss the checkpoint by a few hundred feet, you may be out of sight of it and will not know whether to turn right or left. Anticipate this possible error by deliberately making one as you set out for the lake and aim either a little to the right or left of the goal on purpose. Then when you reach shore you know just which way to turn and won't lose critical minutes in a timed contest.

Mapping the action

For an outdoor lover, there is probably no pleasanter way to learn an essential survival skill than to study a topographic map of where you are or would like to be. The U.S. Geological Survey has free indexes of its 40,000 topo maps for each state plus Puerto Rico, American Samoa, Guam and the U.S. Virgin Islands, and an information booklet on maps and their symbols. These, and the maps (at \$1.25 for the popular standard 7.5 and 15-minute topo quadrangle maps), are available from more than 1500 local dealers or

(Please turn to page 74)

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†Source: R. L. Polk & Company, Trucks registered as of 7/1/76.



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ORIENTEERING

(Continued from page 72)

directly from the Branch of Distribution, U.S.G.S., 1220 South Eads St., Arlington, Va. 22202, for states east of the Mississippi, including Minnesota. For western states, including Louisiana, it's the Branch of Distribution, U.S.G.S., Denver Federal Center, Denver, Colo. 80225. Alaskans can contact the U.S.G.S. Distribution offices at 310 First Ave., Fairbanks, Alaska 99701.

Special orienteering maps for certain areas can be obtained from Orienteering Service, 308 West Fillmore, Colorado Springs, Colo. 80907. They are also a source for orienteering pamphlets and instructions, as is the Silva Co., 2466 State Road 39N, La Porte, Ind. 46350.

One inch equals 2000 feet on the 7.5-minute maps; each map covers about 50 to 70 square miles. Smaller-scale 15-minute maps are less suitable for detail work needed for orienteering. Best book on the subject is the new edition of *Be Expert with Map & Compass—The Orienteering Handbook* by Bjorn Kjellstrom, published by Charles Scribner's Sons at \$6.95.

Cross-country competition

Best test of your skill is a race against other map and compass readers. The cross-country type is most popular for international trials. The course setter for a cross-country race selects 5 to 10 natural or man-made features 300 to 1500 feet apart to form a course up to three miles long for beginners and 8 to 10 miles for experts. You get a map with control points numbered in order, and you copy a code word or number as you find each check point. Fastest time wins.

So-called Score courses do not require control points to be passed in sequence, and each is given a point value so that if you pick difficult ones your total will be higher. More controls are listed than the allotted time will let you find; you must estimate how much ground you can cover.

Preset-course orienteering includes Line and Project orienteering, among others. The Line contestant follows a fixed route on the map and finds and marks on it the sequence of numbered controls encountered along the way. Projects might include identifying a tree or performing an outdoor skill at each checkpoint.

No matter which orienteering you choose, you are perfecting an essential survival skill while having lots of outdoor fun. **FM**



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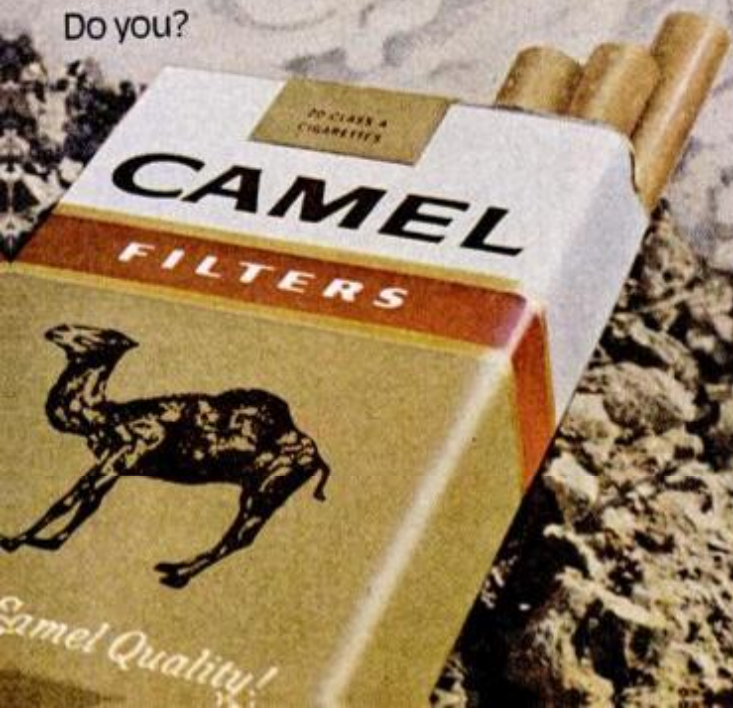
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PM

NEW RUBBER STAMP BUSINESS PAYS BEGINNERS UP TO \$16.50 AN HR. Start at Home in Spare Time

The multi-million dollar Rubber Stamp business—once controlled by a few big companies—is now being taken over by small operators—one in each community throughout the United States. Men and Women who have this inexpensive machine can turn out huge quantities of Rubber Stamps with special wording that buyers once were forced to buy from big cities. Material costing only 27c makes a stamp that sells for \$2.75. The machine that does the work is simple and easy to operate and it turns out as many as six Rubber Stamps at a time, each with different wording such as names, addresses, notices, stock numbers, prices and other "copy" needed by offices, factories and individuals. Working full capacity, it can earn as much as \$33.00 an hour for the operator! Now you can get into the big-pay business yourself, with your own home as headquarters. You don't need experience. We supply everything, including complete instructions and eight ways to get business coming in fast. **We even help finance your start!** Start making up to \$16.50 an hour from the very beginning. Cash in on the profitable Rubber Stamp business in your community, right away. We'll mail full particulars FREE and no salesman will call. Be first in your locality. Rush coupon today or send your name on postcard to:

RUBBER STAMP DIV., Dept. R-2-HC
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THIS LITTLE TABLE TOP MACHINE
MAKES EVERYTHING SIMPLE & EASY



MAIL
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FREE!

Please rush full particulars about your financing plan and the little machine that can get me started in the profitable Rubber Stamp business at home in spare time. Everything you send me is FREE and no salesman will call.

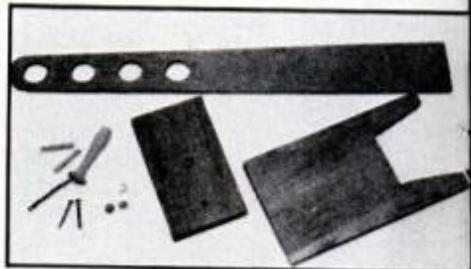
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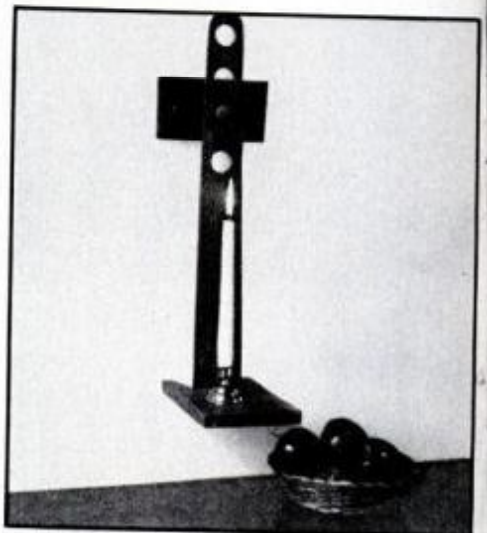
Shaker candleholder from a kit



All hardware and cut lumber are included.



Sand, glue, assemble and apply finish.



The holder is a handsome candle support.

Assembling this distinctive Shaker candleholder is a pleasant and productive way to spend an evening. The kit comes with parts, thorough assembly and finishing instructions, and bonus recipes for Shaker herb bread and soup. (Candle and its candlestick are not included.)

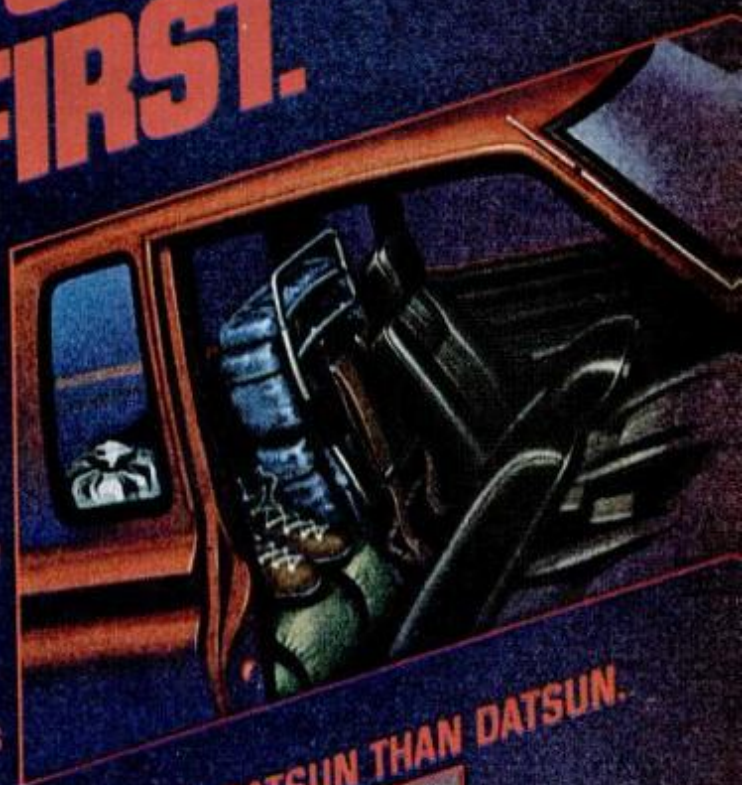
Dowel pins, peg and other wood parts are pre-cut and sanded. Simply finish-sand them and assemble with white glue. Finishing directions include those for antiquing, applying oil, wax, polyurethane and paint. The postpaid kit in pine is \$11.45; in maple, \$13.45; cherry, \$15.45.

Other colonial kits, such as trays, benches and high chairs, are available. Colonial Crafts, Inc., 11731 Detroit Ave., Box 710 Edgewater Sta., Lakewood, Ohio 44107.—P.A.



**IT'S A CAR. IT'S A TRUCK.
IT'S A FIRST.**

KING CAB.™ The most unique personality in small pickups. Only from Datsun. Inside the cab, all the features of a car—carpeting, console, more leg room than any other small truck and the only reclining bucket seats in any size pickup. But Datsun didn't stop there. Behind those bucket seats—up to 11.3 cubic feet of lockable storage space. Try finding that in any other small pickup. Not available. Yet the King Cab is pure truck tough. Even a 1400 pound payload of passengers and cargo can't hurt its performance. It's built to very demanding specifications: Datsun's! Come see the complete line of America's No. 1 small pickups and test drive the King Cab. It's Datsun—dedicated to the different—driven to the exclusive.

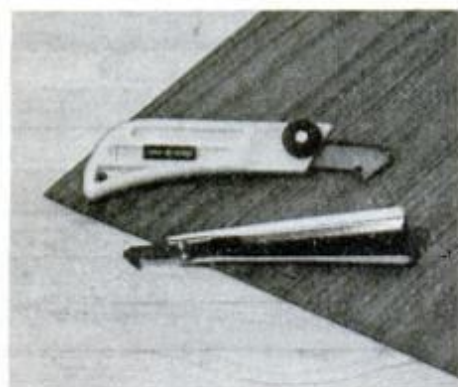


NOBODY DEMANDS MORE FROM A DATSUN THAN DATSUN.
DATSUN.
WE ARE DRIVEN.



Keep thinking big, Datsun.

PM LOOKS AT PLASTIC LAMINATE TRIMMING KNIFE



Two versions of the same cutter—one large and one small. Both work fine.



Cantilever piece over edge of bench and break off waste with downward snap.

I discovered this tool at the National Hardware Show in Chicago. It's a dandy hand trimmer for those who cut laminates (such as Formica) on a once-in-awhile basis. When



For accuracy, make several passes using a securely held metal straightedge.



Use hook part of blade to dress newly cut edge; blade back can also be used.

used as shown, it performed without a hitch. At hardware stores, it's \$3.49 with six blades. Olfa Products Corp., Box 747, Plattsburgh, N.Y. 12901.—H.W.



Next, bend cutoff portion up—that is, against the decorative surface as here.



Five blades come with the cutter. They store conveniently in the handle.



With Elmer's Cabinetmaker's Contact Cement you don't need a pro's hands to give it the pro's touch.



Solvent-type competitor vs. Elmer's Cabinetmaker's Contact Cement

Elmer's® Cabinetmaker's Contact Cement has a unique, non-flammable[®] acrylic latex formula. It not only gives you the strength and permanence of acrylics, it goes on easier than solvent-type cements... and goes further. After application, it even tells you it's ready to bond by turning from white to crystal clear.

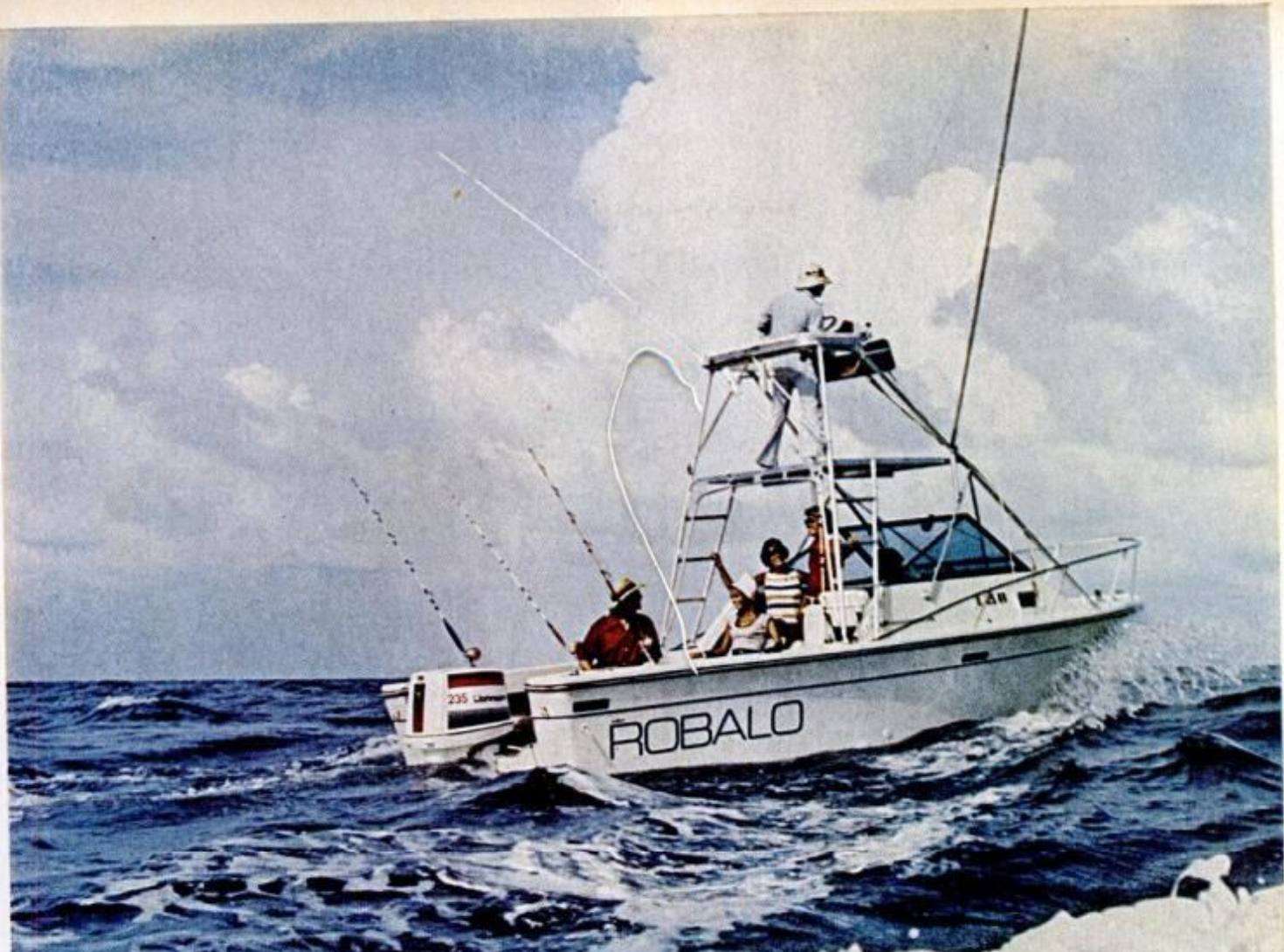
*As defined by Federal Hazardous Substances Act.

It's a lot more convenient too, because it cleans up with plain water before it dries. (Try that with a solvent-type cement.) No fires or ventilation problems to worry about either, when you work with Elmer's.

In an accelerated aging test, 220°F. of test-oven heat for four days actually warped the laminate on the left and made the conventional contact cement let go. But Elmer's Cabinetmaker's Contact Cement held.

Elmer's. When results count.





New 235-hp V-6.
When you need
all the outboard power
you can get.

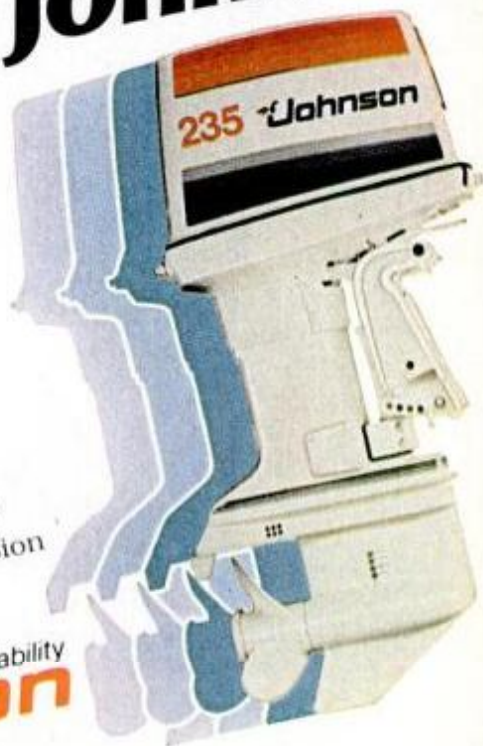
Now's the time for Johnson.

You're looking at the world's most powerful production outboard. Our all-new 235-hp V-6. Built for off-shore fishing rigs. Large runabouts and cruisers. High-performance hulls. And we built it with all the performance and economy features you need to take on big water and cut it down to size. Like a full 90° V-6 with 149.4 cubes that delivers the power you need to get on plane fast. A new carburetion system that improves mid-range fuel economy. And remote single-lever Command Center™ control, with thumb control for the built-in TNT power trim and tilt.

Like our 175- and 200-hp V-6s, our new 235 rests comfortably on the transom, for more room onboard. And like all our outboards, down to our little 2-hp, our V-6s have Johnson's reputation for dependability. See our new 235 at your Johnson® dealer, or write for free catalog, Johnson Outboards, Division of Outboard Marine Corporation, 3832 Sea-Horse Drive, Waukegan, Illinois 60085.



First in Dependability
Johnson
OUTBOARDS



Come to
where the
flavor is.



Marlboro Red or Longhorn 100's—
you get a lot to like.

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

17 mg "tar," 1.0 mg nicotine av. per cigarette. FTC Report Aug. 77





Look closely and you can actually see where we hid a case of Canadian Club.



There are more than 7 million stories in the Big Apple. And one of them is a hidden case of Canadian Club whisky that is yours ...if you can find it.

Begin your search for the world's finest tasting whisky at the

bottom of the world's 3rd tallest building. Immediately proceed by taxi in as straight a line as possible toward "The House that Ruth Built." Get out the second the meter reads \$3.65 and walk toward the wonderful sound of 196 fountains. Hop onto the nearest double-decker bus and ride the same number of blocks as there are bridges out of town.

You're getting very close.

Now stroll over to a familiar mounted officer and climb into one of the cabs waiting for you. Tell the driver to make a right, a left and a right.

It is now time to board a train that some think was named after the smoothest whisky in 87 lands. Get off at a station near Adam Van Den Berg's cow pasture. Without paying another fare, take another train three stops.

Say, "C.C., please" and the case is yours.

Walk two blocks toward the setting sun and half that distance toward the nearest city reservoir. There, at a very prominent address, higher up than the eye can see, someone is ready to hand you the case of Canadian Club when you say, "C.C., please."

But if for some reason you should get a little weary along the way, don't panic. The New York area has 10,848 bars and restaurants that will be delighted to serve you Canada's favorite Canadian.

Canadian Club

"The Best In The House"™ in 87 lands.



When GM's front-wheel-drive compacts
hit the showrooms, you'll know
that the new decade has arrived.

by Karl Ludvigsen

CARS OF THE '80s

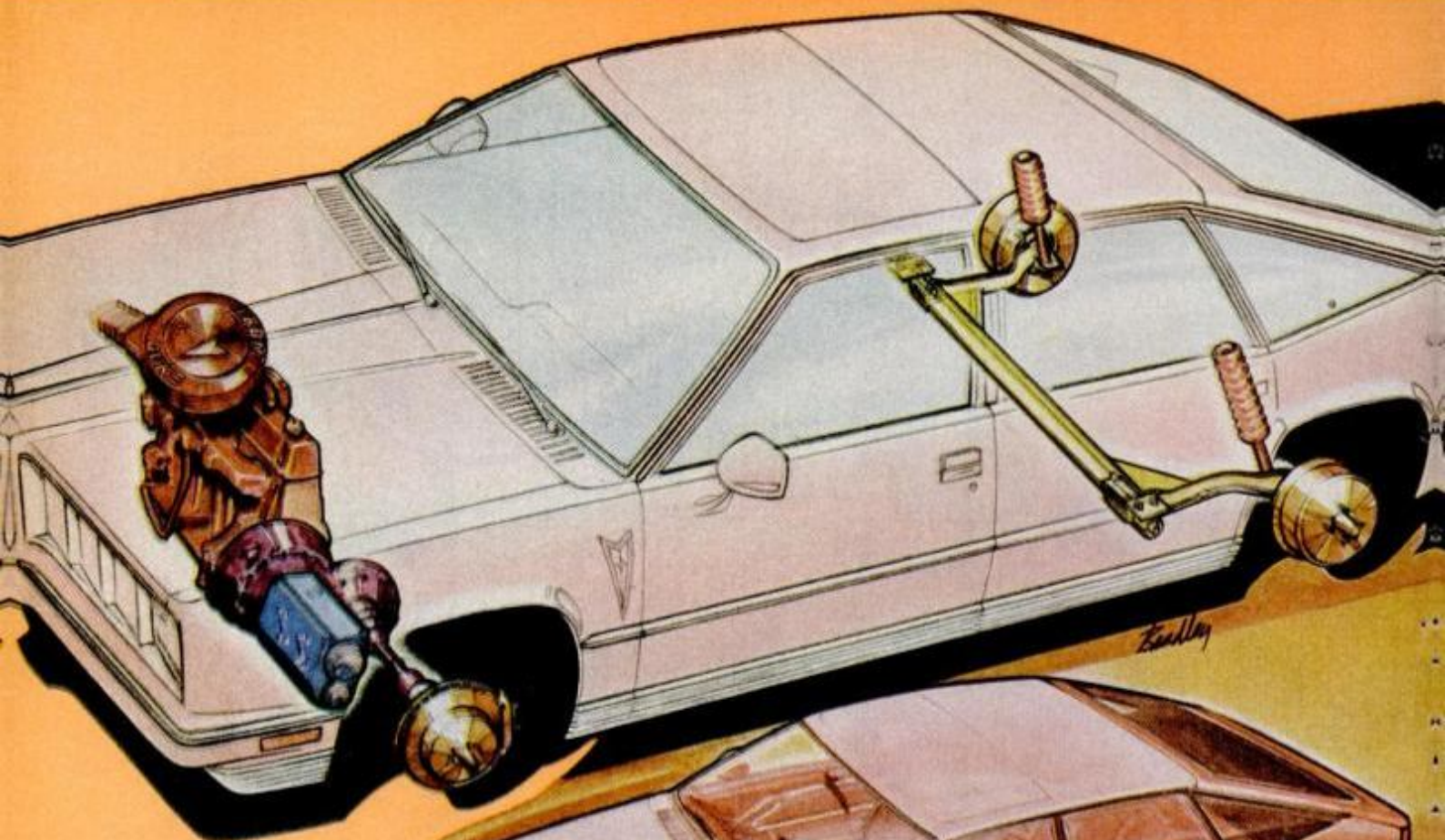


The 1980 Chevrolet Nova with transverse engine and front-wheel drive will weigh in at less than 2570 pounds. It'll be a hatchback on a 103.5-inch wheelbase, will be 174.7 inches overall, 68.6 inches wide and 55.1 inches high.

As you well know, this is the age of the Big Shrink. The Monte Carlo of today is not the Monte Carlo of yesterday. It's smaller and lighter, and gets better gas mileage. You've seen the ways that cars have been chopped down in size and weight in 1977 and '78, and you've heard that there's much more of the same still to come.

That couldn't be more true. Just how true it is you can see on these pages, where we present your first detailed look at the compact models that General

Motors will be selling in the 1980s. They're radically changed—so radically that no car in that huge corporation's history has ever posed a greater potential for a change in its fortunes. It could be the best thing that's ever happened to GM—or the worst. The impact these cars will have will be that strong because almost every part in them will be brand-new. They'll also be sharply different in design from anything GM has made before, combining front-wheel drive with transverse engines and all-inde-



pendent suspension. The bill for designing, testing and tooling up for them is expected to run to a cool one billion dollars. In case you haven't thought lately about just what that means, that's a thousand times one million dollars. It gives one pause.

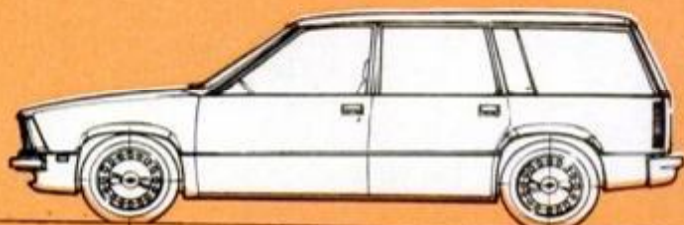
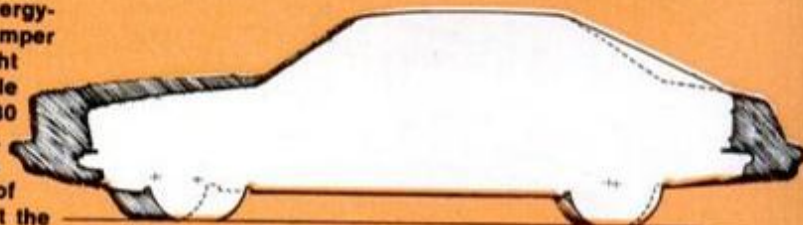
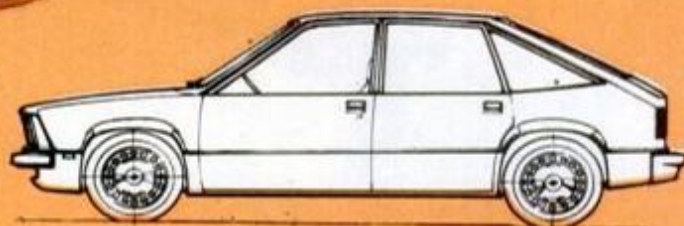
But just being radically different doesn't account for the kind of impact these cars could have on the finances of General Motors. The Corvair was even more radical, and its erratic rise and fall had little effect on the General.

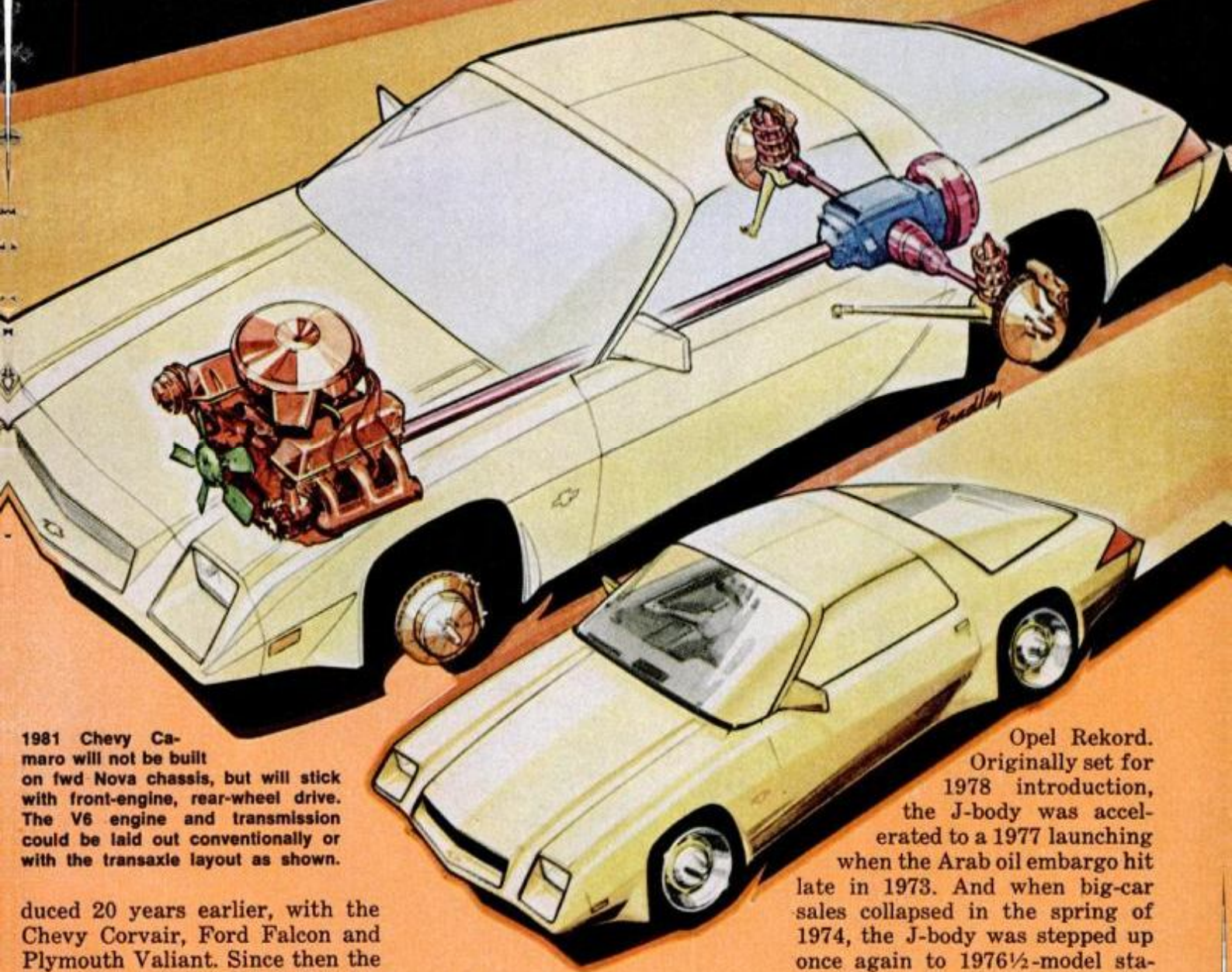
A lot riding on new models

These new front-drive models will be woven much more deeply into the fabric of the corporation because they'll be offered by four of its five divisions. They'll appear in the summer of 1979 as the 1980 Chevrolet Nova, Pontiac Phoenix, Oldsmobile Omega and Buick Skylark—the basic bread-and-butter cars of these volume-producing divisions. If they don't work, and work well, GM is in big trouble.

These are GM's entries in the compact-car market of the 1980s. They'll represent the first real attempt to redefine the compact car since that class was intro-

1980 Pontiac Phoenix shown in two views above will have the same hatchback configuration as the Nova. Use of urethane front end could eliminate weighty and cumbersome energy-absorbing bumper hardware. At right top is a profile view of the 1980 Nova hatchback. At right center is a profile outline of fwd Nova against the current Nova. Right bottom is an artist's conception of the station wagon version of the Nova.





1981 Chevy Camaro will not be built on fwd Nova chassis, but will stick with front-engine, rear-wheel drive. The V6 engine and transmission could be laid out conventionally or with the transaxle layout as shown.

duced 20 years earlier, with the Chevy Corvair, Ford Falcon and Plymouth Valiant. Since then the names have changed, but the cars we think of as compacts have stayed much the same. New though they are in detail, the Ford Fairmont and Mercury Zephyr are traditional compacts in size and design. But these front-drive GM cars are something else.

Today's GM compacts are all descendants of the Chevy II, introduced in 1962. From that the bigger and heavier Nova evolved in 1968. Known inside GM as the

X-body, it was given to the other divisions to sell in the early 1970s. All were face-lifted, with a new hatchback body style, for the '75 model year. When that car came out, however, planning of its front-wheel-drive successor was already rolling ahead.

In 1972 and '73 the GM designers were working on a "J-body" car to replace the Nova. They wanted it to be about the size of one of GM's German cars, the

Opel Rekord. Originally set for 1978 introduction, the J-body was accelerated to a 1977 launching when the Arab oil embargo hit late in 1973. And when big-car sales collapsed in the spring of 1974, the J-body was stepped up once again to 1976½-model status.

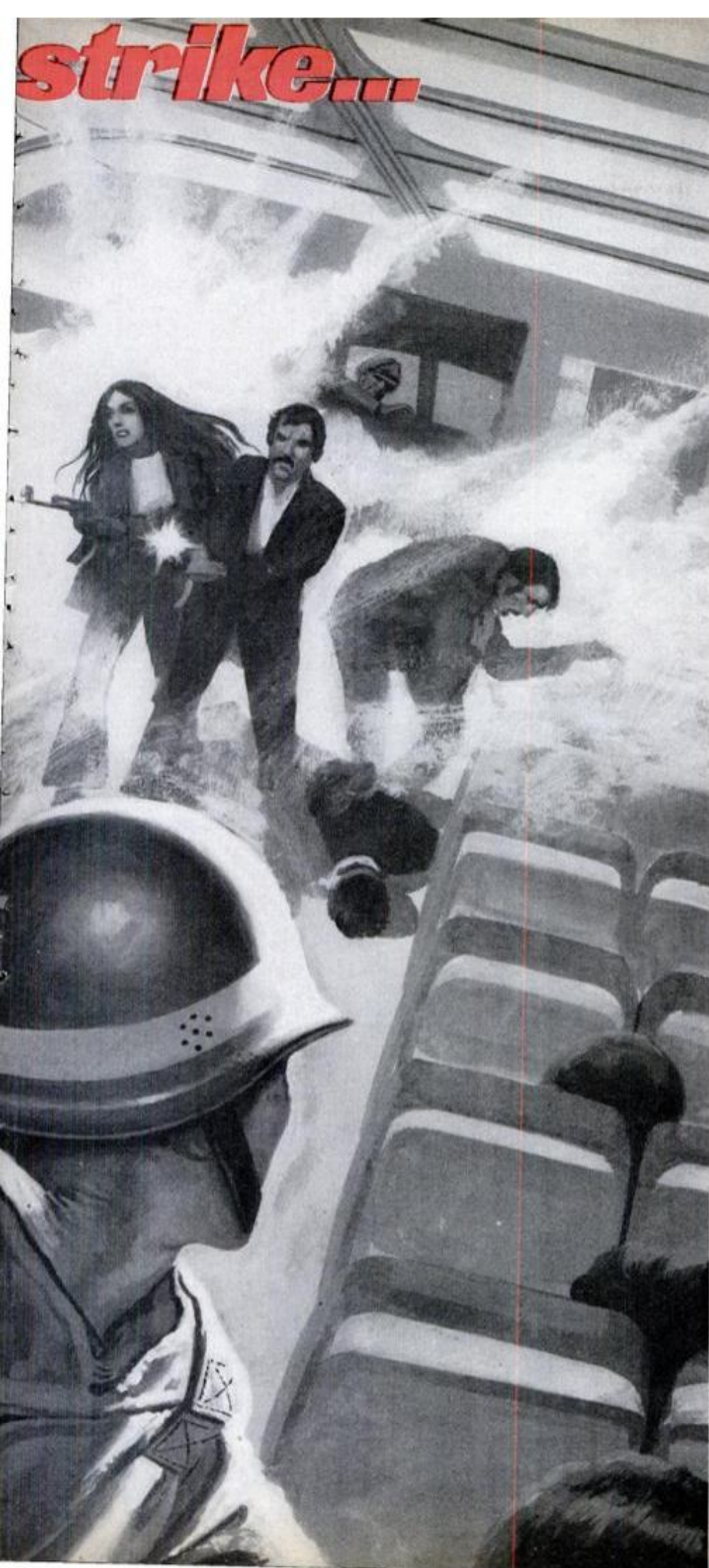
Then that schedule was scrubbed in the fall of 1974 when GM's planners realized they'd have to shake up their whole range of cars. That's when they decided to make them all smaller, starting with the big B-body models and working down from there. And that's when work on these front-wheel-drive X-body cars began.

As it had done with full-sized
[\(Please turn to page 198\)](#)

When the terrorists



strike...



... commando groups must move swiftly and surely. To save hostages, it takes special skills, mental toughness and sophisticated weapons.

by Murray Rubenstein

The leader, the one who called himself Walter Mahmoud, forced the Lufthansa pilot to kneel in the aisle as he, Mahmoud, harangued the passengers. Then, without warning, he bent over, placed the barrel of his pistol in the airline captain's mouth and pulled the trigger. So died Jurgen Schumann, 37 years old, married, the father of two.

Frightened passengers were beaten and threatened with death as the Boeing 737 sat at the dusty airport of Mogadishu, Somalia, on Africa's east coast. Afterward, they would say that they were treated like animals and that their captors were nothing short of sadistic. Before landing in Somalia, the passengers of hijacked Lufthansa Flight 181 had been flown from country to country for four days, never knowing when they might be killed. They were lashed to their seats and even doused with flammable liquids as an additional threat. The cabin was mined with explosives.

Suddenly, there were deafening explosions, blinding flashes of light and murderous gunfire blazing along the aisle. The action ended quickly. The three male terrorists lay dead and their female companion, clad in a Che Guavera T-shirt, was wounded. The 86 hostages were freed.

Israel airport raid

There have been other terrorist acts—and many of them haven't had happy endings. Christian pilgrims, newly arrived in the Holy Land, were machine-gunned at Lod Airport in Israel in 1972 by three members of the so-called Japanese Red Army. Children have been tossed out of upper-story windows and bombs placed in marketplaces and on buses. Terrorists, wherever they have operated, have done so totally without regard for any humane principles. Death is their legacy.

According to a recent statement

In an unfortunate, but increasingly common scenario, commandos get the jump on jet hijackers.

PH art: Ken Barr

by the United States Central Intelligence Agency, "There is a real danger that the (worldwide terrorist) attacks will become more frequent in the future." There are only two real alternatives: to give in to terrorists' demands or to declare war against them as we did against the Barbary pirates more than a century and a half ago.

The Israelis, who have had the most experience in dealing with terrorists, have concluded that giving in inevitably means that the demands will be stiffer the next time. If this is the case, there is only one answer to the ever-increasing terrorist problem, as more countries are concluding all the time.

There are now at least 13 nations that maintain specially trained anti-terrorist units. They are the United States, Great Britain, Germany, Israel, France, Belgium, the Netherlands, Italy, Norway, Austria, Indonesia, Switzerland and Denmark. There is considerable cooperation among the specialist groups though individual tactics, weapons and organization differ considerably. What holds true for all of these antiterrorist units is that their methods have been refined in answer to the increasingly sophisticated tactics and technology of terrorist groups.

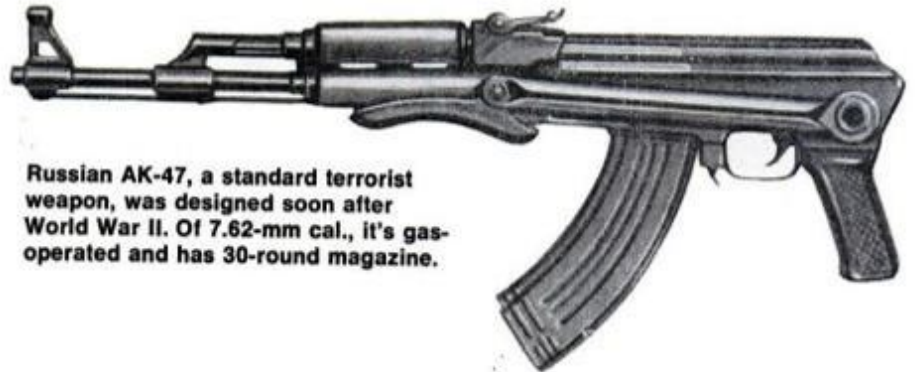
Commandos organized

The man who led the Somalia rescue, Lt. Col. Ulrich Wegener, is a flinty veteran of World War II. Five years ago, he was asked by his government to build a crack force of West German antiterrorist commandos, a group that would come to be known as Border Protection Group 9 (*Grenzschutzgruppe Neun*, or simply G.S.G. 9). Wegener began his own preparations by taking an intensive paratroop training course in Israel. Later, he received further training from the F.B.I. in the United States. Col. Wegener accompanied the Israelis to Entebbe in July 1976 as an observer and, during that dramatic rescue operation he

(Please turn to page 204)



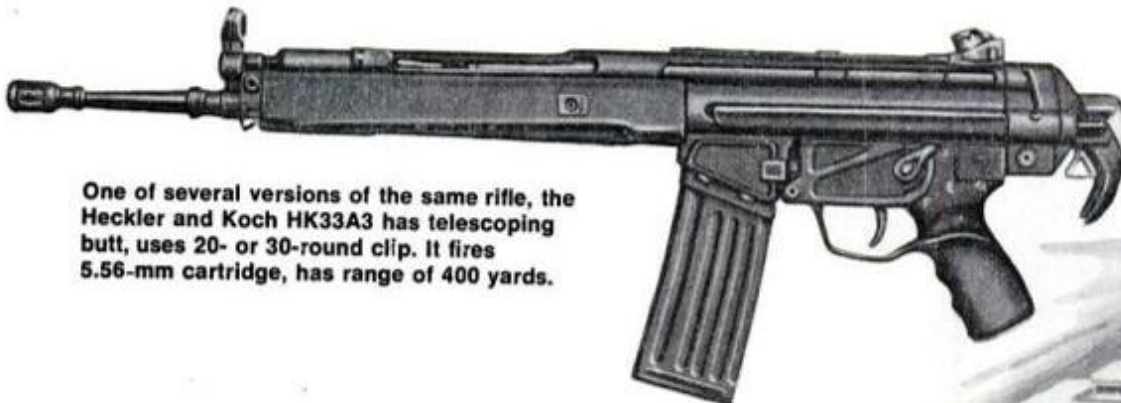
Commando units of many countries are equipped with the Uzi, an Israeli submachine gun firing 650 rounds per minute. U.S. Secret Service men carry Uzis when guarding the President.



Russian AK-47, a standard terrorist weapon, was designed soon after World War II. Of 7.62-mm cal., it's gas-operated and has 30-round magazine.



Introduced in 1963 for use by West German police and naval units, the Walther MP-K submachine gun is a 9-mm weapon that weighs about 6.75 pounds, has firing rate of 550 rpm. Its maximum range is over 200 yards.



One of several versions of the same rifle, the Heckler and Koch HK33A3 has telescoping butt, uses 20- or 30-round clip. It fires 5.56-mm cartridge, has range of 400 yards.





The M16A1, standard rifle of U.S. Army, is a 5.56-mm weapon with range of 420 yards. Some Asian nations have adopted it because of its light weight (7.6 pounds) and small size.

Heckler and Koch MP5K submachine gun (right) was designed for anti-terrorist units. It provides heavy fire-power in a compact weapon, yet is highly accurate in firing of single shots. Below: While of soft, flexible material, body armor jacket can stop a 7.62 round fired at short range.



The "stun" grenade (left) has proved effective in immobilizing terrorists during an assault. A laminated paper cylinder with sheet-metal ends, it contains TNT flakes. After pin is pulled, grenade explodes in 4½ seconds.



A typical antiterrorist commando, a weapons expert, is shown in an airport operation. He surveys the tarmac through a light-intensifying Startron-scope, on the alert for a possible target. The rifle is a German-made Heckler and Koch G3A3, a 7.62-mm weapon that can fire single shots or spray slugs at a rate of 500 to 600 rounds per minute.

J.C. DOYLE

PM dives with our deadliest missile sub

A PM reporter rides with the crew of a missile-launching nuclear sub—America's mighty deterrent built for peace but ready for war. Here's his firsthand account of what it's like.

by Richard Petrow

As I walked across the gangplank onto the deck of the nuclear-powered Fleet Ballistic Missile (FBM) submarine *Tecumseh*, I knew I was in for an adventure that few civilians have shared. I was about to live the life of a nuclear submariner—an experience ordinarily restricted to a very small percentage of our sailors, and then only after a rigid screening and training program.

On first glance, the *Tecumseh*, at her pier in New London, Conn., seemed a strange vessel, more submerged than surfaced, with a whale-like black hull and sharklike sail, or conning tower—the telltale silhouette of our nuclear submarines.

I stepped gingerly aboard. *Tecum-*



PM reporter Petrow takes notes as he is briefed by Lt. (j.g.) Kurt Kersch, officer of the deck. Looming dramatically at left is sub's huge sail (conning tower) with its fairwater diving planes stretching out like wings. Below: *Tecumseh* tied up at nuclear sub base in New London, Conn. Men salute "Morning Colors" prior to sailing with author.



seh's deck consisted of only a few feet of flat space. One misstep, I thought, and I would find myself rolling down her sloping hull into the waters of the Thames River. Experienced crewmen were, of course, scampering over the same surface like sure-footed mountain goats. They were preparing *Tecumseh* for sea.

Lt. (j.g.) Kurt Kersch, officer of the deck, welcomed me aboard. He is an extroverted submariner with a big smile and an obvious pride in the submarine service. "I hope you'll like riding our boat," he said, as he helped me crawl into the hatchway that would bring me down into the interior of the sub. As I later learned, all submariners call their vessels

"boats," a throwback to the days of the first subs, which were only boat-sized, indeed.

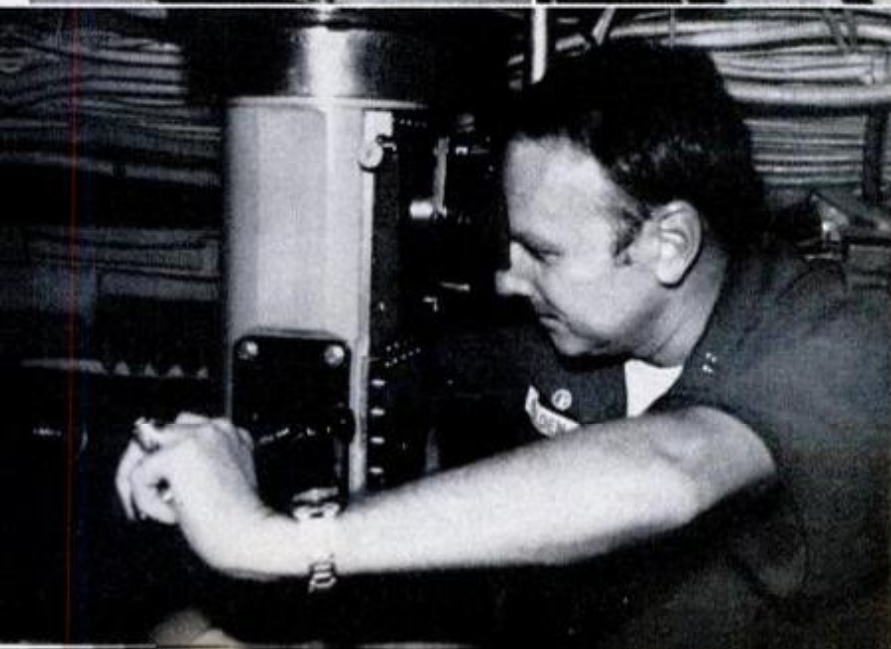
"Once you get squared away," Kersch called out, "come on back up. It's nice on deck going out to sea."

Down below, I found myself in a passageway that looked surprisingly similar to the passageways of many other vessels I have been aboard,

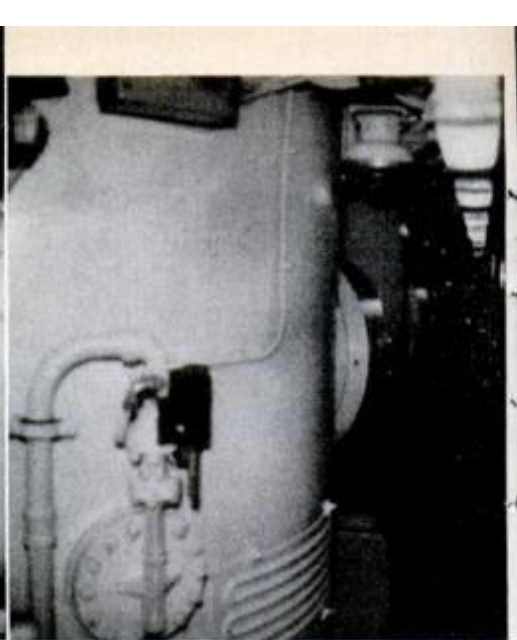
with one exception—there were no portholes or hatches leading to the outside. I was in a fully enclosed environment.

Lt. Cmdr. Paul Mickelson, executive officer, showed me my berth in the chiefs' sleeping quarters and then introduced me to Cmdr. Mark Golden, skipper of the *Tecumseh*, who explained that while nuclear

Dual aircraft-type controls like one at right "fly" sub, have yoke for steering, movable column for operating the diving planes. Below: one of many radar and sonar scopes (top), ballast gauges (bottom).



Cmdr. Mark Golden, *Tecumseh* skipper, mans periscope (left) during cruise. Above is navigation center with chart table in foreground. Fleet Ballistic Missile subs like *Tecumseh* can strike distant enemy targets in wartime and thus are a prime deterrent.



Author Petrow gets chance to try his hand at periscope (above, left). Above are missile "silos"—vertical tubes containing long-range nuclear SLBMs. Missiles can be fired even with sub submerged. Spacious mess hall (lower left) is much more luxurious than you'd expect on a sub. A multi-purpose room, it can be transformed from dining hall to lecture auditorium to recreation center for games, movies.

subs have carried civilians aboard for short trips, it was unusual for the Navy to permit a civilian writer to live aboard during a cruise.

But, he continued, the submarine service is one of the few branches of the Navy that is expanding and, consequently, has a need for additional high-caliber enlisted men and officers. Because of this manpower need, which will increase in the years ahead, the submarine service is happy to have its story told to the young men of America. That's one reason why *Popular Mechanics* was welcomed aboard. I can tell you that it would be an exciting, rewarding experience to serve on such a sub with such a crew.

Two types of submarines

The Navy now has 41 Fleet Ballistic Missile (FBM) submarines, that are assigned the task of operating deterrent patrols at sea, and 69 attack subs designed to hunt down and destroy enemy submarines. Each ballistic missile sub is staffed by two separate crews—the blue crew and the gold crew. When one crew is at sea, the other crew is ashore, enjoy-

ing liberty and undergoing further training.

(Once you get submariners at ease, however, they will confide that there really are three crews for each sub—the blue crew, the gold crew and the "other" crew. The "other" crew is responsible for anything that goes wrong.)

"Usually," Cmdr. Golden explained, "we sail on deterrent patrols lasting approximately 72 days. Today, we're on our way to the U.S. Naval Shipyard at Portsmouth, N.H., where we will undergo refitting and modernization."

The *Tecumseh* is a Lafayette-class FBM (submariners call FBMs "boomers") that was launched on June 22, 1963. During the past few years, she has operated out of an advance base at Holy Loch, Scotland, running deterrent patrols in the Atlantic and adjoining seas. (The exact locations of her patrols are highly secret.) The *Tecumseh* can carry 16 Poseidon missiles, each capable of mounting as many as 14 nuclear warheads. The range of a Poseidon is greater than 2500 miles.

After a quick introduction to the

sub, I returned topsides in time for our departure. The morning sun sparkled as we got underway on nuclear power.

We sailed down the Thames toward open sea, passing the General Dynamics Electric Boat shipyard where the first nuclear submarine, the *Nautilus*, was launched. Now Electric Boat is engaged in another vital construction project—the next generation of nuclear subs, the Trident class, the first of which will be ready for sea some time in 1981.

Even bigger subs to come

The hull of the first Trident, the *Ohio*, loomed like a superdirigible above the building ways of the boatyard as we passed. When launched, the *Ohio* will dwarf subs like the *Tecumseh*. The *Ohio's* surface displacement of about 18,700 tons will be more than double *Tecumseh's* approximately 7000 tons. Her length will be 560 feet compared to the *Tecumseh's* 425 feet. And the Tridents will carry a heavier punch—24 long-range Trident missiles, each capable of carrying multiple warheads over a range of more than 4000 miles.

Trident subs, with their longer-range missiles, will be capable of reaching any enemy target from either the Atlantic or Pacific Ocean. And they will have over 16 times the ocean area in which to hide while keeping their targets in range.

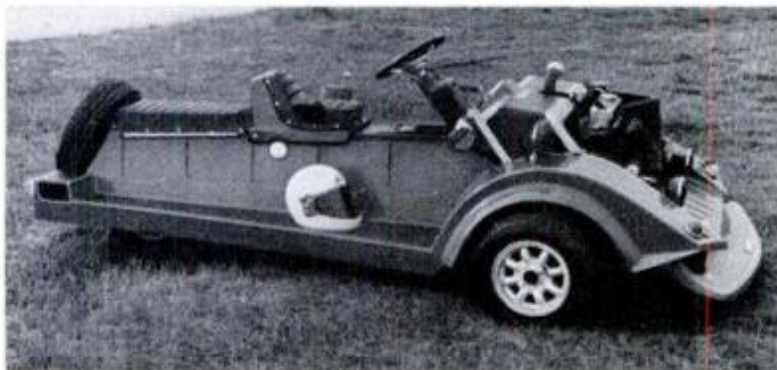
For anyone used to the pulsating

(Please turn to page 210)

IT'S NEW NOW

What has three wheels and a gas pedal?

A motorcycle? Yes, that's what designer Barry Stimson calls his new three-wheeled vehicle. In Great Britain, the Scorcher can be classified as a motorcycle because it weighs less than 500 pounds—even though it looks and handles more like a car. The three-passenger vehicle has a fiberglass body, tubular chassis, and suspension based on that of the British Leyland Mini. A 998-cc Mini Cooper engine powers the rig to speeds of 100 mph, according to Stimson. The Scorcher is available preassembled or as a kit (sans engine). The kit sells for about \$700 in Britain.



A nation of pedalers

Air pollution and costly oil imports have caused the Japanese government to promote bicycles. A recent Tokyo exhibition featured odd bikes like a "zigzag goer" (top) and a pedal-powered monorail.

For sailors and lifeguards

Throw the Balcan Emergency Life Line capsule and it pays out up to 135 feet of braided polypropylene line in a water rescue. Repackable, \$18.95. Tudox, Ltd., Box 965, Oak Park, Ill. 60303.



Concrete advertisement

From a front or side view, this new office building in Spain looks as though it might topple. But have no fear. The structure is designed to "lean"—and to promote company product, cement.



It's rugged, tough in traffic

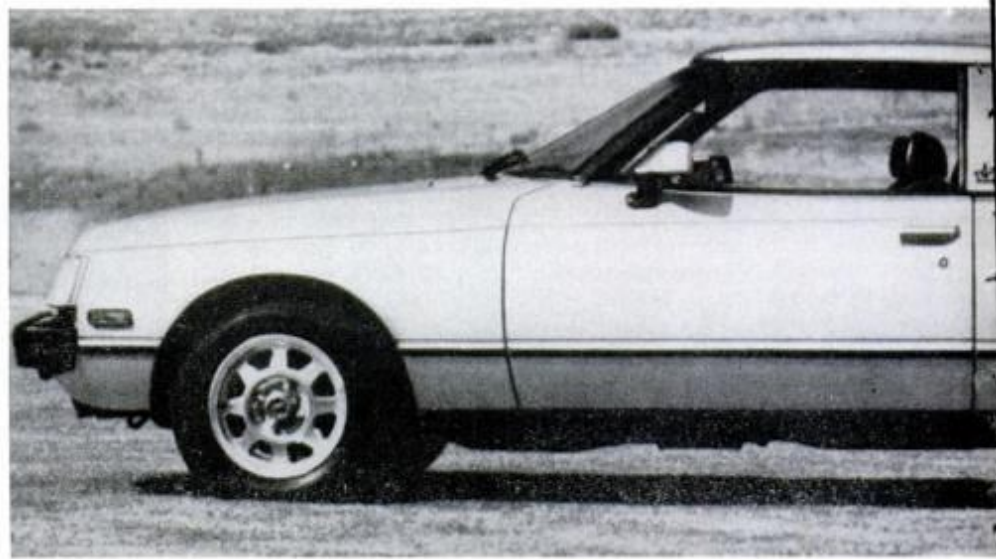
The ultimate weapon for timid drivers was created by Seattle mechanic Jeff Zerr, who used a big crate, a bed frame and part of a garage door to convert his '62 Ford into a "tank." On highways, he says, "people just naturally stop and stare, so I just slip into the traffic flow."

FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR



Driving Toyota's new Celica



Making a good car better is no easy trick, but Toyota has done it with the 1978 Celica.

In 1971, when the Celica first came to these shores, it impressed me as a car worth perhaps a bit more than its price, which at that time was about \$2600. Amazingly, a clean '71 Celica still brings very close to \$2600 today.

The Celica, good as it was from the beginning, has been markedly improved over the years. In 1974, Toyota introduced the GT package, with a five-speed, all-synchro gearbox, wider wheels, bigger radial tires, an improved suspension system, and AM/FM radio. Not a bad deal for only \$200 more than that year's standard Celica ST, and again you can get most of your original investment back when you resell one of these cars today.

In 1975, the Celica went from the previous 1968-cc engine to the 2189-cc soho Four with crossflow head and added torque—the 20R. It's this powerplant that the new Celica still uses.

Liftback starts big new change

But the Celica's most significant update before this year's restyling came in May 1976, when the Liftback was introduced. Wheelbase increased 2.8 inches, cargo capacity expanded dramatically (a pinched trunk had always been one of the Celica's failings), yet overall weight went up a mere five pounds. The Celica Liftback also brought with it the popular mini-Mustang haunch that distinguished it from earlier models.

Now comes the 1978 Celica, which represents the biggest change in these seven years. Again, the car turns out to be a fantastic piece of machinery, and while no prices have yet been announced, if they're in line with those of past Celicas, the '78 is going to be another good deal.

The Celica's 1978 restyling, as before, aims directly at the American mini-ponycar market. The car's rivals include the VW Scirocco, Capri II, Challenger and Sapporo and the Mustang II. Toyota, by the way, now maintains a U.S. styling adjunct that works closely with the company's Japanese design studios, and that explains why recent Toyotas have been such hits in this country.

Even with its dramatic new skins and redone interiors, though, the 1978 Celica hasn't changed all that much inside. True, it's 75 pounds lighter and weight has been more evenly distributed, but underneath it still stands on the Corona floor pan, still shares the 20R engine with the Corona and pickups, and makes the same series lineup of ST, GT and Liftback GT available.

Driving the 1978 Celica im-

pressed me not only with the great attention paid to driver and front passenger comfort, but also the quiet, good ride coupled with excellent handling. Instrumentation is complete, as before, right down to a tach in Celicas with automatic transmissions.

The five-speed overdrive gearbox is now standard in all lines, and the seats recline as previously. But this year Toyota has added a lumbar support adjustment to both front seatbacks. This, plus the fact that the leading edges of the seat bottoms adjust up and down for knee support, makes the Celica one of the most comfortable-to-drive cars anywhere.

Cramps for long-leg drivers?

Even so, I found fore-and-aft seat travel on the floor tracks a little limited. Long-legged drivers might



Celica is a driver's car—there's even a tach with the automatic transmission.

not find enough room to unkink their knees, even with the seat all the way back. And with it in that position, there's virtually no legroom for back-seat passengers. However, drivers with average-length legs won't find any problem.

Rear passengers have little vents in the B-pillars and can adjust the



airstream manually. They can also reach the door handles, which I appreciate, and there's plenty of glass for good all-around views.

The rear seats, while snug and slightly short of headroom in the new GT Liftback, have separately folding seatbacks—another handy touch, especially when carrying bulky loads plus one rear passenger.

Twin release levers on the floor near the driver's door let the rear hatch and the locking gas filler be opened without the driver having to leave the front seat.

The Celica provides one of the best five-speed transmissions I've had the pleasure of shifting recently. It's quick and positive, gives crisp shifts up or down at any reasonable speed, and doesn't make you wonder which gear you've just slipped into. Fifth is against a little detent, and at 60 mph in fifth, the engine is turning 2600 rpm. That's fast enough not to lug during freeway passing. Yet you can shift down to third at 55 mph and still have a good burst of power up to about 70.

The engine idles smoothly, does not hesitate on acceleration and puts out plenty of torque for any situation. Even Celicas with the three-speed automatic give good acceleration, but the trouble with the automatic is that it won't kick down above about 55 mph. You can shift into intermediate speed manually, but what's the point? You're immediately at redline when you drop down.

The GT package again upgrades the Celica's tires and suspension



Liftback GT (left) is the attention getter, but sport coupes are also offered in the '78 Celica lineup. Fold-down rear seats, as shown at top, offer versatility, and the front-end styling is the cleanest and neatest from Toyota to date.

over the standard ST version. All use MacPherson front struts and four-link live rear axles, but the GT

somehow manages to combine good handling with a very nice ride. It corners with just a hint of understeer and very little body roll.

Many items come standard

As in the past, the Celica comes with an extensive list of standard equipment, including power disc brakes, electric rear-window defroster, radial tires, front stabilizer bar, the previously mentioned complete instrumentation, quartz clock, AM/FM stereo radio, carpeting, console, leather-wrapped steering wheel, and transistorized ignition. Aluminum-alloy wheels are now standard on all black Celicas and optional on others.

About all you can order extra, then, are airconditioning, power steering (for the first time, and it really isn't needed), and a sliding steel sunroof. The airconditioner, I found, starts blowing cold air within 15 seconds of switching it on.

Also as in the past, everything in and on the Celica fits nicely, and the car is well finished. I couldn't find any gaps, glue streaks, or paint runs anywhere, not even under the hood. It's another very good rendition of a well-engineered, well-put-together car.

FM

SPECIFICATIONS—1978 TOYOTA CELICA

Engine

Type: In-line sohc 4, five main bearings, cast-iron block, full-pressure lubrication
Bore and stroke: 88.4 mm x 88.9 mm (3.48 x 3.50 in.)
Displacement: 2189 cc (134 cu. in.)
Bhp @ rpm: 95 @ 4800 (fed.); 90 @ 4800 (Calif.)
Torque @ rpm: 122 @ 2400
Compression ratio: 8.4:1

Transmission

Standard: Five-speed manual, floor lever, all synchromesh
Ratios: 1st, 3.287:1
2nd, 2.043:1
3rd, 1.394:1
4th, 1.000:1
5th, 0.853:1
Optional: Automatic three-speed, floor lever
Ratios: 1st, 2.450:1

2nd, 1.450:1
3rd, 1.000:1
Reverse, 2.222:1

Brakes

Front: Power discs, 10-in. dia.
Rear: Power drums, 9-in. dia.

Dimensions and weights

Wheelbase: 98.4 in.
Overall length: 173.6 in.
Overall width (GT): 64.6 in.
Overall height (GT): 51.8 in.
Curb weight (GT coupe): 2395 lbs.

Capacities

Fuel: 16.1 gal.
Oil: 5.3 qts.
Cooling system: 7.4 qts.

EPA mileage figures: five-speed overdrive

City: 20 mpg; highway: 34 mpg

Wide B-pillar and huge rear-glass areas quickly identify the Liftback on the road.



This tire quiz can

- a) Save your life
- b) Save you money
- c) Save you work
- d) All of the above

by Mort Schultz

Of course the answer to the above question is (d)—all of the above. You probably got that right, but is your knowledge of tires all you think it is? Try this quiz and find out. Mark your answers right on this page and then check our answers starting on the facing page. Read the whole answer. Don't just glance at the first line and think you have it right. You may miss an important point that could make a big difference in how you buy or use your tires.

CIRCLE YOUR CHOICE

(1) A designation such as P215/75R15 embossed on sidewalls of tires on 1978-model cars indicates which of the following:

- a. The tire's serial number.
- b. A metric marking.
- c. The designation of the mold used for marking the tire.
- d. Government regulation number covering the applicable tire standard.

(2) What is California wander?

- a. The name of a specially made tire designed for California roads.
- b. A ride sensation caused by parallel grooves in highways.
- c. A racing tire.
- d. Jargon among tire dealers that describes a tire run until bald.

(3) Firestone recently made a survey of tire trends in four American cities. It revealed that:

- a. A majority of car owners run tires in an underinflated condition.
- b. Consumers are generally satisfied with the quality of today's tires.
- c. Consumers want more government regulation of the tire industry.
- d. Approximately 25 percent of the tires examined were worn to unacceptable limits.

(4) Hydroplaning is a problem.

- a. Peculiar to airplane tires.
- b. That can't occur with new tires.
- c. That causes loss of steering.
- d. That occurs when water is trapped between tire beads and rim.

(5) Which of the following applies to radial tires?

- a. They can be mixed with bias or bias-belted tires if they are inflated to the same pressure.
- b. They can't be rotated from front to rear on same side of the car.
- c. They don't provide better traction than nonradials on packed snow.
- d. They have lower rolling resistance than bias-belted tires.

(6) What is an elliptic tire?

- a. A new concept in tire design.
- b. A tire for trucks.
- c. A tire with thicker beads.
- d. A tire with elevated treads.

(7) Tiempo is a term now being used by a tire manufacturer. It refers to which of the following:

- a. A new tire manufactured by Goodyear.
- b. Name of new Goodrich blimp.
- c. The new name for Firestone's Town and Country tire.
- d. The name for Pirelli Tire Company's new U.S. subsidiary.

(8) Aramid is a relatively new term that is being applied to some tires. It refers to which of these:

- a. That the tire was manufactured in an Arab nation.
- b. That the tire is intended for use only in arid regions.
- c. A new tradename now used by B. F. Goodrich
- d. A new fabric used in tire construction.

(9) A bad tire can cause which of the following conditions:

- a. Shake.
- b. Roughness.

c. Thump.

d. All of the above.

(10) What do the initials TPC stand for?

- a. Tire profile contour.
- b. Tire polyester cord.
- c. Tire performance criteria.
- d. Tire pressure condition.

WHAT'S TRUE?

WHAT'S FALSE?

(11) General Motors introduced the run-flat tire on its 1978 intermediates.

(12) A fiberglass-belted radial tire can be used safely on the same axle as a steel-belted radial tire.

(13) Air pressure in a tire will drop one pound for every 10° F. drop in outside air temperature.

(14) With experience, you can visually check the inflation pressure of your radials to within plus or minus 3 p.s.i.

(15) Cleaning the sidewalls of tires with steel-wool pads will damage the rubber.

(16) It's wise to increase air pressure in tires above normal before beginning a long trip.

(17) Abnormal tread wear of new tires indicates that you probably purchased a defective lot.

(18) A tire that has a cut in the sidewall or tread area which extends into the cord body should be patched immediately.

(19) If a tire blows out, apply the brakes and steer off the road.

(20) If you won't be driving your car, camper or motor home for several months, deflate tires to one-half their normal pressure.

ANSWERS

(1) *b.* Although the 1977 Chevette was the first U.S.-made car to carry tires marked with a metric designation, the 1978 models are the real beginning of the U.S. tire industry's switch to metric. Here is how to translate the designation, using the one in the question as a guide:

■ The first letter indicates the kind of tire. "P" refers to passenger-car tire. Another series you will find on the 1978 models is "T" for temporary use tire. This is the small, lightweight spare tire used by some lines of cars.

■ The next three numerals metrically designate the section width of the tire from one sidewall to the other. Thus, "215" means the tire is 215 millimeters across its widest point.

■ The next two numerals give the



New metric marking on tire sidewalls shows section width in millimeters (215), but gives wheel diameter in inches (15).

height-to-width ratio. For example, "75" means that the tire height is 75 percent of its width. Keep in mind that the lower the number, the wider or more squat the tire.

■ The next letter spells out tire construction. "R" stands for radial; "B" stands for bias-belted; "D" stands for diagonal, or bias-ply.

■ The final two numerals are the wheel's diameter, and this is an inconsistency in the designation. It is an *inch* designation. It's because in Europe where tire sizes have always been measured in metric units, wheel diameter has always been designated in inches.

(2) *b.* It's a ride sensation caused by parallel grooves in high-

ways. Grooves improve traction. The designation has been pinned on California, because grooved highways to help lower the accident rate on wet pavement are in widest use there.

California wander occurs when the spaces between grooves in a highway line up with the spaces between grooves of a standard rib tire—regardless of type or brand. A harmless, but noticeable, swaying motion results. Goodyear states that California wander "does not affect steering, lane changing or maneuverability and is not a safety problem." Nevertheless, it's disconcerting enough for drivers for five manufacturers to want to do something about it: Tread patterns using five or six ribs that don't line up with grooves are being tested now.

(3) *d.* Of 4500 tires inspected, it was discovered that about 1125 of them were worn below the tread wear indicators, which appear as smooth bands running horizontally across the tire tread pattern. There have to be at least eight tread wear indicators per tire, and they appear when there is only 2/32 (1/16) inch of tread remaining. When a tire is worn below allowable standards, chances are 40 times greater of a blowout or the tire going flat than when the tire was new. The balder a tire gets, furthermore, the greater are the chances of skidding on wet pavement.

If this isn't enough, in 39 states you could, by law, be fined for driving a car having worn tires.



When tire tread is worn so wear indicator spans two adjacent ribs (painted circle), you must replace it. Life of this tire was shortened by running too long with wrong camber, causing the uneven wear.

(4) *c.* When a thin film of water between your tires and the pavement cause them actually to lose contact with the road, your car is hydroplaning. The amount of water

on the road, your car's weight and the condition of your tires are factors that determine at what speed you could begin to hydroplane and lose control of your car. Naturally, bald or near-bald tires will "lift off" at relatively low speeds. Hydroplaning on new or nearly new tires won't occur until car speed is relatively high, of course, but when enough water is trapped under new tires, they, too, will glide over the pavement. Tread pattern is a factor in how fast a tire can squish out the water between it and the road to maintain traction.

(5) *d.* The lower rolling resis-



Deep, wide grooves in tread of Kléber V12 radial give water an easy escape route, minimize chance of hydroplaning.

tance of radials is why their use results in better fuel mileage. They should *never* be used on a car with other types, because they have a far quicker steering response and different ride characteristics. Mixing can cause adverse steering effects and poor control.

Furthermore, the four radials on a car should be rotated from front to rear on the same side rather than being criss-crossed as are bias and bias-belted tires when they are rotated.

By the way, tire manufacturers suggest different rotation intervals for radials. Firestone, for example, recommends rotation every 5000 miles, while General suggests rotation after the first 7500 and thereafter at 15,000-mile intervals.

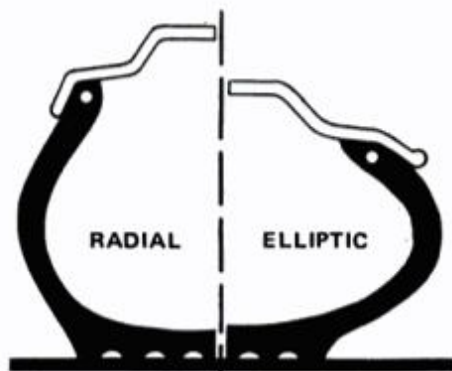
Radials do provide better traction than nonradials on packed or shallow snow, but they are not a substitute for snow tires in deep snow.

(6) *a.* An elliptic tire is a new concept



in tire design that was announced last year by Goodyear Tire and Rubber Co. (see *The PM Garage*, page 50, Nov. '77). This second generation radial is now undergoing evaluation testing. Goodyear claims that the tire can provide more miles per gallon—"from three to six percent more than present radials."

The elliptic design, which gives



Elliptic radial (right) has lower profile and runs at higher pressure than the conventional radial tire (left).

the tire a squat appearance with more of a curve to the sidewall than a conventional radial, runs at a pressure which is eight to 12 pounds higher than conventional auto tire pressure. Higher inflation pressure in a tire designed for it reduces rolling resistance and increases fuel economy. The elliptic or low-profile tire requires a special rim so it can't be used as a replacement tire yet. Michelin's TRX low-profile radial is similar to Goodyear's elliptic and will be seen on the '79 Mustang/Capri this August.

(7) *a.* Tiempo is a Goodyear development that provides one tire for all-weather use (summer and winter). Instead of a conventional rib design, the tread of this radial has dog-biscuit-shaped elements with one rib running down the center. According to Goodyear, the Tiempo is the "first auto tire to meet tire industry standards for a winter tire while delivering the smooth, quiet ride and long wear of a conventional rib tire."

(8) *d.* Aramid is the generic name for a manufactured fiber that DuPont developed and calls by the trade name of Kevlar. It's used in the bodies of some tires. Pound for pound, aramid is much stronger than steel. This means that tires can be made just as strong and weigh less.

(9) *d.* Each of them could signify a problem tire. Shake is felt as a continuous or cycling vibration in the steering wheel, floor pan or seat on a smooth pavement at speeds of between 55 and 60 mph

and above. It is induced by unbalance or runout in a wheel, tire, or brake drum or disc. Runout refers to a part that doesn't revolve smoothly. To correct the condition, tires, wheels and brake elements should be tested for runout and balance. Parts that show excessive runout should be replaced.

Roughness and/or thump is felt as a high-frequency vibration in the steering wheel, floor pan or seat. It may be heard as a cycling rumble at speeds of 25 mph and above.

You can usually find the guilty tire by inflating all tires to 50 p.s.i. This will eliminate the roughness or thump when the car is driven if the fault lies with a tire. Reduce pressure to normal, one tire at a time, road testing each time, until the bad tire is found.

(10) *c.* Tire performance criteria. The TPC Spec. No. is molded into the sidewall of tires. The designation indicates that the tire is designed to dimension and performance levels specified by the vehicle's manufacturer if the tires are original equipment. Replacing your wornout original tires with tires bearing an identical TPC Spec. No. will assure you of tires that are designed to the same dimensional and performance specifications.

Other important data molded into a tire sidewall are as follows:

- Size. In a tire identified with a nonmetric size, the first letter designates size; the second letter will be "R" if the tire is radial; the next two numerals identify the tire's section height-to-width ratio; and the last two numerals identify the tire's rim diameter. A sample designation for this would be HR 78-15.

- Name of the manufacturer and trade name of the tire.

- Maximum load that should be imposed on a tire when it is inflated to its maximum "cold" inflation pressure, which is also spelled out.

- Load range, which is a letter that designates the load that can safely be placed on a tire according to the pressure you keep in the tire. Load range B, for example, is equivalent to a four-ply rating, but for this to have meaning you have to interpret it vis-a-vis a load-limit table which a tire dealer can provide.

- Tire-ply composition and materials used in construction.

- DOT number to indicate that the tire complies with Department of Transportation safety standards.

- An identification code number to identify the tire's manufacturer if

the manufacturer's name doesn't appear elsewhere.

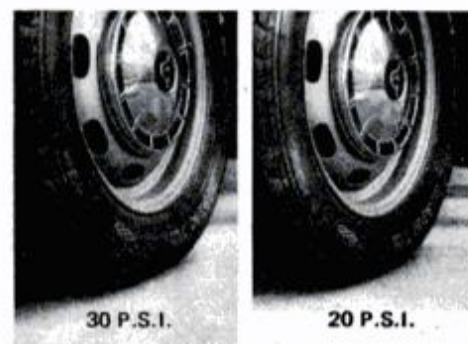
All tires contain some of this information on the sidewall, but all tires don't have to have all of it.

(11) *False.* The run-flat tire, which would eliminate the need for a spare of any kind, has not yet been marketed by any tire manufacturer or car company. It will be "several years before the run-flat is on the market," according to John D. Kelly, director of tire development for Firestone. Since a driver wouldn't know it if a tire had gone flat, a low-pressure warning indicator on the dash would be needed in conjunction with a set of run-flat tires. Technologically, a run-flat could be marketed today. The problem of destructive heat buildup, for example, is easily solved by using a lubricant in the tire, so it's a matter of economics as to when run-flats will be offered.

(12) *True.* But, as we said before, radials (steel- or fiberglass-belted) should never be mixed with bias or bias-belted tires.

(13) *True.* That's why it is very important to check air pressure if there is a sudden drop in temperature. Don't wait.

(14) *False.* The bulge in the sidewall of a radial changes almost imperceptibly from maximum allowable inflation pressure down to minimum recommended pressure—a range that can be as great as 10 p.s.i. Only when a tire becomes dangerously underinflated can the trained eye detect a pronounced bulge. Maximum inflation pressure of the radial shown in the photo below, is 36 p.s.i. Compare its inflation



Characteristic bulge of radial tires makes it almost impossible to read pressure by eye. See the difference?

bulge at a normal 30 p.s.i. (left) with that at an underinflated 20 p.s.i. (right).

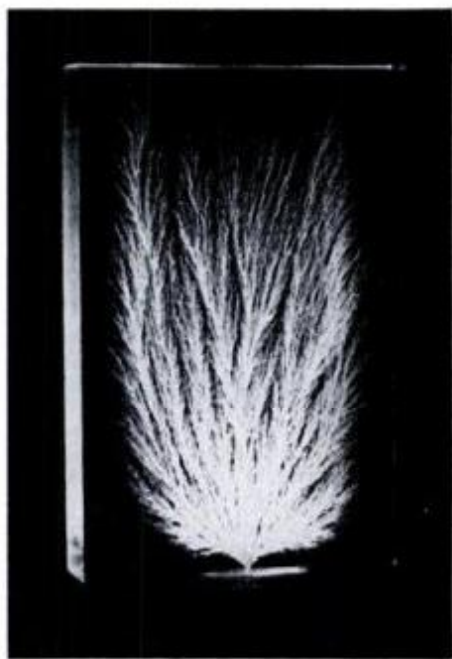
(15) *False.* You can use steel-wool pads and approved tire cleaners available at auto supply counters. However, never apply any cleaner containing petroleum, since

(Please turn to page 222)

IT'S NEW
NOW

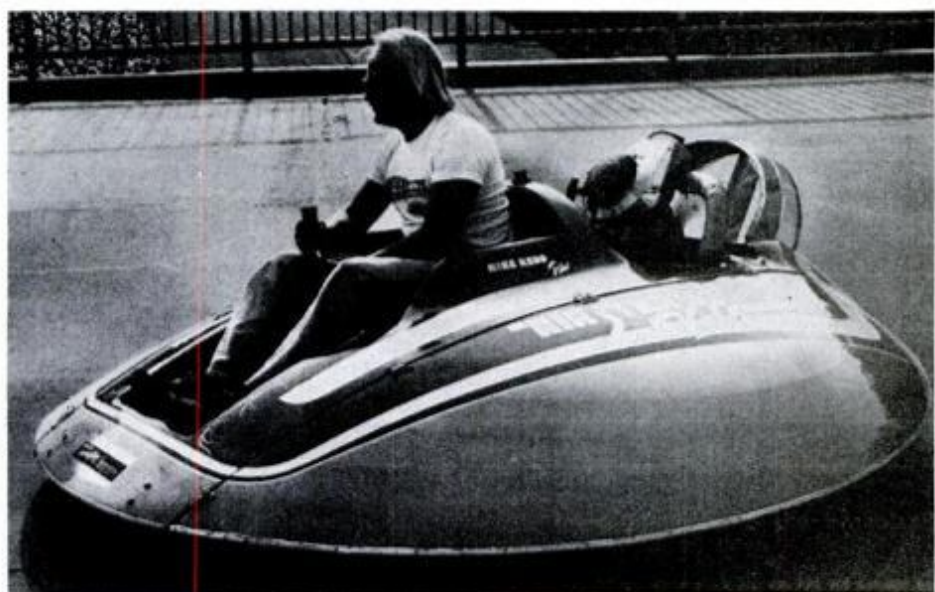
Light fantastic in plastic

Blast a plastic block with a beam of electrons and you get a decorative piece for the home. The feathery tracings in the clear plastic are actually the discharge paths of billions of electrons. A 1 by 4 by 6-inch block with lighted base is \$100. Twinson Co., Box 788, Los Altos, Calif. 94022.



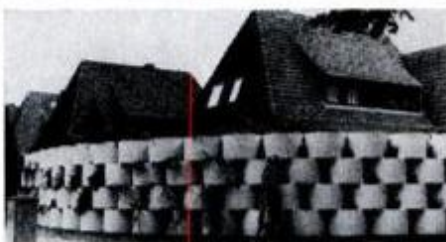
More pull with big claws

Large extracting claws make two new forged-steel nail pullers effective in yanking out embedded nails. Larger puller has a 90° offset claw and a ripping chisel end with sharpened bevel to start prying of fully driven nails. Smaller tool is for tight places. From Stanley, they list for \$4.99 and \$4.73.



A smooth ride and plenty of fresh air

If you think air-cushion craft must be squarish, hefty vehicles that appear to be hiding behind a huge rubber skirt, look at this one-man sportster recently unveiled in Georgia. The slick runabout has a 29-hp engine and can hit 40 mph. Since it rides on air, it skims over ice and water as easily as it does on land.



Neighborhood gone to pots

Residents of a West German suburb set up concrete flowerpots as a shield against noise of traffic. A bonus is the beauty of the flowers.



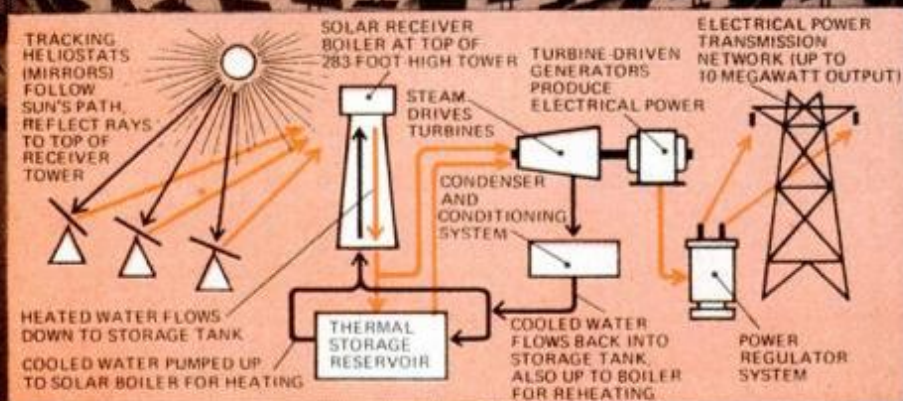
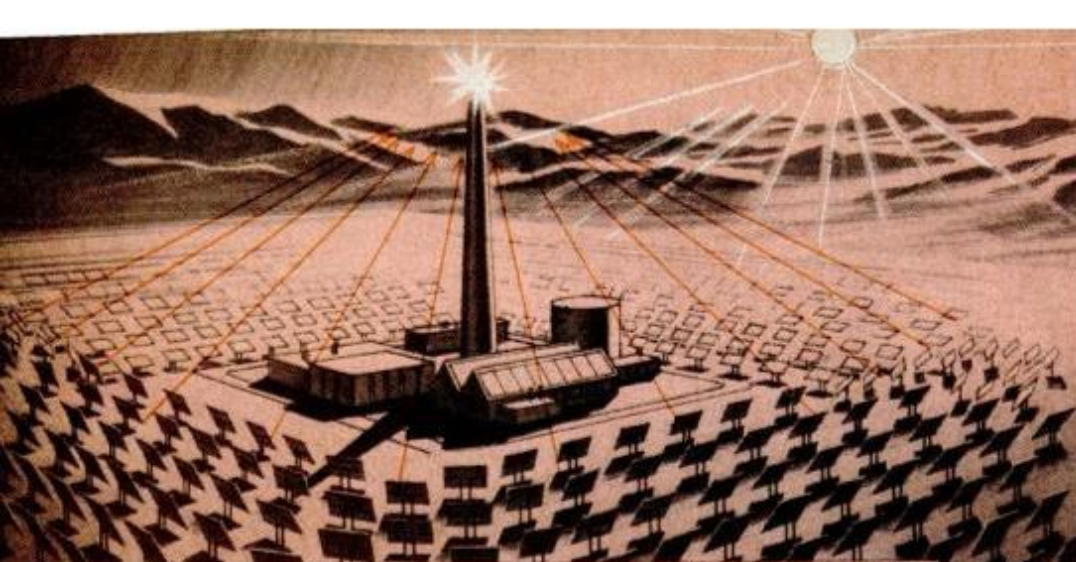
Fireplace for efficiency

The Energy Saving Fireplace is a pre-fabricated unit with stainless-steel heat exchanger and side liners for better radiant heating. About \$475. Majestic Co., 245 Erie St., Huntington, Ind. 46750.



Safety aid for motorcyclists

British safety researchers have designed an energy-absorbing chest pad to prevent motorcyclists from being thrown over the handlebars in a panic stop or accident. The pad is attached to a bracket on the gas tank. It may be used in the design of future bikes.



HOW SOLAR MIRRORS LIGHT UP A CITY

Acres of mirrors surround 283-foot-tall tower in artist's concept at left, depicting what will be world's largest solar furnace when completed in the desert wilderness near Barstow, Calif. Pivoting mirrors, called heliostats, automatically track sun, focusing rays on giant boiler atop tower. Diagram shows how concentrated heat on boiler turns water into steam, driving turbo-generators to produce electrical power—up to 10 megawatts, enough to run a city of 10,000. Photo above shows pilot plant at Sandia Laboratories near Albuquerque, N.M., where components for future solar furnace are being tested.

Bold new look at a bright new sun

New schemes to harness solar energy on a large powerplant scale now appear more promising. Here's how acres of mirrors might energize a city.

by Mort Schultz

"Shades of Akhnaton," I thought. They've built a blooming sun temple right here on American soil."

There before me, sprawling out over 100 acres of New Mexico desert near Albuquerque, was an enormous field of some 300 giant, shimmering mirrors all aimed toward the sun. Rising from their midst was a 200-foot-tall tower, looking much like a king surveying his subjects. Solar rays caught and reflected by the mirrors were focused on a pinpoint spot near the tower's top. The desert glowed in a blaze of light.

The effect was eerie. As the sun tracked across the sky, the mirrors turned slowly in unison to follow it, like worshipful robots, always keeping their reflected light beams shining precisely at the tower.

And what was atop that awesome tower? No—not a solid gold idol like that which adorned King Akhnaton's temple to the sun god more than 3000 years ago in ancient Egypt. There, looking out upon its "kingdom," was a boiler—an ordinary steam boiler filled with water.

What prompts modern man to build a sun temple to a boiler? Why spend \$21 million in tax dollars to cultivate a monstrous crop of glass?

The answer is simple: power. The idea behind this huge "solar farm," built by New Mexico's Sandia Laboratories, is to use intense solar heat to create steam that, in turn, drives turbogenerators to produce electricity. Many scientists have concluded that solar energy, to be really practical, must be "harvested" in

massive amounts and converted into electricity at large, central powerplants that would supply entire communities, just as conventional powerplants now do. Small, individual solar collectors of the type now being installed on many residential homes are fine for providing supplemental heat or power, especially in mild, sunny climates, but they lack the tremendous capacity needed to light a city, run a factory or drive a train. In other words, say experts, when you think solar, think big.

No solar shortage

Actually there is no shortage of solar energy. It has been estimated that sunlight falling on the earth in a single day, if converted into usable forms, could satisfy the power needs of the whole world for a year. But sunlight is not concentrated, does not fall in all areas at the same time, and does not always shine when you want it to.

With fossil fuels dwindling fast, the energy shortage has become so critical that the U.S. Department of Energy has established an extensive program to develop a means for harnessing sunpower on a large scale. Involved are four industrial research giants—Boeing, Honeywell, McDonnell Douglas Astronautics and Martin Marietta Aerospace. Sandia Laboratories acts as a testing and advisory facility.

At Sandia, the purpose of that gigantic field of mirrors is to capture scattered light rays and concentrate them into a beam so sharply focused and intensely hot that temperatures in the steam-producing boiler can reach 1000° F. The principle is similar to the old trick of using a magnifying glass to burn a hole in paper—the lens focuses normal solar rays to a point where they can start a fire. (This is why you should never look directly at the sun through a camera lens, binoculars, telescope or other optical instrument—the concentrated sunlight could blind you.)

Automated mirrors

The self-moving mirrors, called heliostats, are swivel-mounted, motor-driven and computer-controlled so they follow the path of the sun automatically at the exact angle to keep reflected rays beamed constantly at the boiler throughout the duration of daylight. Each heliostat consists of 25 4-foot-square silver-plated, laminated-glass mirrors, totaling 7500 individual pieces of glass. The rated electrical output of such a system is 6.5 megawatts—impressive now, but modest compared with what's to come.

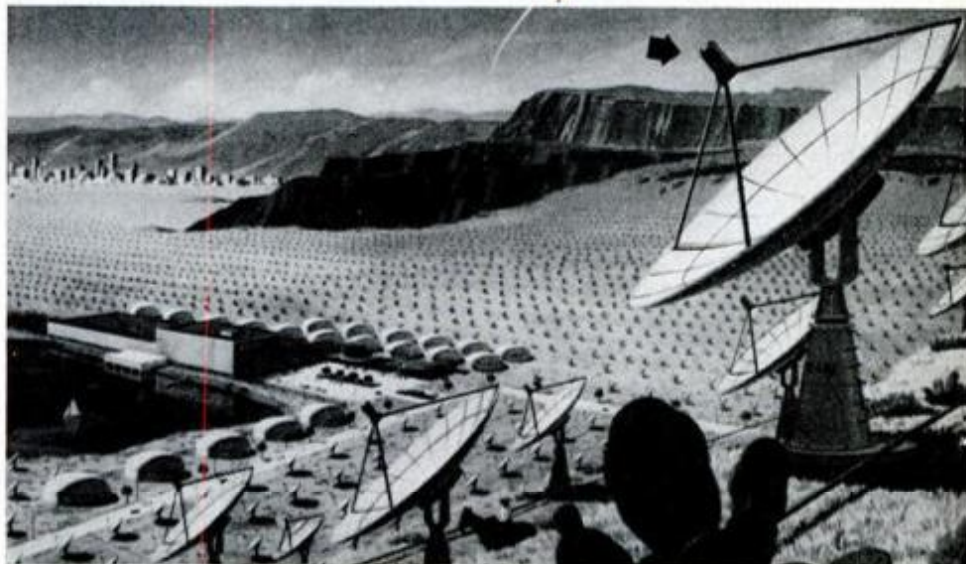
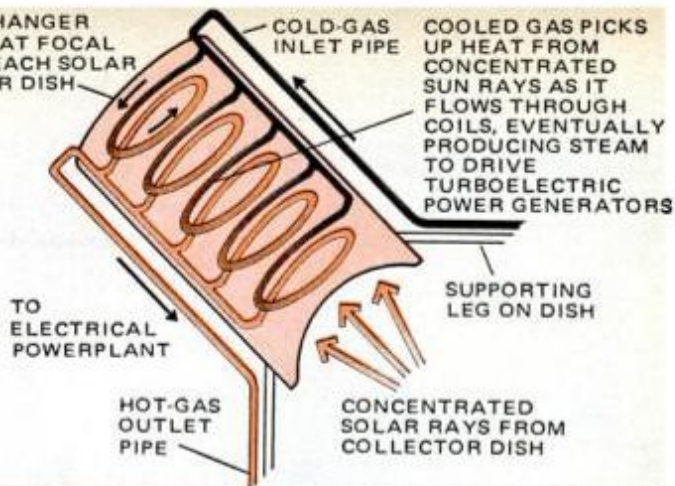
Small by comparison

As extensive as it is, the Sandia operation is actually a relatively small pilot plant designed to test components for use in much bigger installations. It will be dwarfed by a 10-megawatt colossus already sprouting in desert wilderness near Barstow, Calif. This installation will employ more than 1500 heliostats surrounding a 283-foot-high tower. Each heliostat, if it follows the Sandia design, will be 20 feet square and contain 25 separate mirrors for a total of 37,000 reflectors all aiming reflected solar rays at an immense boiler atop the tower. As in the Sandia system, the blistering concentrated heat will turn water into high-pressure, superheated steam to drive powerful electricity-producing generators. Cooled water is fed up the tower to the boiler and the solar-sizzled steam piped down to giant turbogenerators.

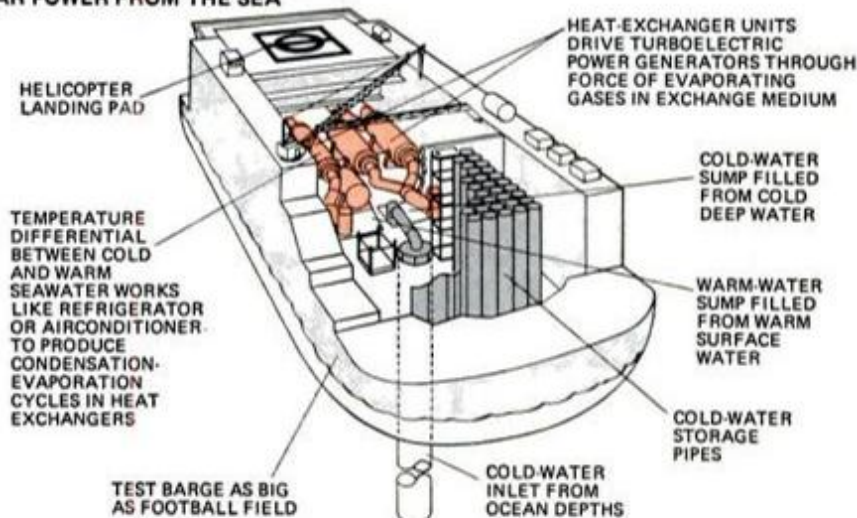
At night or on sunless days, excess heat retained in a thermal storage system will be sufficient to keep the generators running up to about six hours in present designs. Beyond that, conventionally fired backup furnaces will kick in to bridge the gap until the sun shines again. The 10-megawatt output (a megawatt equals a million watts) will supply enough power to serve a community of 10,000 inhabitants.

When the Barstow plant is com-

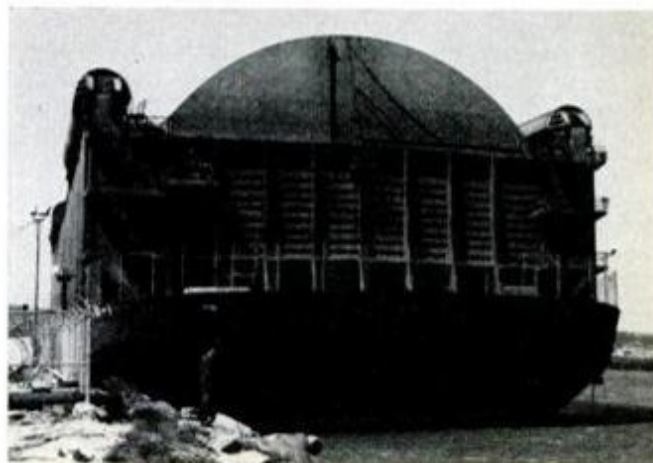
Solchem scheme (for "solar chemistry") is similar to sun furnace on facing page. It, too, uses solar collectors but has no boiler tower. Each collector aims sun rays at coil mounted at its focal point (arrow below, drawing at right). Complex system basically heats gases to run steam-driven generators through exchangers.

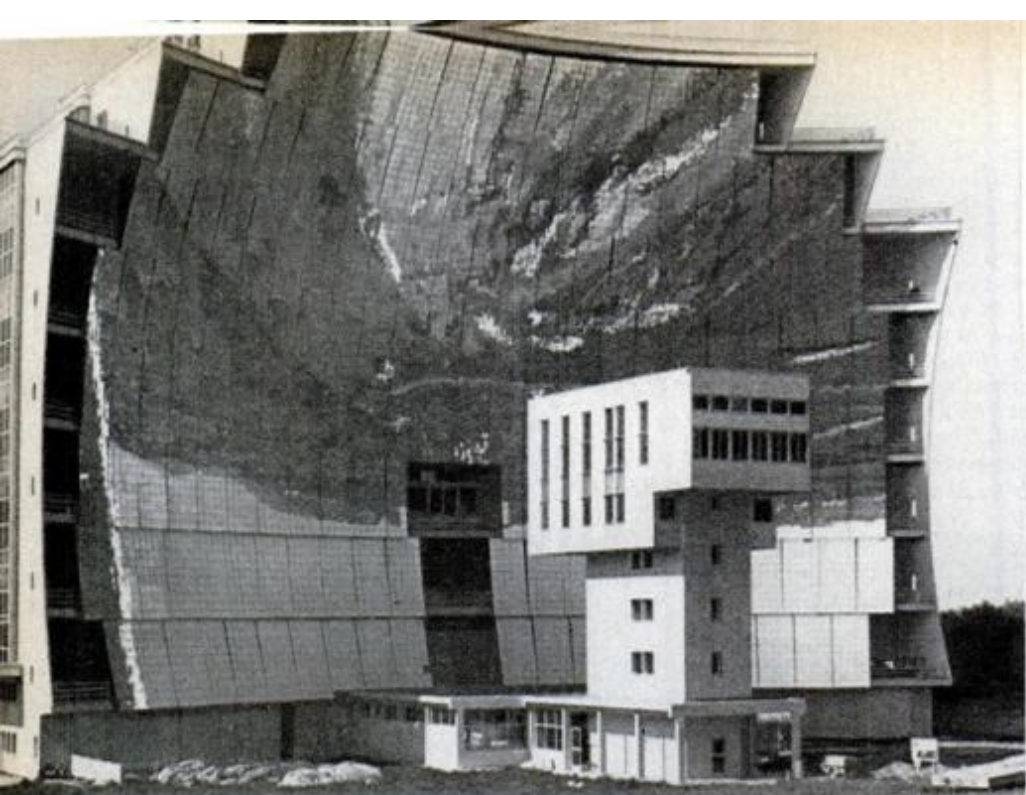


SOLAR POWER FROM THE SEA

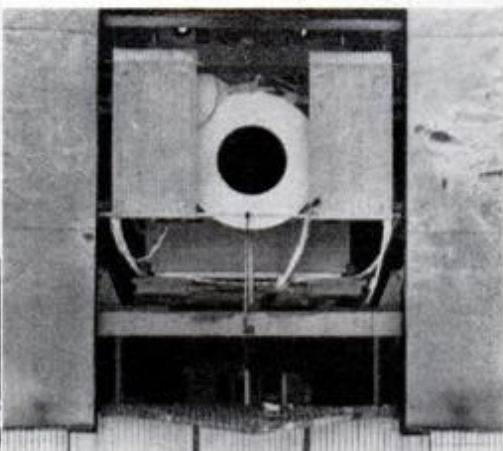


Giant barge will go into operation next year to test new method of extracting solar energy from seawater, called "ocean thermal energy conversion" (OTEC). System works on temperature differential between warm surface water and cold deep water—up to 45° F. Warm water heats fluid in coils, producing high-pressure gases to drive electric generators. Cold water condenses gases and the cycle repeats.

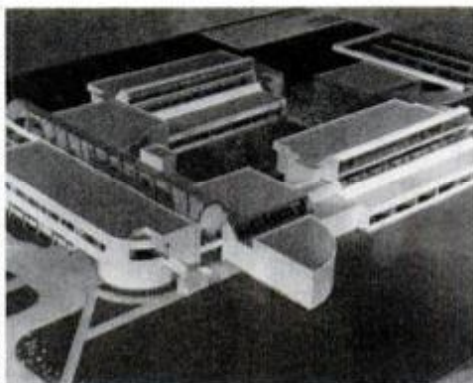




World's largest mirror is 10-story-high parabolic reflector atop Pyrenees Mountains in southern France. Not seen in foreground are sun-tracking solar collectors that aim sunlight at huge reflector. Reflector then concentrates sun's energy on boiler in small building in front of it. Photo below shows pinpoint hole into which energy is beamed to heat boiler, producing steam for power generators.



Already in operation, the nation's largest solar heating and cooling system is currently in use at the George A. Towns Elementary School in Atlanta, Ga. Over 50 A-shaped rooftop solar collectors supply more than 60 percent of the school's heating and cooling needs. Reflectors on back slope of each unit allow collectors to absorb energy from both direct and reflected sunlight for maximum efficiency.



Coming soon is new solar-powered facility for Mississippi County Community College in Blytheville, Ark. Shown in model above, it will employ photovoltaic solar cells instead of conventional fluid-type solar collectors. The cells, like those used on spacecraft, convert sun energy directly into electricity—enough to supply MCCC's entire heating, lighting, cooking, airconditioning and other power needs.

pleted in late 1980 or early 1981, it will be the world's largest solar furnace—but not for long. Already being planned are solar powerplants capable of producing 100 to 300 megawatts in as little as 10 years. And vast solar facilities turning out 40,000 megawatts—4000 times the Barstow capacity—are foreseen by the turn of the century.

Big mirror on a mountain

High atop a towering peak in the Pyrenees Mountains near Odeillo in southern France looms a dish-shaped mirror so big its diameter spans the height of a 10-story building. Its use is basically similar to that of the Sandia and Barstow installations except that it involves a two-stage collection-reflection system of capturing solar energy.

Surrounding the mirror is an array of sun-tracking heliostats, but instead of beaming their light rays directly at a boiler, they aim them at the center of the huge mirror. The parabolic mirror, resembling a giant radar antenna, then further intensifies the light rays and concentrates them on a boiler at its optical focal point, also the point of maximum heat buildup. From here on, the power-producing process is that of Sandia's and Barstow's—steam from the sun-heated boiler spins turbine-driven electric generators.

Temperatures reach 7000° F.

Using this method, boiler temperatures of up to 7000° F. can be reached. Some experts, however, argue that, despite the high temperatures generated, there is actual-

ly a loss in solar-conversion efficiency due to the double-reflection arrangement used—something like the loss in fidelity you get when recording a recording or making a copy print from an original photo. (Electrical output from the Odeillo installation is a mere 1 megawatt—puny alongside Sandia's 6.5 and Barstow's 10—though a direct comparison is unfair since the unique mountain-top collector is much smaller.)

In any case, the joint French-American venture, under the direction of the U.S. Department of Energy, is not meant to be a major power producer, but was built to function as an experimental center, like the Sandia plant, for testing components for use in future solar projects. Nobody argues about the impressive size of that 10-story-high parabolic mirror.

Chemical solar collectors

Still another scheme to harness sunpower in massive amounts has been proposed by scientists at the Naval Research Laboratory in Washington, D.C. Called Solchem for "solar chemistry," it may sound complicated but appears to represent an ingenious use of the chemistry of gases to collect and store solar energy at maximum efficiency.

The system uses sun-tracking solar collectors like heliostats but dish-shaped like the parabolic French mirror. Instead of beaming sunlight at a boiler, they concentrate it on a series of coils mounted on legs at the focal point of each dish. Sulfur trioxide gas (SO_3) enters the coils cold on the intake side, is rapidly heated by the focused sun-

(Please turn to page 134)

IT'S NEW NOW

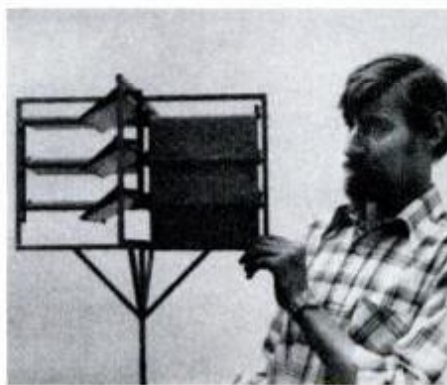
Six wheels—and a big price tag

The Panther Six, recently unveiled in Britain, appears to have been inspired by a six-wheeled racing car seen on the Grand Prix circuit during the past two years (page 47, Jan. '77). The four front wheels add stability to this 200-mph super road car. Power comes from rear-mounted Cadillac V8 with twin turbochargers. Though the car costs \$70,000, its maker says there's a six-month waiting list.



That's no metal detector

It's a magnifying mirror, used in London these days to check for bombs underneath cars. Mirror rides on a wheel for better control. A security guard from the British Museum is shown inspecting an auto parked nearby.



New twist for windmill

An unusual vertical-axis windmill design from West Germany uses sets of swiveling vanes for greater efficiency. When down, the vanes catch the wind (see model). As they turn into the wind, they swivel up to cut air resistance.

Laminate with stonelike surface

For an interesting touch in your bathroom or kitchen, try Stonehenge, a Nevamar plastic laminate now available in a textured surface that has the look and feel of quarried stone. This muted, random marble design is made by Exxon Chemical Co., and sold in 4 by 8 foot sheets for about \$24.



How to listen to your plants

Insert probes of the Plant Communicator in soil to measure fertilizer and moisture content electronically. An audible signal, interpreted with an accompanying "plant talk" dictionary, indicates need for water or nutrients. Under \$10. St. Croix Corp., 9909 South Shore Dr., Minneapolis, Minn. 55441.

Compass gives audible 'reading'

You can stay on course in the dark with the Audio Compass. Set your heading and start hiking. The compass ticks slowly if you wander off course, more rapidly the farther you stray. Silence means you're on target. Unit weighs 5 ounces with batteries, is \$39.95. Vibra-tronics, Box 997, Oak View Calif. 93022.



Old radios: New turn-on

Collecting and restoring antique receivers is a fast-growing new hobby.

by James A. Fred

You find it in an elderly aunt's attic. Or you spot it at a garage sale or a weekend flea market. It's a dusty, massive contraption made of mahogany, busbars, Bakelite and glass bulbs, with a loudspeaker horn that looks like an ear trumpet.

Suddenly you own an antique radio receiver, and you wish you could make it work again—squeals between stations and all.

In most cases, you can restore that old radio to operation—and in others, you can do it if you're willing to cheat a little. (When obsolete tubes are no longer available, transistors can often be wired into their sockets.) And you'll find yourself involved in one of the fastest-growing



Collector's prize: a complete McMurdo-Silver Masterpiece receiver with cabinet.

nostalgia-oriented hobbies: collecting and restoring old radio sets.

You'll need a little knowledge of vacuum-tube circuits—they're discussed in plenty of easily-available books—and building a brand-new tube set (see page 182) will give you some firsthand experience. You'll need circuit diagrams, parts and maybe a little guidance; those are available, too.

Old receivers are actually easier to find now than they were 10 years ago. Growing interest in early radios has created a dozen regional and national clubs and several periodicals, and produced a market for businesses that sell parts and schematics (see listings on page 182). Most of these suppliers, however, operate on



Component system, circa 1927: Crosley Gembox receiver and Musicone speaker.

a spare-time, next-to-nonprofit basis. For this reason, you should always send a 4 by 9½-in. self-addressed, stamped envelope with your inquiry. Give the model number of your set and explain clearly what you want to know. Don't write to one of these suppliers and ask him to tell you everything he knows about collecting old radios; he just won't have the time.

For general information, joining a collector club is the best bet. You'll pick up plenty of lore as you read the group's publications and attend meetings.

Most radio collectors join more than one club. They usually join the Antique Wireless Assn., which was the first collector club and now has nearly 2000 members. The AWA holds five regional conferences a year and a national conference in October. It publishes a 32-page quarterly magazine and has its own



Battery radios like this 1932 Grunow long held sway on unelectrified farms.

museum in East Bloomfield, N.Y., with displays of radios, tubes and other parts plus early transmitters.

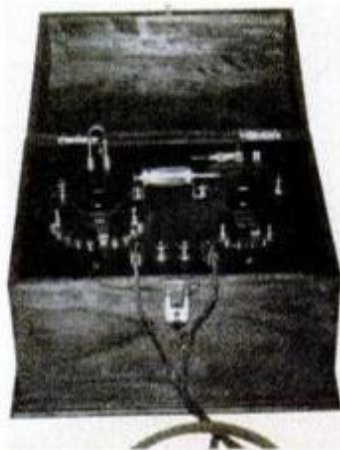
Regional, state and local clubs are forming so rapidly—nearly one a month—that the list on page 182 is necessarily incomplete.

Old-radio eras

You're entitled to cherish the radio that first aroused your interest, even if it's a fairly common cathedral-style set, but you'll soon learn that some receivers are rarer and more interesting than others. Historically, they fall into three rough periods: before 1924, 1924 to 1927 and 1928 to about 1940.

It was in 1920 that the Westinghouse Corp. began transmitting regular programs of news, weather reports and music, and amateurs began building receivers to tune in the wonderful free-of-charge programs.

Incomes were low in the early '20s, so thousands of listeners built their own radio sets. Before 1922 there



Early British-made crystal set from around 1920 has solid-walnut cabinet.

was little organized receiver manufacturing, and most early sets were crystal receivers, named for the galena (lead sulfide) crystal that served as a detector. A crystal set required an outdoor antenna 100 ft. long and mounted as high as possible, and a ground connection—usually a wire running from the set to a piece of pipe driven into the ground. One person could listen, with headphones.

The one-tube radio was little improvement because headphones were still needed, but when one or two amplifying tubes were put in the circuit after the detector, a loudspeaker could be used and the whole family could listen at once.

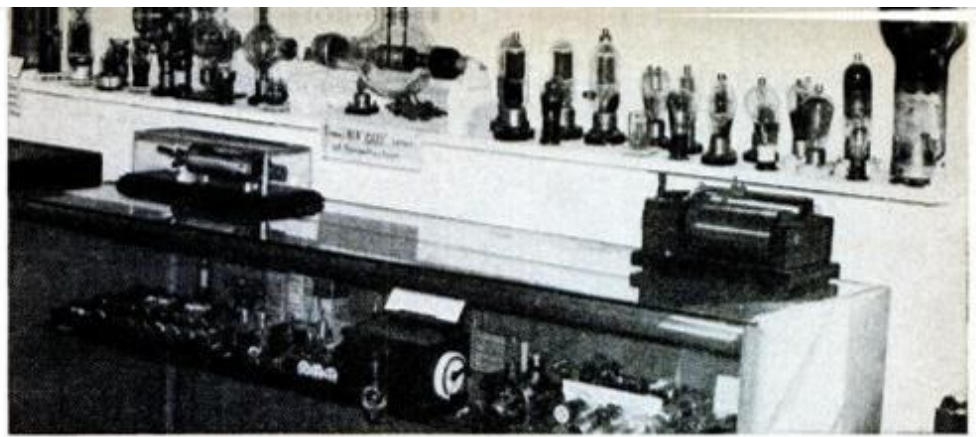
Soon there were so many broad-

casting stations that the simple radios couldn't separate them. The five-tube, three-dial, tuned-radio-frequency (TRF) set solved this problem and, around 1924, began a new period in radio.

With two amplifying tubes and additional tuned circuits ahead of the detector, TRF radios gained greatly in sensitivity (ability to pick up distant stations) and selectivity (ability to separate stations). Thousands of these radios were sold. Soon manufacturers learned how to use ganged capacitors to build single-tuning-dial receivers, greatly simplifying the tuning process.

At this stage, radios were battery-powered, and housewives were complaining about holes in carpets and linoleum resulting from acid spills. The expenses of charging the wet cell storage battery every week and buying a set of heavy-duty "B" batteries every three months were also a nuisance. "B"-battery eliminators had appeared, but there was demand for a radio that would simply plug into a wall outlet. It finally appeared in 1928—and ushered in radio's Golden Age.

AM radios reached a high-water



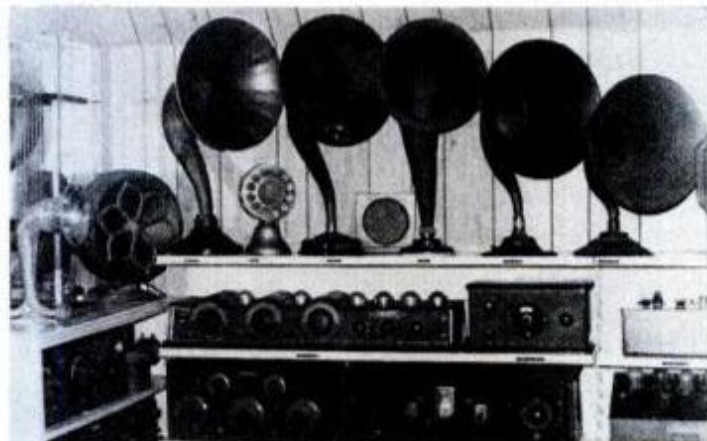
Display of old and unusual transmitting and receiving tubes is part of museum operated by the Antique Wireless Assn. in East Bloomfield, N.Y., largest collectors' group.



Omaha collector Steve Meyekorth proudly displays early radios and speakers in his home.



Grebe Synchrophase MU-1 radio: along with components, literature.



Some hobbyists' collections are in private museums—this is part of Taylor's Electrical Archives Museum in Indianapolis.



Members of the Indiana Historical Radio Society trade and talk at a meeting at Purdue University in West Lafayette, Ind.



Cathedral-style classic: a 1932 Atwater Kent Model 82, awaiting restoration.

mark with the 33-tube Scott Philharmonic. Other radios of the period prized by collectors are certain models of Capehart, Lincoln, Zenith, Silver-Marshall and McMurdo-Silver.

In this era, shortwave listening was introduced and you could tune in London, Paris, Moscow and Melbourne. Electronically amplified phonographs arrived, and soon the radio-phonograph, with automatic record changer, graced the American living room.

Finding them

Where do you find old radios when there aren't any left in the family? Lots of places—other collectors, flea markets, second-hand stores, antique shops, auction sales and even dumps.

Antique shows and sales usually bring the highest prices, especially in larger towns and where admission is charged.

Auction sales held on farms owned by elderly persons are most likely to have radios at reasonable prices. These sales are listed in local newspapers. Rummage and garage sales are another good source. And don't overlook the local landfill or city dump—I've found several collectible radios in our county landfill.

Radio collecting has other facets besides the radios themselves. I know collectors who specialize in loudspeakers, tubes, radio literature—even telegraph keys.

It's probably fortunate that ra-

(Please turn to page 182)



Indoor-outdoor cooking is easy with door-mounted ice chest and hook-on galley box under an awning shelter.

When business requires long trips at night, the extra illumination from quartz lights aids safety.



Camp/work conversion

No need to spend a bundle on a posh-pad van. This business and pleasure rig converts quickly from work to play and back.

by Jim Elder

Somewhere between Detroit and California, the van has evolved into something more than a delivery truck. There is the shag-carpet "sin bin" with its fur upholstery, mahogany paneling, stained glass, color TV and chrome sidepipes. But some of us must make our vehicles work *and* play, carrying passengers, cargo and tools during the week, then kids, bikes, boats and tackle on weekends. A "camp-and-work bin" van conversion seems a practical compromise.

My "Budget Bin" is intended as an economical 10-year investment. Original equipment and added accessories have been selected on the basis of cost, utility, long life, convenience and safety. We sometimes skimmed, other times spent, but always stayed within practical limits.

Which van and what equipment were the first decisions. Brand selection is a personal choice, and there are no bad vans. We picked a Ford based on good past experience, easy engine access and a roomy inside cockpit. To get stiffer suspension and extra hauling capacity, and to avoid the no-lead engine, we ordered the 138-inch-wheelbase 150 series with 6100-pound GVW rating. A 3.25 Trac-Loc rear axle seemed a good choice

for winter roads, mountain performance and highway economy.

For accessories, we studied cost/benefit ratios and factory versus aftermarket options very carefully. The combination of a Heavy Duty Trailer-towing Package and the Northland Special Package gave us extra cooling, trailer wiring harness with HD flasher, 77-amp.-hour battery, dual horns, ammeter and oil pressure gauges, HD shocks front and rear, 90-amp. alternator, twin engine-block heaters, high-output passenger heater, and an auxiliary oil cooler. For a bit over \$200, these factory options proved much less expensive than adding them piecemeal later.

Options added later

Ford also offered the best deal on the auxiliary gas tank, swing-lock mirrors, and two-tone paint. (We wanted a white top for lower interior summer temperatures.) Detroit was competitive on captain's chairs when freight on aftermarket seats was figured. A regular-gas 351-cu.-in. V8 and Cruise-O-Matic transmission closed out the order.

But what we didn't order, and why, are also important: No factory airconditioning—at about \$500, plus higher gas consumption. No tinted



Plans from T&H Van Works are checked before tracings for panel cutting are made.



Holes for floor screws could start rust, so author cemented in Ensolite, plywood.

Extra hands help for bowing ceiling into place. Here are jack, bat and tripod.



Even a Hobie Cat can cartop aboard this van, and a Devin Safety Step Ladder hinge-mounts on roof without straining the door.

Within easy reach of driver is rucksack on door, CB and kit bag Velcro-attached to dash top, serving tray on engine cover.



You can do on a budget



View aft shows ice chest and stove (left), rear seat with speakers and flag (above).



With storage boxes in place and Masonite cover unfolded, cushions act as mattress.

Sleeping bags complete bed made from storage boxes, awning-covered cushions.



glass, which cost an extra \$100 and cuts night vision. We figured we could insulate when we paneled the interior, and could do it both better and cheaper. Detroit wants \$400 or more for a good AM/FM/cassette stereo set. No sale. Not even a cigaret lighter for \$12, when any junkyard will sell a complete unit for two bucks. In fact, our van was delivered as a bare shell from the driver's seat back. Windows are on the right for light and sightseeing, with metal on the left for privacy and more interior storage. Ford calls this a Display Van—many dealers don't even know about it.

Three priorities

Then the fun began. Our projects, which may take up to 10 years, were divided into three priorities:

- Safety—quartz lights, fire extinguisher, grille guard, special tires, alarm system, CB radio.
- Utility—hitch, top rack, cargo capabilities.
- Comfort and convenience—air-conditioning, seat/bed system, paneling, insulation, interior lighting, roof ladder, radio/tape deck, storage, cooking and refrigeration, awning and many more luxuries.

Our van arrived in a snowstorm, and it was a pleasure to discover that our choice of F32 Goodyear studless radial winter tires gave the van sports-car handling in the slippery going.

Good sense suggested doing all the safety items first, but because

we would be spending hours working in and around the Ford we started with a sound system. For half the factory installation cost, you can buy dozens of aftermarket radio/tape systems. We chose a Panasonic CQ1711EV and a pair of AFS Kriket 6079 rear speakers. Vans do not have good resonating chambers—no trunks or thick doors—so the 36-watt 6x9-inch coaxial Kriket enclosures made a great difference. We also used a Kriket auxiliary speaker, mounted near the driver's ear, for our Johnson 4175 CB radio. And since thousands of truckers can't be wrong, we chose Antenna Specialists' MR415 "Dual-Momma" center-loaded antennas, mounted on home-made brackets outside the mirrors to get as close as possible to the magic 108-inch separation.

Inexpensive extras

After those luxury electronics, it was time for pinchpenny projects. A Coleman rucksack on the driver's door and a zipper "fannypack" on the passenger door helped end cockpit clutter. From the hardware store came holders for flashlight, tire gauge and ice scraper. From the boat stored for the winter we pirated a fire extinguisher and cigaret lighter with map light. (When we removed six screws and pulled the dash panel to install the radio, we found Ford has a 12-volt wire waiting for do-it-yourselfers.)

Midwinter was no time to run

(Please turn to page 214)

RV '78 Camping

12 that are great for camping

by Bill McKeown
OUTDOORS EDITOR

They're packing more features, better fuel economy and bigger accommodations into smaller rigs.



A new conversion that sleeps four and includes a bathtub, Cobra Supreme turns a van into a motor home with three optional layouts. It features full self-containment, and a choice of Dodge, Chevy or Ford chassis.

Changes that add up to major improvements—that's the recreational vehicle story for this coming camping season. New RVs along the highways will be more attractive and offer better fuel economy.

Good looks and good gas mileage go together, and the trend is toward better streamlining and less boxy shapes to push air out of the way more efficiently. The boom in mini motor homes and van conversions is also putting smaller rigs that burn less fuel on the roads.

And gasoline is not the only source of push power for RVs this year. GMC, Chevy and Dodge have joined International in making diesel engines available. Jeep is experimenting with diesel marketing in Europe. Midland Motorhomes of South El Monte, Calif., offers 26 and 28-foot motor homes with 170-



Customized van that can double as a tow vehicle, the Shasta Travel Van can link up with Shasta travel trailers and be equipped with full tow package and wiring.



Economical to buy and to own, the new Coachmen Cadet 26-foot fifth-wheel travel trailer (left) is designed for luxury on a budget. Coachmen's big 35-foot QuinStar (above) makes park living mobile with deluxe features.



Only the characteristic W emblem indicates that this newly styled 26-foot Brave is from the famous Winnebago line. Interior modular layouts allow 20 floor-plan options.



New 25-foot mini motor home from Itasca, the 25RB with rear bath, comes on a Chevy chassis with four floor-plan options, forced air furnace, four-burner range with oven.



Camp cooking indoors or outside is easy with Starcraft's SwingOut kitchen for the large Galaxy camp trailer that sleeps up to eight adults and the smaller Stardust SwingOut or Starlite with PullOut galley.

hp Cat diesels. Leisure Time Products, Nappanee, Ind., has an 18-foot mini home on a Mercedes diesel that sleeps up to six. Fuel economy, low maintenance, long life and low exhaust emission levels under current federal air-pollution standards are among the advantages given to offset the high price of diesel engine power, but all builders point out that the bonus comes with high mileage. It doesn't pay to buy diesel for occasional short runs around town.

Another trend that doesn't show on the outside of the rigs but adds to their sphere of action is four-wheel drive. That's nothing new for tow vehicles like pickup trucks and off-road 4WDs, but now it's an option from Travco, Apache, Cobra and others in full-size and mini motor homes. Cobra's Trailrider, in fact, uses the new full-time VX4 all-wheel drive that gives extra ground clearance without making the vehicle higher. Drive from the back of the engine goes into a transfer case that sends it aft to the rear differential and vees it forward as well, on each side of the engine, to each of the front wheels. For the camper who likes to head down to a Baja beach or up a logger's road in the mountains, 4WD capability allows towing a small trailer, toting a pickup camper body or rolling a self-contained motor home away from it all.

Pickup-truck camping will show up this summer with a number of improvements. Smaller compact camp bodies to fit Courier, Luv, Datsun, Toyota and others come in streamlined fiberglass, lift-top and fold-out tent-camper models this year. Chopped-van conversions of the minis are also available from Chinook. Full-size pickup trucks convert easily for overnighting with



Blazon's Elite Center Bath 375 5th Wheel Trailer is towed by its matching Elite 188 Towlounge. A cabover bunk sleeps two, and three passengers can sit in swivel seats around a table located behind the driver of the tow-truck chassis.



Sportsmen and big families should approve of compact accommodations in the new 22½-foot Tioga Model L with two extra bunk beds for total sleeping of five or more. Sliding cabover bed and convertible dinette sleep three.

slide-in camper bodies from Bethany and Coleman that resemble a canvas-sided fold-out tent trailer. These bodies fold compactly to provide for less height and wind resistance in the typical camp-trailer compact package.

Anything but compact are the

huge new tow-truck and fifth-wheel trailer rigs. The Dreamer division of Neonex calls theirs a seven-wheeler, in fact, since the trailer rides on six wheels and the hitch fits in the bed of a special cut-down pickup van. Because the sides of the van have been removed, this Dreamer Artic



Vans and large station wagons can increase space without cutting top or sides with the Jutter, from J.C. Industries, Cherry Hill, N.J. A detachable 125-pound package mounts on the roof and opens into 4x8-foot sleeping loft and 8x8-foot room with roll-down sides.



Campers who have trouble getting around on foot can now get around cross-country by wheelchair in a Blazon 220 Mini-motor home featuring a large door, lift, tub, full kitchen and beds that sleep four.



The extra convenience and safety of a driver door is new for all Pace Arrows, from 25 feet to the Luxury Flagship 31 (above).



Front bunkhouse, other beds, sleep total of eight in Monitor, Wide World, Free Spirit travel trailers from Holiday Rambler.

Sun model has raised the headroom of their over-hitch quarters by lowering the floor. Six-feet, two inches of walk-around height and picture windows make it a living room with the forward view of a tow-truck van. It seats six, sleeps two. Blazon has a 188 Elite Towlounge to pull its

Elite Center Bath 375 fifth-wheeler or any other. The Towlounge has a cabover double bed, seats for five (counting the driver) and even a refrigerator to make the tow vehicle capable of unhitching and camping on its own.

And for campers who never seem

to find a parking site in the shade, Coons Manufacturing in Oswego, Kans., is offering a solar heater for its Diamond Minihomes and others. Even partly cloudy days are said to provide enough infrared rays for the \$575 Diamond heater to take the morning chill out of your rig. **FM**

Togetherness touring can be great on the road, but difficult when you try to stop, our novices report.

FIRST-TIMERS TEST A MOTOR HOME

by Michael Lamm
WEST COAST EDITOR



Inside a 25-foot Itasca, the Lamm clan (above) found a motor home provides a Cape Cod beach house (below) or a tour-bus view of the Capitol while the driver searches for nonexistent parking spots.

Our experiment began with the question: Can a family of five—total newcomers to motor-homing—have fun, save money, and survive on speaking terms after three weeks and 2000 miles in a home-on-wheels? The answers, we found, had a number of yes-and-no qualifications.

The motor home we borrowed was a 25-foot Itasca made by Winnebago on Chevrolet's 157-inch-wheelbase truck chassis. The Itasca sleeps six so it did have plenty of room for three teen-aged boys and two adults. It's really at its best out on the open highway because you cruise along majestically and in marvelous comfort. The family can sightsee, walk around, play cards, stretch out, even snooze. Meanwhile, Dad (me) sets the cruise control, turns on the stereo, gets treated to snacks (thanks to Joanne) and feels like a king. As long as you're moving, it's really a great way to travel, and you never have to search for a restroom.

Takes time to get used to

But, first of all, it took me about four days to get comfortable driving a vehicle this size. After a lot of luck and guesswork you loosen up, but rear visibility always tends to be iffy. By the fifth day you learn where you stand in a lane

[\(please turn to page 196\)](#)

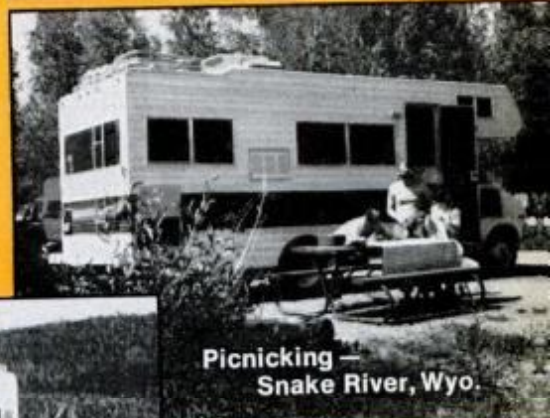


PREVIEW: FLEETWOOD'S FLAIR

It's called their Model T, but it's so new that only now is it getting national distribution. We tested it over 3500 miles a few months ago, and from 115° F. in the Mohave Desert up to altitudes over 7500 feet in Utah, Wyoming, Idaho, Nevada and California, the rig proved to be a particularly reliable one. Comfortable, too. Although Fleetwood calls this its economically-priced RV line, we found that the manufacturer had not cut any corners. With standard features like water heater and electric pump, dual holding tanks, marine toilet, 20-amp. converter, three-burner range with oven, roof vent, porch light and many other refinements, the equipment added up to luxury we had not expected. The Dodge 360-cu.-in. V8 had plenty of pep for the long grades and hills, the airconditioning did not hamper performance, and down-shifting was seldom required. With a two-barrel carburetor, we averaged 8.4 mpg at just over 50 mph. The Flair comes in six layouts and we certainly rate our Model T as superior.—*JoAnn Berryhill*



Rest stop — Half Moon Lake, Wyo.



Picnicking — Snake River, Wyo.



Overnighting — Half Moon Lake, Wyo.

The 22.5-foot Flair did not seem to be cramped for a family of four, and the queen-sized cabover bunk, amidships galley and dinette, plus rear beds, did help to provide for restful sightseeing.



Sightseeing — Geyser Basin, Wyo.

Stops for fishing, photos, lunches or looks at scenery were easy with views through the Flair's big windows or a step outside. Hookups were quick.

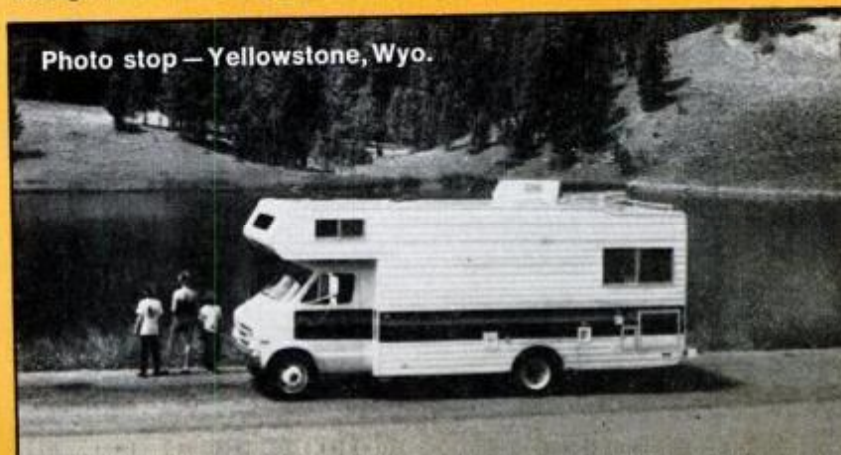


Photo stop — Yellowstone, Wyo.

FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR



Driving the Subaru BRAT

This 4wd pickup is officially a Bi-drive Recreational All-terrain Transporter.



You can now buy various makes of Japanese mini-pickups with four-wheel drive: Datsun, Toyota, Courier, Luv, Mazda. But these all amount to custom 4wd conversions. So they're high in price and the way they ride up in the air.

Subaru, however, has begun exporting a 4wd pickup that's priced (\$4249) just a hair above deluxe two-wheel-drive Japanese pickups, and it incorporates four-wheel drive in a normal riding height plus twin "rumble seats" in the cargo bed.

Called the Brat (*groan*; it's an acronym for "Bi-drive Recreational All-terrain Transporter"), Subaru's new pickup has a few drawbacks plus a number of advantages over its competitors.

The Brat's ride, for instance, is far and away superior to other small

A new twist by Subaru reverses the rumble seat with two buckets facing aft. Hop in, belt up, grab the joy sticks and hang on for the ride of your life!

pickups I've driven in recent years. Most of them tend to jostle and jiggle on rough roads, some to the point where you wish you had on a kidney belt. Yet the Brat isn't—it's smooth on the highway and on rough

surfaces, with amazingly generous suspension travel.

The Subaru people had us destroying Brats in the sandy desert wastes around Palm Springs, flogging the little goats up dunes and around the Sinai-like landscape. I was amazed by the vehicle's ability not only to conquer seemingly impassable torture courses but also to give a decent ride while doing it.

It's possible to get anything stuck in deep sand, even a Sherman tank, but in four-wheel-drive and with wide, low-pressure, steel-belted radial tires (optional), the Brat can plow fields and climb mountains with the best. Its low ground clearance does pose problems in extremely rugged country, and I feel the optional skidplate might not be a bad investment for people who do a lot of off-roading.

By and large, the Brat feels as surefooted and rugged as a burro, and since it's so good in sand I'm sure it'll be a whiz in the snow.

The nice thing about Subaru's 4wd system is that you can shift in or out of it at any speed. There's a stubby lever ahead of the four-speed gearshift, and for 4wd you merely shove in the clutch and tug the lever rearward. Subaru recommends you don't drive over 50 mph in 4wd for prolonged periods, but otherwise there are no hubs to lock up manually, and no need to stop—you just shift and head off into the boonies.

On the minus side

The Brat has several drawbacks. First, it's a light-duty pickup, with a rated load capacity of only 350 pounds. That accounts in some measure for the Brat's good ride—it doesn't have to be stiffly sprung to compensate for heavy cargo. A 350-pound load rating means it's not suited for real hauling, though, and Subaru admits that it's a recreational vehicle, not a workhorse.

The twin, rear-facing rumble seats in the bed might raise a few eyebrows, too, but I've ridden in them on smooth and rough surfaces and they're lots of fun. I think the kids will get a kick out of them. The seats have seatbelts and you'll need them when the going gets rough.

One problem with the rumble seats is that if you're leaning back on a hard plastic seatback, it whams you right in the small of the spine when the Brat hits a hard bump. The trick is to lean forward, away from the seatback, and hang onto the grab handles.

Otherwise, controls inside the cab are conventional, and the Brat drives nicely. It's got plenty of spunk, and except for a little slop in the transmission linkage, all controls are well engineered. Carpeting and an AM radio come standard; the cab seats recline and there's room behind them for small cargo—camera cases and such.

Subaru uses a water-cooled Flat Four ahead of the front axle, along with front-wheel drive. That puts 59 percent of the Brat's weight on the front tires, which would give miserable handling if this vehicle had conventional rear drive. But with front-wheel drive, it does just fine. In hard cornering, you have to keep the accelerator down hard, so the tires keep pulling; otherwise you run into drastic understeer. In 4wd, hard cornering feels very much the same as in fwd alone.

The Brat does show typical fwd torque-steer—that habit of tugging slightly to the right on hard

acceleration. It's noticeable but not bothersome. Subaru's rack-and-pinion steering, while quick and precise, amplifies the Brat's torque-steer tendency and also amplifies steering-wheel whip that's so prominent when driving in ruts.

The Brat's styling got a boost from U.S. consultant Alex Tremulis, the famous designer who did the 1948 Tucker Torpedo and Ford's futuristic showcars of the 1950s. Alex also designed some of the Brat's accessories, including the fiberglass

camper shell, the Conestoga canvas roof and the bed tonneau.

Offroader Bill Stroppe designed the optional winch, skidplate, heavy-duty bumpers, rollbars, and so on; most can be dealer-installed.

Subaru plans to market the Brat first through southern U.S. dealers, but by now the vehicle should be available nationally. There's nothing quite like the Brat on the market, and as a fun RV that easily doubles as a family's second or third car, it seems a natural. **PM**



Instrument layout on the Brat dash is especially attractive and easy to read.



Front bucket seats in the cab adjust so you can stow some gear behind them.



Gimme shelter: Accessories for the Brat include the fiberglass camper shell, shown at left above, and a Conestoga canvas roof, the frame of which is shown at the right.



Specifications 1978 Subaru Brat 4wd

Engine

Type: opposed ohv Four, water-cooled
Bore, stroke: 92x60 mm (3.62 x 2.36 in.)
Displacement: 1595 cc (97 cu. in.)
Bhp @ rpm: 65 @ 5200
Torque @ rpm: 80 @ 2400
Compression ratio: 8.5:1

Transmission

Type: four-speed manual, all-synchro, floor lever; transaxle, fwd to 4wd
Ratios—1st: 4.090:1
2nd: 2.312:1
3rd: 1.464:1
4th: 1.029:1
Reverse: 4.100:1
Final axle ratio: 3.889:1

Steering

Type: Rack and pinion

Brakes

Front: power discs
Rear: power drums

Suspension

Front: Independent, MacPherson strut
Rear: Independent, semitrailing arms

Dimensions and weight

Wheelbase: 96.5 in.
Overall length: 164.8 in.
Overall width: 61.0 in.
Overall height: 56.7 in.
Ground clearance: 7.1 in.
Curb weight: 2145 lbs.
Fuel capacity: 11.9 gal.

EPA mileage figures

City driving: 26 mpg
Highway driving: 36 mpg

New add-ons for RVs



Debugging a van or car of insects is easier with Indy/Bug-Barrier screens by Carefree of Colorado for roll-up or swing-out windows.



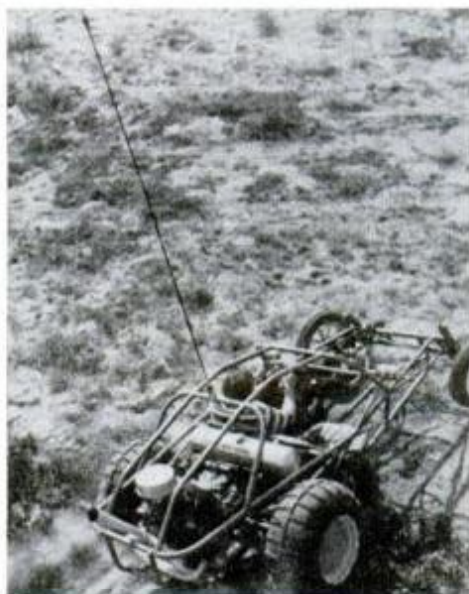
Sporting-up a pickup is a one-day job according to the American Hatch Corp., Dallas, when its T-Top for Chevy and GMC half-, three-quarter- and one-ton models is installed by a hatch dealer.



A Shadow Awning especially for vans has automatic rewind but can be slipped out of its awning rail for inside storage. Carefree also has a matching screened enclosure.



Old-fashioned running boards are new for vans, pickups and RVs as step and body protection; in aluminum from Reiten Corp.



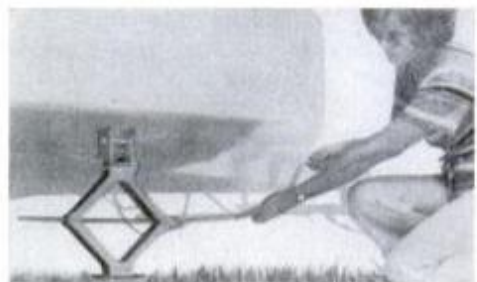
Light at top of 8-foot fiberglass Lite 'n Rod from Illuminated Products gives 80 flashes a minute for off-roaders.

Neat new accessories for RVs are another result of the custom van boom. This year many extras built into larger rigs have been packaged for do-it-yourself campers.

Convertible tops may have disappeared from Detroit's assembly lines, but a number of rag-top, bubble-top and removable-hatch options are available for RVs from aftermarket suppliers. Off-road drivers can choose from assortments of trail, swamp and sand flotation tires, high-intensity driving, fog and spot lights, and evaporative air coolers designed for low humidity conditions. No vehicle needs to go without compact kitchen and plumbing facilities. Mobile mini-systems are made for any truck, camper or car. **PM**



Convertible soft vinyl-coated tops are available from Dick Cepek with mounting hardware for Jeeps, Toyota Land Cruisers.



For a level rig on almost any terrain, a set of four Fold-A-Way stabilizing jacks by Valley Tow-Rite are bolted or welded on.



Delivering a gallon a minute but weighing only 20 ounces, Coleman's new 12-volt Mini Pump is for RV, van water systems.

Latest for tenters and packers



Soft Pack from Recreational Equipment co-op is frameless, has foam-padded back, slots behind side pockets to hold skis, section for stuffing sleeping bag.

For bare-bones backpackers, posh motor-home owners, and all the breeds of campers in between, the sport of outdoor living is being simplified with more new accessories that add convenience and safety.

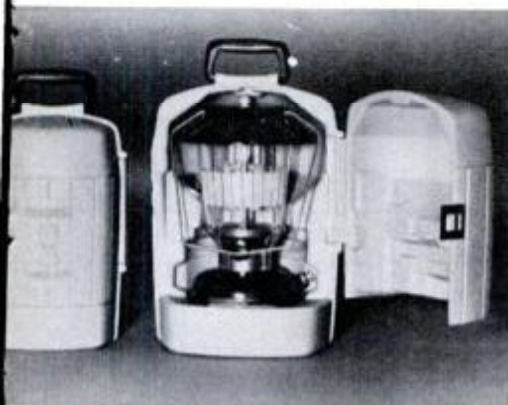
Packs are frequently smaller, sometimes without a frame, often more comfortable. For hikers who head out for only an afternoon away from car or campsite, a rucksack or other soft day-bag is sufficient. Heavier loads can be carried in contoured backpacks that have no frame, or those with the new adjustable and flexible frames that can be customized for better fit.

Clothing is making use of new fabrics and laminate coatings that claim breathability while keeping

wind and rain out. Goose down insulation is rivaled by new, cheaper synthetics that aren't quite as warm but don't get waterlogged. Foul-weather gear is being improved with materials like Ensolite that can help ward off hypothermia while providing life-saving flotation.

Tents now on the market are also using the new fabrics or waterproof rainflies and nearly all are fire-retardant. Look, as well, for self-supporting arrangements that will not require guy lines and pegs except when windstorms threaten.

Heat for cooking and warmth is easier to get from efficient pack stoves and LP appliances that also light the camp. Outdoor equipment is more expensive—but better. **PM**



New Lantern Carrying Cases from Coleman hold and protect single and double-mantle lanterns, funnel, spare generator.



High Trails Pack Tent from Wenzel weighs only five pounds without center pole but gives 7-foot headroom, 7x7 sleep space.



Sports Pouch by Sima Products for cameras and binoculars is claimed shock-resistant, waterproof and even bouyant.



An improvement over bare feet for wind-surfing, sailing or surfing are traction-soled shoes with sporty Adidas stripes.



Climbers can plot an exact ascent up to 15,000 feet or check weather with Eddie Bauer's Thommen Altimeter/Barometer.



Protection from rain, cold and accidental dunking are offered by Sportsman's Flotation Jacket, matching pants by Stearns.

Comfortable, roomy, well made, safe, durable. All these words describe two different, yet similar, cars.

But one of them—the 504 diesel with automatic—suffers from a chronic lack of power.

That's basically what Peugeot owners we surveyed told us. We sent questionnaires to 1000 Peugeot owners. Their replies emphasized that while the 504 and 604 do differ, they're essentially the same when it comes to dealer service, workmanship, handling, comfort and driveability.



Narrow roof pillars give good visibility, and filaments heat rear glass.

It's no secret that diesel cars lack the horsepower of their gas-powered counterparts. That's never been clearer than in the case of the Peugeot 504D. (The number of owners with the 504 gas engine



was too low to provide useful data.) Buyers concede that this car, especially with automatic, can barely keep up with its shadow.

Most respondents (64.7 percent) had bought the 504D, and nearly all (91.1 percent) had ordered the three-speed automatic. So it was no surprise when 15.1 percent listed "lack of power" as their No. 1 complaint and 13.5 percent suggested "more power" as their prime recommendation toward making Peugeot a better car.

The 604 series doesn't come as a diesel and marks Peugeot's top of the line. This highly optionized V6 automobile was intended to compete with the smaller Mercedes,

in purpose if not in price. It seems odd, therefore, that the 604 doesn't offer a diesel.

Several owners mentioned test-driving Mercedes before settling on a Peugeot, and their comments are interesting.

A New York Buick mechanic, for example, writes, "Peugeot quality is far better than GM's. I feel this car [a 504D] is close to Mercedes at half the price. We looked at two used 300-D Mercedes at \$10,000 each. These cars had 40,000 to 50,000 miles on them. We felt the ride and quality of Peugeot at \$8900 was close to or better than Mercedes, and here we had a brand-new car to boot."

"We bought our 604 sedan because it's like a Mercedes, only better," said an Iowa housewife.

Owners give handling excellent marks, and riding comfort rates even higher.



BY MICHAEL LAMM WEST COAST EDITOR

Peugeot's 504 diesel may be slow and the 604 not perfect, but comfort is tops!

Peugot developed its 604 twin-cam V6 jointly with Volvo and Renault.

Squared quad headlamps interchange with American units.

Rack-and-pinion power steering combines with radials to give driver confidence.



PM photos: Bill P. Maduros



Instruments include tach. Some owners don't like right-side turn lever.

Comfort topped the owners' "most-liked" ranking, and extremely high percentages rated front and rear-seat comfort "excellent."

A North Carolina traveling salesman notes, "I put 50,000 to 60,000 miles a year on my cars, and this is the only comfortable automobile I've found that costs less than \$10,000. Friends who drive my 504 can't believe the way it rides and handles. I say it's the best kept secret in the auto industry."

And a 64-year-old retiree: "Comfort rates excellent in my book."

Even the center rear-seat passenger is comfortable when we drive with five aboard. My wife and I really appreciate the reclining front seats, especially on long trips and while waiting in the parked car. We never thought we'd like the sunroof, but we find we enjoy it."

Dealer service came in for the usual mixed bag of good and bad feelings, with good predominating but bad winning out in the shouting. Long waits for parts proved a persistent complaint.

A Texas electronics expert op-
(Please turn to page 208)

Rear seat has ample legroom, and a third passenger can sit in middle.



Different, but similar

We're talking in this report about two different but closely related cars, the Peugeot 504 and 604—each with a unique engine and body.

The 504, introduced initially in 1967, uses an in-line Four. This engine comes in either gasoline or diesel versions (120 and 141 cu. in., respectively), delivering 88 and 71 bhp.

The larger 604, which arrived in the United States late in 1975, shares its 90° V6 with Renault and Volvo. These three automakers engineered the twin-cam V6 jointly. The 2.7-liter V6 is a gasoline engine and Peugeot doesn't offer a diesel in the 604.

Both the 504 and 604 use unitized bodies, with rigid passenger compartments and crushable sections fore and aft. Suspension systems for both cars boast MacPherson struts up front and semi-trailing independent axles in the rear. Both cars also have four-wheel disc brakes as standard equipment.

Additional standard items in the 604 include airconditioning, power-assisted steering and brakes, sun roof, electric window lifts, Michelin radials, tachometer and tinted glass. A four-speed manual transmission comes as standard equipment, while a three-speed automatic transmission is optional.

A NATIONWIDE SURVEY BASED ON 760,412 OWNER-DRIVEN MILES



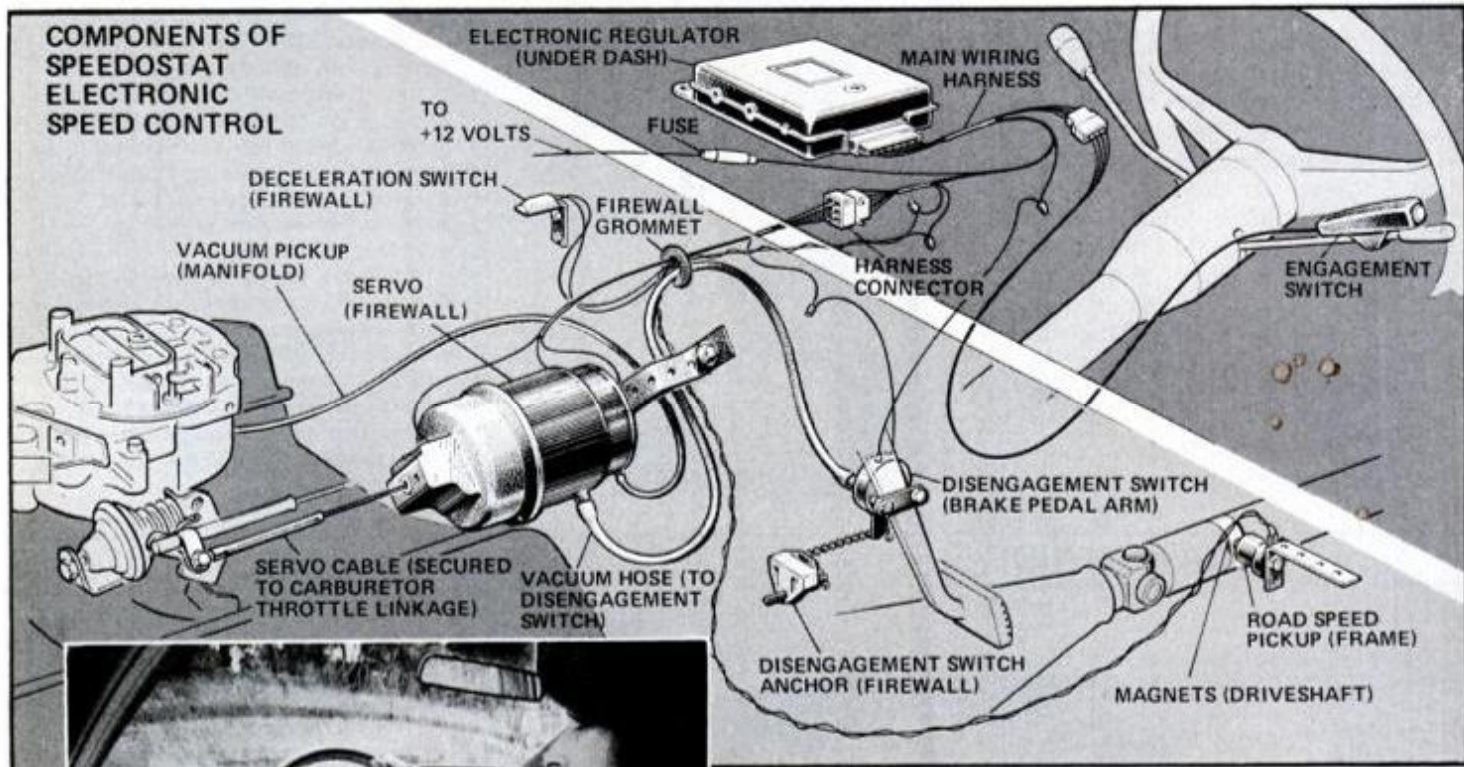
The 604's trunk has 2.4 cu. ft. less capacity than 504 because gas tank stands over differential.

Peugeot 604 spans 2.2 inches more wheelbase than its smaller brother.

Power four-wheel disc brakes and independent rear suspension grace both series.

How to add the luxury of cruise control to your car

by Mort Schultz



Cadillac driver at left enjoys the luxury of cruise control, which is engaged with switch mounted on directional signal stalk. You can enjoy this accessory, too, by installing a kit as shown above.

Speed control offers more value to some drivers than to others. It hardly benefits the driver who drives mostly around town or who drives a limited number of miles.

The driver who will realize the most benefit is the one who does considerable driving every year, particularly over long, monotonous stretches of smooth superhighway where speeds change little hour after hour.

Different types

Let's start by talking about the kinds of speed-control units available and how much they cost. Suppose that you are ordering a 1978 model and want speed control installed at the factory.

If you order from a GM division, except Cadillac, you will get a straight speed-control unit with no frills. This means that the unit will

(Please turn to page 186)

Be forewarned: Speed control—or “cruise control” as it’s sometimes called—is one of those accessories that, once you have it, you won’t ever want to be without.

Speed control lets you drive a car without having to keep your foot on the accelerator pedal. It has been offered as an optional accessory by car manufacturers since about 1960. But now it’s more widely available and you can even purchase a speed control *kit* and install it yourself.

With speed control, you accelerate to a desired speed using the ac-

celerator pedal and engage the control unit. From then on, until you hit the brake or accelerator pedal, speed is maintained for you. The control unit holds the car at this speed smoothly and consistently over both level and hilly roads.

Aside from making driving more relaxing and less tiresome, speed control results in maximum fuel economy. Few of us can maintain the consistency of speed that an automatic control device provides. Naturally, a rock-steady driving pace gives the best fuel mileage.

Installing a cruise-control unit in 3 easy steps



Parts of Speedostat Electronic Speed Control kit are laid out before work begins.

With proper planning, good mechanical skills and the required patience for such projects, you can install your own cruise control in three easy steps—first you go to work under the car, then under the hood and, finally, under the dash. You can do the complete job on a Saturday or in three separate sessions of about two hours each.

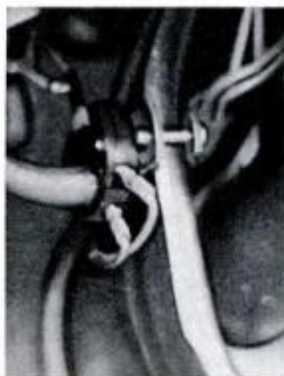
We did the job on a 1969 Pontiac Catalina using Dana Corp.'s Speedostat Electronic Speed Control kit, which lists



Magnets are cemented and taped on driveshaft; pickup coil is adjacent.



Servo is mounted on firewall and its cable is secured to throttle linkage.



Under-dash work includes installation of disengagement switch to brake pedal arm (detailed at left) and disengagement switch anchor (not visible); connection of wires to main harness. Regulator (hand-held) is compact, easy to position.

for a little over \$100. Included is a thorough, illustrated owner's manual with excellent operation and installation instructions. Components of this kit are shown installed on the opposite page.

Under the car

To install the road-speed pickup components at the driveshaft, put the front end on ramps or use jack stands. Secure the pickup coil to the floor pan using the self-tapping screws provided. It must face the driveshaft within 12 inches behind the front U-joint, with a clearance of $\frac{3}{4}$ to $1\frac{1}{4}$ inches between coil and shaft. Cement and tape the magnets to the driveshaft 180° opposite each other. We wound the leads for the pickup around the speedometer cable and up to the firewall grommet.

Under the hood

First, remove the air cleaner so you have room to work on installation of the servo and deceleration switch and can comfortably drill the 1-inch hole in the firewall and insert the grommet. Note: While working, check that your positioning of the servo and cable to the throttle linkage will let them clear the air cleaner when it's replaced! Also check the passenger-compartment side

of the firewall before drilling bracket holes to make sure you're not drilling into wires or other parts. It may be hard to find an appropriate location for the servo bracket on firewalls of late-model cars; jam-packed engine compartments make this installation tricky. The position needed should allow the servo cable to run as parallel as possible to the throttle linkage—20° is the maximum allowable angle between cable and linkage.

Normally, assembly of the vacuum line from manifold to servo is done now, but we left it until last, since we wanted to use the car during the period of several days while we were installing the kit. If you do the job in one "sitting," route the vacuum line now, but be sure to check that it clears all linkages.



Engagement switch mounts on stalk, is preferably about $\frac{3}{4}$ inch from the end.

With the "dirty" work done, you can move to the front floor of your car and install the disengagement switch on your brake-pedal arm and its anchor on the firewall. At this point, you also mount the engagement switch on your turn-signal lever, make all connections to the main wiring harness and +12 volts, and find a good spot under the dash for the electronic regulator. After a brief electrical check, you're ready for road test and final adjustments.

We didn't meet a single snag installing the Speedostat and now enjoy long trips in the Pontiac as if it were a luxurious new car!—Harold J. Hartford



Build this movable cabinet for small tool storage

The author built his version of a \$150 cabinet using plywood scraps.

by Charles Matthews

This 17-drawer tool organizer moves on casters and is the next best thing to having extra pairs of hands and feet. Wheel it to within arm's reach—and during those critical moments you won't have to search all over the shop for the proper bit, clamp or turning tool.

The cabinet can be built with scraps of 1/4, 1/2, and 3/4-in.-thick A-D (good-one-side) interior-grade plywood and pine or fir scrap. Cut out the pieces as shown in plans, including a 29 1/8 x 34 7/8-in. back panel of either 1/4-in. hardboard or plywood. Then carefully cut grooves in sides and divider. Mine were done with a dado blade on my bench saw, but a router will do. Test groove widths on scrap before final cuts.

To assure rapid, accurate cabinet assembly, make a dry run. Brace unglued sides, top and bases around back panel and check for correct fit. Cabinet top should be positioned with rear edge flush to back and a

2-in. overhang on each side. Mark on underside of top to make it easier to locate and drill for screw pilot holes before final assembly. Also mark where surface of first wide plywood shelf butts bottom edge of center divider for the same reason.

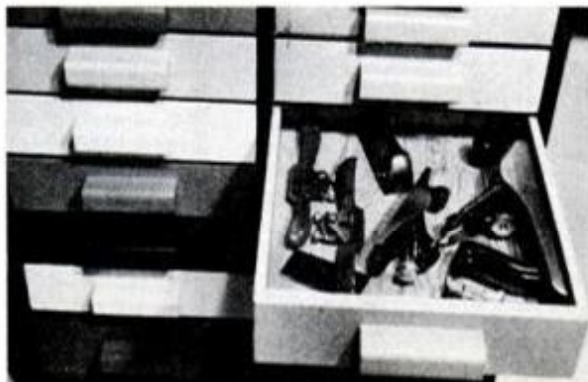
Pull apart dry assembly and drill pilot holes, three per edge for securing top to sides and first wide shelf to bottom of divider. Proceed to secure top to center divider and to sides with countersunk 1 1/4-in. No. 8 fh wood screws and carpenter's glue. Attach base and sub-base to sides with 1 1/4-in. brads and glue. (Base and sub-base should be glued and screwed together to form one piece using four 1 1/4-in. No. 8 fh wood screws.) Now, without gluing, slip two narrow shelves into divider grooves to center it. Spread glue evenly on bottom edge of center divider, and slip in the wide shelf that butts against it after putting a few drops of glue in the shelf grooves. Se-

cure shelf to divider with 1 1/4-in. No. 8 fh wood screws. Check for squareness, clamp and let dry overnight.

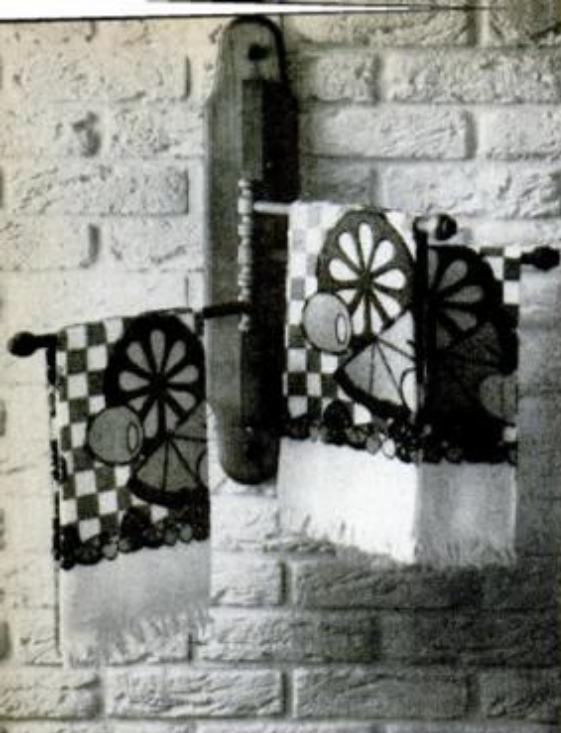
Next morning remove the clamps and clean off the hardened glue squeezings with a chisel. Put a few drops of glue in each groove and slip in the remaining plywood shelves. After glue has dried, turn the case onto its front side and fasten the back to sides, top and base with 3/4-in. No. 6 fh wood screws at about 8-in. intervals. Also fasten the back to the rear of the center divider with at least three screws.

With the cabinet top resting on the floor, mount four 3-in. swivel base-plate type, ball-bearing casters as near to the case corners as possible. For greater cabinet rigidity, install a pair of corner braces on the outside corners—sides to top and bottom—see photo on facing page. Use hefty braces at the bottom corners.

Well-organized cabinet keeps tools ready for use and protects cutting edges from nicks. Additional work surface comes in handy when cabinet is near your lathe, saw or workbench.



Three practical, attractive towel racks you can make quickly

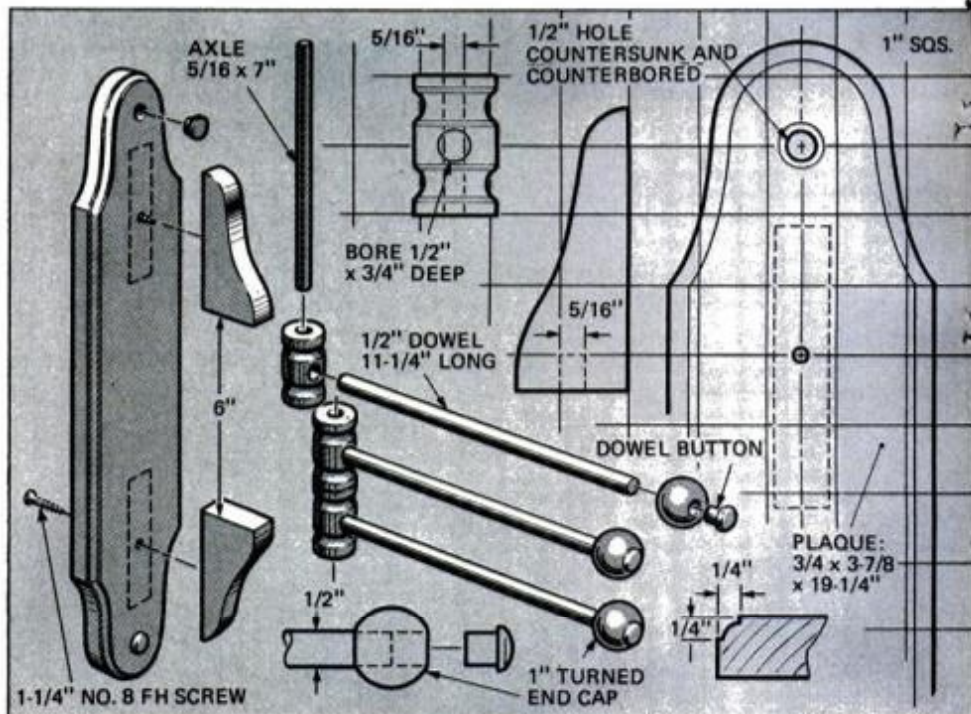


Early American-style rack lets you swing towels against wall or into easy reach.

I started making towel racks like these when a friend complained that he couldn't buy anything of this type that was attractive and well constructed.

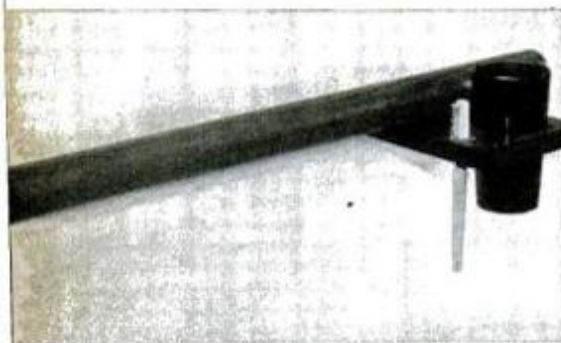
The example shown above is made of maple, with a Danish oil finish. I've made others of white pine and walnut.

The basic design is easily adaptable to a variety of decor styles—you may want to try changing the shapes of the plaque, axle blocks,



and end caps. Ask at your lumberyard for wood fitments and see what ready-made shapes are available.—*P.G. Howerton*

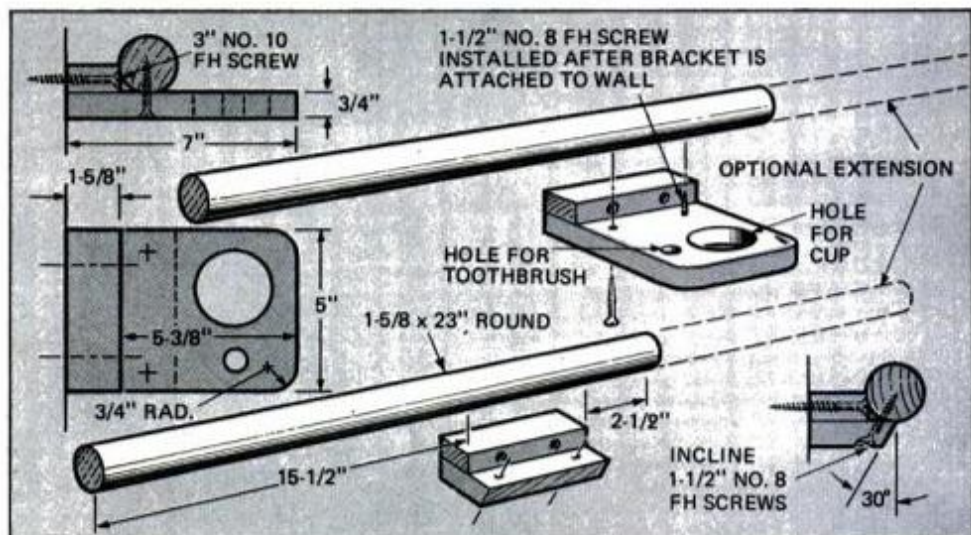
and end caps. Ask at your lumberyard for wood fitments and see what ready-made shapes are available.—*P.G. Howerton*



Cantilevered contemporary towel bar has places for toothbrush and drinking cup.



This double-ended version of the towel bar omits the brush and the cup holder.



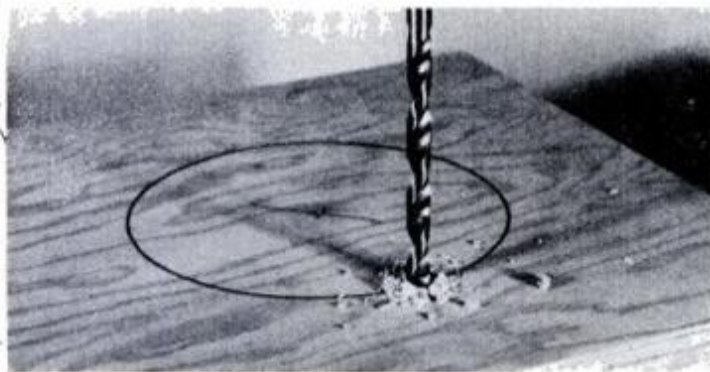
Rather than purchase towel racks for our new home, we designed these inexpensive towel bars. They are easy to make and their blind construction and attachment give a clean, modern look.

I turned my 1 5/8-in.-dia. bars on the lathe from glued-up 1 1/2-in. stock, but purchased rounds are fine. Each bracket is made from two

pieces of wood glued together with their grain directions at right angles for strength. Brackets and bars were stained and finished with two coats of urethane varnish, rubbed lightly with steel wool between coats. Mount the brackets with wood screws where there are studs behind—otherwise with toggle bolts—then attach the bars.—*David M. Carter*

1. PERFECT CIRCLE, PERFECT HOLE

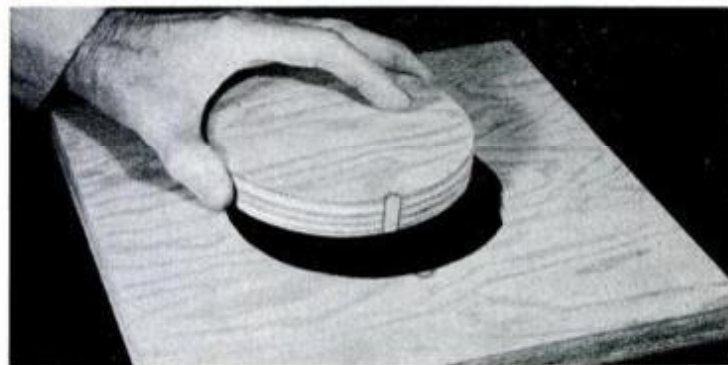
From time to time, you may encounter a project, or come up with a design of your own, that requires cutting a large, perfect circle out of wood and leaving a perfectly circular surround behind. The problem is that you have to have a place to start cutting with your sabre saw or jigsaw. The solution is to fill in that starting point neatly, after the circular cut has already been started.—Warren W. Bender Jr.



After you mark the outline of circle needed, bore a 1/4-in.-dia. hole centered at a point right on the circle-cutting line.



Insert the saw blade into the hole and cut until clear of it. Then plug hole with a length of 1/4-in. dowel and white glue.



Allow time for glue to dry; then continue cutting the circle, ending by slicing through the dowel. The result: perfection.

2. CUT GLASS WITH SCISSORS UNDER WATER

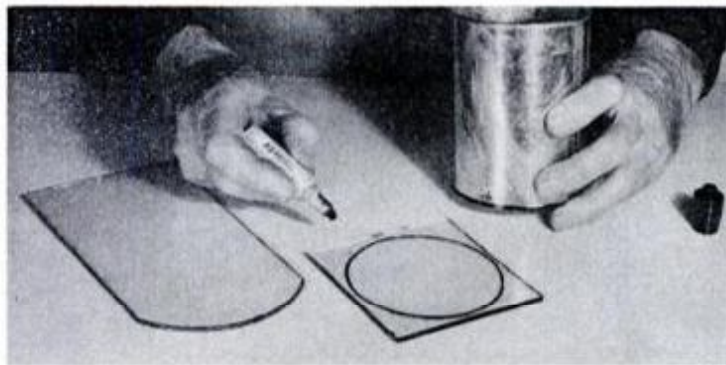
It sounds crazy, and it's hard to believe until you've tried it yourself, but you can cut glass circles with scissors—if you do it under water.

Apparently the water damps vibrations that would otherwise shatter the glass—does anyone have a more complete explanation? At any rate, you can use this trick to re-

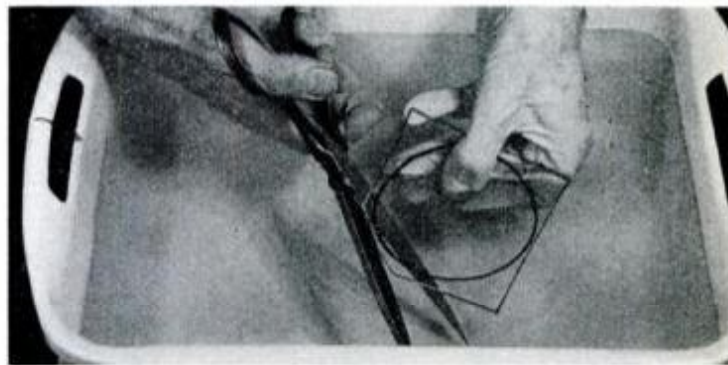
place a broken flashlight lens, meter cover or rear-view mirror when a proper circle cutter is unavailable.

Use a container large enough that the cutting point will be at least a couple of inches below the water surface. (Don't use the bathtub or sink—it's too easy to leave glass splinters behind.) Use a rugged pair of scissors or small, sharp tin snips

—you'll want plenty of cutting power. Practice before attempting a finished product. It may be necessary to resharpen cutting edges as you go. The glass that falls to the container bottom is easily removed if you place a layer of newspaper there first. Don't forget to dry scissors or snips thoroughly when you're done.—Charles G. Buscombe



Mark your cutting outline with something that will stand up to water—permanent-type felt-tip marker or a grease pencil.



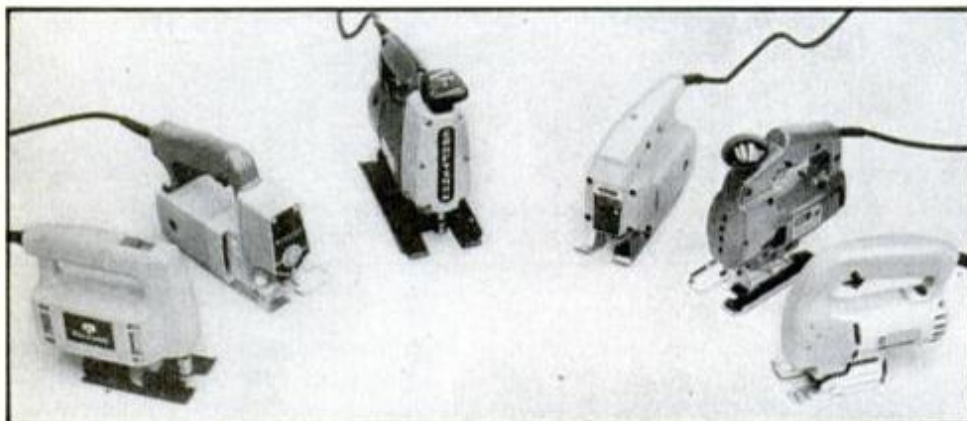
Cutting the glass is like cutting heavy cardboard. Use a nibbling technique instead of trying to lop off large pieces.



Basic cutting with a sabre saw

With solid know-how and the aid of a few simple jigs, you can rely on this versatile tool to do some impressive cutting jobs.

by Rosario Capotosto



Typical sabre saws for serious do-it-yourselfers, from left to right: Rockwell Variable Speed, No. 4320, \$24.99; Milwaukee Variable Speed, No. 6282, \$160; Craftsman

Half hp, Automatic Scroll, \$74.50; Stanley Industrial, No. 90076, \$112; Skil Variable Speed, No. 497, \$39.99; Black & Decker Variable Speed, No. 7560, \$54.99.

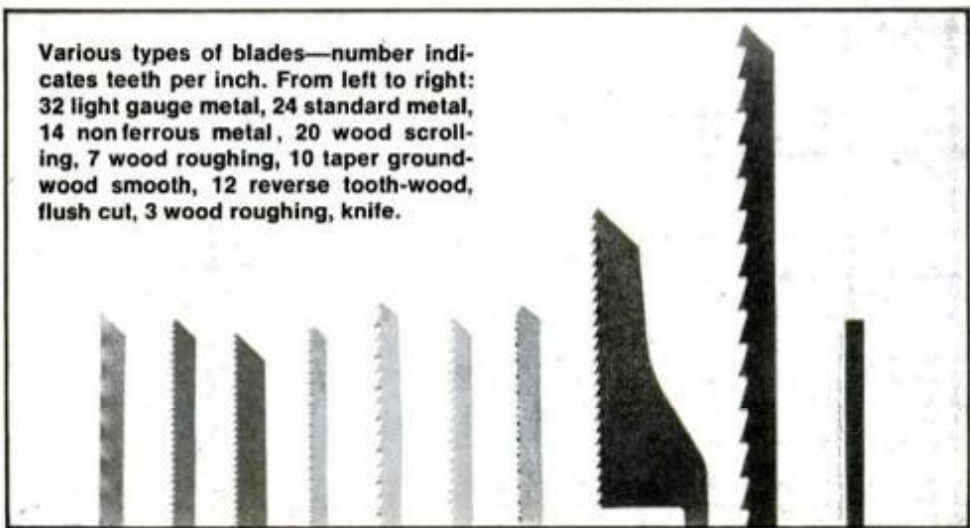
The versatile sabre saw can do practically any cutting job that can be done with a handsaw, jigsaw, bandsaw or even table and radial-arm saws—within limits of course.

Without question, the greater horsepower tools will cut more quickly—provided they can do it at all. Circular-type saws can only cut in straight lines, while band and jigsaws can only handle materials as wide as the depth of their throat permits. In fact, certain jobs can only be done effectively with the sabre saw.

Blades for specific tasks

A wide variety of blades are available for cutting ferrous and non-ferrous metal, wood, plastic, mineral and composition materials. For problem materials, such as ceramic tile, slate, cast stone and brick, a special blade edged with tungsten carbide grit is available. There is also a knife blade for cutting fibrous and rigid foam insulating materials, leather, rubber, cardboard, ceiling tile and wallboard. Most blades will fit all brands of saws.

For cutting woodwork, there are two basic kinds of blades: set tooth and hollow ground. Set blades have teeth which point alternately to each side. The set serves to cut a kerf wider than the back of the blade to allow it to pass through the cut without binding. Teeth of a hollow



Various types of blades—number indicates teeth per inch. From left to right: 32 light gauge metal, 24 standard metal, 14 nonferrous metal, 20 wood scrolling, 7 wood roughing, 10 taper ground-wood smooth, 12 reverse tooth-wood, flush cut, 3 wood roughing, knife.

ground blade have no set—they're all in a line. However, the sides of the blade are tapered towards the back to provide clearance. Set teeth cut fast, but leave a rougher edge than the slower cutting hollow ground blade. The number of teeth per inch (TPI) is another factor—the more TPI, the slower and smoother the cut.

When working with wood heavier than 1/4-in., it is advisable to use a blade of ample width because narrow blades have a tendency to flex and drift off vertical. For any guided saw techniques shown, a set tooth blade is strongly recommended to get true cuts.

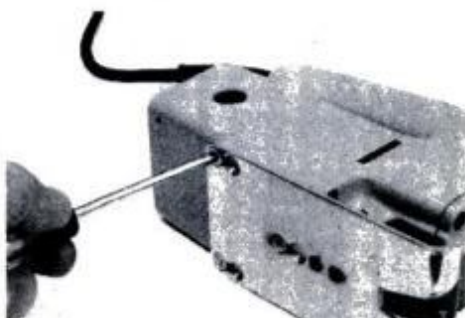
Rules for cutting

Cut with the wrong (back) side of workpiece facing up whenever possible. This is a good policy because blades usually cut on the up-stroke, causing slight splintering—especially when sawing plywood. The exception is when using a reverse tooth blade—it cuts on the

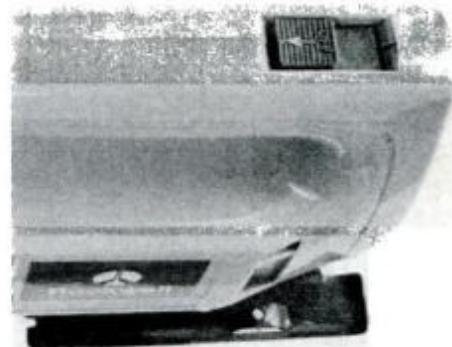
Special features on popular sabre saws



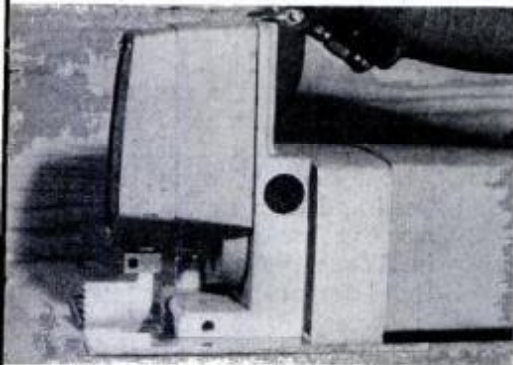
Base insert surrounds blade and reduces splintering of plywood veneer along cut.



Stanley's base shifts to support the saw front while using a flush-cut blade.



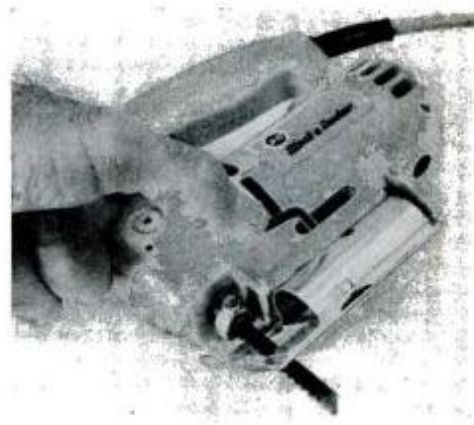
Rockwell's control switch slides forward to increase blade speed gradually.



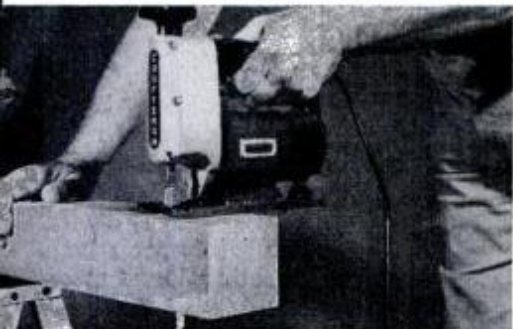
Flush-cut blade aligns with shoe front, lets you cut right up to a vertical plane.



Trigger on many models increases speed as it's pulled. The knob selects top speed.

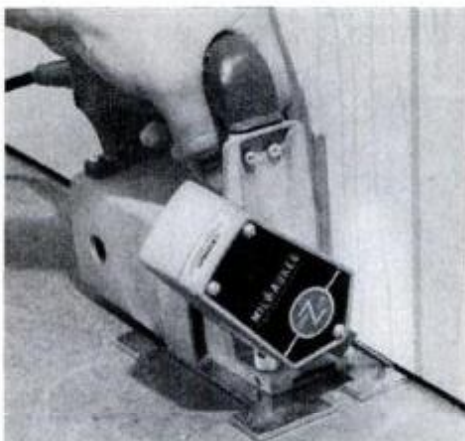
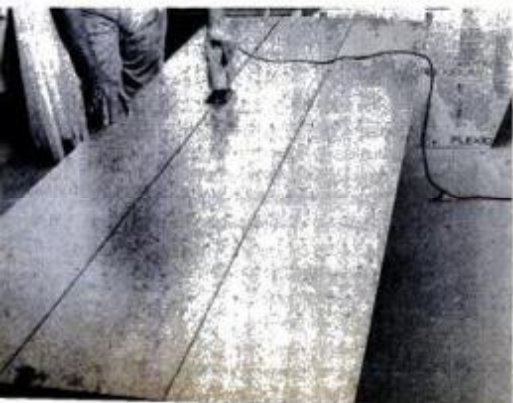


Shoe on Black & Decker unit is released or locked in position by means of lever.

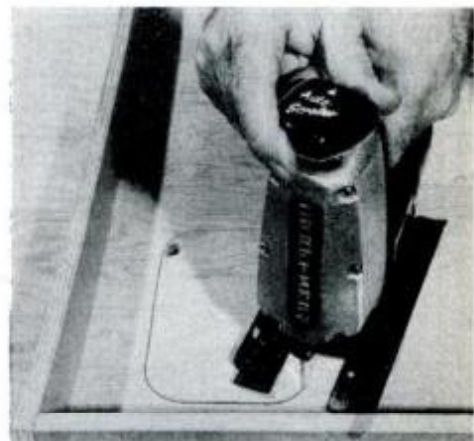


A 6-in. blade with 3 TPI (teeth per inch) cuts through 4 x 4. Use medium speed.

At high speed, 32-TPI metal blade cuts sheet metal quicker and easier than snips.

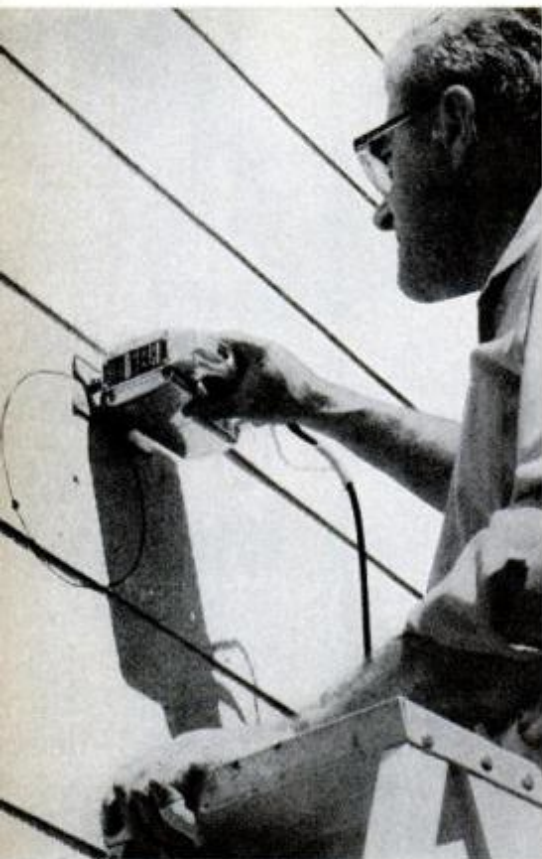


Milwaukee's pivoting head and five-position shoe reaches into the tough corners.



Blade on Craftsman turns 360° for intricate scrolling and getting into corners.

BASIC FREEHAND CUTS WITH VERSATILE SABRE SAW



Cut rough openings for soffit vents, louvers, stovepipes and more.

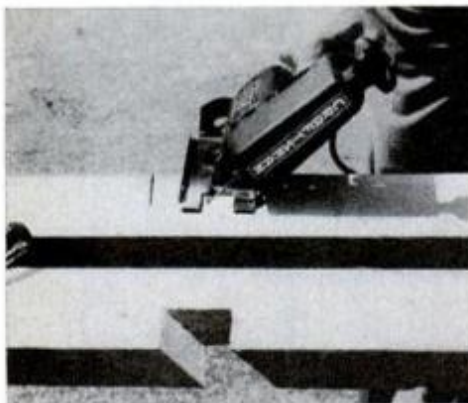


For plunge cut, use short, stout blade. Pivot saw into wood as it reaches full speed.

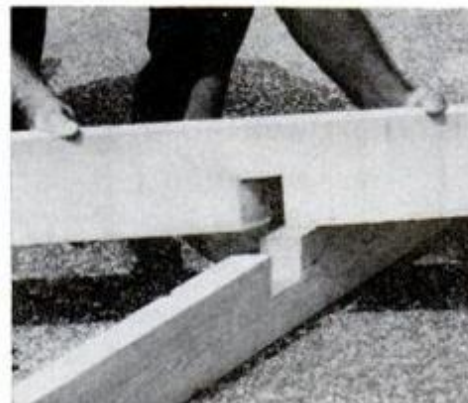


To minimize vibration damage, the hands and feet of this figure will be cut last.

CUTTING BEVELS—EVEN IN HEAVY STOCK

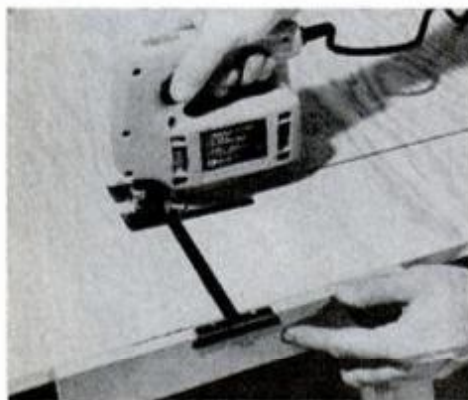


Shoe plate on most saws rotates for cutting bevels between 45° and 90°.

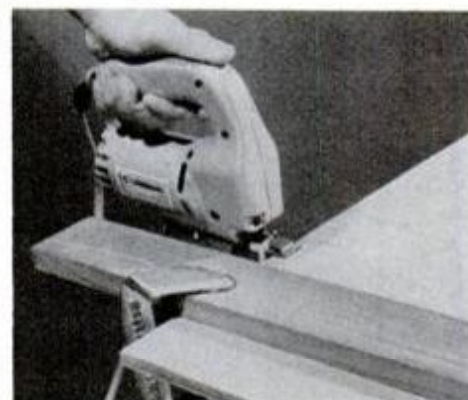


Angled crosslap joint is strong, easy to cut with a sabre saw. Chisel away waste.

CONTROLLED CUTS WITH GUIDES AND TEMPLATES



To modify accessory rip guide, add wood strip for surer contact with work edge.



Clamped-on straightedge guides should extend beyond both ends of workpiece.

downstroke and makes right-side-up work possible.

Always clamp small pieces of work for safety and accuracy. The nature of the cutting action sets up considerable vibration which would otherwise bounce the work around and obscure the cutting line.

It's wise to start your saw before touching the blade to the work. If the saw has variable speed, start the cut at low speed. It is often possible to start the cut by entering from the edge of the workpiece. When an inside or pocket cut is desired, the blade can be started in a predrilled hole. For a rectangular-shaped pocket, drill a hole at each corner and then make straight cuts from hole to hole. If a straightedge (or pivot guide for circular cutouts) is to be used to obtain a precise outline, the size of the blade entry hole must be big enough to let the blade rest almost flush to the circumference of the hole. This enables it to start off on the line of cut.

Making a plunge cut is the alternative method for starting an interior cut and doesn't require a predrilled blade entry hole. Use a short, stout blade and tilt the saw forward so it rests on the front of the shoe with the blade not touching the work. Hold the saw firmly, turn to full speed and then slowly pivot the saw back to allow the blade to cut its way in. When the arc is completed and the base rests firmly on the work, advance saw to make the cut.

Intricate scrollwork calls for a narrow scrolling blade with 12 to 20 TPI and 3/16 in. width. To support the work best, place it onto two lengths of 2x4 (set on edge) on the worktable. The 3 1/2-in. standoff allows clearance for the blade. If the work has a delicate pattern, try to leave some uncut bridges in the waste area until the main parts have been cut. This will minimize vibration problems.

Handy cross lap joints are advantageous for assembling large structural members and easy to make with a sabre saw. If the parts are to cross at other than right angles, determine the angle and tilt the saw shoe (or base) accordingly. Lock base into position and make double parallel cuts equal to the thickness of the stock, halfway through the planks. Chisel out the waste.

For smaller assemblies such as partitions for cabinets and built-ins, the same joint at right angles can be used. This should not be done freehand. Tack or clamp two straightedge strips of wood to the work, separated by the thickness of the work plus width of the shoe, less thickness of the blade. Run the saw



Long curves can be cut with flexible guide-strip tacked in an offset position.

along both sides of the guide strips halfway through the work and then remove the waste.

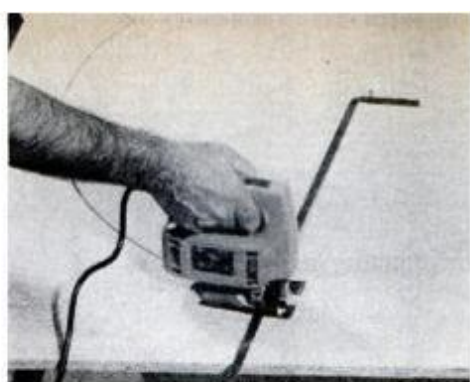
Making accurate rip or cross cuts requires an accessory guide for narrow widths and a straightedge guide for wider cuts. Clamp or tack-nail straightedge guide parallel to the line of cut (see photo).

Perfect circles are a cinch to cut with a sabre saw, but imperfect ones can easily result if you're not careful. T-shaped accessory rip guides are designed to also serve as circle guides. A nail driven through a hole in the crossbar support allows the saw to pivot in an arc. A blade entry hole tangent to the line of cut and in the waste area gets the blade started. Circle guides will work properly only if the front edge of the teeth and pivot point are equidistant from the support bar (see diagram).

The best way to cut *long sweeping curves* is with a sabre saw and a flexible wooden guide. Use a thin strip of wood, about $\frac{1}{2} \times \frac{3}{4}$ -in., bent to desired curve and tacked (on edge) to the workpiece. Position the guide so the saw will ride against the inside of the curve. Keep front and rear corners of the saw base in contact with the guide as you saw.

Template sawing economizes on both labor and lumber—and at the same time produces perfectly fitted flush doors or drawer fronts on plywood constructions such as bunk beds, cabinets and built-ins. Lay out the area to be cut by first measuring the distance between the shoe edge and the side of the blade. Double this figure and subtract it from the length and width of the desired opening.

Use these new dimensions to make the template from $\frac{1}{4}$ -in. hardboard or plywood and round the corners to the desired radius. Next, center and tack the template over the opening area. Bore a blade entry hole equal to the thickness of the blade and centered on a straight segment of the line to be cut. Elongate the hole with a coping saw blade, just enough for the blade to be inserted. Place

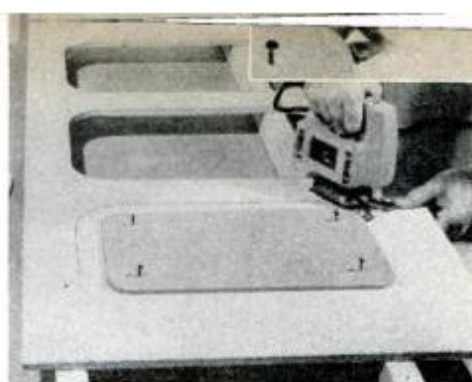


Make your own pivot guide for cutting circles beyond range of accessory guides.

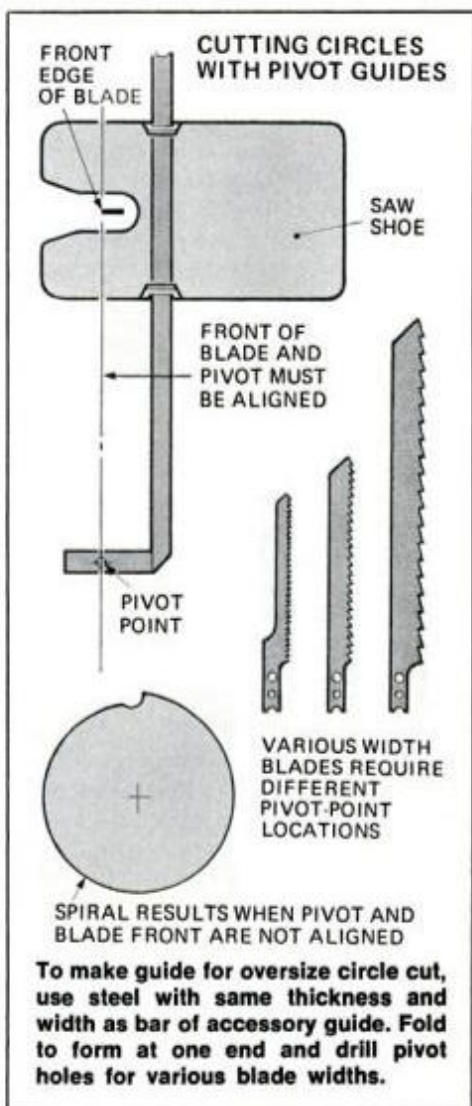
a masking tape arrow on the shoe's edge precisely opposite the blade teeth. Insert the saw blade and start the cut with the saw base pressed against the template edge. When you get to a corner curve, do not sharply pivot the saw. Instead, slowly advance it, keeping arrow point in contact with curved edge of the template. (See photo, above right).

Mortising jig is made by cutting an opening in a piece of hardboard or plywood. The width is determined by adding the saw base width to the width of the desired mortise and subtracting the thickness of the blade. The length of the jig opening is determined by adding the length of the mortise to the length of the shoe and subtracting the width of the blade. The rectangular jig can be made in two sections consisting of a U shape and a straight back piece. Bore a blade entry hole as wide as the slot near one end of the proposed mortise. Tack the jig into position so it will put the blade on one of the lines of cut. Insert the saw and make two forward cuts with saw base alternately pressed against each side of the jig. Make repeated cuts to clear out waste.

To square the end, slide the saw laterally against the jigs front. To cut out back of slot, reverse the blade so teeth point to the rear. Return saw to the jig and repeat cuts by pushing the saw backward. **PM**



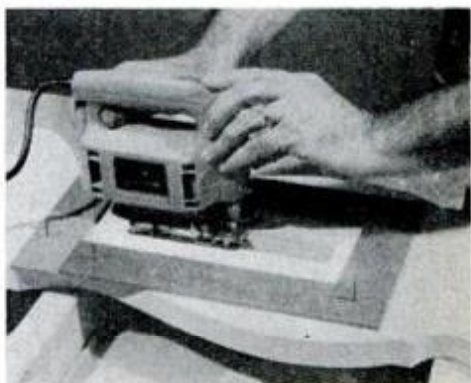
Mark on shoe, aligned with blade teeth, keeps constant radius on curved corners.



MORTISING TECHNIQUE WITH TEMPLATE



Rectangular hardboard jig permits accurate mortising in this trestle table leg.



With blade reversed, saw is pushed backward to complete mortise. (See text.)

light, then flows into a reaction chamber where it is further heated by more concentrated sunlight.

Clever idea saves energy

Now comes the clever part. The hot SO_2 gas is passed over a catalyst that breaks it down into sulfur dioxide and oxygen. This allows the separated gases to be drawn off at low pressure and piped to a central powerplant with minimum energy loss. Here the gases are recombined and in the process release the tremendous heat absorbed at each collector. Through a heat exchanger, hot SO_2 gas transfers its energy to eutectic salts acting as a high-capacity, heat-of-fusion thermal storage medium. By means of another exchanger, water is boiled by heat from the storage medium to run conventional steam-driven power generators.

While the Solchem concept is still on paper, it seems promising. Since each collector is, in effect, a self-contained solar furnace, there is no need for a huge central boiler tower, and the units can be placed more or less at random. Also, the use of a high-energy storage medium means the system may be able to continue operating through long sunless periods without auxiliary backup power.

Solar power from the sea

Meanwhile, we're not putting all our sunbeams in one basket. Another approach now under way is to extract solar energy from the sea. Since some 70 percent of the earth's surface is covered by water, our oceans thus constitute the world's largest natural solar collector. The plan to put it to practical use is called "ocean thermal energy conversion"—OTEC. It is based on temperature differential between sun-heated surface water and icy-cold deep water—a difference that can be as much as 45° F., especially in tropical and subtropical regions.

Some time next year a football-field-sized barge will put out to sea to test the idea. In principle, the system works like an ordinary refrigerator or air conditioner—but on an enormously larger scale. The barge is fitted with a series of coils having a highly volatile circulating fluid, like ammonia or propane. Warm surface water is first drawn in to heat the fluid, causing it to evaporate and expand into high-pressure vapor. This vapor drives turbines that drive electric-power generators the same way as steam is used at Sandia and Barstow.

The vapor is then chilled by water pumped from depths of up to 3000 feet. The cooling effect causes the vapor to condense back into liquid form, ready for reuse. This evaporation-condensation sequence continues in an endless cycle, keeping the generators running. When the system goes into operation, electricity from the generators will be fed to shore-based power stations through underwater cables.

The OTEC scheme's big advantage is that, unlike other solar systems, it does not depend on direct sunshine for efficient operation. Since ocean temperatures remain relatively stable, it can function around the clock in good or bad weather, continuously churning out a large amount of electrical power.

According to the National Science Foundation, working from a study made by Lockheed and TRW, similar floating powerplants will be able to generate 100 megawatts and more. A 100-megawatt unit producing enough electricity to supply 100,000 homes could be in use as early as 1983.

Big little solar plants

Not all current solar projects are on as mighty a scale as Barstow and OTEC, but some are still impressively big. Four large building complexes are—or soon will be—demonstrating the feasibility of using individual, on-site solar equipment to fulfill their power needs. They are the George A. Towns Elementary School in Atlanta, Ga.; Wilhelm Bleyle Knitwear factory in Shenandoah, Ga.; Mississippi County Community College (MCCC), Blytheville, Ark., and the University of Miami, Coral Gables, Fla.

The Towns School is operating, two others are being built and the fourth, Miami University, is under study. The 660-pupil Towns School has the nation's largest solar heating and cooling system in use. Solar collector panels covering 32,000 square feet of roof area supply over 60 percent of the facility's year-round needs. A conventional gas-fired boiler backs up the solar system.

Scheduled for mid-1979, the Mississippi County Community College will be the first large building to draw electrical power from photovoltaic solar cells like those in the space program. Solar cells will convert solar energy directly into electrical power. Providing a 250,000-watt peak output, they will represent the largest photovoltaic system ever assembled and satisfy all power requirements for the 60,000-square-foot facility.

New storage battery coming

Moving along hand-in-hand is a major research effort to produce a significantly new, high-capacity storage battery. Under development by G.E.L. Corp of Durham, N.C., it operates on what is known as the "iron-redox" process. Reacting agents, unlike those in a common lead-acid battery, stay in solution in the cells; there is no reduction process. Even when discharged, the battery is undamaged and recharging is unaffected.

The new iron-redox battery will have more than a 250-kilowatt output and a storage capacity of 2000 kwh. It will be charged in daylight from excess electricity generated by MCCC's solar cells, then feed this stored energy back when the sun doesn't shine. Its capacity will be enough to provide full-power electricity for 24 hours, meaning the school will be able to operate at night and at least one sunless day without the need for supplementary power.

Thinking big

The knitwear building, to open in 1981, will boast a whopping solar powerplant spreading over five acres. It will use curved reflectors to concentrate sun heat on a vapor-producer to drive a turbogenerator. It will provide most of the heat and electrical power needed by the big 42,000-square-foot, 300-employee factory.

And talk about thinking big: It gets hot in Coral Gables, Fla., and the cost of operating air conditioners for the University of Florida runs to about \$3.5 million a year. University officials would like to eliminate this horrendous expense by using free solar energy—but how do you electrify a campus that sprawls out over 260 acres? Simple, say experts. Just roof over the giant complex to accommodate the multitude of solar collectors required to do the job.

In the proposed university system, rooftop collectors would heat a circulating fluid, such as ammonia. This, in turn, would create steam through a heat exchanger to drive turbogenerators. The plan is feasible and the hardware available, but the initial installation cost would be about \$15 million. Bonus benefits would include covered walkways between buildings, pleasantly shaded outdoor areas and acres of roofed-over parking space provided to keep cars cool.

Whether the mind-boggling proposal goes through or not, you can't deny that solar scientists are thinking big. Future solar energy prospects look brighter than ever. **PM**

FENCES
Build one that lasts

Here are loads of ideas for better gardening and outdoor living... and lots of know-how about the topics illustrated on this page... and much more!

ROCK GARDENS
How to plan yours

PM's GARDENING AND OUTDOOR LIVING GUIDE

ROTARY TILLERS
Big help for gardeners

GREENHOUSES
What to look for when you buy

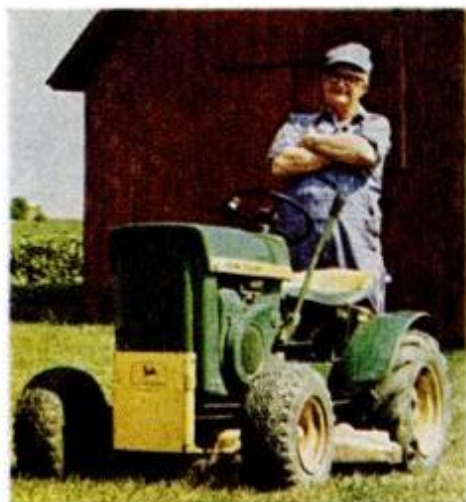
VEGETABLE GARDENS
Easier ways to grow a bonanza



ABOVE-GROUND POOL DECK
Build a wow of an entertainment center

"You'd have to whip me to get this tractor away from me."

Bill Hendrickson, Arthur, Illinois



It's been 13 years now since Bill Hendrickson bought his John Deere lawn and garden tractor.

Over the years, he's given it plenty of hard use—mowing grass and weeds, pushing snow, pulling wagons, and doing other odd jobs around his place.

Yet, as Hendrickson himself puts it, "This old John Deere has done everything I've ever asked of it. And it's still running fine today."

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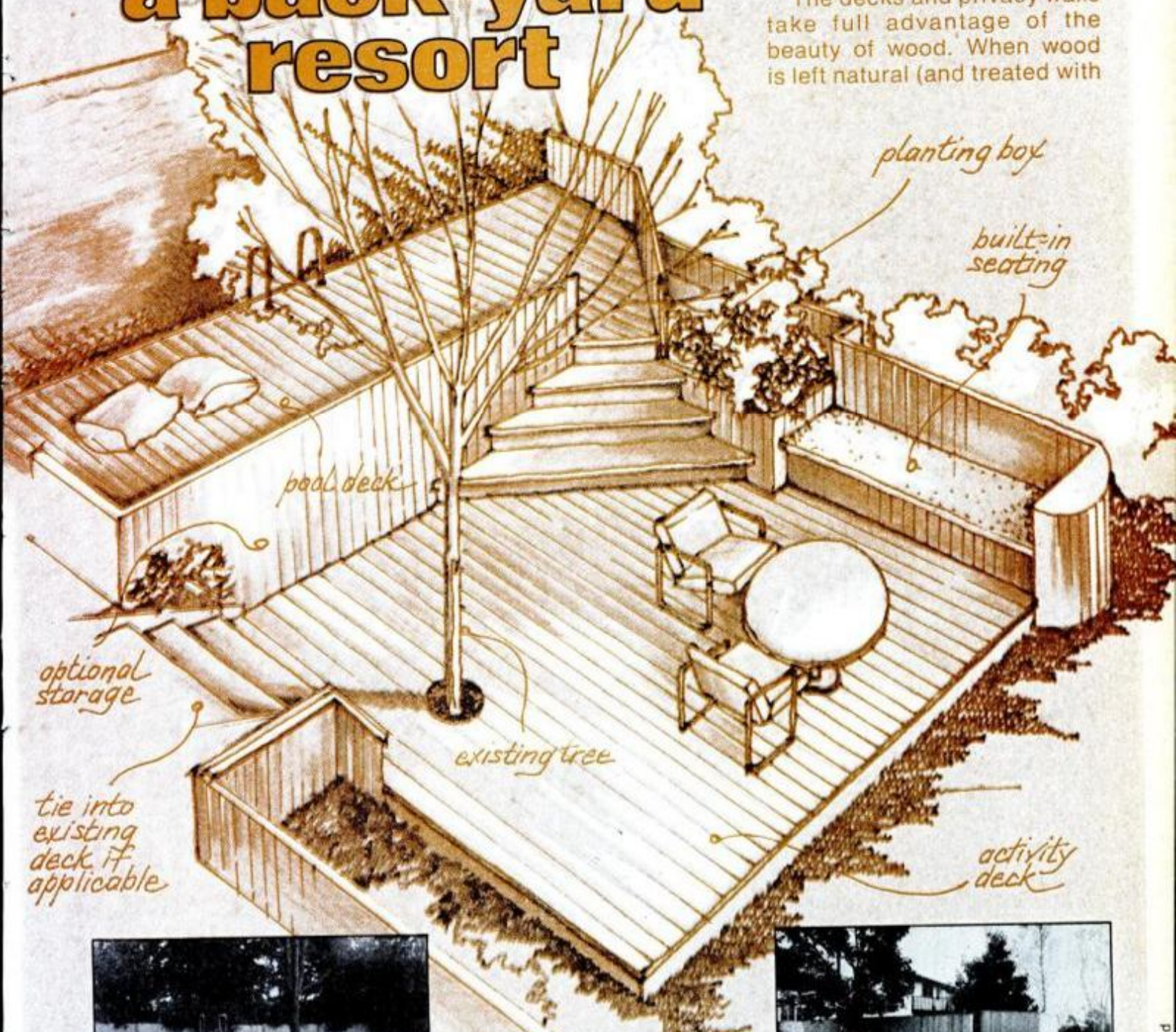
For a free folder write John Deere, Moline, Illinois 61265. Please indicate whether interested in tractors, riders or walk-behind mowers.

Turn your above-ground pool into a back-yard resort

by Harry Wicks
HOME AND SHOP EDITOR

Your above-ground pool will nestle beautifully into PM's back-yard entertainment center—and still remain the focal point of summer fun.

The decks and privacy walls take full advantage of the beauty of wood. When wood is left natural (and treated with



optional storage

tie into existing deck if applicable

pool deck

existing tree

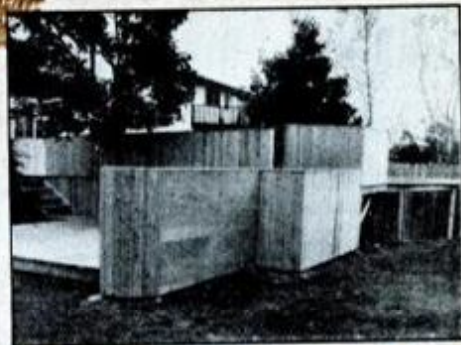
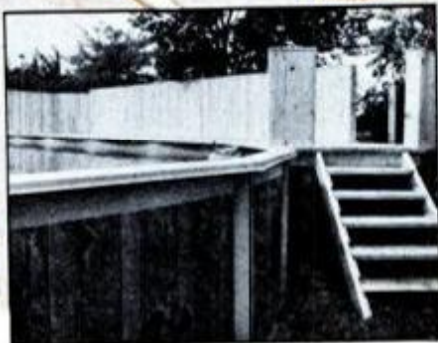
planting box

built-in seating


activity deck



Pool, completed by contractor, awaits our deck addition (above and following pages) to transform it into outdoor living center.



Ample-sized diving platform (left) has a second set of stairs to house. Planter-settee wall assures privacy (above).



clear preservative), it will eventually weather to a subtle silver gray to achieve an even greater harmony with its surroundings.

The pool shown is owned by the Benjamin Mark family on Long Island, N.Y. The challenge that we gave architect Ira Grandberg, AIA, was to create a new look for above-ground pools—something other than the over-used, wrap-around, doughnut-shaped decks that are so frequently built. His solution is a two-level deck to provide separate areas for bathing and entertaining activities. The finished product is the result of a joint effort by Western Wood Products Assn. and *Popular Mechanics*.

Where to start

Using stakes and mason's line, lay out your deck to suit your property and pool size. Make certain that your intended



Pool view from existing house deck is enhanced dramatically by the use of woods left to weather naturally. Western pine and fir were used throughout.

structure conforms to local building codes before turning the first spadeful of earth. Start by staking out what will be the upper level to suit. Next, work up a scale drawing of deck elevations—and an elevation for a fence around the upper deck. The latter should be no less

than 1 ft. above the upper deck and no more than 3 ft. higher than the flooring.

Elevations for both levels as well as the fence are determined by several factors, including pool height, land contour and existing plantings. All three elements should be taken

Please turn to page 190

PM color photo: George Ancona Furniture from Porch and Patio, Rockville Center, N.Y.

9 great ways to fence your yard

Besides assuring privacy, a fence can screen high winds, hide bad views, serve as a backdrop for plantings—and more.

A fence makes more than good neighbors when well designed and carefully laid out. It's a great opportunity to add a visually pleasing and functional element to your home's landscape. Some things to consider when planning a fence include:

- **Privacy**—extend your living space with a fresh-air room.
- **Shelter**—a strategically placed fence can act as a barrier to prevailing winds, dust and soot from the street.
- **Noise insulation**—a fence can help muffle unwanted noise—especially if your house fronts close to the street.
- **Pest (and pet) control**—fences can be designed for keeping animals from gardens and yard.
- **Safety**—a fence can make hazardous areas (like pools, high-traffic roads, precipices) around your home off-limits to children at play.
- **Codes and zoning**—check local zoning laws that may restrict fence

heights and locations or specify a certain amount of area that must be left open.

Setting and style

Certain fences are better suited to the shape and landscape of your home. For example, fences can serve as solid backdrops to garden and patio areas—and be painted, stained or textured to suit the mood of the setting. Horizontal designs will feel as though they extend the enclosed space. They carry the viewer's perspective to the horizon.

Vertical patterns create a greater sense of enclosure and intimacy. Wide intervals between boards or pickets allow greater interaction between inside and outside—narrow or butted verticals shut out and isolate. Interesting rhythms of light and shadow can be achieved with picket and trellis configurations—louver-type fences will change your perspective as you change points of view. Study the styles pictured here

and in other available sources before deciding which will suit your own particular setting best.

Material and economy

Budget is always a factor in good design. Since posts are structurally critical in a fence, don't skimp on them. If they fail, they're the most difficult component to replace. Posts are also subject to greatest damage due to rot from moisture and insects like termites. Wood naturally preserved, like cedar and redwood heartwoods, is well suited for posts.

A better alternative is pressure-treated wood, like Kopper's Wolmanized lumber, that will stand for decades. The price varies, but generally speaking, it is 30 to 50-percent less expensive than its equivalent in cedar or redwood heartwood—and about double the cost of untreated wood of the same species.

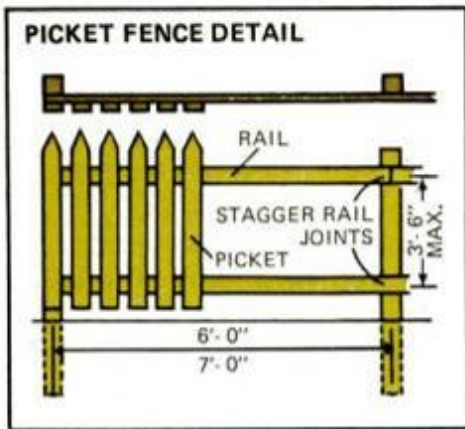
Pressure-treated lumber (usually yellow pine and fir) is stocked by





Creative variations fit their settings: 1. Alternating of boards on rails provides privacy without that closed-in feeling. 2. Gate stands out because vertical paneling contrasts with rest of fence. 3. Imposing panel fence defines yard boundary, while post-and-rail fence (foreground) divides interior spaces. 4. Board-and-board style with verticals creates a rustic garden backdrop. 5. Picket fence with elegant alternative to conventional tapered pickets. 6. Stately variation of board-and-board style has extended posts for formal effect.

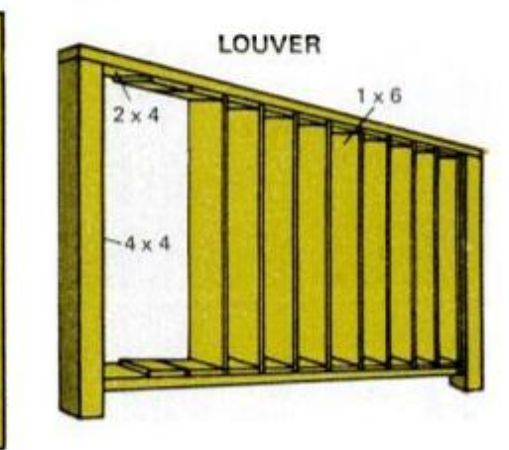
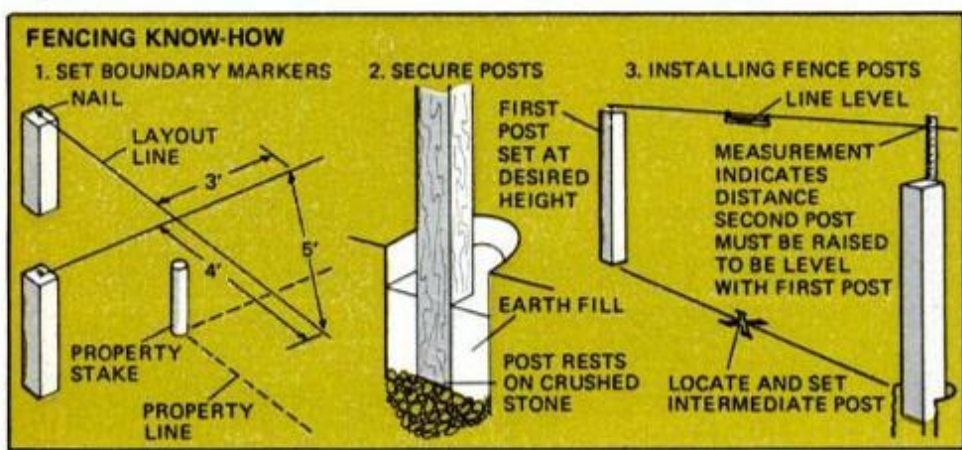
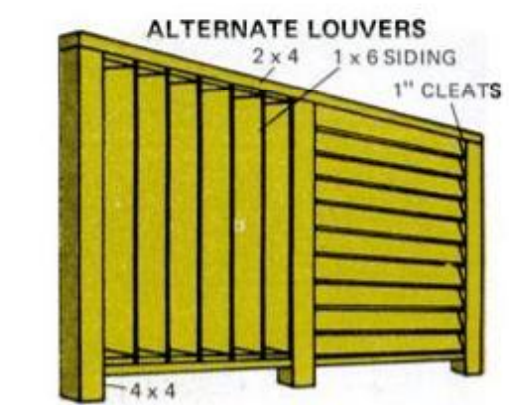
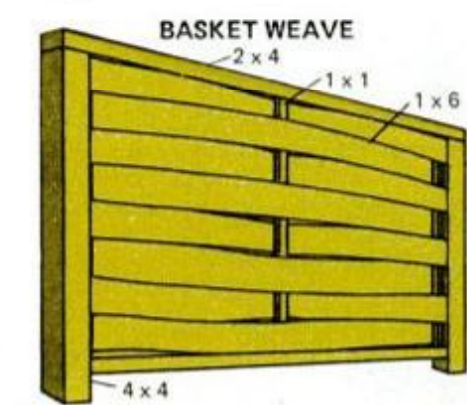
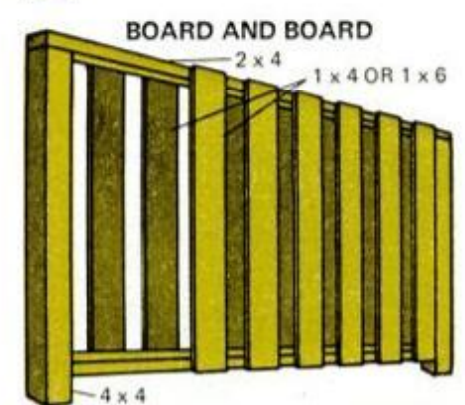
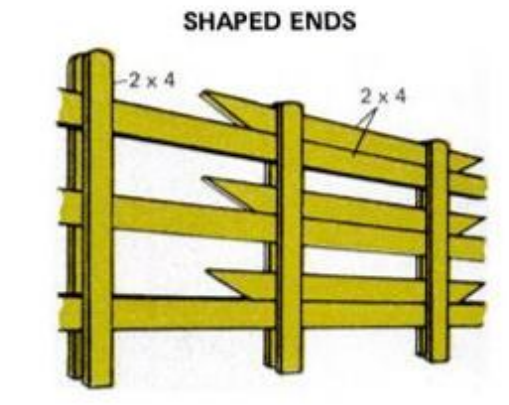
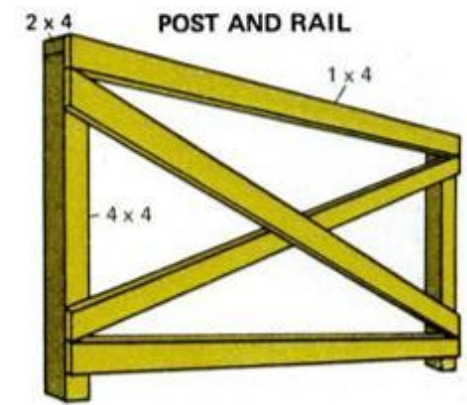
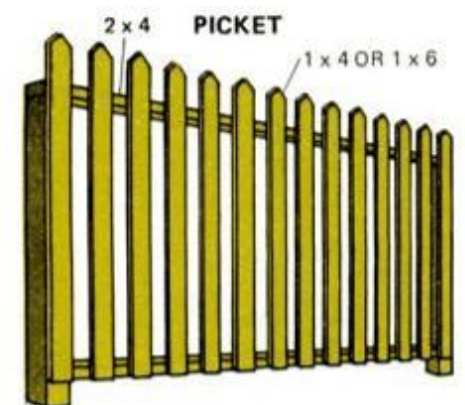




Picket fence in detail is constructed with 1x4 rails nailed to 4x4 posts. Alternative method below butts top rails over every other post. Bottom rail is toenailed between posts on 8-ft. centers. Extend pickets at least 6 in. above top rail and 2 in. below bottom. Average fence height is 36 in., with a 2-in. minimum ground clearance.



Alternating boards on either side of rails sets up wind screen, but also allows ventilation to prevent moisture buildup. Top rail acts as cap to post's end grain, thereby protecting it from rot.



many supply yards in common dimensions—including 4x4, 2x4 and 2x6. Salts used to treat Wolmanized lumber are stable and will not leach into soil or affect plantings. For sure identification of Wolmanized fencing products, look for the label "Outdoor Wood" stamped on stock.

Although results are not as satisfactory as with pressure-treated wood, you can treat fir posts yourself. Fill a

50-gal. drum with copper naphthenate solution to a height as deep as your post holes—plus a few inches. Let post bottoms soak in this for 24 to 48 hours.

Railings and panels are less critical than posts, but should be at least brush-treated with wood preservatives or primer and paint. Remember, all joints are moisture traps and must be treated before assembly.

Tools and techniques

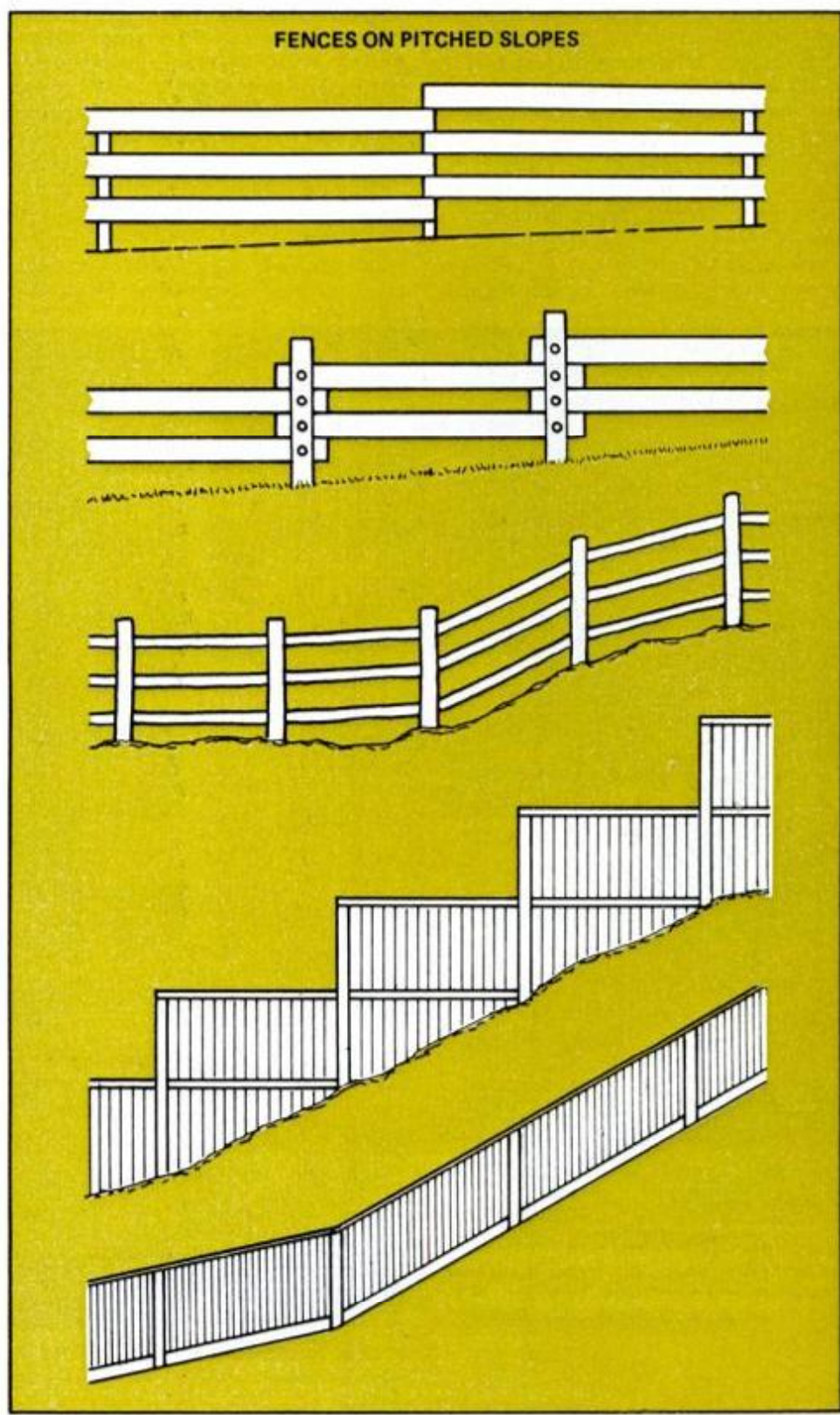
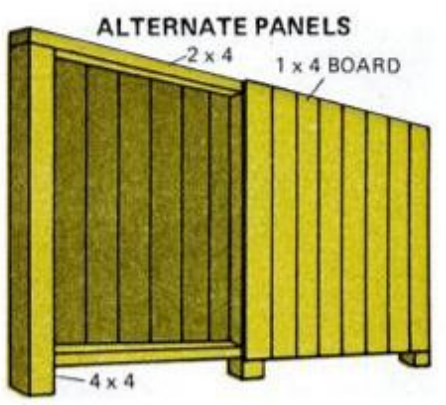
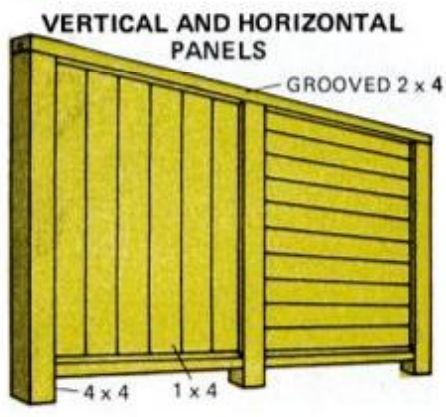
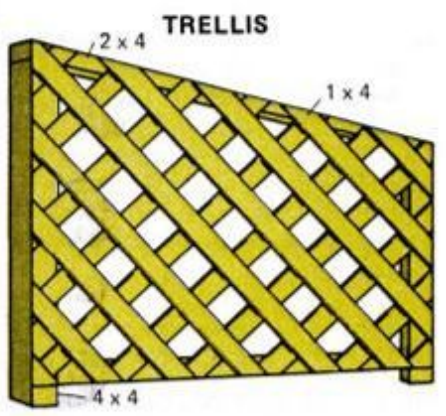
A clamshell post-hole digger makes it easy to break ground and start the hole. When the hole narrows, an auger-type digger works better to deepen it. These tools and gasoline-powered augers are available at many rental shops. You'll also need a 2x4 for tamping, a line level, carpenter's level, mason's line, shovel, pickaxe, hammer, saw and 16-ft. tape measure.



Tall picket variation has verticals nailed to both sides of three rails. Leave enough space between pickets and other types of vertical paneling to permit easy painting or staining.



Paneled and louvered fences on pitched grades are easier to construct in a stepped sequence than canted to fit a hillside. Picket and post-and-rail fences are more suited to the contours.



Start by locating your property lines and eliminating any possibility of building on your neighbor's plot. Use a 3-4-5 triangle to obtain perfectly square corners where necessary (see diagram) *Caution:* Some zoning laws require fences to be a minimum distance from property lines—so offset accordingly.

After locating corners or end points,
[\(Please turn to page 180\)](#)

Gardening with pebbles and rocks

A successful landscape takes its cue from nature. Here's how to plan your setting with stones.

Some of nature's most striking scenery is composed of stones. A stark surrounding with a solitary boulder, an expanse of flat ground covered with colorful pebbles and an alpine garden of greenery and blooming plants nestled among rocks—the artistry of these landscapes involves the use of stones.

Used as a ground cover, pebbles, gravel and other loose aggregate can

take the place of greenery to provide an easily maintained ground cover that needs no water. They can also substitute for concrete as inexpensive paving.

Used in a rock garden, rocks are the backbone of the garden design. The most colorful type of rock garden is a re-creation of an alpine setting—the mountainous area above the tree line where wild flowers grow in rock crevices. A well-designed rock garden looks like natural alpine growth transplanted to where it can be appreciated.

Whether you use rock for ground cover or an alpine garden, natural-looking stones that blend with neighboring buildings and other outdoor surfaces are the most convincing. Stone sup-

pliers are listed in your classified directory under "Stone-natural," "Garden Supplies" or "Building Supplies."

Laying a ground cover

Rounded pebbles, sharp-edged crushed rock and rock pulverized to a fine texture make satisfactory ground covers. You'll want to purchase enough of the larger stones to cover the area to a 2 to 3-in. depth. Cover to a 2 to 4-in. depth with the pulverized materials. Prices will vary drastically, depending on the type and quantity of material—25 cents to \$2 per sq. ft., possibly more.

Before you position the ground cov-
(Please turn to page 146)



Stones bonded together with epoxy make an attractive, easy-care, nonskid surface. Designed by Astro-Stone, Brooklyn, N.Y., the covering is professionally installed.



Glacial boulders are the basis for the rock garden at Brooklyn Botanic Garden. Blooms are pink phlox, yellow golden-tuft, white candytuft and grape-hyacinth.

Garden rocks not only visually separate a planting bed, but physically protect it from stray feet. Here rocks also serve as a retaining wall for the garden soil.



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INTERNATIONAL HARVESTER

GARDENING WITH PEBBLES, ROCKS

(Continued from page 144)

er, grade the area. Now is the time to install brick, railroad ties or other edging if you wish.

After the initial preparation, you're ready to place the stones. You begin by unloading from a wheelbarrow or dump truck. Then use a rake to smooth them over the area. To keep the ground cover looking its best after placement, it will need an occasional raking and weeding by hand or chemical spray. You may prefer laying perforated plastic sheet before placing the rocks, to combat weed growth.

Planning a rock garden

A rock garden requires more preparation than rock used in a ground cover. Two basic requirements for a successful rock garden are a location proper for such a garden and rocks that look at home there.

Location. A gentle slope is the most natural setting, preferably slanting toward the south or southwest. You can make a slight slope if you have flat land. You may want to begin with an area of 1 or 2 sq. yds; rock gardens don't have to be large. Any spot that gets 6 hours of sunlight daily is a possibility.

The location should have easy access for depositing rocks and be near a water source for easy watering, particularly if you plan to have a pool or waterfall.

Rocks. Use of only one type of rock arranged naturally produces the most attractive result. Rocks from your locale are the least expensive and most convincing. Choose porous rocks such as limestone, shale and sandstone.

Soil. Most alpine plants appreciate good drainage more than common garden flowers. A good soil mixture that will facilitate drainage is made up of equal parts of loam or good topsoil that is easily crumbled, humus in the form of leaf-mold or well-rotted garden compost and grit, such as coarse sand or fine stone chips. True alpiners prefer a lean diet. For the most part, they don't need fertilizers.

Design. Draw a scale plan of the garden before you begin work. Note any natural formations and slopes and draw in the proposed rock placement. You might plan to have a small pool nestled at the foot of a rock ledge. Make use of limited space by building a wall garden, but be sure you have plenty of soil between rocks for plant roots. You could use only a few rocks with flowers grouped around them.

Preparing the site

Start work on the soil by spading to a 6-in. depth and removing large weed



Water—a pool, fountain or waterfall—adds the finishing touch to a rock garden. This waterfall comes in an easy-to-assemble kit from Little Giant, Oklahoma City, Okla.



Stone materials combined successfully in this ground cover include white marble chips, black slate circles and lightweight boulders from Featherock, Burbank, Calif.



Sedum and sempervivum, often called hen and chicks, are good rock-garden candidates. They grow well with little soil and moisture and need little upkeep.

roots. Then spread the prepared soil.

Begin laying larger rocks naturally on their broadest face—not on end like tombstones—burying them securely in the soil. Tilt the rocks into the soil so water that falls on them will run toward plant roots. If the rocks are stratified so they show fine horizontal lines, place the rocks so all lines run parallel. Leave plenty of soil pockets for flowers.

Finally, give your garden some life with color and foliage plants. Your garden center can help you choose. You'll want low shrubs like creeping juniper and dwarf mugho pine. Plant some ground foliage, such as sedum and artemisia. Then add blooming plants, such as alyssum, phlox, vinca and portulaca. **PM**

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WORLD'S STANDARD IN WOODWORKING EQUIPMENT

How to have a greenhouse this spring

From a window greenhouse to a freestanding structure, here's what you should know about each before you buy.

If your living room is beginning to resemble a dense jungle, or if you've considered renting out one of your children due to rising food costs, it's time for you to think about buying a greenhouse. The right-size one can hold your pet plants with room to spare for growing vegetables. It can also be used as a family room or greenery-filled breakfast nook.

Greenhouse manufacturers are competing for your dollars by offering relatively low-cost kits of pre-cut panels and frames for you to erect. It pays to know about the many types of



Glass-to-ground design of National's Eaglet greenhouse (about 13 x 16½ ft.) gives light to ground plants. Cost is \$1700.



Vegetable Factory's 5½ x 16-ft. lean-to has double acrylic-fiberglass panels separated by an air space to help retain heat. Cost of the unit is \$1200.

A greenhouse attached to the house offers endless possibilities for use as an extra room. This glass-and-aluminum unit is by Lord and Burnham.



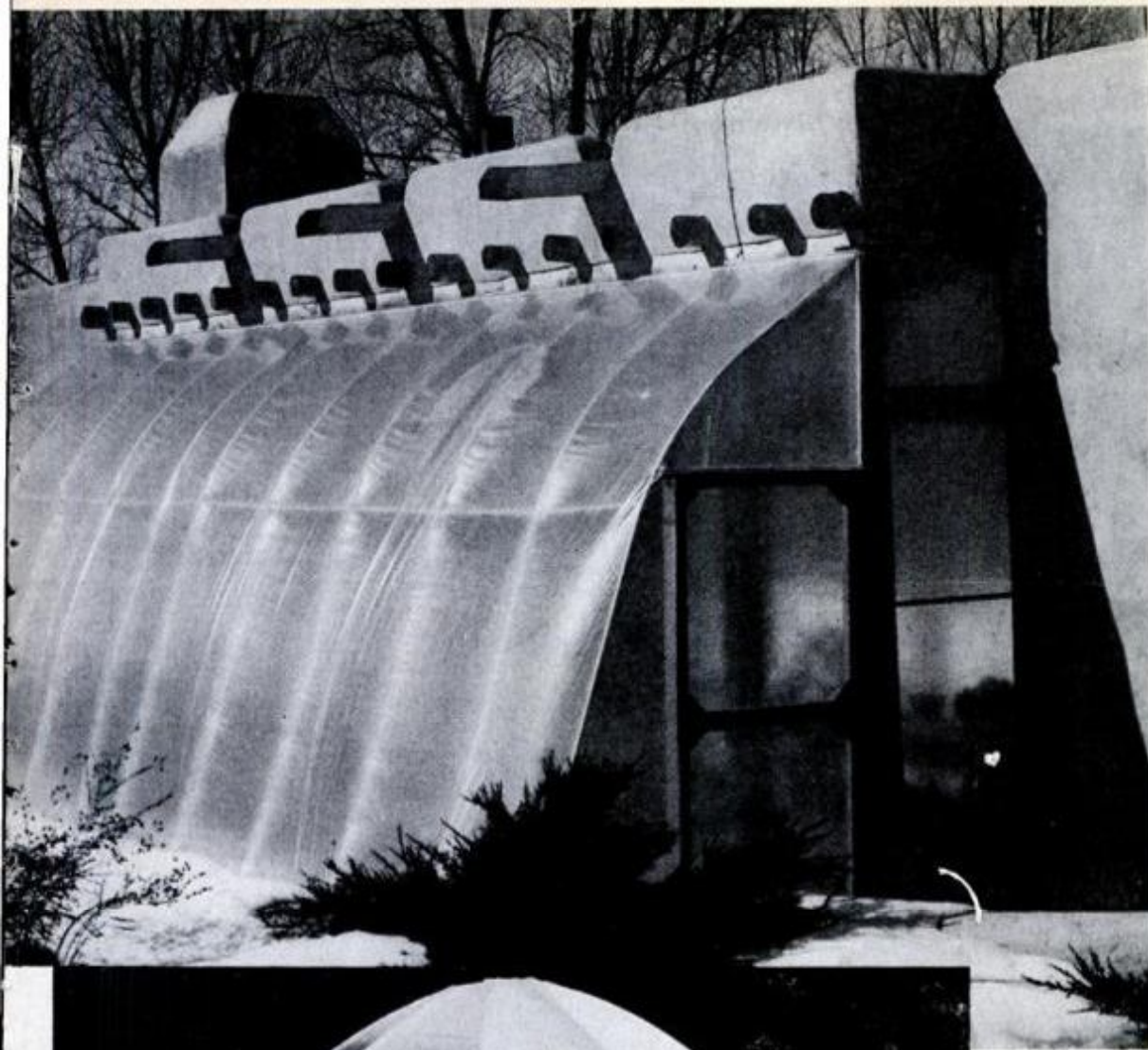
Texas Greenhouse's Oasis is relatively inexpensive at \$625. It is 10 x 12 ft., clear or green fiberglass on redwood frame.

greenhouse kits on the market before you make your purchase.

Choosing a greenhouse

Besides price, the considerations in choosing a greenhouse include size, construction materials and style.

To determine the size greenhouse you'll need, consider how you intend to use it, how many plants you plan to grow and the space you have available. It's surprising how quickly plants can



Besides being a greenhouse, a Solar Room unit is a heat source for your home. The frame consists of an aluminum perimeter with galvanized steel struts. A double polyethylene layer of glazing inflated by a blower transmits 90 percent of the available solar radiation into the room. A 7 x 30 ft. unit costs \$800.



The portable Gro-dome by Botanical Environments requires no foundation. A pea-gravel floor cover is suggested. The dome has a PVC frame with polyethylene glazing. It can be assembled without tools. Cost of a 13-ft.-dia. dome like one above is \$100.



Dutch doors are an added feature of this redwood-frame unit with fiberglass panels. The 4x8-ft. house is \$113 from Reimuller.

fill a greenhouse, so be liberal in judging your space requirements.

Most greenhouse frames are made of aluminum, plastic or redwood. Aluminum frames are often the longest-lasting. Usually plastic frames are portable but not as long-lasting as aluminum ones. In addition to their durability, redwood frames are probably the most attractive.

Glass, fiberglass and polyethylene plastic are common covering materi-

als. Ordinary glass will transmit light best, but is easily broken. Particularly in cold climates where freezing and thawing result in ground heaving, glass-paneled houses must have a permanent foundation. Fiberglass is less expensive than glass, is shatter-resistant to hail (and baseballs) and provides good light diffusion so there are no hot spots. Plastics, like polyethylene, are quite inexpensive, but need replacing frequently.

There are three basic greenhouse styles. The even-span house has a roof with three walls and an open side that fits against a building. Add a fourth wall and the unit is *free-standing*. A *lean-to* greenhouse has one major wall, usually curving up to form a roof, and must attach to a building.

Some units have glass extending to the ground. Others have a waist-high wall. Greenhouse makers give foundation recommendations and send de-



If you have a small yard, satisfy your green-thumb instinct with a window greenhouse. This one, by Janco, is aluminum with glass panels sealed to guard against leaks and drafts. Accessory fluorescent lights attach to the shelves. A 16x48x60-in. window unit is \$170.

tailed construction information when they receive your order.

Greenhouse accessories

Allow for accessories in your budget. A heating system, for example, is necessary, and an automatic one will eliminate many problems. Louver ventilation systems will probably be built into your greenhouse, but additional automatic ventilation may be needed. Most greenhouses require some type of shading such as roll-up shades. Benches and shelves, tools, potting

soil, fertilizers and lights for night work complete the basic needs.

Planning the greenhouse

Your greenhouse should be located where plants can get full sun for a half-day in winter. South, southeast or southwest exposures are best.

Check your local building codes to

see if a building permit is needed. Or if there are restrictions on greenhouse use: It must be closed off from direct access to the house; its use as a bedroom may not be permitted, and so on.

To insure successful growth of your plants, begin with just a few. Later, you can diversify as you become familiar with your greenhouse. **PM**

GREENHOUSE MANUFACTURERS AND PLANS

- Aluminum Greenhouses, Inc., 14605 Lorain Ave., Cleveland, Ohio 44111.
- Botanical Environments, 1044 Pioneer Way, Suite C, El Cajon, Calif. 92020.
- W. Atlee Burpee Co., 300 Park Ave., Warminster, Pa. 18974.
- Lord and Burnham, Irvington, N.Y. 10533.
- McGregor Greenhouses, Box 36-PM, Santa Cruz, Calif. 95063.
- National Greenhouse Co., Box 100, Pana, Ill. 62557.
- J.A. Nearing Co., Inc. (Janco), 9390 Davis Ave., Laurel, Md. 20810.
- Popular Mechanics Plans Library (Plexiglass window greenhouse), 1014 Radio City Station, New York, N.Y. 10019; send check or money order for \$2.95.
- Peter Reimuller The Greenhouseman, 960 17th Ave., Santa Cruz, Calif. 95062.
- Solar Room Co., Box 1377, Taos, N.M. 87571.
- Texas Greenhouse Co., Inc., 2717 St. Louis Ave., Fort Worth, Tex. 76110.
- Vegetable Factory Greenhouses, Box 2235, Grand Central Station, New York, N.Y. 10017.



1 To erect this Janco unit, first sort the parts.



2 Assemble the frame from base, working upward.



3 Place the frame on a permanent foundation.



4 Attach the ridge and sill sections together.



5 Install the gable ends to the freestanding unit.



6 Next, add the roof sash to the greenhouse.



7 Apply glazing tape, place glass and seal the joint.



8 Lock the glass in place with bar cap and screws.



9 Repeat steps 7 and 8 for the rest of the glazing.



10 Completed unit with benches ready to paint.

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Plane it.



Hammer it.



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Shave it.



Level it.



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Grow under glass to get a jump on the season

by James Underwood Crockett

The growing season is never long enough. One way to stretch it is to set out six-week-old seedlings when the weather permits, rather than to start with seeds. Here are three pieces of inexpensive, portable outdoor equipment which provide the temperature and light that seedlings need to get them ready for planting.

Cold frame

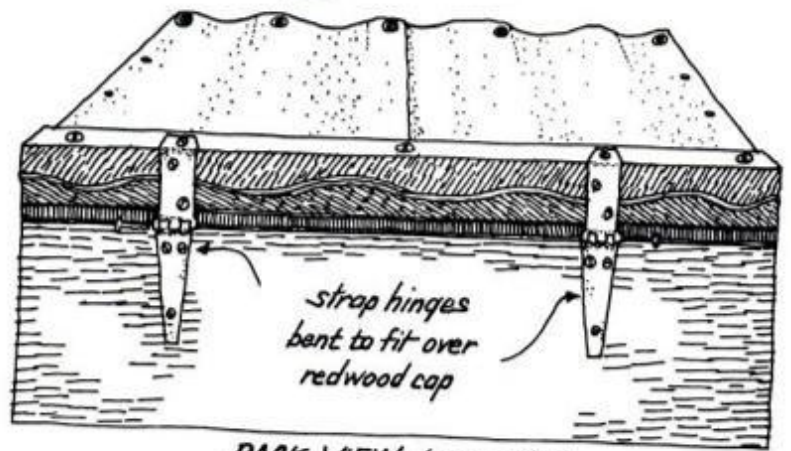
Cold frames are simply glass or plastic-covered boxes that store the sun's heat while giving the gardener some control over temperatures with ventilation. They can be used all year—in spring to harden off seedlings, through the growing season to grow plants from smaller containers, in the summer as nursery beds and in winter to store plants.

In spring, proper temperature is the critical element in a cold frame. During the winter the goal is to maintain temperatures just above freezing to hold bulbs, herbs and perennials in suspended animation. In October I pack soil or leaves around the walls. Before the ground freezes, I cover the frames with water-repellent tarps.

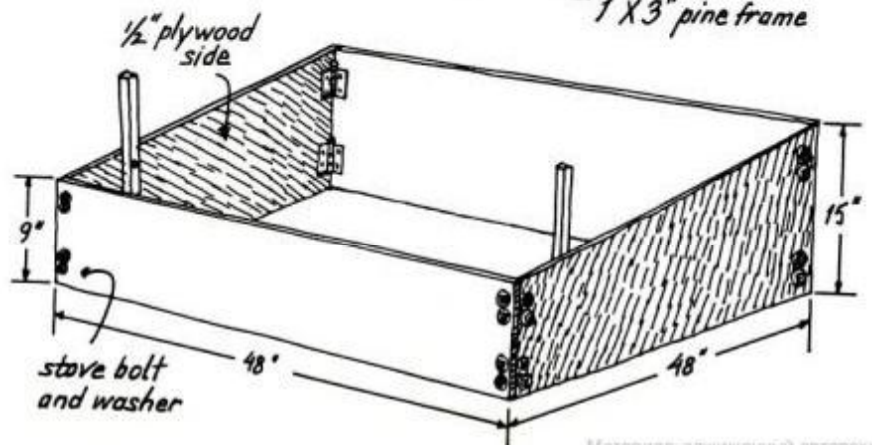
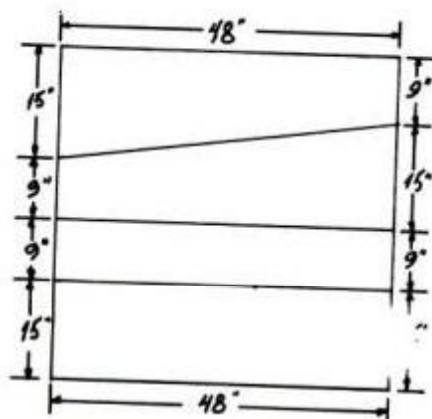
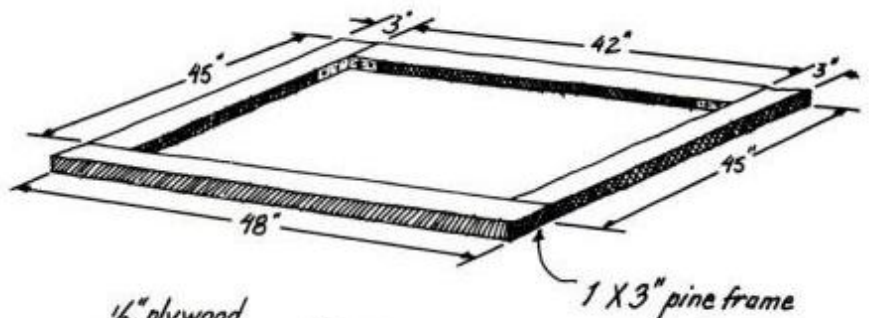
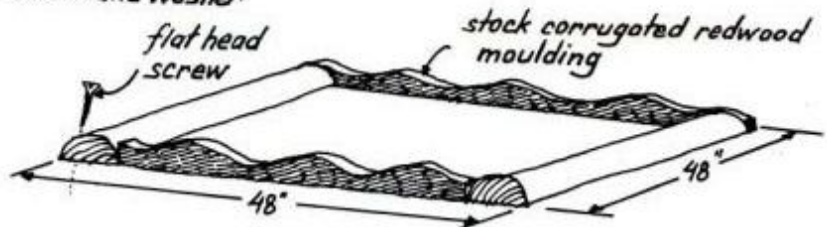
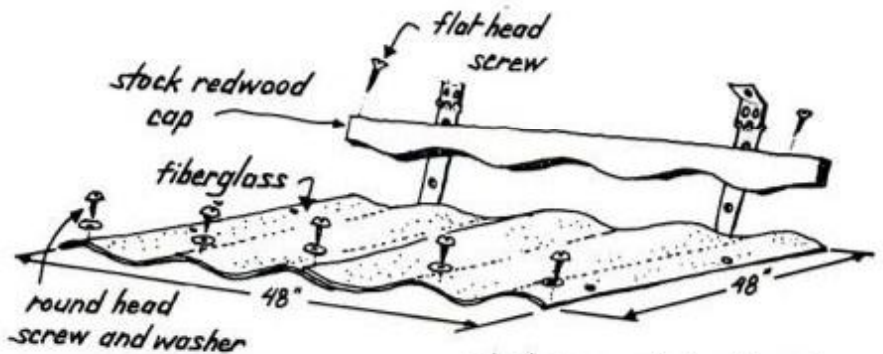
Building the cold frame

The walls of the box are cut from 1/2-in. exterior-grade plywood and assembled with two 2x2-in. galvanized loose-pin

(Please turn to page 154)



BACK VIEW (assembled)



McCulloch. You've got to saw it to believe it.



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Or the Pro Mac 10-10, built for heavy-duty cutting. Its powerful 3.3 cu. in. engine and 16"

sprocket tip bar will make short work of just about any job. Plus Chain Brake/Hand Guard and automatic and manual oiling. It's McCulloch's best selling saw.

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the dam.*

*Yeah—
my teeth need
a rest. /*



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GROW UNDER GLASS

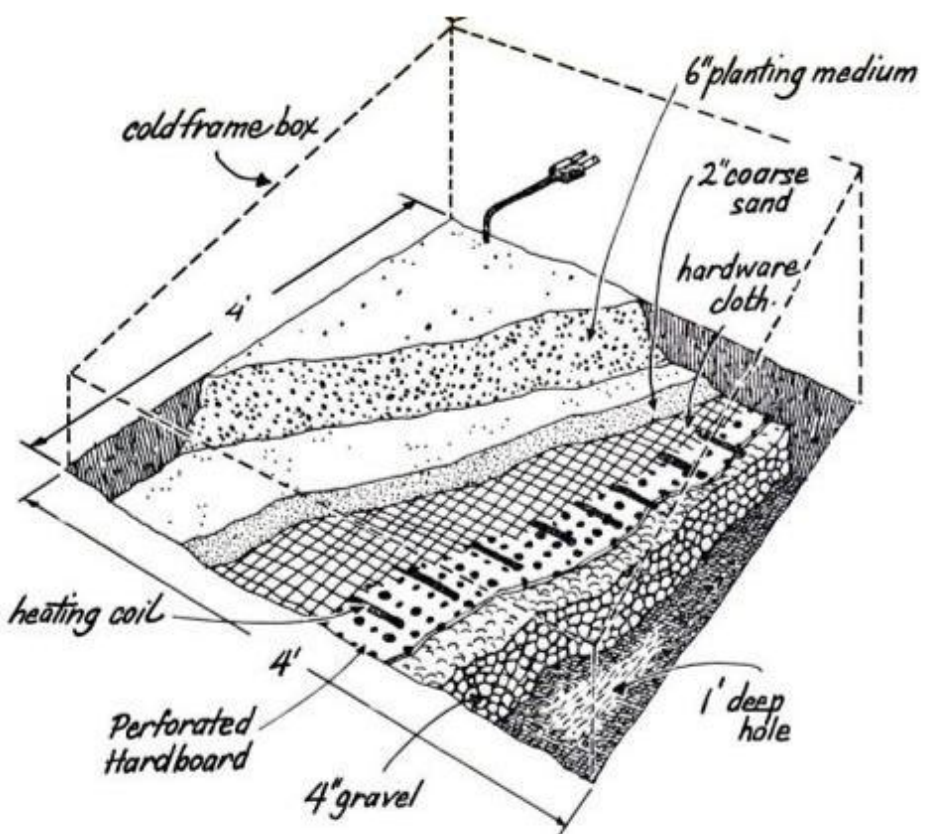
(Continued from page 152)

hinges at each corner. Ventilation is provided by two 1-ft. stakes screwed slightly off-center so that they swivel into two support positions.

The cover is assembled on a frame of 1x3-in. pine with four 2-in. angle irons. The second layer consists of two lengths of corrugated redwood molding along the front and back of the cover and 1½-in. half-round redwood molding along the sides. Next, two 26x48-in. panels of translucent fiberglass overlap in the center fastened with ¾-in. No. 8 roundhead wood screws and washers. Secure the cover with a 4-ft. length of corrugated redwood across the back with 1¼-in. No. 8 flathead wood screws. The whole cover is fastened to the base with 4-in. loose-pin strap hinges. The hinges have to be bent to a 90° angle to wrap around the cover; smaller hinges aren't sturdy enough. We drive stakes into the soil behind the frame so the fully-opened cover can rest on them to take pressure off the hinges.

Hotbed

A hotbed is an inexpensive alternative to a greenhouse. It's a cold frame with plastic heating cables. I selected



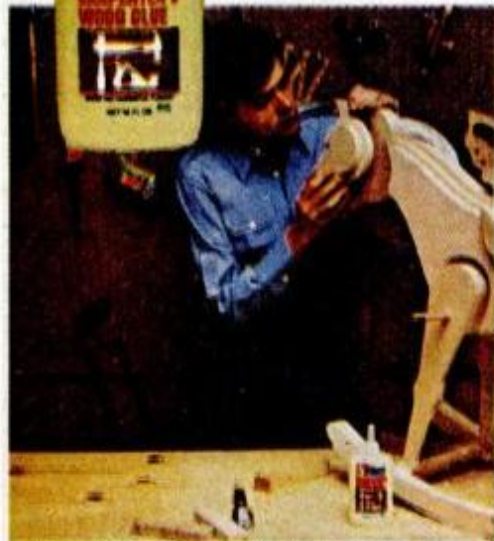
a sunny spot in our garden and excavated a 4-ft.-sq. area 1 ft. deep. On the bottom I put 4 in. of coarse gravel for drainage. Next I laid a sheet of ½-in. perforated hardboard, treated side down, then stapled the cable to it.

To protect the cables from a trow-

el or spade jab, I laid a 4-ft.-sq. sheet of galvanized hardware cloth over the wires. Then I spread 2 in. of coarse builders' sand to help distribute the heat evenly through the 6-in. planting medium which comprises equal parts of peat moss, topsoil and sand.



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It's also better because it "grabs" immediately and dries fast. Yet it allows realignment before it sets. So you can join surfaces as soon as it's applied.

Elmer's Carpenter's Wood Glue is also sandable, paintable and gumming resistant. Its non-toxic*, solvent-free formula also washes off your hands and project with water. So you won't get light spots when you stain near glue joints.

Elmer's. When results count.



*As defined by Federal Hazardous Substances Act.

When the cold-frame structure is placed over the heated foundation, it is ready for seed as early as February.

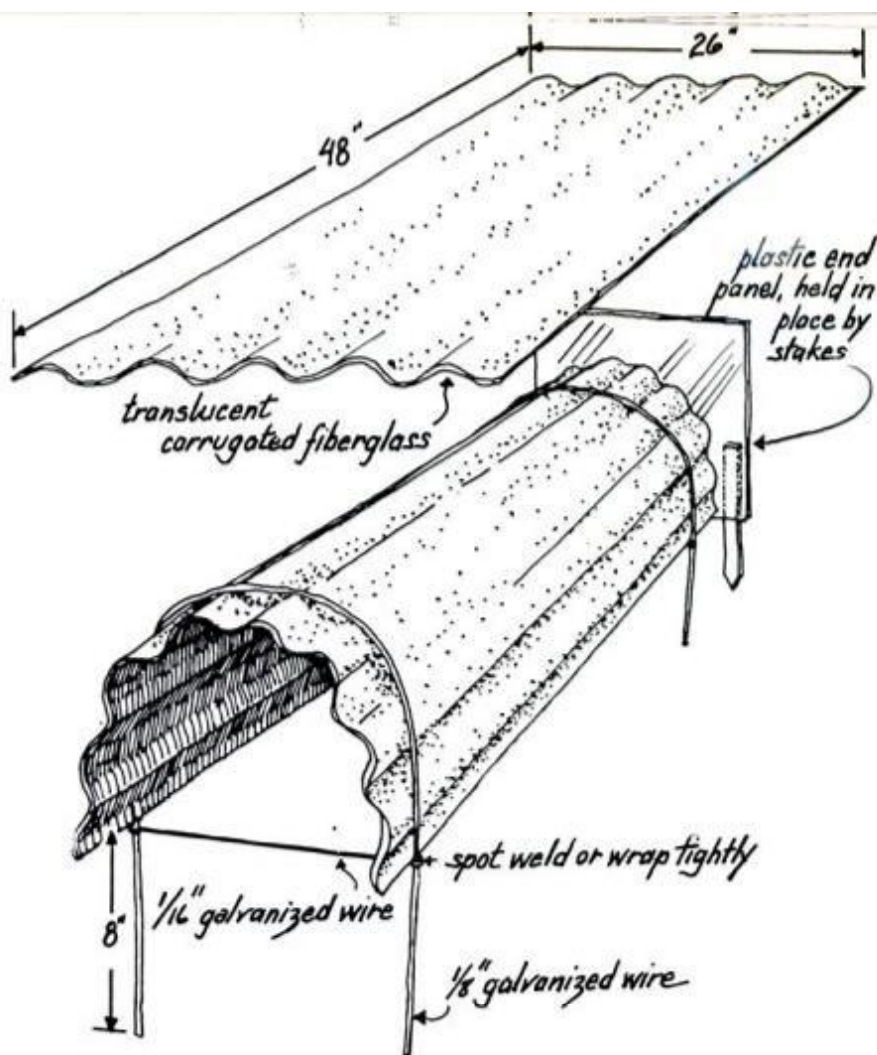
Hotbeds need ventilation so they won't overheat in sunny weather. They also require insulating carpet at night to trap the heat being produced. Crops should have a watering check every day so the seed can't dry out.

Cloche

A cloche is a protective structure for an entire garden row. But the cloche crops do call for some watchful attention. They need ventilation to prevent overheating on sunny days. They can be lifted off entirely or the ends can be removed to allow hot air to escape. The cloches should be raised occasionally to check that the seeds are getting the moisture they need.

Each section is made of a 26x48-in. panel of corrugated fiberglass, secured into a semicircular position with stiff wiring. The wiring projects off the bottom edge of the fiberglass to give each section legs to stick into the soil to hold it in place. A pair of crosswires keeps the fiberglass bowed like a Quonset hut.

FM



Excerpted from *Crockett's Victory Garden* by James Underwood Crockett; Little, Brown & Co., (paperback, \$9.95; hardcover, \$17.50).

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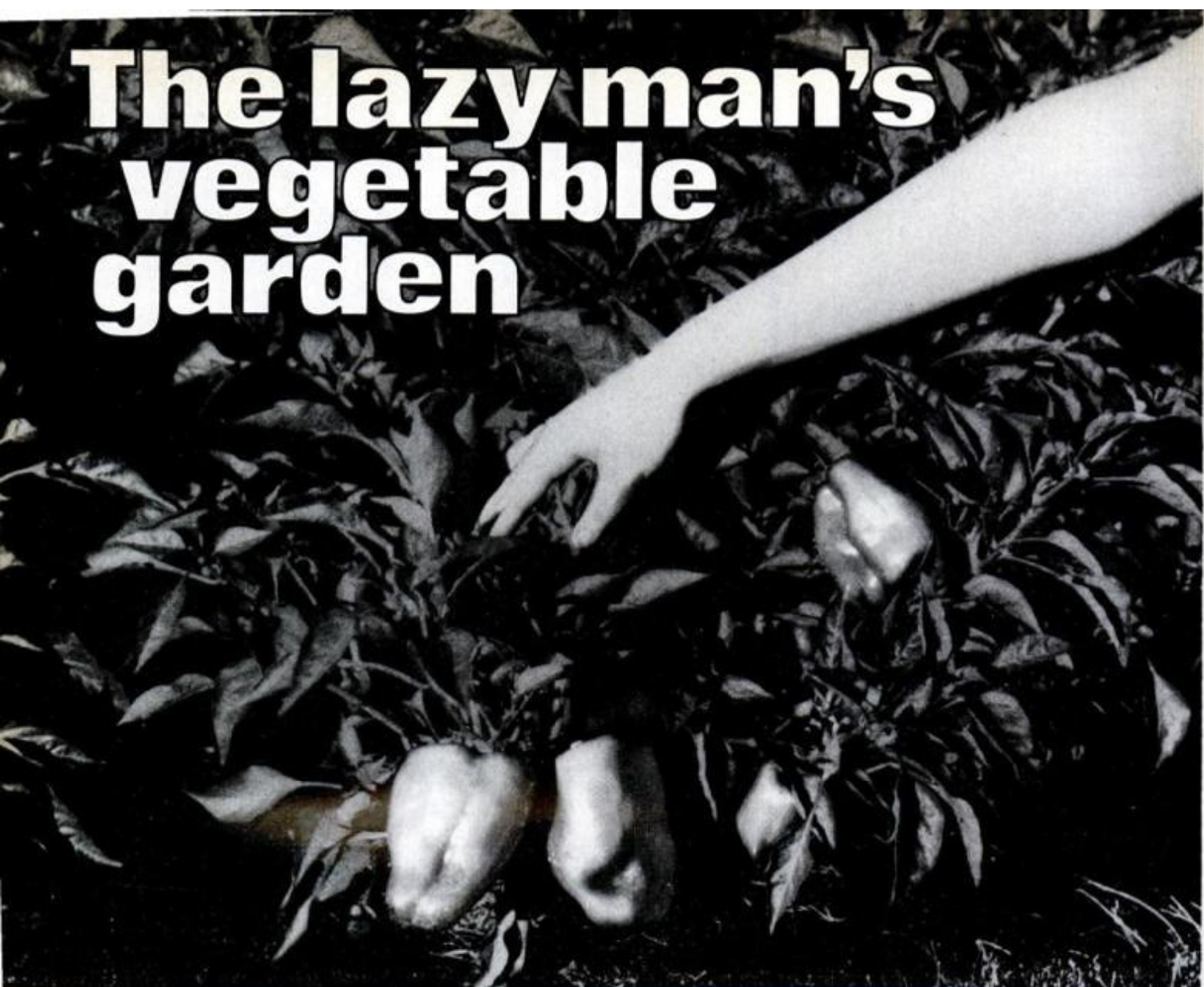
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The lazy man's vegetable garden



by James Dwyer
and John Albert

Vegetable gardening need not be the back-breaking, time-consuming chore that many make it. If you want a vegetable garden in order to have something to keep you busy, if you are one of those remarkably industrious folk whose idea of a good time is a weekend on hands and knees pulling weeds, read no further; this project will just spoil your fun. But if you're an arm-chair gardener who dreams of putting a few plants in the ground and waiting for them to give back food, read on—the 45-minute garden is meant for you.

It requires a small investment. You will need a roll of black plastic film 3 feet wide and as long as your garden plot is to be. You will also need a bulb planter, a razor blade, some fertilizer and a source of water. And of course, you'll need some plants. For a fast harvest with the least effort, set out seedlings rather than planting seed outdoors. You can start your own in small plastic

(Please turn to page 159)

To start your lazy man's 45-minute garden, lay out a plot 2 feet, 9 inches wide and 15 feet or more long. Cut into sod—to depth of 2 in.—along perimeter.





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But this is where nature needs some help. There's a desperate competition for food among the roots your lawn already has. Your soil alone can't come up with the nutrition all those grass plants need to branch out and form new plants.

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And if you ever come by Marysville, Ohio, drop in. Take a look at our lawn.

THE LAZY MAN'S VEGETABLE GARDEN

(Continued from page 156)



After you've rolled out black plastic, tuck its edges under the sod in small trenches you've dug. Sod anchors the plastic.

pots or specially designed peat pots, or you can buy seedlings of most vegetables from garden supply centers when it is best to plant them. And you'll have to invest about 45 minutes of not-too-hard labor early in the spring.

Begin by marking out a strip of land 2 feet, 9 inches wide and as long as you wish. A 15-foot plot will probably produce enough fresh vegetables to keep a family of four well supplied during the summer and fall; for extra crops to can or freeze, plan on another 15 to 20 feet.

For the best exposure, lay the plot out with the long measure running east-west. Choose a fairly level, grassy spot that gets at least half a day of full sun throughout the growing season—the more sun the better. Avoid low spots and steep slopes; one floods when it rains, the other drains too fast. In general, a place where the grass grows thick and green is good for vegetables. The ideal spot is about midway down a very gentle south-facing slope.

Using the plastic film virtually eliminates weeding. Grass under the plastic decomposes and feeds plants. As photo shows, this type of garden can produce lush growth.



With a spade, cut through the sod about 2 inches deep, all along the perimeter of the plot. Then roll the sod back toward the outside, slicing through roots with the spade if necessary, to make a shallow trench. When you unroll the plastic film, the edges will fit into this trench to be covered over with the rolled-back sod.

Soak the plot with water, to which you have added a high-nitrogen-soluble fertilizer. (The high nitrogen content is valuable because the grass will die and decay after it is covered over, and the microorganisms that carry out the early stages of decomposition use up a great



With a bulb planter, it's easy to cut an even hole in plastic and remove a plug of sod. Now plant seedlings in the holes.

deal of nitrogen in the process.) Alternatively, apply well-rotted manure or compost at the rate of 75 lbs. per 100 square feet, and bonemeal at the rate of 10 lbs. per 100 square feet, and water the plot well.

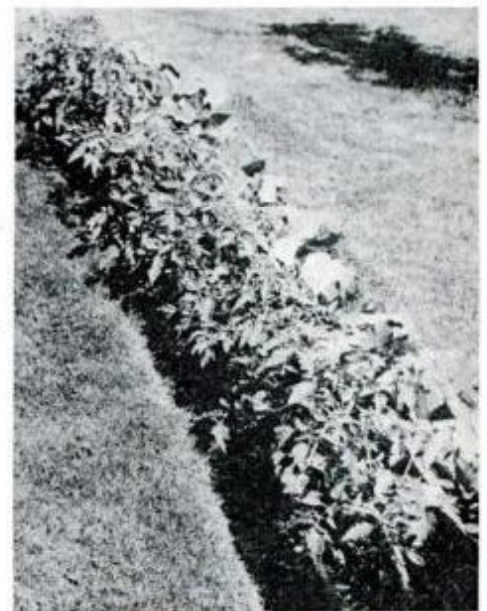
Start unrolling the plastic film at one end, tucking the edges into the trenches along the sides as you go and covering over with sod. When you have finished, tread the sod down firmly all around.

Use stakes and string to mark three equidistant rows along the length of the plot. At 1 to 1½-foot intervals along each line, cut a small "X" in the

plastic with a razor blade; stagger the intervals from one row to another so that no plant grows directly behind another. Then, with a bulb planter, remove a plug of sod where X marks each spot. The plug you remove should be no deeper than the planting depth of the seedling meant for that hole.

Place a plant in each hole. This is easiest done if each seedling is growing in a separate small pot; simply remove it from the pot, soil and all, and pop it into the hole. (Peat pots are even easier—there is nothing to remove.) Fill in around the seedling with loose soil if necessary. Be sure to plant tall-growing plants in the north row, short plants in the south row, so that all plants will get their fair share of sunlight.

For all practical purposes, your garden is now finished. The dark plastic eliminates weeds, holds in moisture, warms the soil in the spring, and helps keep it cool in summer. The grass



If you get an early start the "easy" garden can produce up to three crops a year in many parts of the country.

provides a continual source of nourishment as it slowly decomposes.

Some watering is needed

It may be necessary, from time to time, to water a little. Use a hose at medium flow to apply water directly into the holes—too fast a flow will dig up the soil at the base of plants, too slow will concentrate water around the stem rather than in the root feeding area a few inches away. In addition, the harvest will probably be enhanced by two or three applications of balanced soluble fertilizer during the growing season.

Next year, place your garden in another spot; the following year in another. Then, after two summers of "lying fallow," the original site of your garden will be ready to plant again. **PM**

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How to get the most from your garden tiller.

A good tiller is plow, disc, cultivator and sheet composting machine—all in one.

by Dick Raymond

If you are planning a garden of a quarter acre or more, you should consider buying a rotary tiller. With it you can do succession planting quickly and easily, raise green manure and cover crops, sheet-compost leaves, organic garbage, mulches and trimmings right in the garden and turn crop residues back to the soil.

The most efficient rotary tillers have their tines mounted in the rear. Although more expensive, they are a better investment than front-end tillers—which are little more than cultivating machines. I own a rear-end tiller made by Troy-Bilt and use it for more than preparing my soil in the

(Please turn to page 162)



Ariens tiller eliminates the backbreaking work involved with large vegetable garden.



Prepare deep, smooth seedbed in one operation—no discing, raking or spading. Hinged hood flap smooths out tilled bed.



Planting is made easy with an inexpensive furrower that attaches to the rear of tiller and opens trench as deep as 8 in.



Wings which attach to the furrower can be used for hilling and making raised rows as well as covering seed in furrow.



No wheel marks or footprints means you are not replanting seeds or spoiling fine, moisture-holding mulch from cultivation.

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The Gravelly 8-speed transmission is a good example. The result of years of testing, it delivers the precise speeds and power you need to do a lot of jobs a lot easier. And a lot better. You get steady power at its lowest ground speeds to handle the muscle jobs. You also get a choice of seven other speeds for mowing, hauling and other tasks.

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The exclusive Gravelly all-gear, direct drive from engine to attachments improves power transmission. And because it is all-gear, it completely eliminates bothersome belts which have always been prone to break, slip or wear out.

Also, the precision-cut gears run in an oil bath, for less friction and longer life.

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Gravelly offers both 2 and 4-wheel tractors which operate 10 different mowing attachments. Other attachments are available for plowing, tilling, cultivating, and snow removal. A Gravelly also powers a seeder, sprayer, compost shredder, thatcher, aerator and even a log splitter.

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In addition to building tractors to last, Gravelly wants its attachments to last, too. That's why most Gravelly attachments are completely compatible. This protects your investment by making sure that most Gravelly attachments are compatible with old and new tractors.

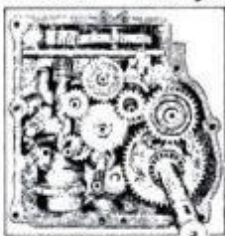
Which brings us to yet another reason our customers have grown so attached to us.

With as well as a Gravelly performs, you won't want to replace it.

With as well as a Gravelly is built, you probably won't have to.

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Till crop residues under after harvest. Otherwise, they become a haven for all kinds of pests and disease organisms.



Grow a green manure cover crop (such as alfalfa, rye, buckwheat) and then till it right into the soil to create a rich humus.

GARDEN TILLER

(Continued from page 160)

spring. When the first crops have gone by, I use it to till them under to get ready for new ones. I cultivate with it constantly and also work organic matter into the soil whenever possible. After my sweet corn has been harvested, I go down the row and work the standing stalks into the ground. This gives something back to the land—and takes nothing out except what we eat.

The rear-end tiller is a complete gardening machine that you will use even after the gardening season. If you collect a lot of leaves—or any other kind of organic matter—spread them on the garden 8 or 10 inches thick and work them right into the soil. The machine's tines will not only chop and bury this layer of organic material; they will mix it with the soil particles, making it decompose that much faster.

PM

Above story excerpted from *Down-to-Earth Vegetable Gardening Know-How*, written by Dick Raymond and published by Garden Way Publishing, Charlotte, Vt. 05445. Book price is \$5.95.

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How to avoid the 13 most common back-yard accidents

by Arthur J. Maher

What could be healthier than a quiet afternoon of outdoor work in your own back yard? Well—if you're not safety-conscious—a lot of things. Because the back yard is too often the place where an unsuspecting homeowner comes to grief.

The National Safety Council estimates that 2500 Americans are fatally injured each year in back-yard accidents of all kinds; an additional 500,000 are disabled. Figures from the federal Consumer Product Safety Commission (CPSC) show that in a 12-month period during 1976 and 1977, 113,000 people were treated in hospital emergency rooms for injuries from tool-related back-yard accidents.

Using CPSC data for the last six months of 1976 and the first six

months of 1977, we've determined which are the 13 most frequent kinds of back-yard accidents and ranked them in order of frequency. They account for 79,431 of all the accidents.

The figures for these 13 worst hazards present a staggering picture, but don't tell the entire tale. Many implements in the yard—particularly power equipment—can be lethal.

You still don't really have the whole story, though. Not all yard accidents wind up classified as such—which means that the statistics tend to be conservative.

It all adds up to this: Be careful when you're working in your yard, and when anyone else is. The safety pointers that follow will help you avoid the most prevalent hazards. The directions packed with your tools give further help. Read them before using a

tool. Learn to respect the equipment you use. And never relax your vigilance—that means looking out for children, pets and others who could get themselves into trouble with what you're doing. The unexpected can happen—not only to the other guy, but to you or someone you love. Don't let yourself or anyone close to you fall victim to the back yard's unlucky 13.

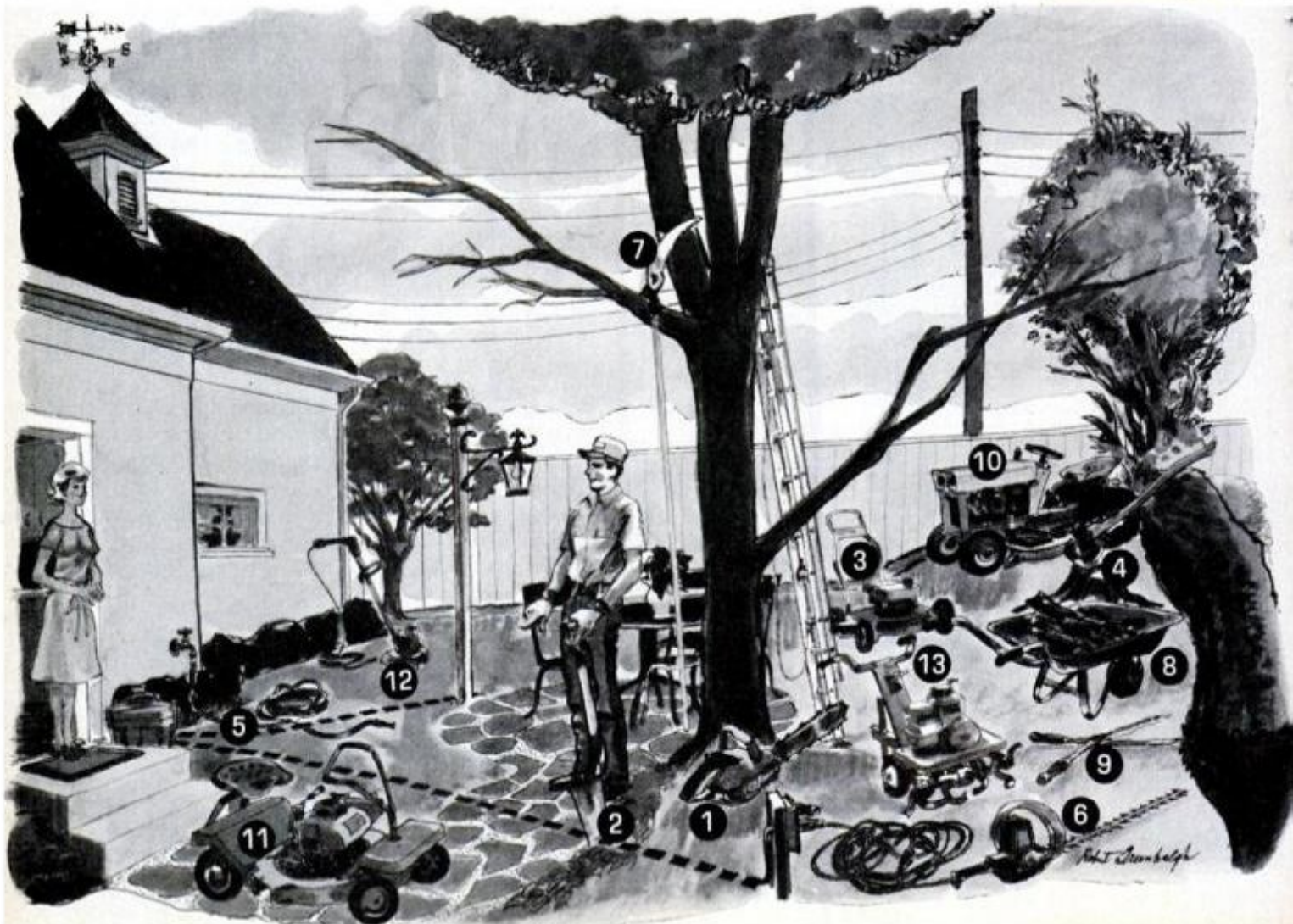
1 Chain saws

Accidents per year: 14,400

PROTECTION:

- Always start on a firm, even surface, preferably a stump.
- Maintain correct chain tension.
- Keep chain sharp.

(Please turn to page 166)



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Watch where you're going with a garden tractor—especially when backing up.

- Protect your ears.
- Cut away from your body.
- Don't stand under limbs you're cutting.
- Keep running saw in cutting position.
- Keep both hands on handles.
- Make no sudden swings of your body.
- Turn saw off before walking to next cutting area.
- Avoid power lines when pruning.
- Wear goggles or safety glasses.

The best ear protection is a pair of shooter's muffs or fitted earplugs, which are harder to get. Form-fitting wax or foam plugs, drugstore items, are also good. Cotton is useless. If your ears ring when you stop the saw, you've inflicted permanent damage on your hearing, even if only a little.

Most saws drown out voices, so be on the lookout for people approaching you unheard, especially children. If you see someone shouting or gesturing, stop the saw.

A tight chain wears out; a loose one binds or breaks. Never check tension with bare hands. Professionals sharpen chains before starting work—some even sharpen at lunch time.



Power edgers kick up debris and throw it hard. Clear the area before you start.

2 Rakes, shovels, spades, hoes, pitchforks, trowels, other hand tools

Accidents per year: 13,200

PROTECTION:

- Don't leave tools lying around.
- Avoid digging near underground wires, pipes, gas lines.
- Inspect handles for splinters.
- Repair or replace loose, split or cracked handles.
- Keep spectators away when you're using a pick or sledge.

Yes, people still bang themselves in the head or the eye by stepping on rakes and hoes. To find the locations of underground pipes, wires and gas lines, you'll probably have to ask for help from the utility companies. Otherwise, locate them with a metal detector. If buying a new house, insist that the builder give you the locations. Once you know where they are, place small stakes or make a detailed plot plan for your permanent records.

3 Power mowers

Accidents per year: 11,000

PROTECTION:

- Observe power-tool precautions.
- Mow along sides of slope, never up or down.
- Don't mow wet grass or on rough ground.
- Set the blade high for tall grass and uneven ground.
- Wear goggles or safety glasses.
- Use a collection bag (except with mulching mowers).
- Sharpen reel-type mowers only with a tool made for the purpose.

Be especially careful about onlooker safety—and about disconnecting the sparkplug or power cord when stopping the engine. If the blade is accidentally moved, a gasoline engine can restart.

Mowing up or down a slope can cause the mower to pull away from you or roll back over you. Why not mow wet grass? Because the mower can slip and slide out of control; with electric mowers, there's also a shock hazard.

4 Hatchets and axes

Accidents per year: 10,100

PROTECTION:

- Beginners should use a single-bit ax.
- Be sure handle is tight.
- Repair or replace cracked or split handle, remove splinters.
- Never brace wood with your foot.
- Wear goggles or safety glasses.
- Keep onlookers well away.
- Be sure you have a clear swing.

Power-tool precautions

Don't let kids operate power tools. Keep all safety shields in place and well maintained.

Know how to turn the tool off quickly.

Clear ground of pebbles, debris, toys—anything that can be thrown by blades.

Keep onlookers well away—especially kids.

Start the engine outdoors—even a garage is unsafe.

Refuel outdoors, too.

Use proper gasoline can or funnel. Don't smoke around gasoline.

Wipe up spilled gasoline before you start the engine.

Never refuel with the engine running or still hot.

Refuel away from your work area.

Don't restart the engine where you've refueled it.

Any time you stop the engine to refuel, store the tool, make adjustments or clear blades, immediately disconnect sparkplugs or power cords.

Don't work on wet ground.

Never step on power cords.

With electric tools, always use ground-fault circuit interrupters—three-wire cords, rubber gloves and boots are not sufficient protection.



Turn the little hitchh'ker down—a riding mower is a cutting tool, not a toy car.

General safety rules

Always wear industrial shoes, preferably with high tops and metal toe protection.

Always wear tough work gloves.

Be sure you have firm footing, especially when using power tools or cutting tools.

Keep all equipment in good shape.

Keep cutting edges sharp.

Store tools away from kids and pets.

- Keep blades sharp.
- Chop wood on wood.
- Don't use an ax as a sledgehammer.

A dull ax or hatchet skips out of control and is more apt to cause injury than a sharp one. Loose handles can be tightened with new wedges or by a half-hour soak in water, but a wood-swelling compound or epoxy tightens permanently. Remember that kids love to play woodsman—so store all your axes and hatchets well out of their reach.

5 Hoses, sprinklers, nozzles

Accidents per year: 8400

PROTECTION:

- Buy hoses of visible colors.
- Don't leave unused hoses or sprinklers lying around.
- Don't engage in horseplay or let kids fool with hoses.

A green hose placed in green grass is just about perfectly camouflaged. Bright colors such as red and yellow, although they are harder to find in stores, are much safer. Horseplay can result in broken teeth or nasty cuts from flailing nozzles—not to mention eye and ear injuries from high-speed water streams.

6 Power hedge trimmers

Accidents per year: 6800

PROTECTION:

- Observe power-tool precautions.
- Keep cord behind tool—never drape it over a hedge.
- Don't work on wet hedges or stand on wet ground.
- Keep hands on handles and tool in cutting position.
- Keep blades sharp and oiled.

It's amazing how easy it is to cut a trimmer cord, sending electricity through your body. A ground-fault circuit interrupter is vital!

7 Pruning equipment, including ladders

Accidents per year: 2900

PROTECTION:

- Stay at least 10 ft. away from electric power lines.
- Watch where limbs fall.
- Be sure ladder is firmly set on ground.
- Don't play Tarzan.
- Test all limbs before putting your full weight on them.

The power-line hazard cannot be overstressed. It's far too easy to cut into a power line, with obvious results. But also watch limbs near power lines

—if one contacts a line the shock can kill you. Or a falling limb can bridge a power line and your house gutters, electrifying them—or touch an aluminum ladder, making it lethal. Be extremely careful near power lines.

8 Wheelbarrows, lawn carts

Accidents per year: 2520

PROTECTION:

- Beginners should consider using two-wheeled carts, but if you do use a single-wheel barrow, be sure not to overload or unbalance it.
- Lift with your legs, not your back.
- Position the load over the axle.
- Prevent shifting loads.
- Underload rather than overload.
- Be careful while on slopes and avoid the steep ones.

Back strain is the worry here. Proper lifting technique: Keep your back straight, squat, then lift with your legs. A shifting load can also strain your back, as can too heavy a load. Make more trips with fewer pounds, but don't underload to the point where the load might shift.

9 Manual hedge trimmers, snips, pruning knives

Accidents per year: 2515

PROTECTION:

- Observe rules for cutting tools.

Rusty and dull blades bind and slip, causing you to put your fingers where they don't belong. These simple tools can be more dangerous than they look; don't let kids play with them.

10 Garden tractors

Accidents per year: 2300

PROTECTION:

- Observe power-tool precautions.
- Ride up or down—never along—slopes. Avoid steep slopes altogether.
- Reduce speed on slopes and avoid sharp turns.
- If about to tip on a slope, turn down-slope.
- Never gun the engine on an upgrade or rear-wheel torque could flip you over backward (this has happened even to professional tractor drivers).
- No passengers!
- Look before you back up.
- Use only well-made power-take-off devices.
- Watch out for ditches, creeks, road edges and curbs.
- Shut off engine before dismounting.

Biggest problem here is tipping over—and it can be a lethal one. You don't need an 800-lb. tractor lying on your chest. Kids are usually attracted to tractors, but you must be strict about keeping them off and away.



A power line and an aluminum ladder can make a deadly combination. Give yourself a safety margin; do not work any closer than 10 ft. from your power lines.

11 Riding mowers

Accidents per year: 2000

PROTECTION:

- Observe power-tool precautions.
- Observe rules for garden tractors.
- Ride on slopes only when necessary.
- Ride up or down slopes—never along.
- No passengers!
- Don't overestimate cutting power on thick branches, debris.
- Shut off engine, disengage cutters before leaving seat.

Riding mowers are less stable than tractors, so be extra careful in handling them. Don't use the mower as a means of transportation; it's a cutter, not a chariot. Need we add that kids love these things?

12 Power lawn trimmers, edgers

Accidents per year: 1800

(Please turn to page 180)

20-step spring tune-up for your garden tools

by Joseph R. Provey
ASSISTANT HOME AND SHOP EDITOR

A good tool—even if it has been taken for granted—will respond to reconditioning by lasting longer. Well-cared tools will also let you last a lot longer because they are safer and require less effort to use.

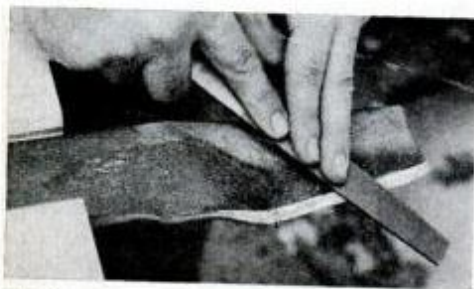
■ Wash foam air cleaner on gas-engine mowers with kerosene, squeeze dry, sparingly distribute SAE 30 oil.

■ Sharpen rotary mower blade to the



To get better performance from mower engines, wash clogged foam air cleaners.

original bevel with a 10-in. mill bastard file. (Nicholson makes a home and garden file for this purpose.) Take equal amounts of metal off each cutting edge.



To be safe, unscrew sparkplug before removing blade for sharpening. Deep nicks need only be smoothed slightly.

■ Replace sparkplug on mower if deposits have accumulated on electrode or if electrode is worn thin. Wipe ceramic insulator clean with rag.

■ Lubricate moving parts on chassis with liquid graphite or penetrating oil. Place a few drops on pulley shafts, chain and cables. Replace drive belts when surface cracks appear.

■ Add SAE 30 grade oil to mower. If you neglected to drain the crankcase last fall, run engine 15 minutes and then drain while hot. Also check transmission grease. (Check manual.)

■ Fill tank with unleaded regular gasoline. Don't transfer winter formulated gas in snow blower to mower—it will work best with heavier hydrocarbons of summer formulations.

■ Lubricate blades and bearings on electric trimmers and shears with machine oil. Use liquid graphite, like Lock-Ease, on gears and joints of hand-powered pruners, clippers, lopping shears and tree trimmers.

■ Remove caked mud and corrosion from hoes, rakes, forks, shovels and other metal garden tools—they will last longer and be easier to use. Rust



Wire cup brush, chucked in drill, is an easy way to remove rust from shovel.

removers like Naval Jelly are good on tough jobs, but wear rubber gloves.

■ Paint metal surfaces on spreaders and other garden equipment with an acid-resisting rust inhibitor like Flecto's Ferrothane (needs no primer).



Protect lawn spreader agitator from corrosive fertilizers with rust inhibitor.

Also replace badly affected nuts, washers and bolts wherever necessary.

■ Recondition pressure sprayer by cleaning inside metal tank with washing soda solution (sodium carbonate and water). Then clean rubber hose with mild vinegar and water solution. Oil leather plunger washer or replace it if dried and cracked. Remove nozzle sleeve to clean inside as shown.

■ Sharpen cutting edge on grass snips, lopping shears, grass whips, hedge clippers, and the like to the bevel the manufacturer had originally ground on tool. Use sharpening stones



Use fine wire and kerosene to clean debris from the grooves in sprayer nozzle.

or files suited to your task—Carborundum makes multipurpose gardener and scythe stones. Remove the minimum amount of metal needed to smooth nicks and whet edges.

■ Edges on hoe and spade blades are easy to maintain. First hammer out turned-up edges. File a hoe blade at 45°, away from edge. Spades may be beveled equally on both sides, forming an included angle of about 20°. Don't weaken the edges by filing too thin, making them prone to nicks.

■ Sand wooden handles smooth to



Properly beveled edge increases hoe control by helping it bite into the ground.

ease friction during use and to avoid blistered hands. Then rub in boiled linseed oil or polish with paste wax.

- *Repair diagonal splits* by gluing with resorcinol resin glue, clamping until the glue is hard and then letting it cure in a warm place overnight. Use plastic tape on surface fractures.
- *Replace damaged through-type handle* by shaping the slotted end with a



Maintaining handles may not seem worth it, but replacements are expensive.

rasp until the head fits with slight play and the stem protrudes 1/2 to 3/4 in. Drive a wood wedge (provided) into slot until fit is tight, then saw away excess. For metal wedges, saw off excess first.

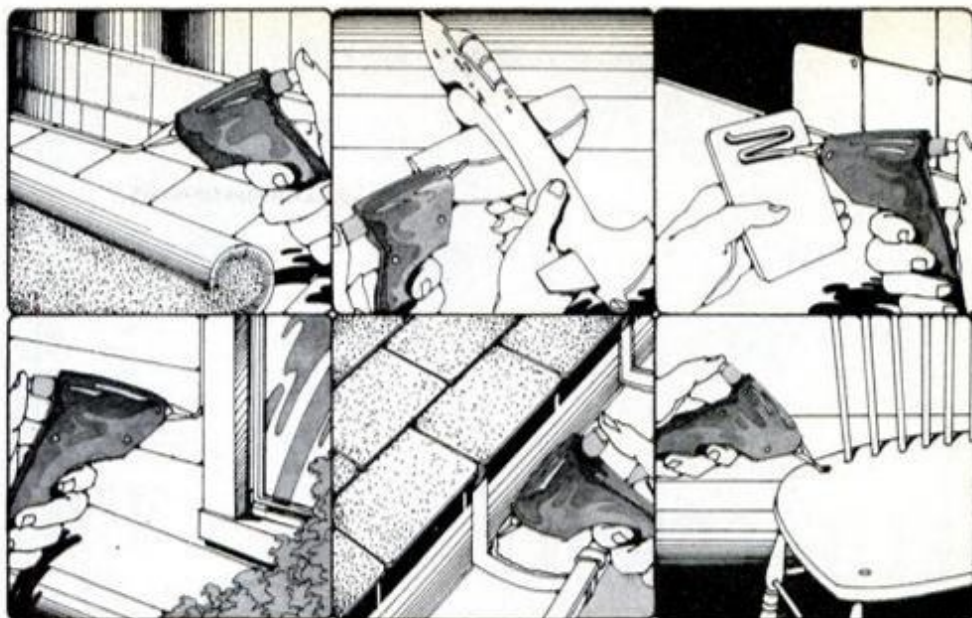


From left to right: handle replacements for hoe or rake, ax and spade.

- *Replace a spade handle* no longer serviceable by first filing away the old rivet heads and hammering them out with a punch. Seat a new handle into the ferrule by pounding the handle top on a wood block. Drill new holes and reassemble with rivets (often provided) or stovebolts and nuts.

- *Hoe and rake replacement handles* make old tools like new. Some handles are seated into a tapered ferrule and secured with a rivet. Others (see below) have a force-fit ferrule and hole

(Please turn to page 170)



Neat as a pin. And lightning fast.

The Thermogrip® Electric Glue Gun from Bostik applies glue in a controlled flow with no mixing, no mess. Makes all your gluing jobs even easier. And Thermogrip Hot Melt Glue is so fast it bonds surfaces together permanently in just one minute. That means no more clamps. And a far greater variety of repairs you can make yourself.

Look for the Thermogrip Electric Glue Gun and Thermogrip Hot Melt Glue in the fastener department of your hardware store.



Thermogrip Electric Glue Gun from Bostik

Bostik Consumer Division
USM Corporation An EMHART Unit

LOOK FOR THE 1978
"CAR CARE GUIDE"
IN THE MAY ISSUE OF
POPULAR MECHANICS

SPECIAL-BY-MAIL OFFER!

COLORADO

4 year old
10-18"



BLUE SPRUCE

3 for \$1⁰⁰
(7 for \$2.00)
(16 for \$4.00)

Yes--that's right--now you can purchase the beautiful Colorado Blue Spruce (*Pinus pungens glauca*) at amazingly low prices. These are strong northern grown, well rooted, branched (4-year old, 10-18") seedlings that are all nursery grown. Just the right size for transplanting. Excellent for use as corner groups, windbreaks, or as individual specimens. Buy now and have the added pleasure of shaping your trees just the way you want while you watch them grow. Order today. **SEND NO MONEY.** On delivery pay postman \$1.00 for 3, \$2.00 for 7, or \$4.00 for 16 trees, plus COD charges and postage. We pay postage on prepaid orders. If not 100% satisfied, just return shipping label for refund of purchase price--you keep the trees. Free planting guide included with each order.

MAIL THIS FOR FREE GIFT

HOUSE OF WESLEY, Nursery Division
Dept. 9176-68 Bloomington, Ill. 61701

Send me _____ Blue Spruce Prepaid COD

Name _____

Address _____

City _____ State _____ Zip _____

FREE for immediate orders, an amazing air plant leaf. Lives on air -- just pin to a curtain -- sends out 8 to 12 tiny new plants.



SPRING TUNE-UP FOR GARDEN TOOLS

(Continued from page 169)

to accept a shank or tine on metal part of the tool.

■ Protect metal surfaces on spades,



To remove shank, hammer ferrule against hard surface to crush wood fibers inside.



Use rubber cement to glue shank into predrilled socket of new handle.

hoes and other soil-working implements by wiping them with clean engine oil. On tools that work directly in a vegetable garden, however, use non-



Silicone spray keeps dirt from sticking to the spade and makes digging easier.

"I've got two power saws. One that won't start. And a Stihl. The one that won't start is for sale."

Stihl 015AV. The best at less than you'd expect. Dependable, professional and easily converted to hedge trimmer or brush cutter.

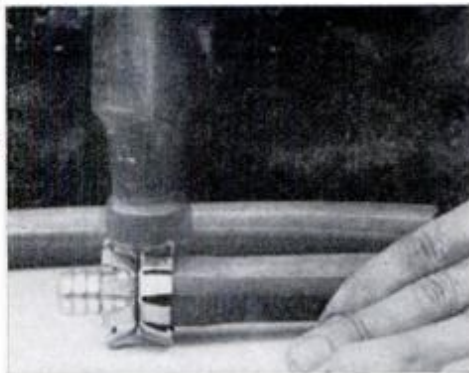


STIHL

The world's largest selling chain saw.
For sales and service, see the Yellow Pages.

toxic, vegetable-derived oil sprays to avoid contaminating the soil.

■ **Repair a damaged hose section or faulty couplings and save the price of a new hose.** There are many coupling and splicing devices available. Crimp-on types work well on rubber hose. Those with tapered internal nuts or ferrules are better for plastic hose and can be reused. Match the diameter of the fitting to your inside hose diameter.



To splice rubber hose sections, insert metal stem, crimp prongs with hammer.



Male and female couplings are secured to hose by screwing ferrule into opening.

■ **Mend rusted-out holes in a wheelbarrow to extend service and prevent leakage.** Cut a circular patch from aluminum or stainless-steel flashing scraps, drill holes spaced 1 in. apart and rivet in place. Paint surface with rust inhibitor to prevent further deterioration. **PM**



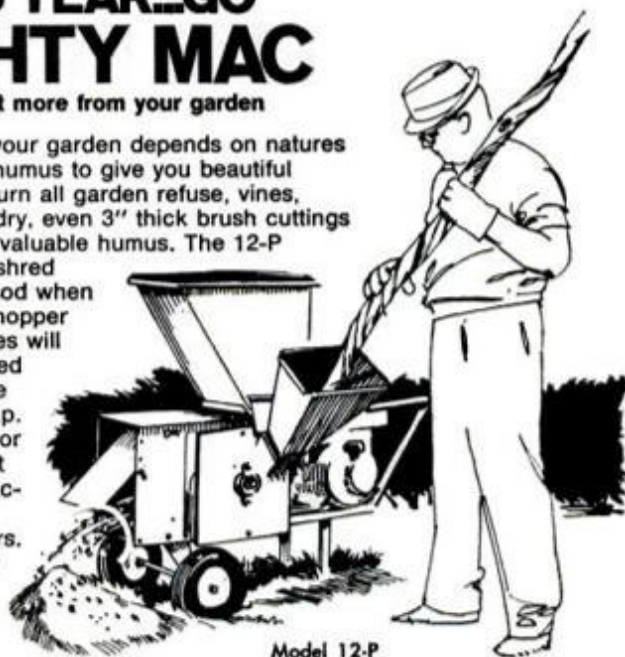
Rivet tool makes awkward patching easy. Use standard, medium-duty Pop rivets.

SHREDDER-CHIPPERS • TILLERS •

THIS YEAR GO MIGHTY MAC

If you want more from your garden

More and more your garden depends on nature's own mulch and humus to give you beautiful healthy plants. Turn all garden refuse, vines, stalks, green or dry, even 3" thick brush cuttings or prunings into valuable humus. The 12-P shown here will shred stalks, manure, sod when fed into the top hopper or heavy branches will be cleanly chipped when fed into the side hopper. 5 h.p. or 7 h.p. engine or as an attachment to many lawn tractors. A must for organic gardeners. Write for free literature on this quality shredder-chipper.



Model 12-P

AM
Amerind MacKissic
Incorporated
Box 111
Parker Ford, Penna. 19457

Gentlemen: Please send me the latest information on Mighty Mac shredder chippers.

Name _____

Address _____

City _____ State _____ Zip _____

...everything for your lawn and garden!

Shop at the store with the Sentry on the door!

Your neighborhood Sentry hardware dealer is one of over 4,500 in the United States. He stocks everything you need to grow a more beautiful lawn... and a better garden. See him for grass, flower and vegetable seeds... spades and shovels, rakes and hoes... fertilizer, hose, tillers and power mowers. Look in the Yellow Pages under "Hardware" for your Sentry store. Come in and get acquainted. Browse! Have fun while you shop.



Sentry® offers a complete selection of power mowers...



If your lawn is small and level... or large and hilly, you're sure to find a Sentry mower that will meet your needs perfectly! The 20-inch, rear discharge No. 335, as illustrated, is one of eight new models for '78. Power propelled, with constant mesh drive, it adjusts to five different cutting heights. Between-the-wheels bag makes it easy to cut around trees, shrubs, fences. You can trim close on the right and left as well as in front.

AA-7638

Merchandise, shown in this advertisement, is available from participating Sentry dealers only. The 4,500 Sentry dealers own their stores. They select their merchandise and set their own prices. There may be variations in products, available quantities and prices in individual stores. Sentry Hardware Corporation, Cleveland, OH 44113.

What's a Kubota?

People are always getting our name mixed up with something else.



We're not a fig. That's Kadota. We're not a couple of states. They're Dakotas.

We're Kubota. The tractor company. But even people who know tractors don't know us too well. We're not that famous. Yet.

WHO ARE WE?

Our company is 87 years old, and we're the fifth largest tractor maker in

the world. Since 1970 we've had the good fortune to sell our tractors in the U.S.A. And we've sold more than 34,000 of them.

As American tractor sales go, that's not a lot. But we've been growing steadily. And here's why.

THE MID-SIZE TRACTOR.

Kubota is giving America something it needs. A mid-size tractor. We don't make 100 horsepower giants. And we don't make glorified garden tools. Instead, we cover the ground in between.

Our tractors range in size from 12 to 47.5 horsepower. And they are real tractors. Tough, durable, strong. You can get power take-offs front and rear and 4-wheel drive. And a three-point hitch that handles just about every implement under the sun. Rear- or mid-mount mower, back hoe, cultivator, dozer blade, whatever you need.

WHO NEEDS IT?

Whether you're working three acres or three thousand, you probably have a place for Kubota.

If your place is small, we have a model that's exactly right to do all those hard jobs that involve tilling, digging, or hauling.

If your place is big, you probably own several big tractors already. But it doesn't make much sense to fire up a 100-plus horsepower rig to clear some weeds. Not with today's fuel and maintenance costs.

GIVE THIS TRACTOR A JOB.

Now that you know a little bit about us, we hope you'll consider our job application.

But no matter how much we tell you here, your Kubota dealer is best

qualified to clue you in on what our tractors can do. And participating dealers will also explain how you can get in on Kubota's Super Sweepstakes going on now.

So see your dealer soon. And talk to him about a job.

We're looking for work.

QUICK! Please rush me your newest, brightest, full-color brochure so I can find out even more about what makes your tractors so terrific.

Mail to: Advertising Department
Kubota Tractor Corporation
300 West Carob Street, Compton, CA 90220

NAME _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

PM 3



 **KUBOTA**



Meet the Minnie.

The new little Merry Tiller for smaller gardens.

If you always thought tillers were too large or expensive for your small garden, you should meet the Minnie. This new tiller is lightweight (less than 70 pounds), has fold-up handles, adjustable steel rotors and a dependable 2-hp engine.

It not only does a great tilling job and maneuvers easily around your garden, but its folding handles make it easy to carry in your car trunk or store under a shelf.

With all these features and more, the Minnie still costs less than most power mowers. The suggested list price is only \$199.50. Meet the Minnie soon at your garden supply dealer or write us for a free brochure.



The original... since 1947

Merry Manufacturing Co., P.O. Box 168-PM, Marysville, WA 98270

New products for lawn and garden



This versatile mower, dubbed Lawn Genie, attaches to a tractor to offer complete lawn care—it mows, sweeps, mulches, chops, shreds and thatches. A hopper to collect debris is also available. The model shown has a 35-in. cutting width and costs \$950 from the Mathews Co., 500 Industrial Ave., Crystal Lake, Ill. 60014.



Relax outdoors free of irritating flies. The Flygon Electric Fly Killer electrocutes flies and emits no harmful chemicals. Electroplated screens resist corrosion and bulb replacement is easy. The zapped insects collect on removable tray. Unit is \$190; Charmglow Products, Rid-O-Ray Div., Box 127, Bristol, Wis. 53104.



Grow herbs and salad greens, harvest a strawberry crop or create a floral sculpture. It's possible to grow dozens of plants on your patio or outside the kitchen door in a compact 2-sq.-ft. area with the Patio Tower Garden. Redwood frame, caster-mounted for mobility, can be assembled in 15 minutes with a screwdriver. \$40 from Burpee, Warminster, Pa. 18974.

(Please turn to page 176)

Ask these questions before buying any Garden Tractor.



When you're shopping for a garden tractor, Ariens feels that taking the time to compare various tractor

makes will be a rewarding experience and time well spent. Ask questions about each like:

1. How easy is it to attach and remove implements from your tractor like a Mower — Tiller or Snow-Thrower? — SHOW ME
2. Are the attachments for your tractor Shaft Driven or Belt Driven? — SHOW ME
3. Can I use more than one attachment at the same time on your tractor?
4. Do you offer a 2-stage Snow Thrower for All your Garden Tractors?
5. What is the capacity of your tractor's gas tank?

Ariens welcomes your thorough comparison and is confident that their Garden Tractors will be stand-out quality favorites when you've made it. If you'd like more

information about the complete Ariens Garden Tractor line, please write to: Tractors • Ariens Company • 806 West Ryan Street • Brillion, Wisconsin 54110.

 **Ariens**
A CUT ABOVE THE REST!

ARIENS—MORE THAN A NAME...IT'S A PROMISE!

LOOKING FOR IDEAS ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS. THEN USE THE COUPON BELOW.

WORTH WRITING FOR

782 Tractors for all seasons

A 16-page, full-color brochure gives details on the eight models of lawn and garden tractors from Ariens—they range in size from an 8 hp model to a new 18 hp hydrostatic drive model. A wide variety of accessories and attachments let you use the tractor year round for such jobs as mowing, hauling, cultivating, sweeping and snow throwing. Free.

783 Till with power

Here are the facts on the power tillers from Amerind-MacKissic. They're ideal for the gardener with a quarter-acre or more to care for. Power drive wheels do all the work, and the chain drive gives unbeatable power. Detailed descriptions and specs. Free.

784 Guidelines for a better looking lawn

With the proper care, your lawn can be greener, healthier and more beautiful. This valuable, 16-page, full-color booklet from Scotts tell you how to care for your lawn throughout the year. Hints on what to do during each season, including tips on seeding, fertilizing, weeding and disease prevention. Highly informative and free.

785 Reference guide to power lawn equipment

International Harvester's big 20-page brochure is a complete guide to all their power lawn products, from the big tractors to the walk-behind mowers. Also includes information on their shredders, tillers and snow blowers. Gives specs and accessories. Free.

786 Build a mini-dozer

A brochure from Struck Corp. describes their Crawler Tractor Kit—it's a versatile outdoor machine you can easily assemble yourself. The Mini-Dozer's heavy-duty track gives you the same ground-hugging grip as its bulldozer big brother. A choice of three motor sizes, plus a wide assortment of attachments. 75¢.

787 PM's Complete Gardening Guide

Here is every bit of information needed to have a beautiful lawn and garden. All the basics with more than 20 fact-packed tables and charts, and 130 "show-how" drawings. 12 heavy plastic-coated cards—24 pages in all—spiral bound for quick reference. Only \$4.95 + 50¢ for postage and handling.

788 Man-size tractors

Here's a complete information on the powerful, heavy-duty tractors from Engineering Products, Co.—they're built for faster, easier grass cutting, snow removal, garden plowing, tilling, cultivating and many other chores. Includes descriptive information on 12, 14 and 18-horsepower tractors and attachments, as well as the complete specifications on all. Free.

789 Light and water landscaping

In your own back yard, you can enjoy the sights and sounds of water splashing in a lighted fountain or tumbling over a natural

rock waterfall—and with very little expense and effort! A new booklet from the Little Giant Pump Company explains how to landscape with light and water. \$1.00.

790 PM's Stowaway Picnic Table Plans

Your picnic table doesn't have to sit out in the yard all year long; now you can have a picnic table that folds for easy storage and moving. It's the Stowaway Picnic Table, the newest addition to the Popular Mechanics plans library. The table is constructed of tough redwood, and the entire unit, including benches, folds to fit in a 2-ft. x 5-ft. area. Send for the easy-to-follow plans! \$3.95.

791 Garden tilling made easier

Whether you do light- or heavy-duty tilling, Merry Tiller has a tiller and rotor attachment that'll fit the job. A color brochure illustrates tillers for the weekend gardener. Shown also are six different rotor attachments that let you do everything from cultivating and mulching to aerating the soil. Free.

792 Popular Mechanics all-new Special Projects Catalog

Get to see the best of PM's famous projects and plans. They're all here, plus more in this brand new edition of PM's fabulous Special Projects Catalog. Included also are titles of past great PM articles that you can order. Thumb through the pages for loads of fascinating ideas to save time and money, and best of all, to enjoy! 50¢.

793-795 Equipment for any size job

Whatever the size of your outdoor job, John Deere has the right equipment for you. Folders describe their Lawn and Garden Tractors, Riding Mowers and Walk Behind Mowers (please check the information you're interested in). It's free.

796 Pleasing your plants

Having trouble with finicky plants? A 16-page plant feeding guide from Ra-Pid-Gro helps solve your problem with helpful tips and information. Covers feeding care of roses, shrubs, trees, lawns, vegetables and more. Free.

797 Have a lot of woodcutting?

Well, then, see these saws. Here's a guide to the McCulloch power woodcutting tools for home, farm and professional use. A full-color pamphlet reviews all the features and specs for the complete line of chain saws. Free.

798 Lawn care made easy

See the complete line of Snapper lawn and garden equipment in this full-color brochure. Includes all the information on their riding lawn mowers, walk-behind mowers and garden tillers. Free.

799 Tractor that can do it all

Here's all the information on the newest mid-size Kubota tractor—it's a 25-hp diesel high clearance machine capable of doing tough farm cultivating jobs. Plus, a wide assortment of implements are available. Free.

Popular Mechanics 3/78
Box 1718, Sandusky, Ohio 44870

This Coupon Expires May 31, 1978

Please see that I receive the items checked below

- | | | | | |
|------------------------------|-------------------------------------|--|---|------------------------------|
| <input type="checkbox"/> 782 | <input type="checkbox"/> 786 75¢ | <input type="checkbox"/> 790 \$3.95 | <input type="checkbox"/> 794 (ride mower) | <input type="checkbox"/> 798 |
| <input type="checkbox"/> 783 | <input type="checkbox"/> 787 \$5.45 | <input type="checkbox"/> 791 | <input type="checkbox"/> 795 (walk mower) | <input type="checkbox"/> 799 |
| <input type="checkbox"/> 784 | <input type="checkbox"/> 788 | <input type="checkbox"/> 792 50¢ | <input type="checkbox"/> 796 | |
| <input type="checkbox"/> 785 | <input type="checkbox"/> 789 \$1.00 | <input type="checkbox"/> 793 (tractor) | <input type="checkbox"/> 797 | |

Total money for priced items \$ _____

Service Charge \$ _____ .35

Total money enclosed \$ _____

Total items requested _____

Name (Please Print) _____

Address _____

Town _____

State _____

Zip Code _____

(Please send cash, check or money order made out to POPULAR MECHANICS. No stamps, please.)

Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

You're the boss on **ECONOMY** **POWERKING** tractor

Now 12, 14, & 18 Hp



Prepare seed beds with 32" rotary tiller



Load gravel, dirt, manure with 1/2-ton bucket.

Puts power in your hands like no other compact tractor you've ever seen. Power to do big jobs... more kinds of jobs... fast and easy.

Not just a "weekend toy", Power King gives you big wheels, high clearance, extra weight and traction. Automotive all-gear drive converts nearly 100% of horsepower into work... saves gas and gives you more push- and pull-power.

So you can handle big, productive tools. Plow field and gardens with ease. Mow up to 3 acres an hour with 60" rotary mower. Bulldoze with 48" angling blade. Split 26" logs. Clear deep snow with 48" snowblower. Handle all your yard and garden tasks with 20 quick-change attachments. Get the extra workpower of a Power King at competitive prices.

Send for free color catalog today.

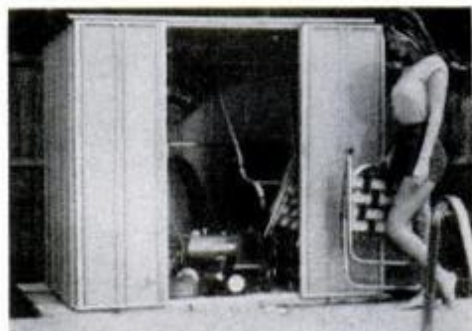
C-96

ECONOMY **POWERKING**

1005K-3 Anoka Ave., Waukesha, WI 53186

NEW PRODUCTS FOR LAWN, GARDEN

(Continued from page 174)



Convenient storage of lawn tools, lounge chairs, barbecue equipment and sports gear is the idea behind the Little Giant aluminum storage building. The 60-in.-high shed has a roomy 42x66-in. base and a good-sized doorway for easy entry with oversized equipment. Its sliding doors can be padlocked for security. The Little Giant is painted pale green enamel to blend with outdoor surroundings. It comes in a single carton that is easily transported—in a compact station wagon. It can be assembled in two to three hours. The price is \$90 from the Capitol Products Corp., 3990 Paxton St., Harrisburg, Pa. 17111.



Preserve fresh food easily and economically with an Equi-flow dehydrator and enjoy dried foods for meals, snacks or camping trips. Nutrient loss is often minimal. Foods maintain their color and flavor and can be stored in a cool, dry place almost indefinitely after drying. This 10-tray model dehydrates up to 13 lbs. of food in about 10 hours at an operating cost of 5 cents. About \$165, from Stokes Seeds, 1127 Stokes Bldg., Buffalo, N.Y. 14240.



This rake on wheels spreads fertilizer, clears cuttings and leaves, then cleans itself when it's rolled away, ready for more work. Wheelrakes are 18 and 36 in. wide, \$28.50 and \$42.50 respectively. From Tandon Products, Lancashire, c/o British Information Services, 845 Third Ave., New York, N.Y. 10022.

(Please turn to page 222)

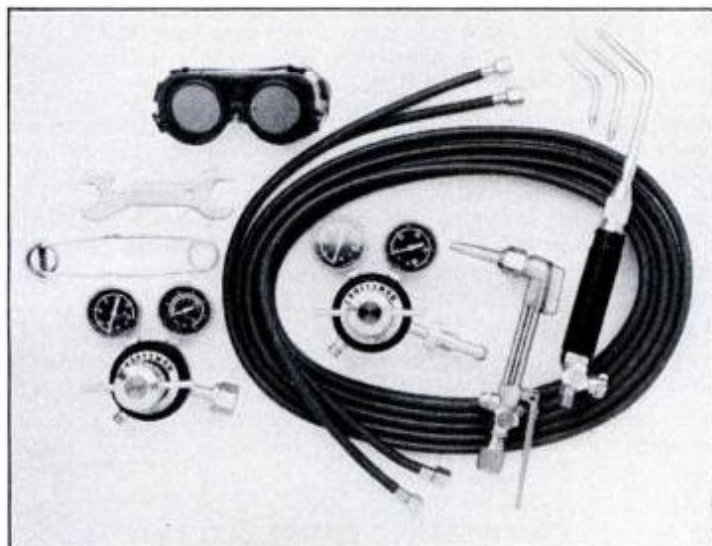
LOOK FOR THE 1978
"HOME IDEAS GUIDE"
IN THE APRIL ISSUE
OF POPULAR MECHANICS

The heat's on!

Save \$60

on Sears Best Craftsman 2-Stage
Oxy-Acetylene Cutting/Welding Outfit.

Now only \$119⁹⁹.



The outfit that comes equipped with 2-stage regulation. An automatic feature that adjusts to changes in cylinder pressure, automatically assuring you of constant torch pressure for a better flame characteristic. A solid brass-forged body and cutting head for durability, and stainless steel valve stems for delicate flame settings. A comfort balanced handle that reduces arm fatigue so you can cut, weld or braze longer and more accurately. Plus, two-inch easy-to-read white on black pressure gauges. And 20 feet of Siameez hose—for those jobs that are difficult to reach. That's Sears Best 2-Stage Oxy-Acetylene Cutting and Welding Outfit. And the best part? It's yours for only \$119.99.

© Sears, Roebuck and Co., 1978

Save \$60

on Sears Craftsman 230-Amp
Dual-Range Arc Welder

Only \$119⁹⁹ also.



This is the unit that takes the guesswork out of arc welding in 3 easy steps. One, our handy material thickness gauge determines the thickness of the metal and the recommended electrode size. Two, our convenient electrode size index holes verify the correct electrode size. And three, turn the indicator to the specified electrode size and you've automatically located the proper heat setting. All you have to do after that is weld. What's more, you also enjoy such additional features as a dual-range transformer designed for maximum arc stability and a minimal line draw. Plus, an exclusive top-mounted heat selector control that gives you infinite heat selections, from 30-230 amps between the two ranges. All that for only \$119.99. (And that's all the more to enjoy.)

ON SALE
February 26—
April 1, 1978.

Available in most Sears Retail Stores.

Sears

CRAFTSMAN.

Tools that have earned the right
to wear the name.

Outdoor Decorating Ideas from Little Giant



starbrite

LOW-VOLTAGE LIGHTING

sets the stage for your pool and garden area. Economical, child and pet safe, available in 3, 6, and 12 light sets that come ready to install without tools. Includes clear or colored lenses. Mushroom and garden area lighting feature downward illumination. Automatic timers available.

FOUNTAIN RING SETS

Continuously flowing water enhances any landscape. Sets available in three sizes, with 5, 10 or 16 jets — contain pool liner, fountain ring, pump. No plumbing necessary.



This potent power tool moves water

Little Giant's potent pump belongs in the tool caddy with the rest of your power tools. Runs on house current and pumps 300 gallons per hour. Comes with two 10 ft sections of hose. 12 volt DC model also available.



Little Giant
PUMP COMPANY

3810 N. Tulsa Street, Department 83C
Oklahoma City, Ok 73112

9 steps toward a healthier lawn this spring



EARLY SPRING

1



GET RID OF DEBRIS

It's time to gently rake matted tree leaves out of the lawn. If left, the leaves will smother early upcoming grass shoots. Also clean up twigs, stones and other debris.

2

MOW OLD, BROWN GRASS

If you remove an inch or so of the brown, dead blades, more vitalizing sunshine can reach the plant's crown where the stem and root merge. This will hasten greening.



3

FERTILIZE EARLY

It's essential to fertilize as soon as possible, when grass has come out of winter dormancy and has a healthy appetite. Grass is ready to develop green shoots, new roots and underground rhizomes reaching out to form offshoots.

a

Prevent crabgrass. It's a plant that starts every year from seed. You can put an overall "barrier" on the soil at the same time you fertilize with a product such as Turf Builder Plus Halts.

b

Control dandelions. If dandelions or other broadleaf weeds appear on your lawn in early spring, you can control them when you fertilize by using a dual-purpose fertilizer with dandelion control.

c

Prevent disease. Given the right combination of cool, moist weather conditions, a lawn can suddenly show signs of snowmold, leafspot or other disease. One convenient way to prevent this: use a disease-preventer fertilizer.

4

RESEED THIN AND BARE AREAS

A lawn that's so thin you can see bare soil when looking down needs seed. Soil crevices formed by early spring protect the seed. Use a special seed fertilizer.

5

WATER YOUR LAWN

Older lawns usually need no watering now; seedlings do—at least an inch weekly. Check volume by placing several empty cans on lawn when you sprinkle. Average the water depth collected in cans until it's an inch.



6

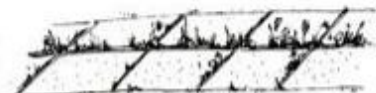
MOW THE GRASS

Although you want to trim the lawn, the green leaves on grass are essential to its survival. Mow high enough so that not all the green leaf surface is cut off.

7

CONTROL UNWANTED GREENERY

Grass is great, but not in driveway cracks or between bricks in a walk. To check such growth, use a grass and weed-control product.



LATE SPRING

8

FERTILIZE AGAIN

By now all the fertilizer that you applied earlier has been used, and the soil is ready for more. Give your lawn another dose of fertilizer to keep it looking its best through the tough, hot part of summer that lies ahead.

9

GET RID OF DANDELIONS

The bad news: No one has a selective control for dandelions, chickweeds and other nongrass weeds before they appear. The good news: Fertilizers that not only fertilize the lawn, but get rid of these weeds—and their hard-to-get-to roots—after they appear are available.



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9 GREAT WAYS TO FENCE YOUR YARD

(Continued from page 143)

measure the proposed fence perimeter and estimate your material needs. Once you've obtained everything, cut posts and any other vertical members to desired lengths. Don't forget to include depth of hole when determining post lengths. It is more practical to saw horizontal members to suit during construction, because slight variations in post placement may arise due to large boulders, pipe lines and other obstructions. Wear safety glasses and a dust mask to keep sawdust from treated wood out of your eyes and lungs.

To lay out the fence, stretch mason's line taut between nails on top of corner or end markers—and drive in marker stakes for post intervals. Light, picket-type fences have posts set 1 1/2 to 2 ft. deep. Heavier fences require holes 2 1/2 to 3 1/2 ft. deep—especially if they are solid and must resist high winds. Set corner or end post first at desired height. Check for plumb with a carpenter's level. Use a line level with tape measure or ruler to level height of second end post (see diagram).

Next, dig intermediate holes—the narrower the hole's diameter, the easier it will be to fill and stabilize each post. Stretch mason's line between two nails on the tops of the end posts to help align heights and front edges of intermediate posts. Note: The post on which the gate is to be hinged is subject to greatest stress. Pouring a concrete collar around its base is recommended. For an economical method for adding a collar to any post: (a) rest post on a stone about 4 in. high and centered in the bottom of the hole; (b) add a 6-in. layer of gravel to fill in around stone and post; (c) add a 6 to 12-in. layer of concrete, then 4 to 8 in. of clean rocks and 6 to 12 in. more concrete; (d) taper the collar and several inches of earth away from post. This procedure insures that the post extends through the collar and prevents formation of a water trap.

Tamped-earth holes should also have a 6-in. gravel bed for drainage (with another 6 in. in clay soil). Tamp soil in 4-in. layers around aligned posts. For holes dug wide because of rocky soil, backfill with a compacted layer of stones between layers of earth.

Use only galvanized common nails in fence construction. Spacer blocks are handy for gauging uniform intervals between pickets or boards. Pre-drill holes near end grains to prevent splitting if you plan to fasten rails there, 10d nails are suitable for upper rails that rest on top of 4x4 posts; 8d nails are better for attaching 1-in.-thick materials to rails and for toenailing lower rails between posts. Wooden

or metal cleats may also be used to support butted lower rails.

Tips on gate construction

Check the posts on which your gate hinges and latches—they should be parallel to each other and perpendicular to the ground. Measure for gate members, leaving 1/2 to 3/4-in. space on each side for swing and hinges. Make a 2x4 frame with two verticals, two rails and a snug-fitting diagonal brace extending from the inside lower corner on the hinge side to the inside corner above the latch. Nail members together and add siding on ground, checking all corners for squareness. Be sure the gate is plumb before marking and drilling for heavy-duty gate hinges. Add latches or hooks, bumper stops or gate springs to suit. **PM**

AVOID BACK-YARD ACCIDENTS

(Continued from page 167)

PROTECTION:

- Observe power-tool precautions.
- Use new whip-line trimmer with a "soft" cutting line.

Trimming accidents will become less frequent as more people use the newer type of trimmer that cuts with a monofilament nylon line similar to a heavy fishing line. But power lawn trimmers with vertical blades do remain in use. They can throw pebbles hard and far, so you should be especially careful about onlooker precautions, particularly in front of the machine. And, of course, clear the ground of debris, toys and stones—anything that's a potential projectile—before you start.

13 Tillers, cultivators

Accidents per year: 1500

PROTECTION:

- Observe power-tool precautions.
- Don't use too large a machine.
- Don't get in front of a moving tiller.
- Wear goggles or safety glasses.

Tillers can be mean, so more power than you really need is simply an extra hazard. Look at the newer compact models now available.

A dead-man switch that kills the engine if you should let go of the controls, is a good feature. A feature to avoid, on some older units, is a lock-in reverse control that can let the tiller walk backward over you or pin you against a wall or fence. If your tiller has such a control, don't use it; better still, disable it. **PM**

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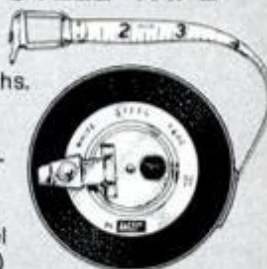
Ideal for hobbyists. Featherweight, 25-watt iron has three different interchangeable plated-copper tips. Kit includes soldering aid tool, five feet of 60/40 rosin core solder and use instructions. U. L. listed (SP23K)



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STANLEY UTILITY KNIFE

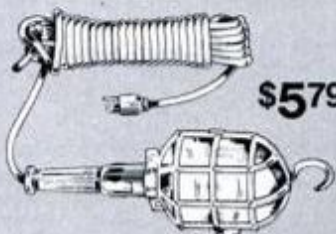
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HM Specialties

OLD RADIOS: NEW TURN-ON

(Continued from page 109)

Radio collecting is still a hobby and not an investors' game. Despite stories about fabulous prices paid for



Philco Model 511 radio and speaker from 1927 also carry out component idea.

old radios, only five or 10 models are worth more than \$100. You should be able to buy many collectible radios for \$15 or less since more radios and parts are available now, and the interest of collectors is bringing still more out of hiding.

If you want to combine the fun of an old radio with the fun of old radio programs like "The Shadow" and "Fibber McGee and Molly," it's not difficult. Many old programs are available on tape, and you can play them through an inexpensive modern wireless transmitter to your antique radio receiver.

PM



Amateurs built receivers like this in the early '20s—often from designs in PM.

RADIO RESOURCES

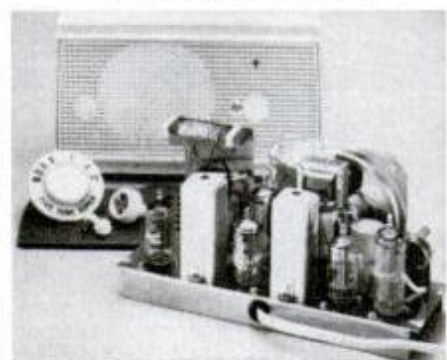
Parts and schematics: Mini Radio Co., Box 468, Gainesville, Ga. 30501; send a self-addressed stamped envelope (SASE) for a list of obsolete tubes, some other parts. Antique Radio Parts, Box 42, Rossville, Ind. 46065; send SASE for catalog of parts, services offered. Puett Electronics, Box 28572, Dallas, Tex. 75228; send 65 cents for catalog. G. B. Schneider, 6848 Commonwealth, Parma Heights, Ohio 44130; send SASE for spec sheet on solid-state power supplies for old radios.

Clubs: Antique Wireless Assn., Main St., Holcomb, N.Y. 14469; Antique Radio Club of America, 81 Steeplechase Rd., Devon, Pa. 19333; Buckeye Antique Radio and Phonograph Club, 1937 Stoney Hill Dr., Hudson, Ohio 44236; California Historical Radio Society, 635 Phelan Ave., San Jose, Calif. 95112; Canadian Vintage Wireless Assn., 102 Parkhurst Blvd., Toronto, Ont., Canada M4G 2E6; Indiana Historical Radio Society, 15 Todd Pl., Terre Haute, Ind. 47803; Mid-America Antique Radio Club, 2301 Independence Ave., Kansas City, Mo. 64214; Northwest Vintage Radio Society, Box 13544, Portland, Ore. 97213; Rocky Mountain Antique Wireless Assn., 16500 W. 12th Dr., Golden, Colo. 80401; Southern California Antique Radio Society, 6712 Bisby Lake Ave., San Diego, Calif. 92119; Southwest Vintage Radio and Phonograph Society, Box 19406, Dallas, Tex. 75219; Niagara Frontier Wireless Assn., 500 Smith Rd. East, Amherst, N.Y. 14051.

Publications: *The Classic Newsletter*, Box 28572, Dallas, Tex. 75228; *The Horn Speaker*, 9820 Silver Meadow Dr., Dallas, Tex. 75217; *Radio Age*, 1220 Meigs St., Augusta, Ga. 30904; *Antique Radio Topics*, Box 42, Rossville, Ind. 46065.

More information: Historical Radio Services, Box 15370, Long Beach Calif. 90815; "Antique Radio Corner," the author's column in *Elementary Electronics* magazine.—J.A.F.

TUBE RADIO IN A KIT



It's hard to buy a new tube radio now, but you can build this one from a kit.

If you don't have an old radio to restore, you can build a new tube radio from a kit. Graymark Industries of 1751 McGary Ave., Irvine, Calif. 92714, explains that it sells the kits because it deals with schools and some instructors still insist that their students learn vacuum-tube fundamentals. That's your good luck. Graymark's Penmar 510, at \$29.95 postpaid, is a classic five-tube, super-heterodyne broadcast-band AM receiver that goes together in a few hours—most of the work involves simple point-to-point wiring on the chassis underside. The kit is complete, down to solder and a nonconductive alignment tool. Instructions are clear and complete, with tests for each construction stage, and the finished product performs well.

Graymark also sells, for the same price, its 511 All-Band Radio kit—a three-tube regenerative set that also provides an introduction to coil winding.—Stephen Walton

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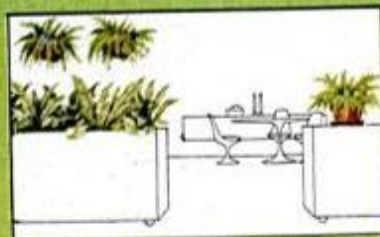
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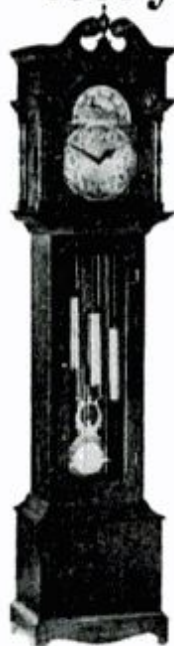
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CRUISE CONTROL FOR YOUR CAR

(Continued from page 124)

maintain speed automatically, but won't have any other features various other units offer. Among these are "resume," "accel" and "coast."

"Resume"—what's that? With every speed-control unit, when you depress the brake pedal, the speed control automatically disengages. This is true for factory-installed units and those sold over-the-counter.

To re-engage a factory-installed unit in a GM car, you have to accelerate to the desired speed once again by depressing the accelerator pedal. You then have to activate the speed-control unit as before.

With a control unit having resume, the unit is disengaged when you step on the brake. However, you can return the car to the previously set speed merely by pressing or turning the speed control. You don't have to re-accelerate using the accelerator pedal.

Some units with resume have another feature called "accel," which is short for acceleration. While you are cruising, this feature lets you accelerate the car by partially depressing the button. When you release the button, the vehicle returns to its original preset cruising speed.

Resume and accel features have been built into speed-control units installed at the factory in 1978 Chrysler Corp. and Cadillac models.

Ford Motor Co. models with factory-installed speed control don't have resume or accel features but do have something called "coast." This allows you to decelerate the car to 35 mph by pressing and holding the "coast" switch. When you wish to resume speed, you press the "set/accel" switch.

Representative retail prices charged for factory-installed speed-control units in 1978 models as this article was written are:

- 1978 AMC models: \$85.
- 1978 Chrysler Corp. models: \$86 to \$99.
- 1978 FoMoCo models: \$99 to \$127.
- 1978 GM models: \$90 to \$95.

Add-on kit units

A car that has no factory-installed speed control can be retrofitted with a kit that a dealer will install. Units sold by AMC, Chrysler and GM dealers are the same type installed in the particular model car at the factory. They're about \$100.

The speed-control unit sold by Ford-Mercury-Lincoln dealers for retrofit is not the one that's factory-installed. It is similar to the one I've

seen advertised by Sears, Roebuck

The FoMoCo retail price of this kit is \$112. Sears sells it for \$85 (on sale it's \$65).

If you decide to have one of these kits installed by your dealer, add the labor charge to the cost. I can't give you an exact amount, but you can figure it will take a mechanic about 2½ hours to do the job. A fee of \$16 per labor hour seems to be the national average.

How speed control works

A speed-control unit comparable to a factory-installed unit works on engine vacuum. I'm referring to units judged to be safe and reliable. The one I'll describe is that installed in GM models and sold by GM dealers. Units put into AMC, Chrysler and FoMoCo models or sold by dealers, or units of similar design sold by retail stores, are just as good and work similarly.

The GM unit consists basically of a power unit, transducer and engagement switch. The power unit and transducer are mounted in the engine compartment. (In some systems, both are combined in a single unit called a servo.) The engagement switch is located at the driver's fingertips.

The power unit, which is connected by a chain to the carburetor's throttle linkage, employs vacuum to control the throttle. It gets vacuum from the transducer, which is connected to a vacuum port on the engine. The transducer, in turn, is controlled by the electrically operated engagement switch.

Backup braking system

A brake-release switch is tied into the unit. Actually, the unit I'm discussing has two brake-release switches. One is an electric switch. When the brake pedal is depressed, this switch cuts off voltage to the transducer. The other is a vacuum switch that operates in conjunction with the electric switch. This switch opens a port to atmospheric pressure, which bleeds off the vacuum in the power unit and allows the throttle to return to idle. In effect, this switch is a backup if the electric switch fails. (In some systems it's called the "deceleration" switch).

The speedometer is tied into all of this. The speedometer cable from the transmission drives the transducer and a cable from the transducer drives the speedometer.

Newer systems do away with this mechanical arrangement and road speed is picked up electrically from the driveshaft.

When you accelerate to a desired

(Please turn to page 188)

You're gonna love our Great Little Car. Mazda GLC.

Great little piston engine. Great little goodies. Great little price.

The 1978 Mazda GLC is a phenomenal automobile. It's not often a car of special merit comes along that doesn't cost a small fortune. It's not often a car comes along with this kind of equipment, this kind of styling, for this kind of money: \$3595** for the GLC Deluxe 3-door Hatchback.

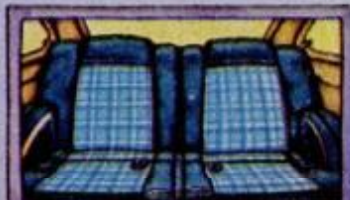
An electric remote control button under the instrument panel allows you to unlatch the hatch from the driver's seat. Or, you may open the hatch from the outside, when that's more convenient.



REAR WIPER/WASHER/DEFROSTER

Every Deluxe GLC has a rear wiper, washer, and defroster as standard equipment. A choice of 4-speed, 5-speed, or automatic transmission. And a rear seat that splits in half, so you can carry people and stuff, or just stuff.

There's a lot more to a GLC than this of course. Yet it doesn't cost a lot of money — whether



SPLIT REAR SEAT



CHOICE OF TRANSMISSIONS

it's the GLC Deluxe 3-door Hatchback, or the GLC 5-door Hatchback, or the GLC Sport, or the GLC Standard model.

Mazda's Great Little Car is a great little car. You're gonna love it.



REMOTE HATCH RELEASE



*EPA estimates based on optional 5-speed transmission. Your mileage may vary depending on how and where you drive, your car's condition, and optional equipment. 42/33 mpg Calif.

**FOE Los Angeles prices (slightly higher in California, and other areas). Taxes, license, freight, and optional equipment are extra. GLC prices for models not shown range from \$3245 to \$3920.



mazda

GLC. Now, four great little cars in all, from \$3245**

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WOODEN TOYS: A Simple One-Evening Project (an excellent first time woodworking adventure) A quick and easy project. You can make this yard engine steam train plus five different trucks using common hand tools by tracing our full-size easy to understand patterns. The patterns include the

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ALL TEN PATTERNS ONLY: \$4.00 ppd.



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This is a fine wooden toy reproduction of a nineteenth century steam train. An order for the woodworking drawings brings you plans for the locomotive plus seven cars: tender, freight car, flat car, passenger car, gondola, crane car and caboose. This is a handsome sturdy toy and detailed full size drawings make it an easy project.

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CRUISE CONTROL FOR YOUR CAR

(Continued from page 186)

speed and activate the engagement button, current in the transducer solenoid creates a "hold-up" magnetic field. This introduces vacuum into the system to activate the power unit.

The power unit diaphragm moves and pulls the chain to set the throttle at the desired speed. As long as current and vacuum are maintained, the throttle is kept at that particular position.

However, depressing the brake pedal cuts off current and bleeds vacuum to release the hold that the speed-control mechanism has on the throttle. Another act that overrides the system is the use of the accelerator pedal to gain more speed. Once the new desired speed is attained, the engagement button has to be depressed again.

Speed-control mechanisms with the resume feature have a second solenoid in the transducer unit that allows a small amount of air to leak into the system when the brake is applied. This is sufficient to override the speed control momentarily, but not to disengage the system. When you activate the resume control, the leak is "sealed," and the primary control takes over.

'Resume' used only above 35 mph

The resume feature can be utilized only if the car is traveling above 35 mph. If it is traveling at lesser speeds, the primary control will be de-energized when the brake pedal is pressed.

When you buy a speed-control unit, remember that the one I've described can be installed in vehicles with standard or automatic transmission. Some units can be installed only in cars with automatic transmission.

Speed-control kits come with explicit and easy-to-understand installation instructions. I suggest you find out which companies offer what you want. We've discussed units offered by new-car dealers before, so you needn't go over that ground again.

The following are among the principal makers of speed-control kits sold by retail stores, such as Penney's, Ward's and Sears:

- A.R.A. Mfg. Co., 606 Fountain Pky., Grand Prairie, Tex. 75050.
- Annuncionics, Inc., 2205 Stoner Ave., Los Angeles, Calif. 90064.
- Dana Corp., Box 455, Toledo, Ohio 43692.
- Otto Goodys, Div. of Polymer Industries, Inc., 17 East Orange St., Chagrin Falls, Ohio 44022.
- Perfection Automotive Products Corp., 12445 Levan Rd., Livonia, Mich. 48150. **PM**

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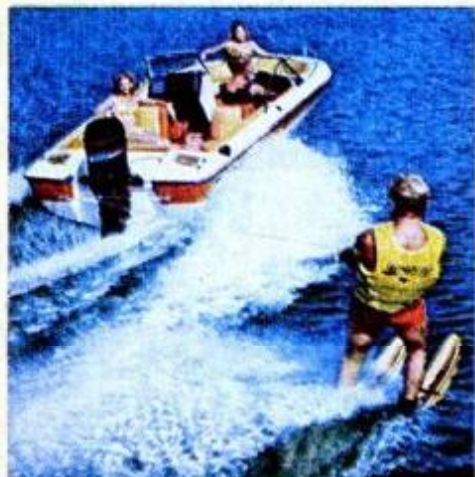
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Black Max.® Symbol of the new Mercury® Black Max Series. Three top-of-the-line outboards—150, 175 and 200 hp—with compact 60° V-6 engine design. The product of six years of uncompromising engineering, refining and testing.

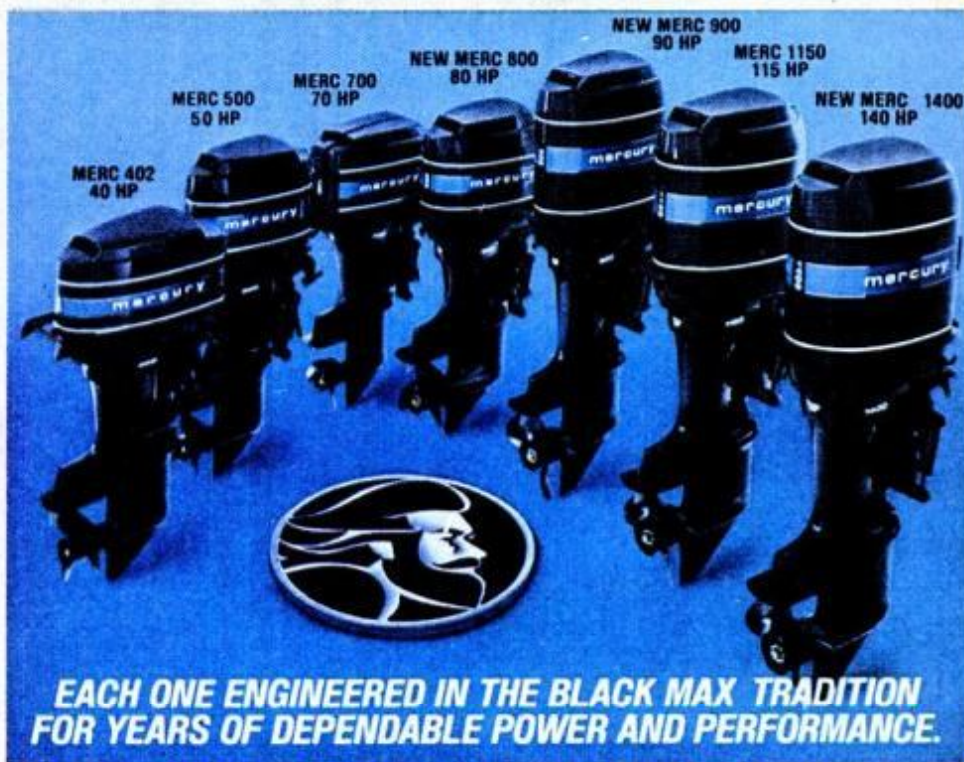
HOW BLACK MAX MAKES EVERY MERCURY A LITTLE BETTER.

Now the same standards of engineering excellence achieved with Black Max have been applied to every Mercury outboard—from fast, dependable starts through remarkable fuel economy to ease of operation.

Mercury has gone all out to make the outboard of your choice—whether it's a small fishing Merc, a new 80-hp model, or a mighty Black Max—an extraordinarily dependable performer.



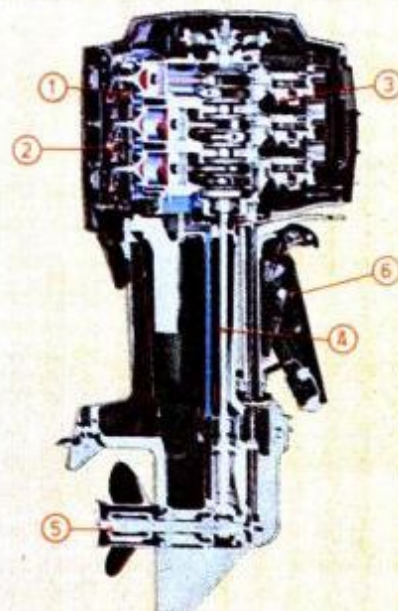
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EACH ONE ENGINEERED IN THE BLACK MAX TRADITION FOR YEARS OF DEPENDABLE POWER AND PERFORMANCE.

DEPENDABILITY THROUGHOUT, FROM THUNDERBOLT IGNITION TO SHOCK-ABSORBING PROPELLER HUB.

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(1) You'll get fast, sure starts with Thunderbolt® CD sealed ignition. (2) Clean-firing Perma Gap® plugs almost eliminate tune-ups. (3) And for smooth, trouble-free running, fixed jet carburetion meters a steady, even flow of fuel, from idling to high-speed running. (4) The stainless steel shift shaft, drive shaft and prop shaft combat corrosion. (5) And your Merc can keep on going despite most unexpected bumps and thumps because of the sturdy lower unit housing and the shock-absorbing propeller hub. You can't shear a pin—because there aren't any. (6) All Mercs from 50 hp to 140 hp have Dyna Shock™ absorber systems, providing an extra margin of safety should your engine be kicked up by high-speed impact with a heavy obstacle in or under the water.

In high-horsepower outboards, less horsepower per cylinder means less wear and longer engine life.

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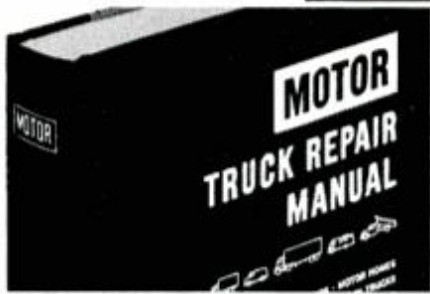
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BACK-YARD RESORT

(Continued from page 139)

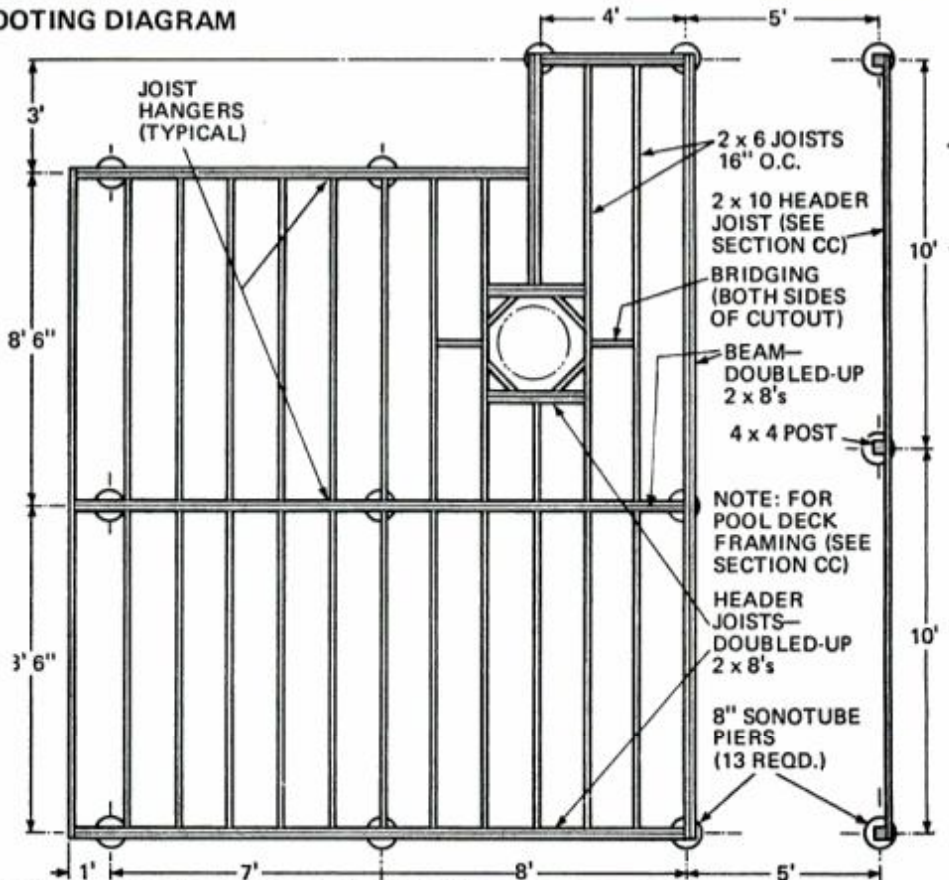
into careful account before you begin.

The lower deck rests on cylindrical footings (concrete poured into Sonotube forms). The deck joists, in turn,

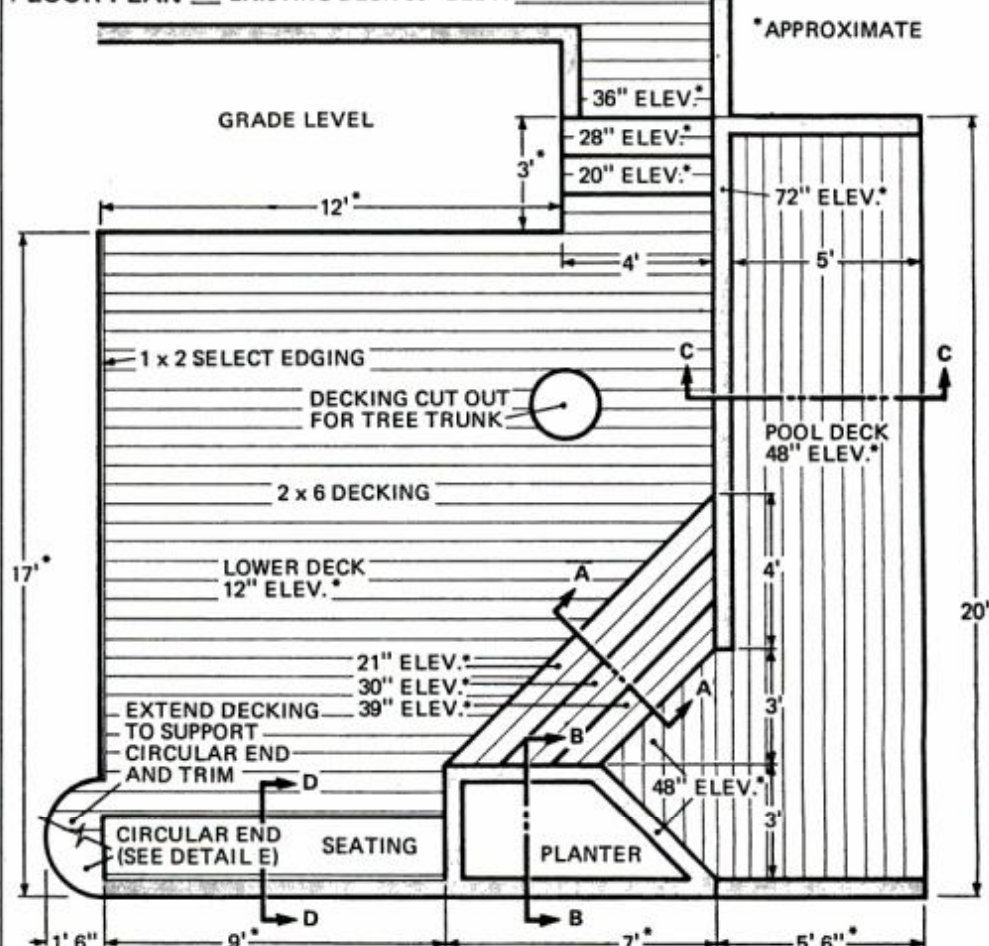
are secured to footings using commercially available hardware, or drift pins embedded in the concrete. Decking is nailed to joists with 8d hot-dipped galvanized nails.

The near side of the upper level (Please turn to page 192)

FOOTING DIAGRAM



FLOOR PLAN — EXISTING DECK 36" ELEV.



The Cobra 50XLR CB has it all. AM/FM Stereo. Cassette. And CB. All in one compact unit. All engineered to bring you the same loud and clear sound Cobra is famous for.

The remote mike houses the channel selector, squelch control, and channel indicator. So all you need for talking CB is right there in your hand. The cassette player features through the dial loading and four-way fader control.

Because they're only five inches deep, there's a Cobra in-dash radio to fit almost any car with little or no modification to the dash. This feature, plus the step-by-step Installation Manual and Universal

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Tone frequencies are crystal controlled, providing accuracy 5 times beyond actual requirements. The built-in microphone is similar to those found in finest tape recorders. Clarity is better than the old carbon microphones currently used in most telephones. **Important:** Soft-Touch™ is approved for you to put on your own phone. If you can unscrew a bottlecap, you can install your own Soft-Touch™ in less than a minute. But, if you lease your phone from the phone company, they may wish to install it. Regulations and telephone company charges for this service differ among local telephone companies.

Make Your Phone A Conversation Piece. The Soft-Touch™ is so new that, recently, several banks have introduced it to their customers for banking and paying bills by tone dial direct from their home phone!

Use It For 10 Days...At Our Expense. If you are not absolutely satisfied with the quality, convenience and uniqueness of the extraordinary Soft-Touch™, return it to us within 10 days for a prompt and courteous refund of the purchase price.

Soft-Touch™ is a registered trademark of 2001 Telephone Systems, Inc. It is protected under U.S. Patent Number 4042793 and is backed by the manufacturer's FULL YEAR guarantee.

Please send me _____ Soft-Touch™ Tone Dials. My color choice is:

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Check or M.O. Enclosed Charge My Credit Card:

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BACK-YARD RESORT

(Continued from page 190)

is built directly over the edge of the lower level. For that reason, the joist along that edge of the lower level is doubled up to create a beam. The pool side of the upper level is supported by three 4x4 posts secured atop cylindrical footings with drift pins.

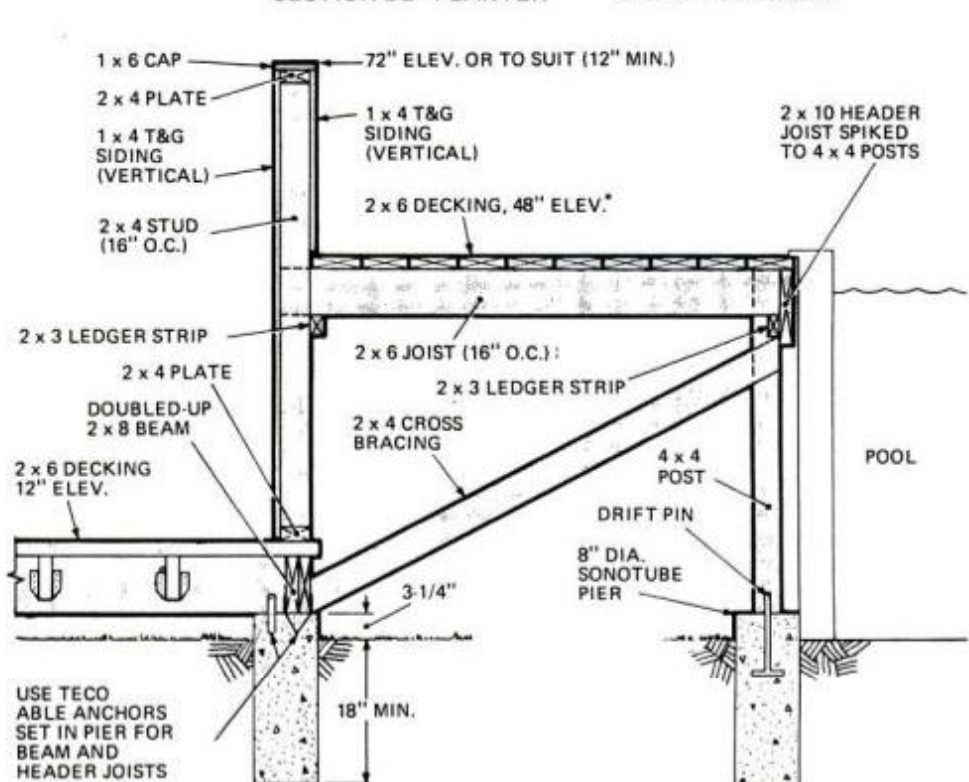
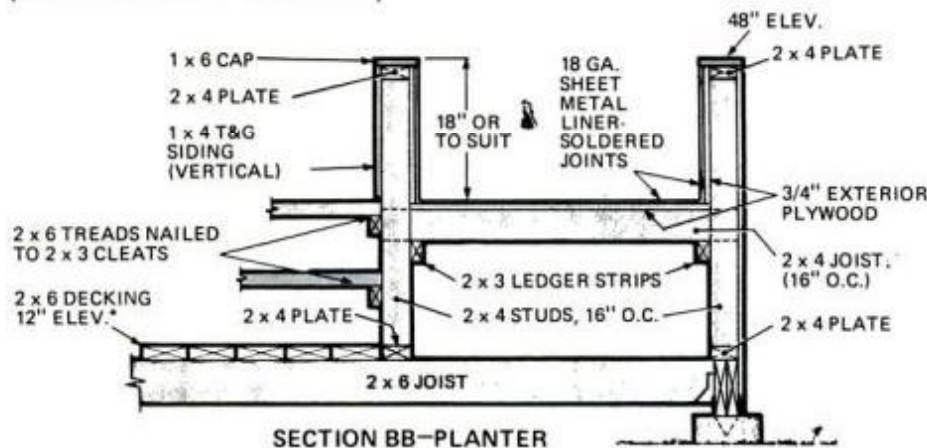
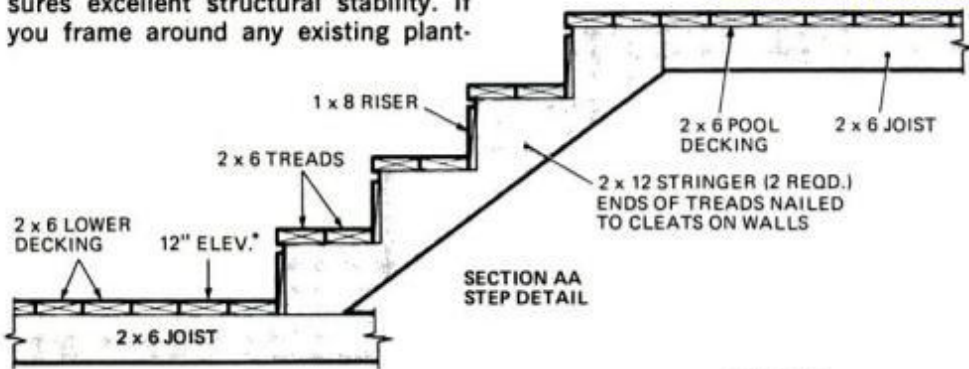
Metal joist hangers are used throughout; these are available at lumberyards and homebuilding supply centers. Use of such hardware makes the task a lot easier, yet assures excellent structural stability. If you frame around any existing plant-

ings, as we did with the tree at stage center, you will inevitably have to cut at least one joist and install headers.

To minimize deflection (bounciness) in that area, you would be wise to install bridging between pairs of joists flanking both sides of the framed opening (see drawing). To create the round opening, simply install decking over joists in a conventional manner, but leave a goodly amount to overhang the opening and cut the decking with a sabre saw.

The high point of this deck design

(Please turn to page 194)



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**Measure Your
Share of Our
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page 21

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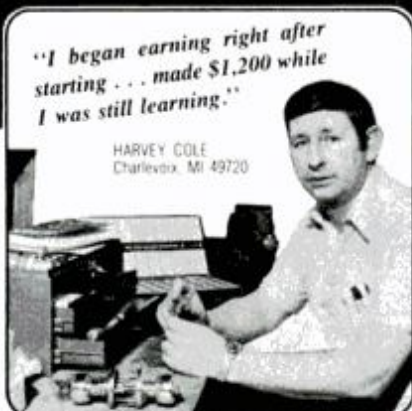
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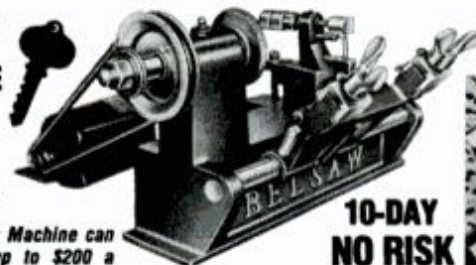
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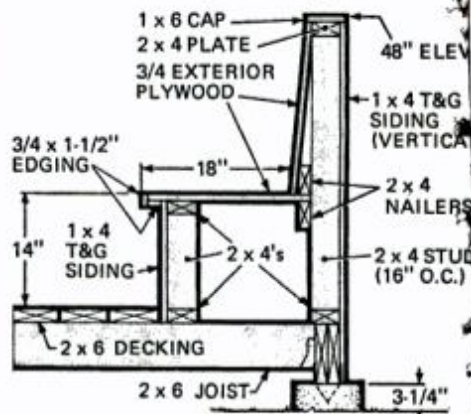
BACK-YARD RESORT

(Continued from page 192)

is the privacy screen established by installing the built-in seating/plant wall. This line continues on the upper deck with installation of the fence.

Note that the half-cylinder at the right end of the seat is supported by being cantilevered on extended decking in the corner, and by being tied into the wall behind the seat. Since the half-cylinder doesn't weigh very much this procedure is structurally sound.

When building the steps to the upper



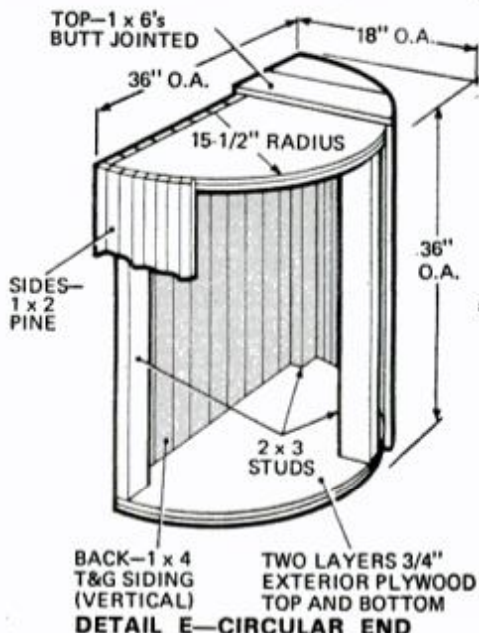
SECTION DD-SEATING

per deck, lay them out so that rise height falls in the comfortable-to-navigate 6-to-7 1/2-in. range.

Construction hints

■ Make certain that all lumber that comes in close contact with the ground is protected by wood preservative. Though joists rest on concrete piers, you are well advised to coat them immediately after they are installed.

■ To prevent water problems or rot, the planter is fitted with a sheet-metal liner. To guarantee against water seepage, solder the corners with the box in place. Note that the liner folds over the planter sides and is capped by the top trim detail on the planter. **FM**



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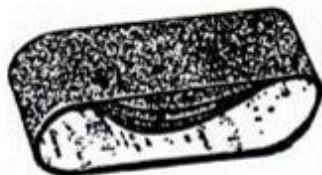
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FIRST-TIMERS TEST A MOTOR HOME (Continued from page 116)



Not the equivalent of a stately home, but a lot more convenient for a tour, the motor home proved handy as a summer cottage or mobile beach bungalow. The built-in generator (below) supplied 110-volt a.c. for an air conditioner and refrigerator. Best campsites proved to be friends' driveways equipped with a house-current cord.

and how much space it'll take to negotiate a tight corner in the city. Trouble is, in town there's rarely a decent place to park. In Washington, D.C., we spent one morning driving around in frustration looking for some place—anyplace—to get rid of the beast. Parking attendants just kept waving us on. Finally, we ended up in a distant lot that cost \$18 for three hours plus that much more in cabs. Just before leaving D.C. we learned that somewhere in the city there is supposed to be a parking area reserved for motor homes and trailers.

Where to stop?

Finding a place for the night can be a problem as well. Our guidebooks listed campgrounds, but we didn't realize we had to call ahead for reservations, sight unseen. Usually there wasn't much privacy, although near Worcester, Mass., at the only campground we really enjoyed, we had a whole open field to ourselves. On Cape Cod we were jammed cheek to jowl with hundreds of other "campers" on a couple of grassless acres, but during our days there we'd take the motor home right down to the shore and use it as a beach house. That was great as we changed clothes, cooked, ate, and relaxed right there inside.

Our central airconditioning could be run on the coach's own engine-driven 110-volt a.c. generator or plugged into campground current, and the rig also had a Harrison unit



powered by the 454-cu.-in. Chevy V8. Our hot water was heated by the engine or by butane, with automatic switching by a clever system. The refrigerator, a large one with handy freezer compartment, could run off plug-in current, the coach's generator, or butane. Cooking facilities were excellent: double sink, four-burner stove, oven with broiler and even a warming oven.

Motor homes are cleverly engineered, but you find that practically everything converts into something else. One son slept on the converted dinette, for example, which meant he got up early or we breakfasted elsewhere. Sleeping and bathroom accommodations can be so compact, in fact, that you may find more togetherness than you're prepared for.

We averaged 7.4 miles per gallon on premium leaded fuel—not bad for an 11,165-pound vehicle. But the unit costs about \$20,000. Try several rentals first to see if you'll be buying an albatross or a magic carpet.

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CARS OF THE '80S (Continued from page 89)

cars and the intermediates, GM set up a special design group at its central engineering staff to develop the X-body. Named to head this was Robert J. Eaton, a Chevrolet man, and designers from all the divisions involved were assigned to him to represent their engineering groups. But before they put pencil to paper, Eaton visited Opel in Germany to see what plans for the future this GM leader in small-car design was making. What he found there, and what his other engineers confirmed, was that the lightest and most compact design for the new X-body would have front-wheel drive and a transverse engine.

Drive through the front wheels is no novelty to GM, which has offered it in the Olds Toronado since 1966 and the Cadillac Eldorado since '67. But these were big, heavy, expensive cars. They'd fostered a belief at General Motors that front drive was a costly special feature, too expensive to be used in lower-priced small cars. This was especially the view of S. E. "Bunkie" Knudsen while he held top GM jobs, and he made key top-level converts to his belief. So it has been a huge turnaround for GM to okay a line of low-cost compacts making use of front-wheel drive.

In preparing the new X-body design, Eaton's team worked with interior dimensions much like those of the new '78 GM intermediates. Their challenge was to get that kind of room in a much lighter car that would give far better gas mileage. In fact, they were given a weight target by GM management and told to meet it "come hell or high water," as one product planner put it. That target was the EPA's 2750-pound inertia weight category, the one it uses for emissions and economy testing. Making allowances for the various EPA calculations, this 2750 pounds will be some 800 pounds less than the X-bodies of today.

Sadly goes V8 engine

One of the toughest decisions that had to be made in planning the 1980 X-body was the elimination of a V8 engine from the line. To many of us the V8 is a symbol of luxury, power and smoothness. Also, Ford offers a V8 in its Fairmont/Zephyr compact line. But the Eaton team concluded that the added weight and bulk of a V8 would push the new X-bodies too far over the weight limit. They went with a V6 and a Four instead, and placed them transversely at the front. The new GM Xs will be the first cars in the world to

offer a choice of a Four or a Six in a transverse front-drive layout.

For the Four, they turned to the 151-cu.-in. (2.5-liter) cast-iron engine with pushrod overhead valves that Pontiac now produces. Originally a Chevrolet design, it traces its origins back to the Chevy II of 1962. For the X-bodies it'll be lightened and offered also in a smaller 135-cu.-in. (2.2-liter) size. The V6 option will be a completely new engine designed and built by Chevrolet. To make it compact and improve its dynamic balance, it'll have the classic 60° angle between its cylinder banks instead of the 90° angle used in the other GM V6s, which are made on V8 tooling. This neat-looking new Six is expected to displace 165 cu. in. (2.7 liters).

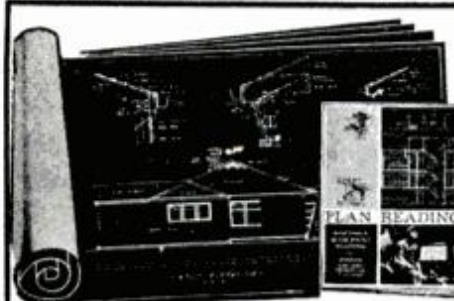
More use of aluminum

Initially, both engines will have cast-iron blocks and heads. Some parts, such as intake manifolds, will be aluminum from the start of production and others will be converted to the light metal as experience with its use is gained. Chevrolet is carrying out a massive expansion of its aluminum die-casting plant at Massena, N.Y., to meet the demands of the X-body program. To pass the tougher emissions standards taking effect in 1980, the larger engines will have air pumps as well as catalyts. And for those who want hotter performance, turbochargers will soon become optional.

A lot of the Massena aluminum will go into the X-body transmission housings. All of them will be die-cast of aluminum. The automatic will be a new Turbo-Hydramatic Type 125, with a torque converter and three forward speeds, and the manual will have four synchronized speeds. It'll be made at Chevrolet's Muncie, Ind., plant.

Since the engine will be offset to the right side of the car, the trans-axle units will be placed to the left, extending out from the helical "ring and pinion" gears that drive the differential. With all the shafts placed transversely, there's no right-angle turn like that in a normal car's rear axle. This, according to Pontiac general manager Alex Mair, gets rid of a 40-percent loss in efficiency caused by the conventional rear axle.

With such a compact power pack, the design group could pare down the X-body's outside dimensions. They set its wheelbase at 103.5 inches, two inches shorter than the Ford Fairmont, and gave it an overall length of only 174.7 inches, a full foot and a half shorter than the



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Ford. The X-body width is expected to be 68.6 inches, and its height 55.1 inches.

By U.S. standards, this is an inch or two on the tall side, but times are changing. People have to sit up straighter if the cars are to get any shorter.

As one GM stylist told me, "The American designer is becoming more Europeanized. They're getting used to seeing the gas tank under the rear passengers, to seeing a higher car." In its proportions the X-body is more European than American, and in its dimensions it's midway between the Ford Fairmont and the new Plymouth Horizon.

More 'European' influence

European methods were also put to work in the running gear under the X-body. At the front it's suspended by MacPherson struts, with coil springs, and steered by a rack-and-pinion gear. Power steering will be an option with the Four and probably standard with the heavier V6. Both the power steering (made by Saginaw) and the front struts (from Delco Products) are already being tried out on the new Chrysler Omni and Horizon; GM sells those parts to Chrysler. Coil springs and tubular

shocks are also used at the rear, where the trailing-arm suspension resembles the design used by VW for the Rabbit. Brakes will be disc in front and drum in the rear, inside 13-inch wheels.

As if to top off the European influences on this new compact, the stylists gave it a decidedly Continental look. Most so are the body styles that Chevrolet and Pontiac will share (and which are shown in the accompanying illustrations): fastback two-door and four-door sedans with a lift-up hatch at the rear. They have the six-window layout and deep side glass of some of the latest Italian and French designs. For Buick and Oldsmobile, the body is reworked to a more conservative notchback design. These have conventional trunk openings.

Station wagon may come

In the way it always manages to do so well, GM will give each car special features to play up its divisional identity. Pontiac, for example, is considering the use of the new Daimler-Benz S/L urethane bumper system. This uses plastic alone to meet the bumper rules, with no metal inserts or energy-absorbing cylinders. With this bumper its Phoenix

could have a highly distinctive front-end design.

No station wagon as such is part of the initial X-body lineup (but a concept of how a wagon design may be handled appears on page 88). Instead, GM will use the front-drive components on a separate chassis which it calls the MPC, for multi-purpose carrier. The idea behind the MPC is to build a single basic vehicle, with forward steering and a sliding side door at the right, that can serve as either a van or a station wagon. GM planners feel this will come closer to fitting the changing lifestyles of the younger buyers who'll be interested in the X-body cars. Both Chevrolet and Pontiac will have wagon versions of the MPC in time for the beginning of the 1980 model year.

After these X-body models, GM has to deal with the question of its F-body cars: the Chevy Camaro and Pontiac Firebird. These are based on the present X-body chassis, so when that goes out of production early in 1979 those sporty cars will be obliged, for economic reasons, to switch over to the new X-body parts. But many at GM, both designers and engineers, fought hard against the

(Please turn to page 200)

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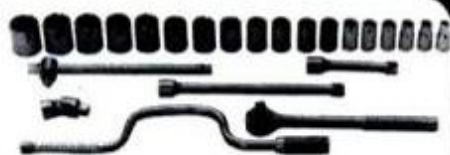
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CARS OF THE '80S

(Continued from page 199)

idea of front-wheel drive for cars like the Camaro and Firebird. Yet any other arrangement wouldn't take advantage of the low-cost parts that were being tooled for large-scale production for the X-body.

Tested foreign cars

To weigh the alternatives, the GM engineers tested prototype cars plus samples of existing cars—Lancias, VW Sciroccos, Alfa Romeos—with different drive layouts. They decided that rear-wheel drive was still the best way to go for a sporty car. For 1981 introduction, they're readying a new F-body line that will use the V6 engine in front powering a rear axle, probably in the conventional manner. Some designs being evaluated have independent rear suspension also. And it's still not too late to rule out a transaxle setup (as shown in the Camaro illustration).

In the looks department, future Firebirds are expected to hold up today's high standards. The styles being developed for it and the Camaro have subtly curving, rounded forms instead of the angular wedge shape that's so popular in Europe now. The '81 F-bodies will both look and be highly aerodynamic, truly streamlined. It goes almost without saying that cars like these will be offered in turbocharged form, for performance to match their looks.

Detroiters have been startled by the openness with which GM has been testing its X-body prototypes, even on the roads outside its Milford Proving Grounds. And many Lancia Beta sedans and coupes are being used as rolling test beds for the engines and transaxles. It seems likely that GM is giving the X-body its most thorough preproduction check-out of recent years, precisely because it does realize how essential it is that the cars work right from the start.

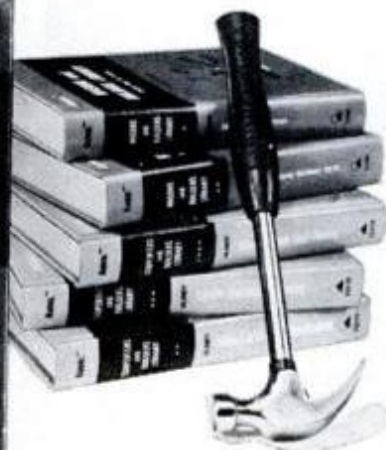
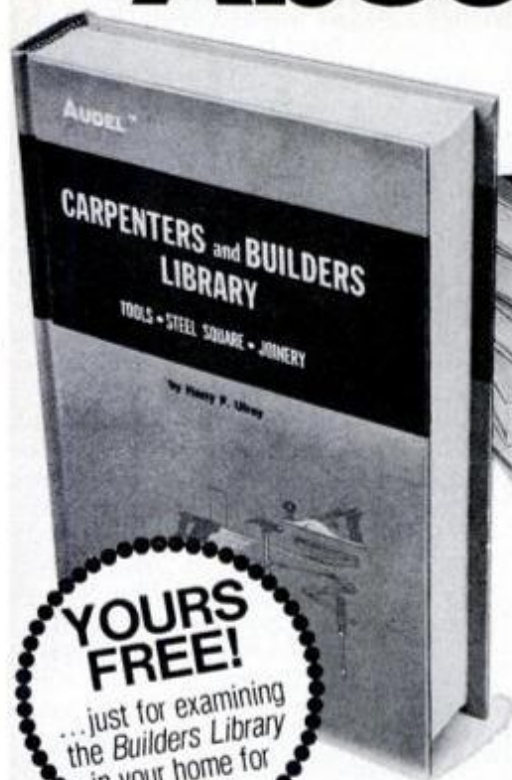
X-bodies must prove successful

In the spring of 1979, the X-body models will start rolling down assembly lines at GM plants in Oklahoma City, North Tarrytown, N.Y., and Willow Run, Mich. After that, they must keep rolling in the hands of happy owners. On the scale of the X-body, GM can't afford the legal entanglements of the Corvair or the dismal service reputation of the Vega. These new Novas, Phoenixes, Omegas and Skylarks have to be debugged before production starts, not afterward. A lot of GM's very blue chips are riding on this throw of the dice. They'd better not come up snake eyes.

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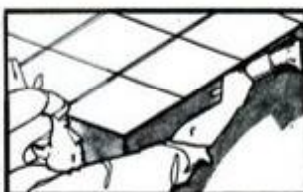
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WHEN THE TERRORISTS STRIKE (Continued from page 92)

received a bullet wound in his arm.

G.S.G. 9 grew to 178 officers and men, divided into one 30-man assault squad and four 30-man support units, plus officers. These hand-picked volunteers don't fall apart in a high-stress situation, are expert in karate, explosives handling and are crack shots with rifles and sub-machine guns. All have high I.Q.s and many have received supplemental training in the United States.

Since terrorists have the choice of time and place of attack, antiterrorists must have flexibility in their choice of weapons. There are limitations, too, when hostages are involved. Shotguns are out, since hostages would be endangered. Pistols are no good either, since terrorists usually are armed with automatic weapons. Submachine guns and assault rifles are the logical choices.

Star-Tron scopes—or their equivalent—which intensify light by as much as 80,000 times, allow an antiterrorist commando to see his target in substarlight conditions. Infrared sniper scopes are also used on assault rifles. When terrorists are holed up in a building or airliner, the more compact submachine guns

are preferred to assault rifles.

The ideal submachine gun would be chambered to fire a 9-mm round and have a rate of fire of about 450 rounds per minute (rpm). The heavier the recoil mechanism, the slower the rate of fire—and the heavier the gun. Too high a rate of fire makes the weapon less controllable and wastes ammunition (unacceptable where each round counts). The Israeli commando groups use their own excellent Uzi submachine gun, a compact weapon slightly more than 17 inches long, with a rate of fire of about 650 rpm. A Uzi weighs about nine pounds, which takes it out of the lightweight class.

Widely used weapon

United States Secret Service agents carry Uzis in compact black leather cases when guarding the President. Uzis are also the standard submachine gun of Peru, the West German army, South Africa, Rhodesia, the Netherlands and a number of other countries. West German police units—and Protection Group 9—have opted for German designs produced by the Heckler & Koch GmbH and Walther companies.

The Walther MP-K is a snub-nosed 9-mm weapon some 15 inches long (with stock folded), has a 32-round magazine, weighs 6.75 pounds and has a rate of fire of 550 rpm. Heckler & Koch's MP5A3 is 22 inches long, fires 600 rpm, has a 40-round magazine and weighs 7.37 pounds. A recent introduction to the arsenal of Border Protection Group 9 is the new H&K MP5K, developed from the MP5A3. The MP5K is only 12¾ inches long and weighs 4.37 pounds. A drawback of this light weapon is that its rate of fire has been increased to 840 rpm. (A heavy-handed shooter can empty its 30-round magazine in about two seconds!)

As a backup, the commando group uses H&K 33A3 rifles, which can be equipped with night-vision scopes. Body armor, capable of stopping the 7.62-mm round of a Russian AK-47 (a standard terrorist weapon) at short range, is worn by these assault troops to minimize casualties.

The West German group—as well as commando groups of several other nations—have mock-ups of every commercial airliner and practice assaults against them and against conventional buildings. To gain entry into a sealed airliner, a space-age explosive is used, fabricated in the form of a plastic tape.

Like opening a can

The tape was originally developed to separate missile stages. It was placed around the missile and, at the precise time of separation, was ignited electrically. The igniting charge traveled along the tape at virtually the speed of light, resulting in an instantaneous explosion around the entire perimeter. This explosive cutting method has been extended to the field of antiterror weapons, where it is used as a "can opener" on emergency exits. This was how G.S.G. 9 gained entrance so quickly to the Lufthansa aircraft at Mogadishu.

"Stun" grenades, as used by the German group against the Lufthansa hijackers, is another high-technology gadget being used to turn the tide against terrorists. Typical is the Israeli No. 14 assault grenade. Made of laminated paper with sheet-metal ends, the grenade contains 7 ounces (200 grams) of TNT flakes, weighs 11.5 ounces (325 grams) overall and is under 5 inches long.

The grenade fuse is actuated when the pin is pulled and the weapon explodes just 4.5 seconds later.

The Israeli stun grenade is made in Germany where it is called the DT11B1 assault grenade. A similar weapon, with some flash powder added, is made for Britain's 900-man

Special Air Services (S.A.S.) anti-terrorist regiment. As an indication of the cooperation to be found among antiterrorist units, two S.A.S. officers accompanied Protection Group 9 to Mogadishu and provided them with British grenades.

Many nations form units

Antiterrorist tactics are still being developed and results shared among nations. The Swiss are in the process of forming a 200-man anti-terrorist unit along the lines of the German group. The Dutch have two units that complement one another. The first, consisting of members of the Royal Dutch Marines, is trained for close-quarter hand-to-hand combat. A second unit is made up of picked sharpshooters from the army, navy and police and provides covering fire. In June 1977, the units were used to storm a hijacked train and a schoolhouse being held by South Moluccan terrorists. In the fighting that followed, six terrorists and two hostages on board the train were killed.

Unquestionably, the Israeli anti-terrorist units have had the most experience. Their groups, unlike the German police unit, are made up of highly trained soldiers. In 1972, a hijacked Sabena jet was flown to Israel. Israeli commandos, disguised as airplane mechanics, burst into the airplane. Three of the four hijackers and one passenger were killed. At Entebbe, the Israeli unit freed more than 100 hostages from a hijacked Air France airliner. Six terrorists lost their lives in the battle as did a number of Ugandan soldiers attempting to intervene on behalf of the terrorists. It is a grim measure of the level of efficiency at which the special units operate that more than 30 Ugandan troops were killed with the loss of only one Israeli.

The crack Israeli commando group is General Intelligence and Reconnaissance Unit 269, or *Saiyeret* (often simply referred to as "the unit"). In addition to the Entebbe raid and the Sabena airliner rescue at Lod in 1972, the unit has had more encounters with terrorists than all other antiterrorist groups combined.

America's Black Berets

The United States has two 600-man Ranger battalions trained for antiterrorist operations. Training for these Black Berets include rescuing American diplomats—the American ambassador to the Sudan was murdered by terrorists—and going to the aid of American hostages anywhere in the world. Basic weapon of these troops is the 5.56-

mm Colt M-16 (and submachine-gun derivatives). For close-quarter work, as in a skyjacking, this is less than the ideal weapon, since the bullets are light and deflected easily, a real danger when there are hostages around.

France employs a 30-man antiterrorist group known as *Gigene*—the National Gendarmerie Action Group. This small force is bolstered by less-specialized military units. Italy's answer to terror is a 50-man squad armed with sniper rifles and Berretta submachine guns, known as the *Squadra Anti-commando*.

Oldest among such commando groups is Britain's SAS, which dates back to the World War II. At that time it was a purely military unit that often operated behind enemy lines in North Africa and, later, in Italy. At that time, it was stiffened by Gurkha units. Today, it operates mainly against members of the Irish Republican Army in Northern Ireland.

Nine athletes killed

The turning point in antiterrorist thinking and tactics occurred in 1972, after nine Israeli athletes at the Munich Olympic games died when West German police (before

the formation of G.S.G. 9) bungled a rescue attempt.

The attack against the Munich terrorists failed for three major reasons: The police units involved had not received any special training in antiterrorist operations; they were inadequately armed (when the lights at the airport were shut off by mistake, they had no night-vision equipment), and there were too few sharpshooters among them to cut down the terrorists quickly enough.

A quiet revolution has taken place since then in the attitude of a number of nations in response to terrorism. For most of these nations, the Munich massacre was the last straw. A hard look at what had happened and the recognition of the fact that there are countries that actually reward, arm and give sanctuary to terrorists convinced moderate nations that only specially trained and equipped forces could turn the tide. One more ingredient—the will to act—was required, and the Munich massacre provided that.

Terrorism goes far back

There is nothing new about the use of terrorist tactics to achieve political ends. In the 12th century a

(Please turn to page 206)

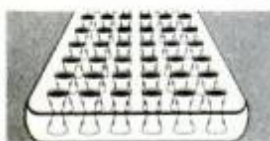
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WHEN THE TERRORISTS STRIKE

(Continued from page 205)

sect known as the *Hashishim*, or Assassins, influenced the entire Middle East through attempts to murder any or all who opposed them. No one was safe from these fanatics who, at a word from their leader, known as the Old Man of the Mountain, would go to certain death in order to eliminate anyone who had displeased him. Things haven't changed much in eight centuries, except that modern weapons and more open societies had tilted the odds in favor of the terrorists—until recently.

Today's terrorists still can't be isolated by nationality or cause. Japanese Red Army terrorists slipped into Lod Airport and sprayed the terminal with machine-gun fire, a deed designed to underline their solidarity with the Palestinian cause. Similarly, the Lufthansa Boeing 737 was hijacked by Arabs who demanded the freedom of 11 German radicals in prison.

As never before, terrorist groups, in a loose confederation, are united on a global basis. Libya has supplied arms to the Philippine rejectionists in Mindanao, to the Irish Republican Army and to German radical groups. South American revolutionaries have trained Arab groups in urban guerrilla tactics. Hijackers have moved about Europe freely with passports provided by Kuwait, Algeria, Libya and Iraq. Ilich Ramirez Sanchez, a Venezuelan known by the code name of "Carlos," has carried out operations for a radical Palestinian group and has been in regular contact with the Japanese Red Army, the IRA and the remnants of the Baader-Meinhoff gang of German anarchists. Sanchez has been dubbed the "Jackal" by Western police forces.

They train to kill

Terrorists today are often as well armed as a commando group. Their training includes the handling of automatic weapons and the manufacture of mines, booby traps and other explosive devices. They have been taught the tactics of urban warfare and methods of ambush and concealment. Terrorists have no scruples when it comes to taking hostages. When they say they will kill their hostages if their demands are not met, they mean it. What is more, they are themselves often prepared to die, if necessary. In this, they share a common heritage with the Assassins sent out to kill by the Old Man of the Mountain.

But terrorist activities aren't likely to be as successful anymore—now we're fighting back. **PM**

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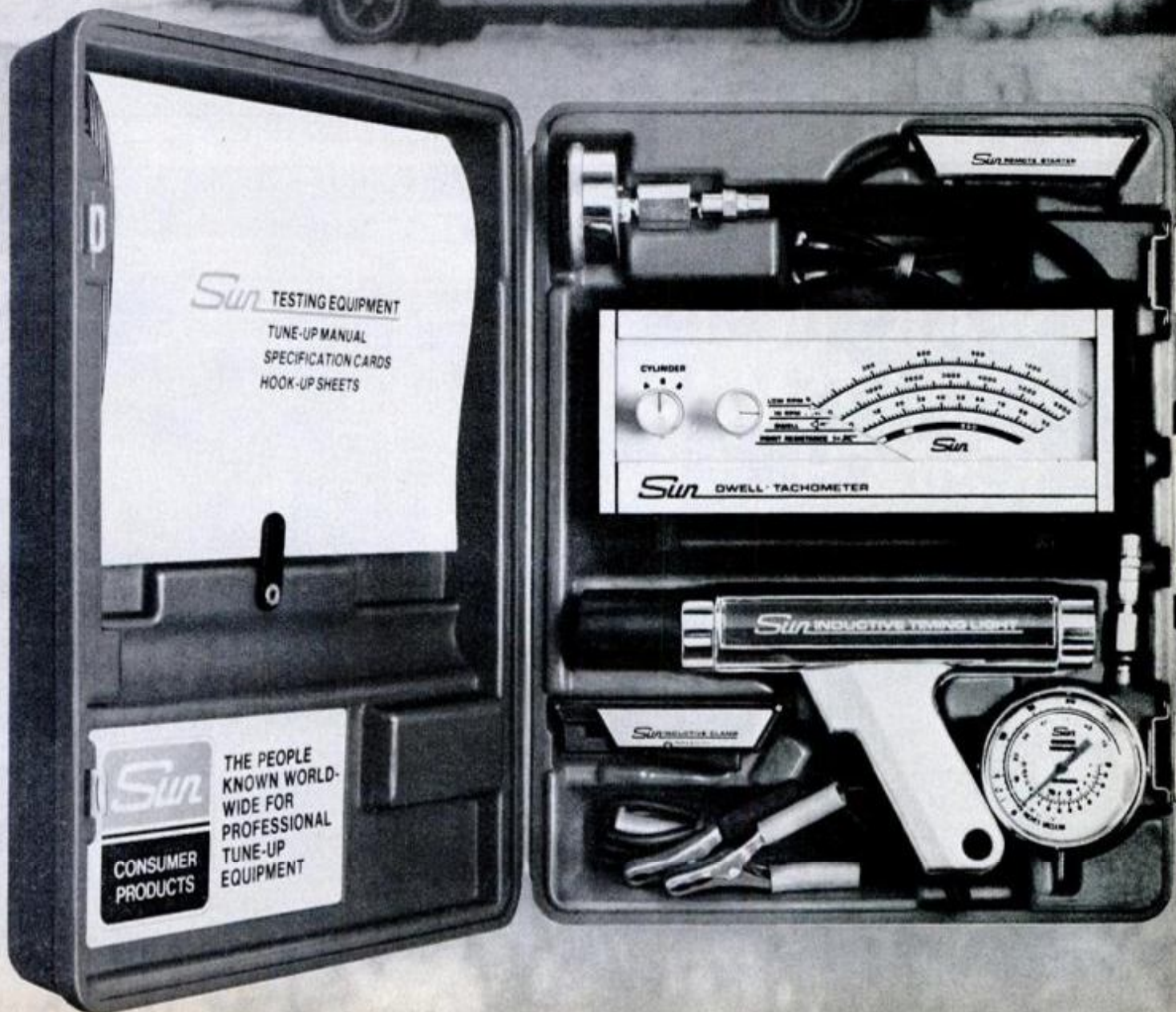
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ined: "I feel the Peugeot factory should have a more thorough training program before it turns mechanics loose in authorized dealerships. The 504D is a complicated piece of precision machinery. I ran into some dirty diesel fuel that gummed up the injectors. In 'fixing' it, the mechanic messed up the adjustments on just about everything to do with the injectors. Peugeot has been building diesels since 1923. That's longer than Mercedes. Yet the average U.S. mechanic can't comprehend what's involved. I was without my car 14 days waiting for injectors, then 15 days while they installed them, then three days more while an independent diesel mechanic finally got them adjusted."

A New York CPA comments, "I believe the dealer and his employees are more important to me than the manufacturer, whether GM, Ford, Peugeot or Volvo. I've been with this dealer for 14 years. He serviced my two Volvos during that time, and now that he's switched to Peugeot, he's the rea-



Twin-cam V6 delivers 88 bhp, has different valve timing right to left.

son I bought one." There's hardly higher praise than that.

On workmanship, owners agree it's outstanding: 91.3 percent rated it "good to excellent."

Even so, more owners did run into mechanical problems than didn't. Most problems were with the electrical system and the air conditioner. A Texas retiree summed it up by saying: "In city driving, the alternator doesn't keep the battery charged enough to operate the accessories. For instance, often the turn indicator or horn barely work. My mechanic believes the battery's

voltage isn't high enough; also that the alternator's output is too low. He's trying to get the factory to correct these problems. Meanwhile, if I don't run the air conditioner, everything's all right."

When we asked owners to list changes they'd like, "more horsepower" came in loudest and clearest. A few would like the turn-signal lever moved to the left side of the column and an equal number said they wanted more cooling power from the air conditioner (back to the electrical problem).

Other items from the "I'd like to see" file include the following:

"Doors should have spring-loaded stops to keep them open in two positions."—California stockbroker.

"Change the angle of the steering wheel—it's too horizontal."—California retiree.

"A better ventilation system."—New York physician.

"The engine oil dipstick is poorly positioned, and the V6 engine vibrates at idle."—Louisiana M.D.

"Don't change anything about

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the 504 diesel, but add a diesel to the 604 line."—California insurance agent.

"Turbocharge the engine."—Colorado sales manager.

"The diesel needs to start more quickly on cold mornings—takes too long for the glowplugs to do

their job."—Illinois businessman.

A minority of owners we surveyed talked about Peugeot's styling. A Rhode Island surgeon said he liked it because the car looked clean and neat, and wasn't an obvious status symbol. Others added that they felt it was an attractive car that didn't

make concessions to visibility and headroom.

In all, 83.3 percent said they'd buy another Peugeot next time, adding that it might be a while before that happens, because they intend to keep their present cars for 10 to 15 years. **PM**

SUMMARY OF 1978 PEUGEOT OWNERS REPORTS*

Total miles driven 760,412	For comfort 23.8	Poor 1.0	Dealer repairs satisfactory?
Average miles per gallon	For the diesel engine 19.8	Comfort opinion (front seat):	Yes 59.6%
504D (diesel)	For Peugeot's styling 14.9	Excellent 76.7%	No 40.4
In town (EPA, man. wagon, 28) 26.1	Specific likes:	Very good 16.5	Dealer service opinion:
Long trips (EPA, man. wagon, 34) 30.0	Comfort 62.6%	Good 5.8	Excellent 25.3%
604 (gasoline)	Economy 43.4	Fair 1.0	Good 36.4
In town (EPA, auto. sedan, 15) 14.7	Handling 38.4	Poor 0.0	Average 11.1
Long trips (EPA, auto. sedan, 19) 19.0	Ride 28.3	Comfort opinion (rear seat):	Fair 13.1
Series choices:	Styling 16.2	Excellent 69.4%	Poor 14.1
504 gas engine 2.0%	Specific dislikes:	Very good 22.4	Number of vehicles owned:
504D diesel 64.7	Dealer service 17.2%	Good 7.1	Peugeot only 27.2%
604 33.3	Lack of power 15.1	Fair 1.0	Two cars 52.4
Body style choices:	Gas mileage 7.5	Poor 0.0	Three cars 16.5
Four-door sedan 84.5%	Rattles 7.5	Had any mechanical trouble?	Four or more cars 3.8
Five-door wagon 15.5	What changes would you like?	Yes 57.4%	Makes of other cars owned:
Transmission choices:	More horsepower for diesel 13.5%	No 42.6	Chevrolet 13.3%
Automatic 91.1%	Rear wiper 7.3	What type of trouble?	Peugeot 12.0
Four-speed manual 8.9	Turn-signal lever position 6.3	Electrical 26.3%	Cadillac 9.3
Why did you choose the Peugeot?	Better airconditioner 6.3	Airconditioner 22.8	Dodge 9.3
For diesel's economy 24.8%	Workmanship opinion:	Transmission 14.0	Age distribution of owners:
	Excellent 58.3%	Gas gauge 8.8	15-29 years 8.5%
	Good 33.0	Did you repair it yourself?	30-49 years 36.2
	Average 3.9	No 96.5%	50-plus 55.2
	Fair 3.9	Yes 3.5	Would you buy another Peugeot?
			Yes 83.3%
			No 16.7

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



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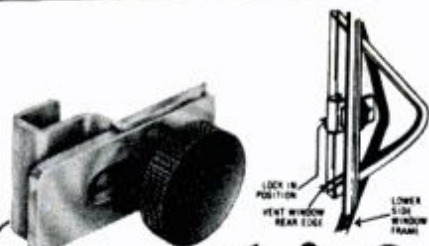
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PM DIVES WITH DEADLIEST MISSILE SUB

(Continued from page 96)

throb of engines on an ordinary surface ship, riding a nuclear sub on a calm sea is like gliding through air on a soft carpet. Standing on deck, watching the passing scene on shore, I could feel no vibrations, hear no engines. For a moment I had the strange sensation that the *Tecumseh* was motionless and that it was the shoreline itself that was passing in review. But, glancing aft, I saw our wake, and the momentary illusion passed.

With Cmdr. Golden's permission, I climbed up to one of the fairwater planes that jut out on both sides of the sub's sail-like conning tower. These fairwater planes are what were called diving planes on earlier subs, with one exception—on nuclear subs, they are above water when a craft is surfaced. In this case, they are locked into a horizontal position like fixed wings. A second set of underwater stern diving planes initiates the start of a dive. Once the fairwater planes are submerged, they, too, can be pivoted up or down for additional control over ascent and descent. They also serve as large horizontal stabilizers.

Rigged for diving

From the starboard plane, which I shared with a lookout, I could see the bow of *Tecumseh* part the water ahead. I felt as though we were riding on top of a silent whale, a powerful creature accustomed to the depths of the sea.

"We are rigged for diving," Cmdr. Golden explained. "We'll submerge once we get into deeper water." Because of heavy traffic near the East Coast, submarines coming into and leaving port are required to run submerged only in designated areas—like traffic lanes under the sea.

As land faded from sight, I went below to explore the heart of the submarine. Electronics Technician 2.C. Mike Abbott, a 23-year-old native of Knoxville, Tenn., was assigned to show me around. There was only one area of the boat that was off limits—the nuclear reactor compartment.

Missile tubes stand like silos

Abbott proved a knowledgeable guide. He began by explaining that the sub was divided into six watertight compartments, one of which was the missile compartment where 16 missile tubes, each standing like a giant silo, remained motionless and white. Berths for crewmen lined the missile compartment to permit those men charged with the care of the missiles to be nearby.

Abbott showed me the air-revitalization plant where the interior air is scrubbed and purified for reuse. If fresh air were the only factor, a nuclear sub could stay submerged indefinitely.

Dummy firing key for safety

From there, we went on to the launcher post where the temperature and humidity of the missile tubes are monitored constantly.

"And this," said Abbott, moving on to the Missile Fire Control Center, "is the firing key we use in training exercises." He showed me a black grip handle with a red button on top. The real firing key, he explained, is red with a black button, but it is safely locked away behind a shield to prevent any chance of accidental firing.

Abbott led me next to the communications center. "We stay as quiet as a calm on patrol," he explained. "We maintain a regular listening watch, but we never transmit."

Can tell position at any time

From there we went to the SINS (for Ship's Inertial Navigation System), which lets the commanding officer and his navigational officer know exactly where the sub is on the globe at any time. It's necessary information, not only for safe underwater navigation, but also for accurate firing of the sub's missiles—should that day ever come.

Uniformly, crew and officers alike will tell you that if they ever did fire their Poseidons in anger, they will have failed in their mission: prevent an atomic war, not participate in one.

"If we ever fire," said Abbott, "we all know that there won't be much of a home to come back to. It's a grim thought."

Our final stop was the sonar listening room, where the "ears" of the sub are located. For listening, the *Tecumseh* relies primarily on 48 hydrophones planted near the bow, passive yet extraordinarily sensitive listening devices that permit the sub to hear anything at sea within miles. These noises can be plotted pictorially and the resultant sound pictures used to identify the vessel producing the noise.

Can tell any type of vessel

"We can tell if the vessel is a trawler, merchant ship or warship," explained 31-year-old Philip Lee, Sonar Technician 2.C. "If it's a warship, we can tell if it's a sub or a surface ship. If it's a sub, we can

(Please turn to page 212)




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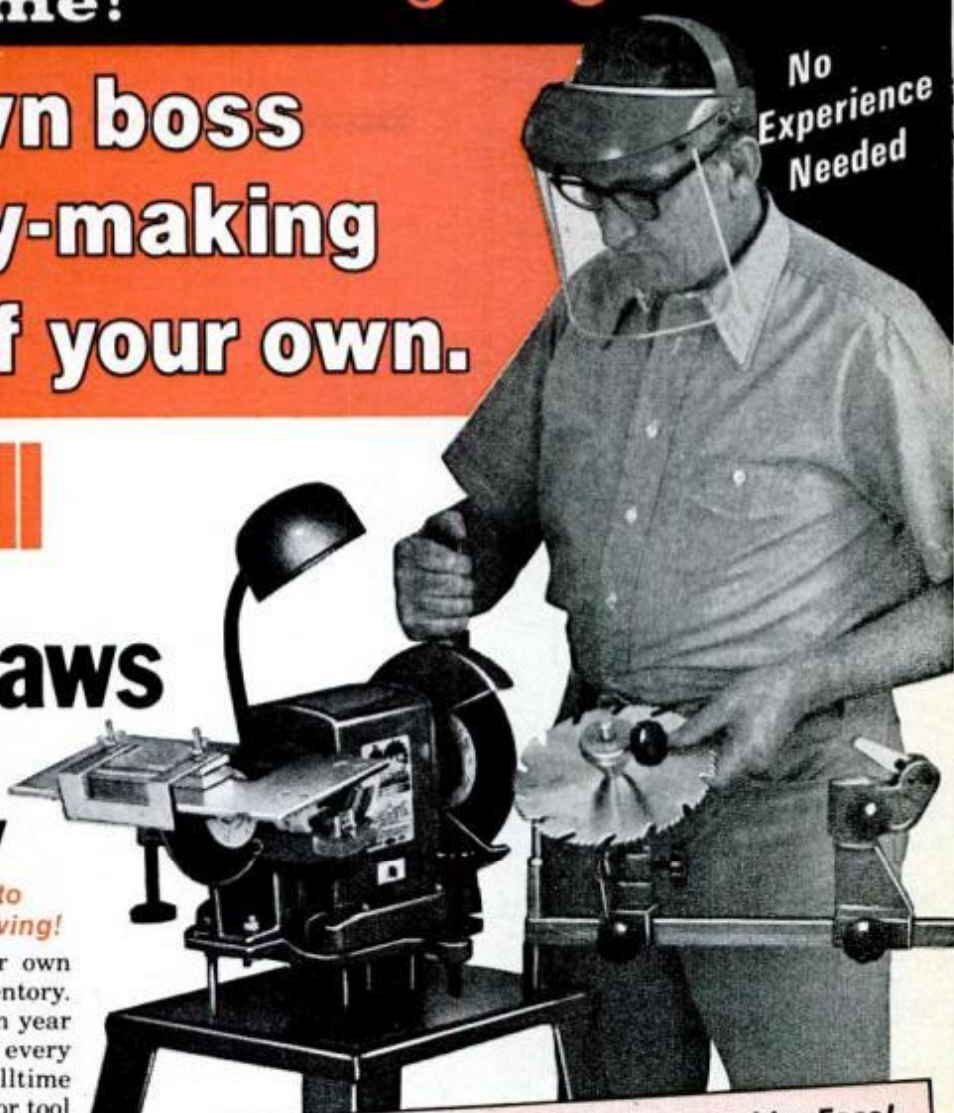
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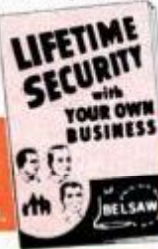
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PM DIVES WITH DEADLIEST MISSILE SUB

(Continued from page 210)

tell if it's nuclear or not, and if it's one of ours or one of theirs. If it's one of theirs, we can tell if it's an attack submarine or their version of the fleet ballistic missile sub."

"How far can you pick up sound?" I asked.

"That's classified information," Lee responded, "but when we're running on the surface, I can often hear a target before the radar boys can pick it up on their scope."

Suddenly a Klaxon sounded throughout the boat. *Ahh oohh gah, Ahh oohh gah.* A voice boomed over the loudspeaker system: "DIVE. DIVE."

We had reached deep water. *Tecumseh* was diving.

I made my way to the control center—what passes for a bridge on a submerged sub. Already the hatches leading to the deck had been closed and Cmdr. Golden was seated in his "captain's chair" near one of the sub's two periscopes.

Despite the fact that his vessel was diving, Cmdr. Golden still found time to point out for me the two helmsmen. They "drive" the sub by controlling its direction and angle of ascent or descent. The control system is both flexible and ingenious. There are dual aircraft-type control columns, each with a steerable yoke and movable "stick." What's unique about the arrangement, unlike an airplane's, is that the twin controls, while apparently identical in appearance, are designed to perform different functions simultaneously.

Complex control system

Two crewmen man the control stations, each with a different job. There is the "inboard man," also known as the "planesman," whose primary responsibility is control of the big fairwater planes on the sail. Then there is the "outboard man" who has control over rudder and stern planes. Because he actually "steers" the ship, he is technically known as the "helmsman."

But now comes the clever part: In emergency or other unusual conditions, *either* station can be quickly set up to perform the functions of the other. In other words, the planesman *could* take over control of the rudder and steer the sub with his yoke if need be, and the helmsman could operate the diving planes. In a serious emergency, if either crewman were knocked out, the craft could be controlled from either of the two stations.

Sitting between the two "pilots" is the diving officer. He constantly monitors the dials and gauges on

the instrument panel in front and relays commands to the planesman and helmsman. Also monitoring a battery of gauges is the chief of the watch, who is in charge of checking water ballast and shifting it from one tank to another, depending on a particular dive or rise requirement. In simple terms, ballast in a submarine is what determines positive or negative buoyancy—blow it out and you go up; take it in and you go down; or you can switch it between bow and stern tanks for deliberate control over the sub's attitude.

Watching a dive

"Would you like to watch the sub go down?" Cmdr. Golden asked, indicating that I was free to use one of the sub's two periscopes. Each periscope can rotate 360°, can tilt up or down, and can be adjusted for focus and range. My first glimpse showed me the bow of the *Tecumseh*, already awash, with its sonar dome cutting through the water. Swinging the periscope through an arc of 180° brought the long expanse of missile deck into view and, beyond it, the sub's rudder and stern planes.

The sight held me spellbound. As I watched, blue-green swells started to break gently over the sub. As each swell fell off, the hull itself re-emerged into view, glistening black. Then another swell swept over. Finally only the swirling waters, now foaming white, indicated the line of the hull.

Turning from the periscope, I watched the helmsmen at work. They were seated side by side, like the pilot and copilot of a large jet. Each man was strapped into his seat and each grasped a steering yoke. In front of them an instrument panel indicated the sub's depth, speed and direction, the rate of dive or rise for the stern and fairwater planes and the degree of roll the ship was taking.

Throughout our descent, the sub maintained an even keel, slowly submerging to 150 feet. Once at that depth, we rode quietly and smoothly. No hint of the unruly surface wave action reached us down below. Men moved on their various missions with precision and competence. *Tecumseh* was obviously in her element, and so were the submariners who manned her.

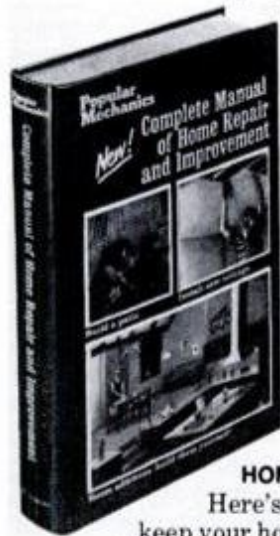
Submariners are special breed

Submariners, I learned, are an exceptional group. To begin with, all are volunteers. And while submariners do get extra pay, it is not the

(Please turn to page 214)

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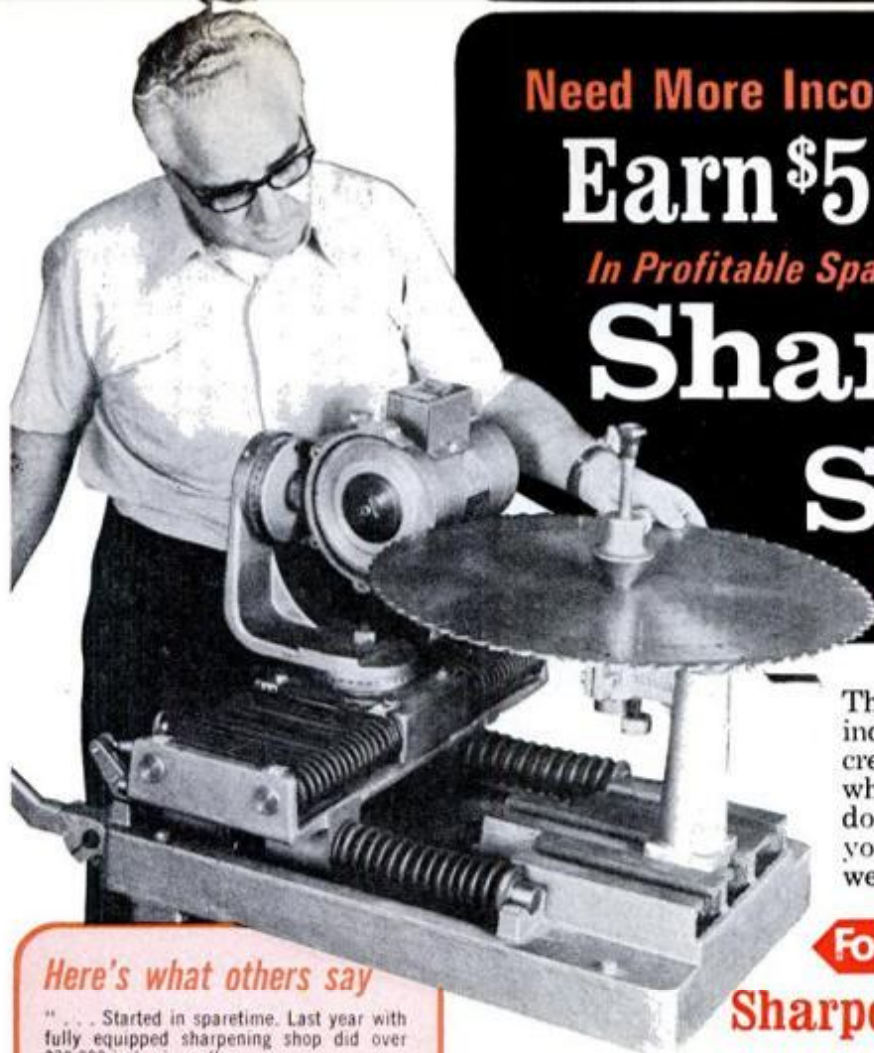
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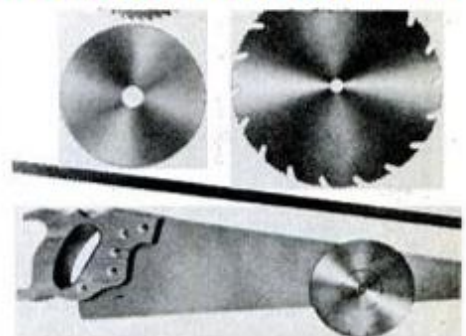
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scope, reported, "It's raining out. One hundred percent overcast and raining hard."

Cmdr. Golden cut in sharply. "Chief of the watch. Get some raincoats for the lookouts." Golden then turned to Kersch, "You have the deck, I have the con."

The remark indicated that it was about time for Kersch to leave the control center and climb to the bridge. Kersch relinquished the periscope and began to make preparations to climb to the top of the sail, where all watches are maintained when the sub is surfaced. Golden took over the periscope. The sub meanwhile was continuing to rise.

Suddenly the ship's Klaxon sounded and the public-address system boomed: "SURFACE. SURFACE. SURFACE."

Orders fly thick and fast

At that point, the orders and commands began to flow too fast for my note-taking abilities. Later I deciphered my scribble in some fashion.

"Blow the forward group. Blow the aft group." (The commanding officer wanted water blown from our

forward and aft ballast tanks to make the sub lighter.)

"Open lower hatch." (Two hatches lead up to the bridge. It was now safe to open the lower one.)

"Put another 30-second blow on all main ballast tanks." (Cmdr. Golden wanted us lighter still.)

"Raise the radar mast. Rotate and radiate on radar." (Once surfaced, radar could come into play.)

"Crack the upper hatch." (Cracked, but not opened. This procedure permitted the equalization of air pressure inside the sub with that outside.)

"Permission to open upper hatch?" (A crew member, inquiring.)

"Open upper hatch," Cmdr. Golden replied.

Safely on top

"Captain," the radar man reported, "radar holds no contacts within 15 miles." (We had surfaced safely.)

By this time, Kersch had scrambled up the ladder and was taking over both the deck and the con. Down came the periscopes. *Tecumseh* was a surface ship again.

I spent my last few hours aboard the *Tecumseh* with Kersch on the

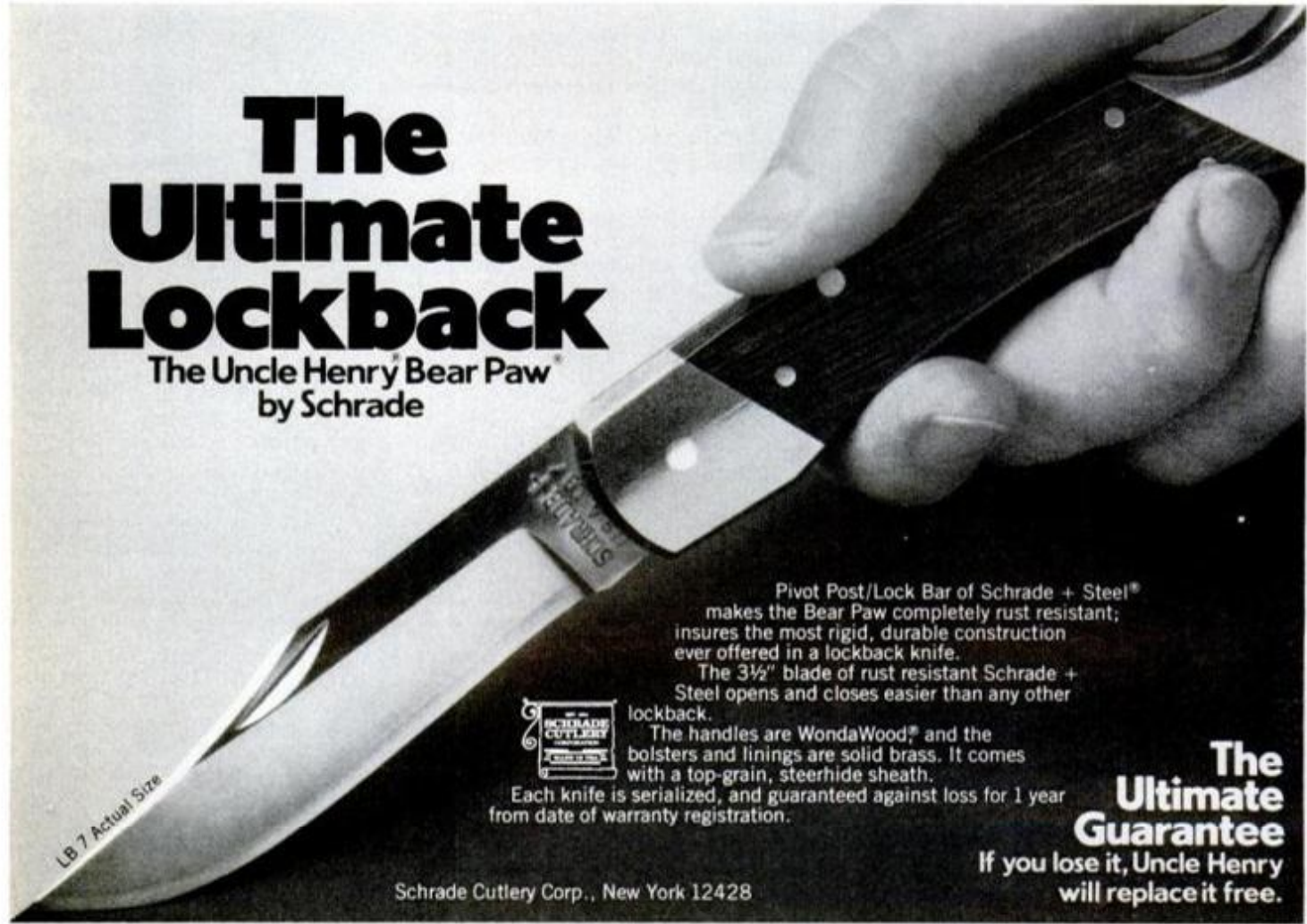
bridge. It was a different ocean from the one we had left earlier. Then it sparkled in light greens and blues. Now, with dark clouds overhead and the waves building, it roiled in more somber colors. Gusts of rain whipped our faces. The sub rolled and bucked. We came into Portsmouth in a drenching rain.

There I left her. After refitting, *Tecumseh* will set sail once again from Portsmouth to resume her deterrent patrol.

I came away from my journey on her with mixed emotions. By any measure, *Tecumseh* was a happy, efficient submarine, manned by a competent confident crew. Nevertheless, I found it hard to reconcile this with the knowledge that when fully armed, *Tecumseh* carried more firepower than all the bombs dropped in all theaters of war by all the combatants of World War II. I comforted myself with the thought that *Tecumseh's* job was not to fire those missiles, but to act as a deterrent to war. For as I heard more than once, if the *Tecumseh* ever does what she was designed to do, there will in fact be no home left to come back to— for any of us. **PM**

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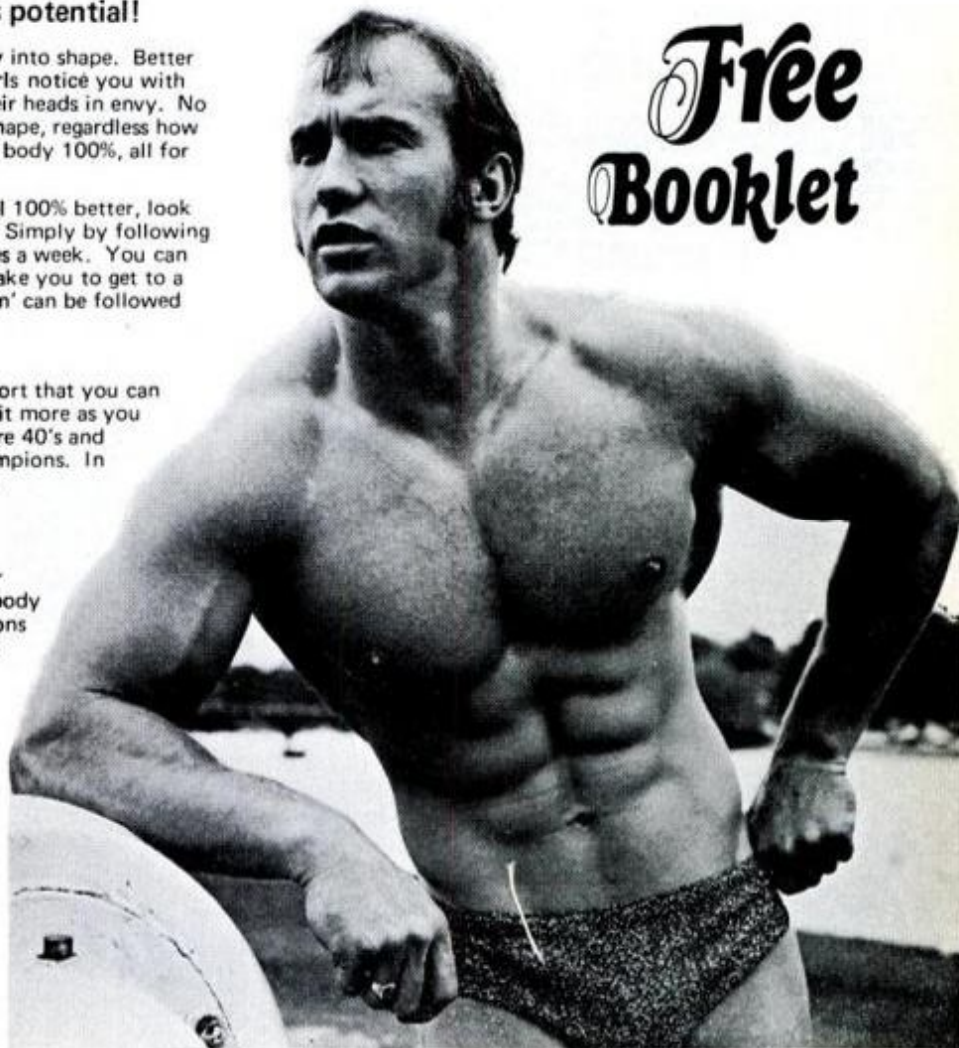
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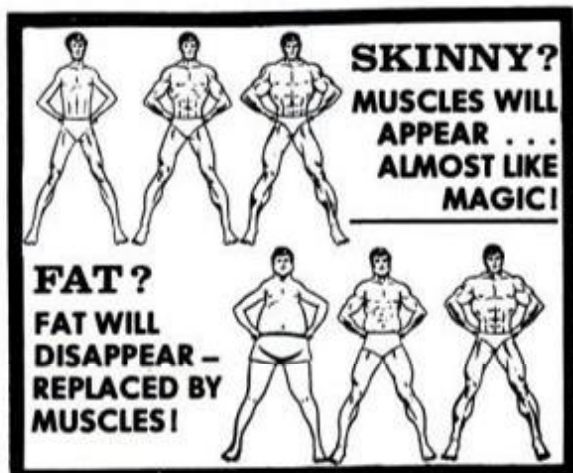
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feet. Coming up is a 600-square-foot Optimum with a core unit of plumbing, kitchen and utilities.

Another newcomer is the one-man, Dacron Jonah, raised on an arch of fiberglass rods and staked at the corners. It has a tapered tub floor and nylon fly. On the go, it rolls into a 4x22-inch package. For more information write: Moss Designs by Tent Works, Camden, Me. 04843.—Richard F. Dempewolf



Optimum 200 tent has three alcoves and nearly 200 square feet of floor space.



Inside the roomy Optimum, well-defined alcoves suggest rooms, or areas for separate functions. Upcoming enlarged version has a plumbing and utility core.



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CAMP/WORK CONVERSION

(Continued from page 111)

around with bare van walls, but with no immediate money or time for a full interior paneling job, we glued in 2-inch Styrofoam panels and filled the odd-shaped spaces with aerosol urethane foam. Fiberglass in the roof was held temporarily by the factory-equipment cardboard panels. Interior temperature now stayed up and the noise level went down. We moved the spare tire outside on a Dick Cepek rear mount. Also from Cepek: a Filtron air cleaner, dipstick wiper, plus interior lights.

With 2000 miles on the odometer, we drained the break-in lubricant, flushed the engine and dumped in six quarts of Mobil 1 synthetic along with a new filter. Highway mpg jumped from 15 to 17 and cold winter starts sounded like summer.

Triple-duty storage boxes

Saving money, we built three plywood boxes, 24x24x12 inches, and one larger 48x12x12-inch box. The long one holds tripods, reflectors and fishing rods. The squares carry sleeping bags, food and camping gear. Pushed back they are seats and spread out they support a hinged bed—three 2x4-foot Masonite panels which are topped by three cushions. Bedsprad and rainfly covers, home-sewn over 4-inch foam, serve as seat cushions or a mattress.

Night driving can be a nightmare if you're used to European quartz lights. We next installed Marchal H-4 headlight conversions, legal in Oregon and Washington, tolerated by intelligent Bears in most other states and illegal in California. On an Off-Road Performance grille guard, we mounted Cibié fog and driving lights. If you think \$150 worth of quartz-halogen lighting and \$100 more in a grille guard violates the "budget" approach, just drive once with good night sight and price the bodywork bill for even a minor front-end dent.

After 12,000 miles, summer finally came, and to cool the van we installed a Coleman Polar Cub II evaporative airconditioner. It uses water and 12-volt power, works well in areas where the relative humidity is low to moderate, doubles as an exhaust fan, and costs less than half the factory-air price. It can be cut in and hooked up in one afternoon, and we mounted it on the left side of the roof so we could still cartop our noncar cool-offs—canoes and Hobie Cats. A Quick-N-Easy roof carrier anchors our homemade awning, also created from a tent rainfly, and

transports canoes. A T.H.E. rack cartops the 16-foot Hobie Cat.

To get up top, we needed a ladder, but most van ladders bolt to a rear door and Detroit didn't make those hinges to support heavy climbers. Our selection, Bill Devin's Safety Step ladder, mounts on the roof, rests on the bumper, and swings up to allow opening the door.

Many things we work or play with are too big to ride on top—snowmobiles, larger boats, trailers full of firewood, antique Model A hulks we



With rear side door open, cookstove with antirattle hot mitt sits on wire crate. With door closed, you can eat in bed.

find and tow home to restore. From Valley Tow-Rite we bought a Class III hitch platform. It took one hour to install, counting the holes Ford forgot to drill. They didn't forget the wiring harness, however, so hooking up the trailer light connections took only 10 minutes. We use a Bargman seven-wire heavy-duty socket so we can plug into anything the Ford can pull.

Swing-out 'kitchen'

Next, a side door was modified to swing out with a Coleman upright cooler. We bolted this ice chest to the rear side door and then built a cook center to fit over it. This contraption holds a Coleman LP-gas cookstove, provides a work surface, and features a combination storage/service shelf which looks like a metal dairy delivery basket. That's because it is, but it wasn't ripped off. We asked the dairy if we could buy one, and they were so overwhelmed by the honest offer that they gave it to us.

In an on-the-go kitchen, stoves rattle and all pans have hot handles. Pack a hot mitt under the stove lid so you have it along and it will also stop the metal noises. Mount the cooler so that when the van door holding it is closed, the cooler rests on the van floor.

After 15,000 miles, we finally got around to paneling. T&H Van Works Unltd., Canoga Park, Calif., understands that not everyone wants a fur-lined surfer van (al-

though they supply all those customizing accessories, too). We ordered a set of full-size cutting plans from them. Home carpenters should check every dimension and rib spacing since all vans are not assembled just the same. Our Ford proved close to the T&H patterns, and we used 1/4-inch A-C fir plywood since we wanted something cheap and tough, with enough substance to take screws. We covered it halfway up with carpet sample squares that are gougeproof, easy to clean and sound-deadening. Above that we glued on inexpensive lightweight canvas sprayed with a stain repellent for easy cleaning. On the ceiling are the maps and flags that are personal favorites of ours when it comes to decorating.

After 20,000 miles, success

After 20,000 miles and almost a year into our project we can report the van a success. Seat-bed boxes and camping supplies are pulled out easily to make room for equipment required on business trips. Smaller refinement projects are still underway, with many more planned. An old tripod swivel head and quick clamps were adapted to a serving tray and a clipboard. The tripod head is attached to the engine cover next to the driver's seat. Notes are made on the clipboard, or the tray is quickly mounted instead to hold a pocket tape recorder or coffee cup and snacks.

Projects we'll be starting soon include courtesy-light switches on all doors and a security alarm system (we strung the wires for both before we paneled). We also want to add a hanging closet, arrangements for hanging wet wetsuits, life jackets and flyfishing waders as well. A bracket for a small outboard motor will be useful plus an outside bracket for a jerrycan of outboard fuel mix. A roof-mount Marchal quartz-halogen spotlight is on our future list, and a dash mount for a Bearcat 210 Scanner. Boman's tempered-glass roof hatch is built and priced for yachts, but is our choice for a great van skylight. And for cold winters we may install a Coleman LP-gas furnace. That should keep us fairly satisfied for nine more years.

You don't think our van will last that long? Ours will. We bought the Ford Shop Manual, Service Specs, and Wiring Diagrams. That \$25 has already paid off. The van has never been back to the shop; we do our own preventive maintenance. If trucking firms can get a million miles from their rigs, we can hope for our yearly 50,000 times 10. **PM**

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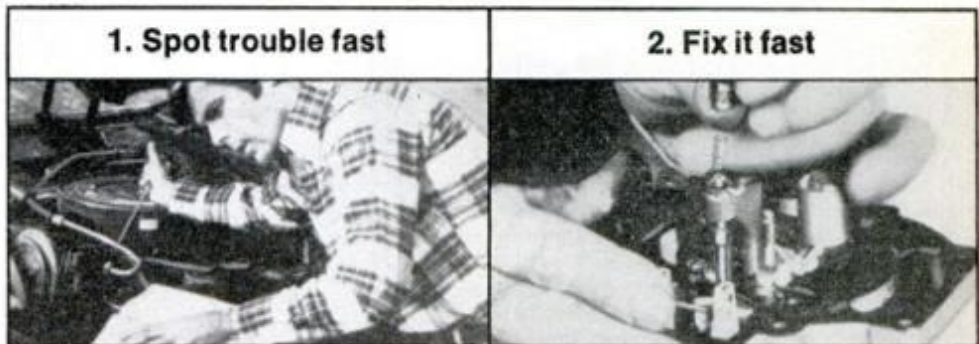
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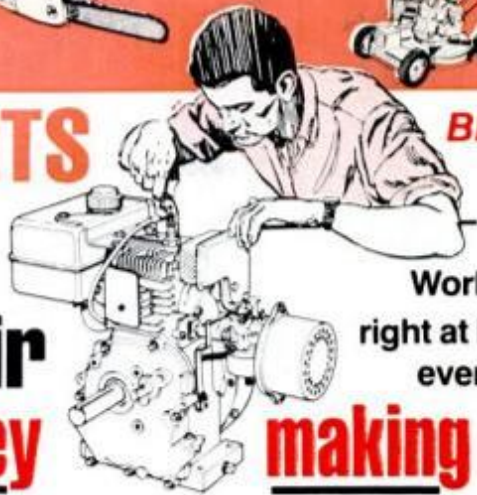
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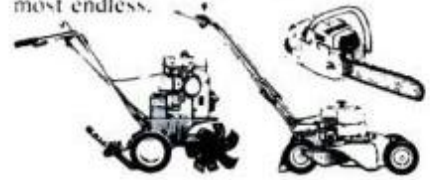
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Bone-shaking bike-o-mania



Ned Passey rides the largest penny-farthing in his collection. Note extended pedals.

Vintage bikes are "in" in England. And king of the "in" crowd is an Oxfordshire gentleman named Ned Passey whose collection—all reconstructed to mint condition—numbers 267. His oldest, built in 1818, he describes as "a wooden shaft with a wheel on each end." It was known as "the Hobby Horse." An unsprung, rigid-seated descendant of that vehicle was a high-wheeled monster called "the Bone-Shaker." It came in a broad range of models, usually with a high front wheel.

On a tandem version Passey found, the front rider pedaled with his feet; the rear rider with hands.

Most popular among bike buffs is the "penny-farthing," with a high front wheel and a tiny one behind. It was the rage of the 1890s, featured in some classic races. Largest of these in Passey's collection of 31 has a front wheel 60 inches across. Its inventor had to devise

(Please turn to page 226)



Passeys ride a Warwick; Olympia follows.



Wooden Willard Sayer is Passey's rarest.

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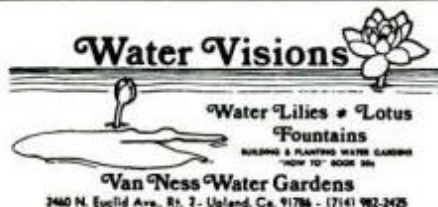
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BIKE-O-MANIA

(Continued from page 224)

extension bars for the pedals so the cyclist could reach them with his feet. A pair of steps on the frame allowed a rider to climb up to the seat—quickly, before the thing toppled. Standard penny-farthings had



Old bike parts are found in rural dumps.



Rudge Triplet was stately four-wheeler.

38-inch front wheels and a single step up.

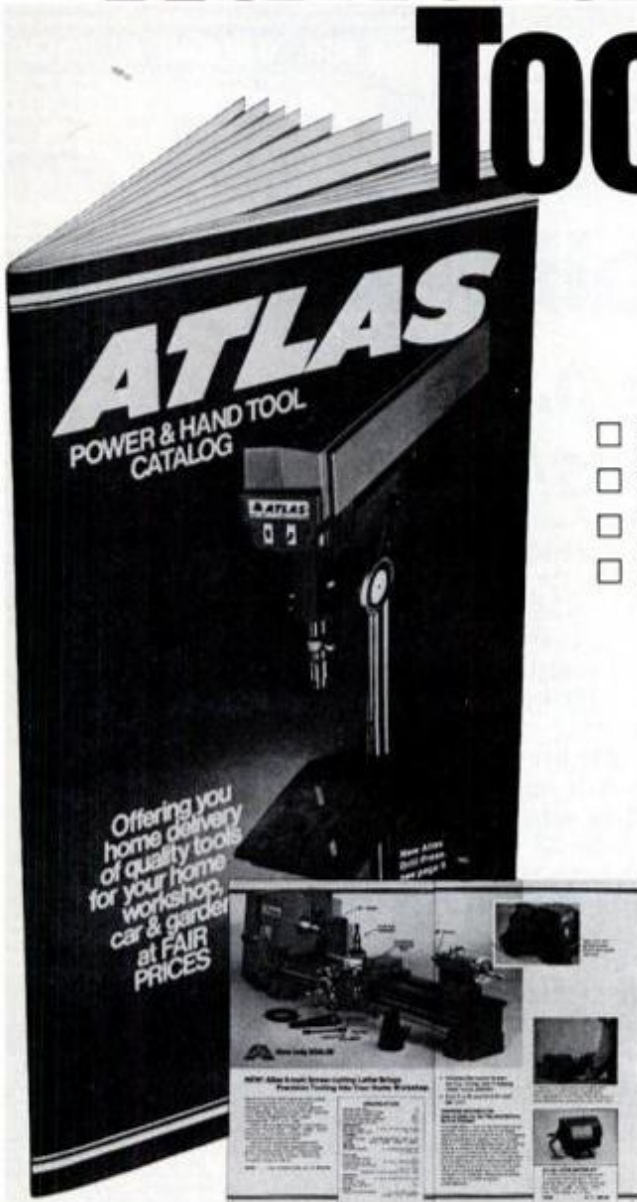
Among the curious old bikes are 19th century tricycles—the Warwick Monarch Caddi and the Olympia Tandem. Their unique feature: the paired wheels were in front. Touted as nontippable, they were used by adults, riding tandem.

Another unusual pedal-pusher was an 1880 four-wheeler, the Rudge Triplet Quadrocycle, resembling a chassis for a light buggy.

Passey found most of his bikes stashed away in barns. Parts come from rural dumps. "People who find parts of old cycles around—especially in the country—just throw them away," he notes.

He has been able to date most specimens by the nameplate that almost every 19th-century manufacturer fastened to his product.—*Richard F. Dempewolf*

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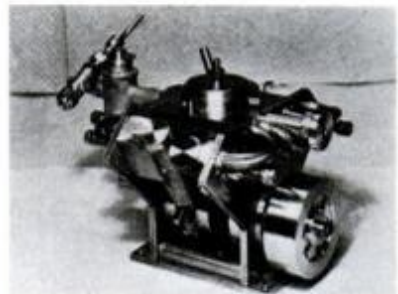
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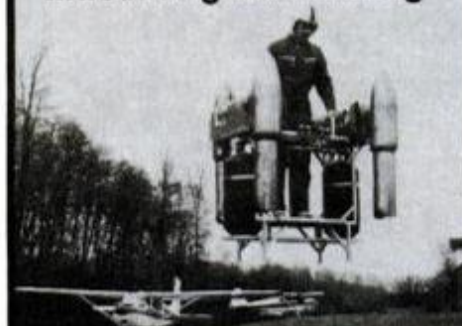
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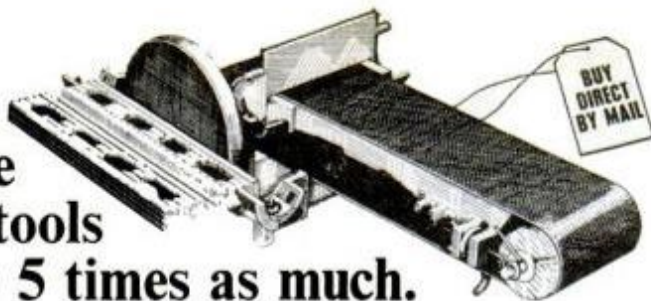
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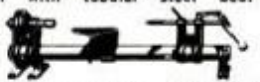


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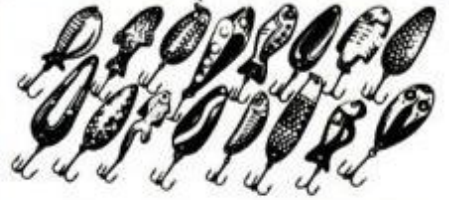
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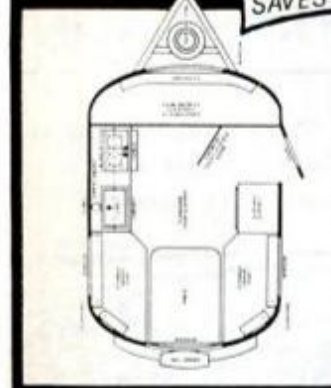
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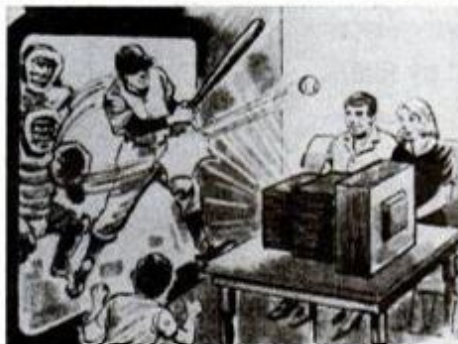


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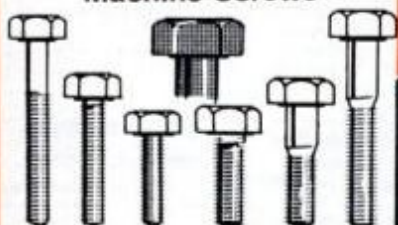


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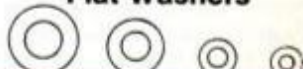
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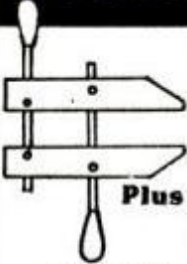
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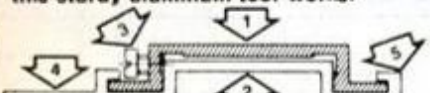


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(Continued from preceding page)

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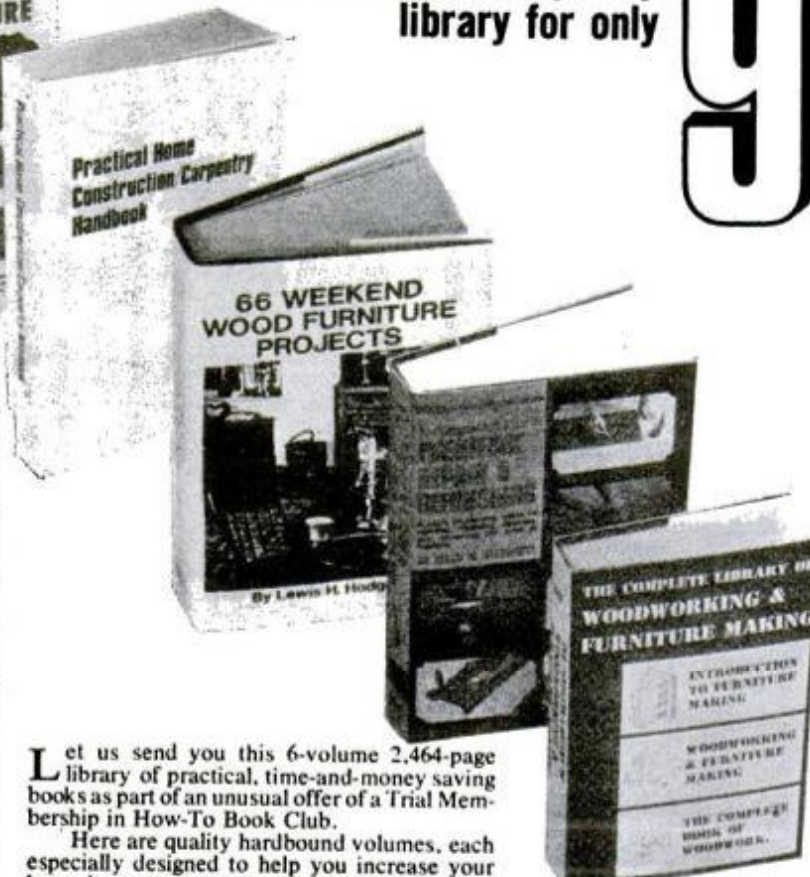
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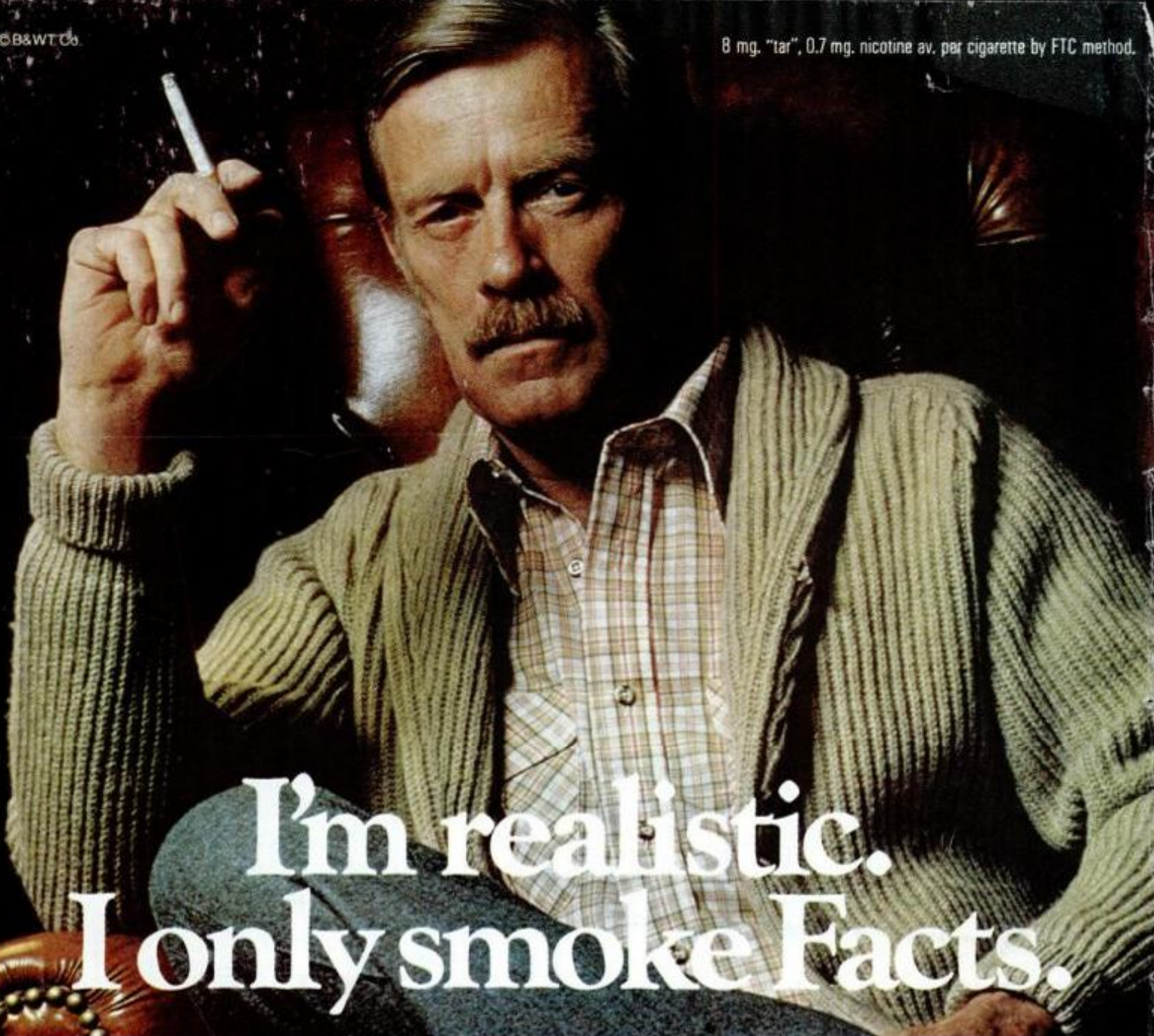
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