

SEPTEMBER 1978 \$1.00

# Popular Mechanics

**SOLAR-POWERED PLANES: Now flying!**

**COMPLETE PLANS: Make your own cider press**

**79 CARS: Complete lineup from Ford, Lincoln, Mercury**

**4,000,000 MILES OF DRIVING**

**OMNI and HORIZON: Owners like the way they handle!**

**OLDS DIESELS: Best-loved U.S. cars in years**

**6 HOME TV RECORDERS PM tests and compares them**

**Build our solar-heated garden shed**



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# Popular Mechanics

## On the cover

Designed to PM's specifications by architect Ira Grandberg, our factory-built, year-round vacation home was photographed by George Ancona on its site at Tan-Tar-A Estates, Osage Beach, Mo. Available complete at a price of \$35,000, including carpeting and major appliances, the design innovation is PM's answer to the high cost of housing (see page 106)



SEPTEMBER 1978

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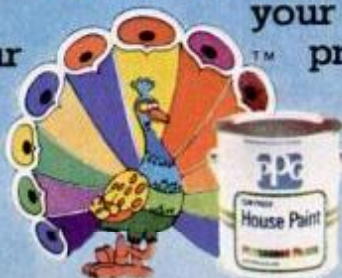
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# LETTERS TO THE EDITOR

## Plane facts

Thank you! Thank you for your article on the DC-3 (*The Glory Days of a Grand Old Lady*, June '78 page 89). We flew in one of those sleepers in 1940 from San Francisco to Chicago, and whenever we have occasion to refer to the flight people think we are nuts—who ever heard of berths on a plane! But you told it as it was and it was certainly an experience. We even helped the stewardess make up the berths, since she was airsick most of the time. The only thing you did not mention—we had to wear our seat belts in bed.

MR. AND MRS. M.R. EHRER  
MILL VALLEY, CALIF.

I was interested in reading about the many examples of the durability and longevity of the DC-3.

You state that the oldest DC-3 was perhaps one that retired at 84,875 hours. At Nathaniel Hawthorne College in Antrim, N.H., there's a DC-3 still flying at over 100,000 hours.

JEFFREY A. HORNER  
BURLINGTON, VT.

*Apparently the 100,000-hour figure was sometimes bandied about the Hawthorne campus, Mr. Horner, but it's a bit optimistic. According to Maj. George W. Gibson, USAF (Ret.), director of aviation at the college, the plane had at least 83,414 hours on it as of June 1978. There are no plans to ground it in the near future. Maj. Gibson says he hopes to keep her flying "another 10 years anyway." A recent issue of Flying featured a Naples Airlines DC-3 with 82,616 hours on it as of April 1978. It would seem that, barring any untoward occurrences, both planes will surpass the Edison Museum DC-3 soon. Thanks for telling us about the Hawthorne plane.*

## Poles apart

I would like to bring some items to your attention regarding the *Scenery Pollution* piece in the *All Outdoors* column in your June '78 issue (page 20).

At the present time, Mountain Bell is installing virtually 100 percent of all distribution cable in new subdivisions completely underground. Approximately 85 percent of all construction is underground

or buried. Pole lines and aerial cable are installed as a last choice when terrain problems make buried construction extremely expensive. Only within the last five or six years has technology given the telephone industry a buried cable which can withstand the moisture problems of underground installation over a long period of time.

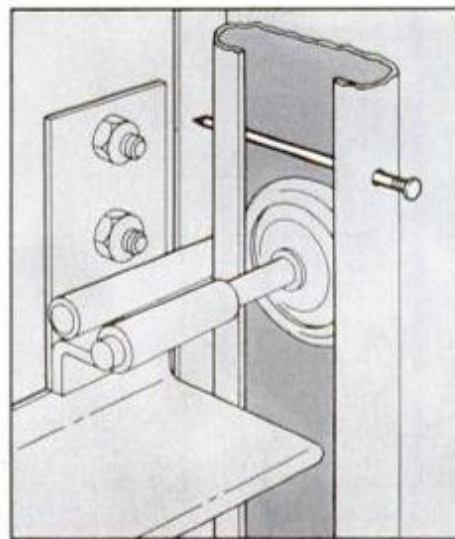
The Bell System long ago began this "Out of Sight" policy without governmental action or pressure from environmental groups.

SAM MARTIN  
FACILITIES PLANNER,  
MOUNTAIN BELL  
ALBUQUERQUE, N.M.

## Dead, as in doornail

As a garage door and electronic service man, your reader's hint in May, *Simple Garage Door Lock* (*Hints from Readers*, page 32) was welcome.

With the door nailed down and a



The garage door lock in question.

"stray garage-door opening signal," I will be able to charge some customers for a new clutch in their operator, others for a new motor-starting capacitor. Some will burn up the V-belt and others will ruin the gears.

With an electronic opener, keep the nail out of the rail.

ROGER DE LANGHE  
STERLING, ILL.

*Reader De Langhe is correct. A garage door track lock—like the one shown—should be used only on manually operated doors. Also, reader Arthur Lee of Santa Cruz, Calif.,*

*suggests the nail be slanted at least 30° (tip down) so it can't be rattled loose.*

## Coming up short

You are wrong when you say, on page 22 of the May issue (*Imports and Motorsports*), that LeCar is the shortest car on sale in the United States. A Jeep CJ-5 is 138.4 inches long, almost 4 inches shorter than LeCar.

Of course, this debate doesn't interest me. My 1972 Honda Coupe 600 (at 122.8 inches) is doing fine and I don't expect to have to replace it in the next couple of years. Since I live in Manhattan, it's too easy to park to part with.

KENNETH MATTHEWS  
NEW YORK, N.Y.

*Reader Matthews is right about the CJ-5's dimensions, but other PM readers might question whether a Jeep is a car. As for the 600, it's no longer available here.*

## Missing homeowners

As soon as I received my May '78 issue and read the informative article on the new Homeowners '76 insurance (*What You Should Know About Your New Homeowners Insurance*, page 274), I called my agent (Allstate) and subsequently several others to find out how to acquire this coverage. Unfortunately, none of the companies I contacted had heard of this policy. How can I obtain a list of companies in the Washington, D.C., area who'll be offering this coverage?

BARBARA RICHTMYER  
GERMANTOWN, MD.

*Best bet is to consult an independent insurance agent, says Alex Picone, director of public relations of the Independent Insurance Agents of America. Allstate and some other well-known companies do not offer Homeowners '76 per se, but have similar policies. Homeowners '76 has been approved in 25 states and was pending in 7 others as of this June. It has been disapproved in New York and New Jersey. For further information contact the Insurance Services Office, 2 World Trade Center, New York, N.Y. 10048; the American Insurance Assn., 85 St., New York, N.Y. 10038, or your state insurance department.* **PM**



# TO FULLY APPRECIATE PIONEER'S NEW DIRECT-DRIVE TURNTABLE, YOU HAVE TO TAKE APART THE COMPETITION.

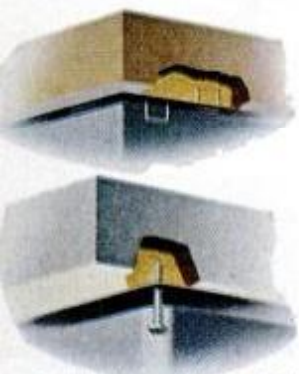
When you compare what goes into most \$175\* high-fidelity turntables to what goes into Pioneer's new PL-518, you'll find there's no comparison.



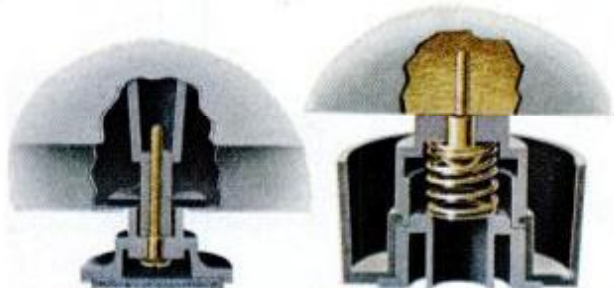
On many turntables, the motor is suspended from the base itself, where the slightest vibration can be picked up by the stylus. The PL-518's direct-drive motor is anchored to a metal plate beneath the base, where this is far less likely to happen.



Most high-fidelity turntables have flimsy plastic or metal headshells that can distort the music. Pioneer's is made of glass fiber, a substance with far greater mass yet less weight, which is unaffected by resonance.



Some turntables are held together by staples, which can work themselves loose. Pioneer uses aluminum screws to seal the base to the base plate.



A lot of turntables have skinny plastic legs that merely support the weight of the turntable. The feet of the PL-518 are spring-mounted which helps reduce acoustic feedback. So you can play your music loud enough to rattle the walls without rattling the turntable.



Many tone arms are mounted on piano wire and cheap plastic casings which vibrate. Instead, ours float on pivot bearings which are immune to vibration.



Some rely on 3 ball bearings for stability in the tone arm shaft, but Pioneer uses 34.



Some turntables get by with a common plastic or sheet metal base which is susceptible to vibration and can cause acoustic feedback. Not the base of the PL-518. It's made of two solid blocks of compressed wood, which when joined eliminate feedback.



What you see here will tell you a lot about Pioneer's PL-518.

It'll not only tell you what kind of care and engineering went into it, but also the kind of exceptional performance you can expect to get out of it. Performance free of audible distortion, acoustic feedback and rumble.

Because at Pioneer, we believe that to get the most out of every piece of music, you've got to get the most out of every part of the turntable.

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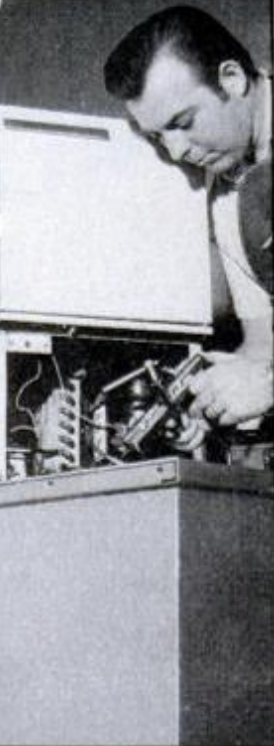
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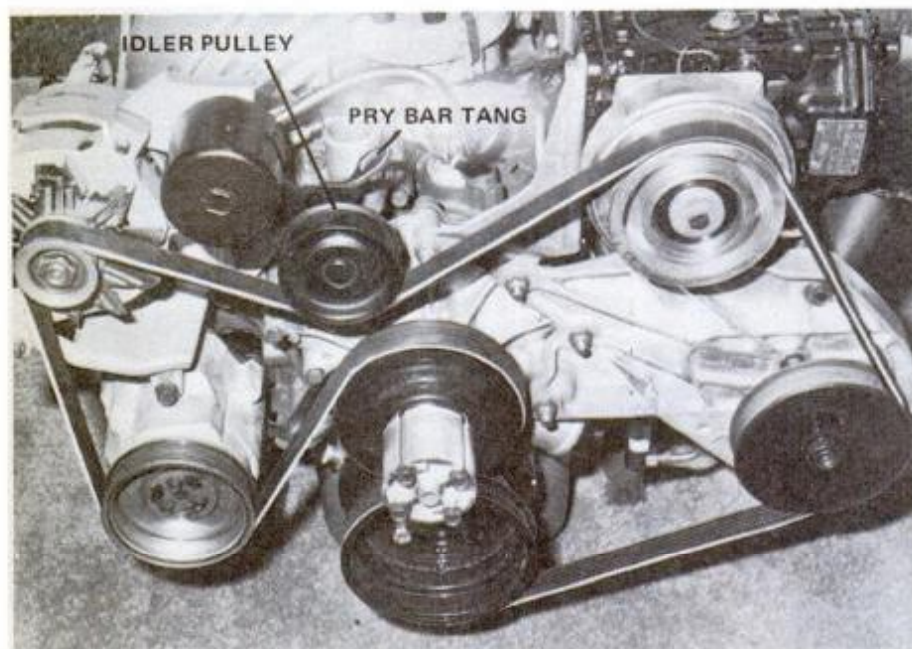
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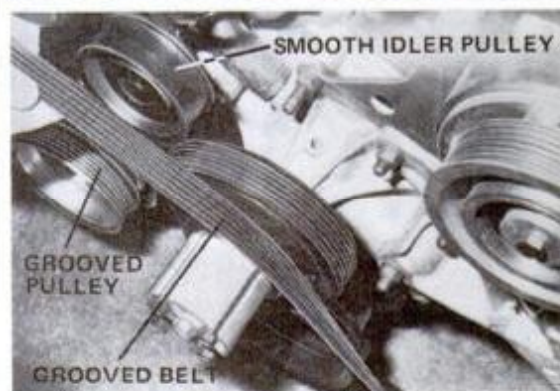
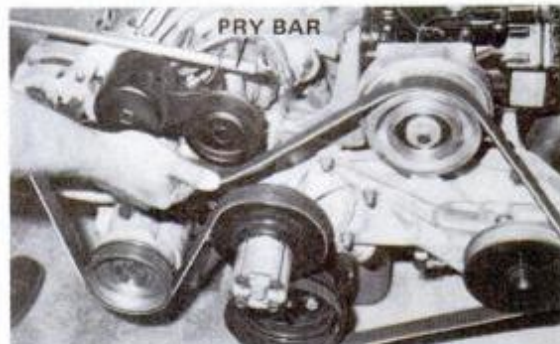


J421-BF9-57RG

# Servicing the '79 Ford and Lincoln-Mercury models



On some engines a single, serpentine belt (above) takes the place of four used previously. Fortunately, it is easy to replace (right, top) with a pry bar. Close-up look (right, bottom) shows the grooved belt plus smooth and grooved pulleys.



## '79 CARS

Here's a head start on what you do-it-yourselfers need to know about next year's cars.

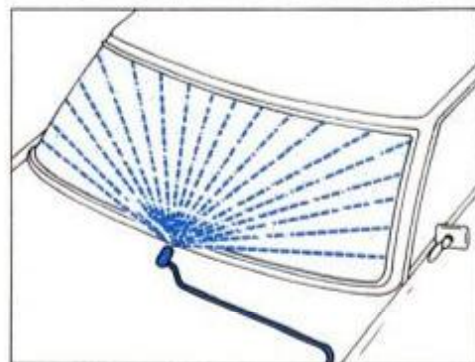
by Paul Weissler

**T**he 1979 Ford lineup presents an assortment of new service procedures for the weekend mechanic. Some, like Electronic Engine Control II (EEC II) and the Mustang-Capri turbo, covered last month, are highly complex. However, the new features make things easier, including a revolutionary single drive belt that's super-easy to change.

The new belt, which will go into Mustangs and Capris with the 302 V8, does the job that as many as four belts did before. It wraps around pulleys for the alternator, air pump, airconditioning and power steering, then doubles back in serpentine fashion to pick up the water pump/fan and an idler pulley.

The belt is automatically tensioned by the idler pulley, which is spring-loaded so it never needs adjustment. To change the belt, just insert a pry bar into a tang projecting from the idler pulley, pull to release spring tension and slide the old belt off. Place the new belt on all pulleys, pry on the spring and slide the belt onto the idler. The whole thing takes about a minute.

The belt differs from a conventional design in that it has five ribs, each actually a tiny V, in addition to the V edges. The accessory pul-



Single-nozzle windshield washer uses fluidic principle to spray windshield in oscillating S-pattern. But eye can't detect oscillation, so spray appears fan-like.

leys into which it fits have mating grooves. Result: the belt contact area is very substantial, roughly close to that provided by individual belts. Only the water pump/fan and idler pulleys, which come in contact with the smooth opposite side of the belt, have no ribs.

Cost to Ford of the single multi-rib belt is "within a penny" of the cost of the four belts it replaces, according to a Ford engineer, so you can expect to pay about that for a new one at the auto parts store.

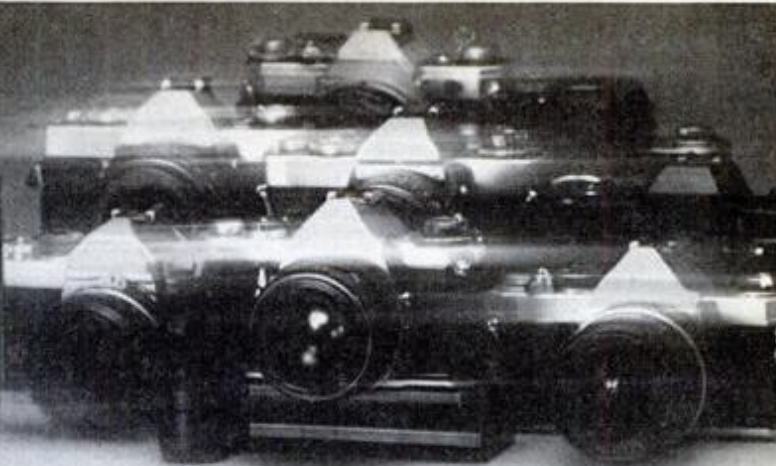
The belt is so easy to change that the labor savings—whether you do it yourself or have the work done, should make the design a winner.

Ford will phase in the new belt design on other models in the next few years. The belt alone also will be tested in 1979 on LTD and Marquis models with the 351 V8, for water pump/fan, alternator and power steering. Other accessories on these cars still will be operated by conventional V-belts.

### Belts

If you do your own brake work, you'll be happy to know that the

*(Please turn to page 14)*



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# The crop.

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And of course, the OM-2 shares every other innovation and system component with the OM-1.

## **We Wrote The Book On Compact SLR's.**

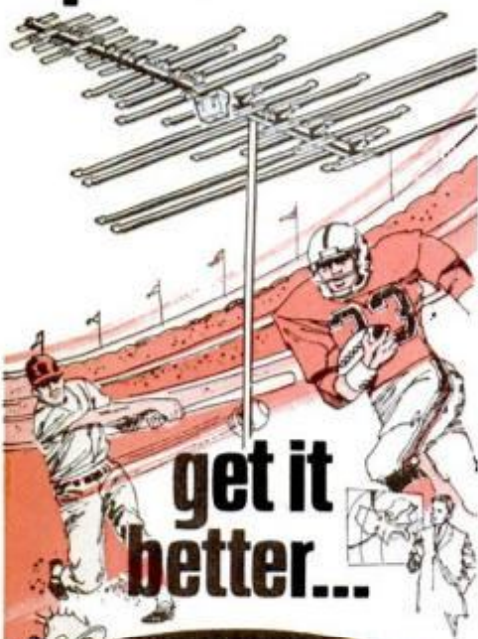
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Steering column switches are accessible by first removing two cover halves.

### SATURDAY MECHANIC

(Continued from page 12)

new LTD and Marquis have dropped the disc caliper with the machined slides in favor of a conventional pin-slider type. Ford made the change primarily for easier brake action (the machined slides rusted and resulted in sluggish brake performance). However, the guide pin design also is easier to handle when you're changing brake pads.

The pads themselves have been equipped with curved springs that create a scratching noise when the linings are worn.

Another brake change you'll notice on these cars, and also on Mustang-Capri 302 V8 models, is an aluminum master cylinder for weight reduction. It can't be honed, so it's replaced if the bore corrodes.

Aluminum also will be used for rear brake drums on LTD-Marquis and turbo versions of Mustang-Capri. The drums, like those introduced on some GM cars last year, have a steel insert, so they can be machined to correct scoring or out-of-round. The Ford drums are tabbed for extra-positive retention of the insert.

### Steering column

Both Mustang-Capri and LTD-Marquis reflect the increasing use of multipurpose stalk switches on the steering column. There are two—one for wiper and washer, a second for directional signals, horn and headlamp dimmer.

To reach the switches, just remove the instrument panel bezel (four accessible screws), then the plastic covers on the steering column (four more screws). To take out a switch, just push off the electrical connector and undo top and bottom retaining screws. The job takes less than five minutes.



WIPER/WASH SWITCH

Remove wiper/washer switch from steering column after unscrewing retainers.

Fuse boxes on both new models also are easier to get to. Forget struggling with the little glass tubes somewhere under the dash. The boxes are behind a cover plate on the front of the dashboard, next to the steering column, and the fuses themselves are the spade type, which are easy to pull out.

The Mustang and Capri, which are derived from the Fairmont-Zephyr series, share other of the easy-service features of that line, including the front end with only two grease fittings, the separation of strut and coil spring (so the strut can be changed without a coil spring compressor) and the heater-core-in-a-drawer on non-airconditioned models.

Capri buffs will appreciate the easy under-hood location of the wiper motor. In European-built versions, the motor was deeply buried behind the dashboard.

### Heater-air module

The LTD and Marquis get a brand-new heater/air module, but unfortunately more attention was given to heater output than serviceability. The heater core is in the ductwork under the dash, and replacing it is no fun. You've got to disconnect the right side of the dashboard, then the dashboard side of the ductwork from the engine compartment part, pull rearward on the flexible dash and drop the duct section to the floor of the passenger compartment. In the previous design, the heater core was behind a cover plate in the engine compartment and was easily replaced.

There are however, three plus factors in the new module:

■ Blower motor replacement is a snap. Just undo a few screws at the passenger's side of the engine compartment and lift it out.

(Please turn to page 16)

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GENERAL  ELECTRIC

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Electrical connectors, like one on turn/horn/dimmer switch, are easy to flick off.

### SATURDAY MECHANIC

(Continued from page 14)

■ The evaporator is very easy to change. Just take out the engine compartment duct section—not difficult. Saturday mechanics normally wouldn't tackle this, but if you do, you'll find it feasible.

■ The heater/air controls and the radio are easily removed for service from the front of the dash.

The new heater/air setup will be used on cars without air as well, but with no air components in the shell.

### Fluidic washer

About 10 years ago, everyone saw a bright future for fluidics, a science of fluid transfer that was the mechanical version of the transistor. Fluidics had potential for fuel injection, automatic transmis-

(Please turn to page 18)



Windshield wiper motor was behind dash; now it's on the firewall in plain view.

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## LUCITE® RUSTIC STAIN. ALL THE BEAUTY OF AN OIL STAIN WITH THE EASE OF LATEX.

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*Gardiner Mummau already has over 90,000 miles on his 1966 Oldsmobile Cutlass, and it's still going strong. If he has his way, it'll keep on going til he's good and ready to trade it in.*



*Gardiner Mummau, Columbia, Pa.*

**Mr. Mummau, 90,000 is a lot of miles. Do you do anything special to your car?**

Nothing anybody else couldn't do. I get the usual check-ups...keep her tuned up...change the plugs, points and condenser regularly. And the only motor oil I use is Quaker State.

**What about the way you drive?**

Well I guess you could call me a careful driver. I try not to go past the speed limit. No fast starts, either.

**Ever had any major problems with your car?**

No sir. Plenty of people have problems at 40 to 50,000 miles. But with proper maintenance, I think you can go a lot more miles than that.

**Why Quaker State?**

Now how could you go 90,000 miles with a car that wasn't lubricated properly? I started using Quaker State in the late thirties or early forties, I forget which.

And it's always given me top quality protection and performance.

**How often do you change the oil?**

The Oldsmobile maintenance manual said to change it every 6,000 miles. I change every 3,000.

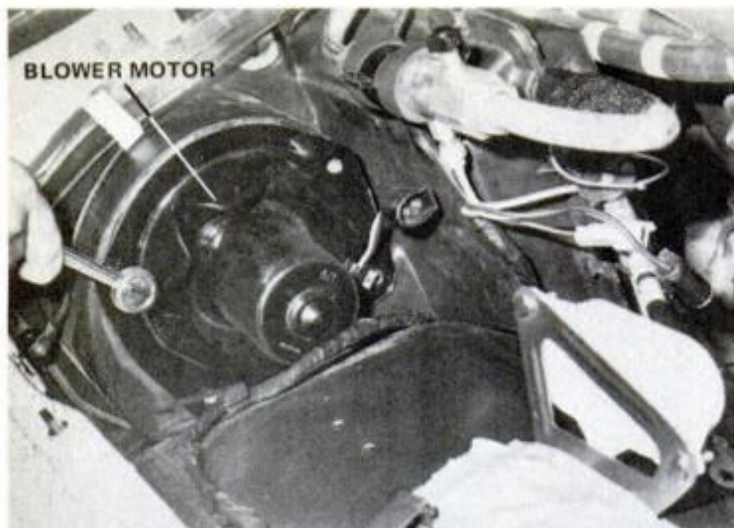
**Quaker State says their motor oil cuts down on the friction that makes cars old, so it helps cars last. Do you think that's true?**

There's my car. That's the proof of the pudding.

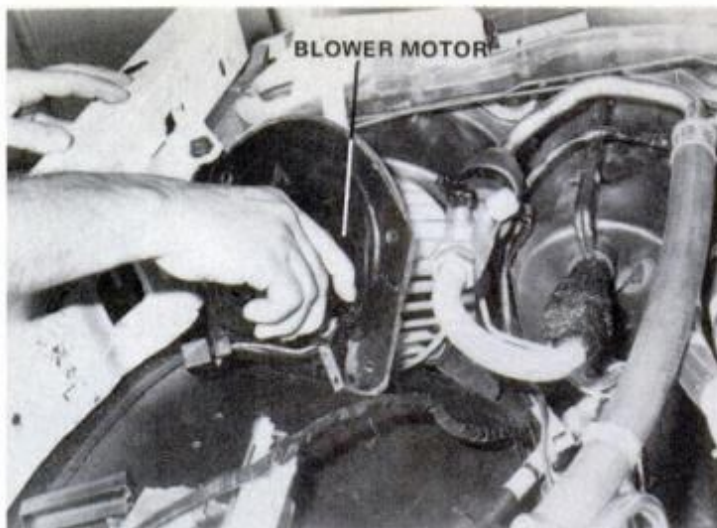
# Helps cars last.

Quaker State can't promise mileage like this for every car. But along with regular check-ups and proper maintenance, QUAKER STATE HELPS CARS LAST.





Locate the blower motor on the passenger side of the engine compartment and loosen the mounting screws.



Blower motor can then be pulled straight out, a big improvement over the previous nightmarish setup.

## SATURDAY MECHANIC

(Continued from page 16)

sion valve bodies, anywhere you wanted electronic or computer-like qualities from fluid movement. The attention, however, went hot and heavy to electronics, and it seemed fluidics was completely forgotten.

But no. It finally makes its automotive debut—on the '79 Mustang and Capri—in a windshield washer with single-nozzle design. A stream of water under pressure enters the fluidic nozzle, where the shape of the passages inside, and the air inside them, causes it to become unstable. The stream deflects against a left or right side wall. Whichever way it deflects results in a feedback passage filling with water, causing the stream to deflect back and forth, but so fast that it creates what looks like a fan-like

spray over the entire windshield, with no more power draw than the standard washer reservoir motor provides.

The fluidic nozzle is a simple plastic piece and probably will cost little or no more than two conventional nozzles. Its large opening should reduce the clogging problem, usual cause of nozzle failure.

You might be able to retrofit the fluidic nozzle to another car, but the job may not be all that simple. The ideal position for a spray to cover the entire windshield, or most of it, may not be dead center, and on some cars there may be no really good position possible. Even if a reasonably good position exists, it might present installation difficulties.

## Sealed-adjustment carburetors

Carburetors you can't adjust are on the way, and Ford is trying out

the concept on its 1979 models with the variable-venturi job, installed on all models with 302 and 351 V8s.

Ford will be fine-tuning the carbs on the assembly line, then installing plugs so you can't adjust the control vacuum to the variable venturi, and a plastic cap held by hollow rivets, so you can't get to and block open the cold enrichment system's bi-metal valve (resulting in enrichment of the warm-engine mixture). The government has been pushing for this to prevent tampering (and higher exhaust emissions).

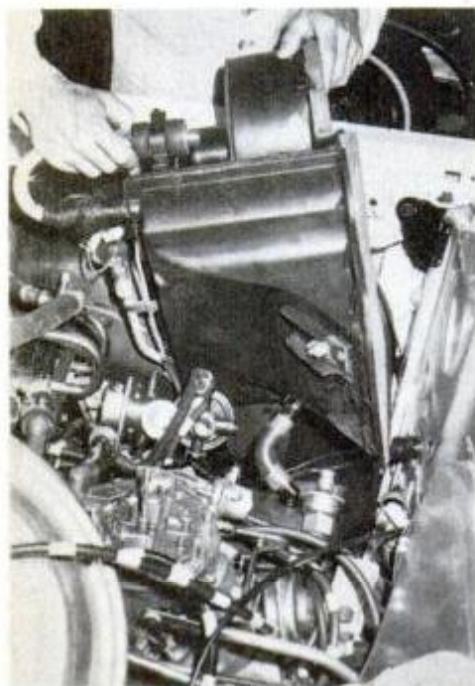
## Halogen headlamps

Every sports car rally driver who regularly runs night events knows the bright light that the quartz-halogen lamp provides. They are popular pieces of rally equipment as a result. Now Ford will try quartz-halogen sealed beams on the 1979 Lincoln Versailles.

There's no price yet on the replacements for the four eyes, but if the replacement bulbs only for the non-sealed-beam driving lights are any indication, they could approach \$25 each. Can you imagine spending \$100 to replace burned-out headlamps, or ones smashed in a minor mishap?

Quartz-halogen do last longer than conventional sealed beams and draw a lot less power, so a smaller, lighter alternator can be used.

Quartz-halogen is one of those things Detroit feels it has to try, to win the weight reduction/fuel economy/lower emissions battle. With everything else they're trying in that battle, the resulting sophistication may not be completely offset by easy-change drive belts, switches, and the like. However, there's little that Ford (or other makers) can do about the sophistication, so be glad there's an effort to simplify where possible. It is paying off. **PM**

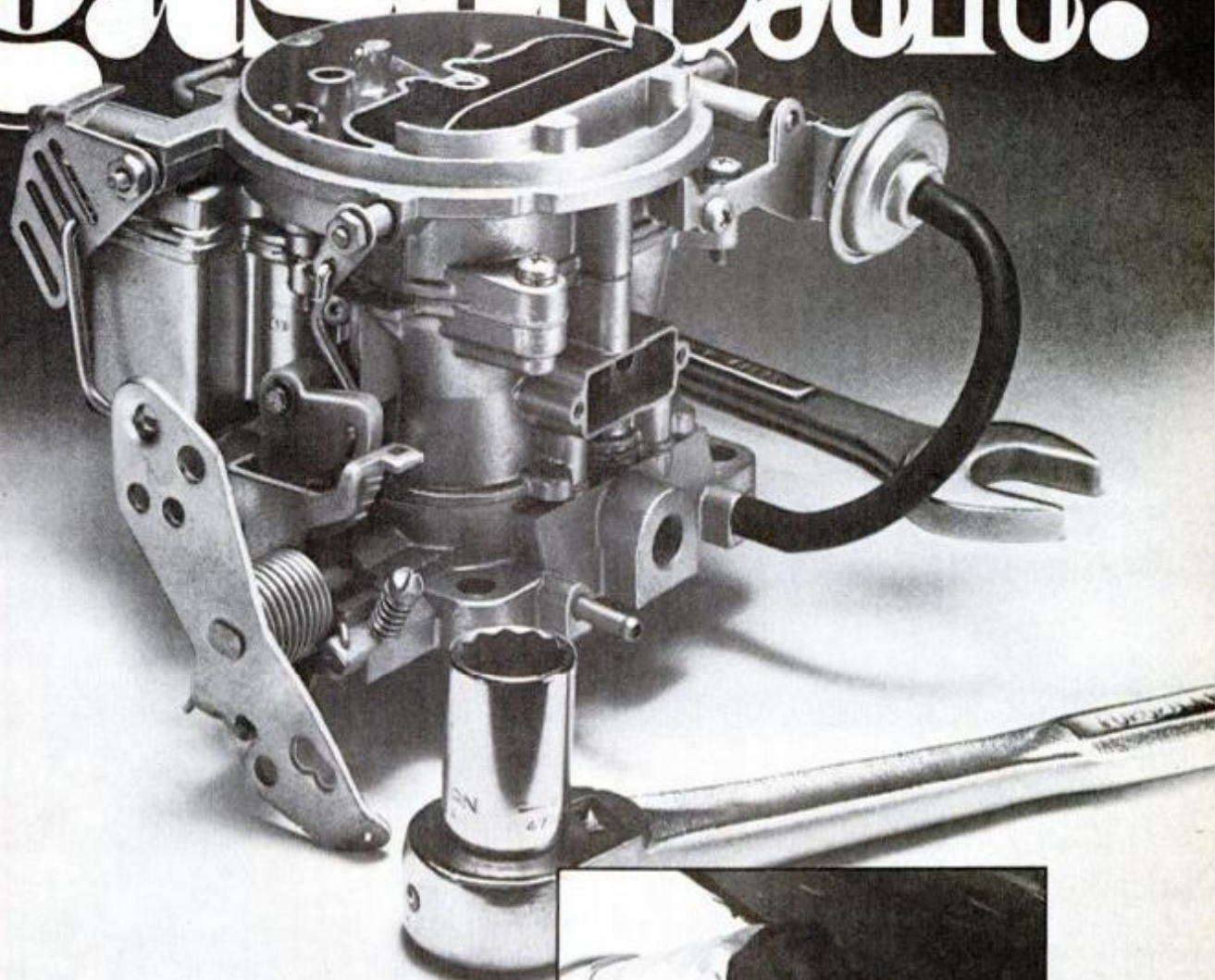


Airconditioning evaporator is located in the engine compartment duct section.



Evaporator is easily changed if necessary after duct section is removed from the car.

# gas mileage.



Bolt-on economy, that's Holley's Economaster carburetors. But they're not some jury-rigged setup that gives you a few more miles while robbing your car's performance.

Holley engineered the Economaster line to deliver improved fuel economy, along with new carburetor reliability and performance. Design innovations include two-stage power valves to minimize fuel use in mid-vacuum ranges, enlarged metering ports to increase fuel velocities for improved atomization, and sophisticated booster venturii that better condition fuel mixtures. Innovations that get the most out of every drop of gas.

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*Actual economy gains may vary depending on individual application and driving conditions.*



*A complete Economaster applications listing can be found in Holley's 1978 Performance Parts Catalog, part no. 73000-8. Send \$1.50, allow 45 days for handling.*

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# Surface your own lumber with this homemade jig

You can supplement your chain saw and router with this fixture for about \$50.

by David Warren



PM photos: Matt Doherty

**Y**ou may already have some of the tools needed for our surfacing system, but don't be misled; you do need husky equipment to saw and surface your own lumber. The setup we used is Homelite's 3½-cu.-in. chain saw with a 20-in. bar and a Haddon Lumber/Maker. The router is Rockwell's heavy-duty 2½-hp with ½-in. collet. A special 2-in. carbide-tipped router bit and PM's jig complete the system.

Onsrud Cutter Mfg. Co. designed the bit to suit PM's jig. It spins at 28,000 rpm. The cutter's rake finishes linear wood grain easily as well as end grain to ⅛-in. depth. (PM-2 bit costs \$71.25 postpaid from Onsrud, Box 550, Libertyville, Ill. 60048.)

Size your jig to suit your needs. Ours can handle slabs about 21 in. high and log sections about 14 in. high. The jig fits well on a 46-in.-long workbench.

Before surfacing stock, you must air-dry it until it stabilizes—as a rule of thumb, allow about one year for each inch of stock thickness. Coat the log ends with white glue and date each plank. (Note: To seal out moisture, many purists will opt for wax on the board ends.)

## How the jig works

When the jig is moved either left or right it pivots to form a parallel-

ogram. This movement, of course, raises or lowers the top rails to achieve a rough depth setting. The fine adjustment for depth is done with the router's adjustment collar. One or two pieces of wood support the sides so the jig doesn't sag, and the top rails support the cross assembly upon which the router slides. Secure the setup to a bench.

## Fabricating parallelogram

Begin by cutting angle-iron pieces to length. Lay out and bore the bench mounting holes. Lay out and bore pivot holes. Cut the two angle-iron top pieces and lay out and scribe center lines for a pivot hole and two tie-rod holes in each end of the top rails. Punch, drill and countersink for machine screws as shown. Deburr both sides of all drilled holes. To assure clearance for the cross assembly, lay out and scribe curved lines at top ends of riser bars. File tie rod ends flat. Scribe center line on ends of rods. Lay out and bore three holes on each end as shown in detail.

Fasten base angle to bench and riser bars to base angle as shown. Attach tie rods and riser bars to top rails. Tighten securely. Use lock washers on bolts to minimize loosening due to vibration. Top rails now have an up-and-down adjustment

*(Please turn to page 22)*



Large chunks of hardwood, such as parallel-cut log sections, are sliced using the Haddon Lumber/Maker guide. After air drying, wood is ready for surfacing.

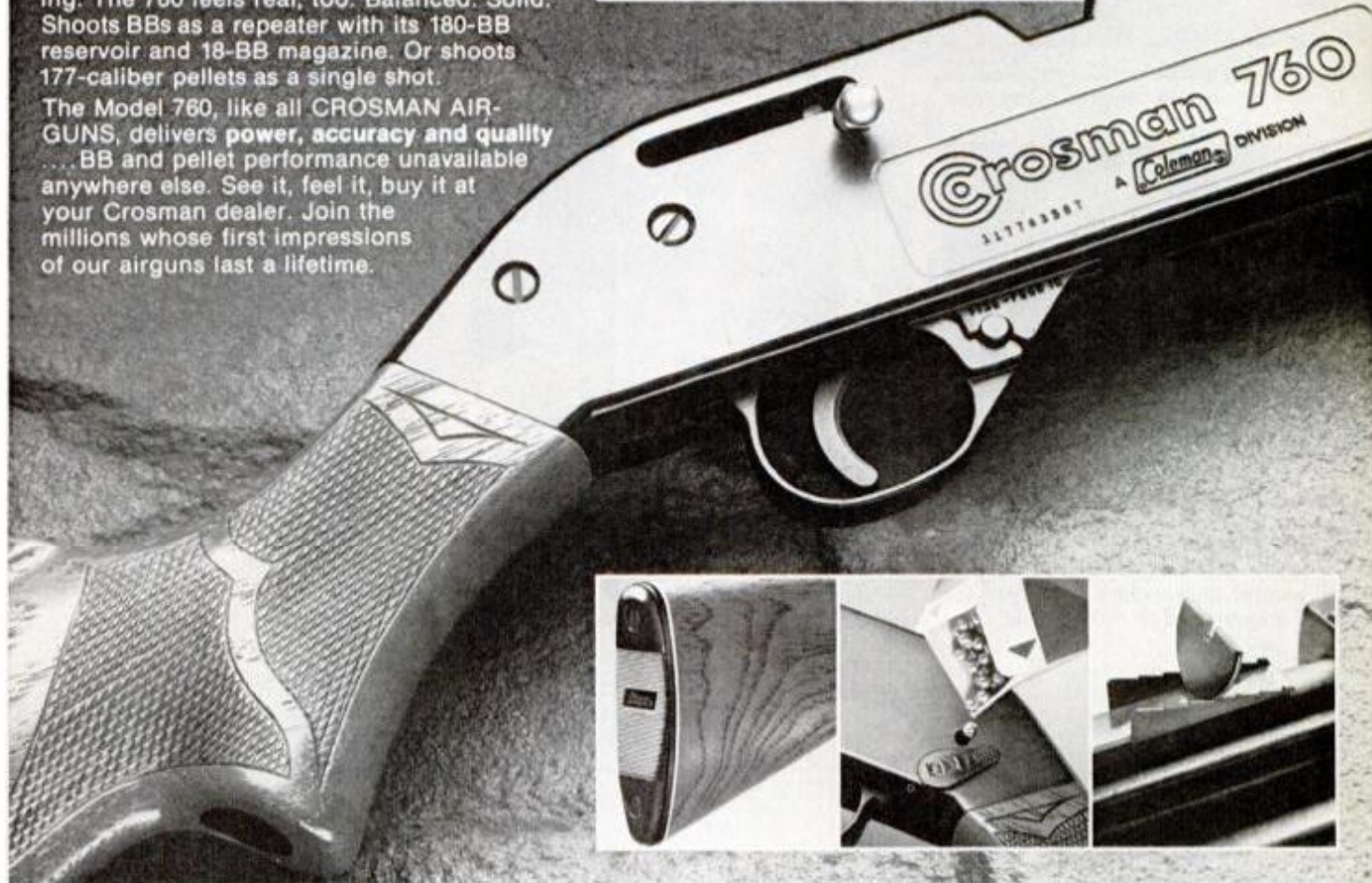


Lumber/Maker is also used to cut off log end sections to be surfaced in the jig.

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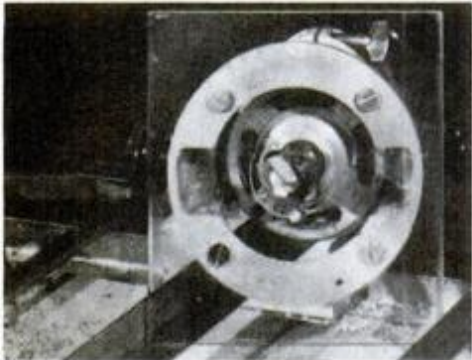
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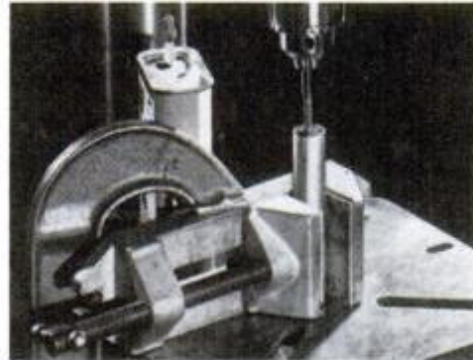
Even end grain can be surfaced to produce one-of-a-kind lumber finishes every time.

### MATERIALS LIST—SURFACING JIG

Amt.	Size and description
4	1 1/4 x 48" long angle iron
2	1 1/4 x 36" long angle iron
2	3/4"-dia. x 24" long steel rod
4	1/2 x 3/4 x 19" steel
2	1/2 x 3/4 x 8" steel
24	1/4" flat washers
12	lock washers
18	1/4-20 bolts 1 1/4" long
4	1/4-20 bolts 1" long
22	1/4-20 nuts
1	1/4 x 8 x 8 3/4" sheet acrylic
10	8-32 x 3/4" fh machine screws
8	6-32 x 1/2" fh machine screws
1	1/2"-dia. plastic rod



The heart of the surfacing system, Onsrud's carbide-tipped cutter, polishes a 2-in. wide swath. For sighting aid, use a replacement see-through router base of sheet acrylic. It provides long, parallel bearing edges to slide on the rails.



To drill and tap holes in tie-rod ends, use a bench vise turned on its side and clamped to drill press table. Put rods through table's center hole and secure in vise. For more clearance, rotate table and motor 180° to clear base of press.

### SURFACING JIG

(Continued from page 20)

you can tighten at the desired height.

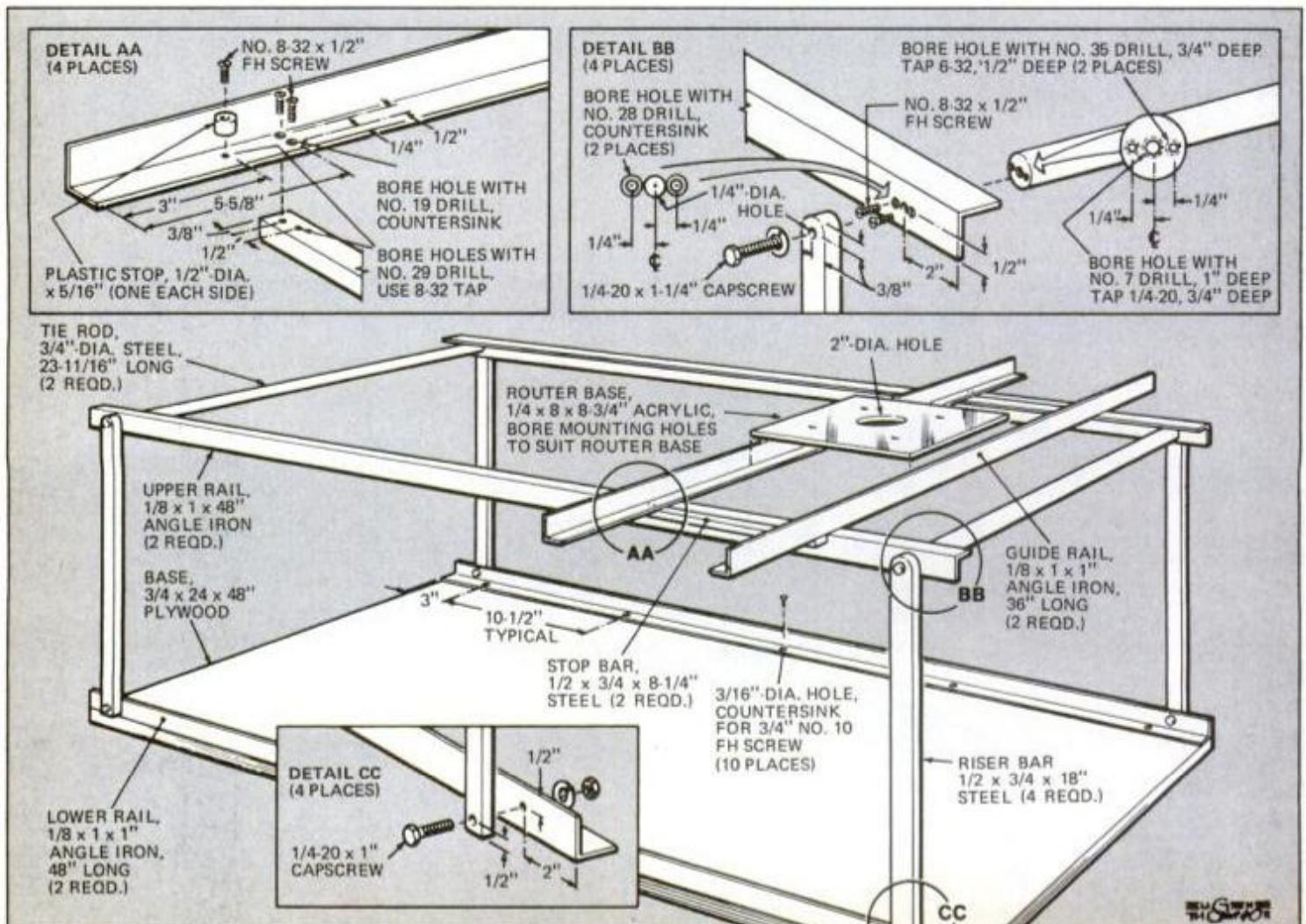
There should be some end play when the guide rail assembly is in place. Lay out and scribe center lines for machine screws. Bore holes and countersink for screws as shown. Align stop bars under guide rails and center-punch four holes in each. Bore holes and assemble. Cut stops from plastic rod, drill holes and install on each rail at the ends.

To modify router for use with jig, replace its base with one of sheet acrylic. Locate the base-mounting holes so router handles are perpendicular to guide rails and drill. Use jig or hole saw to cut center hole large enough to accommodate router bit.

Apply Liquid Gold lube to angle iron and put the jig to work.

Surfacing capability allows you to match lumber for color and graining if you cut boards from the same log. It also enables you to cut hard-to-find patterns. For a brochure on Lumber/Maker uses, write to Haddon Tools, 4719 West Route 120, McHenry, Ill. 60050.

Workbench shown is \$105.30 post-paid from Atlas Press, 2019 Pitcher St., Kalamazoo, Mich. 49007. **PM**



# Give your GM car our best.

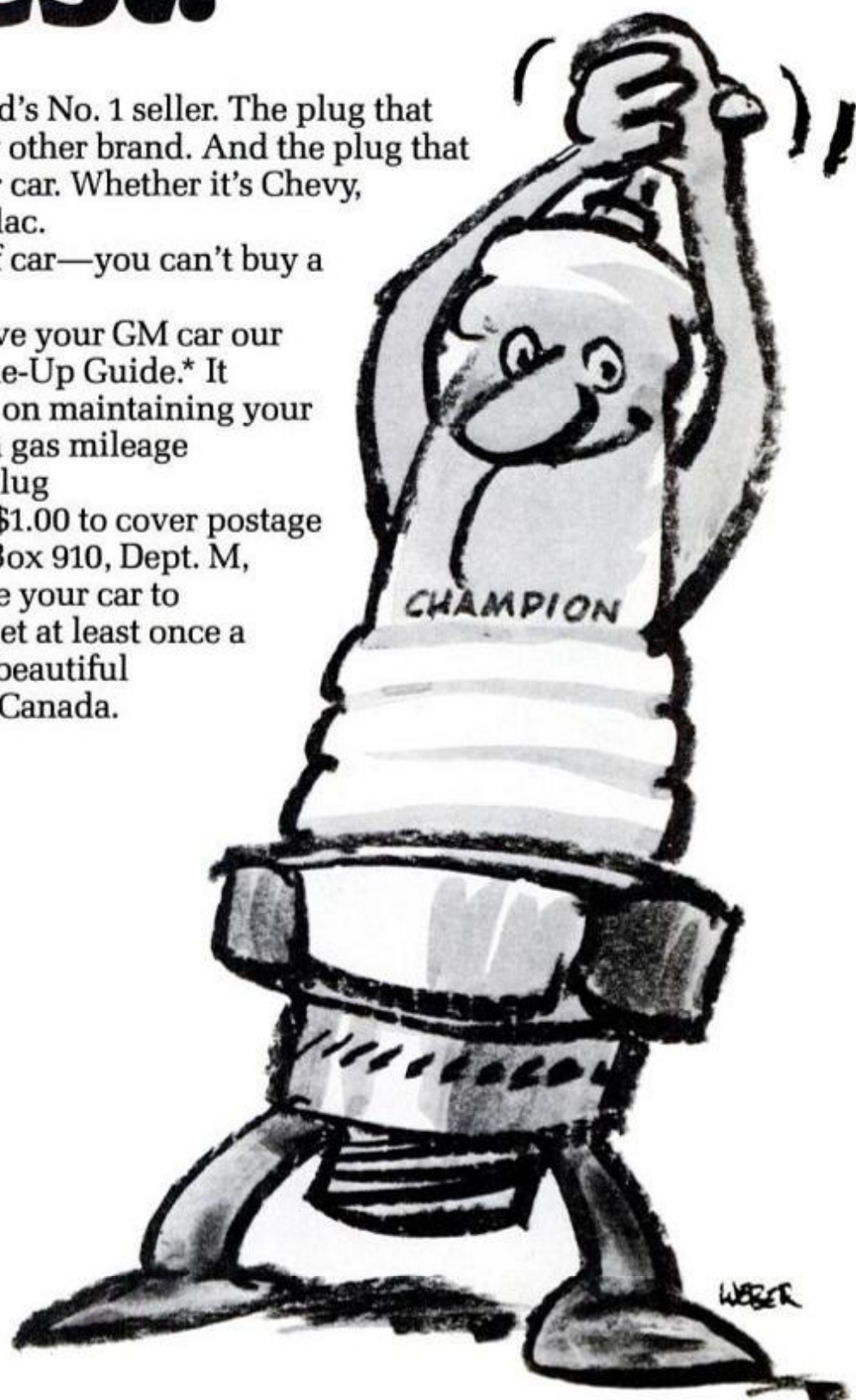
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**You can't buy  
a better plug.**







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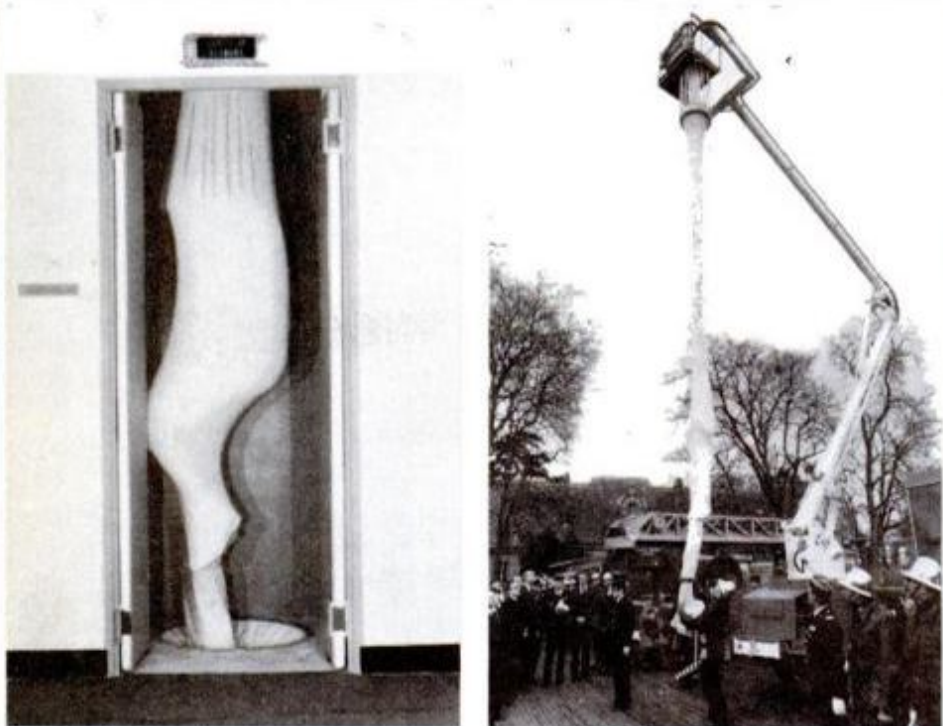


# IT'S NEW NOW



## One if by land . . .

The ACV-4000 Backhoe is said to be the only commercially-employed hovercraft in the country. The 4000-pound craft operates where the footing is too soft for wheeled or tracked vehicles. The unit above is shown harvesting oysters on tidal mudflats. Riding on an air cushion, it's propelled by an outboard over water and soft tires over land. MariDyne, 1169 East Ash Ave., Fullerton, Calif. 92631.



## Down the tubes

The odd-shaped bulge at left is someone descending the Otis Safety Sleeve, a system designed to evacuate a burning building rapidly. Marketed in Europe by a division of Otis Elevator, it consists of three concentric sleeves. The inner sleeve supports the users' weight; the second is a stretchy braking sleeve (just stick out your limbs to slow down or stop), and the outer one provides fire protection. In practice drills there have been no mishaps or friction burns, Otis says. Systems can be multiple entry (left) or single entry (right).

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# IMPORTS & MOTORSPORTS

## New nose on stretched Saab



Saab 900 joins the model lineup for '79. It's eight inches longer than 99 models.

In Scandinavia, automotive noses are designed for bumping into things. The bigger the schnozz, the better the protection when a pole or another car stops you alive in your tracks. The longer front end of the new Saab 900 model allows safe, controlled deformation in a frontal collision (and more room in the engine compartment for easier servicing). Another bonus of the new chassis, with its wheelbase two inches longer than that of 99 models, is more toe-twiddling area for the driver and better leg room for rear-seat passengers.

The new instrument panel (shown below) is exceptionally well laid out, and was designed to accept air bags for driver (in steering wheel hub) and passenger (in glove box area) when the law requires them. The 900 will be available later this year in five models: three-door EMS, GL and Turbo versions; and five-door GLEs and Turbos. The Turbo versions get the rear spoiler as shown in the photo above.

The 900 may become the Hayfever Sufferers' Special. On the long hood near the cowl are two sets of air louvers: the right nostril is a fresh air inlet with a replaceable filter cartridge that traps dust, pollen, pollution, even bacteria. Less

sneezing, more concentration on the road. The price of a new 900 might even qualify with the IRS as a medical tax deduction . . . or is that stretching it too far?

## Book for know-it-alls

If you think you know cars, this book will bust your bubble. Just open to the list of makes and models in production, alphabetically by country. You'll see: Austria's Custoca with its Hurrycane and Strato ES models. Next is Czechoslovakia with its lineup of Skodas and Tatras. Shall I go on? or have you been humbled? Over 1000 models from 35 different countries and six continents are indexed. What's the last listing in the book? It's Australia's Holden in the Middle East/Africa/Asia/Australasia section. Of the 438 pages, 110 are devoted to indices, essays and color pics about the world automotive scene. It's \$26.95 from Herald Books, Box 17, Pelham, N.Y. 10803.



Even the Bradley is in World Cars 1978.



Saab 900 speedometer has electronic pulse transmitter to operate cruise control.

## Subarus in the snow

It takes a lot to snow-in a Subaru—especially the four-wheel-drive (4wd) models. The BRAT and 4wd station wagons have, in fact, become cult cars among drivers who want to go in snow. Now Subaru owners can do more than just get through the deep stuff; they can plow their own driveways, maybe even go into business plowing others'. A snow plow designed specifically for Subarus has just hit the



Subaru owners can plow their drives.

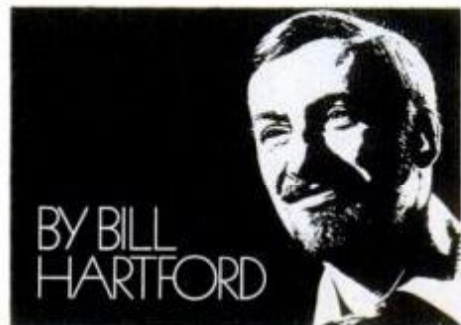
market. The Snow-way Plow weighs 275 pounds, is six feet wide and comes with all electric and hydraulic connections. It's \$1149 from Snow-way Plows, 6102 West North Ave., Milwaukee, Wis. 53213.

## Quick as a Rabbit



New for cops: VW Rabbit police cars.

You may argue about policies of police pursuit, but you can't argue the effectiveness of VW Rabbit police cars to officers of the Greensboro, N.C., Police Dept. They've hauled in offenders after 100-mph chases, and get an overall 20 mpg, three times the average for their other cars. **PM**



BY BILL HARTFORD



# Le Sports Car

When it comes to economy, Le Car can compete with just about any small car.

But when it comes to performance, not many small cars can compete with Le Car.

## Le Performance Car.

Le Car may not look like a sports car. Until you check the features. They're the most sophisticated that you'll find on any car at any price.

*Front-wheel drive, rack and pinion steering, four-wheel independent suspension and Michelin steel-belted radials are all standard. (Cars like Rabbit, Fiesta, Honda Civic and*



*Chevette don't offer this combination of features as standard equipment. And, surprisingly, neither do cars like MGB, Triumph TR7, Fiat 124 and Porsche 924.)*

The result is a car that will handle and corner about as fast as anyone would really care to.

Of course, what we promise in our ads we prove on the track. Le Car so dominated its class in racing in 1977, that Sports Car Magazine wrote: "Showroom Stock Class C is spelled R-E-N-A-U-L-T."

Le Car gets 41 MPG highway/26 MPG city according to 1978 EPA figures.<sup>1</sup> Remember: these mileage figures are estimates. The actual mileage you get will vary depending on the type of driving you do, your driving habits, your car's condition and optional equipment.

**A level of comfort unheard of in small, sporty cars.**

Unlike other cars in its class, Le Car recognizes the fact that people have to ride in it.

Le Car offers a ride that's so smooth critics have called it

"unbelievable" for a car of its size. And it has wide, comfortable front bucket seats (fully reclining in the GTL deluxe).

What's more, in proportion to its exterior length, Le Car has more interior space than any other car on the road.

## A track record with owners, too.

In Europe, where people drive with a passion, nearly 2 million people drive Le Car. (That's more than Fiesta and Rabbit combined.)

And in America, Le Car sales have more than doubled in just one year.

What's more, three separate surveys showed that Le Car owner satisfaction is at an incredible 95%.

Le Car prices start at only \$3630.\* And that includes one more feature you won't find in every sports car.

A back seat.

For more information call 800-631-1616 for your nearest dealer. In New Jersey call collect 201-461-6000.

\*Price excludes transportation, dealer preparation and taxes. Stripe, Mag wheels and Rear wiper/washer optional at extra cost. (California excluded. Renault USA, Inc. ©1978.

# Le Car by Renault

# HOMEOWNERS' CLINIC

## QUESTIONS ANSWERED

### More spray suggestions

We've received many letters from readers suggesting ways to cut a hole through a sink apron in order to install a spray attachment (*Make Way for the Spray, Homeowners' Clinic*, page 16, Feb. '78).

The simplest solution requires no cutting at all. Simply buy a single-lever faucet (three-hole) which has the spray attachment in its deck. Delta, Peerless and Moen, to name a few manufacturers, sell them.

If you have a stainless-steel sink, you can drill a series of holes in the steel, then file them until you've attained the desired cutout size.

The most ingenious method of drilling through a porcelain-on-steel sink was sent to us by Albert Affolter, Mankato, Minn., who first drilled the desired size hole through a 2x4. Then he clamped the 2x4 so the hole was over the area to be drilled and used it as a guide while he hand-rotated a pipe in the hole. To assure a clean cut he added carborundum powder and linseed oil to the hole. The porcelain was cut smooth, allowing him to proceed with drilling through the steel.

### Talking floors

To avoid the cost of hardwood flooring 10 years ago, we carpeted directly over our plywood subfloor. Our floors now squeak constantly. Short of removing the carpeting, how can we correct this?—L.L. Jones, Royal Oak, Mich.

If your squeaking is widespread, the only solution is to roll back the carpet and underlying pad. Use 8d common nails every 6 in. along the edges of the plywood sheets, and every 12 in. on center in each panel's field.

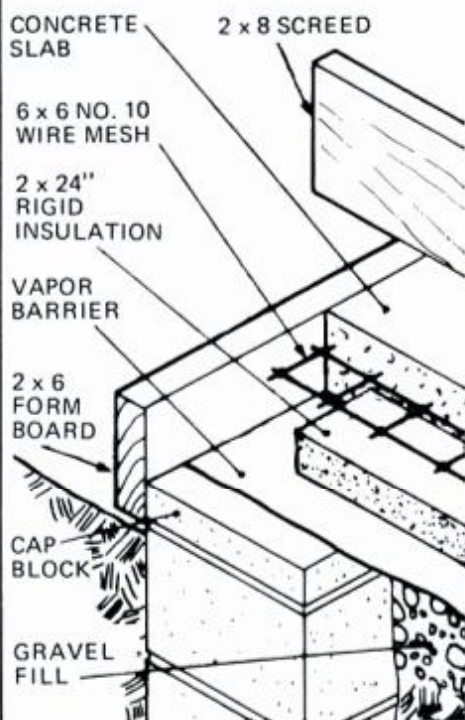
Isolated squeaks can sometimes be eliminated by driving and setting 10d finishing nails through the carpet and underlying pad into the joist.

The joist location can usually be found from the ceiling below and transferred to the floor through careful measurement from a common reference point, like a wall or partition.

### Another try at pouring concrete

Our recent tip on pouring a con-

crete floor (*Homeowners' Clinic*, page 10, June '78) included a diagram that incorrectly showed rigid insulation flat against the form board, leaving it vulnerable to moisture from the outside. The diagram below has the insulation



Typical concrete floor-slab design.

crete floor (*Homeowners' Clinic*, page 10, June '78) included a diagram that incorrectly showed rigid insulation flat against the form board, leaving it vulnerable to moisture from the outside. The diagram below has the insulation

### Crumbling brick ledge

The concrete ledge that my brick veneer rests on breaks off at the corners. I have patched it several times, but the patch always breaks off within a year. What causes this, and how can I get the patch to stay?—Jan Berger, Belvidere, Ill.

The weakest points in unreinforced concrete are the corners. A hairline crack, allowing water en-

try, might have started when the form was removed. Judging from the photograph you sent us, your ledge appears to be in no danger of failing. If the look bothers you, your previous patches failed due to their shape. They had nothing to grab on to.

Using a masonry carbide-tipped bit, I would bore several 3/16-in.-dia. holes in the existing concrete. Tap in some short masonry nails, leaving 1/4 in. exposed. Dampen the concrete slightly and apply mortar mix with a trowel, making certain the mortar is pressed firmly around the heads of the masonry nails, to assure keying to the existing concrete.

### House too vapor-tight?

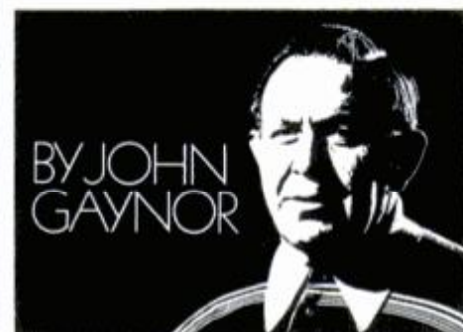
When we built our electrically-heated house, we made certain we had a vapor barrier installed under the dry wall in all walls and ceilings. In the winter, with the thermostat set in the mid sixties the humidity level hovers around 60-65 percent. The dehumidifier doesn't seem to work well under these conditions. Even our Thermopane windows sweat, and we're now seeing signs of mildew. What should we do?—Richard Castor, Bedford, N.Y.

I assume your house has electrically-heated warm air, and as such, is too tight for the same air to be constantly recirculated. Fresh, cooler air must be introduced into your plenum, and provision made for eliminating the excess. Duct systems with automatic dampers can be installed. Such a system will alleviate your high winter humidity quickly.

Since I've outlined only the basics, a licensed mechanical engineer or heating contractor should be consulted for system design and layout.

PM

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.



**"I smoke for taste,  
the best taste I can get.  
I smoke Winston."**



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

**King. 100's.**

# ALL OUTDOORS

## Better than the birds

Anyone who's been outdoors recently during cool weather knows it's the fat look now that's in. Puffy parkas and pants stuffed with waterfowl fuzz make you look like an overweight Arctic explorer—but they do keep you warm. Down—the light, tiny and so expensive fluffy filaments that geese and ducks wear under their feathers—has proved to be the best filling for cold weather gear. So far.

But this fall, down's top rating may start to go out of date. The 3M Company is introducing a new keep-you-warm material that is said to be even better than down. It's called Thinsulate thermal insulation and 3M rates it almost twice as effective as down and other synthetics now on the market.

That's saying a lot. Until now down has been accepted as the best material, for its weight, to retain body warmth, followed closely by man-made polyester fibers such as Hollofil and Polarguard. Slightly more down could be compressed into a stuff sack, and its light weight also made it popular with backpackers as the insulation in parkas, jackets, vests, and sleeping bags.

But get down well soaked through and you're in trouble. It compresses, loses its loft and ability to hold heat, and may take days in the field to dry out thoroughly. It is difficult to wash or dry-clean without removing its natural oils, and down has to be quilted into place so that it won't move around inside the layers of the garment or sleeping bag and end up all in one corner. Synthetics, on the other hand, wash easily and do not absorb much water so they dry out quickly and retain their insulating properties.

Down has also had definition problems. "Prime white northern goose down" doesn't really mean much, since "prime" is just a matter of opinion, black down is just as warm as "white," all down comes at present from northern waterfowl, and "goose down" has often been found to include chopped up feathers from ducks, geese and chickens. There has been so much adulteration of down, in fact, with fibers, feathers and residue, that the Federal Trade Commission has been asked to help stop the mislabeling of imports.

Much down comes from Poland and China.

Good down is good, however, so how do you measure the claims of something reported to be better? We watched 3M's St. Paul, Minn., development laboratories, using elaborate temperature measuring devices, take equal thicknesses of their Thinsulate, down, polyester and other materials and record thermal resistance to determine relative warmth. With the conductivity of air assigned a theoretical insulating value of 2, Thinsulate measured 1.8, down 1.0, polyester batt .9 and other materials less.

In "real life," test gloves and jackets have been made up and given extensive in-use and thermo-



Sensors under jacket rate 3M Thinsulate.

graphic infrared workouts for direct comparison with existing cold-weather gear. When we grabbed a chunk of dry ice with a Thinsulate mitten and then one of another synthetic we found the difference dramatic. Ski jackets are predicted to be one of the first garments to use the development; they can be kept thin and stylish with the new material and still deliver great warmth. A few should be available this winter.

How does the new fiber work? 3M claims the microfibers are infinitely finer than those of down or the other synthetics and thus can hold a doubly efficient layer of "dead air." They weren't about to reveal how they create this material, but for future cold weather we should be happy with the results.

## New gear and guides

Good sources of outdoor equipment are the 3000 distributors of Boy Scout gear. All can sell to the general public, and revenue from the sales helps support Scout programs. A lightweight red nylon Day Hiker backpack recently added to the line, sells for under \$10.

Call the nearest Boy Scouts of America office for a supplier's name.

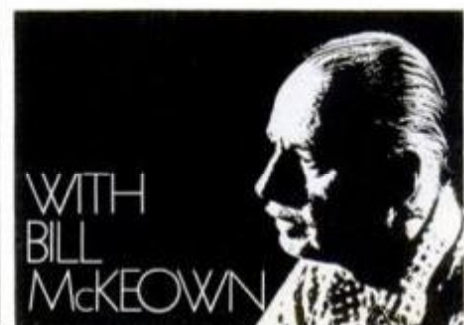
One of the best and most cheerful fishermen around is Stan Fagerstrom and his writing shows it. His books, *Catch More Bass*, \$8.60; *Catch More Steelhead*, \$7.60; and *Catch More Crappie*, \$6.30 (all postpaid), tell how to catch that special fish, where to find it, what tackle to use, and even what to wear. The excellent volumes are available in book stores, or you can do as I did and get personally autographed copies directly from Stan at Box 27, Silver Lake, Wash. 98645.

For RV campers, the members of the Starcraft Camper Club have gotten together a cookbook of recipes particularly suitable for on-the-go and campfire meals. It's \$5 from Starcraft, 2704 College Ave., Goshen, Ind. 46526.

And a neat little booklet, *A Guide to Knives for Today's Frontiersman*, tells how to select knives, sharpen them and use them for camping, dressing game, cleaning fish and survival. It's \$1 with a powder-horn lapel pin from Imperial knife dealers or Imperial, Department P, Box 866, Providence, R.I. 02901.

## NH&F Day

In his statement naming Saturday, Sept. 23, as National Hunting and Fishing Day, President Carter points out that leaders in the effort to conserve our wilderness, wildlife and natural resources for the last 80 years have been the hunting and fishing sportsmen of the country. They currently provide most of the funding for the state agencies charged with the conservation and protection of fish and wildlife. The day is an appropriate time to call the attention of everyone to the many activities available to the outdoorsman, and to the role played by sportsmen in making them available. **PM**





# Seagram's 7 Crown

**Announces the Seven Crowns of Sports Award.**



**The pros have to work harder, scramble more and make fewer mistakes to win them than any other trophies in sports.**

This annual award isn't based on a popularity contest. It's a precise evaluation of all that an athlete's got to give, in each of the 7 major professional spectator sports—football, baseball, basketball, hockey, golf, tennis and horse racing.

**Everything counts, so we count everything.**

Seagram's 7 commissioned the most sophisticated computer program ever developed for weighting and measuring every aspect of competition. So we get a numerical evaluation of how close to professional perfection an athlete's performance really is.

**At stake: trophies, \$110,000 in awards... and a lot more.**

It's called professional pride.

In fact, to the men and women who win in their particular sport, the satisfaction in outperforming everyone else may be the most important thing.

Because competition is the name of the game in any sport.

**Send for the Seagram's 7 Crown Sports Calendar.**

Our colorful 16-month, September 1978 to December 1979, calendar gives you a lot more than the day of the month. It includes all the year's major sports events... trivia questions... and great milestones in sports history.

... Plus dramatic illustrations depicting the origins of the sports featured in our 7 Crowns of Sports Awards.

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**Seagram's**  
SEVEN CROWNS OF SPORTS

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

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OCTOBER 1978

SEAGRAM DISTILLERS CO., N.Y.C. AMERICAN WHISKEY - A BLEND. 80 PROOF.

**Visit your favorite store or tavern to pick up a coupon for this exciting offer or send \$2.95 to Seagram's 7 Crown Sports Calendar, P.O. Box 5062, Smithtown, N.Y. 11787. Allow 4 to 6 weeks for delivery. Offer expires Oct. 31, 1978. Void where prohibited by law.**

# MILLION DOLLAR SHINE.



## IT'S SO EASY.

© 1978 S. C. Johnson & Son, Inc.

## Remember!

Whether you work on your car yourself, or have your service station do it, remember to check the radiator cap. It's the easiest component to forget, yet the easiest to replace. And regular replacement is vital. A faulty cap will not keep the pressure in the cooling system

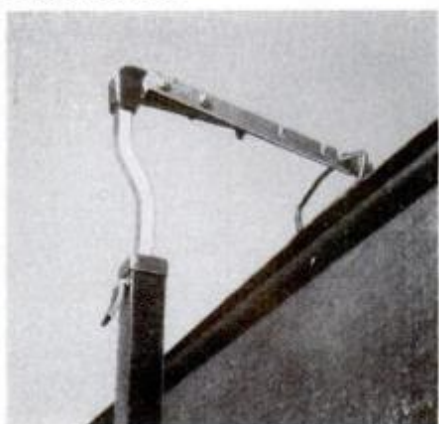
within safe limits. So be safe. Install a Stant Lev-R-Vent® Pressure Cap ... the safest, most dependable radiator cap available anywhere. And for expert tips on cooling system care, write for "The Stant Cooling System Fact Book". It's free.

STANT MANUFACTURING CO., Inc.  
Connersville, Indiana 47331  
A Purolator Products Company



## PHOTO HINTS

### Alignment aid



For perfect slide or movie projection, the plane of the screen must be parallel to the plane of the film. Faulty alignment results in "keystoning" and uneven focus. The problem is common because most home screens can't be tilted, while projectors are easily adjusted. The solution is simple: an extension arm of  $\frac{1}{8}$  by  $\frac{1}{2}$  by 9-in. iron or aluminum bar stock, bolted to the existing hook, with notches filed in the free end to take the screen's handle. After you experiment with the screen angle, you may be seeing your pictures at their best for the first time.—Robert Hertzberg

### Light-sealing tube

You can cure an enlarger-head light leak by sewing a  $1\frac{1}{2}$ -in.-dia. tube of dark, soft fabric, filling it loosely with rice or aquarium gravel, wrapping it around the head and fastening it with a clip.—Ruth Ann Haley

### Loading corral



When you're working with parts of a developing tank in total darkness, it's easy to push one of them off the table. Keep them together in a three-sided corral of plywood, hardboard or heavy cardboard.—Robert Hertzberg

# THE EAGLE IS READY.



Cleared for Take-Off.



Eagle Flight, Left Heading Two-Three-Zero.



Mission Completed.

**TEAMWORK.** Electricians. Mechanics. Pilots. Radio repairmen. Security police. Fuel and hydraulic specialists. All working together. Each dedicated to their profession, the Air Force, and America.

**GREAT OPPORTUNITIES.** If you enlist, you're trained in one of over 140 jobs. You earn good pay. You can even work toward an Associate Degree through the Community College of the Air Force.

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**AIR FORCE** 



Kings: 12 mg "tar," 0.8 mg nicotine av. per cigarette, FTC Report May '78  
100's: 12 mg "tar," 0.8 mg nicotine av. per cigarette by FTC Method.

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

# Marlboro Lights



The spirit of Marlboro in a low tar cigarette.

# APPLIANCE CLINIC

## QUESTIONS ANSWERED

### Water torture

*My experience with a Sears Kenmore Model 700 automatic clothes washer may benefit others. My problem was incomplete draining in the spin-and-rinse cycle. A half tub of water remained. The usual trouble-shooting procedures—assuring a clear drain, for example—failed to work. Then the light dawned.*

*This unit has a self-cleaning filter, but after seven years of use, it was ineffective. Lint had accumulated, blocking the filter. Draining slowed to a mere trickle. The timer would advance to spin before the washer drained completely. I bought a new filter from Sears for \$5.95, and now I'm back in business.—Robert G. Gill, Richmond, Va.*

You're right, Mr. Gill. This information should help those who own washing machines with self-cleaning filters. Thanks.

### Disposing of a problem

*We have a General Electric Disposall that leaks at its base. I removed the base plate, but I couldn't find a way to get at seals or bearings that might need replacing. Must I junk the unit to get rid of the leak?—Don Cole, Lompoc, Calif.*

No. But you have to be more specific about where it's leaking. Is it at the hopper-shredder housing joint? At the hopper boot where the unit connects to the sink drain? In the shredder housing?

The shredder housing, which contains the motor, is apparently what you call the "base." There's no reason to replace the seal or bearings in the shredder housing unless water is getting into the motor, which obviously is not the case. From your description, the leak appears to be external.

Okay. Suppose the leak is occurring at the hopper-shredder housing joint. The hopper sits atop the shredder housing and receives the refuse. A leak at this joint could be caused by a damaged or misaligned gasket or a loose clamp band, which holds the two parts together. First, try tightening the band screw. If that doesn't stop the leak, remove the Disposall from the sink and separate the hopper and shredder housings. Re-

place the gasket. Then make sure the two housings are securely clamped back together.

If the unit is leaking at the hopper boot, check for a loose lower support ring at the hopper-sink flange and for a damaged hopper gasket. Make sure the unit hangs vertically and isn't pulled off center to meet the plumbing.

Finally, examine the outside of the shredder for a hole that may have been punched through the housing by a metal object inadvertently thrown in with garbage. Also look for a hairline crack in the housing.

### Looking for clues

*Our new Frigidaire refrigerator-freezer worked okay for about six months, but now it runs too cold on the "warmest" setting. The freezer stays at 20° below zero, and the food compartment holds steady at 20° above zero. Two new thermostats have failed to solve the problem. The serviceman says the unit is cycling properly. What will it take to control temperature?—Harry W. Huffman, Mitchell, S.D.*

We sympathize with the serviceman. This is a tough one to track down. If a low temperature was prevalent in either the freezer or the food compartment, the solution would be more apparent. Another factor muddying the water is the onset of the problem six months after the refrigerator was in use.

The thermostat, which controls temperature in both compartments, appears to be the likely culprit. But suppose the scenario went like this:

Six months after you bought the refrigerator, the original thermostat went bad. It was replaced—twice. Assuming the replacements weren't defective, what else could cause the thermostat to fail within a normal temperature range? The only thing we can think of is the sensing tube. This tube (or bulb) is attached to the thermostat and "tells" when the temperature has reached the desired level. The thermostat then turns off and the refrigeration cycle ceases.

It's possible that the serviceman inadvertently mispositioned the sensing tube when he replaced the original thermostat. The sensing

tube should be located at the cold air inlet.

If it's not in its proper place, the temperature will drop below normal before the tube senses the cold and "tells" the thermostat to turn off refrigeration.

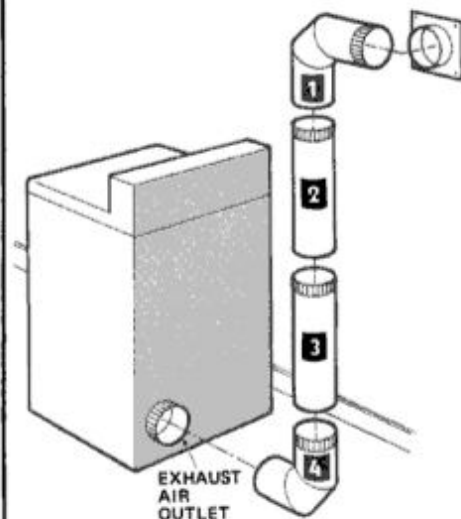
### Getting exposure

*The soap dispenser lid of our Frigidaire Custom Imperial dishwasher won't stay closed. It dumps detergent as soon as the door is swung shut. I can't figure out how to remove the dispenser to see what's wrong. What now?—John E. Romine, Indianapolis.*

The soap dispenser is held by fasteners on the inside of the door panel. You'll have to remove the outer panel, which is held by screws, to expose the dispenser assembly. The dispenser's spring latch is probably broken and should be replaced.

### SERVICE TIP

Have you ever taken apart the metal duct of a clothes dryer to clean out lint, and then tried to figure out how the pipes fit back together again? Here's



Number duct parts before disassembly.

a method that's so simple you'll kick yourself for not using it until now:

Starting at the top (or bottom) duct, just number each section in succession. Write the numbers on pieces of duct tape and stick the tape to the pipes. **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.

# 1979 Coachmen, The Name To Remember In Recreational Vehicles

There's a lot of excitement in the Coachmen lineup of new '79 recreational vehicles. RVs that you helped design. Your RV needs were detailed in an extensive consumer "livability" study; owners told us what they liked and disliked about RVs, as well as their eating, sleeping and traveling needs. The result? Recreational vehicles that give you a great sense of "fitness", of comfort with good taste and the reliability of quality construction.

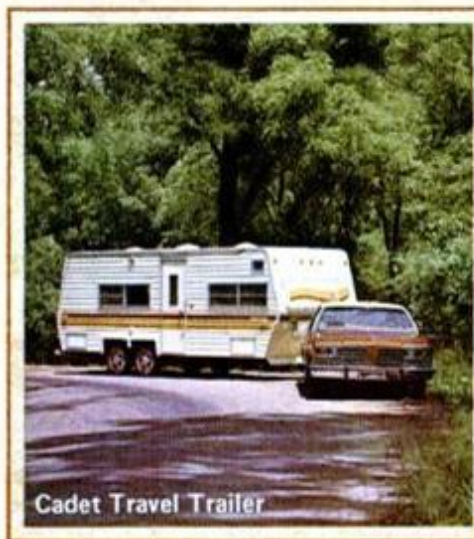
Coachmen offers dozens of family-pleasing floorplans. From the Deluxe line of Travel Trailers, QuinStar 5th Wheels, Leprechaun Mini-Motor Homes and Class A Motor Homes, to the economical Cadet Travel Trailers, 5th Wheels, Mini-Motor Homes and Truck Campers. The entire '79 line has been redesigned, including the versatile Travel Vans and Van Campers and the easy-towing Camping Trailers.

Stylish and aerodynamic exteriors. Colorful and easy-to-care-for interiors. Models that let you see the wide-open spaces outside while enjoying the wide-open spaces inside. Comfortable and efficient kitchens, remarkably roomy baths, lights where you want 'em. Plenty of outside and inside storage. Top brand name appliances and components. And all Coachmen recreational vehicles are backed with famous "Buck Stopper" service from dealers all over North America.

Write today or visit your local Coachmen dealer—he's in the Yellow Pages. And take a look at the recreational vehicles designed the way you want them. Coachmen for 1979—The Name To Remember in recreational vehicles.



Deluxe Travel Trailer



Cadet Travel Trailer



Leprechaun



## Coachmen

Recreational Vehicle Company

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Middlebury, Indiana 46540



Deluxe Travel Trailer & Travel Van

# PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

## Help for home buyers

To assure getting a good deal, the Department of Housing and Urban Development (HUD) cautions home buyers to ask the right questions when house shopping. HUD also advises hiring a reputable house inspection firm to check out your dream home when you find it. The firm's authoritative report will be worth the \$50 to \$100 fee charged. These and other good home-buying ideas are in the booklet, *Wise Home Buying*. Send a postcard to Consumer Information Center, Dept. 636E, Pueblo, Colo., 81009. The booklet is free.—H.W.

## Better paint pouring

Platypus Paint Guard fits tightly over the lid groove of a gallon paint can to make paint pouring a much neater job. The guard, wide enough to rest a paintbrush on, keeps the



lid groove free of paint so you can replace the cover without spattering. The

Platypus is priced at \$2 in most hardware and paint stores and building supply centers.—P.A.

## Drill-powered pump

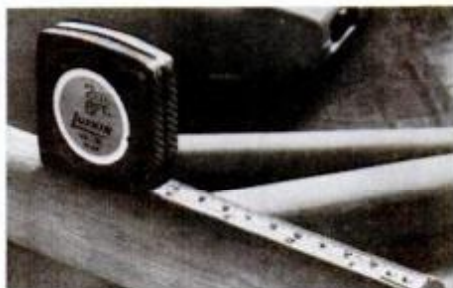


Efficient pump can be toted in drill box

Claimed to pump four times more than an impeller pump at same rpm, Mighty Max (bottom, left) boasts an all-purpose rotary roller vane pump for use with any electric drill. Maker says pump can move any liquid without damaging unit. It's \$15 at hardware and housewares stores. Matex Gear & Pump Co., Box 13634, Atlanta, Ga. 30324.—H.W.

## Economy measuring tape

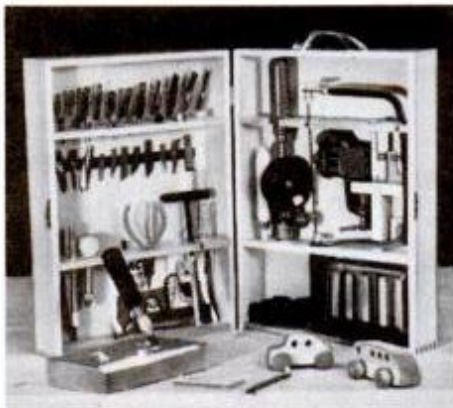
Designed for the once-in-a-while tape user (rather than a pro), this \$2.29 tape has quality-built features like those of higher-priced versions. A 6-ft. or 2-meter tape



can be read in feet and inches on its top edge, millimeters on the bottom. Lufkin, The Cooper Group, Box 728, Apex, N.C. 27502.—H.W.

## Hobbyist workshop-in-a-box

Deluxe hobbyist's kit No. 89 from X-Acto, 45-35 Van Dam St., Long Island City, N.Y. 11101, has an extra-sturdy wood case. The 8-lb. 3½ x 10 x 14-in. box contains four routers, four gouges, nine refill



blades, razor-saw blade, coping saw, block plane, tweezer and still other tools every woodworking craftsperson needs. At art and craft supply stores and department stores, \$55.—H.W.

## Accurate chain-saw sharpening

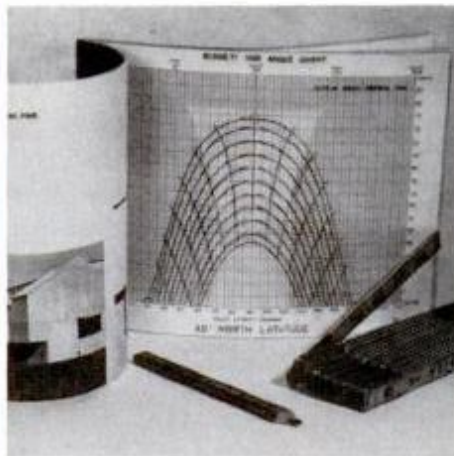
Pro Sharpener for chain saws uses a miniature grinding wheel to produce a ground—rather than filed edge on a saw chain. I tried a ground chain vs. a filed one recently and found it cut with greater efficiency.



Unit at left has three grinding wheels, electric drill adapter, hand file adapter for when there's no power, guide and height gauge. Easy to use, \$14.90 postpaid. Pro Sharp, Corp., Box 11378, Newington, Conn. 06111.—H.W.

## Calculating sun's position

In order for architects and engineers to lay out buildings accurately for solar energy collection, an understanding of the daily and seasonal changes of the sun is a must. In *Sun Angle for Design*,



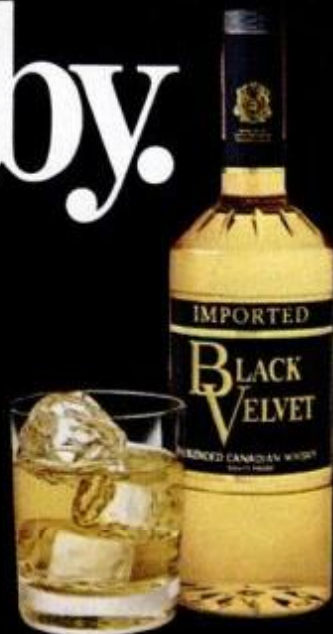
the author spells out this information in easy-to-understand graph form (see typical page, above) so reader can chart sun's position any time. The book is priced at \$5 postpaid from Robert Bennett, Architect and Engineer, 6 Snowden Rd., Bala Cynwyd, Pa. 19004.—H.W.



Telly Savalas is now appearing in "Mati."



# Feel the Velvet, baby.

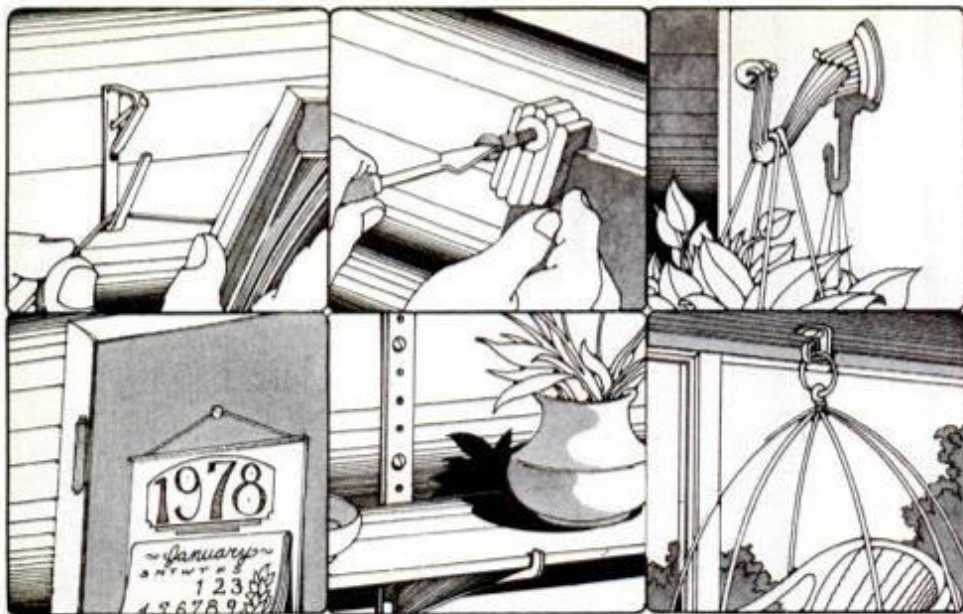


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## Hang-it-all. Molly<sup>®</sup> brand fasteners.

MOLLY brand Fasteners give you a tight grip on any hanging situation. Hang lamps, planters, or drapery rods; photographs, paintings, or mirrors; hooks, fixtures... or anything.

And hang them on any surface—plaster, wallboard, plywood, concrete, hollow walls, or doors.

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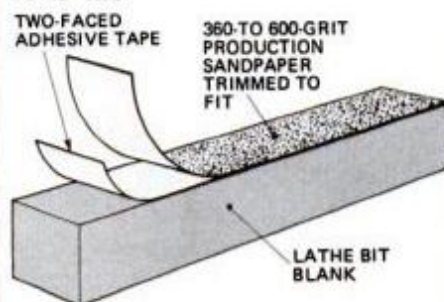
## HINTS FROM READERS

### Tools that moonlight



These common household tools can help out in your shop. Use erasers for polishing metal or removing layout marks from wood. A soda-can opener can serve as a minipry bar or tack puller. Use toothpicks to apply tiny amounts of glue, paint or soldering flux. Cosmetic tweezers can be used to pick up smaller parts when shop tweezers are too clumsy. A dip tube—glass tubing with smaller opening at one end—is good for dipping small amounts of liquid from containers. Use nail clippers to round corners of thin materials like cardboard. ("Toenail" size is best for heavier work.) Scrape or spread putty or crack filler with an old table knife. Whisk dirt and chips from narrow openings, like in machine tools, with a percolator brush.—Walter E. Burton

### Fine file



For very delicate work, make a handy precision file with teeth finer than those of any needle file. Cover one side of a blank lathe bit with two-faced adhesive tape and apply a layer of 360- or 600-grit production sandpaper. Tape paper flush with lathe-bit edges.—Mark W. Fleming

### 'Lead' lubrication

The tip of a soft lead pencil rubbed against the teeth of a stuck zipper helps it to slide freely.—Harry Radzinsky



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# You get more training and equipment for your money with NRI's small engine repair course.

When NRI educators design a course, they make sure it's completely practical. That's why, along with easy-to-comprehend lessons, you get a full set of professional tools and the components to build a 3 1/2 HP, 4-cycle Clinton engine from the ground up. That's the kind of training that sticks with you!

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NRI trains you at home, in your spare time. But you get real, hands-on experience that gives you practical bench time to start you out right. Only NRI includes professional-quality tools like an inductive tachometer, volt-ohm meter, torque wrench, valve spring and ring compressors, a complete set of high quality wrenches and more. Use them to build a working engine as you learn, use them on the job when you start your own full- or part-time business. And install the engine at a profit on one of your first jobs.

## Choose From Two Courses

NRI's 30-lesson basic course covers the theory and practice of small engine operation and repair, including lubrication, ignition, cooling, and starting systems, and overhaul. You specialize in the servicing and repair of power mowers and other lawn and garden equipment. And you learn in depth, with up

to 10 times the information provided in other courses.

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## More Training, More Equipment for the Money

Only NRI gives you so much for your money. Up-to-the-minute training in easy, bite-size lessons . . . a full array of professional working tools . . . and a quality engine that



you build as you learn. NRI is the oldest and largest school of its kind in the country, with more than a million students in over 60 years of training people for new futures.

Send for the big free catalog and see what NRI can do for you. No salesman will call. If postcard has been removed, write to the address below.

## Other income opportunities from NRI.

### Auto Repair approved by Richard Petty

America's winningest stock car racer says, "If you really want to learn how to repair cars, NRI is best." Includes professional tools like ignition analyzer scope, diagnostic engine analyzer, timing light, case-hardened wrenches, and much more. Basic and advanced courses. Check postcard for catalog.

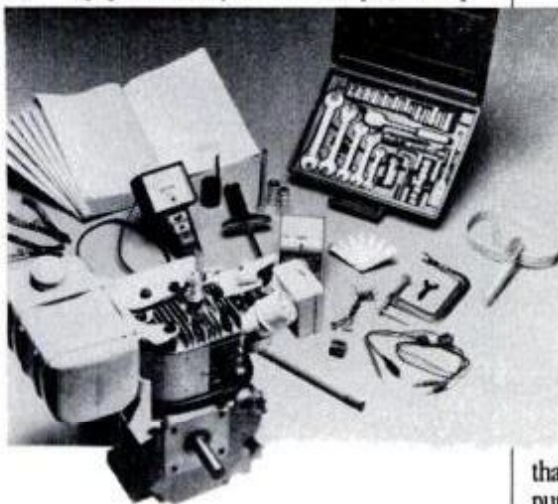
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Gets you into a wide-open, fast-growing area with practical training that includes lessons on solar heating, heat pumps, etc. Course is complete with professional tools, and you even get a top-quality Lammert

vacuum pump for troubleshooting experiments and use on the job. Two courses, with Master Course including optional training at York Institute Resident School at no extra charge. Check card for catalog.

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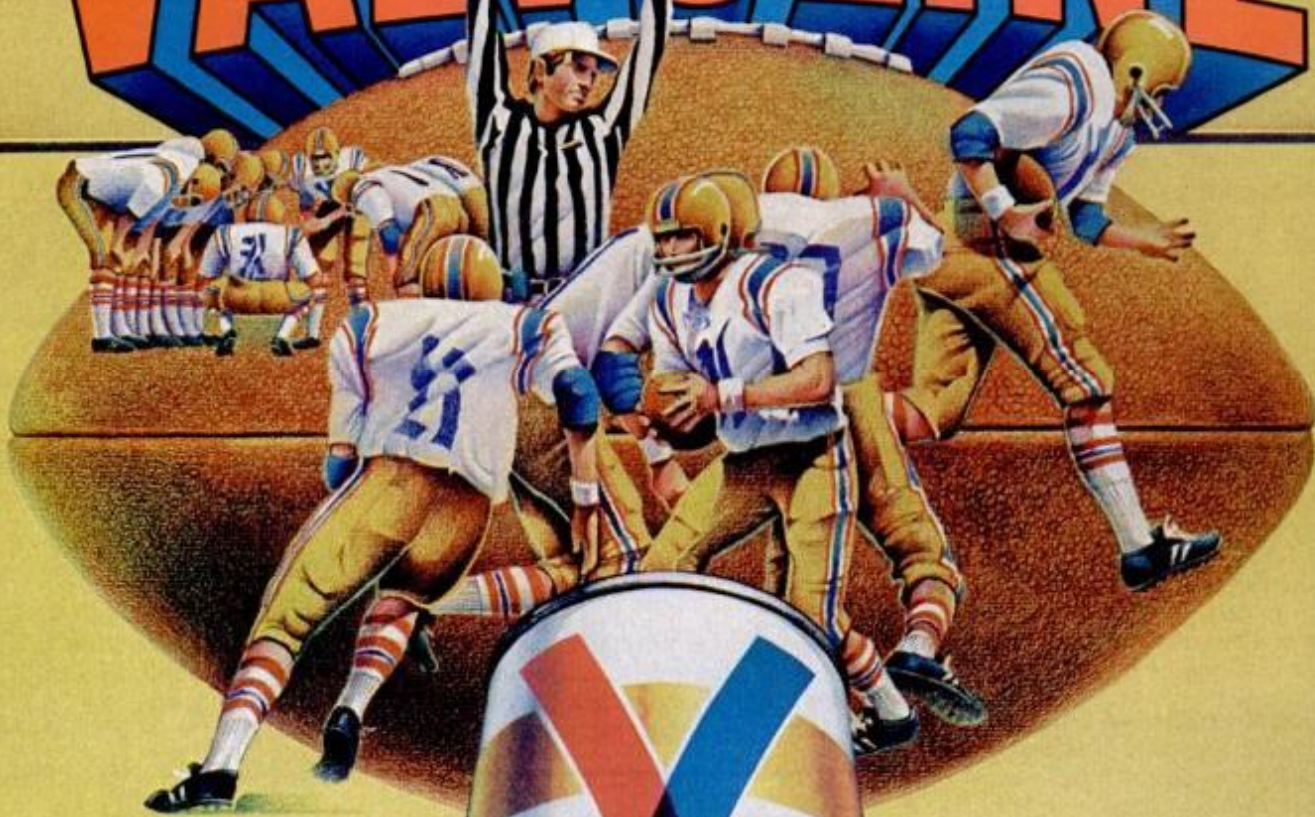
# This could be your ticket to the Super Bowl!

WEEKLY

FOOTBALL POOL

SWEEPSTAKES

# VALVOLINE



## YOU'LL GET A KICK OUT OF PLAYING IT...

A Pro Football Pool Sweepstakes where you pick weekly winners, not scores. You've got to call that fun. But consider, every week someone wins a trip-for-two to the Super Bowl. You've got to call that fantastic! Now consider the Grand Prize... "A Super Bowl Party for Ten." No way you won't call the Valvoline Weekly Football Pool Sweepstakes... a super deal!

## HOW TO ENTER...

Just stop at any participating outlet where Valvoline® Motor Oil is sold and look for the Valvoline Weekly Football Pool Sweepstakes display. Take a booklet that contains weekly entries. Then, just make your picks each week and mail them.

## A WINNER EVERY WEEK FOR 16 WEEKS...

Every week someone wins a weekend trip-for-two to the Super Bowl. But only those who can pick all the week's winners are eligible to win that week's drawing for a Super Bowl weekend trip-for-two. Valvoline flies both of you round-trip to the big game

in Miami, pays your hotel, your meals. Then takes you to the biggest football event of them all... the Super Bowl.

## GRAND PRIZE: SUPER BOWL PARTY FOR TEN...

Everyone who enters the Valvoline Weekly Football Pool Sweepstakes is eligible for the Grand Prize drawing, regardless of the accuracy of selections.

Just imagine... a Super Bowl weekend party for ten people. Valvoline flies all of you round-trip to Miami, pays your hotel, your meals. Then takes the whole

party of ten to the big Super Bowl game. Enter the Valvoline Weekly Football Pool Sweepstakes. You'll get a kick out of playing it.

Entry booklets and complete details are available at all participating outlets. Sweepstakes closes December 14, 1978.

**Valvoline** is Valvoline Oil Company, Ashland, Ky. Division of Ashland Oil, Inc. NO PURCHASE NECESSARY. Valvoline Weekly Football Pool Sweepstakes open to residents of the United States and Canada. Void in the states of Missouri, New Mexico, Utah, Howard County, Maryland and wherever prohibited by law. All laws and regulations apply. Ohio residents only may send a self-addressed stamped #10 envelope for entry booklet to: Valvoline Sweepstakes, 29th and Mill Street, P.O. Box 391, Ashland, KY 41101. This sweepstakes is not associated with nor sanctioned by the National Football League.

# THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

## Remote boost starter

If you want the safest possible way to boost-start your car, or if you're the perpetual good Samaritan, the Jumpak remote boost-starting box is a perfect product. It looks like a box with battery posts, and you connect jumper cables just as you would to a



Battery posts mount at remote location.

battery. But you can install it in a remote location, such as a trunk compartment, so you're far away from the car battery, where the spark from a jumper cable could cause a battery to explode. This box (mounted in the trunk) also eliminates nose-to-nose alignment of the cars for boosting.

The box comes with a long battery cable and crimp-on connec-



Jump starting is easy with posts in trunk.

tors for wiring one post to the starter solenoid. Mounting screws serve as ground for the other post. List \$20, Jumpak Products, Inc., 1090 Armando St., Anaheim, Calif. 92806.—B.H.

## Universal tachometer

In PM's reports on the Rabbit and Olds diesels, we said that because

the engine has no electrical ignition system, there's no simple way to get an rpm reading. Now there is: a tachometer for any engine—diesel, conventional gasoline and even a lawnmower or other small gas engine which has electrical ignition but no distributor. It will also let you set ignition timing on GM and Chrysler products without looking at the timing marks.

The tach features an electromagnetic probe. If you've looked at a late-model car, you may have noticed a little holder built into the fixed timing indicator for such a probe. With it, you read ignition timing on a remote meter, so you needn't struggle to read the marks on an accessory-loaded car. The universal tach uses the probe holder for rpm readings as well.



Electromagnetic probe is used with tach.

If you have an Olds diesel, therefore, you can use the probe holder (it's there because the block is also used for the gasoline engine) for rpm readings. The Rabbit diesel has a probe hole (at the flywheel bellhousing). While it's not the same size, you can tape it and brace it in the hole.

On diesels with no probe holder, you will have to make a holder for the probe, and file a notch on the crank pulley to take rpm readings.

The tach also has an inductive pickup that clamps onto the spark-plug wires. The clamp is included for two reasons:

■ If you have a gasoline engine on which a conventional tach is difficult to connect (no distributor), you can get an rpm reading from

the inductive pickup, which senses sparkplug firings.

■ If you have a GM or Chrysler product with a probe holder, you can read ignition timing without looking at the marks.

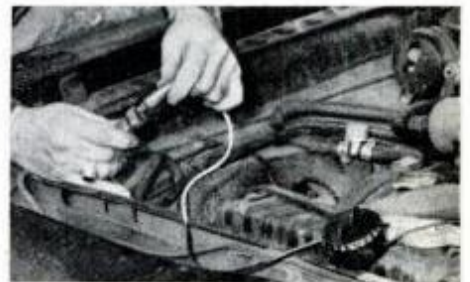
Ford products also have a probe holder almost directly opposite the fixed timing indicator. It can't be used with the ignition timing scale on the universal tachometer, which reads only to 600.

We took rpm readings with the probe on a Chevette, with the inductive pickup, and with our shop tach. All were within 50 rpm—as good as you can expect. We also did a comparison timing check, and the tester was just about on the button. If you use the probe on a Chrysler product, wrap it with tape, because the holder is slightly larger than GM's. The tester is \$150 list, but is expected to sell under \$120. Kai-Equip. Co., 411 Washington St., Otsego, Mich. 49078.—B.H.

## Adjustable-length test lead

If you never have the right length test lead (jumper wire), here's a five-foot test lead that retracts into a spool. The five-foot length is the maximum you normally need, and by retracting what you don't want into the spool, you don't have wire dangling in dangerous places.

The wire is 16-gauge, normal thickness for electrical trouble-



Test lead retracts into the spool.

shooting. One of the features I liked best is that there is no spring in the spool, so you can pull the wire ends out to the length you want, and they stay. When you want to retract the wires, you turn a couple of ears on the spool. Priced at \$6.50, from Thexton Manufacturing Co., 7685 Parklawn Ave., Box 35008, Minneapolis, Minn. 55435.—B.H.

# CAR CLINIC

## SOLUTIONS FOR MECHANICAL HEADACHES BY MORT SCHULTZ



### With pleasure

*While tuning up my Chevrolet, I noticed that a porcelain chip was broken off one of the sparkplugs. As far as I know, it's bouncing around in the combustion chamber. I turned the engine over a few cycles, hoping it would be blown out through the sparkplug port, but no luck. Can you tell me if I've got trouble?—Edward J. Pleasure, North Syracuse, N.Y.*

You don't know for sure if the porcelain chip fell into the cylinder. If it did and piston damage hasn't occurred by now, the chip has probably been ejected out the exhaust, or has fractured into fine particles and disintegrated.

### According to Meisner

*Have I got a good one for you, Mort. It concerns Honda Accords equipped with airconditioners. My experience has been that sudden battery failure can be caused by washing the car.*

*After a few visits to my local automatic carwash, my battery had sudden heart failure. An investigation revealed that water had entered the cooling fan relay (part No. 61400). This relay operates the radiator cooling fan motor when the airconditioning is on. It is mounted on the right-side inner fender in an inverted position (that is, with the base up).*

*The relay is not sealed, so that water entering the case rusts the relay return spring, which eventually breaks. When this happens, the relay contacts, which the spring keeps open except when the cooling fan motor is working, close and stay closed. This energizes the cooling fan motor and drains the battery when the ignition is off.*

*The solution is to replace the relay and seal its openings with a silicone sealer.—Charles Meisner, New Berlin, Wis.*

Hey, hey, Accord owners—this one is a top-drawer tip. Thanks, Charles.

### Two for one

*I'm stumped. My 1970 Buick Wildcat's 455-cu.-in. engine started pushing oil into the carburetor air-cleaner housing at 140,000 miles, at 160,000 miles I rebuilt the powerplant, which included replacing valve guides. The engine is still doing what I thought the overhaul would keep it from doing—blowing oil into the air cleaner. How about a hint?—Steve Sabat, Levittown, N.Y.*

How about two? The first—have you checked the PCV system, especially the PCV valve? A blocked PCV valve can cause strong back pressure forcing oil into the air cleaner through the valve-cover-to-air cleaner hose.

The second—in rebuilding the engine, did you re-ring the pistons? If not, blowby could be pushing oil past worn rings into the valve covers and onto the air cleaner through the closed PCV system.

### Searching for roots

*My problem concerns a 1978 AMC Concord D/L. The gas gauge needle quivers over the dial. I was told*

*that there are no baffles in the fuel tank to keep gas from sloshing. They say that it's this surging of gas that's causing the problem. Is this bunk?—H. Dilettuso, Glenshaw, Pa.*

Is what bunk—that there are no baffles in the fuel tank? No—that's not bunk. But the story that lack of baffles is causing the gauge to have the heebie-jeebies—well, that's something else again.

AMC had a problem early in the '78 production run with sensitive fuel gauges. Since then, the cause (using a lubricant of insufficient viscosity) has been corrected.

What can you do to desensitize your car's gauge? Buy a new one, but when you get the price, you may settle for a jumpy needle.

### Confusin' fusin'

*Why is it that my car keeps knocking out the fuse protecting the airconditioner blower motor circuit? It's a 1978 Ford Fairmont. I keep replacing the fuse (15-amp.), but soon lose it. Is there a deeply rooted electrical problem here?—Tony Kemper, Ft. Worth, Tex.*

Probably not. During early production, Ford put 15-amp. fuses in airconditioner blower motor circuits of '78 Fairmonts and Zephyrs. You need a 35-amp. fuse.

### The Jimmy drag

*Ever since I purchased my 1976 four-wheel-drive ½-ton Suburban, I've had trouble with the right front tire wearing unevenly. The vehicle has been driven 12,000 miles and is equipped with manually operated lockout hubs and manual transmission. The truck*

*(Please turn to page 54)*



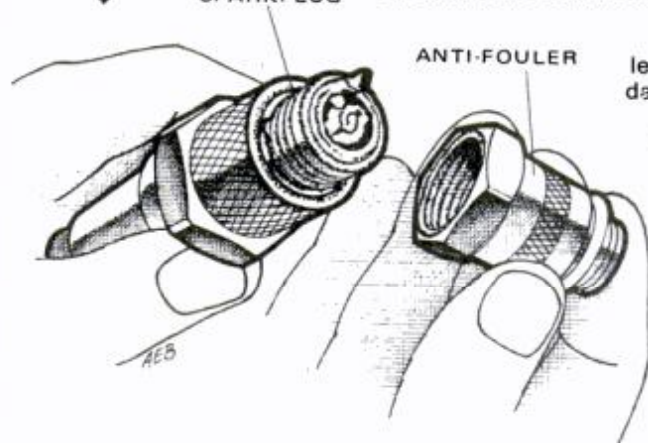
PM CAR CARE

### Antifoulers aren't for foolin'

Champion Spark Plug Co. has issued a warning about antifoulers that supposedly help stop sparkplug fouling. The devices are sold in auto supply stores and are screwed onto plugs. The antifouler and plug are installed together in the engine. Tests run by Champion

SPARKPLUG

ANTI-FOULER



show that the combination of antifoulers and high engine temperature can cause preignition, which leads to subsequent engine damage. The temperature of sparkplug insulator tips becomes extremely high, causing plug damage. The illustration shows a sparkplug and anti-fouler team that was taken from a test vehicle. Note the severe preignition damage sustained by the sparkplug.

# '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.



**Built  
Ford  
Tough**

**FORD**  
FORD DIVISION



## CAR CLINIC

(Continued from page 52)

has never been operated in four-wheel drive. The only time the hubs have been in "Lock" position has been during the recommended break-in period and also during the once-a-month recommended drive period thereafter.

My dealer says the condition is caused by the four-wheel drive, and frequent tire rotation is the only solution. But I've rotated tires as often as he suggests. I presently have a new eight-ply Firestone Snowbiter on this wheel, and it's showing uneven wear in less than 1,000 miles.

Can you offer a solution to this annoying, expensive problem?—*F.L. Bingham, Quaker Hill, Conn.*

I don't follow your dealer's reasoning. Why will a truck with four-wheel drive wear one particular tire on one side unless there's a defect or alignment problem?

My thinking runs to an alignment problem. The toe-in should be set exactly at 0 and camber should be tested by the service manual method to manual specification. Also have the vehicle's turning radius checked.

In cases like this, there is also the possibility of a bent steering arm.

### Oh Solex Mia

I have a 1970 Opel Kadette with 1.9-liter engine and one-barrel Solex carburetor. I had a new carburetor installed at 27,000 miles and had the carburetor overhauled again at 35,000 miles, but I can't

get rid of the problem. The engine starts and runs well when cold, but starting is hard when the engine is warm. Is there a cure?—*Dr. Mervin A. Mathias, San Carlos, Calif.*

Sure. This model had an inherent hot-hard start problem which was recognized in 1970-71. The trouble is caused by high fuel pump line pressure when the en-

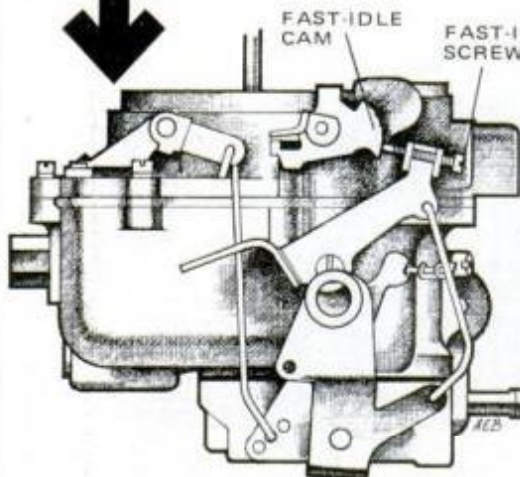


### FAST-inating

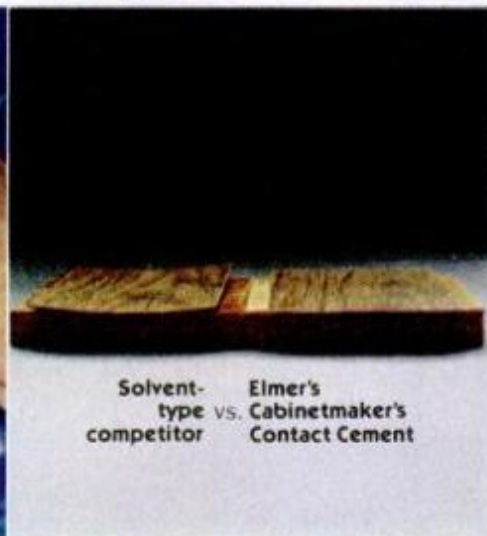
In case you don't know what we're pointing to (see the

illustration at left), it's the fast-idle cam assembly. Its purposes are to hold the throttle valve open so cold engine starting is efficient

and to keep an engine running fast enough so stalling during warm-up is prevented. As soon as the engine is warmer and running smoothly, a tap on accelerator pedal throws the fast-idle screw off cam, dropping the fast-idle speed and reducing lurching when the transmission is engaged. The fast-idle cam assembly does all this when it works right. So adjust it according to manufacturer's service manual the next time you do a tune-up—and certainly before cold weather.



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



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.

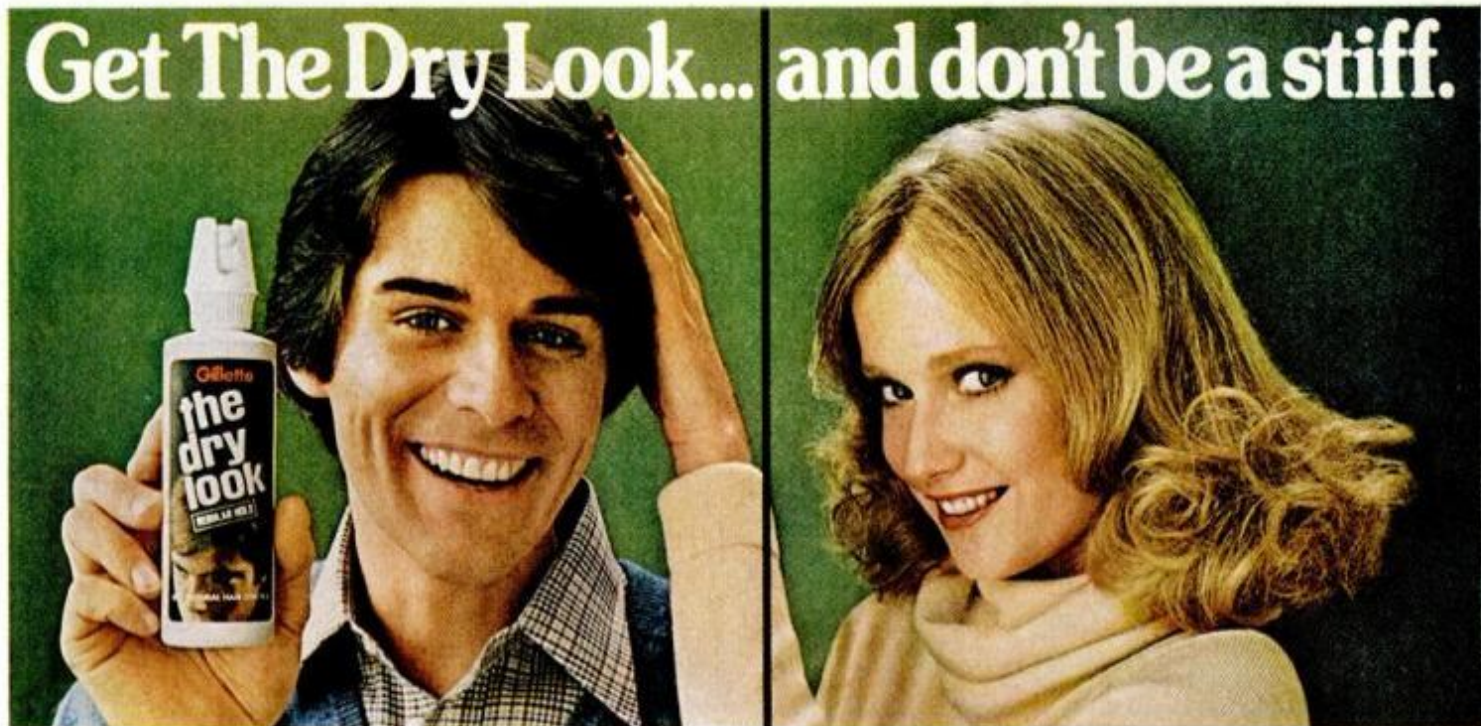
In an accelerated aging test, 220°F. of test-oven heat for four days actually warped the laminate on the left and made the conventional contact cement let go. But Elmer's Cabinetmaker's Contact Cement held.

Elmer's. When results count.





# Get The Dry Look... and don't be a stiff.



## The Dry Look pump leaves hair feeling as soft and natural as it looks.

The Dry Look gives you more than a great look. It leaves your hair feeling soft and natural, too—not stiff. The Dry Look in pump spray or aerosol—with a formula that's right for your hair. Get The Dry Look... and don't be a stiff!

© The Gillette Company, 1978



gine is hot. To relieve the condition, remove the fuel pump, take off the cover and take out the strainer. Drill a 1/64-inch relief hole in the body of the pump at the groove nearest the outlet pipe. Clean particles from the pump, install the strainer after cleaning, then reinstall the cover and pump.

### Old ways die hard

*Recently, after purchasing a Sears Die Hard battery, I noticed a bulge in the case. The Sears people insist it's normal and showed me other batteries in the store which also have bulges. I always thought a bulge indicated a defect in the case, but I'll submit to Sears' explanation if you tell me to.—Frederick K. Pollock, Fort Huachuca, Ariz.*

I know I'll hear from some of you for what I'm about to say, but I've got support from several authorities in the battery business. The Sears people are right, Mr. Pollock. A bulge in a battery case does not indicate a defective battery. A defective battery is one that has a cracked case and also, of course, one that happens to be electrically weak.

I, too, was brought up to believe

### SERVICE AND SAFETY TIPS

■ "It has been many years since my days as a state trooper, but not then or not since have I ever seen mentioned in magazines or newspapers one of the greatest killers of them all. This killer is the partially rolled-down window of a car. It is a guillotine. A broadside collision from another car, going even at a slow speed, can decapitate or split a skull. You can help save a lot of fine people by telling your readers to keep windows full up or full down—no in between."—Babe Keber, Lake Worth, Fla.

■ Dodge warns that incorrect lifting methods are damaging prop shafts and

undercarriages of compact trucks. Don't let anyone use a single-frame contact hoist. It could bend the prop shaft. Never try to jack one side of the vehicle by placing a mechanical axle or floor jack midway between front and rear wheels. You'll permanently damage the body.

■ Ford says that a warmed-up 1978 Fairmont or Zephyr engine that hesitates on acceleration can be cured by installing an accelerator pump piston cap (part No. D8ZZ-9635A). Details are in service bulletin 152. The same fix holds true for other models with the 302-cu. in. engine and the 351W engine.

that a bulge denotes a weakness in the battery case. There is a fine line of distinction between a bulge and a bubble or balloon. A bubble or balloon, which is a distinct raised area of small size, like a bubble-gum bubble, indicates a weakness in the case. Your battery doesn't seem to have this.

For those of you who are going to take exception with me on this, here's another antiquated battery tale to chomp on. A battery left on a concrete floor will not—repeat, not—go dead. Not unless it's an old-time battery made of a rubber

composition. Old-timers placed on unsealed concrete floors would have charge drawn from them by moisture emanating from the floor. That's why we used to store batteries on a plank of wood or off the floor. Modern battery cases are plastic. Moisture won't affect them. Now, how about that?

### 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.

Introducing Model 37 Ultrafeatherlight™  
the world's lightest, fastest 20-gauge pump.

## Now...one pound lighter than Featherlight.

From the new Ultrafeatherlight to the new 12-gauge 3" magnum you get all the quality features that have made the Ithaca Model 37 an American tradition.

All Model 37 Featherlights feature bottom ejection.

The Ithaca Model 37 shucks hot empties straight down —without distracting right or left handed gunners. Bottom ejection puts empties conveniently at your feet for easy clean up, and helps keep snow, rain, dirt and debris from entering your Featherlight's action. Our standard Model 37 is lighter than competition due to an action designed for 2¾" ammunition. And its smooth pumping action and exclusive Raybar fluorescent sight are just some of the many quality features that have sold nearly 2 million Ithaca 37's over the past 41 years.

**The New Ultrafeatherlight™ is the Ultimate All Day Carrying Gun For Upland Game.**

We've added a new version of our famous 20-gauge Model 37 pump to make it the ultimate all-day carrying gun for quail, woodcock, grouse, dove and other upland game. At 5 lbs\*, the new Ultrafeatherlight with perfect balance and a shorter 25" barrel gets on game lightening fast, and is light enough for women and young shooters. It also has special stock dimensions for softer recoil sensation. And the high gloss American Walnut stock, streamlined forearm, gold trigger, plus a Sid Bell designed grip cap make the new Ultrafeatherlight a beauty to behold. **Also available in Deerslayer.\***

*The NEW Ultrafeatherlight is possibly  
the world's fastest handling gun.*

**More range to you: the new Model 37,  
12-gauge— 3" Magnum.**

Longer range. More shot. More effectiveness. For those high flying ducks and geese. This new Model 37 is specifically designed with an action to give you 5 devastating shots of 3" Magnum ammunition. It weighs 7½ lbs. and has all the quality and reliability that have made Ithaca famous.



\*Actual weight may vary slightly due to wood density.

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Send 50¢ handling charge  
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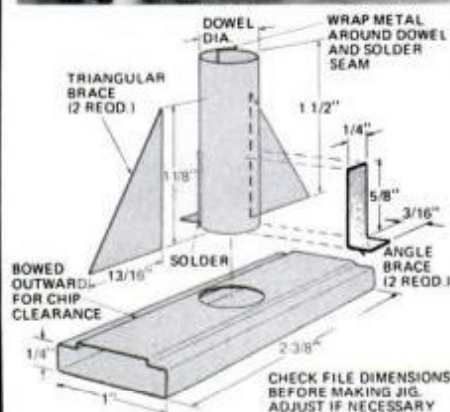
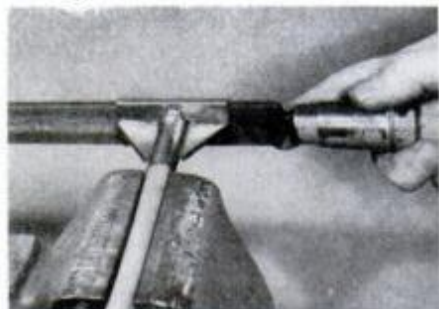
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Steel shot warranty... on Ithaca guns  
Roto-Forged® barrels is the same as with lead shot.

## HINTS FROM READERS

### File guide smooths dowel ends



With tin and solder, you can improvise an effective tool for smoothing or filing wooden dowels. Shape a guide as shown to fit around a file. Secure guide perpendicular to a tube holding the dowel. To make the tube, wrap tin-can material around the dowel, solder overlap. Solder triangular and angle braces as shown. Bow the file guide slightly for chip clearance and cover the file back with adhesive so it won't wear out the guide. To use the jig, clamp dowel in a vise, attach the guide, and insert file (which should move snugly). If greater accuracy is desirable, machine the parts from metal.—*Walter E. Burton*

### Heat unsticks it



Cellophane tape that's been on paper or cardboard for a while will peel off easily without tearing the surface if you run a pressing iron set for rayon over it a few times.—*H. Miller*

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# SCIENCE WORLDWIDE

## Only 13 months to go

If Donald A. Henderson is right, Oct. 26 of next year will be a momentous day in the history of science. On that day it will have been two years since the last reported case of smallpox, and Henderson will feel confident enough to say that the disease has been eliminated—a scientific first.

Henderson, dean of the School of Hygiene and Public Health of Johns Hopkins University and a prime mover in the battle against smallpox, says the two-year figure is three times longer than the longest time the disease has gone undetected in any country and is thus "very conservative." He believes there are no unreported cases, partly because of excellent worldwide cooperation and partly because there are "substantial rewards" offered for reporting verifiable cases (as a result, a lot of nonsmallpox is reported).

The smallpox virus species will still exist, frozen at minus 20°C., in four laboratories around the world, for reference if needed.

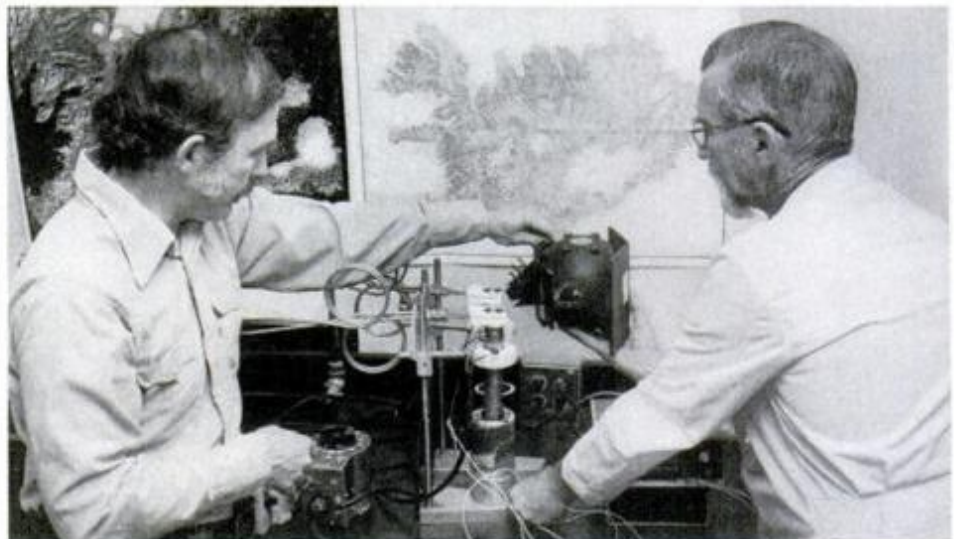
If the two years pass with no reported cases, all smallpox vaccination programs will end, and it will no longer be necessary to be immunized to travel anywhere in the world. What if cases are reported? "We'll just have to track the virus down, tighten our surveillance program, and try again," Henderson says. "But I don't think it will happen."

## Bringing Mars down to Earth

If you know what you're looking for, you can figure out the best way to find it, right? That's the principle behind an environmental chamber (see photo) that simulates the surface of Mars.

Designed by David B. Wenner of the geology department at the University of Georgia, the silver-dollar-size chamber provides a carbon dioxide atmosphere of 1 to 10 millibars pressure at about minus 80°C. Mineral samples placed in the chamber can be analyzed for light reflectance spectra to see if they match those of Mars obtained by telescope.

Of particular interest to researchers is palagonite, a volcanic rock found in Iceland and Antarctica that looks similar to the rust-red soil of Mars. If palagonite seems to exist on Mars, instru-



University of Georgia scientists adjust Mars simulator. Note map of Iceland.

ments on future probes can be designed to seek confirmation. Such confirmation would shed new light on Martian geology, especially the possible existence of a layer of permafrost like Earth's.

## The dating game

A method for dating objects as old as 30 million years has been developed at the Lawrence Berkeley Laboratory in California. The previous limit with conventional carbon-14 dating has been about 40,000 years.

In both the new and old methods, a small bit of the object to be dated is burned to form carbon dioxide gas. With the old method, the gas is introduced into a Geiger counter, which counts the decaying C-14 atoms. With the new method, known as direct counting, the gas becomes ionized when placed in a cyclotron and its C-14 atoms can be counted.

Much older objects can be dated this way, because billions of atoms are being counted, not just the one or two per minute that decay in older samples. Also, a much smaller sample need be burned. Where 1 to 10 grams were needed, only 1 to 10 milligrams are required—so that objects too precious to be destroyed can now be dated.

The new method is not restricted to C-14. Other radioactive isotopes can be used to date different types of objects. Beryllium-10, with a half-life of 1.5 million years, shows promise for use in dating rocks from 1 million to 30 million years old.

Accuracy of  $\pm 1000$  years on a

40,000-year-old sample has been achieved with the new method so far (C-14 accuracy is about  $\pm 100$  to 200 years), and scientists hope to tighten it to  $\pm 200$  soon. According to Richard Muller, inventor of direct counting, a few years of development are needed. Then, he says, he hopes that "beryllium-10 will become the carbon 14 of sedimentary rock. Direct counting will not supplant C-14 but rather supplement it for objects that cannot now be dated."

## If you're a real spacenik . . .

. . . you can have your own experiment placed on a Space Shuttle flight for as little as \$3000. A 5-cu.-ft. space is \$10,000, two-and-a-half is \$5000, and one-and-a-half is \$3000. Weight limits are 200, 100 and 60 pounds, respectively.

Dubbed Getaway Specials, the spaces are open to anyone. "We've had everyone from Boy Scout troops to international government agencies apply for them," says Ernest Ott of the Goddard Space Flight Center in Greenbelt, Md., and customer liaison officer for the project. As of mid-June, about 250 spaces had been sold to about 130 different groups. Materials processing (e.g., metals refining) and biology (e.g., zero-gravity effects on insect reproduction) are the two most popular categories.

After a \$500 down payment, if your experiment is accepted (it need not be original), you pay the rest in two other installments.

The shuttle is scheduled to make its first operational flight in mid-1980.—Tom Sahagian



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# DETROIT LISTENING POST

## '79 car news

When the all-new, front-drive Cadillac Eldorado, Buick Riviera and Olds Toronado debut next month, the Eldorado will be slightly longer than the other two in both wheelbase (115.8 vs. inches 114) and overall length, and it may also get the optional 350-cu.-in. Olds-built diesel that was offered in the Seville earlier this year. Apparently, Cadillac feels its customers still equate size with value and will be willing to pay a bunch more for a few extra inches of status.

Pontiac's immensely popular Firebird will get a front and rear facelift for '79. In front, there is no conventional grille opening at all, just two large air intake slots below the bumper line. Around back, the '79 model will be distinguished by full-width taillamp lenses that appear totally black until the bulbs are lit and red light shows through from underneath. Very tricky.



1979 Firebirds get "blackout" taillights as part of their '79-model facelift.

Chrysler's '79 three-door sporty hatchbacks, sleek little numbers with very Italian-looking fastback rooflines and Chevy Monza-like soft-nosed front ends, taking a cue from Chevy's popular Camaro Z-28 performance model, will be called Horizon TC3 and Omni 2+2. An Omni appearance package will be called "024." Chrysler's all-new '79 big cars, rather ordinary-looking four-doors (in profile) with impressive standup grilles and Buick-like sweptback headlamps, will boast chrome-plated aluminum bumpers and optional stamped aluminum wheels—both industry firsts. Base models will use the 225-cu.-in. "slant six" as standard engine, and both 400 and 440 V8 will be dropped for passenger-car use.

Chrysler also will expand usage of its unique electron beam-welded

die-cast aluminum intake manifold, will have electrical system diagnostic connectors on all '79 cars, will replace Lean Burn with a more sophisticated electronic spark-control system on most engines, will have an electronic device to detect and eliminate detonation on certain 318 V8s and will introduce a unique intake manifold fuel-injection system (called EFM, for Electronic Fuel Metering) in some 360 V8-powered cars later in the year.

## Federal follies

General Motors has calculated that it spent some \$1.25 billion in 1977 just in meeting government regulations. That's about \$2100 per U.S. employee or \$200 per GM car and truck sold during the year, *not including* money spent to add the required equipment or to improve fuel economy. Total expenditures for 1974 through 1977 are more than \$4.5 billion, or over 1.1 billion per year.

But just in case you thought the feds were thinking of backing off a bit, listen to the new speedometer rules they want for '80-model cars, which will be introduced just one year from now. In addition to tamperproof speedometers (not a bad idea) and dual (miles and kilometers per hour) graduations, the National Highway Traffic Safety Administration (NHTSA) plans to require even spacing between all numerals (ruling out anything but circular dials) and that the 55-mph point shall be not only included but also prominently highlighted.

Presumably our guardians in Washington feel that we motorists are too stupid to read an unevenly-graduated dial and that spotlighting the 55-mph mark would help us comply with the federal speed limit, which is now widely ignored.

GM says the law would require redesign of no less than nine instrument panels in 1980 cars just to accommodate the circular dials—at a cost of more than \$9 million. And we all know whose pockets that extra money will come out of.

## New engines for '79-'82

Expected engine developments for the near future include a host of

new displacement sizes coming in the next few model years—most of them will be smaller—and a few all-new units.

GM is considering a V4 powerplant for both front-drive and rear-drive small cars by 1982, the primary advantage of the "V" configuration over an inline "four" being compactness and adaptability to different drivetrains. Other GM plans include a 267-cu.-in. V8 for certain '79 intermediates, a 229-cu.-in. version of the current 200 V6 and an all-new smaller 60° V6 for the '80 front-drive compacts, a diesel version of the 260-V8 to supplement Oldsmobile's successful 350-cu.-in. diesel and a larger, new-design diesel (primarily for trucks) in '81 or '82. Also look for Pontiac to turbocharge its 2.5-liter four-cylinder engine for the '80 compact.

Among other plans, Ford will have a 254-cu.-in. version of its current 305 V8 ready for '80 compact, intermediate and large cars; and Chrysler will replace the 1.7-liter VW-built engine currently used in its Omni and Horizon front-drive small cars with a new 2.2-liter Four of its own by the '81 model year—and may have a smaller-displacement version ready for 1982.

## The mini trucks battle intensifies

Reliable sources at Chevrolet report that the Japanese-built LUV mini-pickup will get a factory four-wheel-drive option along about November of this year, which should make it an instant favorite with the economy-minded off-road bunch and the California Custom crowd. Mazda hinted at a 4x4 mini-truck as long ago as 1974, but it looks like Chevy will get there first.

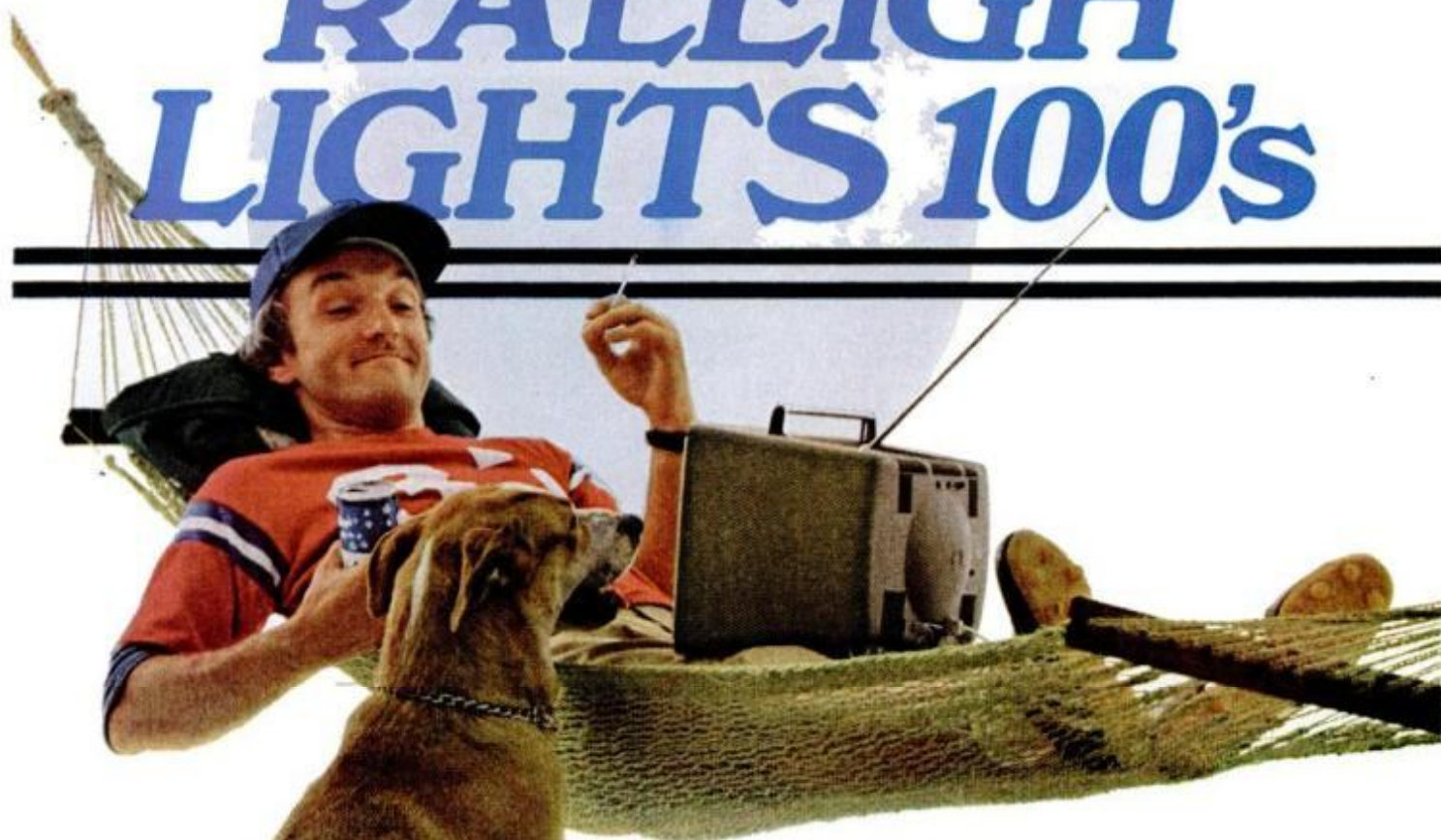
Also jumping, although belatedly, on the tiny-truck bandwagon is Chrysler Corp., which will begin importation of a Mitsubishi-built mini this fall. Mitsubishi, as you know, is a Japanese Chrysler partner and already does the excellent Dodge Colt and Challenger, also Plymouth Sapporo and Arrow. The vehicle will be a pickup version of the Arrow and will be sold by Chrysler-Plymouth dealers.

VW, too, is chomping the pro-

(Please turn to page 190)

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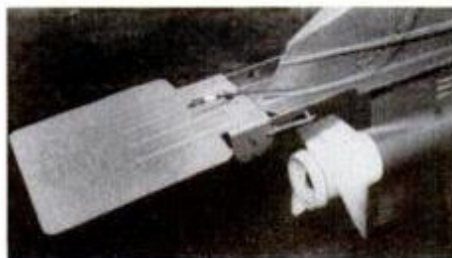


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### Moped sprouts another wheel

Afraid to straddle a moped? Then perhaps the Tri-Ped will appeal. It's powered by a 49-cc Minarelli moped engine but is built primarily of domestic components. The two-seater has a lockable trunk (with capacity for two grocery bags) and an easily detachable windshield and roof. The 140-pound vehicle is said to deliver about 85 mpg. Tri-Ped's maker asserts that it is legally classified as a moped. About \$890 from American Triped Corp., 115 Florida St., Farmingdale, N.Y. 11735.



### Boat-slower

The Happy Troller makes it possible to idle a large-displacement outboard and still move a boat slow enough for trolling. A spring-loaded plate snaps down for trolling and flips up for cruising. In cruising position, the plate also acts like a trim tab, the maker says. About \$80 with hardware. Idea Development Corp., Box 1155, Bellevue, Wash. 98009.

### Stop wristwatch

LCD's make the Wrist Microsplit readable in bright sun. The quartz electronic stopwatch measures splits, timeouts and running time to 1/100th of a second up to 59 minutes, 59.99 seconds. It's said to be water resistant and to have a two-year battery life. About \$130. Heuer, 960 South Springfield Ave., Springfield, N.J. 07081.





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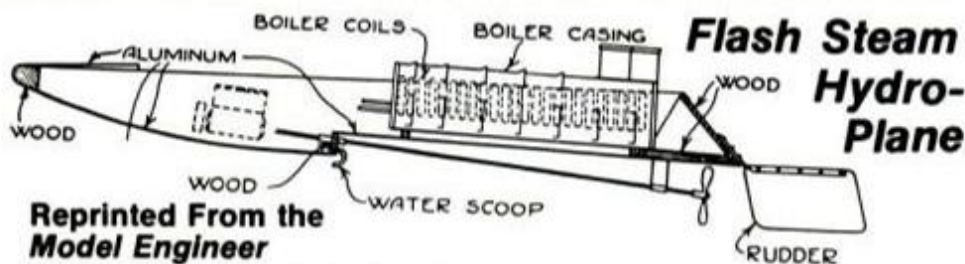
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## HINTS FROM READERS

### Prevent laundry tub overflow



Water draining rapidly from a washer to a slow-draining laundry tub may overflow, even though the lower tub partition is a safeguard. As an added precaution, drill a water outlet hole in the partition to let more water drain faster to the empty basin before it reaches the partition.

—Dr. D. Schlenoff

### Tape aids glue

When gluing wooden parts where clamps can't reach, use masking tape as a substitute clamp. The tape will hold the parts together tightly while glue dries, and it can be easily removed.—Henry Brodersen

### Simple seasoning



You can make a simple rack for seasoning pieces of wood for carving and sculpture. Apply several coats of shellac or wax to board ends to prevent checking and splitting. Wood dries evenly while air circulates completely around it. This example, made of 1/4-in. hardware cloth stapled to boards, is 6x9x9 in. The two top and two bottom shelves are spaced 1 in. apart for stability.

—Maurice Aase

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**William Wescott  
Willoughby, Ohio 44094**



**Husband and wife have a going spare time shop**

*"I'm a construction foreman, and my wife is a nurse's aide. Our Foley shop fits in nicely with our regular jobs, and we earn extra money. Our sons help out too, so ours is a real family business."*

*"I'm still too young to retire, but when I do I'll have a very good business built up. Foley equipment helps us to do good work and brings customers back with more jobs on a regular basis... we have a lot of repeat business the year around."*

**Victor Kosloski  
Sturgis, Michigan 49091**



**Glad he chose Foley for his saw shop**

*"I worked as a carpenter all my life, but when a back injury forced me to quit I decided to go into sharpening full time. I'm very proud of my shop and glad my choice was Foley equipment... it is superb. I made over \$48,000 last year, and this year it will go more than \$50,000."*

**Victor Johnson  
Lincoln, Nebraska 68507**

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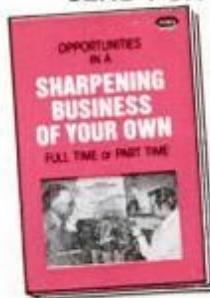
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# PM PLAN OF THE MONTH

## HOW TO TURN A LITTLE-USED PORCH INTO A MUCH-USED ROOM

**E**nclosing an existing porch is one good way of adding an extra room to your home. You can keep the wide-open, outdoor feeling that a porch has and at the same time make use of the sun's natural light by incorporating large glass areas into the room design. Since your porch already has a roof and floor, you're several steps along the way toward creating a permanent living space for very little money.

The porch enclosure shown is designed around PPG Industries' concept of turning a porch into a room by using glass walls. It utilizes four pairs of standard 6-ft. safety glass patio doors and solid wall sections. Widths of the three wall sections can be either enlarged or reduced to suit your existing porch.

The sliding glass door that opens to the deck is the entry to the room. The other three glass doors actually function as large slider windows. Decorative plant shelves serve the same purpose as an inside railing to prevent mistaking these doors for entries.

Other useful and attractive features of the plan include a 14-ft. octagonal deck and a free-standing fireplace. A beamed cathedral ceiling adds to the spacious feeling of the room. The deck is adjustable to suit available space. The fireplace is a focal point of the room. In temperate climates it can also serve as the sole source of heat for the room; in colder climates it can be a valuable extra heat source.

For plans of this porch enclosure see the directions below. These plans include specific construction details and information for building the addition, such as details for connecting the new walls to the existing one, details of header and sole plate construction and door details. **PM**

### HOW TO ORDER PLANS

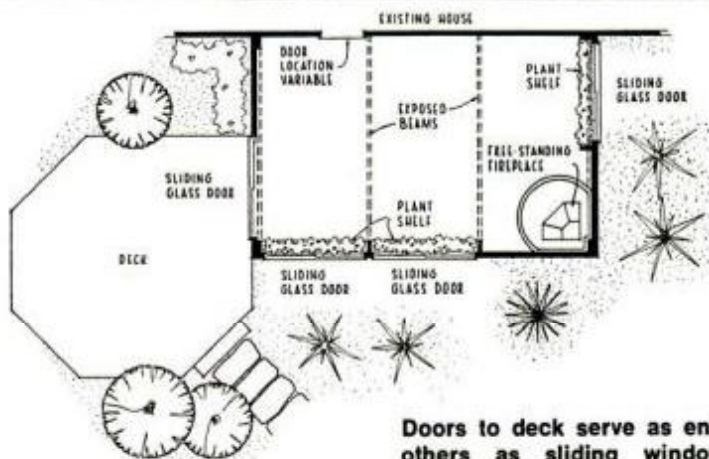
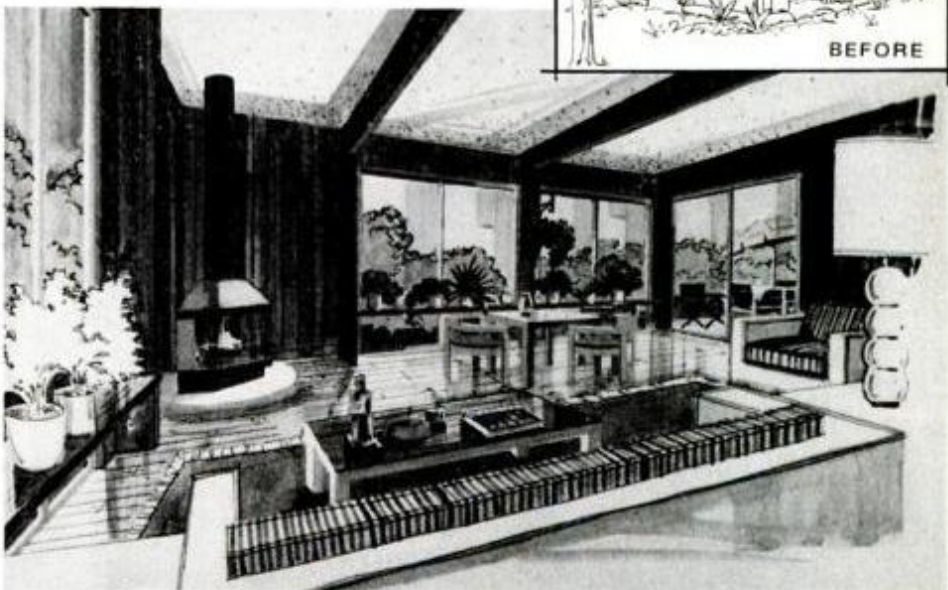
To order the two-sheet set of detailed drawings showing how to build the porch enclosure, send \$4.50 per set to York and Schenke, Architects, P.C., Dept. PM 978, 226 Seventh St., Garden City, N.Y. 11530. The plans will be sent to you via first-class mail.



Elegant porch room (above) started out as an open, existing porch (right). Careful planning and use of glass doors makes room a winner.



BEFORE



Doors to deck serve as entry, others as sliding windows.

# Easy-build rack keeps food processor parts handy



PM photos by the author

**S**ore food processor parts neatly and conveniently on hand in this accessory rack. It's quick, easy and inexpensive to make.

Since the rack shelf consists of two pieces glued together, you can make the odd-shaped cutouts with a saw rather than carving or routing them. Make sure you select perfectly flat wood to facilitate joining.

Cut the four pieces needed. Either use your processor parts as guides to outline the cutouts, or enlarge the patterns below and trace them. Then bore entry holes for the saw blade in the cutouts: six in the top piece and four in the bottom one. Position holes for the long slots at the cutout ends so that two parallel cuts from hole to hole will form the slots.

Use a jigsaw or coping saw to make the internal cuts, making the cutouts slightly larger than the accessories to assure an easy fit.



Use processor parts as templates for marking cutouts, or use patterns below.



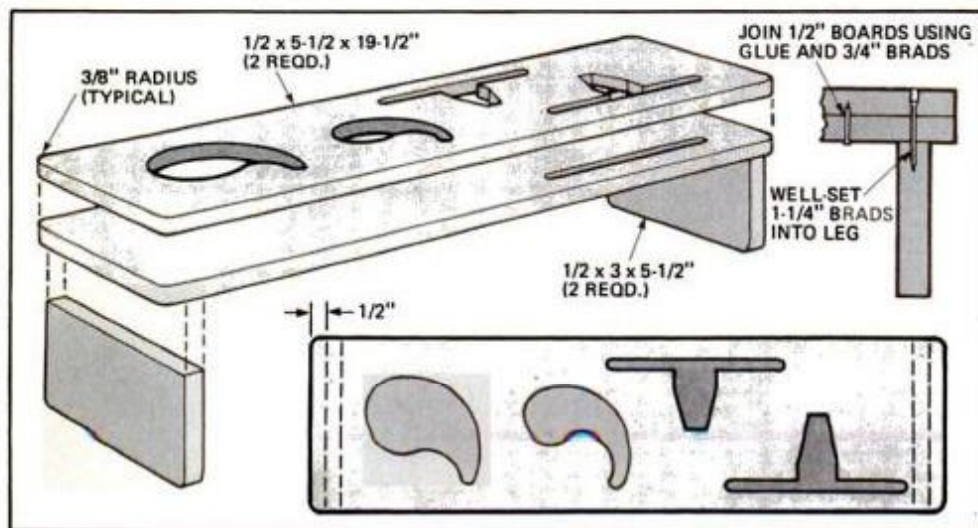
Bore saw-blade entry holes. One at each end makes it easier to cut narrow slots.



For precise cutouts, use set-tooth blade. For parts fit, remove line when cutting.



Use two nails to prealign shelf parts. Apply glue sparingly to mating surfaces, nail.



Use half-round and flat wood files, then sand to smooth any saw marks.

Glue shelf sections together and secure parts with finishing nails from below. To do this, drive two pilot nails partway to align sections. Separate and apply glue to both surfaces. Clamp shelf parts and fasten with nails. When the glue has dried, cut the shelf corners round, break the edges with a plane and sand smooth.

Attach the legs with glue and finishing nails. Set the heads below the surface and use plastic wood filler. Apply polyurethane varnish, following instructions on the label.—Rosario Capotosto



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Bone-chilling temperature. Blinding snow. Freezing rain. You can bet your insulated boots you'll have at least one of these to cope with when you're huddled on a deer stand. Especially if that big 10-pointer finally makes a mistake and heads your way.

That's when you need a center fire rifle that's completely dependable, fast handling and accurate. One that gives you extra aimed shots in split seconds. You need the world's best-selling center fire autoloader, the Model 742. Or the best-selling pump, the Model 760.

**WOODS-MASTER 742** Here's the brush-bred autoloader with the gas-operated action that reduces recoil sensation to a gentle push. Not a punch. You keep your head down, instinctively, so firing extra accurate shots comes naturally.

The "Woodsmaster" has a tough artillery-type bolt with multiple locking lugs to handle big-game calibers like 30-06 and 308. Three rings of solid steel surround the cartridge head; there are no extractor cuts to weaken this critical area.

The 742 is available in 6mm Rem., 280 Rem., 30-06, 308 Win., and 243 Win.; or as a carbine in 30-06 and 308 Win.

**GAME-MASTER 760** Here's the perfect whitetail pump-action rifle; it's as reliable as you are. Its smooth action lets you shoot as fast as you can pump and pull the trigger. The rifle stays in a natural

shooting position with the game always in sight for quick extra shots if needed. Your finger never leaves the trigger, never gets pinched by a lever.

The 760's strength comes from a receiver, like the 742's, machined from a solid block of steel. The 760 rifle is available in 6mm Rem., 270 Win., 30-06, 308 Win. and 243 Win. A carbine with 18½" barrel is chambered for the 30-06 and 308 Win.

Both the 742 and 760 feature removable clip magazines which make fast reloading a snap. Both feature receivers drilled and tapped for scopes. Both are 100% made and serviced in the U.S.A.

In the looks department, both these deer guns feature an American walnut stock and fore-end with handsome checkering. Available in standard ADL and custom-grade BDL versions, all protected by a tough Du Pont RK-W wood finish.

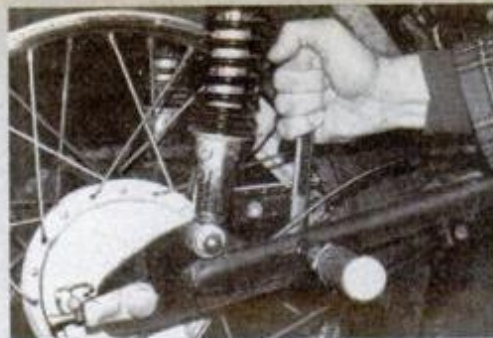
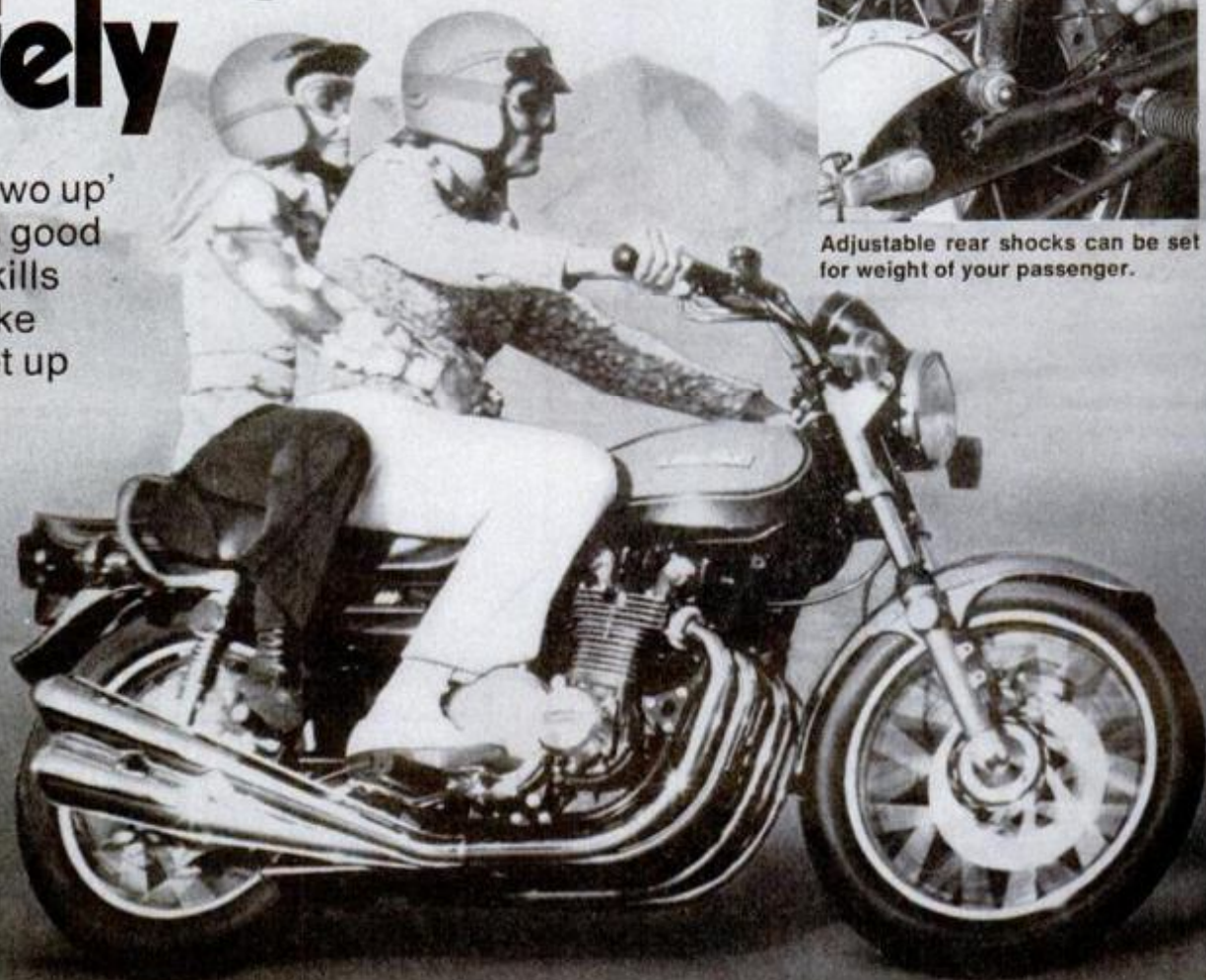
To get that smart swamp buck with the trophy rack, you need the perfect combination—rifle and ammunition. Remington cartridges with "Core-Lokt" bullets really plow through brush and deliver superior mushrooming for maximum stopping power. Learn more about our 10-point favorites in our free 40-page catalog. See your Remington dealer, or write us. Remington Arms Company, Inc., Bridgeport, Conn. 06602.

**Remington.** 

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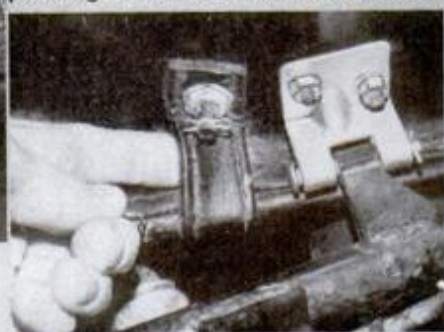
# How to carry a passenger safely

Riding 'two up' requires good riding skills and a bike that's set up right.



Passenger footrests on your motorcycle must be tight; check them frequently.

Seat strap should be checked for fraying and looseness, but best grip for passenger is around the rider's waist.



Adjustable rear shocks can be set for weight of your passenger.

by Bill Hampton

**R**emember your first ride as a passenger on a motorcycle? Fun, wasn't it? Or was it scary? If you were sitting behind some reckless throttle jockey, it undoubtedly was a hair-raising experience.

In fact, more than one potential motorcyclist has been turned off because of a frightening first ride. It seems that some cyclists feel they have to ride wildly to impress their passengers. It's hard to enjoy biking as a passenger if the guy up

front is popping wheelies, riding hands off and scraping mufflers in the turns.

Consider your passenger's viewpoint: Maneuvers or situations normal to you might be downright frightening to him. For example, the person in back has no way of knowing what you're planning to do, so he can't react as you can. Worse, he may—in false anticipation—react *against* you and cause you to lose control. Even if you're carrying a model passenger, the extra weight affects your bike's balance and control.

## The right bike

Is your bike equipped for hauling a passenger? It should be adequately powered. You can't expect a 100-cc machine to haul two people safely on a crowded highway. A 250 is minimum, and, depending on the size of you and your passenger, even a 250 might not have enough stuff. For serious two-up riding, consider at least a 400-cc bike.

Your two-wheeler should have a set of passenger footrests and either a seat strap or a grab rail. Rear-tire pressure is important, too. Check the owner's manual for rec-



ommended pressure when carrying someone. If necessary, set up the rear shocks (if adjustable) to firm setting to accommodate the extra weight. And make sure your passenger is wearing a good helmet along with suitable eye protection.

### How to sit and lean

Before you and your friend start chasing the horizon, brief him or her on the fine points of two-up riding. Your passenger should sit as near to you as possible. In this way, the center-of-gravity effect of your total weight will be near to the motorcycle's center of gravity. The bike, therefore, will be more controllable and responsive.

A passenger who sits too far rearward shifts the center of gravity effect too far back. The front end becomes light and tends to wander. Conversely, the passenger shouldn't sit too far forward and push you up on the gas tank.

If your passenger holds onto either the seat strap or the grab rail, he'll tend to sit farther away from you. The best way is to have him place his arms around your waist, with fingers interlocked. This way he or she won't be so inclined to *counterlean* in the turns. Emphasize importance of leaning *with you* in the turns. It's a natural reaction, though, for an inexperienced passenger to lean opposite the bank side. So be prepared for it.

Make sure your passenger is centered in the seat. In other words, there shouldn't be any leaning to one side. It's not only annoying, but it affects steering.


Tell your passenger to keep his feet on the footrests at all times. Even when you're stopped for a red light or a stop sign, you'll find it easier to manage the bike.

### Warn about bumps ahead


Another good idea is to give your passenger some warning of impending jolts or bumps in the road. In this way, your friend can brace or support himself against the footrests to absorb the jolt better and not lose balance. A passenger who is jolted unexpectedly may react by grabbing you or by shifting his weight sharply.

When riding long distances packing double, plan periodic stops. It's tiring to both rider and passenger to sit cramped for long periods of time. A tired passenger will shift around a lot more trying to get comfortable.

A little consideration will make motorcycling more enjoyable and safer for your passengers. They'll thank you for it. **PM**



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METRIC STEEL BELTED RADIAL



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Ordinary cigarettes just don't have what Camel Filters has.

Its blend of Turkish and Domestic tobaccos gives him what he smokes for.

Pleasure. Satisfaction.

A Camel Filters Man understands why the best times are often the simplest.

Do you?

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

Sustained flight on sunlight energy is no longer a far-fetched dream. It's being done—at a price.

# Solar-powered aircraft



A remotely-piloted, solar-powered aircraft, built under an Air Force contract, Astro Flight 7404 takes off with help of runners on wings and tail. It can climb at up to 400 f.p.m., to altitudes of over 17,000 feet. But solar cells alone (dark areas on wings, right) cost \$40,000.

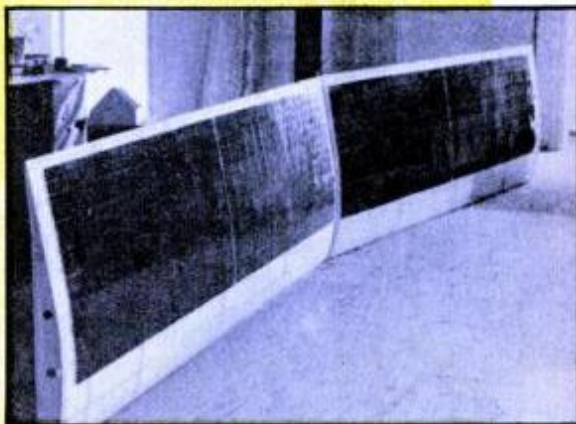
by Bill Allen

**M**anned flight made possible and sustained by nothing more than sunlight? It has the ring of a madman's obsession, of alchemy, a shell game . . . a free lunch. Yet it's none of these; as preparations for the first manned solar-powered flight move toward completion at several technology centers around the globe, this once mythical proposition is being taken quite seriously.

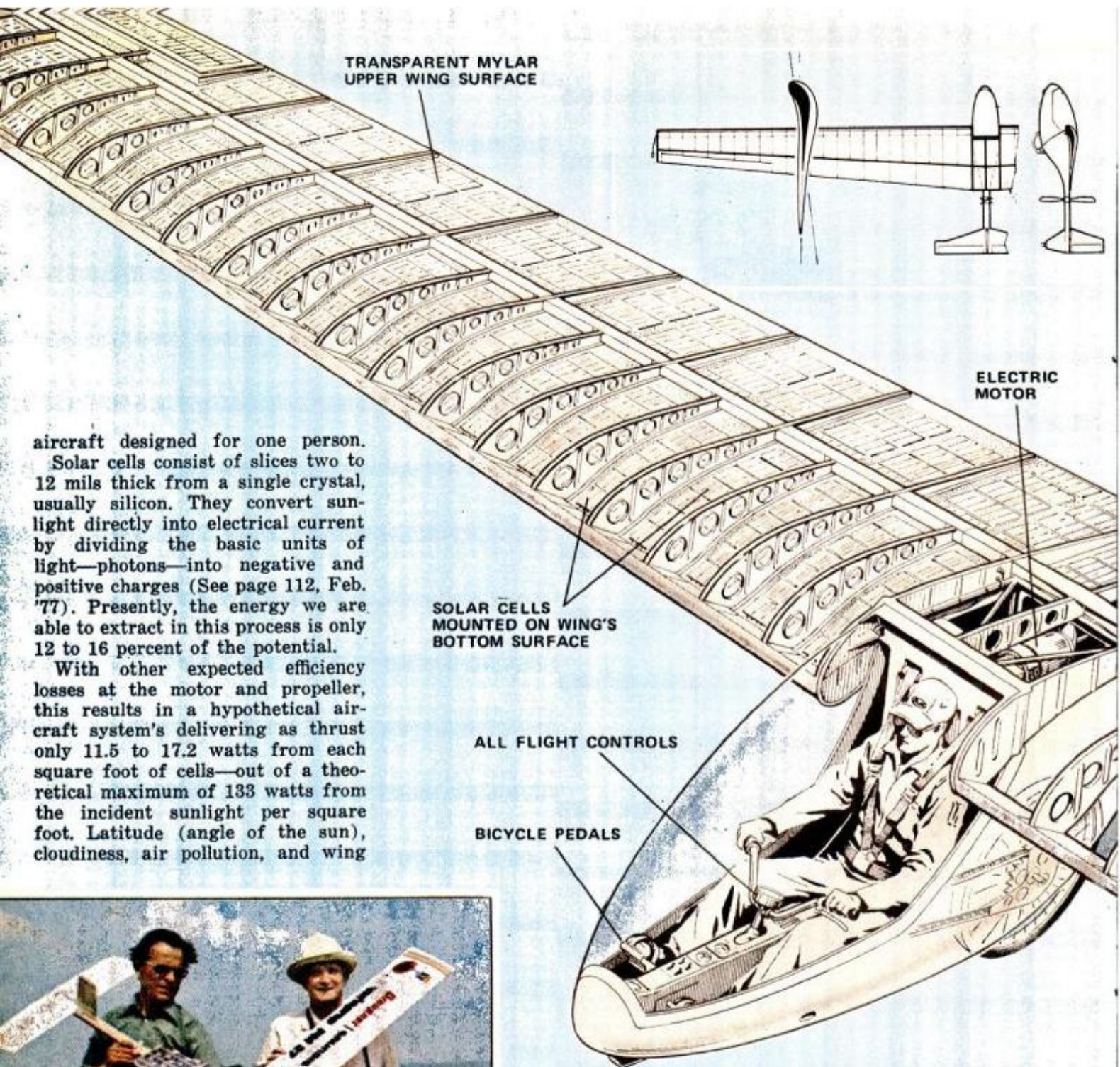
All energy—fossil fuels, nuclear, wind, solar—emanates directly or indirectly from the sun. But so far, only indirect solar power sources have normally been used to take aircraft aloft. Now

solar and ultralight aircraft technologies are melding to perfect a new flight format: direct solar-powered airplanes. The cost of cells which convert sunlight to electricity, still prohibitive but descending, is the primary barrier to this ultimate in ecologically sound aircraft.

With development of practical solar cells in the early 1950s came realization that an airplane's wings are potential ready-made platforms for thousands of solar cells which could power flight. Probably the first serious proposal came from the late Gus Raspet of Mississippi State University, and



his former student, Bruce Carmichael, in 1954. Twenty years later, it was updated by F.G. Irving and D. Morgan of London's Imperial College of Science and Technology, at an M.I.T. symposium. Their paper outlined how the idea had become practical technically, but at a projected price of around \$100,000 for solar cells alone on an



aircraft designed for one person.

Solar cells consist of slices two to 12 mils thick from a single crystal, usually silicon. They convert sunlight directly into electrical current by dividing the basic units of light—photons—into negative and positive charges (See page 112, Feb. '77). Presently, the energy we are able to extract in this process is only 12 to 16 percent of the potential.

With other expected efficiency losses at the motor and propeller, this results in a hypothetical aircraft system's delivering as thrust only 11.5 to 17.2 watts from each square foot of cells—out of a theoretical maximum of 133 watts from the incident sunlight per square foot. Latitude (angle of the sun), cloudiness, air pollution, and wing



Experimental Solaris model airplane built in West Germany awaits price drop in solar cells (detailed at right).



orientation further reduce power production.

Yet fairly sizable remotely-piloted vehicles (RPVs) have already been flown on solar power alone. At this moment, a solar, man-carrying airplane is being completed in England, with its first flight to take place possibly before year's end. Another project may be underway in Japan, designed—as in the English version—to incorporate some auxiliary manpower. PM will follow these developments closely.

On these pages is a design for a practical solar-powered airplane, drawn from parameters given by Irving and Morgan plus other sources. Its 76.5-foot wing plus tail carry about 375 square feet of solar cells. This array would cost about

Feasible manpower-augmented solar plane would have 76.5-ft. wing on a 19.5-ft. fuselage.

SOLAR CELLS ON TOP SURFACE OF HORIZONTAL STABILIZER, ELEVATORS

6" PROPELLER

HOLES REDUCE WEIGHT, ALLOW LIGHT TO PASS THROUGH



### SOLAR BALLOONS— RISING WITH THE SUN

Balloons can be solar-powered too, using direct heating of internal air to make them rise. In the early 1970s, two man-carrying versions were flown in the U.S. and England. Neither seemed practical for recreational use. But this year Raven Industries and Frederick Eshoo, an Iranian, revived the concept.

The Raven/Ishoo Sunstat is just a basket and fabric envelope. It uses no fuel except some propane for quick inflation, and for standby in case of overcast, low sun angle or emergency maneuvering.

The transparent, reinforced-plastic half of its envelope admits sunlight and heat is absorbed by the other half's black ripstop nylon, backed with silvery Mylar to reduce heat transfer. Two small electric fans rotate air bag in relation to sun for more or less solar heating. A top vent speeds cooling.

By hot-air-balloon standards, the 70-foot-high Sunstat is enormous—105,000 cubic feet in volume. But it's a warm-air balloon. Instead of propane-heated air with a 100-degree-plus internal/external temperature differential, the sun raises Sunstat's about 50°, so that more air volume must be heated for equal lift. Sunstat may sell at about \$10,000.—B.A.

\$139,000 and deliver 6.45 peak kilowatts as thrust through a motor of two to three horsepower. It would sustain level flight and give low climb rates (300 feet per minute (f.p.m.) or less) at airspeeds from 18 to 60 mph (optimum cruise would be about 24 mph). Take-offs could be assisted by precharged lightweight silver cell batteries and/or by the pilot pedaling hard enough to add half a horsepower to the propeller and 27-inch, bicycle-type ground wheel. These features also could prolong a projected solar-only flight time of four to eight hours. Sailplane-type performance would enable skilled pilots to utilize favorable air currents in

(Please turn to page 166)

# Startling new theories on LIGHT and COLOR

by Lorraine Dusky



## Some scientists now believe that the kind of light you are exposed to can affect your moods, your behavior and even your health.

**C**olor is such an everyday part of our lives it is hard to imagine that it can have any effect other than to please or irritate. But there lies the clue—all of us are aware that there are some colors we like and some we don't; some make us feel calm, while others are energizing. And if, as recent biochemical research indicates, for each psychological event there is a physiological reaction, the premise that color might actually influence our well-being sounds not so wild after all.

The use of color as therapy (see page 184) has been attempted in one form or another since the ancient Egyptians. The healers divined which color the patient was deficient in and put him in a room of that color. Gems of various hues were also employed, and could either be worn, held, or used to treat water: You soak the gem in the water, which "charges it" with the color of the gem, and then drink the water. Pythagoras experimented with color therapy, basing his methods on the notion that color could be "fed" through the eyes.

The idea behind the gems as talismans of health is that the various stones—which are minerals—vibrate at different frequencies and act as condensers of energy from the sun.

Now considering that light and color are frequency vibrations of a sort, the thinking that gems could alter the energy field around you is not so farfetched. Furthermore, some of the latest research in nutrition suggests that minerals are exceedingly important to health. The difference here is that proponents of gem therapy advanced the concept that it is not necessary to ingest the mineral; merely keeping it in contact with the skin was thought to be sufficient.

### Different nutritive effects

Color therapists today generally believe that when the body is in balance it filters out of white light the colors that it needs. When something's amiss, hues applied in a variety of ways—even wearing a light blue sweater on a day when you have a sore throat—are supposed to help. Green, for instance, is thought to build muscle and tissue, and likewise, they attest, eating green foods will also help. Considering that green vegetables are a rich source of vitamins and minerals,

needed to build strong tissues, the color therapists have a point there.

Although color therapy smacks of the occult, some serious researchers, most of whom would scoff at matters psychic, are coming up with seemingly amazing results.

If we consider light a source of energy, it is reasonable to assume that each kind of light—each color—might have a different nutritive effect. Generally, foods of a certain color tend to have the same vitamins: Reddish foods (such as meat and beets) frequently are high sources of B vitamins; yellow-green foods (lemons, greens) are rich in Vitamin C.

At this stage of knowledge our concept of color is a combination of two theories, and the reality is probably somewhere in between. Light seems to act like a wave, with a crest and a trough. When two beams of light hit each other crest to crest, their brightness increases, and when a crest of one wave touches a trough of another, the brightness is diminished.

Yet, light remains a mystery, even to the physicists, because sometimes it behaves like a particle and not like a wave system. We do know that no matter what form it assumes it travels at the speed of 186,000 miles per second. This is a fact that we accept without fully comprehending.

Sir Isaac Newton passed light through a prism and a single white beam was dispersed into red, orange, yellow, green, blue, indigo and violet. He attempted to relate these colors to the seven notes in an octave, and while critics derided that connection as mystical nonsense, we now know that sound, in fact, has an effect on our perception of color. Low-pitched sounds tend to make color appear to deepen; red moves toward blue, orange appears more red. The opposite is true of high-pitched tones, which make colors seem lighter.

Light affects us in more ways than simply allowing us to see. Anything other than the full spectrum of natural sunlight has been shown to produce abnormalities in plants and animals. Light, in addition to being necessary for vision, stimulates both the pituitary and pineal

glands and possibly other regions of the midbrain which control the production of hormones and have a great deal to do with how we feel.

It is not simply that portion of the spectrum which we can see that is important, but also the bands of long-wave ultra-violet that are present but not visible to the naked eye.

### Are we light-starved?

Several studies over the last few decades link ordinary fluorescent lights, which contain only a part of the spectrum of light waves, to a host of general ills far beyond tired and aching eyes—from hyperactivity to cavities. And there is some data suggesting that limited lighting may be related to some forms of cancer. At least a half dozen animal studies have come up with a similar conclusion: reduced-spectrum lighting influences the growth and incidence of some types of cancer.

Incandescent lights, while they lack the full spectrum of natural sunlight, do not appear to cause the same problems as limited fluorescence. Nevertheless, incandescent bulbs emit little or no ultraviolet and have a graduated continuum which is slanted toward large amounts of red and infrared.

John Ott, former chairman and executive director of the Environmental Health and Light Research Institute in Fort Lauderdale, developed full-spectrum fluorescents after nearly 40 years observing the effects of lights upon plant growth.

Ott created the full-spectrum by adding the proportionate amount of non-visible "black light" to the blend of phosphors currently used in a fluorescent tube.

Improved fluorescents are manufactured by several companies: General Electric Chroma 50, Duro-Test Optima, Philips Verd-A-Ray and Vita Lite. They cost a bit more than the limited-spectrum tubes, and the black light burns out in approximately a year with normal use, although the tube will still appear to be going strong, making it necessary to replace the fixture before you can "see" that it needs to be.

Garco Lighting of Chicago is manufacturing a system using regular tubes with a small black light tube that can be changed when necessary during the normal life of the larger tubes. Called Spectralite,

(Please turn to page 184)

# What to look for in the new video recorders

The right choice of features will help you get the most out of home TV recording.

by Andy Morgan

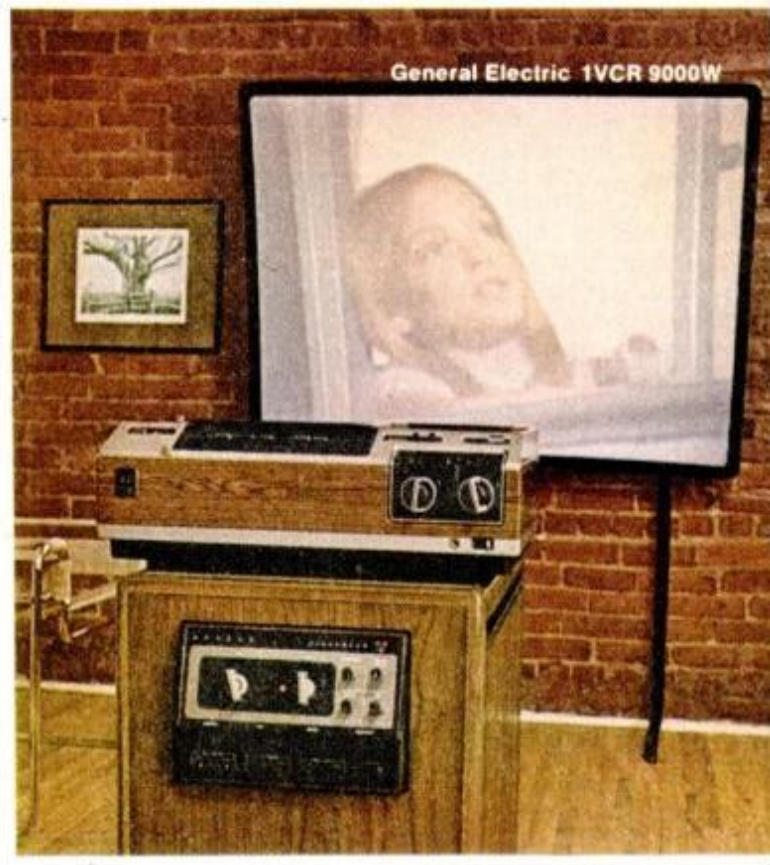
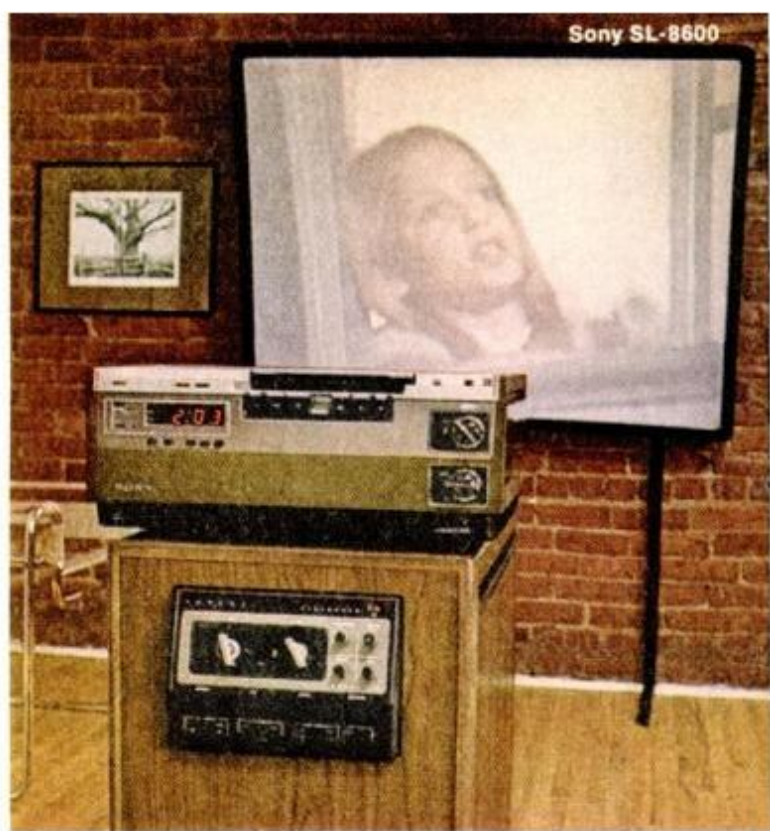
The home video cassette recorder (VCR) is the hot new status appliance—for \$1000 or so, you may still be able to be the first on your block to own one. Everyone knows they let you store programs on tape for later viewing. But it's harder to know precisely which machine will meet your particular needs in terms of such factors as picture quality, record-and-playback time and convenience of operation.

To find out just how good today's VCRs are, we chose a cross section of the available machines. The six you see here ably represent the general level of performance you can expect from a home video tape recorder. But this is far from a complete collection of VCRs—there already are dozens on the market.

In addition, newer models may already be available from each manufacturer. New machines are being introduced so often, it would be impossible to be completely up-to-date and still give each unit a thorough inspection. It's not as bad as it sounds, though. Most of the newer machines differ only in cosmetics and in additional features compared with the units we tested. The guts of the machines haven't changed much. So the performance you can expect from a VCR you see today is about the same as the performance of the machines we tested, even if it looks a little different or has a few extra conveniences.

The most important thing to remember when you shop for a VCR is that there are two major types of machines—Beta and VHS (Video Home System)—along with a couple of other versions that don't fit into either of these categories. The different types are *not compatible*—tapes made on one type of machine can't be played on another type. And formats that have few manufacturers behind them—those other than VHS and Beta—may not survive, so getting both prerecorded and blank tape could become a problem. Therefore, choosing the format family to join is an important buying decision.

In any case, the recording tape is housed in a plastic cartridge about the size of a soft-cover book and about



an inch thick. Inside the machine, the tape is drawn out of the cartridge and wrapped around a rotating drum that contains the record and playback heads. The tape is in contact with the drum for a little more than half the drum's circumference, so that the path the tape takes as it passes the heads is roughly the horseshoe shape of the Greek letter omega. That's why video recorders are said to use an "omega wrap."

The way the tape is drawn out of the cassette and wrapped around the heads differs for the different machine types. In the Beta system, one swinging arm draws the tape out at one point and wraps it around the drum. Recorders that belong to the VHS family use two parallel arms that pull the tape out at points on either



Zenith KR-9000W



JVC Vidstar HR-3300U



PM photos: Harry Hartman

RCA SelectaVision VBT200



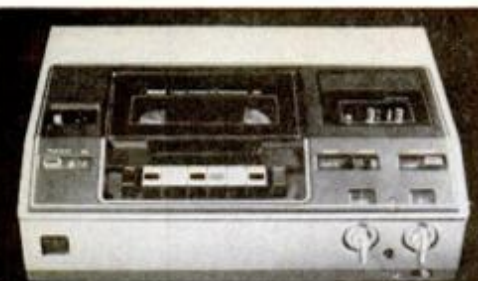
Panasonic Omnivision IV PV-1000



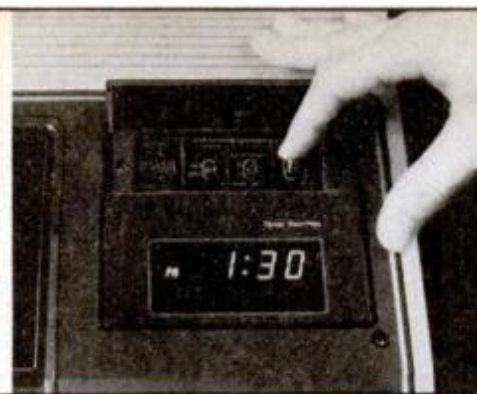
side of the drum, then swing together to wrap the tape tightly against the spinning drum. The VHS two-arm "M-loading" system is a little quicker, but the tape can't run at high speed once it's in playing position, so you have to wait for the tape to load and unload every time you switch from play or record to *Fast Forward* or *Rewind*, or vice versa. The second or two of delay gets to be a pain, especially if you're used to audio tape recorders and their immediate response.

Beta-format machines, on the other hand, wrap the tape as soon as the cassette is inserted into the machine, and keep it wrapped until you hit the *Eject* button. That creates a minor nuisance of its own. You can't get the tape out if you turn off the power before

Bright, clear pictures are possible with all of the half-dozen video cassette recorders (VCRs) we tested. To magnify any flaws that might appear in their reproduced pictures, we coupled them to the 5-foot diagonal Advent Videobeam projection television system, Model 710. In the top row (above) the Sony and Zenith VCRs are Beta-format machines; the JVC records two hours in the VHS format. Units in the bottom row are all four-hour VHS recorders.



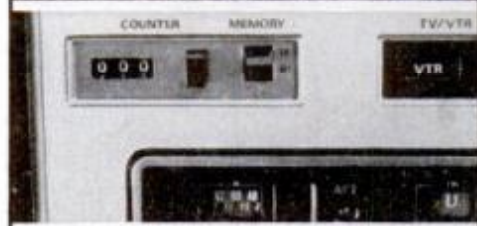
Time-setting controls on some of the VHS-format recorders, like RCA Select-Vision, are somewhat awkward to use.



Moisture can damage a recorder, so machines like GE Command Performance won't run when Dew light is on.



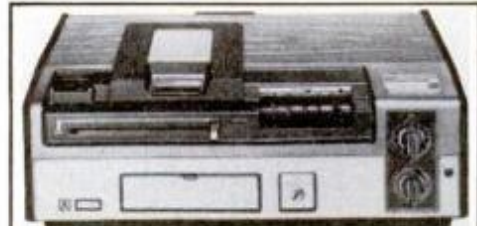
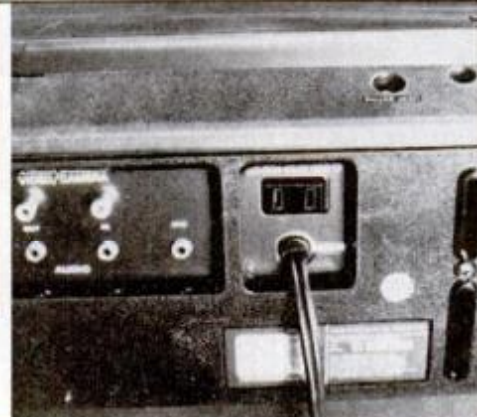
All controls are clearly marked, easy to use on front panel of JVC's Vidstar VHS recorder—ideal for a tight shelf.



Memory feature of machines like Panasonic gives automatic tape rewind to any point where counter is set to 000.



You won't run out of outlets near the TV set if your recorder has an auxiliary socket like this Zenith Beta unit.



Lower-priced Quasar VR1000PW uses incompatible VX format. Quasar also offers Panasonic-type VHS machine.



Tracking adjusts VCR to play tapes made on other machines. Tracking control on this Sony Betamax is hard to find and use.



ejecting the cassette. You have to turn the machine on again first. Strangely, VHS cassettes are larger, but the machines are smaller. The JVC recorder is substantially more compact than others. So it's easier to find somewhere to put it.

The complicated tape path causes another problem with VCRs. If the machines get cold—transporting one to a friend's house, say—bringing them into a warm room can cause moisture in the air to condense on the drum and other mechanical parts. The tape can stick

and cause severe damage to the machine's fragile innards. So you have to let a VCR sit for an hour or so after exposure to cold. Three of the VHS machines we tested—Panasonic, RCA and GE—have Dew lights to warn that the machine isn't ready. When the light is on, the machine won't start, so at least you don't have to worry that you haven't waited long enough.

Recording time is another confusing point. Basic Beta-format machines, like Sony's and Zenith's, can record up to three hours on a

cassette. Basic VHS machines like the JVC can record up to two hours on one cartridge. The other VHS machines we tested—Panasonic, RCA and GE—have two playing speeds, so they can record up to four hours on a single cassette. If you want to record entire sporting events or long movies, the extended recording mode of some units could be very important.

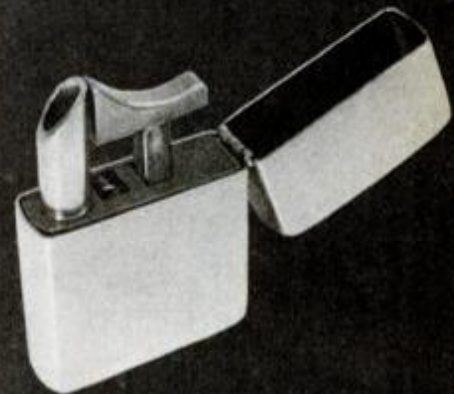
The longer-recording units though, offer somewhat lower picture quality, not only at the slower speed

*(Please turn to page 178)*

# Our treasury's armory of LETHAL IMPOSTERS



This familiar cigaret pack and lighter look harmless. But lift the pack foil and flip the lighter lid (right) and both turn out to be guns that fire .25-cal. bullets.



PM photos: Fred Ward/Black Star

Here's a real oddball number," Ed Owen says, lifting a sleek gray plastic device from a glass case. It was faintly reminiscent of a hand-held color slide viewer.

"It's a Taser," he explains, "an electronic weapon manufactured in California. It works somewhat like a capacitor discharge system in a car. You fit little plugs in it. Each has two small barbs tethered to 15 feet of insulated wire. When you fire the thing its batteries discharge 50,000 volts of current. This explodes an electric squib that spits out the tethered barbs which, in turn, supposedly snag in the clothing of whoever you fired at. As long as you keep the trigger depressed it pulses 50,000 volts, feeding it to the barbs and giving the victim a charge designed to keep him 'pulsating' and out of action."

Edward M. Owen, a technician for the U.S. Treasury Department's Bureau of Alcohol, Tobacco and Firearms (ATF), notes that the unique "persuader" originally was developed to stop airplane hijackers. By the time it was perfected, hijacking had fallen off under the Sky Marshal program.

Watch that cigaret pack—it could be a gun. Basement gunsmiths have made deadly weapons from keys, grease guns, tire gauges and pens. Some you wouldn't believe.

by Richard F. Dempewolff

The company, says Owen, tried to market Tasers commercially—as a deterrent to muggers and a general civilian protector. But as a commercially available weapon, the ATF could not approve it.

The Taser is only one of more than 4000 weapons in a "Firearms Technical Library" assembled by a team of five technical specialists under Technology Chief Nicholas Vainovich, in the Treasury Department's ATF Bureau.

The unique arsenal, located in the steel and concrete basement of the U.S. Post Office Building in Washington, D.C., is not open to the public. A wide variety of intrusion devices alerts security guards whenever an unauthorized person passes through the bank-vault-type door to the sealed area. It is, in fact, a "library" of guns available to law enforcement agencies as a weapons

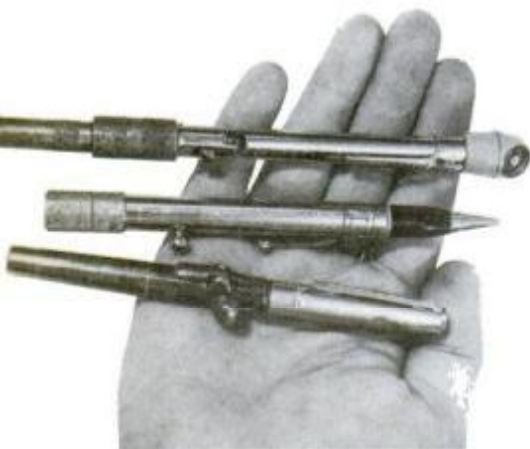
information reference file. The growing collection represents guns that have been seized in criminal cases, or were bought from criminals by members of ATF's army of 1600 agents. Representative military weapons have been donated by the armed services. Other weapons may be samples submitted by manufacturers, or guns confiscated by ATF under the National Firearms Act of 1934, and the Gun Control Act of 1968.

As Ed Owen explains it, there's no such thing as an "illegal firearm" in this country. However, certain weapons—such as machine guns, sawed-off shotguns, short-barreled rifles, pen guns, cane guns, most military-type "destructive weapons" and other specified lethal devices—must be registered. An individual who wants to make such a device, which Treasury men call a



Treasury Department's gallery of guns includes racks of rifles of every description, military weapons (behind Technician Ed

Owen, examining gun), a collection of nearly every handgun type known (above) and cases filled with oddball homebuilts.



Innocent-looking pen, pencil and a tire pressure gauge are all lethal weapons. Each accepts a single .25-cal. bullet and is fired by a simple trigger button.



Heartbreaker for gun fanciers is the classic \$13,500 Purdy shotgun, which was stolen by a totally ignorant thief. He

promptly sawed a foot from the barrel and six inches from the stock for a narcotics stickup—in which he was caught.



Thompson submachine gun—"the gun that made the 20's roar"—is a collectors' item today, bringing up to \$5000 or more. Now

a currently produced mini-Thompson, about half scale, takes .25-cal. bullets in a 20-round drum magazine.

"National Firearms Act (NFA) weapon," may do so legally with ATF approval plus a registration fee (up to \$200)—*provided* local authorities and laws of his state permit him to own it. It costs a like fee to transfer most registered NFA weapons later, unless they're going to ATF.

Many of the exotic guns, "gangster-type" weapons and Saturday night specials on display in the gun library were seized in criminal cases. Biggest heartbreaker to a sportsman is the \$13,500 Purdy double-barreled shotgun, that a thief stole from the workshop of an Abercrombie and Fitch gunsmith. After sawing a foot off the barrels and six inches from the stock, he got caught using it in a narcotics stickup.

Stories behind most weapons in the library are hard to come by. "Objectivity is our rule," Owen explains. "When I'd get a gun in a court case, I put the case report aside. I don't want to know about it. If I should find that some guy killed 47 people with the weapon, it could

cloud my judgment when I testify."

Many devices, however, tell a graphic story by themselves. Typical is an attache case "assassination kit" seized in a Florida crime syndicate operation. Inside the innocent-looking thing is an Armalite AR7 .22 rifle with silencer and cutdown barrel. A simple linkage bar extends from the trigger to a brass finger loop under the handle. A small hole, framed in ragged leather on the front end of the case, attests to the fact that the kit served its purpose. But Ed Owen apologizes for it.

"It's sloppy," he says. "The thick

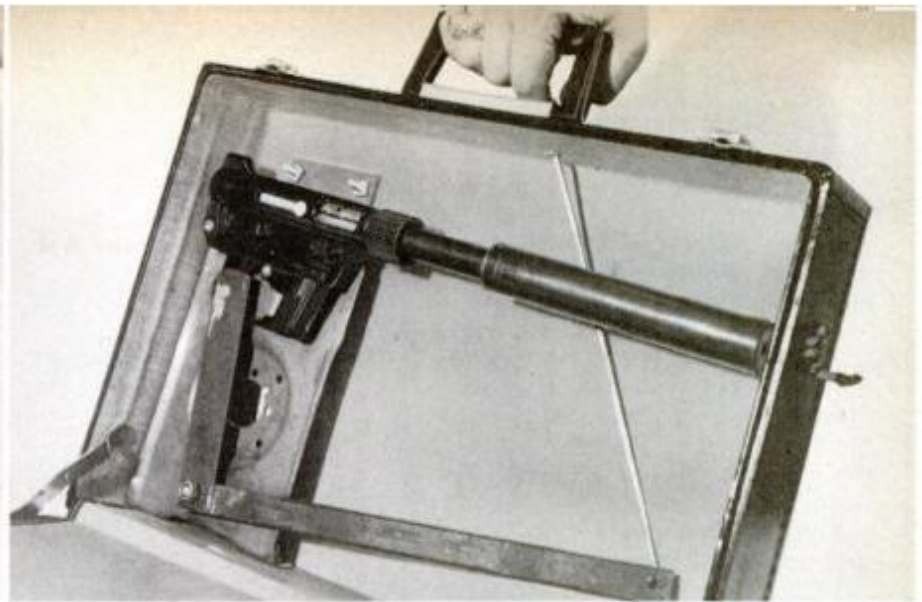
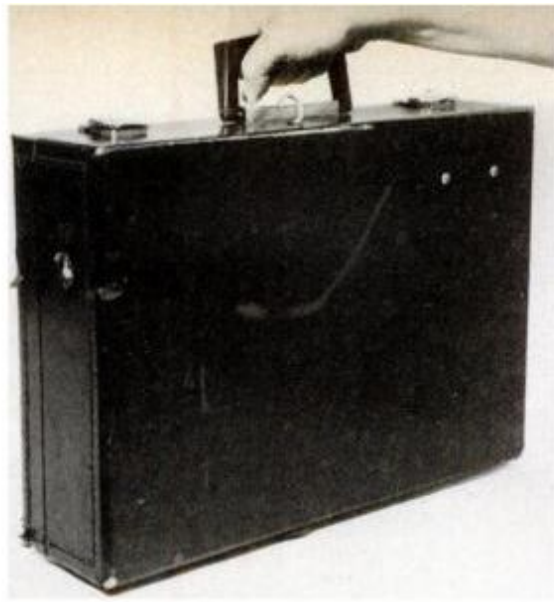
rod and finger ring give it away. We've seen sophisticated ones with black pushbutton triggers. One we made, as an example for our museum, had a camera cable release that ran through the handle to a finger-pull. This one is crude."

Most assassination kits, Vainovich and Owen point out, are used by organized crime, (rather than in political "hits").

### Guns in everyday disguises

Back at the glass case that houses "homebuilts," Ed Owen selects a number of everyday items and lays

*(Please turn to page 174)*

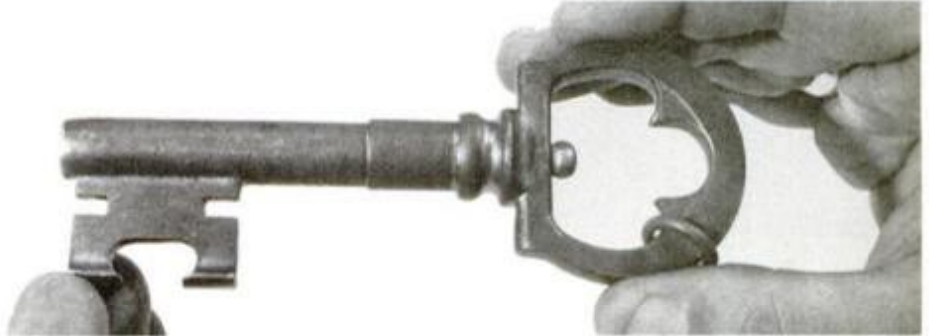


Assassination kit in an attache case has bullet hole in front end, indicating it had seen actual use before confiscation by

ATF agents. Open lid (right) reveals cut-down rifle and crude trigger bar connected to finger loop under case's handle.



Rocket pistol made by American manufacturer fired tiny missiles with four venturis. It became an Air Force flare gun.



Decorative brass gate key is actually a single-shot .25-cal. weapon that can kill. Stem detaches to accept bullet. The gun

is fired by pulling back the spring-mounted firing-pin knob, visible at the bottom end of the key's handle.



Taser, an electronic gun, fired barbs tethered to wires carrying 50,000-volt pulsating charge to its target victim.



Cane guns, popular at the turn of the century, often were works of art. One with carved jade handle (left) opened to

take a .410-gauge shot shell. Plain handled one (right) detached stick from handle to reveal revolver with bayonet.



Miniature grease gun fires a bullet instead of grease. It's typical of specials that wind up in gun fanciers' collections.

I had been waiting for America to build a car like the Rabbit and Honda. It finally came, but with better styling, a more roomy interior and a lower price tag," says a Wisconsin production supervisor and Horizon owner.

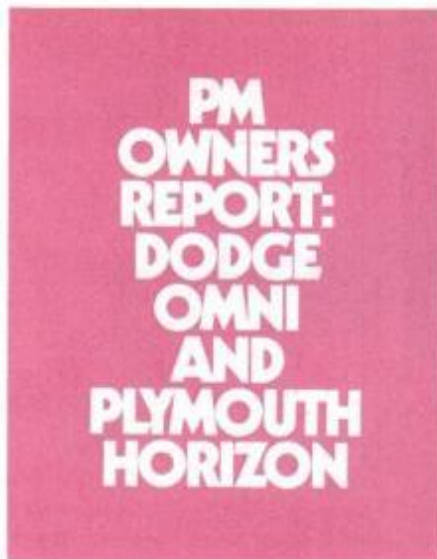
He's one of 2000 Plymouth Horizon and Dodge Omni owners we surveyed to get a wide spectrum of reactions to their cars. Most Omni-Horizon (O-H) owners thought the vehicles themselves were great, particularly as to economy, handling, roominess and comfort. But a few report un-



Front-wheel drive feature was reason many bought an Omni or Horizon.

satisfactory dealer mechanics and small, annoying early problems.

Before we get into specific problems, let's review some over-



all reactions to the cars. A Minnesota office manager observes that "interior roominess is surprising. The trunk area holds a fantastic amount, especially when you put the rear seat-back down."

A Colorado Omni owner and industrial parts manager: "The front-wheel drive (fwd) gives exceptional stability in crosswinds despite the surface area of the car. I also like the precise, fairly short throws of the shifter and the performance from this small, economical engine."

A Michigan writer: "We like our Horizon's fuel economy—26 mpg in town and 31 on the highway. Also the fwd roadability and overall efficiency of layout. Interior space is intelligently used. Very comfortable. We love it!"

A Florida aircraft mechanic: "I originally wanted a VW Rabbit, but they cost too much. The wife wanted an American-made car with economy and good service. So we made a deal. We're very pleased with the Omni. It's quiet, has an excellent paint job, good fit and it rides a lot better than my old 1970 Dodge."

Omni owners rated dealer service *average to poor* by a 51-percent majority. Plymouth dealers scored better: only 46.8 percent of Horizon owners rated them *average to poor*. Repeated bring-backs, waits for parts and repairs, and lack of familiarity were some more-often-voiced criticisms.

Over 65 percent of the owners we queried had experienced mechanical or fit-and-finish problems that needed dealer adjustment—fairly high when compared with other cars we've reported in this price class. Most problems, though, were minor.

A Texas schoolteacher re-

BY MICHAEL LAMM WEST COAST EDITOR

## Handle very well, thank you, and fuel economy is great, but too many rattles

### DODGE OMNI

Fuel-tank placement is ahead of rear wheels for safety in rear impacts.

Design of door handles makes their use difficult and they pinch fingers.

Access space around 1.7-liter Four makes do-it-yourself service easy.



ports: "First the spring near the carburetor came loose, then a broken clip on one rear door kept it from opening, next I got a vibration at a specific speed, and finally the wiper switch on the steering column quit. These aren't anything major, and all were repaired



Accelerator-pedal size and/or location didn't measure up to some owners' feet.

under warranty, but it surely is annoying to have to go back every week for service."

Over 80 percent of O-H owners rated workmanship *good to excellent*. "Every part is put together well," opines a South Carolina student. And a New York retiree echoes, "I was pleasantly surprised by the quality of my Omni. It's really sumptuous—well put together mechanically, neat and efficient."

We got the following responses from owners about comfort:

"Excellent spaciousness front and rear," comments a Michigan quality controller. "I have a six-foot-two friend who's comfortable in the rear seat."

A Wisconsin dairy farmer: "For a small car, the ride is outstanding. There is also more legroom in the back seat than in a lot of full-sized cars."

A New York computer specialist: "This is truly a 4/5-passenger car, and it can seat that many in comfort and still not bottom out on most road surfaces."

Front-wheel drive and general handling characteristics received spontaneous praise. A New York



PM survey found four-cylinder powerplant is perfectly suited to the car.

## First U.S. subcompacts with front-wheel drive

The Omni and Horizon are nimble and predictable handlers as PM found in its Firsthand Report (page 64, Jan. '78) and its coast-to-coast drive (page 93, Apr. '78). Owners, too, rate handling as a most-liked feature (second to fuel economy).

When it comes to fuel economy, owners are especially satisfied. In our surveys, low or lower-than-expected mpg usually is cited as a dislike or area needing improvement. Only a low (Omni) or insignificant number (Horizon) of owners complained.

The Omni-Horizon (O-H) uses a front-wheel-drive (fwd) VW Rabbit engine block, stroked slightly to give 128 cc more displacement and a little more torque. Chrysler puts on its own manifolds, a Holley two-barrel carb, ignition, and accessories. The O-H also uses the Rabbit's four-speed manual gearbox, although a Chrysler Torque-Flite is optional.

Slightly larger than the Rabbit and several hundred dollars less expensive, the O-H makes efficient use of space and boasts 34.4 cu. ft. of luggage area. Contrast this with 29.2 cu. ft. for the Nova hatchback. O-H weighs a mere 2100 lbs., thanks to such economies as 8-lb. aluminum bumpers that interchange front to rear. MacPherson struts fore and independent and coil-sprung axles aft suspend OH; front discs are standard.

A NATIONWIDE SURVEY BASED ON 1,992,165 OWNER-DRIVEN MILES

Excellent all-around visibility dispels small-car feeling.

## PLYMOUTH HORIZON

Horizontal bar in grille distinguishes Horizon from Omni.



Front-wheel drive impressed buyers; front disc brakes are standard equipment.

Spare lies flat and out of the way under the rear cargo floor.

schoolteacher says, "We test-drove our Horizon in 8 to 12 inches of snow, and because it negotiated our driveway with a 20-percent grade in deep snow, we bought it."

"It's a fun car to drive—puts me back in the driver's seat again," enthuses a Vermont physician. "We live on a curving, steep road eight miles out of town and find traction excellent."

A Florida car renter: "Front-wheel drive and steering really make the Horizon corner and hold the road very well."

A New York physician: "Excellent design. Easy to handle. Responsive. Good ride. Easy to park. A delight to drive. Easily maneuverable."

We next asked respondents to list features of their Omnis and Horizons they liked *least*. Roughly 15 percent had no complaints; here's a cross section of the rest:

"My fingers get caught in the door handles," complains a Delaware pipefitter, "and I can't get the doors open in wintertime when I wear gloves."

Illinois piano tuner: "The gas pedal is all wrong. Its angle is too steep, and it's too far to the right. It's impossible to drive any distance without getting a cramp." (The gas pedal position in later O-Hs has been changed for greater comfort.)

An independent Michigan mechanic criticized his dealer's service department: "The Omni is the first car we would like to own two of. However, after having to deal with the company's service staff, I have serious reservations."

"Rattles like a can of marbles when you go over railroad



Owners praise versatility: (from top) security panel raised; same panel covering "trunk"; rear seat folded for "station-wagon" configuration.

tracks," groans an Oregon housewife.

Minnesota baker: "Noises in the

dashboard, no underneath vents, can hear shock absorbers and gas tank when rear seat folded flat, and it's hard to remove the oil filter."

Wisconsin postal clerk: "Gas mileage not so good as expected, and it's hard to find a comfortable position for your right foot when cruising."

Here's what Omni and Horizon owners like best about their cars.

A Colorado flower grower: "This Omni has replaced our Saab for personal use and a Ford van for business. It has traveled every major mountain pass in Colorado, driven through 18 or more inches of heavy, wet snow without snow tires, and done everything we expected of it and more. If it continues to perform as it has, we agree that it is the car of the future."

A Wisconsin carpenter foreman: "We like the solid feeling of the car, the front-wheel drive, the four doors, the comfortable and roomy back seat, the visibility, the idea of the hatch and rear storage area, but we especially like the Horizon's looks. *That* is what attracted us initially and what probably sold us on the car."

An independent designer/technician from Wisconsin: "I tried the Honda and Rabbit but wanted to buy American. This was the only car on the market comparable to the Accord. It has excellent visibility, and handling is tops. I took delivery in mid-January, so I had the opportunity to try my Horizon out all winter. Can't praise front-wheel drive enough for safety in snow and on ice. I came from a Chrysler New Yorker, and

(Please turn to page 172)

## SUMMARY OF 1978 OMNI-HORIZON OWNER REPORTS

	Dodge Omni	Plymouth Horizon		Dodge Omni	Plymouth Horizon		Dodge Omni	Plymouth Horizon		Dodge Omni	Plymouth Horizon
Total miles driven	983,573	1,008,592	Sloppy workmanship	6.7	9.9	Fair	3.0	3.5	Good	32.5	32.8
Average mpg (with 4-speed manual transmission):			Unhandy door handles	6.2	10.4	Poor	0.0	0.0	Average	17.0	15.6
In town	25.4	25.6	Gas mileage	6.2	---	Comfort opinion (rear seat):			Fair	11.3	15.6
Long trips	31.9	31.8	What changes would you like?			Excellent	36.0%	27.9%	Poor	22.7	15.6
Why did you choose this car?			Gas pedal location, angle	15.1%	12.2%	Very good	37.6	46.8	Number of vehicles owned:		
Economy	54.5%	55.3%	No changes	12.4	12.2	Good	18.3	19.5	This car only	34.7%	38.7%
Front-wheel drive	33.0	29.6	Different door handles	8.1	13.8	Fair	7.6	5.3	Two cars	48.5	52.8
Styling	24.0	26.6	Different seat shape, size	8.1	7.7	Poor	0.5	0.5	Three cars	12.9	6.0
Roominess	20.0	19.6	Better quality/materials	7.6	9.9	Had any mechanical trouble?			Four or more cars	4.0	2.5
Overall size	18.5	26.1	Workmanship opinion:			Yes	67.8%	66.7%	Makes of other cars owned:		
Specific likes:			Excellent	19.0%	19.6%	No	32.2	33.3	Chevrolet	22.7%	9.8%
Economy	60.1%	61.0%	Very good	46.5	44.7	What type of trouble?			Ford	22.0	15.6
Handling	55.1	51.3	Good	16.0	17.1	Carburetor	14.1%	22.1%	Plymouth	12.1	18.9
Roominess	33.8	35.4	Fair	12.5	8.0	Shifting	12.6	7.6	Chrysler	10.6	9.0
Styling	28.3	22.1	Poor	6.0	10.6	Brakes	10.4	10.7	Dodge	9.8	14.8
Front-wheel drive	22.2	---	Comfort opinion (front seat):			Transmission	9.6	8.4	Age distribution of owners:		
Comfort	21.7	26.7	Excellent	46.0%	39.4%	Wipers	8.9	7.6	15-29 years	28.3%	26.6%
Specific dislikes:			Very good	38.6	47.5	Dealer repairs satisfactory?			30-49 years	51.6	53.9
Noise and rattles	18.6%	10.9%	Good	12.4	9.6	Yes	51.2%	55.8%	50-plus	20.1	19.4
Poor dealer service	14.4	9.9				No	48.8	44.2	Would you buy another Omni-Horizon?		
No complaints	14.4	17.7				Excellent	16.5%	20.6%	Yes	77.2%	83.2%
									No	22.8	16.8

\*Percentages might not equal 100% due to rounding, insufficient data or multiple responses.



# New electronics for education, convenience, fun



A portable breath analyzer—imported from Sweden, where drunk-driving laws are especially tough—lets you check your own or a guest's blood alcohol level by electronically measuring the concentration of volatile gas in the breath. The test subject breathes into the top of the device, then Alcocheck lights a green LED for blood alcohol below .04 percent (safe), a yellow one for .04 to .08 percent (questionable) or a red one for a level above .08 percent (unsafe). Price is \$70; Western World Trading Co., 1456 Winchester Ave., Glendale, Calif. 91201.



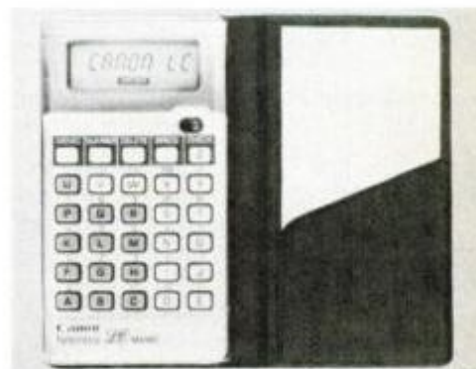
Combining floating-point digital time delay and computer models of performance environments, Advent SoundSpace control recreates a range of acoustic spaces—from a small club to a cathedral—by providing signals for an additional stereo amp and rear speakers. You control size and brightness of the space. Suggested retail price of the unit is \$595.



Versatile concept in home computers, Exidy Sorcerer puts the programming language into a plug-in cartridge, yet also has full keyboard and numeric pad, 8000 bytes of user memory, dual-cassette and modem (telephone) interfaces, S-100 bus for compatibility. System is \$895 with Basic module. Exidy Inc., 969 West Maude Ave., Sunnyvale, Calif. 94086.



Newly available for direct purchase, Happy Talker replaces conventional telephone mike, blanks out background noise so only your voice gets through. It's \$13; as shown, \$20. Roanwell Corp., 180 Varick St., New York, N.Y. 10014.



Throw away your little black book and replace it with an electronic notebook. Canon LC-Memo will store 21 names and numbers for a year in its alpha-numeric memories. Enter a name via the keyboard, and the device gives you the number on its LCD display. Good for short notes and lists, too, it's also an eight-digit calculator, and costs \$90.



Six-digit, liquid-crystal-display watch from National Semiconductor has an alarm that alerts you by chirping for a minute or until shut off. It gives continuous display of hours, minutes and seconds, shows the day of the week on a button-push, has glow-in-the-dark tritium backlighting. Three models are \$60 to \$80.



New teaching toy from Texas Instruments, Speak & Spell talks to tykes without using magnetic tape or mechanical sound reproduction. Its speech-synthesis circuitry pronounces one of 200 words (those most troublesome for youngsters) at random, lets user type a spelling of the word, then tells him if he's right and pronounces the spelling, announces his score after 10 words; it also plays word games. Extra word lists will be available in plug-in modules. Retail price is \$50.



Superphone 7700 does everything but talk to you. It's a dial-exchange-compatible pushbutton phone with dialed-number display, timer, autodialing of 20 numbers, digital alarm clock, stop-watch and calculator. It's \$199; made by Integrated Circuits Packaging, Inc., 3008 Scott Blvd., Santa Clara, Calif. 95050.

# Tuning in on the 'ghost beam'

More theory than substance, the shadowy neutrino may soon carry messages anywhere—through anything.

by Robert L. Perry

Unique bubble chamber photograph from Fermilab shows four extremely rare neutrino interactions (small squares) occurring.

Imagine the worst: a thermonuclear war is imminent. The first burst of atomic radiation fills the atmosphere. All telecommunications halt.

How will our military commanders—and the President—stay in touch with the nuclear submarines still submerged and operational? Their remaining missiles might prove the margin between total victory and total defeat. But, according to sealed orders, they have to wait until they receive a direct Presidential command. How will anyone ever tell them where and when to strike?

Today, there is no foolproof way anyone could reach those submarines with any existing communication system. But if teams of both Naval and private scientists succeed, there may soon be a completely undetectable and jamproof way to communicate.

Even more incredibly, these supersecret beams will travel *through* the Earth, not over or around it like conventional radio messages. This improbable communications network will be based on radiation-free, subatomic particles called neutrinos.

Nuclear physicists have only been able to detect neutrinos regularly for about five years. Yet, forward looking scientists like Dr. Peter Kotzer of Western Washington Uni-

versity, Bellingham, Wash., say intense, powerful beams of these particles could also revolutionize all telecommunications—television, telephone and radio—in a few decades.

Neutrinos (Italian for "little neutrons") are exceptional because they pass through matter—all kinds—as if it were transparent (see *The Shot Heard Around the World*, page 94). Neutrinos have no mass and no electric charge. They are the offspring of subatomic particle collisions—protons colliding with protons. They travel at or near the speed of light.

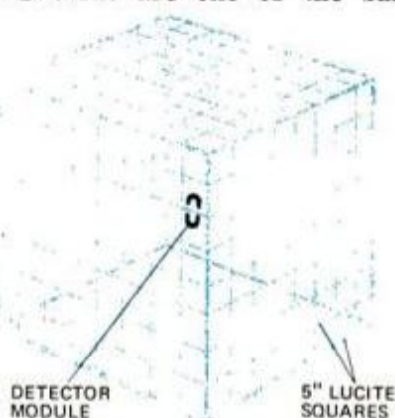
Neutrinos are so small—about 100,000 times smaller than a proton—as to be almost incomprehensible. Protons are one of the basic

building blocks of the universe: One proton and one electron make up a hydrogen atom, the smallest atom. The space between the proton in the center of the atom and the rotating electron has been compared to the space between the Earth and the sun. Imagine how much smaller the neutrinos are!

A radio wave, or any kind of electromagnetic transmission, bumps against matter and is deflected or attenuated. Yet with just the shortest burst of energy, neutrinos will zoom right through any known medium. This ghost-like quality makes them almost impossible to intercept.

But tracking neutrinos, on the other hand, is fairly easy—if anything in the world of particle physics is easy—says Dr. Albert Saenz, head of a research team at the Naval Research Laboratory near Washington, D.C. Saenz's group is currently conducting studies in close contact with Kotzer and others. A decade ago, researchers began to realize that neutrinos fired in short bursts from man-made, high energy accelerators, such as one at Fermilab, near Batavia, Ill., occasionally collide with other subatomic particles and leave tracks that can be recorded on special detectors.

The frequency of these collisions is very, very low—on the order of one for every 17 tons of matter traversed. Yet, within a year, Kot-



Cherenkov detector, named for the Russian scientist who devised it, uses a photocell to monitor neutrino collisions.

zer's group may actually send and receive the first human "message" on a neutrino beam. Kotzer has three proposals before a Fermilab Review Committee: The first is a small test within the target area of an accelerator like Fermilab. The second would shoot a neutrino beam into Washington's Puget Sound to test working neutrino detectors. During most of its passage in that test, the neutrino beam would be above ground. So, the third proposed test—with no target yet fixed—would send a beam *entirely through the Earth*.

Since neutrinos were first found in 1956, they've only been "used" to explore pure scientific theories—the sun's structure, galactic explosions and even more exotic atomic particles. Kotzer's team wants its first test to examine "a simple coding scheme—like Morse code—to demonstrate that we can recognize patterns in neutrino beam bursts," he says.

### 640,000-watt bursts

Using a high-powered particle accelerator like Fermilab isn't like playing catch in the back yard, though. This huge accelerator is actually a series of small accelerators which, within seconds, generate more than 400 billion electron volts (giga-volts or GeV.) at 53.1 megahertz (millions of radio waves per second). An electron volt is a measure of the energy which a particle acquires when it is introduced into a field created by a specific voltage. In conventional terms, the energy of one proton thrown out from the 400 GeV. accelerator is .0000000064 joule. But the average number of protons emitted in a one-second burst is 100,000,000,000,000 or  $10^{14}$  protons. Each burst packs a very dangerous wallop of 640,000 watts.

Besides Fermilab, only three other accelerators in the world are powerful enough to conduct neutrino communications experiments: Brookhaven Laboratory on Long Island, Serpukhov Laboratory near Moscow (which has more power than Fermilab) and the CERN Laboratory in Zurich, Switzerland. Brookhaven, with 40 GeV. power—the minimum for these tests—was recently given the money to expand to Fermilab's present size.

Fermilab offers an excellent example of how such tests would occur at any of these locations. The Fermilab accelerator is a mile-wide ring of 1000 supermagnets buried 19 feet below ground. The proton burst begins in the "injector," a pre-accelerator, a linear accelerator and a booster. The protons gather speed

and power through these three and are hurled into the main ring.

### Driving protons with magnets

The magnets in the main ring "bend" the proton burst and increase its energy. Each time a proton burst circles this ring—about once every 20 *billionths* of a second (20 nanoseconds)—it can be driven out of the main ring by different magnets.

The protons hurtle through a series of stronger magnets, which fling them into "the switchyard." In this long, underground passage, the proton beam is magnetically manipulated, shaped and literally split into three separate beams. First, one is quickly "shaved off" into a proton testing area; another part into a meson (another particle) testing area a few hundred yards further along. The main beam shoots into the neutrino area (433 yards wide and 867 yards long), striking a 20-ton aluminum bar.

The proton beam collides with aluminum atoms and immediately releases a trillion neutrinos. Normally, the neutrinos fly into a 15-foot-high bubble chamber filled with about 8000 gallons of liquid hydrogen. Even then, the trillion neutrinos leave only a few "tracks" during each burst (see photo, page 92).

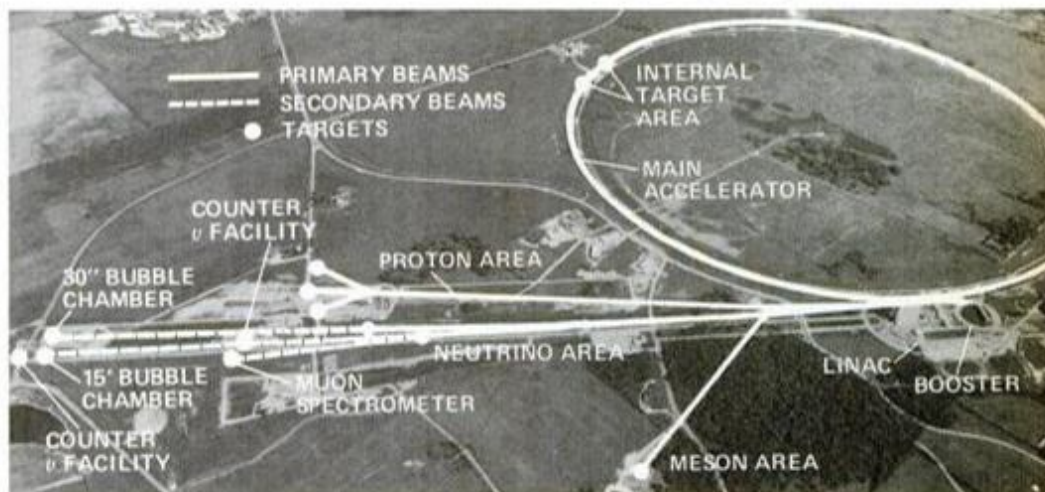
In Kotzer's experiment, however,

### UPDIKE VS. NEUTRINOS

Almost two decades ago, when science's early guesses as to the nature of the shadowy world of subatomic particles served mainly to confuse the general public, the neutrino's suspected presence was announced. One of those taken a-back by its bizarre properties was the respected novelist, John Updike, whose poem on the subject, *Cosmic Gall*, first appeared in *The New Yorker* in 1960. It remains a classic of its type:

*Neutrinos, they are very small  
They have no charge and have no mass  
And do not interact at all.  
The earth is just a silly ball  
To them, through which they simply pass,  
Like dustmaids down a drafty hall  
Or photons through a sheet of glass.  
They snub the most exquisite gas,  
Ignore the most substantial wall,  
Cold shoulder steel and sounding brass,  
Insult the stallion in his stall,  
And, scorning barriers of class,  
Infiltrate you and me. Like tall  
And painless guillotines, they fall  
Down through our heads into the grass.  
At night, they enter at Nepal  
And pierce the lover and his lass  
From underneath the bed—you call  
It wonderful; I call it crass.*

Copyright © 1960 by John Updike; reprinted from *Telephone Poles and Other Poems* by permission of Alfred A. Knopf, Inc.



Aerial view of Fermilab, Batavia, Ill., showing main accelerator and its targets.

Closer view of neutrino area shown above; neutrino beam is in the center.



the plan is to simulate special detectors like those that could constitute a deep underwater communications system. They will test to see if "Cherenkov detectors" will actually track and record neutrinos in synchronized bursts, the way electronic pulses are recorded in digital and analog computing.

"We will transmit specific neutri-

no patterns so we can tell if the receiver "reads" the pattern. We want to tune up for a search for special heavy-mass neutrinos that *may* travel slower than the speed of light. If we can trace them we'll learn how to control neutrinos in pulsed signals," says Kotzer.

The Cherenkov detectors, first built in 1970, don't actually catch

neutrinos. They record on "photomultipliers" the infinitesimal flashes of blue light emitted when neutrinos collide with other particles. The light is emitted along a 41° *muon cone* which races in front of the neutrinos.

Cherenkov, an 86-year-old Russian scientist, discovered and studied the bluish flashes as a researcher at a Moscow University laboratory in the early 1930s. Now retired after directing the same lab for many years, he still continues his particle physics research.

The detector is made of deceptively simple materials: two 5-inch-square Lucite sheets. In a quarter-inch space between the sheets, a sodium fluorescin solution is trapped. Photocells and conventional electronic devices record the flashes when they hit the Lucite sheets. If the flashes equal the same number, timing and spacing as that mathematically predicted from the neutrino beam at its origin, then neutrino "communications" will be a reality.

Kotzer's Cherenkov detector will include three photomultipliers. It will be five feet in diameter, will look like an eyeball, and will weigh about 50 pounds.

### Undersea photomultipliers

This first "message" will also teach scientists how to calibrate undersea arrays of these photomultipliers. They'll then know how to refine the neutrino bursts and the detectors to operate within the same billionths of a second.

Yet this is only a beginning. The power of the Fermilab accelerator will soon be increased by 250 percent to one *trillion* electron volts (TeV.) and will thus achieve "Tevatron" status. Kotzer says that will increase the neutrino detection rate by 1500 percent while costs increase only 250 percent.

Dr. Saenz says the current neutrino beam collision rate averages only 25 collisions per hour for every million tons of water at a distance of 600 miles from the accelerator. With the Tevatron, Saenz speculates, the collision rate should jump to 25,000 per hour for every 10 million tons of water at 600 miles, and 2500 collisions per hour at 6000 miles. The one-yard-wide (at the Fermilab aperture) neutrino beam widens to three-fifths of a mile at a 600-mile distance and to six miles wide at 6000 miles. The water "catch basin" at 6000 miles would have to have a volume of 1350 cubic feet with several hundred detectors

(Please turn to page 176)

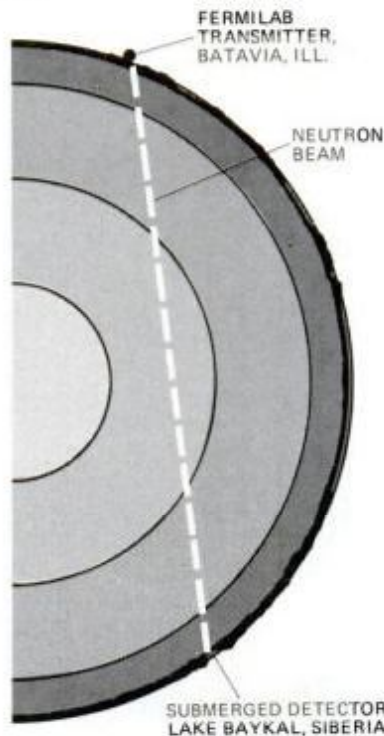
## The shot heard through the world

"It's been proposed that we work with the Russians to send neutrino beams from Fermilab to Lake Baykal, the largest freshwater lake in the world, near Mongolia," says Dr. Peter Kotzer of Western Washington University. "The lake is about 6000 miles through the Earth from Fermilab. (Remember the Earth's diameter is only 7917.) The lake is about 5000 feet deep and holds 6 percent of the world's fresh water." As if sending messages through the Earth isn't enough, Dr. Kotzer says "several new kinds of physics" will soon be possible using neutrino beams. Among them are:

**Earth measurements.** Neutrinos may oscillate in relation to other particles. If they do, we'll have a way to measure the motion of the Earth's subsurface plates and test the "Plate Tectonics" theory with a device 1000 times more sensitive than anything used now, Kotzer says. Neutrino beam determinations of these plate movements would be accurate to within one foot or less.

**Extraterrestrial communications.** The NASA Cyclops project is trying to detect intelligent signals from outer space. "Our opinion is that intelligent beings elsewhere in the universe would use neutrinos to send signals because of their distinct advantages over any kind of electromagnetic waves," Kotzer says. "We can now use our detectors to receive neutrinos from point-like sources in the galaxies and attempt to decode possible intelligent transmissions." This extragalactic search could be an extension of two very vigorous current programs to differentiate neutrinos from cosmic rays.

**Cosmic ray detectors:** "The largest of these programs is Project DUMAND (Deep Underwater Muon and Neutrino Detection) sponsored by the Naval Research Laboratory and concentrating on refining Cherenkov detectors to measure cosmic neutrino sources. A second project group is using manned submersibles carrying detectors to



Suggested international experiment would send neutrino message through Earth from Illinois to U.S.S.R.'s detector.

1000 and 2000 feet deep, and is funded by the Harbor Beach Foundation. It's led by Edwin Link, who developed the famous Link Trainer for pilots, and J. Sword Johns. Off the Bahamas recently, this group set a world record by submerging cosmic ray recording equipment 2000 feet deep at *normal* atmospheric pressure and retrieving it. No small feat when you consider the tons of pressure per square inch at that depth.

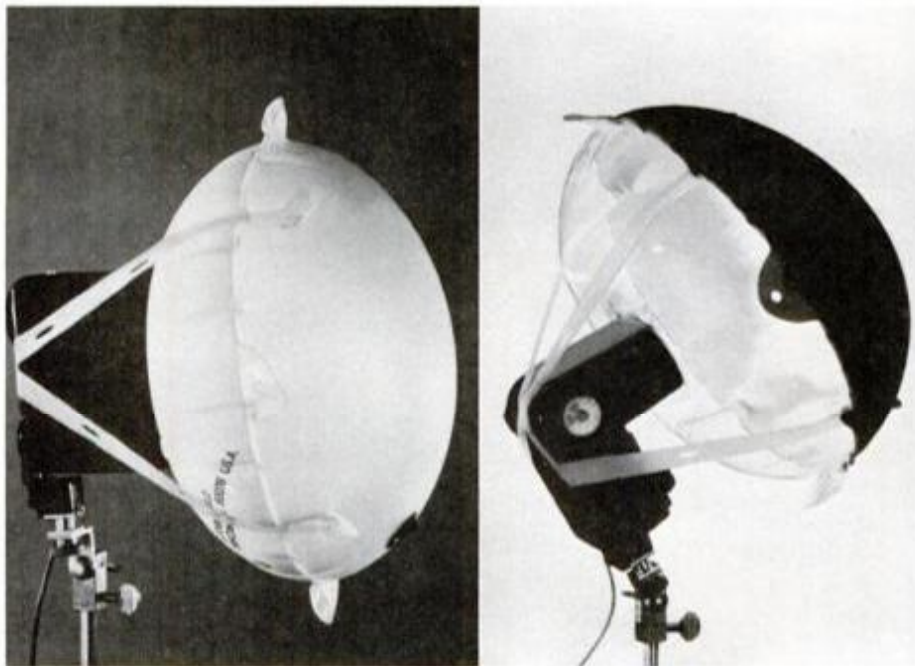
**Faster-than light particles.** Neutrino communication refinements could detect and record suspected subatomic particles that move *faster* than light, Kotzer says.

**New neutrinos.** Kotzer also thinks the experiments may reveal new principles of particle physics. The theory is neutrinos can change into mu-mesons, heavy leptons or even electrons. As he puts it, "Proving that would be like proving humans can change their sex without the aid of surgery."

# IT'S NEW NOW

## Blow-up

Inflatable Air-Diffuser (below left) and Air-Brella (below right) are two photo aids that don't add much weight or bulk to your camera bag. Air-Diffuser softens and spreads out the light of a flash unit. Air-Brella supplants larger and heavier white umbrellas for use in bounce flash and is said to reduce harsh shadows. Both items strap to any flash unit and come with a set of six colored filters. Each is \$12.50 from New Ideas, Inc., 3728 West Enfield, Skokie, Ill. 60076.

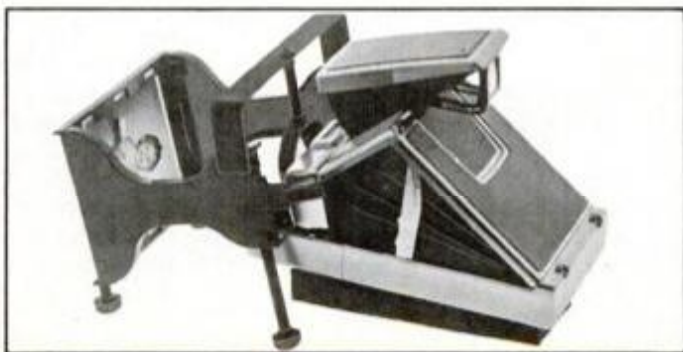
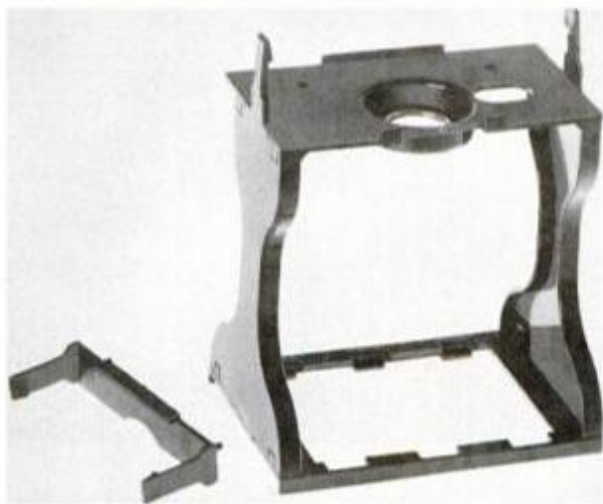


## Sound Minder

Audiophiles and people with noisy neighbors can measure sound levels from 60 to 126 dB with this battery-powered meter from Radio Shack. Unit measures across the weighted scales C (wideband sound) or A (greatest human sensitivity). A slow/fast response switch allows checking average or peak levels. Meter is said to be accurate to  $\pm 2$  dB at 114 dB, costs about \$40.

## Copy stand for instant cameras

Make instant copies of instant photos, snapshots, printed matter and small objects with a Rhedan Copier Kit. Six different models make it possible to adapt any instant camera for copying purposes. Most cameras connect to the Copier Kit in an upright position (top photo); some, like Polaroid's SX-70, set up horizontally (bottom photo). The manufacturer claims that pictures that are too light may be copied darker, and vice versa. The kit includes lens, copier stand, adapter set and object positioning base. It's priced from about \$9 to \$15 from Rhedan Co., Box 768, New Haven, Conn. 06503.



## Hold the phone

With a simple two-wire connection, Hold-A-Call enables you to hang up one phone and pick up an extension—no phones left off the hook by mistake. An LED indicates a call is being held. About \$15 from Radatron, Box 177, 2424 Niagara Falls Boulevard, North Tonawanda, N.Y. 14120.

# The home inferno— now it's deadlier than ever



New materials emitting toxic fumes, plus phenomena like 'cold fires' and 'flashover,' make any fire in your home a serious threat to life.

by Ed Fales

**T**he idea of a fire breaking out in your home has never been a pleasant one. Unfortunately, the evidence mounting up now in reports from fire investigators, insurance companies and municipal officials points to an entirely new syndrome of fire in the home.

In brief, these fires, which can cause death in a number of ways, are deadlier than ever.

From these reports, the consensus describes the new fire syndrome as a new pattern of toxic or combustible

gases being generated, sometimes leading to an explosive inferno from which there can be no escape.

Day after day, newspapers are reporting: "House explodes as firemen arrive. Seven die. Puzzled firemen find family dead but no one was burned."

And so on. It happens, too, in apartments, and even one-story ranch style homes—and mobile homes, many of which now are known to be literal firetraps.

Fires weren't always like this.

You'd smell wood smoke. (Now there may be no wood, no smell at first.) You'd hear the crackle of flames. (Now there may be silence—right up until the booming phenomenon known as "flashover.") And before, there would be time to phone firemen, or use a garden hose or fire extinguisher. (Now, says the National Fire Protection Assn., you're lucky if you have 20 seconds in which to act.)

The trouble is: We fill our homes today with plastics and flammables



The night inferno—a deadly fire that begins noiselessly and with little or no flame before a sudden violent eruption into holocaust—can claim human lives long before its telltale signs give any alarm.

## DEATH IN SEVEN MINUTES



Here's how engineers tested the effects of a lighted cigarette on a foam-rubber cushion:

■ **0.5 min.:** Fire's a smoky spot: Anyone could snuff it out? "But that's not how foam-rubber mattresses burn," says an expert.

■ **1 min.:** Flames appear up to 10 inches high.

■ **2 min.:** Fire area now a foot wide; first smoke and gases touch ceiling.

■ **3 min.:** Flames are 3 feet high.

■ **4 min.:** Sudden tower of flame; thick oily, blinding smoke a foot below ceiling.

■ **4.5 min.:** Smoke 4 feet below ceiling. You can no longer stand and breathe safely. Your last chance to escape—by crawling.

■ **5 min.:** Flames go up the wall, light curtain. Smoke layer reaches bed.

■ **6.5 min.:** Flashover! Gas and soot explode, blowing out windows and door.

and fluids, some of which are toxic, others explosive. Experts say some plastics burn in weird new ways, much hotter and faster, emitting deadly fumes that if inhaled, can alter the senses and kill by asphyxiation. "Two breaths of some of these fumes and you're in serious trouble," firemen say.

### Homes can seal in fumes

To make matters worse, many homes now are almost virtually sealed—for heating and cooling ef-

iciency. Fumes can't escape. Meanwhile we keep filling them with wonderful new devices and decorations not realizing that we're virtually priming a bomb.

Today's firemen are magnificent. They arrive in seconds, and readily risk their lives. But more often, houses and apartments are infernos even before firemen get there. And even if firemen can still get in, *they can't see*. "Smoke is often oily and thick," they say.

"We just have to pass our hands

over the beds and *feel* for people."

Officials didn't begin to piece together what was happening until one day in Washington, DC., three years ago.

At 10:30 a.m. firemen received an alarm. It came from Building 213 at the U.S. Navy Yard, where a common office copying-machine had overheated and caught fire.

It wasn't much of a fire. Firemen didn't even use masks. They doused the machine, had the fire out in a jiffy. Within 20 minutes they were

on their way back to the station.

Then began a strange series of events. Back at the firehouse, firemen began falling ill. Some described it as tightness in the chest. Others had splitting headaches, dizziness, vomiting.

Next day, an engine driver fainted. Then he came to, said he "felt fine," and dropped dead.

Shocked, two Washington physicians, Drs. Robert Dyer and Victor Esch, began a long, careful investigation. The finger pointed not at CO (carbon monoxide), the old familiar cause of fire death, but at a gas which develops whenever polyvinyl chloride (PVC), a common household plastic, burns. The gas was hydrogen chloride (HCl), a real killer.

Before long the inquiry had also turned up other poisons: chlorine, phosgene, nitrogen dioxide, sulfur dioxide, ammonia.

As a service to doctors and firemen, the *Journal of the American Medical Assn.* recently devoted eight pages to fire dangers, including a five-page report from Drs. Dyer and Esch.

"Practically every structure today contains plastics capable of producing lung-damaging gases," the physicians warned. "The firefighter faces a great, new risk. . . ."

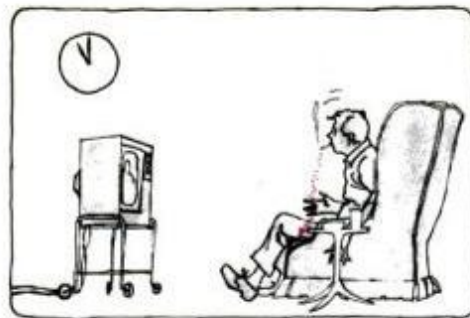
### Dangerous slow burn

But what AMA didn't say was that the same risk now faces anyone whose house catches fire. Even "fire-retardant" furnishings like some drapes and rugs contribute new danger, for the very fact that they burn slowly, it's now being discovered, can lead to the emission of more gases.

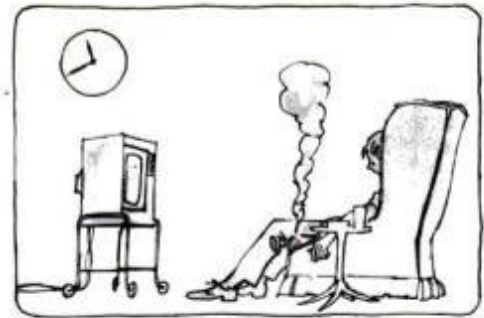
One trouble, the medical investigation found, is that some plastics have a combustion temperature two to five times higher than other household combustibles. And even the wiring (including telephone wiring) in your house can give off poisonous gas, for it may be coated with PVC insulation.

Here's what might happen if a fire starts in your main switch box: The plastic insulation emits white, mist-like HCl fumes that resemble steam. One or two breaths can derange you to the point where it is impossible for you to *think* your way out.

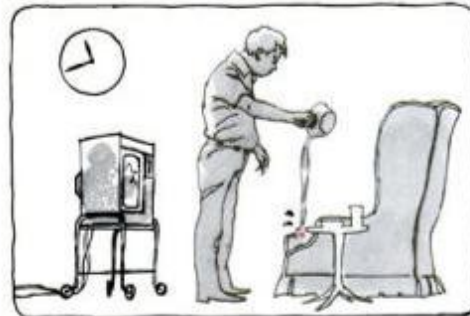
Newspapers every day report deaths from "smoke inhalation." The real cause is often fire gases. In California recently, a confused woman could have escaped her one-story house merely by opening an outside bedroom door and stepping out to her lawn. Instead she opened



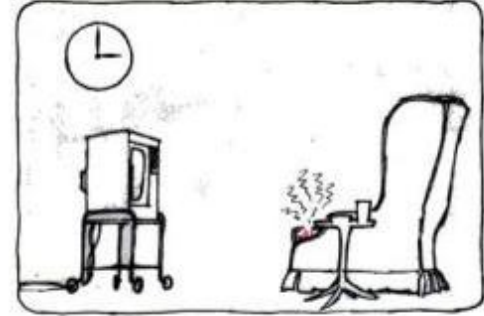
11:00 p.m.: Man watching TV show dozes off; his cigaret falls onto the plastic-base upholstery of his lounge chair.



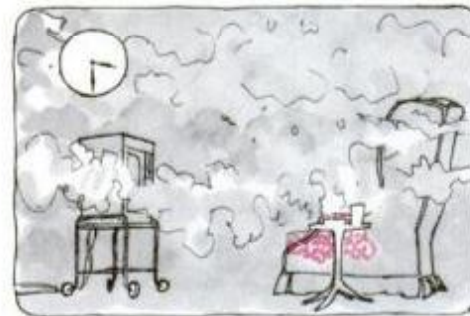
11:40: Material has been smoldering very gradually; only now does it begin to emit visible amounts of thin smoke.



11:41: Man starts awake, gets water in a pan from the kitchen to douse the smoldering spot. Smoke gone, he goes to bed.



3:00 a.m.: Fire in plastic material, never really put out, burns slowly as a "cold fire" for hours, emitting gases.



3:30: Lots of gas and smoke now; toxic fumes have already affected sleepers' mental processes—perhaps even fatally.



4:00: As gases continue to fill the house, the first real flames now appear—five hours after the cigaret was dropped.



4:10: Firemen summoned by neighbors arrive just as flashover occurs and the fire explodes from the TV room into the rest of the house. Sorrowful friends and relatives are amazed that the family was not aroused soon enough to save it.



the wrong door, and ran into a flaming hall.

The danger can continue even after fires are out because of "heat sink." Hot concrete, for instance, can pour forth toxic HCl for about an hour.

Another danger, the AMA reported, is slowness to awaken. Most of us think we can jump right out of bed and escape. Instead, the AMA cited tests showing it can take a sleeper as much as 12 to 15 minutes to wake up and act.

Firemen say one primary pattern is the "bed-smoker's fire" (see photos on page 97). Another, nearly as common, is the "TV-chair" fire.

Here's how the latter happens, as in the illustrations at right:

The time, let's say, is 10:50 p.m. You're watching TV with friends. It's been a jovial evening. One friend puts down a glass, lights a cigaret.

But the TV show proves dull—and he dozes off.

Time, 11:02 p.m.: Someone says, "I see smoke!" A thin thread of blue from the sleeper's chair. "Hey, man, you're on fire!" But it's only his cigaret in the foam rubber cushion.

The cushion is smoldering. You get some water and douse it. Laughter. Friend apologizes. (You say, "Oh, it's just an old chair.")

At midnight, friends leave. You go to bed.

3:40 a.m. Alone in the dark, the plastic chair is still invisibly smoldering. It's what's called a "cold fire." (Chairs have actually been known to turn entirely to ash without flame.)

4:47 a.m. Sudden hammering on your door. A neighbor leaving for an early job has seen a flicker of flame. He shouts, runs to call firemen.

4:52 a.m. It suddenly dawns on you that you've heard noises and smell something strange. It seems to take forever to wake up. Then the awful fact finally penetrates: Your house is on fire.

You run to collect your family. But the door's not where it should be. You bang your face against a wall. You don't realize you've inhaled toxic fumes and aren't thinking right. But let's say somehow, at last, you collect your family and go out a window.

4:58 a.m. Just as firemen arrive, your TV room literally blows up. You've had a flashover, in which superheated gases and soot have exploded. Your house is gone, but you were lucky.

### Lesson from Texas

One of the nation's best protected

## 10 RULES FOR SURVIVING A HOME INFERNO

It was the writer's privilege, some years ago, to develop the "Family Fire Drill" program, now widely advocated by fire departments and insurance companies, with the help of the National Fire Protection Assn. Now, with new help from NFPA, the National Safety Council and the National Fire Prevention and Control Administration (a new government agency), I recommend this new inferno-escape procedure:

**1. Sleep with bedroom doors closed** to keep out fire gases.

**2. Install at least one smoke detector** right now. They no longer cost a fortune. One major supplier is offering them at under \$17 retail. Get a reliable brand.

**3. Put it in the right place**—never a "dead air" space. A preferred place is in the hall entrance to your sleeping area or at the top of a stairwell outside your bedrooms.

**4. Make an up-to-date home fire escape plan**, remembering about those gases. Train everyone. How will you all get out if separated by a flaming hall? After you're out, where will you meet—so you know everyone's out?

**5. If yours is a two-story house, install (neatly boxed) rope or metal fire ladders in bedrooms.** If separated by a hall from a child or someone infirm, give him a bedroom with a porch or carport roof which can be reached from a window. Consider purchasing one of the new escape devices (see text on this page).

**6. If you buy a new house, be sure**

**it has detectors.** If you build a house, be sure your architect designs every bedroom with an escape route.

**7. Have an absolute rule: No one in your house ever again smokes in bed** (already a criminal offense in some states). And be sure no one makes it a habit to smoke, drink and fall asleep while watching TV. Next to the bed-smoker, this person is one of the greatest threats to a household.

**8. Add smoke detectors as soon as possible** in strategic places where rising smoke would go, such as hallway ceilings, over TV sets, up stairways. And remember that children sometimes start fires in their rooms, so have detectors there, too.

**9. Install inexpensive "remote" horns** (about \$12 and up) so a detector alarm in one room will be broadcast in all bedrooms. Some now broadcast up to 200 feet by radio, even farther over electric light wiring. We tested one such unit in our TV room. It set off two bedroom alarms upstairs—plus two in a neighbor's house 300 feet away!

**10. Best of all, add one of the new automatic home-sprinkler systems** now being developed. Compact new systems can be installed in the ceiling without spoiling your room decor. Firemen say you can now virtually fireproof any home with them. Cost: In a new or remodeled home, as low as \$50 a room; can also be installed in older homes, with obvious additional work. But they can help pay for themselves in lower insurance costs.

communities is Farmers Branch, Tex. (pop. 30,000), a Dallas suburb. May 3, 1975, worried by growing fire danger, Farmers Branch city fathers ordered an electronic smoke detector (ESD) program into effect. Whenever anyone moved into a house, a detector was to be installed.

There were a few protests. But these died out on the very first day of the program when fire gases killed a woman. Since then, Fire Marshal Jack Dyer estimates, ESDs have saved 10 lives. And as this is written, they have helped 13 others escape.

There's no doubt that smoke detectors, which can sense fire long before you do (see *Fire Alarm: New Home Appliance That May Save Your Life*, page 74, Dec. '76), save lives. Some states now require them in all new dwellings and apartments. And one small Pennsylvania city now actually buys them at wholesale for its citizens. In some communities there's talk of selling them for \$3 a month—added to residents' water bills.

Other safeguards may come, soon. One is home fire masks. Against the new dangers, firemen in some cities now are ordered to wear masks in

all fires. "In Farmers Branch," says Jack Dyer, "you'll see our men putting masks on while riding our trucks."

Masks and reserve air tanks now cost \$640 and up. But it's only a matter of time before home masks are available at lower cost.

### New escape systems

"There is really no reason you should have to crawl out of a window and jump, or fall or try to fumble your way to a rope ladder," one researcher says. "From now on, our building codes should require all new homes and apartments to have ladders, or escape chutes like those in airliners. Or small window-balconies reachable through doors, with drop-down ladders or poles.

Already, several new products are making escape easier. One, is Reinhard Corp.'s "life ladder." Installed near a window, it looks like a downspout—but has rungs that flip out to make it a sturdy aluminum ladder. This can be used for up to 25-foot (three-story) heights. Another is the Booth balcony, with drop-down steps, which can be installed outside any window. Others include the

(Please turn to page 208)

# Driving the '79 Ford and Lincoln-Mercury models

The once-portly Ford LTD and Mercury Marquis are the latest cars to come back from a successful, but expensive, treatment at Weightwatchers.

by Gary Witzenburg DETROIT AUTO EDITOR

PM color photos: Mark Madow



New front end on Bobcat has vertical grille bars; Pinto's are horizontal.

It isn't often that an automaker completely re-engineers two high-volume model lines in one year, but Ford Motor Co. has done just that for 1979.

Phase Two of Ford's massive resizing program (Phase One magically transformed the stodgy Maverick/Comet into the light and lively Fairmont/Zephyr a year ago) features the all-new LTD/Marquis "family-size" cars, in addition to the fresh Mustang/Capri entries I reviewed last month.

If you've had an opportunity to try a Fairmont or Zephyr this year, you know that Ford scored a home run in its first trip to the plate in the efficiency-car World Series. And if you can arrange a test drive in a '79 Mustang/Capri, and then in a new LTD/Marquis, you'll likely agree that the score is now three runs in three times at bat. Following GM by two years in its big-car downsizing effort, Ford engineers have had plenty of opportunity to observe just what makes the smaller GM models work so well, and they have hardly missed a trick in bringing the new LTD/Marquis to market.

If you are among those who have loved the big, soft, freeway cruiser school of design that has distinguished full-size Ford products in the past, you won't be disappointed in the '79 versions. They have lost

none of the roominess, interior quiet or riding comfort of the gunboats they replace.

On the other hand, if you have never been a land yacht fan and thought the big Fords have always been a study in oversize, overweight mushy-handling excess, get ready for a pleasant surprise: These new cars actually respond to a driver's inputs, and they go around corners quite briskly without scraping their door handles. They are as much a departure from the cars they replace as the excellent Fairmont/Zephyr was from its predecessor.

In short, the '79 LTD/Marquis is easily the best big car Ford Motor Co. has ever built; and if the Phase Three intermediates, the downsized luxury cars and the Pinto/Bobcat replacement come out as good . . . look out GM!

Like the GM entries, the new Ford and Mercury are more than a foot shorter and hundreds of pounds lighter than the cars they replace. All three body styles (two-door sedan, four-door sedan and four-door wagon) sit on a 114.4-in. wheelbase, which is down 6.6 in. from last year's Ford and 9.6 in. compared to the '78 Mercurys. (For styling reasons, the '79 Mercurys are still 3 inches longer than the Fords.) Yet the total interior volume (as measured by the EPA) has been increased by 1.6 cu. ft. in the four-door and a full 10 cu. ft. in the two-door. Trunk capacity is also up slightly, and the deep-well trunk floor has been retained.

## Pleasing appearance

Styling, of course, is subjective, but I found the appearance of both Ford and Mercury generally pleasing, if not very original. There's a lot of GM design character in the cars, particularly in the highline Ford front end . . . if it didn't say "Ford" on the header panel, we'd swear it was an Oldsmobile. The lower-cost Ford front is better, but the Mercury designers seem to have given to their Marquis a greater family identity with a narrower, vertical-theme grille. However, the horizontally-ribbed taillamps around back are a direct steal from Pontiac. As for the LTD's rear, if you parked one in a row of Chrysler Cordobas, nobody would ever notice. Rooflines are standard American big-car practice, with large "opera" windows in the two-door version.

The new cars' interiors range from taxicab plain to bordello plush, depending on how much you care to spend, and there is plenty of stretching-out room in all directions in both front and rear.

I don't much care for the new four-spoke highline steering wheel, which is just too small in diameter, too skinny in rim width and much too "plastic" for my taste. Either the standard wheel or the optional sport wheel is advised if you are sensitive to such things—except that you can't get Ford's speed control with anything other than the four-spoker because the controls (they have a new "resume" feature

## 1979 SCORECARD

Model	Wheelbase (in.)
Ford Fiesta	90.0
Ford Pinto/Mercury Bobcat	94.5
Ford Mustang/Mercury Capri	100.4
Ford Fairmont/Mercury Zephyr	105.5
Ford Granada/Mercury Monarch/ Lincoln Versailles	109.9
Ford LTD II/Mercury Cougar/ Ford Thunderbird	114.0 (4-dr. 118.0)
Ford LTD/Mercury Monarch	114.4
Lincoln Continental Mark V	120.4
Lincoln Continental	127.2

# '79 CARS

Mercury Marquis four-door pillared hardtop for '79 is shown at right; below is the two-door hardtop.

Base engine for both sedans is five-liter (302-cu.-in.) V8.



Ford LTD two- and four-door sedans are shown at right and above right, and the top-line Country Squire station wagon is above (Mercury's top-line wagon is called the Colony Park). Base-model wagons are available in both lines. Cargo capacity of the station wagons with rear seat folded is 91.8 cu. ft. Fuel-tank capacity is 20.0 gallons (19.0 gallons in sedans).



## LTD/MARQUIS

New dimensions and weight for '79

Wheelbase: 114.4 in.

Front/rear track: 62.2/62.0 in.

Height: 54.5 in. (sta. wagon, 56.8)

Width: 77.5 in. (sta. wagon, 79.3)

Overall length: Ford, 209.0 in.; (sta. wagon, 212.9) Mercury, 212.0 in.; (sta. wagon, 217.7)

Approx. curb weight: 3600 lbs. (sta. wagon, 3900)

this year) are built into its spokes. Also, long-armed drivers should stay away from the three-spoke sport wheel since it is more deeply dished, and Ford still likes to place its steering wheels too close to the chest for our comfort. A telescoping-column option could solve this. While we're on the negative side, we just can't understand why American interior designers continually refuse to think in terms of places to put things. Open the deceptively large glove-box door in the LTD/Marquis and you'll find a little box inside that's barely adequate for the owner's manual and a

couple of maps. Look around for some flat surface on which to rest your morning coffee cup . . . or sunglasses, or cigarets, or tollbooth change . . . and you won't find one anywhere. Now walk across the showroom and check out Ford's smallest car, the German-built Fiesta. It has a huge, bin-type glove box and a handy, sectioned parcel shelf on the dash above it—plus console bins and usable door-panel compartments in highline models. Otherwise, the new cars' interiors are attractive, contemporary and well thought out. There's a multi-function control stalk for wip-

er/washer, headlamp dimmer and horn, and the radio/heater/air controls are in a central pod (GM style) in easy reach.

One other complaint involves the restraint system: it's a modern and comfortable "single loop" design, but the male buckle end parks way up high and far behind your head, so you have to twist, reach and strain to grab it and pull it across.

### 0-60 mph in 14 seconds

I got a sneak preview and test drive of a '79 Marquis back in May, courtesy of the Lincoln-Mercury Div., and I was *very* impressed with

## HALOGEN HEADLAMPS AND HOW THEY WORK

Halogen gas acts like a magnet. As a light-bulb filament glows, it throws off particles of evaporated tungsten that the halogen gas in the bulb draws back onto the filament. In a conventional headlight, particles are deposited on the lens, causing the bulb to blacken.

There are five halogens—astatine, bromine, chlorine, fluorine and iodine. Bromine and iodine are the ones used in the production of halogen headlamps because of greater stability.

The regenerative qualities of a halogen headlamp allow the bulb to maintain the same white light output for practically the life of the lamp. A whiter light is generated than that produced by conventional headlamps, because a filament in a halogen atmosphere glows at a higher temperature, which brings up the use of quartz.

Quartz is often used in conjunction with the term, "halogen headlamp," because it refers to the composition of some halogen headlight bulbs. Since quartz won't crack under the heat created in a halogen headlamp, some manufacturers have been using an envelope made of quartz to enclose the filament and halogen element. High-temperature (hard) glass is also used.

Headlamps of cars built for use in the United States must be sealed beams. A sealed beam has bulb, lens and reflector combined into one hermetically sealed unit. Many cars built for sale in foreign countries use separate halogen bulbs and reflectors. They are not sealed-beam units.

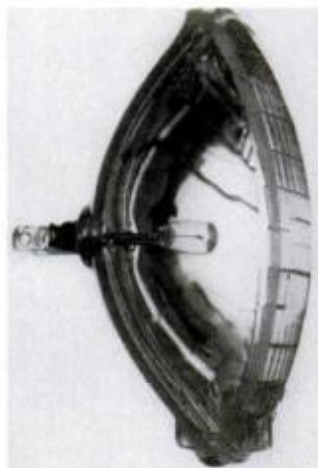
The 1979 Lincoln Versailles is the first domestically produced car to offer U.S.-legal halogen headlamps. (Ford has indicated it will change to halogen headlamps on all models by 1981.)

A big reason for using halogen

headlamps in the Versailles is to reduce weight and improve fuel economy. The Versailles headlight uses less electrical energy to illuminate the same distance. Thus, a lighter-weight alternator and battery are employed.

The halogen headlamps double the upper beam output—150,000 rather than 75,000 candlepower. Although the candlepower is doubled, the light output is increased only 25 percent. It has to do with the inverse square law—"Light output diminishes with the square of the distance."

However, light output on high beam is 10 to 15 percent more glaring than the high beam of a conventional sealed beam. If those drivers who install the halogen headlamps



**New headlamps with higher candlepower use halogen bulb in sealed unit—bulb cannot be replaced alone.**

aren't courteous and fail to dim their lights as they approach another car, there will be light fights, more blinded drivers and probably more accidents.

The halogen headlamps, which can be fitted on practically any car (Citroen is an example of the kind of car that's the exception), will be available in round or rectangular shape. They will cost "several times" the price of regular sealed beams.

No price is set yet, but one source says it will be three to five times the price of conventional lamps. For the extra cost, you get more light, which is great if you drive a lot in rural areas. But there is no advantage to having halogen sealed beams on a car driven mainly in town.—Mort Schultz

Photos: General Electric Co.



**Standard high beams illuminate a road (left) and new halogen the same road (right). Ahead 300 feet is a man-size cardboard cutout and more cutouts every 100 feet, out to 900 feet. Increased reaction time at the wheel is apparent.**

the car's driving character. It was a standard Marquis equipped with the base 302-cu.-in. V8 (with Ford's variable venturi two-barrel carb) and the supertall 2.26:1 standard rear axle. Even so, it moved along quite respectably, recording 14-second, 0-60-mph times with two aboard and cruising quietly and comfortably at well over the national speed limit.

Our test preprototype was not equipped with the new optional handling package (higher-rate springs, shocks and front sway bar, police-package rear sway bar, larger wheels and tires), but even in its base form it cornered flatter and with more axle control on rough surfaces than any other big Ford product in recent memory. The power steering was neither too quick nor too light and it did provide good feedback through the steering wheel in every maneuver we tried.

Well . . . almost every maneuver. Attempting a tight slalom test the engineers have been using to develop their Mustang/Capri suspension, we found ourselves spinning the wheel too quickly for the power assist to keep up. But I don't anticipate that many LTD/Marquis owners will be entering the local parking-lot gymkhanas.

On the handling course and skid pad, the big Merc acquitted itself well, with a lot of noise from the front tires but no more understeer than necessary for safety at the limit of adhesion. On the other hand, the brakes (at least on that car) could stand some improvement. The rears locked up and slid too easily in simulated panic stops, and there was noticeable fade after only a couple of fast 60-mph stops with two aboard.

### New suspension design

Engineering features include much usage of computerized structural analysis and design and lightweight materials to keep the weight down, plus a new (for Ford) suspension design using twin "A" arms in front, a four-link, live-axle rear and coil springs all around. Also, all Marquis and California-bound LTDs with the optional 351-cu.-in. V8 will get Ford's very sophisticated new electronic engine control (EEC II) which uses a three-way catalyst and electronic feedback to the carburetor (Volvo's Lambda Sond) to monitor and control various engine functions. This is a preview of things to come in high-economy, low emissions engine control for the 1980s, and Ford has high hopes for it.

Finally, both heating and aircon-



Lincoln Versailles' big change on top is new roofline with half-vinyl treatment and wrapover molding; in rear, padded-vinyl deck lid insert; up front, halogen headlamps.

ditioning systems have been improved over '78, and the cars' body shapes have benefited from more than 270 hours in the wind tunnel for most aerodynamic efficiency.

New options are mainly in the entertainment system area: a slick electronic search-tune stereo radio with quadrasonic tape, an ultrafidelity sound system with high-output amplifier and special speakers, stereo radio with cassette tape, 40-channel CB and power antenna; plus dual reclining seatbacks for the "flight" bench seat, the handling suspension mentioned earlier and a new electronic digital clock with time, date and elapsed-time functions.

### Mustang and Capri

As for the rest of Ford's '79 lineup, we've already covered the Mustang/Capri at length in the last issue (see page 82), and there's

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**For maintenance and service tips for '79 Ford-Linc-Merc models, see Saturday Mechanic, page 12.**

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little but detail changes to report in other car lines. You'll recall that the Mustang/Capri is a very nice sporty spinoff on the efficient Fairmont/Zephyr chassis, with engine choices ranging from a 2.3-liter four-cylinder through a 2.8-liter V6 to a 302 V8 and even a turbocharged 2.3-liter Four. There's a handsome notchback and a three-door hatchback Capri for Lincoln-Mercury. No question: the Fairmont/Zephyr is the best compact and the LTD/Marquis the best big car; the Mustang/Capri is the best sporty car from Ford since the original Mustang 15 years ago.

### Pinto and Bobcat

The aged subcompact Pinto/Bobcat gets new front styling and taillamps for its second-last year be-

fore replacement by a more efficient front-drive design; and at the other end of the scale Lincoln's compact-luxury Versailles gets an extended, squared-off (Seville-like) padded roof to make it look less like the Granada/Monarch it's based on, plus the industry's first use of standard-equipment halogen headlamps. Granada/Monarch itself benefits from some interior and exterior trim changes, including a smooth-looking two-tone paint treatment, addition of an electronic voltage regulator and a four-speed manual overdrive as base transmission.

### LTD II, T-bird and Cougar

Enjoying its last overweight year before downsizing, the intermediate LTD II/Thunderbird/Cougar also gets the maintenance-free electronic voltage regulator, plus revised grille and taillamp themes for T-Bird and Cougar XR-7 and a new optional 27-gallon fuel tank for a bit longer range between gas stops if you don't mind \$20 fillups.

### Fairmont and Zephyr

Fairmont/Zephyr, which was light on option availability at its introduction a year ago, has been making up the distance with the addition of power seats, windows and door locks and a clip-up removable Moon-roof to its option list during 1978. New available equipment for '79 includes speed control, tilt steering wheel, "performance" instrumentation and an electric decklid release. Also, Ford's four-speed manual overdrive transmission is now standard with the optional 200-cu.-in. Six and 302 V8 engines.

### The Continentals

Finally, both the Lincoln Continental and Continental Mark V luxury cars will now be available in very special Collector's Series, for those collectors who may have missed out the first time dinosaurs became extinct. **PM**

# 5 ways to stretch

New tents and techniques mean extra action afloat.

by Bill McKeown  
BOATING EDITOR

Now you can turn the off-season on with weather protectors that make any boat a cruiser. Autumn, when the water is still warm and the crowds are long gone, provides



Add aft canvas navy top to hardtop of Cruisers' Barnegat 22 (above), and the shade is fine for midday fishing. Zip on curtains (right) for breezy evenings.



PM photos: Lorraine McKeown

**1** The action doesn't end on Labor Day up North once you have the right boat and gear for local conditions. For bigger seas, a larger cabin boat like Cruisers' Barnegat 22 is better. Built in Oconto, Wis., it has a deep-V hull by Jim Wynne, best known of the offshore performance-powerboat designers. Its bottom shape cuts waves instead of pounding and smashing through them. The rig we tested mounted an OMC sterndrive with characteristic extra high tilt-up so the boat can be run up on a beach easily.

A navy top extended back from the hardtop keeps cockpit anglers dry. Side curtains protect against chill autumn winds and add an extra cabin for sleeping a family or fishing party aboard.



Aboard a 19-foot Camper-Craft outboard, two couples or a family can cruise in comfort (right) or enclose cockpit between two cabins (above) for overnight.

**2** The Camper-Craft (3000 Biscayne Blvd., Miami, Fla.) may be the most compact cruiser afloat. A center cockpit divides bow storage from an aft cabin sleeping two. Midship seats can be extended to sleep two more. A 12-gallon water supply, 40-gallon fuel tank, head and storage compartments make this easily trailerable 19-footer an overnigher with the performance of a runabout. Consider



er it for fast passages along off-season waterways. Previewing two 1979 55-horse Johnson outboards, we got speeds well over 30 mph.

When the cruiser is buttoned up with full canvas, headroom and visibility are restricted for driving but enough for camping at anchor.



Even an open runabout, like Glastron's SSV-188, can carry canvas to ward off autumn winds, Pop-Tent for use ashore.

**3** Glastron's versatile SSV-188, a bowrider runabout from the noted Austin, Tex., builder, can launch quickly almost any month of the year, thanks to a seakindly hull and weather-deflecting options. Pick this model for exploring sheltered waters.

Windshield and convertible top help bounce away spray when the waves kick up. Using Evinrude's new 140-hp V4 engine for 1979, this model showed the performance that should get you home ahead of a threatening fall squall. Canvas

# your boating season

some of the best days and nights for boat camping. And when winter comes, trailer your rig south for a vacation where you can use the same system for more fun afloat.

To test our season stretchers, we picked hulls from backpack to sleep-a-crew-aboard size. The craft below were designed for on- and off-shore fishing, water skiing,

exploring the shallows and crossing deep water.

Family's total supply of fishing tackle, life jackets, wet wear and sleeping bags fits in two duffel bags.

End-of-season fishing can continue even after the leaves have fallen with an inflatable pack raft (left) plus tent and gear that stow into a Camp Trails pack.

**4** Bring-along boats can make any warm day suitable for going afloat. Equipment includes a large backpack, small inflatable dinghy or kayak, sleeping bag and mattress, life vest, shelter or tent, regular camping equipment and supplies plus (probably) fishing tackle. Early and late months, before the crowds arrive and after they leave, are often the best of times for angling, hiking and exploring by small boat.

Select clothes suitable for changeable weather and pack along an oversize poncho. This is required to cover both the hiker and backpack as well during a rain. Keep a checklist of items carried plus those you often wish you had along. On a trip, you quickly know which gear you can do without and which is essential.

Try this kind of boating with a companion or two for safety. Wilderness hiking and boating can take you far from help in an emergency.

PM photos: Jerry Latado



With a backpacking tent pitched on the beach and sunlounger seats stretched in cockpit, Glastron sleeps four or more.

can enclose the cockpit, and the sunlounger seats extend out to make a pair of bunks—with even more space on the cockpit deck for kids in sleeping bags. But now so many beaches are nearly deserted that we found it easier to tie up ashore and pitch a Pop-Tent cabana or backpacker tent.

An ice chest can hold a weekend supply of food; use another chest for waterproof storage of warm clothes and foul-weather gear, sleeping bags and air or foam mattresses.



Hydra-Sports 2100 CC center-console high-performance offshore fisherman of Kevlar can carry tent for beach camping.

**5** The offshore open fishing boat was not designed for cold-weather runs and camping out. A rugged deep-V model, however, like the deep-water 2100 CC made of extra light and strong Kevlar 49 aramid, from Hydra-Sports, 1011 Kirkland Ave., Nashville, Tenn. 37202, is designed to take the choppy conditions that autumn weather may stir up.

Rated for big horsepower and a one-ton load, this model can handle the largest outboards in open seas. We tested it with the new Evinrude 235-hp mill for next year and found it fully maneuverable in rough going. Pack a tent and gear in the forward cuddy and camp ashore on any deserted beach. **PM**

PM photos: Jim Jost



# PM'S YEAR-ROUND VACATION HOUSE:



## Lots of good living at low cost

The average cost of a new house has soared to \$60,100. Yet, by combining innovative design and current technology, PM has developed an attractive vacation home you can purchase for \$35,000 or less!

by Harry Wicks  
HOME AND SHOP EDITOR

**T**he charming three-bedroom house shown on these pages was created by Popular Mechanics and Armstrong Cork Co. to fill the prime need in today's housing market—a highly livable, full-feature home at an affordable price. Our finished product is a one-story contemporary-style dwelling that boasts 1378 sq. ft. of living space and can be erected for approximately \$23 to \$26 per sq. ft., depending upon local market conditions.

In addition, we added PM's own "how-to" touch. We designed a group of handsome additions for the Vacation Home that you can easily put on your present home if you want better living without moving. We'll show how to build the carport, decks, storage built-ins and lots more in a series that begins in this issue. These



The exterior of the PM leisure home is Grand Canyon textured hardboard siding by Masonite. The front entry is greatly enhanced by the do-it-yourself deck and step project.





Elegance of our home belies the fact that it was factory-built. The optional carport is a project that you can add any time after you move in. For how to build this carport, see page 109.

Interior designer's clever solution to sports-gear storage problem—"Hang it on the wall and let it work as a wall graphic." Plans for this will appear in an upcoming issue.

Dining area, on same level as the kitchen, uses space wisely. Living room (below) is one step lower. View toward fireplace reveals the handsome kitchen that includes a snack bar.





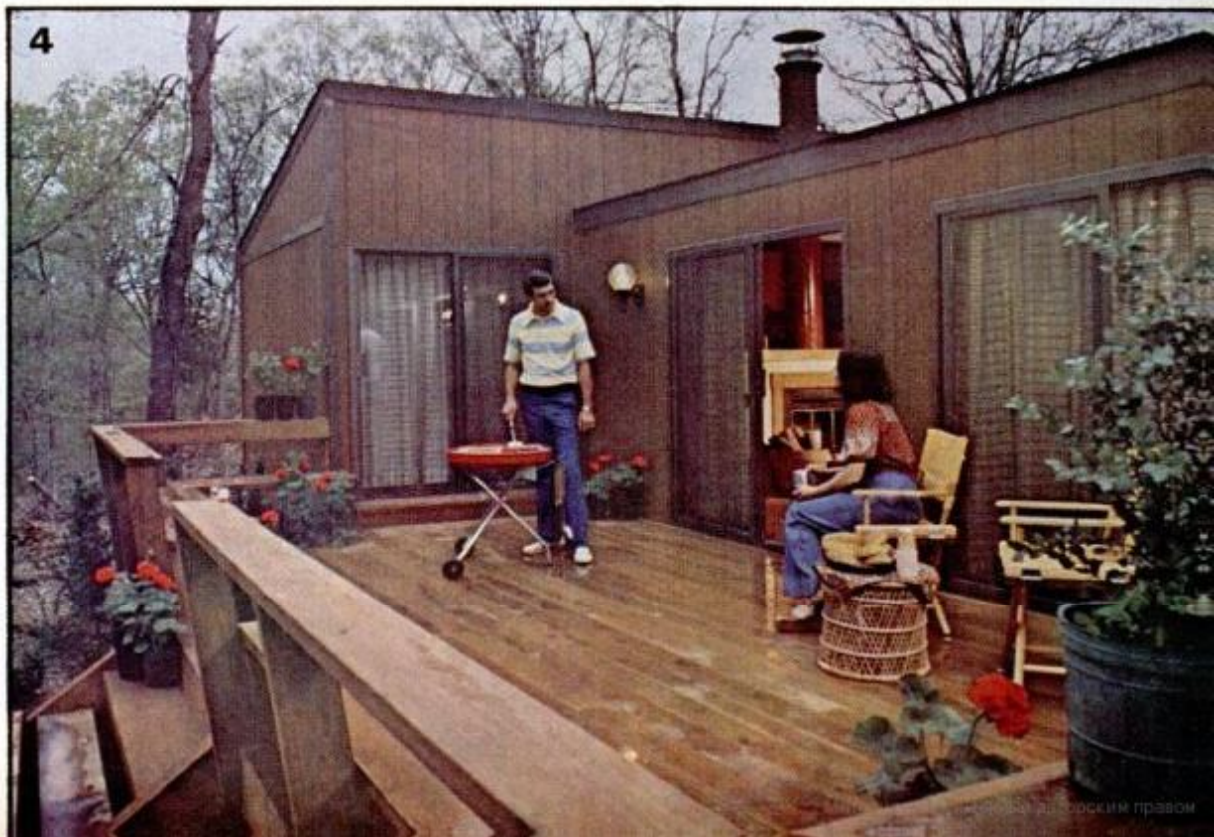
add-ons are *not* included with the basic, ready-to-live-in house.

To get the project rolling (more than 18 months ago) we commissioned award-winning architect Ira Grandberg, AIA, to come up with a new approach to putting together a factory-built house. It was apparent shortly after we started the project that factory construction could be the key to producing a lot of house for a low price. But, a house must look appealing. Thus, the challenge we posed to Grandberg was to create a factory-made house that didn't look like one.

The results, after a year and a half of meetings, planning, cost factoring and the like, are shown here. The architect successfully achieved a *new look* in manufactured housing by a) erecting the house in two levels instead of one, to emphasize the custom-built feeling, b) abutting the modules in nonconventional fashion so as to create a dynamic arrangement of roof lines outside. For good measure, PM and Armstrong then worked to create nu-



Our bedrooms suit specific family requirements: 1. Master bedroom assures privacy for Mom and Dad, has a private bath and sliding door to rear deck (see floor plan). 2. Second bedroom is designed for today's young woman. 3. Ski-Trek bedroom is intended for boys and/or friends in for ski weekends. Room sleeps three because it includes a triple decker bunk-bed (plans will appear in October PM). 4. Spacious railed deck at rear extends family living space to outdoors. Access to deck is via sliding doors from dining and living rooms as well as master bedroom.



merous home-built projects that can be added any time—as budget allows—after you move in.

The concept might have been just a dream unless a manufacturer with imagination was found who would be willing to invest in the prototype by running it down the factory assembly line. Fuqua Homes, Inc. readily accepted the challenge after viewing Grandberg's design. Finally, in May of this year, the prototype home was erected at Tan-Tar-A Estates in Osage Beach, Mo.

### About a factory home

Our home is available through nine regional Fuqua divisions; it will be offered by more than 40 dealers. For a complete list of both dealers and divisions write to the manufacturer at the address listed below. The delivered price includes normal setup, carpeting and ap-

*(Please turn to page 196)*

### CREDITS

**Interior design:** Armstrong Cork Co., Lancaster, Pa. 17604.

**Builder:** Fuqua Homes, Inc., Dept. PM, 7100 South Cooper, Arlington Tex. 76017.

**Developer:** Tan-Tar-A Estates, Inc., Osage Beach, Mo. 65065.

**Coordinators:** Robert McKowen, Armstrong, and Harry Wicks, PM.

**Architect:** Ira Grandberg, AIA.

**Interior decoration:** Nancy Gilbert, ASID, Armstrong Interior Design Center.

**Factory technical consultant:** Robert Brooks, Fuqua Homes.

**PM color photography:** Richard Garland.

**PM black and white photography:** Leon Lopez.

### SHOPPING INFORMATION

**Resilient floor covering:** Tredway by Armstrong Cork Co.

**Carpeting:** Evans and Black carpet by Armstrong—Living room, "Pembroke", Master and second bedrooms, "Informality", Ski-Trek room, "Edgemont carpet squares."

**Ceilings:** Amarillo Caliber Phase 5, Armstrong.

**Interior walls, siding:** Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606.

**Roof shingles:** Bird & Son, Inc., East Walpole, Mass. 02032.

**Countertops:** Wilson Art, 600 General Bruce Dr., Temple, Tex. 76501.

**Appliances:** General Electric Co., 2100 Gardiner Lane, Louisville, Ky. 40205.

**Fireplace:** Preway, Wisconsin Rapids, Wis. 54494.

**Furnace:** Coleman Co., Inc., 250 North St. Francis, Wichita, Kans. 67201.

**Sports Equipment, Clothing, TV:** Sears, Roebuck and Co., Chicago, Ill. 60684.

**Snow shoes:** Vermont Tubbs, Inc., Forestdale, Vt. 05745.

**Furniture shown includes:** Founders upholstery and Huntley and Armstrong casegoods—all from Thomasville Furniture Ind., Inc., Box 339, Thomasville, N.C. 27360.

## HOW THE PM HOME WAS CREATED

Until Popular Mechanics coordinated the design of this house, the typical impression of a mobile home was that of a shiny rectangular cube being hauled down the road behind a truck. And that conception wasn't far from wrong. Many mobile homes lack the design features that buyers in the market for low-cost housing are seeking. But PM's vacation home design dramatically changes the picture. And as is shown on these pages, it's proof that a lot of handsome house can still be factory-produced at considerably less cost than an equal-quality, "stick-built" dwelling. Though our home is loaded with innovative ideas and top-quality products, it can be built for approximately \$25 per sq. ft.—or less if your building site is especially convenient to one of the manufacturer's plants.

The secret is that the house is entirely built in a

to heat the home quickly upon entering, and then turn down the unit serving the area that isn't being used.

The home is covered by a one-year manufacturer's limited warranty against defects in material or workmanship. Protection is also provided against structural defects for three years through a homeowner's protection plan offered by the manufacturer. For where you can see the PM Home, [please turn to page 196.](#)—H.W.



Prototype home was built in Fuqua's Boonville, Mo., plant. Above, walls are finished in first section—kitchen, dining Ski-Trek bedroom. Left, hauling first two sections. Below, at site in Tan-Tar-A Estates, Osage Beach, Mo., wheels are removed, sections lowered onto foundation.

factory and then hauled to your site for erection and assembly. The price includes delivery and setup—as well as carpeting and appliances. Though the PM Home consists of four sections, clever architectural design arranges for hauling on just three trailers, cutting trucking costs by 25 percent. Once the units arrive at the job-site they are lowered one at a time onto foundation walls that have been erected to meet maker specifications.

The home is designed to comply with the federal standard for mobile homes, established by the Department of Housing and Urban Development (HUD) to assure conformance to exacting materials and construction requirements. State codes for mobile homes vary slightly, so Fuqua Homes engineered the PM Home to meet the strictest criteria, thus making it acceptable to all state codes.

An important energy-saving feature designed into the PM Vacation Home is the zoned heating system which provides for two separate forced-air units, situated to serve different parts of the house. This means that the homeowner can turn on both systems

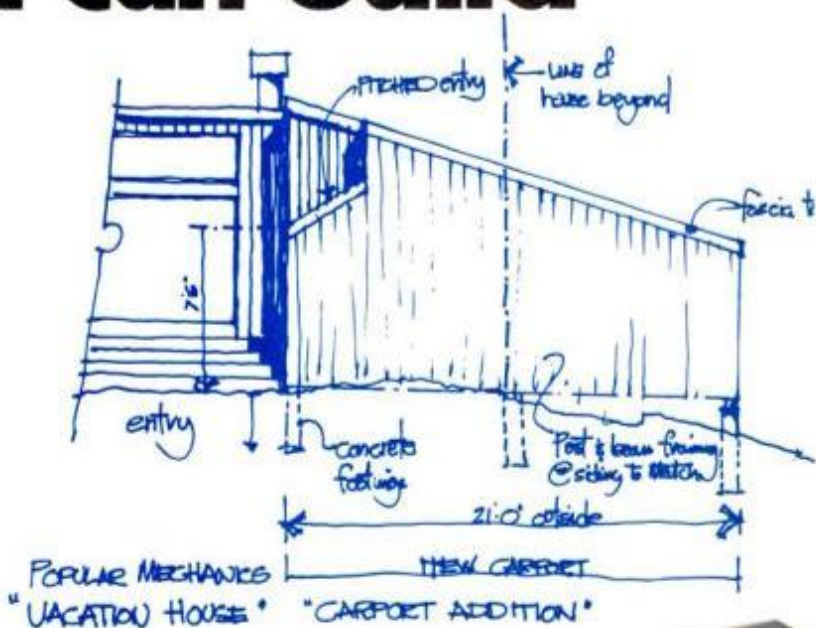


# Great storage ideas and a carport you can build

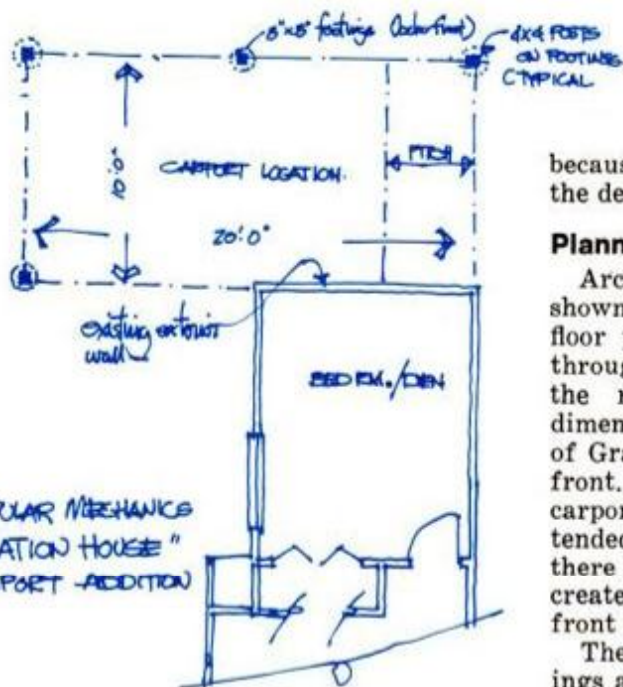
This month PM starts its home carpentry series of super projects from our Year-Round Vacation Home.

by Harry Wicks HOME AND SHOP EDITOR

Once the basic guidelines were established for the PM Vacation House—good looks, good living and low cost—we knew one of the surest routes to success would be to include a number of features that PM readers could duplicate themselves. Happily, all of the good ideas aren't exclusive to the owners of the PM house; you can build them for your own home



Addition of a carport to PM's Great Value Vacation Home dramatically increases the dynamic visual interplay of the roof lines—see sketch of architect (top right). Carport construction is of conventional framing and box is attached to the house as seen at the right. The carport can be adapted to any contemporary dwelling.



because PM's Home Carpentry series will give the details in the months ahead.

## Planning a carport

Architect Ira Grandberg located the carport shown at the front-right of the house (see the floor plan at the left). Access to the house is through the front door and the offset created at the rear adds an interesting architectural dimension to the exterior. An important feature of Grandberg's design is the roof setback at the front. Without this break in the plane, the carport's front plane would have simply extended one of the house planes. With the break there is a dynamic interplay of roof lines to create interest and to direct your eye to the front deck and entry.

The carport shown is built on perimeter footings and a floor slab. It costs about \$1150 if you do the work yourself. You can cut costs by

approximately \$400 more if you install just the footings for the walls to set upon, and use gravel on the floor. The concrete slab can always be added later. Standard framing is used.

Make certain that the wall between the house and carport is finished to meet your local code requirements for fire safety. In more areas a double layer of 1/2-in.-thick plasterboard will do. Check this with your local building department.

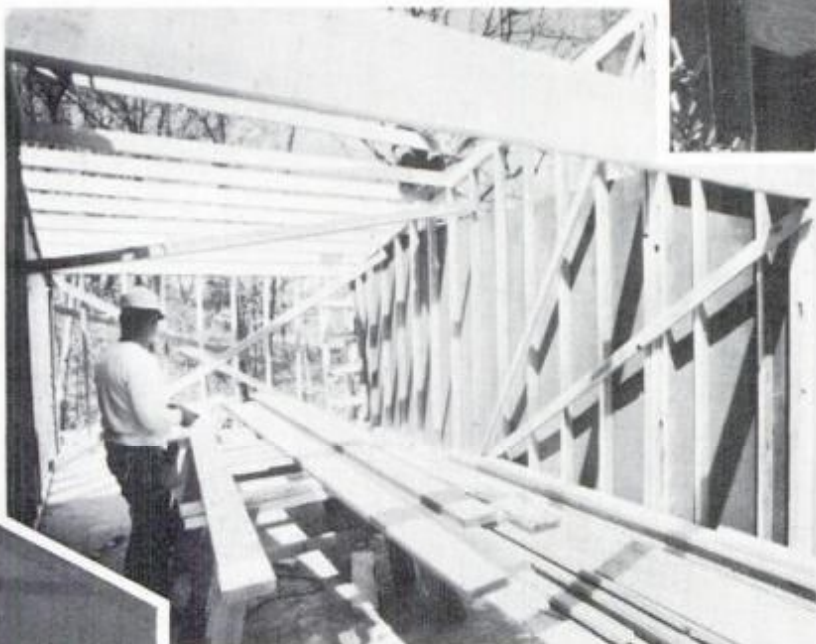
The outside of our carport is finished with Masonite siding and Bird shingles to match the house proper. The inside walls are of Sheetrock.

### Two great storage ideas

These are particularly clever because they stand in full view—thus the space that would



Wall framing is held plumb with temporary diagonal bracing until framing is in and walls covered both sides.



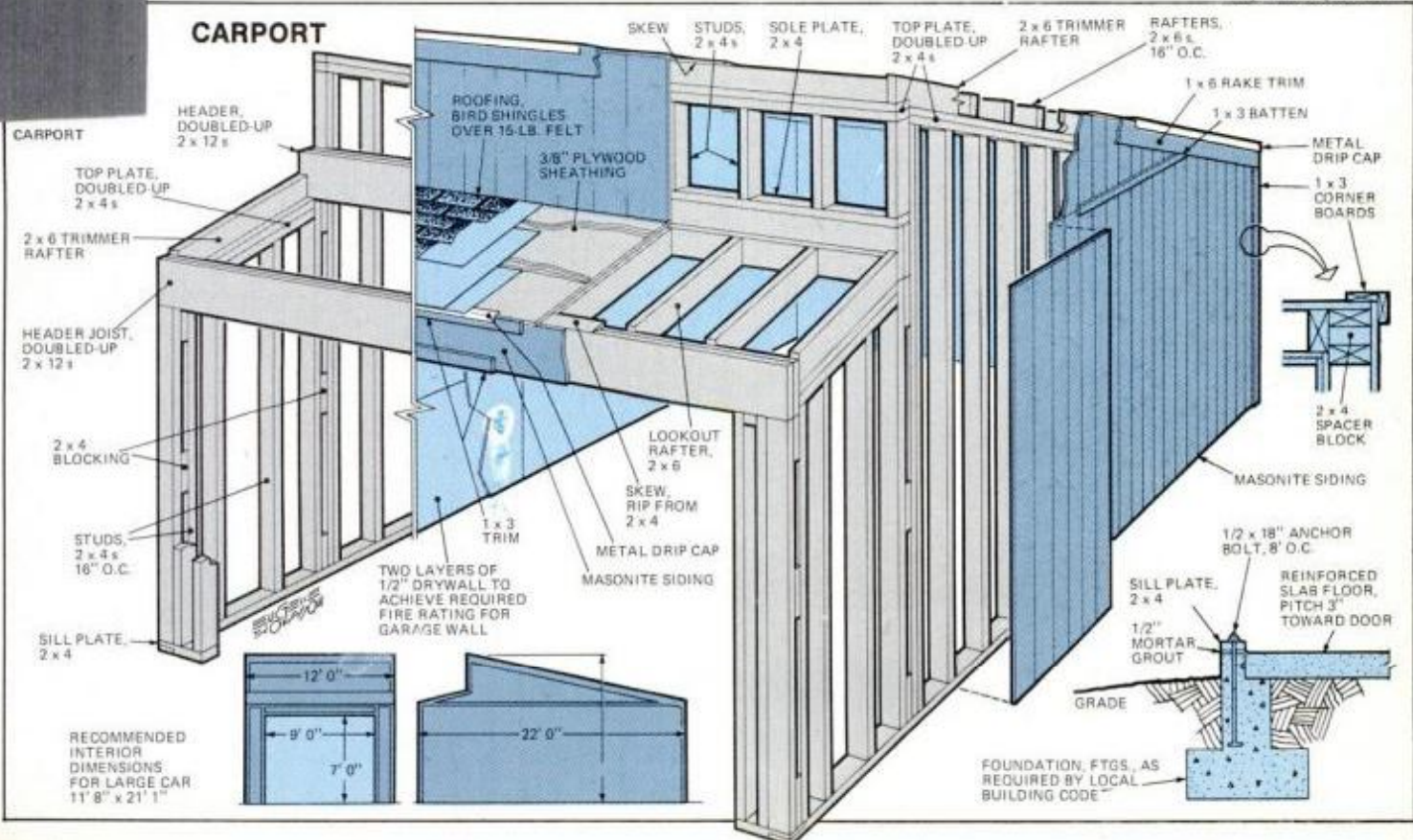
Standard framing in carport includes 2x6 rafters installed across the shorter span to simplify erection.

ordinarily go unused is used wisely, and with flair. The entry hall in the PM vacation house is of generous width so there is no inconvenience caused by placing the units as shown in the photos. Before building either one for your own home, do check the areas where you want to use it, in order to make certain that passage is not impeded.

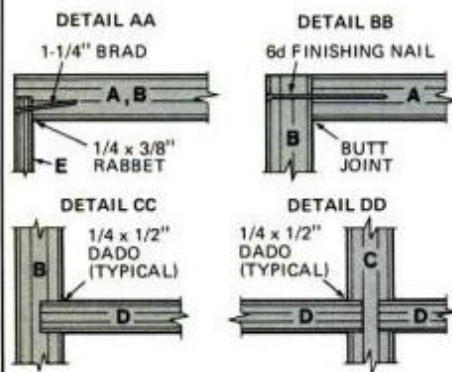
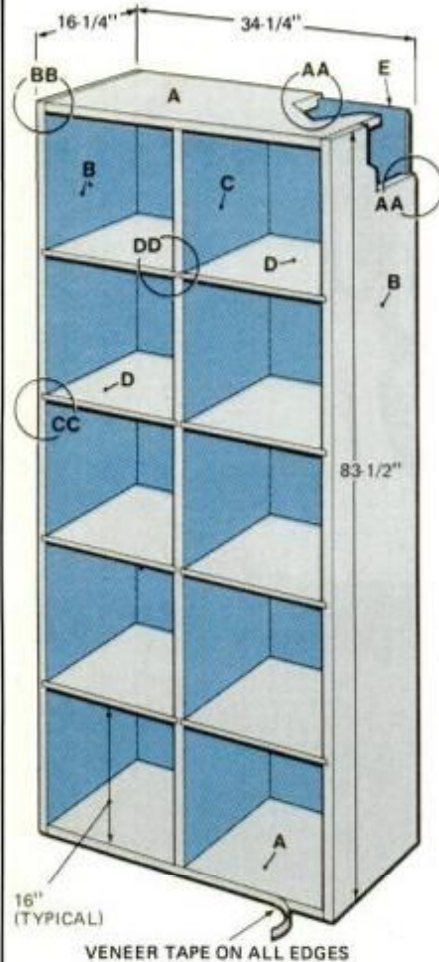
### Boot cube

Basically the cube is a rectangular box divided into equal-size storage compartments. There are no exotic woodworking techniques involved in its construction. Use either A-D

PM photos by the author



## BOOT CUBE CONSTRUCTION

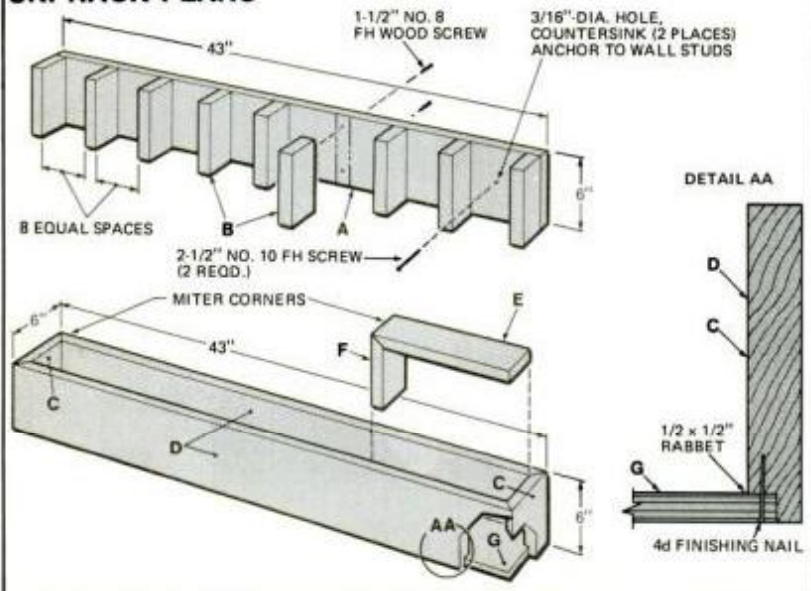


Entry hall—looking toward Ski-Trek Room—focuses on pair of easy-build storage racks. Designs by Nancy Gilbert, ASID, Armstrong Interior Design Center.

plywood or particleboard to build the unit; the plywood will hold nails better while the particleboard will provide a smoother finish for paint.

Start work by cutting all pieces to size, then carefully lay out the pieces for grooves, dados and edge rabbets. Plough the grooves with your router and the appropriate cutters. Assemble the unit with finishing nails and white glue.

## SKI RACK PLANS



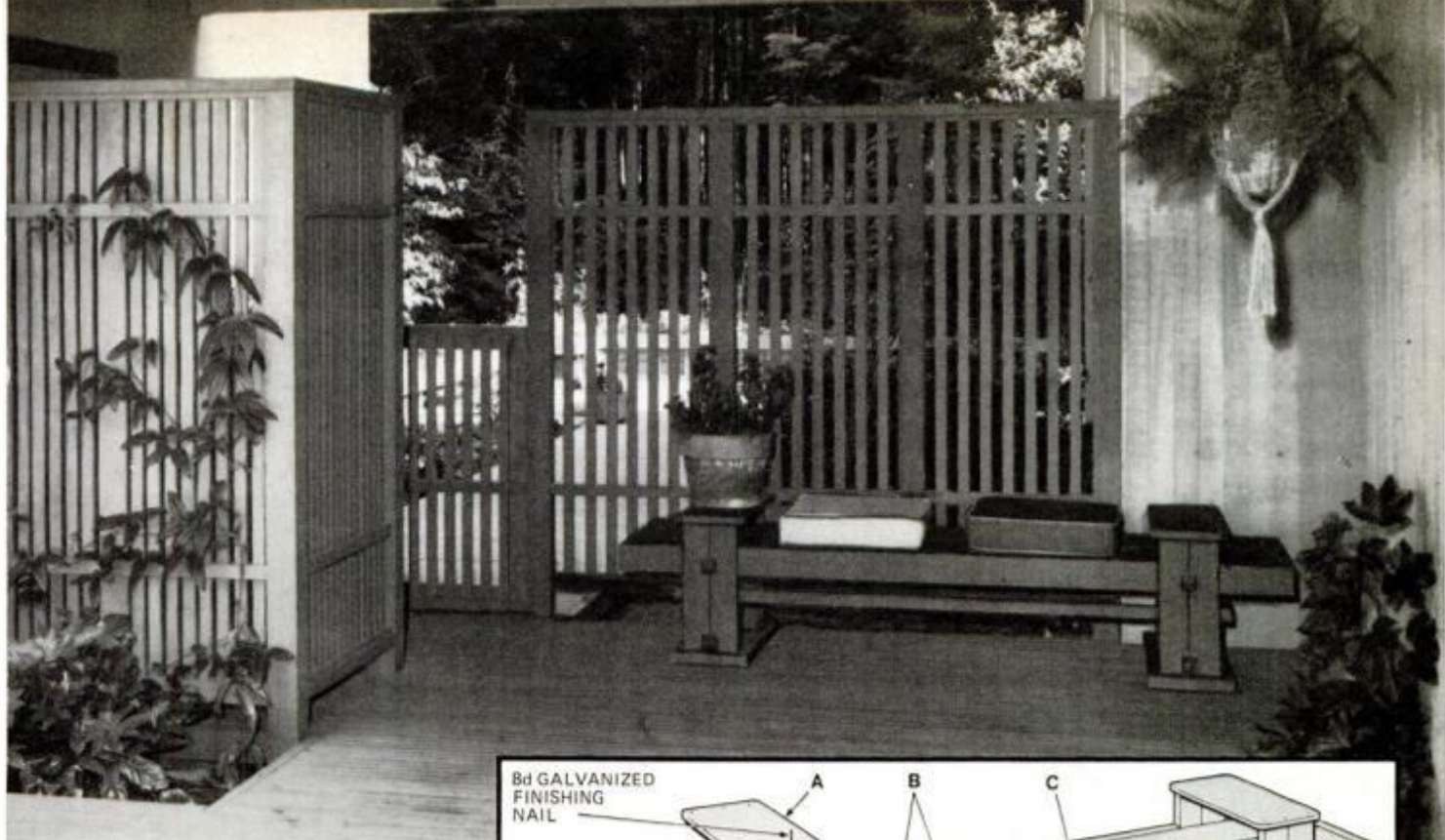
### Ski rack

This rack will conveniently store your family skis in full view where their looks can be appreciated. Cut parts for both the top and bottom sections to size and lightly mark each with a code letter to avoid a mixup before assembly. Lay out the panel for the top section and attach the divider blocks with screws and glue. Complete the bottom section as detailed at left.

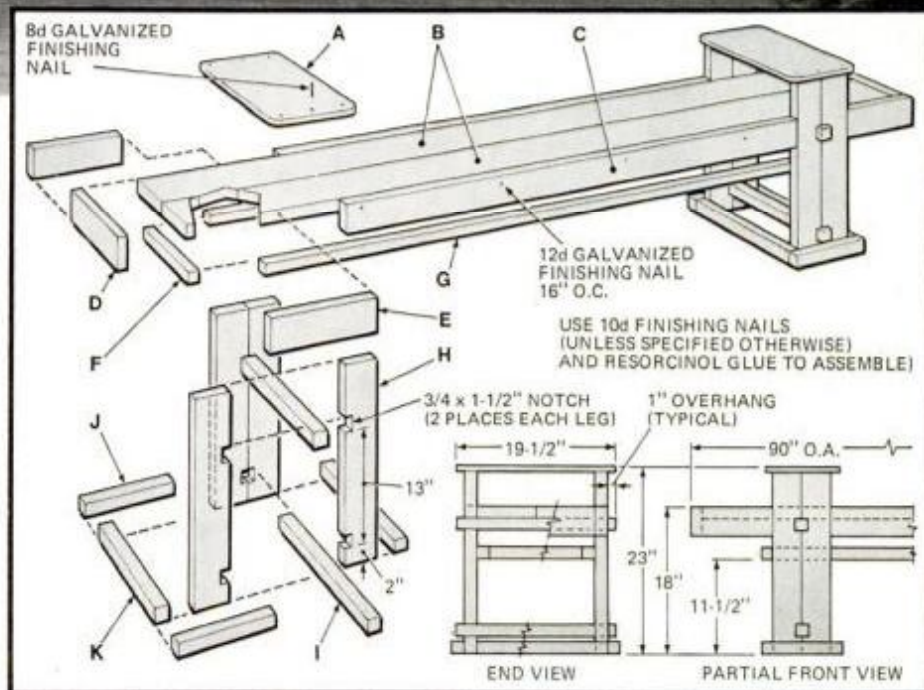
### General directions

If you sand all parts of the ski rack smooth before you assemble the job, it will go a lot faster—and turn out better.

After assembly, dust off the pieces, wipe with a tack rag and prime-paint all of the wood members. Allow the ski rack to dry 24 hours and finish with semigloss enamel.



# Build this bench for your patio



The clean lines of this contemporary patio bench harmonize perfectly with almost any outdoor setting. The seat is a welcome addition to a shady corner of the patio, or a pleasant spot overlooking your garden. The shelves atop its bench legs can be used to display potted green or blooming plants.

Douglas fir was used throughout in this bench design from Western Wood Products Assn. Or you may choose to use a western pine with its handsome wood grain.

## Bench construction

Except for the notched crosspiece and leg joint, all joinery is with butt joints. Assemble the bench with galvanized finishing nails and waterproof glue. Face-nail all parts,

countersink nails and fill depressions with wood putty.

Begin by cutting the leg and shelf pieces (A, H, J, K); cut notches in legs for the crosspieces (I). Clamp and glue the leg verticals (H). Then nail the leg finishing pieces and glue the crosspieces in place. Do not attach the shelves until after the bench seat is in position.

Cut the lower rail (G) and end parts (F). Space the legs as needed then glue and nail the lower rails in place.

The bench seat rests on the leg crosspieces. Cut and assemble the seat parts (B) and end edging (D, E) on the ground. (Note: A slight space between bench slats allows rainwater to drain.) Test fit the bench before you drive nails

home. After you have positioned the seat you can cut and nail the rest of the edging (C). Nail the shelves in place.

Finish with an oil-base preserving stain. Bright pillows will add extra color to the bench. **PM**

## MATERIALS LIST—PATIO BENCH

Key	Pcs.	Size (use)
A	2	3/4 x 9 x 19 1/2" (shelf)
B	2	1 1/2 x 7 1/4 x 87" (seat)
C	2	1 1/2 x 3 1/2 x 56" (edging)
D	2	1 1/2 x 3 1/2 x 14 1/2" (edging)
E	4	1 1/2 x 3 1/2 x 10" (edging)
F	2	1 1/2 x 1 1/2 x 13" (rail)
G	2	1 1/2 x 1 1/2 x 73" (rail)
H	8	1 1/2 x 3 1/2 x 22 1/4" (leg, vertical)
I	4	1 1/2 x 1 1/2 x 19 1/2" (crosspiece)
J	4	1 1/2 x 1 1/2 x 10" (leg piece)
K	4	1 1/2 x 1 1/2 x 17 1/2" (leg piece)

Misc: 8d, 10d and 12d galvanized finishing nails; resorcinol glue; wood putty.

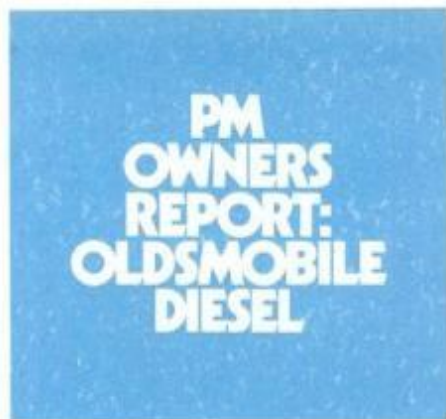
It's the best thing since the electric toothbrush," beams a Minnesota chemical counselor. "My Olds 88 diesel coupe gets 28-plus miles per gallon on the highway, takes cheaper fuel, needs no tune-ups, and has no smog controls. And I like the sound of it!"

A Mississippi farmer adds, "I just like the fact that it's a diesel. Once it starts, it goes—no miss, no skip, no stall. The shop boys are bound to go crazy. They won't be able to find plugs, points, carburetor, nor smog stuff to blame for poor performance."

And a California aerospace engineer observes, "Overall, I see the Olds diesel as a car that's superior to the Mercedes 300D.



Oldsmobile's 350-cu.-in. V8 diesel is derived from the 350 gasoline V8.



### A NATIONWIDE SURVEY OF 2,366,571 OWNER-DRIVEN MILES

Anyone who buys a 300D just hasn't bothered to compare. Olds has built an obvious winner."

It takes a special person to buy a diesel automobile. Not just anybody owns and drives one. People who do have usually thought long and hard about their purchase.

Retirees make up the largest single category among the 1000 Olds diesel owners we surveyed for this report: 16.3 percent. So it's definitely not a young person's car.

Salesmen—particularly traveling salesmen—constitute the next

largest group: 12.0 percent of our respondents. They're followed in turn by executives and managers (6.3 percent) academicians (6.3 percent), engineers (6.0), medical people (5.3), and mechanics (also 5.3 percent). Almost as well represented are farmers, small businessmen, contractors, real estate brokers and truck drivers.

Are these diesel owners happy with their choices? Obviously so, because a record 97.4 percent told us they'd buy another Olds diesel next time around. That's a record in the annals of PM Owners Reports and an enthusiastic endorsement that beats anything we've seen in years.

A retired California broadcaster notes, "My previous car was a 300D Mercedes five-cylinder. It was underpowered. The Olds is 50 percent better on power and 50 percent better on price."

"I bought this car," says a Minnesota salesman, "to get small-car economy in an affordable, family-sized sedan. I figure the Olds will need less maintenance, fewer tuneups, and will be worth more when I trade."

A Michigan charter boat operator: "Having owned a Peugeot 504 diesel, I'm fully sold on diesel economy. However, I wouldn't

BY MICHAEL LAMM WEST COAST EDITOR

A little lower noise level is the wish of the more critical owners

## Ecstatic over their diesels, Olds owners, in record numbers, would buy another



Fuel tank holds 27.3 gallons for cruising range over 600 miles

Photos by the author

Olds Custom Cruiser diesel joins Peugeot as diesel wagon. To come: Mercedes 300TD





Owners say Olds achieves full-size car comfort with subcompact economy.

own another foreign car on account of lack of service outlets," and he adds, "... there has been some comment on the noise of a diesel. I find nothing objectionable."

Economy of operation ranks No. 1 among owners' specific likes. A field sales engineer for a Michigan switch company says, "I pick the self-serve stations where I pay 53.9 cents a gallon for No. 2 diesel fuel."

A Georgia restaurant franchiser: "We put 40,000 to 50,000 miles a year on our cars and have been trading every year. But with this diesel, we hope to get 150,000 to 300,000 miles."

An Iowa engineer figures, "The diesel engine option's true cost pays for itself in 15,250 miles when compared with a similar Olds 88 with a conventional V8. I get about 20 mpg in town and 30 on the highway and spend less on maintenance."

Two traditional diesel handicaps are noise and power—too much of one and too little of the other. But neither drew many complaints this time. Only 12.1 percent of our respondents mentioned noise, and a mere 4.2 percent voted for more horses.

An Illinois school business manager mentioned, "On the topic of power, I was disappointed to

## Engineering a winner

Oldsmobile took its 350-cu.-in. V8 and completely reworked it for diesel duty. Almost no components of the gasoline engine interchange.

To handle the 22.3:1 compression ratio, the diesel V8's beefier crankshaft uses half-inch-wider mains. Bearing support webs have been filled in. Oil capacity is 7.5 quarts instead of the usual four. The block, pan, crankshaft, pistons, rods, cam, and everything topside are unique to the diesel. And it weighs 111 pounds more than the gasoline V8.

Olds hoped to deliver 100,000 diesels during 1978 but has had problems with suppliers. Thus there's a backlog of orders. Some 45 percent of Olds diesel production goes to Chevrolet for installation in pickups.

Oldsmobile has done lots of development work to rid the diesel of its "truck" reputation. Extensive sound deadening, an automatic glowplug system, auxiliary hydraulic pumps for vacuum functions, twin batteries and an oil cooler in the radiator header tank are among its nuances.

The diesel adds \$800-\$1000 to the price of a new Oldsmobile, depending on series. It's available in the Olds 88, 98, and Custom Cruiser wagon. The Olds diesel is now available in the Cadillac Seville, and a smaller, 260-cu.-in. V8 diesel is in the works.

learn that we could not tow even a small trailer without violating our warranty. I hope Oldsmobile will soon build a diesel sedan with a standard transmission capable of pulling a recreation trailer."

A Delaware industrial equipment serviceman: "The Olds has very

*(Please turn to page 202)*

## SUMMARY OF 1978 OLDSMOBILE DIESEL OWNERS REPORTS\*

<b>Total miles driven</b> 2,366,571	<b>Fuel mileage</b> 7.3	<b>What type of trouble?</b>	<b>Age distribution of owners:</b>
<b>Average miles per gallon</b>	<b>Dealer service</b> 7.0	Oil leaks 32.2%	15-29 years 2.4%
<b>In town</b> 20.8	<b>Workmanship</b> 5.9	Electrical 15.3	30-49 years 44.8
(EPA: Delta 88, 21; Olds 98, 21; Custom Cruiser, 19)	<b>What changes would you like?</b>	Transmission 10.9	50-plus 52.8
<b>Long trips</b> 26.0	No changes 25.4%	Fuel leaks 5.5	<b>Occupations:</b>
(EPA: Delta 88, 30; Olds 98, 30; Custom Cruiser, 27)	Less engine noise/rattles 11.0	Fuel injectors 5.5	Retired 16.3%
<b>Series choices:</b>	Better gas mileage 7.3	<b>Did you repair it yourself?</b>	Salesman 12.0
Olds Delta 88 58.2%	Working gauges 7.1	No 95.1%	Academician 6.3
Oldsmobile 98 29.5	More power 4.2	Yes 4.9	Executives and managers 6.3
Custom Cruiser 12.3	<b>Workmanship opinion:</b>	<b>Dealer repairs satisfactory?</b>	Engineer 6.0
<b>Sedan body-style choices:</b>	Excellent 49.1%	Yes 72.7%	Mechanic 5.3
Four-door 66.1%	Very good 35.0	No 27.3	Medical 5.3
Two-door 22.7	Good 8.7	<b>Dealer service opinion:</b>	Farmer 5.0
<b>Why did you choose Olds diesel?</b>	Fair 3.3	Excellent 37.6%	Small businessman 4.6
Economy 67.1%	Poor 3.8	Good 38.2	Real estate 4.0
Diesel engine 33.7	<b>Comfort opinion (front seat):</b>	Average 12.6	Contractor 3.7
Size 12.7	Excellent 62.4%	Fair 3.2	Housewife 3.3
Performance 7.1	Very good 28.0	Poor 8.2	Heavy equipment, trucker 3.0
Comfort 6.6	Good 7.1	<b>Number of vehicles owned:</b>	Civil servant 3.0
<b>Specific likes:</b>	Fair 2.0	Olds diesel only 25.9%	Factory worker 3.0
Economy 79.3%	Poor 0.5	Two cars 54.0	Scientist 2.3
Comfort 28.8	<b>Comfort opinion (rear seat):</b>	Three cars 13.6	Attorney 2.3
Handling 21.5	Excellent 45.7%	Four or more cars 6.6	Electrician 1.7
Performance 18.7	Very good 36.8	<b>Other cars owned:</b>	Clergyman 1.7
Ride 15.3	Good 15.3	Chevrolet 23.7%	Insurance 1.2
<b>Specific dislikes:</b>	Fair 1.7	Oldsmobile 23.1	Secretary 1.0
No complaints 31.7%	Poor 0.6	Ford 16.6	Banker 0.6
Noise 12.1	<b>Had any mechanical trouble?</b>	Buick 7.8	Pharmacist 0.6
	No 53.9%	Volkswagen 7.8	Locksmith 0.6
	Yes 46.1		Military 0.6
			Student 0.6
			<b>Would you buy another Olds diesel?</b>
			Yes 97.4%
			No 2.6

\* Percentages might not equal 100% due to rounding, multiple responses or insufficient data.



Safe, sturdy playhouse features contemporary styling with an integral door panel.

# Make this PLAY CUBE for your youngsters

Kids will have hours of fun in this spacious, open-to-outdoors playhouse.

by Paul Levine

**H**ere's a contemporary playhouse that will please your young ones and give them a place to entertain their friends.

Handsome red knotty cedar siding, in a diagonal pattern, is used to side a sturdy, plywood-sheathed frame of 2x3s. Four circular cut-outs, one in each wall, help soften the angularity of the simple cube. They also dramatically set off the entrance, two large, round windows and a louver wall.

## Framing the cube

Begin by constructing frames for floor and roof panels as shown in the framing plan on page 118. Cover one side of each with  $\frac{3}{4}$ -in. exterior plywood. In order to prevent children from picking up splinters from the floor, use A-D exterior-grade plywood—A side exposed to the interior.

Next, build the two wall frames. Note that the door-side panel must be  $\frac{3}{4}$  in. shorter than the louver side to create a slight pitch in the roof. Cut diagonal braces and top and bottom plates for window walls.

Now, position the floor on four leveled concrete block piers (footings). Tip door and louver walls in place and secure through plywood floor to floor framing with 16d common nails. Add the bottom plates for the two studless walls and tie into door and louver walls with lower diagonal braces. Checking squareness with a level or framing square as you go will assure accuracy and make sheathing and siding easier. Use 3-in. No. 16 fh screws to fasten braces to studs and plates.

The easiest way to assemble the top plates for the studless walls is to nail them to the roof section while it's still on the ground. After positioning the roof unit on top of the walls, toenail it to the two top plates already in place, using 10d

common nails. Add upper diagonal braces, checking for plumb as you go.

## Sheathing and siding the cube

Before you start to sheath the framed cube, make a rudimentary compass for marking the circular window openings. First draw a line down the center of a narrow strip of plywood which is at least 29 in. long. Drill two holes  $\frac{3}{8}$  in. apart, about 1 in. from one end. At the other end, drive a 10d nail to act as a pivot, through a point 27 in. from the closer of the two holes. The compass can be mounted on a scrap plywood crosspiece between the middle two studs of a wall—or when that is not possible, it can be centered on a stake fashioned from a 2x3 and driven into the ground. In any case, the pivot nail must be positioned in the center of whichever face of the house you are about to sheath. Find centers by tacking four small nails at the corners, then tie two pieces of string diagonally across the face. The center will be where the strings intersect.

Use  $\frac{3}{8}$ -in. exterior plywood (best side to the interior) to sheath the four walls. On all sides except the entry side, the sheathing can be cut into 12-in.-wide strips and nailed on as shown in plans on page 119. The door side should be sheathed, leaving an opening for the entrance. Recheck for plumb as you go.

Draw circles on wall faces using a pencil inserted in the outer hole of the compass arm. Use a sabre saw to cut out the circles on three sides. *Do not* cut a circle out of the door wall.

Use 8d galvanized finishing nails to secure cedar siding to 2x3s beneath sheathing. Using a nailset, set nails. When you install siding at the roof line, take care to make it appear horizontal.

A good method for cutting out

the circles in the siding on the window and louver sides is to first nail the cedar in place, letting the ends run ragged beyond the circumference. Then use the inner hole of the compass, with pencil, to scribe a circle. Make finished cut with a sabre saw. (See drawing, page 119.)

On the door side, the cedar siding boards have to be individually pre-fit, marked, removed, cut and then nailed in place.

Construct the door as shown and hang it between middle studs which act as jambs. Fasten the cedar siding on the door through the plywood from the inside. The cedar must be beveled back on the hinge side of the door to allow for opening clearance.

Finally, rip  $\frac{3}{4}$ -in.-wide strips from siding material to make cedar trim. Nail it in place with 8d galvanized finishing nails.

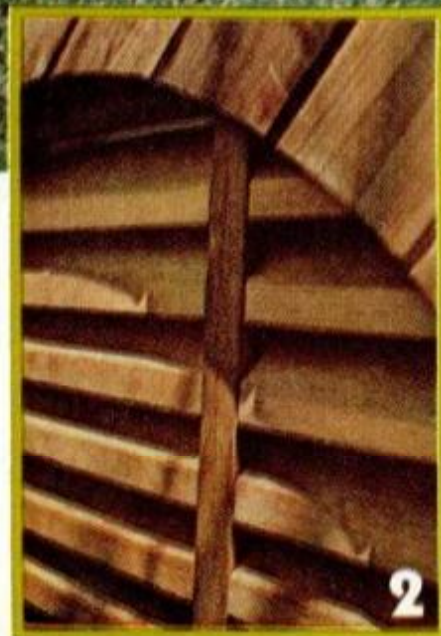
To save time, you can substitute 1x2 pine for cedar trim at corners. Adjust dimensions accordingly.

## Making the louver wall

First rip 45° bevels on both edges of 1x4 pine stock and then cut into 17 $\frac{1}{8}$ -in. lengths. Nail slats to three pairs of 1x2 uprights, leaving a  $\frac{3}{4}$ -in. overhang as shown in plans. The three completed louver units are face-nailed through uprights into the studs. Now you are ready to cover the playhouse with penetrating wood preservative and two coats of spar varnish. The wood panel of the door side was given two coats of exterior enamel.

## Installing the windows

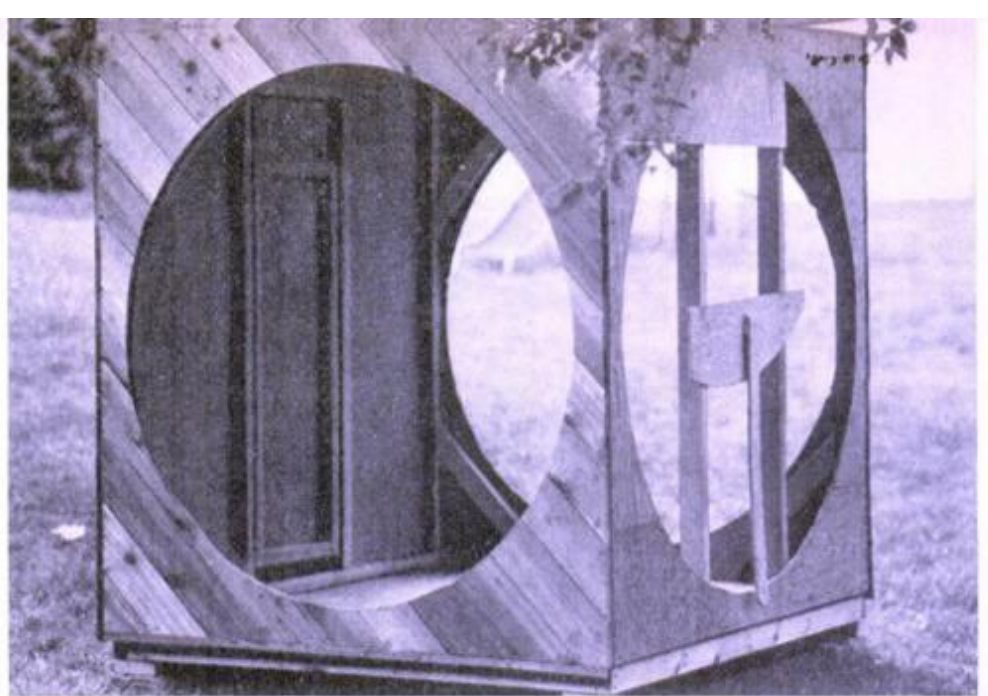
When the finish is dry, you are ready to cut and install the transparent sheet acrylic windows. Have a helper hold the plastic against the outside face of the window wall and trace the circle opening from the



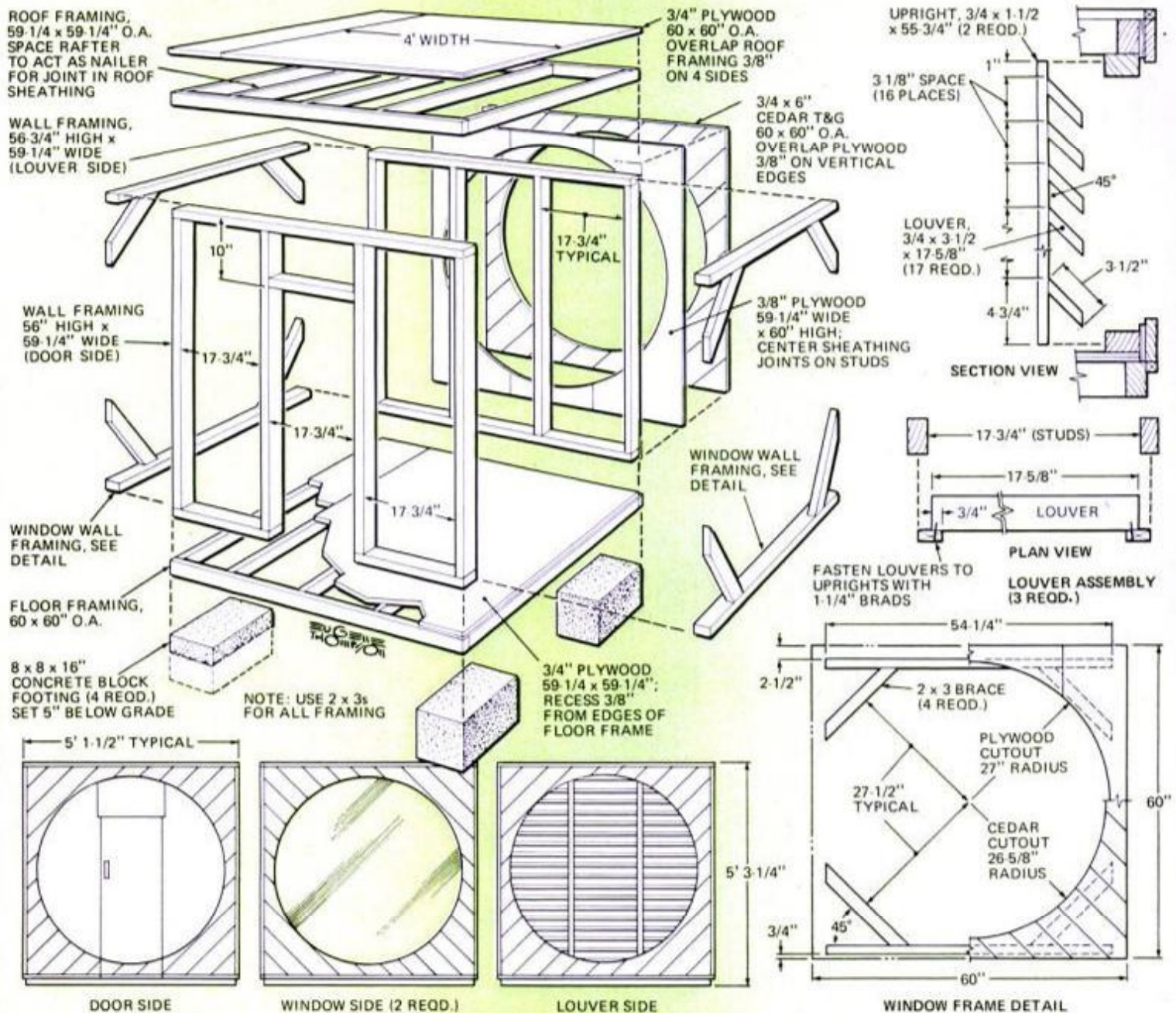
1. Play space is light and airy, while large floor area (25 sq. ft.) is roomy enough for two kids plus guests.
2. Louvers assure that play-cube will not become stuffy.
3. Optional hatch/skylight in roof provides natural lighting and additional ventilation.



Hatch opening is cut between two rafters, trimmed with cedar and then fitted with sheet-acrylic lid. Note: Roof access may not be safe for very young children.



Improvised plywood compass allows you to scribe perfect circles on cedar walls.





Diagonal braces add rigidity to the window walls. Cut 2x3s so that they fit inside the corners and are tangent to the circular cutout in the plywood.

inside onto the protective paper covering. Remove the plastic and enlarge the circle tracing so that the radius is  $\frac{1}{4}$  in. longer. Cut on this second line, using a sabre saw with a fine-tooth, hollow-ground blade. Spread silicone sealant along the inner lip of the window frame and press the window into place. You can bend the plastic slightly in order to bring it inside the house.

You can make the optional loose hatch/skylight from a scrap piece of transparent acrylic. The opening perimeter is trimmed with  $\frac{3}{4}$  x  $\frac{3}{4}$ -in. cedar. The transparent lid, sized 1 in. larger than perimeter trim on all sides, is simply screwed to a frame made of the  $\frac{3}{4}$  x  $\frac{3}{4}$ -in. cedar.

### Safety check

Children's playhouses cannot be made too safe. When you're finished

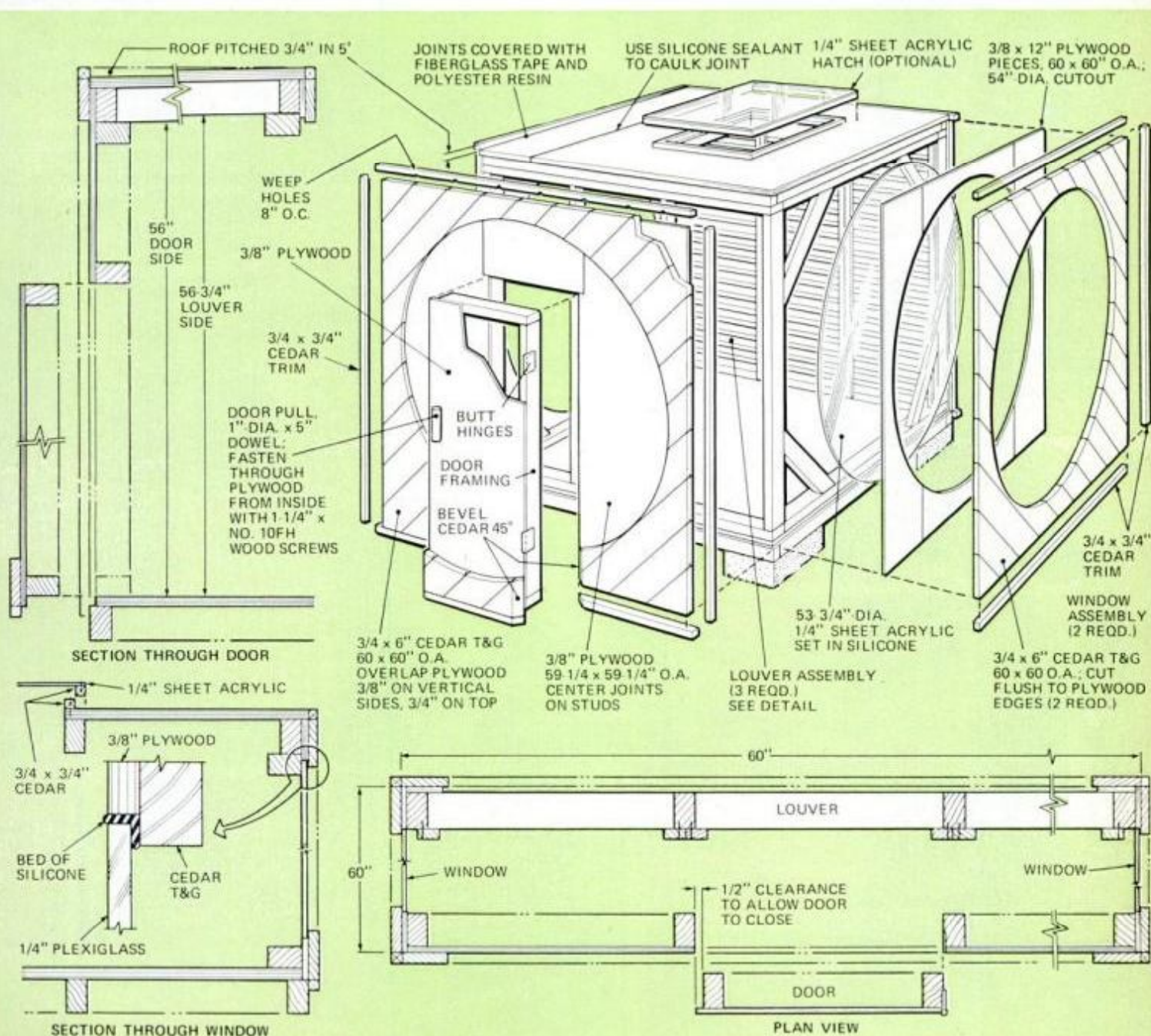
building this one, make a thorough check for hazards. Pull out all protruding nails and sand smooth any rough spots or splintered corners. The entry step, from grade level onto the floor, should be suited to the size of your children. Do not make it any higher than 6 in.

At this point, you can relax and let the kids loose. **PM**

### MATERIALS LIST—PLAY-CUBE

Quantity	Size and description
3	$\frac{3}{4}$ x 2 $\frac{1}{2}$ " x 10' pine
8	$\frac{3}{4}$ x 3 $\frac{1}{2}$ " x 10' pine
16	1 $\frac{1}{2}$ x 2 $\frac{1}{2}$ " x 10' fir
2 $\frac{1}{2}$ sheets	$\frac{3}{8}$ " x 4 x 8' exterior plywood
2	$\frac{3}{4}$ " x 4 x 8' exterior plywood
130 lineal ft.	1x6" knotty red cedar T&G
2	$\frac{1}{4}$ " x 5 x 5' transparent acrylic plastic

Misc.: 10d and 16d common nails; 8d galvanized finishing nails; 3" No. 16 wood screws; 2 3x3" butt hinges; silicone sealant; 1 gal. wood preservative; 2 pts. polyurethane varnish; 4 8x8x16" concrete blocks.



# Make your own cider



2

In Step 2, press is opened to receive a bagful of apples that have been run through the grinder (in Step 1). For maximum portability, press simply rests upon a pair of shop-built sawhorses.



1

Before pressing, apples are piled on grinder "rooftop." From there they are fed into hopper. In Step 3, juice drains into clean pail.



3

P.M. color photos: Harry Hartman

# With PM's press

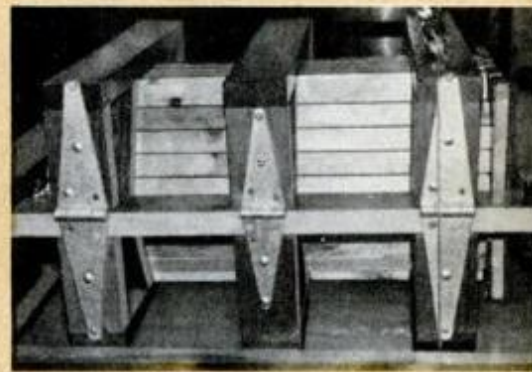
Just in time for this year's apple crop—a press that is easy to build and to use.

by Kathleen Stilwell and Mark Jensen

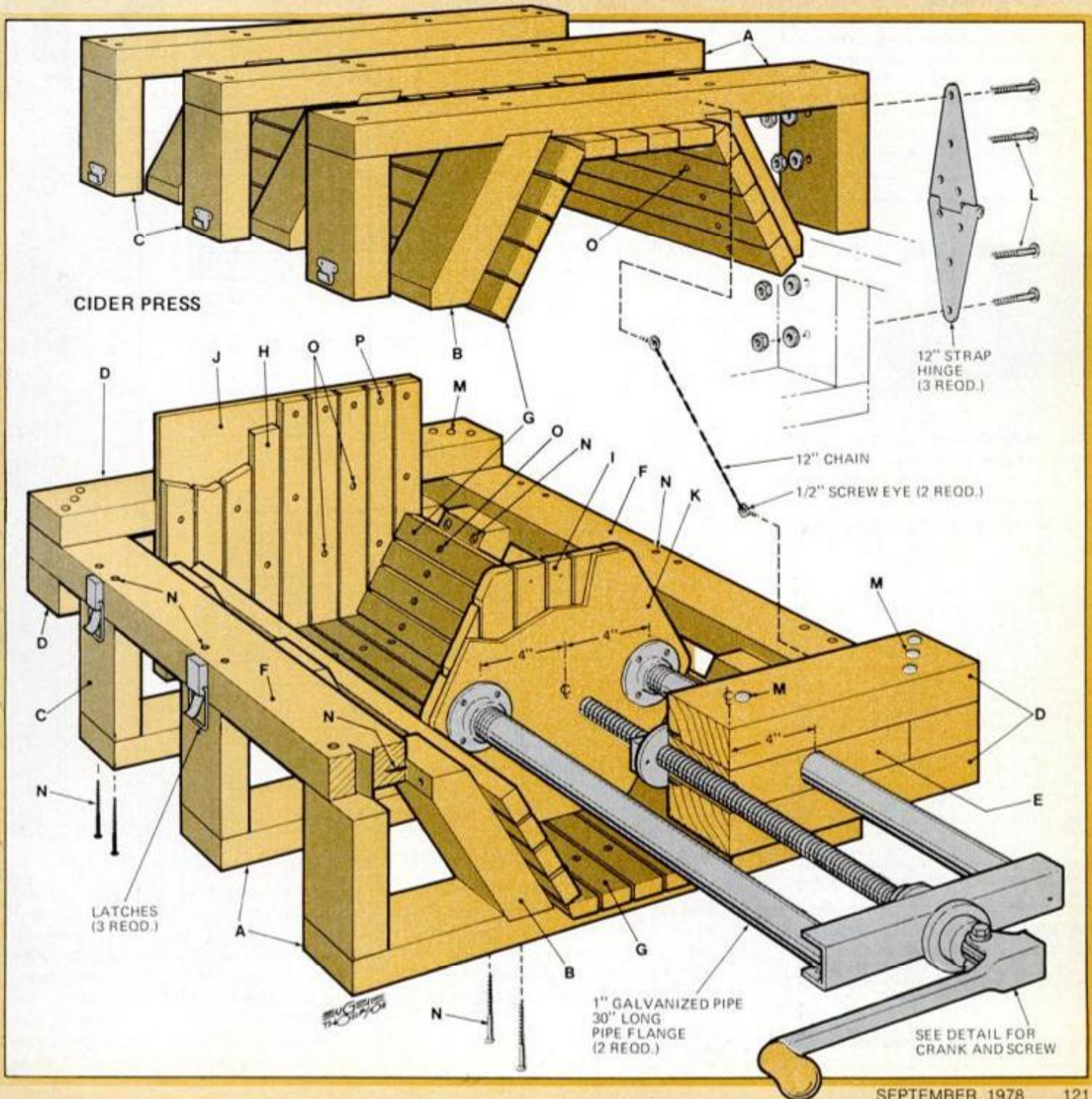
**Y**ou can make the most of this year's apple crop if you have your own cider press. The prototype shown on the facing page—which consists of a sprocket-wheel grinder and a clam-shell-design press—has yielded as much as 12 gallons of juice in an hour when operated by just one person. Using portable

power tools and some careful craftsmanship, you can build your own press, grinder and sawhorse stand for about half the cost of manufactured units.

There's nothing quite like tangy, sweet cider as a family drink in the fall. Happily it's possible to freeze the juice for drinking later. (If



Back view of this closed cider press shows the three hefty hinges used on the unit.



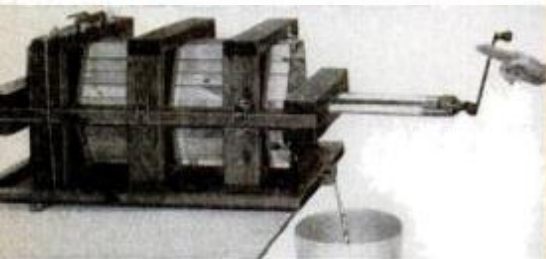
you're planning to ferment it, remember that making hard cider is subject to the same restrictions as wine and beer making.)

After pressing for cider use the leftover apple pulp to make apple butter, or use it as garden compost. Bury the pulp rather than spreading it on top of the soil.

Begin work on the press by constructing the 24x36-in. rectangular

### MAKING CIDER ACROSS THE COUNTRY

Most cider makers agree that a blend of apple varieties makes the tastiest cider. A few crabapples added to a batch of cider made from blander varieties can perk up its taste. In the northeastern states McIntosh, Jonathan, Red Delicious and Golden Delicious are among those varieties that make the best cider. In the middle and southern states the Red Delicious, Golden Delicious and Jonathan are also good choices; in the Appalachian area Stayman Winesaps are good. Red Delicious and Golden Delicious are favorites in the northwestern states. Experiment by blending varieties until you get one you like.



The tightly secured pressing chamber allows one person to crank out as much as 12 gallons of apple juice in one hour.

#### MATERIALS LIST—CIDER PRESS

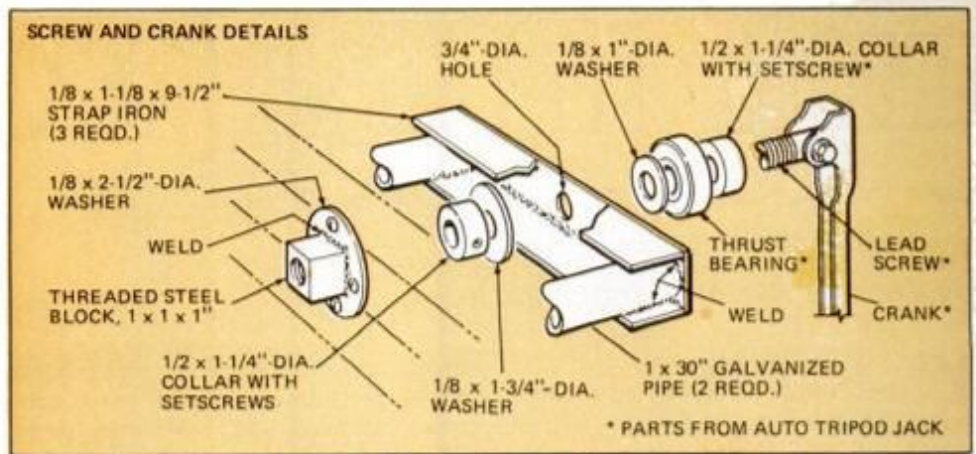
Key	Pcs.	Size and description
A	6	1 1/2 x 3 1/2 x 23 1/2" fir
B	12	1 1/2 x 3 1/2 x 9" fir
C	12	1 1/2 x 3 1/2 x 6" fir
D	4	1 1/2 x 3 1/2 x 23 1/2" fir
E	1	1 1/2 x 3 1/2 x 14 1/2" fir
F	2	1 1/2 x 3 1/2 x 36" fir
G	27	3/4 x 1 1/2 x 27" pine
H	9	3/4 x 1 1/2 x 13 1/2" pine
I	8	3/4 x 1 1/2 x 12" pine
J	1	1/2 x 13 1/2 x 14" plywood
K	1	1/2 x 12 x 12" plywood
L	12	3/16 x 2" rh machine screws, washers and nuts
M	14	1/4 x 5" carriage bolts, washers and nuts
N	72	3" No. 10 fh screws
O	90	1 1/2" No. 8 fh screws
P	36	1" No. 8 fh screws

Misc.: 3 latches, 2 pcs. 1" galvanized pipe x 30" with flanges, 3 pcs. 1/8 x 1 1/8 x 9 1/2" strap iron, 1/8 x 1 1/4"-dia. washer, 1/2 x 1 1/4"-dia. collar with setscrews, parts from auto tripod jack, 2 pcs. 1x30" galvanized pipe, 3 12"-long heavy strap hinges.

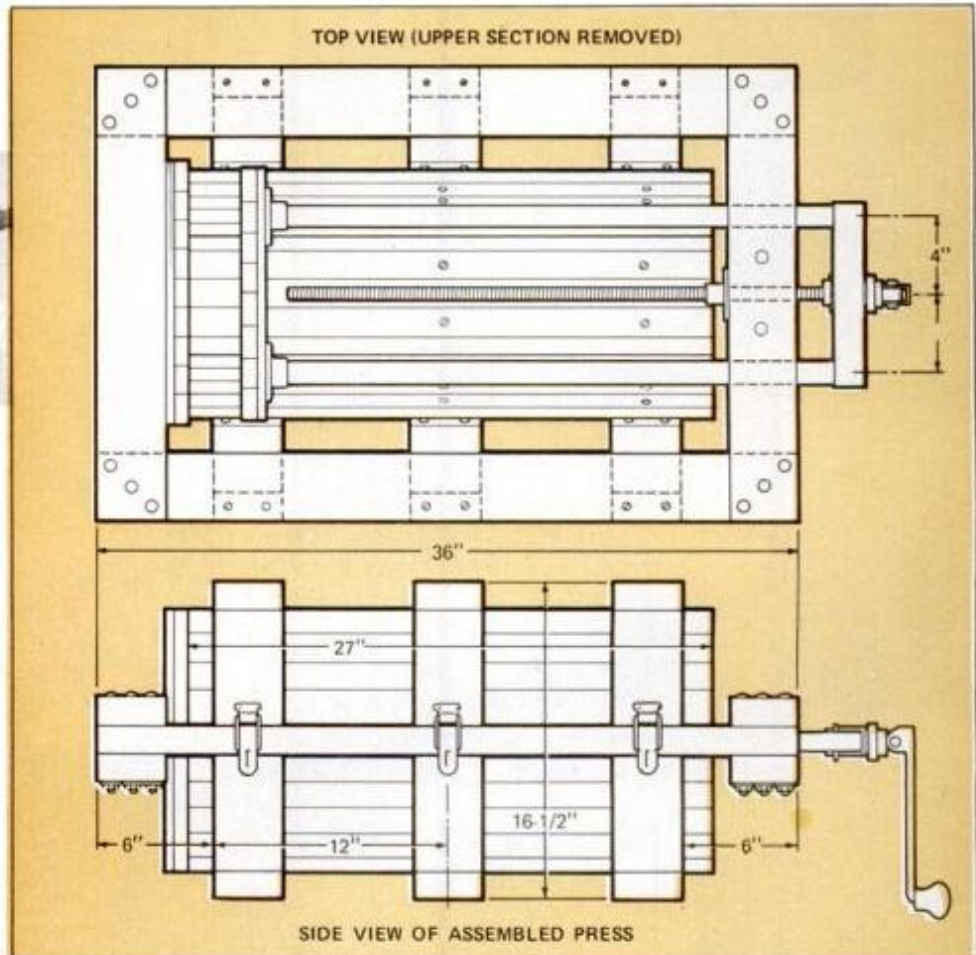
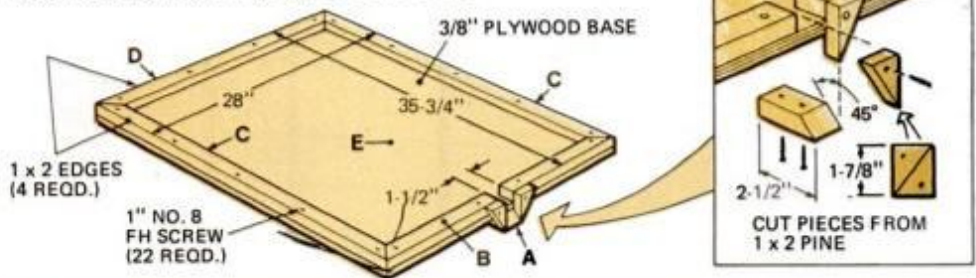
#### MATERIALS LIST—COLLECTION BOARD

Key	Pcs.	Size and description (use)
A	1	5" scrap 1x2 pine (spout)
B	3	3/4 x 1 1/2 x 13 1/4" pine
C	2	3/4 x 1 1/2 x 35 3/4" pine
D	1	3/4 x 1 1/2 x 28" pine
E	1	3/8 x 28 x 35 3/4" plywood

Misc.: 22 1" No. 8 fh screws, nontoxic white glue.



#### CIDER COLLECTION BOARD AND SPOUT DETAIL



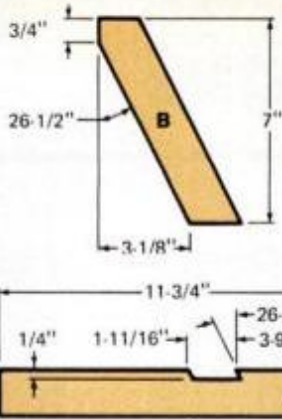
frame made of 2x4s. Make six ribs. Nest the bottom three ribs in the frame. Then cut a 14-in.-square plate of plywood and nine 14-in. 1x2s to screw to the inside end of the frame. Fasten 13 sanded and rounded 1x2s into the bottom half with 1 1/2-in. No. 8 wood screws. The corner 1x2s must be notched

to fit the slant of the ribs. Attach the top 1x2s so the top ribs will align with the bottom three ribs. Hinge the top to the bottom with strap hinges at the back and catch locks at the front. A chain keeps the top from falling too far open.

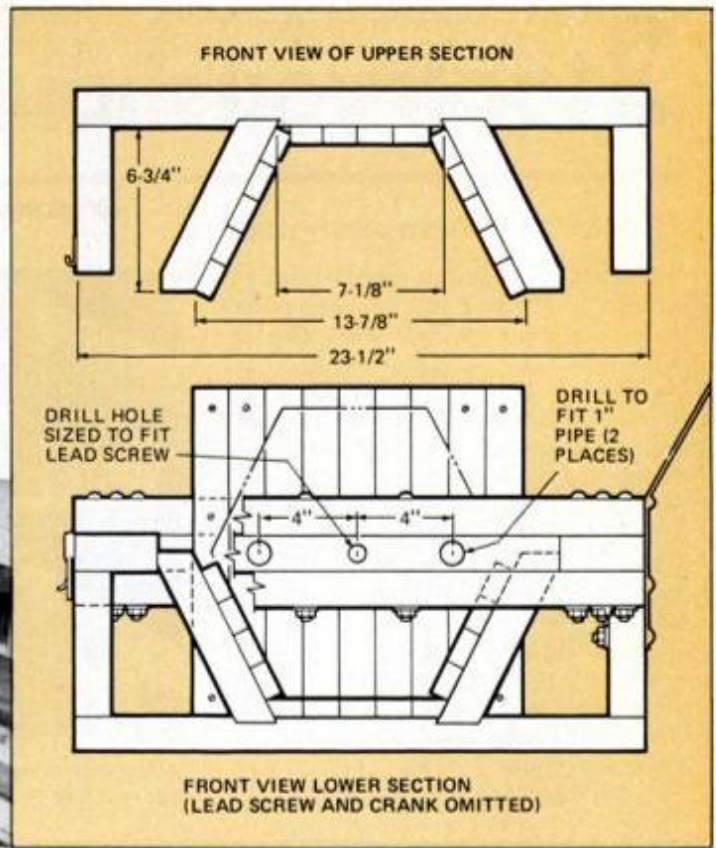
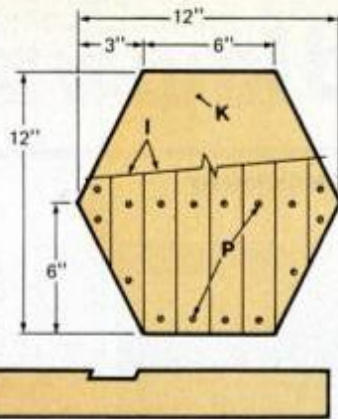
When assembling the plunger, remember the action achieved will be



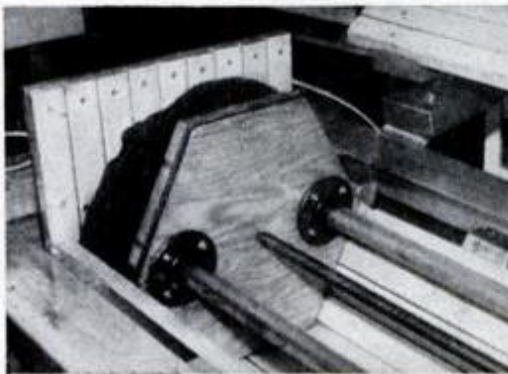
DETAIL OF PIECES A & B



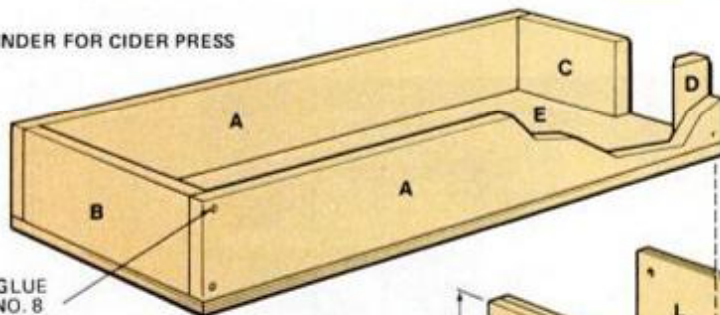
DETAIL OF PIECES K & I



The open cider press is ready for the big squeeze. It will receive a bag of apples that has already gone through the grinder and been crushed. Even as the apples are being loaded, some of the juice will collect underneath the press in the collection board.

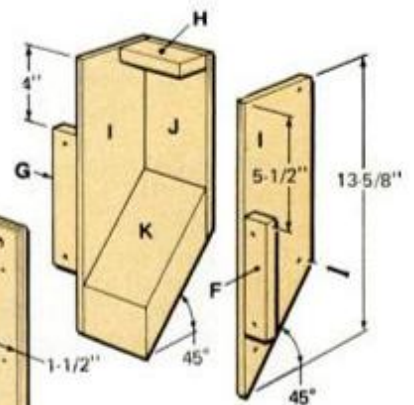
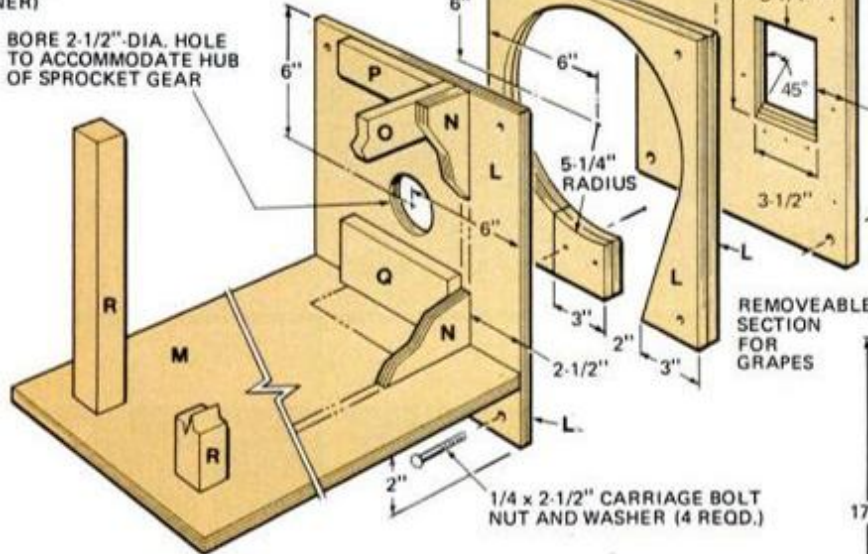


GRINDER FOR CIDER PRESS



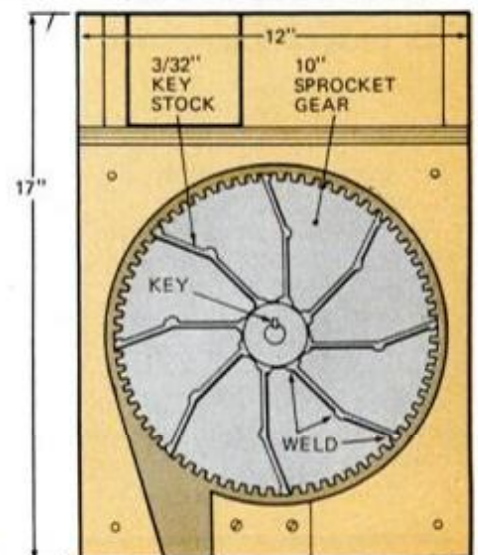
USE WHITE GLUE AND 1-1/2" NO. 8 FH WOODSCREWS (2 PER CORNER)

BORE 2-1/2"-DIA. HOLE TO ACCOMMODATE HUB OF SPROCKET GEAR



NOTE: ALL 3/8" PLYWOOD ASSEMBLED WITH 1" NO. 8 FH WOODSCREWS

END VIEW (COVER REMOVED)



a push-pull type. The jack, being cranked into a threaded block, will be pushing the pipe and plunger plate into the chamber.

To convert the car jack, remove the three leg standards. Replace the crank-handle rivet with a 3/8-in. bolt. Weld a crossbar made of 1 1/8-in. strap iron to two 30-in. lengths

of pipe. Insert the jack and clamp it with 5/8-in. set collars above the thrust bearing and below the crossbar. Screw on the pipe flange.

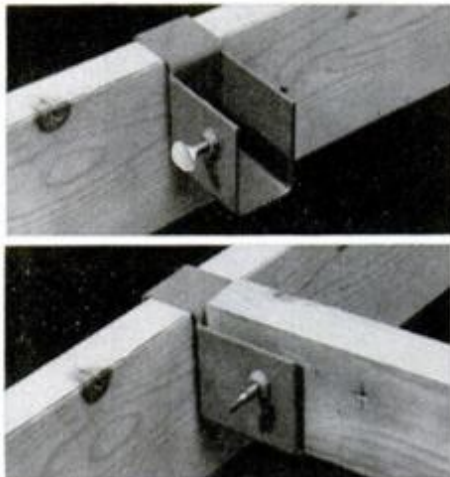
To maximize a tight fit, cut the plunger-plate slightly oversize. Cover it with lengths of 1x2s and trim. Assemble the plunger and plate

*(Please turn to page 192)*

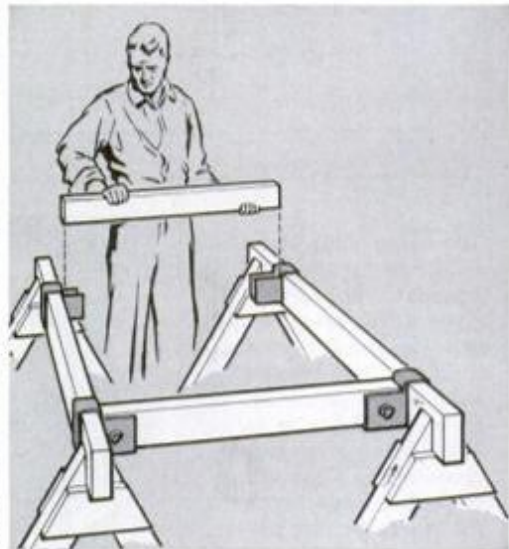
# 3 tools you should know about

## Brackets improve sawhorses

Though a pair of sawhorses is undoubtedly one of a carpenter's most valuable tools, they can be inadequate for certain chores, such as laying out plywood paneling. Lack of stability can cause costly marking and cutting errors. If you tackle a lot of jobs away from your workbench, you might want to consider buying a set of Sawhorse Table Converter Brackets. Using the brackets, a pair of 2x4s cut to suit and a piece of plywood, you can quickly set up a sturdy carpentry worktable or roomy scaffold for painting and siding jobs. The brackets come four to a package with wingnuts for \$9. Loclan, Inc., Box 83, Lawton, Okla. 73501.



Attach brackets to sawhorse cross member, put 2x4 in channel, tighten wingnut.

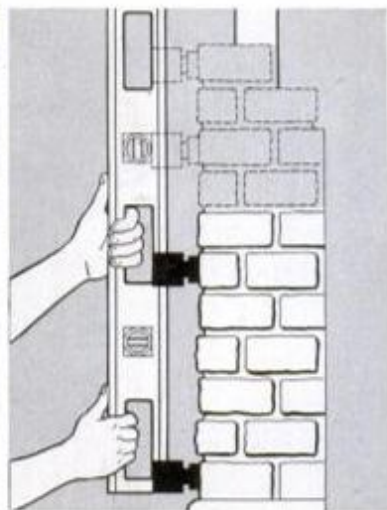
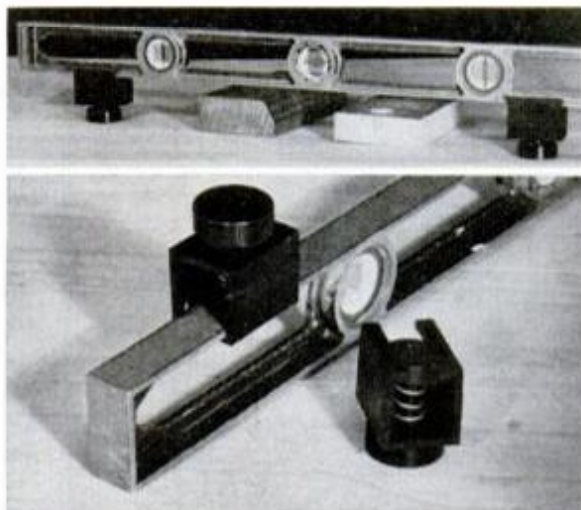


## Accessories for a level

Use these Adjustable Level Stand-offs with a standard I-beam spirit level to determine level and plumb between surface points—even if the surface is uneven, distorted or bowed. The Stand-offs help correct for out-of-plumb brick courses on corner constructions. Or use them to get over obstacles such as wood braces or crosspieces on the surface line that you want to level.

Stand-off clamps are extruded aluminum with corrosion-resistant black anodized finish. They're spring-loaded for position adjustment.

A pair is \$7 from Rich Manufacturing Co., Box 413, Bound Brook, N.J. 08805.

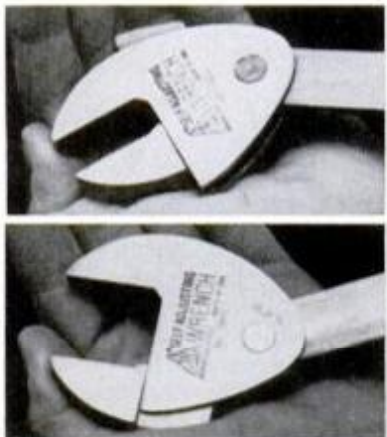
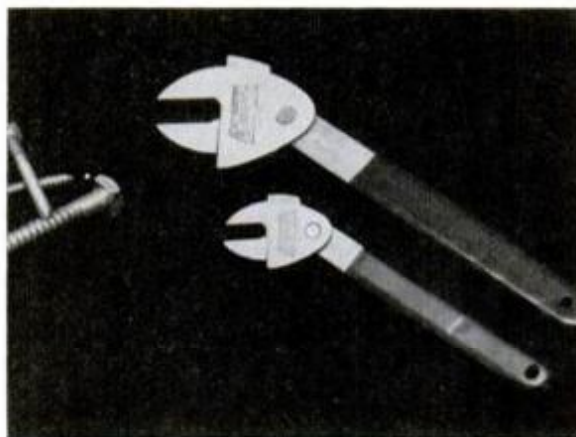


Pair of Stand-offs attached to level as in sketch above lets you check rough surface.

## Self-adjusting wrench

Wonderench self-adjusts to firmly grip nuts and pipes that need loosening or tightening. The 6 $\frac{3}{4}$ -in. wrench, priced at \$10, has a maximum jaw opening of 9/16 in. The 9 $\frac{1}{8}$ -in. size, \$16, opens to 1 $\frac{1}{8}$ -in. Together they sell for \$23.

The more pressure you apply to the wrench handle when turning, the tighter the jaw grip becomes. For tightening, use the wrench with the name side up. For loosening, place the name side down. The tools are made by RCJ International, Secor Rd., Mahopac, N.Y. 10541.



**Popular  
Mechanics**

# HOME ENERGY GUIDE '78

**Solar-heated  
shed you can build  
in your back yard.**

Use it for storage, workshop  
or a potting shed. Or  
adapt it to heat your pool  
and domestic hot water.

**Insulation: How much is enough?**

Should you believe it when you're advised to  
pour more insulation into wall and floor cavities?

Here are facts and figures that will  
help you decide when enough is enough.

**Solar products for your home.**

We've rounded up a passel of solar products  
that you don't have to be rich to own right now.

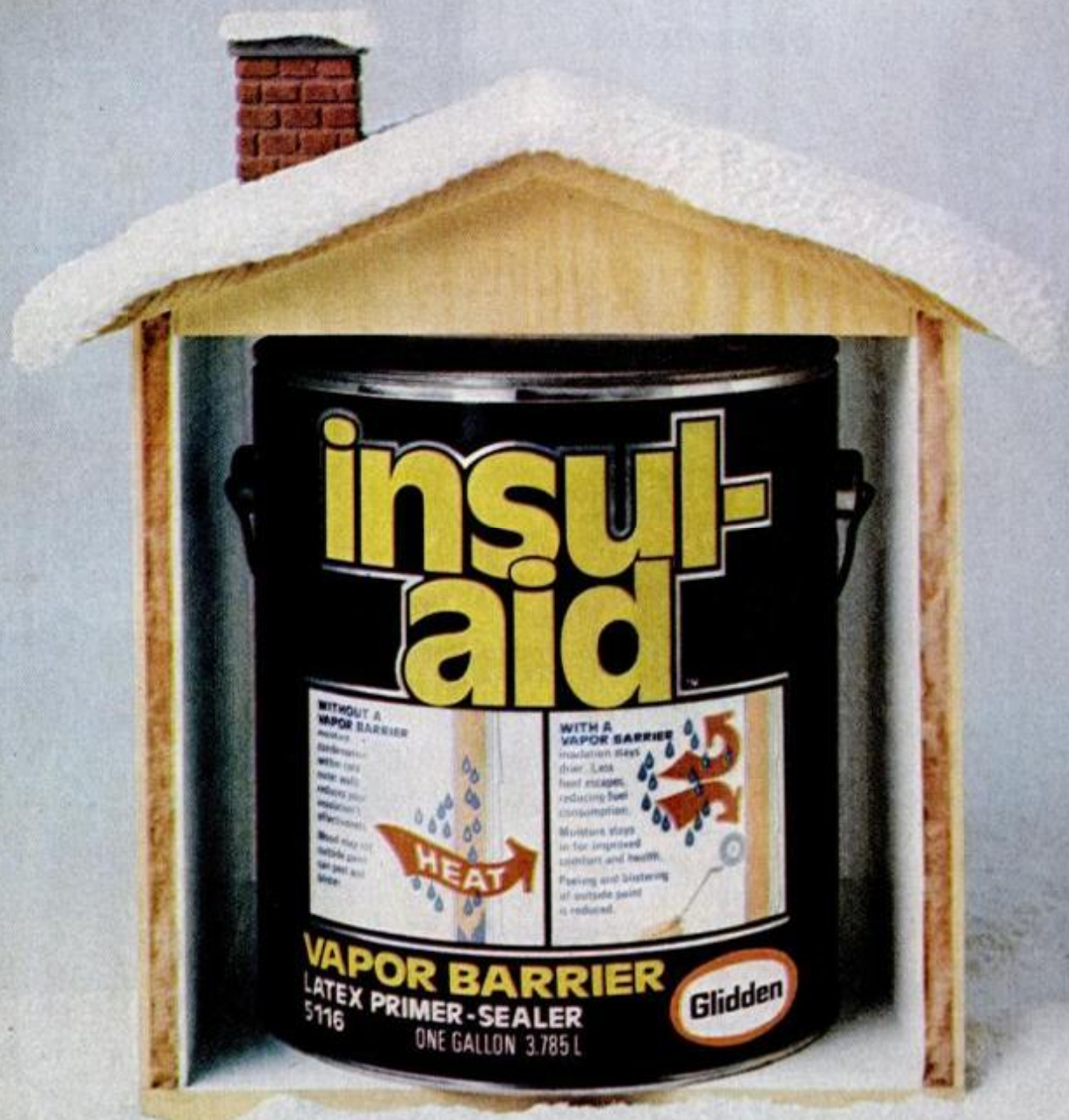
Extra: Solar units you can install yourself.

**Plus more . . . lots more!**

Prepared by the **Popular Mechanics**  
Home & Shop Department: HARRY WICKS, Editor;  
JOSEPH PROVEY, PENELOPE ANGELL, Assistant Editors;  
DON MANNES, Art Director;  
VICTOR CHASE, Contributor.

# Only from Glidden...Insul-aid.™

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Insul-aid is the only latex vapor barrier coating that more than meets FHA standards for vapor transmission.

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## SOLAR-HEATED STORAGE SHED YOU CAN PUT UP YOURSELF

Designed by solar-expert architect Harry Wenning, PM's back-yard beauty can serve many uses.



PM photos by Harry Hartman

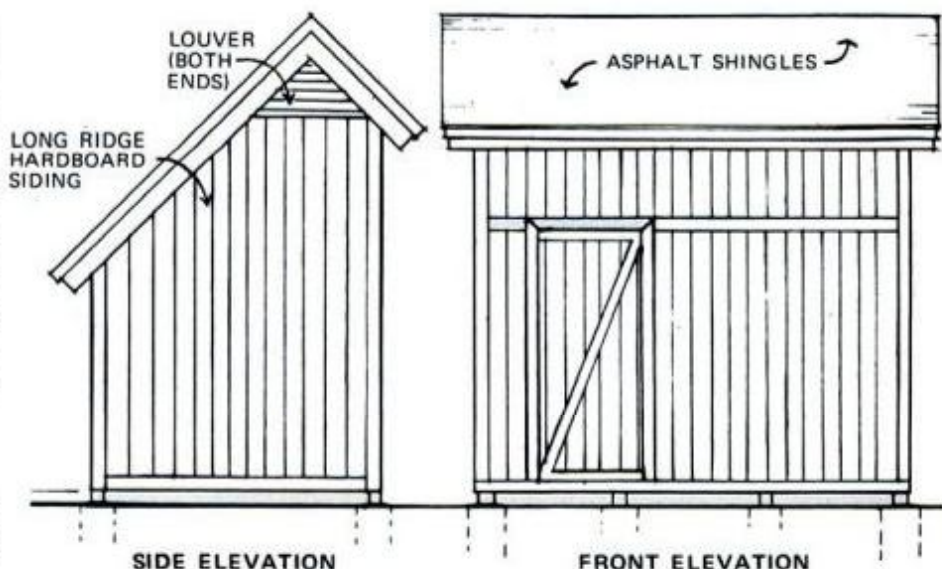
Solar collector panels add a beauty of their own, and bring in heat so that the building can be utilized during the cold-weather months.

The uses for a back-yard structure such as this one are practically endless. Depending on your own particular requirements, it can serve as a workshop, greenhouse, a pool cabana or even be used as a storage shed just as is shown in these pictures of the prototype.

Conventional construction methods are employed to build this versatile structure, and its 2x4 framing will make the job a snap for the average home craftsman. Don't get the idea that building this little beauty is far beyond your skills just because of the solar aspect—installation of the solar panels is as easy as any other phase of the project.

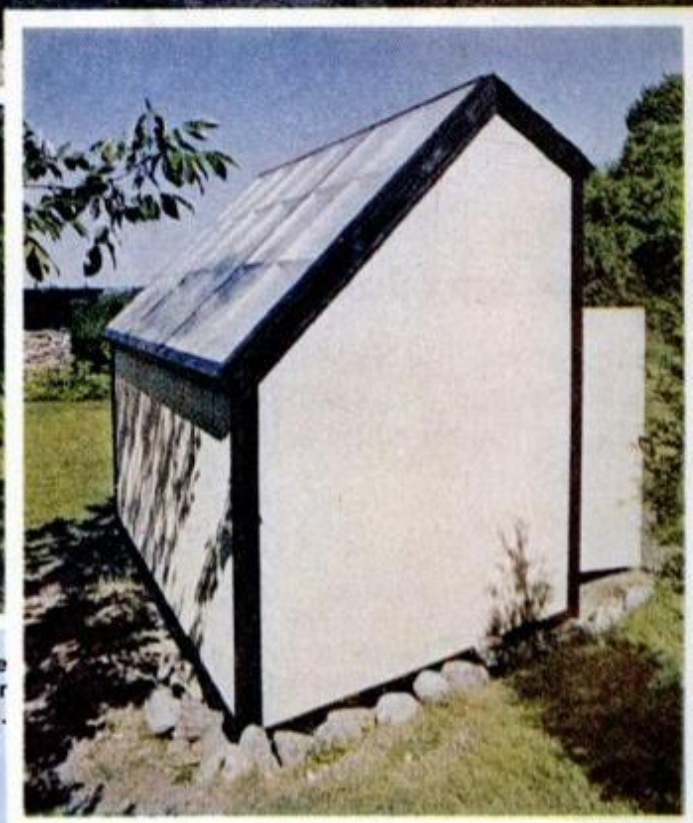
### Designed for PM

The shed was designed by Harry Wenning, A'A, and erected to meet design parameters spelled out by the editors of





Handsome back-yard building features saltbox roof line, Long Ridge hardboard siding by Champion Building Products (top). The solar collection panels can be seen in rear, side views (above and at right).



*Popular Mechanics.* It features the use of passive solar collectors, but you could substitute an active system if you should want your shed to be capable of heating water for use in your swimming pool or your hot-water system.

For a snappy appearance the exterior of our shed version is covered with Long Ridge hardboard siding manufactured by Champion Building

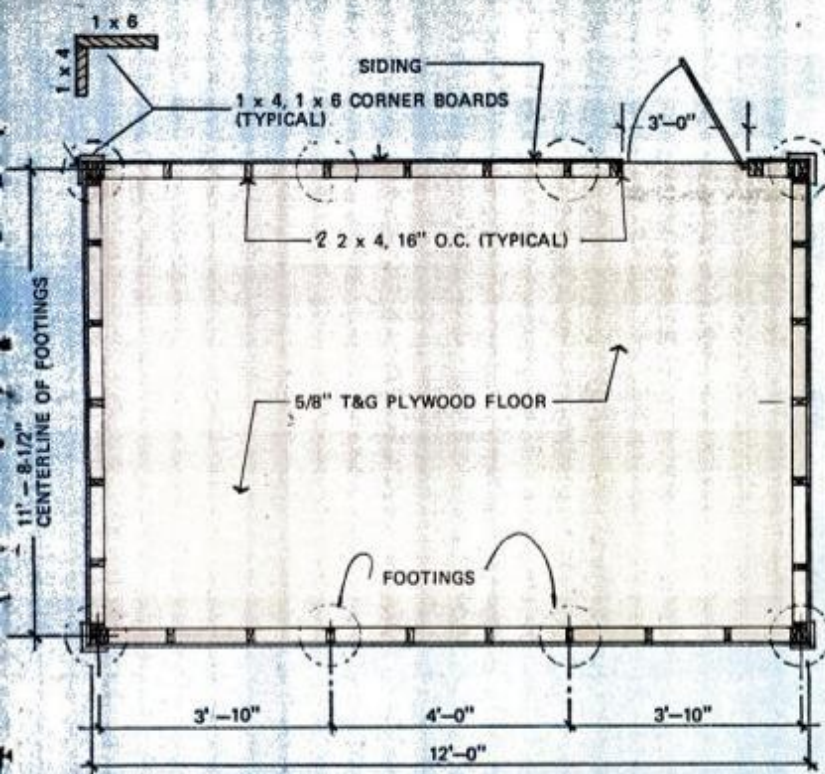
Products. This is a factory-primed type of hardboard that simulates the board-and-batten look. Textured asphalt shingles in the Timbertone pattern of Bird & Son complete this simple, yet stately-appearing little structure.

#### **Economical post footings used**

Starting from the ground, the individual post footings make the dig-

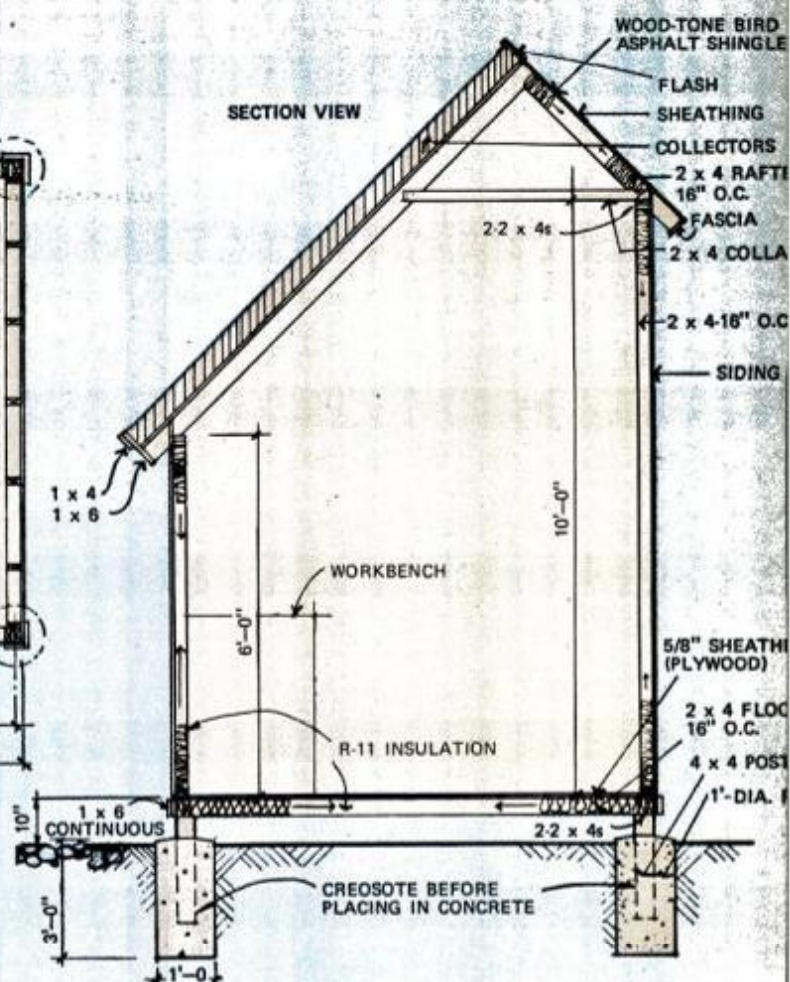
ging and concrete-pouring procedure a little bit easier as well as a lot less expensive than it would be for other foundations. The footings serve the same function as a continuous footing.

Before you place the concrete, you should set the 4x4 posts in the holes and place the concrete around each post. Then you place the 2x4 double-headers around the prime-



**FLOOR PLAN**  
SCALE 1/2" = 1'0"

Solar shed is built using conventional housebuilding carpentry, standard-size lumber. Posts on prototype are set in concrete piers poured to below the frostline. Note that insulation is indicated for floor, walls and roof.



## HOME ENERGY GUIDE '78

ter of the shed on top of the 4x4 posts. Take care that these headers are exactly level.

The next step is to install the 2x4 floor system. Locate the 2x4 joists 16 in. on center (o. c.) and along the 8-ft. length, as shown in the floor plan above. Now you can place the 5/8-in. tongue-and-groove plywood floor over the 2x4 floor-framing system and fasten it.

Next, you put up the 2x4 wall. Start with a 2x4 base plate on the "oor for each wall section, then add the studs 16 in. o.c. and complete each wall section with a doubled-up top plate.

### Check for correct roof angle

Your roof framing system may now be put together using 2x4s of the proper length. Make sure that the roof angle of the collectors is approximately equal to the degrees of latitude where you are working (on our solar shed in New York State the roof pitch on the collector side is 45°).

Next to go on is the siding, followed by the roof sheathing on the noncollector section of the roof. Install 1/2-in. CDX plywood over the 2x4 roof framing. On top of the

plywood put 16-lb. saturated felt building paper and 235-lb. asphalt roof shingles.

For more efficient heat storage, install 3 1/2-in.-thick insulation in the floor, walls and ceiling.

You may treat the entire shed, inside and out, with a coat of paint, stain or any other finish desired. For the sake of neatness, we suggest that the exposed 2x4s which carry the solar collectors either be stained or painted before you mount the collectors.

The panels used for this project form a passive solar system; that is, they collect the sun's energy to heat the shed only. There are no mechanical devices installed, such as fans or pumps, to distribute the heat elsewhere.

### Installing the passive system

Installation of the passive system is quite simple. Each of the three 4x8-ft. collectors is propped into position and held in place by nails through the bottom and sides. A flexible self-adhesive sealant tape is placed around the perimeter of each panel; a task that can best be done on the ground before you prop the panels into position. The metal an-

gles and battens are then placed around the panels and screw-fastened to the wall studs with self-sealing screws.

Installation instructions that are supplied with the collector panels are precise and spell out all details so that you will find them easy to follow.

In the event you should elect to substitute an active solar system for the passive collectors, you can mount the panels in the same manner, but since they will be approximately 3 ft. wide instead of 4 ft., you will have to modify the framing system accordingly.

### Active system offers hot water

In the active type of system, a liquid will flow through the collectors to be heated and then piped to a storage tank of approximately 80-gallon capacity to be used for storage of hot water. Since your existing water heater remains in your home, the solar system is operated in conjunction with your present system.

Here's a breakdown of approximate costs you'll find for the solar collectors (prices include shipping and handling charges):

## PRICING

### 1. Sun-Lite panels (passive system only):

1½-in. glazing panel	
3 panels @ \$92	\$276
Foam tape	16
Misc. aluminum trim	90
Screws	3

Total .....\$385

### 2. Solar-Kal Airheater (passive system, but may be used for an active system):

3 panels @ \$175	\$525
Foam tape	16
Misc. aluminum trim	90
Screws	3

Total .....\$634

Light transmission for the 1½-in. Sun-lite glazing panel is 84 percent—the "U" rating is .46 and the temperature service limit is 200°F. Sun-Lite

ignites at 950°F.

The Solar-Kal Airheater is constructed of noncorrosive materials and also utilizes Sun-Lite as its glazing.

For more information on either the Sun-Lite glazing panels or the Solar-Kal Airheater collectors, write directly to the Kalwall Corp., Solar Components Div., Box 237, Manchester, N.H. 03105. Its catalogue lists other Kalwall products and related products by other solar equipment manufacturers such as sealants, fasteners, installation accessories, absorber plates for air and water collectors, insulation, differential controllers and circulation devices for air or liquid collectors. It's free, and items listed in the catalog are inventoried for off-the-shelf shipment. Brochures for particular products and price lists are also available.

## MATERIALS LIST—SOLAR SHED

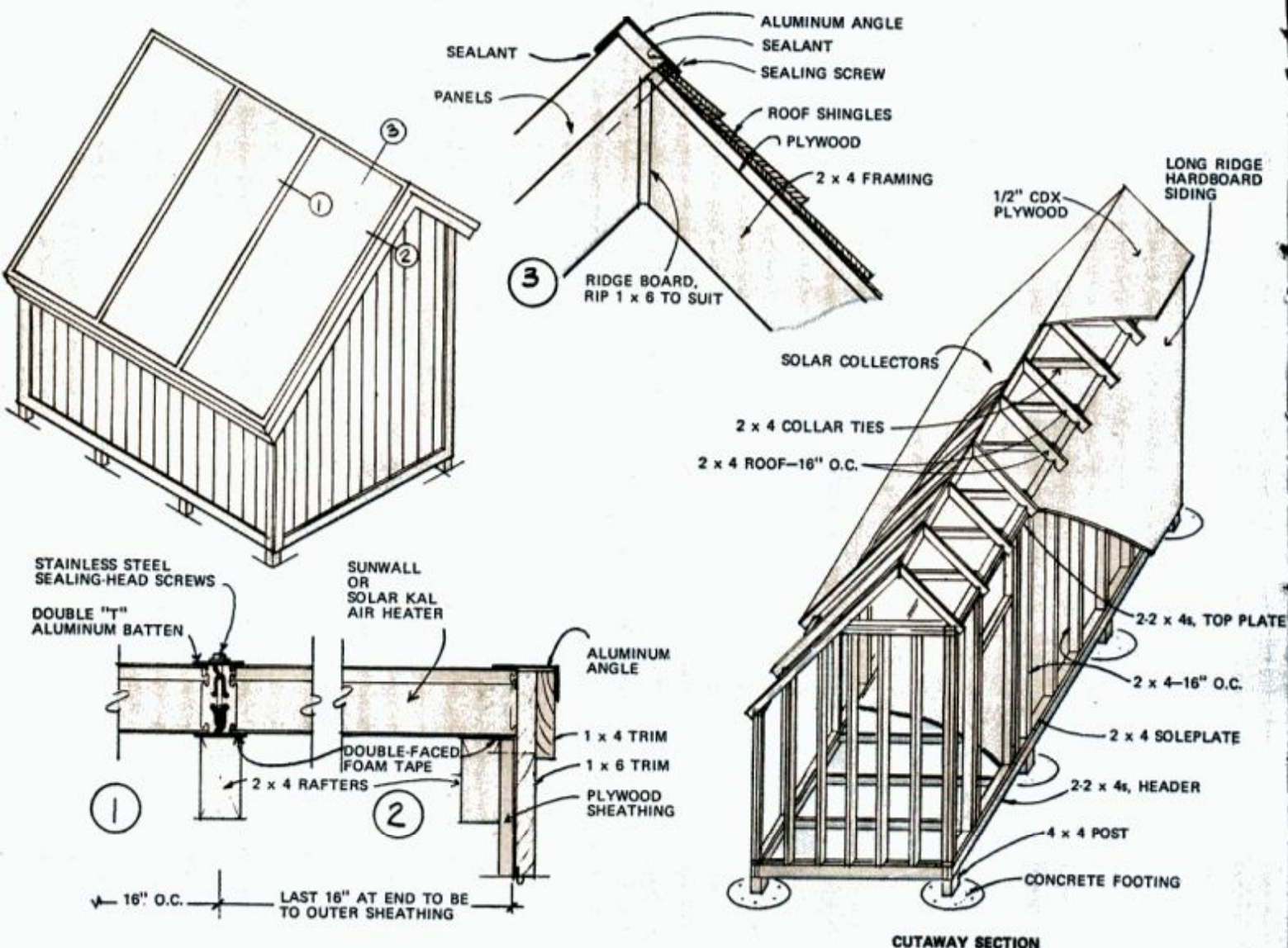
Quantity	Size and description
14	2x4 fir, 6' long
44	2x4 fir, 8' long
20	2x4 fir, 10' long
10	2x4 fir, 12' long
1	4x4 fir, 8' long
116 lin. ft.	1x4 common pine boards
120 lin. ft.	1x6 common pine boards
4 rolls	3½" insulation (R-11)
3 sheets	½"x4x8' T&G plywood (floor)
2 sheets	½"x4x8' CDX plywood (roof)
10 sheets	4x8' T-11 plywood (siding)
1 set	door hinges and latch
2	gable vents
50 sq. ft.	15-lb. felt building paper
2 bundles	roof shingles (½ square)
	concrete footings (depth as required by your local building code)
2 lbs.	1½" galvanized roofing nails
10 lbs.	10d common nails
5 lbs.	6d and 10d finishing nails
10 sheets	4x8' perforated hardboard or gypsumboard (interior finish)
3	4x8' (approx.) solar panels*

### Panel accessories

40 lin. ft.	1x3 aluminum closure piece
16 lin. ft.	2" aluminum batten strips
100 ft.	sealant tape
30	1½" sealing-head screws

\*Sizes may vary from maker to maker. Check exact sizes prior to installation for exact roof-rafter spacing.

Solar collection panels cover the entire rear (long) section of the saltbox-shaped roof. Panels should be installed to assure that a weatherproof joint will be formed at ridge.





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It makes the outside of your house  
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Take a good look and you'll see that your roof is probably the most important part of your home's design. That's why we design our Bird shingles to do a lot more than keep the rain out.

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Please send me your revised, 36-page color booklet, "What you should know about roofing and siding before you build or remodel." I'm sending 50¢ in payment, and I'm planning to  build  remodel.  
Popular Mechanics-Sept. '78

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The best dressed homes  
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# Insulation: How much is enough?

All kinds of claims are being made for insulation—and why you should add more. Here's what you should know before plunking down any more cash.



Data: Mort Schultz

**C**harges! Countercharges! Warnings! Denials! Contradictions! Sounds like a United Nations debate, no?

Would you believe it's all about old-fashioned home insulation—that low-density porous material which curtails heat flow? Notwithstanding its other advantages, insulation helps keep a lid on what it costs to heat and cool a home.

A study five years ago by the then Federal Energy Administration revealed that seven of 10 houses in this country had no or insufficient insulation. Most people couldn't have cared less before 1973. Energy was cheap.

But with spurt after spurt in energy prices, people have been rushing to buy insulation. With the rush has come a preponderance of data that previously went unpublished or unnoticed.

Do you know, for instance, that in April a U.S. Congressional subcommittee took to task the prestigious Consumer Product Safety Commission (CPSC) for not urging stronger standards to govern cellulose insulation?

Cellulose insulation is made of a finely-ground cellulose product, usually paper, but sometimes wood fiber. It can be poured from a bag

between joists of an open attic floor or blown into place behind finished walls. It has good insulating qualities and is one of the least expensive materials on the market.

The problem? Cellulose is highly combustible in raw form. To lessen combustibility manufacturers treated the product with a borax derivative before borax became in short supply. Then, some reverted to aluminum sulfate. However, aluminum sulfate produces sulfuric acid as it absorbs moisture, and sulfuric acid rots wood framing. The subcommittee cited, as an example, a warehouse in Michigan that was insulated with aluminum sulfate-treated insulation. The structure had collapsed.

If this were the only finger of doubt pointed at insulation, people could live with it. But listen to these charges—some of which are unsupported by evidence and/or denied by the affected industry:

- Glass fiber insulation may cause cancer.
- Urea formaldehyde insulation emits an obnoxious odor that may be toxic.
- Urea formaldehyde shrinks seven to 15 percent, which leaves gaps in the insulation.
- Mineral wool that is blown into

place between walls can cause interior walls to blister.

And then, there's the controversy over how much insulation is enough. It's time to put the subject into perspective so you can examine facts and "non-facts" critically. This article, which is separated into five specific areas, does this for the most commonly used insulating materials. The five areas are as follows:

1. Summary of insulation forms and materials that insulation is made from. Advantages and disadvantages are emphasized.

2. The importance of the R value, which is the resistance to heat of insulation materials.

3. How to figure the amount of insulation you need to buy so you don't end up with too much or not enough.

4. Facts about the all-important vapor barrier.

5. How to read packaging labels.

**Important:** Some types of insulation are in short supply. For example, none of three suppliers contacted had bagged mineral wool (glass fiber or rock wool) insulation in stock. They could supply high-priced vermiculite. Two were willing to place an order for mineral wool but there would be a six-week wait.

## About R values

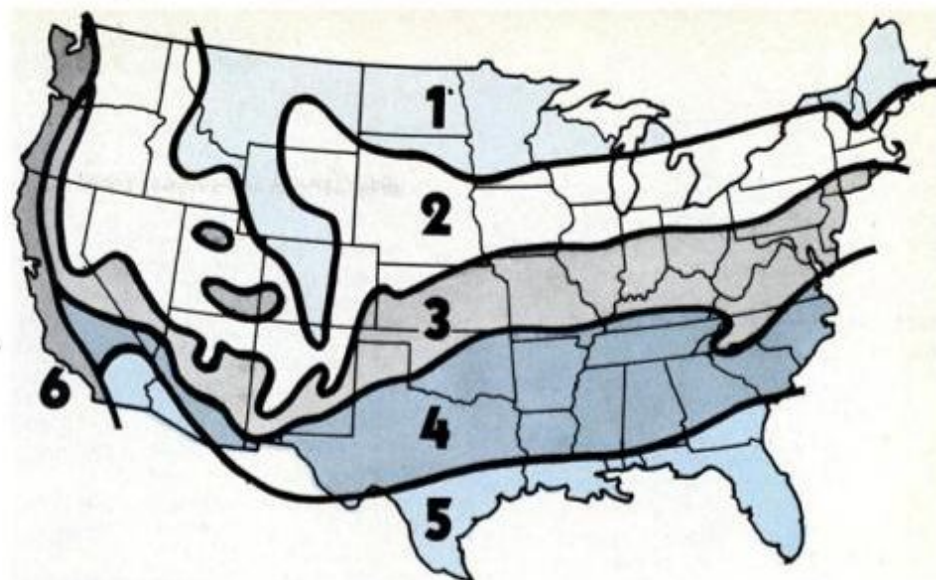
**R** value is a number indicating how much resistance insulation presents to heat flow. The higher the R value, the more effective the insulation. Blankets, batts and bags of insulation should be stamped with the R value. Don't buy any that aren't.

Different kinds of insulating materials of equal thickness have different R values. The following list outlines the approximate R values for the most commonly used insulating materials (where ranges are given, they indicate the difference in R value among manufacturers using the same material):

Insulation	Maximum R-Value (per inch of thickness)
Vermiculite	2.08
Glass fiber loose fill	2.1-2.4
Rock wool loose fill	2.7-3.2
Cellulose	3.1-3.8
Glass fiber blankets/batts	2.7-3.7
Rock wool blankets/batts	3.1-3.6
Urea formaldehyde	4.1
Polystyrene, polyurethane	6.25

Don't deal with a contractor who talks in terms of inches instead of R value. Make certain your contract stipulates the R value of material he installs. The Federal Trade Commission warns that a claim about a product's thermal resistance, "either through generalization or exaggeration of R value, is the most common deceptive contractor practice." Combining two pieces of insulation will provide a sum total of their R values. For example, R 11 + R 19 = R 30.

A point is eventually reached where the benefits obtained from installing more insulation are too



REGION	CEILING	WALL	FLOOR
1	38	19	22
2	33	19	22
3	30	19	19
4	26	19	13
5	26	13	11
6	19	11	11

insignificant to justify cost. At what point no one can agree. Recommendations by manufacturers and government agencies vary somewhat as to the minimum R values that are needed for a home. Here are some examples:

- (a) Federal Housing Administration  
*Ceilings (i.e. attic floors):* R 22 (R 19 for areas with less than 8000 degree days).  
*Exterior walls:* R 13 (R 11 for areas with less than 8000 degree days).  
*Floors over unheated basements:* R 1.

- (b) Edison Electric Institute (for electric homes)

*Ceilings:* R 30 (R 19 for areas with less than 3500 degree days).

*Exterior walls (existing construction):* R 11.

*Floors over unheated basements:* R 11.

- (c) Council of Better Business Bureaus:

*Ceilings:* R 30.

*Exterior walls:* R 13.

*Floors over unheated basements:* R 19.

Or, use the map and chart above to find the recommended R value for ceilings, walls and floors in your area. Locate your home zone on the map and read the corresponding R values on the chart. (Figures supplied by Owens-Corning Fiberglass Corp.)

R value is the most important factor in insulation, but also know the advantages of different forms and materials before you buy.



## Calculating quantities

**H**ere's how to figure out how much insulating material you'll need to do the job:

### 1. Blanket rolls or batts

Obtain the overall area dimension by multiplying length times width. Allow for the space taken by framing. This is a constant. If studs are 16 in. on center (O.C.), multiply the area dimension by 0.9. If studs are 24 in. O.C., multiply the area dimension by 0.94. The number you get is the total square feet of blanket roll or batt insulation you need.

**Example:** 1250 square feet of attic floor space. Studs are 16 in. O.C. Thus,  $1250 \times 0.9 = 1125$  square feet of insulation.

### 2. Loose fill

Determine the overall square footage, considering the constant number for the existing stud layout (see above). Determine the "maximum net coverage per bag" for the desired R value from label information.

Divide the overall square footage by "maximum net coverage per bag."

**Example:** Overall square footage is 1125. Each bag covers 32 square feet to obtain a desired R value of 30. Thus,  $1125 \div 32 = 35.15$  bags—make it 36.

# FORMS AND MATERIALS

## BLANKET ROLLS

### Dimensions:

**Thickness:** variable from 1½ to 8 in.

**Length:** variable from 10 to 200 ft.

**Width:** 15, 19 or 23 in. to fit 16, 20 or 24 in. on center (OC) stud spacing, respectively.

### Best uses:

Where framing is open.

**Important:** Spaces between framing members should be relatively free of obstructions.

Unfinished attic floor.

Open rafters in attic or dormer to be finished.

**Important:** Do not insulate rafters of an unfinished attic. It serves no purpose.

Open basement or crawlspace floor joists.

Unfinished walls (new-home construction).

### Materials:

Glass fiber.

Rock wool.

**Note:** The above materials are commonly grouped together under the term "mineral wool." According to the Council of Better Business Bureaus, rock wool has a higher insulating value per inch thickness than glass fiber.

### Physical properties:

Fire-resistant.

Nonhygroscopic (it is moisture-resistant).

Odorless.

Vermin- and rodent-resistant.

Required by federal specification to be noncorrosive to metal.

### Other characteristics:

Available with or without vapor barrier backing.

### Advantages:

Relatively inexpensive (14¾ cents per sq. ft.).

**Note:** Prices quoted throughout were obtained from retail sources. They are given for comparison reasons only and may differ from area to area. Prices are for do-it-yourself materials.

Allows for uninterrupted vapor barrier.

### Disadvantages:

Has to be cut to size (use heavy-duty shears or sharp knife).

May irritate skin; wear gloves and protective breathing mask when installing. Some paper vapor barriers are flammable.

### Speculation:

Fibers inhaled from glass fiber insulation may be carcinogenic. CPSC states: "While CPSC currently has no evidence supporting any pathological effects in humans, it is continuing to review ongoing studies to determine if some type of regulatory action may be needed."

## BATT

### Dimensions:

Thickness and width: same as blanket rolls.

Length: 4 and 8 feet.

### Best uses:

Same as blanket rolls.

### Materials:

Same as blanket rolls.

### Physical properties:

Same as blanket rolls.

### Other characteristics:

Same as blanket rolls.

### Advantages:

Easy to handle because of relatively small size. Less work involved to install; batts are precut.

### Disadvantages:

Over an area longer than 8 ft. breaks occur in vapor barrier coverage, require taping.

Some paper vapor barriers are flammable.

Waste results if trimming has to be done. May irritate skin or nose.

More expensive than blanket rolls (23¾ cents per sq. ft.).



### Speculation:

Same as blanket rolls.

## FOAM

### Material:

Urea formaldehyde, which is combined with a catalyst so it can be forced from a nozzle under pressure. Foam sets within 10 to 60 seconds.

### Best uses:

To insulate exterior walls that are enclosed (existing structures). Urea formaldehyde foam is a contractor installed material.

### Cost:

50 cents per sq. ft. (varies with area, contractor).

### Areas of disagreement:

"If properly manufactured and installed, urea formaldehyde products can meet accepted levels for flammability safety, but they are not 'fireproof' as distributors sometimes claim (CPSC).

"The normal linear shrinkage of urea formaldehyde foam is in the seven to

15 percent range" (*Modern Plastics Encyclopedia*, 1975-76, supported by a test conducted by the Bureau of Standards). On the other hand, the National Association of Urea Formaldehyde Insulation Manufacturers claims normal shrinkage is one to three percent.

"Another possible hazard linked with urea formaldehyde insulation is emission of toxic fumes after the product has been installed. Improper mixing and curing of this product can contribute to production of such fumes" (CPSC).

### Advantages:

One of the most effective insulating materials (inch-for-inch thickness) available.

"Rapco-Foam will not hydrolyze (i.e., absorb moisture). Moisture absorption in wet cavity wall over 24-hour period, two percent by weight" (Rapperswill Corp., a producer of urea formaldehyde).

### Disadvantages:

If installed in an attic, high temperature may cause the material to disintegrate and fumes to seep into the living quarters.

"Quality of application to date has been very inconsistent. Choose a qualified contractor who will guarantee his work" (Department of Housing and Urban Development).

## LOOSE FILL FOR POURING

### Materials:

Rock wool.

Glass fiber.

Cellulose.

Vermiculite (manufactured from lightweight mica rock).

### Best uses:

Attic floors, especially those interrupted by framing, piping that would reduce the effectiveness of blanket rolls, and those having nonstandard stud spacing.

Finished exterior walls if the home has exposed openings in the attic that allow pouring of insulation down between the studs.

### Cost:

Cellulose: 10 cents sq. ft.

Rock wool: 15 cents sq. ft.

Glass fiber: 18 cents sq. ft.

Vermiculite: 33 cents sq. ft.

### Physical properties:

Rock wool and glass fiber: Same as blanket rolls.

Cellulose: Not fire-resistant if untreated.

**Note:** CPSC warns that cellulose insulation, although treated, can catch fire if subjected to flame or spark. Do not install near light fixtures or heat ducts.

Federal specification HH-1-515C requires that if starch is added to cellulose insulation, the manufacturer certify in writing that the product has been chemically treated to resist vermin.

Odorless.

Hygroscopic—will absorb moisture and

become less effective.

Some chemicals (aluminum sulfate is one) that are used to treat cellulose are corrosive.

**Vermiculite:** Least flammable insulating material with zero rating for all three Underwriters Laboratories tests (flame spread, fuel contributed, smoke developed—see "Reading Labels," page 136).

**Odorless.**  
**Vermin- and rodent-resistant.**  
**Nonhygroscopic.**  
**Noncorrosive.**

**Advantages:**  
All pour easily and fill holes and gaps readily.

From the standpoint of insulating value, cellulose provides the most per inch thickness, followed by rock wool, glass fiber and vermiculite. According to the Department of Housing and Urban Development, cellulose has "about 30 percent more insulating value than rock wool for the same installed thickness."



#### Disadvantages:

A separate vapor barrier (heavy polyethylene) should be laid before insulation is poured in an uninsulated attic.

Mineral wool has tendency to sag when installed in walls.

Must be contractor-installed.

### LOOSE FILL FOR BLOWING.

#### Materials:

Rock wool.  
Glass fiber.  
Cellulose.

#### Best uses:

Finished or unfinished attic floors.  
Finished exterior walls.

#### Cost:

Materials cost same as loose fill for pouring. Add 100 percent for contractor installation.

#### Physical properties:

Same as loose fill for pouring.

#### Advantages:

Same as loose fill for pouring.

#### Disadvantages:

Same as loose fill for pouring.



#### Rigid board.

#### Dimensions:

Some are precut  $\frac{3}{4}$  x  $13\frac{1}{2}$  x 48" to fit between standard  $2\frac{1}{2}$ " wide furring strips set 16" on center. Also available in 24" length up to 4" thick.

#### Best uses:

Basement walls.

#### Materials:

Polystyrene.  
Polyurethane.



#### Physical properties:

Combustible. Must not be exposed to open flames, sparks or other excessive heat. Must be covered with a minimum  $\frac{1}{2}$ " gypsum wallboard.

Vermin- and rodent-resistant.

Noncorrosive.

Nonhygroscopic.

#### Advantages

Extremely high insulating value.

Precut size referred to above fits between furring strips. No adhesive or tacking required.

Easily trimmed (use serrated knife).

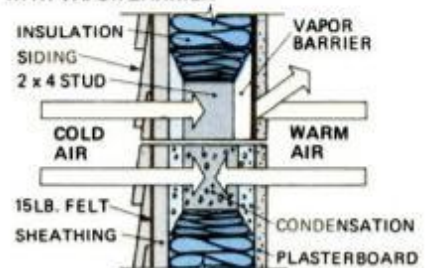
No vapor barrier necessary.

## What you should know about vapor barriers

**A** vapor barrier prevents water vapor from condensing and collecting in new insulation and on wood framing. Vapor control is also maintained by assuring adequate ventilation so don't cover attic (either gable or soffit) or crawl-space vents with insulation.

Most people assume that material used as coverings on mineral wool blankets and batts are vapor barriers, but these do not completely bar moisture transmission.

#### WITH VAPOR BARRIER



#### WITHOUT VAPOR BARRIER

These membranes are satisfactory for some vapor barrier purposes. Where no membrane is attached to the insulation, a separate vapor barrier is necessary. Materials that may be used as a vapor barrier include:

- Polyethylene sheeting, 2 mils or thicker in the attic and walls, and 4 mils or thicker as ground cover under slabs or over crawl-space earth.

- Foil-backed gypsum board.

- Waterproof laminated asphalt-coated paper.

**Important:** Always install a vapor barrier facing the "warm" side of the wall, the side heated in winter. If blanket rolls or batts with vapor membranes are to be installed over existing attic insulation, remove the membranes of the new insulation or slash them free with a knife. If a membrane is slashed, install new blankets or batts with the membrane side down. If you damage the vapor membrane during installation, use tape for repairs.

**Caution:** Some vapor membranes are flammable. The National Mineral Wool Insulation Assn. warns that a membrane with a flame spread greater than 200 (see "Reading labels") be marked as follows: "This vapor barrier is flammable and should not be left exposed. Special care should be taken when working close to the facing with an open flame."

## Reading labels

The federal government and the American Society for Testing and Materials (ASTM) have set minimum specifications and standards for cellulose and mineral wool loose-fill insulation. On those that apply to cellulose. *Packages should state that products meet these specifications.*

1. Fed. Spec. HH-1-515C—"Insulation, Thermal (Loose Fill for Pneumatic or Poured Application): Cellulosic or Wood Fiber."

2. ASTM Standard C739-73—"Standard Specification for Cellulosic Fiber (Wood Base) Loose-Fill Thermal Insulation."

The following are minimum specifications that apply to mineral wool:

1. Fed. Spec. HH-1-1030A—"Insulation, Thermal (Mineral Fiber for Pneumatic or Poured Application)."

2. ASTM Standard C236-66—"Test for Thermal Conductance and Transmittance of Built-up Sections by Means of the Guarded Hot Box."

3. ASTM Standard C687-71—"Recommended Practice for Determination of Thermal Resistance of Low Density Fibrous Loose-Fill Type Building Insulation."

Underwriters Laboratories (UL) also evaluates insulating materials with respect to flammability. According to UL, "if the material has passed the UL testing program and the follow-up factory inspections to ascertain that the product is the same as that which was originally tested, then, and then only, can the maker use the UL classified marking."

The UL marking indicates "flame spread," "fuel contributed" and "smoke developed." "Flame spread" rates how quickly the material burns. "Fuel contributed" rates the material's contribution as a fuel. "Smoke developed" is the amount of smoke the material generates. Ratings are based on a comparison with

noncombustible (asbestos-cement boards), which is zero, and with a combustible (untreated red oak lumber), which is 100.

In the sample label (below left) the flame spread of the insulation batt or blanket is 25, which means it burns one-quarter as quickly as red oak. The insulation contributes fuel to the fire one-half as much as red oak. Thus the value 50. The insulation is also rated 50 as a smoke developer.

You may see a label similar to the second sample (right). The FHC 25/50 designation means that the product has a flame spread of 25, and fuel contributed and smoke developed values of 50. FHC stands for "Fire Hazard Classification."

**UNDERWRITERS LABORATORIES INC.®  
CLASSIFIED**

**FACED BATTS OR BLANKET**

Contents Not Over 300 Sq. Ft. (Form D) Issue No. 5290

**FIRE HAZARD CLASSIFICATION**  
(BASED ON 100 FOR UNTREATED RED OAK)

	Vinyl Film Rating	Full-Series-Blanket Rating
FLAME SPREAD .....	25	25
FUEL CONTRIBUTED .....	50	50
SMOKE DEVELOPED .....	50	50

SEE U.L. CLASSIFIED BUILDING MATERIALS INDEX

UL label gives information concerning insulation's burning characteristics.

**UL-500-5  
UNDERWRITERS LABORATORIES INC.  
CLASSIFIED**

**PROCESSED BATTS OR BLANKET**

Contents Not Over 500 Sq. Ft. Issue No. 5028

**FIRE HAZARD CLASSIFICATION**  
(Based on 100 for untreated Red Oak)

**FHC 25/50**

SEE U.L. CLASSIFIED BUILDING MATERIALS INDEX

FHC and number flag a product's "Fire Hazard Classification" rating for buyers.

U.S. Department of Commerce  
**VOLUNTARY CONSUMER PRODUCT  
INFORMATION LABELING PROGRAM**  
**INFOTAG**

**Thermal Insulation for Homes  
Cellulose  
Loose Fill for Blowing**

• For use in:  
 Attic floors     Floors over crawl spaces     Enclosed walls  
 Basement ceilings     Open walls

• CAUTION: Follow instructions. Proper installation is necessary for safety and effectiveness.

• The contents of this package will provide:

An R value* of	And will cover (square feet)	To give a settled thickness of (inches)
3.8	166	1.0
13	53	3.5
21	33.8	5.5
30	23.8	7.5
40	17.7	10.5

\*NOTE: A higher R value means less energy loss. Find the best R value for your location and home. For the best dollar value, compare fuel savings to insulation cost.

• Price Comparison  
 The Price Comparison Numbers should be used to find your best value. To find the Price Comparison Number for this package, multiply 1.41 by the price per package.

**1.41 × Price of this Package = PRICE COMPARISON NUMBER**

The smaller the Price Comparison Number, the less your cost for insulation.

• Fire Resistance Ratings

**Resistance to Surface Flame Spread**

0     1.0  
 less resistant    more resistant

**Resistance to Smoldering**

0     10  
 less resistant    more resistant

• Building Code Compliance  
 Some building codes and other regulations require that the FSC number not exceed a certain value. Check with your local authorities. The FSC number for this package is 45.

• Corrosion  
 This material may corrode:  
 Aluminum     Copper     Steel     Galvanized steel     None of these

Date on this label certified by:

This specification for labeling home thermal insulation, proposed by the Department of Commerce, gives easily understood product information to consumers at the point of sale.

## Uniform home insulation labeling

The Department of Commerce has proposed that manufacturers of home thermal insulation voluntarily adopt a uniform label to aid consumers. The label will list an insulating product's chemical material and form, along with its safety rating, area of coverage, R value and recommended application. Home insulation is the first product selected under new Vo-

luntary Consumer Product Information Labeling Program (CPILP). The government is seeking industry support, and if manufacturers participate, most types of insulation will be tested, rated and labeled. The National Bureau of Standards will select test procedures and design a label that can be easily understood by consumers (see sample at left).

## Booklet on blown insulation

"Mineral Blowing Wool," a technical guide for pneumatic installation of fiber glass and rock wool in residential and other light-frame construction, has been published by the National Mineral Wool Insulation Association.

Although the manual is intended primarily for insulation contractors and their application crews, it is useful to builders, home improvement specialists, building inspectors, utility representatives, home owners and oth-

ers who want to understand the techniques of installing blowing wool.

The 28-page, illustrated booklet gives guidelines for planning crew operations and detailed instructions for blowing mineral fiber insulation into attics, stairways and sidewalls.

Single copies (50 cents) are available from the National Mineral Wool Insulation, PM 978, 382 Springfield Avenue, Summit, N.J. 07901.

# SuperSander™

**It outperforms  
ordinary  
sandpaper  
up to 10 to 1.  
And that's a  
promise.**

SuperSander cuts faster. Lasts longer. And resists tearing better than ordinary packaged sandpaper. Try it.

You'll agree SuperSander is the best sanding product you've ever used, or Carborundum will give you your money back.

Look for SuperSander belts, sheets and pressure sensitive discs wherever you buy power sanding supplies. Or write for the address of the SuperSander dealer nearest you.

The Carborundum Company  
Consumer Products Division  
P.O. Box 337  
Niagara Falls, New York 14302

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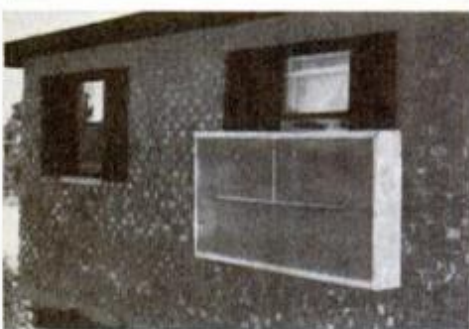
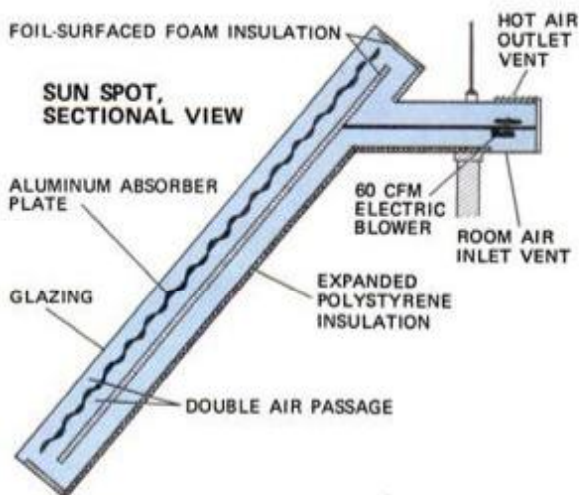
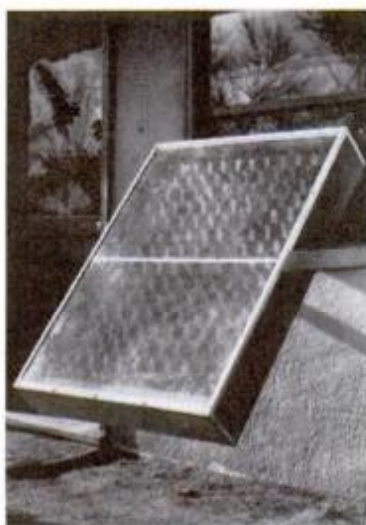


## 7 solar products you don't have to be rich to buy

For everyone who is interested in giving solar collection a try—but not quite ready to remortgage the house to do it, PM has shopped around and come up with the following inexpensive space-heating, water-heating and solar-shading devices. Space-heating units are small and do not store heat, thus limiting them to daytime booster heating. But they provide a way to plunge into solar without extensive renovations and great expense. Water heaters are one of the most cost-effective ways to use solar energy, but require basic plumbing skills. Solar shading devices are actually more effective than conventional shades, blinds and draperies, and they are just as easy to install.

### One for your window

This unit retails for \$370, weighs under 55 lbs., and can be installed in about 30 minutes. Sun Spot uses an automatic 17 W. blower that moves 55 cu. ft. of air per minute. A thermostat activates the blower when the sun heats the collector's absorber plate to 10°F. above room temperature. The blower shuts off when the plate cools to within 6°F. of room temperature. Even with the temperature outside in the high teens, it can produce 140-145°F. air, claims the manufacturer. Unit comes with a two-year warranty. Sun Spot will soon offer additional solar window unit kits; one will allow rock storage of solar heat. For more information, write to Sun Spot Research, 1070 South Leyden, Denver, Colo. 80224.

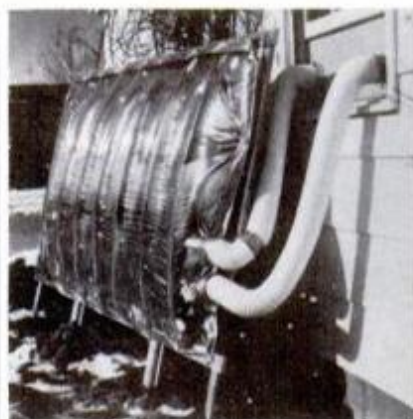
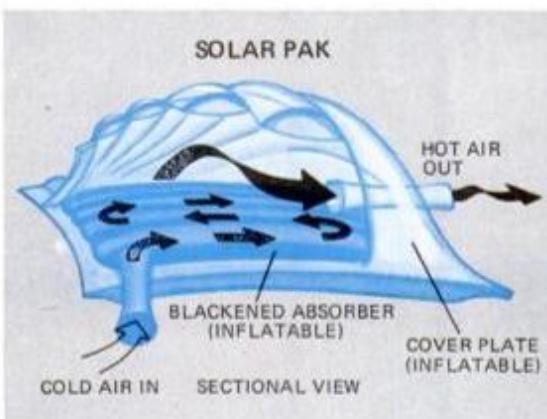


### There she blows

The compact 75-lb. Isis solar heater incorporates a blower, differential thermostat and monitoring thermometers in one unit which installs in a window. It sells for \$649.

Although the solar collector is fixed in a vertical position, the low southern-sky trajectory of the winter sun prevents this from being a significant drawback. Some efficiency may be lost during the spring when heating is still required and the sun is rising to its summertime peak.

The typical hot-air output for a day when the sun is shining is enough to heat a 16x16-ft. exterior room in the average insulated house (2300 BTUs-per-hour loss). The maker offers a one-year parts warranty. Write to Impac Corp., 312 Bolondeau St., Keokuk, Iowa, 52632.



### An ugly duckling that works

Billed by its manufacturer as including "The World's Ugliest Solar Collector," this window unit sells for \$335. It includes 100 sq. ft. of a flexible polyethylene collector, flexible hose, and the air-handling unit with blower and thermometers showing room and collector temperatures. A thermostat that turns the blower on when the collector reaches 80° F. is \$16 extra.

The fascinating part of this unit is the collector itself (shown in cutaway). Because the collector can be situated separately from the air handler and ducted to it, the room you wish to heat doesn't

even have to have a south-facing window. You can locate the collector around a corner if necessary.

In operation, cold air blows through a serpentine duct in the absorber unit (see drawing). Air is then released between the absorber unit and lens and flows out the hot-air duct. Temperatures of up to 140° F. can be achieved, the manufacturer says. The collector can be purchased separately. Life expectancy is three to five years.



















For additional information, write to the Chicago Solar Corp., 5151 North Harlem Ave., Chicago, Ill. 60656.



# McCulloch just made a good deal great.

## Mac 110 now just \$74<sup>95</sup>\*



FEATURES	McCULLOCH MAC 110	POULAN MICRO 25	HOMELITE XL 10	SEARS 35201	REMINGTON YARDMASTER
PRICE (Manufacturer's suggested list)	<del>\$89.95</del>	\$79.95	\$84.95	\$79.99	\$89.95
DISPLACEMENT	32 cc	33 cc	26 cc	33 cc	31 cc
BAR LENGTH	10"	10"	10"	10"	12"
CHAIN BRAKE					
HAND GUARD					
AUTOMATIC OILING					
MANUAL OILING					
MUFFLER SHIELD					
SAFETY TRIGGER					
THROTTLE LATCH					
RIGHT HAND GUARD					
CHAIN CATCHER					
SAFETY TIP					

The above prices are the suggested list or retail prices published by individual manufacturers or their agents. Actual retail prices may vary at the discretion of individual dealers. Data for the above models are on file at McCulloch Corporation and are available upon request.

\*Save \$15 on Mac 110 from September 1 through December 31, 1978  
The lowest priced chain saw with Chain Brake.



McCulloch Corporation, Los Angeles, California 90009

## Solar hot water

This system relies on convection and gravity to circulate heat transfer fluid—and requires the tank to be placed higher than the collectors. Anti-freeze, heated in the collector, naturally rises to a heat-exchanger jacket surrounding the 66-gal. tank holding the potable water. Cooled antifreeze then drops down to the collectors to be reheated.

The water tank is connected to the home's cold-water source and the other line runs to a conventional water heater. The apparatus can be placed on the ground; the maker provides plans for a platform to raise the tank. Costs \$660 from Zomeworks; see address below.

## PASSIVE WATER HEATING SYSTEM

BLACKENED COPPER ABSORBER PLATE

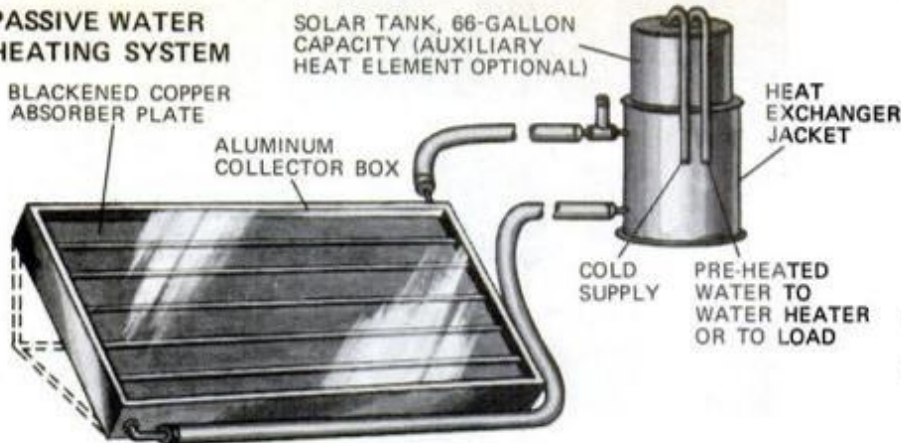
ALUMINUM COLLECTOR BOX

SOLAR TANK, 66-GALLON CAPACITY (AUXILIARY HEAT ELEMENT OPTIONAL)

HEAT EXCHANGER JACKET

COLD SUPPLY

PRE-HEATED WATER TO WATER HEATER OR TO LOAD



The handyman's golden rule:  
**Do it right the first time.**



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**Dow Corning Silicone Rubber Coating** is tough, flexible, long-lasting protection you brush on to prevent water leaks around chimneys, vents, and flashings. Versatile, too. Use it almost anywhere.

**Dow Corning Urethane Bond** is for gluing jobs you want to do only once. Strong as epoxy, but much easier to use.

**Dow Corning Silicone Rubber Bathtub Caulk** provides a permanently flexible, tight, waterproof seal around tub, shower, or sink.

See your local home center or hardware store for Dow Corning home maintenance products. Do it right. Now.  
Dow Corning Corporation, Dept. B-8567,  
Midland, Michigan 48640.

**DOW CORNING**



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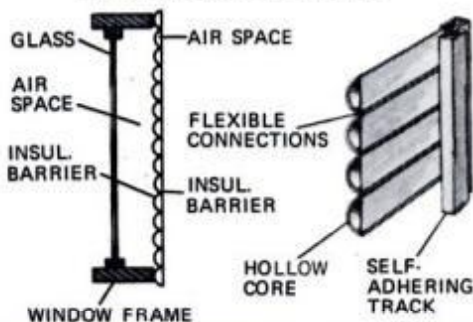


## Super simple solar hot water

Available in two sizes (42-gal. for \$288 and 66-gal. for \$390), the Pro is a very simple domestic solar water heater. It consists of a black, glass-lined tank placed outside the south side of your home with a double-layer acrylic cover to help retain heat. A 2-in.-thick rigid foam insulating jacket is also supplied to cover the tank at night and on cloudy days. This rudimentary system serves best when used as a solar preheat tank in mild climates. It can be hooked up between the cold-water supply line and a water heating system. From Zomeworks Corp., Box 712, Albuquerque, N.M. 87103.



**THERMO-SHADE DETAIL**



**Double-wall thermal shade**

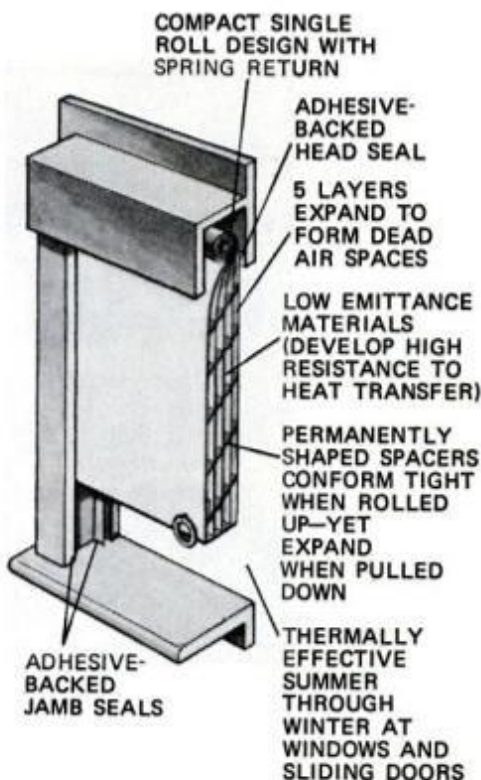
Thermo-shade device shown at left has a series of white, lens-shaped slats extruded from PVC. Flexible joints between the slats allow the shade to be rolled into a valance above the window. The combination of dead airspace in the slats and their white reflective surface cuts heat loss and gain through a single pane of glass about 75 percent. Cost is \$2.75 per sq. ft., plus \$15 for the valance end plates that contain the spring tension roll-up mechanism. Contact Solar Energy Components Inc., 212 Welsh Pool Rd., Lionville, Pa., 19353.

**Shade with high 'R' value**

The IS (Insulating Shade) is made of five layers of plastic film that roll down and expand to create four insulating dead air spaces. Self-adhering jamb seals are provided for use along the sides of the shade to prevent air circulation. In the rolled-up position, an IS for a typical sliding glass door compresses to 2 3/4-in. dia.

According to the manufacturer, this shade provides an R-value of about eight when combined with an insulated window. The price is approximately \$2.75 per sq. ft. from Insulating Shade, 17 Water St., Guilford, Conn. 06437. Enclose \$1 for product brochure.

**INSULATING SHADE**



# Our stove company has the same name as your country.

We're the United States Stove Company. Call us U.S. Stove for short. We're the oldest stove company in America. We've been in business since 1869, concentrating real hard on making the best stoves and heaters going.

**U.S. Stove's Wonderwood® is America's favorite wood-burning circulator heater, and no wonder.** It's so efficient and hard working it can pay its own way in one winter or less with the money it saves you on heating bills. Just feed it and it'll heat for hours—10 hours or more on one load of wood. Has a new, improved, automatic thermostat for accurate comfort control. To extend the heat into other rooms, you can add an optional 2-speed blower (requires electricity). You can install Wonderwood in one day and enjoy it for many years.



**U.S. Stove's 19th Century Space Age Franklin**

We've been making Franklins since the 1890's. Recently, we introduced our Glass Door Franklin. It's got the traditional 19th century styling. And space age glass-ceramic doors, tougher and more trustworthy than any glass. Closed, they turn the Franklin into a terrifically efficient heater—but you can still enjoy the beauty of an open fire. How's that for Yankee ingenuity?

**U.S. Stove has a whole family of heaters and stoves—wood, coal, gas, oil, kerosene. Any one of them is a warm friend and a hard worker. So when you need supplemental heat in your home, think of U.S. Stove. It's an easy name to remember.**



The original Wonderwood is also available in U.L. Listed Model and Lift-Top Model with auxiliary cooking surface.



Both Glass Door and Traditional Franklins come with 5-year written warranty.

For a brochure on our family of stoves and heaters, write:

**U.S. STOVE COMPANY**

Dept. PM, South Pittsburg, TN 37380



Warm friends and hard workers since 1869.

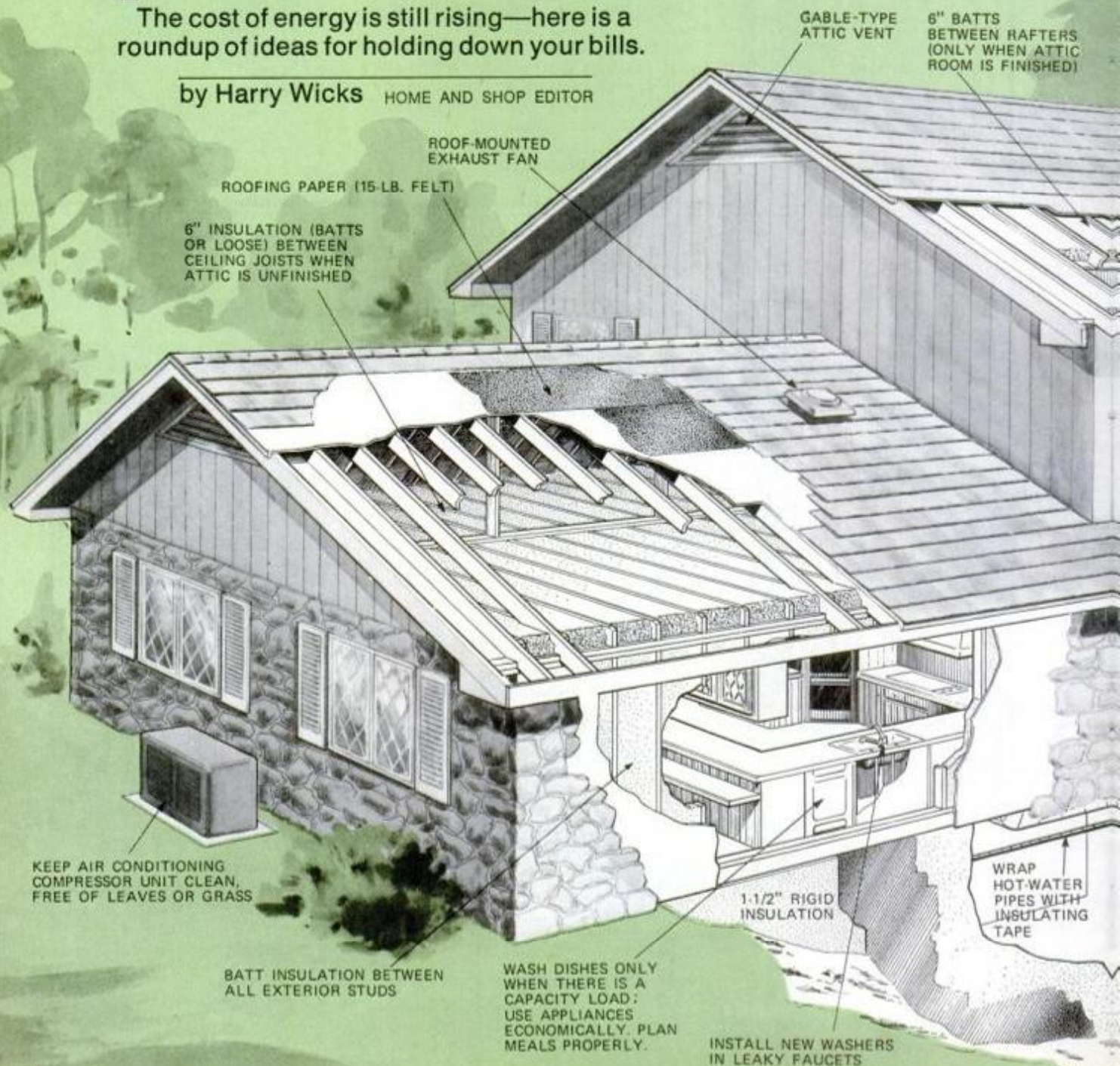
## 22 ways you can save energy around your house

The cost of energy is still rising—here is a roundup of ideas for holding down your bills.

by Harry Wicks HOME AND SHOP EDITOR

These days a homeowner doesn't have to look very far to be reminded that his heating and cooling expenses are the highest ever since man moved indoors. Though industry and government are now pouring dollars into finding a practical alternative to oil and natural gas, we are years away from economically solution to the energy crisis. So it makes sense to get the most mileage out of the energy you are paying for.

**1. Heat-loss audit.** This year many commercial and industrial buildings will be checked for heat loss by infrared photography, a process



which may soon be practical for homeowners. But don't wait for it. If you devote a Saturday to making a heat-loss audit of your home, you can probably locate, and correct, most of your heat loss problems. And, the savings in heating fuel costs can be substantial.

The secret is in knowing where to look. An infrared photo of your home would visually show you areas where heat is escaping and we can make a pretty good guess as to where most of them would be. Depending on the age and construction of your house, you'll probably find heat escaping at

some or all of these points:

- Around doors and windows.
- At structural joints, particularly where dissimilar materials meet.
- Through the roof.

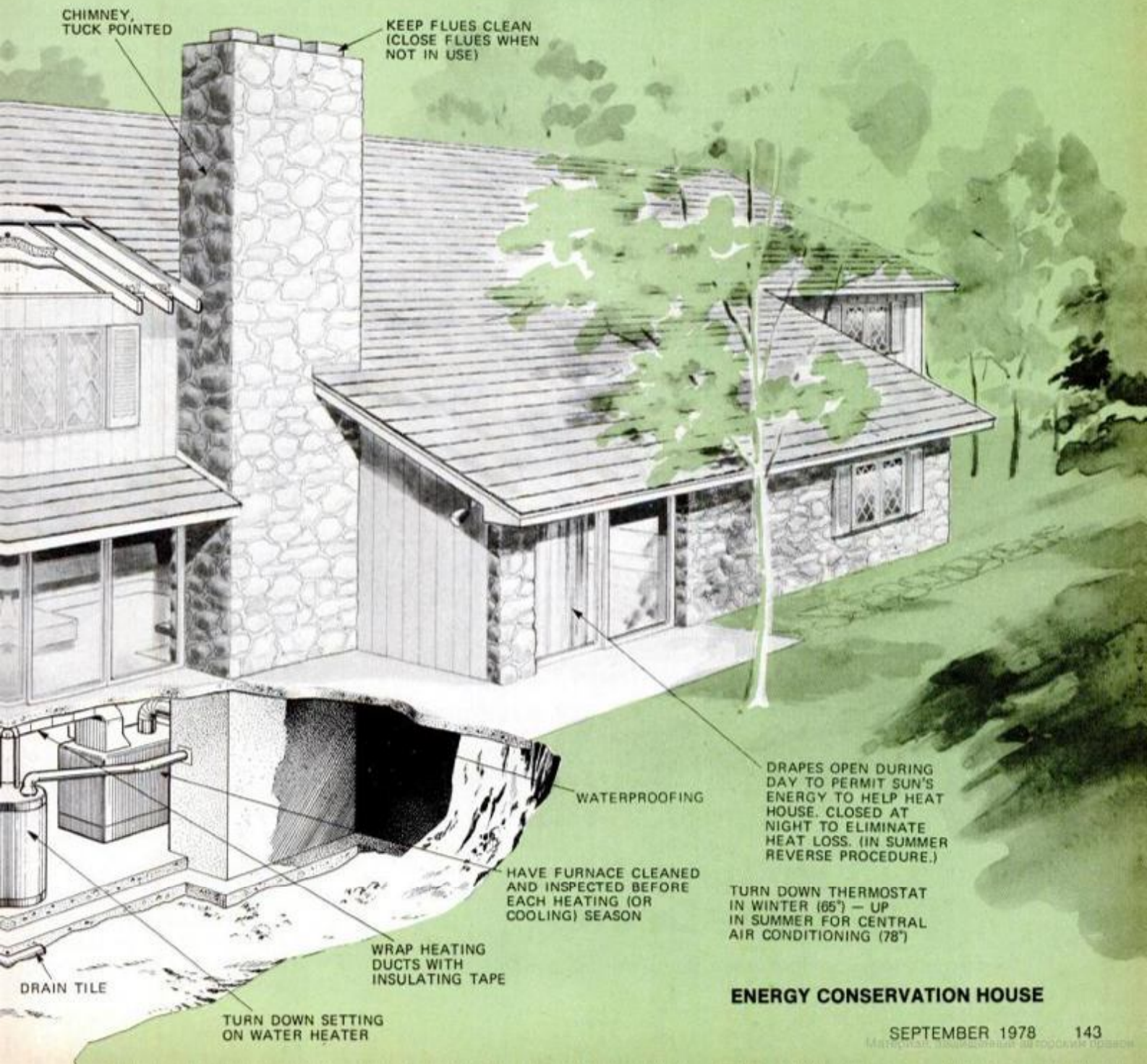
If you inspect these areas you can probably learn more about your home's heat losses than any infrared photo can tell you. Armed with that knowledge, put these pointers to work:

**2. Caulking.** Unless your house is fairly new, or you have been very conscientious about exterior maintenance, there are probably several places where joints have opened up

or the old caulking has dried up and fallen out of the joint.

Check for cracks around door and window frames, places where wood and brick siding meet, and joints between the chimney and siding. Also check where the house framing meets the concrete foundation (you may be able to do this from the basement) and where water pipes, dryer vents, wires pass through walls.

Since caulking is not much fun, choose a caulking compound that won't have to be replaced for a long time. The silicone caulks are the



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**If you want to cut wood,  
buy a John Deere Chain Saw.  
If you want to cut corners,  
don't.**



After you've paid your money, it's no time to discover that bargain-priced chain saws do a bargain-priced job. At John Deere, we believe that the best way to do business is to offer the best chain saws possible.

The five John Deere Chain Saws range all the way from lightweight to industrial weight. They are powerful machines, and that's why these important safety features are included. Standard on all "V" Series saws is a molded plastic handguard, a "chain-catch" to protect you if the chain should ever break, and a throttle/trigger interlock that must be disengaged before the engine will accelerate.

The isolated engine absorbs vibration to make your cutting job less tiring. That job is done with the aid of our sprocket nose guidebar and a chisel or semi-chisel chain that chews through even the hardest wood.

John Deere never cuts back on quality.

Once you cut big trees into smaller logs, you'll need a way to split them. Our new gasoline engine-powered No. 5 Log Splitter performs the task with 10 tons of ram force. Its compact size makes it easily portable.

See your local John Deere dealer soon for a demonstration of our log splitter and chain saw line. If you can't afford a John Deere, you can't afford a chain saw.



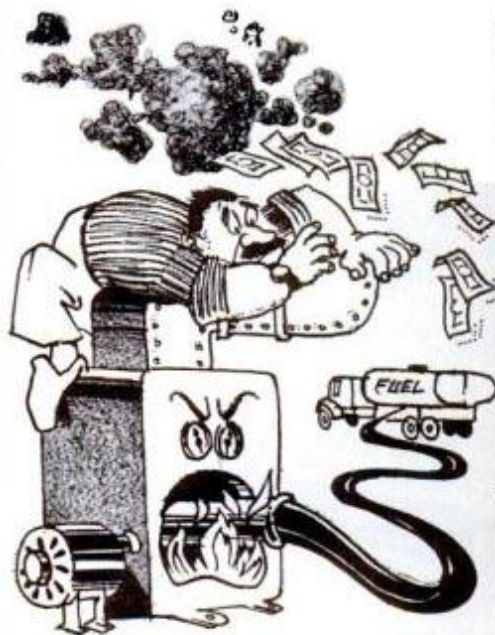
**Nothing Runs  
Like a Deere®**

For a free folder, write John Deere, Box 52, Moline, IL 61265.

longest lasting. There are two basic types: Silicone rubber caulks and paintable silicone caulks. Silicone rubber types are most familiar because of their widespread use as a bathtub seal. The paintable silicone caulks are less rubberlike, but are still extremely resilient. They have the best adhesion to concrete. Paint will not stick to paintable silicone caulks, but will form a film over the surface. With silicone rubber caulks, paint first and then caulk. Both types are available in caulking cartridges for conventional caulking guns. Silicone rubber caulks also come in squeeze tubes—more convenient for some applications.

Vinyl and latex caulks are also premium-priced and premium-performance materials, although their resistance to weather and temperature is less than that of the silicones. Long exposure to sunlight and moisture reduce their flexibility and bond strength.

Most butyl caulks usually contain



**Stop wasting dollars up the chimney;  
keep your burner running efficiently.**

high percentages of solvents and shrink during cure. They do not stand up well to sunlight, but are frequently recommended for below-ground-level applications.

Oil-based caulks are the cheapest and have the shortest useful life.

Whatever caulk you use, be sure you remove all the old loose, dry caulk from the joint and brush out dust and dirt before recaulking. The joint should be clean and dry when the caulk is applied.



Insulation is the quickest and surest way to bring down your heating and cooling bills. But make certain that what you plan to add is, in fact, needed and will actually improve the insulation picture in your home.

**3. Weatherstripping.** Use this where doors or windows meet the frame. Since wooden doors and windows shrink and swell with weather changes, it is almost impossible to maintain a tight seal unless compressible weatherstripping material is applied where the surfaces meet.

The most common weatherstrippings are adhesive-backed foam strips and strips of formed plastic which must be tacked or stapled in place. The foam strips, which have an adhesive backing, are easily installed but not particularly durable. They also tend to become permanently compressed in time. The formed plastic strips do a better job and last longer but are harder to install and not particularly attractive. They are less compressible, thus not suitable for all applications.

**4. Gaskets.** Another solution to the weatherstripping problem is an idea borrowed from the automotive industry: "formed-in-place gaskets" made of a silicone sealant similar to the silicone rubber caulk you can buy. A clear silicone will be almost invisible and it will conform exactly to fill the space between door and door frame.

To make custom-fitted weatherstripping, squeeze a bead of silicone on the portion of the door frame that comes in contact with the face of the door. The bead should fill the gap between door and frame. Before doing this, coat the portions of the door that will come in contact with the silicone with soap or dishwashing detergent to prevent the silicone from sticking to the door. Let the silicone caulk cure about 20 minutes or until it is not tacky to the touch.

Then shut the door and wipe away any sealant squeeze-out.

Do this when you can leave the door shut a day or two since the silicone needs time to cure. Test the release material (soap or detergent) to be sure the silicone won't stick to a surface coated with it. Then apply the release material liberally. Otherwise, you may end up with a permanently closed door.

**5. Attic doors, windows.** In the same way you can weatherstrip the bottom of windows to assure a tight seal. If you have a trap door or fold-down stairway to your attic, use the same technique to prevent heat escaping to the cold attic.

**6. Storm windows.** If you don't have storm windows, installing them will be an excellent investment. They can reduce heat loss through the glass by as much as 50 percent.

**7. Loose screws.** If you already have aluminum storms and screens, the screws holding the storm window flanges may have loosened or the frames may have buckled slightly to let in drafts. The best cure for this is to retighten the screws and caulk the joint where the storm window joins the wooden window frame. It's best, and easiest, to do this from the inside. A clear silicone gives the best appearance if the storm window and window frame are not the same color.

**8. Inoperable storms.** The storm window and screen inserts should slide easily in their tracks. If they don't, remove the inserts and clean the edges and channels with a soft rag and detergent. Use steel wool if necessary. Then lubricate the channel. Unless the unit is out-of-square,

## This weekend seal your doors and windows with M-D weatherstripping

Save from 5% to 30% on home fuel cost!



Drafts around doors and windows of your home are costly. They can cause your home fuel bills to soar! And it is so easy to stop drafts with do-it-yourself M-D window and door weatherstripping. Many M-D weatherproofing products come in kits ready to install on standard doors and windows. This weekend cut your home fuel bills as much as 5% to 30% by sealing out those drafts around your doors and windows with M-D weatherstripping. You'll find a complete line of energy-saving M-D weatherproofing products at your hardware, building supply or home center dealer. And always ask for M-D products by name.



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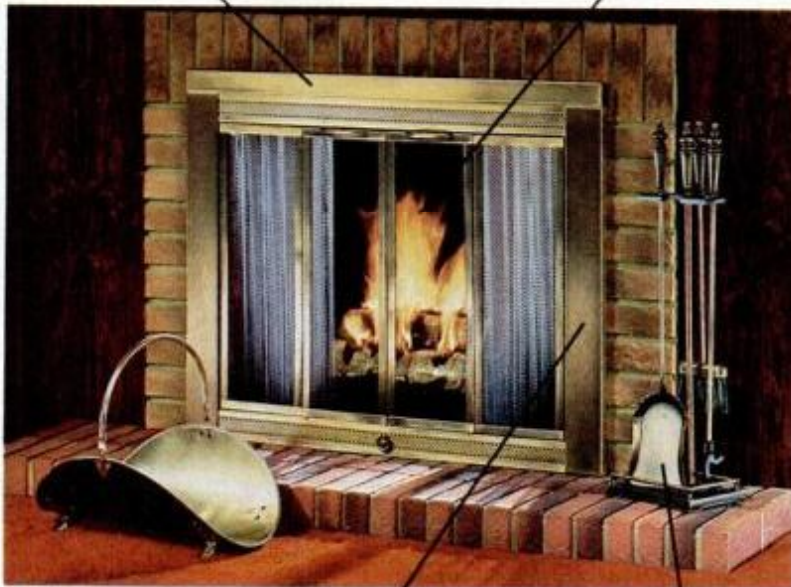
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Mail with 25 cents in stamps or coins to:  
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# SEARS LOWEST PRICE EVER! GLASS DOOR FIRESCREEN— NOW JUST \$98<sup>99</sup>

Save \$21\*  
... lowest price  
ever on this fully  
assembled antique  
brass finish fire-  
screen. Helps save  
heat too.

Energy-efficient, shatter-resistant tempered glass doors (3/16 in. thick) help cut house heat loss after fire is out and damper is still open. Optional mesh screen (pictured) only \$12.99. Glass doors could save more than heat—they help protect against sparks jumping from fireplace onto floors and carpeting.



Thick (1-3/16 in.) insulated frame comes in seven sizes, easy to install. Measure the height and width of fireplace opening before shopping.

\*Black and brass finish screen also on sale at just \$98.99. Save \$21. Unassembled glass door fire-screens start as low as \$74.99.

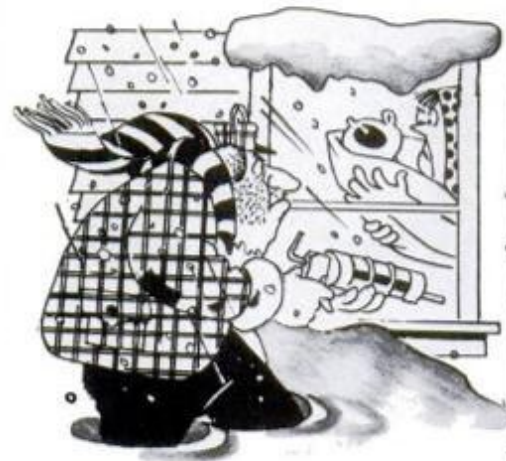
Save \$7  
... on tool set  
pictured. Just  
\$29.99. Wood  
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AT MOST SEARS STORES.

**Sears**

**THE  
FIRESIDE  
SHOP**

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Prices and dates may vary in Alaska and Hawaii.



Now is the time to check for cracks, and seal any you find with a quality caulk.

it should then slide freely.

**9. Sticky catches.** The spring-loaded lugs that fit into notches in the frame to hold the window or screen in place should operate easily. If they don't secure the window in the closed position, it may work up and permit air leaks. Or they may permit the window to slide down when it should be locked in the up position. These catches often stick with disuse and should be lubricated and worked several times until they operate freely.

**10. Choosing the right lubricant.** For your storm windows this is very important. Windows and slides are probably bare aluminum or have a baked-on painted surface. Ordinary petroleum oil does not work very well on paint or aluminum. Graphite is fairly effective but is dirty and messy. Most silicone sprays are no more effective than petroleum oils on aluminum.

An effective aluminum lubricant is General Electric's Silicone Lubricant; it forms a tough film.

**11. Clogged weep holes.** Your storm window unit probably has small weep holes in the bottom tracks to permit rainwater to drain off. If clogged, clean them out with a thin, pointed tool.

**12. Don't compare fuel bills—compare heat degree days.** Because fuel prices change rapidly and weather varies from one season to the next, it is difficult to measure energy savings. To find out what you are saving, compare heating-degree days.

Since space heating accounts for a large percentage of home energy use—especially in the northern and northeastern parts of the United States—degree days give an accu-



rate method for calculating fuel needs from month to month and year to year. You can get degree-day information from a newspaper, local weather station, oil dealer or the local power company.

In most areas, heating is not required when the mean outdoor temperature is 65° F. or above. To obtain the mean temperature simply add the daily high and low temperatures together and divide by two.

The degree-days for a given day is calculated by subtracting the mean outdoor temperature from 65° F. For instance, if the daily high is 30° F. and the low is 10°, the equation reads  $30 + 10 \div 2$ , or 40 divided by 2 = 20° F. mean temperature. Next, you subtract the mean temperature from 65° F. Thus, in our sample day above you would have  $65 - 20 = 45$  degree days.

**13. Economical cooling.** The conservation of energy has as much bearing on home cooling as it does on heating. That's why you should pay special attention to airconditioner maintenance during the cooling season to assure your unit working efficiently.

If you detected any mechanical problems at the end of the last cooling season, ask your airconditioning service specialist to check it over. Or, you may need only basic maintenance—such as the replacement or cleaning of the air filter.

A strong, steady flow of air is a must for an airconditioner to perform its cooling function. To assure clean air the unit is equipped with a filter that traps dust, dirt, pollen and other airborne contaminants. If the filter is clogged it will reduce the airflow and cause the unit to operate inefficiently.

To clean a room airconditioner, first remove the front panel. Then,

use a vacuum cleaner attachment to go over the inside walls, louvers in the front panel and inlet louvers. The inside may also need wiping with water and detergent or liquid cleaner.

Next, inspect the air filter. If it's aluminum, it can be washed and used for years. Nonwashable filters should be replaced when dirty. If you need a new one, buy a washable aluminum-mesh filter that can be trimmed to the correct size with scissors. A filter can be cleaned in warm soapy water and air-dried. After each washing it should be recoated with a filter adhesive to restore its original performance. The spray-on coating is usually available along with filters in most hardware and department stores.

When the hot season arrives, keep these suggestions in mind:

**14.** Be energy-conservation minded. Use your air conditioner in accordance with current energy recommendations or regulations.

**15.** Turn on the airconditioning before your rooms heat up.

**16.** Keep windows and doors shut.

**17.** Don't let cold air escape.

**18.** Use shades, awnings and drapes to protect against direct sunlight.

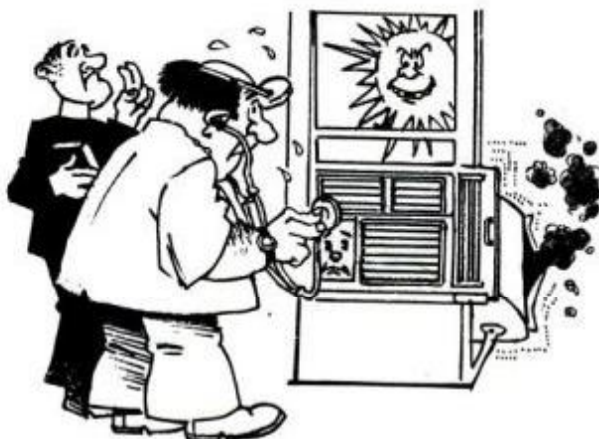
**19.** Keep grills and registers open for proper air movement.

**20.** Check and clean the air filter periodically.

**21.** Remember: Fans are more economical to run than airconditioners.

**22.** An attic fan can make your whole house a little cooler. **PM**

Use common sense when installing a room airconditioner. If possible, place it in a window on the north or east side so the unit can produce cool air with less effort. If it must be in a window on the south or west side, consider installing an awning over it to help ease the load. For maximum airconditioner efficiency check its filter regularly (see No. 13 in text).



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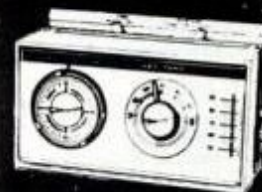
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# TOTAL SUN



...a PM compendium of solar minutiae

**S**olar observatory scientists, museum guides and science teachers say the question most often asked about the sun is: How long will it last? The best available answer is no more than a consensus of solar astronomers' rough guesses—at least another 5 billion years.



In 1901, a practical solar-powered steam engine was put to work pumping irrigation water on an ostrich farm in Pasadena, Calif.



The Solar Constant is the standard intensity of solar radiation impinging on the Earth's atmosphere at the mean distance between Earth and sun. It is the energy equivalent of 1.353 kilowatts of electricity per square meter. Under clear skies, some 80 to 90 percent of this radiation reaches the ground; under heavy cloud cover 10 percent or less. The average energy rate at the Earth's surface is about 1 kw per square meter.



Upon its completion in the coming year, the world's largest solar heating system will service a 14-building education complex in Saudi Arabia.



According to contemporary accounts, the great Greek mathematician, Archimedes, was supposed to

have fashioned parabolic reflectors that focused the sun's rays on the sails of Roman ships and set them afire, thus assuring the Greeks' victory at the battle of Syracuse in 212 B.C. Most historians doubt that this ever really happened.



Despite considerable publicity given to warnings from medical authorities, every solar eclipse visible in heavily populated areas of the world produces a few isolated cases of blindness due to retinal burns suffered by people who have stared at the eclipse without any eye protection. Recommended densities of protective media vary up to three layers of completely exposed (and developed) photographic film for any sustained observation. The next solar eclipse visible in parts of the United States will occur on Feb. 26, 1979.



John Ericson, who designed the Union's Civil War armored ship, *Monitor*, built several solar-powered steam engines before announcing that the idea was totally impractical.



If you could see all the sun's radiation, it would seem twice as bright. Only 47 percent of solar radiation is within the visible spectrum—appears as sunlight. Approximately seven percent is in the ultraviolet range, while the remainder is in the near-infrared portion of the

spectrum.



Twenty years ago, when the space program's pioneers wanted to test spacecraft components' ability to resist the heat of re-entry, they decided to build a "solar furnace" based on a large reflector to generate the necessary high temperatures. Instead, somebody figured out a way to convert surplus World War II searchlights into a solar furnace—capable of 8000° F.—at one-eighth the cost of building one from scratch.



The solar energy—total sunlight—that falls on the land area of the United States in one year is estimated to be the equivalent of 500 times the amount of all the energy the United States will consume annually by the year 2000. Worldwide, the total energy available in solar radiation equates to 25 times that available in all known terrestrial energy sources.



The sun still contains more than 99 percent of the total mass of the Solar System, even though it loses mass—through radiation of energy—at the rate of 4.6 million tons per second.



During the Truman Administration,

government energy specialists predicted that some 13-million solar-powered homes would exist in the United States by the year 2000.



The sun is often symbolized in ancient Egyptian art by a golden scarab beetle. If the scarab is painted black, however, it represents the forces of darkness or the underworld.



According to the American Bar Assn., the Latin maxim *Cujus est solum ejus est usque ad coelum et ad inferos*, meaning "The owner of the soil also owns to the sky and to the depths," was being applied in legal proceedings as early as the late 13th Century in cases where the blocking or interruption of sunlight above a person's property was found to constitute a trespass. In a notable exception, an Englishman named Bury was found to have built too close to his own property line and therefore could not legally prevent his neighbor from building a house that obstructed Bury's sunlight. The Latin maxim (of unknown origin) was quoted in that opinion, handed down in 1586, and has been a part of Anglo-American law ever since.



If you want to avoid using the word "sun" as a verb in a particular sentence, some alternatives are: apricate; bask; illumine; irradiate; luxuriate.



At its equator, the sun makes one complete rotation in a little less than 25 days. Since it is a fluid body, however, its varying rates of rotation—slower toward the poles—contribute to the whorls and eddies associated with solar storms and sunspots that are believed to affect our weather.



Gene Autry's version of *You Are My Sunshine* is the all-time best-selling recording of that song.



If the sun were made entirely of coal, it would have burned to a cinder in about 5000 years.



We could—at considerable cost—load all of our dangerous radioactive wastes, surplus products of biochemical warfare experiments, extremely volatile toxic substances, etc., into a giant orbiting trash can which, say, every decade or so would be shot into the sun and incinerated.



"Take note, theologians, that in your desire to make matters of faith out of propositions relating to the fixity of sun and Earth you run the risk of eventually having to condemn as heretics those who would declare the Earth to stand still and the sun to change position—eventually, I say, at such a time as it might be physically or logically proved that the Earth moves and the sun

*(Please turn to page 150)*

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### TOTAL SUN

(Continued from page 149)

stands still." [Galileo Galilei, on being condemned as a heretic by the Inquisition in 1634 for publishing his proof that Earth orbits the sun.]



"*Il sole no si move*—The sun does not move." [Leonardo da Vinci, more than a century prior to the trial of Galileo.]



Earthlight, or Earthshine, is the sunlight reflected from the surface of the Earth that gives a faint illumination to the dark side of the moon.



At no time anywhere within the continental United States does sunlight come from directly overhead.



At least one team of astronomers believes there is a possibility that the sun is orbiting a "black hole"—an unimaginably dense, collapsed star whose gravitational field swallows everything that comes too near it, even light.



The pineal gland (or pineal body), found in the brains of all vertebrates, is obscure in function but believed to partially regulate sexual development. Biologists postulate that in primordial reptiles it was actually a *third eye* that tracked the sun and provided "navigational" inputs for seasonal events, including migration and mating. Atrophied and receded into the head, it may still respond to the stimulation of sunlight in unknown ways.



If the sun's total radiation were halved, the Earth's temperature would plunge below the freezing point. If the sun's radiation were doubled, the oceans would evaporate.



More scientists have become convinced that there is a connection between the approximately 11.5-year cycle of sunspot activity and climate phenomena on Earth. Yet others have attempted to correlate bird migrations, animal behavior and even human sociology to the sunspot cycle. Oddly enough, the American Revolution, French Revolution and Russian Revolution all took place during periods of peak sunspot activity.



In 1958, the Fontainebleau Hotel in Miami Beach announced a 14-story addition. The neighboring Eden Roc hotel's management calculated that the additional floors would cast a shadow over their swimming pool, sunbathing and cabana areas—so they sued to prevent the new construction. A lower court handed down an injunction against the Fontainebleau, but it was overturned by the Florida Appellate Court and work proceeded.

PM

# 14 solar kits you can install

Install your own domestic water heating or space heating system and save money.

by Joseph R. Provey  
ASSISTANT HOME AND SHOP EDITOR



Nonmetallic collectors such as these by Calmac Manufacturing Corp. keep water-heating system costs under \$1000.

One way to boost the economic feasibility of tapping the sun's energy is to consider installing a solar-heating system yourself. A good percentage of solar equipment buyers are apparently up to the task. Grumman Energy Systems reports that in a recent survey of their Sunstream domestic hot water systems, about a third of all installations were done by do-it-yourselfers. Other solar manufacturers are also beginning to realize the benefits of designing and packaging systems that are easier to install.

"Kit" means different things to different manufacturers. Water-heating kits will usually not supply standard stock items which can be easily obtained locally, such as pipes, ducts, caulking, electric cables and even collector glazing. Other systems are complete down to the last pipe coupling. One such system is Solar Comfort's Joule Box Solar Water Heater. The optional plumbing package includes just about everything you'll need.

Before ordering a kit from a manufacturer, obtain the components list to be sure you know what you're getting, which items are optional, and what you must supply.

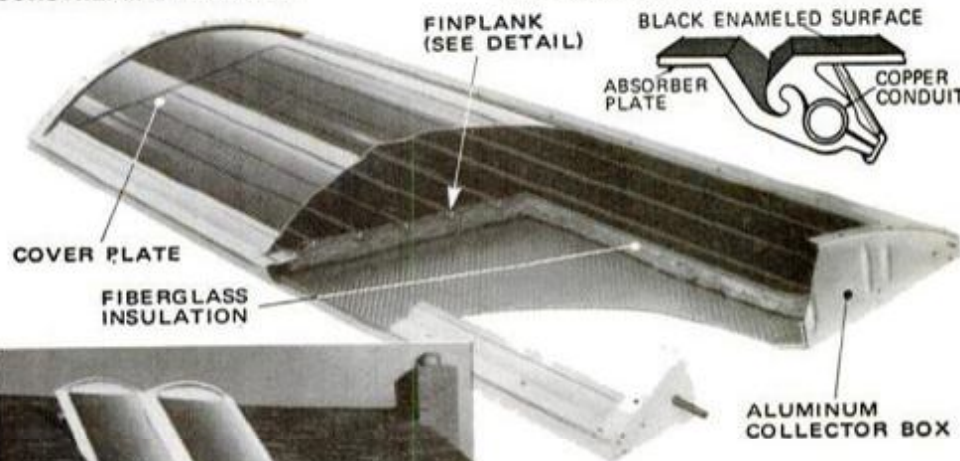
Some kits can be characterized as "loose" packaged—which generally means there will be more for you to put together. But loose packaging is not always a disadvantage. A kit

which requires on-site assembly of the collector, for instance, may prove easier than lifting a heavy pre-assembled unit onto the roof. On the other hand, loose-packed pumps, valves, gauges, heat exchangers and electronic controls may cause installation headaches for the do-it-yourselfer with average solar know-how. Try to choose a system that doesn't require a lot of wiring, plumbing and special fittings.

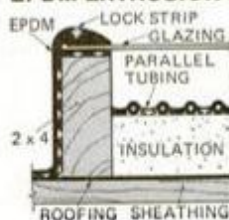
### From the sun to the faucet

The newest concept in heating

### SUNSTREAM COLLECTOR



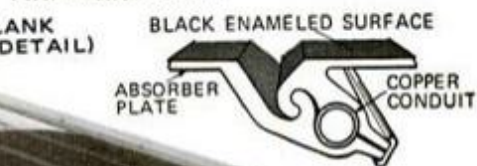
### EPDM EXTRUSION DETAIL



Elastomeric glazing and tube-plate extrusions by Bio-Energy Systems Inc. permit on-site collector assembly: \$5 to \$7 per sq. ft.

water for domestic use has been pioneered by Calmac Inc. in conjunction with the Marshall Space Flight Center. The key material is Ethylene-Propylene Diene Monomer (EPDM). It can be extruded into

### FINPLANK DETAIL



Distinctive arch of Grumman 60 series collectors have a self-cleansing action and cut glare. Award-winning absorber-plate design allows excellent thermal connection. Kit prices range from \$1200 to \$1500.

narrow-width strips with integral tubes to serve as an absorber plate. In addition, EPDM is freeze-tolerant—water freezing inside the extruded tubes will not cause damage. EPDM also can maintain its shape in extreme heat—up to 375° if not subjected to pressure. Life expectancy is 30 to 60 years, due to its resistance to ozone, ultraviolet light, chemicals and abrasion.

Bio-Energy Systems, Inc., also using EPDM, has developed a line of uniquely shaped glazing and tube

#### DAYSTAR SOLAR COLLECTOR

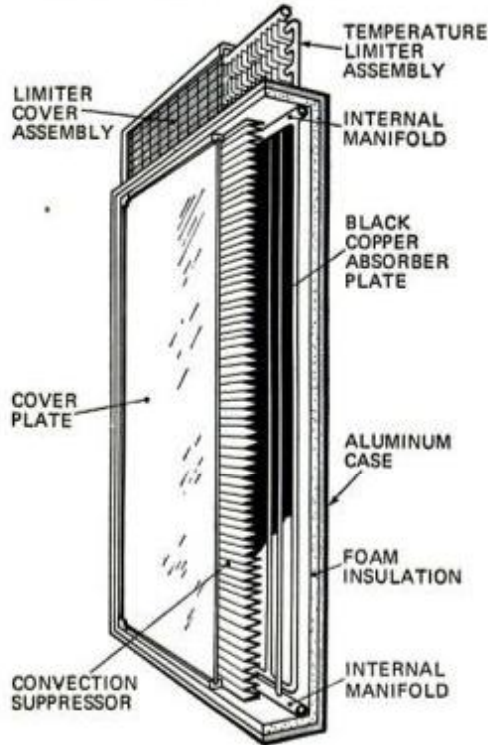


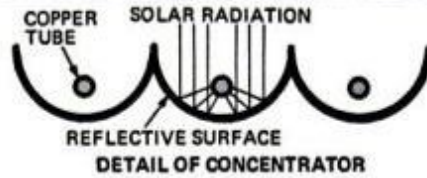
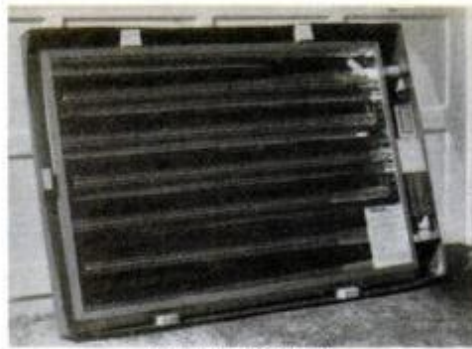
plate extrusions which can be used to help fabricate anything from a collector or skylight, to a passive solar heating south wall.

The advantages of these collector systems are numerous. Low conductivity of the plastic is compensated for by spacing the tubing close together. Cost is significantly less than copper or aluminum and EPDM is non-corroding. Since it is freeze-tolerant, a freeze-inhibited, closed-loop system is not necessary. In fact, potable water can be run directly through the collectors, allowing a direct hookup with the existing hot-water heating system.

EPDM lightweight extrusions are also easy to work with. On-site installation lets you size a system to satisfy your needs.

Both Calmac and Bio-Energy systems offer hot-water heating systems for under \$1000.

Grumman Energy Systems' Sun-stream water heating systems boast around 3000 installations. They offer several options, including a closed-loop, freeze-inhibited system for



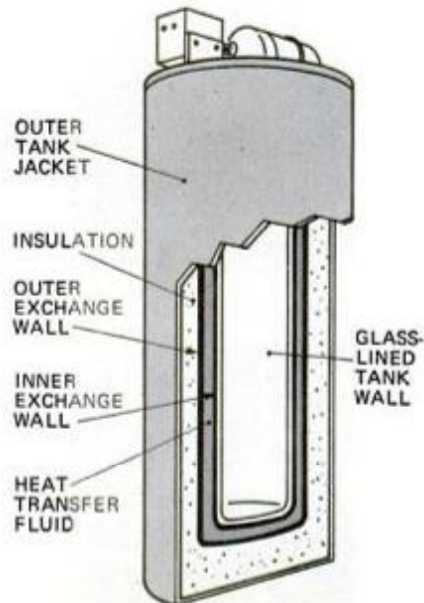
Solarcell's concentrating collector, and plumbing kit for solar hot water heating system (model A-40, \$650), are shipped in one 100-lb. package (above).

cold climates and open-loop systems for areas where freezing is infrequent or unlikely. You can also choose between a loose-packaged kit like the 60AS model (\$1238) or a factory-assembled tank-mounted control system like the 60AST, (\$1439). Grumman's installation manual is a good one.

Solarcell Corp. also packages both open- and closed-loop domestic hot water heating systems. They come with one or two non-tracking, focusing concentrator-type collectors constructed of high-impact ABS polymer plastic with extruded aluminum trim. The reflectors are of vacuum-metalized plating on ABS and the unit is sealed with 1/8-in. acrylic glazing. Depending on options you choose, kit prices range from about \$650 to \$1050. A price list on water storage tanks is also available.

Another innovative approach to flatplate collectors is at the heart of

#### DOUBLE-WALL HEAT EXCHANGER TANK

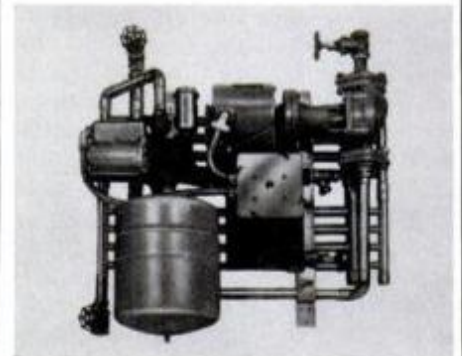
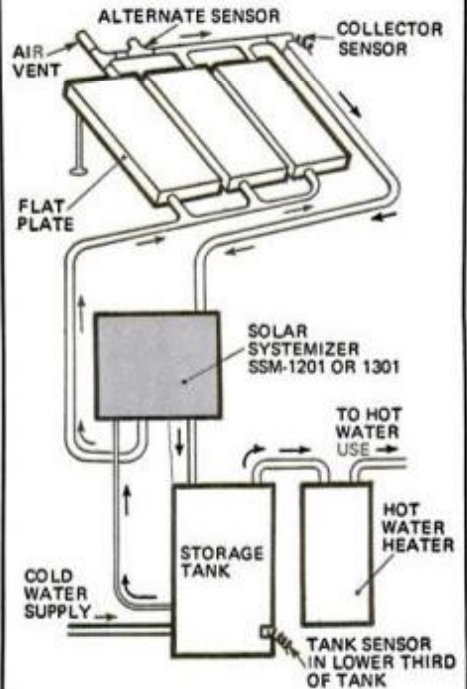


Daystar's closed-loop systems. It features a convection suppressor—an accordion-like transparent plastic which helps to trap collected heat. The collectors are also equipped with a temperature limiter system to help re-radiate heat during periods of excessive temperature buildup.

#### TWO MODULAR CONTROL PACKAGES

Taco, Inc. has good news for solar do-it-yourselfers. Their Solar Systemizers combine pumps, a highly efficient "counterflow" heat exchanger (optional), air separator, differential control, and hydronic controls. The only on-site connections required are supply and return piping, one power lead and two sensor connections. Although Taco doesn't package a complete hot water heating system, kits sold by many manufacturers include Taco components.

Solar Research also markets an easy-to-install, factory-assembled control package. A further advantage of both systems is that they don't have to be built into or onto the water heater—Should the existing water heater or storage tank deteriorate, the entire system doesn't have to be reinstalled.



Because Taco's Solar Systemizers are pre-wired and pre-plumbed, they are easier to install, with less chance for error. SSM 1201 (shown) is \$737.

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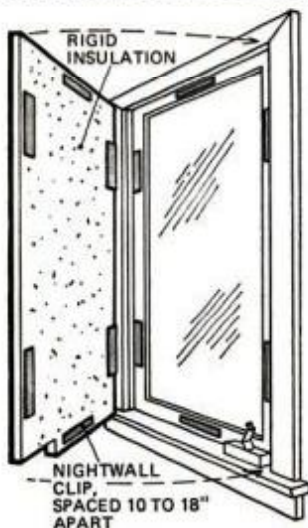
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Double-glazed Beadwall becomes insulated wall with Styrofoam beads blown between glass. 50x80 in. unit is \$400 up.

#### REMOVABLE WINDOW INSULATION



The price tag for a typical system, including solar tank, is near \$1500.

An effective method of heat transfer has been developed by Mor-Flo Industries. Their Solarstream water heating system features a patented solar storage tank which is encased by a second, heat exchanging tank. Between the tanks, a rust inhibiting and glycol solution circulates and transfers heat from collectors to the potable water stored in the inner tank. Double inner-wall construction keeps the solar fluid from contaminating the potable water. This arrangement is highly efficient due to the fully insulated, large surface design of the heat exchanging tank.

A variety of tank sizes with or without an auxiliary heat element is available. A worthwhile option is a pre-assembled control package mounted atop the tank. The Solar-

stream system utilizes lightweight Reynolds aluminum collectors.

#### Sun-heated living spaces

The following selection of solar devices that you can install includes at least one to match the skills of every home owner.

The first and most rudimentary, called Nightwalls, can turn even single-glazed windows, or patio doors into energy-assets rather than liabilities. Used during winter nights to reduce heat loss, a nightwall is made of 1-in.-thick rigid insulation sized to the shape of your opening and held in position with Nightwall

clips by Zomeworks. The clips are simply a pair of 1/2 x 6-in. flexible magnetic strips with adhesive backing. One strip adheres to the glass or window casing, the other to the panel of insulation. The clips cost about 35 cents each from Zomeworks.

If you don't want to bother with putting up, taking down and storing Nightwalls, Zomeworks markets the plans and components for a more sophisticated insulated window. A Beadwall is double-glazed with a 2 3/4-in. thick cavity that can be filled or emptied of its insulating Styrofoam beads, depending on whether

#### GLOSSARY OF SOLAR TERMS

**Absorber plate**—the surface of a flat-plate collector which absorbs solar radiation and converts it to heat.

**Active system**—requires mechanical power to collect, store or distribute solar heat.

**Closed-loop system**—a hot water heating system which continually recirculates antifreeze through collectors. Heat is transferred to potable water by a heat exchanger.

**Collector control sensors**—temperature sensitive elements that signal the differential thermostat controller when conditions are right for activating system, collecting heat.

**Concentrating solar collector**—a device using reflective surfaces to focus sunlight on a small area where it is absorbed and converted to heat. Often capable of generating higher temperatures than flat plate collectors.

**Cover plate**—glazing used above absorber plate of collector to prevent excessive heat loss.

**Differential-temperature thermostat**—activates the pump or blower when collector temperature is sufficiently above tank temperature; it deactivates pump or blower when collector temperature does not exceed the storage temperature by preset amount.

**Flat-plate collector**—device which converts sunlight to heat energy on a plane surface of metal or plastic.

**Heat exchanger**—device used to transfer heat from one fluid to another (either liquid to liquid or air to liquid).

**Heat storage**—any devices, containers, masonry walls or mediums such as pebbles or water which can store collected solar heat for future use.

**Liquid-based solar heating system**—uses liquid (either water or antifreeze solution) to transport heat from collector to storage.

**Open-loop system**—hot water heating system which needs no heat exchanger, and circulates potable water through collectors.

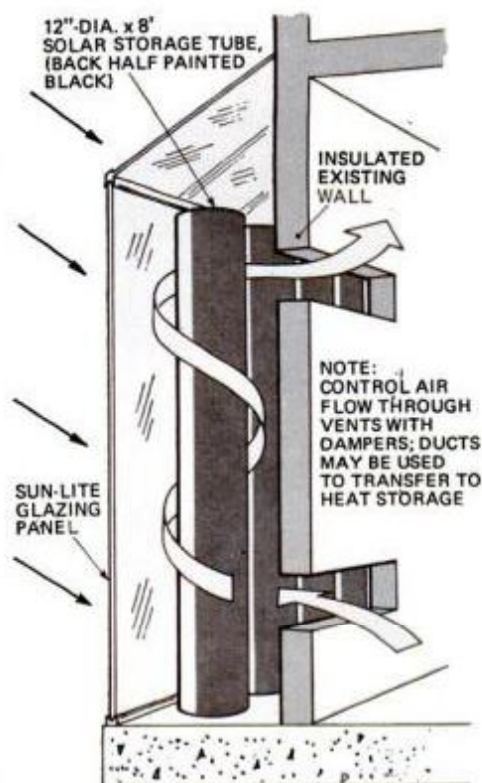
**Passive system**—relies on convection, not external mechanical power, to move the collected solar heat.

**Solar water storage tank, or preheat tank**—stone or glass-lined insulated tank used in a domestic water heating system to store hot water. May be equipped with an integral external heat exchanger. Solar tanks may be hooked-up in series with an existing hot-water heater—or one may be used as the sole hot-water storage tank if it's equipped with an auxiliary heat element.

Sol-air collector (\$150) can be window-mounted between sill and open sash. Gaps are filled with rigid insulation.



#### KALWALL SOLAR FURNACE





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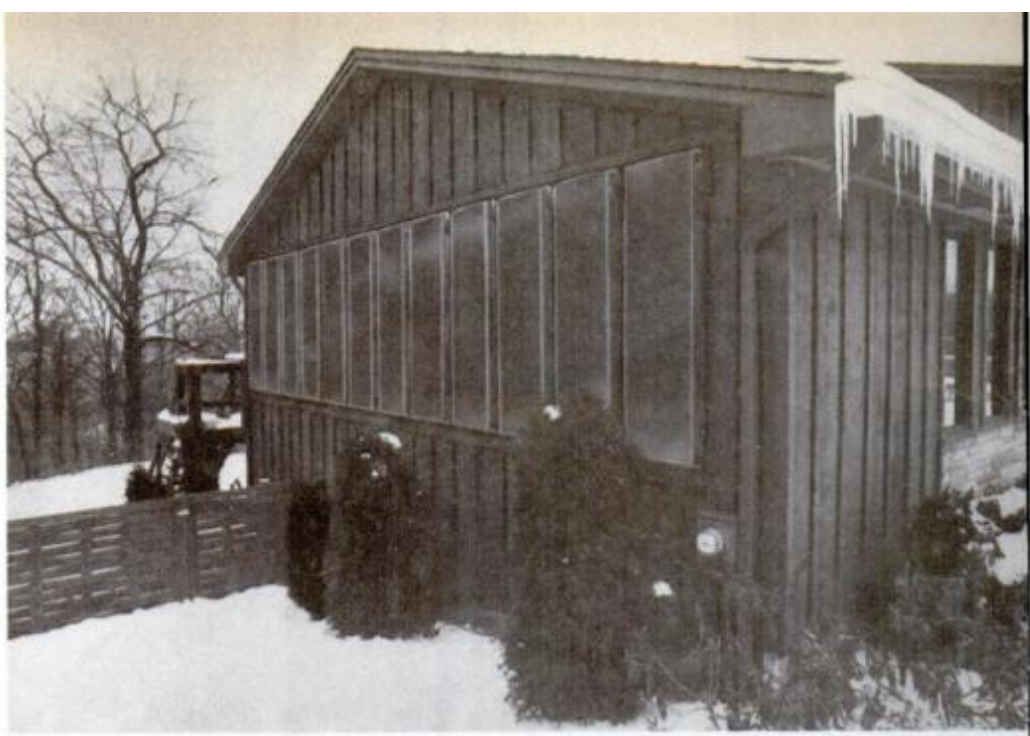
- Information for replacing a wooden door.
- "How-To" booklet for adding outside entrance to present home.
- Data for new home to be built.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_



South-facing Sunwall collector panels provide hot air that can be used directly or

stored for future use. Panels with finned tube can be used for water heating.

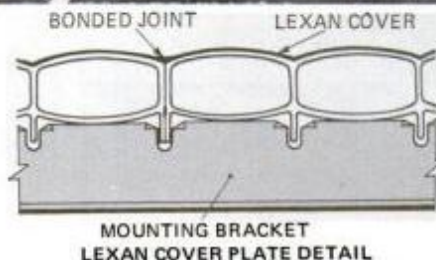
or not the sun is shining and what the outside temperature is. Zome-works will supply you with everything but the glazing, including preassembled, vented panels, motor-storage units, insulating beads, mounting and glazing accessories.

The Kalwall Solar Furnace is another version of a glazed/insulated south wall—but with the addition of an effective means of storing solar heat. Vertical storage tubes made of a fiberglass-reinforced polyester (Sun-lite) and filled with water are better than a masonry wall when it comes to heat-storage capacity. The back of each tube is painted black in order to increase heat absorption—and the water is kept bacteria-free with chlorine. Natural convective currents or forced circulation of air may be used to move air around the warmed tubes to living spaces.

Kalwall also makes 2¾-in.-thick window-wall panels of Sun-lite with U-factor of .41 (30 percent better than double-paned glass) and transmissivity of 77 percent. Other ways to obtain a well-insulated weather-wall include movable insulating panels (such as the Nightwall system) or thermal drapery.

A remarkable window- or wall-mounted collector by Sol-air generates far more useful heat than its surface area would indicate. Two units will heat a normally insulated, average-sized room on a cold winter day.

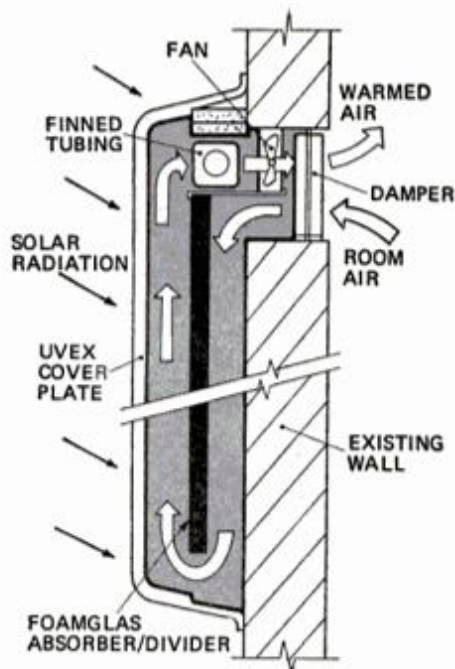
The collector is double-glazed and is divided by insulating absorber panels to form a hot front side and a cooler back side. Air from the room enters the top of the unit, flows to the



Park Energy's Thruflo collector also functions as southerly exposed roof. On-site assembly keeps down cost of collector to between \$8 and \$9 per sq. ft.



## SUNWALL PANEL—SECTIONAL VIEW



foot of the collector (since it is cooler and denser than the air already there) and then is forced to rise across the hot absorber/divider's front. The heated air then re-enters the room. The real key to the heat transfer from the sun to the air is the black fibrous composition and the three-dimensional design of the absorber/divider. It presents a much greater surface area to the flow of air than a typical flat-plate, air-type collector.

Based on the same principle as the Sol-air collector, Sunwall Inc. has developed a multipanel system which offers several practical water- and space-heating options. The panels are typically wall-mounted and consist of a vacuum-formed, double-layer Uvex optical cover plate and a blackened Foamglas insulator/absorber. Uvex, manufactured by Eastman Chemical Products, Inc., is a lightweight, impact-resistant glazing material which is inhibited against UV degradation. Foamglas, from Pittsburgh Corning, is an inorganic, non-corrosive, closed-cell material with a surface of tiny, light/heat absorbing cavities. It gives off its heat payload quickly to the air stream circulated around it. A finned tube installed in the upper plenum of a Sunwall panel can be used to transfer heat from air to water for domestic uses. The Sunwall people recommend a minimum order of four optical covers (4 x 7½ ft.) and four boxes of absorber/insulators, (totaling \$532 plus freight and tax), to assure a significant impact on your fuel bills. They can provide you with all the components, including a choice of two heat storage units.

One is a rock-bin kit, the other an Aquabin complete with an EPDM bladder.

One final air-type system is Park Energy's Thruflo Solar collector, which doubles as a weathertight roof membrane on southern exposures. Savings on roofing materials, for either new construction or when reroofing, help to offset the cost of the collector. The system has primarily been used for space-heating systems with rock storage, but a new domestic water heating system will also soon be available.

The collector is built up on a grid of 2x2s to allow air flow through a black, perforated aluminum sheet. This effective absorber-plate design allows air to pass through it—thereby maximizing heat transfer from the hot aluminum.

The transparent polycarbonate cover plate is extruded from GE's Lexan plastic resins to form a tubular, impact-resistant, highly insulating glazing material. Transmissivity is 78 percent, with a gradual loss over the years of a few percent.

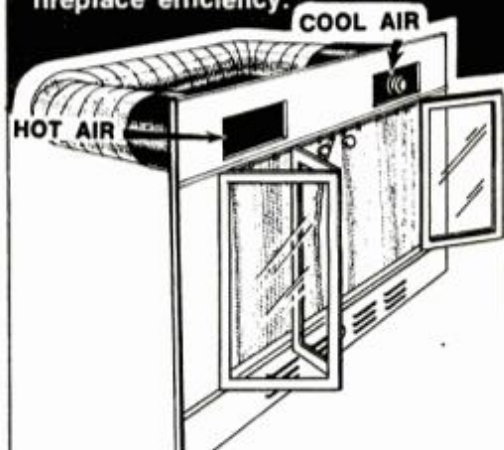
Park Energy Company sells the perforated collector sheets in 22x24-in sections or in rolls, and the cover plate in 1-ft. widths and varying lengths. Optional, hat-shaped steel channel members (which can be used to replace the grid of 2x2s), cover brackets, gaskets, cover-plate bonding liquid, sealant, screws, a complete installation manual and the license and plans for building the patented Rock Trench Storage system are also available. Cost per square foot of collector is about \$8.32. **PM**

### SOLAR KIT MANUFACTURERS

For more information and prices on various options, call or write the manufacturer.  
 Bio-Energy Systems, Inc., Solaroll Div., Mountaintale Rd., Spring Glen, N.Y. 12483. (914) 434-7858.  
 Calmac Manufacturing Corp., 150 South Van Brunt St., Englewood, N.J. 07631. (201) 569-0420.  
 Daystar Corp., 90 Cambridge St., Burlington, Mass. 01803. (617) 272-8460.  
 Grumman Energy Systems, 4175 Veterans Memorial Highway, Ronkonkoma, N.Y. 11779.  
 Kalwall Corp., Solar Components Div., Box 237, Manchester, N.H. 03105. (603) 668-8186.  
 Mor-Flo Industries, Inc., Solar Div., 18450 South Miles Rd., Cleveland, Ohio 44128. (216) 663-7300.  
 Park Energy Co., Box SR9, Jackson, Wyo. 83001. (307) 733-4950.  
 Sol-air Co., 24 Limerock St. Camden, Me. 04843. (207) 236-4772.  
 Solar Cell Corp., 1455 Northeast 57th St., Fort Lauderdale, Fla. 33334. (305) 462-2215.  
 Solar Comfort Sales, 800 Follin Lane, Suite 210 Vienna, Va. 22180. (202) 951-0095.  
 Solar Research, Div. of Refrigeration Research Inc., 525 North Fifth St., Brighton, Mich. 48116. (313) 227-1151.  
 Sunwall Incorporated, Box 9723, Pittsburgh, Pa. 15229. (412) 364-7402.  
 Taco, Inc., 1160 Cranston St., Cranston, R.I. 02920. (401) 942-8000.  
 Zomeworks Corp., Box 712, Albuquerque, N.M. 87103. (505) 242-5354.

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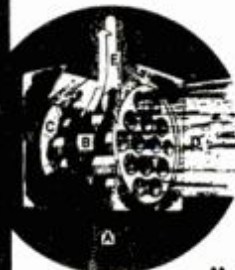
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# How to stop winter's drafts at windows and doors

Here are products that help reduce heat loss around existing openings—plus how to replace an ill-fitting window.

by Joseph R. Provey  
ASSISTANT HOME AND SHOP EDITOR

**T**here are three ways to improve the insulating qualities of your windows and doors. The easiest and most cost effective is to seal around openings to prevent loss of heated air and infiltration of cold air. Fixed joints, such as where window casings meet the siding, should be caulked. Use long-lasting silicone, acrylic latex or butyl rubber compounds. Movable joints at operable windows and at doors require weatherstripping. The Polyflex system (shown in photo, page 159) is easy to install—scissors can be used to cut it to length. It can also be used at the head and sill of a window sash. To complete the seal around your door, The Stanley Works has just introduced a wood and vinyl door-bottom seal (photo, page 159). The wood portion can be finished to match the door interior.

The second approach to improved doors and windows is to provide insulating dead-air spaces at openings by using storm panels. Traditionally, these have been placed on the exterior, but many low-cost, interior storm units are now available. They are easier to install and remove since you don't need to work from a ladder, and they're just as effective as the outside variety. The clear plastic glazings are simple to size to your requirements.

The Reynolds insulating panel kit

Interior PVC-film insulating panel; \$10.75 per 3x5-ft. window. Reynolds, Box 27003, Richmond, Va. 23261.



In-sider storm window of Mylar plastic, \$6.90 for a 2x3-ft. window. Plaskolite, 1770 Joyce Ave., Columbus, Ohio 43216.

includes a spline for fastening PVC film to an aluminum frame. Two-sided foam tape secures the frame to the opening (photo, top right).

Similar products from Plaskolite utilize semirigid Dupont Mylar held in place by either self-adhering plastic trim molding or by acrylic tape. Mylar is of high optical quality and comes in rolls for large applications such as at patio doors and large picture windows.



Velcro tabs that seal thermal drapery liner to wall cost \$4.50 yd. Wind-N-Sun Shield, Box 1434, Melbourne, Fla 32935.

Exterior-type storm units, although usually more expensive than inside types, are not visible on the inside. Two such energy savers are the Bucks County aluminum storm door, by Chamberlain, which is completely weatherstripped, and Anaconda's new Patio Glide storm unit, which comes with its own track system. (See photos, page 159.)

Two more updated traditional methods of trapping air are the use



Roomaker window-walls for winterizing porches, include insulated knee-wall, weatherstripping; \$195 for 36x82½ in. Continental Aluminum, McHenry, Ill. 60050.



Polyflex weatherstripping self-adheres. Kit for a door is \$4.99 from Schlegel Corp., Box 197, Rochester, N.Y. 14601.



Screw-on-door-bottom strip stops drafts. Kit costs \$2.94 from The Stanley Works, 195 Lake St., New Britain, Conn. 06050.



Polyurethane-core steel door, perimeter weather seal, oak/aluminum sill are \$191. Peachtree Doors, Norcross, Ga. 30091.



Insulating sidelight of steel with polystyrene core, insulating glass, starts at \$90. Pease Ever-Strait, Fairfield, Ohio 45023.



Storm door (\$150) has insulated kick panel, integral weatherstripping. Chamberlain, 845 Larch Ave., Elmhurst, Ill. 60126.



Patio storm fits most standard 80-in. door heights. About \$299 from Anaconda, Cascade Plaza, Suite 1800, Akron, Ohio 44308.

Double-walled PVC rolling shutter is priced at \$225 for a 6-ft.-wide sliding door. Also made by Pease, Ever-Strait Div.



of thermal drapery liners and horizontal rolling shutters. The latter are derivatives of once-functional hinged shutters. The Velcro-fastened drapery liners, it is claimed, can improve single-glazed windows by 50 percent. The PVC extruded, double-wall insulating shutters can be controlled manually or electrically.

The final approach to improved doors or windows is to replace them. This is expensive—and usually in-

volves other considerations. Perhaps you want the additional security of an insulated steel door. Or, if you need new storms and screens, the cost of a new combination unit will be somewhat offset by what you would have spent. The replacement door systems shown above were designed with thermal breaks, core insulation and integral weatherstripping. The insulated sidelights can be purchased in many styles.



## HOW TO REPLACE AN OLD WINDOW

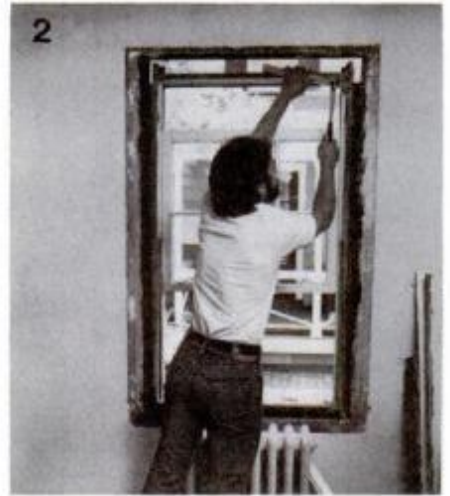
For our replacement unit, we chose Andersen's Perma-Shield, Narroline combination unit which measures 29 $\frac{5}{8}$  x 53 $\frac{1}{4}$  in. and costs about \$160. This window is vinyl clad on the exterior for low maintenance and comes with a screen and integral storm window to provide triple glazing.

To obtain the proper-size replacement unit: measure the existing glass width (including the edge covered by glazing compound) and add 4 in. This total approximates the proper width for the new unit. For the approximate height, measure the glass height of one sash, double it and add 6 in. Choose a unit that is equal to

*(Please turn to page 164B)*



**1** Flat pry bar neatly removes inside casing. If reusing trim, pull old nails through back of pieces with pliers.



**2** Pound tops of jambs with hammer to get window started out of opening. Use blocks to avoid smashing old frame.



**3** Lift out the window from outside after using wrecking bar (if needed) to finish popping old unit from opening.



**4** When needed, frame-in to recommended rough opening with spacer blocks, 2x4s. Stuff all voids with insulation.



**5** Sheath new framing flush with existing sheathing. Rough opening is now ready to accept the new window unit.



**6** After inserting window, shim under jamb horns to level unit (see text). Helper steadies window, holds level.



**7** Nail window to wall. Fin-type window, shown, has vinyl flange for nailing—others are nailed through casement.



**8** Nail drywall patches over areas which interior trim will not cover. Tape and spackle all exposed joints.

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PHILADELPHIA	Aluminum Slider	\$ 59.18	\$ 48.33	\$ 4.55	\$ 54.63	\$ 31.00

\*\*Very few homes in Dallas have exterior storm windows installed. \*Complete test data available on request from Plaskolite, Inc.

Even if you already have storm windows, the In-Sider can save you plenty by sealing against heat loss and drafts.

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- Cuts to fit with ordinary tools.
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The inventor of the original tubular heat exchanger has developed two new heaters, combining the safety and elegance of glass doors with a long-life Stainless Steel Tubular Heat Exchanger. Engineering tests show these highly efficient heating units are the most effective fireplace heaters on the market today! (Data available upon request. See below.)

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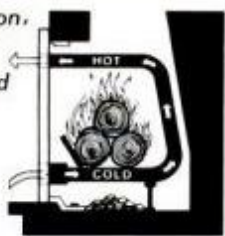
When it's cold outside, burning in a typical fireplace can actually result in a net heat loss. A fireplace must draw room air to prevent smoking and, with a 2 ft. x 3 ft. opening, approximately 22,000 cu. ft. of warm room air can be drawn up the chimney per hour! To replace it, cold outside air is pulled into your home through cracks.

New Glass Door THERMOGRATE Heaters dramatically reduce this heat loss and, utilizing the scientific principle of natural convection, produce a constant flow of warm air into your room.

### HERE'S HOW IT WORKS:

By natural convection, cool air is drawn in at the bottom, heated and returned to the room.

*It really works!*



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Glass Door THERMOGRATE Fireplace Heaters increase the net heat output of ordinary fireplaces up to 10 times. With auxiliary blowers, the largest units are capable of producing up to 100,000 BTU per hour! (Compare this with the 75,000 to 100,000 BTU per hour output of the average home furnace.) It's enough to heat a house, and provides insurance against power outage, fuel shortages and other emergencies, too, because the units will produce up to 60,000 BTU per hour by natural convection... even without blowers!

## SAVE MONEY AND ENERGY: BURN STORED SOLAR FUEL

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## FUNCTIONAL AND BEAUTIFUL

With a Glass Door THERMOGRATE Fireplace Unit or a Free-Standing Fireplace/Stove, you retain all the charm and beauty of an open fire and add the elegance of glass doors. Heavy brass-finish trim complements the handsome flat black finish and full width glass viewing area.

The deluxe bi-fold tempered glass doors are both functional and beautiful. They stop approximately 60% of your warm room air from escaping up the chimney, and also provide maximum protection against sparks.



## DURABLE WELDED CONSTRUCTION

THERMOGRATE Units are designed and manufactured for high output performance and long life. Durable welded construction assures safe operation in the extreme temperatures from burning wood or coal for home heating. The Stainless Steel Tubes are fully warranted for five (5) years from date of purchase against burnout!

## UNIQUELY DESIGNED THERMAL EXPANSION SEALS

When metal is heated, it expands. In a heating device this expansion could result in door frame distortion, thermal fatigue and potential fracture of the heat exchanger unit. That's why unique, protective thermal expansion seals have been designed into THERMOGRATE Units to allow the Convection Tubes to expand individually at high operating temperatures.



## PROPER FIREPLACE FIT IS ASSURED FOR EFFICIENCY

Proper fit is very important in achieving maximum efficiency and effective heat output. THERMOGRATE Fireplace Heaters come in a full range of width, depth and height combinations and you receive complete sizing instructions before placing your order.

## EXTREMELY SIMPLE TO INSTALL

Engineered for ease of installation, Glass Door THERMOGRATE Fireplace Heaters require no construction. There's no need to tear up your fireplace or chimney. All you do is set two anchors into your hearth... anchors, bolts and even the masonry drill bit are provided.



## NEW FREE-STANDING STOVE USES THERMOGRATE PRINCIPLE

The same principle of natural convection has now been applied for the first time to a unique, high efficiency stove. Even if you don't have a fireplace, you can still enjoy the benefits of this dramatic alternate energy heating system.

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## FREE PUBLICATION OFFERED

If you're interested in saving money and energy in your own home, write for the FREE full-color publication: "How to Burn Wood & Fight Rising Fuel Bills" which reports on heat output tests and includes complete product and ordering information.

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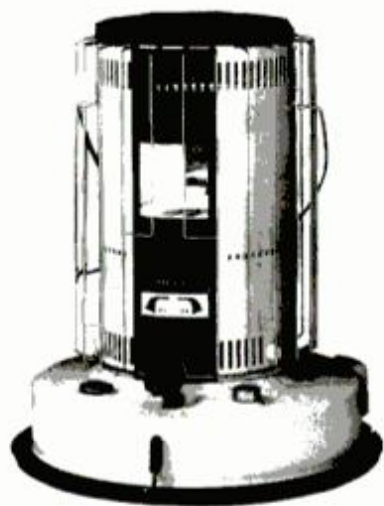
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Or call TOLL FREE: 1-800-328-0882  
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U.S. Pat. D247,973. Other patents pending.

# KERO-SUN portable heaters: so different, they're like an entirely new idea in heating comfort.



"Omni" models



"Radiant" models

*Here is a line of portable heaters that is well known around the world, but new to the U.S.A. America, meet Kero-Sun! The "Radiant" models feature stainless steel reflectors for both quick-action radiant heat along with room-filling convection heat. "Omni" models deliver omnidirectional heat that warms every corner. There is a Kero-Sun portable heater that's ideal for that nasty cold spot. Great for supplemental heat. Ideal for leisure time activities — boat, barn, greenhouse, workshop, and garage. You name it!*

## Space-Age Efficiency

Take a peek inside any Kero-Sun heater at its performance mechanism. You'll quickly realize what an advance in heater technology these unusual machines represent. The design is advanced, efficient, no-nonsense. Kero-Sun heaters truly make others you may have looked at seem old fashioned.

## Tested For Pollution Safety

All Kero-Sun heater models have been tested for combustion by-products. The results are impressive: all models can be operated in continuous use with breathing safety. What's more, they burn with no annoying odor in operation, and no need for venting.

## Budget-Wise Economy

Energy is expensive — that's why Kero-Sun heaters are "cheap-skates." With kerosene averaging 60-70¢ a gallon, their average cost of operation is only 3-4¢ an hour. In most areas of the country, it is far cheaper than supplemental electric heat. Biggest economy: you enjoy all the heat the Kero-Sun produces . . . none goes up the flue pipe!

## Automatic Convenience

All Kero-Sun portable heaters except Model K offer a feature that people are particularly grateful for: the pushbutton lighting system. Press a button and a battery powered electric igniter automatically starts glowing right above the heater's wick. Within minutes your Kero-Sun is lighted and warming you. Convenient!

## Quality Construction

We can talk about Kero-Sun quality — but the best proof is to see it for yourself. See the sturdy gauge of metal used throughout these heaters. See the handsome white, baked-enamel finish, carefully hand applied. See the stainless steel reflectors in "Radiant" models. See all the many construction features that say, loud and clear, "Quality."

## Plus Other Features

Automatic shutoff in event of tilt-over (except Model K) . . . operate without pressurization . . . long burning duration . . . all with handy cooktop . . . three models feature radiant heat . . . Clear View fuel gauge . . . protective spill tray . . . portable.

Please send me full facts about Kero-Sun portable heaters and the name of my nearest dealer.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

# KERO-SUN<sup>®</sup>

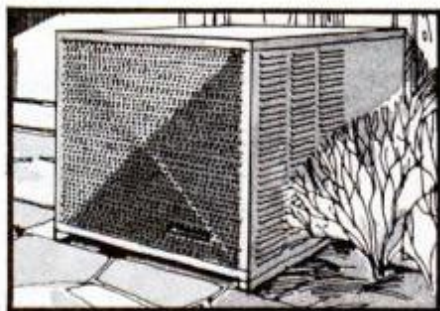
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It's incredible how an Amana High Efficiency Heat Pump takes heat from cold outdoor air (even below 32°) and uses it to heat your home. Even more incredible is how much it can save you on heating costs.

From 28% to 64% depending on where you live and the model you choose. That's compared to a conventional electric furnace and based on design conditions and a full heating season for these cities:

Minneapolis, MN . . . . . 28.6% to 29.1%  
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Atlanta, GA . . . . . 56.9% to 57.4%  
Tampa, FL . . . . . 62.8% to 64.2%

Conventional electric furnaces return only 1 unit of heat for every unit of electricity. An Amana High Efficiency Heat Pump gives you 2.5 to 2.9 units of heat for every unit of electricity (at Air Conditioning Refrigeration Institute 47°F rating point).

Amana High Efficiency Heat Pumps give you energy saving central air conditioning, too.

If your heating costs are too high, it's time for an energy saving Amana Heat Pump. Quality and dependability, backed by over 20 years of heat pump experience.

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**Amana**  
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A Raytheon Company

## STOPPING WINTER DRAFTS

(Continued from page 160)



Factory-installed vinyl flanges seal against water and air leaks except under sill. Here, joint is caulked.



Complete installation by replacing exterior shingles and installing outside casing. Storm/screen unit is optional.

or less than these dimensions.

■ Remove old storms and sash if possible from old unit before removing it from opening. Wear safety goggles.

■ "Oppose" shims when leveling new unit by (1) resting each jamb bottom (or jamb horn) on butt end of shingle/shim; and (2) tapping in second shim feather-edge first in between jamb and first shim. Drive a finishing nail at an angle through the jamb horn to hold each shim in place. When secured, cut away excess shingle with a knife or chisel.

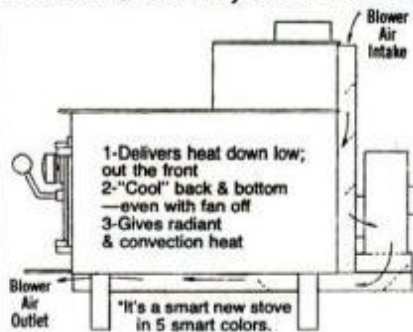
■ If using new trim, check with dealer to determine what stool (inside ledge) size is recommended for your new unit.

■ Fur out inside frame of new unit with wood scrap to provide nailers for inside trim if needed.

■ Do not drive nails into tension spring mechanisms when installing head trim.

■ Install old or new exterior casing with 10d galvanized nails. Prime back side before installing. Set and putty nailheads. **PM**

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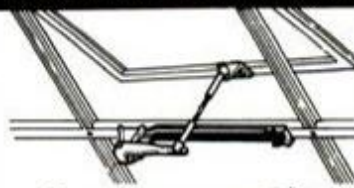
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Switch to wood or coal. Southport Stoves has an alternative to conventional heating systems—wood and coal burning stoves. Here are descriptive brochures on air-tight, long-burning wood and coal stoves from Belgium and Denmark. 25¢.

### 851 Plug the gaps

Energy wasting gaps around doors and windows can raise your fuel costs. This booklet from Macklanburg-Duncan tells how to find and seal them. Includes tips to lower your fuel bills. 25¢.

### 852 An inside job

The In-Sider Storm Window from Plaskolite fits on the inside of your home and can reduce heat loss through windows by up to 88%! Learn how to install the do-it-yourself storm windows—saves energy and money on fuel bills. A free brochure.

### 853 Build your own solar system

Kalwall Corp. offers their catalog of do-it-yourself solar components to build your own solar collector or system. Includes specs, diagrams and detailed explanations of products. Free.

### 854 Capture wasted heat

You can save on heating bills by using heat that normally goes up the chimney. Fireplace heaters and waste heat circulators from Magic Heat capture heat from fireplaces, furnaces and wood, oil or gas stoves and circulate it throughout the home. Free info.

### 855 You can do it with Genie!

Concerned about your family opening the garage door alone at night or just fed up with climbing out of the car to struggle with a heavy garage door? Genie Automatic Garage Door Opener might be the answer. Free literature from Alliance.

### 856 Keep it up

An Arrow staple gun and Ceiltile staples make installing a ceiling easy. And there's a new "piggy-back" attachment that lets you drive two staples at once. All the info in a free, concise leaflet.

### 857 A super way to sand

The new industrial strength power tool abrasives from Carborundum are cloth-backed and resin-bonded for longer wear without tearing or clogging. They're available in belts, discs and sheets. Get all the facts in a free pamphlet.

### 858 Fix it right the first time

If you're tired of doing the same household job again and again, then General Electric has the answer. Caulk, mend, seal, protect and more with GE's Household Silicones. This free brochure shows all of their silicone products and their many uses.

### 859 Heat with more than one fuel

Multi-fuel boilers provide heat and hot water year round from a variety of fuels. Wood can be used in combination with oil, gas or electricity for maximum efficiency. Free information from Tekton Design Corp.

### 860 Save energy with windows

A 16-page booklet from Andersen Corp. explains the role of windows and gliding doors in energy conservation. Covers such

topics as how to heat with windows, planning to save fuel in cold and warm climates and how to shop for windows. Free.

### 861 Protect your roof . . .

with U.S. Polycoat roof coating. It stops leaks and waterproofs your roof all year long. Other coatings protect your home inside and out. Free literature.

### 862 Prevent paint problems

An informative booklet from Pittsburgh Paints tells how to prevent common house painting problems. Tips on eliminating blistering, peeling, flaking, cracking, mildew and more. 25¢.

### 863 Stay warm and save

The complete line of wood, coal, kerosene and oil heaters and stoves from U.S. Stove is described in a color pamphlet. Also details on their Franklin fireplaces, and installation tips. Free.

### 864 Fast and easy liquid barrier

Insul-aid, a new paint from Glidden, keeps insulation drier, reduces energy consumption and reduces moisture-related exterior paint failures. All the info in a free, concise leaflet.

### 865 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.

### 866 Leaks, drips, drafts and cracks?

Fix 'em with Dow Corning's silicone home-maintenance products—they're tougher and more flexible than most rubber. In this handy guide you'll find the right sealant or adhesive to caulk the bathtub, fix the furniture, repair the pottery, seal the boat deck, or do just about any other mending job you can think of. Free 16-page brochure.

### 867 How to burn wood

A full-color 16-page booklet from Thermograte explains how to economically use wood fuel and improve the efficiency of your fireplace. Packed with information. \$1.00.

### 868 Start your own siding dealership

Do you want to become a full or part-time siding dealer? Aluminum Industries of Arkansas will send you all the material you need to begin selling their do-it-yourself aluminum, steel or vinyl siding. Free information package.

### 869 Discover unusual tools

If you can't find that special little tool you've been looking all over for, you'll find it here. National Camera's Flasher catalog is packed with thousands of unique precision tools for the workshop. Free.

### 870 Heaters to meet your needs

Whatever your heating needs, Suburban Manufacturing has a solid-fuel heater to keep your home warm. A free brochure describes their wood and coal heaters, as well as a furnace unit that converts oil, gas or electric systems to a wood-burning system.

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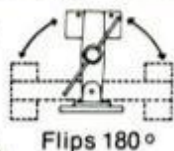
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## SOLAR-POWERED AIRCRAFT

(Continued from page 79)

order to gain altitude and distance.

Solar cells can be attached to a wing's upper surface. But here, instead, we show them inside the wing, exposed to sunlight through the wing's clear upper surface of heavy-duty Mylar. This provides solar cell protection at the cost of a slight loss in efficiency. An impact on silicon crystal can crack it, reducing power output and requiring tedious, expensive replacement.

Solar power as an auxiliary power source is already here for aircraft. Energy Saving Systems, a firm that manufactures solar arrays for marine and home use, now caters directly to homebuilt airplane and sailplane buffs. Their 12- and 14-volt solar pane's charge batteries at 90 to 400 milliamp-hours (prices from \$90 to \$220). The cells are installed inside canopies, above instrument panels, or on external surfaces.

Since they are tied down outdoors for long periods of time and usually flown in clear weather, recreational aircraft thus can have batteries constantly at full charge. Famed aerobat Art Scholl claims he went two months without needing any other battery charging on last year's airshow tour.

### Solar model airplanes

Graupner, a large German model manufacturer, has flown radio-controlled model airplanes powered solely by solar cells (except for Nicad batteries for the R/C equipment). Some of these were designed by Fred Militky, who had previously helped convert a medium-performance motorglider to non-solar electricity in Austria. This ultralight aircraft had managed to achieve 12 minutes of powered flight from 132 pounds of batteries feeding a 13-hp motor. This was probably the world's first manned electric airplane (possibly the first electric aircraft of any type to fly since 1884, when lighter-than-air experiments took place).

Graupner puts no current price on its Solaris model airplane, saying production awaits breakthroughs in the cost of solar cells. ESS's Ray Speicher recently added \$1000 worth of cells to an R/C sailplane and found that they barely sustained level flight.

A U.S. pioneer in electric model airplanes is Robert Boucher of Astro Flight, Inc. His work led to an Air Force project with major aerospace companies. Boucher proposed a \$500,000, 100-foot wingspan, purely solar RPV to be an atmospheric

"satellite." It would range globally and indefinitely at a 120,000-foot altitude, clear of clouds. Sinking slowly by night, it would climb back in sunlight.

To prove its feasibility, Astro Flight made three one-third-scale versions under a government contract. These 22.5-pound models each carried a \$40,000 solar-cell array reportedly delivering 570 peak watts to a 0.6 hp motor. An altitude of 17,200 feet was reached.

Strangely, the Air Force has shown little further interest. Boucher, however, has been encouraged enough to consider a man-carrying version. He is proposing a 64-foot-wingspan craft that will resemble our hypothetical illustration, with cells costing about \$100,000. The aircraft known to be under construction in England reportedly has a cell array which cost \$84,600. Its co-designer says because of price, "it's going to be a long time until the idea is practical. We're doing it just because it's there."

While recreational solar aircraft are not likely to appear in the near future, such craft could be easily justified today for special research projects, such as mingling unobtrusively with migrating bird or animal populations. One geologist is reportedly interested in the idea for remote expeditions. No fuel would have to be transported, and, when not flying, the craft's cells could be used for charging batteries to power ground equipment.

### Solar-powered transport?

Boucher takes a giant conceptual leap, suggesting a solar-powered aircraft for carrying up to 21 passengers on short hauls. Grossing 10,000 pounds and having a 500-foot wing span, it would have a light carbon-graphite geodesic framework covered with fabric. Solar cells, he says, would deliver 500 kilowatts to two 300-hp motors for a cruising speed of 60 mph. Cost is estimated at \$1 million for the basic aircraft; five times that for solar-cell arrays.

A vision for an oil-less world? Gasoline would have to go up to "roughly 20 to 100 dollars per gallon," Boucher figures, to make such vehicles worthwhile. But the investment would be one-time, whereas "gas is energy on the installment plan."

Whatever shape solar-powered airplanes take, the idea is immediately feasible albeit at a price. It only remains to be demonstrated. And with the predicted steady drop in solar cell price per watt, sun-powered flight might soon be nothing to make light of.

PM

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## TUNING IN ON THE GHOST BEAM

(Continued from page 94)

situated precisely throughout the grid.

Dr. Saenz and his team say they want to test a Cherenkov detector placed in 1000-foot-deep water (about right for nuclear submarines). Using the Tevatron, they believe they can easily send 15-bit messages of 1s and 0s (binary numbers) during each eight-second accelerator cycle. The 15-bit burst would actually take place within 30 billionths of a second. The actual

proton beam is only one second "long"; the other seven seconds is how long it takes the accelerator to get the beam up to 1 TeV.

Theoretically, the intrinsic number of collisions (message bits) each neutrino burst could produce, Kotzer notes, is 53 million per second. Even now, Kotzer says, with the proper spacing the Fermilab accelerator could unload 1113 bits in 21 billionths of a second. That's enough to set up a good low-data link between a ground station and submarines.

Dr. Saenz says he can't discuss

any practical interest the Navy may have in neutrino communications, but he notes that it could, in fact, be the only viable means by which to reach submarines in a thermonuclear war.

The Navy, however, is not rushing headlong to develop neutrino communications because it's already spent more than \$115 million on a controversial project to turn most of northern Michigan into a giant very-short-wave transmitter. Called Project Seafarer, the scheme was recently scaled down because of public pressure. The whole area would become a huge grid, with underground cables connecting each point in the grid. It would broadcast radio signals at Extreme Low Frequencies (ELF) to subs in deep water.

The main problem with an ELF communications system is that an enemy could simply build ELF receivers. ELF signals are not tap-proof and their range and a submarine's ability to receive them are limited.

### No radioactive dangers

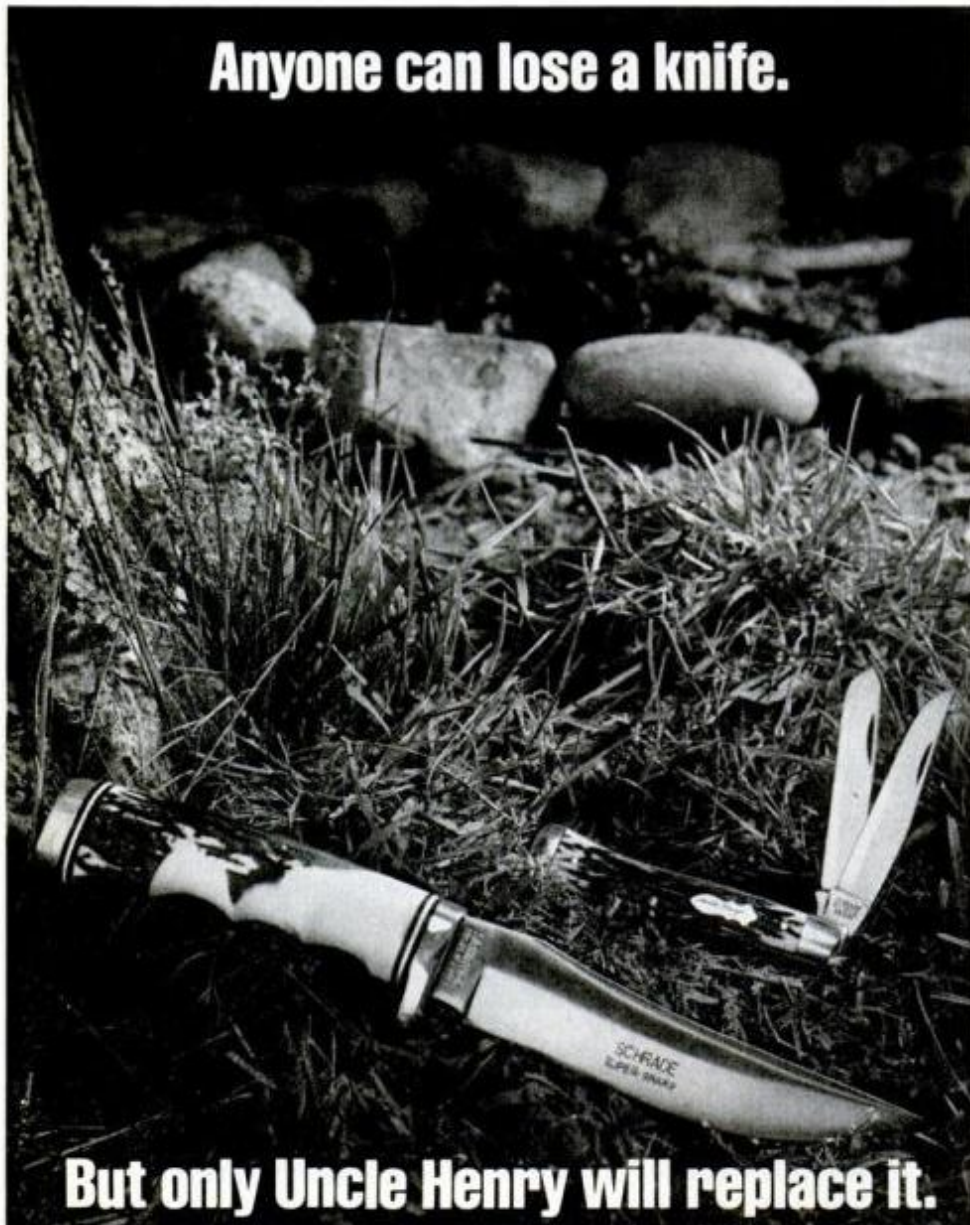
Neutrinos, on the other hand, are transmitted in relatively narrow beams and collide with matter so infrequently that an enemy would have to virtually duplicate our deep-water Cherenkov detector network in the same spot. (Another important advantage of neutrinos is they are 1000 times *less* radioactive than the feeblest cosmic ray. They pose no known public danger at all.)

Unfortunately, cost is the prime factor. To conduct these simple experiments during the next three years will cost about \$10 million, Kotzer says. To build a new Tevatron exclusively for Naval research would take five to 10 years and cost several hundred million dollars. The Navy would need a separate, bomb-sheltered accelerator for its own supersecret communications.

### Neutrino-beamed TV

The not-too-distant future holds great promise, however, for commercial applications. Kotzer and his colleagues say that within 10 to 15 years, accelerators with up to 40 TeV. may be built. The message rates from these would increase by the factor of a million over Fermilab's Tevatron output. Then, the transmission of television and telephone calls by neutrino beam would be possible. One thing is certain: It won't be long before some form of communication via a medium for which the world itself "doesn't exist" becomes a reality. **PM**

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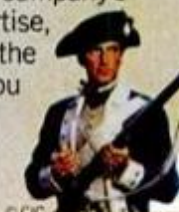
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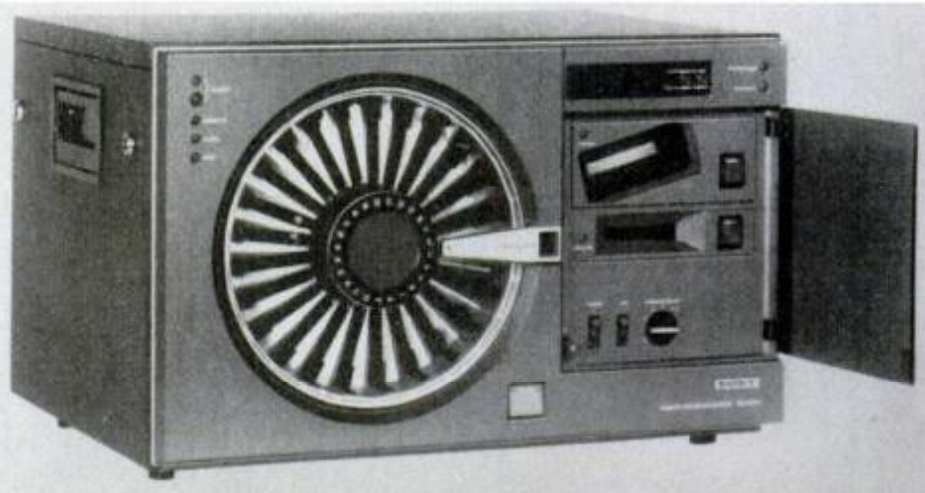
### Night light

The light green glow of the Laser Lite  
(not a real laser) is the brightest of any  
bike light, the maker says. Its fluore-  
scent bulb shines 360° and is visible  
for a quarter mile or more. The 12-volt  
generator powered by the rear wheel  
can be disengaged when not needed.  
The bulb is shielded from weather and  
breakage by a plastic tube and is said  
to last 3000 hours. About \$20 from Life  
Lite Safety Products, 4465 Grinnell  
Ave., Boulder, Colo. 80303.

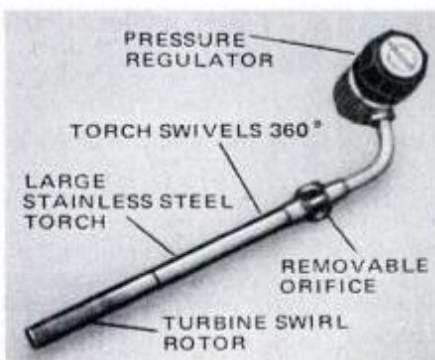


### The great dictator

Computers are dipping into the secretarial pool thanks to the Network, Sony's mi-  
croprocessor-controlled central dictating system. It permits more versatile and effi-  
cient dictation management and is said to minimize human operating errors. The  
unit's 24-cassette carousel can record from any outside or in-office telephone, and  
there's a tape-saving control that stops recording during a speaker's pauses.  
About \$4500 from Sony Industries, 9 West 57th St., New York, N.Y. 10019.



## PM LOOKS AT SPITFIRE TORCH



All components of the Spitfire torch combine to maximize heat on target.



Torch took three minutes to heat joint enough to melt bronze brazing rod.

To try out the new Spitfire propane blazing torch, I borrowed a tricycle in need of repair from a nearby preschool. The kids were pleased with the results—and so was I.

Unlike conventional propane torches, which operate at lower temperatures, the Spitfire can do hard soldering as well as soft. Heat is maximized by precise metering of the gas/air ratio. Also, a helical rotor inside the flame tube swirls the gas/air mixture and spins the heavier inert gases to the outer edge of the flame, where they act as an insulator to help keep heat concentrated. In addition, the stainless-steel torch tip does not conduct heat away from the flame.

Optional accessories include soldering kit, brazing rods (bronze, stainless steel and aluminum), small tips for lighter work, flame spreader for paint removal, heat shield for working close to a wall, spark lighter and spare flints. Five different torch kits range in price from \$10 for the simple torch shown, to about \$35. They are available at many retail hardware outlets. If you can't locate a distributor, write Wingaersheek Inc., 2 Dearborn Rd. Peabody, Mass. 01960.—J.P.

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## The Winner II Runner.

Studded outsole and extended heel for traction. Fiddle-shank and crepe heel wedge for lightness and support. See the entire line of Winner II Imported

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## OMNI AND HORIZON

(Continued from page 90)

can say I'm not disappointed one bit!"

A Minnesota commercial artist: "Handling is fantastic, from parking to high-speed highway cruising. The engine is quiet and peppy and starts in 20-below weather without a block heater. The dealer gave me a good deal and lent me a demo until my car came in; no pressure. This car is well worth what I paid."

Now for some general comments from owners:

"I refer to my Omni as a 'Friday or Monday' car, because I think the parts were thrown at it during assembly," quips a self-employed Michigander, "But it handles incredibly well in every situation, and it's a fun car to maneuver. I find fuel consumption less than the EPA estimate, but it's still okay."

"My wife and I both love our Omni," states a Georgia salesman, "but we were having problems getting it debugged. When the local service department couldn't straighten things out, I got a call from Chrysler Corp. Last week I met a factory rep at the dealer's, and the

car goes back Wednesday. On Friday, when we pick it up, the factory man will be there to see we're satisfied. Looks like Chrysler is really interested."

"It's a good car and almost great," testifies a Michigan auditor. "I find little things wrong, like the difference in height between the folded seat-back and the cargo deck. The awkward gas filler cost me \$20 in two pairs of pants. And the 200-mile spare tire seems like a bad joke."

A South Carolina dentist: "Why can't Chrysler straighten out their carburetor problem? They've used the same no-good electric choke for three years now. It's the same as on my 1977 Aspen, which gets 11 mpg, stalls, and has caused several near accidents. I'd settle for an old-fashioned hand choke on the dashboard."

A Vermont secretary: "I shopped around and found the Horizon to be best in its price range and am very pleased with it to date. My husband, who's 6-8, finds it quite roomy—more so than our previous VW Dasher. I also like the four-speed gearbox much better than the automatic. I rented an automatic Omni in another city, and for an engine of this size



Hatchback beats notchback, most say.

you get much better response from the four-speed."

An Illinois electronics repairman: "The VW-made transmission is sometimes hard to get into gear, especially low and third. I realize that fourth is an overdrive ratio, but I would like a five-speed."

A Michigan plumber: "Love the handling, love the looks, and love the gas mileage, but the oil filter is a bear to get off without a special wrench."

And finally, from a Colorado electrical engineer: "We have four people in our carpool, each a six-footer. Everyone likes my Omni better than my old 1969 Pontiac, better than another guy's Hornet, and a lot better than our 1974 Camaro 350. My wife keeps taking the Omni and leaves me with the gas gussler." **PM**

## With Elmer's Carpenter's Wood Glue you don't need a pro's hands to give it the pro's touch.



Elmer's® Carpenter's Wood Glue is a special wood glue for all your woodworking projects. It penetrates well in hard and soft woods and forms a heat and water resistant bond that's stronger than the wood itself.

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.

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New Gulfpride® Multi-G has everything you need in a premium grade motor oil — plus longer drain intervals than any oil Gulf has ever produced for cars.

New Gulfpride Multi-G fights wear, rust, corrosion, oxidation, and engine deposits. It stays fluid when it's cold, stays tough when it's hot. And it does all those good things for up to one year or 15,000 miles, under normal driving conditions. If you've got a

brand-new car, of course, you should follow the warranty instructions.

There's nearly a million miles of test driving behind new Gulfpride Multi-G — in a fleet of vans and a fleet of taxis; in stop-and-go driving and turnpike driving.

New Gulfpride Multi-G. It's the end of the midwinter oil change. It's also the end of the spring and fall oil change. Pick a nice day, do it once: with new Gulfpride Multi-G.



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**LETHAL IMPOSTERS**

(Continued from page 86)

them out on a desk: a pack of Marlboro cigarettes; an ordinary Zippo lighter; pens and pencils; a tire pressure gauge; a decorative brass key for a large iron gate; a small grease gun and an assortment of similar objects.

They're all guns—most of them confiscated in criminal cases. Fold back the paper of the cigarette pack and a tiny gun barrel appears in the top, with a squeeze-lever trigger on the side, under the thin covering of paper. Flip the lighter lid, and a half-inch barrel projects from the place a wick should be—with a finger-pull trigger where a flint wheel went. The gate key has a pull-snap trigger knob in the handle and the grease gun fires when the handle is rammed home. Most such gadgets are built to fire a single .25- or .22-cal. bullet. All of them can kill.

Ed Owen insists these are pretty ordinary. "Some are really unique," he says. "We've seen smoking-pipe guns, umbrella guns and one that looks like an old-fashioned drinking ladle. At one time the Germans produced a belt buckle gun."

Some cane guns and swords, popular at the turn of the century, were works of art. ATF has several. Most beautiful is a Doumontier, produced by a Frenchman of that name. The polished hardwood stick covering a slick steel barrel is topped by a jade handle carved in the form of a greyhound's head. Twist the handle, pull, and the breech slides open to accept a .410-gauge shot shell. Twist the silver band and a trigger drops into operating position.

A similar beauty has a plain jade handle that detaches to reveal a revolver cylinder that accommodates six .25-cal. shells. A stiletto bayonet projects from it—presumably in case the "gentleman" should miss at close quarters. He might. There's no barrel.

At one time ATF held an instruction class on oddball firearms for law enforcement agencies. "Uniformed police got really upset when they saw these things," Owen notes, "especially the lighter and cigarettes. It seems when a traffic officer arrests someone, the culprit—if a smoker—invariably pulls out a pack of cigarettes nervously and lights up. 'What if that pack is a gun?' they ask.

We reveal that such firearms are mostly for collectors; that they shouldn't go around snapping every little old lady's cane over their knees to see if it's a gun. Hardened

criminals don't bother with non-gun guns. Ordinary guns are too easily concealed."

**Ingenious rocket pistol**

Not all unusual guns come from basement workshops. Not long ago an American manufacturer produced a real rocket pistol. "The projectiles had four pinhead-size venturis in the rear," says Ed, holding up a sample inch-long missile. "You load four or five in the chamber, cock it and fire. The hammer drives the rocket back against a firing pin, which ignites the propellant. A spring clamp holds the projectile long enough to build up pressure, then off it goes. Angled venturis set it spinning—a perfect rocket behind a solid slug."

There was a problem with accuracy, Owen says. The tiny venturis tended to clog and the rockets would "hook into the rough." But the Air Force took the concept and applied it to lifesaving. Today such a unit—designed like a pen gun—fires rocket-powered flares as distress signals.

The most sinister weapons in ATF's arsenal are the automatics that started the whole business of gun registration and regulation, and were responsible for the National Firearms Act of 1934. Most infamous, of course, is the Thompson submachine gun that acquired notoriety in the gang wars of the Prohibition Era. Ed Owen can show you one that most ATF people believe was used in the notorious 1929 St. Valentine's Day massacre in Chicago.

"It was recovered from a man with the friendly name of Fred 'Killer' Burke," says Owen, "along with Chicago Police uniforms and other gangster gear.

"You don't see machine guns in hard crime much anymore," he adds. "The sawed-off shotgun is easier; all you need is a cheap single barrel gun and a hacksaw."

**Collectors want Thompsons**

But the collectors' market for Thompsons is booming. Back in the '20s, Nick Vainovich reveals, a standard one with a drum magazine holding 50 or 100 rounds went for a few hundred dollars. Today, collectors will drop \$1500 to \$5000 and more for a registered Thompson, depending on features.

A recently introduced wrinkle is what Owen calls "toy Thompsons"—replicas that don't require registration fees. "Some look more like the real thing than the guns themselves," says Ed, proceeding to prove

(Please turn to page 176)



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With a low-cost, easy-to-operate Lincoln AC-225 portable welder.

Welding is easy and economical with a Lincoln AC-225 portable welder—even if you've never welded before.

Now you can do hundreds of building and repair projects using plate or sheet metal. Even hard surfacing and heating metal for bending.

Just follow the free *Welder's Guide* included. The AC-225 operates on 230 volt, single phase, 60 hertz input power; has only one dial for current selection, plus an electrode guide right on the machine.

Besides, the AC-225 is UL approved and built to last by Lincoln Electric—the world's largest producer of arc welding products. And the price is far less than you'd expect and includes accessories.

Find out more from your local Lincoln Electric Distributor. He's in the Yellow Pages under Welding Equipment and Supplies. Or send for a free Bulletin. The Lincoln Electric Co., Cleveland, Ohio 44117.



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## LETHAL IMPOSTERS

(Continued from page 174)

it by placing one of the library's genuine guns and a dummy side-by-side. "The difference," says Ed, hefting the toy, "is that this one is about 12 pounds of solid zinc. But if you were to walk into a liquor store with it, you can bet everyone would hit the floor."

### Miniature machine gun

Just as intriguing are the library's samples of a current production miniature of a 1928 Thompson (about half scale). The baby submachine gun takes a drum magazine holding 20 rounds of .25-cal. bullets—and fires them automatically just like its big brother.

Can anyone buy them? Yes, if you're cleared by ATF for registration, and pay the \$200 fee required for ownership or transfer of an automatic weapon.

"Whenever an article appears on unusual guns, people call with questions about what's legal or illegal," Ed Owen notes. "We get letters saying things like: 'Hey! I've got one like that; what do I do about it?'"

"The best thing to do," he says, "is contact the nearest ATF office, listed in the phone book under U.S. Government, Treasury Department."

Can possession of an unreported NFA weapon be made legal? Not for most. ATF may do one of several things (except for unregistered machine-gun types, which automatically are confiscated): 1. If the weapon can be rendered unserviceable, it may be so altered, enabling you to keep it and register it without fee. 2. ATF may require that you give it to an authorized museum. 3. ATF may confiscate the device. For different kinds of weapons, other alternatives are sometimes effected.

Many such weapons eventually are acquired by the ATF weapons library, or destroyed. "A lot of those we keep," says Owen, "are guns we can adapt to the tests we have to run."

What about rare weapons that find their way into the gun library? They will join the burgeoning array of guns in the reference collections, displayed on racks, mounts and galleries of the new quarters. "Our goal," says Ed Owen, "is to have at least one of every firearm ever made anywhere in the world. Obviously that's unachievable, but it's what we're shooting for on the long range." **PM**



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a finish as tough  
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Weather's tough. Ordinary spray paints aren't. That's why I paint with Plasti-Kote. From the automotive aerosol specialists who make all kinds of spray paint — all-weather tough, sparkling smooth.

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## earning extra income.”

Wilbur Hess  
Knapp Shoe Counselor  
Vista, CA

“Due to the higher cost of living, I found it necessary to supplement my income. I’m seventy-one years old and have retired from a steel company after twenty-two years as a machinist.

My brother, Harry Hess, who has been with Knapp Shoe for over twenty years, suggested that I try selling . . . something that I had never done before. I applied for a franchise and shortly thereafter began selling Knapp Shoes. That was in August 1975.

I work about 80 hours per month and last year grossed \$3,295.00. This leaves me plenty of time for fishing and for helping my friends and neighbors.

After wearing Knapp Shoes for 25 years and selling them for nearly three years, I am convinced that they truly are “The Most For The Money Shoe”. I have never had any reason not to be satisfied with them.

The Knapp Company and all of its employees have treated me in a fine manner. All of the people that I have dealt with seem to be well above average in every way. I am happy to be a part of the Knapp Selling Team.”

If you would like information on becoming a Knapp Counselor, please fill out and return the coupon. There is no cost or investment on your part.

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 **KNAPP**  
The more for the money shoe.

## VIDEO RECORDERS

(Continued from page 84)

but at the standard speed as well. The visible differences include a little more snow, a little more jitter and a little more sensitivity to tracking adjustment with the four-hour machines. And while tapes recorded at the standard two-hour VHS speed can be played back on any other VHS machine, some four-hour tapes won't reproduce properly on any but the same machine used for recording. The picture “breaks up” with very annoying black bars across the screen or with snow that can't be adjusted out.

Normally, small differences in tape speed between machines can be compensated for by a “tracking” control found on every VCR. This is easy to find—though its small knob is hard to grasp—on the Panasonic, RCA and GE machines, but it's almost completely hidden under the bottom of the front panel on the Sony machine. You also have to get used to turning the control a bit, then waiting to see if you've made a proper adjustment since the effect of this adjustment isn't instantaneous.

### Few actual manufacturers

You may have noticed that Panasonic, RCA and GE recorders seem to share many features and, in the pictures, look remarkably alike. That's because they are all made by the same company—Matsushita, the giant Japanese corporate parent of Panasonic. In fact, Matsushita makes most VHS machines, including the VHS recorder sold by Quasar, another Matsushita subsidiary. JVC, which developed the VHS format, is also part of the Matsushita “family,” but builds its machine independently.

Most Beta-format machines are built by Sony, so here, too, there are few differences among machines aside from labels and cosmetics. Some older Beta machines had mechanical clock-timer accessories on top of the machine; now most have integrated, electronic clocks.

There are differences among the machines in how convenient it is to use the clock/timers. In the Panasonic-type units, the clock is set by a three-position toggle switch. Push up, and the time changes quickly; push down, and it changes slowly until correct time is displayed. The center position is for normal operation.

The JVC recorder has a much more convenient time-setting system: one pushbutton advances the hours by one every time it is pushed. This way, you don't have to wait for the clock to cycle through a whole day to set it an hour earlier than it is

already set, and you take much less chance that you'll run right past the time you want to set and have to do it all over again.

The Beta machines' timers are like the JVC, with an added wrinkle: a *Fast-Minutes* button that saves wear and tear on the *Minutes-Setting* button (and your finger). The timer is also easier to read on the Beta and JVC machines because it is on their front panels. Mounted on the top surface of the Panasonic, RCA and GE recorders, the timer can be seen only if you're standing. That causes a lot of bobbing and weaving when you're waiting for a program to start before turning on the machine, or wondering how much longer a program will last.

For now, all the timers do is turn power on at a preset time so you can record a program while you're away. Once started, the tape keeps running until the tape runs out. Newer machines beginning to be available have more complex timing functions that let you program four different time segments for starting and stopping the recorder in an ensuing week.

The newer recorders also let you program the channel you want to record—something you can't do with the recorders we tested. Ours are set to the one station you want to record at the time you want to start recording—you can't program a series of stations at different times, even if the shows are consecutive.

### Setup complications

Just tuning-in the stations you want to record—even when you're there to record them—can be a problem. Precise fine-tuning is needed to get the best possible picture, and the fine-tuning knobs on all VCRs we tested were tough to use. They're behind the station-selector knobs and have to be pushed and then turned. It takes a lot of dexterity.

Even before you fine-tune the recorder, you have to turn off the automatic fine-tuning control. You may spend more time looking for the AFT switch than you spend making the adjustment. On the Zenith unit, the AFT switch is hidden in the recess the channel-selector sits in, and on the Sony it's neatly hidden below the front panel's bottom edge.

Other controls are generally scattered about the top and front panels in no apparent order. The JVC is the exception; its controls are all on the front panel. Even so, you really have to study the machine you buy before you can get the most out of it—or use it at all. Read the instruction

(Please turn to page 180)



## A cram course for shade-tree mechanics.

Saving money. That's the biggest reason why people are becoming shade-tree mechanics these days. Doing their own tune-ups. Taking care of their cars. Getting better gas mileage. And cleaner air.

If you'd like to become a shade-tree mechanic (or take a refresher course) we have a booklet for you entitled "A Cram Course for Shade-Tree Mechanics." It's an easy-to-understand, step-by-step guide to tuning your car.

It's available at the same store where you buy easy-to-install Stewart-Warner Sensor Instruments: tachometers, ammeters, water temperature gauges and oil pressure gauges. They're an early warning system for your car—alerting you to problems that come up while you're driving. Sometimes, they'll even warn you of problems before they happen. You can buy

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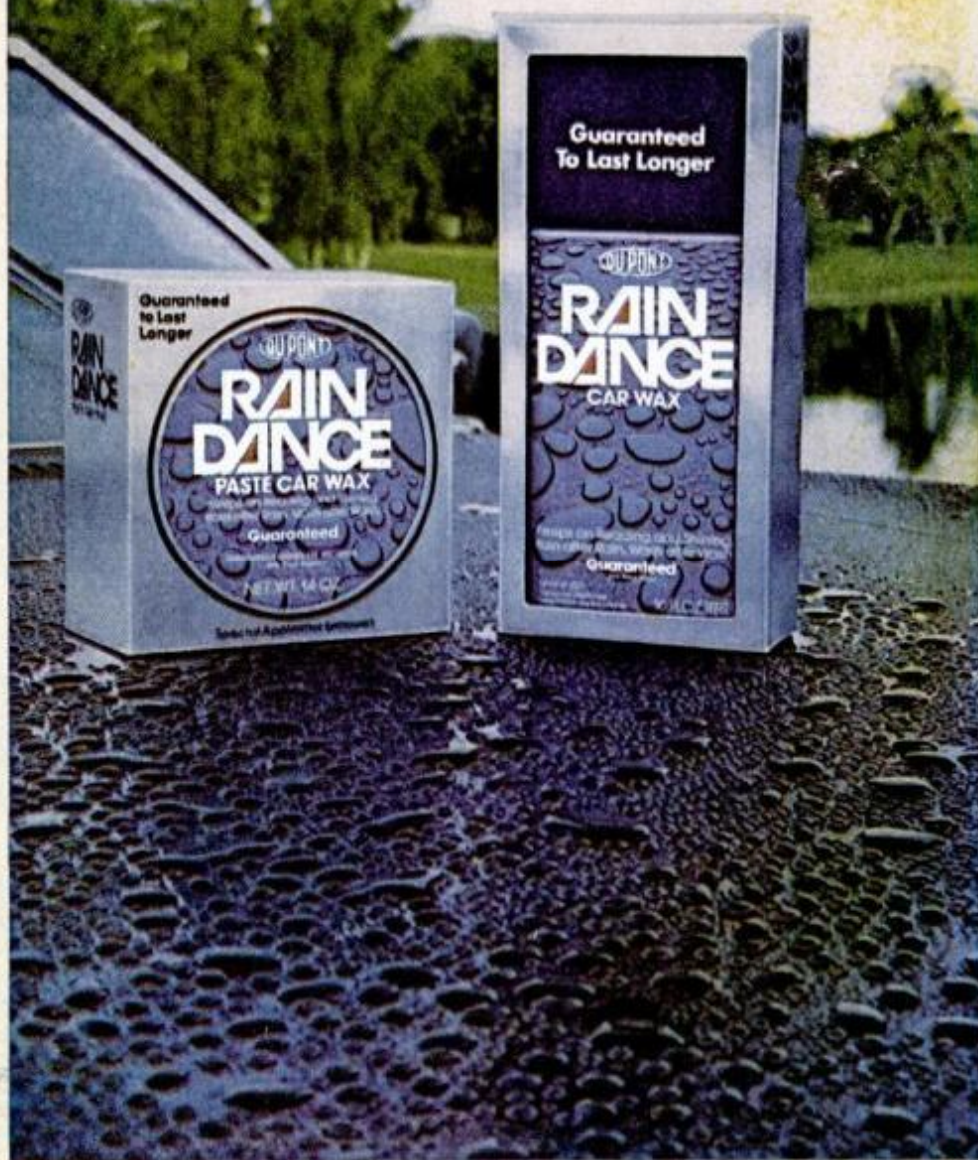
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## VIDEO RECORDERS

(Continued from page 178)

manual carefully to make sure you've hooked the machine up properly. It's not as simple as connecting an audio tape recorder because television sets don't generally have a convenient tap for a video deck the way high-fidelity amplifiers have a tape-output jack. You have to connect the video deck between the antenna and the set, and you have to match the antenna to the recorder, then the recorder to the set. There are so many different antenna/set hookups that provisions have been made on all the recorders for all sorts of options, including cable TV.

You'll have to get used to the VCR's selector switch, too. In the TV position, the antenna signal is fed directly to the TV set. In the VCR position, this signal passes through the recorder's channel selector first. On some machines, this just amounts to pretuning; you can leave your TV set tuned to channel 3 or 4 (choose which one on the VCR), and always use the tuner on the recorder to select a station. All that's required is that the VCR's power be on. Other VCRs can be used for pretuning only if they are in the *Record* mode. If the *Record* button isn't pushed, all you'll get is snow. The other time the VCR position of the selector switch is used, of course, is when you play back a tape.

Not all the tapes you play have to be tapes you make yourself. There is a wide variety of prerecorded video tape available from a dozen or so sources. There are specialists in sports tapes, feature movies, X-rated movies, old films and even transferring your Super 8 or regular 8-mm film or 35-mm slides to video tape—a service Fotomat now offers.

You might want to make your own "home movies" directly on your VCR, too. Color and black-and-white cameras are available for all the VCRs we tested, but pretty expensive. Black-and-white cameras cost \$250 and up; the least expensive color VCR camera goes for around \$800.

### What price entertainment?

Even without a camera, the VCR can provide hours of entertainment with prerecorded tapes and with tapes you make off the air. (All manufacturers caution, though, that off-the-air recording may infringe on producers' copyrights. But with the precedents already set in audio recording, it's unlikely the courts will uphold prosecution for normal home use.) It's up to you to decide whether you'll get enough entertainment to justify a \$1000 investment. **PM**

# Scooter's safer than skateboard



Roller-skate scooters put youngsters in control as they zip along.

This roller-skate scooter is fun both for tots too small to safely use skateboards and for older ones who ride at full speed. Since fixed wheels give it a limited turning radius, there is little danger of the scooter veering sharply. Kids hold onto the handle to help maintain balance and lean in the direction they want to turn.

Using scrap wood and an old pair of roller skates, you can make two of these scooters in short order. Separate the wheel assemblies from the skates and remove or cut off projections from the flat mounting plates. Drill three holes in each plate for attaching to the footboard.

Cut pieces itemized in the materials list from 1-in. scrap wood. Or modify dimensions to suit stock on hand and size of user. Round the lower edge of the handle post to ride over small obstacles. Slightly round and sand all edges.

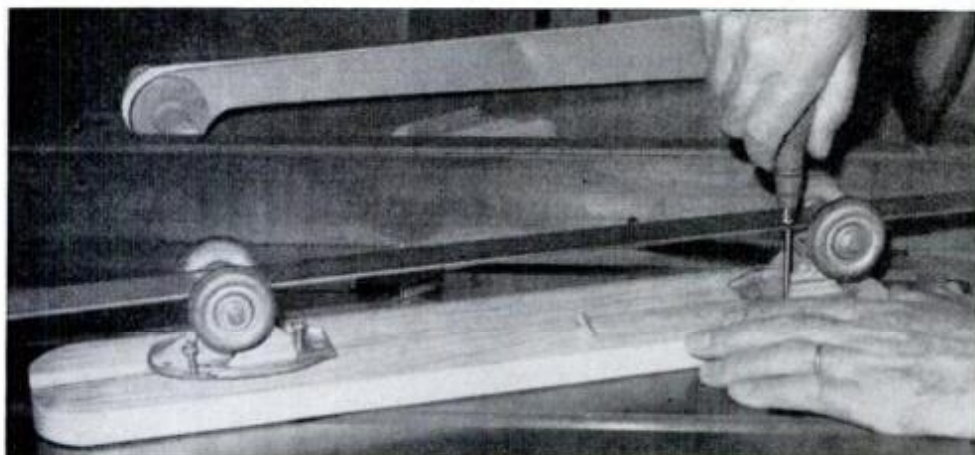
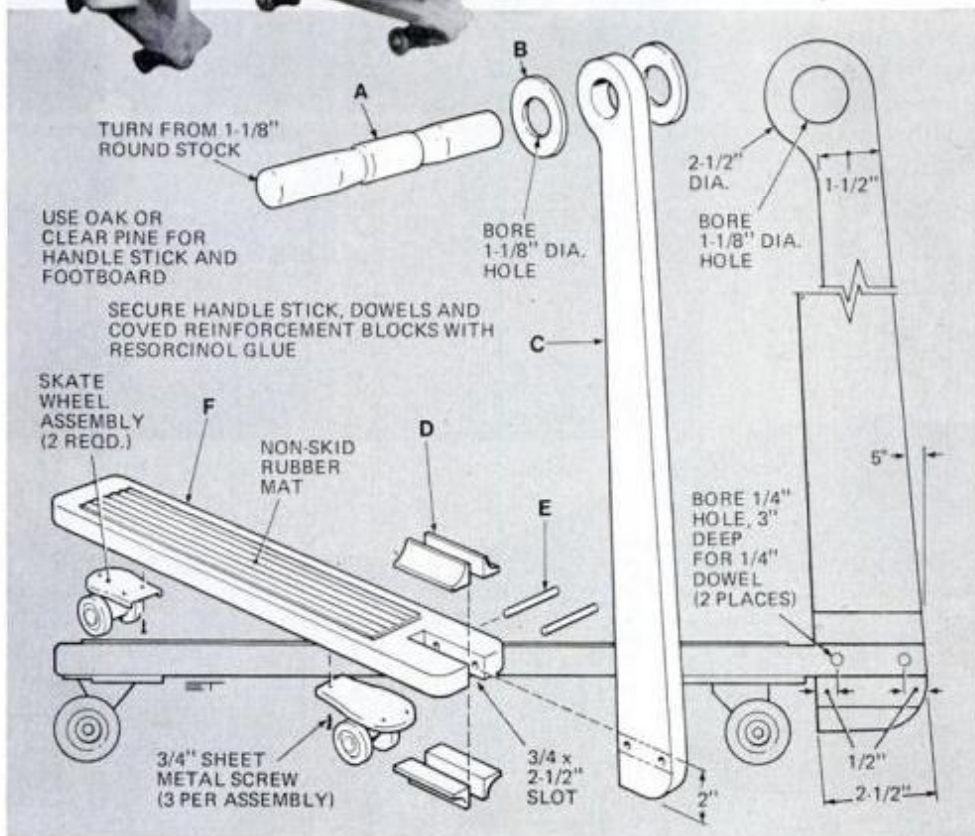
Turn the handle grip from 1 1/8-in.-dia. round stock. Glue the grip into the hole in the handle post, along with a plywood washer on both sides to strengthen assembly.

Draw a centerline on underside of the footboard to position the wheel assemblies but do not attach them yet. Locate the front wheels as close as possible to the handle slot. Position the rear wheels at the very end of the footboard. Hold a straight-edge against the sides of a front and a rear wheel to keep the assemblies aligned while marking for screws. Make holes for the mounting screws with an awl, but don't install them.

Secure the handle post in the footboard slot with glue and dowels. Reinforce this joint at the four 90° corners by gluing in 2 1/2-in.-long pieces of 3/4 x 3/4-in. cove stock.

Sand assembly, round all sharp corners and fill dents with wood putty. Finish with exterior paint.

When paint dries, attach the wheel assemblies. Glue rubber padding to top of the footboard for nonslip footing.—*Emery J. Loisel*



Use an awl to punch starter holes for the screws that hold the skate assembly.

## MATERIALS LIST—SCOOTER

Key Pcs.	Size and description (use)
A	1 1 1/8"-dia. x 8" hardwood (handle grip)
B	2 1/4 x 2 1/2"-dia. (shop-made washers)
C	1 3/4 x 2 1/2 x 27" (handle post)
D	4 3/4 x 3/4 x 2 1/2" (cove reinforcement blocks)
E	2 1/4"-dia. x 3"-long dowels
F	1 3/4 x 4 x 20" (footboard)
Misc.:	Resorcinol glue; 3/4-in. No. 6 sheet metal screws; 1 roller skate; piece of nonskid rubber mat.

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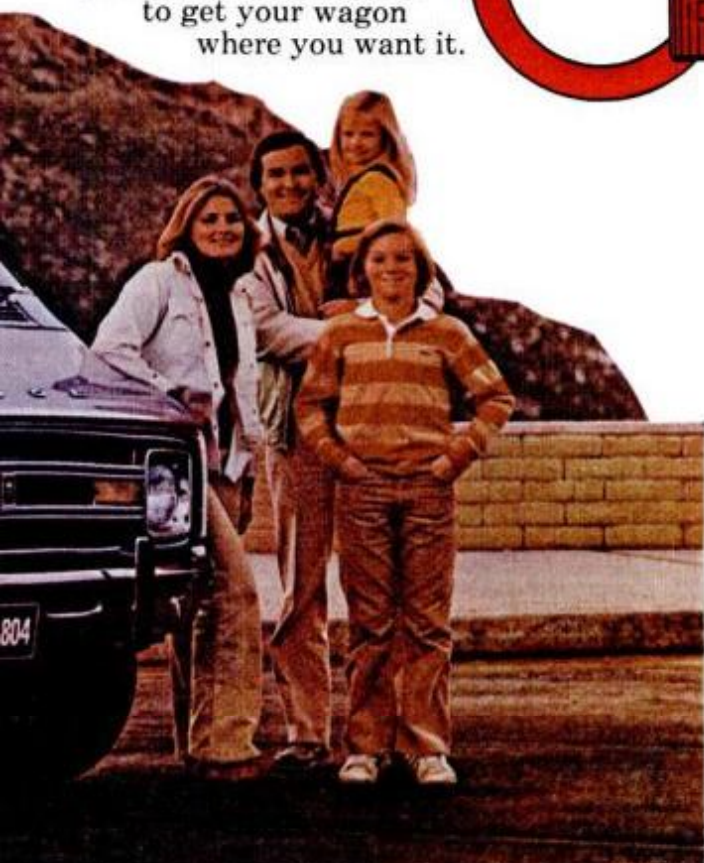
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## LIGHT AND COLOR THEORIES

(Continued from page 81)

it also eliminates the usual flicker of fluorescence, which is recognized as a contributing factor to headaches, eyestrain, skin blemishes, fatigue—and has even been known to cause spasms in some epileptics.

Fluorescent tubes have also been found to emit radiation at the terminals, and any type of fluorescent should have shields over the ends of the tubes. In addition, the whole tube should not be enclosed under plastic or glass since any covering prevents the full spectrum from coming through. Egg-crate de-

signs (with a small grid) cover the tubes but retain open spaces, thus reducing glare but passing ultraviolet and the rest of the spectrum.

### School behavior affected

Just how bad limited-spectrum lighting is was markedly demonstrated with a group of first graders during the 1973-74 school year in Sarasota, Fla. The four classrooms in the trial were windowless, and thus all lighting was artificial. Two classrooms kept their conventional fluorescents, and two had full-spectrum lights installed, with shields to reduce radiation at the terminals.

Under the normal lighting some

first-graders demonstrated nervous fatigue, irritability, lapses of attention and hyperactivity. Yet when full-spectrum lighting was installed, these same children settled down and paid more attention to their teachers, who reported improved overall classroom performance.

Before the lighting was changed students were photographed by concealed cameras fiddling around, leaping from their seats, flailing arms and paying little attention.

After two and three months these children were filmed again. Their behavior was entirely different. The children were calmer and more interested in their work.

One little boy stood out in the earlier photographs because of his extreme hyperactivity. After the lighting was changed he became much quieter and was able to sit still long enough to concentrate. His teacher reported that he now was capable of doing independent work, had overcome what appeared to be a severe learning disability and learned how to read in a relatively short time. In those rooms where the lighting was not changed from standard fluorescence, there was no improvement in behavior.

Although this experiment appears to connect conventional fluorescents and possibly some leaking radiation to hyperactivity, it is likely that they are only one of the many causes. In San Francisco, allergist Dr. Ben Feingold has cured some hyperactive children by simply removing all synthetic additives from their diet—and some of these are artificial colors. It appears that the ingested color reacts with certain wavelengths of light in the environment and in some children produces adverse reactions. Even a single hot dog can cause a tantrum. What is probable is that some youngsters are more susceptible to certain conditions than others, and these tendencies are exacerbated by limited-spectrum lighting.

### And fewer cavities

Amazingly, those Florida first-graders under full-spectrum lighting also developed significantly fewer cavities than the group who studied under conventional light. While the reason for the difference in tooth decay is unclear, animal research backs up these findings.

Intuitively we know that sunlight (which contains all the colors of the spectrum) imbues us with a sense of well-being. Several studies attest to the fact that being in the darkness decreases the red cell count of the blood, while exposure to light

(Please turn to page 186)

## COLOR THERAPY—WHAT'S IT LIKE?

The idea that if someone would only shine a little light on me I would feel better not only struck me as bizarre, but downright foolish. *How could healing be so simple?* So with these misgivings, but, I admit, a predilection to methods of healing other than the strictly Western, I set out for an appointment with Neil Michelsen, lecturer in "holistic healing." "Color, Music and Body Energy" it says at the top of his literature.

Michelsen is a follower of the teachings of the late Dinshah P. Ghadiali, the author of a body of work on color therapy who was eventually stopped from sending his literature or apparatus through the mails by the Food and Drug Administration 25 years ago.

It was agreed Michelson would demonstrate what he believes and teaches on my person. He first examined me for various body imbalances with a complex system of muscle testing called *kinesiology*. With an arm or leg in various positions, I would resist his opposing force. When he pushed, I would push back.

Things were going along quite well; then, with my arm held to my side, knuckles forward, I tried to push my arm away from my torso as Michelsen pushed my arm towards it. I couldn't do it. I felt as if I had no strength at all. "Your pancreas," he said matter of factly. "Let's see if we can change the situation."

He selected two sheets of brightly-colored plastic film and slapped them on a Bell & Howell overhead projector. With the light turned on, they added up to a brilliant violet. He asked me to stand in front of the machine and fixed the light so that it shone on my face and chest. Then he left the room for a few minutes.

When he returned, we tried the muscle test again. This time I was as strong as I had been in the other tests. "Your pancreas is probably overactive," he said. "Have you had any junk food lately?" The night before I had overdosed on a midnight round of coffee cake.

The test proceeded until we hit another snag. Thyroid, he said. Orange was the winning combination this time. After a few minutes of orange treatment, the arm seemed to have the same strength that I had come to know and expect.

"Now let's try something else," Michel-

sen said, this time choosing filters that added up to a deep shade of indigo. After less than a minute of that, my arm seemed weaker than it had been in the first place. Orange, he explained, stimulates the thyroid; indigo turns it down.

Now get this: I have a sluggish thyroid. At times, I have been prescribed medicine by physicians to turn up its action. And yet in a few minutes, Michelsen had apparently determined something that usually requires a complicated and costly laboratory test. Not only that, he had seemingly corrected the condition.

Rather than leave me in the debilitated state, he put me under orange light again to stimulate my thyroid.

I am aware that the power of suggestion could have been at work. But then I hadn't known what the indigo treatment was supposed to do—whether I would end up Wonder Woman or Weak Wanda.

The mysterious filters turn out to be no more than the kind which are used for special effects in stage lighting. They are available from most theatrical lighting stores (or can be obtained from Rosco Laboratories, 36 Bush, Port Chester, N.Y. 10573). All 13 filters, which can be combined to produce the 12 colors of the Dinshah system, cost about \$2.50. It is not necessary to use a projector, Michelsen advises, although it does make it simple. A 10-watt bulb (white, not soft-pink) shining behind the filter is adequate.

How long would the effects of the color last? Unknown, he said, especially since the imbalances in the body are probably due to something we inflict on ourselves, and if we're not willing to take the corrective measure (stop eating too much sugar, salt or whatever), the imbalance will persist.

Michelsen's credentials show him to be past president of the New York City Chapter of something called the National Council for Geocosmic Research. He has recently moved shop from New York to San Diego. He stresses that he is not a color therapist, does not give color treatments, but only conducts workshops for interested parties who may take the information and do with it what they choose. Does it really work? Obviously, more research is needed to answer that question conclusively.—L.D.

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## LIGHT AND COLOR THEORIES

*(Continued from page 184)*

increases it. In either event the blood tends to right itself when the light is stabilized—that is, when we are sometimes in the dark and sometimes in the light.

In some circumstances it appears conclusive that color can have healing properties. When an infant is born with jaundice, giving the skin a sickly yellow tinge, exposure to blue light may correct the condition, depending on the cause. The yellow apparent in the skin is the result of a high bilirubin level in the blood. (Bilirubin is a yellowish substance formed when the body breaks down hemoglobin, the red cell material that transports oxygen through the body.) Premature infants often have livers which are not equipped to deal with this problem, and jaundice is the result. If the level of bilirubin is too high, brain damage and cerebral palsy may result.

### Light replaces transfusion

Previously, the only treatment possible was a complete transfusion, or exchange of blood, which obviously endangers the infant to some degree. Often repeat transfusions were necessary.

In 1958, an English doctor, Richard Cremer, accidentally discovered that the bilirubin level could be corrected with artificial blue light in the nursery for eight hours a day for five or six days. Today, the blue-light treatment is finally replacing the transfusions. While an initial transfusion may still be necessary, the light treatment has considerably reduced the need for additional ones. At some medical centers, including the Mount Sinai Hospital in New York City, full-spectrum fluorescent has been found to work nearly as well as blue light. The babies are kept under the full-spectrum fluorescent around the clock for a few days. Shields cover their eyes. (Yet, the lighting in the rest of the hospital is limited-spectrum fluorescent.)

Medicine makes some people react differently to the sun. The tetracyclines especially cause some people to burn more readily, and as a result the dosage required may be different if you are wintering in sunny climes.

The profound effect of sunlight on human beings can be appreciated from the fact that its total absence can make a woman temporarily infertile. It happens to Eskimos who live near the Arctic Circle during the dark winter days when their land is unrelieved by sunlight.

If light is somehow related to behavior and the female's ability to conceive, might it also influence the sex of her offspring? Well, it appears to do so in chinchillas. In 1970 statistics compiled over five years by more than 2000 ranchers demonstrated that the ratio of females to males could be altered by the color of light under which they lived. Chinchillas, when bred under ordinary incandescent lighting—such as plain light bulbs—have litters averaging 60 to 75 percent male; when the bulbs were changed to "daylight" bulbs—which have a transparent bluish glass—the ratio of females to males reverses. So, in this case, blue is for girls.

### Pink light irritates

We are not suggesting that if you want a boy you replace your bedroom bulbs with pink bulbs; in fact, pink light produces irritability and tension when it is installed in offices to provide a softer feeling, according to light expert John Ott.

In one informal study at the University of South Florida, Ott remembers, three college students out of 300 were found to be "disturbed." All three wore the pink-lens glasses so much in fashion.

In laboratory tests, pink fluorescent lighting kept on for 12 hours a day over a period of six months caused the tails of mice gradually to slough off. This group had the lowest survival rate as compared to mice kept under various types of fluorescent. Survival was highest under daylight—full-spectrum—fluorescent.

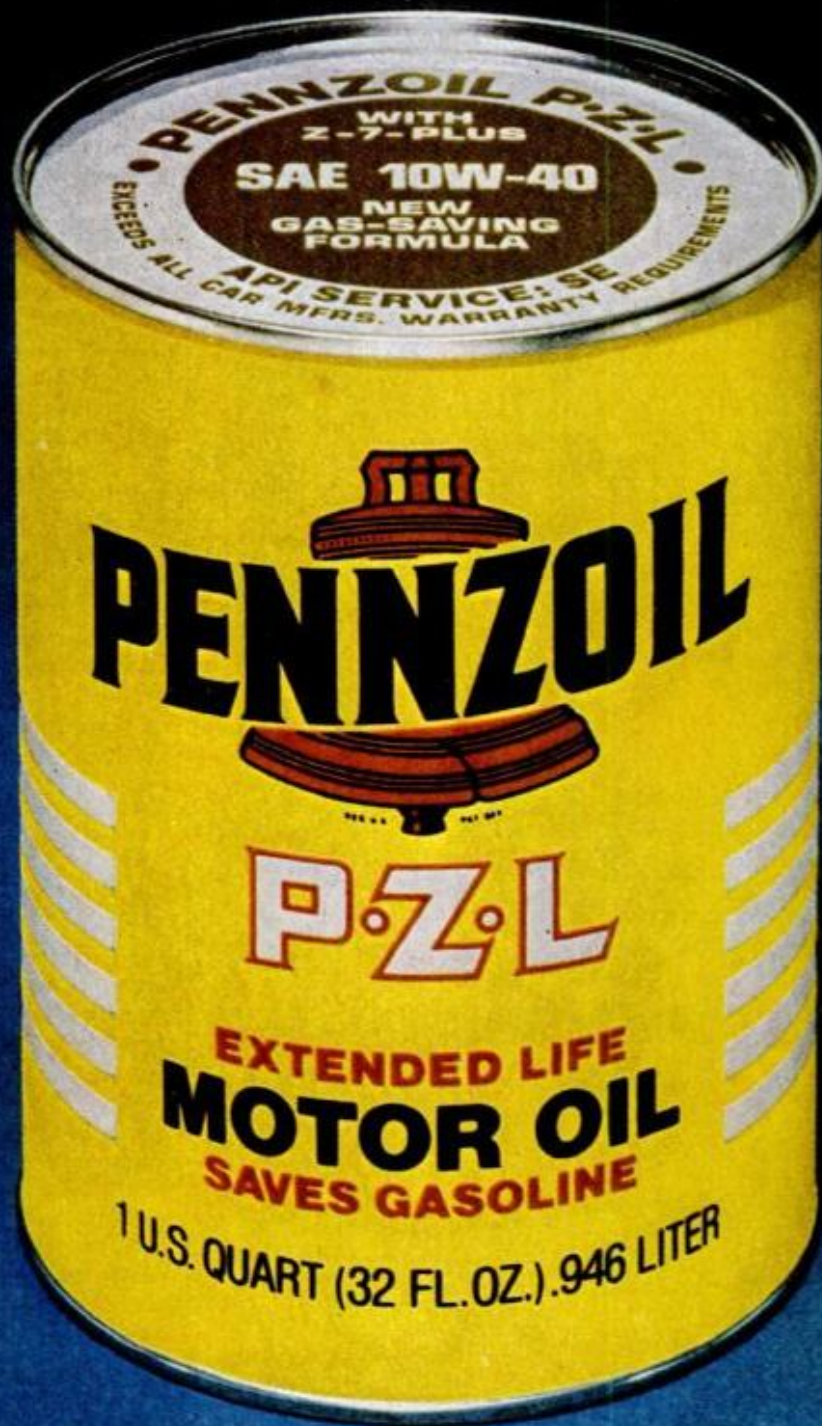
Plant life is similarly affected by color. Generally, long-wave light (red, orange) appears to accelerate plant growth, while short-wave (green, blue, violet) retards it. Plants that bloom during the long days of summer sunlight are found to grow tallest when exposed to orange-red light; they did not bloom at all under yellow, green or blue light, although they did produce heavy foliage. Morning glories, however, which open before dawn, do best under blue and fail under red.

Fish that spend their lives in aquariums thrive if a black light, the safe ultraviolet, is kept on at least part of the day. It not only prevents a disease known as "pop-eye" but also puts a stop to the fin-nipping that is common among aquarium fish. Some fish cannot be kept alive in captivity without the added black light.

Although discos and nightclubs often use this kind of lighting for effect rather than health (it makes white glow in the dark), those who

*(Please turn to page 188)*

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## LIGHT AND COLOR THEORIES

(Continued from page 186)

frequent them may be doing themselves a bit of good. At one Chicago seafood restaurant, according to Ott, the ultraviolet light was added many years ago for special effects. When the owner was queried about the health of the employees, he revealed that they generally got along extremely well, were seldom ill, and that he had the same waiters who had been there when the lights were installed—18 years before.

Although most of us are aware

that there are some colors we are attracted to and some we shun, does color elicit physiological changes that can be measured? That was the question Robert Gerard set out to answer a few years ago when he was working on his doctorate at the University of California at Los Angeles. His research confirmed intuition: Red does excite, blue does soothe. He did detailed studies of blood pressure, the conductivity of the palm that indicates the arousal of the autonomic nervous system, respiration rate, heartbeat, muscle activity, eyeblinks and brain waves.

He asked the subjects how they felt.

The more anxious the subject, the more red disturbed them. Blood pressure, eyeblinks, palm conductivity and breathing rate went up under red, down under blue. No difference was found in heartbeat, but there was in brain-wave activity. While the brain showed an immediate response to red, white and blue (the only colors used in the experiments), after 10 minutes the activity remained consistently greater for red than for blue. White elicited a response similar to red.

Restaurateurs for years have known that vivid red tends to make diners psychologically outgoing and expansive, and they use it in the decor of many posh eating places. How many more times have you seen red goblets, red tablecloths and red-flocked wallpaper than, say, yellow or green in restaurants? Yellow is thought to depress appetite.

Darell Boyd Harmon, a design consultant more interested in the effect of interiors than their appearance, discovered more than 40 years ago that the soft, warm colors in the red family, such as peach, tan and the light emitted from warm fluorescence are conducive to intellectual pursuits and would be good choices in schools, libraries and any other study centers. His extensive work in schools was done for the Texas State Health Dept.

### Locker-room strategy

Soft, cool colors, Harmon found, such as green, blue-green and the light from cool fluorescence induce movement and would be ideal in a gym. However, the deeper, brighter blues have a tendency to orient a person inward, just as deep and vivid red tones energize. The knowledge that red impels people to action has been put to use by some school athletic coaches: They have their locker rooms painted vivid red, the visitors' a low-energy blue.

The tendency today, however, is still to play down the importance of color and concentrate solely on assuring adequate brightness. But the brightness needed to combat the dark walls that decorators make popular every other decade may actually impede your concentration. Think how often you close your eyes to solve a complex problem or comprehend difficult material; you are blocking out all visual stimulation which may be distracting. Color should be directed to help your concentration, not fight against it.

As our knowledge of the full role that color and light play in our lives becomes more comprehensive, the improvements may be dramatic. **PM**

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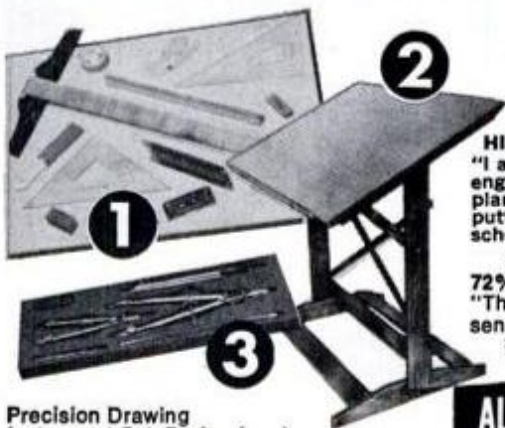
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**DETROIT LISTENING POST**

*(Continued from page 62)*

verbial bit to enter this market; you can almost count on the wily Germans to start pumping out Rabbit-based pickups sometime in this calendar year, now that the Westmoreland, Pa., plant is in operation and the stiff U.S. commercial-vehicle import duty can thus be avoided.

A prototype of this long-eared Bunny-Truck was spotted hopping around the Detroit area even before last Easter.

Finally, everyone in Motor City is humping to get an economical mini-van on the market, and the advent of front-wheel-drive technology in Big Three trick bags is just the impetus that the idea has needed. Chrysler had domestic-built front-drive on the U.S. market first with Omni/Horizon and could do a mini-van version if and when its tight budget permits; but look for GM to be there first, possibly by the '81 model year, with front-drive Nova series mechanicals. Ford, however, with a front-drive Pinto replacement due for 1981, could be a surprise winner with a mini-van version if it can get the little devil out on the road simultaneously with the new car.

A vehicle thought to be a prototype small van was seen in Ford's Dearborn, Mich., home town last March.

**Short notes**

GM reports that a highway traffic fatality (usually caused by driver error) occurs only once in every 30 million vehicle miles, while the electronic control of such items as brakes and steering that some safety people advocate would not be anywhere near as reliable on a failure-per-mile basis.

Also from GM: The company began a pilot program last June to test the effectiveness of "bin'cing arbitration" to settle customer vehicle complaints in the Minneapolis-St. Paul, Minn., area. The program, administered by the Minnesota Better Business Bureau, will enable disgruntled GM customers in the area to take unresolved complaints to a neutral third party when normal customer satisfaction channels fail to work.

Said GM's director of consumer relations: "This is just one more step in our quest of achieving customer satisfaction. Nothing is more important than having our customers feel good about their GM car or truck ownership experience."—Gary Witzenburg





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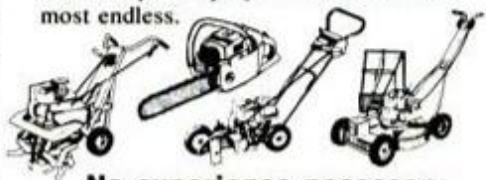
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**MC CREARY**

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## PM'S CIDER PRESS

(Continued from page 123)

after setting them inside the press.

For maximum squeezing pressure, you may consider wrapping a length of cable over the last rib. This is an extra security measure to guard against the wood screws not holding due to the great pressure created.

Make the cider collection board of plywood  $\frac{1}{2}$  x 28 x 35 in. Border it with 1x2s, allowing a  $1\frac{1}{2}$ -in. break for a spout. Apply polyurethane varnish to all pieces. When not needed for juicing, the press can serve as an end table.

### Building the grinder

Have a machinist mill keyways to engage sprocket wheel and pulley. Weld hub. Bend and weld the  $\frac{3}{32}$ -in. key stock to the wheel. This key stock will be shredding the apples at grinding time.

Align and mount the pillow-block

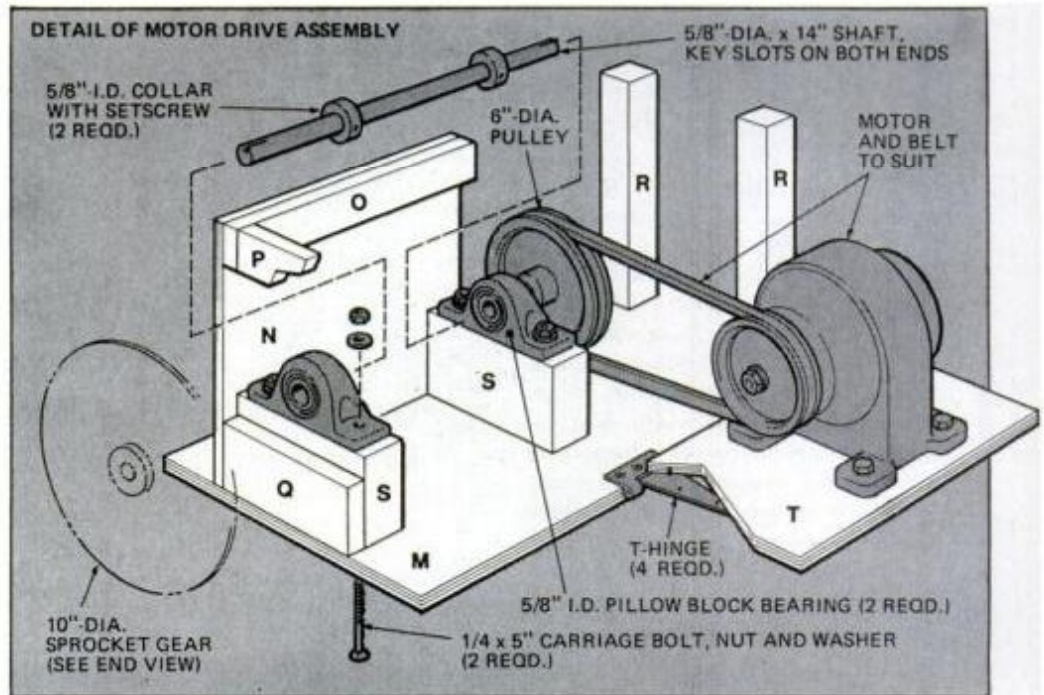
bearings on the grinder base. Mount the motor and second pulley on a board hinged to the base to provide

(Please turn to page 194)

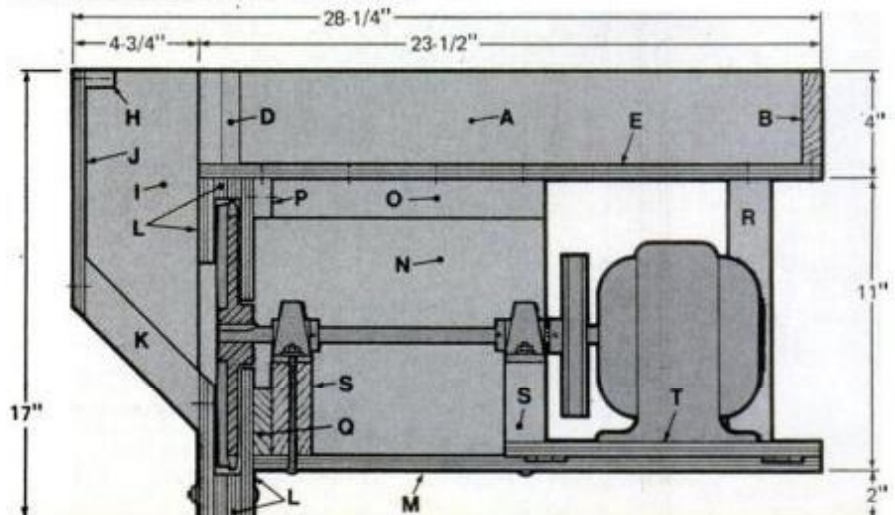
### MATERIALS LIST— CIDER GRINDER

Key	Pcs.	Size and description
A	2	$\frac{3}{4}$ x $3\frac{1}{2}$ x $23\frac{1}{2}$ " pine
B	1	$\frac{3}{4}$ x $3\frac{1}{2}$ x $10\frac{1}{2}$ " pine
C	1	$\frac{3}{4}$ x $3\frac{1}{2}$ x $6\frac{1}{4}$ " pine
D	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $3\frac{1}{2}$ " pine
E	1	$\frac{3}{4}$ x $12$ x $23\frac{1}{2}$ " plywood
F	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $5\frac{1}{2}$ " pine
G	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $7$ " pine
H	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $3\frac{1}{2}$ " pine
I	2	$\frac{3}{8}$ x $4\frac{3}{4}$ x $13\frac{5}{8}$ " plywood
J	1	$\frac{3}{8}$ x $3\frac{1}{2}$ x $9\frac{1}{4}$ " plywood
K	1	$1\frac{1}{2}$ x $3\frac{1}{2}$ x $8$ " fir
L	4	$\frac{3}{8}$ x $12$ x $13$ " plywood
M	1	$\frac{3}{8}$ x $12$ x $23\frac{1}{2}$ " plywood
N	1	$\frac{3}{8}$ x $10\frac{1}{2}$ x $11$ " plywood
O	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $11$ " pine
P	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $6\frac{3}{4}$ " pine
Q	1	$\frac{3}{4}$ x $2\frac{1}{2}$ x $6$ " pine
R	2	$1\frac{1}{2}$ x $1\frac{1}{2}$ x $10\frac{1}{2}$ " fir
S	2	$1\frac{1}{2}$ x $3\frac{1}{2}$ x $6$ " fir
T	1	$\frac{3}{8}$ x $7$ x $12$ " plywood

Misc.: 4  $\frac{1}{4}$ "-dia. x  $2\frac{1}{2}$ " carriage bolts with nuts and washers,  $1\frac{1}{2}$ " x No. 8 fh screws, 2  $\frac{5}{8}$ "-i.d. collars with setscrews,  $\frac{3}{8}$ "-dia. x  $14$ " steel rod, 6"-dia. pulley, 3" dia. pulley, No. 60 sprocket wheel (10" dia.),  $\frac{3}{32}$  x  $\frac{3}{32}$  x  $32$ " key stock, 2  $\frac{5}{8}$ "-i.d. pillow-block bearings,  $\frac{1}{2}$ -hp motor, 1 pr. heavy 6" T-hinges, 4  $\frac{1}{4}$  x 5" carriage bolts with nuts and washers.



### GENERAL ARRANGEMENT (SIDE VIEW)



# GOING FOR PHEASANT?

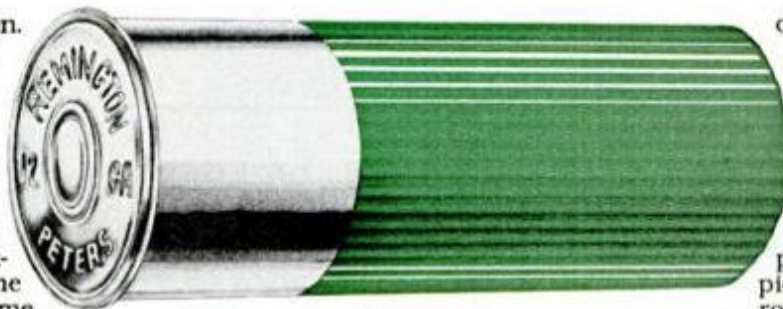


## GO WITH THE GREEN.

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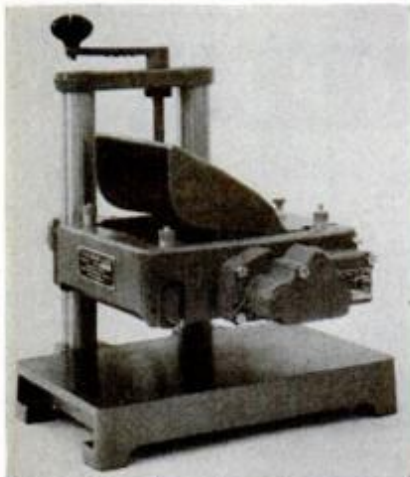
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# "4-in-1 workhorse<sup>™</sup> molder, planer, edger...

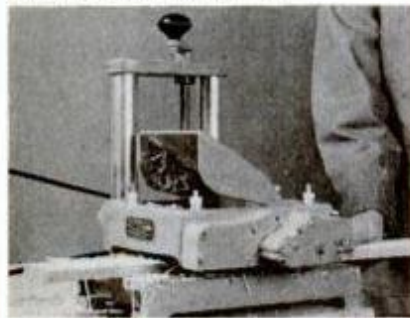


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\*As described by Popular Mechanics, November, 1976, page 128.



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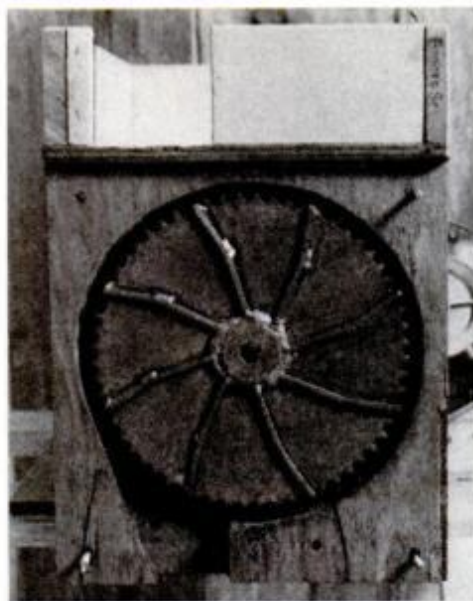
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## PM'S CIDER PRESS

(Continued from page 192)



Removable plywood section permits access to sprocket wheel for cleaning.

a combination of gravity and torque which keeps the belt tight.

Cut four 3/8 x 12 x 13-in. plywood pieces (L in the main drawing on page 192), then cut out space indicated for the wheel and exit channel in the second and third pieces. The channel can have a removable section to make the exit large enough for treating fruits like coarse-stemmed grapes. Cut a 2 1/2-in. hole in the fourth plywood piece for the sprocket-wheel hub. The

Attach hooks for holding prelaunched feed-bag-size burlap bags. When the apples are fed into the hopper the sprocket wheel behind the hopper shreds them and discharges the pulp into the burlap bag, ready to be squeezed in the press.

Burlap bags are used to package some seed, beans, potatoes and industrial parts. If you have a problem locating them, write to Commercial Bag Co., 119 Southwest Columbus, Des Moines, Iowa 50315.

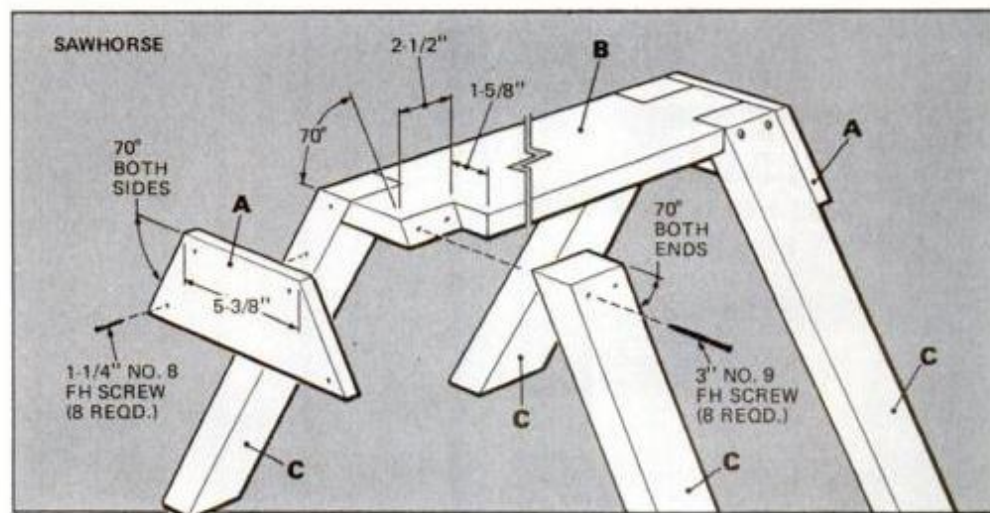
The gusset-reinforced sawhorse is built to hold up under heavy loads and is ideal for supporting the cider press or grinder units. Cut gussets and top from 1x6 stock. Use screws and white glue to assemble. **PM**

### APPLE BUTTER

This is an excellent way to use apple pulp remaining after preparation of apple juice.

- 2 quarts cooked apple pulp
- 4 cups sugar
- 2 teaspoons ground cinnamon
- 1 teaspoon ground ginger
- 1/4 teaspoon ground cloves

Press pulp through a sieve or food mill. Measure pulp, add sugar and spices to two quarts of pulp, and cook about 15 minutes until flavors have blended. Stir frequently. If mixture becomes too thick, add a small amount of water until you have the desired consistency. Pour it hot into hot canning jars, leaving a 1/4-in. airspace at the top. Adjust caps. Let soak about 10 minutes in a boiling-water bath. Yield: five pints.



first plywood piece will hold the front-side hopper. This plywood is removable for cleaning.

Now you can make and mount the rooftop bin and the hopper chute. The rooftop keeps handy the apples to be put in the hopper. The apples will need prodding into the hopper with a small board.

After construction is finished, polyurethane-varnish all wood pieces.

### MATERIALS LIST—SAWHORSE

Key	Pcs.	Size and description
A	2	3/4 x 5 1/2 x 10" pine
B	1	3/4 x 5 3/4 x 32" pine
C	4	1 1/2 x 2 1/2 x 26 1/4" fir

Misc.: 8 1 1/4" No. 8 fh screws, 8 3" No. 9 fh screws, white glue.

Note: The materials list above will make one sawhorse. Multiply the quantities listed above by the number of sawhorses you plan to build to hold the press and the grinder if desired.

# Maybe you thought catching smugglers, stopping poachers and saving lives only happens in the movies.

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These are big jobs, important jobs to our country and to the men and women who perform them. So are the other things we do. Working to pre-

vent pollution of our waterways and coasts. Maintaining the lights and markers that guide ships. Promoting safety in recreational boating.

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It's not all hard work, though there's plenty of that.

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The paycheck you get (over \$400 a month after basic training) goes a lot further. We pay for your uniforms, medical and dental care, and when quarters aren't available, we

provide an allowance for housing and meals. So most of your pay is yours to keep—or save towards a new car, stereo equipment, even college.

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wards. Which means a bigger paycheck, a bigger job and a brighter future.

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## More home fix-up tips from the pro.

**Fill the tub before you caulk.** (Get in if you can, too.) Then, when the tub is empty, it'll rise slightly and squeeze the caulk. Even a good flexible caulk (like Red Devil's) will serve you longer when the filled weight is not stretching it between the tub and wall.

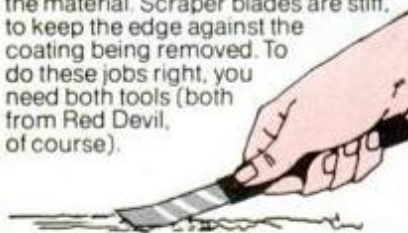


### Caulk is caulk is caulk? Wrong!

Latex or acrylic latex caulk provide excellent durability (especially when painted) and easy clean-up for most uses, but you'll need butyl caulk for the water resistance required at or below ground level. Different caulks for different jobs, that's why Red Devil offers different kinds.



**A putty knife is not a scraper. And vice versa.** Putty knives (for spackling walls and puttying windows) have flexible blades to smooth-on the material. Scraper blades are stiff, to keep the edge against the coating being removed. To do these jobs right, you need both tools (both from Red Devil, of course).



### Save money when you save energy.

This new 72-page **Energy-Saving Book** has dozens of do-it-yourself energy-saving tips that can save you hundreds of dollars. The cost is only \$1.25 plus 50¢ postage and handling. Send check or money order to: Save Energy, Dept. G2, Box 310, Maplewood, N.J. 07040.



### Go easy on the paint with your pad painter.

If you let the pad soak up too much paint, you won't get the best possible results. That's why Red Devil has a patented metering tray designed especially for pad painters. It puts on just the right amount of paint to cover smoothly, evenly. What could be easier?



**Stud finders are un-hole-y.** When hanging pictures on a freshly painted or papered wall, don't fill it with holes before you find the wood behind it. Use a Red Devil Stud Finder. It points out where nails are—and where there are nails, there are studs.



Red Devil has hundreds of things to make your home fix-up easier. Look for them wherever you shop for home-care products. And for best results, always follow directions on the package.

# Red Devil

UNION, N.J. 07083



## PM'S VACATION HOUSE

(Continued from page 109)

pliances. Property and furnishings are not included but furniture shown is available at reasonable cost through the Fuqua dealers. If you choose to have your foundation set by the dealer, rather than doing it yourself, figure on paying another \$1000 to \$1500. The normal delivery of the home will be six to eight weeks from the date the order is placed with the building division.

The house arrives at the site in four sections, hauled by three trucks. It can be erected in a mobile home community or on your own property, provided local regulations permit. Full assembly of the house, including hookup to electric, water and waste lines, is included in the purchase price.

The interior of the Popular Mechanics home was designed by Nancy Gilbert, A.S.I.D., Armstrong Bureau of Interior Design; the actual plant construction and solving of on-site building problems was handled by Robert Brooks, senior product designer for Fuqua Homes, Inc. A number of do-it-yourself projects compatible with this home will appear in PM during the next 12 months. **PM**

## Where you can see the Popular Mechanics Vacation Home

The *Popular Mechanics* Vacation Home will be available throughout the continental United States through the regional divisions of Fuqua Homes, Inc. As of press time, the below-listed divisions were erecting prototype versions of our vacation home:

**Northwest:** Fuqua Homes, Inc./Bend Div., Box 1227, Bend, Ore. 97701. Tel. 503/382-4252.

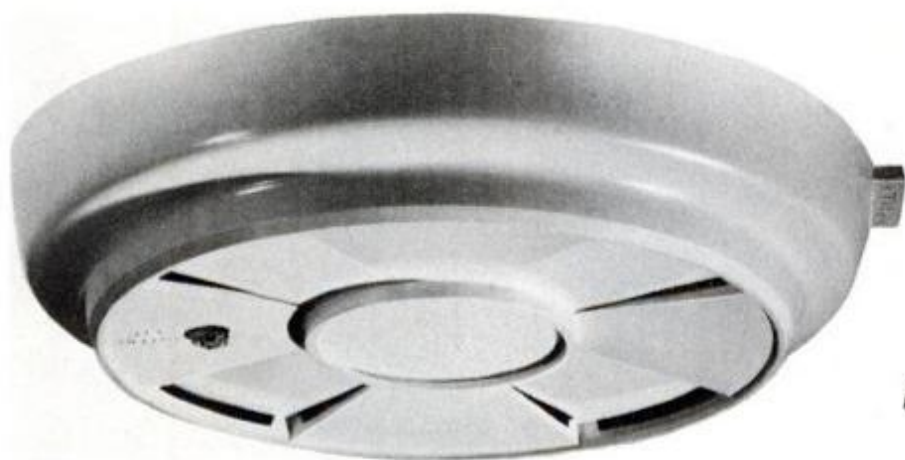
**West:** Fuqua Homes, Inc./Marysville Div., Box 909, Marysville, Calif. 95901. Tel. 916/742-8264.

**South:** Fuqua Homes, Inc./Vance County Div., Box 1208, Henderson, N.C. 27536. Tel. 919/492-1151.

**Midwest:** Fuqua Homes, Inc./Boonville Div., Box 354, Boonville, Md. Tel. 816/882-6581.

The prototype house—the one we've shown—is in Tan-Tar-A Estates, Inc., Osage Beach, Mo. 65065. It can be viewed by appointment; call 314/348-3131. As PM goes to press, Fuqua Homes, Inc., advised that it has plans to build models at additional divisions. Write the manufacturer direct—Fuqua Homes, Inc., Dept. PM 978, 7100 South Cooper, Arlington, Tex. 76017—to learn if a PM Vacation Home is now in your immediate area, and for a list of authorized Fuqua dealers.

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If you want to own the very best solid state alarm with computerized circuitry, a battery that lasts for 10 years and a 10 year warranty on both battery and detector, check the Lifesaver Plus features. They're designed with your safety in mind.

### WHY A SMOKE ALARM?

Most fatalities occur at night and the majority of victims are never touched by flames. They are overcome by smoke and gases as deadly as fire. Our new Lifesaver Plus smoke alarm is designed to alert you of either fast developing or smoldering fires with its loud penetrating warning so you can protect your home, possessions, and most of all, your life.

### HOW DOES IT WORK?

The PDM Lifesaver Plus smoke alarm works on the "ionization" principle of fire detection. Inside the detector is a unique balanced stainless steel dual ionization chamber design with a superior teflon insulator for long life and reliability. The "reference chamber" is designed to keep the sensitivity level constant during normal atmospheric changes in your home. The "sensing chamber" continually monitors the air 24 hours a day and initiates an alarm when smoke and particles of combustion are present. An automatic reset shuts off the alarm when smoke or particles of combustion clear the chamber.

### AUTOMATIC ELECTRONIC CHECKING

The PDM Lifesaver Plus smoke alarm has a testing system that does more than just check the battery to see if it's low. Pressing the test button electronically checks the entire alarm circuitry including the calibrated sensitivity, horn and battery. If the unit is functioning properly, the alarm will sound. Also perfect for fire drills.

### THE BATTERY LIFE BREAKTHROUGH

The detector is battery powered by the

new 10 year UltraCell 9 volt smoke alarm battery, especially designed for the PDM Lifesaver Plus smoke alarm. The UltraCell battery utilizes the active metal lithium and a gaseous electrolyte in hermetically sealed cells. The unique stable chemistry provides a higher cell voltage, more power per unit weight and volume, a wider temperature range and longer life than previous commercially available batteries.

When battery needs replacement, a built-in low battery indicator "chirps" every minute for up to 7 days. Even in an emergency the smoke alarm will function perfectly during the chirping period.

### CHECK THESE IMPORTANT FEATURES:



1. Dual stainless steel ionization chamber design with superior teflon insulator.
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3. Battery powered with the new special 10 year UltraCell smoke alarm battery.
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7. Easy installation with 2 small screws provided—no wiring required.

The PDM Lifesaver Plus smoke alarm gives you more than just a smoke alarm. It gives you all the latest developments and technological advances, proven performance, plus 10 years of service before battery replacement is necessary. Don't be confused—you can't buy a better smoke alarm—plus a 10 year warranty on top of it! The PDM Lifesaver Plus smoke alarm is designed to give you quality, dependability, efficiency and long life.

The unit is easily installed on either ceiling or wall with 2 screws provided. Also included is an operating manual with escape plan, locations for alarms and good safety habits.

To order, send coupon and your check or money order for \$24.99 (Illinois residents add 5% sales tax) plus \$1.50 postage and handling to PDM Sales, Dept. PM9, 119 S. Emerson St., Mt. Prospect, IL 60056. If coupon is missing, send order to PDM. Be sure to indicate number of smoke alarms desired. Credit card buyers may call our toll-free number.

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# 4 new products for your home and shop



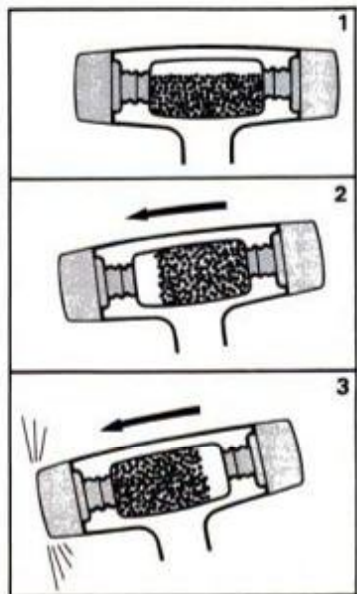
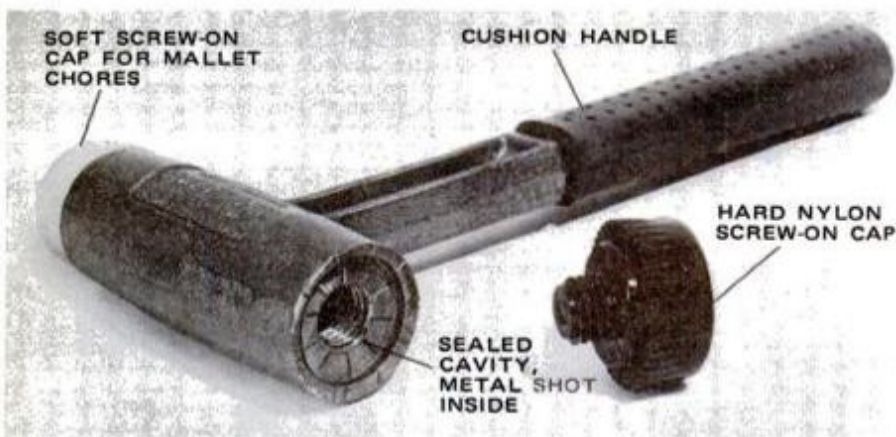
## Programmable oven

The R-9600 Carousel Turntable System microwave oven is microprocessor-controlled. It has a five-stage automatic browning system and a memory that can be programmed for two separate three-sequence cooking routines—with 14 different functions in all. Indicator lights tell the user which function is in operation. Cost is about \$640 from Sharp Electronics Corp., 10 Keystone Pl., Paramus, N.J. 07652.



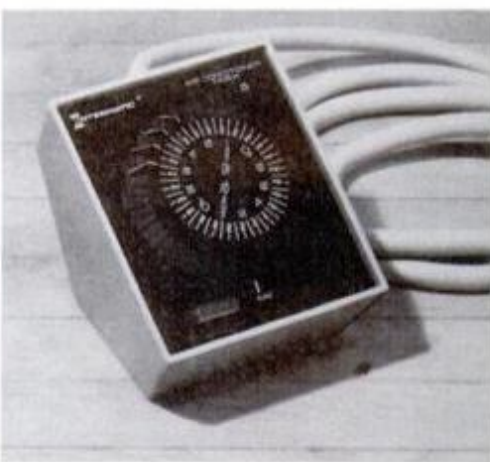
## To the point

The Golden Condor folding hunter's knife features a dropped point, stainless-steel blade, brass rivets and liners and an ebony handle. The release groove for the positive-locking blade is wider than usual to make opening and closing easier. From Atlanta Cutlery Corp., Box 839, Conyers, Ga. 30207. The 2-CG-164 (shown), 3½ in. when closed, is \$15. The 2-CG-166 (4½ in.) and the 2-CG-165 (3 in.) are \$18.75 and \$11.25, respectively.



## Shot in the head

A sealed cavity partly filled with steel shot is inside the Thor Hammer head (drawing 1). As the hammer is swung, shot presses against rear of chamber (2), then moves forward on impact (3). Shot action is said to yield twice the power of a solid hammer—with no rebounds. About \$15 from Beacon Scientific, 482 Sunrise Hwy., Rockville Centre, N.Y. 11570.



## Time in

No need to leave the air conditioner running when you're away from home; Intermatic's EB-41 timer can be set to turn an air conditioner on just before you return so the house will be cool when you arrive. Unit can be used to time multiple intervals and can handle up to 15 amps. of starting current, 12 amps. full load. The EB-41 is about \$18; 250-volt EB-42 is \$19. Both come with three-wire cord. Intermatic Co., Intermatic Plaza, Spring Grove, Ill. 60081.



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# Drilling guide you can build from scrap



their predrilled holes a few times to form threads. Regular steel taps have a tendency to tear out the wood when backing out of the holes.

■ Allow the bit guide to extend at least  $\frac{3}{16}$  in. above the guide holder for "dialing" drill sizes.

■ To help prevent the guide from creeping, attach an old doorknob or a lathe-turned handle to it, and glue a piece of rubber stair tread underneath.

■ Use a wood sealer to keep surfaces dirt-free.

■ To avoid enlarging the holes and destroying their accuracy during use, insert bits fully into the guide before operating your electric drill or hand drill.

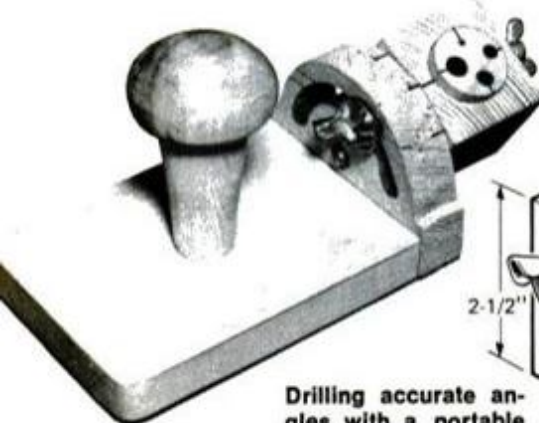
■ For heavy use, you can machine bit grades from aluminum or steel.  
—Robert Bessmer

**W**ith three screws and a few scraps of hardwood, you can build a guide for boring holes at the precise angle you require. Use this jig with a portable electric drill or hand drill. For successful results, consider these critical steps:

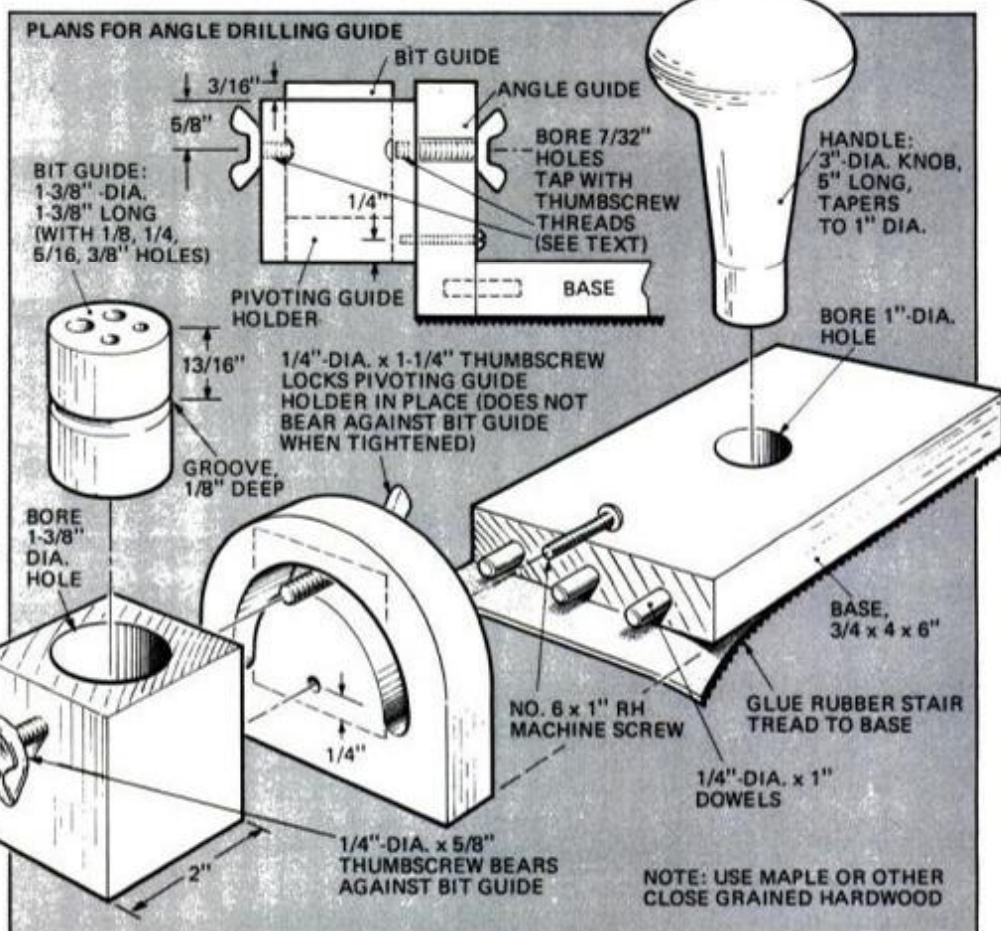
■ Be certain you drill holes in the bit guide parallel to the sides. Use a drill press, if possible.

■ With a protractor, determine your desired angle settings and mark them on top of the guide.

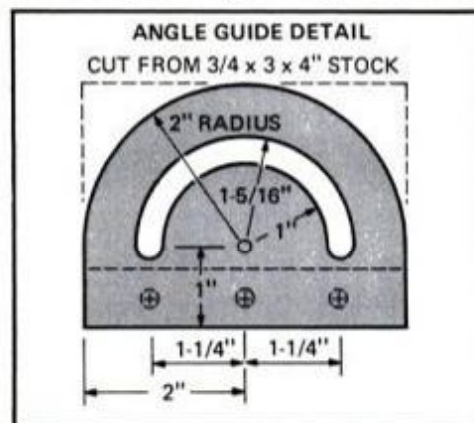
■ Dip thumbscrews in boiled linseed oil and run them in and out of



Drilling accurate angles with a portable drill is a cinch with this easily made unit.



Composed of these simple parts, the jig is light, durable and easy to carry or store. Use a compass to lay out angle guide slot.



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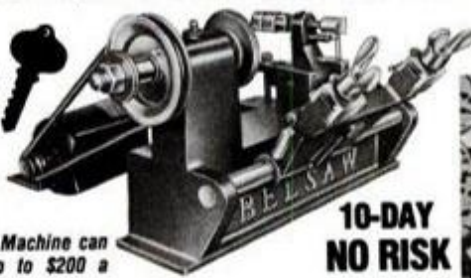
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Back-seat comfort is praised by passengers who ride in the diesel Olds.

## OLDSMOBILE DIESEL

(Continued from page 115)

good pickup and passing power compared with other diesel automobiles. We formerly owned a Mercedes 240D."

And another traditional diesel bugaboo that goes by the boards is cold-weather starting and driveability. "I have to wait about one minute on cold mornings for the glowplugs to warm up," states a Michigan tugboat captain, "but after that there's no wait for engine warmup."

An Illinois kindergarten teacher adds, "The automatic glowplug system is much easier to use than on our previous 220D. And the factory-installed block heater is great. We had no starting problems all winter."

An Illinois retired fireman discloses, "The engine is a little noisy on a cold start, but nothing objectionable. After a short warm-up, there's very little noise. Driving down to Florida recently, I had all the windows shut, and at normal highway cruising speeds, I could hardly hear the engine at all. There's really only one problem with the car. When I stopped for fuel, everyone wanted to look under the hood, including truckers."

Workmanship garnered very high marks, especially for a medium-priced American car. Here are some typical comments:

"Workmanship excellent," observes a Louisiana consulting chemical engineer. "Have not found one defect in 6100 miles of driving, no mechanical or other problems."

A Florida retired Air Force general: "The body is tight and appears to be well put together. There are no rattles or extraneous noises. It's well insulated and quiet inside—much better than other diesel cars."

And a Florida banker: "Excellent—close inspection has shown no flaws in fit and finish, no rattles, no squeaks. Great car!"

Most Olds diesel buyers had had

(Please turn to page 204)

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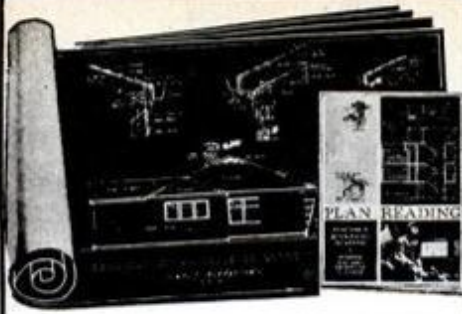
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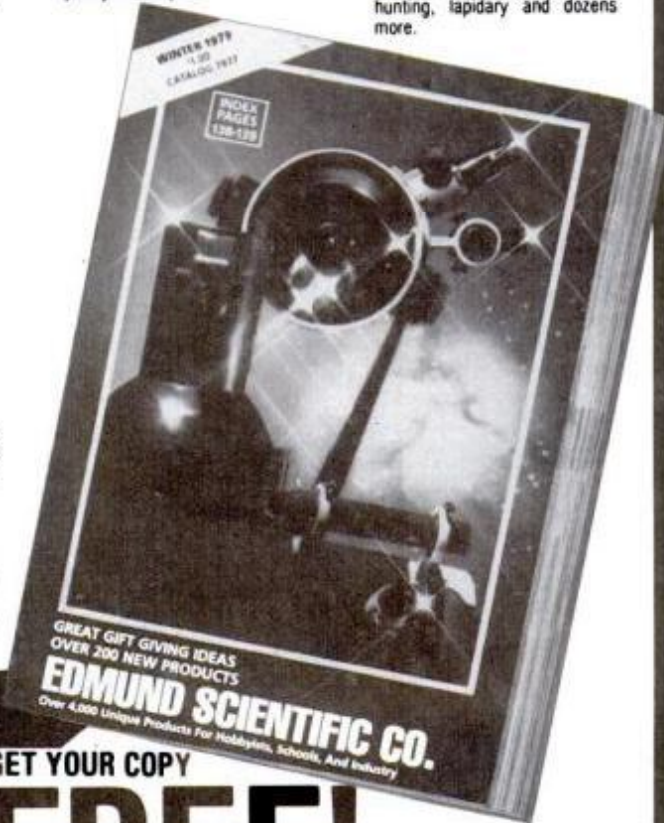


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## OLDSMOBILE DIESEL

(Continued from page 202)

no mechanical problems at all with their cars (53.9 percent). Among those who did, though, 32.2 percent cited oil leaks. Many were the normal sorts of leaks not specific to diesel engines—at the rocker covers, for example. But others were traced to the oil cooler—a diesel add-on—and to an early type of oil-fill cap. At sustained high speeds, crankcase pressure would force oil up the oil-fill tube and past the cap. Both problems have been corrected in later models.

There was also a defect in early fuel injectors that allowed leakage and inaccurate metering. We heard a few complaints about that, too, but again we're assured the problem was one of those early bugs that soon got worked out by the Olds factory.

On the topic of diesel-fuel availability, we received mixed opinions. An Illinois farmer said, for example, "Not too many stations yet offer diesel fuel. I'm forced to travel to truck stops, where I receive a poor second at the pumps. After all, I'm only buying a maximum of 27.5 gallons while the trucks are tanking up with hundreds of gallons."

However, a California apartment house owner counters, "The car comes with a U.S. guide to diesel stations, and it lists *one* here in my town. A search of the city turned up four more that weren't listed. If the same holds true for other towns and cities, I don't believe anyone has to worry about finding diesel fuel. I was a bit apprehensive when we bought the car, and it would be to everyone's advantage if GM could list *all* diesel stations."

Comfort received a good round of applause, with owners commenting favorably on spaciousness, seating front and rear, and riding qualities. Tall drivers praised front-seat legroom, and families told us there was ample space for six.

A few owners voiced concern about having to eventually jump-start their cars. The diesel uses two 12-volt batteries, so some owners assume it has a 24-volt starter. Not so; it's just an H-D 12-volt.

Too, we noted a few comments on the Olds diesel's 3000-mile oil-change recommendation. Lots of drivers have gotten used to longer intervals, and considering that many diesel owners rack up lots of miles per month (e.g. traveling salesmen), 3000 miles sometimes roll around in a big hurry.

We asked owners to make sugges-

(Please turn to page 206)

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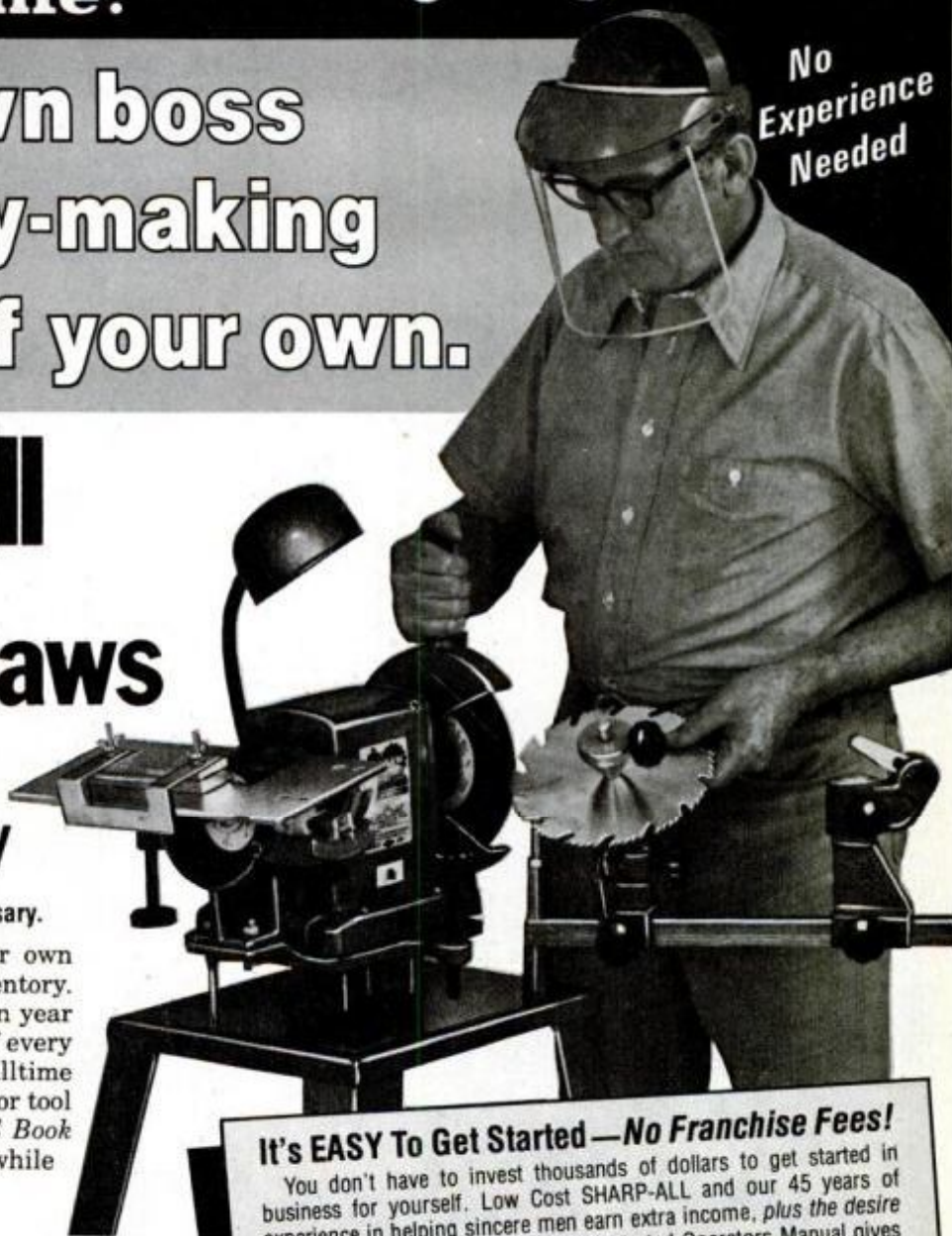
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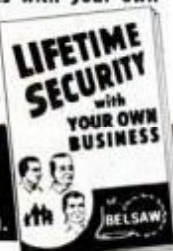
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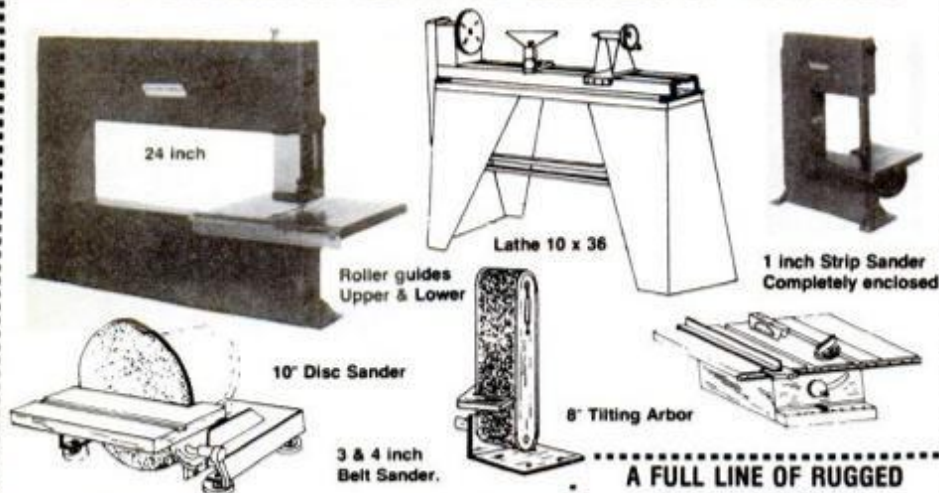
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Station wagon owners enjoy handy bins, cargo area worthy of full-size cars.

### OLDSMOBILE DIESEL

(Continued from page 204)

tions that might improve Olds diesels in the future. Fully 25.4 percent recommended no changes at all—that the car be left as is. Here, though, are some of the suggested improvements offered by the rest:

"Possibly turbocharge the diesel," recommends a Wisconsin farm manager. "Make a full set of gauges available," suggests a Michigan manufacturer's rep. "Re-engineer fuel tank so it doesn't slosh over at every refill."—Texas maintenance mechanic. "Smooth out the shifts in the automatic transmission."—Illinois CPA.

In summing up, a Nebraska farmer's view of his car is typical of a great number of other owners. "I believe this is the greatest car to come out of Detroit in a long time," he writes, "and I think it will be the forerunner of a whole new generation of American luxury cars. The performance of the Olds diesel, the style and comfort are all first-rate. Here's a car designed and built in the good-old U.S.A., and it goes to prove we can still come up with some good ideas in this country."

Finally, a Minnesota accountant signs off with these words: "In my estimation, this is the finest auto I've ever owned. The diesel is the only way to go. Last week I was coming home from an out-of-state business engagement. Driving freeways on cruise control, my average fuel mileage for 1600 miles was 29.9 mpg. This is in a car loaded with every possible luxury and convenience. The week before, I had driven from Chicago to Duluth—520 miles—on 16.5 gallons (31.5 mpg). A little engine growl at idle can't negate the good feeling I get from this car's economy. And the responsiveness is as unbelievable as the fuel mileage. I am quite confident that this car will hold its resale value extremely well. Next year I will buy an additional diesel without hesitation." **PM**

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## THE HOME INFERNO

(Continued from page 99)

Resmatic controlled-descent harness developed by Dr. J. Nigel Ellis of Wilmington, Del., in which a wire reel lowers you at a constant 3-ft.-per-second maximum rate.

### Smoke detectors vital

But your immediate objective, if you don't yet have them, is one or more smoke detectors. There are two types—ionization and photoelectric; some are wired into house circuits, others plug in or are powered by batteries.

Plug-in or battery ESDs are simple to hang from brackets near ceilings. Experts generally prefer permanent wiring connections, and some communities now permit you to make your own hookup if *you know how*. "If you can convince us, we give you a permit, and after the job's done we send an inspector to see it," says Farmers Branch Marshal Dyer.

What about heat detectors and fire extinguishers?

Heat detectors (HDs) are considered very reliable, and automatic heat-activated extinguishers over your furnace, workbench and car, experts say, provide great protection.

But HDs have not been designed to give you a quick alarm *if fire breaks out somewhere else in the house*. Thus, ESDs are being built into HD units: You get HD reliability plus ESD ability to sense smoke drifting in from other rooms.

Fire extinguishers are handy, and can deal adequately with many small daytime fires. "But if fire ever wakes you up at night," warns one expert, "don't waste time with an extinguisher. Get everybody out!"

If you are an apartment dweller, "Pull the little red alarm box and get the hell out," says another expert. "Time spent with an extinguisher is better spent waking people up!"

Experts say some modern condominiums and town houses are no safer than most single-family homes. In one town house fire recently, fire started in the usual first-floor garage. There was only one escape stairway for 100 units.

Luckily, it was a daytime fire and all got out. But its management has since ordered 40 "downspout type" escape ladders!

No matter what the initial cost, precautionary devices that wind up saving the lives you and your family in the event of the new-type home inferno must be judged one of the best investments you can ever make.

PM



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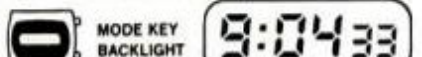
### Personal Alarm

You can set your Quartz Alarm to the exact minute desired. A tiny dot located just above the seconds indicates that the alarm is set.

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At the precise minute you set the alarm, an electronic BEEP sounds. A brief pause follows, allowing you to shut it off. If not deactivated, the alarm beeps for 15 seconds and then automatically shuts off. If pressed once before the cycle has sounded, the alarm automatically sounds again in 5 minutes. It is a pause alarm that gives you 5 extra minutes before signaling again. This delay period can be repeated over and over. There is a backlight for evening wear.

### Here's How Easily The Quartz Alarm Works



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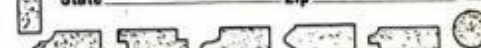
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Jay Hedden, Editor Workbench Magazine



# WORKSHOP MINICOURSE

## SLIP-JOINT PLIERS

**T**hough there are probably special-purpose pliers for almost any gripping task, the old reliable slip-joint pliers is undoubtedly the most familiar-looking and versatile gripping tool you can own.

The term "slip-joint" means the jaw pivot can be adjusted to two (or more) positions—to suit different-size pieces of work—by simply sliding the jaws apart or

together. The pliers' jaw consists of three different usable surfaces: 1. The straight jaw—usually with fine serrations, but which can also be smooth. These are used when a pinching action is needed on small objects such as holding a small brad while you start driving it with a hammer. 2. The curved jaw which has rugged looking teeth that will provide a sure grip on

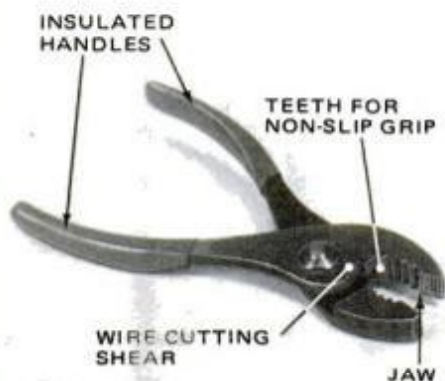
irregular pieces, and for extra power when you have to securely grasp and shift a stubborn object. 3. The crimper—that portion of the jaw nearest the pivot point. As the name suggests, this is used for any crimping chore such as for closing an electric terminal connection. The crimper can also be used to straighten out kinked wire and bent nails and for cutting light-gauge wire such as aluminum and soft copper.

Though pliers can hold a nut while you turn a screw or bolt with screwdriver, don't mistake the pliers for a wrench. For safety reasons, the latter should be used—instead of pliers—when tightening or loosening a stubborn nut. Under extreme pressure pliers can slip off the nut—easier than you might suspect—with resultant severe damage to knuckles and or fingers. When using a pair of pliers to hold a nut that might scratch or burr, it is a good idea to wrap electrician's or friction tape around the nut for the pliers' jaws to grip. The tape will prevent unwanted scratches.

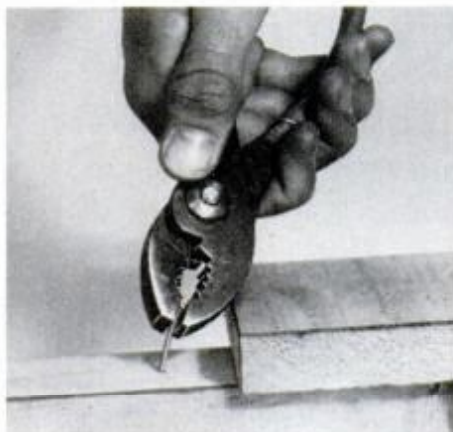
When you want to hold a work-piece with pliers, grip the object with the teeth—as close to the pivot point as possible—to get the maximum handle squeeze.

Do make it your practice to use your pliers for its intended purpose. Do not try to increase leverage by adding pipe "helpers," or the like, to extend handles. If your pliers lack insulating sleeves, you can create a cushioned handle by slipping rubber tubing over the handles.

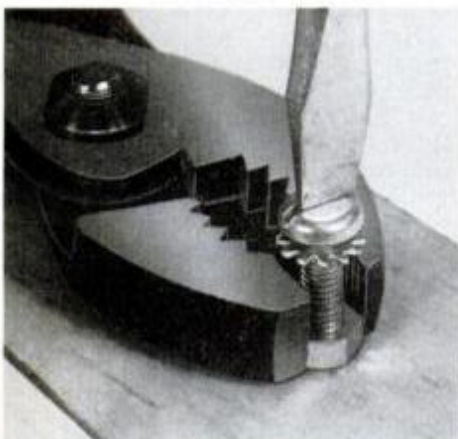
If the teeth in your pliers become worn or damaged you can restore them by filing with a three-square file. Keep your pliers clean. Every so often, wipe it with a light coat of oil to prevent rust and work in a drop or two of oil around the pivot pin. **FM**



Slip-joint pliers have two-position pivot for normal and wide jaw openings.



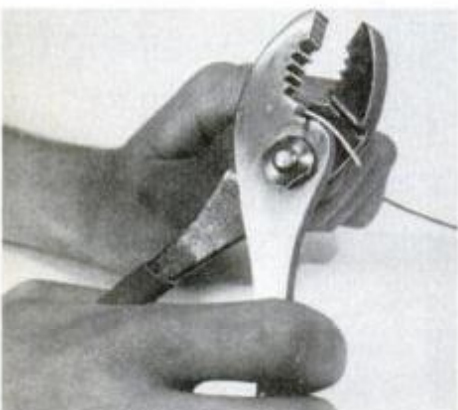
To remove small nail, pull at same angle it was driven, use block for leverage.



Here, the pliers hold a nut while screwdriver is used to turn the bolt.



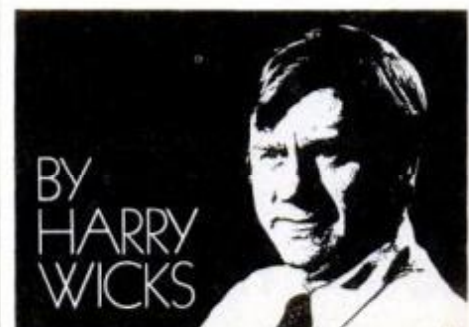
In some cases, pliers can be used to tighten a nut—but do this with caution.



You can use tool's crimping jaw to bend or cut a wire, or to straighten a nail.



Pliers can be used to compress small spring clamp for hose installation.



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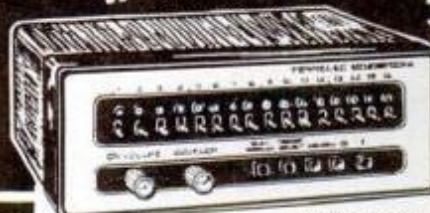
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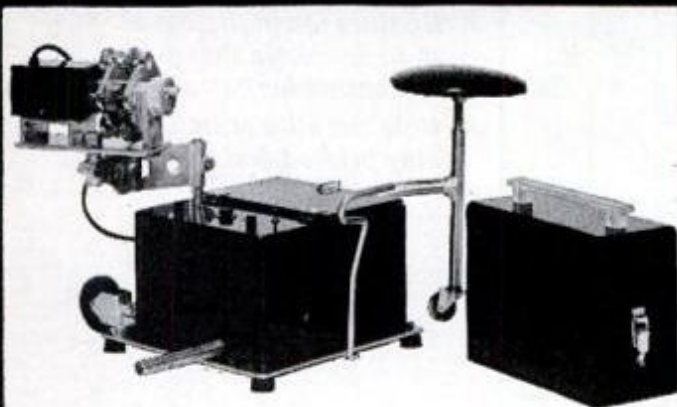
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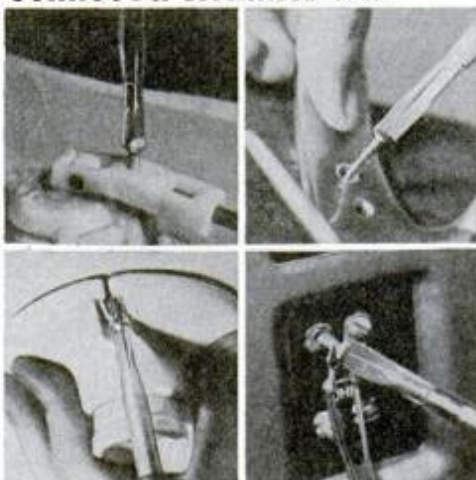
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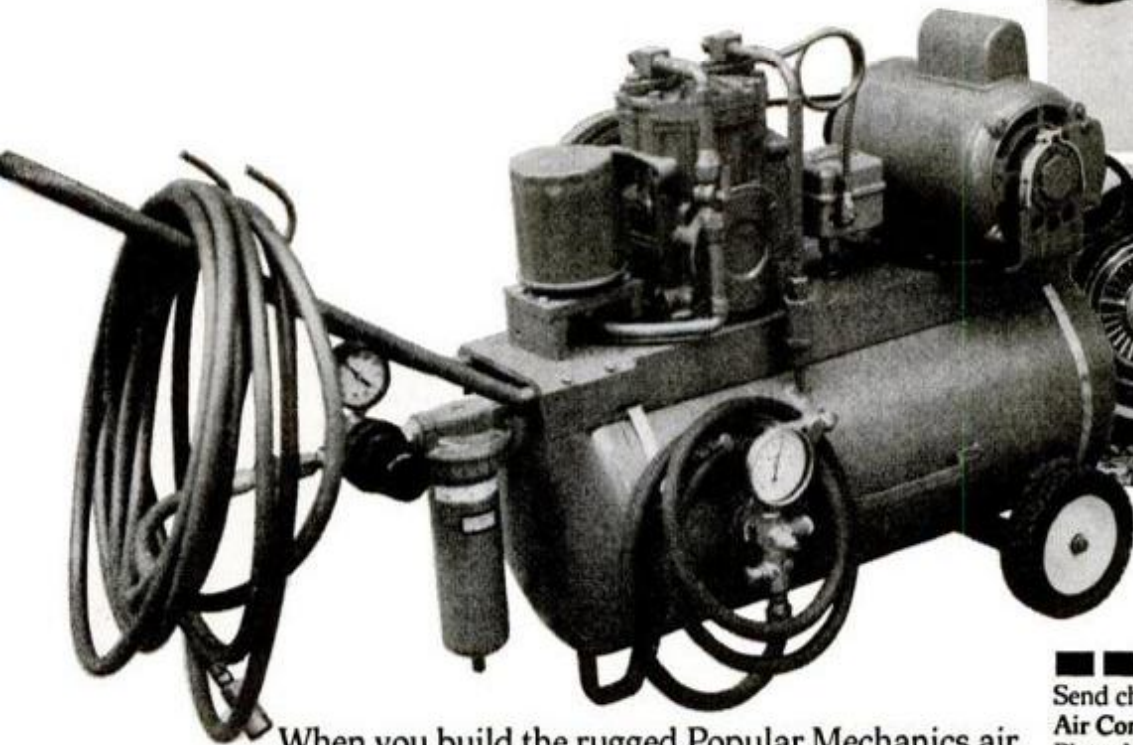
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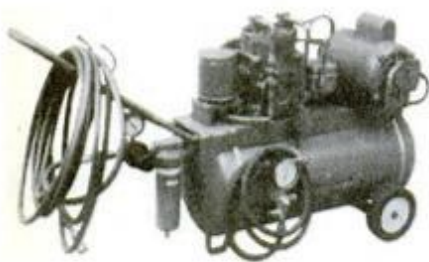
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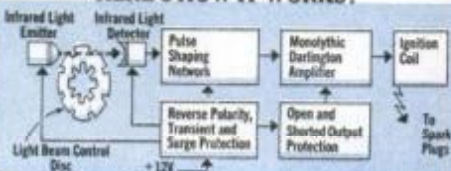
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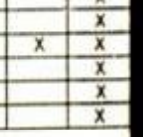
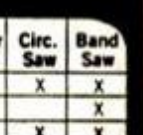
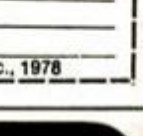
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Carbon	X	X		X	X
Cast Iron	X	X			X
Composites	X	X	X		X
Composition Board			X	X	X
Fiberglass	X	X	X	X	X
Foamed Glass	X	X			X
Friction Materials	X	X	X	X	X
Glass	X	X			X
Hardened Steel	X	X			X
Honeycomb Materials					X
Marble, Natural	X	X	X		X
Marble, Synthetic	X	X	X	X	X
Plaster			X	X	
Plastic Laminates	X	X	X	X	X
Plywood			X	X	X
Stainless Steel	X	X	X		X
Stranded Cable	X	X			X
Superalloys, Iron-base	X	X			X
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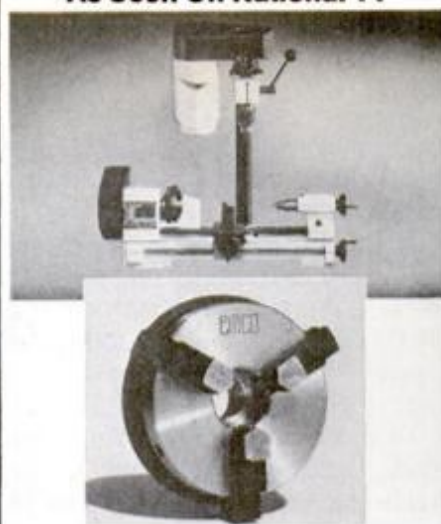
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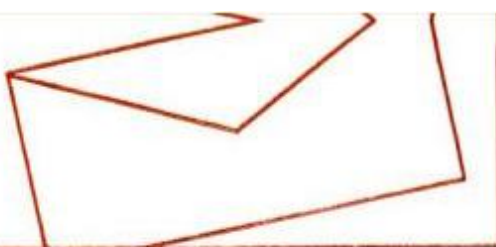
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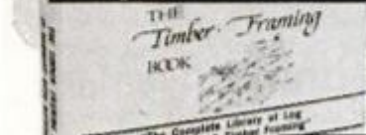
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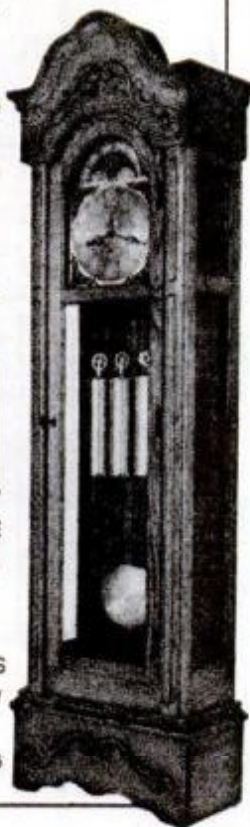
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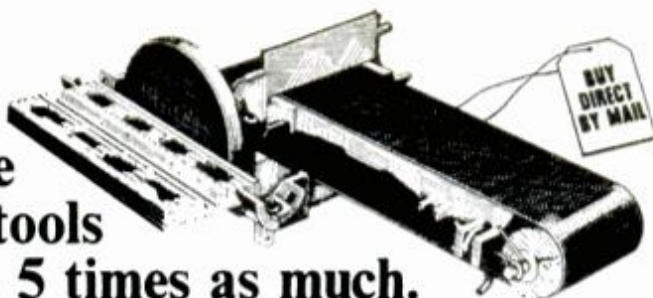
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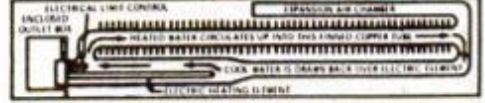
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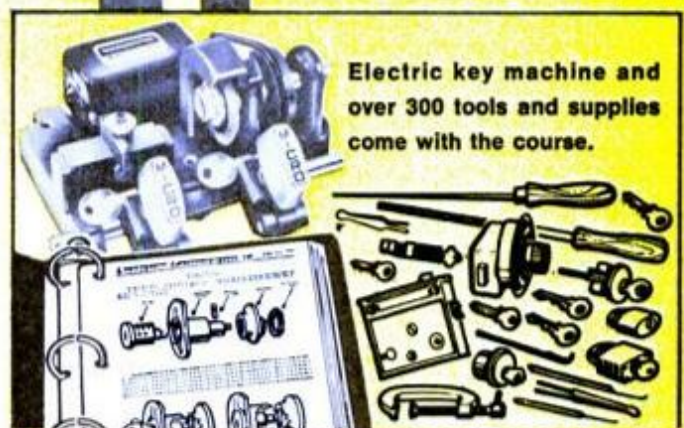
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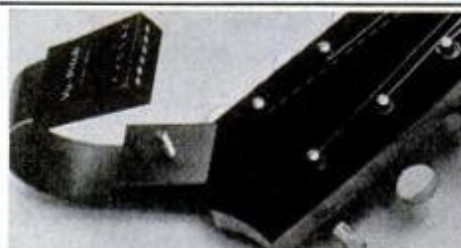
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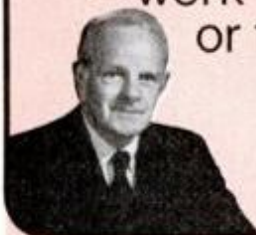
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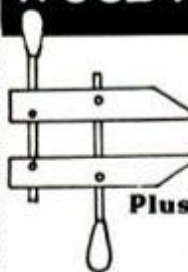
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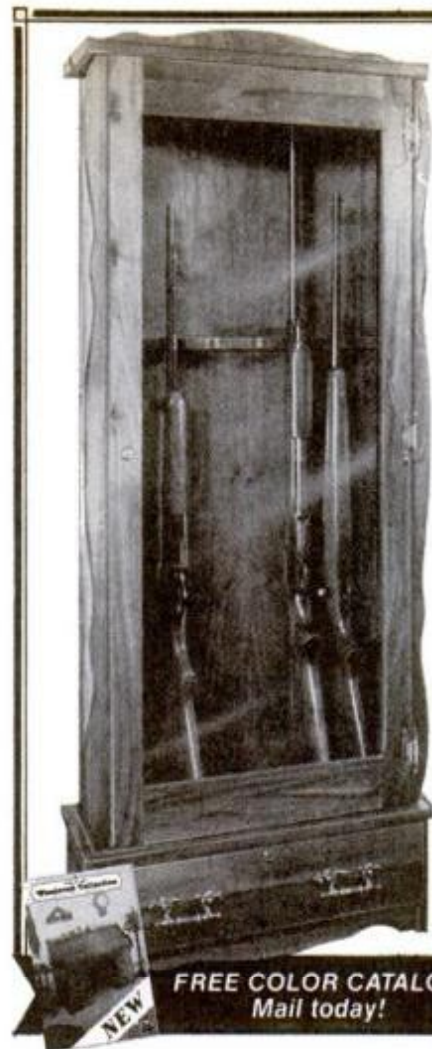
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