

APRIL 1982 \$1.25

# Popular Mechanics

**PM DRIVES FROM COAST TO COAST ON PURE ALCOHOL**

**10 Expert Ways To Maintain and Repair Your Home Computer**

**PM TESTS 6 SUPER COUPES: SCIROCCO IS STILL THE ONE TO BEAT**

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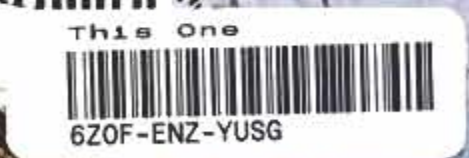


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### On the cover

A breakthrough in sport balloons taking advantage of solar heat was behind last year's crossing of the English Channel, a first for this type of equipment. The story beginning on page 100 in this issue tells you how solar balloons work.

—PM painting by Ed Valigursky

# Popular Mechanics

APRIL 1982

CONTENTS

VOLUME 155 NUMBER 4

INTERNATIONAL EDITIONS: CARIBBEAN, MEXICO, SOUTHERN HEMISPHERE

## Special features:

### Special section on home improvement

Complete guide to repairing your roof is included in 50-page supplement covering everything from basic fix-ups to major remodeling.

**121**

### Coast to coast on pure alcohol

The first rally for alternate-fuel vehicles proves that nonfossil fuels can run the cars of the future.

**89**

### Solving the great cosmic mysteries

Six major questions confront astronomers in this decade—and they aim to get answers.

**92**

### Maintaining your home computer

How experts keep the new machines in perfect shape.

**112**

### Magnetic fishing reel

It came from Japan—and it could make backlash a memory.

**96**

### Six super coupes against Scirocco

PM tests find the field is still hot on VW's tail.

**106**

### Complete plans

A gateleg table you can build . . .

**116**

Plus, a mobile kitchen island

**142**

### Automobiles and bikes

- [12 Imports and Motorsports](#)
- [20 Detroit Listening Post](#)
- [38 Car Clinic](#)
- [48 The PM Garage](#)
- [53 Saturday Mechanic:](#)
  - Troubleshooting Ford's Microcomputer Control Unit
- [89 Eight days on straight alcohol](#)
- [106 PM road-tests the super coupes](#)
- [206 A burnt-out case](#)

### Science and engineering

- [10 Science Worldwide](#)
- [92 The six cosmic questions of the decade](#)
- [100 Now we're ballooning on solar power](#)
- [204 The French connection](#)
- [205 Hot water two ways](#)
- [205 Glass houses](#)

### Home and yard

- [32 Homeowners' Clinic](#)
- [44 Appliance Clinic](#)
- [71 11 ways to ensure trouble-free mowing this summer](#)
- [84 Two basement water alarms you can install yourself](#)
- [210 PM looks at a pour-on resin](#)

### Boating and outdoors

- [26 Versatile new double-duty guns](#)
- [66 All Outdoors](#)
- [96 Now magnets and sonar make anyone an expert fisherman](#)
- [98 New for shoreline sport and offshore fishing](#)

### Electronics, radio and TV

- [8 PM Electronics Monitor](#)
- [110 Get customized sound with an equalizer](#)
- [112 10 tips for home computer care and repair](#)

### Aviation

- [203 It's all in that funny wing on the nose](#)

### Photography

- [62 Photo hints](#)

### PM'S 1982

#### HOME IDEAS GUIDE

- [123 3 projects for a great room](#)
- [130 How to repair and reshingle your roof](#)
- [135 Roofing: Complete guide to materials and installation](#)
- [136 A quick reference chart for roofing materials](#)
- [138 Make this sediment cleaner for your hot-water tank](#)
- [140 Faucet you can install with a screwdriver](#)
- [142 PM's mobile kitchen island rolls where you want it](#)
- [152 Install a tile wall behind your wood stove for beauty and safety](#)
- [157 New products for your home](#)
- [158 How to line your closet with cedar](#)
- [160 Entry alarm protects your family](#)
- [164 Energy-saving ideas that work for readers](#)
- [166 3 easy improvements for your home](#)
- [176 PM looks at an easy-to-use wall patch](#)
- [178 Check list for planning a successful bath remodeling](#)

### Shop and crafts

- [22, 60 Hints from readers](#)
- [72 PM Workbench](#)
- [81 New Now for home and shop](#)
- [102 Fantasy on a tabletop](#)
- [116 Make a traditional "carved" dining set from plywood](#)
- [120 Workshop Minicourse: Using a drill](#)

### Every Month

- [6 Letters](#)
- [16 Notes from the Editor](#)
- [203 Technology Update](#)

### Worth writing for

Looking for more ideas and information? See page 170.

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# LETTERS TO THE EDITOR

## Born-again warbirds

Your article *12 Hot, New Sports Planes You Can Build* (page 79, Jan. '82) was well done with super photos. In the picture of the two S.E.5a replicas, I'm flying the plane at the top. It took me and my son 8½ years to construct this historic World War I fighter—and we're proud to see it in PM.

ROBERT F. ZILINSKY  
HINSDALE, ILL.

I especially enjoyed the part on scaled-down military replicas. I flew the real P-51D fighter in World War II and later owned a Fairchild 24 with the same 200-hp Ranger engine used in the replica P-51. Oddly enough, the Ranger had much the same thunderous sound as the mighty Rolls-Royce Merlin used in the full-size P-51.

LEN MORGAN  
ARGYLE, TEX.

A fascinating article, but, I think, incomplete. You didn't mention the Vulcan Starfire, the most intriguing homebuilt aircraft I've heard about in recent years.

JOSEPH BERNIER  
DANIELSON, CONN.

*We agree the Vulcan Starfire is an intriguing concept—so much so, in fact, that we reported on it a month earlier (see Tech Lines, page 140, Dec. '81).*

## It happened like we said

Right after burglars cleaned us out, I got your issue with the excellent feature on home security (*How to Protect Your Home From Thieves*, page 110, Jan. '82). Your advice on protecting basement windows was something I never considered; the robbers did. They jimmyed a small window and had a kid climb in to unlock the door from inside.

Lights around the premises are also a must, as you state, but I think the best protection, especially in remote areas, is an alarm system that phones the police, not one that just makes a noise. I think this would be a valuable addition to your article.

DANIEL A. MARQUES  
MOUNT CLEMENS, MICH.

*We mentioned that some systems can be connected to an automatic telephone dialer, but also pointed out*

*that the police in many communities won't monitor such a setup because of the high frequency of false alarms. The alternative is a system that alerts an independent security agency, which then verifies the break-in and notifies the police.*

## Kids like PM's play tower

I'm enclosing a photo (below) of the play tower we made from your plans (*Build PM's Play Tower for Your Kids*, page 130, June '81). It was built for use by the children of our Trinity



PM's play tower (above), built by reader Johnson for children of his church. Below: Reader Huckleberry's version with sandbox added to base—a nice extra.



United Methodist Church here in Tulsa.

The tower was easy to build and the children enjoy it very much. We added a car steering wheel to the railing. My wife and I have always enjoyed doing things for others, but I believe this was our greatest project ever.

GEORGE JOHNSON  
TULSA, OKLA.

I found the plans easy to follow and completed the tower in a few weekends. I added a sandbox under the tower platform to take advantage of the shade and keep the mess out of the yard. As is evident from the picture (above) of our three chil-

dren, the structure seems to suit all ages.

TOM HUCKLEBERRY  
INDIANAPOLIS

*It's good to know the tower not only pleases youngsters, but also makes a worthwhile community project. For others who may be interested, photocopies of the plans are available for \$1 postpaid from Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*

## Nice, but no dream car

I read with great pleasure your article *One-of-a-Kind Dream Cars—Built From Scratch!* (page 85, Dec. '81). The two three-wheelers were very interesting and sparked a childhood memory for me. In the early '50s, I saw a similar vehicle in Mexico. I think it was made by a German company. Do you have any information on such a car?

JOHN LANDESS JR.  
STERLING, ALASKA

I was so confused! The photos of Ron Will's Phantom seemed to show two different cars. In the small inset picture, it has wire wheels, drum brakes and five body louvers. In the large photo, it has solid wheels, disc brakes and three louvers. Why the difference?

STEVE L. EPP  
YUKON, OKLA.

*The car that reader Landess remembers from the '50s was very likely the German-made Messerschmitt three-wheeler, a vehicle unfortunately less successful than its maker's notorious warplanes (see The Economy Cars America Never Bought, page 63, July '81).*

*As for Ron Will's Phantom, the small photo showed a scale model of the car, slightly different from the full-size version, but basically the same design.*

## Want a PM plans catalog?

I'd like to find out how to get a copy of your guide to PM plans. I've heard it's great.

DON VALLEY  
TURNERS FALLS, MASS.

*It's entitled Plans and Ideas Catalog and is available for \$1 postpaid from Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*



SUN

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31

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# PM ELECTRONICS MONITOR

## Future rounds corner

In last year's *Car Care Guide*, we ran an eye-catching illustration of the dashboard of the future (*The Computerized Car of Tomorrow*, page 144, May '81). It turns out that technology is already overtaking our dreams.

One of our main forecasts was on-the-road video. Our dream car featured video screens that showed everything from computer-processed and real-time displays of the car's internal workings to a rear-view TV—along with all the usual instrumentation readouts on screen displays.

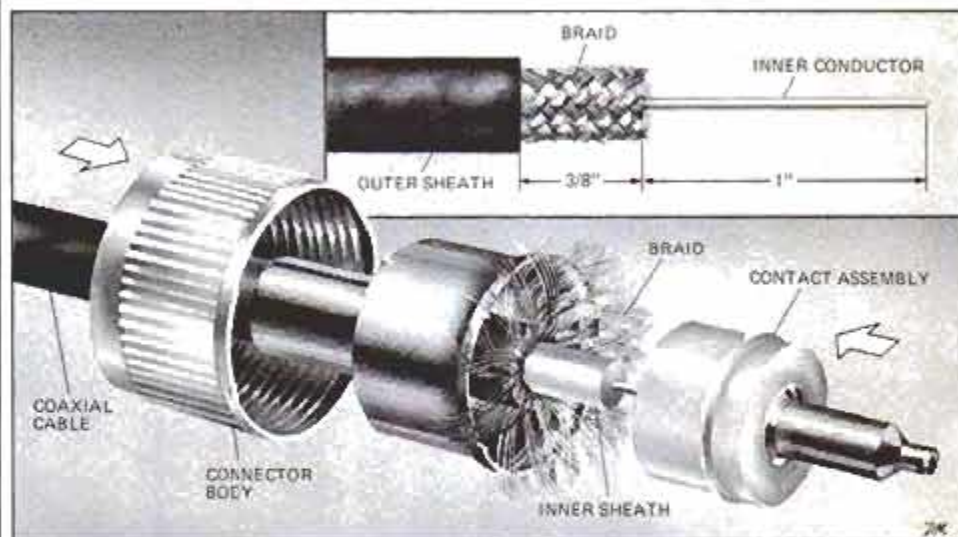
Now, the Zenith Corp. is making strides toward that dream with its "free-format automotive data display panel" (pictured below). This small cathode-ray tube (or TV picture tube) is designed for dashboard installations.

Since it uses no LEDs or other pre-planned readouts, it can be used in any situation fed by computers that have normal video output. It will display anything—as long as the proper video information is supplied to it.

Meanwhile, another company, Motorola Inc., is making great progress in mobile data terminals. The one shown here is structured for



The car of the future is on its way. Zenith video display (top) is a small cathode-ray tube designed for dashboard installation. The Motorola mobile-telephone terminal (above) uses a microprocessor to route information to and from auto by radio.



## Keep on plugging

Video monitors, CB sets, marine radios and many other electronic devices all have one thing in common—they need a special plug to connect coaxial cable to them. This plug is called a PL-259 and is available in an easy, no-solder version (above) from various manufacturers of electronic merchandise.

First, trim the rubbery outer sheath carefully,

without nicking the braid. (The measurements that are shown in the inset above are for the Radio Shack version; check the instructions that are packed with whatever plug you buy.) Trim the inner sheath in a similar manner. Then, fold back the braid so that when you push-fit the center assembly, the braid doesn't touch the inner conductor.

voice-transmission, but it has the capability of sending digitally encoded data, by radio, back and forth from the car and a centralized office. It's a self-contained system run by a microprocessor which can be used on existing radio-telephone frequencies.

Until recently, the Federal Communications Commission (FCC) wouldn't allow computers to send so-called ASCII tones to each other over the air. But now, the prohibition against on-the-air computer "talk" has been lifted.

Now that computers legally can "talk" to each other over the radio and there's equipment to receive and send such "talk," as well as a way to display the results, it's only a matter of time before someone puts all the pieces together. The main thing—the *only* thing—now lacking to make our dream a drive-it-away car is an on-board computer system capable of processing the amount and type of information needed. Such computers exist already, as anyone familiar with the home-computer market knows. Someone just has to make a small computer that's sturdy enough to take bumpy roads. Fill its memory with the right software and give it the right sensors to take advantage of these new video displays and data terminals and the system is complete.

How long will all this be? We

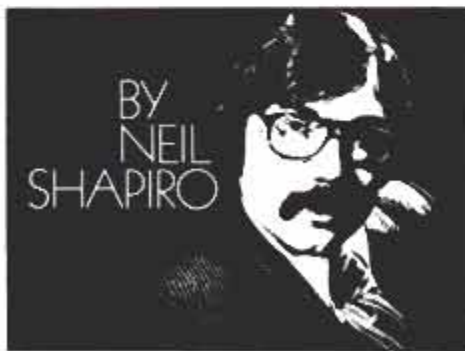
wouldn't be surprised to see such a computerized wonder (in prototype, anyway) before the end of next year.

I can't wait to get one in my garage—though its price tag probably will mean it's just on loan.

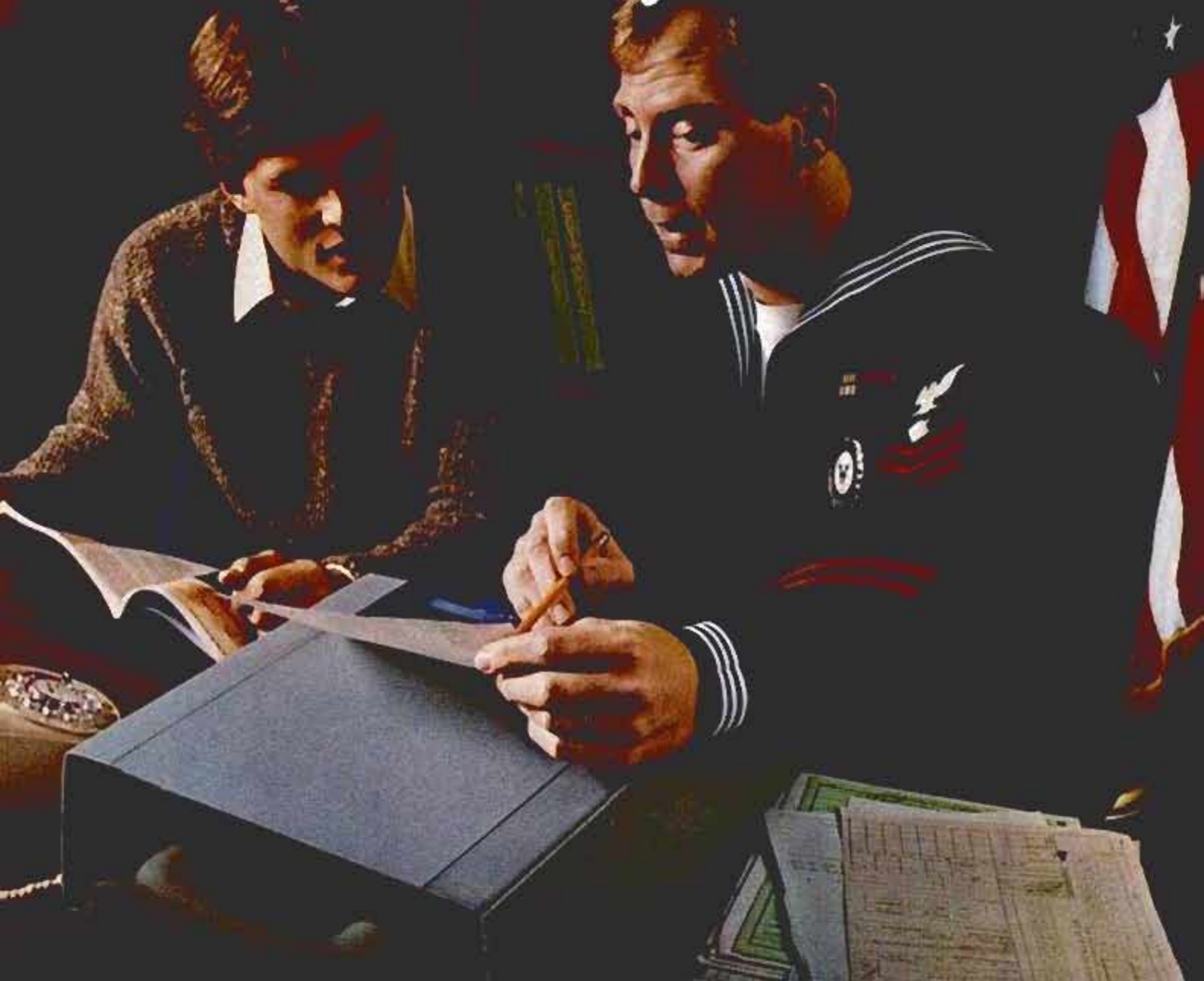
## Billboard news

Shortwave listeners recently have become acquainted with RTTY or radioteletype. Its screeching tones now can be decoded with inexpensive units hooked to a shortwave receiver. These units (such as ones from Microcraft) usually scroll the message across a one-line display like the Times Square news reports.

A new book, *World Press Services*, tells where to listen to electronically read media, from Tass to the AP. The volume is published by Universal Electronics, 1280 Aida Dr., Reynoldsburg, Ohio 43068. It costs \$8.45 by mail.



# Choosing The Career You Want Is Part Of The Navy Adventure.



The Navy Adventure starts with choosing the job skill or technical area you want to learn.

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special pay for sea duty, and benefits that make Navy starting pay good pay for any job.

That's a lot to offer. But the Navy has technical jobs available—over 75,000 each year. The Navy knows that the future belongs to men and women who have highly specialized skills, and gives you the training and experience you need to become the best.

## **Navy. It's Not Just A Job, It's An Adventure.**

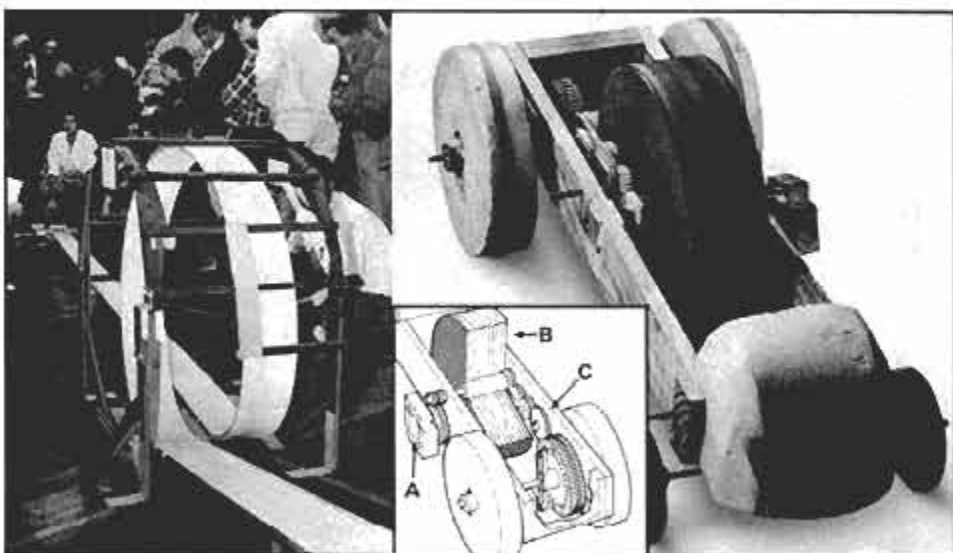
# SCIENCE WORLDWIDE

## Pitted against "The Force"

The Princeton University physics department has nurtured the likes of Albert Einstein, as well as physicists engaged in interesting and esoteric experiments in fusion energy,

mass and ensuing high energy of the flywheels kept the winning cars from falling out of the loop—they attained speeds of 25 feet per second.

The flywheels reached 4,000 rpm



To negotiate loop (left), insert the drill (A in inset), powering the flywheel (B) and gears (C).

particle physics and other disciplines. And now, there's "The Force and the Pits."

Perhaps less sinister than its name implies, the Force and the Pits is the latest in a series of competitions pitting the ingenuity of physics students against odds concocted by professor David Harrje. This year, 30 budding Princeton scientists each were given a plastic bag filled with pieces of wood, fishing line, tape, rubber bands and 2 square feet of 1/4-inch-thick hardboard.

The students had to build a model car that operated on a flywheel powered by a 2,000-rpm electric drill. The car had to stay on a 20-foot track with a loop-the-loop ramp almost 3 feet in diameter. The main idea: Demonstrate the energy-storing capabilities of a flywheel.

Only two of the 30 cars competing were able to navigate the entire course. Each made the circuit twice. The winners were Jonathan Spear, a mechanical engineering major, and Mark Sher, who is studying engineering physics. Their cars were of similar design, with flywheels of about six inches in diameter. The wheels were cut smoothly in the lab's milling and lathing shop. Patience and white glue made it possible to build flywheels that were nearly 2 inches thick. The great

after a standing start in which the drill was inserted and then released from a hole in the wheel.

## Long ago, far away

Near the end of the 18th century, a French astronomer named Messier became annoyed at a number of tiny white blotches that he found in his telescope while looking for comets. He cataloged more than 100 such blotches. In the next century, scientists began to understand what those blotches were. In 1880, New York University professor Henry Draper helped clear up part of the mystery with the first photograph of M42, the 42nd star blotch in Messier's catalog, which is known popularly as the Orion Nebula.

Some 200 astrophysicists gathered at NYU recently to celebrate the photograph's centennial and to discuss recent observations of Orion. Among the more interesting reports was one by Lennox Cowie of the Massachusetts Institute of Technology, who has observed one section of the nebula for several years. He now reports that there may have been as many as five supernova explosions going off at half-million-year intervals in one part of the nebula. Cowie believes that the stellar-type explosions may herald the beginning of a new star system.

## Crowning glory

Crowns of gold and platinum will probably grace the heads of kings and queens as long as royalty exists. But precious metals are getting too expensive to be used as foundations for the crowns dentists use to replace missing or damaged teeth. In addition, a dental crown with a standard metal foundation obscures X-rays.

To cut expenses, many dentists have taken to using baser metals, such as nickel. The X-ray problem persists, however, and the cheaper metals also dull the color of the conventional tooth replacements.

Enter Harvard researchers Ralph Sozio and Edwin Riley. The two, who have collaborated on several papers, went to Coors Biomedical three years ago to ask why the company couldn't use space-age ceramics to make durable, white crowns. Such material also would permit the passage of X-rays.

After a lengthy research program, the Coors-Harvard team reports the creation of that high-tech tooth replacement. The ceramic crown—available to dental labs around the country since early this year—is as



X-rays penetrate ceramic crown (left), but metal-based crown (right), blocks rays.

hard as sapphire, second only to diamonds in hardness. That property is the result of placing highly refined ceramic material into a kiln, heated to 3,500° F.

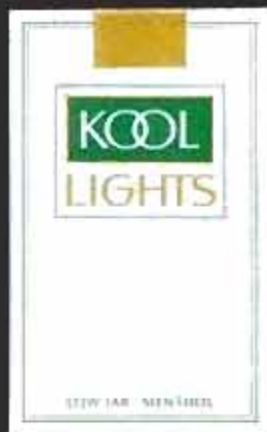
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# IMPORTS & MOTORSPORTS



Fiat's mid-engine, removable-roof X1/9 has outlived all its sports-car competition.

## Survival of the fittest

When Fiat designs a car, it stays designed. The X1/9 is basically the same sports car now as it was when introduced in 1973. When I tested the car in Sicily in the summer of that year (see, *The X1/9: Fiat Has a Deal You Can't Refuse*, page 26B, Sept. '73), I had first crack at a brand-new design that was on its way here to face competition like Porsche's mid-engine 914 and a whole raft of rag tops: MG Midgets and Triumph Spitfires were \$2,500; MGBs were \$3,500. Soon after, the Triumph TR-7s came and went. Now, sports-car buffs face the '80s with just one sports car, and it's perfect for the times: The X1/9 looks like it was designed yesterday. It's a smoother wedge now at 156.3



High in the mountains of Sicily, in the summer of '73, I parked and photographed the new Fiat X1/9, a sports car for the '80s.

inches overall than it was at its original 151 inches (bumper standards, you know). The X1/9 gets an impeccable finish by Bertone, and the custom wheels cap off a handsome profile. Under the hood, rather, in the midships engine compartment, the in-line Four now displaces 1,500 cc (up from original 1,290) and is fuel injected for a power output of 75 hp at 5,500 rpm. A five-speed transmis-

sion is another bonus. An '82 is \$11,000, just three times its original price. However, now the X1/9 is a very smooth and sophisticated sports car—and one that has staying power.

## Real family car



Audi project car: successor to the 5000.

Audi's project car is a four-door technological exercise. It's aerodynamically smooth, lightweight, designed for unique and efficient assembly methods, and safe. Controlled deformation (see *The Crash Crunch That Could Save Your Life*, page 107, Nov. '77) is refined in the project car, and, wisely, belts and knee bolsters are used along with air bags. The rear seats three adults, but when the center section is unfolded it forms an integral child seat. Audi's project car isn't in pro-

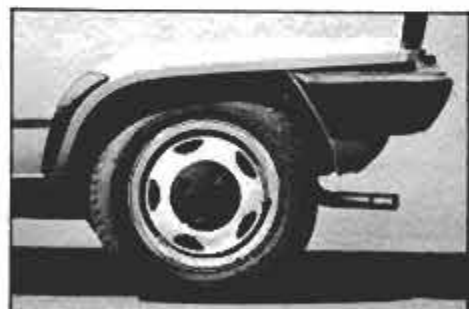


Rear-bench section becomes a child seat.

duction yet, but, remember, every car that is comes with a set of belts. With the odds so great that some day you're going to take a good hit in your car, it puzzles me that so many people who are not otherwise reckless in their behavior persist in driving without buckling up. Can you explain it?

## Kinky design

It used to be that only French automakers designed wheel wells that



This is rear of a French car, right? Wrong!

aren't wheel wells at all. Just look at this one. Must be a Citroën or Renault, right? Actually it's the rear of Volkswagen's new Polo, which is sold in Europe. We'll be seeing this truncation here soon: It's also used by Honda for its new City.

## GM's revenge

Detroit's got two import killers loose with the Chevy Camaro and Pontiac Firebird. After burning up a few hundred miles of road in a silver Z28, I can alert all the big-buck, flashy-car importers that they've got some formidable competition. A sum total of \$12,000 will get you one exotic, high-tech car. The new Camaro/Firebird design is an accomplishment that should make any wealthy, prospective "exotic" buyer think twice before putting a deposit on a \$25,000 De Lorean, a \$65,000 Ferrari Mondial, even a \$100,000-plus Aston Martin. He won't get an exclusive, limited-production marque, but will he ever get a Yankee Doodle dandy of a machine.

PM



BY BILL HARTFORD

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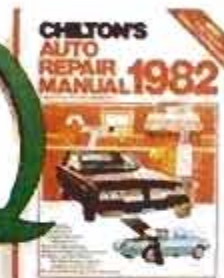


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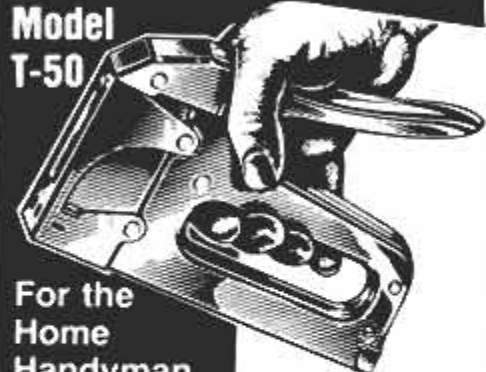


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## NOTES FROM THE EDITOR

John A. Silletta

**S**tuffing an ear of corn into a car's fuel tank really won't do much for performance, of course. But it's a graphic way of illustrating one source of alcohol, the alternate fuel PM's Robin Nelson used in the recent Future Fuels Challenge Rally. Despite such playful diversions—this one on the Living History Farm near Des Moines—alcohol carried Robin coast-to-coast. His story of the unusual event begins on page 89.



Robin Nelson with exotic fuel.

**Do your eyes glaze over** at the mention of microcomputers? If so, you're not alone.

When we meet groups of PM readers, virtually all describe their recent do-it-yourself projects on an expert-to-expert level. They speak casually of adding a wing to a home, wiring a house, replacing plumbing and (to one certain point) maintaining a car. It's when those "black boxes" in today's cars are mentioned that the frustrations come out. What can you do with them when they don't work?

Help has arrived. In this issue, PM's Mort Schultz explains the Ford Motor Co. Microcomputer Control Unit (page 53). His article is the first in a *Saturday Mechanic* series designed to help you understand and work with modern engine controls. Mort says a microcomputer is easier stuff than the first electronic ignition was. So *there's* a beginning.

PM

Of course, it's *de rigueur* these days to give a T-shirt. So that's what we did (right) to observe Publisher Dan Coleman's 25th year with PM. And we gave him a full-scale party, as well. Quite a record: 25 years with one magazine! The shirt may not fit him, but the slogan does. Watch this space: We're planning a 50th for him in 2007.



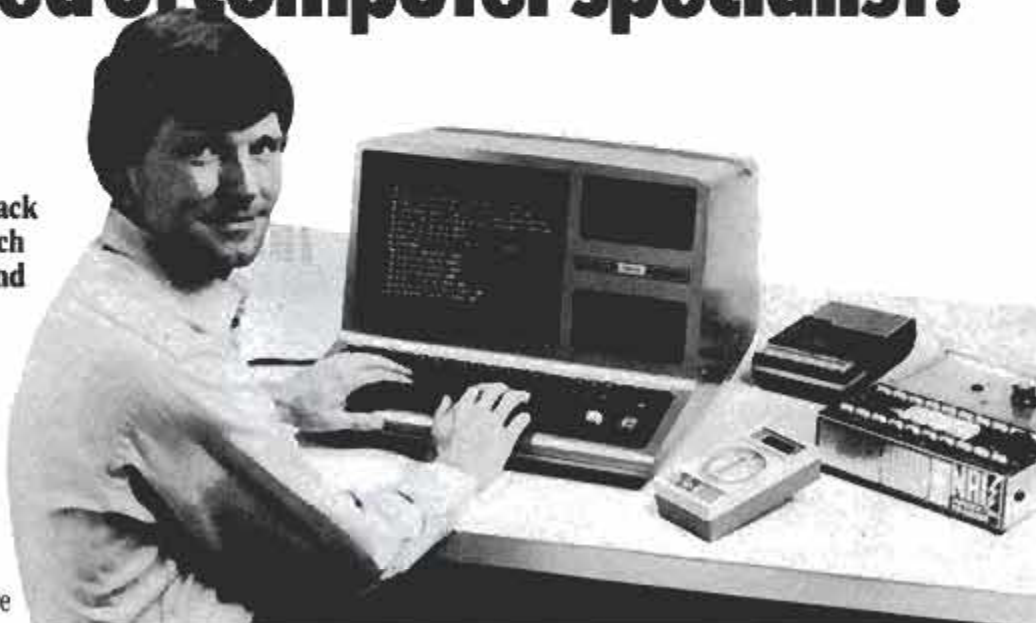
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# DETROIT LISTENING POST

## AMC/Renault Alliance

Lastest rumor-mill word on the name of AMC/Renault's '83 front-wheel-drive subcompact, about ready to enter production in Kenosha, Wis., has it called Renault Alliance. Seems to me it should be an AMC, not a Renault, to capitalize on "Buy American" patriotism in the heartland, with a French-sounding model name to indicate its high-quality European origins. Something like AMC Vitesse (an old Triumph name), perhaps. Still, Alliance, in honor of the two companies' happy partnership, ain't all bad.

You'll recall that the car is an Americanized version of the European Renault 9, already proving very popular over there by breaking all previous Renault sales records.

## '84 Jeep XJ

The next major product news from AMC is an all-new compact series of 4wd Jeeps, code named "XJ." Looking and functioning much like highly contemporary, downsized Cherokees and Wagoneers, these are powered by the company's new 2.5-liter Four, with a 2.8-liter V6 (purchased from Chevrolet) an available option.

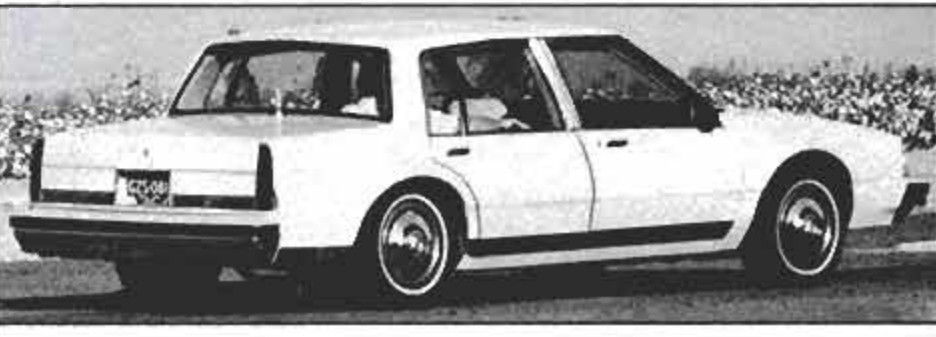
A viscous part-time 4wd similar to the Eagle's system, with in-cab, front-axle disconnect, is standard (two-speed transfer case optional), mated to a choice of four- or five-speed automatic transmissions. The base Four promises EPA ratings in the neighborhood of 25 mpg city, 30 highway, and optional diesel power will be a later addition for still better economy and range.

Overall length is a tidy 165.3 inches, wheelbase 101.4 inches and base curb weight less than 2,800 pounds; yet maximum payload is 1,150 pounds, GVW 4,300 pounds and towing capacity 3,500 pounds (Class II). Though it's 21 inches shorter, 6 inches narrower, 4 inches lower and about 1,000 pounds lighter than today's Cherokee, there's comfortable five-passenger room with 93 percent of the Cherokee's interior volume retained.

Interesting features include a unique four-link front suspension for good on-road and off-road ride and durability, along with low overall height and surprisingly high ground clearance, both statically and dynamically. A complete box-section frame is integral with, and

## Olds 98 for '84

Currently scheduled for '84 introduction, this front-drive Olds C-car will replace the rear-drive 98. The mechanicals will come from the X- and C-car lines with the V6 and four-speed automatic overdrive transaxle as standard powertrain. A diesel engine will likely be available as an option. By 1985, this may be the biggest car GM will make. Though it will seat six, it will be 2 feet shorter than current B-bodies (Impala class).



welded to, the underbody and the rear axle.

The XJ, available in two- and four-door and both sporty and family-type variations, will probably replace the Cherokee (but not the Wagoneer) about a year from now as an '84 model, and it may inherit the Cherokee name, as well. AMC says it has "maximum derivative capability," meaning pickup and even open convertible versions may be added later. It will be sold worldwide through partner Renault.

Judging by models and prototypes we've seen and sat in, it's handsome, modern and trimly efficient in appearance—a practical car/wagon/4wd compromise—yet it maintains the traditional rugged Jeep character. Seems like a sure winner to us.

## GM engine plans

General Motors engineers are developing a new type of electronic fuel injection, halfway between its current single-point TBI (throttle body injection) and the more expensive multipoint TBI, with two or more injector nozzles in a single throttle body. The goal is better fuel distribution for larger V6 and V8 engines

than can be achieved with single-point TBI. It's intended for future fwd C-body luxury cars, but may see its first use in next year's all-new Corvette.

The General's also rethinking its low-compression-only engine policy, instituted a decade ago in anticipation of catalytic converters, which are quickly fouled and rendered useless by leaded fuels. Until recently, most unleaded gas was low octane, requiring low-compression engines; but recent availability, and projections of widespread future availability of higher-octane premium un-

*(Please turn to page 24)*





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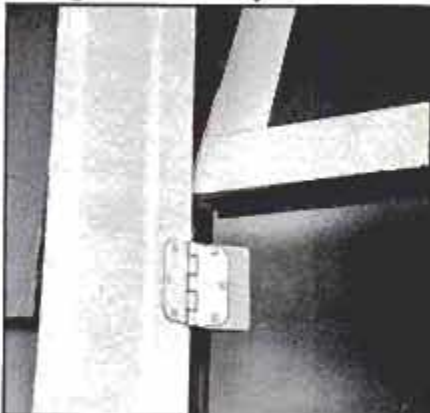
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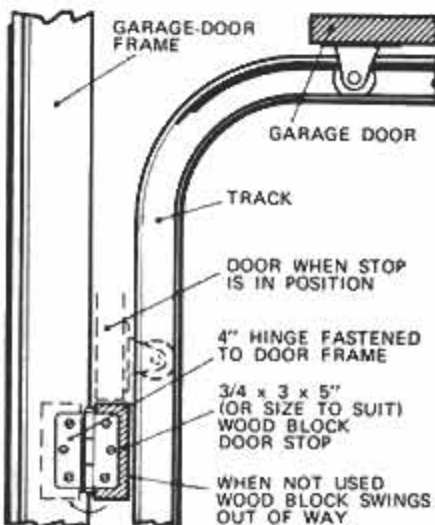
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## HINTS FROM READERS

### Garage-door safety block



Hinge leaf, swung into path of travel, stops accidental closing of the door.



This safety device prevents an overhead garage door from closing accidentally. It's a safety block made of a door hinge and a block of wood, slightly longer and wider than the hinge, and thick enough to fit in the door track. Screw the wood block to one hinge plate. Mount the other plate to the garage-door frame, so the door clears the block when it's swung out of the way.

—Robert J. Spohn

### Inner-tube aid

A scrap of old inner tube is a great aid in wood assembly. When I join two wood pieces with finishing nails, I lay the scrap inner tube directly over the joint and nail through it. If I miss the nail, the inner tube absorbs the impact and prevents hammer marks on the finished workpiece.

—Howard E. Moody

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## DETROIT LISTENING POST

(Continued from page 20)

leaded have the technical folks thinking in terms of compression ratios as high as 10 to 1. Combined with electronic knock sensors and spark-timing control, this would lead to better performance—almost like the good old days—and improved economy.

### Divisional doings

One thing that never changes at GM, and a major reason why the company is so strong, is intense

intramural competition. Each car division has its niche, but each also competes as strongly against the others as it does against the rest of the world. Examples:

Cadillac is thinking seriously of developing some new products even smaller than its J-body Cimarron—like a four-passenger luxury mini, and even a two-seat sports car.

Buick, about to introduce a limited-production Riviera convertible, is also evaluating a Mercedes 380SEC-like sports car. A re-emphasis on turbocharging is also part of the Buick game plan, including at

least one fuel-injected turbocar by the '84 model year.

Pontiac is hard at work on limited-production performance versions of its J2000 (J-car) hatchback, complete with a Bosch-injected, overhead-cam 1.8-liter Four, five-speed transmission, high-performance tires on 14-inch wheels and a Trans-Am WS6-style handling suspension package. A similar treatment for the larger 6000 (A-car) is rumored to be on tap.

Chevrolet is planning a Cavalier (J-car) convertible and looking at a ragtop version of its all-new '83 Corvette, which comes standard with a removable targa top, for possible mid-'84 introduction. Happy days may be here again!

### Ford futures

Ford president Donald E. Petersen promises no less than 10 new vehicles and six new engines (counting the '82s) in a 30-month period, "a parade of efficient, technically advanced, high-quality products that will be dramatically different in appearance and styling from anything we've ever seen before. Aerodynamic shapes will result in clear product differentiation. And better performance will put fun back into driving," he told a recent Detroit Economic Club meeting.

"I am convinced," Petersen added, "that, if all of us involved—both management and workers—strive together to recapture the 'can-do' and cooperative heritage of our past, we Americans can make better cars than anyone else in the world. And we're going to prove just that."

One big reason for such bubbly optimism is the fwd '84 "Topaz" series (the Ford version will be called Tempo) being readied to replace Ford's Fairmont and Mercury's Zephyr a year from now. These are clean, smooth, Euro-style sedans on a stretched (99.5-inch wheelbase) Escort/Lynx platform with overall lengths of about 170 inches and base curb weights in the 2,200-pound range. An updated 2.3 liter Four, mounted transversely, provides the power, and in a special performance-coupe version it sports electronic fuel injection and drives through a five-speed transaxle.

Also on Ford's agenda are high-performance, five-speed, fuel-injected versions of the EXP/LN7 two-seaters for late '82; a similar package for the facelifted '83 Mustang/Capri; upgraded instrument panel and interiors for the '84 Escort/Lynx, and (maybe) a 1.2-liter, 40-mpg, three-cylinder minicar (from Japanese partner Toyo Kogyo) for mid-'84. We'll believe that last one when we see it.

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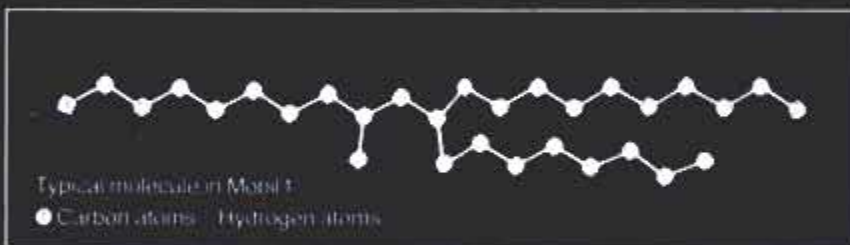
# Mobil 1 costs more than Valvoline, Quaker State and Pennzoil put together, because of the way it's put together.

This typical molecule in Mobil 1<sup>®</sup> is the reason why Mobil 1 lubricates better, cleans better and protects your engine better than conventional oils can.

Conventional oils like Quaker State, Valvoline and Pennzoil are made up of thousands of different molecules of widely varying size, length and shape.

Whenever your engine gets hot, the smaller molecules can evaporate while some of the larger molecules can oxidize and stick to engine parts.

Mobil 1 molecules are "custom built" to just the right length and shape so they



stay liquid longer under a wider temperature range.

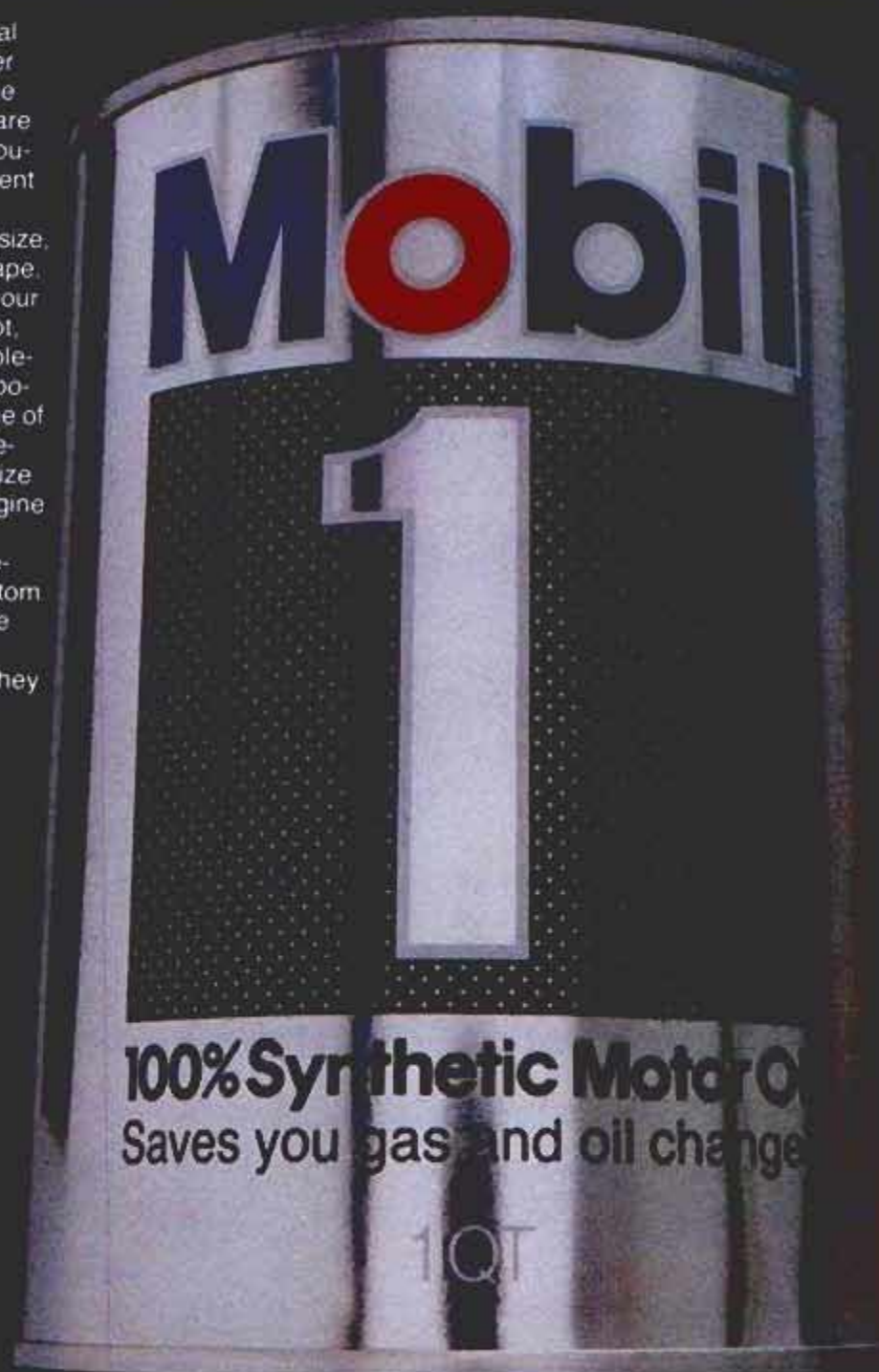
In fact, Mobil 1 will keep protecting your engine up to 500°F above and it'll help get you started even down at 35°F below.

And Mobil 1's special molecular composition is also the reason Mobil 1 saves gas compared to conventional oil and won't need changing for 25,000 miles (or one year whichever comes first).

So change to Mobil 1. You can't find a better motor oil, and you can bet your molecules on that.

Add oil as needed. New car owners follow your ally's instructions. Diesel owners follow manufacturer's instructions.

**Mobil 1** The oil that saves you gas. And more.



# Versatile new double-duty guns

by Angus Laidlaw

Today, a one-gun man may own more versatility than the proud possessor of a whole battery of firearms a few years back. One gun can be adapted to do tasks that took two or more specialized guns to accomplish in the past. For legal and practical reasons, the adaptables and combination guns are catching on in America as never before.

What's more, there are numerous newer and better choices now for the practical sportsman, as well as the dedicated marksman and gun enthusiast. These are rifles, shotguns, handguns and specialized ammunition designed to alter the capability of what were once one-job weapons. Shotguns can become "rifles," calibers and barrels can be switched, rimfire cartridges can be fitted in centerfire chambers. A target gun can be switched for hunting or home-protection.

The combination rifle/shotgun is the oldest—and also newest—of this



Target revolver from Dan Wesson Arms has adjustable rear sight, comes in .22, .38 and .357 calibers and interchangeable barrel lengths of 2½, 4, 6, 8, 10, 12 and 15 inches.



Rifle and shotgun all in one, the Savage Model 24 over/under, and guns like it, can fire a .22, .222 or .30-30 from the top barrel and a .410 or 20-gauge shotshell below.

versatile crew. Oldest, because the idea of combining the precision of the rifle with the versatility and just plain usefulness of the shotgun goes back to wheel-lock days. Newest, because Americans are coming to see what Europeans have known for generations—that one high-quality piece is better, and less of a legal hassle, than two lesser guns.

Typically, American combination guns have been less fancy and far less expensive than their foreign counterparts. An example is our Savage 24 Series. Starting out in the late '50s as a simple and inexpensive double-barreled over/under with a .22 rifle barrel on top and a .410 shotgun underneath, this series is now

one of the company's most successful and imitated lines.

These multipurpose guns have branched out into a line including a short version that comes with a compact carrying case, takes down into separate barrels and stock, and is called the Camper's Companion. Then there are several high and low lines of .22 long-rifle and .22 magnum rimfires over 20-gauge, as well as .410 shotgun barrels, and a burgeoning series of centerfire rifle barrels over a 20-gauge shotgun.

These are now offered in .222, .223, .22 Hornet, .30-30 and .357 magnum pistol calibers (.38 special can be used) over the 20-gauge. Prices remain under \$200 for any of these,

making them bargains as well. Where legal, what finer turkey gun can be imagined to bring in a wild gobbler for Thanksgiving?

## New gauge adapter

Making these superversatile combinations even more useful is a Four-Tenner gauge adapter that's inserted in a 20-gauge barrel to fire light-recoiling, inexpensive .410 shells. These adapters are also available to fit 20-, 16- or 12-gauge shotguns.

Moving up the scale, the recently introduced Valmet 412 Double Rifle from Finland can be purchased with extra shotgun barrels. The gimmick that keeps the price down to \$999 (a pair of shotgun barrels adds \$344; an extra pair combining a rifle and shotgun barrel, \$379) is that this double, like the Savage 24, is an over/under. What's more, screw adjustments make it possible for both rifle barrels to zero in on the same point.

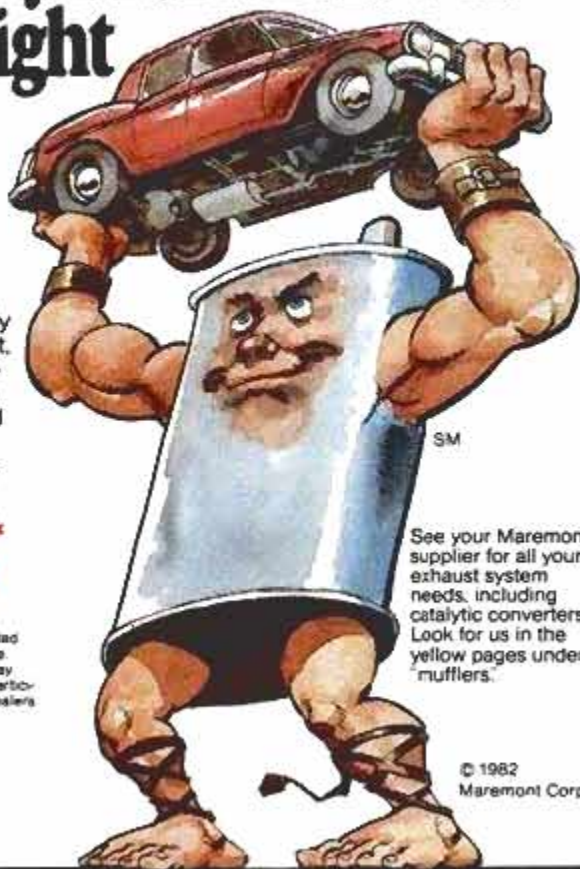
This objective has kept the fine European double side-by-side rifles in the custom category, with prices ranging to \$10,000 and beyond. To regulate these guns to shoot the same target with each barrel, skilled

# Heavy-duty muffler now at a lightweight price!

Replace your noisy worn-out muffler with a quiet, long-lasting Maremont Defender. And do it now, while it's on sale!

Defender is a heavy-duty muffler. And it's built to last, because it's made of alloy-coated steel, with double-wrapped body and welded internal components.

Buy now and save. Sale ends May 31, 1982.



See your Maremont supplier for all your exhaust system needs, including catalytic converters. Look for us in the yellow pages under 'mufflers.'

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**\$24.95\***  
 \*Suggested sale price. Prices may vary at participating dealers.  
**MAREMONT DEFENDER**  
 Heavy-duty Muffler

Dan Wesson continues to add special barrels to its interchangeable-barrel revolvers, which are now offered in .22, .38, .357 magnum and .44 magnum versions. With the 2-inch barrel or other shorties, these revolvers can be effective defensive weapons. With the longer 6-, 10-, and up to 15-inchers, plus oversize grips, the same pistol becomes a competitive target, hunting or silhouette pistol capable of knocking over 50-pound steel ram targets at 200 meters.

The other way a number of revolvers achieve versatility is by having two or more interchangeable cylinders. The most common of these is the .22 long rifle and .22 magnum combo, although .38 special and .357/9-mm Luger, .45 long Colt and .45 auto and other same-bore-size combos are offered by a number of firms.

Most recently, Charter Arms has introduced a handgun version of its AR-7 Explorer .22 rimfire, semiautomatic survival rifle designed first for the U.S. Air Force. This Explorer II pistol offers a number of interchangeable barrels, now in anticorrosion finish, for plinking, target shooting and defense. Olin's Winchester group is also importing qual-

(Please turn to page 30)

craftsmen must solder and resolder the barrels while moving adjustment wedges.

And double rifles, rifle/shotgun combos and reduced-gauge, shotgun-barrel inserts are not the only options for sporting firearms. Handguns are also taking on new talents. With ever more paperwork required to purchase a handgun, the incentive here is both financial and legal. The idea of buying one gun that can double or triple as a target pistol, hunting piece and defensive weapon has increasing appeal.

## Versatile single-shooters

Most versatile are the single-shot models. With these, a simple change of barrels provides an incredible range of calibers, from .17 Remington to .44 magnum and beyond. Way beyond includes everything from shortened wildcat rifle cartridges to full-power .45-70s, and even underloaded .458 Winchester magnum rifle cartridges. Most owners include a .22 rimfire barrel, plus one or more centerfires for the new sport of metallic silhouette shooting.

Top gun in this fast-growing field has to be the Thompson Center Contender break-action single-shot. The Merrill Sportsman is also coming up fast.

## ROCK-BOTTOM PRICES FOR THE ROCKY ROAD.

Gabriel is driving down inflation with rock bottom prices on two heavy-duty shock absorbers. Both shocks are

computer-tuned to your car for a smoother, better ride on all types of tires. Over all types of roads.

**Gabriel**  
SHOCKS & STRUTS



\*Based on MFR's reg. sugg. retail \$24.95 (Red Ryders) and \$18.75 (Road Star). Installation not included. Prices and products available may vary at participating outlets. Offer expires May 31, 1982.



## NEW SEE-THROUGH FUEL FILTER SUPER-POLISHES FUEL

Don't let its size fool you. A fuel filter doesn't have

to be big and clumsy to be effective. The fact is, this little unit combines a major new breakthrough in filter technology with a generous helping of common sense. The result is an automotive fuel filter with some big advantages.

**The little extras in today's fuel can cause some big problems.**

At the bottom of almost every fuel storage tank, you'll find an ugly mixture of dirt and gritty sediment. And it gets stirred up every time the tank is filled. Filtration screens which are built into every gas pump can't remove it all. So even if your service station is careful, they can give you a load of dirty gas.

In small amounts, dirt can wreak havoc with your car's carburetor. Rust particles and grit can stop

check balls and needle valves from seating properly. Tiny jets can clog. And metering rods can stick. It all adds up to poor performance and rotten mileage.

A really dirty load of gasoline can even stop your car entirely by plugging up the fuel filter. (If it hasn't happened to you, it's probably happened to someone you know.)

**More than just good looks.**

The ProFuel is an in-line fuel filter which you can install in less than five minutes. If your car already has an in-line filter, you can replace it once-and-for-all with a ProFuel. On a car without an in-line filter, just splice the unit into the fuel line someplace where it's easy to see.

That's right, easy to see. The ProFuel has a see-through body to permit visual inspection of the filter element so that you can actually see dirt building up from a load of dirty gas. And you can stop the trouble before it stops you.

**Grit grabbing element.**

The ProFuel's filter element is really a long, thin ribbon that's wound layer upon layer to form a cylinder. It's bonded together in such a way that it traps grit and contaminants down to 40 microns in size. Chemical engineers refer to this kind of super-filtration as "polishing" your fuel. And the ProFuel element polishes fuel beyond all existing factory specs—without restricting fuel flow.

Frankly, the new ProFuel filter elements are a

lot more expensive than ordinary paper filters. That's why they've never been available nationally for cars before. But the performance of this type of filter has been proven in industry for years. And the initial cost of the ProFuel unit is offset by another design advantage.

**Economical new idea.**

It doesn't make sense to throw away the entire filter unit at every service interval when the only thing that needs replacing is the element. So the ProFuel has a replaceable element. With a few simple tools, you can even change elements at the roadside (in an emergency).



**Fits your line.**

To keep things simple, the ProFuel filter is sized to fit fuel lines, not cars. There are only three basic sizes for automotive fuel lines (1/4", 5/16" and 3/8"). So three ProFuel models are all that's needed to cover most of the cars, trucks and motorcycles on the road today. There are also ProFuel models available for small engines using fuel lines down to 3/16" in size.

The CR ProFuel. Ask for it in an automotive parts store near you.

## CR PRO-FUEL

A product of CR Industries  
900 North State St., Elgin, IL 60120



# NOW... FOR YOUR HOME, PATIO & YARD!

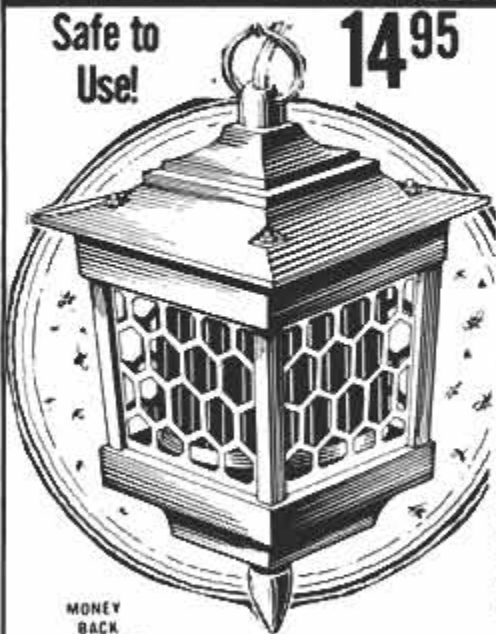
## ELECTRONIC BUG KILLER

**KILLS MOSQUITOS, GNATS, FLIES, WITHOUT DANGEROUS CHEMICALS, POISONOUS SPRAYS OR INSECTICIDES! ODERLESS! HARMLESS TO HUMANS & PETS**

**Safe to Use!**

**14<sup>95</sup>**

**KILLS FLYING INSECTS ON CONTACT**



What a pleasure it is to enjoy outdoor living in the summer without being tormented by pesky insects! Now you can really savor outdoor fun, swimming, gardening, cookouts, and even naps outside — free from stings and bites! Yes, you can have the most wonderful summer of your life with this new **ELECTRONIC BUG KILLER** that attracts insects having phototropic vision with an almost invisible blue light. As insects fly to this irresistible light, they are killed instantly on contact! **100% SAFE TO USE!**

This **ELECTRONIC BUG KILLER** is absolutely safe to use around children or pets because it uses no dangerous chemicals or poisonous sprays or insecticides. Insects are killed by an electronic grid. A few pennies keep it going all day and night—indoors or outside. This model is made of rugged, high impact material, styled like a charming antique Colonial Carriage Light. Hang several on your patio, in the yard, or in your home

No. 4363—Electronic Bug Killer .....\$14.95  
**SPECIAL: Two for \$27.95**

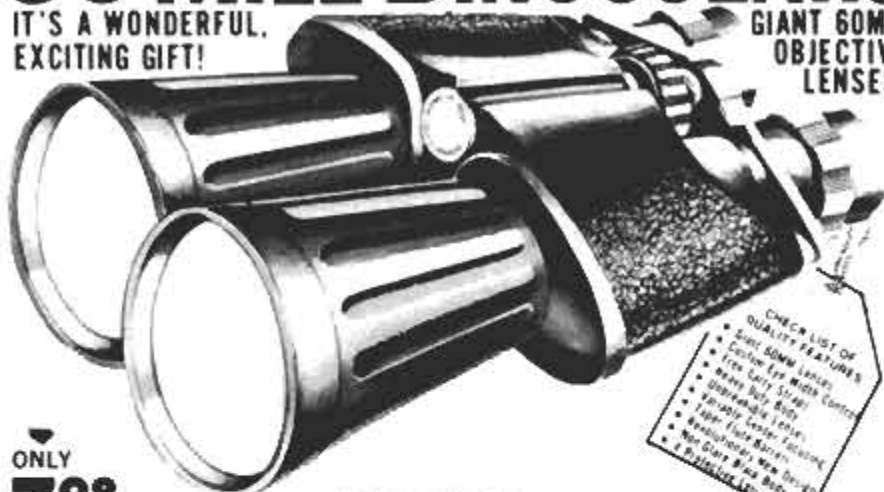
MONEY BACK GUARANTEE

A FANTASTIC VALUE IN BRAND NEW, NON-PRISMATIC

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  - Resistant Body
  - No Glass in Body
  - 10 Year Warranty

**FOSTER-TRENT** proudly presents the Jubilee Model of the famous **POWERHOUSE BINOCULARS**. This Gigantic "SUPER 60" was created in Europe after years of extensive research. It's chock full of revolutionary new design ideas, such as Fluted Barrels for extra strength... Variable Focusing for smoother, pull-in power — from 50 Yards or 50 Miles away! Best of all, **GIANT 60MM Objective Lenses** for massive light gathering power. You'll get terrific views. Now, any reader of this publication can own these superb binoculars at rock-bottom cost.

### ★★★ SPECIAL DELUXE MODEL ★★★

A limited quantity of our **NEW DELUXE MODEL** (not illustrated) is now available. It has all of the great features of the model described in this ad **PLUS Tinted Lenses** and a **New Body Design**. Only \$2 more. It is our **Model No. 195 — Only \$9.98 Each!**

### 10 YEAR CONDITIONAL GUARANTEE

These quality nonprismatic binoculars are ruggedly made and fully warranted against manufacturer's defects for 10 full years. If they should fail to operate properly anytime in 10 years, return with \$1 to cover handling costs and they will be repaired or replaced free. Guarantee ends DECEMBER 31, 1992.

**FOSTER TRENT INC.**, Post Road Larchmont, N. Y. 10538

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**Great For Secret Surveillance!**

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**Try Them On 30 Day Free Home Trial!**

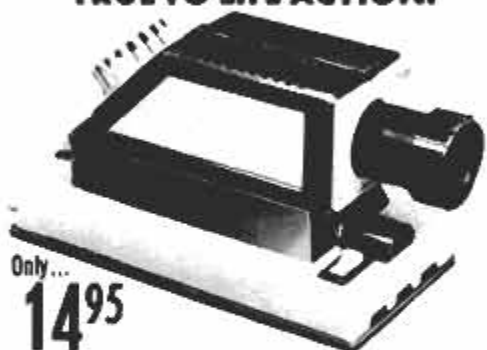
No Risk... No Obligation. Enjoy them for 1 full month before deciding. If you're not 100% satisfied return them for a full, immediate refund except postage & handling. All orders received will be shipped on a first come, first served basis. Please act promptly for fast shipment.

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 TWO BINOCULARS — \$14  
 THREE BINOCULARS — \$19  
 SPECIAL BINOCULAR CASE ONLY \$2.00 EACH.  
 DELUXE MODEL — No. 195 — \$9.98

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No. 4500—Episcoppe Projector .....\$14.95

## POWERFUL CO<sub>2</sub> PISTOL

FIRES 100 SHOTS WITHOUT RELOADING!



### Quality Features

- Precision Made
- Quality Materials
- Checkered Target Grips
- Adjustable Rear Sight
- Positive Safety Catch
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- Midnight Black Finish

A powerful semi-automatic CO<sub>2</sub> BB Pistol that gives you low cost target shooting. Precision-made of finest materials with quality features: 10½" long, 6" barrel, checkered target grips, positive safety catch, adjustable rear sight, velocity adjustment, handsome midnight black finish. Comes with CO<sub>2</sub> cartridge and BBs.

No. 2077—Automatic BB Pistol ..... 32.95  
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Fairhope, Alabama 36532

**VERSATILE NEW DOUBLE-DUTY GUNS** (Continued from page 27)



Adapted from its AR-7 Explorer survival rifle, this new .22 autoloading Charter Arms Explorer II pistol offers interchangeable screw-on barrels of 6, 8, and 10 inches.

ity (over \$2,000) Super Grade shotgun/rifle over/unders.

**Accessories and ammo**

Even if the gun itself doesn't offer the versatility you want, accessories and special ammo may do the job. Remington has a line of Accelerator cartridges that convert .30-06, .308 Winchester (7.62 NATO) and .30-30 to high-velocity .22 varmint cartridges. This makes an autumn deer rifle into a nearly year-round sporting and target rifle, depending on what seasons are open.

Or, like the Savage Four-Tenner for shotguns, you can get chamber inserts for centerfire rifles and handguns to reduce both shooting costs and power. Most .22 centerfires can take an assortment of adapters that convert them to handle .22 rimfire cartridges. The centerfire conversions include the .32 automatic pistol cartridge in the .308-bore high-power rifles. Twenty sizes fit most standard rifles, and there are 19 more for Thompson/Center Contender pistols. All are from Harry Owen, Box 5337, Hacienda Heights, Calif. 91745.

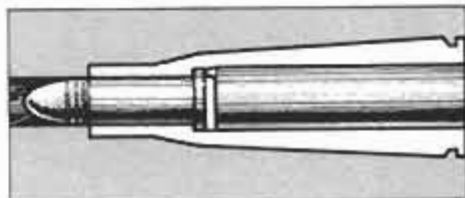
**Reviving old-timers**

Even more versatility can be had by hand-loading cartridges. You can

experiment and adapt them to suit your personal requirements and even bring guns that were chambered for obsolete cartridges back into use.

Cases can be made for almost any cartridge gun that ever existed, including some that go all the way back to Civil War days.

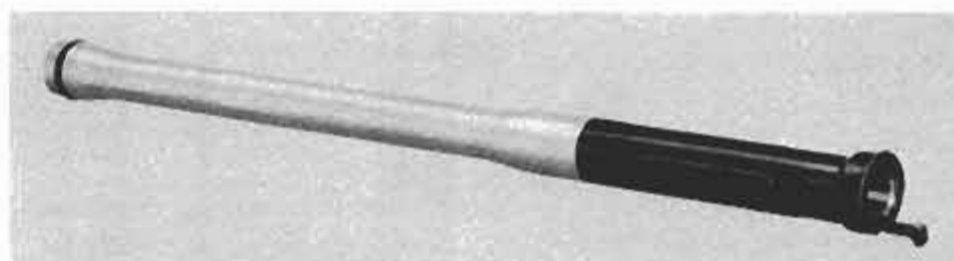
And speaking of oldies, even muzzleloaders are getting into the combination-gun game. Mowry Gun Works in Iowa Park, Tex., offers



Adapter cartridge cases from Harry Owen can chamber inexpensive, lighter rimfire or pistol loads in the same-diameter barrels.

shotgun barrels as an option for some black-powder rifle models; other such combinations are available from various standard-model muzzleloaders.

So the chances for change, while saving money, are appealing. Your dealer can order the guns, and the accessories are often available through the mail. **PM**



The Four-Tenner shotgun gauge adapter from Savage fits most break-action, single-barrel, side-by-side and over/under 12- and 20-gaugers to fire economical .410 shells.

# NO POWER ON EARTH BEATS THESE EPA MILEAGE RATINGS IN FULL-SIZE PICKUPS.

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**IT'S A FACT, BASED ON FULL-SIZE PICKUP FUEL ECONOMY ESTIMATES REPORTED BY THE EPA, AND THE NEW 6.2 LITER DIESEL MAKES IT POSSIBLE.** It's available

in full-size Chevy Pickups, Suburbans and 4WD Blazers, and it's designed specifically for trucks. This optional V8 is built to deliver the kind of raw power you need, without sacrificing economy. In fact, the new 6.2 Liter Diesel is so powerful that a properly equipped full-size '82 Diesel Pickup or Suburban can haul as much as 13,500 lbs., including itself, trailer, passengers, cargo and equipment.

And the 6.2 Diesel offers some very impressive mileage ratings:

	PICKUP	SUBURBAN	BLAZER
2WD	31 23	30 20	-
4WD	29 22	26 18	28 20

Use estimated MPG for comparisons. Your mileage may differ depending on speed, distance, weather. Mileage will be less in heavy city traffic. Actual highway mileage lower. Some Chevrolet trucks are equipped with engines produced by other GM divisions, subsidiaries or affiliated

companies worldwide. See your dealer for details.

The new 6.2 Liter Diesel. It's 379 cubic inches of tough-towing, big-hauling, hardworking, fuel-sipping power. Our nearest sales competitor offers nothing like it at all. And where economy in a full-size pickup is concerned, there's not a power on earth that beats it.



**CHEVY IS THE POWER  
IN TRUCKS.**

# HOMEOWNERS' CLINIC

## QUESTIONS ANSWERED

### Warming a cold floor

*Our asphalt-tiled floor covers a concrete slab over crushed stone. During the winter, it is uncomfortably cold. We plan to cover the floor with wood 1x2s, 16 in. on center, over either tarpaper or polyethylene. Then, we plan to fill the space between the wood with polystyrene such as Styrofoam. We'll nail plywood to the 1x2 sleepers and cover the whole floor with carpet and a pad. Do you see any problem with this? Do you think it will accomplish our purpose?—Leonard H. Point, Warrington, Pa.*

I go along with the polyethylene, 1x2s, plywood and carpet, but skip the polystyrene. Because of the possibility of toxic fumes in case of fire, the makers of Styrofoam, for example, won't sanction its use for your intended purpose, unless both sleepers and plywood are fireproofed—a great expense.

I would lap the polyethylene at the joints and run it up the wall several inches where it will be covered by the baseboard. Make sure that the sleepers are pressure-treated. Then lay the plywood subfloor. Even tempered 1/4-in. hardboard under the carpet and directly on the polyethylene would take a great deal of the chill off your floor. (See "Damp Concrete Floor," *Homeowners' Clinic*, page 23, July '79.)

### Garage-door security

*How secure is an automatic garage-door opener against a would-be burglar? Could he just drive through a neighborhood pressing his opener control to see if any garage doors would open? What can be done to increase safety?—Imre Kertesz, Chandler, Ariz.*

The earlier garage-door openers had the radio codes set at the factory. Today, some manufacturers, such as Stanley Works, have coded, digital controls which can be set by the homeowner. One model has about 500 combinations; the deluxe model has about 1,000 combinations. This doesn't mean, however, that the door wouldn't open if someone hit upon your combination. If someone in your neighborhood had the same combination as yours, you could change your combination.

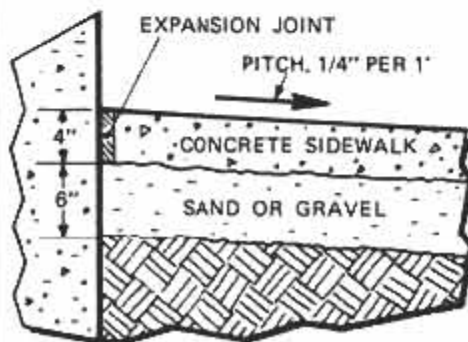
If you are still concerned about the remote possibility of a burglar gaining entry to your house through the garage, you can hook an alarm to your door. You can set it before

retiring for the night or leaving the house.

I personally feel, however, that there are easier ways for a burglar to enter a house than through the garage via an automatic door opener.

### Foundation leaks

*The sidewalk between my home's foundation and driveway has air pockets beneath it. These pockets fill with rainwater and result in foundation leaks. Is there some kind of injectable product that can fill these voids without concrete repair? The product must be able to withstand the heaving of the concrete due to frost. A*



To reduce chance of leaks into house foundation from water pockets under an adjoining concrete sidewalk, pour walk over compacted sand or gravel. Use expansion-joint material between house and walk.

*seal of asphalt material which I applied with a caulking gun didn't last a winter.—M.H., Columbus, Neb.*

There's a common misconception as to why concrete heaves during the freeze. The purpose of a sealer or caulking is to keep the water from getting under the concrete. If water does enter and subsequently freezes, no sealer or caulking will keep the concrete from heaving. The pressure of expanding and freezing water will crack swimming pools.

A porous material (sand or gravel) under the concrete will assure that frost would have to reach a depth of the combined thickness of concrete and porous fill, even if water did pen-

etrate the concrete. Preventing water from penetrating broken concrete is extremely difficult and requires constant maintenance.

Your best bet is to replace the broken concrete. Place the new sidewalk on 6 in. of porous material (sand or gravel) and pitch it 1/4 in. per foot away from the house. Set 1/2x4 in. of expansion-joint material between the house and the sidewalk.

### Patching fiberglass

*The base of my one-piece, molded-fiberglass shower stall was manufactured out of shape, so that water puddles in one section. Can I apply more fiberglass over the white gel coat to make it drain properly?—Dr. Alan Jason Coe, New Orleans.*

PM ran an article, *You Can Patch Almost Anything With Fiberglass* (page 130, Apr. '80), which you might be interested in reading. I checked your plight with one of the larger manufacturers of fiberglass tubs and showers; he could see nothing wrong with the following:

Lightly sand the surface of the area to be filled. Mix only enough resin and hardener (catalyst) to barely cover the low spot. Apply the filler and let it dry thoroughly. Check the drainage by running water onto the patch.

The job may require a second application. I would make a "dry run" first, using water in a measuring cup to determine the exact amount of filler required. Don't mark the area to be filled, as the clear filler may cover the mark, giving you a built-in blemish. Make sure the area is thoroughly dry before you begin work.

Work carefully, since sloppy application could end up relocating the low spot (similar to leveling a four-legged stool).

Read the instructions carefully for the type of resin suited to your repair. Wear goggles and gloves and ventilate the area.

*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 orders to PM, Box 1014, Radio City Station, New York, N.Y. 10101.*



BY JOHN GAVNOR



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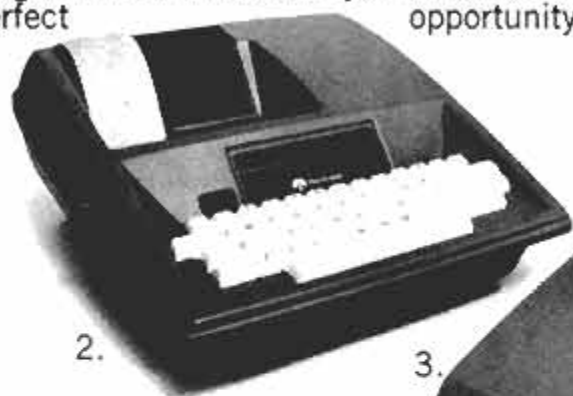
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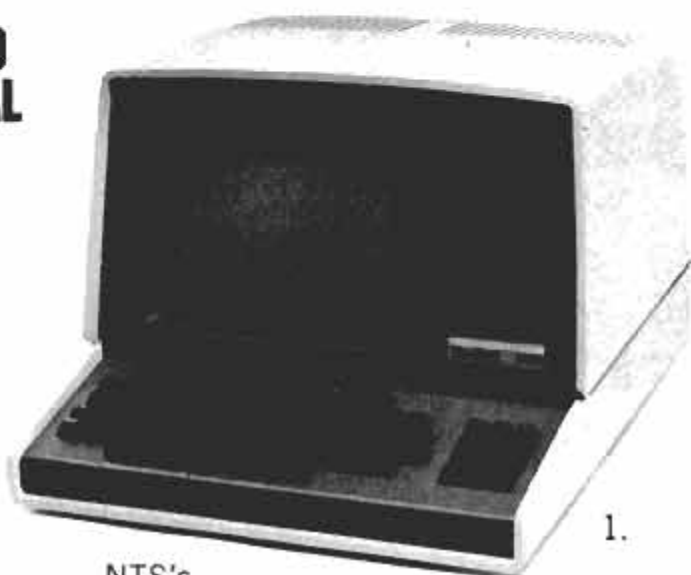
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# CAR CLINIC

SOLUTIONS  
FOR MECHANICAL  
HEADACHES

BY  
MORT SCHULTZ



ette adopted the same propeller shaft-pinion gear joint Opel used for five years without trouble—before Chevette was built.

True, this joint has a unique design. Instead of the propeller shaft sliding into the differential flange, as in most cars, the propeller shaft slides over the front of the pinion to form the flange. If a mechanic attempts to install a new seal without following procedures in the service manual, he may make a mistake that will cause pinion oil-seal failure. He must follow instructions.

There could be these two other reasons for oil leakage:

■ Using other than a GM seal (part No. 359547)—that is, a seal not made to GM specification. GM dealers are not obligated to use GM parts. However, the failure rate of non-GM seals is high.

■ Improper adjustment of pinion-bearing preload. If pinion bearings aren't adjusted properly, the pinion gear shaft will "float" as the car is accelerated and braked. Back and forth movement disrupts the effectiveness of the seal, causing oil to leak.

But if this is happening, you should be hearing a whirring noise from the rear. Perhaps it's there, but because of the noise level that is present when you are driving a small car, you may overlook it and consider the noise to be normal. Listen for it.

These, then, are the three main reasons for Chevette differential oil leaks: not following instructions in replacing the seal, using a non-GM seal and improper adjustment of pinion-bearing preload. Odds are that one of these is the reason for your problem. Good luck on seal replacement No. 6.

## Fender render

I've owned a 1978 Buick Skylark (231-cu.-in. V6 engine) for over 3 1/2 years. As a precaution, I want to

(Please turn to page 40)

## Out of the woods

I was surprised when I read your response to Fred Reimers in the Sept. '81 Car Clinic (page 48), referring to the exclusion of 1980 Omni and Horizon models from the warranty extension (24,000 miles or 24 months) for certain parts. You see, I received a letter from Chrysler Parts Sales and Service informing me that the warranty on my '80 Horizon had been extended.

While I've not had to have a repair made, I'm interested in knowing whether you're right. Are 1980 Omnis and Horizons covered by the warranty extension or aren't they?—Ted Woods, Salem, Va.

Let's go over this whole story to fill in those of you who may not know what it's about. A service tip in the Jan. '81 Car Clinic (page 50) told of Chrysler's warranty extension to 24 months or 24,000 miles, whichever occurs first, on repairs to Omni and Horizon ignition distributors, front wheel bearings, differential transfer-shaft bearings and oil pumps. I reported that the extension covered 1978-80 models.

Fred Reimers wrote that he had repairs made to the distributor of his '80 Omni at 12,400 miles, and five dealers had told him the warranty extension did not apply to the '80s. I rechecked with Chrysler and was informed that the official who had originally told me the extension also covered '80 models was wrong, so I printed a retraction in the Sept. Car Clinic.

Now along comes your letter, Ted, and I'm beginning to feel like a cue ball on a two-sided bank shot. So back I go to Chrysler. And guess what? The information given in Jan. was correct—the warranty extension does apply to '80 models, as well as '78 and '79 (let's not forget them). Don't let anyone, ever again, tell you (or me) otherwise.

Finally, to wrap this thing up (Fred Reimers, are you listening?), here's how to get reimbursed for repairs or replacements you paid for out of your own pocket: Send the

original copy of the repair order (remember to keep a duplicate for your records) to Chrysler Corp., Customer Relations, Box 1718, Detroit, Mich. 48288.

"The repair bill must show the vehicle identification number, repair date, mileage, description of repair, and your complete name and address, including zip code," says the last Chrysler official I checked with. He must know, since he is G.J. Giocondi, director of Chrysler Corp. parts sales and service.

## Odds and percentages

My 1979 Chevrolet Chevette (17,000 miles) has been plagued with a problem of oil leaking past the differential pinion oil seal. In two years, I've had the seal replaced five times. Some have lasted a few weeks—some have lasted several months.

So far, two Chevrolet dealers and an independent transmission shop have checked the possibility of a bent, unbalanced and rough-surfaced propeller shaft, plus other possible causes. Do you know if Chevrolet has issued a service bulletin about this that these mechanics have been overlooking?—John C. Adamchak, Vienna, Va.

As far as I know, there is no service bulletin, John. On the contrary, Chevrolet contends that less than 1/2 of 1 percent of all Chevettas have experienced pinion oil-seal failure during the warranty period. Chev-

## Control agent

Upper and lower control arms take as much of a beating as any other component in a car—in fact, more than most. They're subjected to road-salt-induced corrosion, front-end collisions and impact fatigue caused by potholes. Yet, out of sight keeps them out of mind until one of them snaps in two. Then, sudden loss of the control arm usually leads to sudden loss of vehicle control. When a control arm snaps, the wheel parts company with the rest of the car, throwing the car into a spin. So, give control arms a look-see when you go beneath the vehicle to do some other chore, such as changing oil. If you spot a cracked arm, replace it.





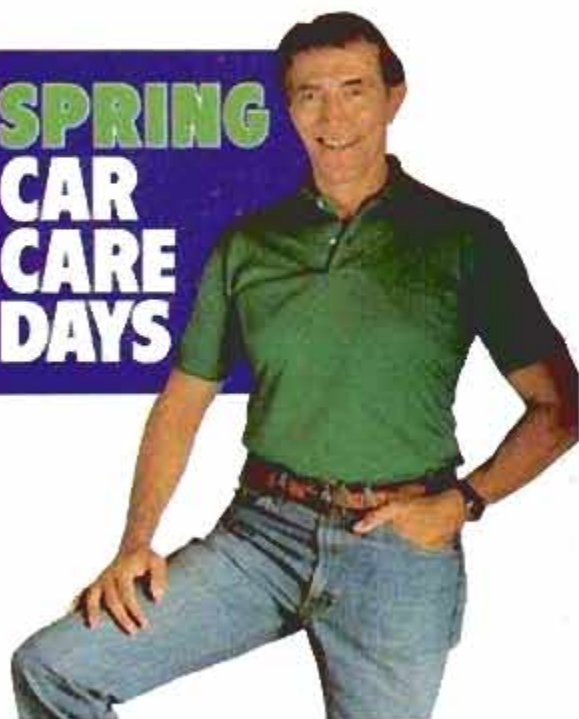
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## CAR CLINIC

(Continued from page 38)

replace all radiator and heater hoses, but getting at that lower heater-hose connection is impossible. Do I have to remove the engine?—Robert Rocha, Towaco, N. J.

No—just the fender. Your car must have an air conditioner or you wouldn't have written. In a nonair-conditioned car, you have a clear shot at the hose connection. In an air-conditioned car, the lower heater-hose connection lies out of reach between the inner fender and evaporator case. To get at it, you have to . . .

- Turn the wheels to the extreme right.
- Disconnect the battery.
- Drain coolant.
- Disconnect the upper part of the heater hose at the heater-core tube. Do this from under the hood—no problem.
- Remove the right-front fender-skirt bolts by reaching in under the wheel housing opening. Then, lower the skirt and loosen the lower heater-hose clamp. Note how the clamp is positioned, so you can put it back the same way when you install the new hose.

■ Using a sharp knife, slit the hose 2 to 3 inches lengthwise in several places. Careful—don't slice the soft brass tube to which the hose is connected. Strip the hose off. The reason for slitting and stripping the hose is to avoid having to pull on it to get it off the brass tube, which might damage the tube.

■ Slip the clamp onto the new hose and push the end of the hose onto the brass tube. If the hose is stiff and inflexible, don't put lubricant on it. You may make the hose so slippery that it will pop off under cooling-system pressure. If necessary, dip the end of the hose in hot water for about 30 seconds to make it flexible.

■ Position and secure the clamp, but don't overtighten. You may crush the brass connection.

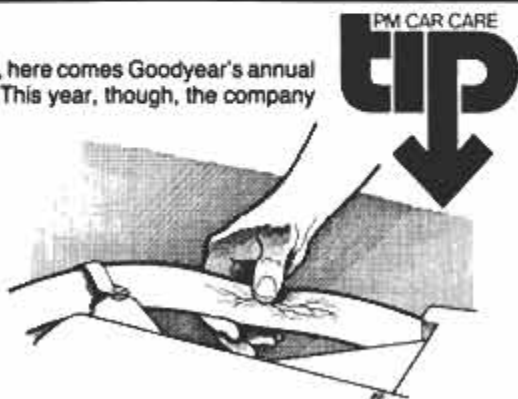
■ Secure the fender skirt, attach the upper part of the hose, add coolant and reconnect the battery.

## CJ has its day

Could you help me with my 1979 CJ-7 Jeep (258-cu.-in. six-cylinder engine)? At high altitudes only (8,000 feet or higher), the engine backfires while I'm coming down a steep road or decelerating rapidly. Ignition timing is set at 11° BTDC, and the diverter (antibackfire) and EGR valves have been replaced. Except for this, the vehicle runs great.—Paul Lewis, Denver.

## It might as well be spring

Along with the return of robins and crocuses, here comes Goodyear's annual springtime warning about hoses and belts. This year, though, the company cites a new statistic. "Almost 9 out of 10 radiator-hose and fan-belt failures occur in an emergency situation," it claims. "Emergency situation" is defined as an on-the-road failure, away from home, where getting a repair is a real pain. No wonder every Saturday mechanic worthy of the title makes it his or her business to check belts and hoses annually, replacing those that look suspicious. Spring is as good a time as any.



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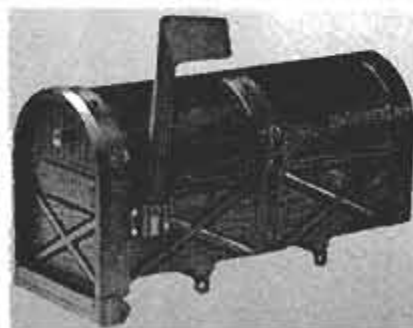


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Charles E. Gooley, Sr.  
Westmont, N.J.

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High altitude (defined as any altitude above 4,000 feet) generally gives engines fits unless compensation is made by setting ignition timing to a high-altitude specification and readjusting the carburetor idle mixture. You've taken care of timing. The high-altitude timing for your engine should be 10° BTDC if your engine is equipped with a one-barrel carburetor or 11° BTDC if your engine has a two-barrel carburetor.

As for the carburetor adjustment, your question leads to several possible answers depending on the carburetor in your vehicle. If the Jeep has a one-barrel carburetor, is it the model YF or YF-1? Check the identification plate on the unit. The YF-1 has an altitude-compensation circuit which mixes a metered amount of additional air with fuel to prevent an over-rich condition at higher altitudes. If you have the YF model which lacks the compensation circuit, over-richness will cause backfiring.

Even with the YF-1, it's possible that the compensator is not adjusted for high altitude. The compensator-adjustment plug can be set at two positions—outer and inner. At altitudes above 4,000 feet, turn the

plug counterclockwise to the outer position. At altitudes below 4,000 feet, turn the plug clockwise to the inner position. The plug must be set all the way in or all the way out—never at a midpoint. The plug is that slotted device alongside the fuel bowl—the slotted device with the longest slot. There is a slotted device alongside it that has a short slot.

If your vehicle has the model YF carburetor (no altitude compensator), have your dealer adjust the idle mixture for leaner operation. If this doesn't work, you may want to consider installing a model YF-1 carburetor.

(Note: The model YF-1 carburetor can be installed only on vehicles that have manual transmissions.)

If your CJ-7 has a two-barrel carburetor, it's a model BBD, which doesn't have an altitude-compensation feature. Have the idle mixture adjusted for high-altitude operation. Hopefully, this will prevent engine backfiring.

#### 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.

#### SERVICE TIPS

■ Rough idling of a diesel engine after the car has had work done on its injection lines may have been caused by a mechanic accidentally striking the transfer pump cover on the injection pump with a tool. So says GM. If the cover has a dimple or crack, the injection pump could draw air into the fuel system through the damaged spot.

■ Watch it when checking automatic transmission fluid level in a Chevy Chevette. The dipstick comes in contact with the sides of the tube, which are wet, as it's withdrawn. This produces a different level indication on one side of the stick than on the other. You can install the dipstick with the handle facing front or back—it doesn't matter. But always use the lower level indication as correct—not the higher level.

■ Here's another hard-to-find cause of spark knock (ping). It concerns 1979 Chrysler models with 360-cu.-in. engines, two-barrel carburetors and automatic transmissions. To get rid of knock, retard ignition timing from 12° BTDC to 8° BTDC, then reset enriched-idle speed, and hot-fast-idle speed to specifications on your vehicle emissions label.

■ To eliminate a low-frequency squealing noise from disc brakes of 1978-80 Jeep Cherokee, Wagoneer and truck models, replace front shoes with Brake Shoe Set 8130435. Have rotors replaced if surfaces are badly damaged, or turned on a lathe if surfaces are only slightly rusted or scored.



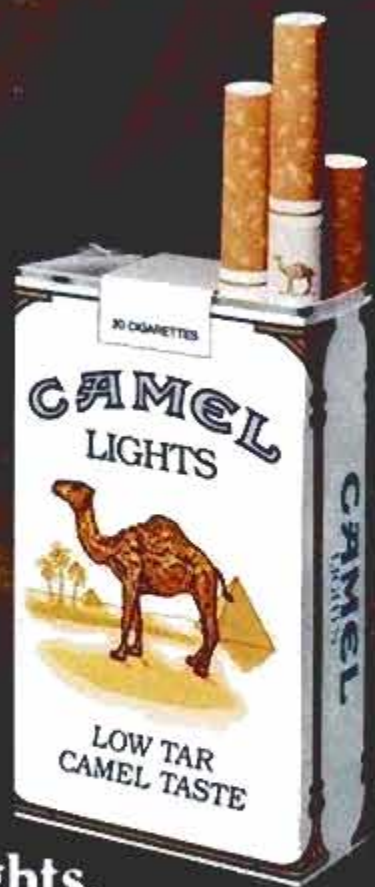
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# APPLIANCE CLINIC

## QUESTIONS ANSWERED

### Toaster-oven element

One of the elements in my General Electric toaster oven, Model A2T-93, burned out. I bought a replacement element, but I'm puzzled as to how to attach the wire leads going to each end of the element. Are the wires spot-welded or is it a self-weld, since the wire leads seem to be coated with a silvery metallic coating? Please hurry with the answer; I can hear my wife bellowing in the kitchen.—Sol Weiman, Queens Village, N.Y.

The wires on the heating element are spot-welded. GE recommends either silver-soldering or brazing the wires to the ends of the element. GE has come out with a modified replacement heating element. The part is No. XT11X64; it costs \$4. The package contains one heating element, plus two barrel connectors. The new-style element has a bus bar welded to the ends of the heating element. To attach the wires to the heating element, first strip back the insulation on the wire. Attach the bare part of the wire to the bus bar. Use the stainless-steel barrel connector to attach the wire to the bus bar. These connectors are crimped over the bus bar and wire. You could use pliers or a crimping tool to do this job.

### Reluctant ice maker

I have a Sears refrigerator Model 106-7679321, serial No. E64631778. It has operated satisfactorily with one exception—the automatic ice maker. When it was new, I noticed that it didn't make as much ice as the old Sears refrigerator that it replaced. Only recently, however, did I remove the guard panel which separates the ice maker from the rest of the freezer compartment. I found that the ice tray is being filled only halfway with water. Is there any way that the amount of water fed to the ice maker can be adjusted, or is the ice tray not supposed to fill completely?—Adm. Andrew McB. Jackson, Annapolis, Md.

Your refrigerator has a flex tray ice maker. It is designed to meter 7 to 8 ounces of water into the ice-cube tray in a 12.5-second fill period. There is no adjustment that can be made to change this water fill.

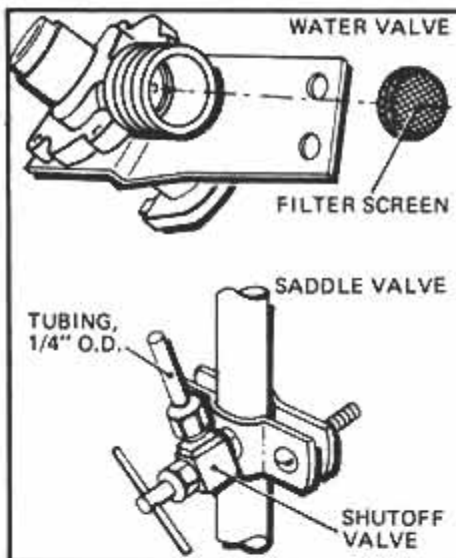
Check the saddle valve which connects the cold-water supply line. If the valve is installed on a horizontal line, the valve should be placed on the top side of the line. Next, shut off

the valve. Disconnect the 1/4-in. o.d. tubing from the valve. Put a pot or bucket under the valve. Turn the water on all the way. You should have a good, steady flow of water at this point. Reconnect the tubing to the valve.

Next, check the other end of the tubing where it connects to the water valve. Disconnect the tubing at this point and check the flow. Also, check the filter screen in the water valve for obstructions.

### Unpredictable refrigerator

I have a Frigidaire refrigerator Model 142-58, serial No. 32A0927. It's about 20 years old. I moved it from my kitchen, where it ran perfectly, to my downstairs rumpus room. The refrigerator was idle for six months. When I reactivated it, it started freezing for about 20 minutes, then



To check water flow to ice-cube trays, inspect the saddle valve at the cold-water supply line, the water valve, its filter and the tubing between the valves.

stopped. This pattern repeated, though the compressor continued running.

A refrigerator technician added some freon to the sealed system. After he left, the refrigerator worked for a while. Now I'm having the same problem. The compressor runs, but the refrigerator isn't cold. What could be

If you have a question about any appliance, send it along with the model and serial numbers 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.

wrong?—S. Warchol, Cumberland, R.I.

Sounds as if you have a freon leak in the sealed system. Maybe the refrigeration tubing was damaged or broken when the refrigerator was moved to the rumpus room. To find this leak and repair the system would be a very costly job.

### Spendthrift washer

On our Sears washer Model 110-7215600, serial No. 14501068, we have replaced the No. 86798 solenoid on the two-way Suds-Saver assembly three times; the present one is bad, too. I don't want to replace the solenoid again, because the cost of the part is outweighing the savings. The solenoid, when removed, is always swollen to a point that it won't move. What's wrong?—Earl Cassidy, Terre Haute, Ind.

The T-bar on the solenoid assembly may not be snapping all the way closed in the coil. This would cause a buildup of heat, possibly causing your problem.

Another area to check would be the two-way valve itself. Possibly there is something inside the valve causing it to seat improperly.

### SERVICE TIP

If you are considering buying a new refrigerator or freezer in the future, you may want to get the Association of Home Appliance Manufacturers' AHAM's Directory of Certified Refrigerators and Freezers, which lists over 50 brands and 1,200 models. It also calculates the annual operating cost and other important comparative ratings.

Another brochure AHAM publishes is AHAM's Directory of Certified Room Air Conditioners. It has comparative ratings for over 22 brands and 700 models of room airconditioners, including the energy-efficiency rating (EER) and B.T.U./hour cooling capacity.

If your local appliance dealer doesn't have copies of these directories on hand, you can purchase them for 50 cents each from AHAM, 20 North Wacker Dr., Chicago, Ill. 60606. PMA



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Key lock electric start engine. 36-in. "floating" twin blade mower deck. 3 forward speeds, 1 reverse. Automotive type steering and differential for easy handling and maximum control. (#25541)

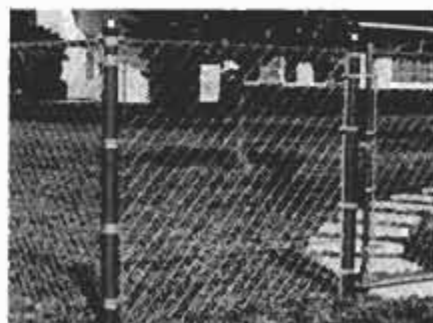
**SAVE \$100**

**on 8-HP Riding Mower  
(Mower only)**

Rear-mounted electric start engine. 30-in. single blade mower deck "floats" to help stop scalping. Five forward speeds plus reverse. Combination clutch/brake pedal for quick stops. easy gear changes. (#25612)

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**Most items at reduced prices.  
SALE DATES: APRIL 4-17**



**SAVE 50%**

on 11½ gauge galvanized steel Chain Link Fencing Fabric when you buy Armadillo® posts, top rails and fittings at Sears everyday low price.

Tough and beautiful Armadillo fence framework is triple coated to help fight off rust, corrosion and weather. 36, 42, 48, 60, and 72-in. heights available. (#9002)

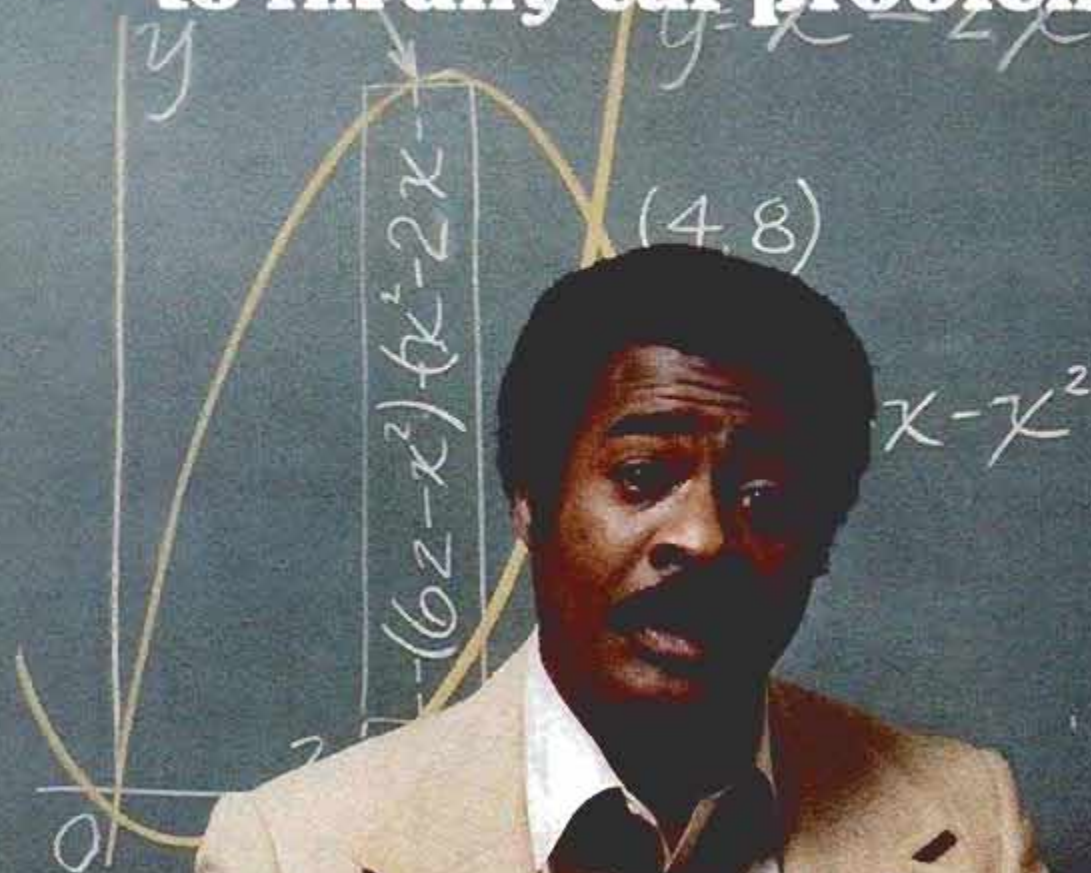
Minimum savings nationally. Prices and dates apply only to the continental United States. Available at most Sears retail stores.

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Once should be enough  
to fix any car problem.



Mr. Good

I figure Mr. Goodwrench has the skills and the tools to do the job right.



Mr. Goodwrench has General Motors training. And he works on GM cars every day. To me, it stands to reason that he's the mechanic I should go to when I need service on my General Motors car. That's not all. He has the right tools. And he has genuine GM parts available.

Mr. Goodwrench is committed to reasonable prices—he has pledged to be competitive with other places I could take my car around here for service. I can get a written estimate from Mr. Goodwrench just by asking. So I know about what I'm spending before I've spent it. I like that.

So keep that great GM feeling with genuine GM parts at participating independent Mr. Goodwrench dealers selling Chevrolets, Pontiacs, Oldsmobiles, Buicks, Cadillacs, GMC and Chevy trucks.



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Mr. Goodwrench

# THE PM GARAGE

## CAPSULE REPORTS ON NEW AUTO PRODUCTS

### Bikin' boots

Racemasters are a line of road racing and touring boots for motorcycle riders from Bates Industries. The boots feature all-leather construction, a full-length brass zipper at the back, reinforced toe in the shifter area, ankle and calf adjustment straps with brass buckles, double-leather ankle protection and expansion gussets on the upper calf area.



Boots are made specifically for bikers; they feature brass fittings and rubber soles.

The sole is nonskid rubber and the entire boot is repairable.

The standard colors are black or brown. Twenty-three custom color choices are available. Bates boots are sold at motorcycle dealers. The Racemasters retail for \$115 and the Bates catalog costs \$3. The address is 636 West 16th St., Long Beach, Calif. 90810.—*Joel Breault*

### Snap-ring pliers

If you're the kind of mechanic who likes to take things apart, sooner or later you're going to run into retaining rings. Owatonna Tool has a nice



Snap-ring pliers handle internal and external snap rings and come with three tips.

set of snap-ring pliers for the pro and home toolbox. The set includes a plastic storage tray and one internal and one external pair of pliers, both with vinyl-covered handles. Four different-sized pairs of interchangeable tips (90°, 45° and two different straight tips) are included to fit most snap rings. The snap-ring pliers cost \$24.40. Owatonna offers a free catalog of all its tools. The address is OTC Tool and Equipment, Eisenhower Dr., Owatonna, Minn. 55060.

—*Joel Breault*

### Cleaning up

Getting your hands clean afterward is one of the biggest auto-repair problems. Sta-Lube Formula II hand cleaner will usually do the job. Just work in a teaspoonful-sized dollop and wipe off. You can also use the product with water.

Besides auto grime, Sta-Lube hand cleaner will take off paint, shellac, printing inks and adhesives. The goop also works on clothing stains, floors, walls and a variety of



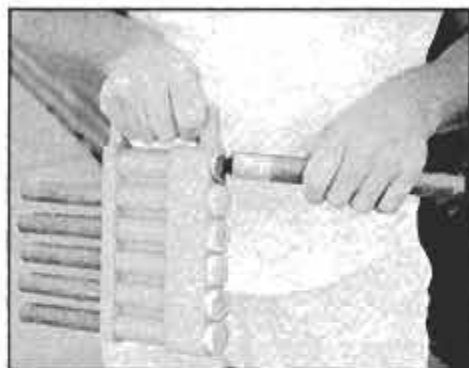
Sta-Lube hand cleaner will also remove grease stains from clothes, floors, walls,

hard-to-clean surfaces. The 16-ounce can cost \$1.75 at my local auto store.—*Joel Breault*

### Handy flares

Keeping flares handy for those inevitable roadside troubles doesn't have to be a problem, thanks to Olin's Flare Caddy.

The bright orange plastic holder is designed to carry six 15-minute flares at a time. The striker assembly of each flare is held within the caddy. All you do is pop the exposed small plastic cap, pull the flare from the caddy body and scrape the flare



Caddy keeps flares handy for roadside use. Striker on the handle has a plastic cap.

against the exposed striker top. It lights almost instantly. The other flares are on deck and ready for action.

The Olin Flare Caddy is \$8.69. The flares are available separately for \$2.96 each. Olin's Signal Products Div. is located in East Alton, Ill. 62024, or look for the Caddy at auto centers.—*Joel Breault*

### Water absorber

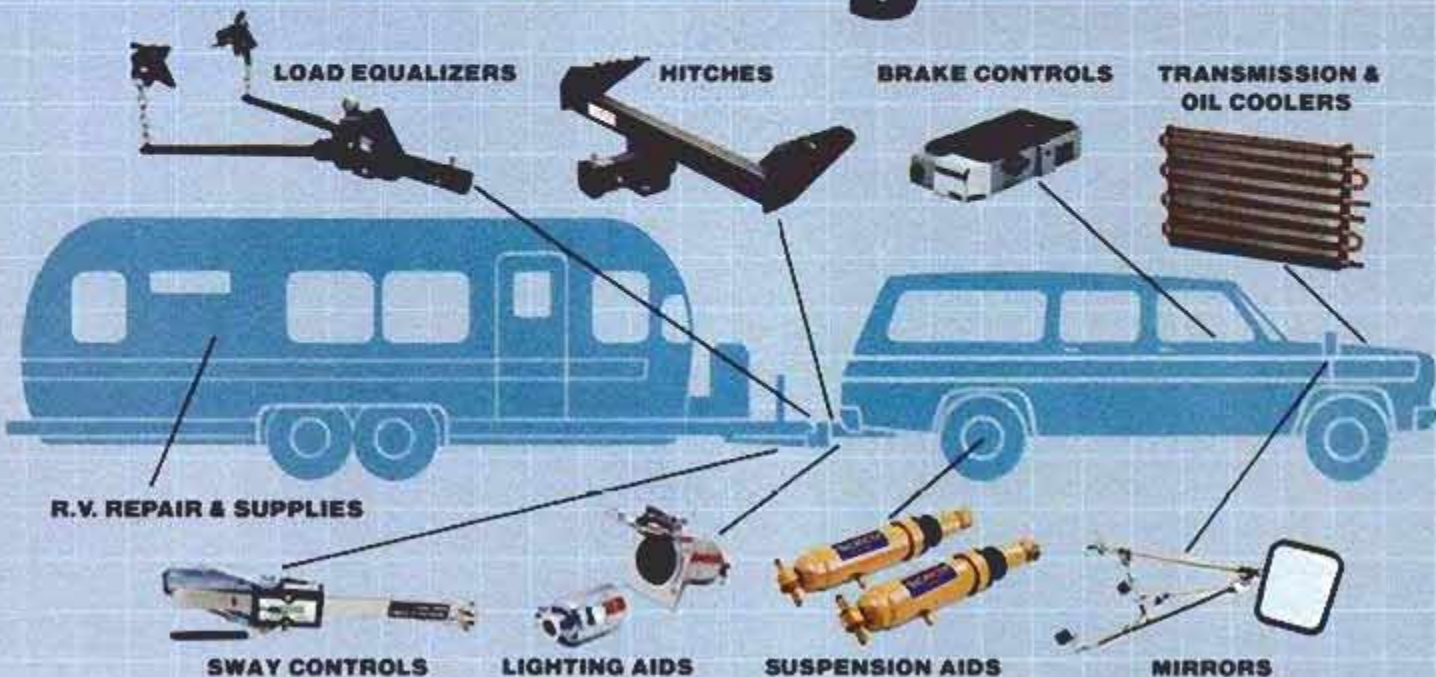
The Absorber is a synthetic chamomile-like product which absorbs water at three times the rate of a conventional animal-skin chamomile. The sheet measures 27 x 17 inches and is resistant to many chemicals, bleach, whitewall cleaners, detergents and most solvents. In addition, it leaves no lint, even when you wipe a window. It's machine-washable and may be squeezed through a wringer.



Synthetic chamomile absorbs better than natural skin and is almost indestructible.

The Absorber is supplied with a handy plastic storage container small enough to fit in a glovebox. I found the product at my local auto-parts outlet at a price of \$11.95. Further information can be obtained from Emgee Marketing, Box 506, Westmont, Ill. 60559.—*Joel Breault*

# Everything for Your Towing Needs



As a trailering enthusiast, you know how important it is to have the right towing accessories.

**U-HAUL HITCH WORLD<sup>SM</sup>** has everything you need for your tow vehicle and trailer to help protect your investment.

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## How the Vanagon Diesel works: Accommodating unusual shapes.

Most things that ought to fit into cars don't lately.

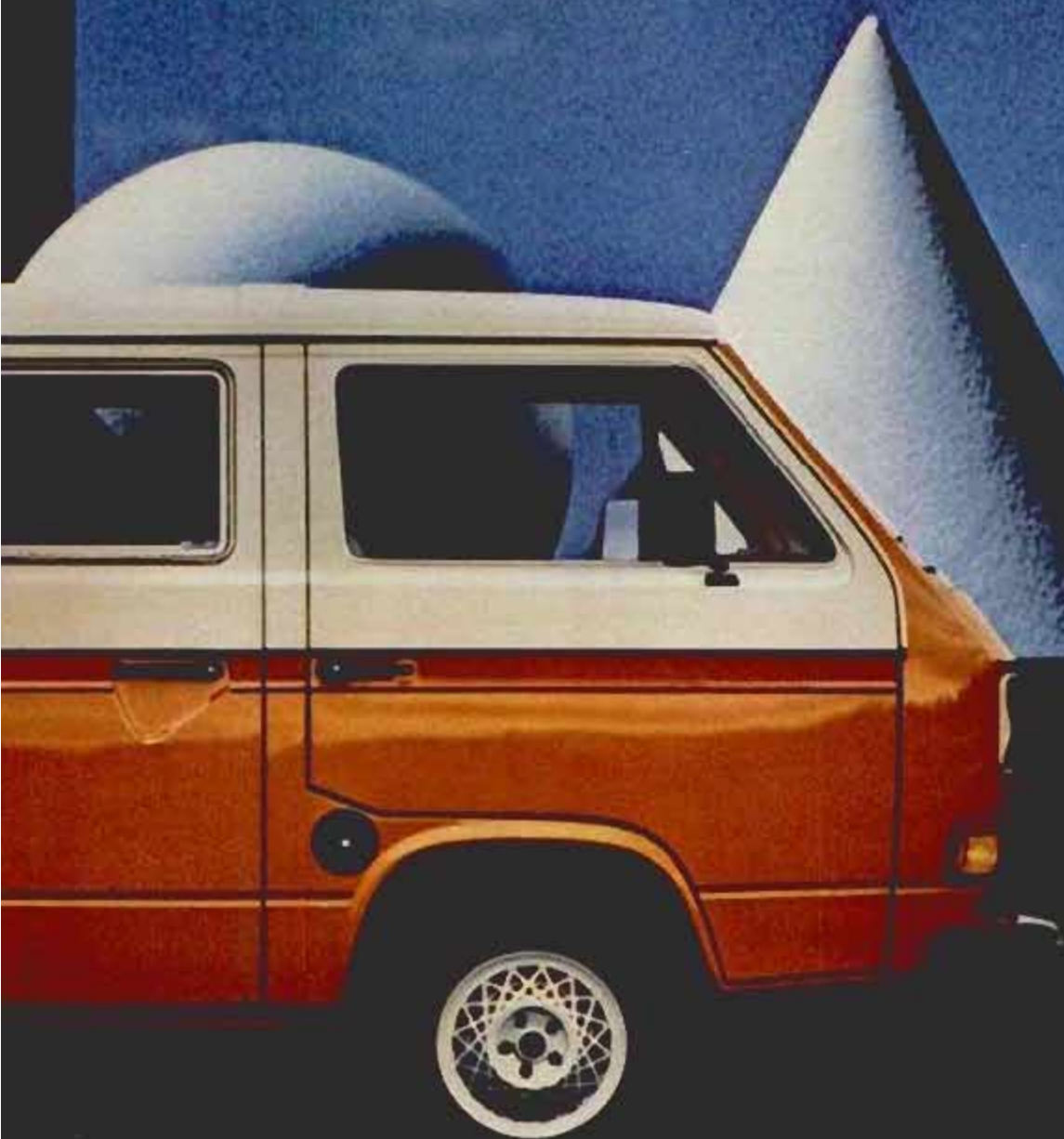
Because just about all cars have gotten smaller lately.

With one big exception: the Volkswagen Vanagon. It now holds nearly a ton in its 200 cubic feet of space.

Now having built over 4 million vehicles of this type, we've also made the Vanagon far more civilized.

The fully independent 4-wheel suspension system lets you carry up to 9 people in solid comfort smoothly over inhospitable terrain.





## Nothing else is a Volkswagen.

The interior looks like a private jet. True, it's not as fast. But its fuel-injected engine delivers an EPA estimated 17 mpg in its gasoline version and an estimated 29 mpg as a Diesel, which makes

it the best mileage van in America.\*

When you add up what you get into it and what you get out of it, the Vanagon is a most extraordinary machine.

And the biggest thing that fits into it may be a whole new style of life.

\*Use "estimated mpg" for comparison. Actual mileage varies with speed, trip length, and weather.

# Which is the lowest menthol 100's? (Hint: it's not Carlton.)

**N**OW is the lowest menthol 100s. But it's easy to see why some people aren't sure. They've had a lot of confusing numbers thrown at them for quite a while.

Just look at the chart at the right and see for yourself.

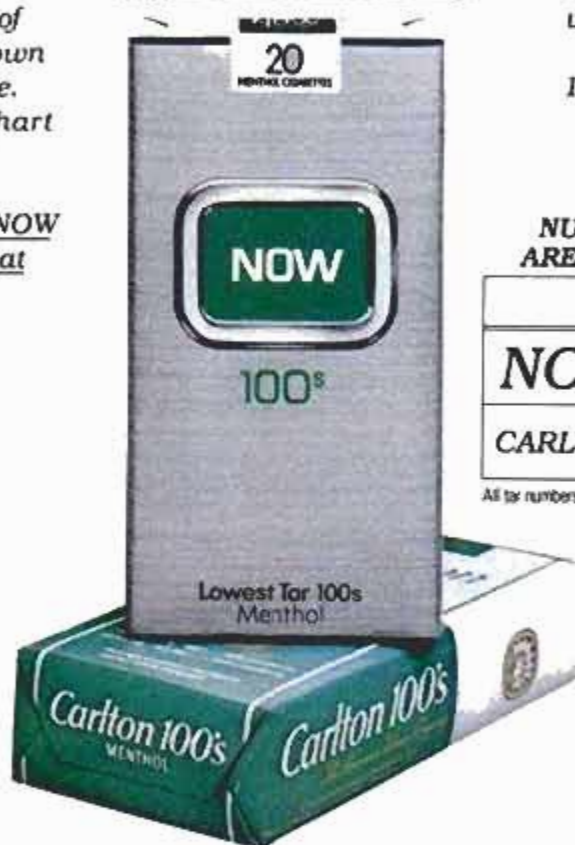
The truth is that NOW 100s Soft Pack Menthol at

2 mg tar contains less than half the tar of Carlton 100s Soft Pack Menthol at 5 mg.

And NOW Menthol 100s is by far and away lower in tar than any other Menthol 100s whatsoever.

Which is the lowest 100s menthol?

No need to guess-NOW.



**NUMBERS DON'T LIE. NOW 100s ARE LOWER THAN CARLTON 100s.**

	100's <small>soft pack menthol</small>	100's <small>soft pack menthol</small>	100's <small>menthol</small>
<b>NOW</b>	2mg	2mg	Less than 0.01mg
<b>CARLTON</b>	5mg	5mg	1mg

All tar numbers are av. per cigarette by FTC method.

**NOW**  
*The Lowest*  
**The lowest in tar of all brands.**

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

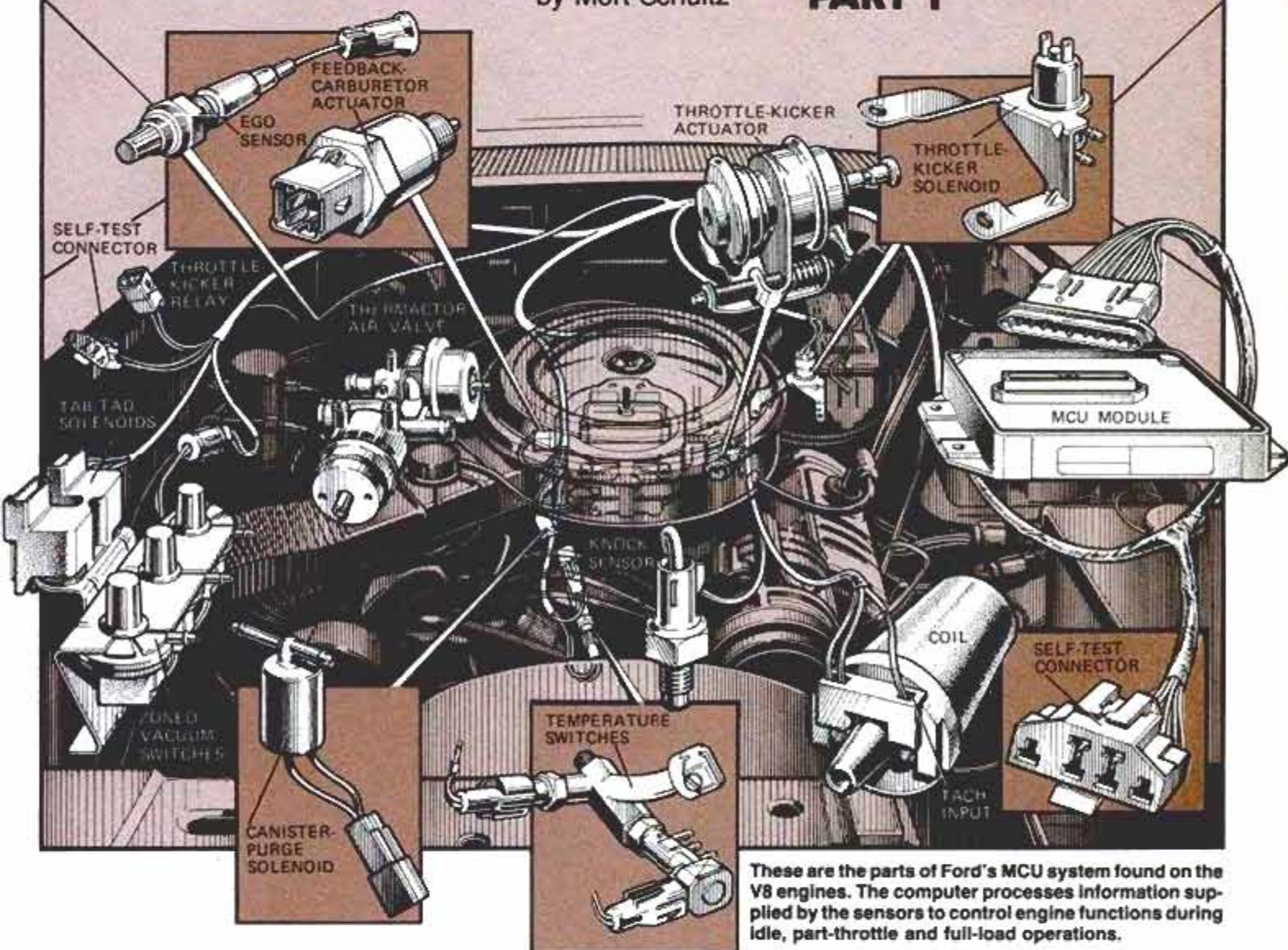
BOX, BOX 100's: Less than 0.01 mg. "tar", 0.001 mg. nicotine, SOFT PACK 85's FILTER, MENTHOL: 1 mg. "tar", 0.1 mg. nicotine, SOFT PACK 100's FILTER, MENTHOL: 2 mg. "tar", 0.2 mg. nicotine, av. per cigarette by FTC method.

MENTHOL 100'S SOFT PACK

# Troubleshooting Ford's Microcomputer Control Unit

by Mort Schultz

## PART 1



These are the parts of Ford's MCU system found on the V8 engines. The computer processes information supplied by the sensors to control engine functions during idle, part-throttle and full-load operations.

Recently, a GM official confided to me the seriousness of the attrition rate of experienced dealership mechanics. These old hands, who had been accustomed to idle mixture screws and simple electromechanical engine controls, were throwing up their hands in horror when confronted with the new, computer-controlled engine systems. "These people are quitting at an alarming rate," he claims.

What about the local repair shop? It's in even worse shape. The corner garage doesn't usually have the resources to buy the expensive diag-

nostic factory equipment or to send workers to the training seminars.

If you can't find a professional skilled in automobile computerization to fix the system when something goes wrong with it, what are you going to do?

And things can go wrong—enough, in fact, to cause one or more of the following problems:

- No starting.
- Rough idling.
- Stalling when the engine is cold or the air conditioner is turned on.
- Surging.
- Hesitation.

- Overheating at idle.

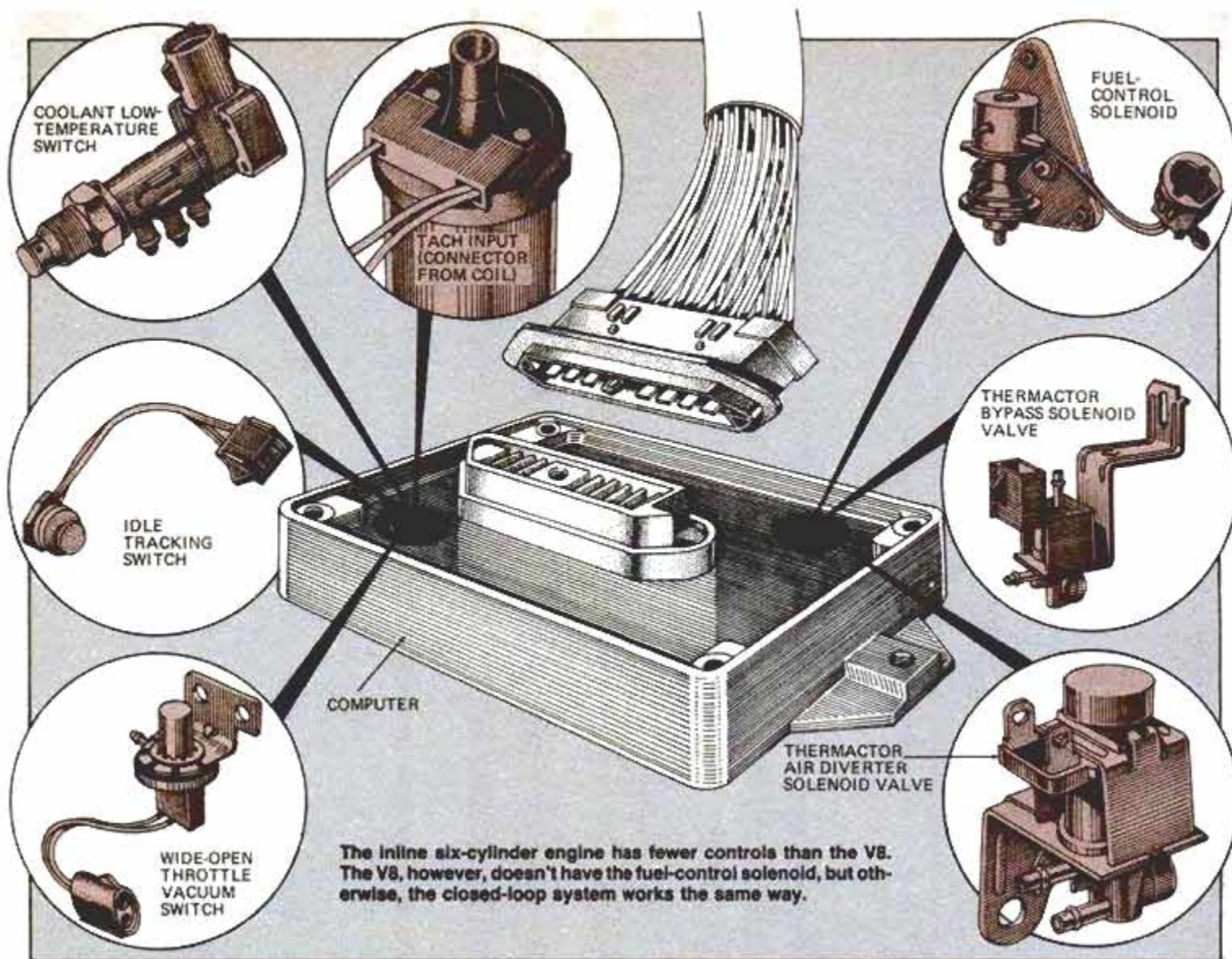
- Detonation (spark knock, ping-ing).

- Higher-than-normal fuel consumption.

- Higher-than-normal emissions levels.

So, when push comes to shove, the burden of responsibility will fall upon you to at least be able to diagnose a computer-related malfunction.

Based on my experience with this new technology, which consists of two weeks of theoretical book learning and a week of hands-on practical



The inline six-cylinder engine has fewer controls than the V8. The V8, however, doesn't have the fuel-control solenoid, but otherwise, the closed-loop system works the same way.

work, I find electronic engine controls *less* difficult to work on than I found electronic ignition systems when they first came along. Most computer systems are self-diagnosing, as long as you know how to get them to "talk."

Repair generally involves replacing faulty parts—a bolt-off, bolt-on situation. There's practically no maintenance. And working on these things is a heck of a lot of fun when you show them who's boss.

Okay, now let me tell you how we're going to handle your computer education. We'll start here with the Ford Motor Co. system. This will be presented in two parts. The GM and Chrysler systems will follow. Then, maybe we'll cover AMC and some imports.

### History of computers

Ford has used two different computerized systems on cars and light trucks since 1978: Electronic Engine Controls (EEC) and the Microprocessor (also called Microcomputer) Control Unit (MCU).

When the MCU system was installed for the first time (on '78 cars

equipped with 2.3-liter engines for sale in California and then on all '79 California cars), it was called ECU. This stands for Electronic Control Unit. But ECU and MCU are basically the same, so we'll just refer to both as MCU.

The essential difference between EEC and MCU lies in what each controls. EEC controls ignition timing, air/fuel ratio and exhaust gas recirculation (EGR). MCU controls the air/fuel ratio and EGR. It does not control overall timing. However, in some cars, as I mention later, MCU retards the spark when detonation is likely to occur.

To tell if a Ford/Mercury/Lincoln has an EEC or MCU system, examine the distributor. If no vacuum (spark) advance chamber is attached, the car has an EEC system. Spark advance and retard are handled electronically, so a vacuum advance chamber is not needed.

Conversely, if the distributor has a vacuum advance chamber, the car has an MCU system, if it has a computer system at all.

Why has Ford developed two different engine computer systems?

"One reason is that different engines have different requirements," explains Walt Doelp Jr., supervisor of equipment research and development at the Ford Motor Co. Service Research Center in Dearborn, Mich. "But, to be honest, we didn't know whether the less expensive MCU would work as well as the EEC."

Ford's future computer system will be the EEC-IV, which is scheduled to be phased into production during the 1983 model year. If plans hold, the EEC-IV will replace all the other EECs (there are three versions) and the MCU. However, according to Doelp, the EEC-IV will be more like the MCU than the EEC I, II and III.

### The EEC system

Despite what I said about the onus for troubleshooting computerized systems falling on you, I'm not going to devote time to EEC. You need a piece of equipment called an Electronic Engine Control System Tester (Rotunda No. T79L-50), which costs \$1,500. At this price, it pays for you to look high and low for a technician.

If you can't find a technician equipped with this tester, you can test the I and II versions of EEC with an analog volt-ohmmeter. The testing procedure is extremely complicated and too long for us to outline here.

Just so you'll know, the following is a list of cars having one of the EEC systems:

- 1978-79 Lincoln Versailles with 5.0-liter (302-cu.-in.) engine.
- 1979 Mercury (49 states) with 5.8-liter (351-cu.-in.) engine.
- 1979 Ford/Mercury (Calif.) with 5.8-liter engine.
- 1980 Ford/Mercury (Calif.) with 5.0-liter engine and feedback carburetor.

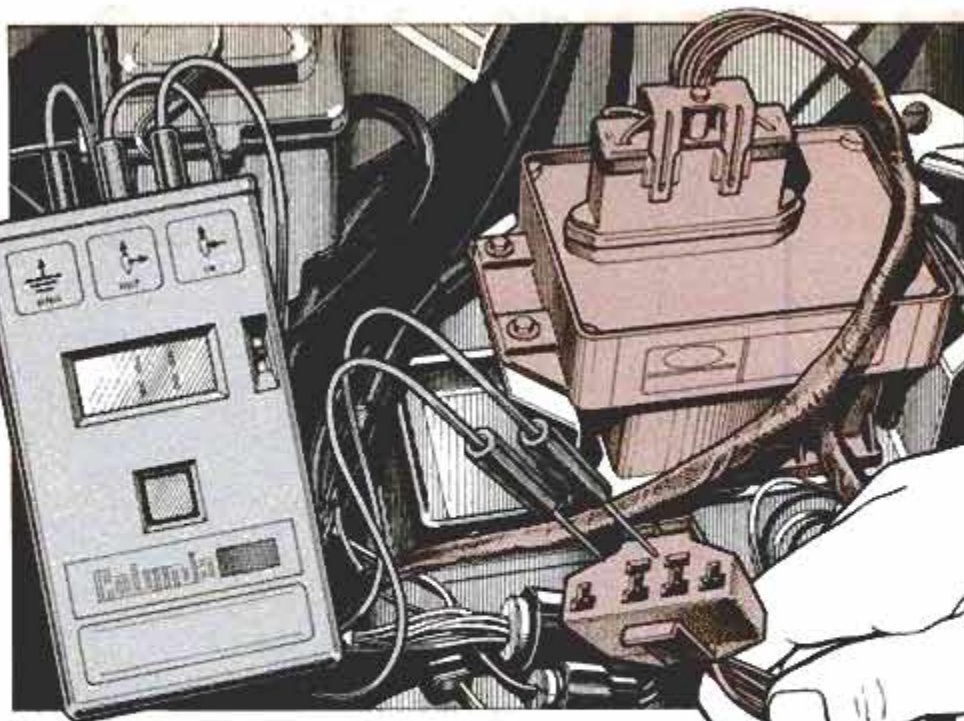
(Note: A feedback carburetor uses a so-called stepper motor, which is controlled by the computer. The motor, at the command of the computer, varies the air/fuel mixture according to the load requirements imposed on the engine.)

- 1980 Ford/Mercury and Lincoln/Mark VI (50 states) with 5.8-liter engine and feedback carburetor.
- 1980-82 Lincoln/Mark VI (50 states) with 5.0-liter engine and electronic fuel injection.
- 1981-82 Ford/Mercury (Calif.) with 5.8-liter engine and feedback carburetor.
- 1981-82 Bronco, F-100, F-250, E-100 and E-250 (under 8,500 pounds GVW) trucks (Calif.) with 5.0-liter and 5.8-liter engines and feedback carburetor.
- 1981-82 Ford/Mercury (Calif.) with 5.0-liter engine and electronic fuel injection.

"Ford Motor Co. will have about 750,000 EEC cars on the road by the end of the 1982 model year," Doelp says.

### The MCU system

About the same number of cars will possess MCU by the end of the 1982 model year. From your standpoint, the major difference between



The STAR analyzer (available for about \$100 from Ford dealers) is the most accurate system for testing the MCU. The service code 11 indicates that all systems are normal.

EEC- and MCU-equipped cars is that you can handle MCU troubleshooting and repair. You'll be able to troubleshoot and repair EEC-IV using the same equipment.

MCU is in 1978-82 California models with 2.3-liter engines and feedback carburetors. (All models with MCU have feedback carburetors.) All 1981 cars with this engine made for sale in the rest of the United States also have MCU.

Other 1982 models with MCU are as follows:

- Some 49-state cars and trucks with the 2.3-liter engine. To find out if a car has MCU, look for the MCU module (computer and module are one and the same) on the left-side fender housing just to the rear of the windshield-washer reservoir.
- Continental with 3.8-liter V6 engine (Calif.).
- Capri, Cougar, Granada and Pan-

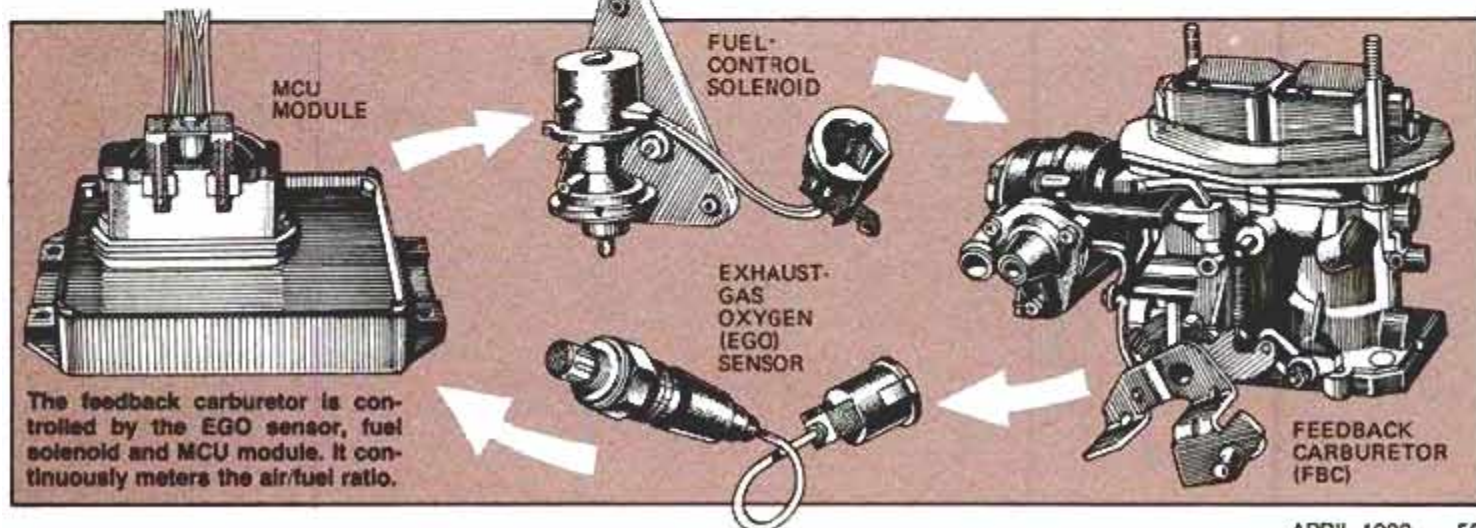
ther with 4.2-liter V8 engine (50 states).

- Mustang with 4.2-liter V8 engine (50 states).
- Cars with 4.9-liter in-line, six-cylinder engine (Calif.).
- Cars with 5.0-liter V8 engine, except Lincoln/Mark VI with electronic fuel injection (50 states).
- Cars with 5.8-liter V8 high-performance engine (49 states).

### How MCU system works

Here's a bit of theory about the MCU system that will help you troubleshoot it.

The heart of MCU is the module, a switch that turns functions on and off. In other words, the module receives vacuum or electrical signals from components that monitor engine operation. It analyzes these signals, which concern the state of engine and catalytic converter effi-



ciency. The module then sends its own signals ("orders," if you will) to other components that control engine operation.

The MCU system is in operation during initialization, closed-loop and open-loop modes. In the days before computers, we called these "modes" engine start-up (initialization), cruising (closed loop) and acceleration, deceleration and idling (open loop).

The initialization mode begins as soon as you turn on the ignition key and is maintained for a brief moment after the engine starts. During this period, the MCU module is programmed to tell the carburetor, "Hey, carburetor, maintain a rich air/fuel ratio, so your owner will get this engine going real fast."

As the car cruises with the engine at normal operating temperature, the MCU system works in the closed-

(provide more air) or rich-up (provide less air). This is the "feedback" part of feedback carburetion.

When the throttle is opened to accelerate, closed to decelerate or the engine is idling, the MCU system goes into open loop. In open loop, the EGO sensor is out of the picture. The MCU module holds the carburetor at a preprogrammed fixed level that is just rich enough to assure suitable engine response and performance.

Another function of the MCU system is to control air from the car's air pump (Thermactor system) to the catalytic converter. Under some conditions, air is injected directly into the converter. Under other conditions, it is directed into the exhaust manifold.

### Inputters and outputters

Along with the computer and feedback carburetor, you have to become familiar with all parts of the MCU system to avoid replacing good components by mistake. Some parts are common to all Ford MCU-equipped engines, while some engines have more or fewer parts. The chart at the right lists all parts.

Service codes (see chart) are the key to MCU system troubleshooting. Service codes are the numbers that appear on the digital tester.

It's called the Self-Test Automatic Readout (STAR) tester (Rotunda No. 07-0004). The STAR tester is plugged into the MCU system self-test connector and provides a digital signal code that tells you if the system as a whole is operating properly. If it isn't, the STAR tester readout reveals which component or subsystem is at fault.

For example, a service code "11" says the MCU system is operating properly. A "42" indicates a problem with the EGO sensor or circuit.

You can make tests with an analog voltmeter and a jumper wire rather than the STAR tester, which costs about \$100. You have to watch the voltmeter needle closely to count the number of flicks (pulses) it registers. We'll explain this in detail in Part 2.

All in all, though, the STAR tester is a more positive tool to use. The chance of making a miscalculation and replacing the wrong part is nil. The tester may be purchased at any dealer selling Rotunda tools, which includes most Ford/Mercury/Lincoln dealers.

The second part in this series will appear in June (because the May PM is the annual Car Care Guide issue). We will complete the discussion of the Ford/Mercury/Lincoln MCU system through the various diagnostic and service stages necessary to isolate faulty parts. **PM**

## MCU PARTS AND WHAT THEY DO

Part/Engine Application	Function/Service Code(s)
Exhaust gas oxygen (EGO) sensor/All	Provides input signals to the module to indicate rich or lean engine operation/41 (lean operation), 42 (rich operation).
Tach input/All	Provides engine input signals to module, which then adjusts air-fuel ratio to meet engine needs/No service code; test with ohmmeter.
Coolant low-temperature switch/2.3 and 4.9-liter	Provides input signals to module to indicate whether engine is at normal operating temperature so the module can call for adjustment of air-fuel ratio to compensate for other than normal temperature/51.
Coolant mid- and dual-temperature switches/3.8, 4.2, 5.0 and 5.8-liter	Provides input signals to module so it can react to changes in various operating conditions, such as air-fuel ratio, spark retard and throttle position/53 or 54.
Idle tracking switch (ITS)/2.3-liter	Provides input signals to module to indicate closed throttle at idle or prolonged deceleration, so module can alter carburetion and Thermactor air accordingly/52 or 62.
Wide-open throttle (WOT) vacuum switch/2.3-liter	Provides input signals to module to indicate wide-open throttle under acceleration so module can signal the carburetor to adjust. Switch also helps control fuel richness at cold start/53 or 63.
Vacuum-switch assembly/4.9-liter	Gang of switches that perform same functions as ITS and WOT switches in 2.3-liter engines/52, 53, 56, 62, 63 or 66.
Zoned vacuum switches/3.8, 4.2, 5.0 and 5.8-liter	These three switches monitor low, mid-range and high engine vacuum, providing input signals to module that concern throttle position under various load (vacuum) conditions. Module then signals needed changes in carburetion and catalytic control/51, 55, 61 or 66.
Knock sensor/3.8, 4.2, 5.0 and 5.8-liter	Provides input signals to module when detonation (spark knock) can occur. When module receives signals, it retards ignition timing to prevent knock/25.
Fuel-control solenoid (FCS)/2.3 and 4.9-liter	Responds to module output signals to adjust air-fuel mixture/41 (mixture too lean), 42 (mixture too rich)
Thermactor air bypass (TAB) and Thermactor air diverter (TAD) solenoid valves/All	Responds to module output signals so air is directed into or away from catalytic converter, as the base may be, to assure effective control of exhaust emissions/44, 45 or 46.
Canister purge (CANP) solenoid valve/3.8, 4.2, 4.9, 5.0 and 5.8-liter	Responds to module output signals to purge fuel vapors from the charcoal canister of the fuel-evaporation system/No service code; test with ohmmeter.
Spark-retard solenoid/4.9-liter	Responds to module output signals to bleed distributor vacuum advance during conditions when detonation (spark knock) may occur/No service code; test with ohmmeter.
Throttle-lucker solenoid (TKS) and throttle-lucker actuator (TKA)/3.8, 4.2, 5.0 (except Ford/Mercury) and 5.8-liter	TKS responds to module output signals to get TKA to provide efficient idling when engine is warming up, when air conditioner is turned on and when increased coolant circulation is needed to avoid overheating at idle/12.
Feedback carb actuator (FBCA)/3.8, 4.2, 5.0 and 5.8-liter	Responds to module output signals to adjust air-fuel mixture/41 (mixture too lean), 42 (mixture too rich).

**Most computer systems are self-diagnosing, as long as you know how to get them to 'talk.'**

loop mode. Input signals tell the computer whether the air/fuel ratio is deviating from the stoichiometric ratio.

As it applies to the air/fuel ratio, stoichiometric (which literally means chemically correct) indicates that the mixture is neither too rich nor too lean, but perfect. Stoichiometric ratio for a gasoline/air mixture is 14.7 parts air to one part gas.

A stoichiometric fuel mixture burns completely, giving off no by-products (pollution). In the closed-loop mode, the MCU module tries to hold the carburetor in line so it supplies a nearly perfect 14.7:1 fuel mixture.

The term "closed loop" refers to the relationship of the exhaust gas oxygen (EGO) sensor, MCU computer and feedback carburetor when the engine is warmed up and operating under light-load, part-throttle (cruising). The EGO sensor in the exhaust manifold sends input signals about the quality of exhaust gases (too rich, too lean or just right) to the MCU module, which, in turn, signals the carburetor to lean-out



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By the way, here's what Sears Limited Warranty on Light Truck Tire Wearout covers. For the number of miles specified, Sears will, upon return, replace the tire

or give a refund, charging a pro-rata charge for the miles received if wearout occurs and is not caused by failure to properly maintain the tire.

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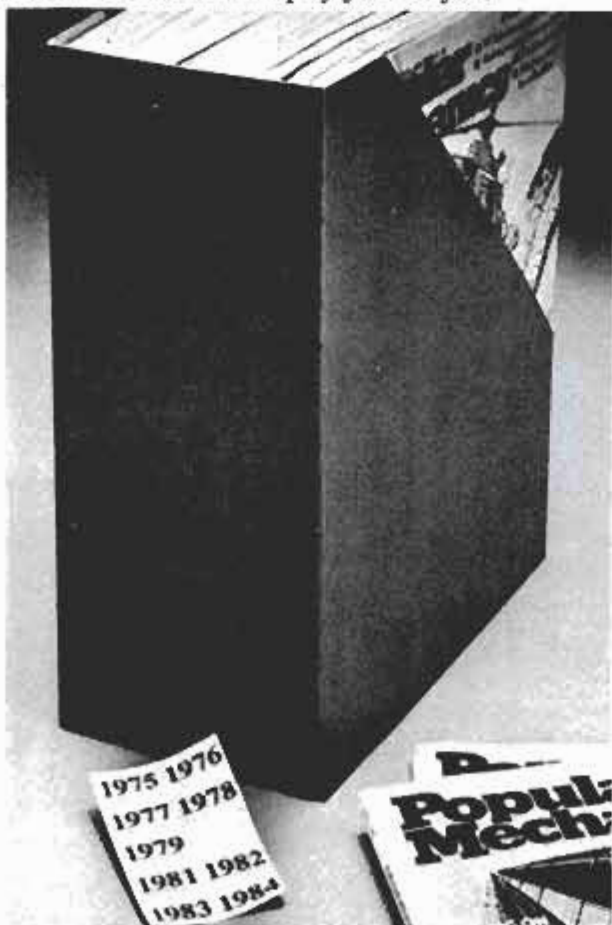
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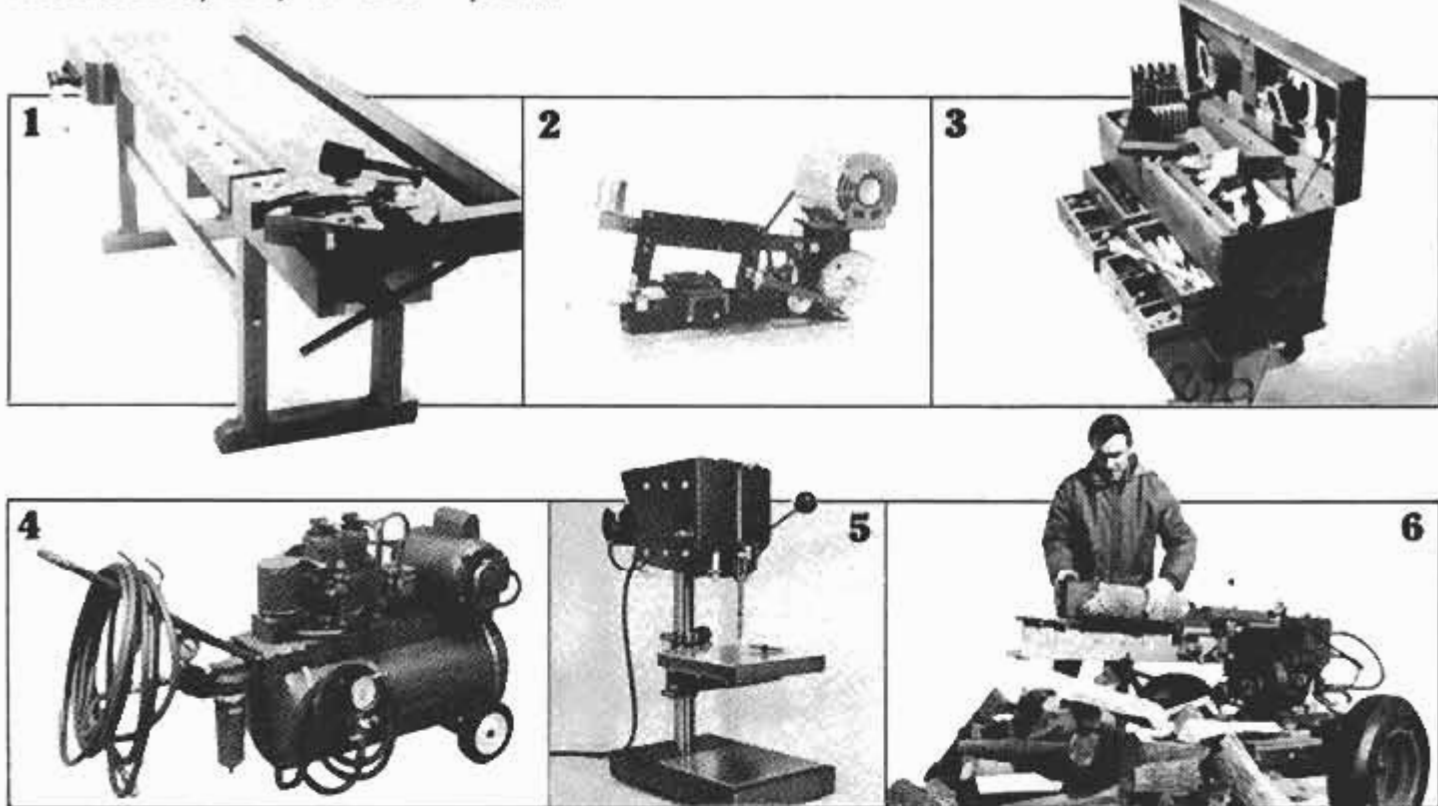
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**1 CLASSIC WORKBENCH** — Here's the classic European workbench every woodworker dreams of owning. Using these plans, you can build this workbench for less than half the cost of a factory-made version. Ours is fashioned of maple to give a lifetime of use. You get detailed plans with instructions and material list. **PL-1748, \$5.95.**

**2 CUTOFF SAW** — Build this low-cost power tool and make hacksawing a lot easier and accurate. This cutoff saw cuts channels, angles, and rounds with ease and precision even up to 3-in. size. Although it can produce work of machine-shop quality, it's not too heavy to be portable. These features make it an ideal workshop project. **PL-1735, \$3.75.**

**3 TOOL CHEST** for a master craftsman. Compact tool chest made from cherry wood. For handling ease, it's actually two boxes. Well-organized hand tool compartments allow easy access. Expert wood construction absorbs moisture and protects tools from rust. Also includes plan for an oak dolly. **PL-1745, \$4.75.**

**4 AIR COMPRESSOR** — Once you build this, you'll wonder how you ever got along without it. You can inflate swimming gear, toys, auto and garden tractor tires — sandblast parts, blow-clean fine mechanisms — vacuum your car's airconditioning system prior to adding Freon. The unit also features a filter/water trap. All can be done with PM's 1-hp. compressor. **PL-1717, \$5.95.**

**5 DRILL PRESS** — features a ball-bearing spindle, variable-speed drive and large, adjustable work table. It's designed for a 1/15 hp. motor, delivers hefty torque, has 1/4 inch capacity in steel. All parts are readily obtainable at hardware stores and bike shops. **PL-1401, \$6.95.**

**6 HYDRAULIC LOG SPLITTER** — split your firewood the easy way. This rig exerts some 10,000 lbs. of pressure and splits with ease 2-ft. lengths of maple and ash logs 12 to 14 in. in diameter. It's backbone is an I-beam, and it's powered by a 3-hp. gas engine. Best of all, you can make money with it too! Plans and instruction booklet included. **PL-1708, \$8.95.**

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## HINTS FROM READERS

### Stirring paint



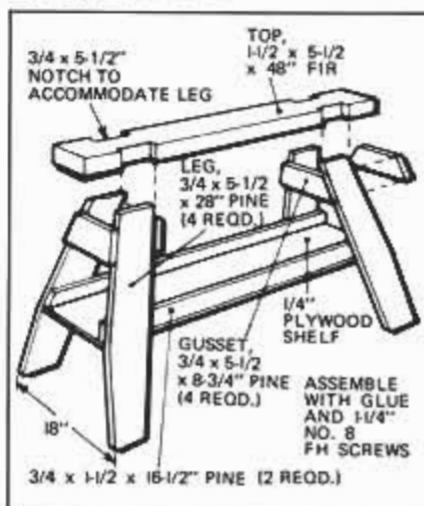
Even after it has been on a shaking machine, a new can of paint may not be mixed completely. Stir the paint and scrape the bottom of the can to distribute pigment for proper color and consistency.

—Walter E. Burton

### Roof-gutter maintenance

To maintain the wooden roof gutters on my home, I sweep them clean with a broom stub, then spray on the body undercoating that's used on cars. This seals gaps between gutter and house trim and covers spots a brush can't reach. One can covers about 40 ft.—Ernest Turner

### Sturdy sawhorses



I make these sawhorses in pairs, one without a shelf, so it stacks on top of its mate. I use fir for the top to give strength and pine for the legs, since fir tends to split. Before assembly, I cut and test-fit parts carefully to ensure sturdy sawhorses.—Robert Udesen

# FRESH AIR ON DEMAND

## Zestron Ionair IG-700 Generates Negative Ions By The Trillions

If you've been in the mountains lately, you know how air is **supposed** to smell.

And perhaps you've captured that clean, fresh, invigorating atmosphere after a thunderstorm, or while standing near a waterfall.

That clean fresh air you enjoyed was **rich in negative ions**. Nature's own air purifiers.

### THE ZESTRON IG-700

Pollution and civilization destroy natural air ions. A ZESTRON ionizer recreates 40 Trillion of these ions every second. They clean the air of smoke, dust, solid pollutants, odors, bacteria and viruses which fall to the floor as dust.

A new solid-state pulse circuit breakthrough is used in the Zestron ionizer. This gives the greatest ion output (with no detectable ozone) at an extremely low price! Compare the performance and prices shown in the chart. The IG-700 clearly has the greatest ion output — yet sells at a remarkably low price.

quality, designed by engineers with many years' experience in zero-defect spacecraft design. Every Zestron is built with quality parts and materials which operate at mere fractions of their maximum values, to give you years of trouble-free service.

New technology, developed by Zestron engineers, has opened the door to improved performance at a lower price. Zestron is the only company to bring price-performance technology to negative ion generators.

### IG-700 SUPERIORITY

The IG-700 features adjustable output, which lets you set the output to your own preference. Some people prefer fewer ions at night, while a large smoke-filled room needs more ions than a small room with no smokers present.

The IG-700 has no moving parts and nothing to wear out or replace, unlike "perfume" filter-type air cleaners which require frequent replacement of expensive filters, and which emit no beneficial negative ions.

The IG-700 is a compact 2¼ by 2¼ by 6¼ inches. At 1.5 watts, it costs about 7 cents a month to run from standard house current.

The IG-700 features an operating-output level indicator that shows you the actual output level. Most competitive units simply indicate that the unit is plugged in.

### ION GENERATOR COMPARISONS

IONIZER	Ions/cc/sec. (at 1 meter)	PRICE
ZESTRON IG-700	1,904,000	\$ 84.95
Ion Cloud XL	840,000	179.95
Energen 402B	550,000	149.70
Energair	438,000	79.95
Energair plus	430,000	59.95
Ion Fountain	430,000	99.95
Ion Cloud	350,000	79.95
Ionosphere	350,000	99.95
Modulian	75,000	85.00
AirCare	72,000	149.95
Omega 700	63,000	245.00
JS&A Air Bubble	???	89.95
Orbit	???	99.95

### WHAT IT DOES

The high-powered output of the IG-700 provides more negative ion benefit for you. It cleans a larger room faster and more thoroughly than lower-powered units. Under ideal conditions, a 40 by 40 foot room can be cleaned by a single IG-700.

### HOW THEY'RE BUILT

Don't let the IG-700's low price mislead you. The unit is of the highest

### FREE TEST DEVICE

A free passive remote ion detector is included with each ionizer. This handy little device gives you independent proof of operation, and permits comparison with other manufacturers' ionizers.

Place the detector first close to a Zestron ionizer, then close to a competitive unit. You will see far less ion output from the competitive ionizer — in some cases no activity at all!

Please study the facts and figures on this page, and then order your Zestron IG-700. Try it for 15 days in your home or office. We predict that you will be delighted with the fresher air and more stimulating atmosphere it provides.



If you are displeased for any reason, however, you may return your unit within 15 days, and we will promptly refund your full purchase price.

### HOW TO ORDER

Send your name, complete mailing address, and phone number with your check or money order. Credit card holders (VISA, MasterCard, American Express, Diners Club, Carte Blanche) can speed delivery of their Zestron Ionair IG-700 by using our TOLL-FREE ordering number. We are offering this superbly engineered Negative Ion Generator for a limited time at the **low price of \$84.95** plus \$4.00 postage and handling. Price includes Remote Ion Detector and Owner's Manual.

### ZESTRON IG-700 - \$84.95

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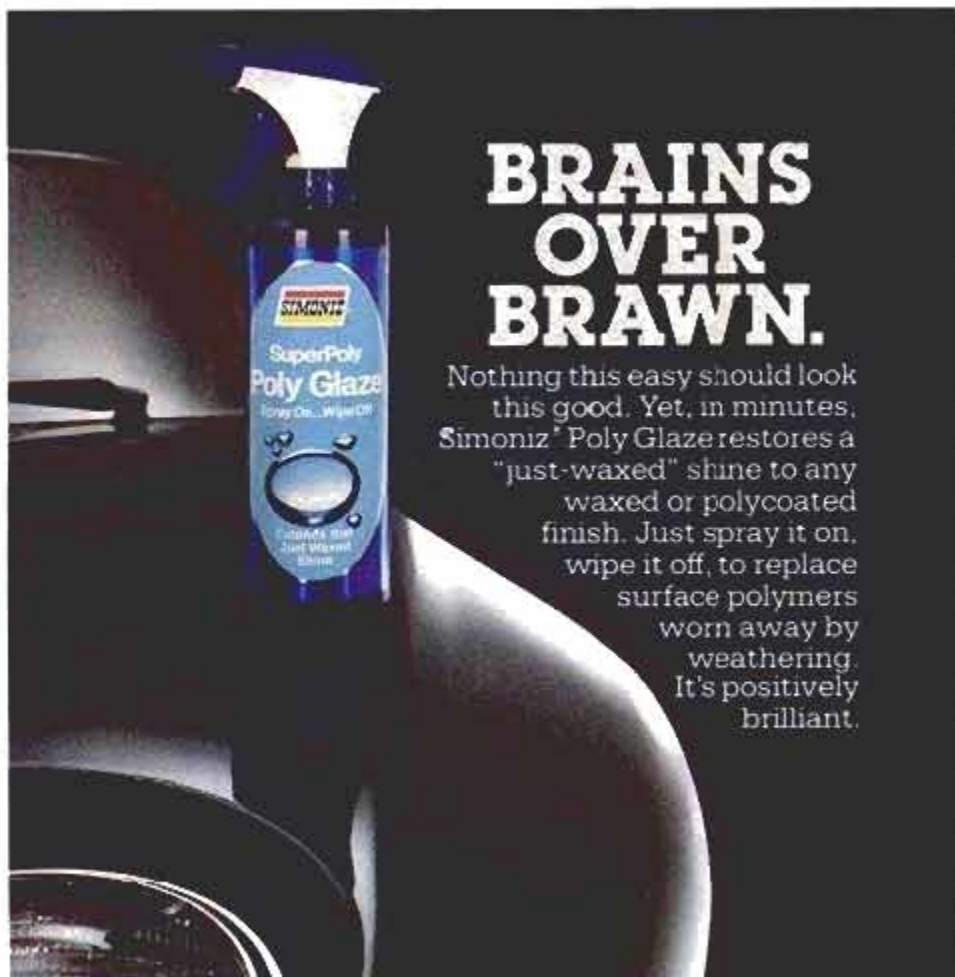
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## BRAINS OVER BRAWN.

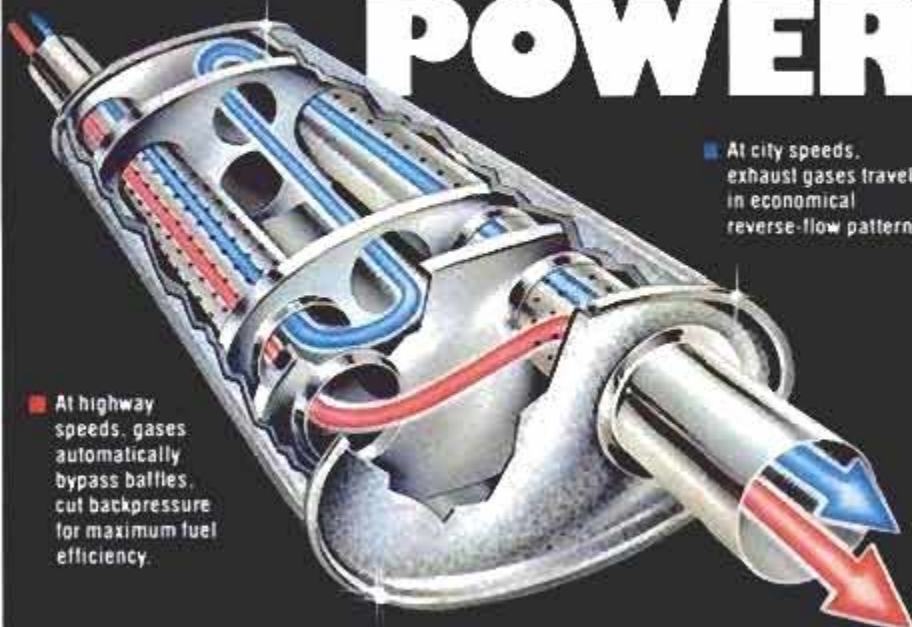
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# TURBO POWER



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## the fuel-efficient muffler!

## PHOTO HINTS

### Spray tames shine



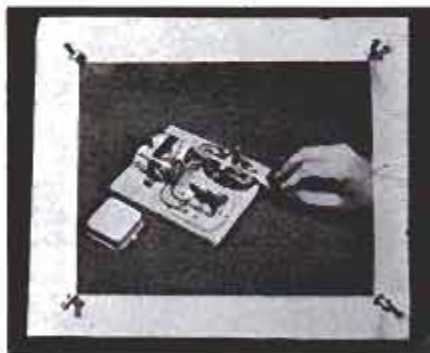
If you've been bothered by glare when photographing metal or glass, here's the solution. A dulling spray, which is available at art stores, will not damage surfaces.—*Robert Hertzberg*

### Emergency magnifier



Those little darkroom magnifying glasses are great—but what do you do if you don't have one handy? Your camera lens makes a good substitute.—*Bob Berger*

### Make borderless prints



Plywood, painted white, makes a good easel. Draw a rectangle on it the size of your paper. Compose your enlarged image on it to extend slightly beyond edges. Secure paper to easel for borderless prints.—*Robert Hertzberg*

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- 11 Easy access for change of blade.

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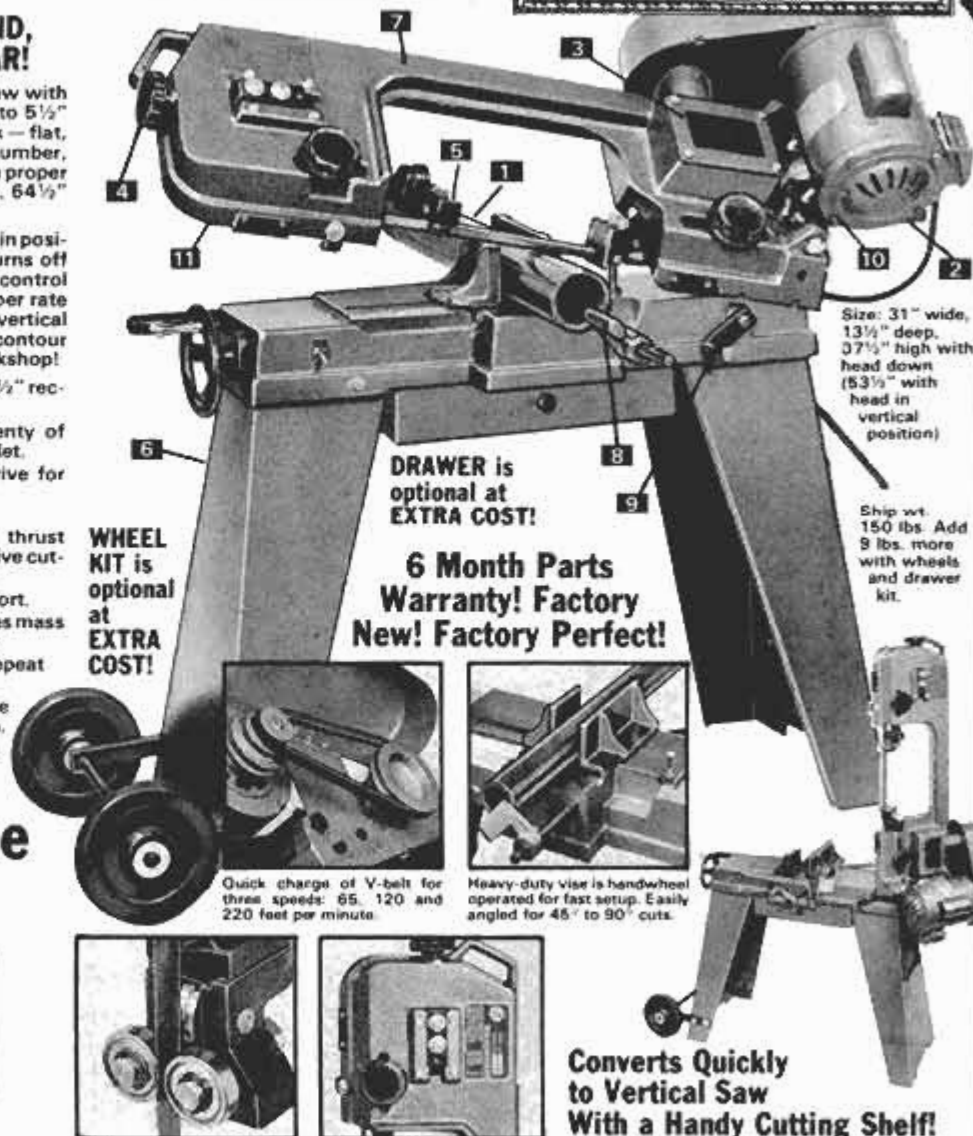
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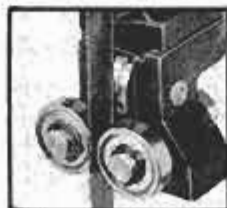
**WHEEL KIT is optional at EXTRA COST!**



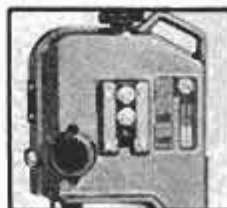
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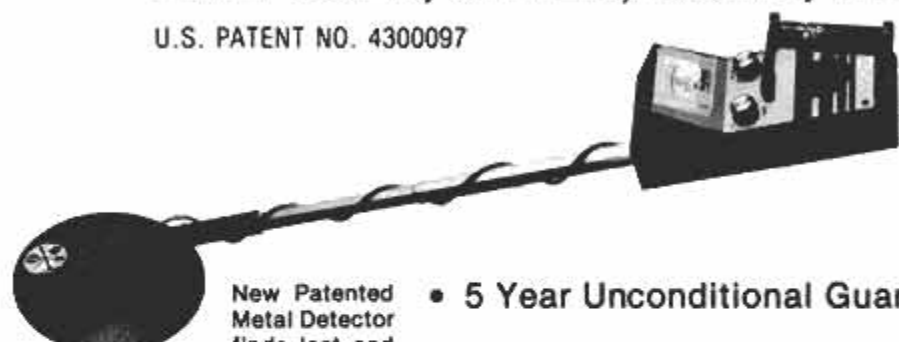
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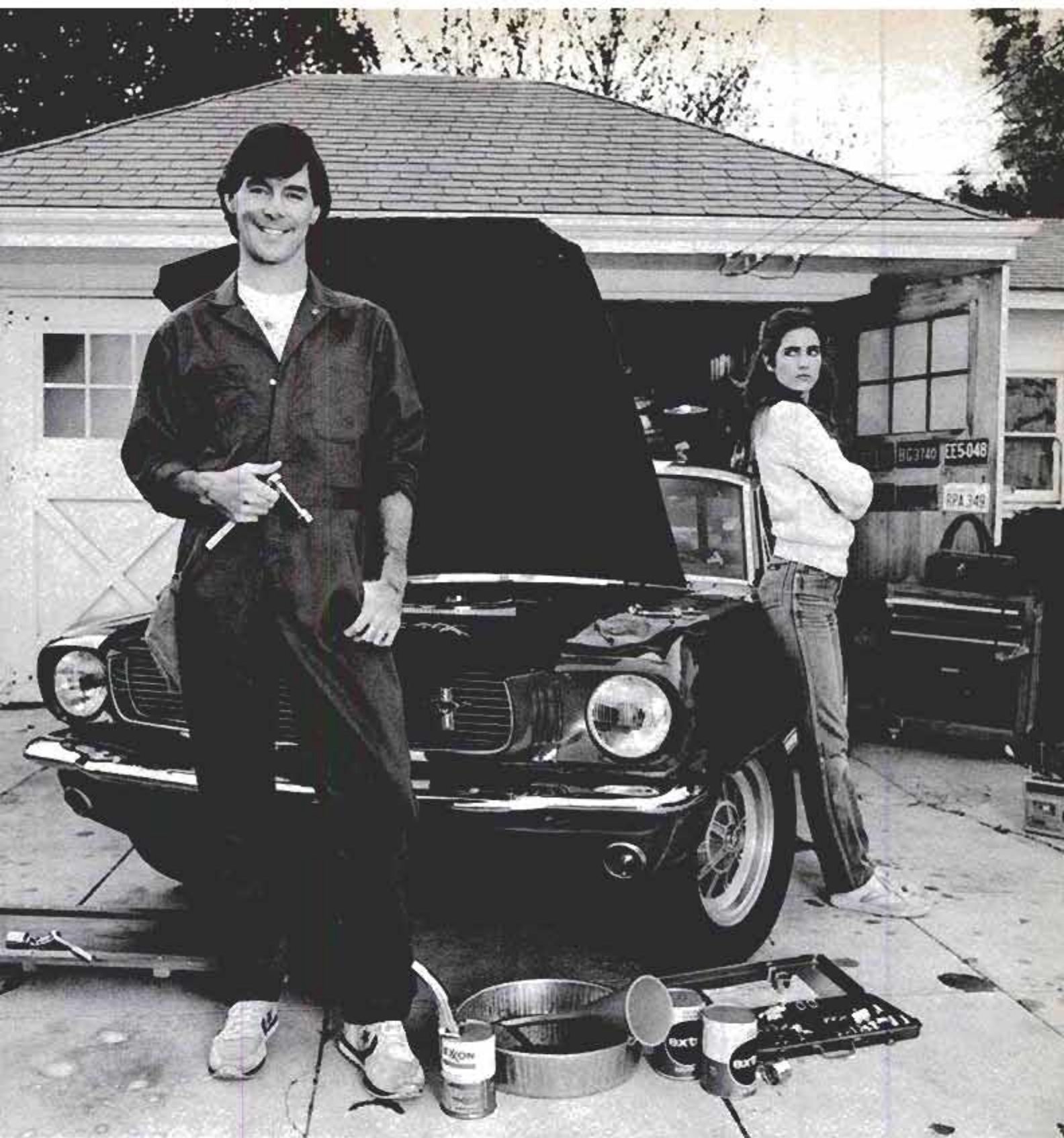
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# ALL OUTDOORS

## Three-wheeling it

First there was hiking. Then came horses, wagons, bicycles, trail bikes, four-wheel drives, beach and dune buggies, all-terrain vehicles and snowmobiles for heading out along back-country trails. Each made the going a little easier when the conditions were right.

Most popular new vehicle to take to the trails is the power tricycle. A three-wheeler that can head off-road for work or fun, the rig is being used by sportsmen, farmers, ranchers and outdoor-maintenance types



Grown-up tricycles are popular new rigs for off-road work and fun. Kawasaki KLT 250 has improved suspension, 246-cc mill.

for year-round convenience. Fat, high-flotation tires can roll it across soft ground or snow without bogging down. More powerful motors take it up steeper slopes and add speed and performance.

Now, refinements are being added for better comfort and control, as well. Kawasaki's new KLT 250 for 1982 has a shock-absorbed front fork, key ignition, electric start, 246-cc, four-stroke engine with five-speed shift transmission, 12-volt lighting, rear trunk, and front and rear drum brakes. It costs about \$1,700, while the 198-cc KLT 200 is \$1,500. These classy trikes have come a long way from toys.

## Winchester winners

For shooters who think of the name "Winchester" as part of the history of settling the West, there was worry last year when rumors went around that the guns might disappear. The good news is that not only is U.S. Repeating Arms continuing to produce them in New Haven, Conn., but specialty models are still being marketed by Olin Corp.'s Winchester Group, former makers of the complete line.

Olin's Japanese affiliate, Kodenshu, will go on turning out top-grade models. Among new shotguns just announced are a Diamond Grade

series of over-and-under trap and skeet guns. More unusual, however, are an over-and-under shotgun/rifle combination and dual-barrel rifle. Four interchangeable Winchoke barrels with varying chokes in 12 gauge are supplied with each Super Grade over a 30-06, 300 Win. Mag. or 243 Win. lower barrel. It's \$2,000. A limited-edition Grand European Double Xpress Winchester rifle, with 23½-inch over-and-under 30-06 barrels, is \$2,500. All Olin's Winchester Group rifles and shotguns, in fact, are over \$1,000. Olin will continue to produce its well-known lines of Winchester-Western shotshells, cartridges and ammunition reloading supplies.

## Putting it together

Some outdoorsmen like finding bargains in quality gear. Others start with plans or kits, and then there are those who want to create their own customized rods and lures, targets and bench rests, tripods and blinds, boats, sails, tents and packs, and cold-season clothing and shelter. Just about all of us fit in at least one of these pleasant categories.

But getting started and finding the necessary materials isn't always easy. When local sportsmen and suppliers can't seem to help, here are some of the sources that we've found particularly useful.

■ **For fishermen:** Boyd Pfeiffer's Tackle Crafter Catalog (14303 Robcaste Rd., Phoenix, Md. 21131) is a fine \$1 collection of 2,800 items for making your own tackle. Free brochures on building rods and lures are also available.

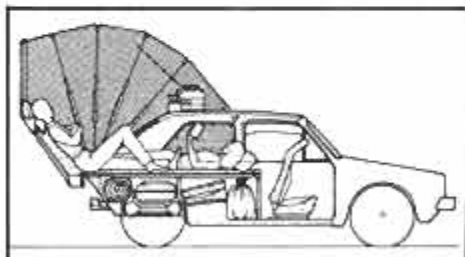
■ **For boating supplies:** Defender Industries, 225 Main St., New Rochelle, N.Y. 10801, also has a \$1 catalog that is one of the most complete around. Boat builders often have trouble locating the wood they need, and should contact M.L. Condon, 258 Ferris Ave., White Plains, N.Y. 10603, and Quality Wood Ltd., Box 205, Lake Hiawatha, N.J. 07034. For marine adhesives, try Travaco Labs, 345 Eastern Ave., Chelsea, Mass. 02150.

■ **For camping kits:** The broadest selection of clothing and luggage kits probably comes from Frostline at Frostline Circle, Denver, Colo. 80241. Goose Dance, 215 North Cayuga St., Ithaca, N.Y. 14850, is a source for Altra kits. Country Ways, 3500 Highway 101 S., Minnetonka, Minn.

55343, stocks an assortment that includes snowshoe furniture, boats, and even blue-grass musical instruments.

## Hatching an RV

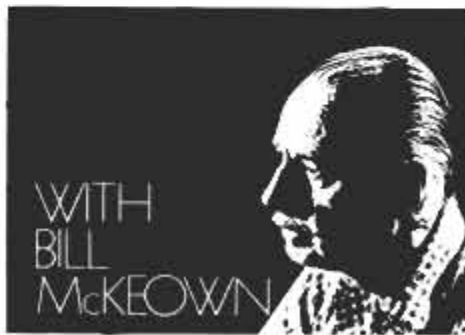
For a quick change from a road Rabbit into one that can create a campground hutch by opening the hatch, there's a new invention on the market. It's made by Mechanical Plastics, Castleton St., Pleasantville,



This VW Rabbit can hatch a hutch called a Hatchpack. Flip-up top opens out to cover a double bed for campground overnighting.

N.Y. 10570, will cost about \$1,500, and is called a "Hatchpack." At present, the unit is only available for Volkswagen Rabbits, but adaptations for other hatchback cars are planned.

When it's closed, the Hatchpack blends into the lines of the car. There is 5 feet of headroom under the roof when the top is up, to change a compact into a camper for quick comfort.





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**NEW-SIZE '83 FORD**



Ranger XLT model shown



**A NEW CONCEPT IN PICKUPS.** Ford's American-built Ranger combines high mileage with big-size room, ride and features.



**39** EST HWY **27** EPA EST MPG

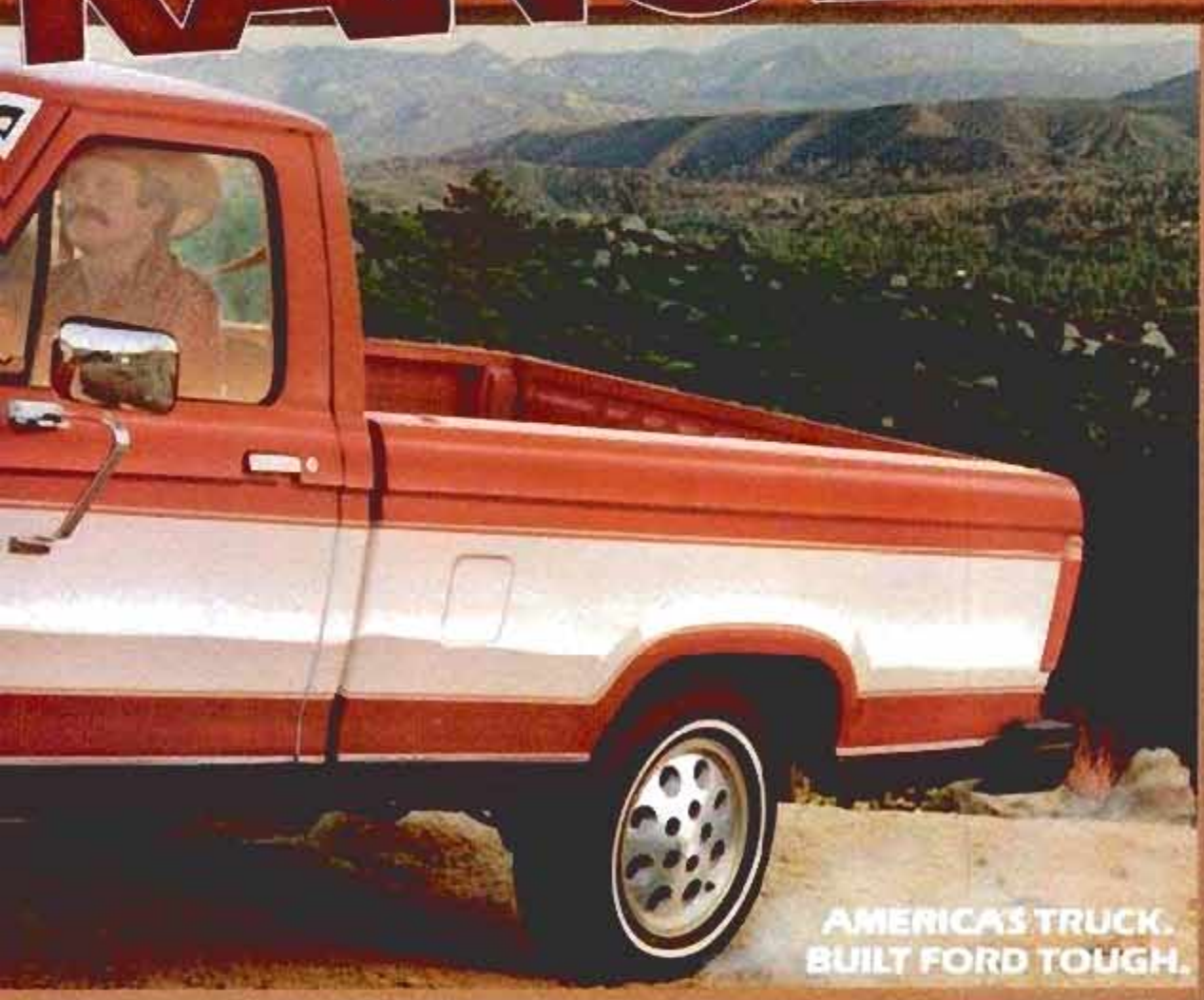
Projected Ford ratings with 2.0L engine. Use for comparison. Your mileage may differ depending on speed, distance and weather. Actual highway mileage and California ratings lower. May require FS option. See your Ford Dealer for EPA mileage guide.

**TWIN-I-BEAM** suspension. The only small truck with it. And it's computer-tuned for smooth ride.

**DOUBLE-WALL** box sides mean dings on inside won't mar the outside. No import has it! Choice of 6- or 7-ft. box.

**BUILT LIKE THE BIG ONES,**

# RANGER



AMERICA'S TRUCK.  
BUILT FORD TOUGH.



**8' PANELS** lie flat on crosspieces fitted into notched sides. The only small truck with it.

**600-LBS.** payload option. More than most compacts and many standard-size pickups!



**SEATS 3** in the widest cab of any small pickup. Ranger rides you high, wide and handsome!



**XLS SPORT MODEL** shown above. Other options: 2.3L 4-cylinder truck engine. Trailer Towing Package. Auxiliary fuel tank.

FORD

FORD DIVISION



## SAVES LIKE THE SMALL ONES.

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

# Winston

Nobody does it better.

This is your world.  
This is your Winston.  
The only low tar  
built on taste.  
**Winston Lights**



11 mg. "tar", 0.9 mg. nicotine av. per cigarette, FTC Report DEC. 81

# 11 ways to ensure trouble-free mowing this summer

Proper preseason maintenance of your power mower can mean savings in time and money.



**1** Clean sparkplugs with a wire brush and set gap as recommended in the owner's manual. Wire feeler gauge is used here.



**2** Turn the mower on its side to give the underside an overall inspection. Make sure each wheel nut is firmly tightened.



**3** Tighten the engine bolts. Then clean and inspect the cutter bar carefully. If it is bent or cracked, replace it.

If you're like many homeowners in the spring, servicing your power mower may be fairly low on your priority list. You put it off and let a few weeks of warm weather slip by and then you realize the grass needs cutting. You assume that if the mower starts up readily after sitting idle all winter, it must be in good running order.

Maybe so and maybe not. The engine may start, but it certainly won't run as efficiently as it could if you are using stale gas in the tank since last winter. If you didn't drain the tank last fall, then do so now. Refill with fresh fuel as recommended by the mower maker after you give the mower a general overall inspection.

Proper maintenance will help your mower cut better, make your job easier and safer, and add several years to the life of the mower.

The major steps that should be followed as a seasonal routine are shown in the photos on these pages.

A dirty sparkplug is one of the most common problems preventing engines from starting and running properly. Reset the plug after cleaning, but for safety, don't attach the sparkplug wire until you have finished the entire maintenance procedure.

If you have an older mower that is noisy and vibrates a lot, you may not notice wheels becoming dangerously loose. If a wheel pops off and the cutter bar is run into the ground, the mower could be jerked from your control. Tighten nuts as shown in photo No. 2.

While the mower is on its side you  
*(Please turn to page 82)*



**4** To remove or tighten cutter bar, hold in place with a screwdriver shaft inserted into a drain hole (left hand). Then use a wrench to turn cutter-bar mounting bolt. To tighten, turn clockwise as shown above.



**5** Remove packed grass from all underside areas of the mower. Don't neglect outer areas that are clear of cutter bar; accumulated grass can cause weight buildup and make mower harder to operate.



**6** Make sure the mower's drive belt is properly tightened and not frayed or cracked. The drive belt may be partly inaccessible, but don't ignore this check. Turn the driveshaft by hand to inspect the full length of the belt. (Check your manual.)



**7** Use a dipstick to check the oil level, and always do it when the engine is on flat ground. Check oil level every five hours of use and change it after 25 hours. Always change oil when the engine is warm.

Photos courtesy Jacobson Consumer Products, Homelite Div. of Textron Inc.

# PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

## Pocket-size sharpener

This handy little sharpener features two, 4-in., alumina-ceramic sharpening rods that store neatly in the body of the unit. To use it, simply stand the rods in the two holes on the base and stroke your knife—or other sharp-edged or pointed tool—along the rods. Unless the tool is in



Rods stand in base holes when sharpening (top), store under base clip when not used.

very bad shape, a few strokes will produce a good keen edge.

Made by Buck Knives Inc., Box 1267, El Cajon, Calif. 92022, the Mini-Crock Stick retails for \$6.50 at hardware stores.—Rosario Capotosto

## Trouble-free attachment

If you have ever been annoyed by a trouble light that seems to always shine in your eyes instead of on your work, here's a solution.



Hook holds the light where you want it.

Called the Adjusta Hook, this tool mounts easily in place of your existing hook and, once installed, directs light where you want it. Just pull down on the light handle, twist to the left or right and release; the fixture will lock in any one of six positions. It sells for \$4.95 postpaid from the manufacturer: Adjusta Hook, Box 129, Dept. PM, Phoenix, Ore. 97535.—H.W.

## A better mousetrap

The Safe-Tee Stick-Em mousetrap is a springless, nonpoisonous, dispos-

able trap that works on the same simple—and sound—principle as flypaper. Once a rodent enters the box, it becomes stuck in adhesive and dies within 24 hours. Then you can dispose of both together. Made by J.T. Eaton & Co. Inc., 1393 East



Mousetrap is 6-in.-long paperboard tunnel with a powerful adhesive coating inside.

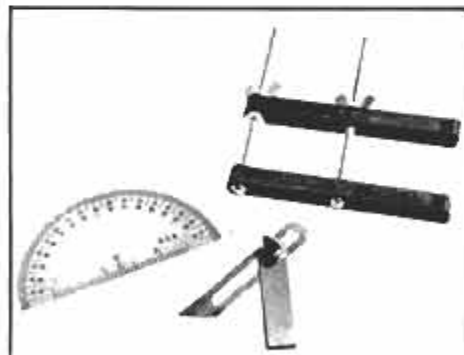


Rodent enters trap from either end and gets stuck. It dies and trap is discarded.

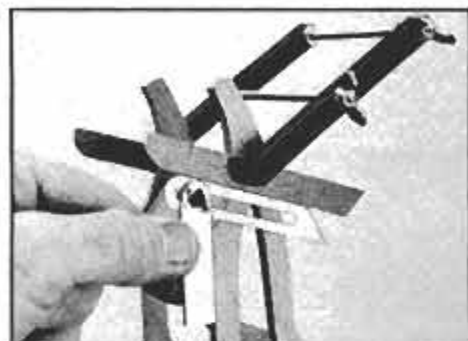
Highland Rd., Twinsburg, Ohio 44087, they are sold at hardware stores for \$2.49 a pair.—S.W.

## Minitools

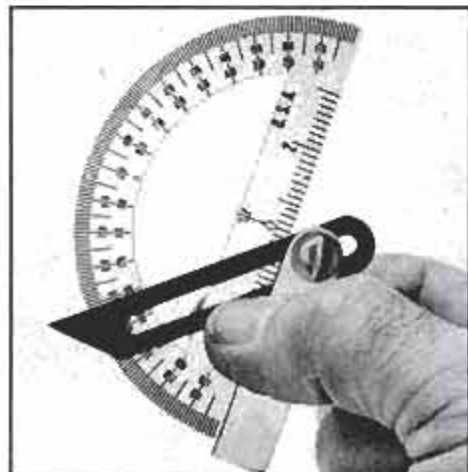
Here are a couple of inexpensive tools made to please anyone who works on a miniature scale. The small plastic clamp retails for \$1.79 and can handle pieces up to 3 x 3/4 in. The brass, sliding T-bevel, called a universal miter, has a tool-steel knife and costs \$6.95, protractor included. Both are available at hobby stores or from the maker: Jarmac,



Mini-adjustable clamp and universal miter with protractor are ideal for small work.



These lightweight tools are easy to control, even when you work on delicate models.



The universal miter comes with a small protractor for setting angles precisely.

Box 2785, Springfield, Ill. 62708. If ordering by mail add \$1.—Rosario Capotosto

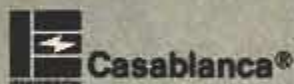
## Home and shop updates

Several readers have written regarding the bin capacity in our plans *How to Build Your Own Back-Yard Coal Bin*, page 190, Oct. '81. Figures differ on the average weight of a cubic foot of anthracite coal, but, according to figures supplied by readers, our bin would be about .8 ton short of 2½ tons. The rule: If you want your bin no larger than necessary, use weight figures supplied by your local distributor, then calculate your dimensions.

In our May 1980 *PM Workbench* (page 84), we told readers about a free, 80-page welding manual available from Nassau Research Corp., Box 175-PM, 1471 Jersey Ave., North Brunswick, N.J. 08902. Nassau is no longer able to furnish the booklet free. The price is now \$1. **PM**

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

# FIX-UP VALUES



Decorative ceiling fan stirs a nostalgic breeze, reduces heating and cooling costs. Quiet 3-speed motor and 36" blades in white or brown. Simple to install. CF2036/W **99.99**



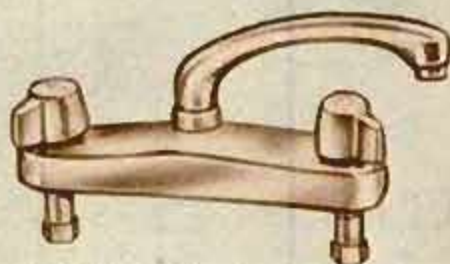
**True Value**  
HARDWARE STORES®

At more than 6,000 True Value Hardware Stores and Home Centers, you'll find friendly, courteous service plus quality brand name products priced to make your home improvements economical and enjoyable, roof top to basement floor. For the True Value Hardware Store or Home Center near you, look under "Hardware" in the Yellow Pages. 



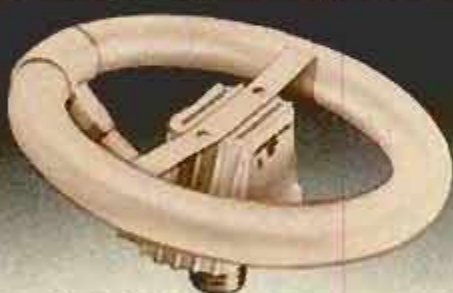
### Great Neck All-Steel Hammer

16-oz. drop forge steel hammer has a sturdy tubular handle plus curved claw design for fast nail pulling. Rubber grip absorbs shock. S160 . . . . . **2.99**



### UNION Washerless

Trouble-free washerless faucet is cast brass with chrome finish and directional spout. 4825 . . . . . **24.95**  
Kitchen faucet with spray. 4835 **29.95**



### L&L "The Little Watt"

22W fluorescent bulb emits as much light as a 75W bulb. Burns longer, cooler, with less glare. Saves up to 69.5% in lighting costs. 2201E . . . **6.33**



### True Value Waste Disposer

Stainless steel blades chew up tough garbage, even bones, fast. Sound insulated, resists jamming and corrosion. Easy to install. TV103 . . . **49.99**



**2 FOR 1**



With this coupon get 2 keys duplicated for the price of one! Single bitting only. Limit 1 pair per customer. Offer expires May 8, 1982.

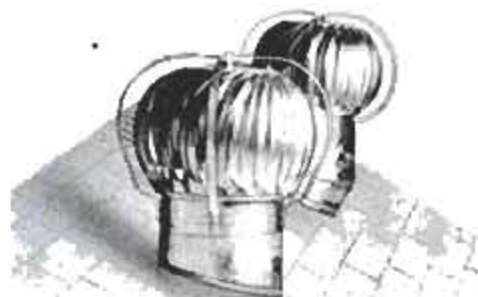
TEAR OUT AND SAVE THIS 8-PAGE SHOPPER.





### Welcome Home Chime

Non-electric decorator door chime sounds a cheerful welcome sound. Provincial white with gold trim. No wiring required. 358C **8.88**  
Lighted pushbutton doorbell. 715G ..... **2.39**



### Arvin Free As The Breeze

Turbo-Vent uses the wind, not electricity, to cut cooling costs up to 25%. Weatherproof and easy to install on the roof. WB12 . . . **19.99**  
Sturdy, adjustable base. AJ-12 ..... **8.99**



### Attic Ventilator

Expel trapped attic heat to cut cooling costs, improve comfort in non-air conditioned homes. Installs on roof. Thermal protected motor. N3400 ..... **44.99**

# Make savings work

Make your headquarters for indoor and outdoor home care one of over 6,000 True Value Hardware



### ITT Yard Light

Automatic 175W mercury vapor light discourages intruders, provides "after dark" illumination for sports, entertaining or chores. R175 . . . **31.88**



### Leviton Sure-Gard

Grounded fault receptacle prevents injuries by protecting all standard outlets on same circuit. Has indicator light, test button. 801-61981 . . . **18.66**



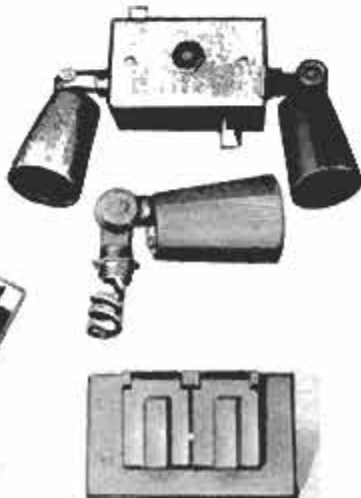
### NIGHT SENTRY Timers

Electronic timer turns lights on and off up to 48 times daily. WTA-341 **16.88**  
3-way timer WTA-343 **19.88**  
Tabletop lamp timer with dimmer. TC485 . . . **22.88**



### CAROL Electricals

3-wire trouble-lite has outlet, 25' cord, grounded metal guard. 14465 . . . **5.99**  
Power center has 3 grounded receptacles, 3' cord. 00645 . . . **2.29**



### Security Light

Night Guard goes on at dusk, off at dawn. Uses 2 par-75W or 150W lamps. 10840G ..... **18.89**  
Lampholder. 10330 . . . **1.79**  
Duplex snap cover. **1.49**



### SQUARE D COMPANY Switch

30-amp indoor safety switch for both residential and commercial use. Handles lighting, air conditioning, appliance loads economically. 0211N . . . **14.99**



### WV Reel Light

Trouble light with heavy-duty steel retractable reel winds 20' of SVT 3-wire cord into tool-tap outlet mounted on a wall or ceiling. Has hardware. 212 **14.99**

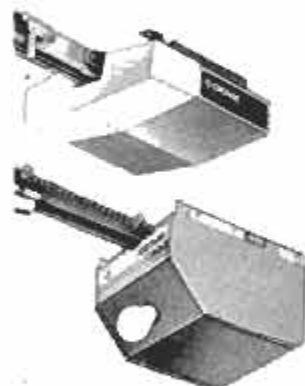


1299  
- 200 rebate  
1099 final cost



### Circle of Light

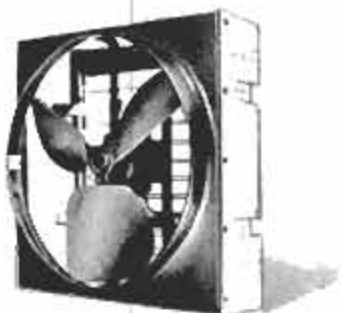
Circlite combines best features of incandescent and fluorescent. Only **12.99** less \$2 factory rebate. FCA44/SW. 2-level Circlite. **16.99** less \$3 rebate. FCA44/SW-2.



### GENIE Open Doors

Chain driven with dual safety adjustments, program relay and light. 1/4-hp. GS209SR . . . **119.99**  
Screw-drive opener with 1/2-hp motor, lights. GS850 . . . **179.99**





### **Top Quality Performance**

Variable speed fan mounts at any angle on ceiling or wall. Venturi funnels air efficiently. Easy to install, no need to cut joist. 1/2-hp, 30" blades with shutter. WHF 1130/WST1130. . . **199.99**

### **Hunter Comfort At Every Turn**

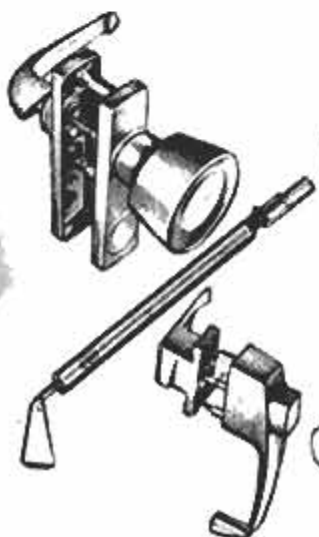
Ceiling fan is a decorative way to supplement heat and air conditioning. Heavy-duty motor runs quietly. 52" pecan-finished wood blades reverse. Easy to install. 22272/580 . . . . **199.95**

### **CONTICO Curbside Mail Box**

This charming weathered barn is actually 1-pc. molded polyethylene with magnetic closure to protect mail from the weather. 9 1/2 x 9 1/4 x 18" inside dimensions. MB101 **22.99**

# for you at

Stores. Look under "Hardware" in the Yellow Pages.



### **Tru-Guard™**

1 1/2" wide laminated steel padlock, double-locking shackle, precision solid brass 4-pin tumbler, 2 keys. 342-22-51 . . . . **2.98**  
2" padlock. 346-22-51 **4.48**

### **Wright Latch It**

Alum. latch for doors 3/8-1 1/8" thick. V777 . . **5.44**  
Hydraulic door closer, latch control. VH440 . **6.44**  
Pushbutton storm door latch. V333 . . . . . **5.74**

### **Kwikset Locks**

Entry lockset has key-in-knob locking and inside button. 4C0BCP-3 . . **11.88**  
Deadlock has 1" steel bolt. 660-KSP-3-KA2 . **10.88**  
Double cylinder . **16.88**

### **Shim City Add Space**

Create tool racks and utility storage shelves. 12" bracket. B-24 . . . **1.37**  
4" channel. C4-10 . . . **2.72**  
6" utility hook. UHR-24 **67¢**  
Tool holder. T60 . . . **47¢**

### **KV Shelving**

Turn empty space into a showplace. Simulated pecan shelves. 1981P. 8x24" **3.99** 8x36" **5.29**  
8" brackets. 176BRP . **1.44**  
4' standards. 76BRP . **3.99**



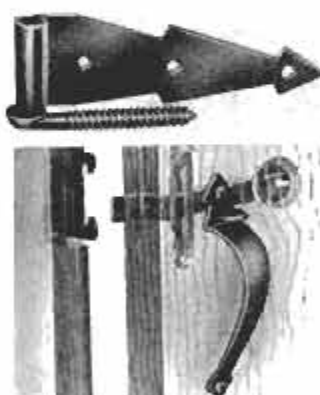
### **md Door Grilles**

Aluminum mesh push grilles protect screen or glass in wood or aluminum doors. 19-36" expanding grille . . . . . **12.99**  
30x36" for patio doors . **19.44**



### **True Value "Big Mover"**

Move furniture, desks, appliances, bulky boxes, etc. with a smooth-rolling steel dolly. 3 ball bearing swivel casters won't mar floors. AS355 . . . . . **3.99**



### **National Secure Gates**

7" ornamental strap hinge with screw hook for gates, doors, posts. V844 . . . . . **7.88**  
Latch for outswinging doors, can be padlocked. V29A00 . **6.44**



### **K Home Protection**

Handy all-purpose Home™ fire extinguisher uses non-toxic dry chemical to snuff out electrical, wood and liquid home fires. UL listed. 1A:10BC:C. H110 . . **12.99**



### Stainless Sink

Stainless steel one-piece unit with pre-drilled faucet holes. Double bowl. 533E ..... **35.95**  
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Utility/bar sink. K15598 .. **39.95**



### Zenith Cabinet

Lighted surface mount medicine chest has sliding full-strength mirrored doors, twin sockets for total illumination. Chromed frame. 701. .... **39.95**



### Hall Mack

### NuTone Bath Set

Add a rich look of antique brass. Towel ring. HM1686AB ..... **7.95**  
16" bar. HM1694. **9.95** 24" . **12.95**  
Double hook. HM1682AB .... **4.49**  
Paper holder. HM1670AB ... **9.95**



### plaskolite Shower

ABS stall won't rust or leak, installs easily. Complete with shower head, curtain, grab bar, faucet. 32x73 1/4". SS1000 . **119.95**  
High-base stall. SS2000 . **159.95**

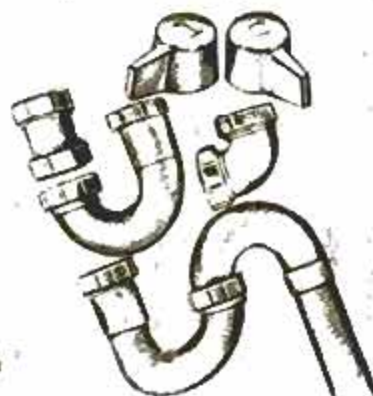
# Catch up on your

The newest, finest fix-up products plus expert how-to advice give you professional



### Chicago Specialty Repair

Steel jawed wrench installs faucets fast. Easy to use in close quarters. 3000C ..... **4.99**  
Choose 1 1/2" or 1 1/4" Flexidrain. 2695/4C. Ea ..... **3.99**



### Chicago Specialty Sink Repair

Faucet handles. 210 ..... **2.99**  
Univer. slip coupler. 2684C **1.49**  
Universal "S" trap. 2662C .. **4.99**  
Your choice universal J-bend or 90° elbow. 2663C/2686C. Each **1.79**



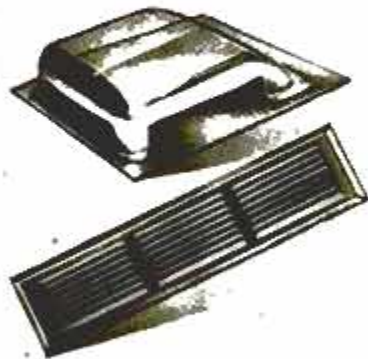
### SANITARY-DASH Parts

It's easy to replace or install plumbing with these quality parts. 1 1/4" chromed J-bend. R60 . **3.99**  
1 1/2" chromed J-bend. R63 . **4.49**  
Chrome duo-strainer. T1461 **6.49**



### MELARD Auger

Drain-cleaning tool bores easily through clogged pipes. 1/4" spring steel wire will not snag or catch. Enclosed in blue cannister. 1761 ..... **5.99**



### Letch Ventilators

Compact aluminum roof ventilator continually siphons attic air, up to 94 sq. foot area. 405 .. **5.99**  
Aluminum under-eave ventilator. 622. 16x4" . **.99¢** 16x8" . **1.19**



### Simar Geyser®

Submersible pump with bottom screen pumps water to within 1/2" of floor. Easy to use with hose or 1" pipe. Metal construction, with 8-ft. cord. 2130 ..... **49.95**



### NEMCO PRODUCTS COMPANY Dryer Kit

Fully-assembled dryer vent kit has aluminum hood, duct, tension-type clamps for easy installation. 4" diam. 5' long. AF45K . **5.49**  
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### True Value Sump Pumps

Cast iron 1/2-hp pedestal, overload protected. TVSPY500 . **59.95**  
1/2-hp upright. TVSPY800 .. **79.95**  
1/2-hp submers. TVCDU790 . **72.95**  
1/2-hp submers. TVCDU800 . **88.95**



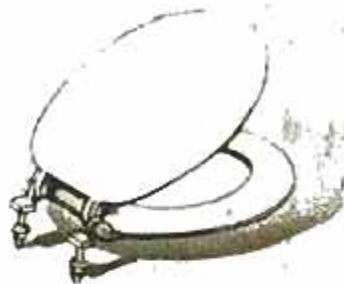
**alsons Pulsating**  
**Massage Action™** shower soothes tired, tensed muscles, hand-held or wall-mounted. Chrome finish with 59" hose, adjustable spray dial. 45C **26.95**



**Mayfair Cane Top**  
 Enamel seats have vinyl cane inserts, easy install dial-on hinges. White/brn. 330Ea. **8.95**  
 Padded vinyl soft seat has dial-on hinges. Colors. 130 . . . . **9.95**



**WaterPik Pure Delight**  
 Pulsating shower massage with adjustable spray. SM2-U . . **19.95**  
 Instapure® filters chemicals & minerals that cloud water. Installs to standard faucet. R-C . **24.95**



**MAGNOLIA Sit Pretty**  
 Enameled wood seat, extended back and top-mount hinges offer beauty, comfort, easy-cleaning. Simple to install. Neutral white. M100 . . . . . **5.99**

# fix-ups at

results when you do-it-yourself. Just say "charge it"



**Wash CONTROL Faucet**  
 "Temperature memory" control can be opened and closed at the same temperature to save water. 84501 . . . . . **26.95**  
 With pop-up drain. 84521 **32.95**



**Delta Washerless**  
 Trouble-free chrome-finished kitchen faucet has convenient one hand operation plus handy spray attachment. Single lever faucet. 400/400WF. . . . . **39.95**

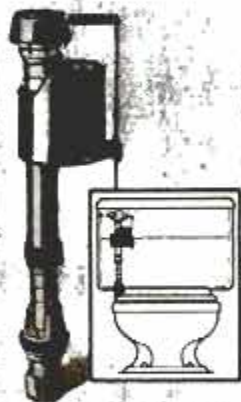


**Aster Laundry Tub**  
 Lightweight polypropylene tub is rust-resistant. With 2 soap rests, splash guard. 725F **20.95**  
 Laundry faucet has 6" spout, hose connection. 871-060 **17.95**

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**FLUIDMASTER, INC.**  
 Non-corrosive FLC valve puts an end to toilet leaks and noises without float-ball or water pressure problems. Fits most standard tanks. 400A . . . . . **4.99**



**BY PRICE PFISTER**  
 Replace rusted and leaking sill cocks with a durable, long life solid flange. Has oval handle for 3/4" hose end. Available in 1/2 or 3/4" I.P.S. V87-010/110 . . . . **2.79**



**INTERMATIC Timer**  
 Controls electric water heater's operation by automatically reducing quantity and temperature of hot water, saves up to 33% on your fuel bill. WH40 **27.98**

**Energy-Savers**  
 Efficient water heaters feature fiberglass insulation to trim fuel bills. Gas unit has low-consumption pilot light. Electric is protected from overheating.



**Master MECHANIC®**

Leather Carpenter Apron has easy-access Square Pockets™, 2 large and 2 small nail pockets, tool pockets, holders for 2 hammers, square, tape. Web belt. MM14427M **21.50**



**Master MECHANIC®**

8" Pipe Wrench has replaceable steel jaws, full-floating hook jaw assures instant grip and easy release. Won't jam on pipe. Hang-up hole. MM8 **7.29**



**Master MECHANIC®**

Utility Knife tackles dozens of tough jobs with a keen cutting edge. Retractable blade locks in 9 positions. Extra blade stores in body. 109819 **1.89**



**Master MECHANIC®**

Carbide-Tipped Blade outlasts others up to 10 times, alternate top bevel cuts smooth. For use in wood, compositions, non-ferrous metals. 7-7/8". 440867 **17.75**

# Master MECHANIC® Professional

Master MECHANIC hand and power tools are sold exclusively by True Value. If any Master MECHANIC tool fails to perform as you would reasonably expect, return it.



**Master MECHANIC®**

Wet-Dry Vacuum cleans up messes an ordinary vac would "choke on", from ashes to flooded basements to workshop debris! Tank design allows free airflow, maximum efficiency empty or near-filled. Float valve prevents liquid overflow; motor protected from water and dirt. Lightweight, easy to use on 4-wheel dolly. 6-gal. tank, 6' hose, 1 1/4" wand, 10" nozzle, squeegee shoe. MM600-6 **49.95**

Home Safety Kit is designed for use in the workshop and yard with goggles that fit over glasses, a non-toxic dust respirator, comfortable earplugs. Protects user running power tools, chain saws and lawn mowers. MM3 **4.89**



**Master MECHANIC®**

Professional Tool Chests have tough "strongbox" construction with sturdy solid steel throughout, reinforced tops, full-length hinges and compound drawer slides. Stacked or used separately, they're big enough for a workshop full of tools. Keyed cylinder locks, baked-on enamel finishes.

6-Drawer Chest has 3 large and 3 smaller drawers, 4-section lift out tray. 15x26x13 1/2". MM1806 **92.99**

3-Drawer Roller Cabinet has large storage area, brakes on 2 casters. 33 1/2 x 26 1/2 x 18". MM1903 **120.99**

19" Hip Roof Tool Box has removable tote tray and single drawbolt with padlock eye. MM819 **12.79**

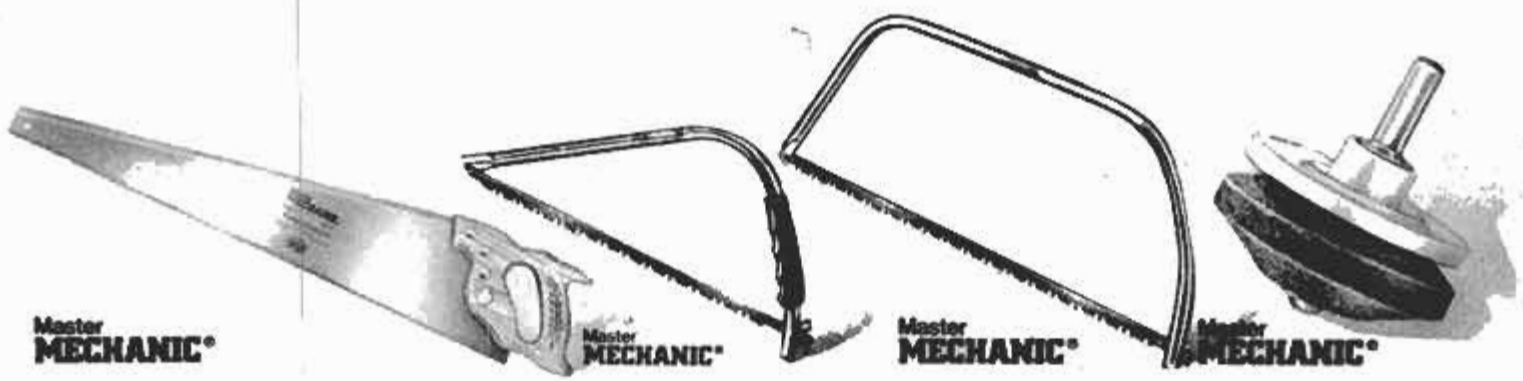


**Master MECHANIC®**

Precision Miter Box lets you make secure, accurate cuts at any angle, from 45° right to 45° left. Cast metal back and wood base, with guides for precision cutting. MM3618 **16.99**

Professional Aluminum Level features six unbreakable vials, four plumb and two level, that are sealed against dirt and moisture by heavy glass windows in a heavy-duty frame. 10121 **14.49**

8" Try Miter Square has a copper-clad blade for easy reading, rust resistance. Top edge is marked in inches, lower edge metric. 6" brass edged mahogany handle. 10191 **6.79**



**Master  
MECHANIC®**

**26" Crosscut Saw.** 8-pt. blade is precision-ground and ribbon-stripped to reduce friction. Hardwood handle is secured by 4 nickel-plated screws. MM30080 **8.29**

**Master  
MECHANIC®**

**21" Pruner** has chromed tubular steel frame with handy grip. Screw adjusts blade tension and allows quick blade change. With 4-tooth raker design. MMP21P. **4.39**

**Master  
MECHANIC®**

**36" Bow Saw** has chromed tubular steel frame with screw adjustments to change blades easily, set tension quickly. Blade has 4 tooth raker design and guard. MMP36BS. **6.39**

**Master  
MECHANIC®**

**Mower Blade Sharpener** works with any electric drill. Self-lubricating nylon guide automatically aligns abrasive wheel to bevelled edge of the blade. MM4294 **1.39**

# Quality Tools



Hardware Stores and carry this customer satisfaction policy: to any participating True Value Hardware Store for immediate replacement.



**Master  
MECHANIC®**

**Professional Claw Hammer**, polished octagon neck and face, contour crown resists chipping, beveled nail claws. Hickory handle is triple wedged, epoxy-sealed to head. F16MM. **8.75**

**6-pc. Screwdriver Set** has large grips that fit your hand for more turning power. Chrome vanadium steel blades give tensile strength without abrasion. Precision tips. T36. **9.49**

**Professional 100' Steel Tape** in vinyl-clad steel case. White epoxy-coated line is graduated feet, inches, 8ths with red and black markings. 16" centers clearly indicated. MMP100 **12.29**



**Propane Torch Kit** with brass valve for long wear, gives adjustable heat to lay tile, thaw pipes, etc. 26.7-oz. fuel cylinder, burner assembly, 3 tips, spark lighter in case. MM99-65. **12.25**

**15-Drawer Parts Cabinet** helps you organize those small, "easy-to-misplace" items in the home, workshop or garage. Transparent drawers in steel frame. MMC15. **6.29**

**Dual Rivet Gun** sets 1/8", 5/32", 3/16" steel and aluminum rivets. Popular, multipurpose tool comes with an interchangeable nosepiece, wrench, rivet assortment, pouch. K110MM. **6.59**



**29-pc. Drill Bit Set** in metal index box. High speed steel with heat-hardened points for smooth 1-stroke drilling. Sizes from 1/16" to 1/2". Reduced shanks on large sizes. 443424. **51.99**

**28-pc. Tap and Die Set** of high speed tool steel has tempered edges to cut NC, NF, NPT threads. 11 taps, 11 dies, 1 die stock, tap and t-handle wrenches, thread gauge, etc. 442640. **38.99**



SEE  
NEXT  
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FOR MORE  
FIX-UP VALUES



### Weller Soldering Iron

Features a  $\frac{1}{8}$ " replaceable tip that reaches temperatures of 750°. Pencil grip makes it easy to use on delicate work. 120V, 25 watts. UL listed. 3P23GA . **6.79**

### VISE-GRIP 7" Pliers

Adjustable straight jaw pliers lock on easily to grip small parts, clamp wood or metal, then release instantly. Has hardened cutters to snip wires. 7WR . **4.79**



### National Socket Set

Streamline work on appliances, electric motors, cars with 29-pc. set. 12 each  $\frac{1}{4}$ " and  $\frac{3}{8}$ " drive sockets, SAE & metric, plus tools and more. C8429 . . . . . **9.99**

### SEVERE Wood Chisels

3-pc. set:  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1" blades, austempered and bevel-ground to keep a keen cutting edge for shaping wood or composition. High-impact grips. 9855 . . . . **6.95**

# True Value *Spring fix-up values*

HARDWARE STORES®

For the True Value Hardware Store near you, look under "Hardware" in the Yellow Pages.



### SKIL. Sharp Performers to Saw and Sand

7 $\frac{1}{4}$ " circular saw features ball bearing construction, 2-hp motor with Vari-Torque clutch for motor overload and burnout protection, sawdust ejection. Cuts 2 $\frac{1}{2}$ " at 90°, 1 $\frac{1}{2}$ " at 45°. 6755 . . . . . **45.50**  
Lightweight Sandcat sander has ease of control of orbital, fast removal & low vibration of belt sander. Locking lever, 5 belts. 593 . **43.99**



### DURACRAFT® All The Works For Your Shop

5" bench grinder gives you 2 grits at once to strip paint and rust, sharpen tools, more. Adjustable tool rests, eye shields. 33-5 . **27.50**  
3-speed ball bearing drill press uses a  $\frac{1}{4}$ -hp motor to drill through hard or soft woods, metals, plastics, more at 700, 1560 and 3720 rpm's. With 4" throat depth and  $\frac{1}{2}$ " drilling capacity. SP30 . . . . **96.95**



### McCulloch Chain Saw

2.1 cu. in. engine has solid-state electronic ignition. 14" bar, chain, hand guard, anti-vibration system, automatic & manual oiling. Mac310 . **166.95**

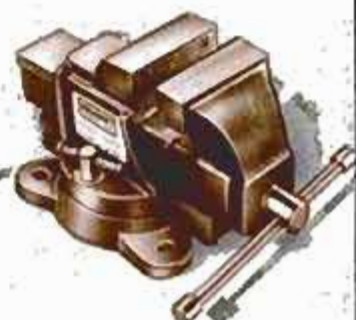
### REMINGTON. Limb'n Trim

Double-insulated electric chain saw has 12" hard nose bar to cut trees up to 24" thick. Has caged roller motor, hand guard, safety trigger lock. 767280 . . . . . **46.50**



### It's The Real McCoy

24" sawhorse provides a rigid, stable surface for the simplest household chores or toughest on-site jobs. Solid pine unit, easy to assemble. 04001 . **14.88**



### DURACRAFT 4 $\frac{1}{2}$ " Vise

Heavy-duty swivel base vise features an extra-wide base, smooth operating chrome steel lead screw, 2 locking nuts, replaceable jaw faces. HDV4 . **28.50**

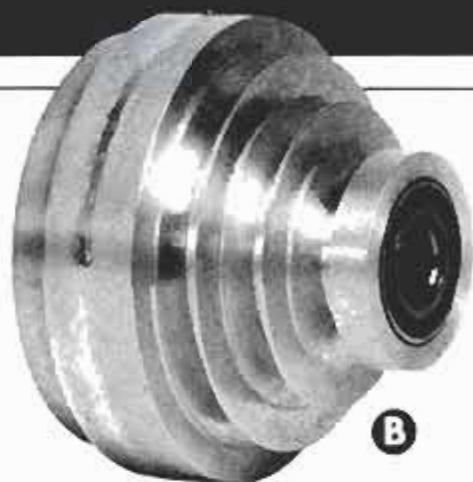
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**8-PAGE TEAR-OUT**

# NEW NOW for home and shop



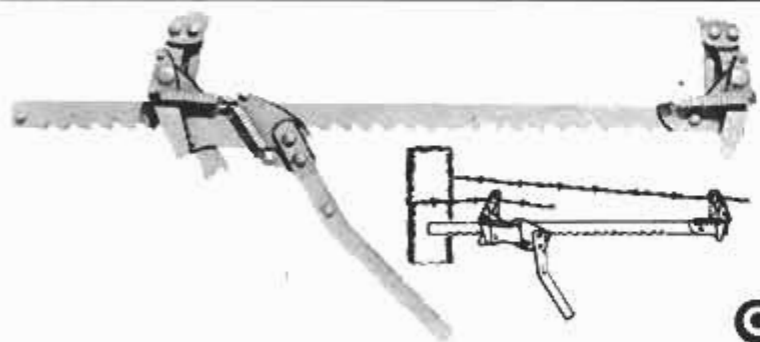
**A**



**B**

**A** The MicroMate (inset) is a combination microwave-oven shelf and range hood. It measures  $19\frac{1}{2} \times 30 \times 30$  in. and has a 20-watt fluorescent light fixture and a dual centrifugal blower which can exhaust up to 300 cu. ft. of air per minute. Solid-state controls automatically turn the blower to high speed if excessive range heat from below threatens the microwave oven. The unit, shown with oven installed at left, comes with a textured black surface and is about \$319 at appliance stores. It's made by Broan Mfg. Co., Inc., Hartford, Wis. 53027.

**B** A new, gear-driven speed reducer called the Pull-Gear is now available from its manufacturer, Darjay Industries, 105 Clark St., Box 4854, Augusta, Ga. 30907. It measures  $4\frac{1}{2} \times 5\frac{1}{8}$ -in.-diameter and was designed to work on machines that use a size A, V-belt drive. This shaft-mounted, three-step sheave unit houses a gear and pinion reducer that —when combined with the sheaves—makes possible spindle speeds between 75 and 3,000 rpm. The Model PG- $4\frac{1}{2}$  shown costs \$173.50 plus shipping.



**C**

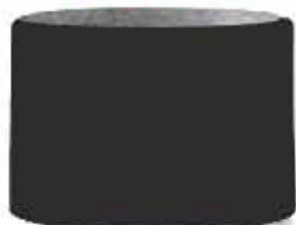
**C** Splicing, stretching and raising fence wire can all be accomplished with the Model 405 Golden Rod Fence Stretcher-Splicer. Made of heavy-duty steel, this tool has a fixed head at one end of a 32-in.-long bar and a traveling ratchet assembly at the other. Both ends have a lever-operated dog for gripping fence wire, as well as a large hook for anchoring either end on a post or tree. The tool provides up to 1,000 pounds of pull and remains locked in the desired position so both hands are free to staple or splice. It weighs 8 pounds and costs about \$28 at hardware and agricultural-supply stores. Made by Dutton-Lainson Co., Hastings, Neb. 68901.



**D**

**D** Hexsign is a new, easy-to-install wash basin that has a distinctive hexagonal shape. Made of enameled cast iron, it measures  $7 \times 19 \times 22\frac{1}{2}$  in. and is available in a wide variety of colors. It weighs 53 pounds and it comes with its faucet holes spaced either 4 or 8 in. apart. The sink's suggested retail price is \$112 at plumbing-supply stores. To obtain more information, contact the manufacturer, Kohler Co., Kohler, Wis. 53044.

**SO EFFECTIVE,  
NOTHING COMES  
CLOSE...**



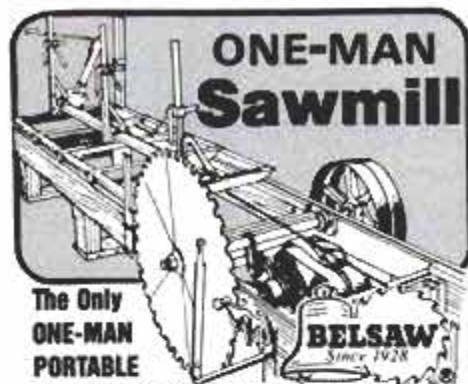
**English  
Leather.**

DEODORANT  
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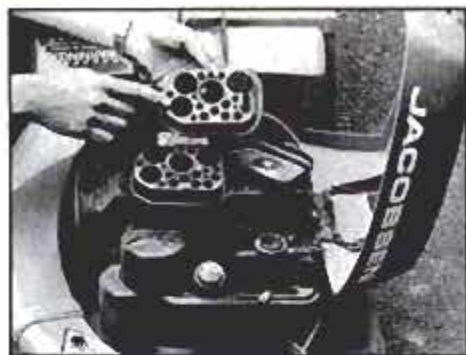
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**TROUBLE-FREE MOWING** (Continued from page 71)



**8** Keep the throttle cable adequately lubricated by regular application of 30-weight oil, as shown here. Aerosol spray lubricants may also be used. This is an important procedure that's often overlooked.



**9** Take the air cleaner apart and remove accumulated dirt and grease. Wash the foam element in kerosene or a liquid detergent. Squeeze it dry before replacing it.

can complete steps No. 3, 4 and 5. Tighten engine bolts and inspect the cutter bar. First, check to see that the bar remains unbent and in a straight line. If the bar is bent, as may happen if it strikes a curb, survey stake or stone, it should be replaced.

Next, check the end of the bar for any fine cracks. Many different cutting conditions can cause these cracks to appear. If any are discovered (scrape the blade clean to be sure) be certain to replace the blade. Such cracks can grow, eventually allowing a piece of the bar to be thrown out and possibly causing serious injury.

To sharpen the cutter bar, consult your maintenance manual for the proper angle.

Once you have completed all maintenance to the underside of the mower, turn it right side up and complete Steps 7 through 11.

Most manufacturers recommend a high-quality detergent oil. Before removing the oil-filler plug, clean the area around it to prevent dirt from entering the oil-filler hole. Add oil as necessary to keep the level full to the point of overflowing.

Many mower owners don't realize that throttle cables need to be lubricated. If your throttle is hard to

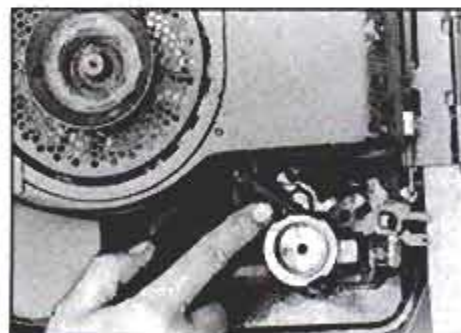
operate or seems to stick a lot, step No. 8 will probably solve the problem.

No two mower manufacturers have designed their air cleaners and carburetors in the same way. For this reason, check your manual or call your dealer for the best recommended cleaning procedure. The important thing to remember is that the foam filter should be thoroughly dry and resealed properly before you operate the mower.

When you have located the carburetor's needle valve, start your engine; let it warm to operating temperature at normal speed and follow these final adjustment steps: 1. Turn valve clockwise until engine starts to lose speed on a lean mixture; 2. Turn counterclockwise past point of smoothest operation until engine begins to run unevenly on a rich mixture; 3. Turn valve back, clockwise, just short of the midpoint for a slightly rich mixture.

Finally, remember the safety rules for operating any kind of power equipment. Watch for rocks or twigs that could be flung by the cutter bar with dangerous force. Do not cut wet grass! Not only will it not cut properly, but the risk of slipping, and a foot sliding under the mower is great.

PM



**10** Use a stiff brush, nonflammable solvent or compressed air to clean the linkage around mower's governor. Clogged linkage prevents proper operation.



**11** To make minor carburetor adjustments to compensate for differences in fuel, temperature, altitude and engine load, use a screwdriver in the slotted needle valve. This valve is usually visible through a hole in the carburetor housing.



# STOP STALLING. PUT IN AUTOLITE, THE WIDE-HEAT-RANGE PLUG.

If, some mornings, your car refuses to leave the driveway, or hates saying goodbye to stop signs, you may well be the victim of something called "cold plugs."

Poor starting, misfiring, and hesitating are often caused by oil and carbon deposits on the spark plug tips.

To burn these off, you need what are called *hot* plugs.

But, for effortless high-speed running on the highway, you're better off with *cold* plugs. (That's what race cars use.)

So what should you put in your car?

Try putting in, not just new plugs, but a new *brand* of plugs.

Autolite spark plugs. With Power Tips.\*

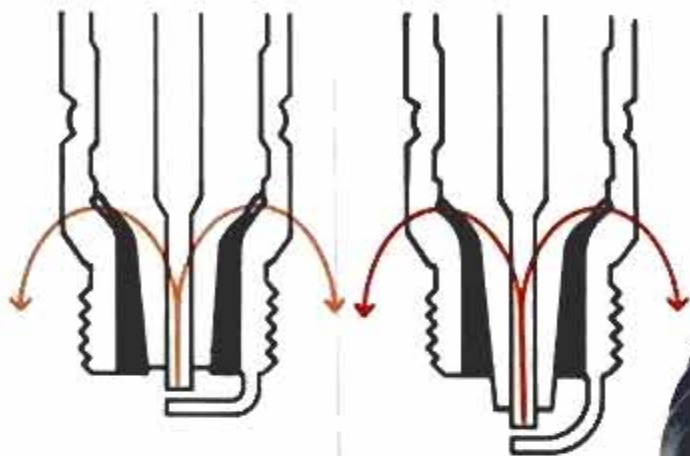
The Power-Tip Autolite is a remarkable plug. It has what mechanics call a *wide heat range*.

Because of its wide-heat-range design it works like two plugs—a hot plug *and* a cold plug.

It runs hot on short trips, to burn off carbon, and cold on long trips, for smooth driving.

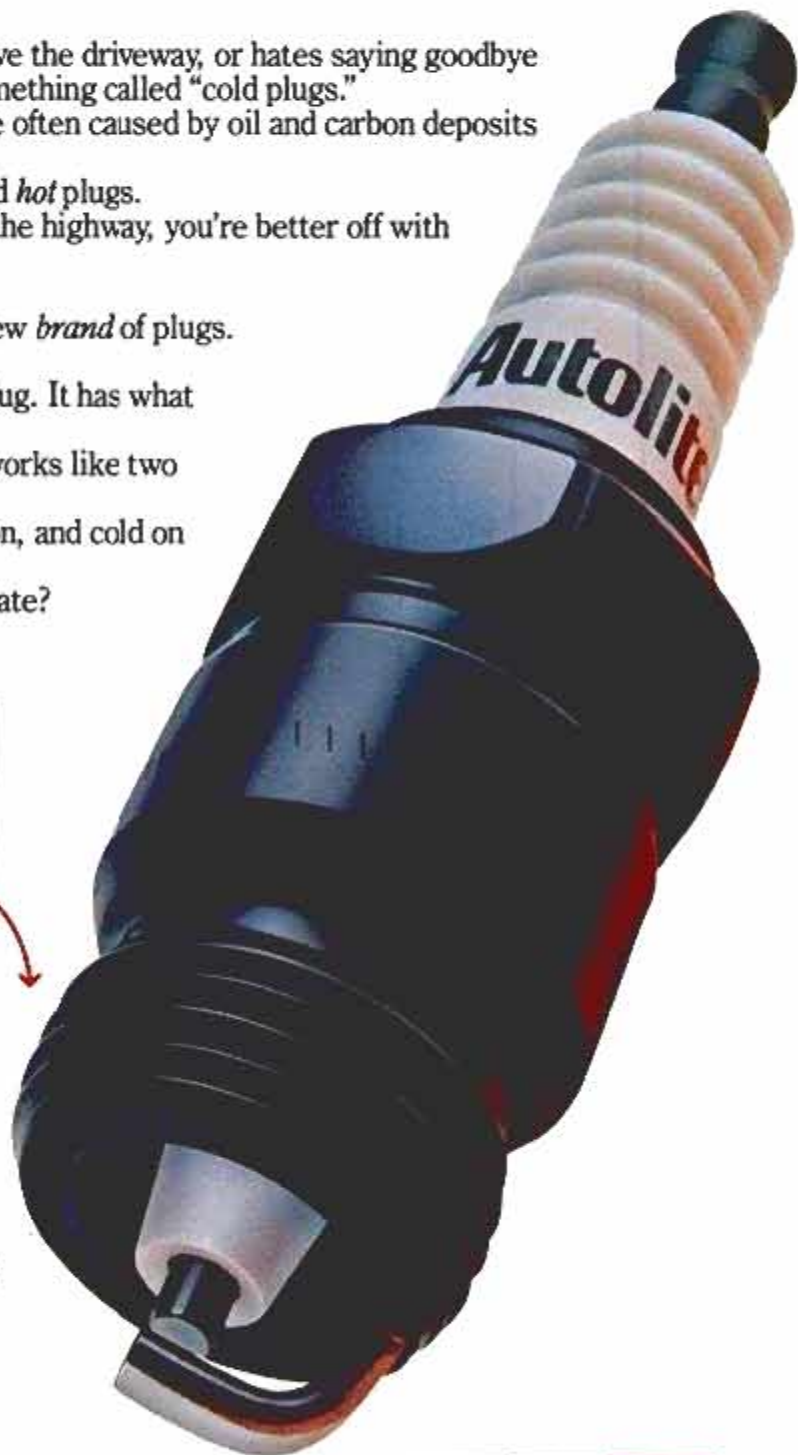
So if your car stalls or misfires, why hesitate?

Put in Autolites.



In an ordinary plug, the tip is short, which makes it lose heat faster at low speeds. And, because it's not as exposed to cool intake gasses, it stays hotter at high speeds.

Autolite Power Tip plugs have longer insulators and electrodes. Heat transfers more slowly at low speeds, so carbon burns off. But at high speeds, low-temperature intake gasses keep the tip cooler, to help prevent pre-ignition and overheating.



\*Available for cars where space in the combustion chamber is sufficient to accommodate the Power Tip.



Fram and Autolite are Bendix Companies  
Fram Corporation, Providence, Rhode Island 02916

# Two basement water alarms you can make yourself

You can control basement flooding with these two easy-to-make alarms.

## Sump-pump alarm

Sump-pump failure is a worry for all homeowners who depend on their pumps to prevent basement flooding. And since sump pumps are located, by necessity, in damp areas, where rust always takes its toll, failures are common. There are commercial alarms, starting at \$17, which you can buy. But many PM readers will enjoy making their own and saving the money.

This inexpensive alarm can be assembled easily by referring to the drawing. Aluminum may be substituted for the Plexiglas sheet and an ordinary carriage bolt could be used in place of the hinge pin. The critical consideration is that the bottle-float shaft move freely within the stationary "sleeve." Sleeves like the one shown are available at electrical-supply stores, but any exterior threaded tube and two nuts could be used.

Place the alarm where it will be heard from the living quarters.

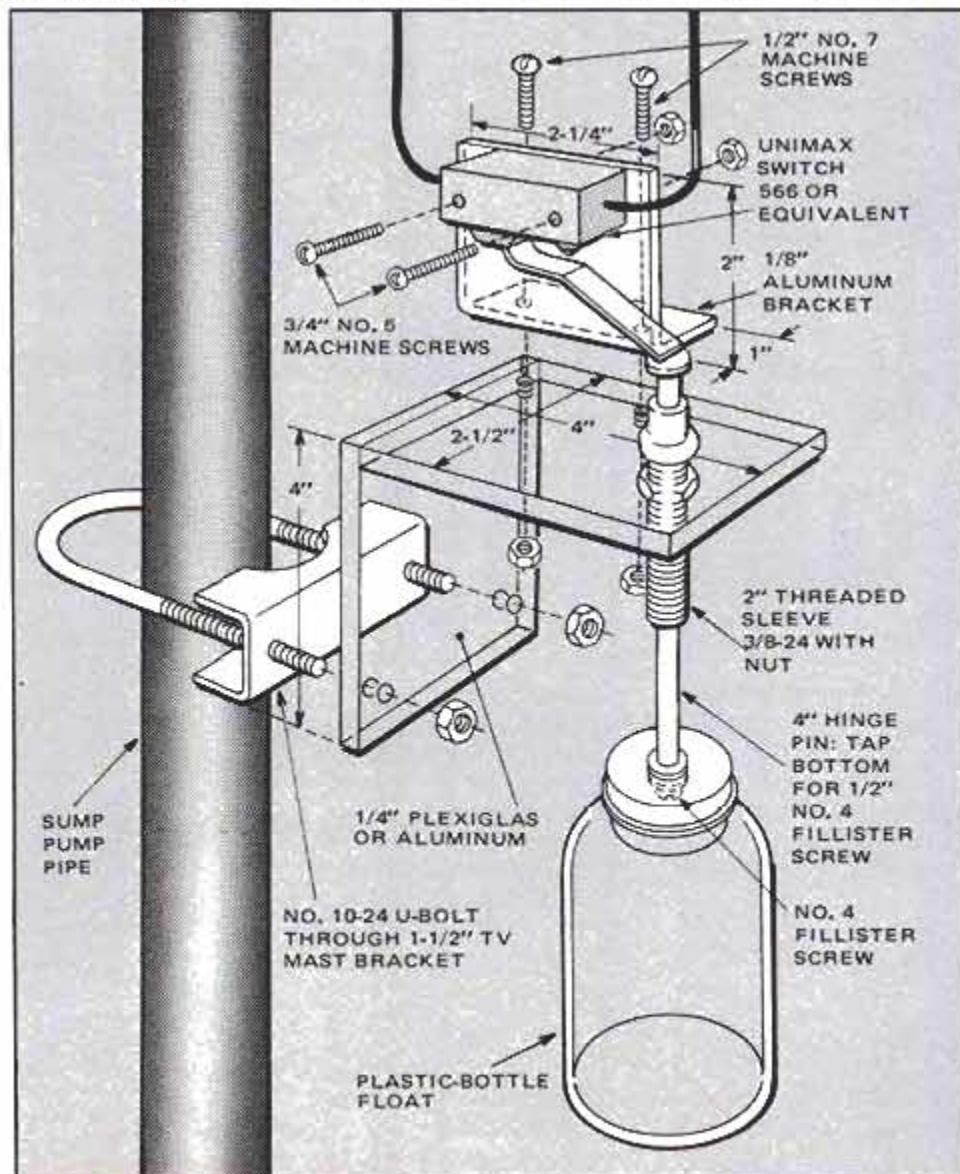
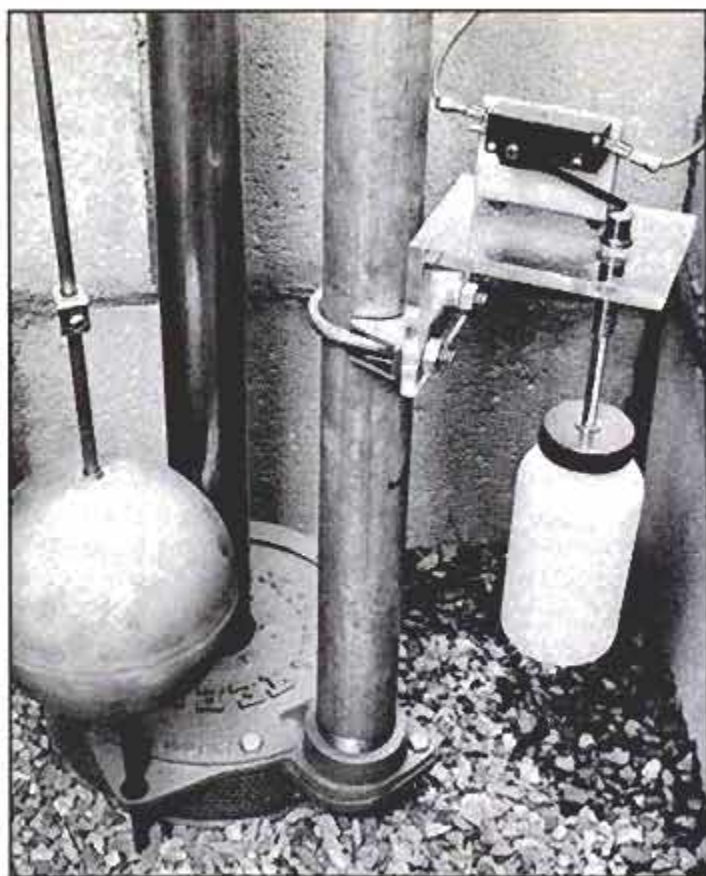
Use a 6-v.d.c. lantern battery to power the alarm bell; test it about every six months. If you're tempted to use a discarded car battery, be aware that it can generate hundreds of amps. To avoid any hazard of melted wires or fire, put a fuse in your circuit between the positive battery pole and the alarm.

We suggest the Unimax switch (available at Radio Shack), because it allows flexibility in the power source you use. The other switch consideration is the pressure needed to trip the switch. Some model No. 556-type switches have lever arms that multiply the force; others don't. If your switch does, you can use a relatively small float.

Place the alarm device with the float slightly above the pump float activating position. This will probably require some trial and error work, as sizes of floats and the pressure in triggering mechanisms will always vary. You can do this by hand, but don't leave the sump pump running for long without any water to pump.—George TenElshof

(Please turn to page 87)

Position your alarm so that its activating position is just above the sump-pump float (near right) activating position. This will be nearly impossible to do by eye alone, so manipulate the sump-pump float by hand, turning pump on momentarily.



# Carol Extension Cords: for people who are hungry for power.

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## CAROL



# It lasts and lasts and lasts


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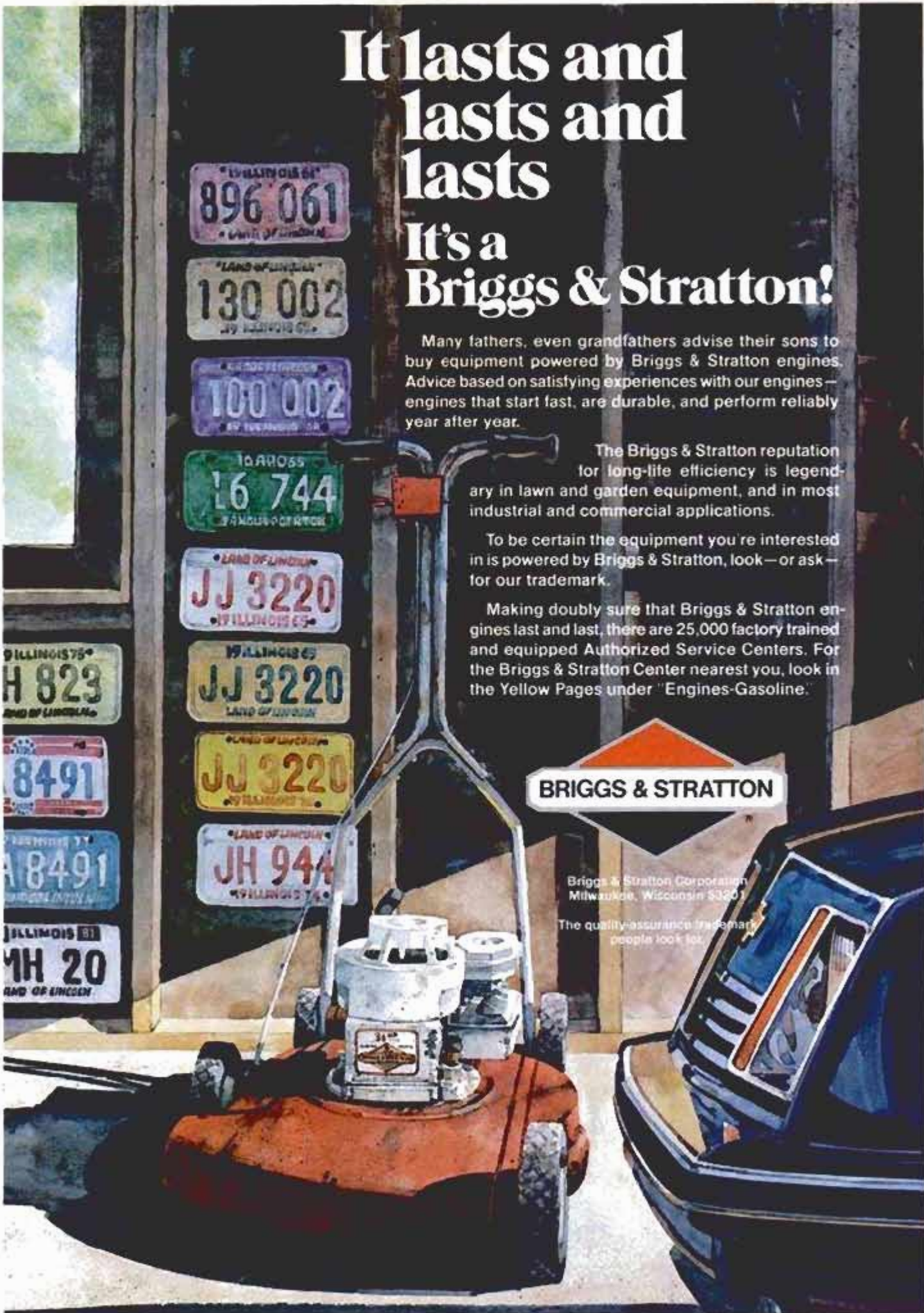
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## Basement drain alarm

Serious flooding may not be a major concern of yours, but sometimes, a sudden, heavy rain causes water to back up in basement drains. This condition can lead to minor flooding that could damage belongings on the floor. If this has happened to you, this gadget should interest you.

Keep the alarm close to the drain. Then, if you suspect a storm or shower may cause flooding, plop the device into the drain hole. If rising water causes the alarm to sound, you'll have ample time to take steps to protect your property.

The alarm is a simple device, easily made from common household articles. But make sure the disc fits evenly inside the lip of the drain hole, so the dowel will hang perpendicular and not bind anywhere inside the aluminum tube. Check the diameter of your drain and adjust any measurements so the disc will rest level, just inside the drain hole.

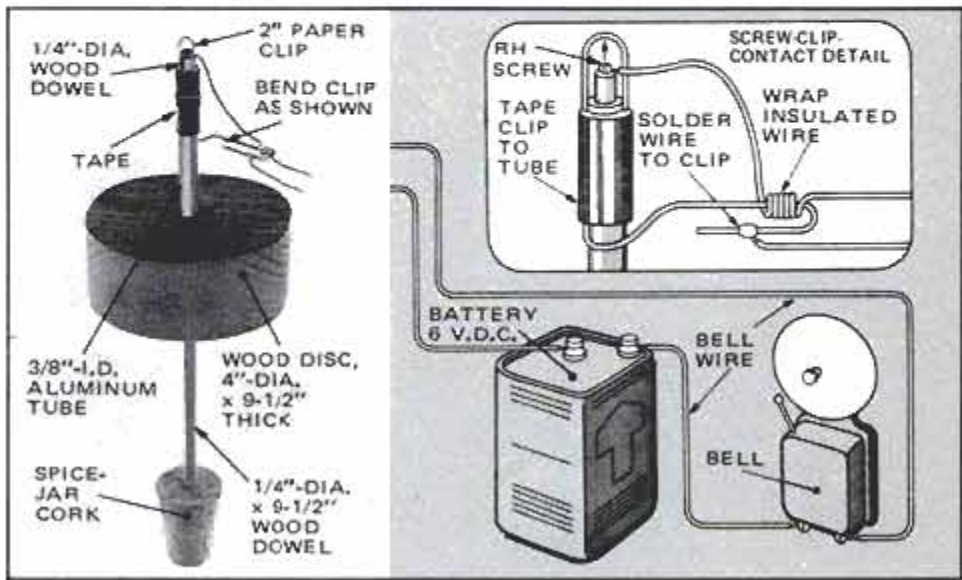
The wire attached to the round-head screw in the top of the dowel acts as a stop, keeping the dowel in its rest position. If you decide you

need a heavy float and relatively long dowel, insert a small brad through the dowel just below the screw shank. This will act as a stop and not interfere with the operation.

Only use a 6-v.d.c. dry-cell battery for this alarm. Because you may be handling the device when it is wet, you must use a perfectly safe power source.—*Jorma Hyypia*



When heavy rains threaten, remove drain cover and place alarm device in position.

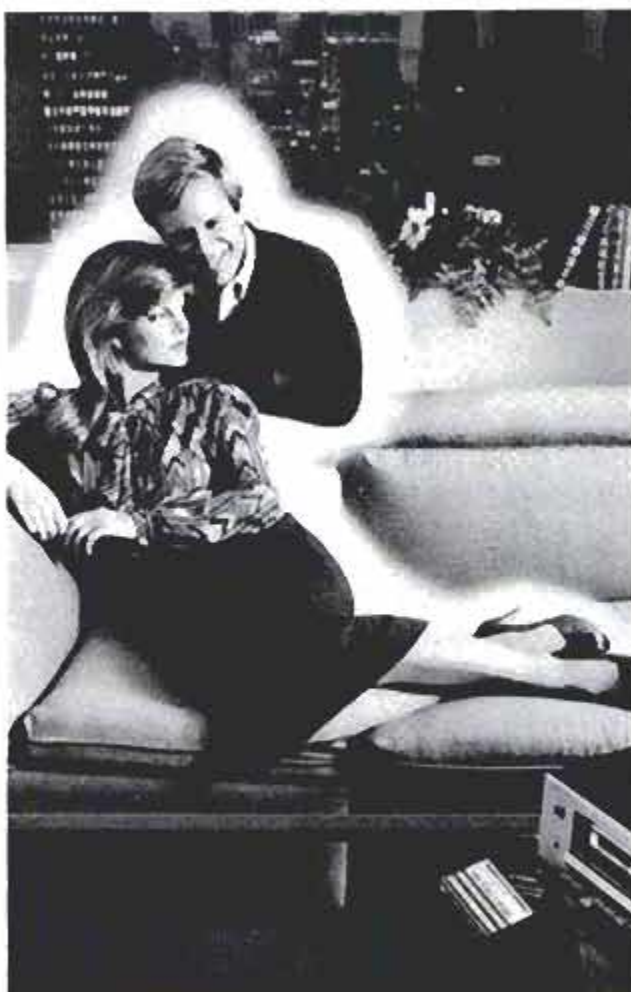


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radial tires,  
standard.

5-speed  
overdrive transmission,  
standard.

## It's hard to believe this is the lowest-priced truck sold in America.

1982 Mazda B2000 Sundowner  
**\$5895\***

You can believe it. The Mazda B2000 Sundowner is today's lowest-priced truck. Yet it comes with an astounding number of standard features, including a 5-speed and steel-belted radials.

Not one of these features is available on Toyota's or Datsun's lowest-priced truck, each of which costs hundreds more.

Just one look inside the cab and you'll see more of the Mazda B2000's exceptional



value. There you'll find a three-passenger seat detailed in textured vinyl. New instrumentation with electronic check panel. And handsomely trimmed door panels complete with armrests.

You can also believe this

truck is built to haul a heavy payload—1400 pounds of it. Even so, its 2-litre, 4-cylinder engine delivers outstanding fuel economy.

**38**

**27**

EST hwy. mpg EST mpg

If you still find it all a little hard to believe, we invite you to visit your Mazda dealer for a close-up look at the B2000 Sundowner.

Seeing is believing.

**MAZDA**

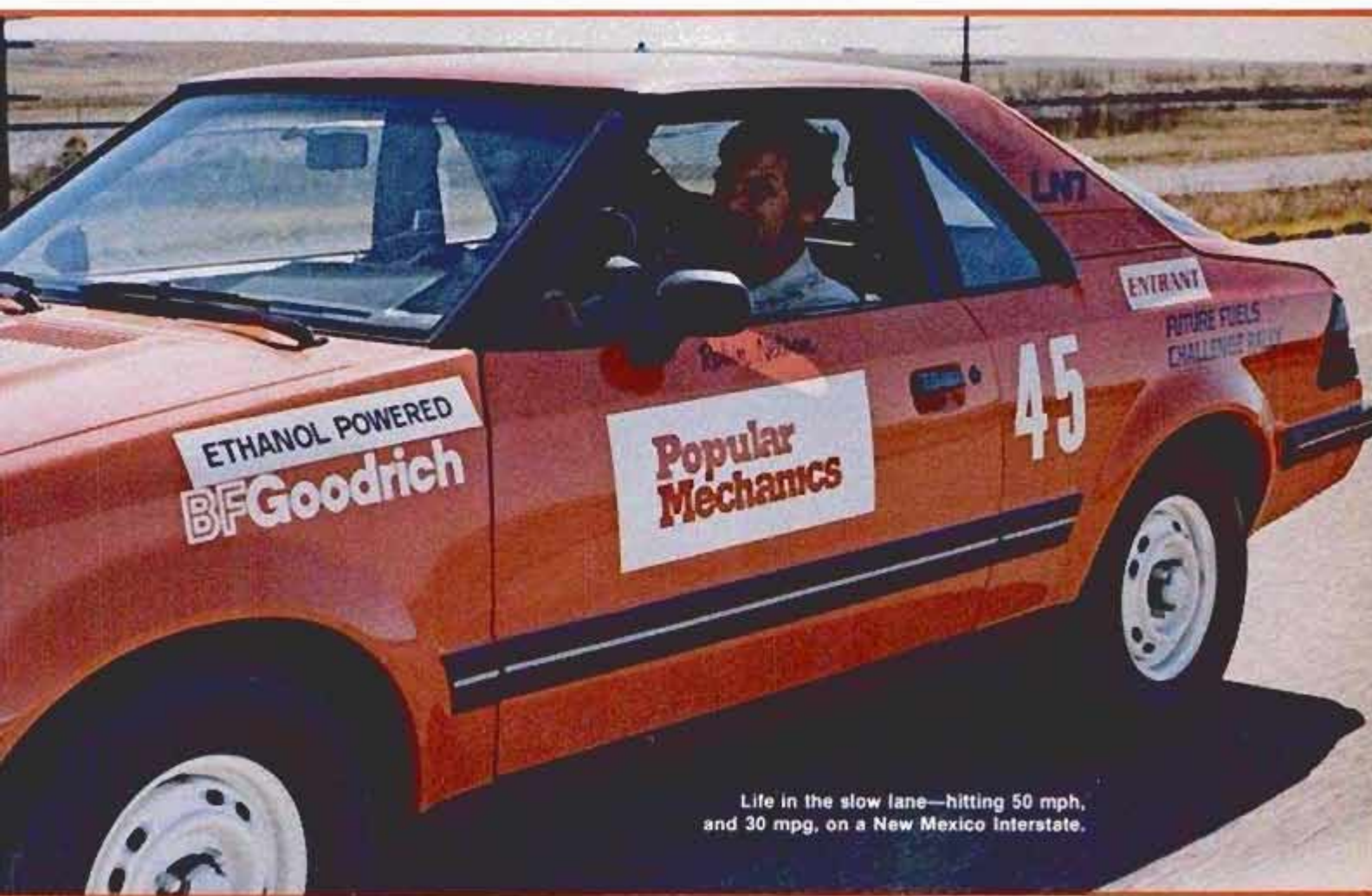
The more you look,  
the more you like.

\*Manufacturer's suggested retail price for B2000 Sundowner Shortbed. Actual prices set by dealers. Taxes, license, freight, options and other dealer charges extra. Prices may change without notice. Availability at dealers of vehicles with specific features may vary. \*\*1982 EPA estimates for comparison purposes for B2000 Sundowner Shortbed. Your mileage may vary with trip length, speed and weather. Actual highway mileage will probably be less. Calif. 36 Est. hwy. mpg. 26 Est. mpg.

# EIGHT DAYS ON STRAIGHT ALCOHOL

The first coast-to-coast auto rally for nonfossil fuels was a sporting event that wasn't, but the finishers who made the L.A.-N.Y. run were all champions.

by Robin Nelson



Life in the slow lane—hitting 50 mph, and 30 mpg, on a New Mexico interstate.

**S**omewhere around where Nebraska becomes Iowa, or vice-versa, I'd had it. Between four hours' sleep and the first bite of the coldest, soggiest Big Mac that was ever passed car-to-car at 50 mph, I'd had it. Between trying to peg 2,350 rpm on one gauge and hold 12 inches vacuum, minimum, on another, I'd had it. Between an Interstate that ran on boringly to infinity, punctuated by occasional killer chuckholes, and the endless caravan of trucks coming up like thun-

der in the rear-view mirror, I'd had it.

The temptation was to jump the next 18-wheeler that came by at 65 mph, draft it all the way to Chicago and sell the alcohol-burning LN-7 to any rube who wants to be the first on his block to have an exhaust pipe that smells like a pot still.

Four days later, leading the first dozen of some 20 survivors of the Future Fuels Challenge Rally through the Holland Tunnel into New York City, I was glad I'd resisted that

temptation. The eight-day, cross-country event had covered more than 3,300 miles and was greeted in a dozen major cities with widely varying degrees of enthusiasm, apathy and even animosity. (The last primarily in New York, where, following the official finish at the Holland Tunnel, an attempt was made at a police-escorted "parade" up 11th Avenue in Saturday afternoon traffic.)

But unless OPEC is planning a permanent oil glut for the future—a highly

unlikely proposition—the Future Fuels Rally will undoubtedly serve as a model for alternate energy trials to follow. To be honest, among the 34 official nonfossil-fueled entries I'd seen for the first time in the Los Angeles Shrine Coliseum, there were only a few I really expected would be able to make it to New York doing 40 miles per hour or better—an average of 10 hours on the road for eight days.

They ranged in structure from a low-slung tricycle carrying two—if you're good friends—cozy, semireclined occupants, to a Cadillac Eldorado with a four-cylinder engine that looked like a small satellite orbiting in the space under its hood. More than half of the entries were fueled with either ethyl (ethanol) or methyl (methanol) alcohol; but the variety of

solids—wood—liquids and gases employed by the rest comprised a true assault on the nostrils. Cars reeked hints of charcoal pits and sewer gas, and the vegetable-oil diesels smelled exactly like the hot end of a Kentucky Fried Chicken franchise.

Now a person doesn't spend his good time cobbling up a vehicle that is completely unorthodox in both operation and aroma unless he has more than an average interest in both the necessity and promise of alternate fuels. But the truth is that a hard-cash offer can make a good cause look even better. By offering \$25,000 as a prize for the alternate-fueled vehicle using fewest BTUs per unit of its weight over the preselected cross-country route, a Rochester, N.Y., businessman named Joe D. Shepard fathered this automotive first.

Among other incentives, Shepard had booked exhibit space in enroute cities; since a number of the entries were corporately sponsored and others run by people who have already built up substantial cottage industries in alternate fuels, automotive conversions, and

*(Please turn to page 188)*

Bob Santoro (below, left) of Stroppe performance shop set up PM's LN-7. Lyn St. James's kit included moon-sized vacuum gauge (center). Arizona schoolkids got time off to greet Rally. Ford team (bottom) led rallyists into New York City.



From left: Performance consultant Bill Stroppe, Robin Nelson, mechanic Jeff Wilson, Ford executive Bob Harner, Lyn St. James, publicist Art Schultz, Brock Yates.



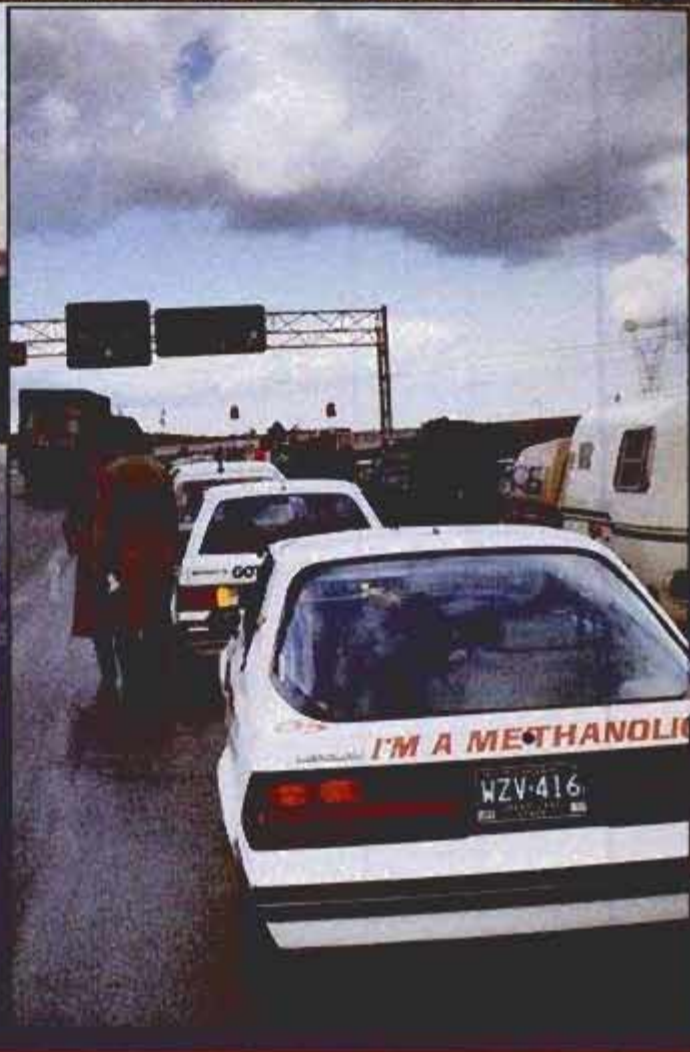


Rallyists started (above, right) by running the course at California's Orange County Dragway, interrupting time trials for national drag-racing championships with some of the slowest quarter-miles ever recorded. Wood-burners (above), provided visual delights, spotty performance. Real heroes were unsponsored entries; Saab No. 29 held up with some repairs, but owner's wallet ran dry.



### 'Cars that reeked of sewer gas, or cooking oil . . .'

With the exception of one nearly disastrous attempt at a formal convoy (right), Future Fuel Rallyists ran cross-country independently, aiming to hit one- to two-hour "windows" at various off-Interstate checkpoints. The 3,300-plus-mile trip involved between 80 and 90 hours of actual road time for most finishers, much of it on the Interstate system. Not surprisingly, Interstates in the southern tier were found to be in much better shape than those farther north (the official route covered both), with traffic density apparently a bigger factor than weather. Some states, like New York (background photo); keep a tidy highway; in the Midwest, this is rarely the case.



# THE SIX COSMIC QUESTIONS OF THIS DECADE



PM looks across the last frontier for answers to questions still puzzling science despite our spectacular achievements in space.

by Terence Dickinson

## IS THE UNIVERSE FOREVER?

Will the galaxies continue expanding like a balloon that can never burst, or is there enough matter to start a universal collapse, a new "big bang" and a new universe?

## DO BLACK HOLES REALLY EXIST?

Can there really be giant gravitational warps of time and space where not even light can escape?

## WHAT ARE QUASARS?

Ghostly images of the distant past may be the nuclei of whole galaxies. Was the Milky Way once a quasar? The answer awaits the launch of the space telescope.

R. WIMMER

**D**uring the past decade, robot space probes photographed the icy rings of Saturn, dug trenches in the sands of Mars and scanned the mountains and valleys of Venus by radar. Of the eight other planets in our solar system, only remote Uranus, Neptune and Pluto have eluded close-up scrutiny.

But now, the wave of planetary exploration has subsided—only one new American mission is planned for the '80s—and the spotlight of cosmic

research has focused on the universe at large. The remainder of the 20th century promises an accelerated quest to penetrate the universe's deepest secrets.

In an informal survey of leading astronomers and space scientists, *Popular Mechanics* found six outstanding celestial puzzles that are destined to occupy a legion of researchers for years to come. When, and if, these questions are answered, we will know, at last, the extent and

### WHERE'S THE MISSING MATTER?

Stars near the centers of galaxies move more slowly than expected, suggesting there's more matter in the universe than predicted. But where is it located?

### WHAT DON'T WE KNOW ABOUT OUR SUN?

It's the closest star to the earth, yet scientists still struggle with questions about the way the sun burns its fuel.

### ARE WE ALONE?

As man looks across the universe and sees countless stars and galaxies that look alike, an old question still evades an answer: Does life, as we know it, exist out there?

Birth of modern astronomy

(1543) Copernicus's sun-centered solar system

Kepler's laws of planetary orbit

Galileo's observations of Jupiter and Venus

Birth of modern physics

(1687) Newton's laws

Improvements on Arabic astronomy

Birth of modern chemistry

Birth of paleontology

Evolutionary biology

(1859) Darwin's theory

Birth of astrophotography

Advances in rocket science

1500

1600

1700

1750

1800

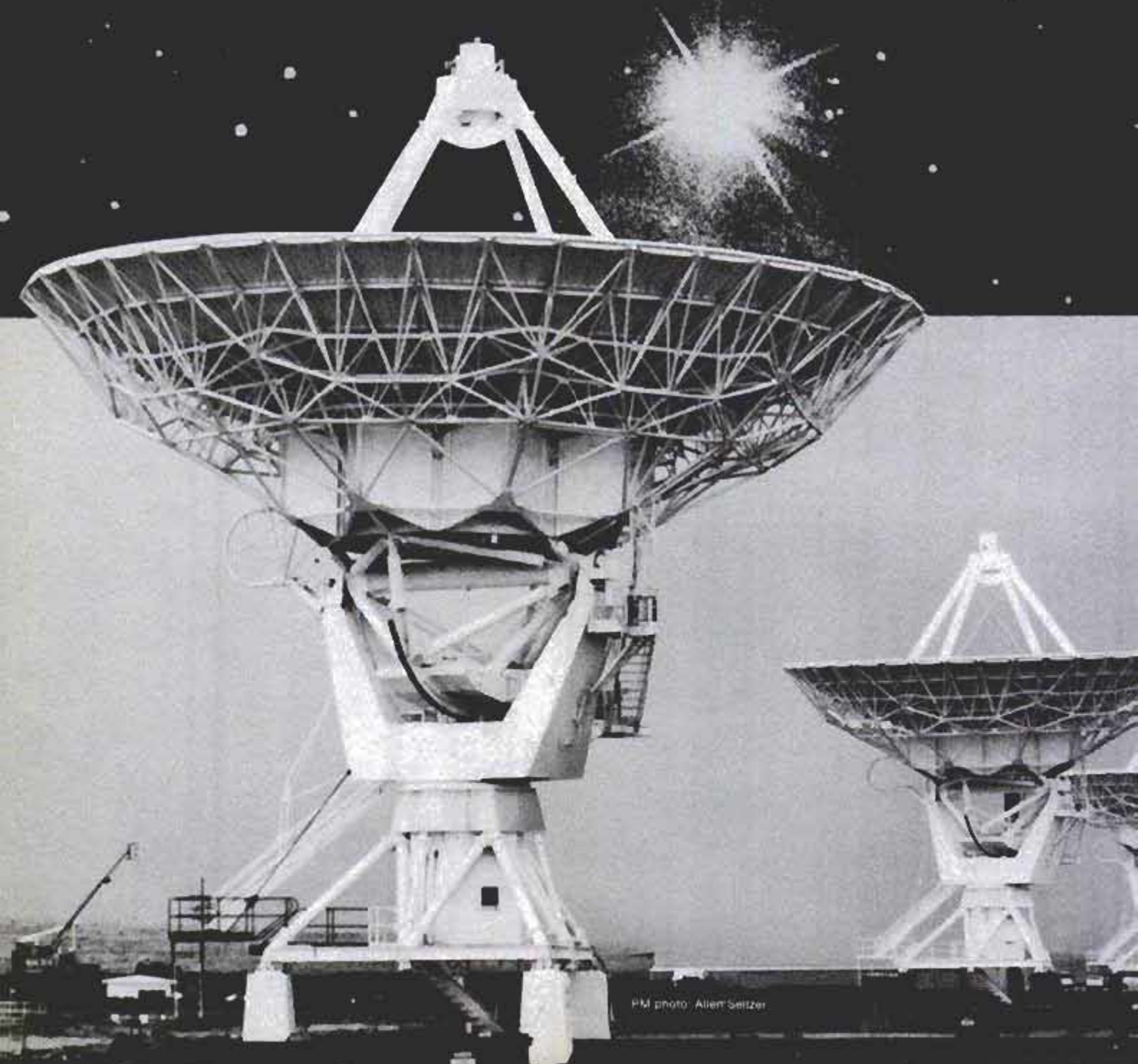
1850

1900

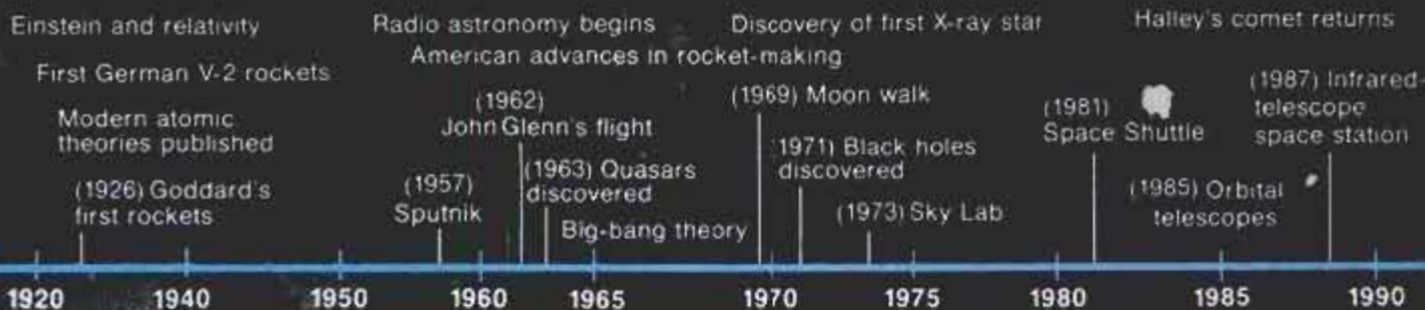
## *Across the centuries: the cosmic search*

The time line above shows the quickening pace of major discoveries leading to present, future understanding of cosmos.

Photo: Edmund Scientific



PM photo: Allen Seitzer



destiny of our universe, how it works and who shares it with us.

## Q IS THE UNIVERSE FOREVER?

In the time it takes to read this sentence, the universe will increase in size by 100 trillion cubic light-years. Propelled by the force of its explosive birth about 15 billion years ago, the universe is expanding like an inflating balloon. A half-century of meticulous observation of the recession of distant galaxies has proved beyond doubt that expansion is taking place. But when astronomers try to predict the fate of the universe billions of years hence,

two widely divergent possibilities emerge. Either the expansion will continue forever, or the outward rush will halt and reverse, ending in a cataclysmic, atom-crunching collapse.

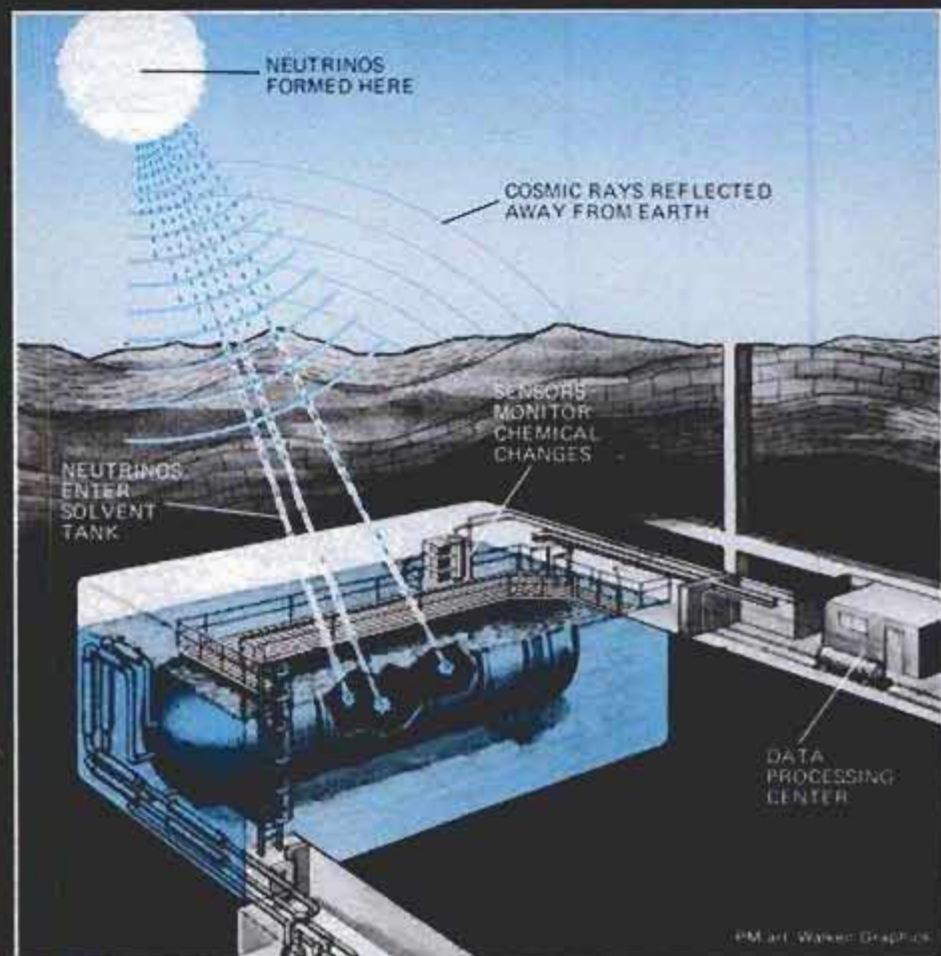
The fate of everything that exists is the supreme question which mere mortals can ask. Yet, as philosophically profound as such a quest may be, there are reasons to believe we will have the answer soon.

Today's astronomers are armed with telescopes sensitive enough to record the equivalent of a lighted match 2,000 miles away. They scan the sky with radiotelescopes that can detect a

*(Please turn to page 192)*



Highly polished Perkin-Elmer mirror of Space Telescope (above) will help to unlock quasars' secrets. New Mexico desert array (left) focuses on stars and other objects hundreds of billions of miles distant. In Brookhaven's underground lab (right), scientists count neutrinos produced at the sun's center. Neutrinos penetrate mine shaft, which cuts out cosmic rays. When neutrino hits solvent in tank, chemical reaction occurs. By counting neutrinos, scientists may infer weight of the whole universe.



PH art: Walker Graphics

# Now magnets and sonar make anyone an expert fisherman

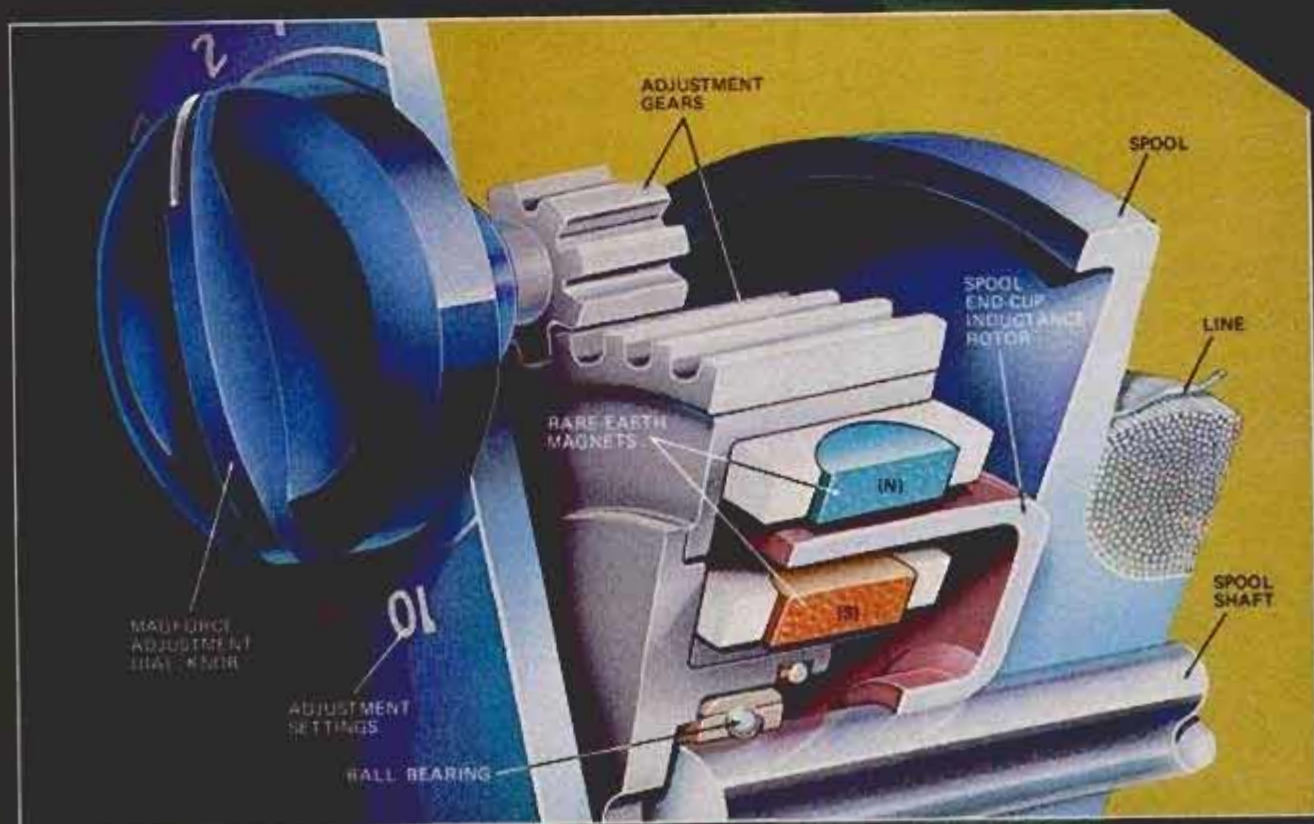
A new bait-casting reel prevents line tangles, and a new graph recorder pinpoints fish under your boat.

by Stan Fagerstrom

The breeze coming across the lake was strong, and the lone fisherman positioned himself to cast into the wind and out toward the edge of a lily-pad field. A new angler with a new reel, he tensed in apprehension as the rod flexed and the lure arced toward the pad cover. He waited for that instant when the reel spool might overspeed, line would blossom off it in a tangled backlash, the lure would jerk in flight and plop in the water halfway to the target.

But this time, it didn't happen. The lure dropped on the target spot, and the fisherman looked in amazement at a brand-new reel with a revolutionary braking system that might make backlash snarls—and the unprintable

*(Please turn to page 188)*



PM art. Jeff Mangiat



### Pick a slot with this recorder

Hidden inside one of the Lowrance top-of-the-line graph recorders (at left) is the new X-15, a futuristic instrument that can practically pick your fish. Next spring, when the X-15 should be available, you'll be able to chart any depth, down to 1,000 feet. Then, when you spot something at, say, 85 feet, you can push buttons and get a printout of 70 to 100 feet, or even the 80- to 90-foot layer for a close-up look at that slot of water. The recorder will even print the depth-range numbers in the margin.—W.M.

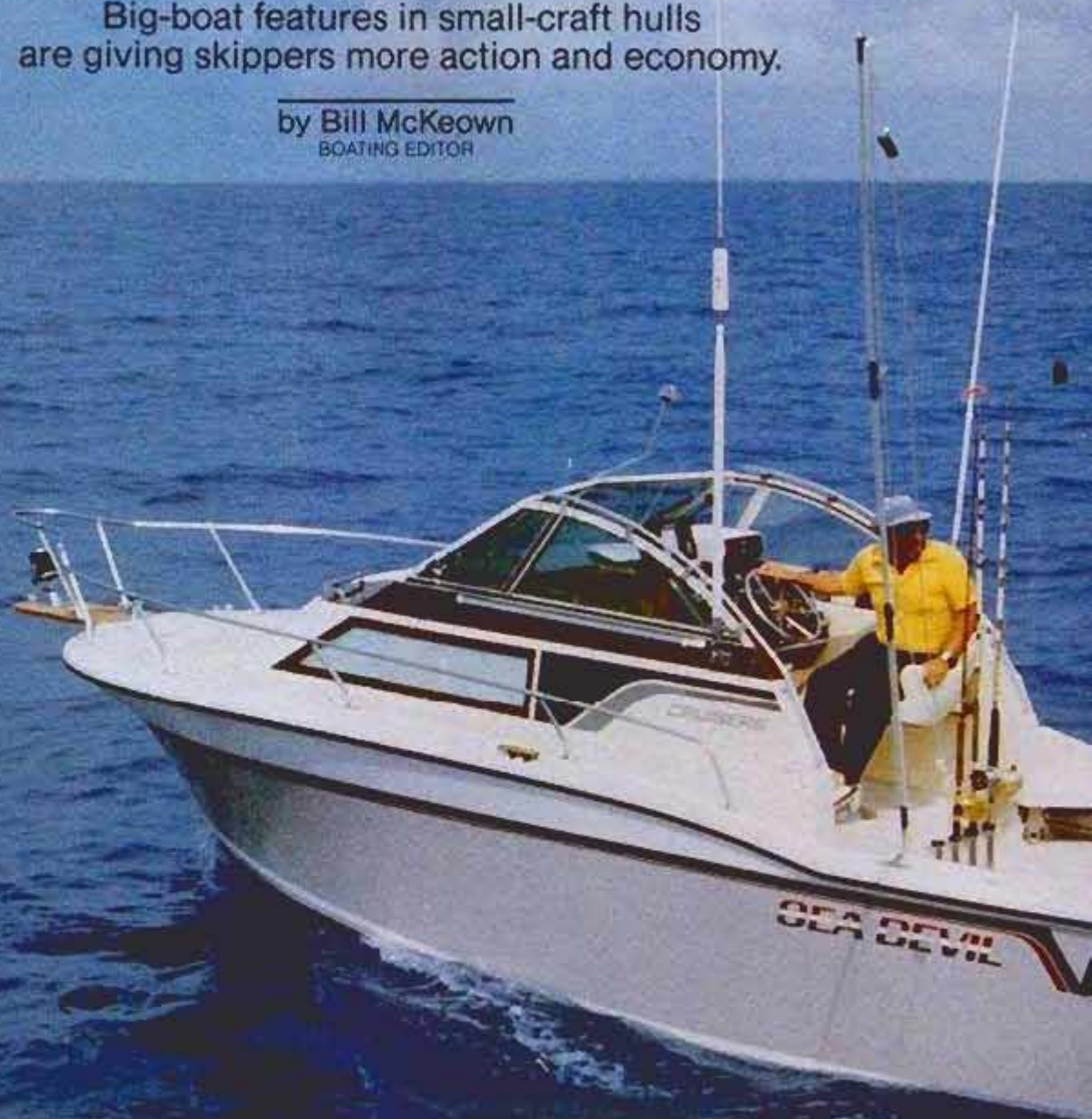


Hidden inside Daiwa's new Procaster-Lite Magforce bait-casting reel (above) are small magnets that prevent overrun backlash. In the detail (left), north and south poles are adjusted to set up the governing resistance you need.

# New for shoreline sport

Big-boat features in small-craft hulls are giving skippers more action and economy.

by Bill McKeown  
BOATING EDITOR



These 16-footers convert quickly from day cruising or water skiing to fishing: The aluminum Mirro Sunburst (left) has a walk-through windshield to get an angler forward to cast; the fiberglass Lund Premier provides a center console.



# and offshore fishing

**S**mall boats do cost less to buy, and burn less gas. And properly designed and used, many new models can take on the chores of bigger, faster (and heavier) models.

A new 25-foot sport fisherman

from Cruisers is a good example. How do you get a larger cockpit in a smaller boat? Taking out the inboard motor is one way. For the Sea Devil, Cruisers installed the new OMC Sea Drive out back.

Because its air intake is inside the boat and the powerhead is sealed and watertight, there's no fear that a following sea might drown it out. Yet the unit can tilt up without

*(Please turn to page 191)*



To build the features of an offshore sport fisherman into new Sea Devil models of 25 and 22 feet, Cruisers uses a proven Jim Wynne deep-V hull and tops it off with a walk-around cabin and cockpit fishing layout designed by Bob Stearns. Details (above and right) include Lowrance graph recorder and Raytheon Loran C, rod holders, tackle shelves and bow pulpit.



Lines of the large droop-snoot offshore racers are reduced to 19½ feet for Silverline's Farallon Concorde (above) with MerCruiser sterndrive. Spitfire V-15 (right) from Tidecraft combines a sharp-bowed runabout look with bass-boat features.



# Now we're ballooning on solar power

by M. Storey Smith

**S**urfboards, dune buggies, hang gliders—that's the stuff of summer in California. But this summer will be different, because the California sun is expected to shine on one flying object never before seen in the United States—a manned, solar-powered balloon.

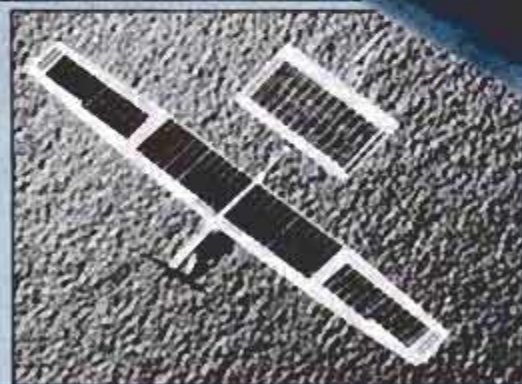
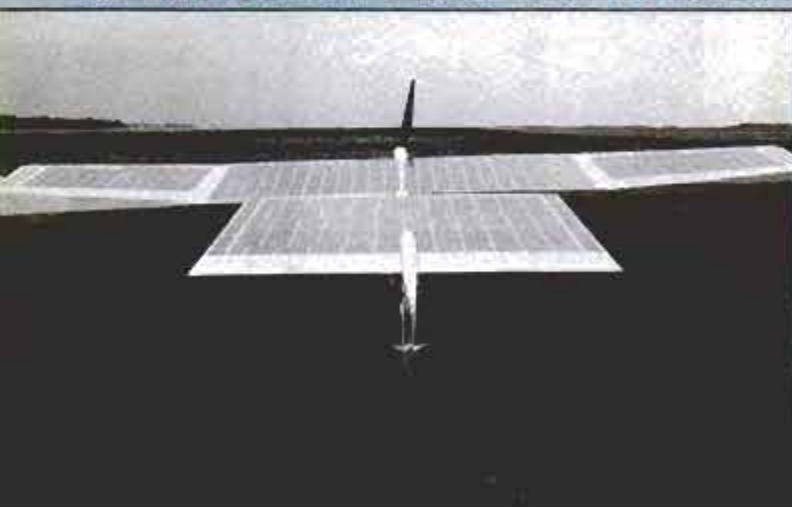
The British team that made history last year by flying this double-envelope balloon across the English Channel plans to cross the 23 miles from Santa Catalina Island to the Pacific Coast just south of Los Angeles in the same balloon in June. Julian Nott, pilot on the first big flight, hopes the steady Pacific wind will make the California crossing even easier.

Nott's balloon won't be the only sun-powered vehicle plying the California skies this summer. Former schoolteacher Janice Brown is scheduled to try flying the Du Pont *Solar Challenger* to a record altitude of 30,000 feet. The single-engine *Challenger* made the first solar-powered flight from London to Paris—a 5½-hour, 188-mile journey—last summer. The *Challenger* has never exceeded 14,000 feet.

"Solar-powered flight probably won't ever compete with the

*(Please turn to page 200)*

## NEXT CHALLENGE: ALTITUDE



Solar Challenger has already crossed the English Channel (above) and has reached a height of 14,000 feet; next is try for 30,000 feet.

SUNLIGHT

CLEAR POLYESTER SCRIM  
SANDWICHED BETWEEN  
CLEAR MYLAR

AIR VALVE

INNER  
BALLOON

**4** The solar balloon is totally inflated at about 3,000 feet. Volume is now 140,000 cu. ft. It may either continue its rise with increasing heat, or it may descend easily, using its air valves.

CROSSBAR  
FOR LINES

LIGHTWEIGHT  
(FIBER-LAM)  
GONDOLA

**3** At altitudes of 500 feet or less, the torch is cut off and heat of the sun continues to expand the balloon. At this stage, the balloon's volume is about 120,000 cu. ft.

**1** First, air is blown into the solar balloon with a fan. When the double envelope is about half full (at approximately 60,000 cu. ft.), propane torch takes over for the fan and speeds inflating.

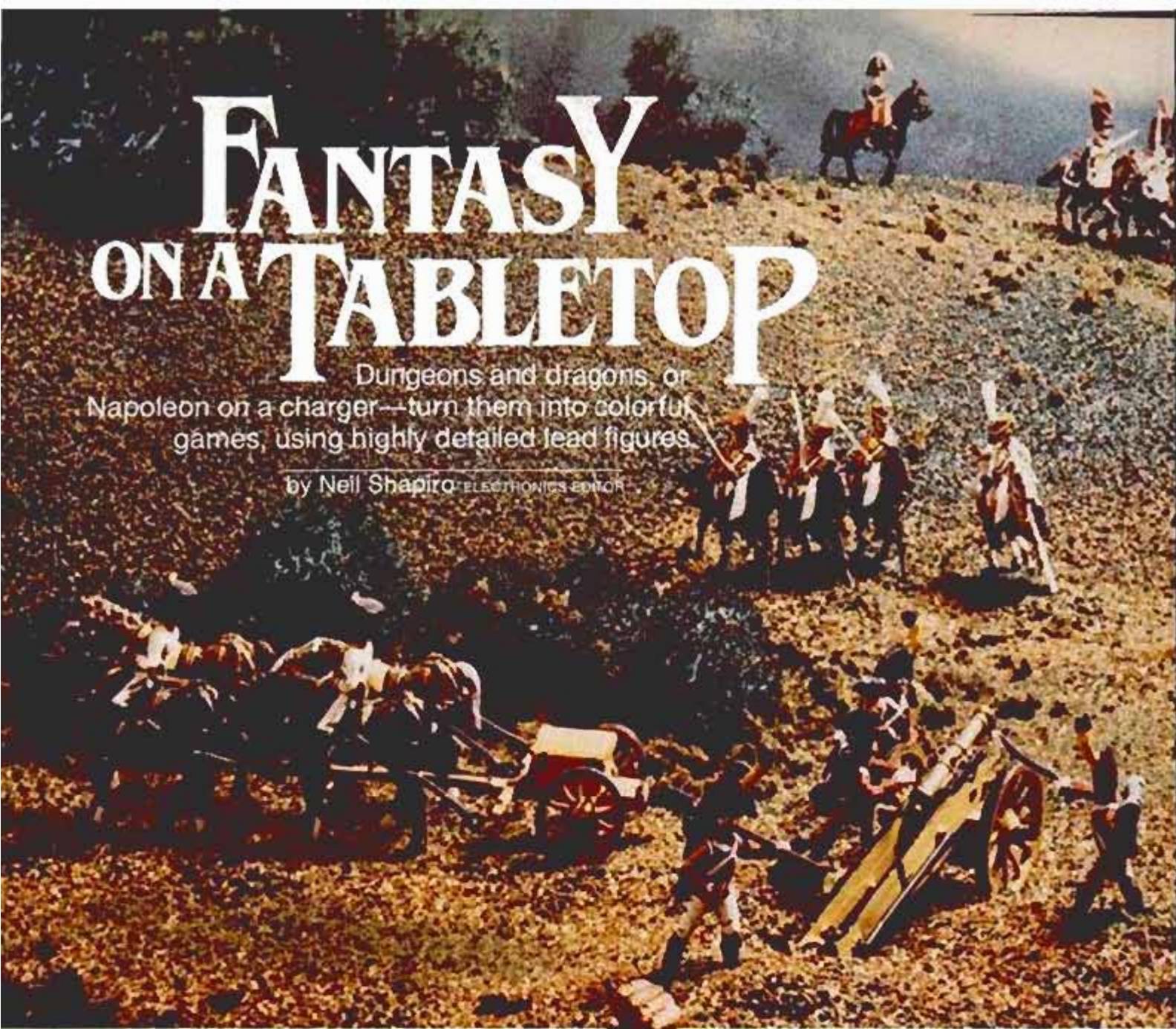
**2** Propane torch is turned on and the air continues to expand. First, the balloon starts to rise above the gondola. Then, it begins to take off.

PM art: Dean Ellis

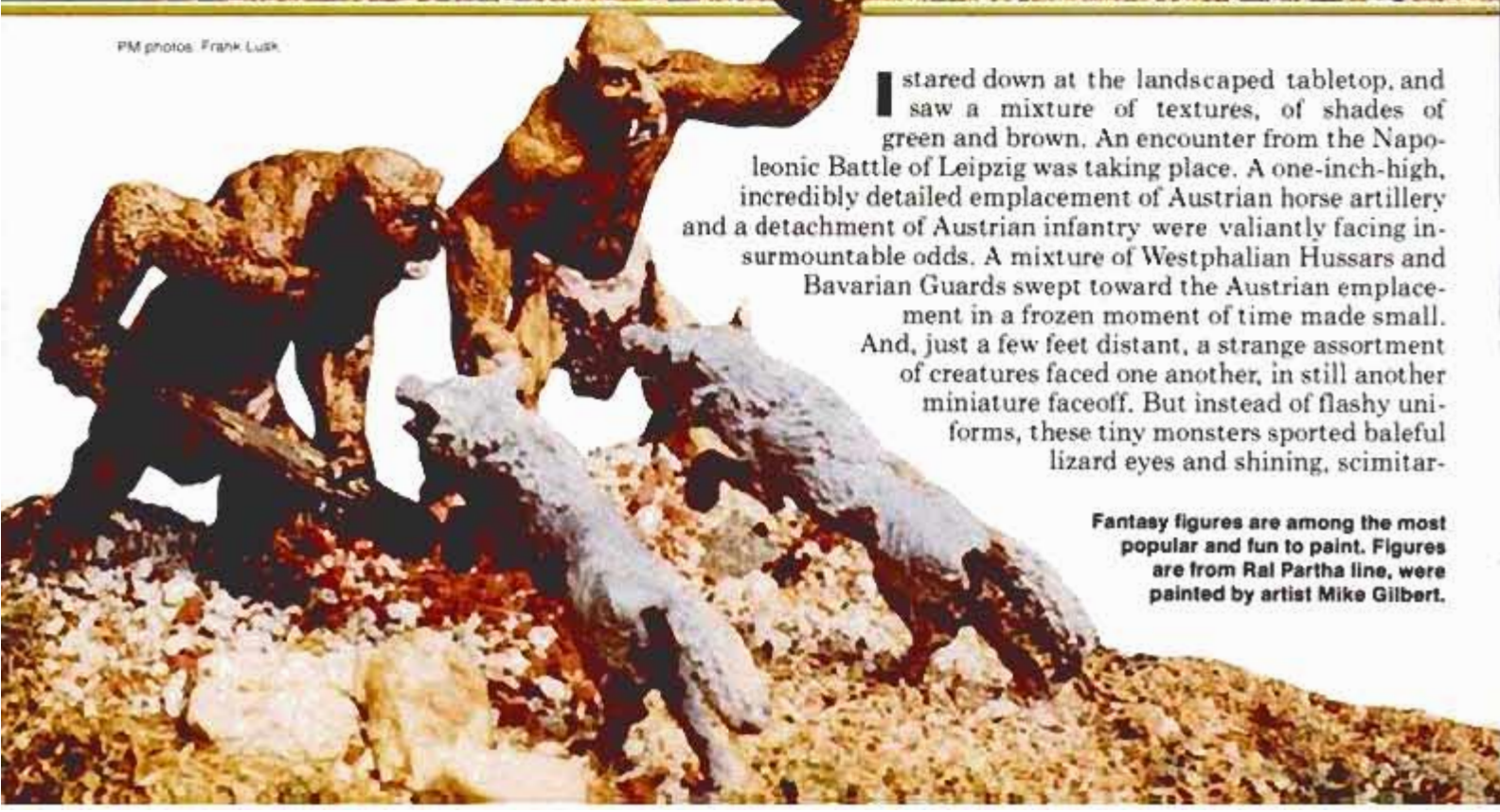
# FANTASY ON A TABLETOP

Dungeons and dragons, or Napoleon on a charger—turn them into colorful games, using highly detailed lead figures.

by Neil Shapiro, ELECTRONICS EDITOR



PM photos: Frank Lusk



I stared down at the landscaped tabletop, and saw a mixture of textures, of shades of green and brown. An encounter from the Napoleonic Battle of Leipzig was taking place. A one-inch-high, incredibly detailed emplacement of Austrian horse artillery and a detachment of Austrian infantry were valiantly facing insurmountable odds. A mixture of Westphalian Hussars and Bavarian Guards swept toward the Austrian emplacement in a frozen moment of time made small. And, just a few feet distant, a strange assortment of creatures faced one another, in still another miniature faceoff. But instead of flashy uniforms, these tiny monsters sported baleful lizard eyes and shining, scimitar-

**Fantasy figures are among the most popular and fun to paint. Figures are from Ral Partha line, were painted by artist Mike Gilbert.**



Here's a scene that could have taken place in 1815 at the Battle of Leipzig. A contingent of Austrian artillery is hard pressed by a group of French Allies. The 25-mm-high figures are from the Mini-Figs line and were painted by Mike Gilbert.



Steve Tofano, above, sculpts a figure using molten wax. The finished model is sold to a manufacturer, who makes a mold.



Here's a one-of-a-kind figure created by Steve Tofano from parts of various lead figures. Hand-detailing, such as saddle tassels, is amazing. Statue is exact size (left) and larger than life (right).





shaped swords clutched in their tiny hands.

The Napoleonic scene was part of a "simulation war game" and the demonic scene was part of a "fantasy role-playing game." Together, they add up to a fantastic new hobby that has attracted tens of thousands of players and spawned a whole new craft industry.

Part of the appeal lies in playing the games, but a large part of the fun is in detailing the tiny, lead-cast models before the game begins. Even unpainted, these 25-mm-high models show amazing detail.

While wondering how the games were played, we happened upon artist and sculptor Steve Tofano. Steve specializes in creating master models. Fantasy figures from Dragon Tooth and other manufacturers make for eerie detail in this scene. All pieces at left were originally sculpted and painted by Steve Tofano.

## How to paint 'em like the pros

Artist Mike Gilbert paints armies for a living. His troops have conquered entire inches of territory from one end of the country to the other. Here are a few hints that he readily passes along to the novice.

Many beginners have troops that can only be described as shiny—and that's not good. "Figures," Mike told us, "should be primed with a flat paint and not a spray paint. If you spray a figure, most of the paint dries before it hits and just flakes. I recommend acrylic or casein-based paints. They're more durable and give a flatter and more natural appearance than enamel."

Brushes are important, and Mike suggests

good water-color brushes. Use a No. 00 for detail; a No. 0 and No. 1 are better for painting larger areas.

For intricate shading, add water to a color. This allows more of the pigment to settle into the folds of the figure, making shadows. Or you can mix a small amount of black into the main color and use the darker color to paint the shadows directly.

One of the final steps that many hobbyists neglect in painting is the wash. When the figure is completed, you should prepare a very dilute solution of brown or black paint. Apply this solution, or "wash," liberally to the figure; it will seep into the figure's crevices and create the

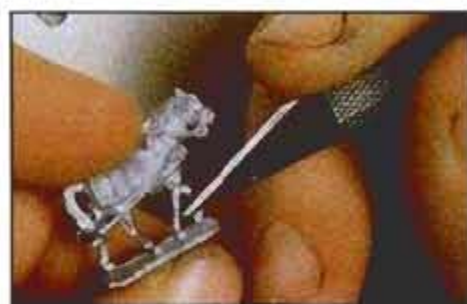
final and very detailed shadow effects necessary for a professional look.

Once the miniature is painted and detailed, don't neglect its base. Cover the base of the figure with the same material which covers the game table—green felt or plastic grass, for example. The piece will seem to be standing right on the simulated ground.

We were impressed by artist Steve Tofano's gaming setup (see the main story for more on Steve). His table has 2-inch-high sides all around and is about 1 inch deep in sand. He uses the same fine sand to cover his unit's bases—which makes for ideal camouflage.

—Neil Shapiro

Mike Gilbert at work shows just how tiny these figures are. But with just a little talent and a whole lot of patience, anyone can create finished pieces he can take great pride in.



Use an Exacto-style knife to take off the mold seam-marks and other "flash" from a figure before you begin to paint it.



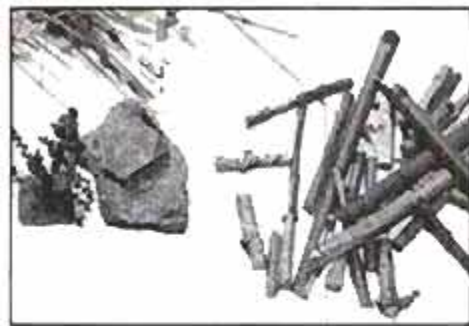
Prime your figure with a flat base coat. This is important, since the primer acts as a surface for other paint to stick to.



Mixing paints is an economic and artistic necessity. Many over-the-counter colors don't have the authentic look you need.



One trick of the trade is to use an artist's pen with heavy India ink, as shown, for drawing in any ultrafine details.



els of fantasy-style pieces for various manufacturers.

Steve invited us down to his workshop—a mixture of basement, medieval sorcerer's alcove and graphic-art gallery—to watch him create a figure. He began with a tiny stick-figure of wax.

Then he dipped a paintbrush into a cauldron of bubbling wax. He used the molten wax to layer onto the figure muscles, anatomy and, finally, the armor and weaponry of a particularly blood-curdling fiend.

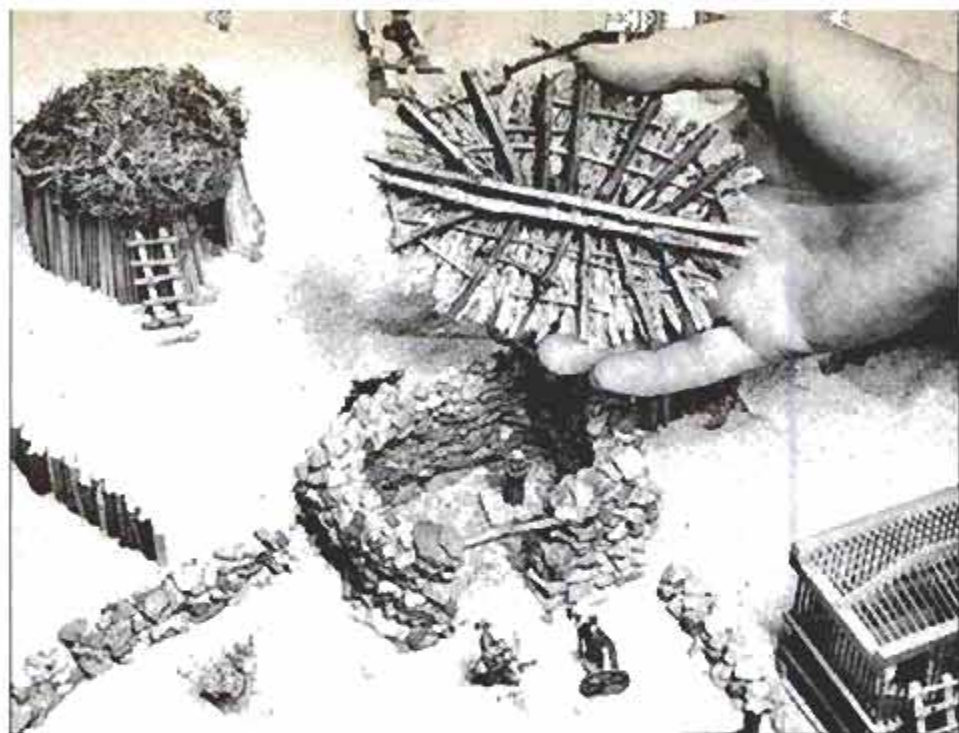
The wax models Steve creates are then sold to a manufacturer who uses the lost-wax process to produce a master mold from them. These finished, but unpainted models, are what the hobbyist usually paints. This is detailed in our interview with artist Mike Gilbert (see *How to Paint 'em Like the Pros*, page 104).

Once the models have been designed, purchased and painted, what are the games like? We found them fantastic—in more ways than one.

Simulation-style war games have been around ever since H.G. Wells wrote *Little Wars* around the turn of the century. A laughably simple game, by today's standards, victory was decided by cork-firing cannons. The winner had the most toy soldiers still standing.

Today, a Napoleonic field marshal may use a thick book, such as *Empire*, to guide troop movements and all other details (see the list at the end of this article). *Empire* contains rules for movement of troops (in inches) through various types of terrain. The amount of movement is further dependent on the type

Tanks and armored vehicles can be designed to look realistic. Steve Tofano captures dirt and grime of a campaign.



Steve Tofano's gaming table shows how miniature huts, fences and other items can be made from roadside materials (photos at

left). Pebbles, sticks (top left) and weeds, lichen and moss (above left) work well. They make objects on soldiers' scale.

of unit (infantry, cavalry, artillery), and the formation the unit is in.

Tables such as: "Artillery fire for tactical combat" detail the tiniest effects of a miniature combat. Throw in rules for supply, routing and rallying troops, how leaders improve or harm troop performance, how square formations can shrug off cavalry charges—and many more variables—and you have a very accurate simulation of a battle, right there on the table.

Simulating Napoleonic warfare, or the British African colonial wars, or a tank battle in 1943 is all well and good for the historical war gamer. But in the past few years, a new type of game, called "fantasy role-playing," has been turning otherwise mild-mannered individuals into sword-wielding barbarians or evil creatures of the night.

War gamers concentrate their en-

ergies from the outside looking in (or down). They are the controllers of their huge model armies, the very forces of destiny personified.

But the fantasy role-player reverses that viewpoint. Instead of massive armies, large strategic sweeps culminating in tactical donnybrooks, the role-player moves one piece at a time through a series of intricately detailed encounters. And the piece that the player moves is the player's miniaturized alter ego.

The first, and still most popular role-playing game, is *Dungeons and Dragons*. There are many other sets of rules, such as *Tunnels and Trolls* and *The Fantasy Trip*, that also have their adherents (see the source list at the end of this story). But *Dungeons and Dragons*, referred to as D & D, is the granddaddy of them all.

In a game of D & D, each player is

*(Please turn to page 183)*



## PM ROAD-TESTS THE SUPER COUPES

# SCIROCCO: STILL THE CAR TO BEAT



Pontiac J2000



VW Scirocco

Newly redesigned Scirocco outclassed rest of field with flawless handling, aggressive performance and super ride quality. Pontiac J2000 was superbly styled, but fell short in overall performance. Toyota Corolla felt loose and not well put together. Honda Accord did most things well, but nothing brilliantly. The LN-7 was hampered by raspy engine and unresponsive handling. Stanza came closest to knocking Scirocco off Super Coupe perch. It handled well, was extremely comfortable and well styled, but was more of a boulevard cruiser than Super Coupe.

PM photos: Brad Jess

Toyota Corolla



Honda Accord





**W**hat we have here is a classic case of taking aim and firing straight at the mark, only to discover that the target has shifted. While Ford (with the EXP and LN-7) and General Motors (with its J-cars) were designing all-new sporty coupes, obviously intended to blow the immensely successful Honda

Accord and Volkswagen Scirocco out of North American waters, Honda and VW were steaming to a whole new set of coordinates. Late last year, they introduced new versions of these cars.

At the same time, Nissan—which used to be Datsun—has neatly torpedoed everyone with the new Stanza—a Q-ship if

ever there was one. Toyota's Corolla Sport Coupe is in the hunt, too. Toyota hasn't given it the publicity blitz budgeted for the more expensive Celica and Supra, but the sleek little Corolla outsells every other imported model. Toyota must be doing something right.

All this is by way of introduc-



**Mercury Lynx LN-7**



**Nissan Stanza**





## J2000

Pontiac's fwd J-car is on a 101.2-inch wheelbase and weight is 2,400 pounds. Its inline Four displaces 1.8 liters and is of overhead-valve design. Suspension is independent in front with a beam axle at rear. Transmission is four-speed manual. Price as tested was \$10,231.



## STANZA

Nissan's fwd Stanza is built on a 97.2-inch wheelbase and weight is 2,150 pounds. Its single-overhead-cam, inline Four displaces 2.0 liters. Suspension is independent all around and transmission is five-speed manual. Price as tested was \$8,574.



## SCIROCCO

Volkswagen's fwd Scirocco is on a 94.5-inch wheelbase and weight is 2,000 pounds. Engine is a single-overhead-cam, inline Four with 1.7-liter displacement. Suspension is four-wheel independent and transmission is five-speed manual. Price as tested was \$10,955.

## ACCORD

Honda's fwd Accord is built on a 96.5-inch wheelbase and it weighs 2,100 pounds. Its single-overhead-cam, in-line Four displaces 1.75 liters. Suspension is independent all around and transmission is five-speed manual. Price as tested was \$7,420.



ing six sporty coupes that look so similar you need a spotter's guide to tell them apart. Since they were all aimed at the same target, they're virtually identical in looks and basic design. All are three-door hatchbacks. All use roughly 1.8-liter engines and four- or five-speed manual transmissions. All but one are front-wheel drive. All return close to 30 EPA mpg, and all cost in the neighborhood of \$8,000 to \$10,000.

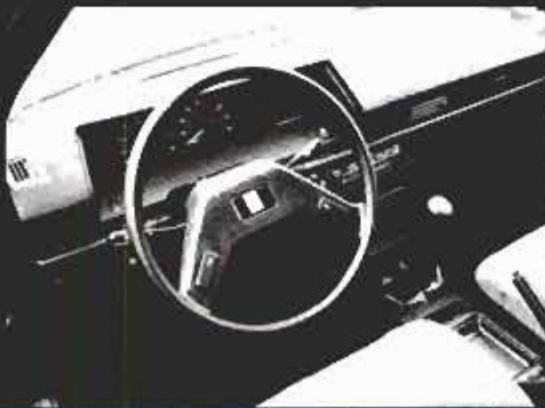
As usual, appearances are deceiving: You couldn't find six more varied cars when it comes time to drive them. We spent a full day at Raceway Park in Englishtown, N.J., doing performance tests—quarter-mile acceleration, 700-foot slalom, skidpad, braking, interior sound level. The second day, we drove off over a variety of road surfaces, freeway to back-country gravel, switching drivers every 20 miles or so.

Then we put it to a vote. Each driver ranked the cars in order, on a secret ballot. When we tallied the votes, one car had clearly won. The winner and still champion was Volks-

*(Please turn to page 202)*

## COROLLA

Toyota's Corolla is a rear-drive hatchback built on a 94.5-inch wheelbase that weighs 2,100 pounds. In-line Four is a single-overhead-cam design displacing 1.8 liters. Suspension is independent in front with rigid rear axle. Transmission is five-speed manual. Price as tested was \$8,538.



## LYNX LN-7

Mercury's fwd Lynx LN-7 is built on a 94.2-inch wheelbase and weighs 2,150 pounds. Engine is a single-overhead-cam, 1.6-liter in-line Four. Suspension is independent all around and transmission is four-speed. Price as tested was \$8,858.



# Get customized sound with an equalizer

An equalizer can't cure a poor stereo system, but it can turn a good one into an audio wonderland. It lets you remix your music to suit both personal taste and room acoustics.

by Christopher Greenleaf

**Y**our greatest advantage in owning an equalizer is the amazing control it gives you over the "shape" of your music. Just as your home listening room has its minor acoustic imperfections, recording engineers and record producers don't always deliver quite the sound mixture you may want. Tone controls—the knobs on your receiver that control bass and treble—are a fine feature, but nothing approaches the convenience and flexibility of an equalizer to iron out hot spots and fill in holes in the sound.

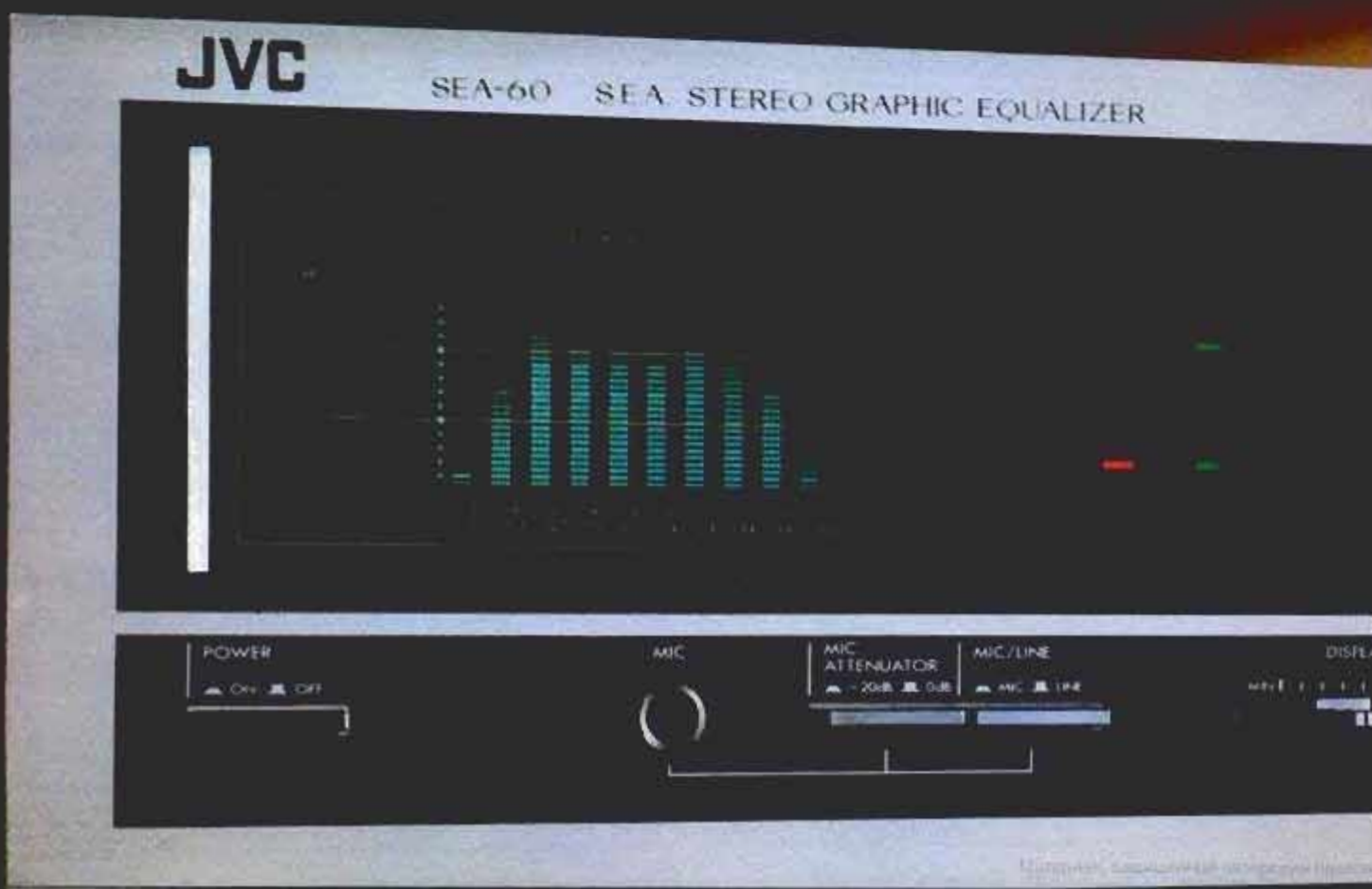
There are dozens of equalizer models on the market. We've lined up nine of the most affordable and versatile and put them through their sonic paces.

Remember that an equalizer is only an elaborate tone control. It lets you adjust the relative level of each portion of the sound spectrum. A 10-band equalizer (10 controls per stereo channel) is often called an *octave* equalizer. Each slide control adjusts one octave of musical frequencies (the eight notes of a scale). On simpler five-band units, each control adjusts two octaves.

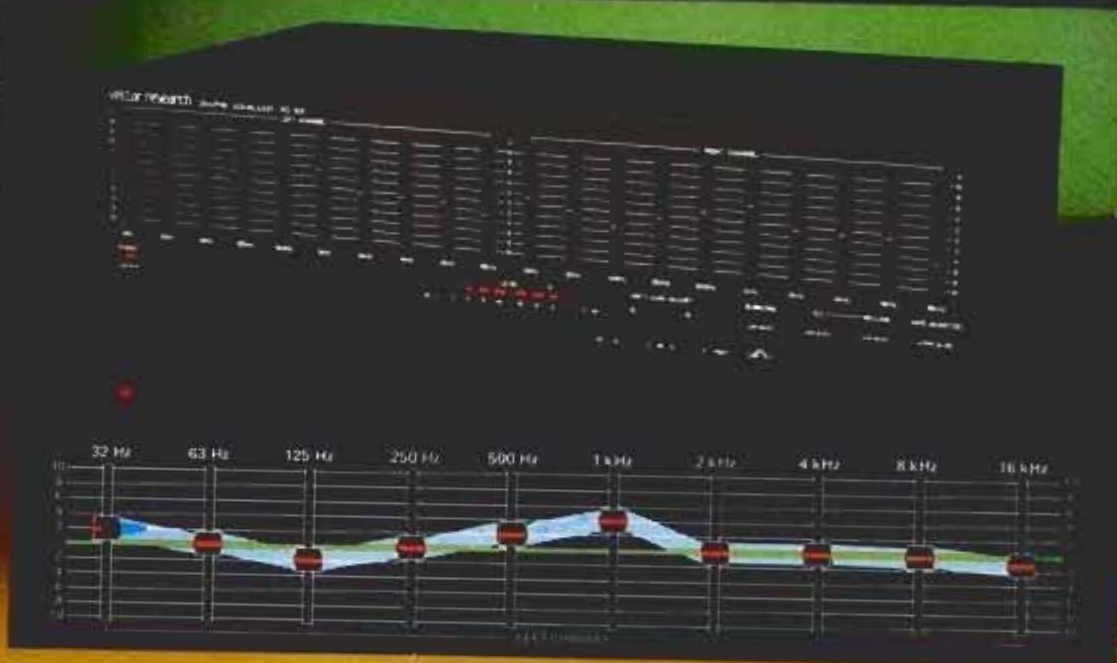
Further, all nine of our equalizers are *graphic* equalizers. When you set the sliders, their position forms a visual graph on the

Your ear is the most sensitive sound equipment you own. In many situations, such as the three we detail here, you can use an equalizer to contour musical sound to suit personal tastes. The JVC SEA-60 equalizer (below) is shown as you might adjust it to compensate for room furniture which swallows bass and highs, but emphasizes the middle range of the music. The SEA-60's slider controls are set to apply a mid-bass boost, some mid-range reduction and substantial treble strengthening. For explanation, settings are actually exaggerated, giving more boost and reduction than normally needed.

(Please turn to page 195)



When you make tapes for the road, pit an equalizer against your car's hostile acoustics. An equalizer such as the Kenwood GE-80 (top) can be used to iron out dead or boomy notes and restore realistic sound. The GE-80 features five bands in each stereo channel. Set as shown in the drawing, it will damp high treble and coax more bass into the cassette you're recording at home for on-the-road enjoyment. Note that settings are a bit different on each channel to allow for such things as door-panel resonances. Another option (bottom) lets you correct loudspeakers to your taste, using subtle hints from an equalizer. Vector Research's 10-band VQ-100 permits separate tuning for each channel. In the drawing, we show it cutting extreme highs, boosting deepest bass and supplying reinforcement to the upper mid range (just for one channel, since the other channel is set identically). For a more extreme setting to correct your speakers, you can also reposition the loudspeakers in the room.



PM photos: Peter Tenzer



# 10 tips for home computer care and repair

If your computer has a nervous breakdown, here's how you can ease its mind.

by Neil Shapiro    ELECTRONICS EDITOR



**1 Use the right tools:** Here we show how to use an IC puller to extract delicate RAM memory chips from their sockets. Any other type of tool could bend the pins, which are delicate, as seen in the inset.

PM photos: Frank Lusk

**T**here's nothing more aggravating than having a computer break down in the middle of an important task—unless it's paying for the repair. Most computer stores or repair centers charge as if the integrated circuits were made of solid gold, not silicon.

But there are some repairs to both the computer and its assorted attachments that you can try yourself. The main problem is figuring out what to do when. Some things, of course, should be done even before the problem crops up.

## RAM memory problems

All your programs are stored in your computer's random-access memory or RAM. A computer with 48K of memory has more than 48,000 memory locations (actually, 49,152) which must be absolutely perfect. If they're not, some strange things may happen.

You may find that one line of a program cannot be entered properly.

For example, no matter how many times you type the command `PRINT`, when you list it, the memory contains an error you know you didn't make—like `PLINT`.

Or, as we show, you may find a repetitive line number in a listing. And when the computer comes to a line numbered 21 following a line numbered 50, for example, it just stops in electronic confusion. Another symptom of this common problem may be that some programs work fine, while others don't run at all, or do so improperly.

You can usually buy a RAM-checking program for a reasonable cost. But if you don't have such a program available, it's easy to write your own. The only drawback is that you will be writing in `BASIC` and most commercial programs use far faster

machine-language routines. But then again, you can go off and read a book while this test runs.

The first thing you must do is determine the decimal addresses of your computer's RAM. You can usually find this in your computer's reference manual on a chart called a memory map. This chart will tell you the lowest and highest numbered address which your computer knows is RAM.

For instance, if your computer has 16K, then 16,384 locations are RAM. Most computers start their RAM off at "the bottom" of "page one." This means the first RAM location is 0 and succeeding locations are numbered consecutively. In our example, memory locations 0 through 16,384 should be tested for failure.

Write a short program, using the `PEEK` and `POKE` commands that are standard in most versions of `BASIC`. The `PEEK` command looks at a value

in a memory location; the POKE command places a new value in a location.

### Implementing the commands

Put the PEEK and POKE commands in a FOR-NEXT loop numbered the same as the memory locations. In the loop, place values such as 0 and 255 into all memory locations and then check to see the values did not change on their own. If they did change, include a visual or audible warning to alert you and print out where things went wrong. Here is a short program that will do all of that for a typical 16K computer:



**2 Kill static electricity:** Sparks can wipe out a program that's stored in memory. Use a static spray as shown—and avoid thick-pile carpets in your computer room.

```

10 FOR A = 1 TO 10
20 FOR X = 1000 TO 16384
30 POKE X, 255
40 NEXT X
50 FOR X = 1000 TO 16384
60 PEEK (X)
70 IF X<255 THEN 1000
80 NEXT X
90 FOR X = 1000 TO 16384
100 POKE X,0
110 NEXT X
120 FOR X = 1000 TO 16384
130 PEEK (X)
140 IF X>0 THEN 1000
150 NEXT X
155 REM CHR$(7) RINGS BELL
160 PRINT CHR$(7): "ALL RAM TESTS
GOOD ON TRY":A
170 NEXT A
180 GO TO 9999
1000 PRINT CHR$(7): "RAM LOCATION
":X: "TESTS BAD!"
9999 END

```

The above program could be improved easily, but as shown, it should run on almost any computer that has the PEEK and POKE function. (Note that we didn't start at 0, but at 1,000. This should allow room for your computer's built-in functions, as well as this program itself. Again, your manual should have a memory

map from which you can figure the lowest location to check.)

If you found a bad location, then you must determine from your manual which row of memory chips contains that location. This is usually easy. The hard part is determining which chip in the row is bad.

It may be quickest to replace the entire row—especially since memory is so cheap these days. Or, you can use one memory chip you're certain is perfect and substitute it for each chip in the suspected row, one by one, until you've located the culprit.

And, by the way, don't try pulling memory chips (or any others) with your fingers. You'll probably damage the needle-like pins on the chips and wind up with tiny, bleeding holes in your fingertips from the pins.

For all such repairs you must use an IC puller, which, as shown, looks like a tweezer. But the tips of its jaws are flanged to fit under the chip's edges. This lets you apply gradual lifting force to both sides equally—and thus not bend or (heaven forbid!) break off the delicate pins.

### ROM problems

Besides the RAM, your computer also contains read-only memory or ROM. This is the memory that contains the computer's own operating system and its "understanding" of BASIC.

If your computer seems to "forget" a BASIC command word, or if the computer suddenly doesn't perform one operation correctly, while



**3 Recognize ROM memory failure:** The ROM memory holds the computer's operating system. If the computer shows amnesia for "built-in" words, suspect the ROM.

most others work, suspect the ROM.

ROMs are expensive—you pay for the permanent program "burned in" their innards. So, you cannot replace them haphazardly.

Some computer manuals contain a listing of the contents of their ROMs or of some of their ROMs. You might want to compare the printed list with what your computer "sees" there. (See your manual for how to examine memory locations in ROM.) Such comparisons can be long and time-consuming. But if you already suspect the ROM, you'll have enough nerve to question a repair bill that itemizes all sorts of tests and replacements, but winds up saying the ROM was the problem all along. Here, a little knowledge can go a long way.

### Clean up your act

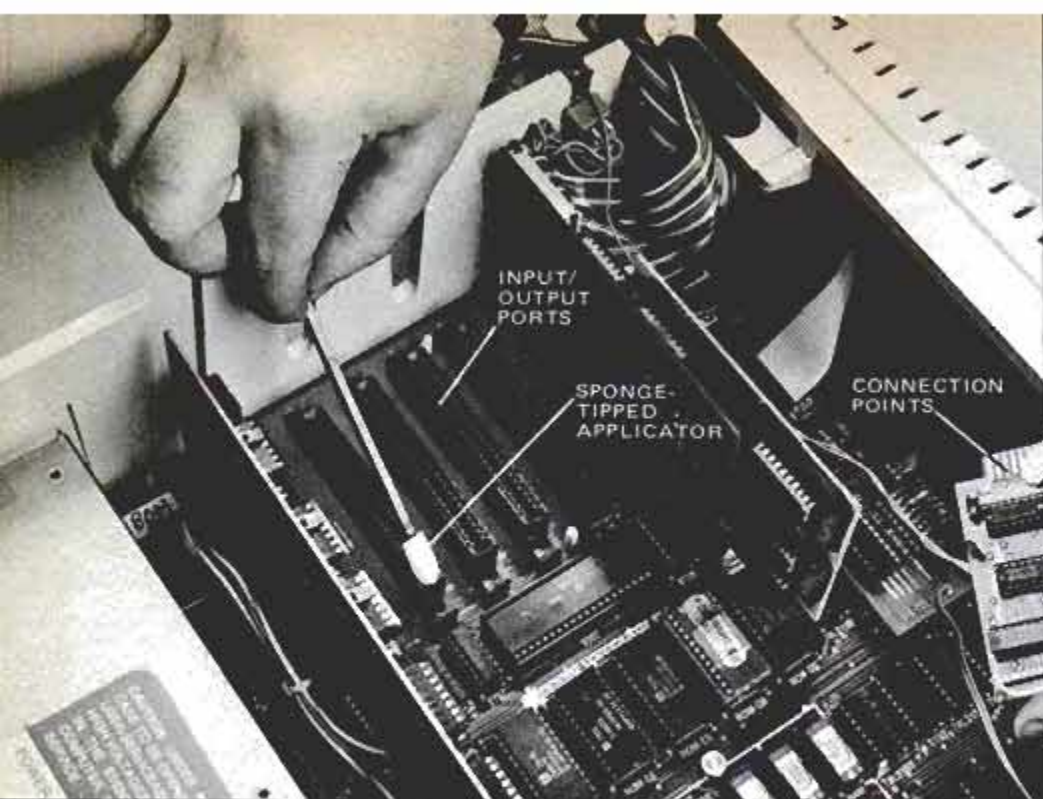
One of the main enemies of your computer system is the environment around it. Dirt, dust and atmospheric debris can wreak havoc in a

**4 Recognize RAM memory failure:** A bad RAM chip can foul up a computer listing. Here, we show a program where a line number repeats (line 21 follows both lines 20 and 50).

```

5 TEXT : HOME
10 DIM A$(20), B1(20), A2(20), B2(20)
    A$(0), A$(1), A$(2), A$(3), A$(4), A$(5), A$(6), A$(7), A$(8), A$(9),
    A$(10), A$(11), A$(12), A$(13), A$(14), A$(15), A$(16), A$(17), A$(18), A$(19),
    A$(20), B1(0), B1(1), B1(2), B1(3), B1(4), B1(5), B1(6), B1(7), B1(8), B1(9),
    B1(10), B1(11), B1(12), B1(13), B1(14), B1(15), B1(16), B1(17), B1(18), B1(19),
    B1(20), B2(0), B2(1), B2(2), B2(3), B2(4), B2(5), B2(6), B2(7), B2(8), B2(9),
    B2(10), B2(11), B2(12), B2(13), B2(14), B2(15), B2(16), B2(17), B2(18), B2(19),
    B2(20)
15 DIM A$(6), N1(20), C2(20), N2(20)
18 DIM C1(20), N3(20), C4(20), N4(20)
    C1(0), C1(1), C1(2), C1(3), C1(4), C1(5), C1(6), C1(7), C1(8), C1(9), C1(10),
    C1(11), C1(12), C1(13), C1(14), C1(15), C1(16), C1(17), C1(18), C1(19), C1(20),
    N3(0), N3(1), N3(2), N3(3), N3(4), N3(5), N3(6), N3(7), N3(8), N3(9), N3(10),
    N3(11), N3(12), N3(13), N3(14), N3(15), N3(16), N3(17), N3(18), N3(19), N3(20),
    C5(20), N5(20)
19 DIM E(16), S(16), L(16), X(85), Y(85)
20 CALL - 936
21 RESTORE
22 A6 = 0: GOSUB 30000: GOSUB 210
    00
25 TI = 120: A6 = 1
30 INPUT "WANT INSTRUCTIONS? "; A
    $: IF LEFT$(A$,1) = "Y" THEN
        GOSUB 56000
40 PRINT "PLEASE STAND BY."
50 OX = 20: OY = 38: X0 = 20: Y0 = 3
21 RESTORE

```



**5 Clean all contacts:** Many computers have plug-in circuit boards. Use denatured alcohol or cleaning solutions and make sure there's good contact at all connection points.



PLUG-IN PRINTED CIRCUIT

computer and its associated equipment, such as cassette recorders and disc drives.

The 3M company makes a multi-purpose cleaning kit (called the CK-90) that contains special cleaning fluid, sponge-tipped applicators and lint-free towels. But you can also use denatured alcohol and tightly rolled cotton swabs.

Many computers feature plug-in circuit boards. As we show, both the contacts on the computer's main board (called the mother-board) and the plug-in card (called the daughter-board) must be cleaned and free of dirt or corrosion. The contacts are small, so it doesn't take much dirt to get in the way of the current flow. Contacts on plug-in cartridges should be cleaned in the same manner.

The next time your disc drive, printer, or whatever, stops working or only works intermittently, first check the point where it plugs into the computer. Make sure that all connections are clean and bright. Many people have lugged equipment into repair stores only to find that they have spent upward of \$40 for a cleaning.

And, of course, it doesn't hurt to schedule routine cleaning maintenance in order to avoid problems in the first place.

### Input blues

Computer programs are loaded into the computer's memory via a tape recorder or a disc drive. Neither unit is fail-safe and both require maintenance.

Diagnosing an input problem is

fairly easy. Usually, your computer works perfectly. Except, when you load a program, there's a 50-50 chance the program won't load properly.

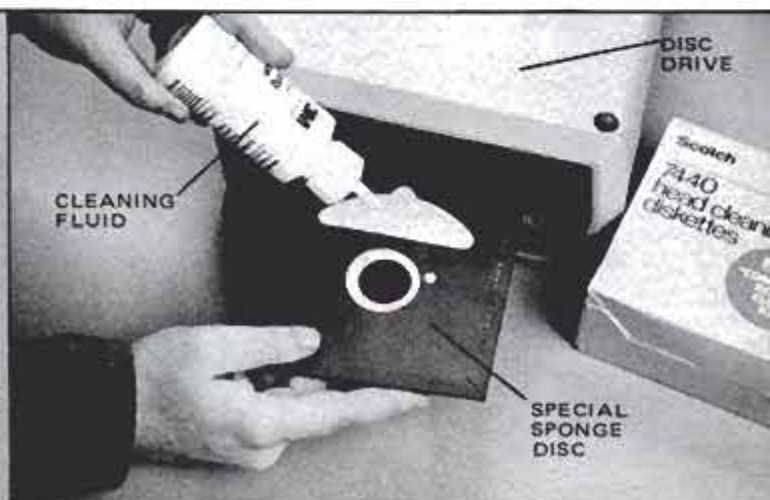
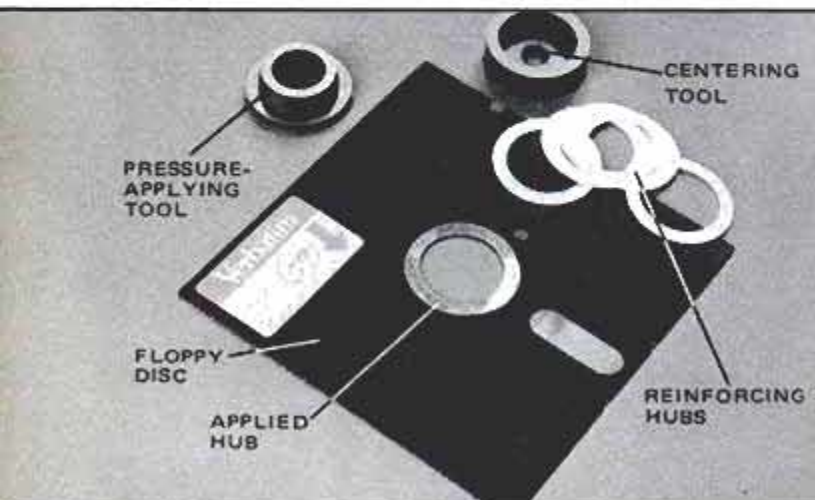
Ask yourself how long it has been since you last cleaned the heads in your disc drive or tape recorder. This should be done every few weeks. Cleaning a recorder is easy. You can use the same kit from 3M mentioned earlier or you can buy any of the many tape-recorder cleaning kits on the market.

As the photograph on page 115 shows, use the applicator to swab the record and play head gently in the tape deck. Be careful never to use anything which might scratch this head.

The handiest way we know of to demagnetize the cassette recorder's

**6 Strengthen floppy discs:** Many brands of discs don't have reinforced hubs. The tool below lets you apply plastic hubs (note shiny surface) to your discs to eliminate the fatal "bends."

**7 Clean your drives:** Don't forget to keep your disc drive's record/play head clean. Kits, such as below, feature a sponge disc and a special cleaning fluid. Use at least monthly.





head is a little device sold by Radio Shack. This demagnetizer (catalog No. 44-1165) looks just like a cassette tape. It contains a small battery and pops directly into the recorder. In one second, it fully demagnetizes the head.

Disc drives call for more specialized equipment. 3M, Radio Shack, Verbatim and other manufacturers all make disc drive cleaning kits similar, or identical, to the one shown here.

The kit contains a special disc. Inside the plastic jacket, instead of a disc of recording material, is a thin, sponge disc. Squeeze a few drops of cleaning fluid onto the sponge and place the cleaning disc in the drive. The drive spins the disc and the head is cleaned. Unfortunately, there's no way for the consumer to demagnetize his own disc drive's head without fear of damaging it.

This cleaning is the kind of repair that may solve a problem. But it might have prevented the problem in the first place if it had been part of an ongoing maintenance program.

Finally, you may want to invest in a tool called a "Floppy Saver." The big hole in the middle of a floppy disc is its Achilles' heel. The centering mechanism of a disc drive puts constant pressure on the hole's inside edges. The best discs carry a reinforcement ring around the hole's inner edge—much like the tiny reinforcement rings a student buys for papers held in a three-ring notebook.

The Floppy Saver lets you put such reinforcing rings on discs that don't have them already. Occasionally, you can "save" a disc that no longer works with one of these. But, it's better to put such rings on the disc before you use it for the first time.

### Stop the zaps

While electricity is a computer's favorite food, it can also give a computer heartburn. Suppose, for in-



**8** Clean your recorder: Tape-reading woes often can be traced to dirty record/play head surfaces. You can use any of the commercially available audio-recorder kits to clean your computer's tape recorder. Be certain you use a cotton or sponge swab (right) that won't scratch the head.



stance, you're typing away at a long and complicated program. You are so involved that you haven't bothered to save the program to disc or tape in the past hour.

Zap! The screen shimmers, blanks and comes back on. But your program has been erased from memory and all your work has been lost.

Static electricity and line-voltage surges can cause this problem. If severe enough, they can even damage your computer permanently.

Static electricity, in particular, is the underestimated computer-killer. A good, rub-your-heels-on-the-floor charge can deliver several hundred volts from your fingertips into your computer's delicate innards.

A static-electric charge of this magnitude can erase your program from memory, as noted previously. But such a charge also can fry a memory chip—or one of the many other types of integrated circuits which are packed into the typical computer board.

Often, static electricity seems an inescapable opponent. Most home computerists are plagued with this problem.

If you can, set your computer up in a static-free environment. Try to avoid thick-pile carpets. And use an antistatic spray. These sprays are available at Radio Shack or computer stores.

As we show in the photo on page 113, spray the liquid onto a cloth and wipe it on the screen of your monitor. The antistatic spray can also be sprayed directly onto the non-scratchable parts of your equipment. Remember—a little spritz will do 'ya. The object is to kill static, not drown your computer.

And try not to trust your power company with your computer's life. Sure, your TV runs reliably, but a computer is far more sensitive to the brief, but very high, voltage surges that often travel down an a.c. power line.

To protect against this, purchase a voltage surge protector. These come in many shapes and varieties. The model we show (bottom, left) is a popular one called "The Clipper." It plugs between the computer and the wall and clips voltage spikes down to size. Other styles look like multijack power stations and can protect many pieces of equipment at the same time. They are expensive (\$40 to over \$100), but are certainly well worth it.

The hints and techniques we've discussed probably won't save you from all repair bills—but they will turn you into your computer's favorite "Saturday mechanic." **FM**



**10** Demagnetize recorders: Next to cleaning your tape recorder, keeping it demagnetized is most important. Cassette-shaped demagnetizer works in under a second.



**9** Protect against voltage surge: Nothing is more aggravating than losing hours of your work to a sudden voltage surge. Protectors like the one shown here, often called voltage clippers, are the equivalent of an electric insurance policy.

# Make a traditional 'carved'

Create '19th-century' furniture with 20th-century tools.

by Rosario Capotosto

**Y**ou may find it hard to believe that this attractive dining set is made almost entirely of plywood. The only exceptions are the gate

The design of this table allows flexible use. With both leaves extended, the table and chairs make an attractive dining-room set. Top inset photo shows the table with its leaves down—for use as sideboard. Lower inset shows table with one leaf up for less constricted areas.

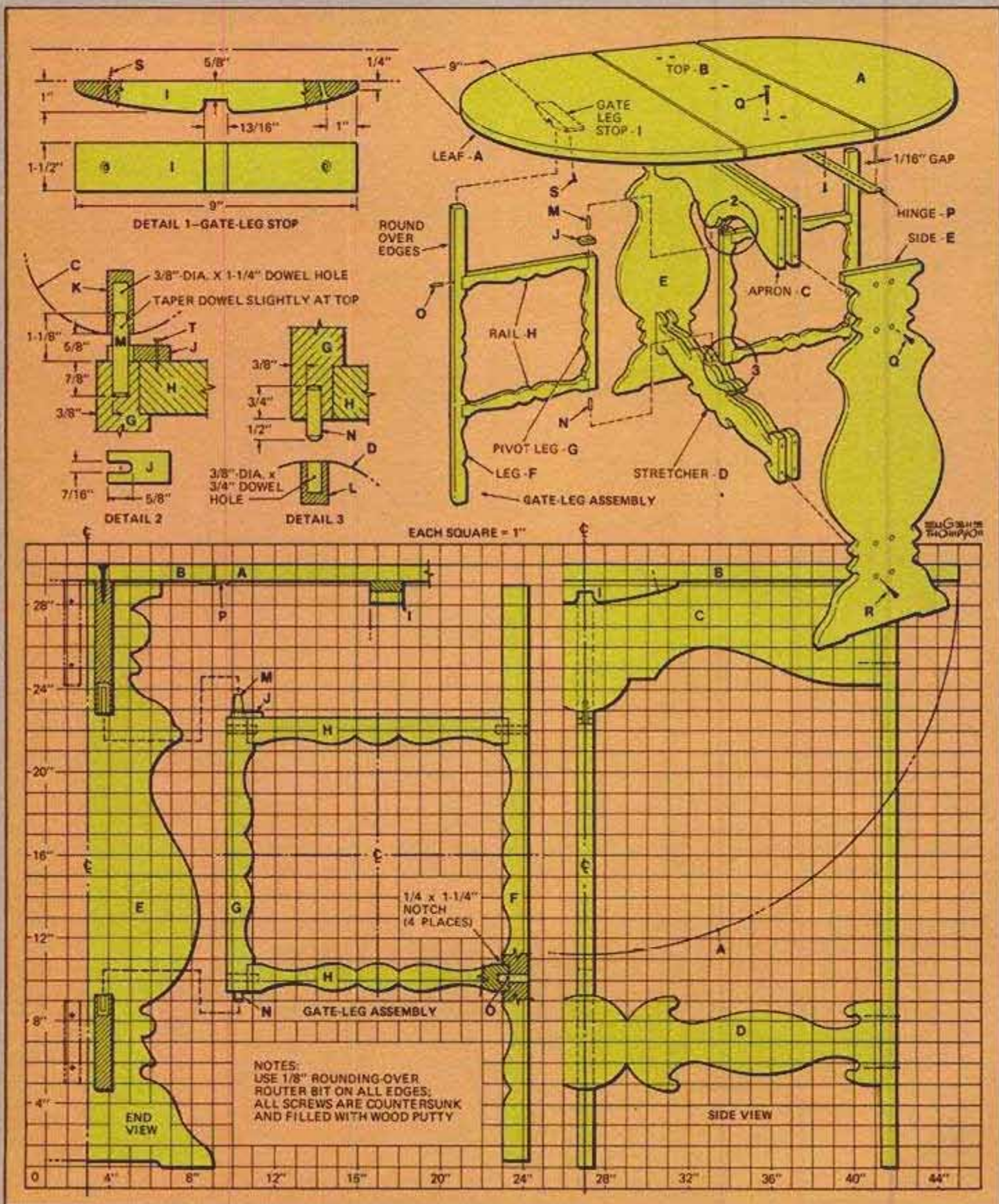


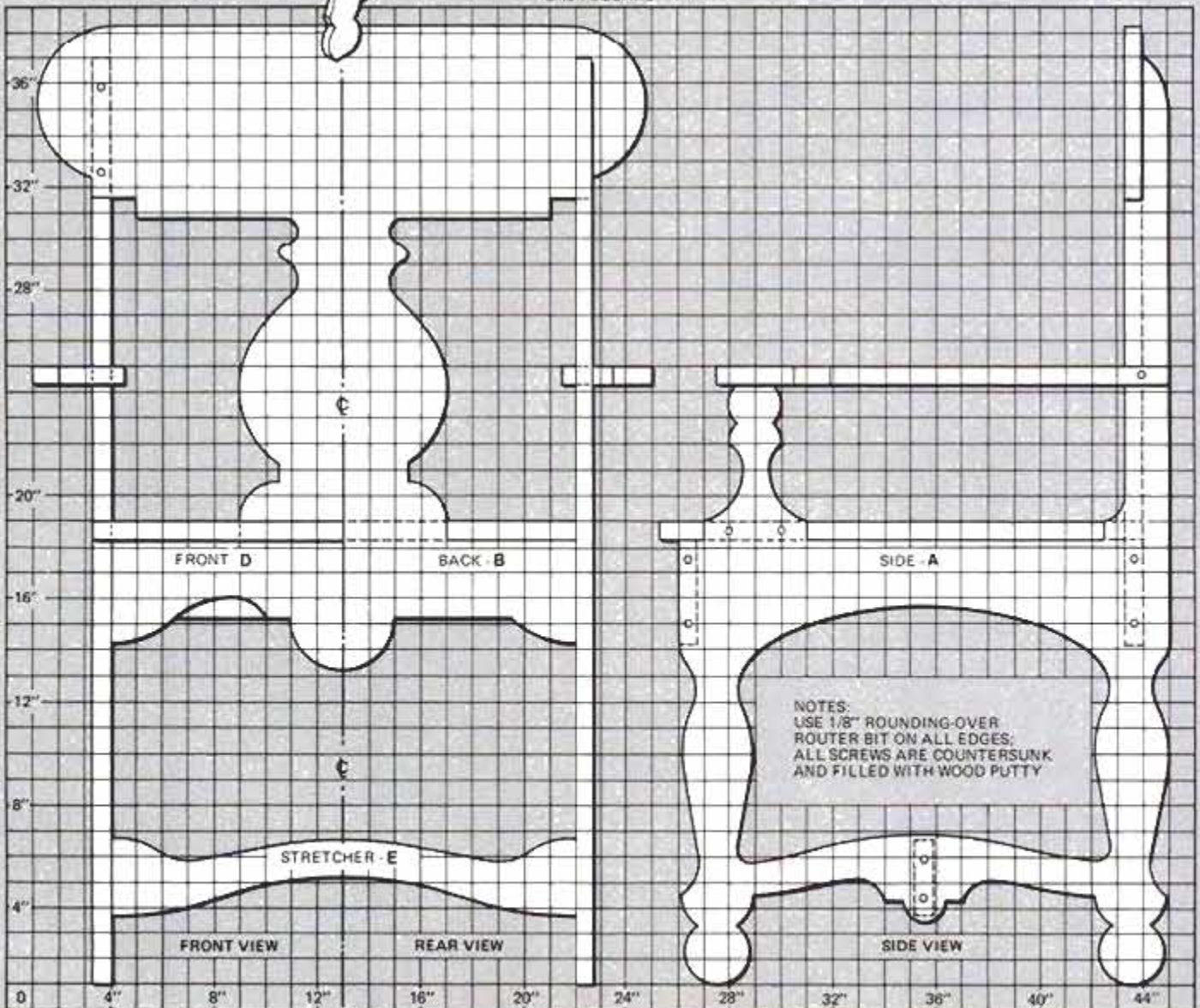
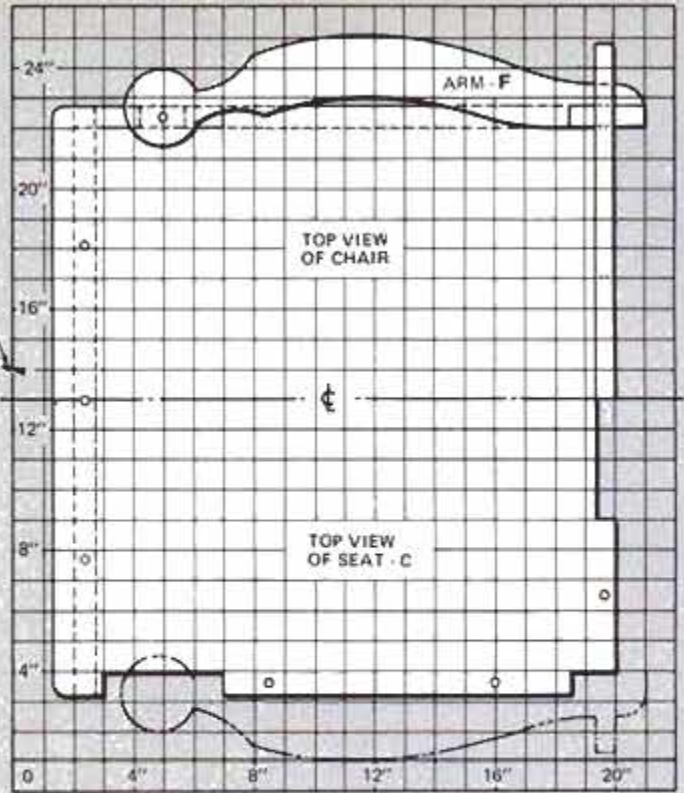
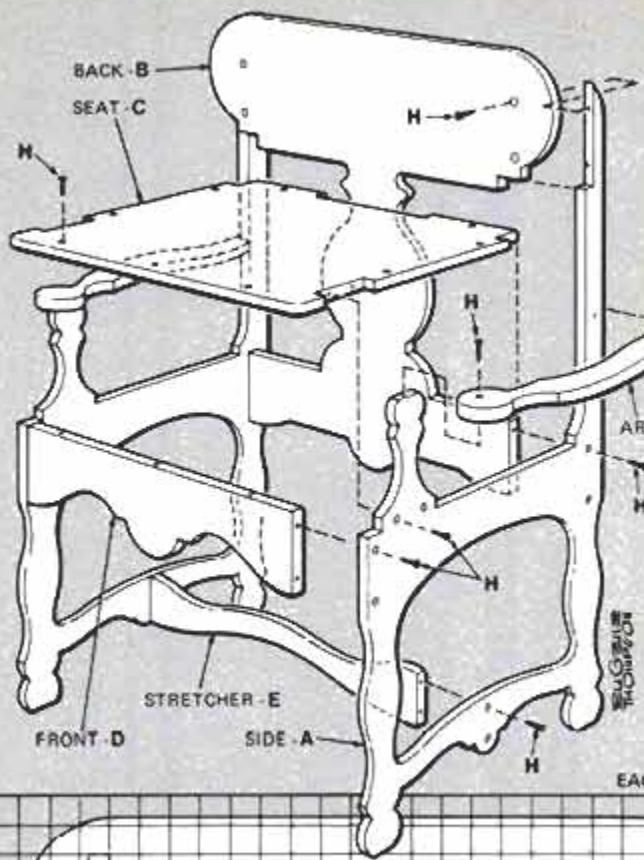
# dining set from plywood

legs, which are of solid southern maple. Assembly is with glue and screws, with the exception of the gate legs, assembled with dowels

and lap joints. All screwheads are recessed and the holes filled with wood putty, then sanded smooth. Draw and cut out full-size pat-

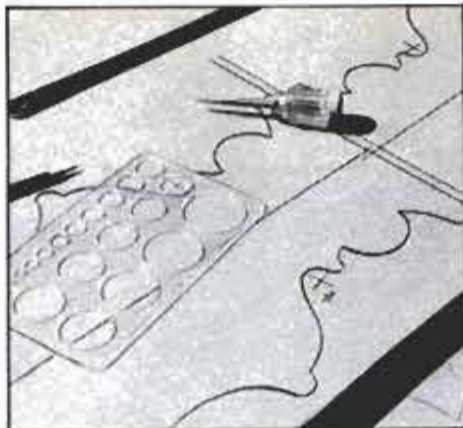
Design: Suzy Taylor  
 PM photos, construction: Rosario Capotosto  
 PM color photos: George Ancona



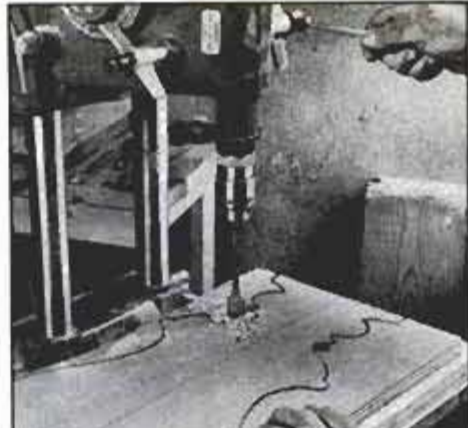




**1** Use heavy paper patterns to draw outlines on panel. Position each piece for the most economical layout. Use a stick as a beam compass to draw the large circle.



**2** Use a circle guide to help find the exact locations for the drill centers. Match best fitting circle to the curve, then punch the centers of the holes with an awl.



**3** Operate this type of drill bit at moderately high speed to obtain smooth-walled holes. Be sure to use a backup board.



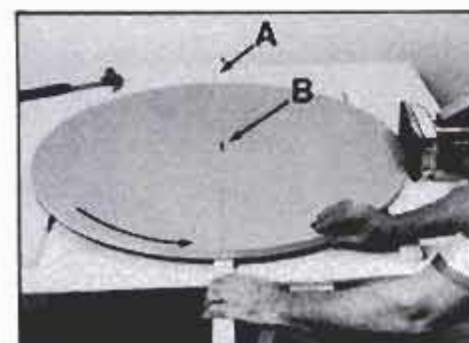
**4** Use a narrow band-saw blade for cutting the sharp curves. Feed the workpiece into the blade slowly; keep to outside of line.



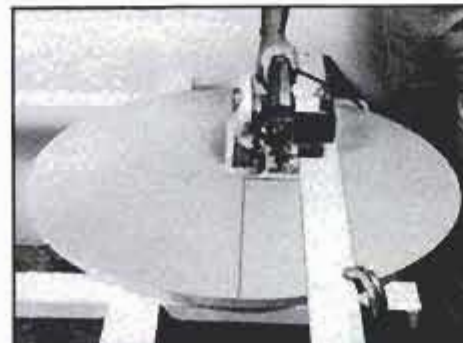
**5** Circle jig (see text) makes easy work of cutting 36-in.-dia. disc. Be sure to support overhang level with the saw's table.



**6** Try this novel setup for sanding the large disc edge. Sander must stand off the table slightly, so shoe can oscillate freely. Level irregular housing with a wedge (arrow). Don't crush housing with clamp.



**7** Pull the disc lightly against the sander, while rotating it continuously (arrow). The nail at A goes into the work table. Drive center nail B into furring strip.



**8** Use a guide and circular saw to make center cut that yields the two drop leaves.



**9** A sanding drum can be used for much of the edge sanding, but some areas require hand-sanding. Next, be sure to shape the corner rounds before assembly, or you won't be able to reach some of the areas.

#### MATERIALS LIST—GATE-LEG TABLE

Key	No.	Size and description (use)
A	2	3/4 x 18 x 36" MDO plywood (leaf)
B	1	3/4 x 12 x 36" MDO plywood (top)
C	2	3/4 x 6 1/4 x 28 1/2" MDO plywood (apron)
D	2	3/4 x 4 1/2 x 28 1/2" MDO plywood (stretcher)
E	2	3/4 x 12 x 28 1/4" MDO plywood (side)
F	2	3/4 x 1 1/4 x 27 5/8" MDO plywood (leg)
G	2	1 3/16 x 1 1/4 x 13 1/8" maple (pivot leg)
H	4	1 3/16 x 1 1/4 x 12 1/2" southern maple (rail)
I	2	1 x 1 1/2 x 9" hardwood (stop)
J	2	1/4 x 3/4 x 1 1/2" hardwood (retainer)
K	2	3/8"-dia. x 1 1/2" hardwood (dowel insert)
L	2	5/8"-dia. x 1 1/2" hardwood (dowel insert)
M	2	3/8"-dia. x 2" hardwood (pivot dowel)
N	2	3/8"-dia. x 1 1/4" hardwood (pivot dowel)
O	4	3/8"-dia. x 1 1/2" hardwood dowels
P	2	1 1/2 x 36" piano hinge
Q	14	1 3/4" No. 8 fh wood screw
R	8	1 1/2" No. 8 fh wood screw
S	4	1" No. 6 fh wood screw
T	2	3/4" common nails

Misc.: Carpenter's glue, finishing materials (see text).

terns on heavy paper and trace the outlines onto the panels. Draw a full 36-in.-diameter circle for the two drop leaves with a centerline through the middle. This disc will be cut in half to form the two leaves after sawing and sanding.

When drawing the different parts, you'll want to position them as closely as possible to economize on stock, but leave about a 1-in. minimum space between each section to allow for initial rough cutting. Use your sabre saw to separate the parts for easy handling while making finish cuts.

Because of the many small-radii,

#### MATERIALS LIST—CHAIR

Key	No.	Size and description (use)
A	2	3/4 x 19 x 36" MDO plywood (side)
B	1	3/4 x 23 1/2 x 25" MDO plywood (back)
C	1	3/4 x 18 3/4 x 19 1/2" MDO plywood (seat)
D	1	3/4 x 5 x 18" MDO plywood (front)
E	1	3/4 x 3 x 18" MDO plywood (stretcher)
F	2	3/4 x 3 1/2 x 17 3/8" MDO plywood (arm)
G	2	1 1/4" No. 8 fh wood screw
H	31	1 3/4" No. 8 fh wood screw

Misc.: Carpenter's glue, finishing materials (see text).

inside curves in this project, predrill holes of the appropriate diameter at each of these locations. This will make sawing easier and assure perfectly formed curves. The holes involved include 1/4-, 3/8-, 7/16- and 3/4-in.

(Please turn to page 179)

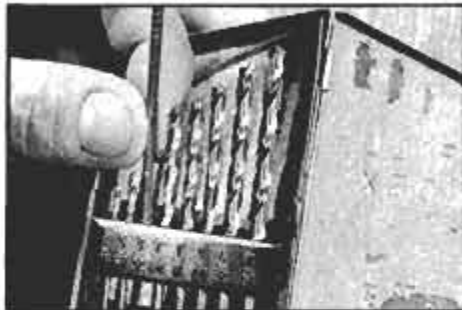
# WORKSHOP MINICOURSE

## USING A DRILL

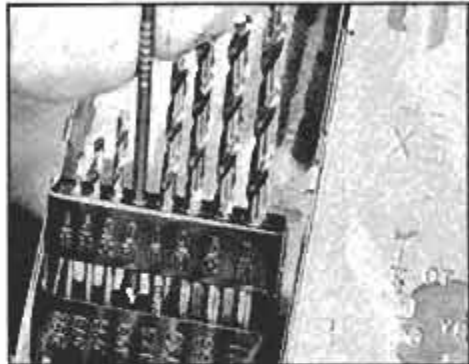
The basic use for an electric drill is to bore holes in wood or metal. Yet, many drill users don't understand the fundamentals of boring pilot holes. Also, in many cases a lead hole is advisable when fastening with nails. This is a must in hardwood, and often essential in softwoods, to avoid splitting the wood.

In predrilling for a screw, the pilot hole (see drawing below) must accommodate the screw easily.

The starter hole—in the second piece—lets the screw threads do their job, which is to hold the pieces together. **PM**



To pick the right bit for boring a nail's pilot (lead) hole, use the bit case. Find the hole the nail enters easily, then use next smaller diameter bit. Here, we use a 1/32-in. bit to accommodate a 10d finishing nail.



The same nail inserted into the next largest hole—1/16 in.—illustrates why this size would eliminate nail's holding power.



To prevent any chance of bit drift—that is, lateral movement of the bit—punch a slight indent, using a scratch awl.



After boring the holes to suit, nails can be driven without fear of splitting the wood—even when the nails are being set near the board's edge, as in this case.



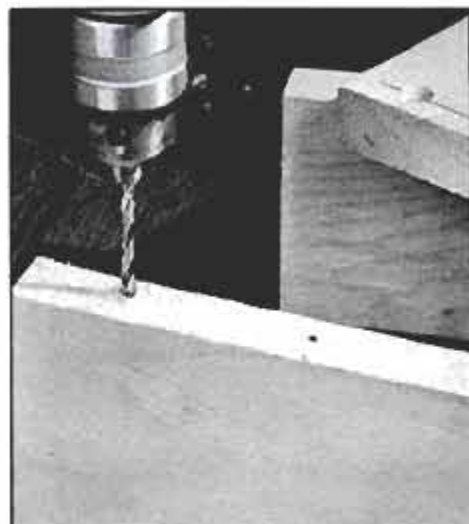
Pilot holes for screws can be sized in a like manner. Here, a No. 8 screw enters a 1/32-in. hole with ease. Thus, this is the correct bit with which to bore the pilot hole. The next smallest bit—1/64 in.—is the one to use when boring the starter hole.



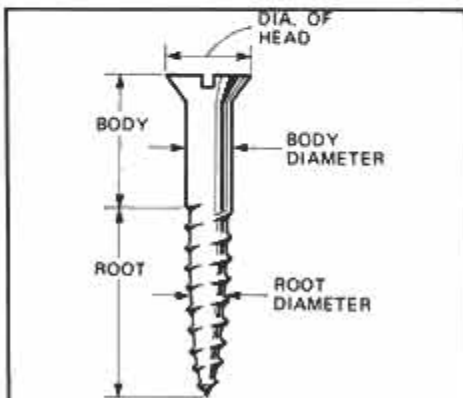
You should bore pilot holes through the top board, using the larger of the two bits.



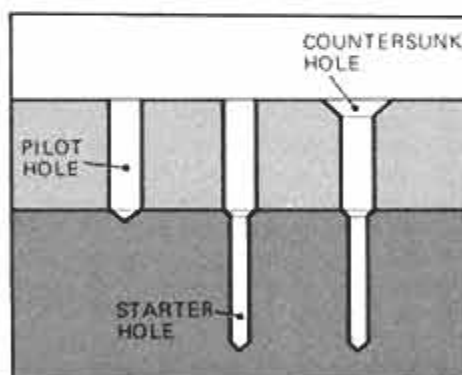
Use this bit to pinpoint the hole location in the second piece of wood, as shown.



Then bore starter holes in second board.



The different diameters of a screw body require different-sized holes—or screw will be either too loose or won't turn home.



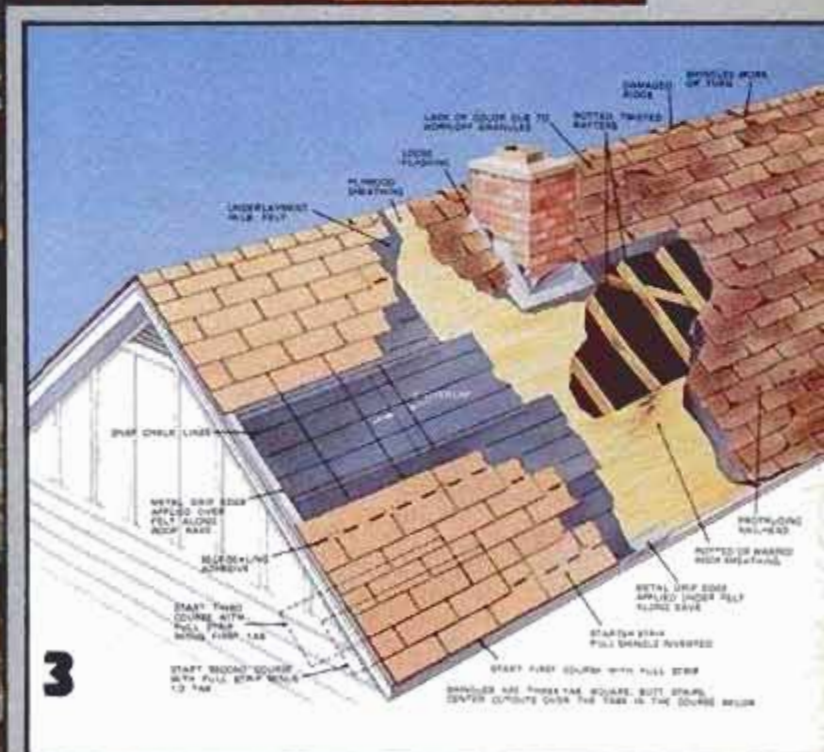
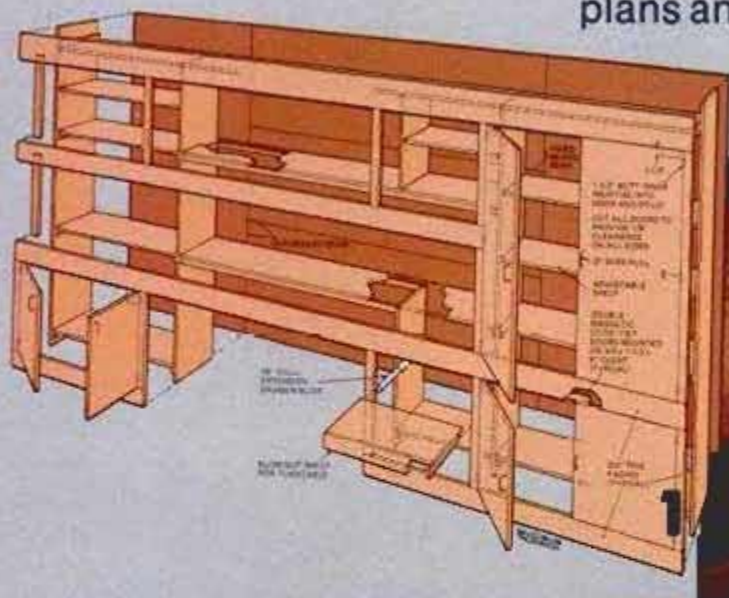
These are the holes you must bore for a wood screw. The countersink bore is necessary for flathead (and oval-head) screws, not for panhead or roundhead screws.



# '82 HOME IDEAS GUIDE

Popular Mechanics

With your own two hands and our good ideas, you can make your home more comfortable, roomy, secure and efficient—and more fun to live in. These projects, plans and products can give you a lot more house than you thought you had.



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# 3 projects for a great room

The name of the energy game these days is to confine family activities to one room, if possible.

Here are some ideas to help you do it.

**A**s the cost of housing continues to rise, more people are choosing to remodel their homes and stay put, rather than buying new and moving. Many of the desired renovations are directed toward making their homes more energy efficient. One way to get more for your energy dollar is to concentrate your family activities in a smaller area. By doing so, you can reduce the heat needed in other rooms and reap the financial benefits.

Working with the Georgia-Pacific Corp., we designed three projects to

help you make better use of your space while, at the same time, giving your home a new contemporary look. The entertainment center shown here is only 18 in. deep, but it has room for stereo equipment, a portable television, records, books and more—plus a cleverly designed gate-leg table that slides easily into the unit. Also presented are sofa and ottoman modules that are not only easy to build, but portable, as well. And, as an added bonus, each sofa module has a large drawer.

Before beginning the wall cabinet, study the drawings carefully. The dimensions given are bound to be different than those in your house, so adjustments will be necessary. Keep

in mind that this cabinet is sized for a ceiling height that is at least 1 in. higher than 8 ft. If your ceiling is lower, cut down the cabinet sides and back until you have at least 1 in. of clearance for maneuvering the unit during installation.

Begin work by cutting the ends and dividers to size. Then carefully lay out the position of all intersecting shelves on these uprights. Glue and screw the shelf-support cleats into position and

*(Please turn to page 124)*

Gate-leg table in folded position and wall cabinet unit (below) make efficient use of small space. Sofa and ottoman are of same-size modules.

Color photos reprinted from Georgia-Pacific's Great Possibilities, Meredith Corp., 1981. Used by permission. PM technical art: Eugene Thompson



countersink the screw heads slightly. Cover the holes with wood filler and sand the filler smooth.

Next, bore  $\frac{1}{4}$ -in.-diameter  $\times$   $\frac{1}{4}$ -in.-deep holes for the pin-type adjustable shelf-support clips as shown on the drawing. Then cut all shelves, counters, and cabinet bottoms and tops to size. Attach the front and back cleats to the underside of the long shelves of the center section for extra support.

Don't try to assemble the whole unit at once. Do it in stages, beginning with the section on the left side of the drawing. Using 4d finishing nails, attach all horizontal members to the uprights by nailing them to the cleats. Move this assembly aside and build the cabinet section on the right-hand side of the drawing. Stand up both sections and position them about 3 ft. from the wall, and check each for squareness. Tack-nail two diagonal braces on each assembly to keep them square.

Next, join these two sections by installing the counter, shelves and short upright for the center section.

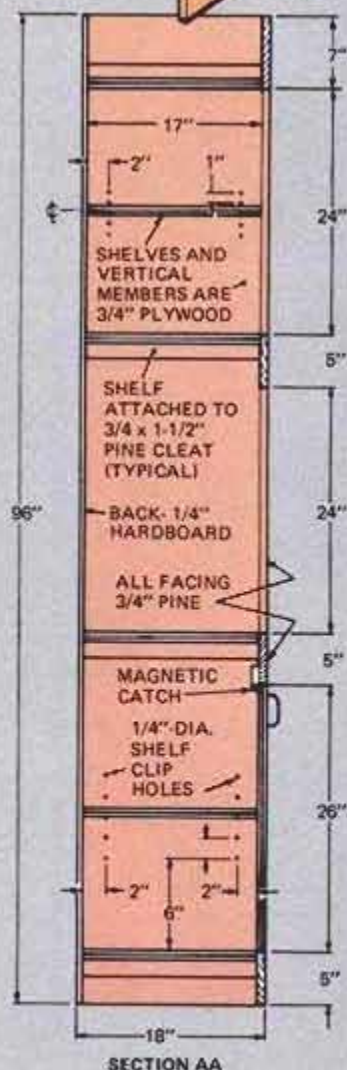
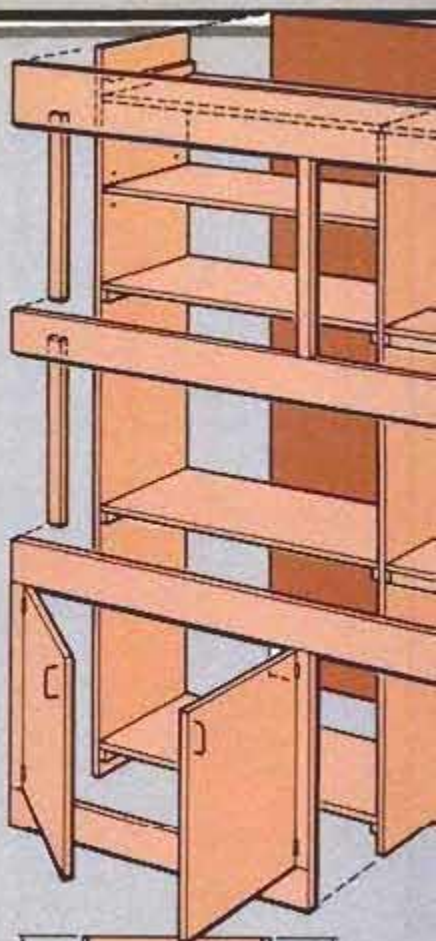
Again, check for square and brace the entire assembly. Cut the hardboard for the back so the seams will be hidden behind either a vertical or horizontal member and attach with 4d nails.

Locate the position of the studs in the wall that's to be covered and note their dimensions for later use. Remove any baseboard or other obstruction from the wall, then slide the unit into place. Level and plumb the assembly using wood shims as necessary under the uprights so it will stay level. Attach unit to the wall with screws turned through the back and into the studs.

Remove the diagonal bracing and cut the various vertical and horizontal pine facings to size. Nail these squarely in place with 6d finishing nails. Set the nailheads, fill the holes with wood filler and sand smooth.

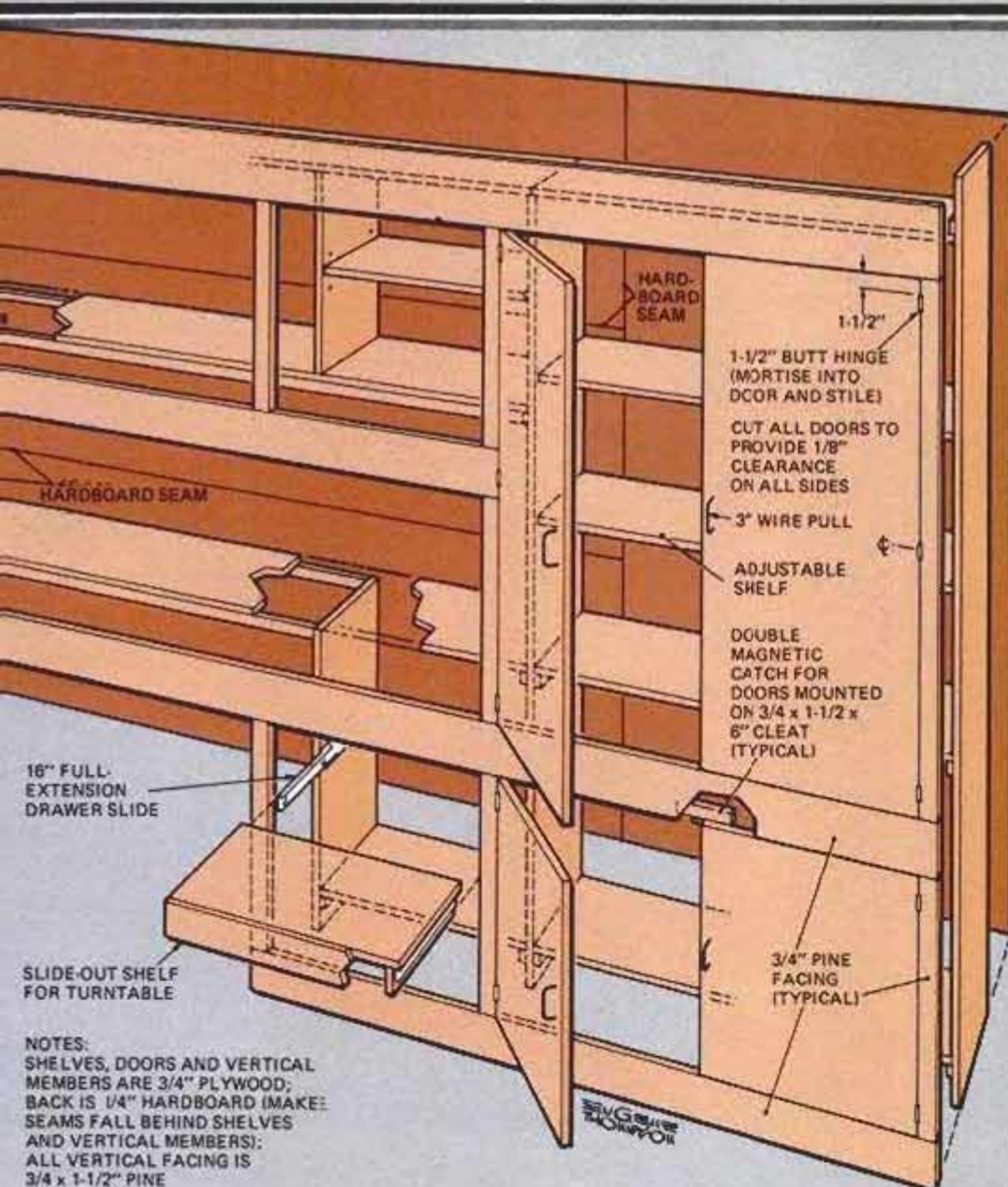
Assemble the slide-out shelf and cut the doors to size. Install both, then sand, prime and paint the cabinet. Install the Slim-line Levolor blinds. Begin making the gate-leg table by cut-

*(Please turn to page 128.)*

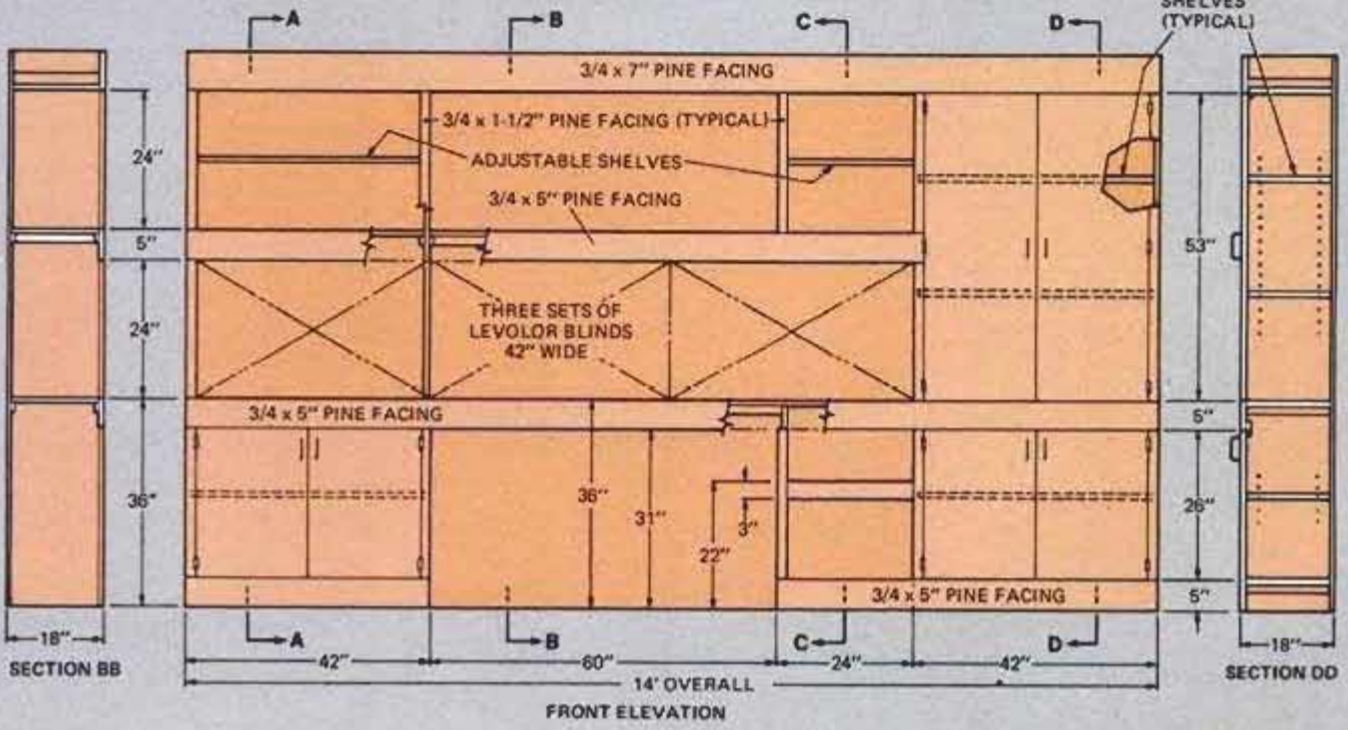
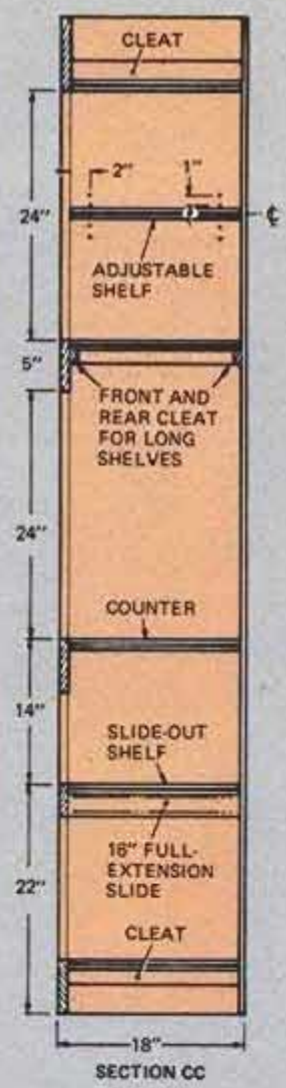


Wall cabinets, gate-leg table, sofa and ottoman modules all transformed this room into a family-activities center. Their sleek contemporary design is not only attractive, but versatile, as well. The table folds neatly within the 18-in.-deep, multipurpose wall unit. The sofa and ottoman units can be combined in many different ways to suit individual space and needs.

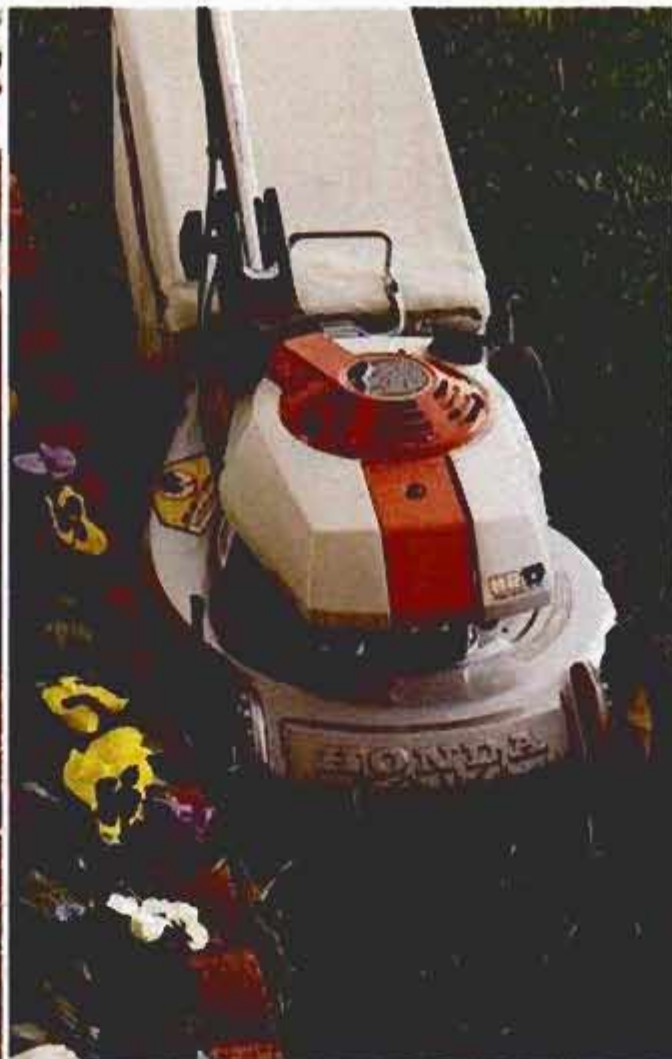




NOTES:  
 SHELVES, DOORS AND VERTICAL MEMBERS ARE 3/4" PLYWOOD;  
 BACK IS 1/4" HARDBOARD (MAKE SEAMS FALL BEHIND SHELVES AND VERTICAL MEMBERS);  
 ALL VERTICAL FACING IS 3/4 x 1-1/2" PINE



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But the best reason to buy any of these products is because it's a Honda. For more information, please check your local Yellow Pages for the closest Honda Power Products dealer or call toll-free 1-800-447-4700, and in Illinois, 1-800-322-4400.

# **IT'S A HONDA**

ling the leaves and tabletop to size from one sheet of cabinet-grade pine plywood. Because the table will have a clear finish, cut these pieces so the grain on the outer pine veneer will run the length of the table and be continuous.

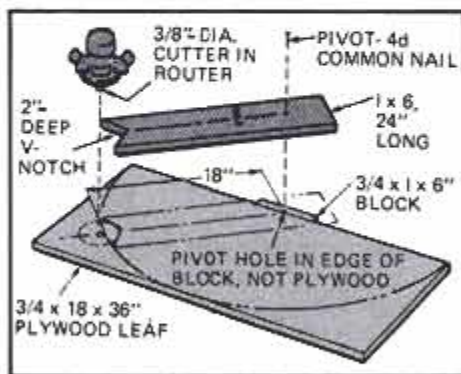
### MATERIALS LIST—GATE-LEG TABLE

Key	No.	Size and description (use)
A	2	3/4 x 18 x 36" pine plywood (leaf)
B	1	3/4 x 12 x 36" pine plywood (top)
C	2	3/4 x 12 x 29 1/4" pine (side)
D	2	3/4 x 6 x 16" pine (foot)
E	2	3/4 x 4 x 23 1/4" pine (stile)
F	2	3/4 x 4 x 23" pine (pivot leg)
G	1	3/4 x 4 x 18" pine (lower table rail)
H	2	3/4 x 4 x 14" pine (lower gate rail)
I	2	3/4 x 2 x 29" pine (leg)
J	1	3/4 x 2 x 18" pine (upper table rail)
K	2	3/4 x 2 x 14" pine (upper gate rail)
L	2	3/4 x 2 x 12" pine (cleat)
M	2	3/4 x 2 x 5" pine (leaf stop)
N	24	3/8"-dia. x 2" dowel
O	2	1 1/2 x 35 1/2" piano hinge
P	2	1 1/2 x 23" piano hinge
Q	11	2" No. 10 fh screws
R	4	1 1/4" No. 10 fh screw
S	4	1" No. 8 fh screw
T	6	3/8"-dia. dowel plug
U	2	3/8"-dia. round magnetic catch
V		3/4" veneer tape, as reqd.

Misc.: Satin-finish varnish.

Next, cut the semicircular shape on the leaves, using a router and the simple jig shown below. Glue veneer tape to all the edges of the leaves and top.

Cut the table sides and feet as shown and join with glue. Clamp overnight. Then cut the rails and stiles for the table-support assembly (parts E, J and G) and join with dowels and glue. Check for square, clamp and let dry overnight. The two gate legs are assembled in the same way.

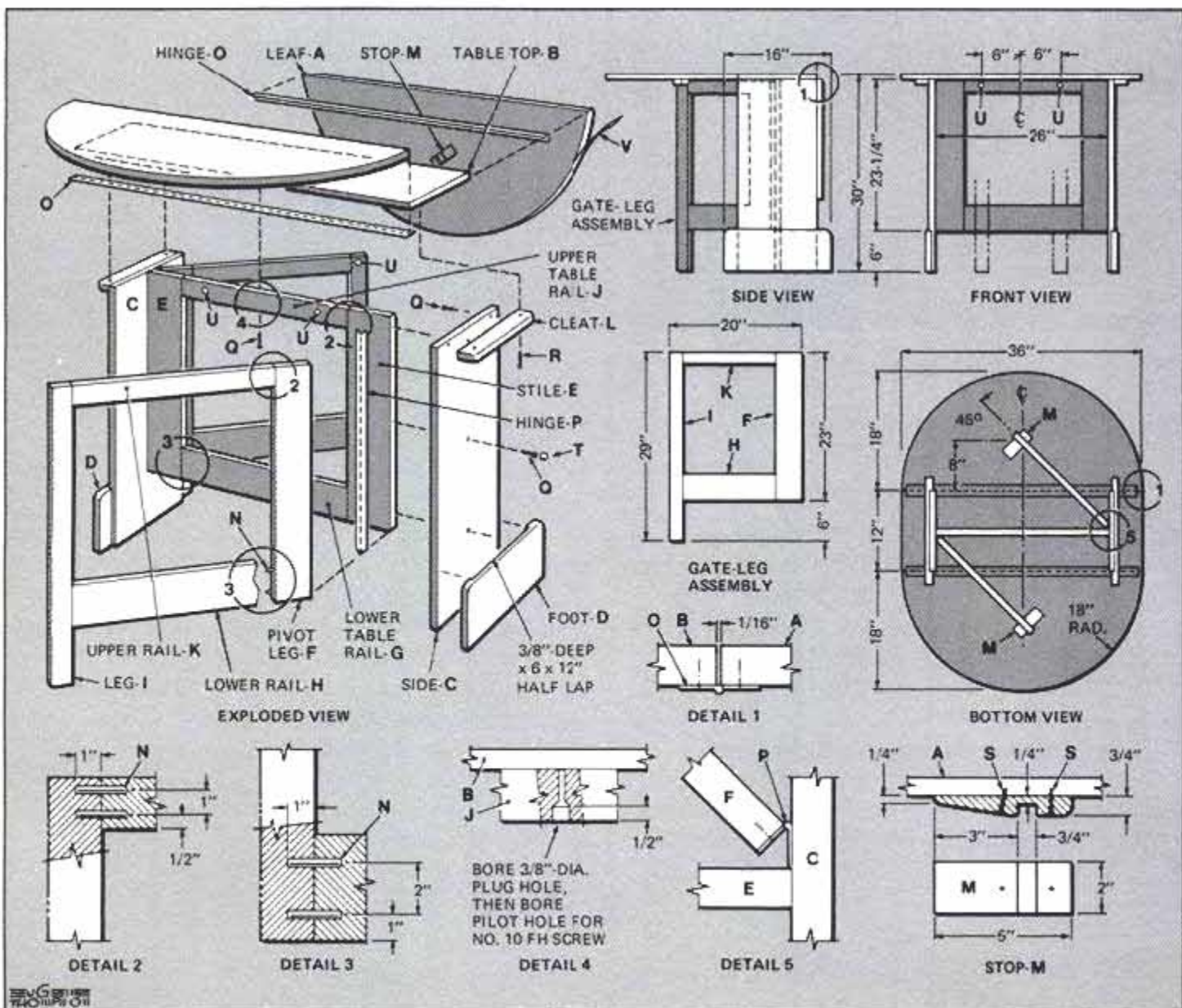


Glue and screw the cleats (for attaching the top to the sides) to the sides. Then glue and screw the sides to the table-support assembly. Countersink these screws and fill the holes with dowel plugs. Next, join the top and leaves by installing the two continuous hinges. Then install the hinges that join the gate legs to the table sides.

Lay the tabletop assembly face down and attach the table support and sides as shown. Position and attach the gate-leg stops, then finish-sand the entire table. Wipe with a tack cloth and apply two coats of varnish.

Begin the sofa modules by cutting the bottom, sides, back and top. Then assemble them with 6d finishing nails and glue. Check for square and allow to dry overnight.

Cut all the trim pieces to size and nail them to the plywood with 4d finishing nails. Sand all joints smooth and stain the trim to either match or contrast with the color of the paneling facing. Carefully



apply, to the trim only, two coats of satin-finish varnish.

Cut the paneling to fit precisely within the confines of the trim and glue it to the plywood with panel adhesive. Cut these panels so the vertical kerfs on the finished surface will be uniform.

Next, cut the drawer parts to size, tack-

nail them together and test-fit the drawer. There should be  $\frac{1}{8}$  in. clearance on each side and on the top. When satisfied, disassemble and cut the drawer-pull notch, then reassemble the drawer with 6d finishing nails and glue. Check for square.

Glue the paneling to the drawer front and, when it's dry, carefully cut the drawer-pull notch in the paneling, using a coping saw. Next, cut the foam cushion to size and cover it with fabric. Sew a zipper into the fabric so it can be removed for cleaning. Make the back cushions in the same way. The ottoman is constructed like the sofa modules. However, it does not have a drawer.

## MATERIALS LIST—SOFA MODULE

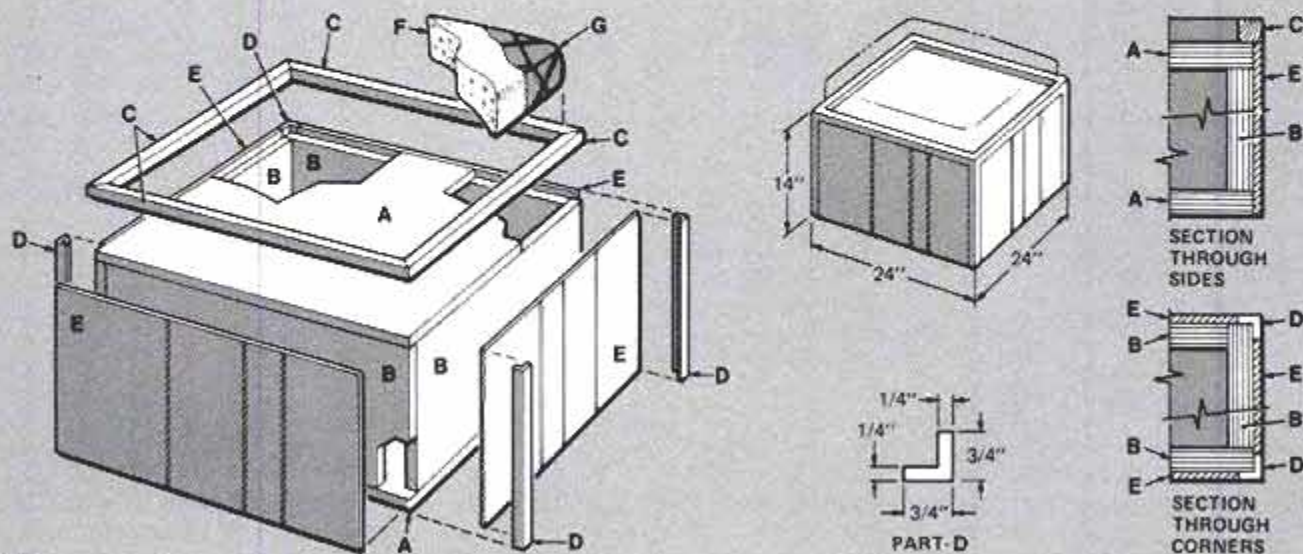
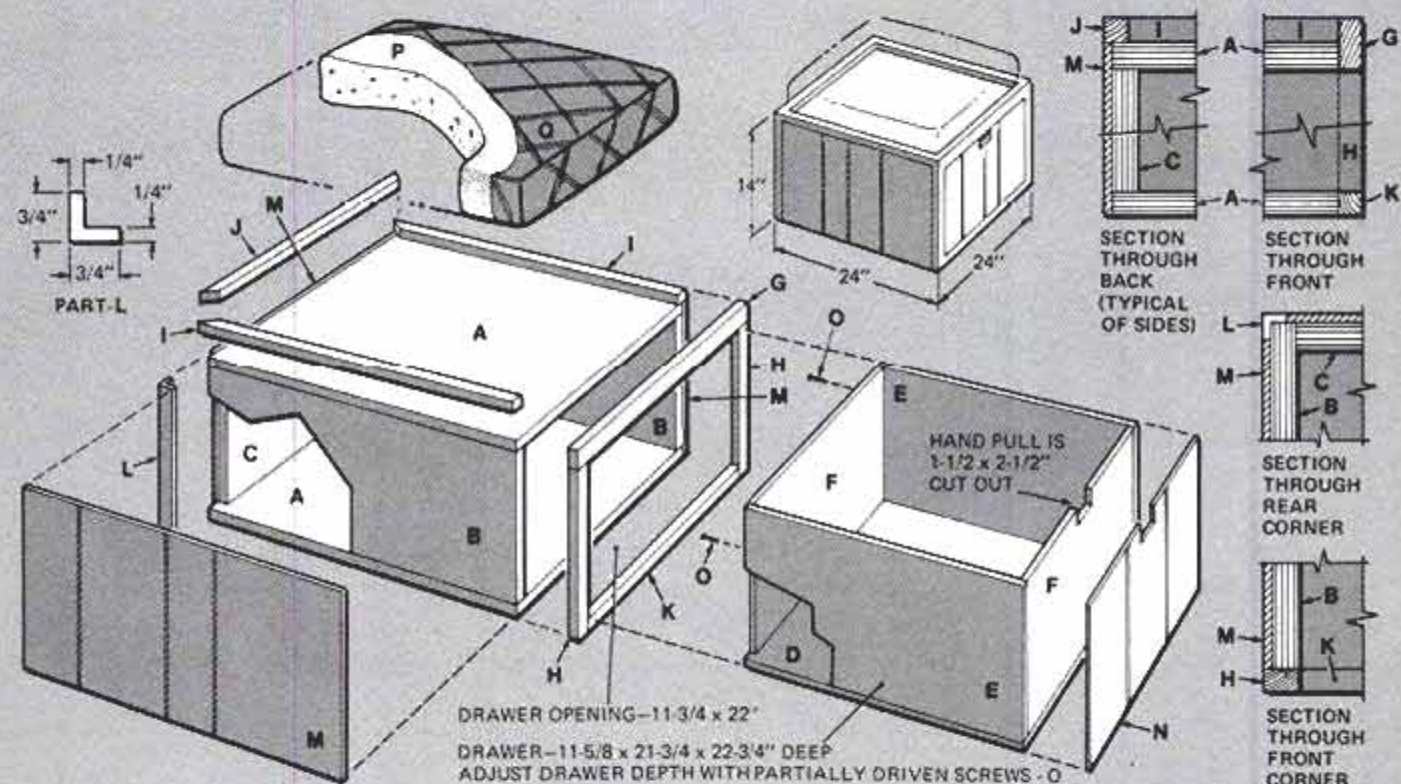
Key	No.	Size and description (use)
A	2	$\frac{3}{4}$ x 23 x 23 $\frac{1}{2}$ " plywood (top and bottom)
B	2	$\frac{3}{4}$ x 11 $\frac{3}{4}$ x 23" plywood (side)
C	1	$\frac{3}{4}$ x 11 $\frac{3}{4}$ x 22" plywood (back)
D	1	$\frac{1}{2}$ x 21 $\frac{3}{4}$ x 22 $\frac{1}{2}$ " plywood (drawer bottom)
E	2	$\frac{1}{2}$ x 11 $\frac{1}{8}$ x 22 $\frac{1}{2}$ " plywood (drawer side)
F	2	$\frac{1}{2}$ x 11 $\frac{1}{8}$ x 20 $\frac{3}{4}$ " plywood (drawer front, back)
G	1	$\frac{3}{4}$ x 1 $\frac{1}{2}$ x 24" pine (front top trim)
H	2	$\frac{3}{4}$ x 1 x 12 $\frac{1}{2}$ " pine (front corner trim)
I	2	$\frac{3}{4}$ x $\frac{3}{4}$ x 23 $\frac{1}{4}$ " pine (top side trim)
J	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 24" pine (top back trim)
K	1	$\frac{3}{4}$ x $\frac{3}{4}$ x 22" pine (front bottom trim)
L	2	$\frac{3}{4}$ x $\frac{3}{4}$ x 13 $\frac{1}{4}$ " pine (back corner trim)
M	3	$\frac{1}{4}$ x 13 $\frac{1}{4}$ x 22 $\frac{1}{2}$ " paneling (back, side)
N	1	$\frac{1}{4}$ x 11 $\frac{1}{8}$ x 21 $\frac{3}{4}$ " paneling (drawer facing)
O	2	$\frac{3}{4}$ " No. 10 rh screw (drawer stop)
P	1	4 x 24 x 24" high-density foam
Q		2 sq. yds. fabric

Misc.: Stain, satin-finish varnish.

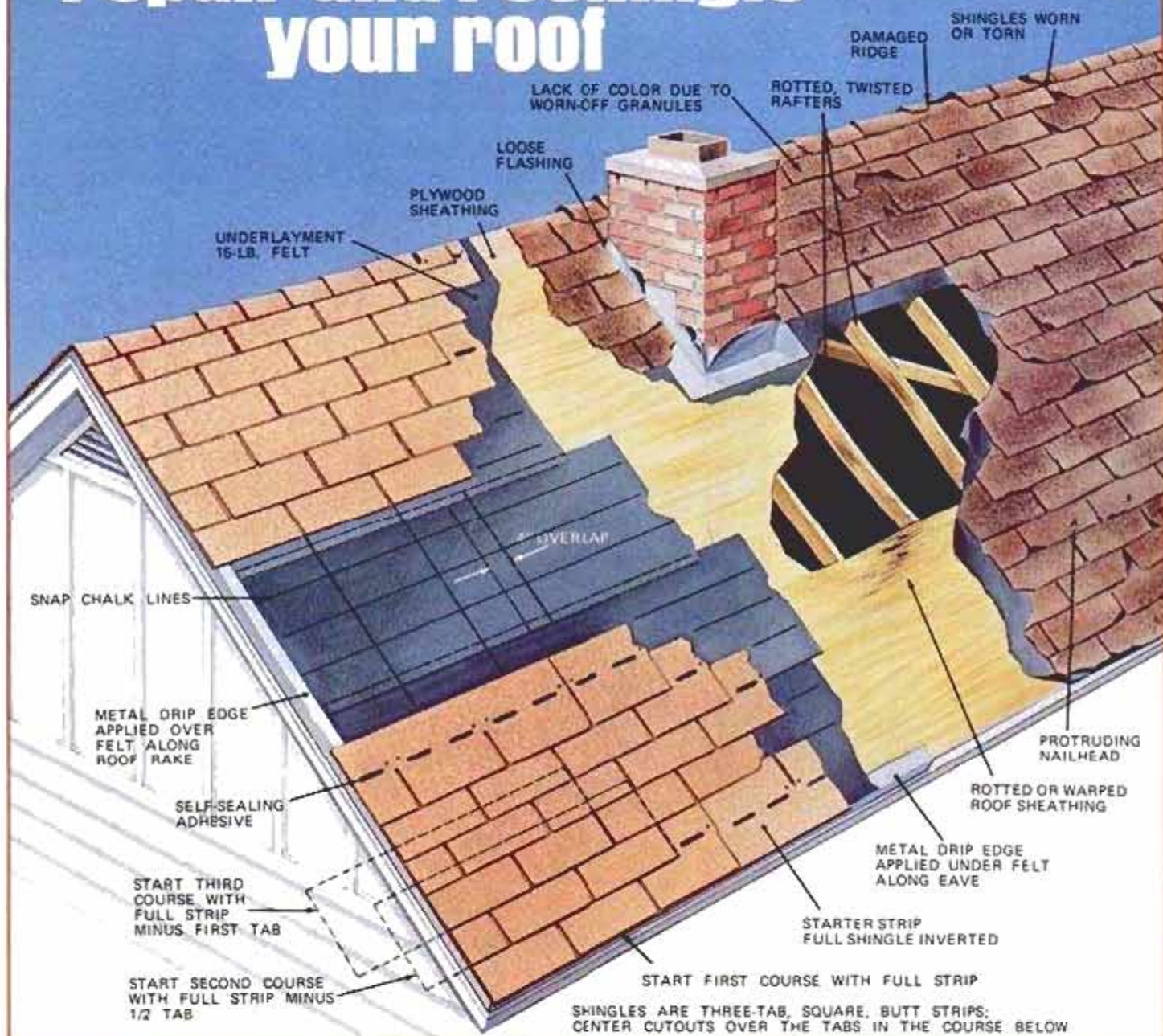
## MATERIALS LIST—OTTOMAN MODULE

Key	No.	Size and description (use)
A	2	$\frac{3}{4}$ x 23 $\frac{1}{2}$ x 23 $\frac{1}{2}$ " plywood (top, bottom)
B	4	$\frac{3}{4}$ x 11 $\frac{3}{4}$ x 22 $\frac{3}{4}$ " plywood (side)
C	4	$\frac{3}{4}$ x $\frac{3}{4}$ x 24" pine (top trim)
D	4	$\frac{3}{4}$ x $\frac{3}{4}$ x 13 $\frac{1}{4}$ " pine (corner trim)
E	4	$\frac{1}{4}$ x 13 $\frac{1}{4}$ x 22 $\frac{1}{2}$ " paneling (side facing)
F	1	4 x 24 x 24" high-density foam
G		2 sq. yds. fabric

Misc.: Stain, satin-finish varnish.



# How to repair and reshingle your roof



New roofing work is under way on left side of this roof. Right side shows all the telltale signs of roof in desperate need of repair.

Reshingling alone may not be enough. Here's how to fix your roof—from rafters to shingles.

Now that the country has survived the fiercest cold spell of the 20th century, homeowners can step outside to learn just how much the mean winter may have cost in terms of damage to the house.

Not unusual is damage to the roof: Using a ladder, or a pair of binoculars

if you don't care for height, check your roof early this spring for signs such as:

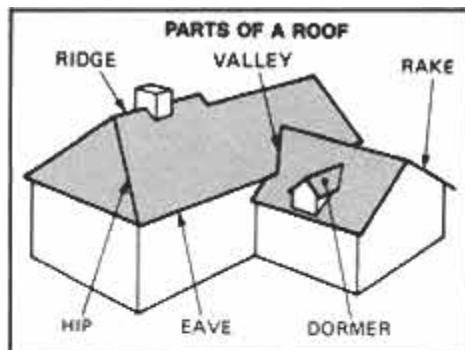
- Torn or loose shingles.
- Worn shingles—granules are off and the asphalt below shows through.
- A crooked ridge, which may indicate serious sheathing problems.
- Soft spots in the roof. These can usually be spotted because the shingles will tear away easily from rotted sheathing in a wind storm.
- Other signs that your home probably needs a roof overhaul include shingles that are curled and blistered, protruding nailheads and worn or torn

shingles on the roof's ridges or in the valleys.

One typical homeowner saved more than \$1,000 by repairing the roof himself, with help from a few friends. Estimates of having the job done by professionals for the moderately sized, two-story frame house with relatively uncomplicated roof (shown here) ranged from \$1,600 to \$2,000. Materials costs, including new CDX decking, felt, nails and shingles, totaled less than \$600.

The roof was 37 years old and badly in need of repair, including the roof deck and two rafters. Fiberglass-based





Flintkote shingles by Gem Star Building Materials Co. were selected for their fire resistance, 20-year limited warranty and economy based on cost-per-year service.

Compared with conventional asphalt shingles, fiberglass shingles, in general, require 30 percent less asphalt (an expensive oil derivative) to make. The nonwoven fiberglass mat of the shingle used is made from PPG's fiberglass chopped strand. Such fiberglass-based shingles carry class-A fire and wind ratings from Underwriters Laboratories, compared to a class-C fire rating held by most felt-based shingles.

### Gathering repair materials

To determine the number of shingles needed to cover a roof, calculate the total square footage to be covered, add 10 percent for error and waste, then divide by 100. This determines the number of "squares" of shingles required. Shingles are sold by the square (one square covers 100 sq. ft. of roof surface). A typical 1,000-sq.-ft. roof would require 11 squares.

In addition to shingles, other roofing materials that you'll need include 15-lb. roofing felt (tarpaper) in rolls to cover the deck and serve as a base for shingles (one roll for every four squares of shingles); metal drip edge (if your roof doesn't already have it); hot-dipped galvanized 1½- to 1¾-in. 11- or 12-gauge roofing nails with ⅜-in. heads (plan 2½ pounds of nails per square) and one to two gallons of black plastic roofing cement for waterproofing and flashing. You should also use eave flashing if you live in a region subject to severe winters; this is 50-lb. smooth-roll roofing, or 90-lb. mineral-surfaced roll roofing at least 36 in. wide.

For tools, you'll need at least one sturdy ladder—two if you want to support a plank platform—ladder jacks, powdered chalk and chalkline, carpenter's apron, utility knife, 25- or 50-ft. tape measure, ripping bar, circular and sabre saws, hammer, square shovel (spade), framing square and two 8-ft.-long 2×6 planks with roof brackets for on-the-roof work area.

Working on a roof requires careful attention to safety. Sneakers or soft-soled shoes provide the best footing. Hard-soled shoes are slippery and can damage shingles. You should also consider wearing a safety rope or harness secured to an

immovable object on the other side of the roof.

Weather is an important factor, too. Don't work on a roof that is wet, frosty or too hot. Do work in good illumination.

Although experienced roofers work with only one ladder, it is easier for homeowners to use a platform supported between two ladders or on ladder jacks. The ladder should rest on flat ground and be extended about 3 ft. above the roof's

eave so you'll have a handhold as you step from ladder to roof (or vice versa) in an erect position. It is also recommended that ladders be tied to a fixed support, such as chimney or interior radiator, to prevent lateral sliding. If you're using a metal ladder, make sure it's kept clear of overhead electrical wires at all times.

When walking on the roof, move slowly and maintain continual awareness of

*(Please turn to page 132)*



Overage shingles on this 37-year-old roof are curling, peeling and shedding granules. The brittle corners are breaking off.

The deck sheathing and a pair of rafters are warped and rotting. This produces readily visible bends and bows in the roof.



Pry all the rotted areas of the sheathing loose with a crowbar. These large sections of damaged roof must be removed.



In areas where the sheathing is still serviceable, simply remove the damaged shingles with either a flat shovel or spade.



The two warped and twisted rafters should be removed and replaced with new ones.



After all damaged sheathing has been removed, measure area to be covered carefully, so new panels are cut for neat fit.



Carefully measure and cut the decking to custom-fit around the soil stacks, protuberances and other openings in the roof.



Plywood sheathing should be installed with its face grain perpendicular to the rafters. End joints are centered over the rafters.



The ladders should be long enough to extend 3 ft. above the edge of the roof. In the photo, the next-to-last decking panel is attached. The decking panels are staggered to avoid long vertical seams.



Next, lay 15-lb. asphalt-saturated roofing felt. Apply drip edge under the felt along eaves; over the felt along the rake.



The starter strip is a row of inverted shingles which is covered by the first course of shingles. The starter strip seals the first shingle course.

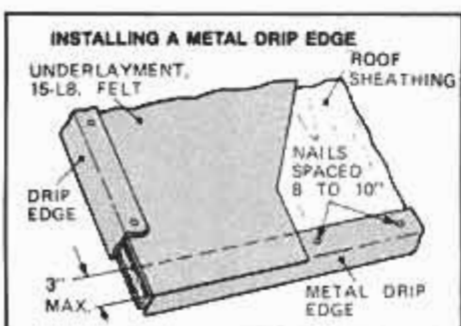


An in-process photo of shingling job shows three courses in place and a fourth course in progress. Note that drips (tab cutouts) are staggered in adjoining courses.

where its edges are at all times. Keep the area as free from tools or shingle stacks as possible. When walking uphill, your weight should be on your heels. Conversely, when you are walking downhill,

put your weight on the balls of your feet.

Provide for the safety of those below you. Keep children and curious adults away from the area near the house by roping it off, if necessary. And there is always a chance that your hammer or another tool will slip from your grasp and slide off the roof.



## Preparing the roof

It is possible to reroof a home in two weekends; it's best to do half of the roof in one weekend. In renewing a roof, you need not remove old shingles in all cases. New ones can be applied over almost any type of existing roofing. The exceptions are brittle tile and slate shingles which must be removed. In cases where old

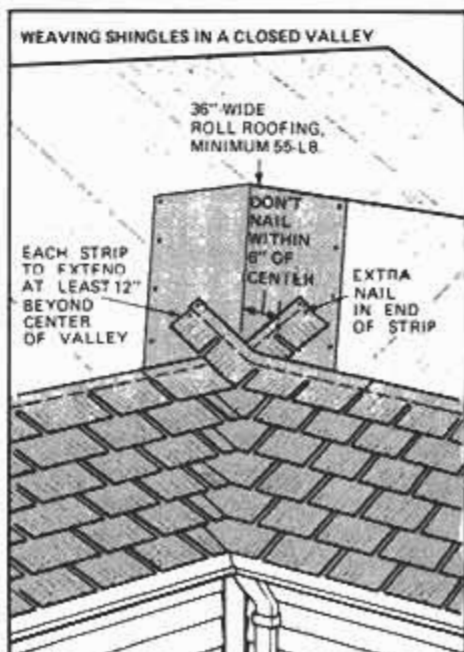


Snap chalklines at measured intervals to guide you in applying the shingles. Mark 5½ in. from the edge of the rake; then snap lines vertically at 6-in. intervals. Snap horizontal lines every 5 in. parallel to both the ridge and the eave.

shingles do need removal, however, a flat-faced coal shovel, or spade, will do the job. Rotted decking can be pried off with a crowbar or ripping bar.

The deck wood was rotted and warped on the roof shown. Before applying the new deck, it was also necessary to replace two badly twisted rafters.

In cases where new shingles can be installed over existing ones, remove all loose nails, drive in protruding nails and



smooth down slightly curled or bent shingles.

The start of a good roofing job depends on a sound deck. Well-seasoned plywood or roof sheathing that is free from knots and resinous areas is the premium material at a premium price. However, on this roof, 1/2-in. CDX (unsanded, exterior sheathing grade) plywood was used at considerably less cost. When you apply decking, stagger the panels to avoid any long vertical seams from top to bottom of the roof.

If your roof doesn't have metal drip edges, now is the time to install them (see drawing, page 132). Space the nails 8 to 10 in. apart and close to the inner edge. Apply drip edges along the eaves before applying the felt underlayment; install the drip edge at the rake after laying the underlayment.

Applying 15-lb. felt underlayment over the new deck is the next step. Use a tape measure and chalkline to ensure a straight installation. Use an ample number of roofing nails or staples to secure the felt. Make certain each layer of felt

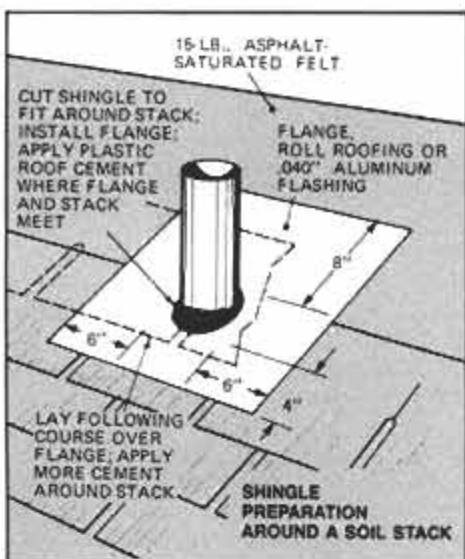
*(Please turn to page 134)*



You should use a sabre saw to cut holes through the underlayment and the decking that's needed for the ventilators.



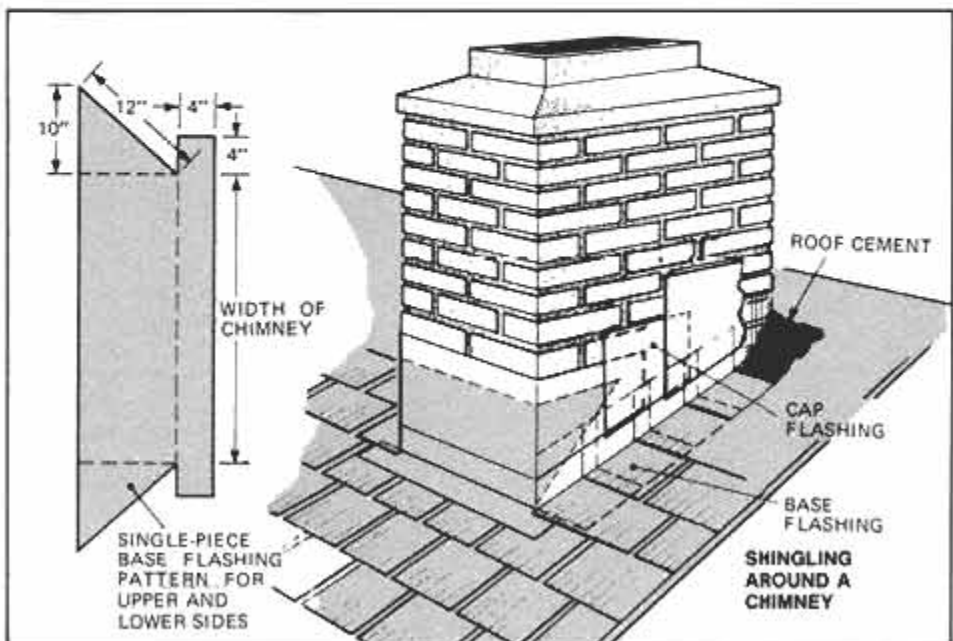
Seal the flanges on the vents and around chimneys thoroughly, using black plastic roofing cement in a cartridge-type gun.



You may have to trim shingles abutting vents and such. Nail as possible. Set shingle; cover the nailheads with cement.



Here the final course of shingles is being applied to the first side of the roof.



The Boston ridge is the most commonly used type of ridge cover. It's made of one-third pieces of shingle, lapped 5 to 6 in. for double coverage, and blind-nailed.

*(Continued from page 133)***WATER, FILL,  
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SPRAY,  
WASH.**

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**pumping power wherever you want it.**



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overlaps the preceding one by 4 to 6 in.

Next, snap chalklines to aid shingle alignment. Begin applying shingles from the outside edge of the roof (rake) and work toward dormers or valleys. In case of hips, start at the center and work toward the edges.

With asphalt shingles the first course is doubled; the usual practice is to install the first layer's tab edge toward the ridge. (On new decking, a course of wood shingles should go on, along the eave, before the starter course.) The first course of shingles should extend over the eave ½ to ¾ in. to ensure water runoff into the gutters.

Start the first regular course with a full shingle over the starter strip. Read the recommended nailing procedure on the shingle packaging. With three-tab, square butt shingles, cut half a tab (6 in.) off the first shingle in the second course. Fasten all shingles, leaving about 5 in. of the preceding course visible. Cut a full tab off the first shingle in the third course. Continue the shingle pattern to the ridge. (Note: For two-tab and no-cut shingles, use a 9-in. offset instead of a 6-in. offset. If you use larger, metrically sized shingles, make adjustments.)

Hammer nails 1 in. from each edge and ⅝ in. above each cutout. Use four nails per shingle. Drive the nails straight so that the edges of the nailheads don't cut the shingle; also, guard against sinking the head into the material. To prevent shingles from buckling, start nailing at the end next to the previously laid shingle.

One method of shingling a valley (an internal angle where two sloped roofs meet) is to lay shingles over a sheet of minimum 55-lb. roll roofing, and apply shingles to both roof areas at once, weaving each course in turn over the valley (see drawing, page 132). Press the shingles tightly into the valley and nail them 6 in. from the valley centerline. Locate two nails at the end of each strip.

At vent pipes, apply shingles up to the pipe (see drawing, page 133). Cut a hole in the next shingle to go over the pipe. Set the shingle in black plastic cement. Cut and place a flashing flange or mineral-surfaced roofing on metal over the shingle and vent pipe; set in black plastic cement. Then cut the rest of the shingles around the pipe and set in cement.

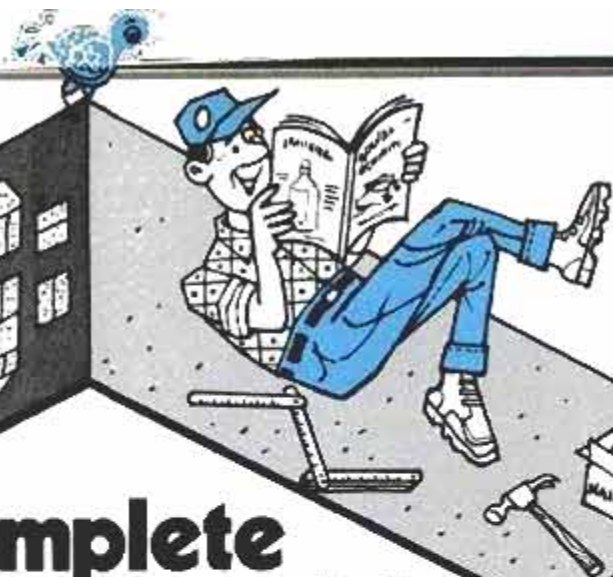
Some manufacturers provide specially cut shingles for hips and ridges (the top edge of the roof). However, you can trim them yourself (last photo, page 133).

Before installing shingles over a hip or ridge, bend them in half lengthwise. Beginning at the bottom of a hip, or at one end of a ridge, apply the shingles over the hip or ridge, leaving a 5-in. exposure. Use only two nails. However, after nailing the last piece with aluminum nails, cover the nailheads with roof cement.

**PM**

# ROOFING

## Complete guide to materials and installation



The majority of residential roofs in the United States (about 70 percent) are covered with either asphalt or fiberglass shingles. These materials are relatively low in cost, easy to apply, and usually last for 20 to 25 years.

But as the chart on the following pages shows, the selection of materials for a house roof is a big one. Some, at a high initial cost, could have a longer expected life than the house. There are even reports that vinyl shingles may soon be on sale. This is essentially the same vinyl used now for siding.

Two of the latest advances in roofing materials are fabrication of shingles from long-lasting copper sheet and shaping of fiberglass roofing mat to resemble a tile shingle. Two companies are listed below as makers of copper shingles. Write to Lunday-Thagard about tile-look fiberglass units.

When reroofing, use the "Rule of Two." That is, when a roof has been reroofed once over the orig-

inal shingles and needs a second reroofing job, the old material—all of it—must come off the sheathing. Otherwise, the strain on the framing will be too great.

Reference is made in the chart to making an existing roof smooth before applying a new roof. This means you should fill spaces where roofing is missing and level spots that are buckled.

Use heavier materials or metal sheet locked at the seam for pitches between  $\frac{3}{12}$  and  $\frac{1}{12}$ , (see chart footnote) or select graveled-in, built-up roofing—good for roofs from flat to  $\frac{3}{12}$ .

As the do-it-yourself roofing story on page 130 indicates, many people are taking the roofing job into their own hands; some are tackling wood and metal shingle jobs, even tile and slate. Along with the increase in owner-completed roofs has come a rise in accidents. Make sure you use ample safety precautions, and think twice before tackling the roof of a three-story house.

### SOURCE LIST—ROOFING MATERIALS

**Asphalt shingles**—Bird & Son Inc., East Walpole, Mass. 02032; Celotex Corp., Box 22602, Tampa, Fla. 33622; CertainTeed Corp., Box 860, Valley Forge, Pa. 19482; Flintkote Building Products, 580 Decker Dr., Irving, Tex. 75062; GAF Corp., 140 West 51st St., New York, N.Y. 10020; Georgia-Pacific Corp., 900 Southwest 5th Ave., Portland, Ore. 97204; Lunday-Thagard Oil Co., Box 1519, South Gate, Calif. 90280; Masonite Corp., Roofing Div., 2500 East Roosevelt Rd., Little Rock, Ark. 72203; Masonite, Roofing Div., Box 391, Meridian, Miss. 39301; United States Gypsum Co., 101 South Wacker Dr., Chicago, Ill. 60606.

**Fiberglass shingles**—All companies listed under asphalt shingles plus Johns-Manville Roofing Div., The Manville Co., Ken-Caryl Ranch, Denver, Colo. 80217.

**Wood shingles/shakes**—More than 500 mills turn out cedar shingles and shakes. Most are small and regional in distribution. For more information, contact the trade association that represents them: Red Cedar Shingle & Handsplit Shake Bureau, 515 116th Ave.

N.E., Suite 275, Bellevue, Wash. 98004.

**Clay tile**—Architectural Engineering Products Co., Box 81664, San Diego, Calif. 92138; Ludowici-Celadon Co., 201 North Talman Ave., Chicago, Ill. 60612; Lunday-Thagard Oil Co. (see asphalt shingles); Pacific Clay Building Products, 9500 South Norwalk Blvd., Santa Fe Springs, Calif. 90670; San Valle Tile Kilns Inc., 1717 North Highland Ave., Los Angeles, Calif. 90028.

**Slate**—Buckingham-Virginia Slate Corp., 4110 Fitzhugh Ave., Richmond, Va. 23230; Evergreen Slate Co. Inc., 34 North St., Granville, N.Y. 12832; Rising & Nelson Slate Co., West Pawlet, Vt. 05775.

**Aluminum shingle/shapes**—Alcoa Building Products Inc., 2 Allegheny Center, Suite 1200, Pittsburgh, Pa. 15212; Alumax Building Products, Box 5350, Riverside, Calif. 92517; Architectural Engineering Products Inc., Box 81664, San Diego, Calif. 92138; Reynolds Metals Co., Box 27003, Richmond, Va. 23261.

**Steel shingles/shapes**—Architectural Engineering Products Inc. (see clay tile); Klauer

Mfg. Co., Box 59, Dubuque, Iowa 52001.

**Copper shingles/shakes**—Berridge Manufacturing Co., 1720 Maury, Houston, Tex. 77026; Zappone Manufacturing Co., 2928 Pittsburg N., Spokane, Wash. 99207.

**Mineral fiber shingles**—Supradur Mfg. Corp., 122 East 42nd St., New York, N.Y. 10017.

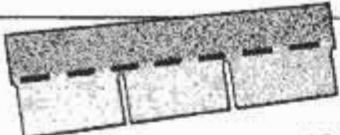






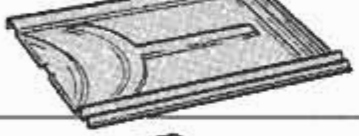
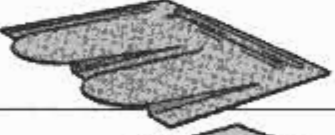




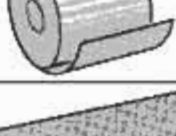
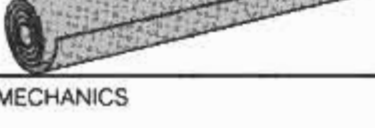
**Roll roofing**—(see addresses listed under asphalt shingles); Bird & Son; CertainTeed Corp.; Flintkote Co.; GAF Corp.; Lunday-Thagard Oil Co.; Masonite, Roofing Div. (Miss.).

**Built-up roofing**—Owens-Corning Fiberglass Corp., Fiberglass Tower, Toledo, Ohio 43659 (except surface gravel). No companies make all the elements of a built-up roof. Local contractors buy from several sources, then apply the finished product.

**Terne metal**—(over stainless or sheet steel)—Follansbee Steel Corp., State St., Follansbee, W. Va. 26037; Ohio Metal & Mfg. Co., Box 923, Dayton, Ohio 45401.

**Copper sheet**—Many companies produce copper sheet. For more information, contact the Copper Development Assn., 405 Lexington Ave., New York, N.Y. 10017.

# A QUICK REFERENCE CHART

	Material	Approximate Cost Per Square*	Installed Cost Per Square*	How Material Is Sold	Colors and Styles
<b>Asphalt Shingles</b>		\$25 to \$40	\$40 to \$75	Three to four bundles per square, depending on weight.	All earth colors, including black and near white, plus near blue, near green. Some with variegated tones, shake "look."
<b>Fiberglass Shingles</b>		\$25 to \$40	\$40 to \$75	Three to four bundles per square, depending on weight.	Somewhat wider color selection than for asphalt shingles. Some variegated tones, shake "look," plus one new barrel-tile "look."
<b>Wood Shingles</b>		\$55 to \$70	\$100 to \$175	Four bundles per square.	Natural wood color; weathers to various gray shades. Butt ends straight, curved, angled.
<b>Wood Shakes‡</b>		\$55 to \$70	\$110 to \$175	Four to five bundles per square, depending on butt thickness, weight.	Natural wood color; weathers to various wood shades.
<b>Clay Tile</b>		\$190 to \$205	\$250 to \$500	Three to four squares per pallet; must be delivered to site or picked up by truck.	Brown and red tones popular; most companies will custom-make color tile to your specifications. Styles: flat, barrel mission, Spanish.
<b>Slate</b>		\$225 to \$375	\$550 to \$1,200	By the square on pallet, delivered to site or picked up by truck.	Black, gray, gray-blue, gray-green, red-brown, purple—all natural colors. Smooth or rough surface.
<b>Aluminum Shingles</b>		\$90 to \$175	\$150 to \$300	Boxed by the square.	Eight to 12 colors, plus white. Formed as shingle, shake, Spanish tile, mission tile.
<b>Steel Shingles</b>		\$100 to \$160	\$240 to \$310	By the carton.	Eight to 12 colors, plus white. Formed as shingle, shake, Spanish tile, mission tile.
<b>Copper Shingles</b>		\$300 to \$500	\$380 to \$600	One to two cartons per square, depending on style, weight.	Copper color weathers to light green, moss green, brown, depending on age, air quality. Various embossed patterns on copper surface available.
<b>Mineral-fiber Shingles</b>		\$50 to \$175	\$80 to \$275	Five to 10 bundles per square, depending on weight.	Red, brown, green, gray; plus white, black. Several shapes; slate, wood-shake textures.
<b>Roll Roofing</b>		\$10 to \$26	\$40 to \$55	One roll per square approximately; about 90 lbs. Mineral-surfaced; two rolls per square.	Black, plus a limited selection of colors. Smooth, mineral-surfaced sheets.
<b>Built-up Roofing</b>		-----	\$65 to \$100	-----	Black, or colors given surface by mineral granules, including white marble chips.
<b>Terne-metal Sheet, over stainless steel</b>		\$150 to \$200	\$450 to \$850	Coils 50' long, 24" wide; weighs 70 lbs. Or preformed pans 24" wide, up to 20' long.	Has spangled look of galvanized iron at outset; weathers to medium gray.
<b>Terne-metal Sheet, over sheet steel</b>		\$130 to \$160	\$350 to \$600	Coils 50' long, 24" wide; weighs 70 lbs. Or preformed pans 24" wide, up to 20' long.	Bare metal requires cleaning and coat of paint. Choose any color you wish.
<b>Copper Sheet</b>		\$250 to \$350	\$400 to \$500	Generally sold in roll-formed pans, ready to install; by the square—about 150 lbs.	Copper color weathers to light green, moss green, brown, depending on age, air quality.

# FOR ROOFING MATERIALS

Fire Resistance	Longevity (years)	Wind Resistance	Installed Weight (lbs. per square)	Quick Facts on Installation
Good	15 to 25	Good when seal-down tabs are used.	230 to 345	See <i>How to Repair and Reshingle Your Roof</i> , page 130.
Excellent	20 to 25	Good when seal-down tabs are used.	210 to 345	See <i>How to Repair and Reshingle Your Roof</i> , page 130.
Flammable, unless chemically treated.	15 to 30	Good when applied to roof with $\frac{1}{2}$ pitch or higher†	200 to 260	Shingles may be laid over one existing course of asphalt, fiberglass or wood shingles, or roll roofing. Where heat and humidity are high, apply 1 x 4" battens to get airflow beneath shingles. Over that goes an overlapping course of 15-lb. felt, then shingles applied with hot-dipped galvanized, stainless-steel or aluminum nails. Follow specifications of the maker or Red Cedar Shingle & Handsplit Shake Bureau, 515 116th Ave. N.E., Suite 275, Bellevue, Wash. 98004.
Flammable, unless chemically treated; then good.	25 to 50	Good when applied to roof with $\frac{1}{2}$ or more pitch; for $\frac{3}{4}$ , follow industry specifications.†	200 to 400	Follow instructions given above for wood shingles.
Excellent	Up to 100 as roof. Individual tiles may be broken by falling limb.	Excellent	600 to 1,600	Old roofing must be stripped to sheathing. Apply tile only over solid-board or plywood sheathing. Because of tile weight, framing may require reinforcement. Lay down two layers of overlapping 30-lb. felt. Use hot-dipped galvanized nails to fasten tiles through prebored nail holes. Follow manufacturer's specifications closely for cave installation, tile overlap, ridge.
Excellent	40 to 100 as roof, depending on quality. Individual slates may be broken by falling limb.	Excellent	700 to 850	Old roofing must be stripped to sheathing. Slate is best applied over solid sheathing. It's also good practice to apply two plies of overlapping 30-lb. felt. Use copper roofing nails, two to each prepunched slate (you can use hot-dipped galvanized nails for cheaper slate). It's best to apply copper flashing (16-oz.). Follow manufacturer's specifications for exposure and cutting slate.
Excellent	20 to 50	Good when applied to roof with pitch of $\frac{1}{2}$ or more.	35 to 65	Can be applied over one course of roofing, if roof surface is relatively smooth and level. Lay down one layer of overlapping 30-lb. felt. Use hot-dipped galvanized or aluminum screw-shank nails to fasten shingles, which, in most cases, interlock with one another. Follow manufacturer's specifications for installation at eave, ridge and interlock steps.
Excellent	20 to 50	Very good when applied to roof with $\frac{3}{4}$ pitch or higher.	80 to 150	Can be installed over one prior application of roofing, provided the surface is relatively smooth and level. Lay down one layer of overlapping 30-lb. felt. Use hot-dipped galvanized nails to fasten shingles-shapes, which, in most cases, interlock. Follow manufacturer's specifications for installation at eaves and ridge, and for interlock.
Excellent	40 to 75	Very good when applied to roof with $\frac{3}{4}$ pitch or higher.	100 to 150	Can be installed over one prior application of roofing, provided the surface is relatively smooth and level. Lay down one layer of overlapping 30-lb. felt. Use copper or silicon-bronze nails. Follow manufacturer's specifications for installation at eaves and ridge, and for interlock.
Excellent	25 to 35	Excellent	245 to 540	Heaviest type (540 lbs. per square) may call for stripping old roofing. Otherwise, this can be applied over the previous layer of roofing, providing surface is smooth and level. Lay down one layer of 30-lb. overlapping asphalt-saturated asbestos felt, with double coverage at eaves, which may need metal drip edge. Use 6d hot-dipped galvanized roof nails over existing roof: ring-barb style over plywood deck—two nails per shingle through predrilled holes.
Good	10 to 15	Good	45 to 110	Can be applied over one application of old roofing, provided surface is smooth and level. Install metal drip edge at rake and eaves. Fasten starter strip or two layers of 15-lb. felt at eave. Roll out roofing, overlapping to point where finished surface begins. Use asphalt cement recommended by the manufacturer to fasten rolls.
Excellent	10 to 20	Excellent	250 to 350 when smooth; 350 to 500 when graveled.	Applied over flat or nearly flat roof, built-up materials are used over new roof. Reroofing generally calls for scraping off top layer, laying down new course of hot tar, felts, more tar and fresh granular topping. Rarely, if ever, done by owner, although owner can patch roof with cold asphaltic cements.
Excellent	Up to 100	Excellent	50 to 75	Existing roof material must be removed. Panels are installed only over a layer of overlapping rosin paper which has been applied to solid sheathing. If you know how to use a sheet-metal brake and are familiar with sheet-metal fabrication, you could follow the manufacturer's specifications for a standard-seam (most popular) or a batten seam roof. All horizontal seams must be soldered.
Excellent	Up to 100, if maintained with a periodic recoating of paint.	Excellent	62 to 76	Installation advice is the same as that given above for terne over stainless steel.
Excellent	Up to 100	Excellent	125 to 155	Existing roof material must be removed. Panels are applied only over solid sheathing, after the latter has been covered with a layer of overlapping rosin paper, plus a layer of 15-lb. felt. As with terne, standing-seam or batten-seam installation requires experience in sheet-metal fabrication.

\*Roofing term for 100 sq. ft. Roof area of average one-story house is about 2,000 sq. ft. (20 squares); of average two-story house, about 14 to 15 squares.  
†Angle of roof. A  $\frac{1}{2}$  pitch indicates roof rises 4" for each 12" measured on the horizontal. ‡Mostly red cedar; some cypress, redwood and white cedar.

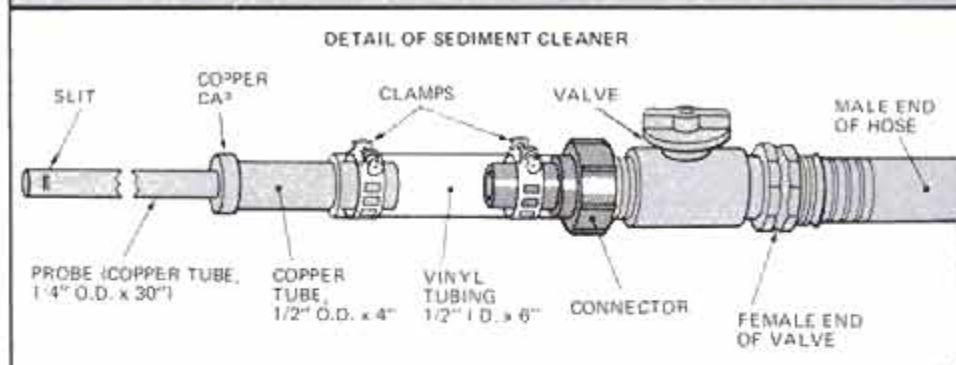
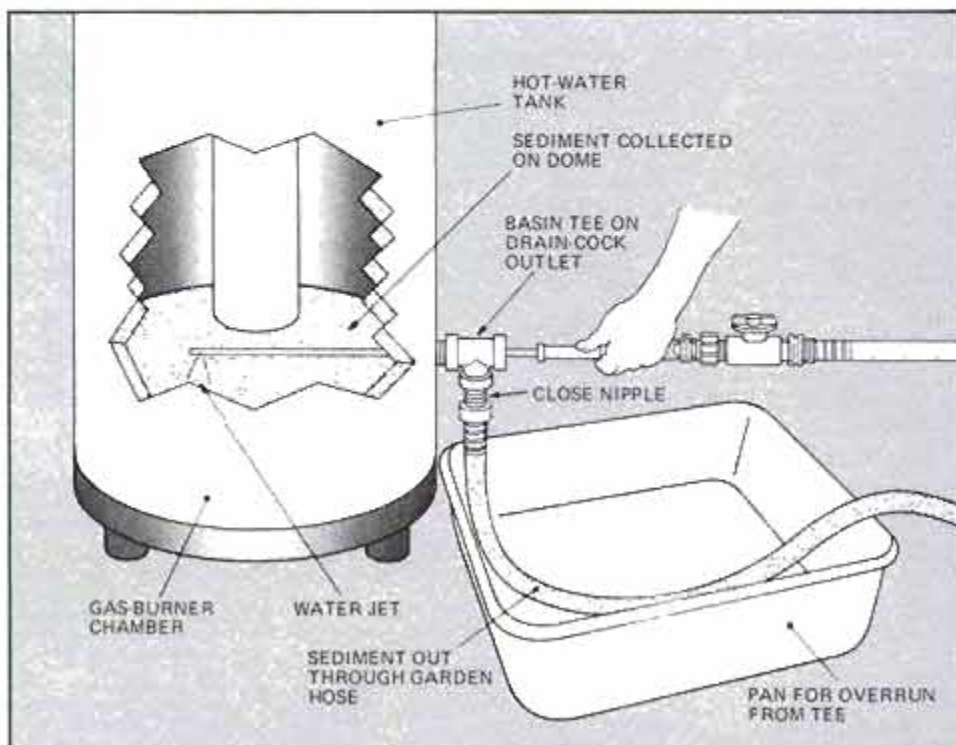
# Make this sediment cleaner for your hot-water tank

If you have one of those gas water heaters that bubble and pop and make all sorts of other noises, you may be surprised to know you are not alone. When these raucous sounds began coming from my heater, I called Barry Head, a service manager for one of the largest manufacturers of water heaters in the country. He quoted from his company's manual: "Certain mineral deposits in the water will form a scale on the inside of the tank that traps minute amounts of moisture. Heat of operation changes these small trapped amounts of moisture to steam, and the pressures, thus developed, cause the rumbling and pounding noise." In addition to being very annoying [the noise], accumulation of sediment and mineral deposits in the bottom of the tank can shorten the life of the heater appreciably, since it interferes with heat transfer."

Head advised me to dislodge and flush sediment through the drain-cock outlet by using a sediment cleaner. You can see in the drawing at right that a cleaner can be made easily from a few pieces of copper tubing, a little solder and connecting parts commonly available at hardware stores. The most important feature of the cleaner is the narrow slit in the end of the probe tube. After sealing the end of the tube with a plug and solder, use a hacksaw to cut a clean slit, as shown. The water "jet" formed by this slit concentrates the force of the water pressure.

To use your cleaner, follow these steps: 1. Turn off gas; 2. Turn off cold-water supply at valve on top of tank; 3. Open drain valve to drain tank; 4. Open a few hot-water valves in house to prevent negative-pressure buildup; 5. When empty, remove drain cock from tank and insert close nipple and a basin tee as shown.

A second close nipple can also be used to attach a draining garden hose to the basin tee. If arranged as shown in the top drawing, most of the sediment can be flushed into the hose for easy disposal. The pan collects any flush water gushing from the probe hole.—John E. Gaynor



Sediment-cleaner parts are available in most hardware stores. Use copper tubing for the probe: It can be soldered and bent easily for maneuvering over the dome-

shaped tank bottom. The slit at the probe end is critical. It concentrates water into a powerful jet. Include a shutoff valve to save trips to the water supply.



Attach drainage garden hose (left) to lower basin-tee outlet with second close nipple and coupling. Most flush water can be drained directly into a basement drain.



Block the probe hole with a sponge or cloth to cut flush water gushing through hole. Use a pan as shown, because some water will escape as probe is maneuvered.



This much sediment was flushed from my tank in approximately 1½ hours using about 50 to 60 gallons of water. The amount of sediment varies with water hardness.



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Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

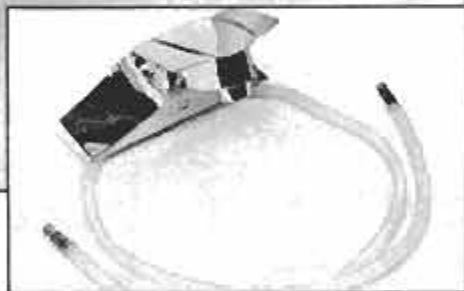
State \_\_\_\_\_ Zip \_\_\_\_\_

Code #932



Entire faucet body is installed from above sink. Plastic tubing (coiled at right) connects directly to water-shutoff valves.

# Faucet you can install with a screwdriver



This new faucet by Fillpro Div. of JH Industries is unique in its method of installation and the mechanical means by which water is turned on and off.

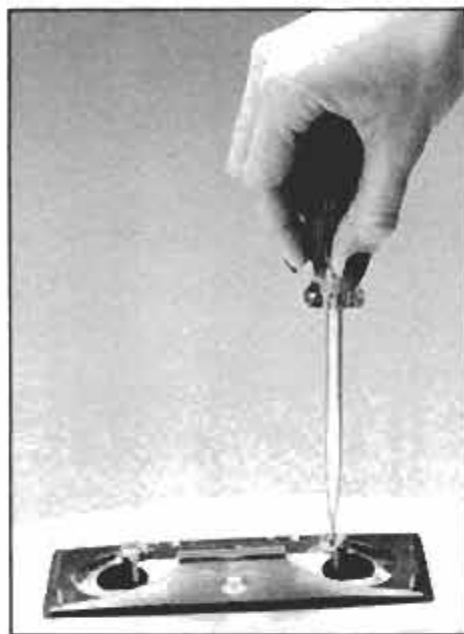
Made of chromed zinc alloy, the entire faucet body installs from above the sink with the use of only a screwdriver. For supply risers it utilizes two 20-in. long sections of flexible Tygon tubing (a plastic material with embedded polyester cord for reinforcement). This tubing connects directly to the water shutoff valves underneath the sink through the compression fittings on the top of the valves.

With this faucet, you'll never have to replace washers or seals—because there aren't any. A remarkably simple system (shown in the drawing below) opens and closes the water flow by the action of a spring and cam-mounted handle. It pinches the tubing to stop the flow and allows the water to run through when it is raised. The tubing will withstand 840 p.s.i. of water pressure, which is about 14 times greater than the 60-p.s.i. pressure typical of most household plumbing.

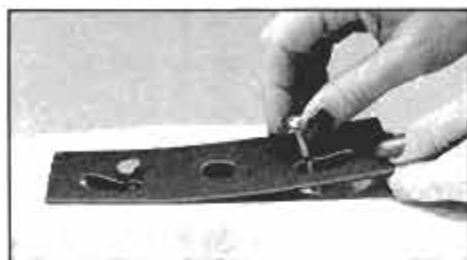
Endura is available at home centers and hardware stores for \$39.95; with a pop-up drain assembly, it's \$49.95. Made by JH Industries, 980 Rancheros Dr., San Marcos, Calif. 92069. **PM**



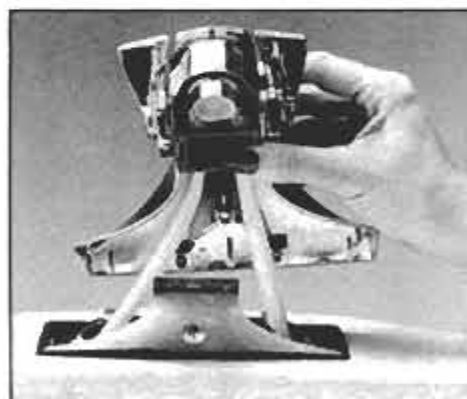
Insert one side of U-shaped tiebar assembly in outside basin hole. Maneuver until same screw comes up other outside hole.



Put base plate over gasket and slide slotted holes under screwheads. Finger-tighten screws, then draw tight with screwdriver.



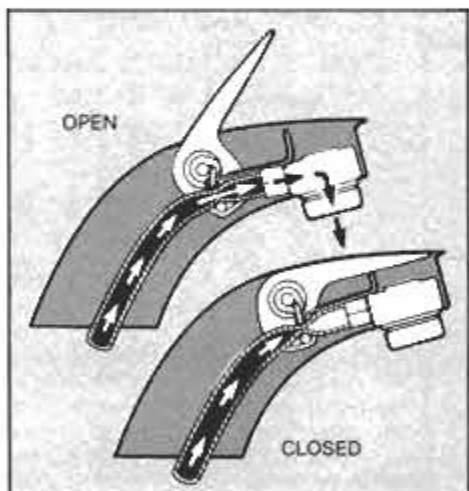
Slide gasket underneath screwheads to seal faucet and prevent tiebar from falling.



Push flexible tubing through holes and set faucet flush on base plate. Fasten with screw driven through plate front.



End of flexible tubing goes directly into compression fitting on shutoff valve.



Handle opens and closes water flow by pinching or releasing the flexible tubing. No washers, seals or valves are used. Tubing will withstand 840 p.s.i. of pressure.

# "Help me, Scotts!

My lawn is fading away before my eyes."

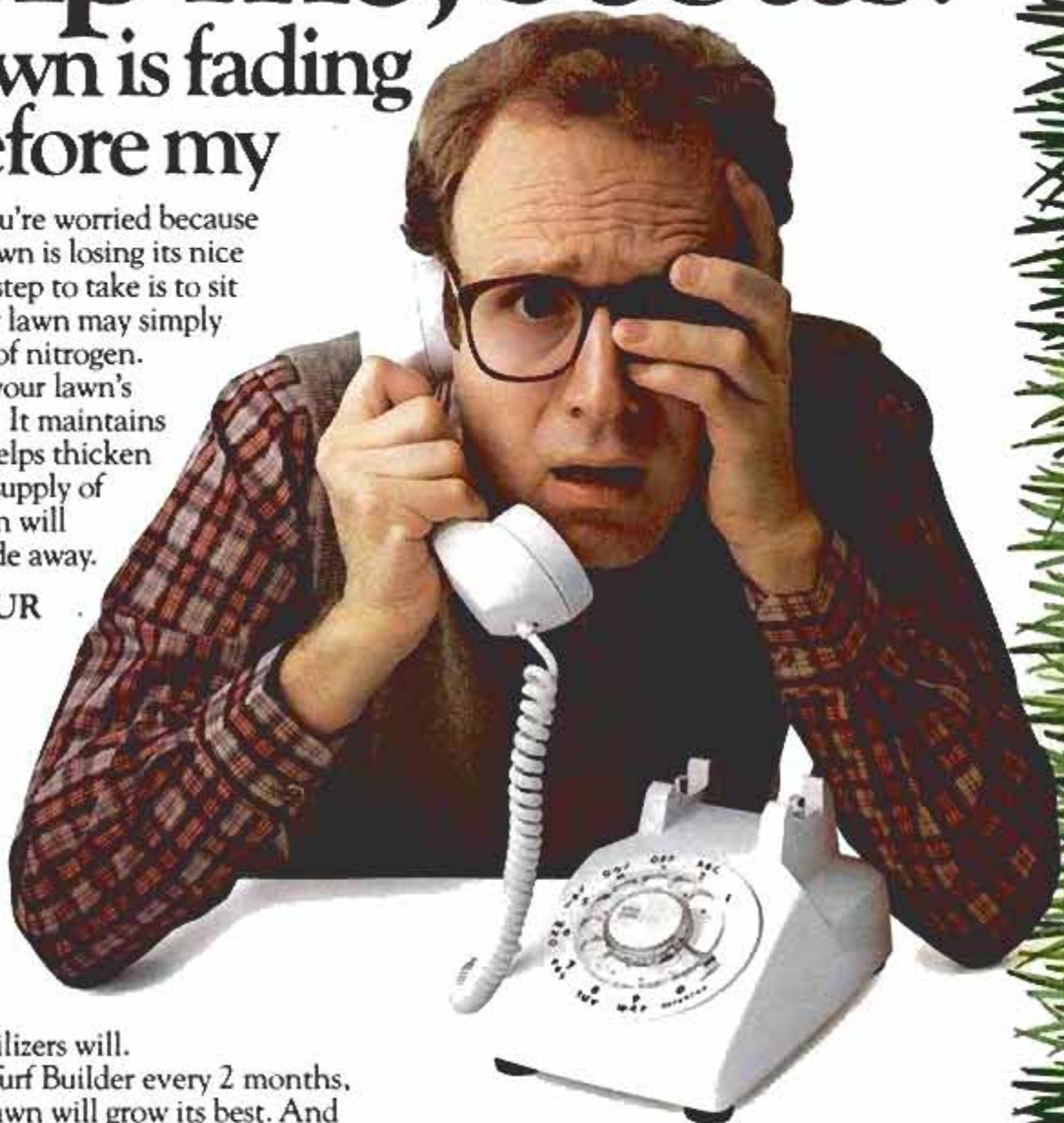
If you're worried because your lawn is losing its nice green color, the first step to take is to sit down and relax. Your lawn may simply need a steady supply of nitrogen.

Nitrogen restores your lawn's faded glory in 2 ways. It maintains a rich green, and it helps thicken your lawn. A steady supply of nitrogen on your lawn will help your problem fade away.

## WE CONTROL OUR NITROGEN.

We make Turf Builder® fertilizer by a unique process we developed. It provides a controlled release nitrogen that feeds your lawn for up to two steadily green months. And our nitrogen is safe, so it won't burn your lawn when other fertilizers will.

In fact, if you use Turf Builder every 2 months, 4 times a year, your lawn will grow its best. And you'll grow accustomed to a thick, green lawn.



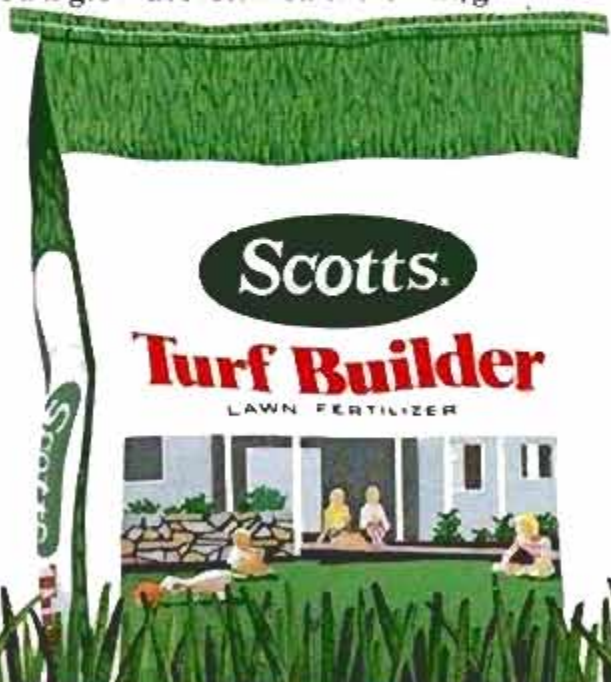
## CALL US WHEN YOU CALL FOR HELP.

People call us from all over the country with all kinds of questions about lawns. So don't hesitate at all. Call our toll-free Hotline at 1-800-543-TURF.\* Our lawn experts will come to your rescue with knowledgeable answers and helpful information.

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Our fertilizer, Hotline, and information services are all part of the Scotts® System. We put it together because the way we do business, we give you more than the best products we know how to make. When you need help, we give you that, too.

**You'll have a better lawn with Scotts.**



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# PM's mobile kitchen island rolls where you want it

**K**itchen islands have long been design favorites of people fortunate enough to have large kitchens. Such cabinets provide additional storage and counter space at the center of the room, while serving as an im-

prompt gathering area for socializing with family or house guests.

Now PM has taken this good idea and made it better. With help from Armstrong World Industries designers, we have created a movable kitchen island that adapts quickly to suit work and decorating needs. Because all three cabinet sections are caster-

mounted and connected with hinges, several different configurations, as well as room positions, are possible. The unit includes space for knives, flat-

*(Please turn to page 144)*

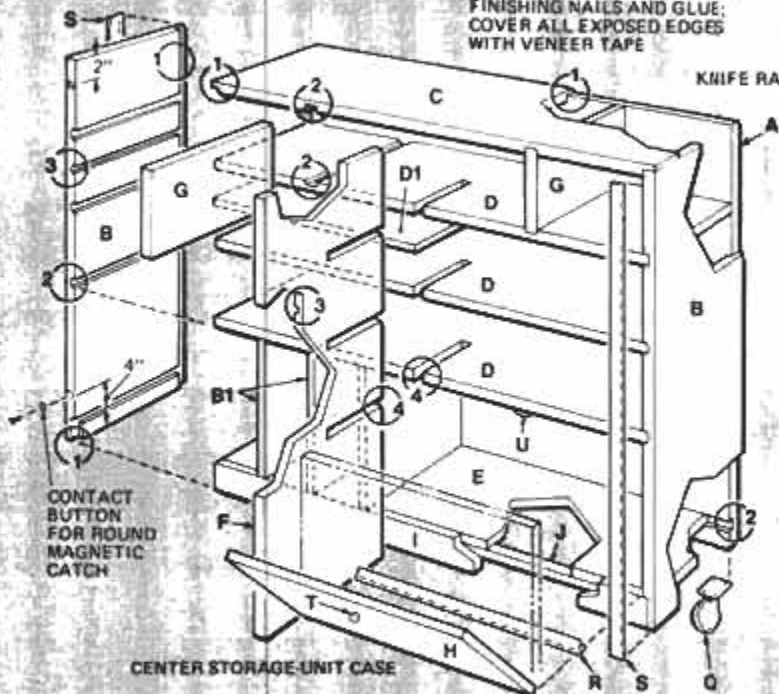
**Attractive roll-about kitchen island can be painted with colors to customize it to suit home-decorating requirements.**

Design: Louisa K. Cowan, ASD, Armstrong World Industries  
PM color photo: Frank S. Errigo  
Technical art, construction details: Eugene Thompson



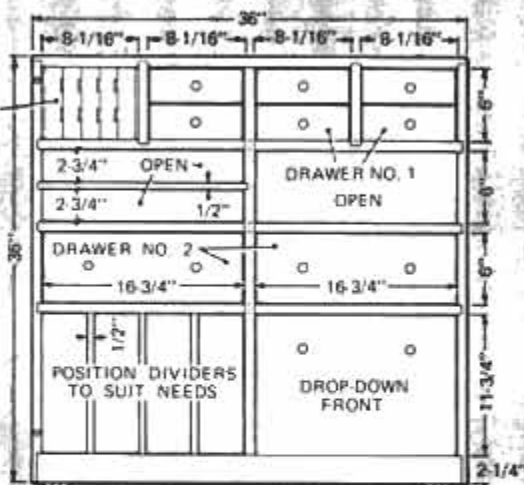
**CENTER STORAGE UNIT**

ASSEMBLE ALL CASES WITH 6d FINISHING NAILS AND GLUE; COVER ALL EXPOSED EDGES WITH VENEER TAPE

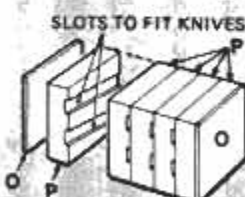


CENTER STORAGE-UNIT CASE

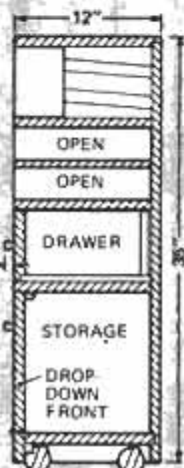
NOTE 1— $3/8 \times 3/4$ " RABBET  
NOTE 2— $3/8 \times 3/4$ " DADO  
NOTE 3— $1/2 \times 3/8$ " DADO  
NOTE 4—EDGE LAP JOINT



FRONT VIEW

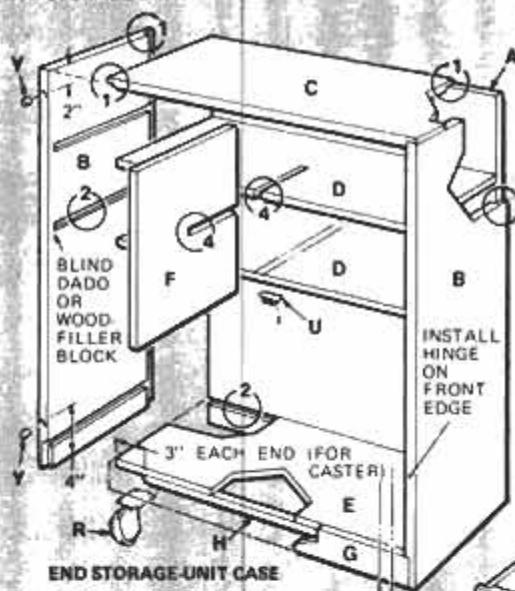


KNIFE-RACK DETAIL



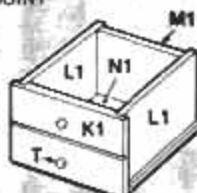
SIDE-SECTION VIEW

**END STORAGE UNIT**

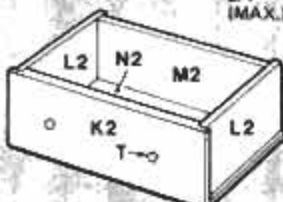


END STORAGE-UNIT CASE

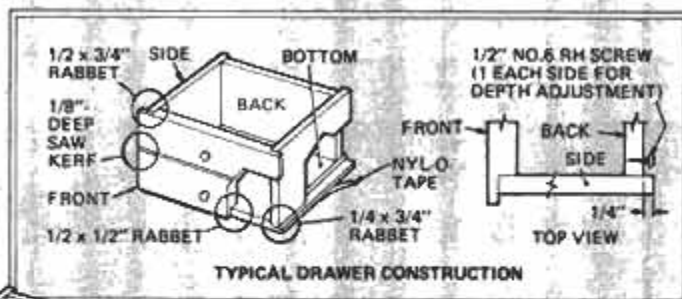
NOTE 1— $3/8 \times 3/4$ " RABBET  
NOTE 3— $1/2 \times 3/8$ " DADO  
NOTE 5— $1/4 \times 3/4$ " RABBET  
NOTE 6— $1/4 \times 1/2$ " DADO



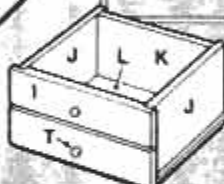
DRAWER NO. 1



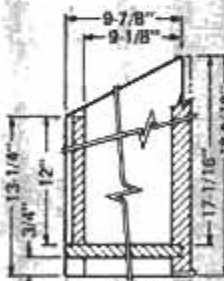
DRAWER NO. 2



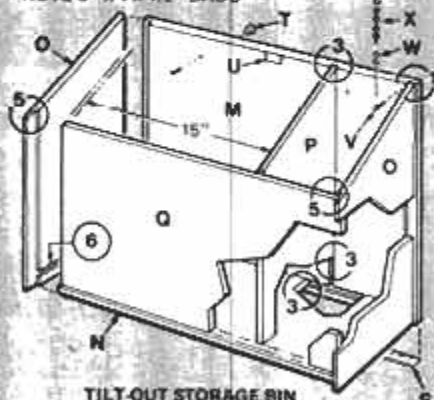
TYPICAL DRAWER CONSTRUCTION



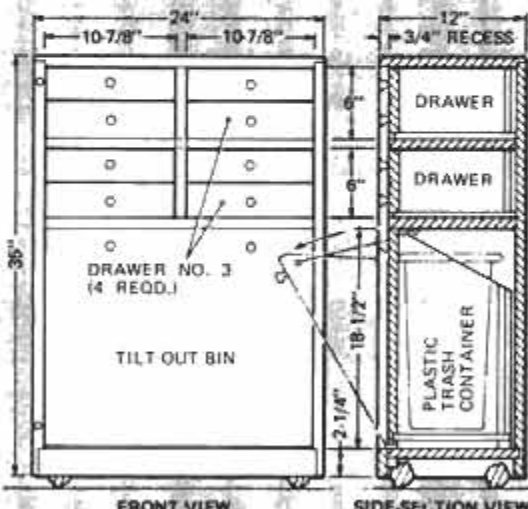
DRAWER NO. 3



BIN CROSS SECTION



TILT-OUT STORAGE BIN



FRONT VIEW

SIDE-SECTION VIEW

# '82 HOME IDEAS GUIDE

ware, paper and canned goods, plus a unique bar cabinet that lets you corral ice, glasses and spirits in one spot.

Complete plans and how-to-build instructions are presented on the following pages.

## Starting the job

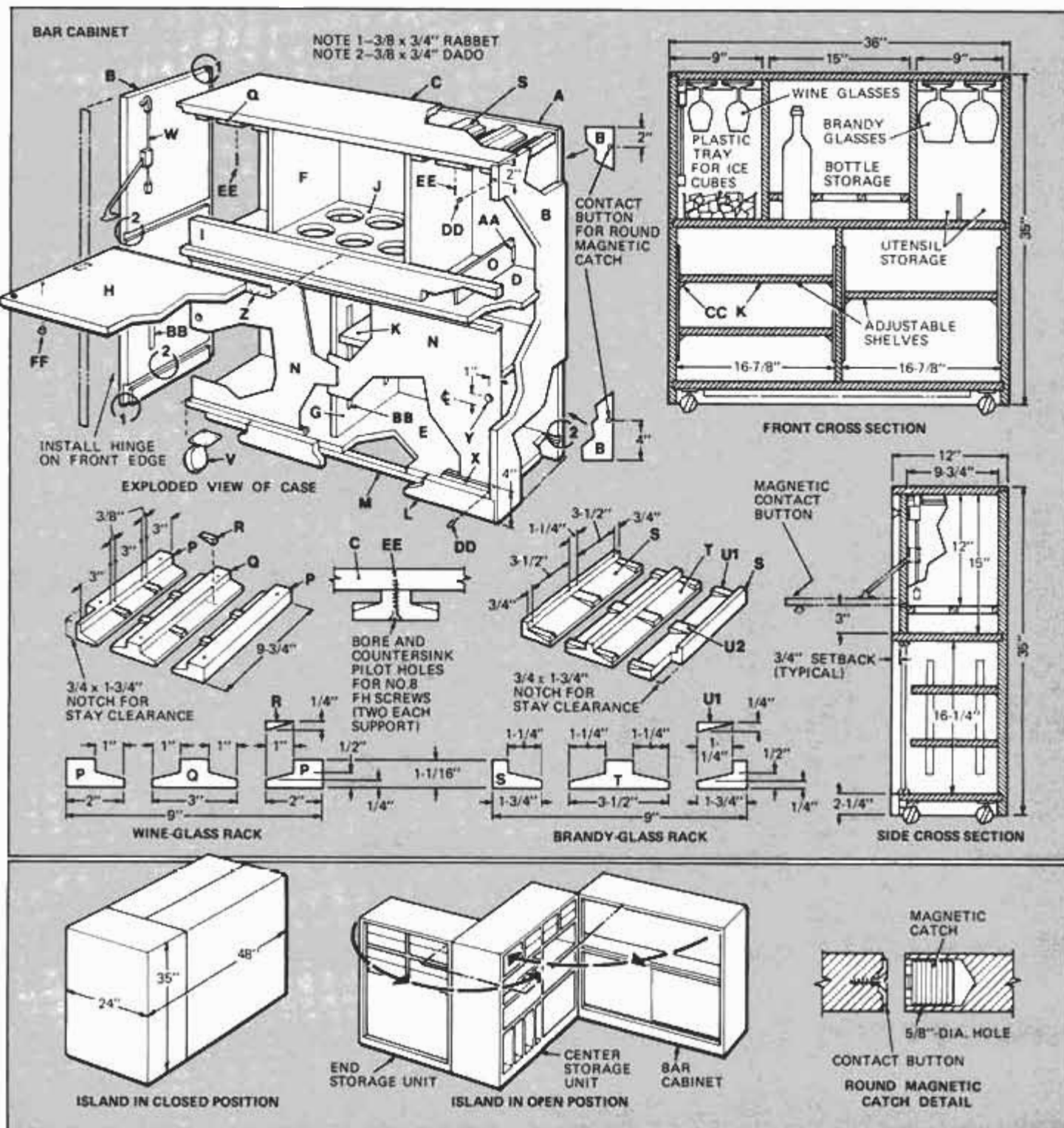
Before cutting anything, study all of the drawings carefully. There is nothing terribly sophisticated about the woodworking techniques employed here, but there are many details that you must observe. The

(Please turn to page 146)

## MATERIALS LIST—BAR CABINET UNIT

Key	No.	Size and description (use)		
A	1	3/4 x 34 1/2 x 35 1/4" plywood (back)	S	2
B	2	3/4 x 12 x 34 1/2" plywood (side)	T	1
C	1	3/4 x 12 x 36" plywood (top)	U1	8
D	1	3/4 x 11 1/2 x 35 1/4" plywood (shelf)	U2	4
E	1	3/4 x 10 1/2 x 35 1/4" plywood (bottom)	V*	4
F	2	3/4 x 9 3/4 x 15" plywood (top divider)	W**	2
G	1	3/4 x 9 1/2 x 16 1/4" plywood (bottom divider)	X	1
H	1	3/4 x 11 3/16 x 34 1/2" plywood (door)	Y	2
I	1	3/4 x 3 x 34 1/2" plywood (rail)	Z	1
J	1	3/4 x 9 3/4 x 15" plywood (bottle shelf)	AA**	2
K	3	3/4 x 9 1/2 x 16 1/4" plywood (adjustable shelf)	BB	8
L	1	3/4 x 2 1/4 x 35 1/4" plywood (toe kick)	CC	12
M	1	3/4 x 3/4 x 30" pine (cleat)	DD**	2
N	2	1/4 x 15 1/2 x 17 3/4" plywood (sliding door)	EE	12
O	1	1/4 x 3 x 9 5/8" plywood (divider)	FF	2
P	2	1 1/16 x 2 x 9 3/4" pine (end support)		
Q	1	1 1/16 x 3 x 9 3/4" pine (center support)		
R	8	1/4 x 3/4 x 1" pine lattice (glass divider)		

Misc.: 6d finishing nails, glue, veneer tape.  
\*Shepherd Products U.S. Inc., 203 Kerth St., St. Joseph, Mich. 49022  
\*\*Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461



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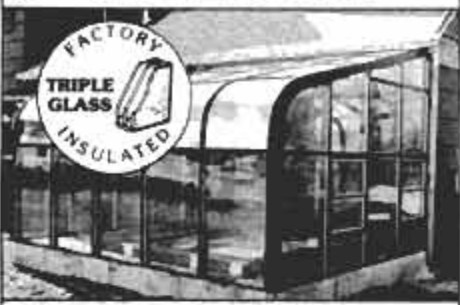
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# '82 HOME IDEAS GUIDE

(Continued from page 144)

layout of all the dadoes, rabbets and half-lapped joints must be precise, otherwise, the cabinet could be assembled out of square. If that happens, it will never open and close properly.

It's best to use plywood that is good on both sides (A-A) for this project, because many of the parts are visible from both sides. If the additional cost of this grade is prohibitive, use stock that's good on one side only (A-D) and fill all surface voids on the poor side. Also, try to construct the cases so that the poorer (D) surfaces face down or in.

### Center storage unit

To build the center storage unit, cut the top, back, bottom, sides, shelves and dividers to size. Then lay out all the rabbets, dadoes and half-lapped joints shown in the drawing on page 143. Next, glue and nail together the sides, top and back, then install the bottom, toe kick (I) and support cleat (J). Check the cabinet for square.

If you've been careful cutting the parts to size—especially the back—the cabinet should be square and no adjustment will be necessary. However, if the case is slightly out of square, you must force (i.e., wrack) it until it's square and hold it that way with tacked-on braces until the glue dries. Leave the squared and braced cabinet clamped overnight.

Preassemble the knife rack and drawers as shown, then insert them into the case. The self-sticking nylon tape on each side of the drawer bottom assures that the drawers will slide easily without drawer guides. (This nylon tape, called Nyl-O-Tape, is available from The Woodwork-

### MATERIALS LIST—END STORAGE UNIT

Key	No.	Size and description (use)
A	1	3/4 x 23 1/4 x 34 1/8" plywood (back)
B	2	3/4 x 12 x 34 1/8" plywood (side)
C	1	3/4 x 12 x 24" plywood (top)
D	2	3/4 x 10 1/2 x 23 1/4" plywood (shelf)
E	1	3/4 x 10 1/2 x 23 1/4" plywood (bottom)
F	1	3/4 x 10 1/2 x 12 3/4" plywood (divider)
G	1	3/4 x 2 1/4 x 23 1/4" plywood (toe kick)
H	1	3/4 x 3/4 x 18" pine (cleat)
<b>DRAWER No. 3</b>		
I	4	3/4 x 5 7/8 x 10 3/4" plywood (front)
J	8	1/2 x 5 7/8 x 10" plywood (side)
K	4	1/2 x 5 7/8 x 9 1/4" plywood (back)
L	4	1/2 x 10 x 10 3/4" plywood (bottom)
<b>TILT-OUT BIN</b>		
M	1	3/4 x 18 5/8 x 22 3/8" plywood (front)
N	1	1/2 x 9 7/8 x 21 3/8" plywood (bottom)
O	2	1/2 x 9 7/8 x 18 5/8" plywood (side)
P	1	1/2 x 9 7/8 x 17 1/8" plywood (divider)
Q	1	1/2 x 12 x 21 3/8" plywood (back)
<b>HARDWARE</b>		
R*	4	Shepherd 2 1/2" flat plate ball caster No. 9360
S	1	1 1/2 x 22 1/4" continuous hinge
T	10	3/4"-dia. x 3/4"-long porcelain knob
U	1	Magnetic catch with strike
V	2	Screw eye
W	2	S-hook
X		12" chain (cut to length)
Y**	2	Constantine No. 55F25 round magnetic catch

Misc.: 6d finishing nails, glue, veneer tape.  
\*Shepherd Products U.S. Inc., 203 Kerth St., St. Joseph, Mich. 49022.

\*\*Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461

ers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374. It is approximately 1/2 in. thick and is used on all the drawers in both the end and center storage units.) This tape also allows minor adjustments in the up and down position of the drawer, relative to the drawer opening. If your drawer is slightly out of square, place a double thickness of tape on the appropriate side.

The stop points of the drawers can also be adjusted. Simply turn the depth-adjustment screws on the back of each drawer until the drawer front is properly aligned in the closed position.

Cut the drop-down front panel to size and attach it to the top edge of the toe kick using a continuous hinge. Install the magnetic catch and contact plate for this door, then finish-sand the entire unit, ending up with 150-grit sandpaper. Remove the dust with a brush and tack cloth.

### End storage unit

There is one major difference between the end storage unit and the center unit which can be seen on the side-section view on page 143: The drawers and the tilt-out bin on the end unit are recessed 3/4 in. from the front edge of the cabinet case. This recess is needed to provide clearance for the drawer and bin pulls when the two units are closed together. Because of this, be sure to use pulls which project no more than 3/4 in. from the drawer and bin fronts.

Also note the blind shelf dadoes on the case sides of this unit. Cut these with a dado head in your table saw or with a router using either of the following methods:

- Plow the dado all the way across the

### MATERIALS LIST—CENTER UNIT

Key	No.	Size and description (use)
A	1	3/4 x 34 1/8 x 35 1/4" plywood (back)
B	2	3/4 x 12 x 34 1/8" plywood (side)
B1	3	1/2 x 11 1/4 x 11 3/4" plywood (divider)
C	1	3/4 x 12 x 36" plywood (top)
D	3	3/4 x 11 1/4 x 35 1/4" plywood (shelf)
D1	1	1/2 x 11 1/4 x 17 5/8" plywood (shelf)
E	1	3/4 x 10 7/8 x 35 1/4" plywood (bottom)
F	1	3/4 x 11 1/4 x 32" plywood (divider)
G	2	3/4 x 6 3/4 x 11 1/4" plywood (divider)
H	1	3/4 x 11 9/16 x 16 3/4" plywood (door)
I	1	3/4 x 2 1/4 x 35 1/4" plywood (toe kick)
J	1	3/4 x 3/4 x 30" pine (cleat)
<b>DRAWER No. 1</b>		
K1	3	3/4 x 5 7/8 x 7 5/8" plywood (front)
L1	6	1/2 x 5 7/8 x 10 3/4" plywood (side)
M1	3	1/2 x 5 7/8 x 6 7/8" plywood (back)
N1	3	1/2 x 7 5/8 x 10 3/4" plywood (bottom)
<b>DRAWER No. 2</b>		
K2	2	3/4 x 5 7/8 x 16 3/4" plywood (front)
L2	4	1/2 x 5 7/8 x 10 3/4" plywood (side)
M2	2	1/2 x 5 7/8 x 15 1/4" plywood (back)
N2	2	1/2 x 10 3/4 x 16 3/4" plywood (bottom)
<b>KNIFE RACK</b>		
O	2	1/4 x 6 x 7 1/4" pine (filler block)
P	5	1 1/2 x 6 x 7 1/4" fir (notched block)
<b>HARDWARE</b>		
Q	4	Shepherd 2 1/2" flat plate ball caster No. 9360
R	1	1 1/2 x 16 5/8" continuous hinge
S	2	1 1/2 x 35" continuous hinge
T	12	3/4"-dia. x 3/4"-long porcelain knob
U	1	Magnetic catch with strike

Misc.: 6d finishing nails, glue, veneer tape.  
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Here's one of the most spectacular sights in all of nature. Guaranteed to bring traffic to a screeching halt in front of your house this very season! As these wondrous "RED ROCKET" strawberries... roar forth into a man-high 'berry-factory', simply loaded with teeming bowlfuls of the most meaty, sugar-packed taste-treats you've ever sunk a tooth into. Why you'll pick 'em by the pintful this very summer—thanks to the most outrageous out-pouring of fruit imaginable.

#### A LIVING STRAWBERRY WATERFALL! SIMPLY PLANT THEM—STAKE THEM—TRAIN THEM—TIE THEM—SEE 'EM ZOOM HIGH AS A MAN IN A SINGLE SEASON!

Yes, unlike regular strawberries that you grow on the ground... you simply plant these wonder plants smack in the middle of any garden fence—trellis—side of your house or garage—why even a drainpipe or a plain old clothesline pole and thrill to see them erupt in massive cascading sprays of fruit like a whole 'strawberry farm' marching up and down in waves of luscious fruit!

Can't you just see the looks of amazement on your neighbors' faces when you invite them to dinner... and tell them to reach out of your dining room window to pick their own luscious strawberry dessert right off the vine! And not some skimpy little berries... but sugar-packed giants SO HUGE AND MEATY, they're virtually impossible to circle with the finger of one hand... YOU ACTUALLY NEED TWO!

#### IN FACT—BERRIES SO BIG YOU CAN BARELY SQUEEZE MORE THAN ONE IN YOUR MOUTH AT A TIME!

Yes, these 'Red Rocket' Strawberries are so eager to grow—so desperate to produce... you'll drape your walls, trellises, fences in cascading fountains of fruit... as these man-high beauties reward you with the most incredible parade of "MAN-HIGH" fruit, flowers and foliage you've ever seen in your life. Yes, teeming bowlfuls of sugar-packed beauties:

**SO BIG & JUICY—**  
Just one berry makes a spoonful!

**SO HUGE & MEATY—**  
Just a single sliced up berry makes a whole strawberry tart... and 5 or 6 make a whole strawberry shortcake!



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Pressure-Treated Lumber

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WOOD**

## '82 HOME IDEAS GUIDE

(Continued from page 146)

side and then glue in a small filler block.  
■ Stop the dado just short of the appropriate point and clean out the curved corners with a sharp chisel.

Install the shelves and divider and let the assembly dry overnight.

Before cutting the parts for the tilt-out bin, measure the case opening and make dimension adjustments if necessary. Test-fit the bin front with the hinge installed; when satisfied with fit, remove the front and assemble the entire bin with glue and nails. Let the assembly dry overnight.

Install the magnetic catch and contact plate. Then assemble and install the drawers as described earlier. Attach the restraining-chain assembly and finish-sand the whole unit.

### Bar cabinet

Assemble the bar cabinet in the same manner as the other units and attach the shelf standards (BB) to the sides and the lower compartment divider. Next, install the upper dividers and the bottle storage rack, and fabricate and install the two glass racks as shown in the drawing on page 144. The wedge-shaped cleats on these racks were designed to prevent the glasses from hitting each other when the island is opened, closed or being rolled around the room.

Install the plywood rail (I) and the utensil divider, then cut the drop-down door to size and attach it with a continuous hinge. Add both stays (W) for this door and the magnetic catch plates. Then install the sliding-door tracks and doors for the lower compartment; bore the holes for the finger pulls. Don't install the pulls yet; wait until after the case has been painted. Apply the veneer tape to the exposed edges, finish-sand the entire unit, then dust and wipe with a tack cloth.

### Paint and hardware

Before priming and painting the cases, position and bore the holes for the four round magnetic catches as shown. These serve to hold the three units together in the closed position. Remove the catches and their corresponding contact buttons and reinstall them after you've finished the painting.

Temporarily install the continuous hinges that join the cabinet units to make certain the units fit as they should. At this time, you should also install the casters to check the unit for roll.

When you're satisfied that all the carpentry is satisfactory, remove the cabinet-joining hinges and cover the casters with masking tape, then paint.

After the paint dries, the units can be reassembled with the continuous hinges and the protective tape can be removed from the casters.

PM

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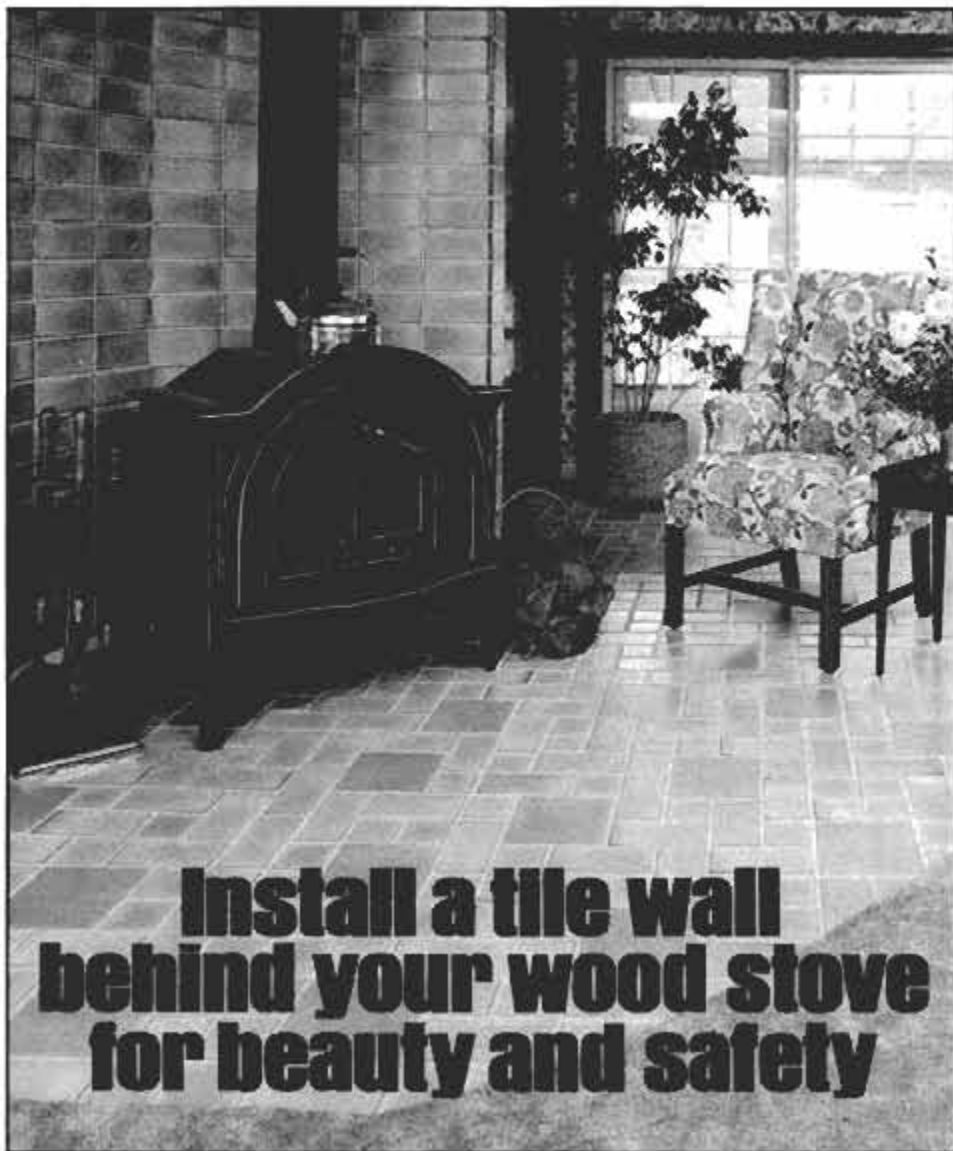
Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip \_\_\_\_\_



## Install a tile wall behind your wood stove for beauty and safety

The high reflectivity of ceramic tile increases this wood stove's efficiency.

**E**nergy-efficient, wood-burning stoves are growing in popularity, as are the increasing number of styles and designs offered to meet homeowners' needs. The beauty, safety and efficiency of any stove can be enhanced by surrounding it with ceramic tile. Choosing a combination of stove and tile for your home can be an enjoyable experience. And you'll be surprised to discover how easy it is to install the tile yourself in combination with "Wonder-Board," a glass-mesh, concrete-reinforced shield made by Modulars Inc., Box 216, Hamilton, Ohio 45012. The stove shown is the Moravian Parlor Stove by Quaker Stove Co. Inc., Box E, Kumry Rd., Trumbauersville, Pa. 18970. For information about styles and colors of tile, write to American Olean Tile Co., 1000 Cannon Ave., Lansdale, Pa. 19446.

We show how to install the shield and tile on a wall behind a stove, according to UL specifications, which require an air space between the shield and the combustible wall. Installing the floor is an even simpler procedure, since the shield may be laid down directly on the subfloor without provisions for an air space. Check your stove maker's installation instructions for the minimum area required for floor protection. Then lay the tile on the floor shield, following the same procedure we describe for applying the tile over the wall shield.

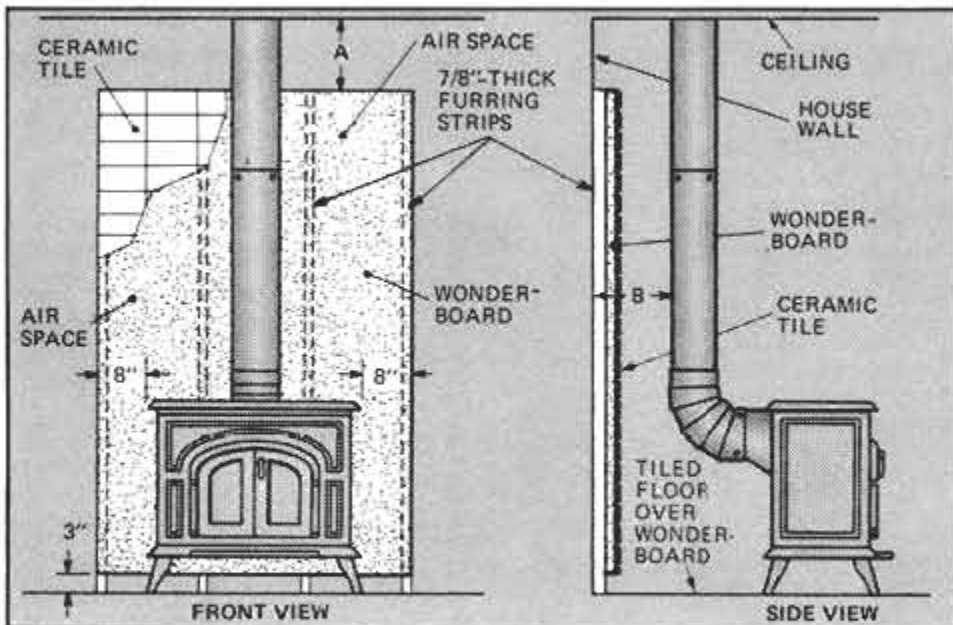
You may attach the wall shield to existing plaster or dry wall in any area you choose, but the clearances as shown in the drawing must not be compromised. Study the drawing at left for minimum clearances for top- and rear-flue stoves.

Note that we show a rear-flue-exit stove in the drawing. Because the rear clearance applies to the flue in this stove design, these stoves require more space, regardless of the use of wall shields. If your primary interest in wall shields is to save space, then you should buy one of the top-flue-exit stoves; or consider replacing your old rear-flue-exit stove.

You can become a pro at working with Wonder-Board in a short time. As it is concrete-reinforced, this kind of shield is heavy (about 4 pounds per sq. ft.) and durable, but easy to cut. Score through the "membrane" on either side with a carbide-tipped scoring tool. Snap the panel along the scored line and then cut the membrane on the other side with one quick run of the tool. You can also use a masonry saw, but this is much more time consuming and produces some dust.

Try not to damage or disturb the surface of the shield in handling, as the

*(Please turn to page 154)*



Wonder-Board's UL listing allows its use as a wall shield to provide a 50 percent reduced clearance (as specified by stove maker) from a combustible wall surface. Drawing shows minimum clearances. Clearance (A) may be 1½ to 12 in. for rear-flue-exit stoves, but the shield need not

extend higher than 8 in. above the top of a top-flue-exit stove. UL-approved clearance at floor is 3 in. Clearance (B) may vary as specified by stove maker, but it always applies to the flue for rear-flue and to the back of stove for top-flue-exit stoves. See text for information regarding floors.

# Low-Cost Gas Saver Now Marketed

## PATENTED WATER/VAPOR INJECTOR HELPS ELIMINATE PING, HELPS REMOVE CARBON, INCREASES HORSEPOWER, EASILY INSTALLED, GUARANTEED

DENVER—The Copley News Service reported that a U. S. Patent has now been issued to Wm. Trevaskis, veteran electrical engineer, for his Vapor-Jet® water/vapor injector (Pat. #4,119,062).

Trevaskis has developed what can amount to a 15 cents per gallon "rebate" potential on gasoline by designing a low-cost injector for all domestic and foreign cars, vans, light trucks, and RVs.

People have noticed for years that their car runs better on a cool rainy day. Vapor-Jet® gives a constant rainy-day effect to the engine. The water injection principle was used during World War II to give combat aircraft increased power and speed.

Trevaskis' new Vapor-Jet® is one of the least expensive on the market (\$29.95 + \$3.00 shipping and handling) and can be easily installed even by a novice in 15 minutes.

The Vapor-Jet® has an unconditional 60-day guarantee. If for any reason you are not satisfied, you may return it within 60 days of the day you installed it for a \$29.95 refund.

### How does the Vapor-Jet® System work?

Vapor-Jet® operates very simply with no moving parts to wear out. It uses engine vacuum to pull outside air through a reservoir containing a water/methanol mixture which is attached to the car under the hood. This causes the fluid to bubble and splash forming a mist of water droplets and vapor in the upper part of the reservoir. The mist is then drawn by vacuum through a hose which is connected to a manifold suction hose. The connection is made very simply by our patented injector nozzle which contains a regulator to allow the right amount of mist to pass into the combustion chamber.

### Will Vapor-Jet® help eliminate engine ping and dieseling?

Yes. The introduction of this mist into the fuel mixture has a cooling effect that increases mixture density, extends the burning rate, and improves combustion efficiency. This has the same effect as increasing the octane of the gas which helps eliminate the engine-damaging ping that is a problem to many vehicles because of the low octane gas sold today. The mist also helps remove the mileage-destroying carbon from the spark plugs and cylinder walls and keeps it removed. All of these effects together with the fact that water, when it turns to steam, expands 1700 times (the principle used in the steam engine) gives your car more horsepower (SAE Bulletins #690018 and #215).

### How much mileage increase is expected?

Mileage improvement may vary due to vehicle, driving habits, geographical area, and weather conditions—but we guarantee your satisfaction or your \$29.95 refunded, no questions asked.

Vapor-Jet® can improve your mileage in



three ways: First, moisture actually causes the gasoline to burn more efficiently.

Second, Vapor-Jet® also allows in many cases the possibility of spark advance without ping. This can also increase gas mileage.

Finally, by helping remove mileage-destroying carbon from spark plugs and cylinder walls, Vapor-Jet® helps restore and keep your car in fresh tune-up condition.

A recent study of about 3,000 cars by the U. S. Dept. of Transportation shows that a startling 70% of the spark plug sets examined were in poor enough condition to cause one or more of the following spark plug induced performance problems: High fuel consumption, miss firing, engine ping-ing, surging, hard starting and/or stalling and an increase in hydrocarbon emissions. One reason for spark plug failure is fouled plugs caused by carbon or oil (DOT Report #PB301062).

If carbon is causing a problem with your spark plugs, certainly the carbon-removing feature of Vapor-Jet® has the potential to further increase your mileage. Also, the removal of carbon from your engine can potentially have a money-saving benefit of longer engine life.

### Will Vapor-Jet® fit all cars, and is it easy to install?

Yes. The same kit fits all cars and contains everything needed. It will work on fuel injection, cars with super chargers, rotary engines, and catalytic converters. It will work with leaded and unleaded gas, gasohol, or propane burning cars. Simple installation instructions with a diagram are

included. Simply take an ice pick or drill and make a small hole through any intake manifold suction hose (i.e., PCV hose, etc.). Screw the injector nozzle into the hole. Mount the reservoir. Use the hose to connect the reservoir to the injector nozzle. **Can Vapor-Jet® damage my engine or cause rust?**

Absolutely not! Vapor-Jet® cools down the fuel air mixture giving a better burn and suppressing ping, thus extending your engine life. The mist that enters into the engine turns immediately into vapor. The excess exits out the exhaust similar to driving on a rainy day.

### What is the purpose of the methanol V.I.M. (vapor injector mix)?

The reservoir measures 3½ × 5½ × 7½ inches and holds just under ½ gallon. A full reservoir should last 700 to 1,100 miles. Methanol (wood alcohol) is mixed with water mainly to prevent freezing and to aid in combustion efficiency. It is easily and cheaply found almost everywhere in the form of windshield washer solution.

For purchase or further information, write or call Progressive Energy Corp., 3148 S. York, Englewood, CO 80110, (303) 762-1385, or call toll free (800) 525-8624. Dealerships available. (Offer void in CA.)

Enclose \$29.95 + \$3.00 shipping and handling.

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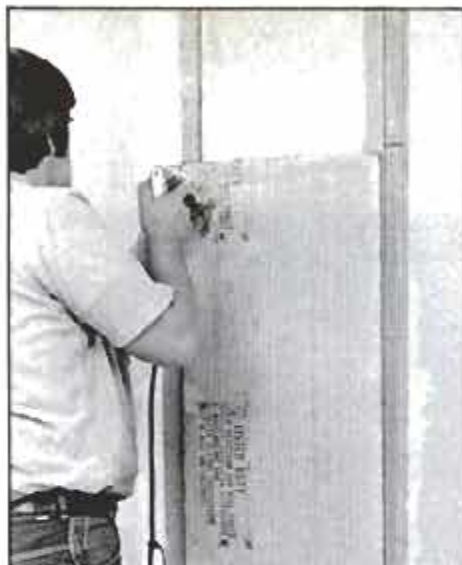
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60-day money-back guarantee



Nail 2-in.-wide, double-thickness wall-shield furring strips to wall, 16 in. on center. Double thickness provides the UL-required  $\frac{1}{8}$ -in. air space between the wall shield and the combustible wall.



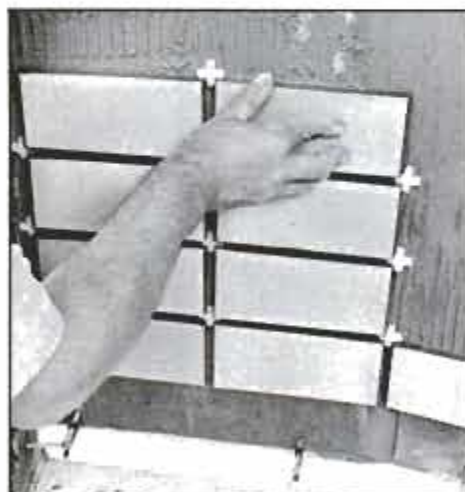
Fasten panels with 4-in. nails or dry-wall screws. A double furring strip is needed at all angles, since the shield isn't flexible. Space the panels  $\frac{1}{4}$  in. apart.



Fill all joints (UL specifications require  $\frac{1}{8}$ -in. spacing between panels) with latex-modified portland cement mortar mixed with sand. Embed glass-fiber tape; cover with more mortar. Trowel the joints flush.



The completed wall-shield installation shows a clearance (3 in. from completed floor) between floor and the bottom edge of the shield. Leave at least  $1\frac{1}{2}$  in. between the top edge and ceiling.



Apply tile over  $\frac{1}{8}$  in. of latex-modified portland cement mortar (thin set) mixed with sand. Use spacers for uniformity. To prevent slippage, attach plywood strips to shield bottom with C-clamps.



After plywood strips are removed from shield bottom, bottom tile course may be set. Apply cement with a square-notch trowel. Use the  $\frac{1}{4} \times \frac{3}{8}$ -in. notches. Allow wall to cure for two days before grouting.

adhering quality of cements may be affected. The manufacturer of these shields recommends using a "sanded latex-modified portland cement mortar, applied with a notched trowel to provide a layer of mortar at least  $\frac{1}{8}$  in. thick over the entire surface to be tiled." The notches in the trowel provide the  $\frac{1}{8}$ -in. thickness in patterns of parallel lines. Let the tool do the work. The mortar will be spread evenly as tiles are pressed into it.

Apply your tile carefully, pushing each tile gently into the mortar and then tapping it lightly to align with adjacent tiles and cross-shaped spacers. This will bring tiles flush with the finished surface.

The bottom left photo on this page shows a technique (using C-clamps and plywood strips) for stabilizing the lower courses of tile as you work from bottom up. Don't skip this procedure. Even though the mortar may seem tacky enough to hold the tiles firmly in place, whole areas of tile can slip before you realize it. Thus, this precautionary step is well worth the effort. It's also an easy way to align your first course. By working from the bottom up, you use gravity to help get a good snug fit between tiles.

After the tile is in place, the wall must be allowed to cure for several days before grouting. Whether or not you have experience grouting, make certain you read the manufacturer's instructions to find out the proper working consistency. A little practice will show you that a diagonal stroke is the most effective for working the grout in between the tiles. Continue stroking in a combination diagonal and circular motion until all grout on the surface is distributed in an ever-widening area from the point where you began. Neatness during this step saves effort at cleanup.

After grout starts to set, but before it begins drying to a lighter color, you may want to run over the grout with a finishing tool for a neat finish. Inquire about this procedure and the tool at your tile supplier.

FM



Apply grout (various colors available) with a rubber-faced trowel. Work grout in and over spacers, using a diagonal movement. Follow all package directions carefully, as some grouts set very quickly.



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Now, a John Deere may cost more. So if you need more good reasons why it's worth it, visit a John Deere dealer. On the way, take a look at what farmers use.

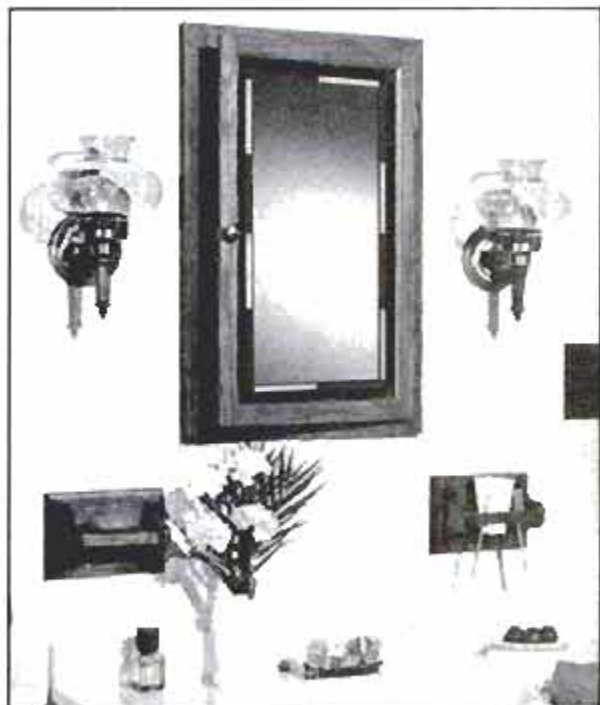
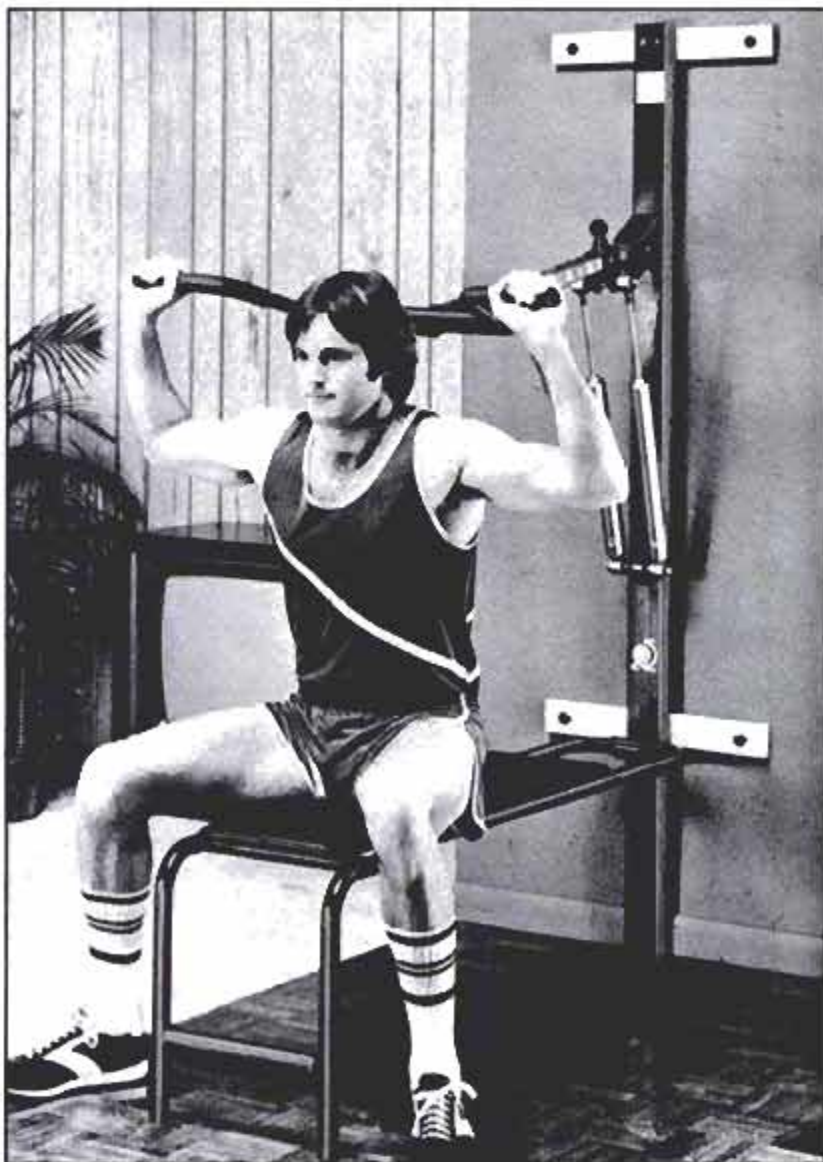
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(Illinois, 800-322-6796) or write John Deere, Dept. 50, Moline, IL 61265.



# New products for your home



The Knobhill is a distinctive bathroom cabinet, made for recessed installation, that measures  $5\frac{1}{2} \times 17\frac{1}{2} \times 27\frac{1}{2}$  in. Its enameled steel body has two adjustable shelves and a solid-oak frame door that surrounds a mirror, edged with colorful glass. It's 20 lbs. and retails for \$252.95 at home centers. The Knobhill is manufactured by Miami-Carey, 203 Garver Rd., Monroe, Ohio 45050.

The Life Styler 2000, from Sears, Roebuck and Co., Dept. 703, Chicago, Ill. 60684, is a hydraulic exercise machine that makes it possible for you to do 60 different exercises. The wall-mounted unit supplies up to 240 lbs. of uninterrupted resistance. It has a 52-in.-long padded bench and a 34-in.-wide, tubular-steel bar—both removable—plus upper and lower rope and pulley assemblies. It retails for about \$320 at Sears stores and is also available through its mail-order catalog.



Cyprus is a new pattern of vinyl wall covering—in the Paris Wall line—that's designed to look like tan-colored ceramic tile with leaves embossed on the surface. It is 55-mils thick and comes in  $31\frac{1}{2}$ -in. wide by 9 $\frac{1}{4}$ -ft. rolls that sell for \$21.95 each at home centers. Designed for application over rough-surfaced walls, such as cinder block, cracked plaster and old paneling, it's distributed by Forbo North America, 218 West Orange St., Lancaster, Pa. 17603.



A new built-in, under-cabinet microwave oven unit, called the MVP, has been introduced by Magic Chef Inc., 740 King Edward Ave., Cleveland, Tenn. 37311. This 19 x 21 x 30-in.-wide unit installs directly above your range and has a 20-watt fluorescent light fixture and a two-speed ventilation blower. A ductless-venting option, using charcoal filters, is also available. The unit costs about \$700 at appliance stores.



The Cedar-al Bath and Shower Pallet is a 24 x 24 in. western red cedar pallet designed as an attractive alternative to a cloth bath mat. According to the maker, each of the eight slats is contoured and sanded to reduce the possibility of splintering. Assembled with polished brass screws and nonskid pads on the bottom, it's \$34.95 postpaid from Cedar-al Products, Dept. 186, Clallam Bay, Wash. 98326.

*(Please turn to page 171)*

# How to line your closet with cedar



**L**ining an entry closet with these cedar panels was a quick, simple and inexpensive undertaking that has yielded continuous satisfaction.

The Giles & Kendall cedar closet panels shown are of Eastern red cedar that's been flaked, then pressed into 1/4-in.-thick, 4x8-ft. sheets. Lumberyards or home centers have them at \$16 to \$18 each. An average hall closet requires four panels; leftovers cover the shelves.

Panel pieces are easily cut to size with a sabre saw. They are simply abutted and secured with 1 1/4-in. finishing nails through plaster or dry wall and into the studs. Or, you can use panel adhesive.

Roughly measure the dimensions of the closet to figure how many panels you need. Don't forget the ceiling and floor. You'll also need 1 1/4-in. finishing nails or

In a few simple steps you can line a standard entry closet (below) with cedar panels (right) that give off a pleasant scent.



PM photos: Cal Weiner

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# With Elmer's Carpenter's Wood Glue, building like a pro can be child's play.

Even do-it-yourselfers can do it like pros with Elmer's® Carpenter's Wood Glue.

Specially made to penetrate both hard and soft woods, it grabs instantly, yet you can still realign the joint before it sets. After drying, it forms a bond that's even stronger than the wood itself.

Elmer's Carpenter's Wood Glue is also paintable, resistant to gumming when sanding. And its solvent-free, non-toxic\* formula quickly washes off with water.

To help make mending and making things like a pro...child's play.

For plans for making these beautiful wooden toys—the antique car and biplane shown and a paddle-driven steamboat—send \$3 to Elmer's, P.O. Box 2383, Van Nuys, CA 91409.

Grabs instantly

Aligns easily



**Elmer's. When results count.**



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\*as defined by Federal Hazardous Substances Act

panel adhesive; 3/4-in. brads to secure the paneling to the shelves; pencil; tape measure; sabre saw, block plane and hammer.

- Remove shelves and wall cleats.
- Second, carefully measure, cut and install one piece of paneling at a time. Cut panels accurately to ensure tight joints. Work in this order: sides, back, front wall (if any flanks the door), ceiling, floor.
- Third, replace shelf cleats.
- Fourth, trim shelves; Cut and attach paneling to shelves and replace them.

For an idea brochure on cedar closet paneling and a panel sample, send 50 cents to Giles & Kendall, Inc., Box 188, Dept. 7, Huntsville, Ala. 35804.

—Penelope Spangler



After you remove the closet shelves and cleats, measure one side of the closet. Check width and height in several spots so the panel you cut from these dimensions will fit perfectly. The joints should be tight.



Support a panel on 2x4s for cutting with a sabre saw (left). Install panels with their stamped sides to the wall. Secure panels to wall studs with 1/4-in. finishing nails every 12 in. vertically (right); nail sides, back.

## Cedar and moth repellency

The often-asked question, "Does cedar really repel moths?", may puzzle do-it-yourselfers: The answer is not simply yes or no.

According to a spokesman for the National Pest Control Assn., Eastern red cedar, when freshly cut, can repel some pests such as common clothes moths; but in time the wood loses its repellency characteristic.

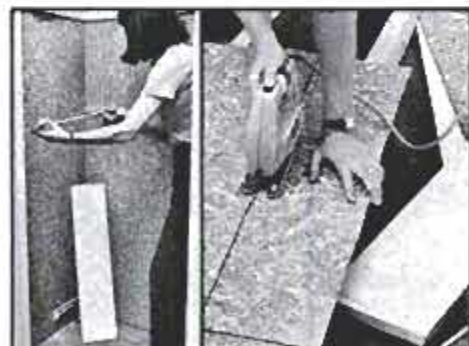
A researcher for U.S. Forest Services, Forest Products Laboratory, told me that oil in cedar is responsible for moth repellency and aromatic fra-

grance. In low concentrations the oil repels egg-laying adult moths. In higher ones, cedar oil inhibits the feeding rate of the larvae.

While cedar repels moths, it's no match for modern insecticides. But when its odor and moth repellency fade, they can be renewed by sanding the wood so inner oils surface.

The best protection against moths may be storing dry-cleaned items in plastic bags in a sealed container, adding insecticides for good measure.

—P.S.



After lining closet, replace cleats. Measure shelf space (left) and trim shelf. Cut scrap cedar to cover shelves (right).

# GIVE YOURSELF THE STANLEY EDGE.

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Precision set bevel filed teeth for fast, accurate cuts.

Chrome-alloy-steel blade for lasting sharpness.

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Super Doers are getting their teeth into more projects, with the help of Stanley. From our Professional™ line, the Rolls-Royce of saws, to the amazing Hard Tooth saws with heat hardened teeth to stay sharp far longer. Cut any job down to size with Stanley. The tools used by America's Super Doers.



**STANLEY** helps you do things right.™



Warning - Protect your eyes  
- Wear safety goggles  
when using tools.

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Super Doers is a trademark of Stanley Tools.

## '82 HOME IDEAS GUIDE

### Entry alarm protects your family

Protecting your family and home from intrusion is a growing concern of homeowners. With more than two million residential burglaries occurring across the country each year, the home-alarm industry is receiving motivation to develop a variety of equipment to suit homeowners' needs.

Pittway offers a system that permits homeowner installation. The basic unit consists of a console and a door-intrusion



Console, with switch for on/off, home/away and test modes, is surrounded by easily installed optional accessories. Door unit (right of airen) comes with the console.

transmitter. When triggered, the transmitter sends a wireless signal to the console. The console identifies the signal by turning on one of three lights and sounding one of three alarms. Other lights and alarms are provided for optional transmitters to monitor window intrusion, fire, leaking gas and personal or medical emergencies at the push of a button.

Operating on standard 120-v.a.c. household electric current, the basic kit also includes a back-up battery provision in case of power failure.

A four-position switch on the console allows for selection of different operational modes. In the "home" mode, the alarm sounds in case of fire or gas leak or an attempted intrusion through a protected door or window. The "away" setting allows for a time delay for exit or entry without triggering the alarm. An "off" mode disarms the intrusion system only and a "test" switch provides a means of checking the system's integrity.

Pittway's basic console with one door-intrusion transmitter is available at home center and hardware stores for a suggested retail price of \$174.95. For additional information write to Pittway Corp., 780 McClure, Aurora, Ill. 60505.—M.S.

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If your family is like mine, you're squeezing every dollar to make sure you have enough to go around. And it looks like things are going to stay that way.

One way to cut expenses is to cut the costs, and work, of lawn care. For example, a woman wrote about her zoysia lawn that she had mowed it only twice ALL SUMMER. She hadn't spent a cent on weed-killers. Not one cent for fertilizers. Yet her lawn was as green and weed-free as a pile carpet.

### ZOYSIA LAWNS STAY GREEN THROUGH HEAT AND DROUGHTS

Let the scorching sun burn lawns around you into hay—your zoysia stays fresh and green, an emerald isle of beauty. I have yet to water my own zoysia lawn. One day I saw that my sprinkler had gotten clogged! In Iowa, a zoysia lawn was declared the area's "Top Lawn—nearly perfect." Yet this lawn had been watered only once that entire summer!

**CUT YOUR WATER BILLS. SAVE THE WORK OF LAWN SPRINKLING. START A FAMOUS ZOYSIA GRASS LAWN NOW.**

### Weed-killing chemicals are NOT NEEDED for a weed-free Famous® Zoysia Lawn

How is it possible that Famous Meyer Z-52 Zoysia stays weed-free without using expensive, risky chemicals? It grows so thick that crabgrass (weed) seeds don't get enough light to germinate!

### Has Cut Mowing To Once A Month

Zoysia grows sideways, not just up like ordinary grass. It forms a thick, interwoven carpet of turf that keeps its well-groomed look weeks longer. It cuts your mowing by half, 3/4 or more!

### No-Reseeding—Not Ever!—With Lakeland's Famous® Zoysia

Plug in Lakeland Zoysia and never buy grass seed again. Zoysia lawns don't grow old; they just grow better. They sparkle under 100° heat... stay green through droughts. They resist diseases and insects which ruin ordinary grasses. After sharp frosts, they only give up their green color, then green up better than ever each following Spring. Famous Zoysia gives you the closest thing to an indestructible lawn you have ever seen.

### Ends Washouts on Steep Slopes Perfect Where Other Grasses Do Poorly

Deep-rooted zoysia holds soil in place, stops it from washing away from slopes. It's your perfect answer for worn out or weedy areas, too.

In a typical newspaper article I read (quote): "upgrading your current lawn" requires the right selection of grass seed plus "regular applications of fertilizer (and lime where needed)." This article also said you need, "weed, insect and disease control." Sound familiar? Of course!

Why not forget all that work and expense, and plug in Famous Meyer Z-52 Zoysia? To upgrade your lawn with zoysia, don't dig it up. Just set plugs into holes in the soil a foot apart more or less. Let those plugs spread toward each other to form a carpet of solid turf. Growth is so vigorous it chokes out old growth you want to get rid of, WEEDS INCLUDED.



From Coast to Coast People Write to Mike Senkiw

From Hudson, N.Y., E. LaRoche writes how he planted plugs "in the worst possible

place—clay with weeds and gravel... It formed a 4" thick carpet of grass. Not children, dogs, cats, rabbits, extremely hot sun or drought could kill it."

From Sacramento, Calif., J. M. writes how he bought our Zoysia "for a weed infested spot—it took care of the problem."

From Indiana, M.A. Low, Sr. writes how he visited a physician friend in Albert Lea, Minn. where he saw a "whole back yard was entirely in zoysia and it was beautiful... a deep green."

The success of many thousands of delighted Famous® Zoysia owners awaits you. Prove it to yourself today.

### Poor Soil? No Problem!

Our Famous Zoysia plugs are so vigorous we guarantee them to grow whatever your soil—from heavy clays to sandy sub-soils. You cannot lose.

### IT'S SO EASY AND INEXPENSIVE TO START A MAGNIFICENT ZOYSIA LAWN

Start your own magnificent, perennial zoysia lawn with as few as 100 plugs. Just let your plugs establish solid turf. Then take up transplants and plug in other places to your heart's desire. Plugged areas grow right back into solid turf. Your supply of plugs is endless.

### Prices and Bargains

If you plant more grass that sits there and struggles—or dies on you—you may not miss your work and money. It's the time you cannot recover! So please don't confuse Lakeland's 30-Below-Zero Zoysia with any ordinary turf offered as a "bargain." If our plugs cost a little more in the beginning, they remain, in the long run, the only true bargain for your lawn.

### Order guaranteed *Famous*

zoysia plugs now, for delivery from our nearest shipping point. Your order will be sent at the earliest proper time to plant in your area.

Meyer Z-52 Zoysia Grass was perfected by the U.S. Govt. and released in cooperation with the U.S. Golf Association.

### "Same Day Fresh"

The day we cut your plugs is the day they are on their way to you. Because freshness counts, Lakeland has 2 shipping points, one in the Midwest and one in the East. Your plugs go out from the nearest point "Same Day Fresh" and ready to grow, shipping charge collection the most economical way. On credit card orders, the shipping cost will be prepaid by us and billed to your account.

### Lakeland's Total Guarantee

- Drought Won't Kill It • Heat Won't Kill It
- Diseases Won't Kill It • Cold Won't Kill It

Even though we don't know your soil, we guarantee EVERY plug of Famous Z-52 Zoysia to live and grow in it. No ifs. No buts. Should any plugs fail to grow, just let us know within 60 days. We replace them FREE. That guarantee clearly means that Famous Zoysia has to do everything we say—and more! Otherwise there's no way we could give you such unique protection.



LAKELAND NURSERY SALES Dept. NL-1821 Hanover, Pa. 17331

Please send me the certified and guaranteed Famous® Zoysia plugs checked.

NAME \_\_\_\_\_ (please print)

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

I enclose check or m.o. for \$\_\_\_\_\_ (KS & AL res. add sales tax) Shipped "Transportation Collect" the most economical way.

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Acct. no. \_\_\_\_\_ Exp. date \_\_\_\_\_

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200 PLUGS & PLUGGER (L000968Y) + 60 FREE PLUGS Value \$20.24... Only \$13.95... You Save \$6.29

PLUGGER INCLUDED FREE WITH ORDERS OF 500 OR MORE PLUGS

500 PLUGS (L000976Y) + FREE PLUGGER & 150 FREE PLUGS Value \$43.17... Only \$25.95... You Save \$17.22

1000 PLUGS (L003301Y) + FREE PLUGGER & 300 FREE PLUGS Value \$81.39... Only \$35.95... You Save \$45.44

2000 PLUGS (L006296Y) + FREE PLUGGER & 600 FREE PLUGS Value \$157.83... Only \$84.95... You Save \$102.88

3000 PLUGS (L001990Y) + 2 FREE PLUGGERS & 900 FREE PLUGS Value \$239.22... Only \$73.95... You Save \$165.27

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NO NEED TO DIG UP YOUR LAWN  
PLUG IN *Famous* Z-52 ZOYSIA

# CAN YOUR LA TRACTOR RAISE





# OWN AND GARDEN CORN?

Naturally your lawn and garden tractor can cut the grass. But can it cut the mustard when it comes to heavier work? Can it help you raise corn? Can you use it to grade that new driveway? Can it dig a trench? Or a post hole?

The Kubota B7100DT, pictured opposite, is a demon for hard work. In fact, you won't find another 16 hp tractor in America that can do more kinds of jobs. From mowing the lawn to heavier chores like plowing, tilling, digging, and lifting.

The Kubota B7100DT isn't just a beefed-up riding mower.

Instead, it's a scaled-down farm tractor, complete with such farm-type features as a fuel-saving diesel engine, 4-wheel drive, six forward and two reverse speeds, rear PTO, and a 3-point hydraulic hitch.

The B7100DT is also ready and willing to accommodate a wide variety of Kubota implements: mid-mount or rear-mount mower, rear blade, front blade, rotary tiller, plow, disc harrow, trencher, front-end loader, backhoe, post hole digger, and snowblower.

We're now in our second decade of selling tractors in America, and one of the reasons for our success is the quality and commitment of our national sales and service organization.

Besides the B7100DT, your local dealer can show you many other Kubota models ranging from 12 to 81 hp. So if you're looking for a hardworking mid-size tractor, please remember, our Kubotas are looking for work.

I'd like more information about the Kubota B7100DT and all your other fine tractors. Please rush me a free copy of your latest brochure.

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Kubota Tractor Corporation, 550 W. Artesia Blvd.  
P.O. Box 7020, Compton, CA 90224

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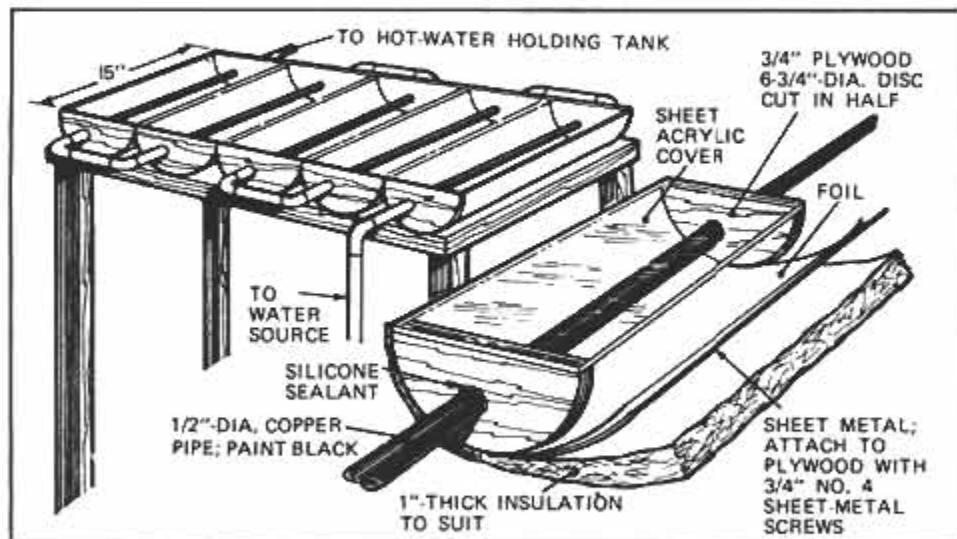
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We're looking for work.

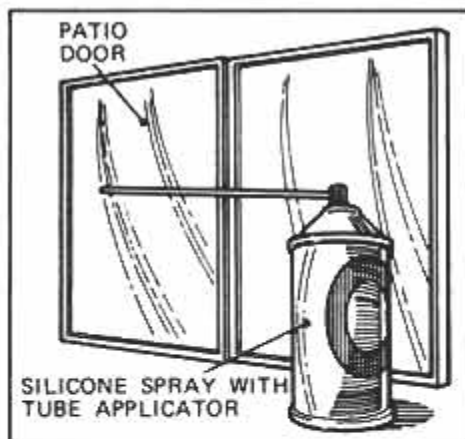
# Energy-saving ideas that work for readers



## Solar water heater

I have a solar water-heater trough that boils water in 30 minutes when the outside temperature is 70°F. You can combine several troughs, or use a single unit on camping trips. To build it, cut a 6 3/4-in.-dia. disc of 3/4-in. plywood; cut it in half. Use sheet-metal screws to fasten the wood at both ends of a 15-in.-long piece of sheet metal, cut to proper width. Mark

the center of both plywood pieces and bore holes for 1/2-in.-dia. copper pipe. Glue heavy-duty aluminum foil inside the trough. Insert copper pipe painted black into the two holes, then seal them. Place acrylic cover on trough and glue insulation on back. Hook up one pipe end to a water source, the other to a holding tank.—*Enoch E. Welch, San Antonio, Tex.*



## Weatherstrip saver

To protect pile weatherstripping on sliding patio doors from wearing out and letting in cold air, lubricate it with silicone spray. First, vacuum all of the grit from the weatherstripping and tracks; then use a silicone spray with a tube applicator (or trade tops with another compatible can with a tube applicator). This will make the door slide more easily, as well. Also, file any rough metal edges that may rub against the weatherstripping and tear it. Repeat this procedure each summer.

—*Tim Verschuyf, Palo Alto, Calif.*

## Foiling the sun

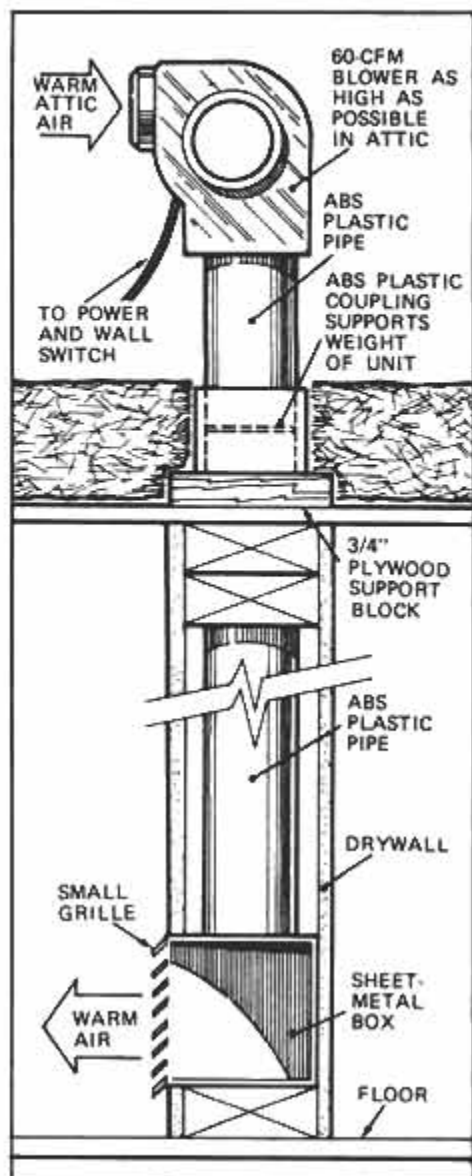
I live in a trailer house which gets no natural shade and is quite warm in summer. Several years ago, I covered my windows with aluminum foil. It reflects the sun away from the trailer so that my home is much cooler. I've used this idea for several summers now, to my great relief.

—*Ann Williams, Lake Village, Ark.*

## Cooling the kitchen

In order to cool the kitchen/family room of my house without airconditioning, I installed a used, hot-air furnace blower on the basement floor with the discharge facing upward. A duct discharges the cooled air through a kitchen cabinet. I've removed the cabinet floor and subflooring under the cabinet. The blower operates from a switch inside the cabinet. I leave the doors open when the blower is on. I've placed return air grilles in the floor of my family room which opens onto the kitchen; these grilles return warmed air to the basement to be cooled again. Since the basement area is about one-third larger than the area cooled, the upstairs is cooled comfortably at minimal cost.

—*Thomas Freemes, Chapel Hill, N.C.*



## Spreading the heat

Since our Northwest home is extremely well insulated, warmth from the sun cannot penetrate on many spring and autumn days, even when the sun is bright. Yet, operating the electric furnace to take off the chill would be overkill. On these days, the attic (under dark shingles) stays quite toasty. I've captured this heat by installing plastic pipe ducts at each end of the house in a centrally located partition. I topped these ducts with 60-cfm blowers in the attic, which feed to small grilles in a sheet-metal box that I pop-riveted together at floor level of the floor below. Each blower is controlled independently by a manual wall switch. When we need heat and the sun's been shining an hour or more, these gadgets do the job, almost for free.—*Ken Brooks, Vashon, Wash.*

Share your home energy-saving ideas. PM will pay \$25 for each published idea. Include sketch or photo, if necessary, and a stamped, self-addressed envelope if you want unused material returned. Send to Energy-Saving, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

# Only one gliding patio door is built like an Andersen window.



Only the Andersen® gliding patio door.

It's made of the same beautiful insulating wood and fuel-saving double-pane insulating glass as the famous Andersen window.

It's built to the same Andersen standards, so you know it's weathertight. (It closes *into* the jamb not just up to it like a swinging door.) It also glides open *without* stealing floor space.

It's from the Window Beauty people, so you can count on it to maximize the view and add charm and drama to your home.

Use one in your new home or to highlight your

remodeling, or to replace your present worn-out metal sliding door. Choose either the vinyl-sheathed, won't need painting Perma-Shield® door (with optional triple glazing), an all-wood door prefinished in Terratone color or an all-wood door with factory-primed exterior and natural interior.

If you're shopping for a gliding patio door think of it as a big window you walk through. Then remember who makes America's favorite window.

Your Andersen dealer is in the Yellow Pages under "Windows." Or send the coupon.

Printing limitations prohibit exact duplication of Terratone color. See actual sample.

Send me a free copy of The Andersen Window and Gliding Door Answer Book.

I plan to  Build  Remodel  Replace

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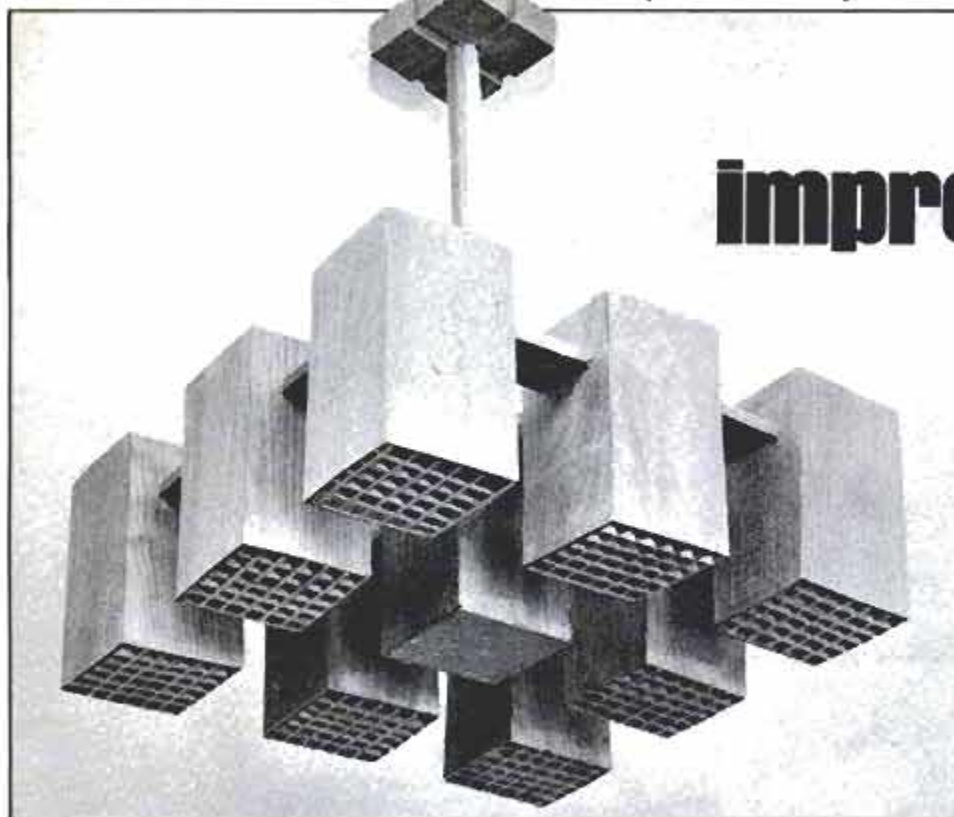
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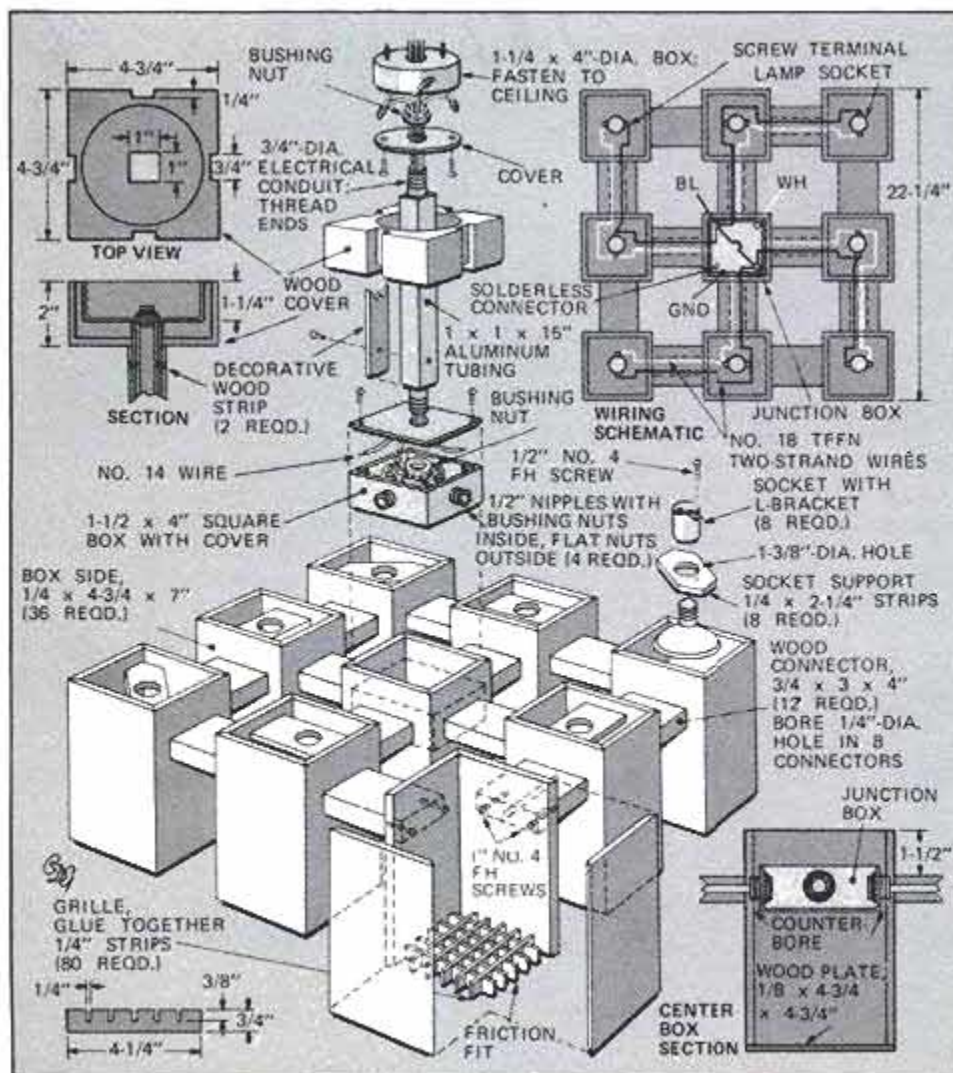
© 1988 Andersen Corp., Bayport, MN

# 3 easy improvements for your home

## 1 Contemporary light fixture



This handsome light fixture of teak accents an entry or dining room. Put on a dimmer switch and the lamps glow through the grilles to cast a playful light pattern below.



This teak fixture consists of eight light boxes surrounding a ninth box which holds an electrical junction box. Holes bored in wood connectors contain the wiring.

The wood parts consist of: nine wood boxes; 12 wood connectors with 1/4-in.-dia. holes through eight of them; eight socket supports, each with a center hole for a lamp socket such as Leviton's No. 005-3152-F porcelain L-bracket socket. The egg-crate grilles are strips of wood, slot-joined and glued together, then friction-fitted in place. A decorative wood cover at the ceiling encloses the upper electrical box; use a router to make the hole for the box. This cover is held at the ceiling by two decorative wood strips attached to Reynolds do-it-yourself aluminum tubing with screws.

Lay out box parts and wood connectors. Prebore screw holes in 12 connectors, 1/2-in. on center (o.c.) from each side, centered top to bottom; prebore screw holes in the box sides, 1 1/2-in. o.c. from each side, and 1 1/4-in. o.c. from top.

Next, glue the box parts together, except for the center wood box. For strong joints, glue box sides around a wood form shielded with wax paper, consisting of two wood blocks whose dimensions equal the inside dimensions of the light boxes. Clamp the assembly with web clamp or rope.

Before assembling the wood box at center around the junction box, counterbore for the nipples and nuts; also bore and attach the four wood-block connectors that adjoin this box with glue and screws. Install the junction box; glue and clamp the wood sides with a web clamp around the junction box area. Glue the bottom plate. (Note: For extra strength, double these four connectors.)

Join the four light boxes to the connectors already attached to the center box, using a stubby screwdriver. Attach remaining connectors and corner boxes.

Install each socket support 1/2 in. down from the top of each box with glue and

brads. Install the sockets. Then wire the fixture with No. 18, two-strand TFFN (Thermoplastic Fixture Flexible Nylon) wire from the junction box (see schematic). At the junction box, join fixture wire to No. 14 wire and secure with solderless connectors; fasten ground wire to its screw.

Bore a center hole in the junction box cover. Secure the conduit to the box cover with a bushing nut. Run No. 14 wire through this conduit, then screw the cover to the junction box. Bore screw holes for the teak-strip attaching screws in the aluminum tubing and get some assistance to install the whole fixture. First slip the aluminum tubing over the conduit, then the wood cover over the tubing. Attach conduit to the upper electrical box cover with a bushing nut and connect wires with solderless connectors. Then screw the box cover to the box. Slip the wood cover in place and secure the supporting wood strips. Install low-wattage lamps and grilles.



Vinyl-tape graphic adds visual impact to this bedroom (above). Tape comes sandwiched between paper. Remove paper from adhesive side, press tape to wall and peel off the top paper (inset).

## 2 Pot-and-pan rack

This pot-and-pan rack is made of fir. Round the top corners of the 2x4 with a block plane and sandpaper. Locate the wall studs (probably 16 in. on center) and secure the 5-ft. spacer (2x2) to three studs, countersinking the screws. Space the screws, attaching the 2x4 to the spacer evenly. Countersink the screws and plug the holes with dowels. Stain the rack; finish with semigloss polyurethane.

You can make the rail hooks of 3/8-in.-dia. Reynolds do-it-yourself aluminum rod. Cut a 12-in. length and mark bends (see drawing). Make a rod holder of two pieces of 3/4 x 3/4 x 3-in. hardwood, clamped into a 3/4 x 1 1/2 x 3 in. block. Bore a 3/8-in.-dia. hole centered on mating surfaces of blocks through shortest

dimension. Then secure blocks between vise jaws. Insert the rod with the 2 1/4-in. section centered. Tighten the jaws firmly. Slip an 8-in. length of 1/2-in.-dia. iron pipe over the rod until the pipe end aligns at the first bend mark; lift up on the pipe to bend. Then make the second bend. Use the bending jig shown in the drawing to make the third bend. Cut off waste after making the bends.

### SUPPLIERS LIST—POT-AND-PAN RACK

If you don't want to make them yourself, buy hooks from suppliers below. Prices applicable through December 1982. Hand-forged steel hooks, six for \$10.95, from The Blacksmith Shop, Box 15, Mount Holy, Vt. 05758. Stainless-steel hooks (prod. No. 42462), 10 for \$19.95 postpaid. Cashier's check or money order, payable to Hartover Inc., at: 2548 Campbell St., Kansas City, Mo. 64141.

## 3 Tape wall graphic

An easy, inexpensive way to perk up a room is with tape stripes—the same type used on vans and four-wheel-drive vehi-

cles. Automotive paint stores often stock these bright, multicolored stripes.

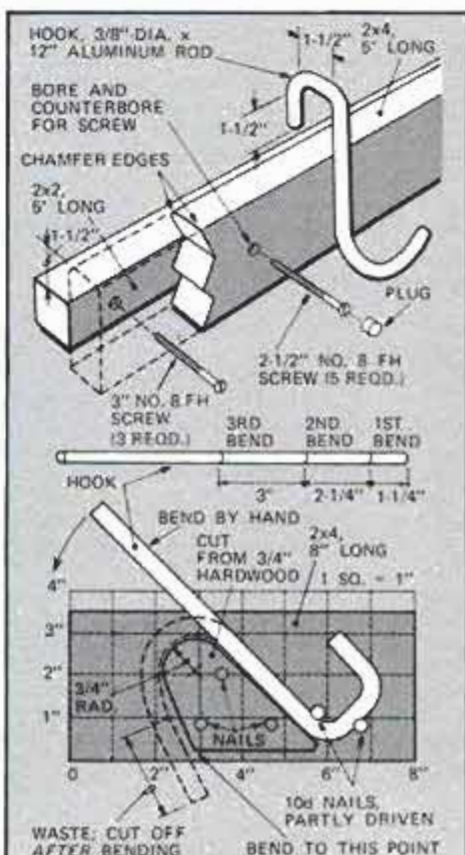
The graphic in this attic bedroom was made with a 50-ft. roll of a 10-in. wide, tricolor stripe called ProStripe Maxiroll; it cost \$38. Installation took an hour.

The tape is double-backed. Peel away the paper protecting the adhesive side, lay the stripe in place, and rub the outer protective paper with a supplied nylon squeegee. The tape successfully covers textured walls. Angled bends other than 90° present a problem. However, if they're only slightly more or less, you can lap pieces of tape.

For information on ProStripe, write: Spartan Plastics Inc., Box 67-PM, Holt, Mich. 48842.—Michael Lamm



This pot-and-pan rack holds kitchen utensils at hand. Traditionally, the movable rail hooks (see drawing at right) are used in the meat-packing industry to hold carcasses.



# New Comfort for Drivers



The world's finest  
sheepskin brings new  
comfort to driving and  
it is washable.

My name is Archibald Mason. I am a wool merchant from New Zealand.

New Zealand has more sheep than people. Our lambswool rugs are the finest in the world. Every year thousands of Americans travel to New Zealand and buy our lambswool rugs and car seat covers.

I began selling lambswool rugs by mail in the United States in 1978. Since then I have supplied many rugs to American homes and offices, and every week we receive further requests for rugs from people who cannot visit New Zealand just yet. I have often been asked by Americans if we can supply car seat covers. New Zealand was the first country to use lambswool car seat covers and we have been making and using them for over 20 years. About three out of five new cars in New Zealand have lambswool seat covers fitted when new, and this figure is even higher for luxury cars. I am the largest single supplier of custom made car seat covers to New Zealanders. I am now ready to offer my seat covers by mail to Americans.

## STRONG FIBERS

If the wool in the photo seems too plush for your car seat, don't worry. We trim the wool to an even  $\frac{3}{4}$ " for car seat covers, so there is enough length for those springy resilient fibers to hold you off the seat and allow air to circulate behind and beneath you; and the  $\frac{3}{4}$ " wool is short enough for easy care and laundering. Yes, laundering! New Zealand tanners have perfected "chrome tanning," which means your car seat cover can be thrown in the washing machine and washed like a woolen sweater. It goes back on your car seat as soft and resilient as new.

When you buy your car seat covers, you need to know they will last for years. New Zealand wool is the world's strongest — and the secret is in the nourishment of the sheep. We have an equable climate with adequate rain falling evenly through the year, so those lush, green pastures you have seen in our

tourist publicity supply plenty of food for the sheep all year. No summer droughts, no harsh winters. The wool grows into even, strong fibers. When your friends run their fingers through the wool in your seat covers, they may find it incredible that the world's longest-lasting wool can be so soft. But you will know, as your seat covers give you comfort for year after year, that you have bought from the people who know how to make the best seat covers.

## THE BEST METHOD

But think about the fixing method. Some of the seat cover advertisements I have seen in the United States worry me — the fixing systems they are offering are clearly inadequate. As you slide in and out of your car seat, there is a tendency for the seat cover to move sideways on the seat, and it may move out of position. It took us many years of experience in New Zealand to develop the best fixing method, which holds the seat covers firmly in place without moving. We use expanding cords positioned in exactly the right places, and we even have light friction strips on the back of each cover to hold them in place.

Wool is a great insulator. When you enter your car on a hot day, the wool seat covers never feel hot, unlike the synthetic materials often used in car seats.

On a cold day, vinyl or synthetic materials drag the heat rapidly out of your body. Wool doesn't do this — wool adjusts slowly to your temperature, at the same time cradling you in thousands of soft, springy fibers. A great way to start any drive.

## LUXURIOUS

But the greatest benefit is the air circulation. No matter how heavily you sit on a sheepskin seat cover, there is always air between the wool fibers, separating you from the car seat. As the air moves behind you, it carries away the moisture given off by your body. No more sticking to the seats, or damp clothing on a hot day. You may even find you use your air-conditioning less, and thus conserve fuel. New Zealand cars seldom use air conditioning.

My seat covers cover the back rest and seat cushion, and they are strikingly beautiful. They will enhance the interior of your automobiles, and they will protect your car seats from scuffing and damage.

We have custom-made seat covers in stock for all makes of American and imported cars. They are in matched pairs, to suit the two front seats of your car. We hold our stock in Honolulu, so United States customs charges have been paid. UPS can deliver to your address within a few days of dispatch.

## MONEY BACK GUARANTEE

Follow the easy instructions to fit the seat covers in your car. Then drive with them and admire their smart appearance. Then decide. If you don't feel you are driving in greater comfort, send them back to us within 30 days. We will refund your money in full, and thank you for the opportunity to bring a little of New Zealand into your life.

Call Toll Free 800-367-6002 Ext. PM-04  
(24 hour service).

Tell us the make, model, and year of your car, and tell us if your seats are high back or low back. Choose your color from white, honey, fawn or charcoal.

The cost to you is:

Pair	\$165.00 plus \$5.50 delivery
Single	\$ 82.50 plus \$3.50 delivery

We will charge to your credit card. Or, if you prefer to pay by check, please include your driver's license number for prompt processing of your order.

## MONARCH TRADING CO.

OF NEW ZEALAND

Pier 39, Dept. PM-04  
Honolulu, Hawaii 96817

"The rug in the photo is our white queen-size rug of never-shorn lambswool. It measures over 5 ft x 2 ft and our price is only \$99.50 plus \$5.50 delivery. Try our rug — it will be the nicest thing you ever did for your feet."

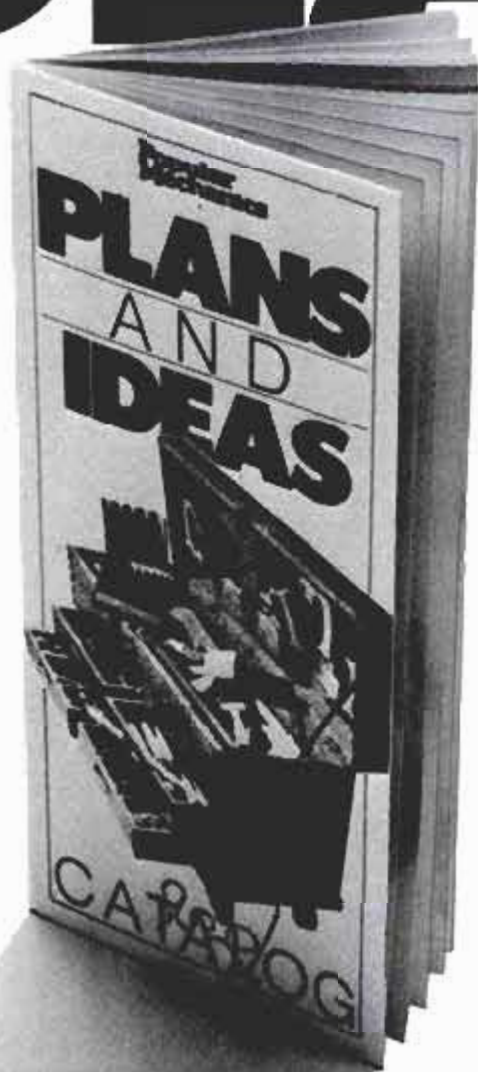
In Hawaii, call 523-5808 or visit our shop, The Prides of New Zealand, Ala Moana Center

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Curtis Homes would like you to know about their nine new affordable homes and the "CHAMP"™—Curtis Homes Assistance Money Plan. Colorful brochure illustrates the homes that you complete and the financial plan. \$2.00

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Design ideas and complete construction details for people with basic carpentry skills. Decks made with pressure-treated Wolmanized Wood resist decay and insect attack indefinitely. This 24-page booklet covers everything from estimating to staining. From Koppers Company. \$1.00

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The Supra KeySafe insures family members are never locked out of the house again. Sturdy safe mounts on the outside of your home providing a convenient, safe place to hide an extra key. Opens with resettable 3-letter combination lock. Free brochure.

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## 524 CATALOG FOR HOME, WORK & PLAY

80-page catalog is chock-full of hydraulic pumps, tools and equipment, motors, valves, hardware, go carts and mini-bikes. From Northern Hydraulics. \$1.00

## 525 IDEAS SET IN CONCRETE

Transform your yard into an outdoor entertainment area in just a few summer weekends. Sakrete Cement gives you step-by-step instruction for 18 different projects in this 16-page booklet. 75¢

## 526 WORKING WITH WOOD

New 1982 four-color, 112-page catalog of over 3,000 products for woodworkers. Includes veneers and inlays, fine hardwoods, tools and hardware. From The Woodworkers' Store. \$1.00

## 527 THE MODERN WOODSMAN

The Wood Master 5-in-1 combines the five most needed power tools in one machine. A complete home workshop for woodworkers, do-it-yourselfers and craftsmen. Brochure from Master Woodcraft & Hobby Machine. Free

## 528 A RARE OPPORTUNITY

Vinyl Industrial Products would like you to have complete information on how you can start your own business in vinyl repair, restoration and recoloring. Opportunities unlimited, full and part time—auto tops and interiors, homes, restaurants—and more. Just 25¢

## 529 DESIGN WITH CERAMIC TILE

16-page color brochure shows unusual applications of ceramic tile on woodstove and fireplace hearths, kitchen and bath niches, seating areas and planter boxes. Detail drawings suggest installation guidelines. From American Olean Tile. 50¢

## 530 MAKING LAWN HISTORY

24-page color lawn care booklet WHEELHORSE "Famous Lawns of America" contains information on seven historic locations. Plus, important lawn care tips for homeowners. Free

## 531 WIDE, WIDE WORLD OF WINDOWS

Andersen Corp. answers the most-asked questions about windows and gliding doors in a 24-page, full-color booklet. Contains special sections on window planning, energy, remodeling and replacement. Both wood and vinyl-sheathed windows are described and illustrated. Free

## 532 MAKE JOBS A SNAP

For beginner or master technician, you'll find just about every hand tool in this catalog from Snap-on-Tools. Too many to list; 300 pages long. Only \$3.00

## 533 RAIN, RAIN GO AWAY

Genova offers a colorful guide to installing Raingo solid vinyl gutter systems. This new 24-page booklet contains lots of how-to photos with easy to follow instructions. 50¢

## 534 CHIMNEY ALERT

Vermont Technology offers a brochure about its Chimney Fire Alert. An electronic system that provides continuous stack temperature readout of any wood or coal stove, furnace, or fireplace insert. Built-in alarm alerts user if appliance overheats. Free

## 535 LIGHT UP YOUR LIFE

Decorative and functional fixtures for the home are illustrated in this 162-page color catalog from Thomas Industries. Chandeliers, wall/ceiling fixtures, bath cabinets/mirrors, outdoor lamps/post lanterns, and recessed lighting are included. \$2.00

## 536 TOOLS, TOOLS AND MORE TOOLS

All 196 pages of the U.S. General Supply Corp. catalog are filled with over 6,000 name brand tools and handyman supplies. Discounted prices, too! \$1.00 (Refundable on first order)

## 537 WALLFLOWER HANG-UPS

Handy brochure gives step-by-step wallcovering instructions. Includes tips on the proper tools to use and how to handle difficult areas. From Warner Manufacturing. 25¢

## 538 POWER TOOLS FOR ALL SKILLS

84-page catalog from Skil Corp. offers power tools rated for do-it-yourselfers, tradesmen and professionals. Saws, drills, sanders, grinders and more. Free

## 539 WOOD THAT YOU WOULD

12-page, four-color booklet from Watco-Dennis shows how to create professional finishes the first time with all types of wood. Watco Danish Oil seals, primes, finishes, hardens, protects, beautifies and penetrates . . . in one application. Free

## 540 MADE-FOR-YOU WINDOWS

New four-color brochure is packed with information on made-to-order replacement windows. Includes information on construction, energy-saving features and 12 easy installation steps. From Marvin Windows. Free

## 541 THINKING CAP FOR YOUR FLUE

Brochure explains how the Thinking Flue Regulator automatically opens to allow smoke out and regulates the volume of heat leaving the chimney. Cap stops animals, rain and snow from entering flue. From American Energy Products. Free

## 542 FUN-FILLED CATALOG

Things you never knew existed. New, world famous 1982 catalog of 1,600 hard to get novelties, hobbies, sports, science, electronics, models and gadgets. From Johnson Smith. 10¢

Popular Mechanics 4/82  
Box 1718, Sandusky, Ohio 44870

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Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

This Coupon Expires June 30, 1982

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Service Charge \$ \_\_\_\_\_ .35

Total money enclosed \$ \_\_\_\_\_



## '82 HOME IDEAS GUIDE

NEW PRODUCTS FOR YOUR HOME (Continued from page 157)

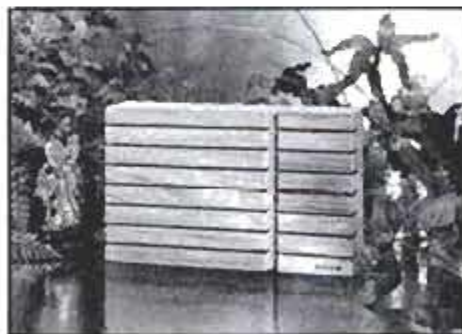


The R-10 Water Heater Insulation Blanket (left) is a hot-water-tank cover made of 3-in.-thick fiberglass insulation encased with heavy-duty vinyl. According to the maker, by adding a blanket to a conventional water heater, you can reduce water heating costs by 67 percent. Cover installs with heat-resistant tape and sells for \$22 at home centers. It's from Bede Industries Inc., 8327 Clinton Rd., Cleveland, Ohio 44144.



Whirlpool's new electric cooktop, model No. RC8800XLH, comes with three interchangeable heating modules that can be arranged any way you choose. The standard unit, which is shown above, costs approximately \$485 and includes a grill and two surface burner units (the one on the left has two 6-in. burners; the one on the right has one 8-in. and one 4-in. burner). The rotisserie, the covered griddle and the cutting-board modules are also available for an additional cost. The unit is sold at appliance stores and is manufactured by Whirlpool Corp., 2000 U.S. 33 N., Benton Harbor, Mich. 49022. (Please turn to page 173)

The new Harmony musical door chime (right) plays any one of 24 different melodies whenever your doorbell is pushed. The unit measures 4 x 7 x 11 in. and its tone, tempo, volume and song-selection controls are hidden neatly behind a small, surface-mounted door. Available in your choice of either teak or bleached finishes, the door chime sells for \$79.95 at hardware stores and home centers. Nutone Div. of Scovill, Cincinnati, Ohio 45227 makes it.



WHEN YOU DO IT  
YOURSELF DO IT RIGHT...  
USE SAKRETE



**SAKRETE** does it right. SAKRETE was the world's first cement mix in a bag. And today, 45 years later, it's still the industry standard for excellence — because the consistent quality of SAKRETE is seldom equaled.

**SAKRETE is Economical.** SAKRETE is the best buy on the market because it's strong — long lasting — use it when you want to — buy only what you need. And you increase the value of your property.

**SAKRETE is Strong.** SAKRETE concrete and mortar mixes are designed, batched, and mixed to be strong and workable.

**SAKRETE is Easy.** No guesswork. Complete step-by-step directions are right on the bag. And the free SAKRETE Project Booklet gives you illustrated pages of ideas and easy-to-follow instructions.

When you do it yourself — do it right with SAKRETE Cement Mixes.

# SAKRETE® Cement Mixes

There's no substitute for the best.



Ask for the SAKRETE Project Booklet — it's free at your SAKRETE dealer. Or send 75¢ for handling to: SAKRETE, Dept. P42, Box 17087, Cincinnati, OH 45217.

SAKRETE is a registered trademark of SAKRETE, INC. © 1982

# FROM RAW WOOD TO RARE BEAUTY WITHOUT A RIBBLE

*Harry Morgan,  
television star and  
proud do-it-yourselfer.*

Bare wood. Just-stripped or unfinished wood. Even previously finished wood. There's no easier way to give them rare new beauty than with Carver Tripp stains and clear finishes.

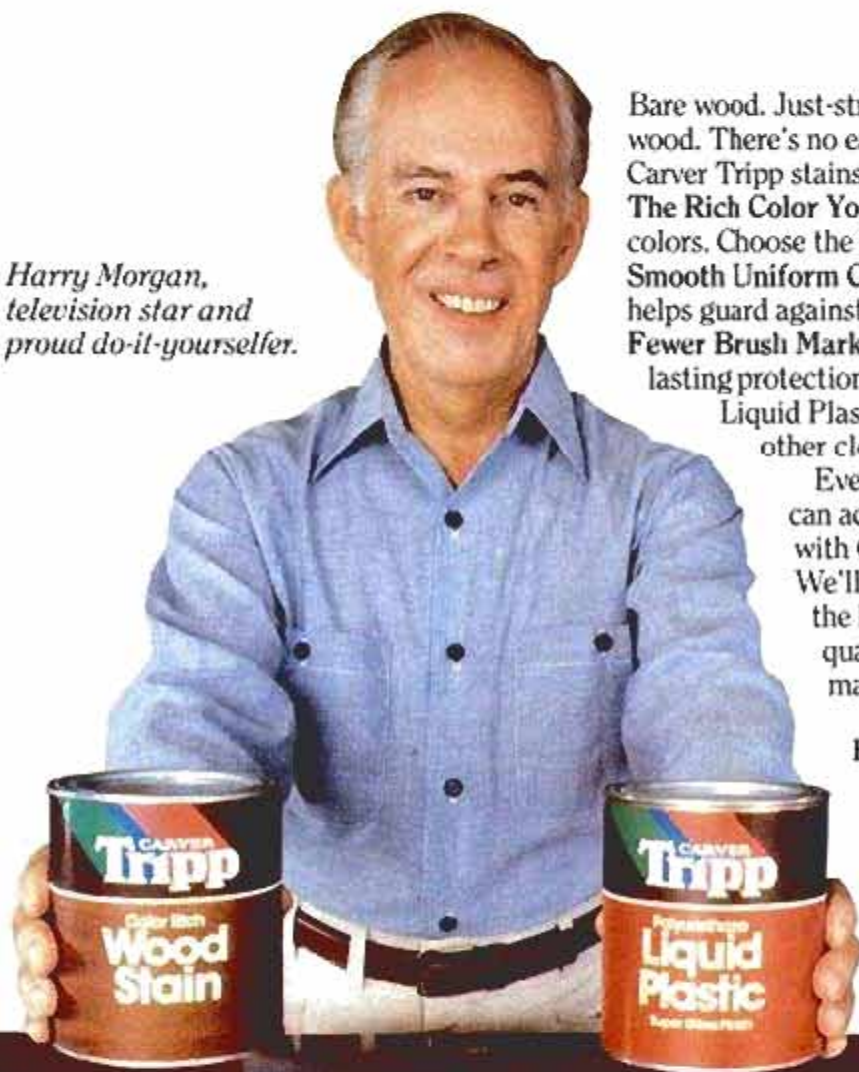
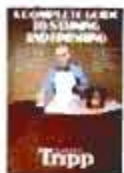
**The Rich Color You Want.** Carver Tripp offers a wide selection of colors. Choose the color you're looking for from our color chips.  
**Smooth Uniform Coverage.** Lap marks? Raising of the grain? Tripp helps guard against them with deep, even coverage in just one coat.  
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Even a raw beginner can achieve real beauty with Carver Tripp. We'll provide you with the how-to help and quality products that make it happen.

## CARVER Tripp



Free "Complete Guide to Staining and Finishing." Take advantage of our know-how. Write for our free 16-page booklet: Carver Tripp, Dept. PM, P.O. Box 85063, San Diego, CA 92138.



## '82 HOME IDEAS GUIDE

NEW PRODUCTS FOR YOUR HOME (Continued from page 171)



Midcor faucet, Model 0525-CH-2A (left) includes a 4-in. washerless faucet, a pop-up drain assembly and two decorator handles—all in one package. All parts and instructions that are necessary for the complete installation are provided with the unit, along with your choice of either chrome or brass finishes and clear, smoke or amber handles. Middlefield Corp., 15650 Madison Rd., Middlefield, Ohio 44062, makes the unit; it's \$25 at home centers.

Pro Duty spray-gun package (right) from Wagner Spray Tech Corp., Box 9362, Minneapolis, Minn. 55440, has a brand-new accessory, called the Power Roller. It attaches to the spray-gun nozzle and paint is forced through the hollow extension handle and into the roller, thus eliminating messy paint trays. The roller costs \$60 and the spray-gun package (with an airless diaphragm pump, 25 ft. of hose and spray gun) costs about \$400 at home centers.



The Stovetemp is a 6-in.-diameter thermostat designed to mount in place of the spin draft on most wood—and some coal—stoves. A heavy-duty bimetallic coil activates a pendulum-type draft plate, which is positioned parallel to the front surface of the stove. As the fire gets warmer, the plate moves to the side and reduces the draft opening. As the fire cools, the opening increases. According to the manufacturer, by controlling the draft opening precisely in this fashion, the stove's burning efficiency will increase by as much as 8 percent. For added comfort, a housing-mounted dial allows you to approximate room temperature. Made by Condar Co., Box 6, Hiram, Ohio 44234, it's \$39.95 at stove dealers.

(Please turn to page 174)

## GOING TO WASTE.

## GOING TO WORK.

COULD THIS BE YOUR TILLER?

make all your gardening easier, look at these features.

- **Lightweight.** One third the weight of big rear-tine tillers—just 76 pounds. So, you can handle it easily without any extra muscle.
- **Tills, Cultivates, Weeds.** Just adjust the working head to fit the job. Use it all season long—not just Spring and Fall.
- **Easy to Handle.** Anyone can use it—from older folks to youngsters. It's small and light so it won't bounce and shake you to death! Enjoy easy control.
- **Affordable.** Half to one-third the cost of big rear-tine tillers—with 4 times the uses!
- **Quality Craftsmanship.** Direct gears, Austempered tines, solid, rugged construction.

TRY THE MASPORT HOME GARDENER

How often do you think you'd use a big, heavy tiller? Probably just a few times a year, right? That's because they're really made to do just one job, tilling. The rest of the time they just gather dust while you do all the back breaking up hoop each week by hand. Pretty ridiculous, right?

### THE MASPORT HOME GARDENER™ IS DIFFERENT.

With its light weight and several quick-change attachments, you can use it often for many of your gardening chores. In fact, 79% of Home Gardener owners we surveyed report using their Masports at **least every 2 weeks!**

If you're looking for a tiller or a way to

For complete information, return this coupon or call toll-free 1-800-227-2864 (in California 1-800-772-3589)



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## '82 HOME IDEAS GUIDE

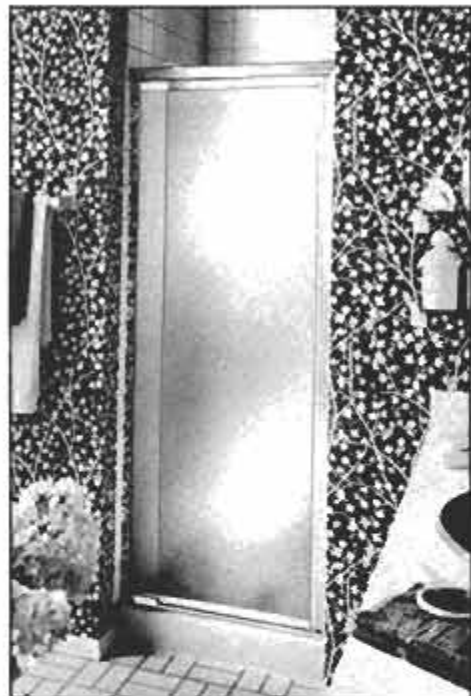
NEW PRODUCTS FOR YOUR HOME (Continued from page 173)



The Autopulse 10 is an easy-to-install automatic dialer designed for home and small-office use. The unit can be programmed with 10 telephone numbers, up to 16 digits long, which can be "dialed" individually with just a touch. It's 1 7/8 x 5 1/4 x 9 3/4 in. and sells for \$69.95 at department stores. Larger capacity models are also available. It's made by Troller Corp., 4445 North Ravenwood Ave., Chicago, Ill. 60640.




The Kitchen Planning Guide is a well-illustrated, 16-page booklet written to help non-professionals design their own kitchens. Standard cabinet sizes and terminology are discussed, as well as how to choose the best cabinet arrangement based on individual needs. Good, functional design is stressed. It's \$1.50 postpaid from Merillat Industries Inc., 2075 West Beecher Rd., Dept. PM 482, Adrian, Mich. 49221.



The Vista-Pivot line of shower-door enclosures can span stall openings from 24 to 36 in. wide with just three adjustable models. All have glass doors mounted on anodized aluminum tracks with gold, bronze or silver finishes. Sold at home centers, these units are available in 66- and 72-in. heights for \$112 to \$214, depending on model. Made by Kinkead Industries Inc., 2801 Finley Rd., Downers Grove, Ill. 60515. **PM**

**LYNCHBURG**  
HARDWARE & GENERAL STORE  
42 Main St., Lynchburg, TN 37352

**JACK DANIEL  
GENTLEMAN DISTILLER  
T-SHIRT**



This handsome black T-shirt boasts the famous portrait of Mr. Jack Daniel with his wide planter's style hat. The legend reads "Jack Daniel... Gentleman Distiller" and makes the shirt a distinguished addition to any collection. 50% cotton/50% polyester. State S, M, L, or XL. \$10.00 delivered.

Send check, money order or use American Express, Visa or MasterCard, including all numbers and signature. (Add 6% sales tax for TN delivery.) For a color catalog full of old Tennessee items and Jack Daniel's memorabilia, send \$1.00 to the above address. In continental U.S. of A. call 1-800-251-8600. Tennessee residents call 615-759-7184

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REFINISHING  
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**ZIP-STRIP**  
Paint, Varnish and Stain Remover will quickly remove 5-6 coats of paint, varnish, lacquer, shellac, enamel, latex, urethane, polyurethane, and stain.

**ZIP-GUARD**, a clear urethane wood finish is available in satin or gloss, eliminates waxing and resists alcohol, water, grease, oil and detergent. Excellent for use on cupboards, paneling, furniture and wood floors.

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### HAVE FAMILY FUN AFLOAT WITH A PONTOON BOAT



#### EASY TO ASSEMBLE KITS THAT SAVE YOU MONEY

- Economical, safe and practically indestructible. Ideal for family parties, fishing or swimming.
- 3 models to choose from. 17', 20' and 24' lengths.
- Polyethylene pontoon sections are urethane foam filled. Retains buoyancy even if punctured. Highly resistant to abrasion and impact.
- Pontoons are maintenance free, color-fast—never needs painting.
- Assembly requires no special tools or equipment. Takes only 12 to 16 hours to complete.
- All kit components are of galvanized or marine grade aluminum.
- Kit contains pontoons, frame, motor mount, helm station, steering, railing and hardware.
- Send \$2.00 for complete information.

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**ROTOCAST FLOTATION PRODUCTS**  
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BROWNWOOD, TEXAS 76801

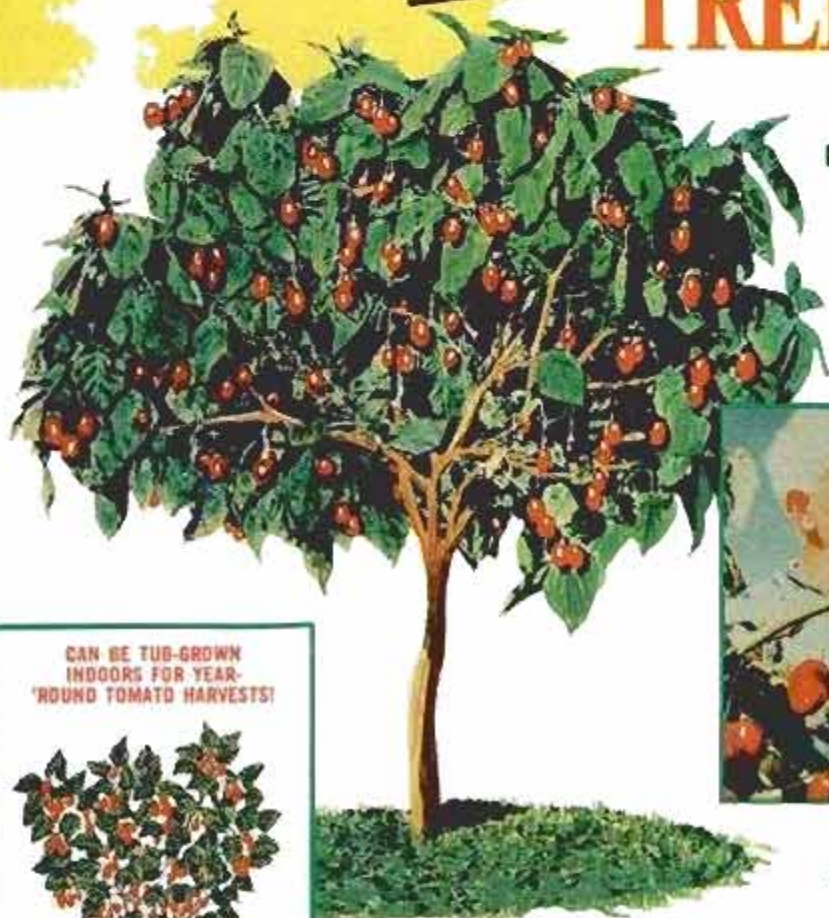
# DOES 60 lbs. OF TOMATOES FROM ONE YIELD SOUND INCREDIBLE?

## NOT IF YOU OWN THE

Amazing

# TREE TOMATO

(*Cyphomandra betacea*)



**GROWS INDOORS OR OUTDOORS . . . YOU PICK BASKET AFTER BASKET OF RIPE, TASTY TOMATOES . . . ONE BUMPER CROP AFTER ANOTHER . . . 5 TO 7 MONTHS A YEAR . . . YEAR AFTER YEAR!**

### We Get Letters!

Read what Mr. L. F. S. of Wis. has to say: "... Just a line to let you know the Tree Tomato is doing great . . . about 5½ ft. tall . . . you said leaves grew 12" . . . mine are 15 and 16". It's just beautiful!"

### Noted Citriculturist of New Zealand

"Ripening in New Zealand from late April to early November, the tree tomato has a very long fruiting season. Its wide range of culinary uses make it a valuable winter and spring fruit . . . a welcome addition to the menu."

"Although introduced into New Zealand many years ago, it is only in recent years that the tree tomato has become better known for its many uses. It is now much sought after, and its popularity is indicated by the high price realized for it on local markets . . . Under suitable conditions the plant will produce from 40 to 60 lbs. of fruit annually."



**From New Zealand comes the biggest garden sensation of the century . . . THE PERENNIAL TOMATO!**

The TREE TOMATO . . . a remarkable new horticultural concept . . . unlike anything you've ever seen before! NOT a vine . . . NOT a regular tomato plant that withers and dies after one summer . . . the TREE TOMATO is a living, growing tree that BEARS FRUIT SEASON AFTER SEASON . . . YEAR AFTER YEAR!

Why settle for garden-fresh tomatoes a few short weeks of the year? Why put up with hothouse tomatoes that taste like cardboard the rest of the time? Not when you can pick crop after crop of red, plump juicy TREE TOMATOES up to 7 months a year (all year 'round when grown indoors!)

**WAVE AFTER WAVE OF SUCCULENT TREE TOMATOES GROW AS QUICK AS YOU CAN PICK 'EM!**

Your TREE TOMATO will arrive already leafed-out . . . in full, green hardy vigor! When ready to bear, the branches will literally droop with huge clusters of delicious TREE TOMATOES, hundreds upon hundreds . . . and, as one crop is harvested, another rushed forth to take its place . . . so you have a virtually constant supply of luscious TREE TOMATOES!

**CAN BE TUB-GROWN INDOORS FOR YEAR-ROUND TOMATO HARVESTS!**



### GROW IT OUTDOORS AS A TREE—INDOORS AS A HOUSEPLANT!

The TREE TOMATO will thrive marvelously—indoors or out! If you live in a temperate zone, plant it outdoors and enjoy its bountiful, exotic beauty in your garden! Or, tub-grow the TREE TOMATO, bring it indoors for winter, and surprise your family and friends with ripe, just-picked tomatoes even during the coldest months of the year! Or . . . cultivate the TREE TOMATO as a house-plant anytime . . . anywhere! The TREE TOMATO will achieve heights of up to 8 ft. outdoors, but it can be trimmed and trained to any size or shape you wish!

### ENJOY TREE TOMATOES SO MANY DELECTABLE WAYS!

We think TREE TOMATOES are much tastier than ordinary tomatoes . . . It's hard to find a meatier, firmer, more bursting-with-goodness taste treat! Rich in Vitamin C, TREE TOMATOES are fabulous in salads, sandwiches and are absolutely fantastic just sliced up and popped in your mouth!

Nothing beats fresh produce, so why continue to pay high supermarket prices for inferior tomatoes, when you can grow your own TREE TOMATOES! REMEMBER, WE SHIP MATURE PLANTS . . . NOT SEEDS . . . ORDER YOUR TREE TOMATOES TODAY! Full growing instructions included.

### LAKELAND'S DOUBLE GUARANTEE

All plants must arrive in perfect condition. If you are not totally satisfied with any order, return within 10 days for a prompt replacement or refund of purchase price (except post. & hdg.). And all plants must thrive after planting, or return anytime within 3 months for prompt replacement—no questions asked!

**LAKELAND NURSERIES SALES, Hanover, Pa. 17331**

**SATISFACTION GUARANTEED! MAIL COUPON TODAY!**

**LAKELAND NURSERIES SALES, Dept. NL-1822  
340 Poplar St., Hanover, Pa. 17331**

Sure, I want to enjoy fresh-picked tomato goodness—even out of season! Kindly RUSH TREE TOMATOES (L101170E) as indicated below on money-back guarantee.

- 1 TREE TOMATO @ only \$5.99 + 90¢ post. & handl.  
 2 TREE TOMATOES @ only \$9.99 + \$1.40 post. & handl.  
 4 TREE TOMATOES @ only \$16.99 + \$2.40 post. & handl.

Enclosed is \$\_\_\_\_\_ (Pa. residents add sales tax.)

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CITY \_\_\_\_\_

STATE \_\_\_\_\_

ZIP \_\_\_\_\_

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# PM LOOKS AT AN EASY-TO-USE WALL PATCH

**H**oles in dry wall cannot be patched by simply troweling in some plaster or joint compound because there is no solid surface directly behind the dry wall. Patching material would simply fall through and down inside the wall.

Construction workers and homeowners have come up with lots of ways to plug

such holes so a foundation can be made for patching material.

However, the usual procedure is to insert a backup plate of some kind behind the hole to serve as a support for the patch and compound. There are several ways to do this, but it is generally a nuisance-type job.

The kit shown here is one way to get the job done quickly and easily.

You use wood-strip patch supports and double-faced, self-stick adhesive tabs to form the foundation for the patching material.

Once the support has been set in place and the square has been attached,

## Enjoy a roaring fire . . . the easy way, with PM's Log Splitter!

What could be more pleasant on a cold, cold day than the warmth of a roaring fire. And, you can have all the firewood you need and save time and money by splitting that firewood yourself. POPULAR MECHANICS LOG SPLITTER exerts some 10,000 lbs. of pressure and will easily split 2 ft. lengths of maple and ash logs 12 to 14 inches in diameter. With an I-beam backbone, double-acting hydraulic cylinder, control valve oil filter, 3-hp. gasoline engine and other features,

you'll find this log splitter easy to build and a fun thing to use. And, you'll save your back from aching as you split logs the easy way.

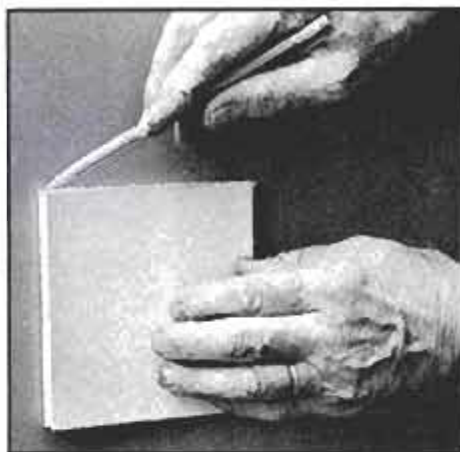
Have more time to enjoy the crackling fire in *your* fireplace. Use it through this year, or start getting ready for next winter. Either way, it's a very sound investment. Send for complete plans and step by step instructions for just \$8.95. Send a check or money order to PM Plans Library-Log Splitter, Box 1014 Radio City Station, N.Y. N.Y. 10101

### PM LOG SPLITTER

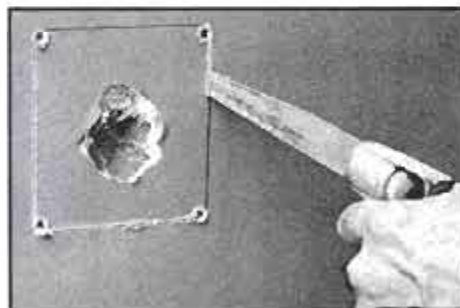
Popular Mechanics is a publication of Hearst Magazines, a Division of THE HEARST CORPORATION



Kit includes wood strips, a 5x5-in. plaster-board patch you cut to size, adhesive tabs, patching plaster and sandpaper.



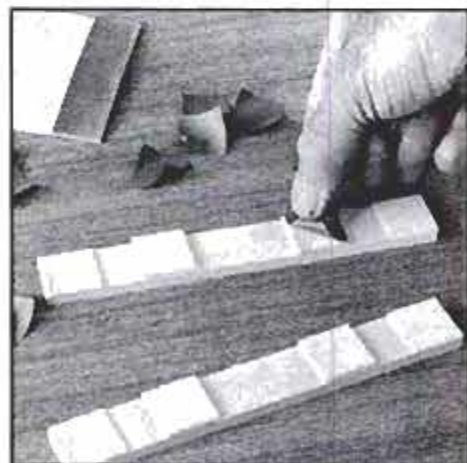
Place patch over damaged spot and draw an outline of the square with a pencil.



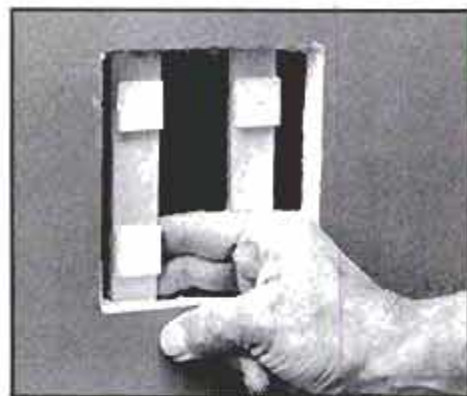
Probe through the hole to check for electric wires or plumbing, then bore four holes at the corners. Finally, carefully cut out a square opening with a keyhole saw.

you patch the hole in the conventional way. Take the time to study the photos to understand the basic steps.

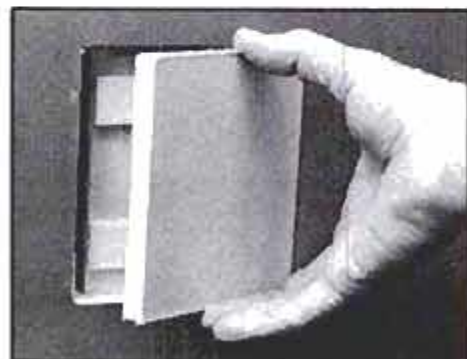
The Easy Wall Patch kit is available from Crete Wood Manufacturing Co., 2321 Greenwood Ave., Crete, Ill. 60417. The price is \$3.98, plus \$1.75 for shipping and handling.—Rosario Capotosto



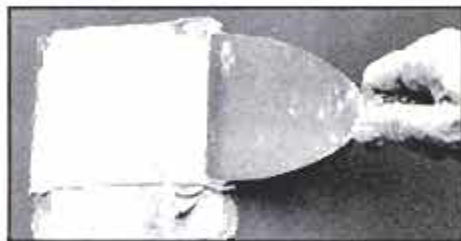
Peel the adhesive tabs from the backing paper and apply firmly to the wood strips, positioned as shown. Then peel off protective paper from the face of the tabs.



Clean all dust and debris from the back of the wall. Next, insert the wood strips in the opening and pull firmly toward the back side of the wall to secure in place.



Dust off the patch and place in opening against adhesive tabs; press into place.



Using water, mix half the bag of plaster to the consistency of heavy paste. Fill the cracks around the patch. After the patch dries, sand it smooth. Then, mix the remaining plaster and apply the finish coat, taking care to feather the edges. Allow the entire patch to dry completely, then sand, prime and paint it.

## "They're easy to use and last for years."

"You can count on DAP performance and quality just like professionals do. That's why DAP is the only brand I recommend."



**Caulks.** DAP gives you the widest selection . . . and DAP caulks last for years. For everything from weather-proofing around windows and doors to sealing around tubs and tile.

**Fillers.** Easy-to-use DAP spackling, glazing, putty and wood filler products are ideal for all your patch-up, seal-up, fix-up projects.

**Adhesives.** DAP gives you more. Top quality, easy-to-use adhesives that assure stronger than nail-tight bonds when installing paneling, furring, molding, flooring and more.

## "No wonder DAP is the most trusted name in caulks, fillers and adhesives."

# DAP

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# Door-it-yourself.



(or let someone door-it-for-you)

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## '82 HOME IDEAS GUIDE

# Check list for planning a successful bath remodeling



Estimating the time you plan to put into your bath remodeling, and projecting a completion date, let you schedule jobs so as to cause minimum inconvenience to your family.

**A**lthough thoughts of a newly redecorated bathroom may lull you for a short time, the inevitable bills that follow will bring you a rude awakening. However, with proper planning and budgeting, you can remodel your bathroom so it's attractive and functional, and fits within a pre-established budget.

Prepare your own plan and spending guidelines by following the handy check

list below. The list, courtesy of the Bradley Corp., divides the remodeling into a three-step procedure. Each step is further broken down into its basic elements. This allows you to plan funds for each, without overlooking a major expense. If you take time to plan your project completely, down to the smallest detail, you'll eliminate any unpleasant surprises along the way.

### BATH-REMODELING CHECK LIST

#### STEP 1

A. Wall Treatment	Type	Amt.	Price	Total
Paint	_____	gal. @ _____	_____	_____
Paper	_____	rolls @ _____	_____	_____
Tile	_____	pcs. @ _____	_____	_____
Mirror	_____	_____	_____	_____
Other	_____	_____	_____	_____
Mix	_____	_____	_____	_____
Area (sq. ft.) per treatment	_____	_____	_____	_____
Estimated cost of material	_____	Professional labor	_____	_____
Total cost	_____			

Vanity and/or top	_____	_____	_____	_____
Sink faucets	_____	_____	_____	_____
Tub/shower control	_____	XX	_____	_____
Towels/washcloths	_____	_____	_____	_____
Towel bars	_____	_____	_____	_____
Seat cover	_____	XX	_____	_____
Dispensers	_____	XX	XX	_____
Soap dish	_____	_____	_____	_____
Shelves	_____	_____	_____	_____
Other	_____	_____	_____	_____
Total cost	_____			

#### STEP 2

B. Ceiling Treatment	Type	Amt.	Price	Total
Paint	_____	gal. @ _____	_____	_____
Paper	_____	rolls @ _____	_____	_____
Other	_____	_____	_____	_____
Area (sq. ft.) to be covered	_____	_____	_____	_____
Estimated cost of material	_____	Professional labor	_____	_____
Total cost	_____			

A. Major Alterations	Type	Size	Cost
Tub/shower	_____	_____	_____
Toilet	_____	_____	_____
New walls	_____	_____	_____
Closet	_____	_____	_____
Ceiling adjustments	_____	_____	_____
Other	_____	_____	_____
Estimated cost of materials	_____	Equipment	_____
Total cost	_____		

#### STEP 3

C. Floor Treatment	Type	Amt.	Price	Total
Tile	_____	pcs. @ _____	_____	_____
Carpet	_____	sq. ft. @ _____	_____	_____
Other	_____	_____	_____	_____
Area (sq. ft.) to be covered	_____	_____	_____	_____
Estimated cost of materials	_____	Professional labor	_____	_____
Total cost	_____			

<b>A. Personal Time to Complete Step 1</b>	_____
Planning _____ hrs.; Work (plus cleanup) _____ hrs.	_____
Total unpaid hours	_____

D. Miscellaneous	Type	No.	Size	Cost
Costs of related equipment and supplies to clean surfaces, steam, patch, glue, size, other	_____	_____	_____	_____

<b>B. Total Cost Estimates</b>	_____
Add total costs from Step 1	_____
Add total costs from Step 2	_____
Add previous two lines for grand total	_____

E. Improvements	Type	No.	Size	Cost
Shower curtains	_____	XX	_____	_____
Window curtains	_____	_____	_____	_____
Window shades	_____	_____	_____	_____
Shutters	_____	_____	_____	_____

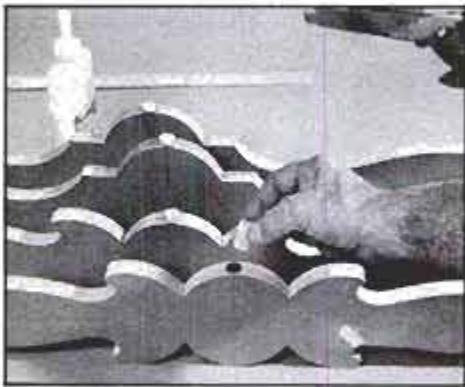
<b>C. Establish Dates</b>	_____
Start of actual work _____; Completion of individual projects (write date to left of each item on checklist)	_____
Completion of job	_____



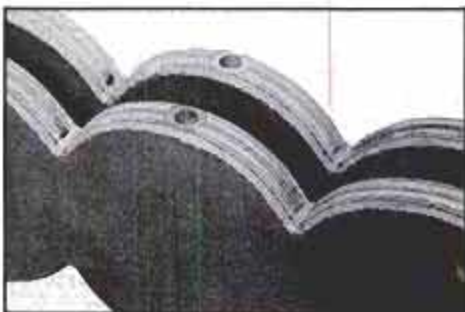
## MAKE A 'CARVED' DINING SET (Continued from page 119)

diameters. Use a circle-guide template as shown in photo No. 2 for accuracy in locating drill centermarks. Drill all the holes before sawing the outlines.

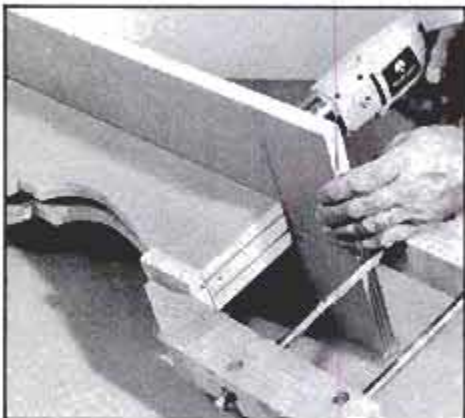
Use a band saw with a  $\frac{3}{16}$ -in.-wide blade to make contoured cuts. A jig or sabre saw can also be used, but



**10** Glue in hardwood dowels to reinforce gate-leg pivot hole areas. Sand them flush with edges before drilling holes.



**11** Drill the holes for the pivot dowels to produce hardwood dowel collars that will prevent splitting and wear well, also.



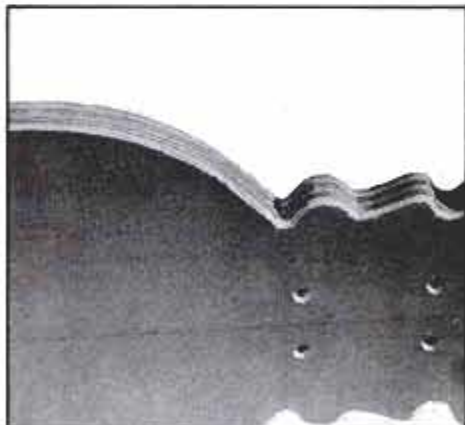
**12** Secure the top members with hand screws for drilling. Use scrap block between cross members for proper spacing.

the band saw is most preferred.

Cut the 36-in.-diameter disc accurately on the band saw by using a circle-cutting jig like the one shown in *9 Woodworking Secrets* (page 118, Nov. '80). If you don't have that issue handy, drill a pilot hole,  $\frac{1}{16}$ -in. dia., in the compass center that was originally used to draw the circle.



**13** Bore holes in outer pieces on drill press. Holes guide portable drill to continue screw pilot holes into mating pieces.



**14** This close-up shot shows the superior, splinter-free finished edge you can get with MDO plywood. We used Champion International's MDO, called Dura-ply.



**15** Follow the steps outlined in text to avoid hang-ups in the assembly process. Note handy use of props, as stretchers are placed into position for final assembly.

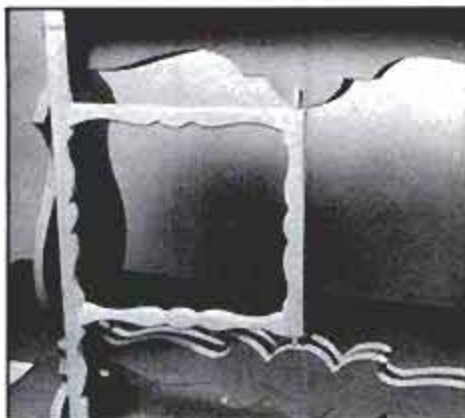
Place the hole on a pivot point such as a nail point projecting from a suitable support. This support must be provided outboard to keep the work on a level plane with the saw's table.

Sand the edge of the large disc freehand or with a finishing sander. If you want to do a real nifty job, try

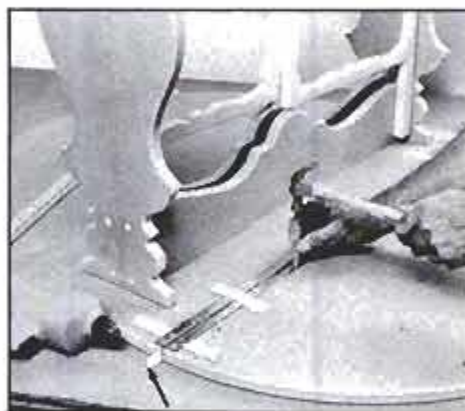
the simple arrangement shown in photos No. 6 and 7. Rig and clamp your sander to the table so that the sanding pad is perpendicular to the table and the bottom edge is about  $\frac{1}{2}$  in. above the table. Lay two pieces of 1x2 stock under the outer edges of the disc to support it. Take a third strip of 1x2, about 5 ft. long, and drive a nail through the center hole in the disc and partly into the strip.



**16** Saw these leg components to shape, sand individually, then glue. Round corners with a router after they're assembled.



**17** Insert the pivot leg as you would insert a sliding track door: The longer, top dowel goes in first, then the bottom dowel.



**18** Use a self-centering center punch for the hinge holes. Use spacer shims between the top parts (arrow) for clearance.

Use a nail that will allow the disc to rotate freely. The disc should be centered roughly on the strip. Position the assembly so the plywood edge is near the sanding pad. Drive a nail

(Please turn to page 180)

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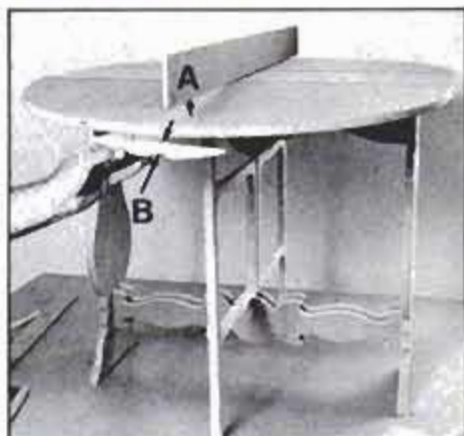
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## MAKE A 'CARVED' DINING SET

*(Continued from page 179)*



**19** The center thickness of the gate-leg stay is critical. Before you attach it, make sure space A equals thickness B.



**20** Here's how the stay secures the leg. Clearance at hinge allows leaf to be raised slightly, so the leg top clears the hump.



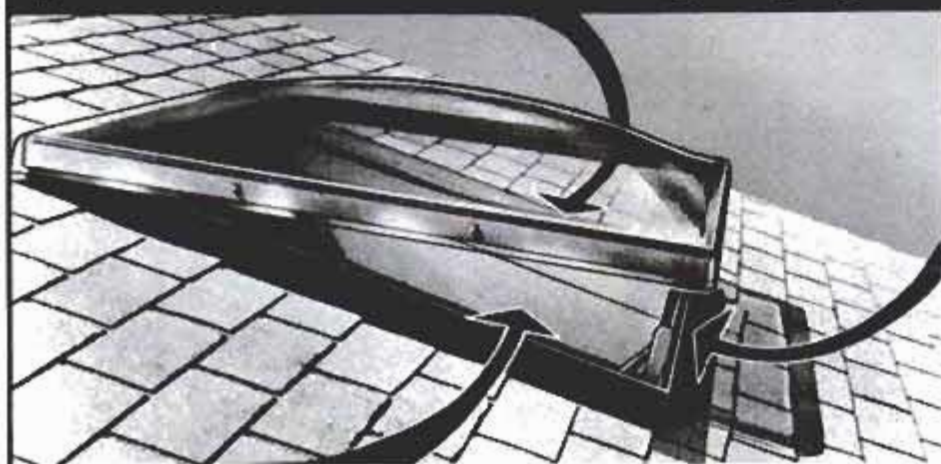
**21** The chair is dry-assembled with clamps to bore the pilot holes for the screws in same way table was preassembled. Use drill press, then portable drill.

through the far end of the strip partly into the table.

To begin sanding, grasp the forward end of the stick and move it so the edge of the work is in contact with the sander. With the other hand, rotate the disc continually on



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its pivot. Sand the edges of the other parts with a drum sander in your drill press. Sand the remaining small areas by hand. Use a corner-rounding bit in your router to slightly round over all edges.

Bore the holes for the gate-leg pivots in the upper and lower cross members. Bore  $\frac{3}{8}$ -in.-dia. holes 1 in. deep and glue in dowels. Sand ends flush, then bore  $\frac{1}{8}$ -in.-dia. holes.

Next, bore the screw holes. Mark the work for the screw locations, then bore  $\frac{1}{8}$ -in.-diameter holes in all the outside pieces, using the drill press for accuracy. When all the pilot holes have been drilled, dry-assemble the parts with clamps. Use a portable drill with the same-size bit and continue the holes into the mating pieces. Identify each piece for later match-up, then disassemble and re-bore the holes in the outer pieces to receive the screw shanks ( $\frac{1}{16}$  in. dia.). Also, countersink the holes deep enough to recess the screwheads.

#### Assembly steps

Assemble the table with glue and  $\frac{1}{4}$ -in. No. 8 flathead screws in this order:

1. Attach upper cross members to top.
2. Add one leg.
3. Attach lower cross members to that leg.
4. Add the second leg.

Cut the strips for the gate legs, saw the contours, then sand the edges before assembly. Round the edges with the router after the legs have been glued.

Now set the continuous hinges. Place the table upside down on a flat work surface. Insert  $\frac{1}{8}$ -in. cardboard spacers between the hinging edges. Tape the hinges in position, then use a self-centering center punch to mark the screw-hole centers. Drill pilot holes for screws.

Drive in only a few hinge screws because you'll find it easier to paint the table later with the leaves removed. Turn the table right side up and test the gate-leg stays before attaching them permanently. Place a straightedge across the table top, then insert the stays. If the three top pieces line up level, you can attach the stays; otherwise, make the necessary adjustments.

Note the gate-leg retaining blocks in the drawing. They serve to prevent the legs from accidentally lifting up and out during swinging. Do not attach these until all painting has been completed. Then, secure them with a single, partly-driven nail to permit removal for future repainting.

The upper gate-leg pivot peg is

*(Please turn to page 182)*

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## MAKE A 'CARVED' DINING SET

(Continued from page 181)

slightly tapered by sanding in order to get it to fit into place. Rub paraffin on both the upper and lower pegs for free movement, and be sure not to get paint on them.

Follow the same general procedure for constructing the chairs as you did for the table. The assembly steps are as follows:

1. Attach front apron to seat.
2. Add the lower stretcher to one side.
3. Attach this side to the seat.
4. Add the other side to the seat.
5. Attach the back, then the arm rests.

Note that the rear arm-rest screws are shorter (1/4 in. long).

### Finishing

Finish the table and chairs in the color of your choice and then antique. Martin-Senour Glade Green M-0076 (table) and Russet Leaf M-3199 (chairs) semigloss latex were used for the base coat of the set shown here.

Apply a primer coat, then the respective base coats. Normally, a base coat is applied directly without need for a primer, but the use of a primer is suggested due to the raw plywood edges. As soon as the base coat dries, you can antique.

To antique, use a ready-made glaze or make your own (as we did)



**22** Handsome table and chair are designed as a complement for each other.

by mixing raw umber with a bit of turpentine and boiled linseed oil.

Apply the glaze with a brush. Allow it to set until it dulls over, then stroke over it with a dry brush to obtain a grained effect. Next, apply a heavier deposit of glaze along and around the edges. Wipe over (light pressure) with a slightly glaze-wetted brush. Increase the brush pressure as you move away from the edges to blend the lighter tones into the larger areas of the base coat. Allow the glaze to dry thoroughly, then apply several coats of satin top-coat finish such as Constantine's Wood Glo. **PM**

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## FANTASY ON A TABLETOP

(Continued from page 105)

given certain "attributes." These are mathematical measurements of the player's strength, intelligence, wisdom, dexterity, constitution and charisma. All of these, along with such things as player's race (human, dwarf, elf, gnome) and class (cleric, fighter, magic user, thief, monk) affect how the player's tiny gaming identity can cope with his phantasmagorical environment.

In a typical encounter between a fighter and a demon, many calculations may have to be performed to determine a victor. A fighter's high dexterity, for example, may make him better with the sword, but a low IQ could make him miss seeing a hidden exit from which reinforcements could descend on him.

One of the players is the referee or Gamemaster. The Gamemaster has the truly awesome responsibility of creating a world in which the fantasy can take place.

If characters wander into a deep labyrinth in search of treasure, for example, it's up to the Gamemaster to keep things interesting with hidden traps, foul foes and surprising alcoves. It is also up to the Gamemaster to provide resolution of combat and all other game-related events.

After learning all of this, I decided to get into a few games. In one memorable Napoleonic scene, I watched helplessly as my infantry square-formation, that had withstood a cavalry charge, was torn figuratively asunder by an artillery barrage.

Even in D & D, I had four or five wizards bite the dust before winding up with one fellow who could stand up to even a pussycat of a demon.

However, one thing about fantasy gaming . . . there's always tomorrow.

PM

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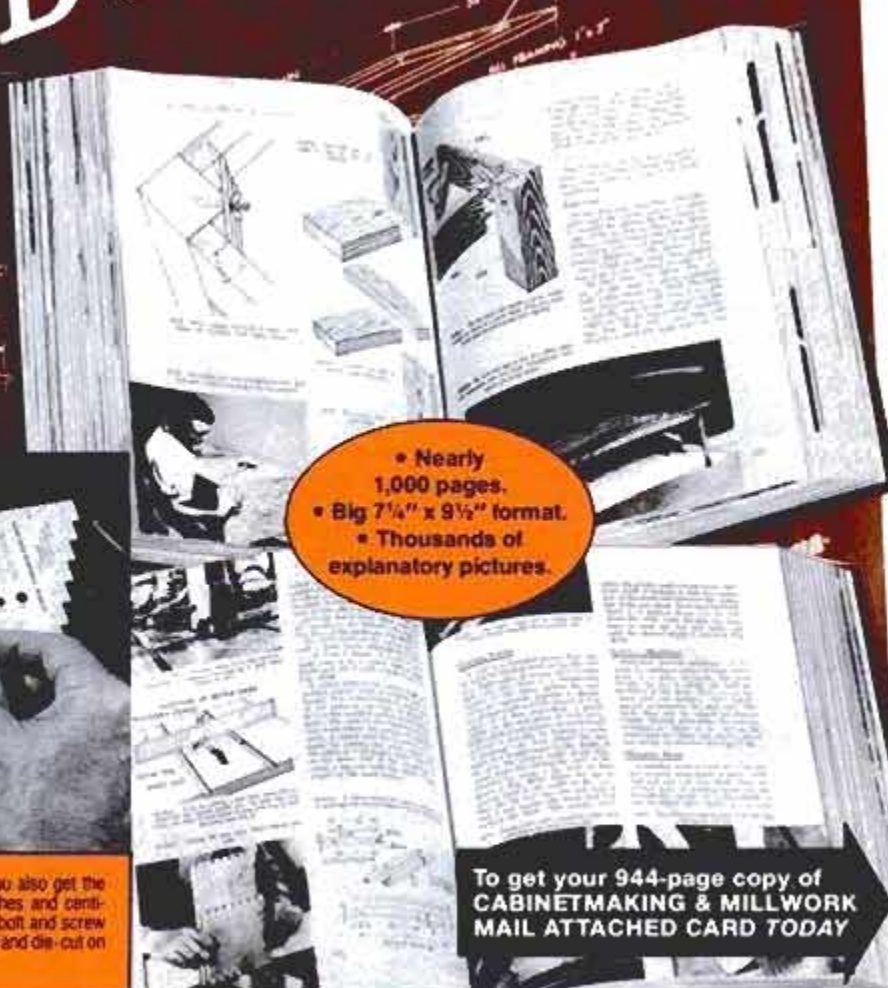


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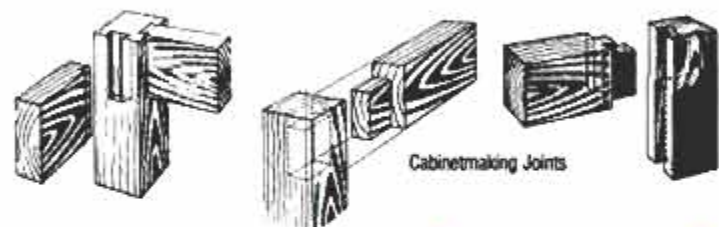
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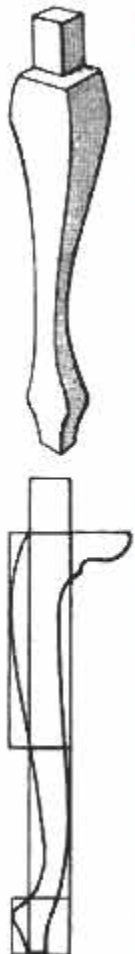
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**EIGHT DAYS ON ALCOHOL**

*(Continued from page 90)*

the like, the expected attention along the way was counted on as free advertising. Only Ford among the major automobile companies—all of whom Shepard had solicited—showed any interest in the event, making three alcohol-powered cars plus extensive technical support available for cosponsors (of which PM was one).

The final BTU/unit weight determination was to be arrived at through the use of Halda flow meters installed on the liquid-fueled vehicles between tank and engine. Wood-burners, of which four showed up in Los Angeles for the start, were to have their solid fuel weighed.

**No run for the money**

Strictly speaking, I wasn't running for the money, nor were the other two Ford drivers: automotive journalist-cum-screenwriter Brock Yates, in an Escort, and race driver Lyn St. James, in an LN-7 (like mine, but hers was methanol-fueled). But nobody, least of all Ford, was too interested in looking bad, either. I was the odds-on weak link in the trio although whether Yates—progenitor of the "Cannonball Run," and the nation's preeminent scofflaw literatus—could sit still for eight days of 50-mph driving was a matter of pure speculation.

The BTU/weight formula favored the heavy, slow machines anyway. Ford would be happy enough if by driving real-world cars at real-world speeds—with occasional deviations up and down for experimental purposes—and finishing the trip in good order, a simple point could be made: When and if alternate fuels have promise of reasonably wide distribution, Detroit can build cars to take advantage of them.

Two days before the Rally began, I went down to Long Beach, Calif., to meet the car that would be my home for a week and learn how to drive it. The LNs and the Escort had been prepared by a performance team under Bill Stroppe, whose association with Ford goes back more than 30 years. The job of converting the stock LN-7 to ethanol had been done primarily by mechanic Bob Santoro.

Step one in burning pure alcohol, which has a little more than half the BTU content of gasoline, per unit volume, is to get back to higher compression. By a happy coincidence, the slightly larger pistons made by Ford for its European four-cylinder engines can be fitted to the U.S. version to up the compression ratio to 11.4 to 1. Then the carburetor must

be rejected to provide more fuel flow, compensating for the BTU loss. After a timing adjustment, which will vary slightly (depending on whether you're running ethanol or methanol, which has a slightly lower BTU value), you're fairly well set. That is, provided your fuel tank is noncorrodable and lines, gaskets, seals, and other components don't use rubber in their composition.

After a half-hour in the car with Santoro on the Freeway, I was ready to list only one major difference: odor. Alcohol effluence just takes a little getting used to, and I was going to have time for that. The LN ran like cars run; maybe a shade off in acceleration, but then I wasn't looking for action at the traffic lights. In fact, I was constantly trying to feel the point at which the secondary carburetor jets cut in—and stay the hell out of them, as Bill Stroppe succinctly put it.

I was still staying the hell out of them at the start, two days later, when I ran one of the slowest quarter miles ever turned in at the Orange County Dragway in Irvine. Starting the official Rally at a drag strip was a Shepard brainstorm; the national championships were being held there that weekend and we interrupted the morning time trials to put 34 variously belching, wheezing and/or exotically odoriferous vehicles through the traps for purposes of a media event. After a moment of incredulity, most of the early-bird dragster fans in attendance seized on the occasion to nap. With the jeers of a wakeful few ringing in our ears, we hit the highway for Phoenix.

**Conditioned behavior**

Driving for economy, competitively, involves an immense psychological adjustment for anyone whose youth coincided with a period in which automobiles were considered an entertainment medium. If we are not born heavy-footed, the conditioning is as automatic as puberty. And you'll never know how ingrained it becomes until some device forces a reorientation; if fuel-flow meters were a stock item on Detroit's dash, I have no doubt the net annual gasoline savings, nationally, would be in hundreds of millions of gallons. If there's an identifiable end—a point to it—suddenly, feather-footing can become as macho as eating glass.

And about as much fun. The LN-7 ran quietly and smoothly in the 80° southern California weather. I knew the wheel bearings were, well, special—to lower rolling resistance—and the temptation to ease the



clutch in on some of the larger downgrades was strong. Stroppe had warned, however, that there might not be a lot of profit in it; more important was the way you handled upgrades. Anticipate on the down-slope, and don't get so far behind, speedwise, that you wind up staying on an uphill forever. When you crest, get your foot out of it right away. The concentration involved was real work, but it made the time pass. With the driver's-side window barely cracked, for low drag, the car was an oven. (Airconditioning is out of the question on an economy run.)

#### Driver's education

For my pains that first morning, I got about 25 miles per gallon; by the afternoon, I was getting close to 30. Not bad—equivalent to between 35 and 40 mpg on gasoline. St. James, in the methanol LN-7, was, at first, a dutiful slave to a pie-sized vacuum gauge, provided in deference to her professional status, along with an air-density gauge with which to further interpret the former. Her savvy told her soon enough to get off that and drive more by feel; she wound up averaging two to three less mpg than I did over the entire 3,300 miles, which is easily accounted for by the methanol/ethanol energy differential. Yates, on the other hand, not as aerodynamic in the (methanol) Escort format, turned in erratic readings in the low to high teens. Although there was some system malfunction or leakage undoubtedly contributing there, a consensus developed to the effect that his right leg has an independent existence.

On day two, prior to our departure from Phoenix for Albuquerque, I found the Stroppe team had affixed a vacuum gauge to my steering column—a lot smaller than Lyn's, but the implication that maybe the old kid was born to run after all afforded me a private moment of moist-eyed pride. It took me the next 300 miles to learn how to use it and chew gum at the same time.

Something else happened outside of Phoenix: David Carmichael, Shepard's organizer, was seriously injured in a predawn accident just after leaving our departure check-point.

That evening in Albuquerque, Shepard wrote off the Rally and said so to the entrants. He later agreed that if we reorganized and ran the course according to the rules—monitored by the Sports Car Club of America referees he'd retained for official sanctioning—the prize money would still be awarded.

But the competition had never

(Please turn to page 190)

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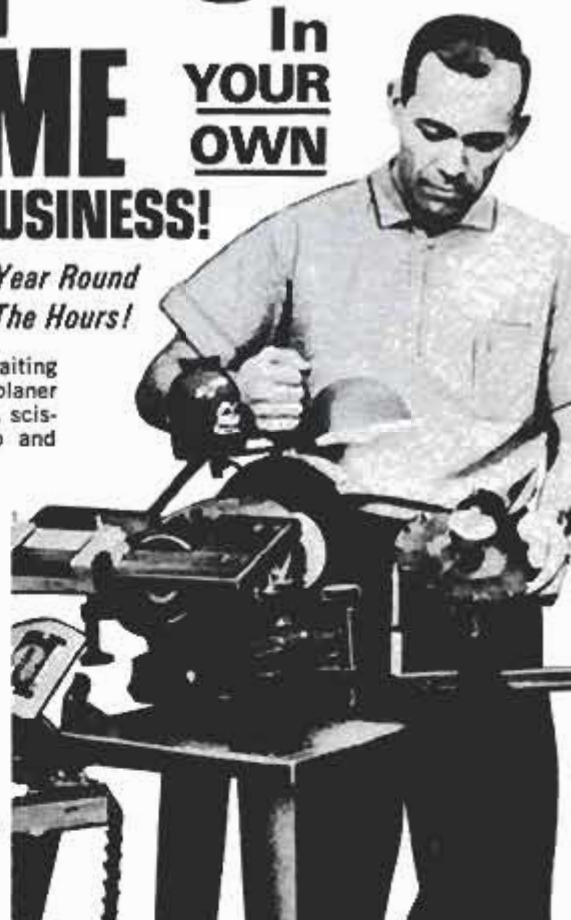
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## EIGHT DAYS ON ALCOHOL

(Continued from page 189)

been seriously on track to begin with. Neither Carmichael nor Shepard had actually predriven the course; checkpoint schedules had been laced with discrepancies that included a missed time zone. Fuel samples were being taken irregularly; the wood for the solid-burners wasn't being weighed and even if it had been, the BTU range can be over 1,000 per pound between, say, Ponderosa pine (lousy) and Interstate rest-area bench slats (reportedly not bad).

Coasting and drafting were indulged in by almost everyone, including someone who was not yours truly and who reportedly pegged an LN-7 at 85 mph on a weaving, six-mile mountain downgrade outside of Flagstaff, Ariz., with the engine turned off. An economy run without an in-car referee for each entry is a fudger's festival.

### Prize disappearance

Yet something else emerged, as the group proceeded across country, with the prospects of Shepard's prize money receding by the mile. Bickering over the rules generally subsided; factionalism evaporated.

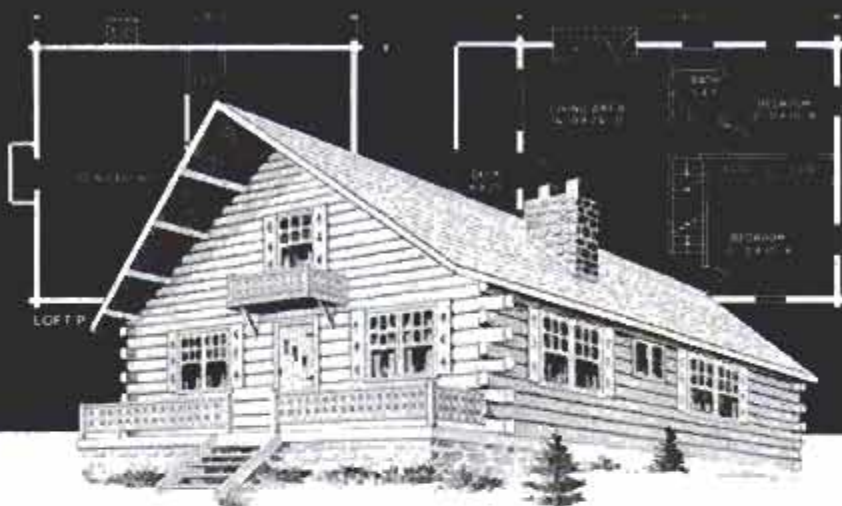
Among the 20 vehicles that reached New York via agreed-upon route and within the allowable time-frame were ethanol, methanol, wood-burning and vegetable-oil diesel cars. The last included the probable winner by Shepard's formula—a Placerville, Calif., car dealer named Bob Harmon who was said to be getting 40-plus mpg in a heavy Jeep wagon running on filtered (dewaxed), preheated sunflower oil.

The S.C.C.A. will not release official results because Shepard has not paid them, and no one can currently find Shepard, including some federal people who have issued a warrant in his honor.

That a car can be made to run on ethanol or methanol with approximately petroleum-equivalent performance, over an extended route in all weather and at all U.S. altitudes, has been established beyond a doubt, and I am happy to have been part of it.

But I kept the LN-7 around for a month after the Rally had ended. As our northeast winter set in, it got extremely hard to start; it began to die at idle—even adjusted wide open. The point is that, as Bobby Santoro said to me the first day in Long Beach, "The cars that will eventually run on alternate fuels will have to be built to do it from scratch."

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## NEW FOR OFFSHORE FISHING

(Continued from page 99)

the need for a transom well. The Sea Devil has unobstructed gunwales so that fishing lines won't be snagged, and a walkway forward around the cabin to allow fighting a fish in any direction. Deep-V hulls designed by Jim Wynne for a sea-kindly ride over open water are topped by topside fishing features laid out by Bob Stearns for these new 22- and 25-foot Cruisers.

Bass boats, favorites of fishermen for more sheltered waters, are adding versatility this year, as well. Lighter aluminum hulls, midship



Runabouts are still favored for sheltered water. Larson Wildfire 16 takes 115 hp.



Tuffy Boats' new 16½-foot Renegade can combine bass fishing with family sports.

windcreens, water-ski racks and bowrider sockets for pedestal seats are being added. Many boatmen are learning that lighter hulls go faster with smaller outboards that burn less gas.

Even some of the weighty diesel inboards are slimming down. The compact Perkins 50-hp Model 4.108M, called the world's most popular sailboat auxiliary diesel, is down 31 pounds to 461. Most powerful ever from 50-year-old Perkins is a 350-hp with turbocharging to increase power while cutting weight. Volvo also has improved small diesels in 9.5, 17, 25 and 36 hp. Yanmar offers four small models of 7.5 to 30 hp. **PH**

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## SIX COSMIC QUESTIONS

(Continued from page 95)

television station operating 100 billion miles distant. And they control an armada of Earth-orbiting observatories that gather exotic X-ray, gamma-ray and ultraviolet radiation, all undetectable to instruments on Earth because they're blocked by our planet's atmosphere.

With these instruments, astronomers can reach through space and time to probe the origin and destiny of stars, galaxies and, ultimately, ourselves. If, as some astrophysicists contend, the universe continues its present expansion forever, then we inhabit a cosmos that had a definite beginning, but will slowly descend into everlasting cold as the last stars wink out.

If, however, the expansion someday reverses, the universe will collapse on itself—a replay in reverse of its explosive creation.

Choosing between these two possible fates for our universe pivots on the seemingly impossible task of *weighing* the entire cosmos. Astronomers are confident they can estimate the universe's mass with sufficient accuracy to chart its destiny.

If the total amount of matter in the universe exceeds a critical mass, the entire affair will yank itself back into its primordial egg. Just as a rocket that doesn't have the thrust to reach escape velocity will plunge back to Earth, the galaxies may eventually be pulled back to their origin.

In the early 1970s, the proponents of continual expansion maintained that the total mass of all the known or suspected galaxies was less than three percent of that needed to reverse the expansion. But researchers have recently accumulated evidence that there may be very much more to the universe than meets the eye.

### Q WHERE IS THE 'MISSING' MASS?

Bart Bok, professor emeritus at the University of Arizona, says that estimates of the masses of galaxies have increased as much as a factor of 10 in the last few years. The new information has emerged from studies of the motions of stars in nearby galaxies.

Just as the planets closer to the sun orbit more quickly than those farther away, stars nearer the center of galaxies *should* orbit

faster than those on the outer edges of the spiral arms. But this isn't the case. "The speeds are basically the same," says Bok, "which means there must be material in a vast corona around the visible part of the galaxy that is unseen, but which adds enormously to the galaxy's mass."

Bok thinks the invisible component consists of herds of old stars dimmed by stellar senility. Trillions of such objects probably wreath our own galaxy, adding enormous mass to the system. This suspicion seems confirmed by the way the Milky Way Galaxy appears to have firm gravitational control over a family of nearby midget galaxies.

Although the missing-mass problem has plagued cosmic theorists for years, a resolution may have finally emerged. At a recent symposium, University of Chicago astrophysicist David Schramm described how neutrinos, the lightest particles in the universe, could be the solution.

Discovered 25 years ago, neutrinos were thought to be without mass, since they are virtually indifferent to ordinary matter. But recent experiments by Soviet physicists and a team from the University of California have produced direct, if controversial, evidence that neutrinos have tiny, but perceptible, masses. Since neutrinos outnumber other particles by about 10 billion to one, just a whisper of mass assigned to each would mean they would account for the majority of the mass in the universe. The mysterious gravitational glue that keeps galaxy clusters bound could be produced by neutrinos.

### Q DO BLACK HOLES EXIST?

Black holes are incredible gravity whirlpools with such awesome force that they can swallow a beam of light, stop time and curve space infinitely. At least, that's what theoreticians tell us. No one has actually seen a black hole. Their existence is inferred from their effects on their surroundings, which can be substantial, considering the hole's enormous power. However, there are compelling theoretical reasons that suggest black holes do exist.

How is such an object created? Take a star about 20 times the mass of the sun. These stars squander their stellar fuel at thousands of times the rate that the sun consumes its nuclear

stockpiles. But this spendthrift activity doesn't last for long. Eventually, depletion of vital energy sources, such as hydrogen and helium, produces convulsions that quickly lead to doomsday nuclear reactions. The last gasp is a titanic explosion that rips off the star's outer layers and hurls billions of cubic miles of matter into surrounding space. Meanwhile, the denser core of the star implodes, shrinking in mere seconds to a sphere a few miles in diameter. Density increases to such incredible proportions that atoms are smashed together in an escalating chain reaction. The mass at the core becomes so great that gravity takes over and the compacting body crushes itself out of existence. All that remains is the gravitational field, the celestial cadaver of a once-brilliant star—a black hole.

Although the reality of black holes is accepted by most astronomers, there are some holdouts, notably the widely respected MIT physicist Philip Morrison. "I am one of the few determined skeptics about black holes," he said in a recent interview. "Even Cygnus X-1, the strongest candidate so far, is not proven. Not everything that is extrapolated from Einstein's [general relativity] theory is going to be real. My opinion is that black holes have been extrapolated beyond justification."

If black holes do exist, astronomers think it is likely there are millions of them in the Milky Way, and there may be a granddaddy black hole, with over five million times the mass of the sun, at the galactic core. Larger galaxies could have black holes with billions of times the sun's mass.

### Q WHAT ARE QUASARS?

Using the Mount Palomar 200-inch telescope in 1963, Cal Tech astrophysicist Maarten Schmidt discovered a bizarre object. It looked like a star, but proved to be an enormously distant body of unknown properties, inexplicably pouring out radiation equal to a hundred galaxies. Thousands of these quasars (quasistellar objects) have been discovered since. Their enormous velocities away from us indicate that quasars are the most remote objects mankind has yet seen.

Because the quasar light we see today has taken billions of years to reach us, these objects are seen

(Please turn to page 194)

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## SIX COSMIC QUESTIONS

*(Continued from page 192)*

as they were, not as they are today. If the universe was created about 15 billion years ago, as believed, quasars are a way to see back into the universe's past.

Using the new, 142-inch Canada-France-Hawaii telescope, located above half the Earth's atmosphere on an extinct Hawaiian volcano, astronomer John Hutchings of the Dominion Astrophysical Observatory, Victoria, B.C., has found a hazy envelope, or fuzz, surrounding the brilliant pinpoint core of all 30 quasars he has examined so far. He suspects that the centers of quasars are energized by enormous black holes. "We may be looking at galaxies in formation—stars being born around supermassive black holes," says Hutchings.

Susan Wyckoff, quasar expert at Arizona State University, says the new observations "constitute convincing evidence that quasars, in general, are the luminous nuclei of distant galaxies." If so, a host of new questions emerges: Was the Milky Way Galaxy once a quasar? Were all galaxies quasars at one time? Do galaxies evolve in bursts of change or gradually?

The heady job of unlocking the quasars' secrets will likely be taken up by NASA's Space Telescope (see *How We'll Peer Back to the Beginning of Time*, page 87, Feb. '79), due to be launched in 1985. Capable of seeing quasars 100 times more sharply than Earth-based scopes because it will be well above the distorting effects of the atmosphere, the Space Telescope may be joined by a larger and more advanced orbiting observatory in the 1990s.

## Q DO WE UNDERSTAND THE SUN?

Either something is wrong with the sun or something is wrong with our understanding of how it produces its energy. The problem is a shortage of neutrinos, those particles that may also figure prominently in the puzzle of the universe's missing mass.

It all started a decade ago when Raymond Davis of the Brookhaven National Laboratory built an astronomical observatory a mile underground in a South Dakota gold mine. His "telescope" is a tank-truck-sized vat of cleaning fluid. Davis calculated that when a neutrino from the sun collided with a chlorine atom in the tank,

the chlorine would change to argon. The vat was placed in the mine to protect the experiment from random hits by other cosmic particles.

So far, Davis's results have stunned solar physicists. Only one-third the predicted number of argon transmutations have been detected. The sun's core, where nuclear fusion and neutrino production occur, is not working the way scientists had predicted. If our theories are right, then the sun is going through a radical convulsion, the effects of which have yet to percolate to its surface, where light and heat are emitted.

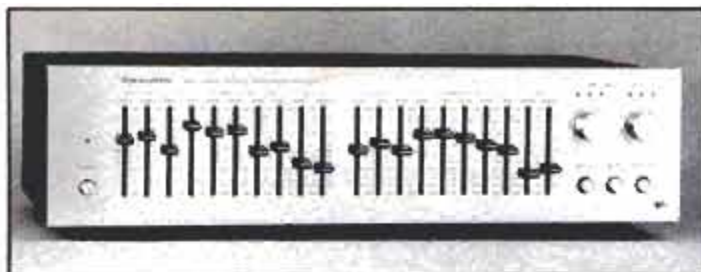
The problem, which remains to be resolved, has been called "a crisis in confidence in basic theories of stellar structure and evolution" by Harvard's Robert W. Noyes. Davis and his colleagues are preparing a new experiment aimed at capturing low-energy neutrinos with a tank of gallium, rather than the high-energy variety that reacts with chlorine. Comparing the results of the two experiments should reveal whether it is the sun that is amiss or our theories.

## Q ARE WE ALONE?

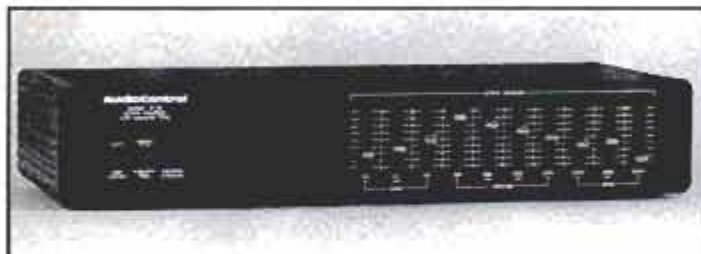
Of all the universe's unknowns, the possibility that other rational creatures share the universe with us looms as the most enigmatic. Astronomer Carl Sagan of Cornell University, a widely known optimist on the subject, estimates that the Milky Way Galaxy harbors a million civilizations more technologically advanced than Earthlings.

In the mid-1960s, Sagan collaborated with the brilliant Soviet astronomer Josef Shklovskii to produce the book, *Intelligent Life in the Universe*, which has since become a classic in the field. However, in recent years, Shklovskii has reversed his stand on the question and no longer shares Sagan's optimism.

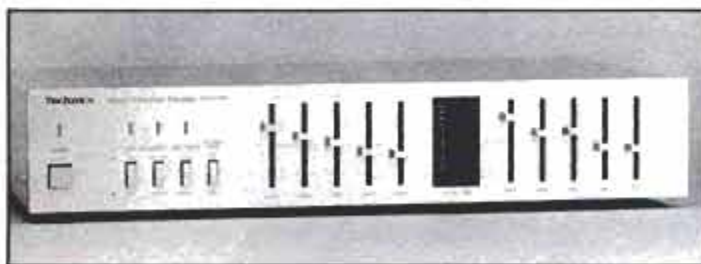
Efforts to detect radio signals that may be beamed our way from other civilizations thousands of light-years away have also failed to bear fruit, and Congress recently ordered NASA to curtail use of public funds for all such searches. Unless we stumble accidentally on unequivocal evidence that somebody is out there, there seems little hope of solving this final, and most vexing, cosmic unknown.



Radio Shack's Realistic 31-200 is a 10 x 2 equalizer (two channels, each broken into 10 frequency ranges). It has a bypass switch and subsonic filter.



Audio Control's D-10 is a 1 x 10 equalizer (each of the 10 ranges affects both speakers equally). Small in size, it offers an EQ bypass switch and a rumble-killing filter.



Technics SH-8015 is a 5 x 2 equalizer (two channels, each broken into five frequency ranges). Its display shows how closely output comes to the original sound.

## CUSTOMIZED SOUND

(Continued from page 110)

unit's face. So you don't really need expensive meters to tell you what's happening to the music—both your ears and your eyes tell you.

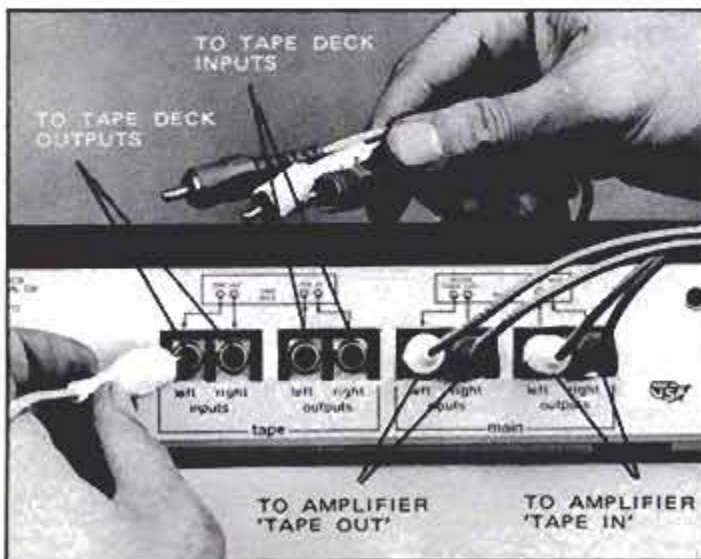
It's not hard to learn how to match frequencies you hear to the frequencies as indicated on the face of the equalizer. Many manufacturers include diagrams with their units which show the frequency range of various instruments and of the four standard human voices: soprano, alto, tenor and bass. These charts give you a ready reference to use with your equalizer. In no time at all, you'll reach for the 1 kilohertz (1 kHz=1,000 cycles per second) slider

when you need to adjust the upper mid-range. To de-emphasize a bass boom slightly, you'll instinctively drop the slider at 63 Hz down a notch or two.

Just about all equalizers have a few things in common. Most feature buttons to equalize music playing over the speakers, or to "EQ" material as you record it onto tape—or to perform both functions simultaneously. There's nearly always a center line (labeled "0" or "0 dB"), with pluses above and minuses below.

All equalizer models can alter the frequency spectrum as it goes onto tape. Most units do this simply by rerouting the appropriate signals at

(Please turn to page 196)



To hook up an equalizer, connect patch cords into the tape-monitor loop of your amplifier. Left- and right-channel equalizer inputs go to the respective tape outputs on back of the amplifier. The equalizer outputs also go to the amplifier, but to the tape inputs. To hear the equalization, switch on amplifier's monitor circuit. You can also attach a tape deck as shown: The equalizer's outputs go to the deck's inputs, the equalizer's inputs to the deck's outputs.

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## CUSTOMIZED SOUND

(Continued from page 195)

the touch of a button. A few require rearrangement of the rear-panel patch cords to do this.

Before you confront an array of equalizers in the store, have a good idea of what you want an equalizer to do for you. You may want to tailor a wide variety of recordings to the sound you want or you may wish to "fix" a car or listening room with acoustic troubles.

The nine models discussed here, ranging in price from \$169 to \$250, give a pretty good picture of equalizers that are readily available.

■ **Kenwood's GE-80 (\$175)** offers an illuminated panel to display the sliders with contrast and show their graphic settings clearly. As a 5 x 2 equalizer—one with five, two-octave bands of control in each channel—the GE-80 is simple and flexible.

■ **The Technics SH-8015 (\$200)** is also a 5 x 2 unit, but it provides a display that audiophiles with tape recorders will appreciate. The display shows how closely the overall level of the equalizer's output comes to matching the original signal. It also provides the choice between a subtle ( $\pm 3$ -dB) or more extreme ( $\pm 12$ -dB) adjustment, both of which read out on the display. By keeping the level of the signal the same as the original, you're less likely to get unwelcome surprises in the form of too high or low recording levels.

■ **Pioneer's SG-300 (\$180)**, a 7 x 2 unit, is a useful compromise between the simplicity of five-band/two-octave models and the greater adjustability of ten-band/one octave EQ units. Large sliders make an illuminated display unnecessary.

■ **Akai's EA-G40 (\$250)** is a very simple device that offers eight separate bands of equalization in each channel. An EQ-defeat button encourages switching between the source signal and the altered one. And it's possible to control the volume at the amplifier or tape-recorder input (for recording level master-fade) with a single knob controlling both channels.

■ **Sony's SEH-310 (\$250)** is a "hybrid graphic equalizer." It has nine bands which control both stereo channels at once. It features a variable echo generator and a variable microphone input (mono to both channels). These target this design for PA hookup, disc jockeys or enterprising home recordists who want to try voice-overs on tape. One very unusual feature is a front-panel microphone input jack for a mono tape recorder or radio. This permits signals that may not be truly hi-fi to

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get a little sprucing up as they go to an amplifier or onto tape.

■ **Audio Control D-10 (\$169)** features an EQ bypass that permits A/B comparison of the original and the equalized signal. A subsonic filter cuts out rumble and amplifier-killing bass from nonmusical sources.

■ **JVC's SEA 60 (\$320)** is a 10-band, feature-loaded equalizer. It teams a bar-graph display with function-indicating LEDs to tell you what the unit is doing at a quick glance. Large, visible sliders show boosts and cuts relative to the flat "0" level. The bar graph relays the actual decibel level in each octave. Display level can be adjusted from virtually nothing to extreme sensitivity. An EQ reverse gives you instant comparison between the "straight" signal and the altered one, while permitting a tape recorded with equalization to be played back "flat." This makes it possible to play your equalized car-stereo tapes on your home system, with your altered frequency spectrum restored to normal.

■ **The Realistic Model 31-2000 (\$180)** and **Vector Research's VQ-100 (\$250)** are 10 x 2 equalizers of considerable usefulness. Radio Shack's no-nonsense Realistic 31-2000 provides large, legible sliders and a minimum of unobtrusive switches. An EQ bypass, for A/B comparison of altered and original signals and a sensitive unity-gain control for each channel give you control over the two main characteristics of a signal: its tonal makeup and its overall level. A green LED glows when a channel's output signal (if a signal is present) matches the level of the unaltered input. This is handy for recording a proper signal onto tape. And when the equalizer is working hard to boost or cut certain frequencies, red LEDs that flank the green center one light up or flicker.

Each channel of the Vector Research VQ-100 is displayed on a separate red LED and the horizontal display ranges from -18 to +18 dB. A pair of infinitely variable, unity-gain knobs adjusts each channel's level. Use the bypass to compare A/B signals and get the level you want. A subsonic filter caps off this moderately complex equalizer.

There is a lot to choose from in the nine sample equalizers in this survey. But no matter how complex an equalizer you choose, don't overlook the standard tone controls on your amplifier. Use one set to help the other and don't be afraid to experiment with settings. With a good equalizer to iron out problems and create new sonic perspectives in music, you'll be surprised at how quickly you become creative. **FM**

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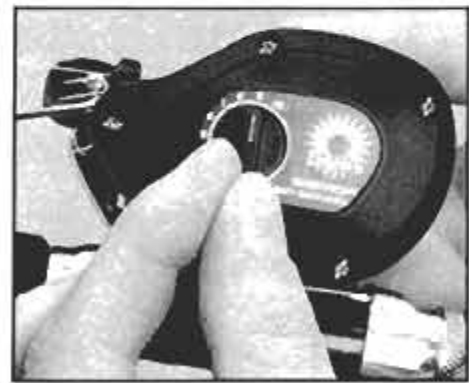
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## MAGNETS AND SONAR (Continued from page 96)

comments that go with them—sights and sounds of the past.

The reel is Daiwa's Procaster Lite with Magforce, and it should help even a beginner to cast without major difficulty. It's the level-wind "bait-casting" type that today is also used to pitch assorted plugs and other hardware. Many fishermen favor it for its lure control and pinpoint accuracy.

I've been demonstrating angling skills at sport shows for many years. Spend eight hours a day target-cast-



Magnet resistance is controlled by a dial with strength settings from 1 up to 10.

ing and you learn what your equipment will do. I tried out this new Daiwa reel for just such demonstration casting at the recent Bassmasters Classic outdoor show at Montgomery, Ala. If the reel performs as well in the field, I think it's a winner.

The great problem with antibacklash devices (and all modern level-wind reels have some type) is that with enough tension to prevent backlash, you're also often tightening the spool too much to get casting distance. Yet Daiwa's Rex Gerlach, a noted fisherman, reports casts of 204.8 feet with 1/8-ounce dummy plugs and 155.2 feet with 1/2-ounce weights with the Magforce dial set at 1.5 for minimal spool resistance. Those are distances many times greater than the average angler has to cast.

The Magforce system works without friction devices, brake collars or tension on the spool shaft. Inside the left sideplate are two plastic rings, one smaller than the other, containing two sets of lifetime magnets, with their north-south fields opposing one another. A flange on the spool revolves between the two sets of magnets. When the spool spins, a flow of electrons is set up in it. The aluminum spool is an electrical conductor and the current dissipates in the spool, creating sufficient resistance to eliminate spool overrun—



Accuracy casting practice by author-fisherman Fagerstrom tests reel for backlash.

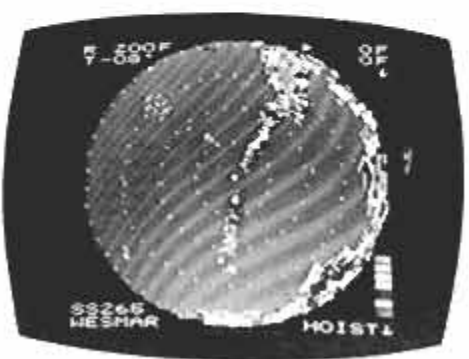
with its backlashes and "bird's nests."

If you're into physics, you might explain Magforce as rotational kinetic energy that is magnetically converted to electrical energy and then dissipated. The faster the spool turns and the more directly opposed the magnets, the more resistance is created and the rate of spool speed governed. Control is determined by a dial with settings from one to 10. At the maximum 10 position, you're still able to get casting distance while using lures from 1/2 ounce up.

Daiwa is making a Magforce PMF-1000 model that holds 125 yards of 10-pound-test monofilament, and the PMF-1500 with wider spool that handles 140.

## Sonar vs. fish

Electrons are also aiding anglers in a Lowrance X-15 sonar graph recorder being developed that can chart selected slices of water from 1,000 feet down to 10 feet thick, and then label on the printout the depths being studied. And Wesmar, in Seattle, has a rotating scanner, the Omnicolor SS265, that provides depth and horizontal distance in color on a TV screen aboard. **PM**



Omnicolor Digital Sonar unit from Wesmar has microprocessor for color display that shows target ranges of up to 2,400 feet.

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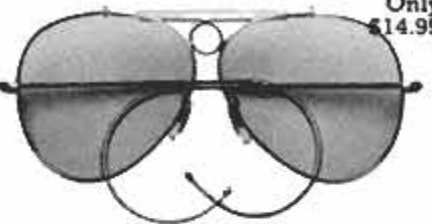
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## NOW WE'RE BALLOONING ON SOLAR POWER (Continued from page 100)

traditional forms," says Donald Cameron, who built the British balloon. "But if solar has any chance at all of finding practical use, it's with balloons."

The 144,000-cu.-ft., "double-envelope" balloon made its record-setting ascent from a dairy farm in South Barham, near the southeast tip of England, last August 22, a day that began with cloudy skies. By 7:30 a.m., however, when the expanding balloon started its climb, the sun was shining. And Julian Nott was flying toward Dover, 10 miles away on the Channel coast. About 20 miles east lay France.

### Not for rookies

"It was one of the most beautiful flights I'd ever been on," says Nott, who is no newcomer to ballooning. He's in the record books with the world mark for altitude in a hot-air balloon, 55,134 feet.

Experience counted on this trip, since the solar balloon is like any other hot-air balloon—it depends on the sun to keep its gases warm. The new twist is the double-envelope insulation that permits the British balloon to rely on the sun for lift, as well as flight-sustaining heat.

The mainspring of the solar balloon is a sun-absorbing, black, dacron inner balloon, surrounded by a clear plastic outer envelope—itsself a balloon. To get off the ground, Cameron explains, an electric fan forces air into both the inner and outer bags.

When the craft is half filled, the fan is turned off and the process of gas expansion and lift begins. The balloon may use the sun alone to gather the heat needed to expand the air inside. But, then, liftoff would take hours.

It's quicker to start with a propane-torch assist, as was the case for the Channel flight. After the air is blown in, the torch is used to expand the air enough to commence climbing. Once the balloon is a few hundred feet aloft, the torch is turned off and the sun does the rest.

With its internal temperature higher than that of the outside air, the balloon continues its expansion and lift. The greater the temperature difference, the greater the lift.

Crossing the channel, the craft had plenty of help from the sun, which generated temperature differences of up to 80°F.—enough to attain an altitude of 3,000 feet. To stay there, Nott tugged at lines that opened and closed valves on both

inner and outer bags, thus maintaining the internal pressure.

### Going sky high

Altitude will be the name of the game this summer when Janice Brown climbs into the cockpit of the *Solar Challenger* (see *Tech Front Lines*, page 127, Apr. '81). The lightweight plane, powered by over 16,000 solar cells, will take off from a desert field in southern California.

The *Challenger*, which climbs a painful 1 foot for every 13 feet of forward motion, is the creation of Dr. Paul B. MacReady Jr., who readily acknowledges that his craft is far from practical. In fact, MacReady emphasizes that the Dupont-financed project is strictly for demonstration purposes.

The 195-pound *Challenger* doesn't have the balloon's propane assist advantage, but climbs on sun power alone "very, very, slowly," says Brown, drawing out her words to emphasize the slowness.

At the same time, Brown luxuriates in the knowledge that her plane will take a long time to fall, with its glide rate of 120 feet per minute.

If she faces any problem at all, it's with the oxygen delivery. At lower altitudes, the *Challenger* pilot needs no oxygen. But at 30,000 feet, a forced-air system will be essential. Such an oxygen system would have to be heavy, and the *Challenger* has room for only 30 more pounds of equipment. Brown said no decision has been reached so far on the type of forced-air system that would be used. She would only acknowledge that several candidates were being considered and that slight changes might have to be made in the body of the *Challenger*.

Many changes were made in the design of the British solar balloon before London architect Domenic Michaelis was ready to allow Nott to fly it. The first part—designing the inner balloon, was easy. Michaelis simply commissioned Donald Cameron to build a standard 105,000-cu.-ft. "A-Type" balloon in black. The outer insulating envelope was a bit trickier.

It had to be transparent, but also strong, and the only way to do that was to laminate clear polyester to a Dacron reinforcing scrim woven loose enough to admit light.

Unfortunately, "if you get glue all over the place, it cuts out the light," Michaelis notes. The solution was a "rolling operation where the scrim carried the glue—hot glue—and rolled it between two sheets of polyester." This created a material with

thousands of tiny windows, each about 1/2-in square.

"It's amazing stuff," says Nott. "It looks very flimsy. I was worried that people would put their fingers through it. But actually, it's remarkably strong."

The laminate was cut to the pattern of another standard Cameron balloon of 140,000 cu. ft.

The full-sized solar balloon is the final stage of a project that began in 1975 with a smaller test version not designed to carry passengers. One such early prototype broke its moorings in France and is thought to have been the culprit in several UFO sightings at that time.

### Trial balloons

Michaelis's first trial balloon looked more like a pup tent than a balloon. It consisted of two cubes—one inside the other—staked to the ground in his back yard. The outside was made of transparent plastic film; the inside was standard Dacron ballooning fabric, colored black.

The next shape he tried was a "trefoil" within a balloon. That craft had a clear-plastic outer balloon. The inner device was again of plastic film, painted black. But it was fashioned in the shape of three arched butterfly wings, sewn together. This collected heat well, but wasn't as aerodynamically sound as the eventual balloon-in-balloon.

Even before those early tests, in November 1965, the U.S. Patent Office granted license to Cambridge, Mass., inventor Lee Ashman and some associates for a solar-energy balloon. Designed for weather forecasting and, perhaps, as a toy, the project eventually lost steam.

Contacted recently by PM, Ashman said he hadn't given the balloon much thought in recent years.

That seems to be the fate of most solar-powered vehicles—among them golf carts and other small, low-speed vehicles. The Solar Surrey, for instance, built at the Lawrence Livermore National Laboratory in California in 1978, logged only 1,800 miles in two years of operation.

Its batteries took seven days to charge fully, after which it could range about 30 miles before a recharge. Of course, the cart's only purpose was to test the performance of solar cells. According to Livermore researchers, the Surrey performed that test admirably.

That, says balloon-builder Cameron, won't be the fate of manned solar balloons. "Solar power is the kind of a thing a balloonist can really appreciate. Flying to the sun is a nice sort of way to think of ballooning." **FPM**

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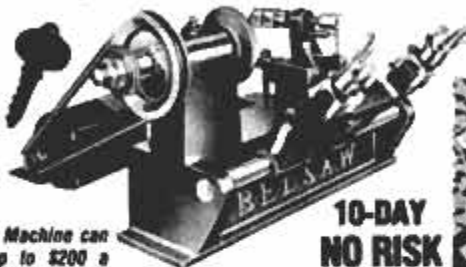
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## SUPER COUPES ROAD TEST

(Continued from page 109)

wagen's Scirocco, the very target at which all these other companies have launched their missiles. But Volkswagen hasn't exactly been sitting still. After all, a moving target is the hardest to hit.

### Volkswagen Scirocco

VW's Scirocco is the perennial standard of excellence when it comes to small, sporty coupes. The first-series Scirocco is the car other companies copied to create their entries for this class, and the mostly-new 1982 Scirocco is the one they'll copy for the next round.

What makes it better? Well, two things stand out. The car is obviously built with care. Every one of our testers mentioned the excellent construction, inside and out, and the way it "exudes quality . . . typically German in fit and finish." But what really appealed to us was the way the Scirocco felt when we drove it. "A nice solid car, extremely stable at high speeds," wrote one tester.

Surprisingly, the Scirocco did not stand out at the track. It was second behind the Stanza in acceleration, third in the slalom and braking and first only on the skidpad.

Fuel economy of less than 27 mpg is nothing to write home about for a 1.7-liter, overdrive, five-speed, 2,000-pound car carrying one passenger and no luggage, though it did place the Scirocco third among our disappointingly gas-thirsty group.

At \$11,000, without any options to speak of, this is a very expensive small car. And it's not all that well appointed. The Scirocco driver gets only tach, speedometer, water temperature and fuel. It's also short on sound-deadening material. There's an annoying resonance at most speeds, plus a tiring highway buzz.

Everyone complained about the awful rear windshield-wiper motor and tacked-on rear spoiler, which conspire to block rear vision.

The chassis of the Scirocco is now 8 years old, and as one tester pointed out, "It still picks up the inside rear wheel in hard corners." No matter,

The steering, shifter, handling and driving position combine to make it an absolute ball to drive fast. As one tester put it, "The cornering limits are actually quite low. But the faster you go, the better it feels."

And that's what really sold the Scirocco to our testers.

### Nissan Stanza

The Stanza came from nowhere to blind-side the competition. Two of our testers ranked it first, ahead of the Scirocco, and the rest of us had it in second. Somebody at Nissan has obviously done his homework, because the Stanza is one terrific car, particularly if you consider price.

The Scirocco is far and away the class of the field. But it is shamefully overpriced. The Stanza, by comparison, cost a whopping \$3,000 less, was just as well put together and ran the pants off the VW at the track.

The Stanza chassis is a collection of miracles. Consider this: The Stanza is heavier than every car in this group except the J2000 and has the largest engine. Yet it was not only the quickest at the drag strip, but the most economical car overall, both by significant margins. The Stanza was second to the Scirocco on the skidpad and only .07 mph slower through the slalom. And it won the braking contest. The Stanza is even significantly quieter than the buzzy Scirocco—and has the largest luggage room.

Everyone agreed that the Stanza interior was well thought out, fully instrumented, comfortable, spacious and "all of a piece." Said one tester, "They've even made plastic look good." And everyone commented on the number of convenience features. It's the most comfortable car of the group.

If the Stanza is so good, why didn't it win? Good question, that. Basically, because the Scirocco is such a joy to drive, while the Stanza has some unwanted slop in the steering, a rubbery shifter, a lot of body roll even in slow corners and a general feeling of looseness.

As one of our group so nicely put it, "This is the kind of car I'd buy my

(Please turn to page 208)

## PM PERFORMANCE-TEST RESULTS

	1/4-mile Acceleration (sec. @ mph)	Braking 60 to 0 mph (ft.)	Slalom* (mph)	Skidpad† (cw/ccw sec.)	Fuel Economy PM/EPA (mpg)	Interior Sound Level‡	
						Constant 30/60 mph	Full Throttle 30 to 60 mph
Scirocco	18.05 @ 74.07	166.0	56.57	.668/.722	26.76/28	69/71	75
Stanza	17.55 @ 76.33	147.1	56.50	.665/.675	30.33/32	68/69	72
Accord	18.42 @ 72.81	152.8	57.39	.625/.648	27.80/30	66/69	74
Corolla	19.48 @ 68.75	190.3	54.99	.610/.608	23.78/30	71/71	75
J2000	19.39 @ 70.64	200.3	53.79	.568/.601	23.94/26	71/74	76
LN-7	19.29 @ 69.93	176.6	58.63	.623/.661	25.42/29	73/73	76

\*Slalom is speed in mph through seven cones spaced 100 feet apart with an entry speed of 60 mph.  
†Skidpad is measured in G force, with a 200-foot-diameter skidpad. cw: clockwise; ccw: counterclockwise.  
‡Interior sound level is measured in decibels.

# TECHNOLOGY UPDATE

## It's all in that funny wing on the nose

### Aviation

"What's that funny wing on the nose?" People have been asking this ever since famed aircraft designer Burt Rutan unveiled his odd-looking VariViggen in the early '70s, followed by the popular little homebuilt Vari-Eze and Quickie—all spectacular, if unorthodox, sports planes, with wings on their noses (see *The Wizard of Homebuilts*, page 116, Feb. '79).

Now Rutan is thinking bigger. His latest adventure into the exotic is a 36-passenger, twin-engine airliner intended for fast, safe, intercity commuter service, a field currently dominated by STOL-type imports of foreign design.

Like Rutan's earlier creations, the new commuter-shuttle concept sports a tail-first horizontal stabilizer called a "canard." Its principle is intriguing. Set at a slightly sharper angle than the main wing, it stalls out first as speed decreases. This

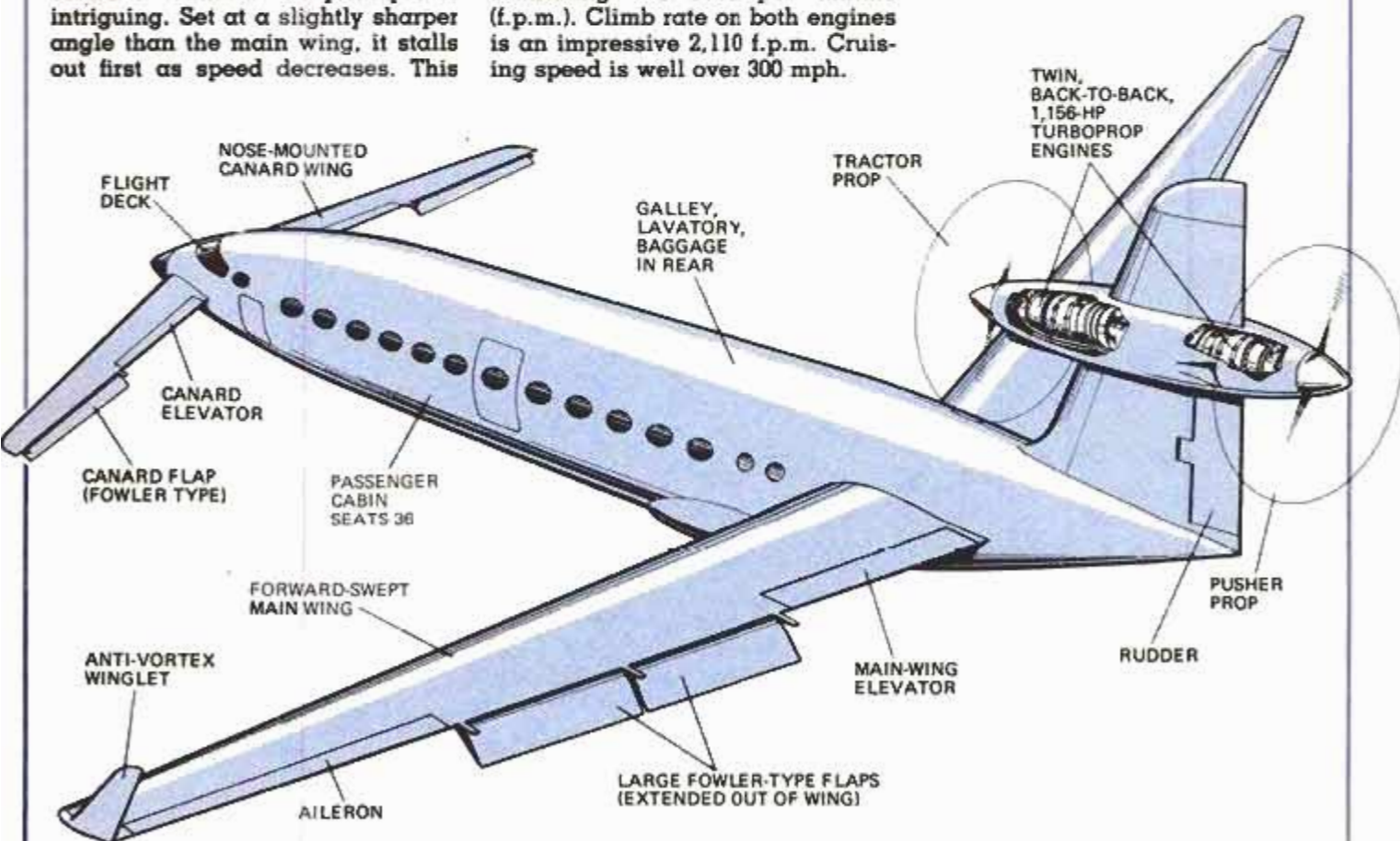
drops the nose, increasing speed automatically and regaining lift before the main wing can stall. Thus, the craft itself never fully stalls—and a plane that can't stall won't go into a spin.

But the canard is only part of Rutan's maverick philosophy. The engines aren't on the wings, where you'd expect them to be. The two, 1,156-hp Pratt & Whitney PT6-45 turboprop powerplants are in the vertical tailfin, one ahead of the other—one pushing, the other pulling. Because the engines are in line with each other, there's no sudden yaw to the side if one loses power—a reaction so violent it can cause a conventional twin to lose altitude and go out of control.

The Rutan commuter, modestly designated the Model 78-I, not only can maintain altitude on one engine; it actually can continue to climb at a comforting 770 feet per minute (f.p.m.). Climb rate on both engines is an impressive 2,110 f.p.m. Cruising speed is well over 300 mph.

While not strictly a STOL configuration, the 78-I is designed for small-field operation. Duplicate elevators and flaps in both the canard and main wing give it high lift and precise control, especially at low landing and takeoff speeds. With flaps down, it can land at a relatively tame 94 mph.

The 78-I is 65 feet long, has a main-wing span of 70 feet and burns an economical 505 pounds of fuel per hour. A scale model is currently undergoing wind-tunnel tests at NASA's Langley Research Center. If the results are as good as the preliminary calculations, Rutan's remarkably prolific Rutan Aircraft Factory in Mojave, Calif., may have the makings of a speedy, fuel-efficient, supersafe commuter shuttle that could pose a U.S. challenge to foreign competition—even with the funny wing on its nose.



Let it all hang out: With dual control surfaces, the craft has superb low-speed maneuverability, needs only 3,500-foot runways.

## Engineering

### The French connection

A new era of American hydroelectric generation begins this month near the small Ohio River town of Vanceburg, Ky., when the world's first fully prefabricated power plant goes into commercial production.

The 75-megawatt W.T. Love Generating Station utilizes a relatively new bulb-type turbine with the generator mounted in front of the turbine blades. The Kaplan-type bulb turbine (a propeller turbine with variable-pitch blades) operates horizontally, as opposed to the conventional vertical turbine associated with high-head plants like Niagara Falls. The low-head (head is the distance the water level drops from intake to outflow) bulb turbine has been used extensively in Europe since the 1930s.

The straight-through design of the horizontal turbine allowed a one-piece design of the \$77-million plant, saving Vanceburg's utility commission millions of dollars in concrete



Completely fabricated in a French shipyard, generating plant for Vanceburg, Ky., was carried transatlantic by a special ship and broken down for the upriver tow.

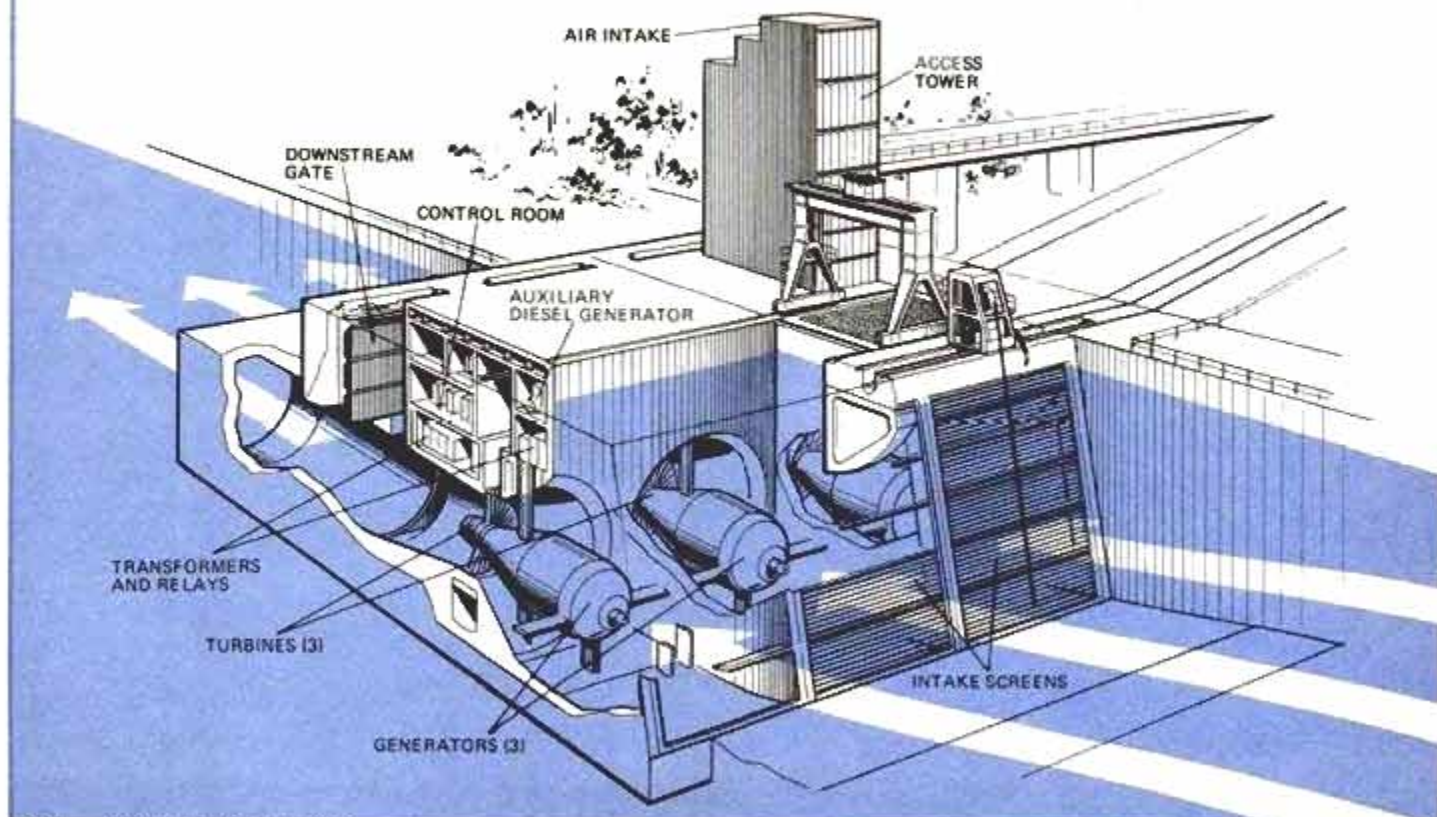
construction costs, according to project manager William Lewis.

Cost was the prime consideration of the utility company in seeking its own source of electricity. Vanceburg (population: 1,939) couldn't afford cost overruns inherent in normal hydroplant projects. Sogreah, a French engineering firm, worked

with the Vanceburg utility for more than eight years, studying prefab hydroplant designs. In 1977, bids were received from firms in Japan, Austria, Norway, Switzerland, the United States and France.

Engineer Lewis was impressed by the welding technology and turbine-building experience of Neyrpic, a

W.T. Love Generating Station, world's first fully prefabricated power plant, starts operation this month on the Ohio River.





subsidiary of the French conglomerate Alstom-Atlantique. The contract was awarded to that firm in 1979. Alstom-Atlantique agreed to get the project to the Vanceburg site in two years or less.

Vanceburg decided on the prefab design for two reasons: a firm construction price and short building time. The plant is the first mixed steel and concrete design of its type in the world. It needs only internal concrete weights to moor on the river bottom and a concrete ramp and walkway to the shore.

Normally, a concrete powerhouse is built around the generating units. The Vanceburg plant doesn't need a concrete housing; everything is contained in the 144-foot-wide, 178-foot-long steel structure. Other recent bulb-turbine ventures that have used conventional concrete structures (one in Wenatchee, Wash., and another in Racine, Ohio) were considerably more expensive.

The 6,500-mile move from France was planned for summer, when the Mississippi and Ohio Rivers were high enough to accommodate the 50,000-metric-ton structure, but not too high to prevent the plant from clearing overhead bridges. On June 23, 1981, the power station was loaded from the French shipyard where it was assembled onto a Dutch-built ship that "sinks" to load the plant. It arrived in Baton Rouge, La., where it was offloaded and split into two parts to ease transportation through narrow river locks. The plant arrived on July 25 and it was reassembled.

River water was pumped out of a cofferdam and the plant sunk 53 feet to moorings on the riverbed. A 146-foot access tower, held alongside one turbine housing on the upriver voyage, was hoisted into place.

Recently, the upstream weir of the government dam was dynamited, allowing the Ohio River to flood in. With the cofferdam removed and the gates opened, the first turbine's 18-foot blades began spinning. The two other units are scheduled to come online by April 1, supplying all Vanceburg's power and netting \$93,000 in revenue this year through the sale of part of the load to Hamilton, Ohio, 100 miles away.

Editor: Robin Nelson  
Contributors: Shel Gallagher, Gary S. Ruderman

## Alternatives

### Hot water two ways

Its looks are not its big advantage, but if you don't mind having a moderate-sized solar collector poised over your chimney on the roof, a new dual-acting hot-water system might be just the thing you've been waiting for. By allowing the circulating water to be heated either by escaping furnace (flue) gases or solar heat—or both—the system provides at least one mode of auxiliary heat in any season of the year.

Think about it—when solar energy is most plentiful in summer, your furnace is down; in wintertime, when a solar system would normally prove less than adequate, the flue is constantly hot.

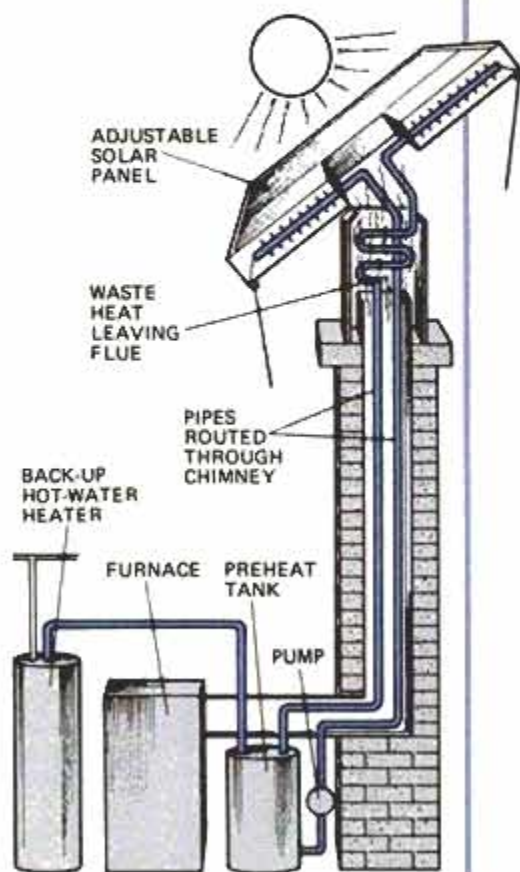
Thus, for this innovative system, there is a fairly "flat" available energy profile the year round.

The main advantage is that a smaller solar collector than would be required normally for a single-source system can be used. Additionally, no separate drain of antifreeze circuits is necessary, according to the developer.

The hardware has been patented by the Wedge Co., Box 201, Media, Pa. 19063, which is looking for a man-



A chimney-mounted solar panel can be adjusted for best sun angle from ground.



Water that's in dual-source hot-water system circulates up and down flue in pipes that are routed through chimney.

ufacturing/distributing firm to handle it (anticipated retail price is about \$1,200 and it qualifies for current tax credits). Both systems are contained in one chimney-mounted unit and the solar panel can be adjusted from below to obtain the optimum sun angle.

A backup water heater is still essential to the system, but this is the case in virtually all alternate-energy hot-water plans. Solar power alone can't do the job.

## Housing

### Glass houses

A prefabricated, five-section fiberglass cathedral-roof system is available at costs running 35 percent less than conventional truss-and-shingle roofing, says E & E Fiberglass Corp., Box 318, Bala Cynwyd, Pa. 19004. The reinforced-polyester-resin roofs can be locked together in series (such as in motel construction) and steam-cleaned (no painting needed). While aimed primarily at land developers,



Fiberglass cathedral-roof unit is maintenance-free, comes in 20- and 24-foot sizes.

the units could also be used for private dwellings, such as summer cottages. The time estimated to complete an average structure is lowered by 25 percent when the glass roof is used.

## Transportation

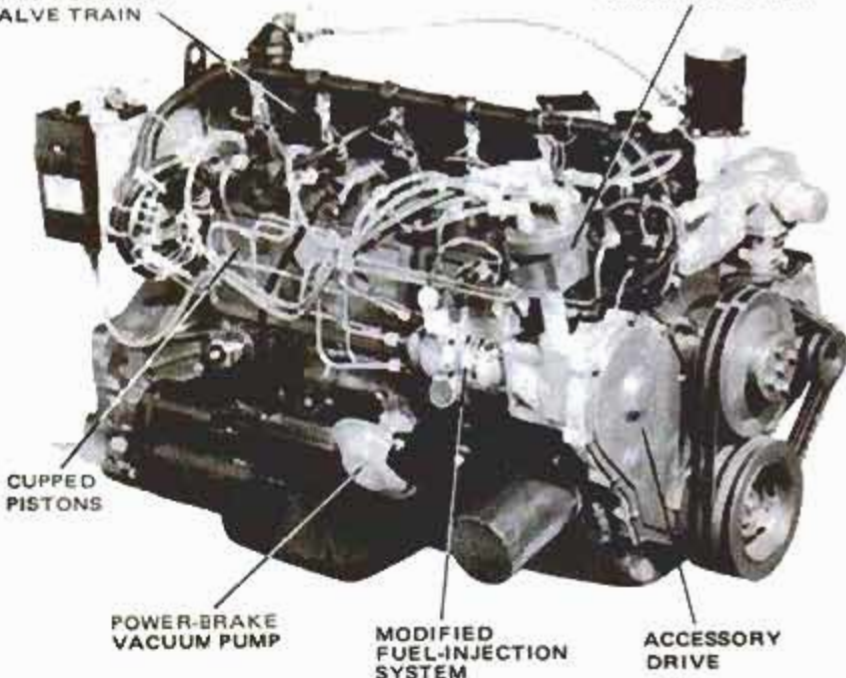
### A burnt-out case

The combustion end of an internal combustion engine is no simple explosion. Example: After more than 30 years of re-engineering the most basic components *inside* a cylinder, Texaco scientists have put together a practical, working engine that doesn't care what fuel it burns. A modification of a GM 292-cu.-in. truck engine, the new mill is based on a stratified-charge, fuel-injection design called the Texaco Controlled Combustion System. It will be installed in 500 United Parcel Service trucks for a full-scale test this year.

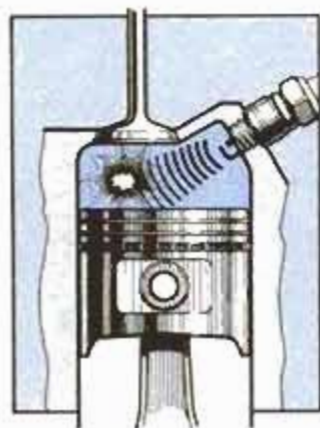
Though no passenger-car applications have been announced, Texaco engineers say the engine could meet emissions requirements and let cars

CYLINDER HEAD WITH MODIFIED VALVE TRAIN

HIGH ENERGY IGNITION SYSTEM



Modified 292-cu.-in. GM truck engine is capable of burning diesel fuel, gasoline or alcohol. It will be fleet-tested on 500 United Parcel Service trucks this year.



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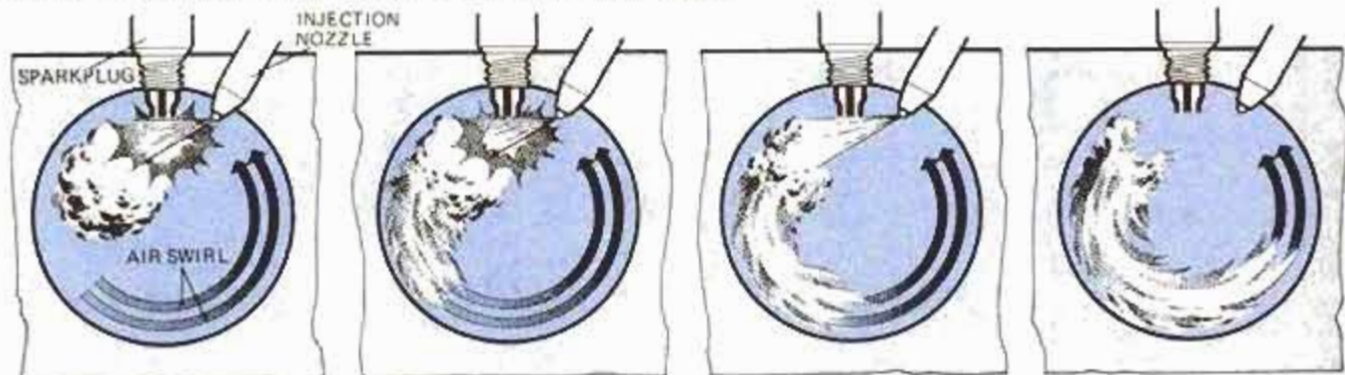
The TCCS engine utilizes a compression ratio of 13 to 1; a redesigned air-intake system provides an initial air swirl which is accelerated near the end of the compression stroke by a hemispherical cylinder head. The compressed air (no fuel in the mix at this point) reaches swirl rates of 30,000 rpm in the cup-shaped head. A fuel injector sprays fuel into the swirl at the peak of compression; a spark-plug is fired just "downstream" of the injector and the flame front follows

the swirl to provide a consistent, clean burn. All this does is make both octane (antiknock property) and cetane (self-ignition property) numbers irrelevant.

The engine has a timed fuel-injection system (modified Stanadyne diesel injection pump). Modified diesel-type roller/lifters, which require special camshafts, are also used.

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## SUPER COUPES ROAD TEST

(Continued from page 202)

wife—safe and comfortable, roomy and economical."

### Honda Accord

It's hard to place the Accord. Unlike the Scirocco, it's not thrilling to drive. The Accord is simply well made, competent, viceless transportation—a good car, but rather uninspired and, thus, uninspiring.

Said one tester, "The Accord isn't really a driver's car. It's a boulevard cruiser for a person who doesn't demand too much performance."

This particular Accord was more bland than most. A \$7,400 stripper, it came without even a radio. Optioned up like the American duo in this test, it would be more like a \$9,000 machine. That still wouldn't have moved it out of the middle of the pack in every performance area, nor moved it past the Scirocco or Stanza in the finals. But it might have made the Accord more memorable.

What can you say about a car which does everything well, but nothing brilliantly? The interior is nicely laid out, all the controls are "so handy your cat could drive it."

The handling is "predictable, but there's too much suspension compliance. It loses the line quickly in the bumpy, twisty bits, and how about some good tires for a change?" Our testers also found lots of road and wind noise, bobbing and weaving at speed, and rear end lockup under braking.

On the other hand, everyone appreciated the excellent luggage room. "You could park a Scirocco back there."

### Toyota Corolla Sports Coupe

The Corolla Sports Coupe has been around for something like five years without change. And yet, judged by almost any yardstick, it easily outdid both brand-new sporty coupes from GM and Ford. It isn't in the same league with the Scirocco.

Most of us thought this was among the best looking cars in the bunch—sleek, crisp and modern. The interior was just as pleasant. "Jazzy without being garish," wrote one tester, "and surprisingly Teutonic."

Unfortunately, the Corolla's chassis has been left behind by today's front-wheel-drive competition. It beat only the J2000 in the handling and braking tests, and was the slowest of all at the drag strip. Even worse, this lack of power was not compensated by good fuel economy. The very noisy engine was called too rough to rev beyond 4,000 rpm, though the redline is 6,000.

Where the Corolla really fell apart was in the driving. The handling was described as "awful, so loose it feels like somebody forgot to tighten all the suspension bolts."

### Pontiac J2000

According to GM, the J-cars are targeted at the Honda Accord and VW Scirocco, while Cadillac has the temerity to be positioning the Cimarron against the BMW 320i.

Our J2000 was barely competitive with a Toyota Corolla designed before the oil embargo in 1974, and outclassed by the new Scirocco, Stanza and Accord.

At the track, it was fourth in acceleration and last in braking, slalom and skidpad. It was also, by far, the noisiest car in the test and only marginally more fuel efficient than Toyota's gas guzzler. The J2000 desperately needs the five-speed transmission and larger engine promised for later this year.

Part of the J-car's trouble is that it's a good 250 pounds overweight compared to the competition.

If the engineers dropped the ball, GM's stylists have done themselves proud. Unanimously, our testers thought the J2000 was by far the best looking car in this group. A typical comment was "Excellent . . . trim and sleek . . . total integration of all components is beautifully handled. A credit to GM styling."

The dashboard carried a full set of gauges, and everything was pretty well bolted together, but it's the details that kill you. For example, take the instruments. There is a gauge for every purpose, true enough. But the angle on the plastic faces reflects your own clothes. It is impossible to read the instruments while wearing a white shirt.

Our testers' comments on driving the J2000 make dreary reading for anybody who's hoping for a Detroit renaissance: "Handling is lousy—lots of wander, limited compliance, rough ride, lots of body roll and wallow that gets worse the faster you go. The cheap General tires don't help."

" . . . Cross your fingers and pray you get the gear you want."

"Poor brakes, engine detonates under acceleration, a scary car to drive because the front wheels have a mind of their own. Tiring to drive fast. Impossible to drive slow because of the high rear-axle ratio."

### Mercury LN-7

Ford seems to have a very naive approach to automobile styling. The surface development of this body is so overdone that it detracts from the basically good silhouette. The heavy

rub strips, high nose and absurdly flared wheel wells scream at your eye. There's no rest, no pause, no subtle integration of forms.

The interior is just as bad. The dashboard on the LN-7, for example, has round dials with white edges in front of the driver, square dials with silver edges in the console, square chrome handles on the heater controls, round chrome knobs on the radio and black plastic door knobs to set off the rest. It's as though five different stylists each worked on a different square foot of the dash.

The rest of the interior is equally unintegrated. The seat guy made his seats too low, flat and slippery, with no lateral support. But the steering wheel designer put the wheel too high, and forgot to include a tilt-wheel option. So the driving position is like that of a Harley-Davidson.

The engineers all seem to have worked in a vacuum, too. The four-speed gearbox has no reverse lock-out, and first gear is right next to reverse. It's got poorly spaced ratios and loose, sloppy linkage.

At the track, the LN-7 was a mixed performer. It finished fifth in acceleration, fourth in braking, third on the skidpad and a resounding first in the slalom. This is consistent with our test results for the Escort sedan, and the curious inconsistency is due to the basic design and the optional TRX suspension package on both cars. In a conversation with Ford engineers subsequent to our testing, we were told the suspension is designed for fast, evasive maneuvers, rather than steady state cornering. This is borne out in the apparent inconsistency between the slalom and skidpad results.

As our slalom tester explained, "This car would be just about undrivable without the TRX option. It wants to slide, there's lots of yaw motion, lots of feedback and nibble through the steering wheel."

The LN-7's little engine is sorely overloaded. It's slow and rough with no redeeming qualities and runs out of breath quickly. It really needs a larger engine and five-speed transmission; both are in the works.

### Imports have the edge

The American car companies are losing a billion dollars every three months, even when the Japanese are restricted by import quotas. And it has nothing to do with interest rates, inflation or UAW pay scales.

The fact of the matter is that most of the cars Ford, GM and Chrysler are failing to sell are, with a few exceptions, not as much fun to drive or as well executed as the cars from other countries.

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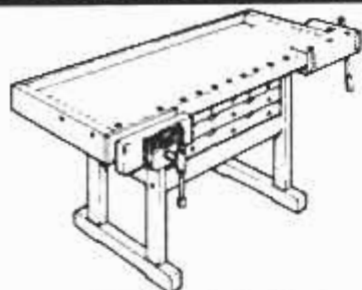
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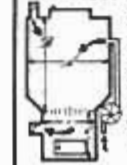
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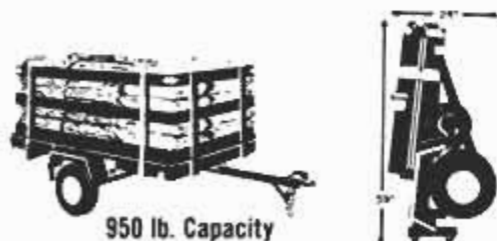
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(Continued from preceding page)

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