

JULY 1981 \$1.25

# Popular Mechanics

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after 1,429,381 miles**

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gear**



## SUPERTANKS

Invincible? Our 'smart' new  
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# NEW LUV DIESEL HAS IT ALL

Terrific news. There's a new LUV. It's a diesel, and it's available in all LUV models, 2- and 4-wheel drive. So you get all the popular LUV features. Plus some new ones. Like LUV Diesel's Quick-On system. Which means the engine is ready to start in just 3½ seconds or less. And LUV Diesel has pep. With a hefty SAE net torque rating of 93 lb.-ft. at 2200 RPMs.

To top it all off, get a look at these 2WD diesel mileage estimates:

#### Diesel 2WD

44

EST HWY

32

EPA EST MPG (CITY)

#### Unbeaten 4-wheel-drive mileage.

No pickup in America offers better 4WD mileage. Which means now you can get both four-wheel-drive traction, and sensational fuel economy.

#### Diesel 4WD

35

EST HWY

28

EPA EST MPG (CITY)

#### Unbeaten payload and cargo box length.

LUV Diesel's 7½-ft. cargo box on the 2WD long wheelbase model is as long as you can get on any small-size pickup. And it has a whopping 1690-lb. payload capacity. Payload includes passengers, equipment and cargo.

#### Unbeaten driving range.

The new LUV Diesel's long wheelbase 2WD model's estimated driving range is 611 miles. Estimated highway range, 840 miles. You can't beat that in any small pickup.

Use estimated MPG for comparisons. Your mileage and range may differ depending on speed, distance, weather. Mileage and range will be less in heavy city traffic. Actual highway mileage and range lower. Range is obtained by multiplying the 19.1-gallon fuel tank capacity by the EPA estimates. Not available in California.

LUV engines are produced by Isuzu Motors Limited, Japan.



Built tough. Built for economy.



OH SAY  
CAN YOU  
SEE?

## Let's bring Fourth of July drinking into focus.

There are signs that warn us when we are overdrinking. We may lose our coordination. Our speech may become slurred. Even our vision may be momentarily impaired.

We will all have a safer and happier holiday weekend if we take the following simple precautions:

**STOP:** Take your last drink of the day hours before you plan to leave for home.

**LOOK:** This weekend, even cautious drivers should become more cautious, especially at night. After dark, the number of alcohol-related auto accidents increases.

**LISTEN:** Ask yourself, "Have I had too much to drink?" Then listen. If the answer is yes, don't drive.

Whenever you've had enough, a little flag should go up to tell you. And we salute those who obey that flag this Fourth of July.

The House of Seagram

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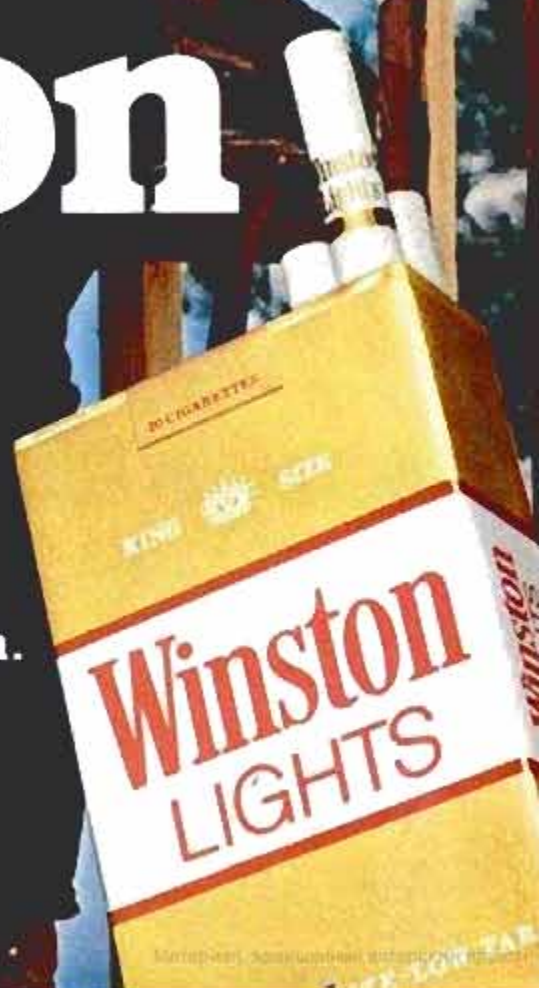
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### On the cover

In a scenario from what conventional armored warfare could be like in this decade, a Warsaw Pact T-72 tank is under attack from a new artillery-fired, parachute-deployed guided missile. Story begins on page 66 in this issue.

—PM painting by Ed Valigursky

# Popular<sup>®</sup> Mechanics

JULY 1981

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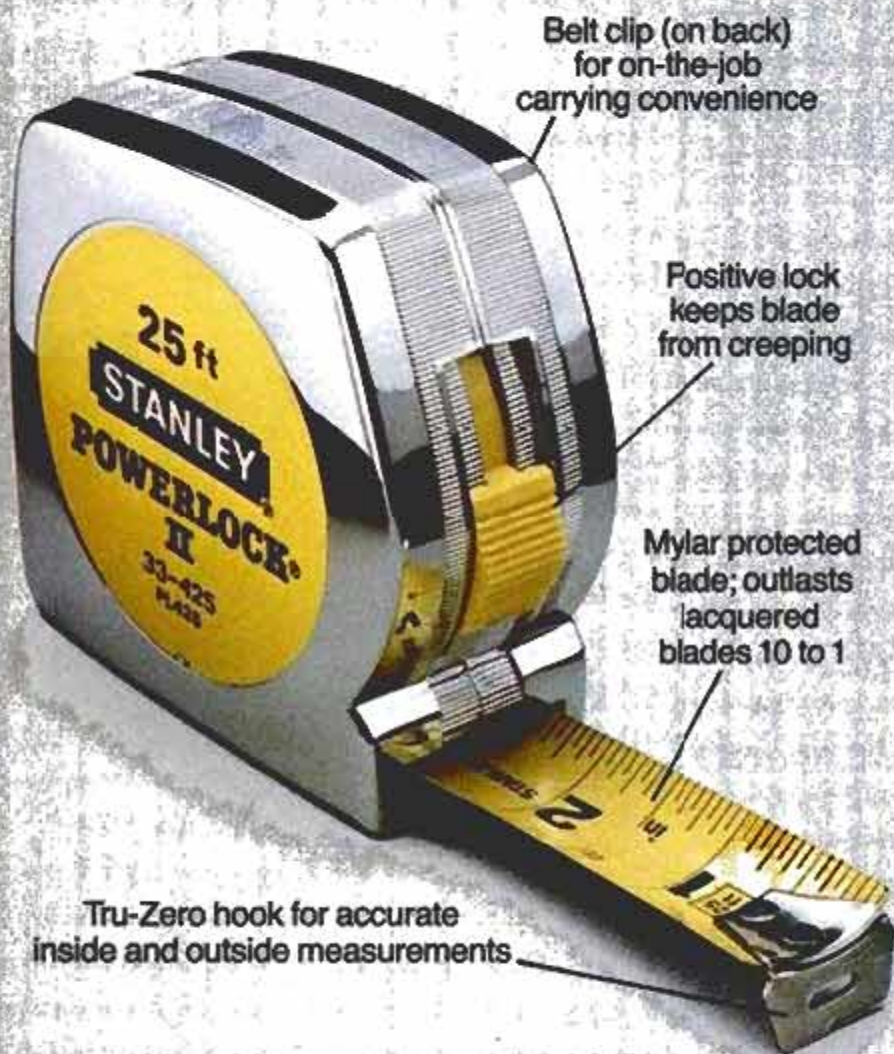
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**Plymouth Reliant K Wagon**  
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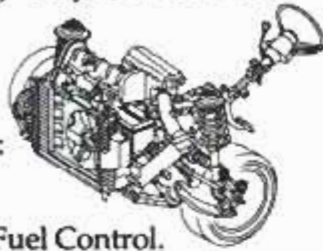
# Plymouth Reliant K Wagon.

## Chrysler engineers America's highest mileage 6-passenger wagon—40 <sup>EST. HWY.</sup> **24** <sup>EPA EST.</sup> mpg.\* And achieves new standards of performance and quality.

What's behind this extraordinary achievement? The advanced technology that's produced Chrysler's direct power front-wheel-drive system. At its heart: the new Trans-4 engine.

**Chrysler's new Trans-4:**  
40 est. hwy. **24** EPA est. mpg.\*  
—with power.

This powerful new 2.2-liter overhead cam engine was designed by Chrysler with a computer controlled feedback system built into it: Chrysler's renowned Electronic Fuel Control.



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The Trans-4 engine is a major reason for Reliant K Wagon's excellent mileage ratings.

**Station wagon hauling,  
road car manners, and a new  
sense of security.**

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**A billion-dollar investment  
to build you a better car.**

In our commitment to a level of Chrysler quality never before achieved, we re-engineered plants with some of the world's most advanced equipment.

To combat the twisting that causes squeaks and rattles, computerized robots weld body and chassis simultaneously into a single incredibly strong unit.

Each Trans-4 engine is hot and cold tested and graded by electronic computer for 37 functions. 66 individual tests. If it doesn't score 66 straight A's, it doesn't go into a Reliant K Wagon.

In total, over 2,000 tests affirm the lasting quality built into each Reliant K.

**Reliant Custom Wagon  
as low as \$6,721.†**

The base sticker price includes: Power front disc brakes. 4-spd. man. overdrive. Digital clock. AM radio.\*\* Woodtone applique instrument panel. Concealed wipers. Halogen headlamps. Luxury steering wheel.

The SE Wagon priced as shown adds as standard: Power steering. Premium upholstery. Dual horns. Remote mirror. Body woodtone applique. And these options: Roof rack. Luxury wheelcovers. 14" glass belted WSW radials.

Other options available:†† Air cond., \$605. Auto. trans., \$360. AM/FM stereo cassette, \$224.

Buy or lease a Reliant Wagon at your Chrysler-Plymouth dealer.



**Chrysler LeBaron Town and Country. 26 est hwy, **17** EPA est mpg.\***

The tradition of America's most distinctive wagon continues in an efficient Chrysler for today. It affords you a nearly unlimited capacity for luxury and driving ease with automatic transmission, power steering, power front disc

brakes and glass belted WSW radials all standard.



**The New Chrysler  
Corporation**

\*40 est. hwy. **24** EPA est. mpg for Reliant Wagon. 26 est. hwy. **17** EPA est. mpg for Town and Country. Use EPA est. mpg for comparison. Actual mileage may vary depending on speed, trip length and weather. Actual highway mileage and Cal. estimates lower. Town and Country estimates with opt. V-R engine.

\*\*May be deleted for credit on factory orders. †Sticker price as of 4/30/81, excluding taxes and destination charges. ††These options may require the purchase of additional optional equipment.





## You can count on Sears service

**Few places in the U.S. are beyond the reach of Sears 16,000 service trucks—and even if you move to Ely, Nevada or Blairs Mills, Kentucky, Sears will arrange for your service and honor your warranties.**

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If you want help hooking up Sears appliances you've taken with you, call your new Sears store in advance and let them know when you expect to move in.

Sears will do its best to be there that very day.

If you bought a Sears appliance from *any* Sears store in the U.S., *every* Sears store and service center in the U.S. will offer you service—and of course you can charge it on your Sears credit card.

If you bought a maintenance agreement from Sears, every Sears store will honor it.

Sears operates 16,000 service trucks, each driven by a Sears-trained technician and stocked with parts for Sears products. Chances are very good that a single service call will





*Sears operates over 16,000 service trucks like this one, all across America. It's one of the largest privately-owned service fleets in the world.*

## to follow you when you move

have things humming again.

Most of America's eighty million homes are within easy reach of this immense service organization. But if you happen to move beyond its range—for example, to some parts of Nevada or Kentucky or Montana—Sears still takes responsibility for providing service for your Sears appliances.

Sears will arrange for a qualified technician in a town near you to handle things. If any Sears warranty or maintenance agreement applies,

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Sears works closely with hundreds of manufacturers to make sure that Sears products give customers what they want, and perform as they expect.

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to improvements in thousands of products.

And backing up everything you buy at Sears is this 50-year old promise:

*Satisfaction guaranteed  
or your money back.*

**Sears**

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# LETTERS TO THE EDITOR

## Reliving two heroic rescues

I recently obtained a copy of your December '80 issue and was surprised to find our rescue mission written up in it (*The Ocean Express Disaster—A Hard Lesson at Sea*, page 86). I was one of the crewmen in the Coast Guard rescue helicopter that night. The story was well written and stirred considerable emotion as I relived the experience.

HAROLD J. THOMAS  
WARSAW, MO.

*Harold Thomas is the crewman who suffered a heart attack following the rescue ordeal. He is now in retirement.*

As Military Awards Project Officer for the *Prinsendam* rescue, I became very involved in the events recounted in your article *The Prinsendam Fire: History's Greatest Sea Rescue* (page 102, April '81). Except for promoting Commander Schoel to Admiral (which he didn't mind), the article was accurate and, in fact, was the best I've read on the rescue operation.

B. A. BUNDY, CMDR., USCG  
WASHINGTON, D.C.

## In search of Great Shops

I've been reading PM for 20 years and one of the features I like best is your Great Shop series. I especially enjoyed the excellent article on John Opfer Jr.'s model shop (*This Master Craftsman's Dream Shop Is in a Log Cabin*, page 108, Nov. '80). I am planning my own "model shop" and hope to include many ideas from those wonderful shops.

BILL PAPINEAU  
DEARBORN, MICH.

*PM is always on the lookout for Great Shop candidates. We'd like to hear from readers who know of shops that would be of interest to others. Please send a few snapshots and a description of their outstanding features to Home and Shop Editor, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.*

## You guessed it!

In your April '81 *Imports & Motorsports* (page 87), you asked readers to identify the car whose unusual headlights were shown in a photo. Well, I'd say it's the Peugeot 505 diesel. Right?

Incidentally, I'm a new subscriber

to PM and have never read a more spectacular magazine in my life. Congratulations to all the fine editors and artists who make the magazine what it is.

RAY THOMAS  
STATEN ISLAND, N.Y.

*Thanks for the kind words—and yes, you're right on the money. It's the Peugeot 505, which comes with choice of a diesel, turbodiesel or fuel-injected gasoline Four.*

## Kids go for PM's pedal car

I am enclosing a picture (below) of your GT-8 pedal car (*Build the GT-8:*



PM's GT-8 pedal car, as built by reader Reynolds, with happy driver at the wheel.

*PM's Grand Tourer for 8-Year-Olds*, page 124, June '80). The rear end was modified to resemble a 1923 Model T with spare tire and small rumble seat. All the neighborhood kids really enjoy the car.

RONALD A. REYNOLDS  
PLAINFIELD, IND.

*A great-looking job; we can see why the kids like it. For others who may wish to obtain the plans, they are \$6 postpaid from PM GT-8, Stevenson Publications, Box 584, Del Mar, Calif. 92014.*

## Unsafe shop motors

Your article *Homemade Lathe from Washing-Machine Motor* (page 158, March '81) suggests that appliance motors should be used for shop projects. The motor shown appears to be a very old Emerson model.

The use of such a motor could create a safety hazard because of its automatic thermal protection. If it becomes overloaded, the thermal

protector will trip and, after a cool-down period, the motor will restart automatically, endangering the operator. The author also suggests that motors lacking a starting winding can be started by hand. This could cause a problem if the operator does not get his hand out of the way in time.

Newer appliance motors have exposed windings and switch contacts which create a shock hazard if used in a shop. Motors made for shop applications normally have a manual reset and a starting switch with enclosed contacts.

A. S. DIMCOFF  
PRODUCT SAFETY OFFICER  
EMERSON ELECTRIC CO.  
ST. LOUIS

## Motorcycle riders take note

As a motorcycle police officer, I read with great interest your article *Your Motorcycle: Staying Alive on Two Wheels* (page 72, April '81). The statistics you cited are important, but others are worth noting, too.

According to a study of 900 motorcycle accidents made by the Motorcycle Safety Foundation, 57 percent occurred during trips of less than five miles; 68 percent occurred during the first 12 minutes of a trip; and, most significantly, 77 percent occurred within the 11:00- to 1:00-o'clock position of the cyclist's view—right in front.

This last statistic points up the importance of conspicuousness. Cyclists should wear highly visible orange or yellow clothing and even a bright-colored helmet. This, along with keeping the headlight on at all times, greatly reduces risk.

PETER F. BENJAMIN  
BALDWIN, N.Y.

Shortly after reading your article on motorcycle safety, we heard a loud crash outside. We rushed out to find a smashed motorcycle and its rider lying on the pavement. Although the man was not seriously injured, he was wearing no helmet and could have been killed.

The accident occurred just as you pictured. A motorist was turning a corner, apparently didn't see the cycle's low silhouette, and the cyclist was going too fast to stop. I hope your excellent article will make cyclists more cautious.

WILLIAM T. ELLIOTT  
SANTA ANA, CALIF.



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# IMPORTS & MOTORSPORTS



PM photo: Irv Dolin

Rabbit convertible, VW's four-seater from Karmann coachworks in Germany, has roll bar.

I never thought I'd consider a \$10,000 Volkswagen a bargain. But the Rabbit convertible is just that. The four-seater, insulated-top, roll-barred, gas-stingy little jewel is one of a kind. Safety and snug tops usually aren't part and parcel of a convertible design. Even comfort is integral to this drophead and gets a boost this year: An automatic transmission joins the options list.

Check out what else you can get for your convertible dollar and you'll see just how appealing the Rabbit is: Only the Fiat Spider 2000 and Triumph TR7 and TR8 are in the same price range; at \$15,000, the Alfa Romeo 2000 Spider Veloce is a pretty package; from there we vault to \$40,000, where you find the Mercedes 380SL, and thence to the Aston Martin Volante, just under \$100,000. The Rolls-Royce Corniche? Well, for its sticker price, you can get



**Nonconvertible:** There's no top with the Athon, a styling exercise from Bertone. Go fast enough and the rain won't come in.

15 Rabbit convertibles. Not one of these soft-tops has a roll bar, and you're lucky if you get a rear jump seat with the affordable ones.

Other convertibles made abroad aren't sold here, or are just one-off dream cars like the Athon above. You can turn to the aftermarket convertible companies for custom jobs (see page 70), but you'll pay, on an average, \$6,000 just for the chop.

That's why, for sunny July, this Rabbit is our car of the month.

## Twelve Hours of Sebring

You can tell when it's time for central Florida's big motorsports weekend: All the neat cars we saw, like the pristine Alfa with the license plate ALFETTA, and the motor homes plastered with racing stickers, are aiming for the airport circuit at Sebring. Once there, race fans who watch from lawn chairs on motor-home roofs are intent on following



Winning 935: Porsche took the top seven spots in the famed endurance classic.

the competition; those fans closer to the ground may be having more fun in the carnival of sights, sounds and smells, even though they, too, have plenty of vantage points around the 5.2-mile circuit. And, then, isolated from the crowds in their roped-off corral, are the scholars of motorsports, the Porsche owners, who watched their marque sweep the 29th running of the 12-hour endurance classic. The No. 86 Porsche 935 of Hurley Haywood, Bruce Leven and Al Holbert covered 1,274 miles in the 12 hours; that was an average



Porsche story is in this new book.

speed of 106.044 mph for 245 laps. The development of these Porsche sports racing cars is a fascinating story and is traced in a just-published account by Paul Frère: *Porsche Racing Cars of the 70s* (Arco

Publishing Inc., 219 Park Ave. South, New York, N.Y. 10003). It's an authoritative book and costs \$19.95; even reading about Porsches costs big money.

Sebring was a perfect place for Pirelli U.S.A. to introduce its addi-



Pirelli P7s are now sized for the Vette.

tions to the P7 Rally tire line. P7s now come in 255/60VR15 and 275/55 sizes so they fit Corvettes, Trans-Ams and Camaros.

## Okay, pull over!

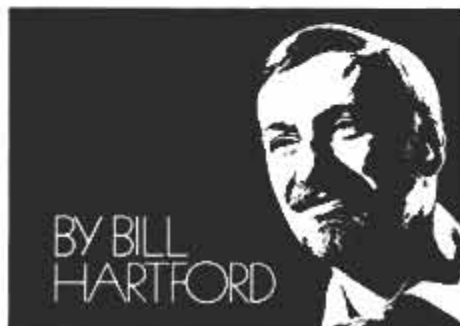
Muscle tone is important to a race car driver. And with this home exerciser you don't have to burn fuel to



"Driver" wrestles with exerciser wheel.

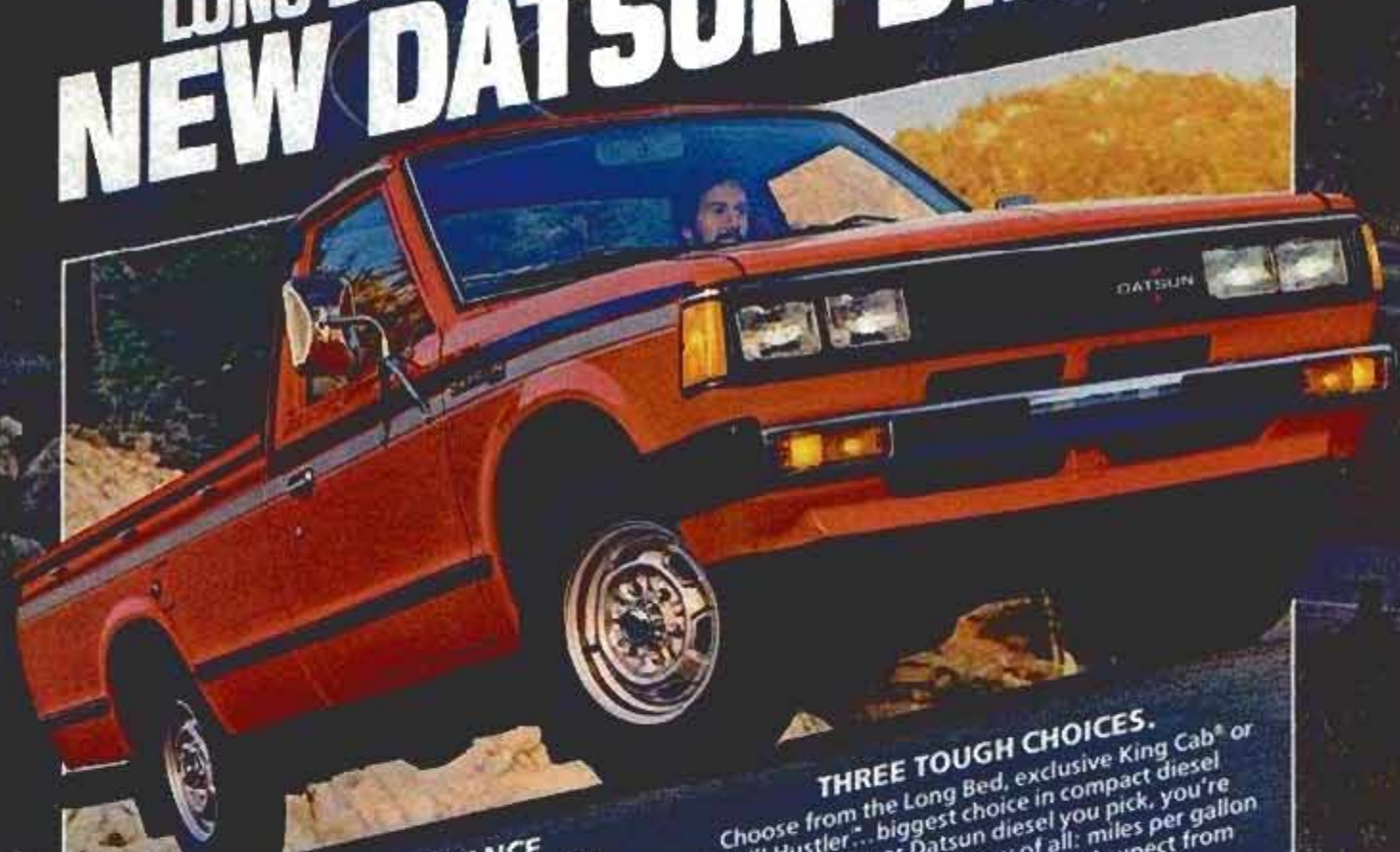
stay fit. It's \$149 from Exer-Driver, 9017 Reseda Blvd., Suite 215, Northridge, Calif. 91324. I think I'll try one: My family car doesn't have power steering.

PM





# LONG DISTANCE HAULER. NEW DATSUN DIESEL



## WHAT'S THE LONGEST DISTANCE BETWEEN TWO PUMPS? FOR DATSUN PICKUPS, IT'S OVER 550 MILES:

Introducing the new Datsun diesel. It has the power and mileage you'd expect in a diesel, and in the Long Bed more range than any Datsun ever: 557\* miles on a tankful, from an engine with over 3 billion miles of experience behind it. Datsun and diesel: a tough combination.

### A TRUE TRUCK.

This rugged rig is a half-ton of tough, suspended in front on ride-smoothing independent front torsion bars. It hauls a full 1,400-pound payload of cargo and passengers on a ladder-type chassis. Just like a semi.

### THREE TOUGH CHOICES.

Choose from the Long Bed, exclusive King Cab® or the Li'l Hustler... biggest choice in compact diesel pickups. Whichever Datsun diesel you pick, you're getting the greatest economy of all: miles per gallon and years per pickup. Just what you'd expect from Nissan Motor Co. Ltd., the worldwide company whose name stands for quality.

Want to go more miles between fill-ups? Go straight to your Datsun truck stop.

**557**

\*MILES EST. RANGE

**33**

EPA EST. MPG

**692**

MILES EST. HWY RANGE

**41**

EPA EST. HWY

Range estimates based on EPA est. mpg and hwy mpg multiplied by 16.9 gal. tank. Use est. mpg for comparison; your mileage may differ depending on speed, trip length and weather. Hwy mileage and range will probably be lower. Not available in California.



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TRUCKS

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## NOTES FROM THE EDITOR

*John A. Sibley*

**S**peak of professional models and most people think of pretty ladies on covers of fashion magazines. Here at PM (hardly anyone's idea of a fashion magazine), we've always found the right models add sparkle to photos of machines and home projects. Look at page 63 and you'll see why we're delighted with the style and animation these two Arizona models added to our story.



Kelly Tiede and Gene Daily add a dash of the Thirties to our vintage economy cars.

The other day, several of us watched as New York City officials announced that the World War II carrier USS *Intrepid* would soon be made into a floating museum in Manhattan. The ceremony was scarcely over when a young man asked if any of us knew pilots who had flown the aircraft of the 1940s in combat. He said he was writing a book.

Today, almost 40 years after America's entry into the war, there seems to be more interest in World War II history than any time I can remember. I wince when I recall the photos of airplanes being melted for scrap right after the war. Too bad only a few people were farsighted enough to preserve some of the aircraft in collections.

Now the *Intrepid* Sea-Air-Space Museum will add to our store of relics from that period. But equally important, it will also preserve historic mementos from the entire history of flight—including the first carrier landings, our early space shots and even the latest: the space shuttle. **PM**

The model at right depicts the carrier USS *Intrepid* as she soon will be—the center of the *Intrepid* Sea-Air-Space Museum in New York. Museum founder Zachary Fisher and Mayor Edward Koch announced the establishment of the museum exactly 36 years after the photo below was taken. The burning *Intrepid* had just been hit by a kamikaze off Okinawa in 1945.





# Seven & Seven. Sounds so good you can taste it.

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Country.**



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

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

17 mg "tar," 1.1 mg nicotine av. per cigarette, FTC Report Dec/79





A trailer that opens to become a camping tent and boat is being developed by the Vesely Co., Lapeer, Mich. Designed for towing behind a compact car and rigged to set

up quickly for lakeside sport and shelter, the prototype Apache Cub also converts for use as utility cargo trailer, or to carry a trolling motor and fishing tackle.

## New for the summer sportsman

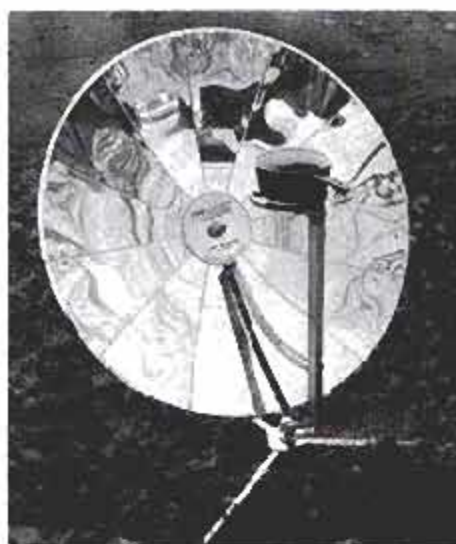
**M**ore action and activities, using lighter rigs and less energy, are among the aims for new warm-weather equipment. Gear is stronger, materials are more durable—and prices are higher.

Little trailers to hitch behind smaller cars are on the market and in the works. Apache is developing a tent trailer for both camping and boating. Empty, it can haul luggage or cargo. Fitted with fold-out frame and canvas, it expands into a camper. Turn over the top, add oars or a motor, and you can launch it for fishing. It's been named Apache Cub, but no production date has yet been set. Already, similar rigs—camping trailers with the new lightweight canoes, kayaks and skiffs inverted and lashed on top—can be seen rolling down highways toward the water.

You can lead your boat to water without a trailer with a drop-in cradle for a pickup truck, invented by Ronald Fluck, 2051 Three Mile Run Rd., Perkasie, Pa. 18944. The cradle has rear wheels and a center plank

*(Please turn to page 18)*

Outdoor gear is easier to use, cheaper to operate and longer lasting. But—no surprise—it costs a bit more.



Sun power for cooking equal to 800-watt hotplate is claimed for \$100 fold-up Sungril from Harthun Co., Cincinnati, Ohio.



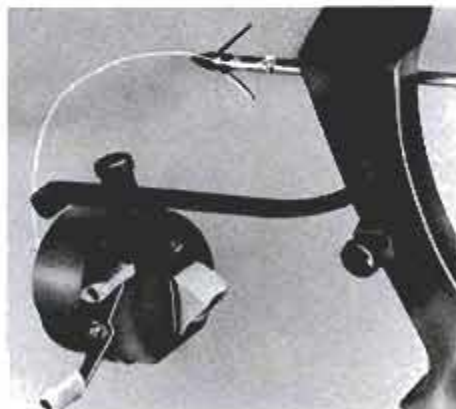
A pickup can replace a boat trailer for craft up to 14 feet with Winch-It System from Fluck Inventions, Perkasie, Pa. 18944.



For launching or hauling out, Winch-It uses a rolling cradle, winch secured in truck's stake holes and tailgate cable supports.



A computerized home weather station with 12 functions and built-in memory is \$1,010 from Edmund Scientific, Barrington, N.J.



For hunting fish with bow and arrow, Saunders Archery, Columbus, Neb., provides a new mount for a standard spinning reel.



Garden tractors, snowmobiles, motorcycles can also be loaded with quickly installed, hand-winch Fluck system.



## NEW FOR SUMMER SPORTSMAN

(Continued from page 17)

that should allow the boatman to launch or haul out his rig without getting wet. Alternately, 2-inch x 12-inch x 10-foot planks can be used as ramps to winch small tractors or motorbikes aboard. Cables support the load on the tailgate. Fluck Inventions now has the \$400 Winch-It System on the market.

High quality and high prices have recently turned knives and guns, even new ones, into collectors' items. Both custom-made and production knives now use top-grade stainless steel that can hold an edge and be resharpened, but does not discolor like carbon steel. Both small pocket knives and larger folding hunter models often feature a lock-back to prevent the blade from folding accidentally. New, clean designs make many attractive to look at, as well as handle.

Several updated and new rifle and shotgun models have been announced by Winchester-Western. Soon to be available are a slide-action, 12-gauge waterfowl gun with 30-inch barrel and Winchoke, Pigeon Grade side-by-side and over-and-



A customized Smith & Wesson M39, the ASP 9-mm Conversion, \$450 from ASP, Appleton, Wis., has clear, smooth grips.



Called a Sleeper Seat by BJD Enterprises, Box 12, Winnipeg, Man., the inflatable pumps up to make the back seat of any two- or four-door car into a convenient camp bed.



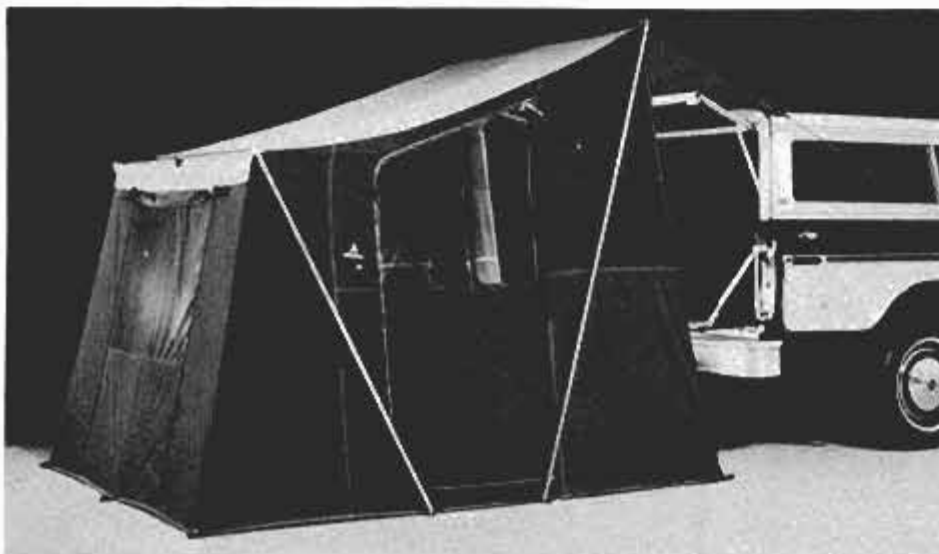
New for sportsman or naturalist, Tasco Bino/Cam 8000 offers wide-angle and tele-photo lenses for \$300 camera-binoculars.



Neat and new, little Silver-Sword from Camillus Cutlery (\$9.95) is stainless steel, has popular Lok-Back, is three inches long.



A handmade knife and sheath form this buckle for a handmade belt; they're \$100 from Bohrmann Knives, Yarmouth, Me.



For stretching pickup-truck accommodations and a camping budget, the Henderson White Stag Pickup Tent adjoins cap-cover or station wagon for tailgating in roomy comfort.

under lightweights with intricate engraving at over \$1,000 each, and a 6¼-pound Featherweight Model 70 rifle. And if rumors are true that Winchester may change ownership, these should become collectors' specials, too. For competition air-gun shooters, Daisy is introducing International Match .177-cal. pellets.

A big-league, 10-foot saltwater surfcasting rod that telescopes down to four feet is now made by Powerscopic for \$43, and a seven-footer that retracts to 14½ inches and reverses the handle for spinning or fly casting is \$30 from the El Segundo, Calif., firm.

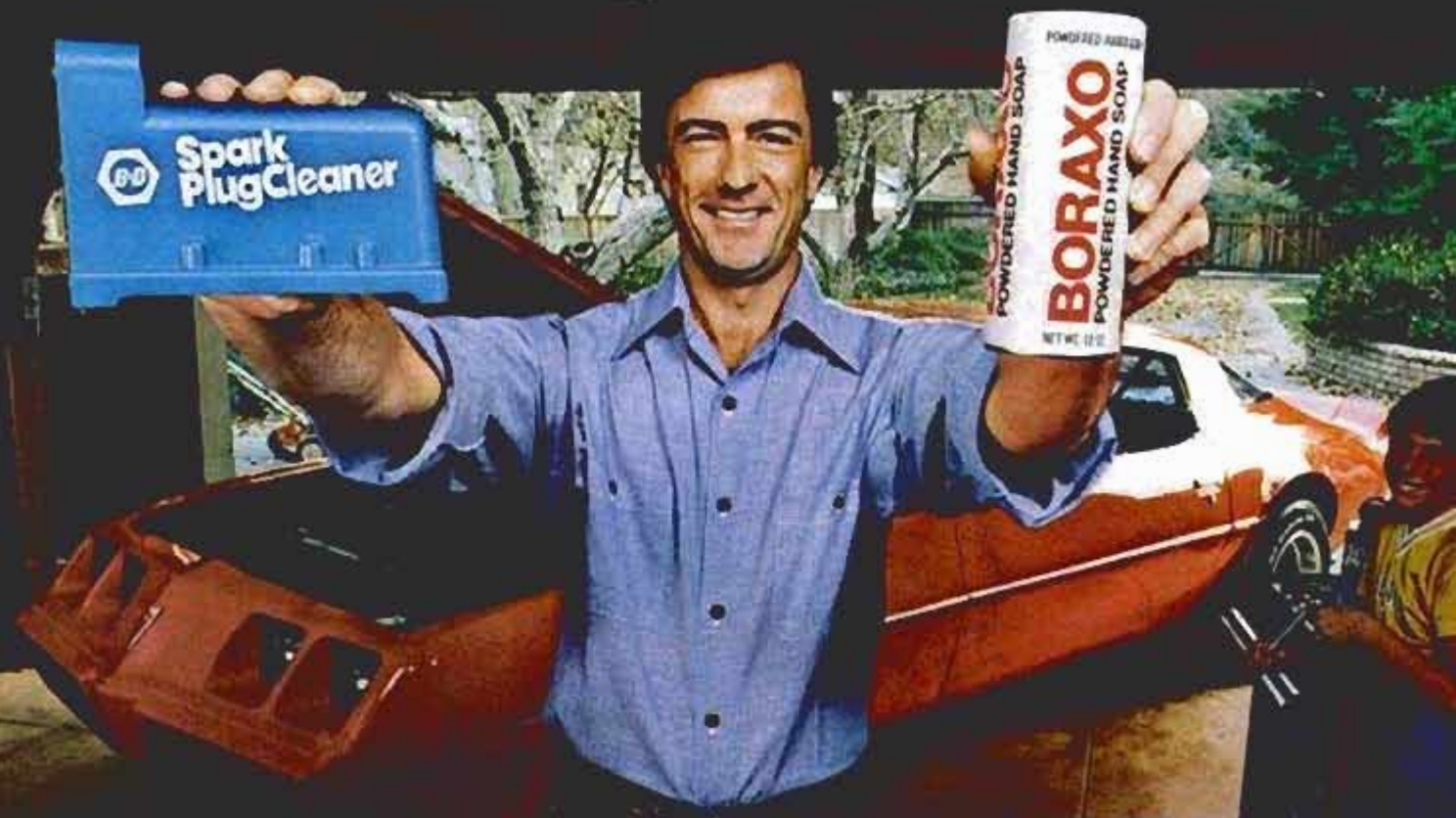
—Bill McKeown



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1. Trim, then peel the UPC code from the BORAXO container.
2. Cut off the top flap from the box of Spark Plug Cleaner (including model #9514).
3. Fill in your name and address on the form below.
4. Send these items with a copy of your Spark Plug Cleaner sales receipt to: Spark Plug Cleaner Rebate Offer, P.O. Box 9345, St. Paul, MINN 55193.

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They have the size and weight of "minis"... the features of "maxis." Features like a full gear shift and a tiller handle with built-in idle adjustment and stop button. Many competitive motors don't even have gearshifts, and their idle adjustments are inside the motor cover. Both our 4.5 and 7.5 have quick,

sure-starting MagFlash® electronic ignition... anti-friction ball and roller bearing design throughout for longer life... plus shallow-water drive, with a one-handed angle adjusting trim rod, for close-in fishing convenience.

### It's a long way between fill-ups.

Our 7.5 comes with a three-gallon gas tank... our 4.5 with either a three-gallon tank or an integral 2.1-quart tank, with a remote tank adapter kit available. Both use so little fuel that most fishermen we know won't use enough gas in one season to fill the tank of a full size car.

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Think of all the fishing water that's right in your own backyard... just a couple of hours away. Then think how easy it is to enjoy weekend after weekend with the family, in this great backyard. See the complete line of Johnson® outboards from

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OUTBOARDS



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# ALL OUTDOORS

## Swimming for shore

This time of year, when water sports reach their peak, many good swimmers are going to get in trouble and some may drown, according to the oceanographers of the National Oceanic and Atmospheric Administration (NOAA). When experts and beginners alike find a rip current "undertow" is pulling them rapidly offshore, their normal reaction is to try to swim rapidly straight back to land. They shouldn't.

Long, gently sloping sand beaches frequently have shifting spots where water washed in by the waves is channeling back out again. Sometimes, the NOAA agency of the Commerce Department points out, bathers can see the breaks in the wave patterns where a rip is heading seaward. But frequently, the first sign of difficulty is when a swimmer is carried out much faster than he can swim back. Don't try, advises NOAA—you'll quickly become exhausted. Instead, swim parallel to the beach. Usually the rips are only 10 to 20 feet wide. Once away from the outflow, it's possible to swim easily back to shore.

The cold waters of early season are also a hazard, and the American Canoe Assn. recommends that when air and water temperatures add up to less than 100°F., you should don a wet suit to help offset the chance of hypothermia. The cold-water chill factor that cuts a swimmer's survival chances can sometimes cause unconsciousness, but actually delay death from drowning. So, it's always wise to try extensive resuscitation efforts, say survival experts.

## Fighting the sea

What's required of boats and gear to withstand marine conditions, and why are they so expensive? A good answer comes from the Underwriters Lab tests set up to simulate a warm salt-air environment and check the life expectancy of nautical equipment.

In a recent test of distress signal flags, the exam began by soaking a flag in salt water for two hours and placing it in a 95-percent humidity chamber for 15 days at 104°F. Next, the flag was mounted in a motorized window frame that lowered it into a vat of 131°F. salt water for three minutes. Then it was raised for three minutes of simulated 40-knot wind at the same 131°F. temperature, and then lowered again. These

three-minute, in-and-out cycles were repeated nonstop with the automated equipment for 24 hours. The flag was then checked for color retention, shrinkage, tears and condition of the hoisting grommets. Flags that pass are found to be in compliance with Coast Guard regulations.

## Medicine versus motion

Test-piloting fighter planes, practicing aerobatics, crossing oceans in small yachts, racing in offshore marathons and rough-riding off-road vehicles, I've never met up with motion sickness—yet. But I'm sure I could get seasick, just like most people, if the conditions were right. NASA reports that 30 percent of American astronauts and Russian cosmonauts have experienced some motion sickness, and they are in better physical condition than most of us.

Now NASA and CIBA Pharmaceutical have announced an anti-motion treatment available for space-shuttle travelers and outdoorsmen,



Medicinal disc worn behind ear is a space-age development to aid motion sickness.

as well. Called the Transderm-V System, it's a little disc about the size of a quarter and requires a doctor's prescription. Instead of taking it by mouth, you remove the adhesive backing and paste it on the skin behind your ear. It then releases scopolamine through your skin into your bloodstream; it's claimed to work for three days if the disc is worn continuously.

It is also reported to have fewer side effects while relieving the usual seasickness symptoms. Some conventional motion remedies (and other drugs) can cause drowsiness, blurred vision and fuzzy judgment. An outdoorsman should probably

check with his doctor and test any remedy before driving a car, shooting a gun, steering a boat, flying a plane—or piloting a space shuttle—where it's important to be constantly alert.

## Sportsmen who save

"Conservation" sometimes means a campaign to keep a wilderness or waterway activity or area for only a select group to enjoy. But, fortunately, there are now less possessive sportsmen who want to share outdoor activities. Zebco, the big fishing tackle manufacturer, is encouraging a campaign that gives special recognition to anglers who return to the water all fish that they won't eat. In just a few months, 1,700 fish have already been released alive and ready for another fisherman. Anyone who catches and releases a fresh or salt water game fish can write to Zebco FishAmerica Sportsmanship Award, Box 270, Tulsa, Okla. 74101, for an entry blank. Fill in the details of the catch, send it back, and you'll receive a patch, decal and certificate.

Fly fishermen have a similar opportunity, thanks to the Scientific Anglers/3M Trophy Release Club, 223-2S 3M Center, St. Paul, Minn. 55144. Send them a letter giving details of a trophy catch, estimated weight, tackle used, when and where the trophy was caught and released, a photo if possible, and \$2.50 for club registration. In return, the noted rod, line and reel maker sends a pin, certificate and membership.

And for hunters, membership is available in I.A.P.G.T., the International Association for the Preservation of Game for the Table, a wild game gourmet society. Its motto is: "If you're not going to retrieve it, clean it, cook and serve it—don't shoot it." Dues in the nonprofit organization are \$15, and entry blanks come from Box 22457, Louisville, Ky. 40222. **FM**





# NEW NOW



# BOATING



## Three-way windjammer

A rowboat that can switch to power, then to sail is the 8-foot Hauler Dinghy from Homar Boats, 29 Mack Dr., Edison, N.J. 08817. The craft is \$789, weighs 70 pounds and can take a 2-hp outboard.

## Gear for more action afloat

There are digital regatta timers and digital depth finders—now there's a digital speedometer for Hobie Cats and other high-speed sailboats. Reading up to 99.9 mph, the Catspeed is \$217 from S. Maremont & Assoc., 8717 East Weldon Ave., Scottsdale, Ariz. 85251. Knot-log models also show distance traveled.

Sun power as well as wind power? Inland Cruising Yachts, Route 10, Box

255E, Orlando, Fla. 32820, calls its 18-foot Ocean Breeze sloop the first energy-self-sufficient sailboat. Cockpit solar panels charge batteries that power an auxiliary electric motor for speeds up to 5 knots. With cabin sleeping four, it costs \$10,000. Or for no-cost muscle power, there's the little \$130 Man-U-Motor outboard from Man-U-Troll, Ennis, Tex. A hand lever spins the prop.



## Rowing for the fun of it

Called the fastest of its kind afloat, a new 18½-foot, sliding-seat, rowing skiff designed by Britton Chance and named the Encounter is \$1,675 from Small Craft, Box 203, Essex, Conn. 06426. Competition oars and canoe seats fore and aft are included in the price.

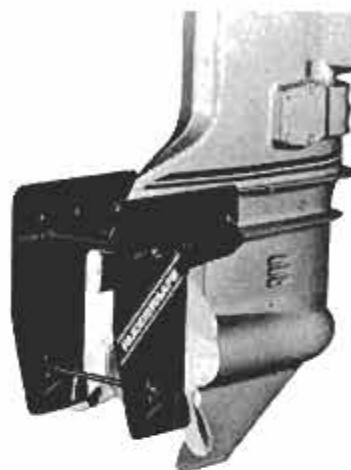


## Pontoon houseboat

A 34-footer that can sleep six, but needs only an outboard motor of 35 to 80 hp, the Explorer from Kayot Boats, Mankato, Minn. 56001, has mechanical steering, LP stove, refrigerator, toilet, water heater. It's \$20,000.

## High-speed steering

Add throttle to a big outboard motor or sterndrive and prop torque can turn the boat. Tru-Trim from Morse Controls, Hudson, Ohio, is claimed to eliminate torque steer. Self-adjusting fins deflect the prop stream. It's available for \$230.



## Low-speed control

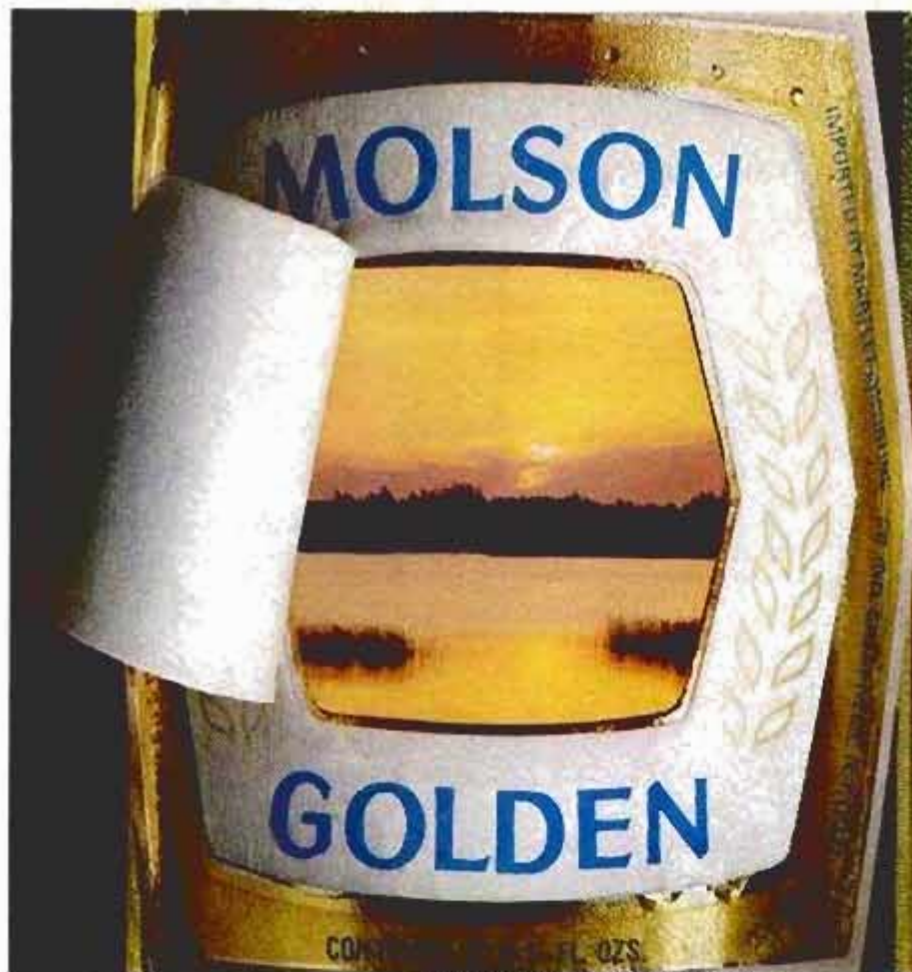
Easing into or away from a dock is a time when exact steering is needed, but is most difficult at slow throttle. Ruddersafe, from American Foreign Industries, 1085 Shary Circle, Concord, Calif. 94518, fastens to outboard and I/O lower units to add dual rudder surfaces. It planes up out of the way at higher speeds, helps protect prop when backing, costs \$160 to \$206.

## New digital tachometer

OMC Parts and Accessories calls its latest tachometer, available at Evinrude and Johnson dealers, the Quartach. Its quartz-crystal control gives exact outboard or I/O rpm.







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The sharpening business allows you to get started with only a minimum investment, requiring little space and effort for a successful operation. It lets you build and expand as fast, or as slowly as you like. You pocket most of the money you take in, because there are exceptionally high profits with no investment in merchandise.

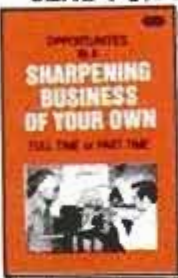
If you need only \$200 or \$400 extra income each month, a sharpening business is ideal for spare time. The additional dollars can be SPENT for more of the good things of life. Or they can be SAVED in a rainy-day fund that the family can bank on.

**More sharpening businesses are needed every year**

As original equipment continues to climb in cost, owners are becoming more concerned that the equipment be maintained so that it performs like new. This means more companies, contractors, carpenters and home owners are having their old saw blades and tools resharpened many times, where in the past, they would have replaced them with new blades or tools. This is where you

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STATE \_\_\_\_\_ ZIP \_\_\_\_\_

# PHOTO HINTS

## A reel trick



A bent coathanger or other piece of wire can save you a considerable amount of aggravation. Use it to snare a developing reel and pull it out of the tank.

—Robert Hertzberg

## Picture this



The instruction sheets of most films include a chart detailing exposure values for various lighting conditions. Cut this out and rubber cement it to the back of your camera.—Bob Berger

## A clear winner

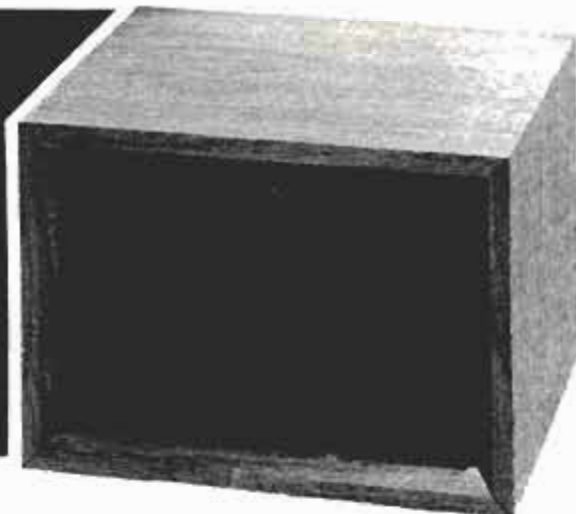


It's a common misconception that amber bottles are best for storing developer. Clear bottles are cheaper, easier to use and preserve your chemicals just as long.—Robert Hertzberg



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Protects Every Square Inch Of Your Building  
Turns On Lights Automatically  
Powerful Electronic Siren



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Just plug the Guardex 8000 alarm system in, make two simple control adjustments to suit your particular building and it works! There are no other wires to run. This totally self-contained burglar alarm can completely seal off every square inch of the surface of your building. It protects doors, windows, and what most alarms miss... your roof, walls and floors.

### HOW CAN ONE SMALL COMPUTER PROTECT MY WHOLE BUILDING?

Guardex 8000 Alarm System works on the principle of audio discrimination. This, put simply, is the process of electronically separating normal everyday sounds, such as voices, telephones, etc. from break-in type noises such as breaking glass, prying metal, or forcing a door open. The Guardex 8000 protects one story homes and offices up to 2000 square feet and open commercial buildings up to 10,000 square feet. The Guardex 9300 with wireless remote sensor capability is available for multi-story homes and offices or single story with more than 2000 square feet. Call the factory for more detailed information.

### TURNS ON LIGHTS AUTOMATICALLY

When the first break-in type sound is detected, the system will instantly turn on lights, radio, or other electronic equipment that you have plugged into the back of the alarm. These lights or other equipment will remain on for a period of five minutes, then automatically turn off.

### POWERFUL ELECTRONIC SIREN

The Guardex 8000 alarm is equipped with a loud built-in siren. If during the five minute period the lights or other electronic equipment has been activated, a second break-in sound is detected. (It can be only a second or two after the first break-in sound) the built-in siren will start blasting for 90 seconds. At the end of approximately 90 seconds the siren will shut off and the alarm listens again. If another break-in sound is heard, the siren will come on for another 90 seconds. If no other break-in sound is detected, the siren will stay off and at the end of the five minute period the lights will shut off and the alarm instantly resets.

The rear control panel contains two standard AC plug receptacles for a table lamp, spot lights, radio, etc., terminals for connecting optional outside siren and back-up battery (battery not included); entry delay time control and sensitivity control.



The Guardex 8000 Alarm System is walnut grained and disguised to look like a small stereo speaker (6 3/4" x 9 3/4" x 8") and weighs less than 6 1/2 pounds.

### EXIT AND ENTRY DELAY

The Guardex 8000 alarm has a built-in exit delay allowing you approximately one minute to lock up and leave the building before the alarm is armed. When you enter your building you may find that just your normal entering sounds activate the siren. You may delay it from starting for up to 30 seconds by turning up the siren entry delay control.

### BATTERY BACK-UP

Burglars rarely cut power. However, to give you total protection from a burglar and possible power failure, our alarm has provisions for a battery back-up. (Batteries not included). 12 volt lantern batteries are available at most hardware stores.

### THE BURGLARY PROBLEM

The F.B.I. statistics show that at the present rate, one out of every four Americans are going to be burglarized. That is not a very pleasant fact, but it is true. You have a greater chance of being burglarized than being a victim of a fire or automobile accident. The time is now to help protect yourself and your valuables with a Guardex 8000 alarm system.

### WARRANTY

One year, 100% parts and labor when returned to factory post-paid. A five year extended warranty is available for a charge of \$25.00.

### OUTSIDE SIREN

The Guardex 8000 alarm is equipped with a loud, built-in siren, but if you desire an additional siren to mount outside or in an area away from main alarm, they are available with 50 feet of wire for \$29.95. (Connecting terminals are provided on the back of the alarm).

### 30 DAY NO RISK TRIAL

This is your opportunity to purchase an alarm system directly from the factory for only \$239.95. Try it in your home or business for thirty days without risking one cent. Put our Guardex 8000 alarm to your own test. See for yourself! It will protect every window and door from break-in. If you are not completely satisfied, return the alarm within 30 days of receipt for a complete refund. To order your Guardex 8000 alarm, CALL TOLL FREE to charge your credit card or send your check to Guardian Electronics, Inc. in the amount of \$239.95 plus \$4.95 postage, handling and insurance. If you want the optional outside siren, add \$29.95. Optional outdoor 7" x 10" metal warning sign (stake not included) add \$9.95. (California residents add 6% sales tax.)

(If you require more information, call during California business hours, Monday - Friday).

Dealer Inquiries Invited

CALL TOLL FREE  
(800) 423-5499



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## VOLKSWAGEN BUS '61



## VOLKSWAGEN VANAGON '81



# AFTER 20 YEARS WE FINALLY GOT IT RIGHT.

Don't get us wrong.

We got it right 20 years ago.

Even then our big Volkswagen was still the most revolutionary wagon of its time. It could carry about twice as much as the average station wagon.

Only one small problem:

Some people thought it was funny looking.

Back to the drawing boards.

Over the years we came up with a modern, aerodynamic body.

We also made the windows bigger. The doors bigger. The interior bigger. And more comfortable.

The dash more dashing. The engine more energetic. And the suspension more sophisticated.

Which led *Car and Driver Magazine* to say: "What we have here is the Porsche 911 of vans. The Vanagon goes down the road with a car-like assurance that's never

existed in vehicles of this type before."

In short, there isn't a nut or even a bolt that we haven't refined or redesigned since we produced our vintage '61 Bus.

So, in every way, we think that our '81 Vanagon is the most beautiful big Bus we've ever produced.

Alas, one small problem:

Some people still think it's funny looking.

# VOLKSWAGEN DOES IT AGAIN





# Build PM's smart control for your attic fan

Here's a genius among attic fans. It not only knows when you need it, but checks the outdoor temperature before deciding whether to turn itself on.

by Robert Gounard

If your summer nights are usually mild, this smart fan is an economical alternative to airconditioning. An attic fan can quickly cool a house. However, most of these fans have only a manual on-off switch or a timer to control their cycle. Our smart fan control senses inside and outside temperatures and turns on the fan only when the outside is cooler! As a result, the smart fan doesn't run

unnecessarily, nor does it draw in unwanted warm air.

## How to educate your fan

The existing heating-system transformer powers the thermostat and the fan control. The fan master switch is used at the beginning and end of the season and during fan maintenance.

Look at the controller schematic:

A voltage proportional to the difference between inside and outside temperatures is amplified by the operational amplifier circuit (IC1), with the fan relay (K1) as its load. D.c. power is obtained by rectifying the 24 v.a.c. from the thermostat in rectifier IC2.

All parts may be mounted on a 4½×5½-inch perforated circuit board. Leads from components, and hook-up wire, are soldered directly to one another, eliminating terminal strips. Bending the leads through the perforated board provides plenty of mechanical strength. Component layout is not critical. We arranged parts as they are drawn in the schematic.

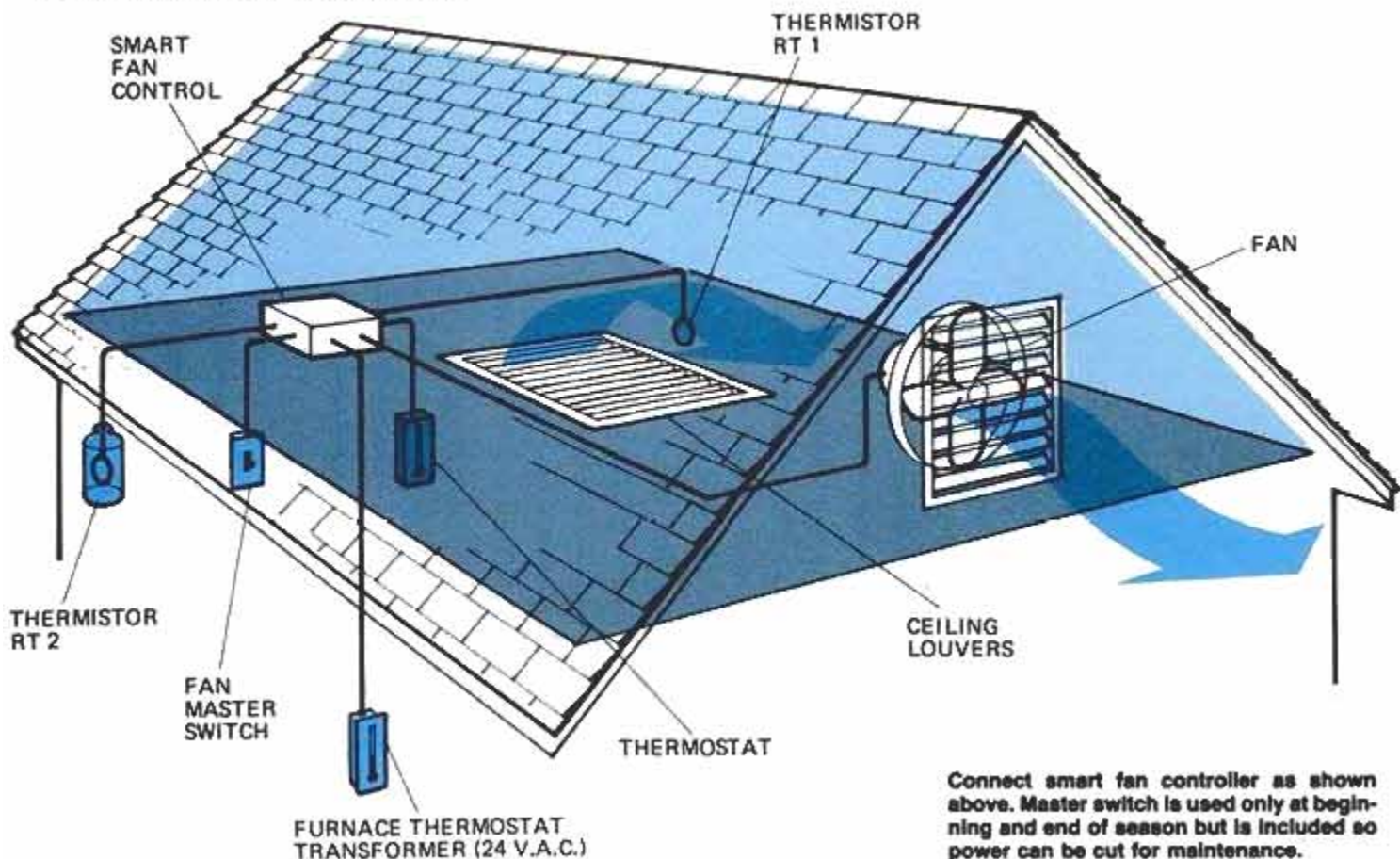
## Hooking it up

A few changes must be made to the existing heating system. The heating thermostat had terminals R and W only and was replaced. The line labeled "common" was run from the furnace in the basement, adjacent to the plumbing's soil stack, to the attic where the controller is located.

Now look over the wiring diagram of the thermostat. The only modification made was to bend the switch contact shown by a dotted line so that contact is *not* made. This allows

*(Please turn to page 28)*

## How PM's smart fan works



Connect smart fan controller as shown above. Master switch is used only at beginning and end of season but is included so power can be cut for maintenance.







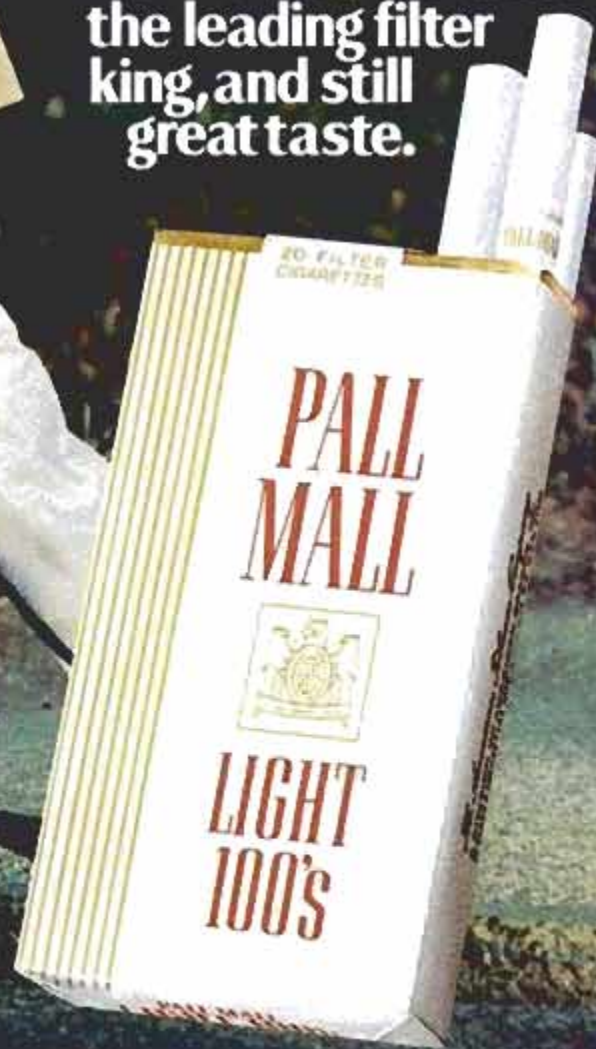
Did you say  $\frac{1}{3}$  less tar?

Pall Mall Light 100's.  
A third less tar than  
the leading filter  
king, and still  
great taste.

Pall Mall  
Light 100s 10mg tar, 0.8mg. nic.

Leading filter king 16mg tar, 1.1mg. nic.

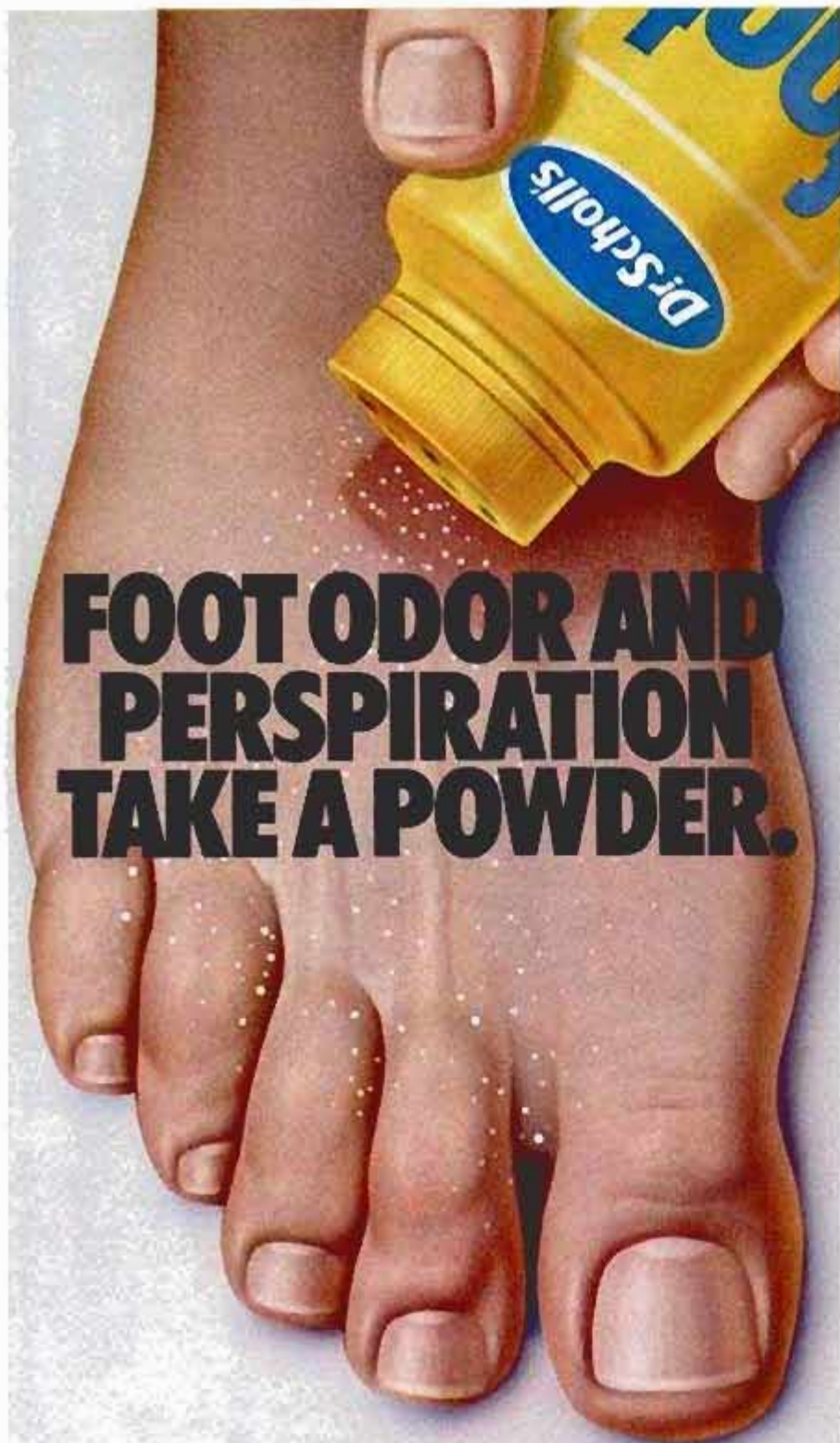
Lowest brand  
less than 0.01mg. tar, 0.002mg. nic.



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

10 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.





# FOOT ODOR AND PERSPIRATION TAKE A POWDER.

Foot odor is often caused by hot, perspiring feet. Which is a big problem for people on the go. But Dr. Scholl's Foot Powder absorbs moisture to help keep your feet cool, dry and comfortable all day.

For more persistent problems, Dr. Scholl's Chlorophyll Foot Powder goes right to work neutralizing odor and refreshing hot, tender feet.

And for extreme odor and perspiration, use Dr. Scholl's Bromidrosis Powder. It's specially formulated to fight odor and absorb even the heaviest perspiration.

If you're worried about foot odor, just remember: it takes a powder from Dr. Scholl.



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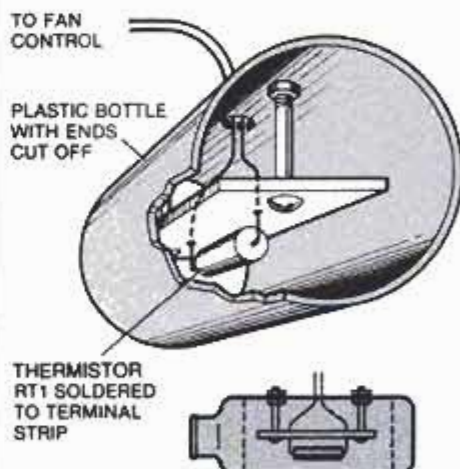
You might wish to install an automatic high-temperature cutoff switch like one here. In case of fire, it shuts fan down.

## BUILD PM'S SMART ATTIC FAN

(Continued from page 28)

the thermostat applies power to the controller. If the outside temperature is cooler than inside, the fan comes on. If not, the fan stays off until the outside is cooler.

We have found the smart fan's performance entirely satisfactory. The fan cycles on and off during the



The outside thermistor assembly should be housed in a plastic assembly. See the text for details on how to construct it.

late afternoon, night and early morning, and is usually off during midday. The first gust of a summer thunderstorm can cause the fan to come on and take advantage of the cool air.

PM

### PARTS LIST—SMART FAN

- C1—33- $\mu$ F ceramic capacitor
- IC1—741CE op. amp. (or equiv.)
- IC2—Bridge rectifier (Radio Shack 276-1152 or equiv.)
- K1—D.p.d.t. relay, 12 v.d.c. (Allied 703-1005 or equiv.)
- Q1—VN40AF power FET (field-effect transistor, or any transistor capable of handling relay current)
- R1, R2—680-ohm resistor, 1/2-watt
- R3—22,000-ohm resistor, 1/2-watt
- R4—50,000-ohm potentiometer
- R5, R6—150,000-ohm resistor, 1/2-watt
- R7, R8—3,900,000-ohm resistor, 1/2-watt
- R9—11,000-ohm resistor, 1/2-watt
- R10, R11—90-ohm resistor, 2-watt
- R12—60,000-ohm resistor, 1/2-watt
- R13—1,400,000-ohm potentiometer
- Misc.—Perforated board, flea clips, wire, solder, cabinet, and necessary tools.



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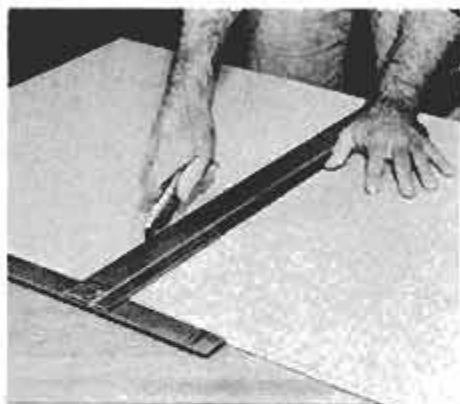
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# WORKSHOP MINICOURSE

## MORE ABOUT PLASTERBOARD



The easiest way to cut plasterboard is with a sharp utility knife. Always use a straight-edge—either a warp-free board or a 4-ft. T-square (above). The first cut in drywall is always made on the front surface.

When it comes to working with plasterboard, do-it-yourself books and magazines tend to focus on how to patch a drywall—as though that's the only thing that homeowners do with the material. At least that's the conclusion I came to after going through many magazines and a shelf full of books.

What my research showed—and what my personal experience as a teacher of an adult-education class verifies—is that many people want information on *installing* drywall.

There are two important steps for plasterboard installation: cutting and making cutouts.

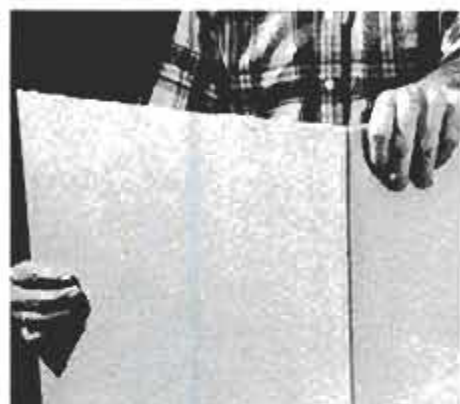
If you do either carelessly, you will have a sloppy job at best, and wasted materials at worst. Plasterboard is surprisingly easy to work with. The biggest difficulty is handling it—especially when you're working with the thicker panels and when applying panels to a ceiling.

### Cutting plasterboard

An ordinary utility knife is the best tool for cutting plasterboard. Select one with replaceable blades because the gypsum core dulls them rapidly. Don't be miserly, either: When the blade dulls, replace it.

Work with a straightedge. Professionals use a metal straightedge such as a 4-ft. T-square which spans the width of a full panel.

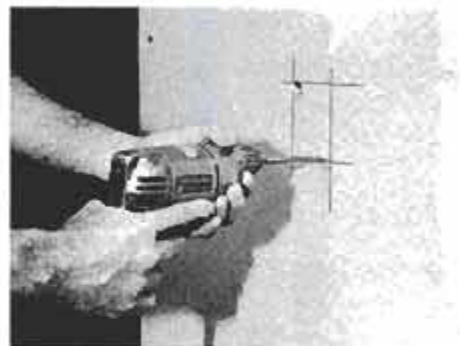
In some instances, you may have to make a freehand cut; when this is necessary, follow the pencil line with your razor blade, bearing lightly on it. Then make another pass over the first incision to complete the cut through the facing paper.



Next, snap the board carefully—as though closing a book. Grasp the panel on both sides of the cut to avoid possible breakage caused by a falling piece of plasterboard.



If the cut edge is rough (has heavy ridges), smooth out the edge by using a coarse file or a Surform rasp, as shown here.



If you prefer, you can use a portable drill and a 1/2-in. spade bit to bore entry holes for the keyhole saw (or use a sabre saw).

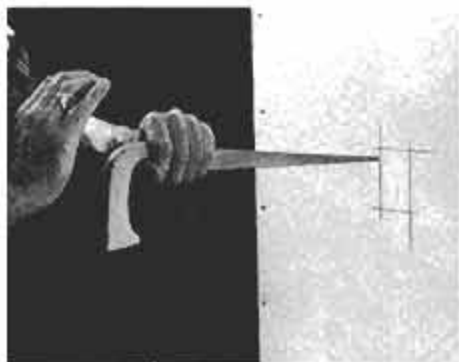
Always make the face cut first so that if a ragged edge is produced, it will be on the back side.

### About cutouts

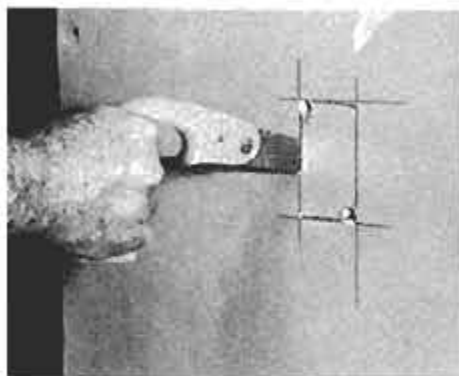
The critical element in making cutouts is measuring. Take the dimensions, lay them out on the board and double check. If the cutout is made with the board on the wall, use the method shown here. **PM**



To complete the cut, you must cut through the backing paper. To prevent damage to the drywall when cutting large pieces, lean the sheet against the wall with the scored line in the vertical position. Then you should make this cut from the rear.



An easy way to make a cutout in panel field is to position a keyhole saw on line and then give the saw handle a sharp rap.



After inserting tip of keyhole saw, cut the first line. Then repeat for the other three.



BY  
HARRY  
WICKS



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## OWNERS REPORT: FORD GRANADA

(Continued from page 32B)



Granada proved to have ample interior room, and a high quality of workmanship.



The most common choice of engine was in-line Six, that owners claimed was weak.

Michigan school business manager volunteered, "This car has comfort! It drives and maneuvers extremely well. On a recent trip to New Orleans, the car performed great. It was a joy to drive and we arrived without fatigue."

A California industrial worker: "It's the sort of good-riding car that doesn't make you tired on long trips. There's plenty of room for four adults."

And a military man from Minnesota says, "My wife and I believe this is, by far, the best-riding, most comfortable car we've ever driven, especially in the front seat. Visibility and handling are also superior."

When asked about workmanship, 77.8 percent of our respondents rated this aspect *good to excellent*. That's pretty much an average score—it leaves room for improvement. Yet the majority of owners have no complaints. The following comments about quality and workmanship are representative.

From a Georgia mail carrier: "Mechanically, this is a good car, but dust filters into the trunk and also gets behind the plastic covers over the instrument faces."

An Illinois lawyer: "Put together average; right front door sticks; several screws installed improperly; and much more engine noise with the Six than my 1976 Monarch or '80 Mustang."

An Ohio carpenter: "Workmanship isn't up to the standards of my 1976 Granada Ghia."

And an Alabama accountant: "Quality is generally good, but I don't believe the quality of any current American car is comparable to that of years past. When I compare the Granada to similar models in the same price range, though, this car's quality and workmanship certainly get my approval."

Fuel economy played an important role in all our respondents' scheme of things. Most owners were pleased with their cars' gas mileage. Some 20 percent had expected better figures, but of those, most reckoned mileage would improve as the cars got more use.

Ironically, drivers of V8-engined Granadas reported getting better mileage than those with Sixes. The 4.2-liter V8 outdid the 3.3-liter Six by 1.3 mpg around town and 2.1 mpg on the highway. The base 2.3-liter Four, though, beat both by that much again, although it didn't live up to EPA promises.

A Tennessee telephone-company engineer made a typical observation: "The car appears to get the combined average indicated on the sticker, but I'd really like to get better in-town mileage."

Granada owners experienced very little mechanical trouble of any sort, the predominant complaint being carburetor maladjustment. Over 75 percent of those surveyed had no reason to take their cars in for anything beyond routine servicing. Dealer service was rated by those who needed it as *good to excellent* by 73.6 percent—a fine showing in that department.

A New York housewife: "I've bought other cars from this dealer, but never received the service he's been giving me with the Granada: really excellent. He even gave me a free wash!" It seems that most dealers are trying hard to keep their customers.

An Ohio yard man: "I'm really pleased with service. The manager even waited for me after closing time."

As we traditionally do, we asked owners to list all the bad things about their cars—the problem areas and aspects they don't like. Complaints tended to be minor and a relatively high 34.0 percent had no negative comments at all. Here's a representative cross section of the rest of our sampling.

"There's no rain gutter over the doors,



Sporty lines and subtle trim make Granada look like a Mercedes, according to some.

so when it rains, water drips into the passenger compartment."—Texas production engineer.

"The trunk isn't deep enough to hold shopping bags in the upright position," a North Carolina contractor told us. This complaint was echoed by a number of owners.

A Louisiana oil inspector: "I'd like to get better fuel mileage with the six-cylinder engine. I'm averaging 14 to 20 mpg. If that's something I have to live with, the gas tank should be bigger."

Unfortunately, it's the size of the fuel tank and spare-tire well that makes the Granada's trunk so shallow. A better solution to both problems (trunk depth and tank size) might be to reposition the tank behind, and partially beneath, the rear seat. "If Mercedes and other cars have figured out a way to position the tank upright behind the seat," noted a New York dentist, "why can't Ford?"

A Michigan program coordinator isn't alone in his opinion that, "... the ashtray is too small and badly positioned." He adds, "... the steering is too sensitive," a feeling not shared by other owners. In fact, many drivers commented on the Granada's quick steering response and the positiveness of the rack-and-pinion system.

An Ohio railroad yardmaster: "The brake and accelerator pedals are too close together, and the column-mounted horn can be equally dangerous. Turn signals and wiper switch also tend to be confusing."

A Ford Motor Co. engineer in Michigan wrote, "I have no real complaints, but I've noticed that when the weather changes, the plastic in the instrument panel begins to squeak."

As mentioned, most owners had no

(Please turn to page 120)



The rear seat has plenty of room for two adults—more than a T-Bird, owners say.





# How My Wife And I Drilled A Well

THROUGH 123 FEET OF  
CLAY, GRANITE AND BOULDERS

Robert Mackey

Unfortunately for me, my home is located in an area that is famous for difficult drilling. There are big granite boulders all over the place. You can imagine what it must be like deep in the ground. That's why most commercial water well drillers won't drill here.

When I told my friends I was going to get a Hydra-Drill and try to drill a water well, they thought I was crazy. "Look," they said, "what makes you think you can succeed where commercial drillers won't even try?" But I'd read that thousands of folks all over the world have drilled Hydra-Drill wells, and I thought if they could do it, so could I.

It was a brand new experience. I wasn't sure how deep I'd have to drill or how long it would take, but my wife got interested in the project and volunteered to help me.

We knew we'd be drilling a lot of rock, and we expected it would go slowly. We agreed to take it in easy stages and follow the instruction book step by step. The big question was whether the Hydra-Drill could handle all that rock. As it turned out, we had to drill through six big boulders. At times, our drilling speed slowed to a few inches per hour, but between the boulders we speeded up tremendously. At times we were drilling as much as a foot per minute. Not bad, not bad at all.

When we reached a depth of 93 feet, I took a mirror and reflected

sunlight down the hole. It was a real thrill to see that we had struck water!

In this area of Nevada, it's sometimes possible to find an underground vein of hot water. If you are lucky enough to find one, you can use the hot water to heat your home and never pay another heating bill. In hopes of finding hot water on our property, we continued drilling to a depth of 123 feet. At that point we had 30 feet of water standing in the well. We measured the temperature of the water, and it was 155 degrees, plenty hot for home heating. We're now using that water to heat our entire home.

We plan on drilling more wells on our property. We're happy to have the hot water. Now we want some cold water for drinking and irrigating.

The really remarkable part is this: we had absolutely no experience in well drilling, and we were drilling in very difficult conditions. We went through blue clay, red clay, decomposed granite and boulders. The Hydra-Drill performed just great, and we saved a bundle of money by drilling our own well.

I can't imagine that there are many places where the drilling is rougher than what we have here. I certainly can recommend the Hydra-Drill to anyone who needs a water well and wants to save money.

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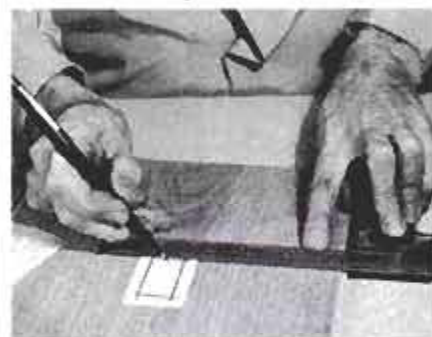
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## HINTS FROM READERS

### Labels aid layout work



Pencil layout mark is easier to read on a paper label than on a workpiece.

Self-adhering paper labels can help greatly in marking the positions of knobs, openings and saw cuts on panels and other surfaces. For example, you can apply a label to the spot where you want to make an opening, then mark the layout directly on the paper. The label fragments are removed easily after the work has been completed.

There are several advantages to using paper labels. You can mark more easily on the label than on many surfaces. If you make a marking error, you can correct it easily on paper without marring the work surface. Layout marks are easier to see on a white label than on most other surfaces. At times, you want to draw a pattern on the label before you position it. Self-adhering labels in many sizes are sold in stationery and business-supply stores.—Walter E. Burton

### Squeeze bottle is bellows

When you need a small bellows to blow sawdust from blind holes and other awkward spots, use an empty plastic squeeze bottle for the job. A small bottle of the type used to dispense ketchup creates enough air to remove sawdust from a small area without stirring up nearby dust that could get into your eyes.

—Lane Olinghouse

### Low-cost hand cleaner

Any dishwashing detergent can be used as an inexpensive substitute for a waterless hand cleaner. Detergent gets grimy hands as clean as any hand cleaner, in some cases for less than half the price.—Robert C. Weaver Jr.



# HINTS FROM READERS

## Glass cutter storage



Just squirt a few drops of oil into a cigar holder and store your glass cutter.

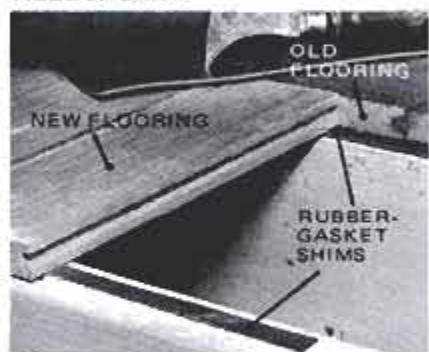
An aluminum cigar tube can provide storage for a glass cutter. Several drops of oil in the tube keep the cutter in shape. A wood block with a hole serves as a stand—*Fred Williams*

## Rubber cement masks chrome

Rubber cement spread over chrome strips works like masking tape to protect trim when you spray-paint a car. When the job is completed, simply rub off the rubber cement.

—*Lane Olinghouse*

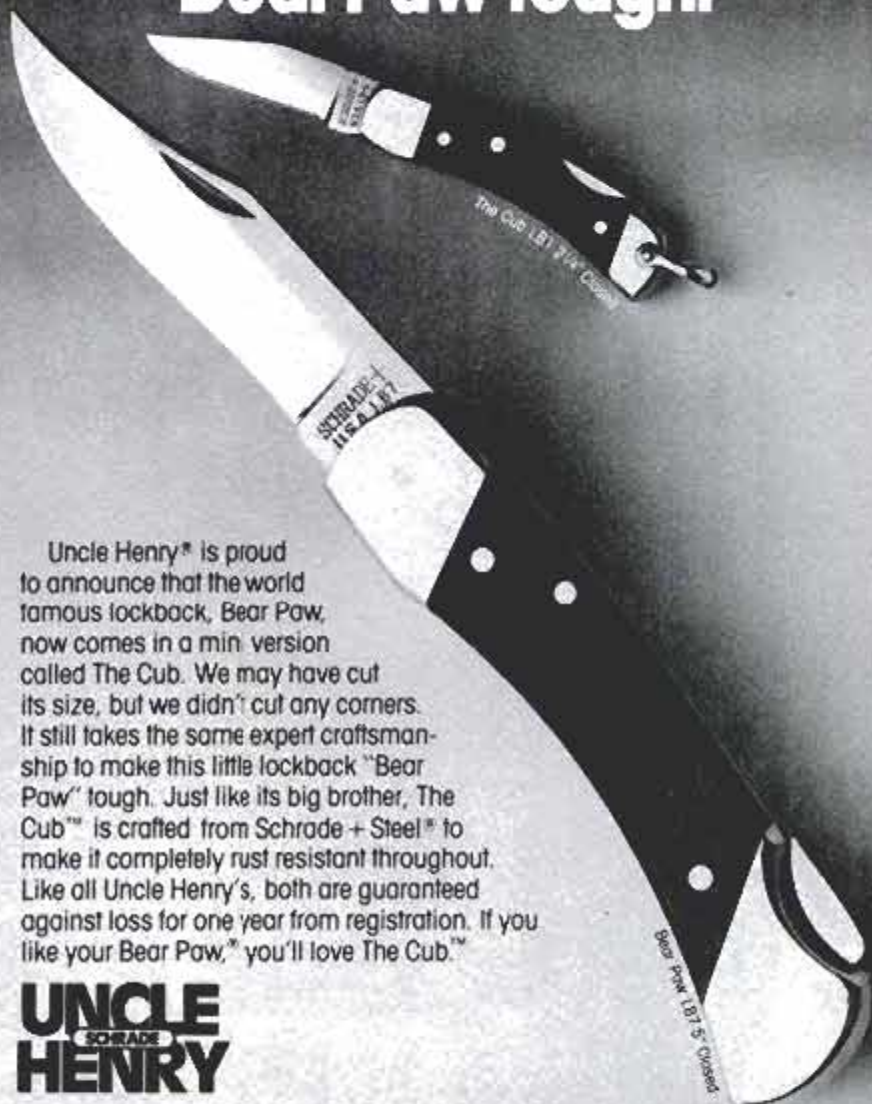
## Rubber shim



Strips of gasket rubber are ideal for shimming new tongue-and-groove flooring level with the thicker lumber of years past. Available at most hardware stores, gasket rubber is quick and easy to use, but is tough, water-resistant and long-lasting.

—*David W. Roberts*

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# New mobile phone system: GRIDS FOR GAB



Transmitting and receiving towers for the Advanced Mobile Phone Service (AMPS) are shown above. Photos were taken in the test city, Chicago. There are three towers per hexagonal cell (left), and each tower can relay a message from one cell to another.



Rooftop antennas for cars have coiled segment, so they're small and easy to install.



The master switching complex is the heart of the AMPS system. Here, a computer will decide how a message is to be routed.

Mobile telephones are in the process of changing—they're becoming more reliable and easier to use. We look at the AMPS and Synapz systems, which both speed conversations through a network of antennas.

by Marc Stern

**T**wo new systems promise to make mobile phone service less expensive and more reliable. Bell Telephone's AMPS system, which was tested in Chicago, received Federal Communications Commission (FCC) approval recently. Another system, called Synapz, is awaiting approval.

Today's mobile phone system is heavily overburdened; there are only 25 channels for 120,000 users, with 25,000 on the waiting list.

If you make a call on today's system, your car's transceiver sends a

signal to a powerful transmitter which covers an area of about 25 miles. This powerful transmitter (usually on top of a tall building) sends your call to the telephone switching office. One call takes two full channels, and often the main transmitters from different areas interfere with each other.

Bell's new system, AMPS, is a cellular phone system that divides a city into hexagonal cells—in the center of each 1- or 2-mile cell is a low-power, 40-watt transmitter operating in the microwave frequen-

cies. It's connected through a computer to a switching station. Car transceivers are also computerized.

When a call is received, the master switching computer "polls" each cellular transmitter's computer. Each cellular computer then polls the mobile units in its area. When the right cell is found, the computers route the call in the most efficient manner. The new system will open 666 voice channels.

Transmitting sites are shifted as

*(Please turn to page 135)*



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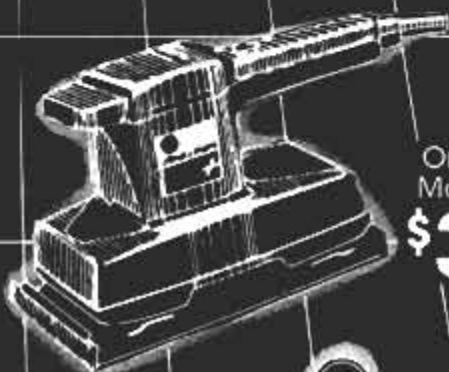
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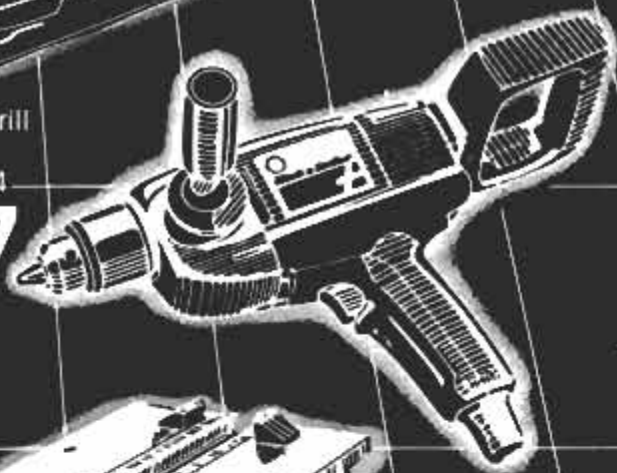
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Model No. 7224

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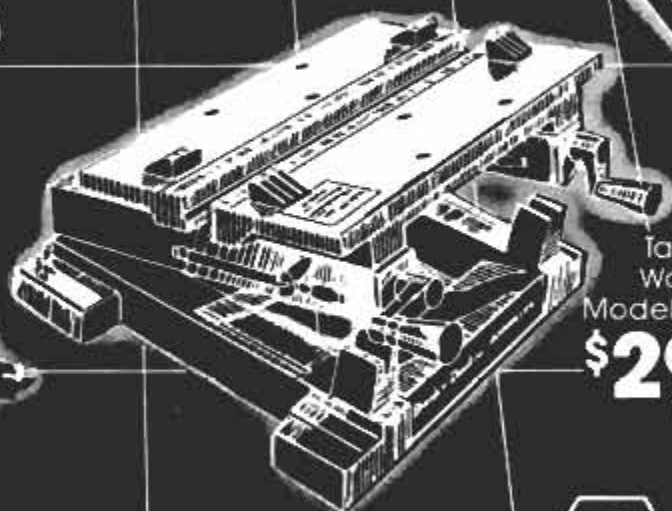
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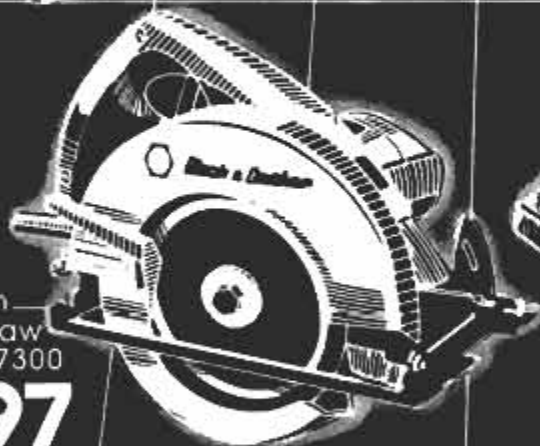
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# APPLIANCE CLINIC

## QUESTIONS ANSWERED

### Iceberg in the freezer

I have a Sears Coldspot frost-free refrigerator with top freezer, model 106-7618440. Lately, the ice cubes in the bottom of the ice pan melt, then refreeze into a solid block of ice. What causes this?—E.P. Lowas, Hot Springs, Ark.

Sounds like a bad defrost terminator. The electrical contacts in the control could be stuck closed. This activates the defrost heater for the entire 20-minute defrost period, instead of only when the temperature falls below a certain level.

The defrost terminator is located in the freezer compartment under the freezer bottom and it is attached to the evaporator coil with a metal clip. The Sears part number for the 70° defrost terminator is 482697. Replacing this part is a fairly complicated procedure; the plastic breaker trim in the freezer compartment can break if it isn't removed properly. Our suggestion is to have a service technician replace it.

### Slow-spin washer

My problem is with a Westinghouse front-loader washing machine, model LT560LXW1. I'm having difficulty with the spin cycle. I've replaced a worn eccentric pulley and spinner belt, and have checked the spinner shaft, idler sleeve, slider pulley and high-speed sheave. I've also had the motor checked for proper rpm. The washer makes a grinding noise as it spins, and at times it stops spinning during the cycle. The clothes aren't coming out dry enough.—Thomas Close, Kittanning, Pa.

You've gone over the machine pretty thoroughly, but you might also look for a worn tub bearing. First make sure the tub is empty. Remove the rear access cover and take the belts off. Turn the spin pulley (the big, round one) slowly by hand. Check for up and down movement on the shaft. If the drum binds or makes a moaning or grinding noise, replace the bearing, shaft and seal.

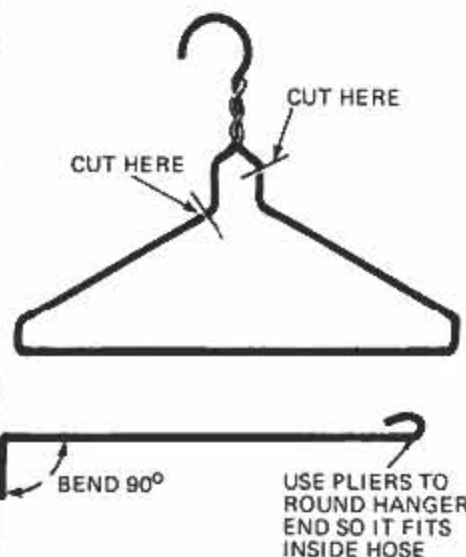
If you want to tackle the job yourself, write to White Westinghouse, 930 Fort Duquesne Blvd., Pittsburgh, Pa. 15222. Ask for service manual No. L-72SE9953. It costs \$4.60, plus state tax and \$1 handling. Section 6, page 14, of the manual explains how to remove and install the tub bearing and seal. Good luck!

### Food flecks

We have a Hotpoint HDA 860-02 dishwasher. The glasses don't rinse clean unless I use the heavy pot cycle. On the regular and light cycles, food particles that should rinse off go up into the glasses and are dried on them. This happens even after the dishes are rinsed first. Is this a common problem and is there any solution for it?—Mrs. J. McCombs, Midland Park, N.J.

Look for a partially blocked or kinked drain hose. This usually results in poor washing.

Disconnect the power to the dishwasher. Next, remove the front



A wire coat hanger (top) can be cut and reshaped (above) for use as a snake to remove any blockages from a drain hose.

access panel. Remove the drain hose from the pump outlet and also from the drain hookup under the sink. Remove the hose and straighten it out. You can use a metal coat hanger to remove the blockage. Cut the hanger with pliers, as shown, and straighten it. Bend one end back on itself so the sharp tip won't damage the hose. Bend about 4 in. of the other end to a 90° angle for use as a handle.

Insert the round end of the hanger into the hose and gently push out any foreign material. After the blockage is free, rinse the hose with water and reinstall it on the dishwasher. Turn the power back on and you should be in business.

### Coil out to lunch

The warmer coils on both of my Mr. Coffee coffeemakers are not working.

These units have seen only about six months of service. Can you help me?—Frank Lecki, Chicago.

The warmer and heating coils in your coffeemaker have no measurable life expectancy, according to the maker. However, the product carries a one-year warranty against both defective workmanship and materials, providing the customer has performed proper home maintenance of the product: keeping it clean, following the instructions and delimiting the unit periodically. If you're within this time limit, take the units to a service center. If these measures are followed, the manufacturer feels the coffeemaker could last indefinitely.

### Garlic-flavored ice cubes

My Signature (Montgomery Ward) frostless refrigerator, model HMG 1570, has an automatic ice maker. It makes ice cubes that have an extremely bad odor and taste, somewhat like onions or garlic. I have cleaned the entire refrigerator, but the problem still exists. What is really baffling is that I can freeze the same water in other plastic ice cube trays in the same freezer and the cubes smell and taste fine. Do you have any suggestions?—Steven Waldo, Muncie, Ind.

The air in your refrigerator is constantly being circulated between the freezer and refrigerator section by the circulating fan. Uncovered food such as onions, garlic and melons are some of the most common foods that will give ice cubes an unpleasant odor or taste. The ice cubes act as a sponge, absorbing any strange odors in the refrigerator.

It appears that the plastic ice-cube tray in the automatic ice maker has also absorbed this odor. My suggestion is to replace the plastic tray. The part is No. 6925910. You can purchase it at any Montgomery Ward service center.

Before installing the new ice-cube tray, remove everything from the refrigerator and freezer sections. You could sponge off the entire inside of the refrigerator with vanilla extract. This will help to rid it of any odor.

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.



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**T**itles are great for jazzing up a slide show—for either personal entertainment or a business presentation. Kodak's new Vericolor Slide Film SO-279 makes shooting title slides a breeze.

This new film will also let you make colorful slides from color negatives and even do some very interesting "tricks" to change color values all around.

Kodak's Vericolor film is available through your photo dealer in 35-mm, 36-exposure rolls, as well as in 100-foot rolls. While the film must usually be specially ordered, there is no minimum order.

### From titles to tricks

Using this film means you will also have to have available some color filters and a 3,200K photo flood light source. We used the Kodak Wratten filters mentioned in the tables that follow.



VACATION!  
HAWAII

# New color film makes title slides

Here's the easiest way we've seen to dress up a slide show. This new, easy-to-use film lets you achieve startling effects.

by Frank Lusk

And if you want to copy negatives or slides, you must also be able to produce closeup images. You might consider a set of closeup lenses or extension tubes that will fit your camera.

You will also need a piece of light-colored diffusing material in order to photograph transparent art (I used a sheet of white acrylic plastic).

Copying black-and-white line art produces reversed transparencies

with white letters on colored or dark backgrounds. The background color will be the complementary color of the color filter used. A table is provided on page 37, listing the background colors produced by various filters.

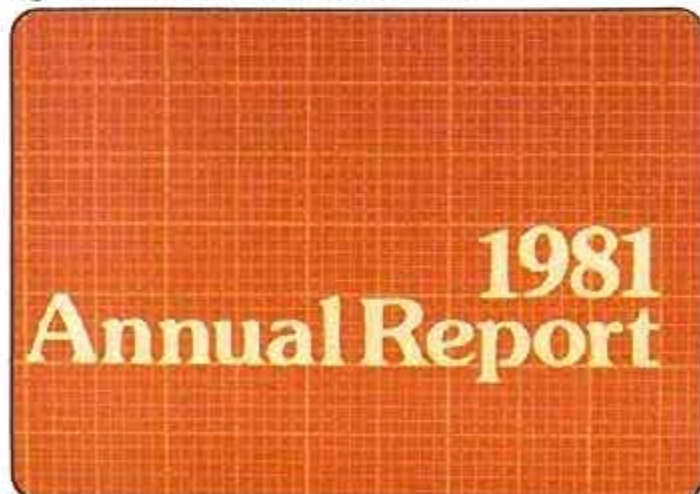
Set your exposure meter to an ASA index of 8. Your exposure times should be between 1 and 8 seconds so the use of a tripod is a necessity. A complete set of light-balancing filters is needed to make slides (posi-

PM photos by the author



Original art (above) can be enhanced using filters and the new SO-279 film.

Use various color filters with the new film to achieve a rainbow of possible backgrounds.



Right choice of filters with this film gives bright, reversed image.



Film also lets you copy materials in new complementary colors.



### BLACK-AND-WHITE DUPLICATION

Desired Background Color	Kodak Wratten Gelatin Filter*	Exposure Increase (in stops)
Dark blue	12 (yellow)	2
Cyan	29 (red)	4
Green	34A (deep magenta)	4
Red	38 (light blue)	4
Orange	44 (cyan)	4
Yellow	45 (deep blue-green)	4
Magenta	61 (deep green)	5
Yellow-brown	47 (deep blue)	4
Dark red	no filter	none

\*Use these filters over the camera lens. Weaker filters give softer colors and may be used for colored lines or text. Stronger filters give more saturated colors.

tive transparencies) from color negatives.

Having some experience with color printing is helpful, but not at all necessary when working with black-and-white originals or when experimenting with the film's unique properties.

SO-279 may be processed at home, using Kodak's C-41 processing kit, or sent to a commercial lab. In either case, you'll have to mount the slides yourself.

More information is supplied with the film. The entire procedure is very simple, even fun, and is more than justified by the results.

### Enhancing images

Making title slides with this new film is one of the more utilitarian uses, but you can also give your creativity full rein. As the tables here detail, you can also use this film with lights and filters to change the color values of normal color shots—even add special-effects-style color to black and white.

The main thing to keep in mind is that too much of a good thing can be simply too much. Experiment with various color combinations on an image *before* you settle for the results.

One thing we found: This is a good film to make repetitive images, but in different color combinations. For a flashy montage effect, try copying the same image under a variety of filters. **FBI**

### COLOR DUPLICATION

Kodak films	Exposed to	Kodak CC filters*
Vericolor II, Type S	Electronic flash or daylight	75M + 60Y
Kodacolor II or Kodacolor 400	Electronic flash or daylight	75M + 40Y
Kodacolor 400	Tungsten	75M + 70Y
Kodacolor 400	Fluorescent	55M + 80Y

\*With tungsten lamps No. 212 or 302.



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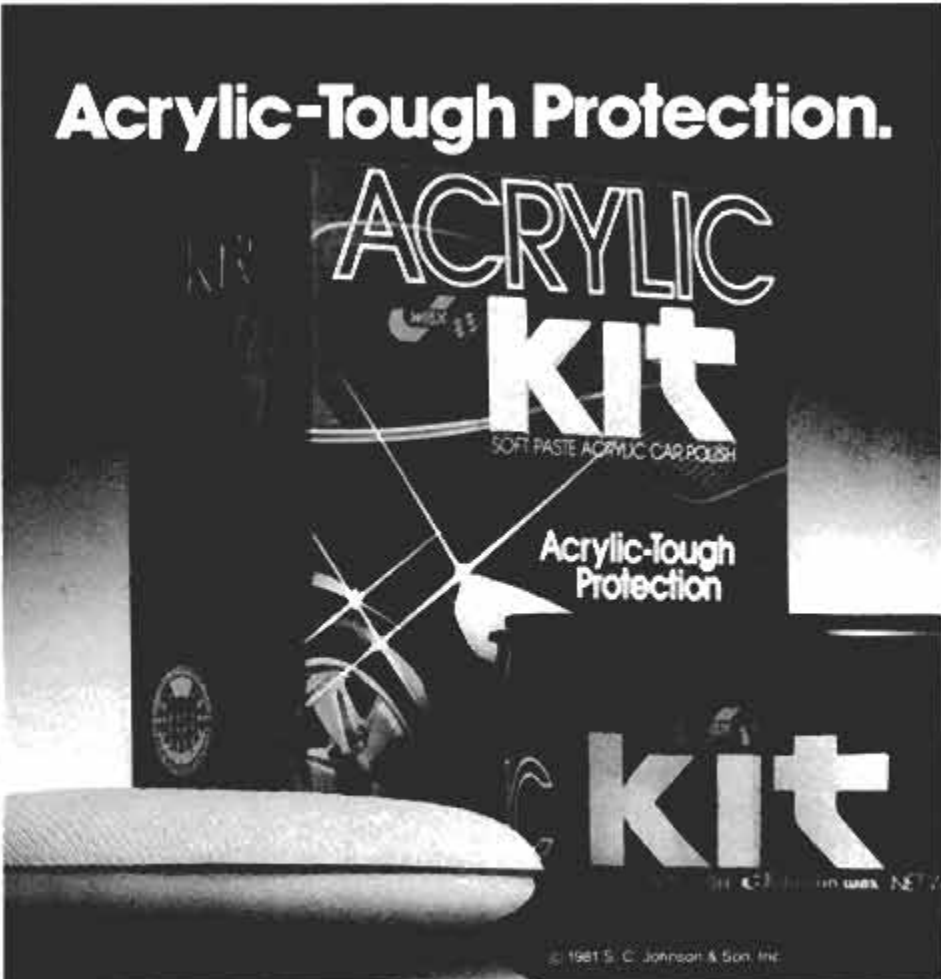
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# CAR CLINIC

SOLUTIONS  
FOR MECHANICAL  
HEADACHES

BY  
MORT SCHULIZ



## Fair-weather friend

*I have an annoying problem with a 1978 AMC Concord (258-cu.-in. engine). The engine stalls only in damp, cool weather. Otherwise, it runs like a top. I've replaced the sparkplugs and cables and I've adjusted the carburetor. But still the engine quits, especially during a short run after the car has been sitting all night. What should I do to solve this annoying problem?—Joseph A. Trembly, New Baltimore, Mich.*

I would look for the following in this order:

- A cracked distributor cap.
- A cracked coil.
- A damaged distributor rotor.
- An automatic choke that's not releasing soon enough because of a defective choke vacuum break, or a choke that's not working properly because of a defective choke heating element.
- Icing in the carburetor. Dampness, along with ambient temperature in the 45° to 55° F. range, make carburetor icing a possibility. If you get this far without tracking down your problem, try some gas-line antifreeze.

## Adapter adaptation

*My 1980 Chrysler LeBaron 318-cu.-in. engine is leaking oil from around the oil filter. I've replaced the filter several times, thinking that was the problem, but so far, I've had no luck. Is there something wrong with my engine?—George Bell, Riverside, Calif.*

Probably not. It sounds as if you're having a problem with the oil filter adapter, which has malfunctioned on some 318- and 360-cu.-in. Chrysler Corp. engines. The bolt holding the aluminum adapter to the cylinder block loses torque and allows oil to leak. This makes it appear that the leak is originating from around the oil filter, which isn't necessarily the case.

There should be no problem correcting the trouble. In fact, the procedure is outlined in service bulletin 09-03-08 (9/22/80). Remove the oil fil-

ter adapter and clean the surfaces. Reinstall the adapter, using the following parts:

1. Adapter-to-cylinder block gasket (part No. 3577674).
2. Adapter-base screw gasket (part No. 2463512), which goes between the adapter and the adapter-to-cylinder block gasket.
3. Metal core gasket (part No. 4105210), which fits like a washer on the bolt.

## Sore throat

*I own a 1978 Jeep CJ-5 Renegade (258-cu.-in., six-cylinder engine) that starts well, hot and cold, idles perfectly and has good acceleration. So what's my beef? Occasionally, when I'm driving at highway speeds and I decelerate to a stop, the engine idles rough and/or stalls. When I give the accelerator pedal a quick blip with my foot, the engine gets squared away.*

*Remember, now: This doesn't happen every time the Jeep is driven. Maybe that's why several mechanics I've spoken to have different theories. Care to give me yours?—Doug Burge, Centralia, Ill.*

Why not! Maybe on those occasions when this occurs, your deceleration procedure is particularly vio-

lent. You may be cutting your foot off the accelerator pedal rapidly and hitting the brake pedal hard, causing fuel to spill from the carburetor into the manifold and creating a temporarily over-rich fuel condition. Blipping the accelerator pedal may allow the manifold to clear its throat by sending a sudden rush of air through the carburetor into the manifold.

Well, it's a possibility.

## When 'loose' is 'tight'

*I have a 1979 Dodge Omni 024 that vibrates at 2000 to 2800 rpm. The vibration is coming from under the floor, so I believe it's being caused by the exhaust system. In fact, one published report about the car said that there was a buzzing and/or vibration from the exhaust. The dealer hasn't been able to help me. Can you offer any suggestions?—Vance White, Paterson, N.J.*

Yep. Exhaust-system alignment is particularly critical. If the system is not tightened from a "relaxed" position, you'll get a resonance. This may sound odd, so let me explain what I mean.

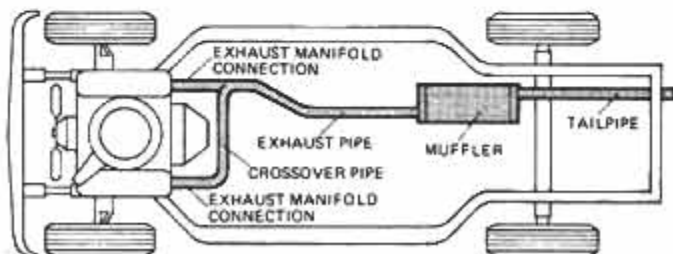
To align this exhaust system correctly, loosen all mounting bolts and let the parts center themselves. This is what I mean by getting the exhaust system in a "relaxed" position.

Now tighten up the mounting bolts to 256 inch-pounds. Pay special attention to the ball-joint coupling between the exhaust pipe and the engine manifold. This is the most likely source of resonance if it isn't secured properly. The joint moves back and forth as the engine moves. This prevents breakage that could result from back-and-forth motion of the transverse-mounted engine. After loosening exhaust pipe-to-en-

*(Please turn to page 40)*

## A matter of life and death

The recent deaths of four people sitting in a buttoned-up car in Long Island should focus our attention on the insidiousness of carbon monoxide (CO). Too many of us think warnings about the dangers of CO are so much bull. They aren't. Obviously, one way to safeguard yourself and passengers from CO poisoning is never to sit in a car with the engine running and windows closed. Another way is to inspect exhaust-system parts every six months: Look for holes, rust, looseness or any other indication that the system has failed or will soon fail. If there's a problem, alleviate it by replacing the affected part or parts. This illustration shows the exhaust system of a V8 engine with a crossover. The crossover is frequently overlooked by someone who is performing an inspection. So are exhaust-pipe-to-exhaust-manifold connections. Don't forget that cars that have dual exhaust systems have two independent systems which serve the engine.







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## CAR CLINIC

(Continued from page 38)

gine manifold flange-bolt nuts, tighten them to 250 in.-lb.

### Let's dance

*My new 1980 Pontiac Catalina with 4.3-liter engine has a jerking motion when the car hits a speed of about 40 mph. The dealer says that this is being caused by a new torque converter that's supposed to give better fuel efficiency, and there's nothing that can be done to rectify the condition. I can't believe that this is a normal operating mode for a brand-new car. I hope your answer will bring me peace of mind.—Manuel Rodriguez, Miami*

Your home-town newspaper, *The Miami Herald*, published an "Ode to General Motors" that summed up the problem pretty well. Written by "Anonymous," the ode goes:

"Do not chuckle at a chuggle,  
Tis an automotive struggle,  
Tis a quirk with a jerk  
That will drive you half berserk,  
Make ye weep with despair,  
As it's quite beyond repair."

Every 1979 and 1980 GM car with a Turbo Hydra-Matic (THM) 200 transmission and new transmission

converter clutch is susceptible to conditions that GM calls "chuggle" and "bump."

According to a service bulletin sent to dealers, "A new condition, which will be referred to as the 'chuggle,' is best described as a varying fore and aft vehicle motion when driving at a constant speed with the converter clutch engaged. This condition has been diagnosed as engine surge, engine miss, or even as tire and wheel imbalance. This is normal, and repairs should not be attempted." ("Chuggle" results from the sensitivity of the torque converter to the engine feedback system.)

"Another condition related to the converter clutch is what could be described as a 'bump' when the accelerator pedal is released abruptly," the GM service bulletin continues. "It results from engine torque reversal and is a normal condition. Repairs should not be attempted for this condition."

My experience has been that the "chuggle" is least objectionable when the new torque converter is needed most to help fuel efficiency—that is, at cruising speed.

In deference to GM policy, I've been told by a GM engineer that if

## New Life for blades



If windshield wiper blades are chattering or causing smears or streaks, accumulated dirt may be the reason. Follow this procedure before deciding to discard blades:

- Turn the ignition switch to the accessory position and turn the wipers to low. When the wipers rise on the windshield, turn ignition off.
- Lift blades off the windshield and wipe them clean with a household window-washer solution. Don't force blades laterally across the windshield. This puts stress on the windshield wiper motor, which may be damaged.
- Using clean rags or paper towels with window-washer solution, wash the windshield. If you are dealing with so-called "hidden" windshield wipers, be sure to clean the glass where the wiper blades park themselves.
- Rinse the windshield and the blades with water. Rub them dry, using either clean rags or paper towels.



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# LEADERS HAVE TASTE



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## A&C GRENADIERS—THE TASTE LEADER

you were to have a toggle switch tapped into the converter clutch electrical circuit, you could switch the clutch off and on. In other words, at lower speeds you can throw the toggle switch to the OFF position and when you're cruising down the highway, you can flip the toggle switch to the ON position. All that an electrical specialist would need to make this modification would be the wiring diagram of the converter clutch circuit, and that's provided on page 7A-2 of the 1980 Pontiac service manual supplement. The same wiring diagram is contained in the service manuals of other 1980 GM cars that have the THM 200 and transmission converter clutch.

### Down Mexico way?

*My Ford F150 pickup has the 351M engine. Does "M" mean that the engine was made in Mexico? This engine misses while idling and no one has been able to find out why. What are the auto mechanics missing?—A.T. Harris, Chattanooga, Tenn.*

The letters "M" and "W" are used to distinguish between 351 engines made in Cleveland, Ohio, and 351 engines made in Windsor, Ont. Your 351M engine was made in Cleveland.

If it had been made in Windsor, it would be designated 351W.

If you've ruled out all the usual causes of missing at idle that are listed in troubleshooting charts in the service manual and general automotive books, perhaps the problem is a loose rear intake-manifold vacuum fitting. To repair it, follow these steps:

1. Take off the vacuum fitting and inspect it. If it's damaged, purchase a new one from a Ford dealer.

2. Clean and degrease the intake manifold and vacuum-fitting surfaces, using either trichloroethylene or alcohol. Do not use kerosene or gasoline since these substances leave a film on surfaces that affects sealing.

3. Apply Loctite No. 242 Thread Lock (part No. D5AZ-19554-A) to the threads of the vacuum fitting and install the fitting in the manifold. Let the Loctite sealer dry for 30 minutes before you start the engine.

### 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

■ Squeaks or pops from the exhaust systems of 1980 Omnis and Horizons during acceleration and deceleration are being caused by defective exhaust pipe-to-exhaust manifold seal rings. Chrysler has issued a new, improved ring (part No. 4150666). To install it, raise the vehicle (engine cold), disconnect the exhaust pipe from the exhaust manifold, remove the old seal ring, replace it with a new one and tighten bolts to 250 in.-lb.

■ GM has two new engine oils, API SF-CC and API SF-CD, that can be used in 1978 to 81 diesel-engine cars. Use SAE 10W-30 when the temperature is usually at or below 32°F. and SAE 30 when temperature is above 32°F.

■ Speaking of GM, the company recommends that you use only fuel filters which come in boxes that specifically say the filters are made by GM. Some fuel filters are being sold in unmarked boxes that look like the GM box. The plastic check valves in some of these filters have broken apart and particles have entered the fuel bowl, where they have wedged the needle valve open, causing engine flooding.

■ Severe ping in 1979 Mustangs and Capris with 302-cu.-in. engines can occur if the vacuum hose vibrates loose from the thermal vacuum switch (TVS) under the air cleaner duct. Through dealers, Ford is distributing a bundling strap (part No. 382987-S) to help prevent this. Wrap the strap around both the TVS vacuum connector and the air cleaner duct to keep the hose in place.



**TAKE  
JUST A  
MOMENT  
TO COVER  
THESE  
POINTS.**

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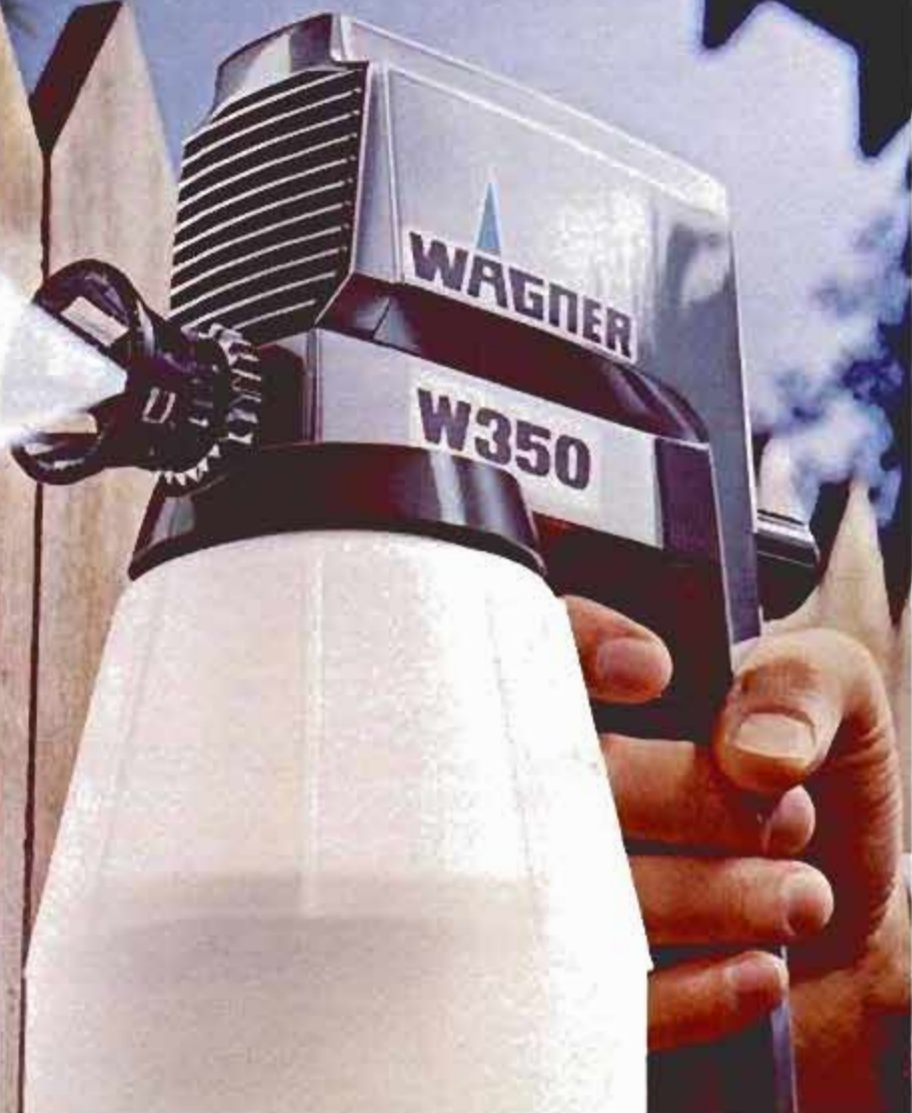
**CLEANER:** The Wagner Power Painter's "airless" design is new technology. It gives you better control with much less mess. And clean-up is easy.

**BETTER:** The new Wagner Power Painter provides a smooth, uniform finish without visible brush strokes or lap marks. It's great for painting houses, both inside and out, fences, shutters, wicker and much more.

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# HOMEOWNERS' CLINIC

## QUESTIONS ANSWERED

### Removing latex paint

How can I remove latex paint that was applied over oil-base paint on my kitchen walls? I believe I may have read the solution recently, perhaps in your magazine.—John M. Stanley, Everett, Pa.

My paint-chemist consultant at Sherwin-Williams says that it is preferable to paint over these walls without removing the existing latex paint. If the paint is in sound condition—not peeling or flaking—you'd probably be successful using an oil-base paint. First wash the existing surfaces with a detergent and rinse them with clear water.

If any painted wall surface is in poor condition, it's better in the long run to cover all the walls with new plasterboard and start from scratch.

As an interesting sidelight, the paint chemist would not recommend oil-base over latex paint on a house exterior because oil-base paint continues to oxidize throughout its lifetime. Thus, eventually, it becomes brittle.

Conversely, quality latex paint tends to remain pliable; normally it doesn't penetrate the surface of the wood as much as oil-base paint does. As the substrate expands and contracts due to changing weather, the more brittle oil-base paint may crack and flake off the pliable latex base.

### Removing creosote

In all of the articles I have read in *Popular Mechanics* and other magazines, I cannot find a method for removing creosote from the walls of a tile-lined brick chimney. Do we have to live with it? Don't tell me to try a wire brush.—George Cowan, Springfield, Mass.

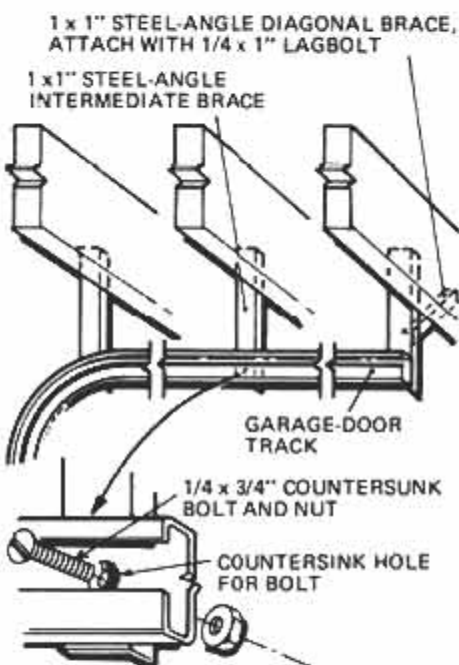
George, I can't speak for other magazines, but PM doesn't prescribe "living with it." Since you don't want to hear about a wire brush, you may not want to read further. Others can find the answer in *Sweep Your Flues Clean and Avoid Costly Chimney Fires* (page 110, Jan. '80). Yup, you use a brush.

### Garage-door lullaby

Our new split-level ranch has a two-car garage under two bedrooms. The garage door is opened by an automatic opener, which vibrates and hums when operated. I'm sure our new

baby, who will occupy one of the bedrooms, will be disturbed. How can we rectify the noise problem?—Patrick Mok, West Peabody, Mass.

Most noise associated with overhead garage doors is due to vibration. Start by reinforcing the existing brace at the end of the track with a diagonal brace to prevent the track from swaying. Then, midway between it and the door opening, add an intermediate brace (see drawing). Make sure that the brace is fas-



To reduce vibration of a garage-door opener, add intermediate brace between existing ones and a diagonal brace to end one.

tened with a flathead bolt in a countersunk hole in the track. It must not interfere with the rollers. Securely fasten the other end of the brace to a joist with hefty wood screws.

You can sound-deaden the garage ceiling by adding unbacked insulation between the joists and ½-in. sound-control board under the carpet on the second floor.

As a last resort, you might substitute rubber rollers for the steel ones. Of course, they will wear faster than

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's *Home Care Guide*. \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

steel. An overhead garage door is naturally noisy, but a combination of the above solutions will help.

You can purchase Soundstop, a sound-control board made by Celotex, at your lumberyard. Rollers with rubber tires are available from Napoleon Spring Works Inc., Box 160, Archbold, Ohio 43502. They're about \$4.20 each, plus handling.

### Fireplace add-on

I want to put a free-standing fireplace in my basement family room and tie it into my existing chimney. I would have to go up 2 ft. and over almost 7 ft. If this is okay, how close can I run the horizontal to the ceiling? Can I enclose it in a suspended ceiling? My existing furnace is natural gas and my 70-year-old house has a brick chimney with a metal liner.—Gregory Wieskamp, Nicholas, Iowa

It isn't recommended that you run a horizontal stovepipe more than 8 ft. Joints in pipe must be fastened with at least three self-tapping screws.

The NFPA (National Fire Protection Assn.) has some very explicit rulings on this subject. The minimum clearance from a stovepipe to the combustible ceiling is 18 in. The stovepipe must be supported by non-combustible brackets every 4 ft. Pitch the pipe slightly downward toward the stove; assemble it with the crimped (smaller) ends toward the stove.

Even if you had an extra 18 in. below the stovepipe for your hung ceiling, the pipe couldn't be installed in such an enclosed space.

Don't forget, these uninsulated pipes get mighty hot from the high-temperature flue gases. Your fireplace must be vented into its own flue; otherwise, flue gases and sparks may pass from one flue opening into another. Also, multiple connections could cause poor operation. **PM**



BY JOHN GAVNOR



# DETROIT LISTENING POST

## GM's fwd intermediates

Three of the four new front-wheel-drive intermediate cars from General Motors will sport new handles when they enter the market this November.

Chevrolet will go with "Celebrity," Pontiac with "A6000" and Oldsmobile with "Cutlass Sierra," while Buick will continue to bank on its popular Century moniker.

These new A-cars will share the X-cars' 104.9-inch wheelbase, drive train and chassis design, but will be slightly longer, 200 pounds heavier and more roomy inside. That means the ubiquitous 2.5-liter (Pontiac) four-cylinder will be the standard engine and the (Chevy) 2.8-liter V6 will be optional.

One new twist, however, will be Olds' new 3.2-liter diesel V6 (which GM chairman Roger Smith says is as quiet as a gasoline V6) as a second engine option.

Both two-door and four-door body styles will be available, all notch-backs.

Interestingly, all four GM divisions will keep their old-style, rear-drive A-car (Malibu, LeMans, Cutlass, Century) four-doors and wagons for the time being, along with the just-restyled A-special (Monte Carlo, Grand Prix, Cutlass Supreme, Century Regal) mid-size personal cars.

The popular X-cars will remain virtually unchanged except for some trim and cosmetic improvements. The facelift that has been performed on Buick's X-body Skylark is shown in the photos below.



Buick Skylark for '82 will feature a new grille and a slightly restyled rear end.



## Small Lincoln due for '82

New this fall at Lincoln-Mercury dealers will be a Thunderbird-based Lincoln Continental, replacement for the ill-starred Versailles and competitor to Cadillac's Seville and Chrysler's Imperial in the "small" luxury sedan market. Wheelbase will be the T-Bird's 108.4 inches, while weight and overall length will be some 600 pounds and one foot less than the GM and Chrysler competition.

Power comes from a fuel-injected, small-block V8 driving through Ford's four-speed overdrive automatic transmission, with a new Canadian-built Ford V6 a possible option. The traditional Rolls-Royce-like vertical Lincoln grille and quad headlamps head up the front; a Seville/Imperial-like "bustle" trunk and (guess what?) a counterfeit continental kit bring up the rear. A four-door model only, it should go for about \$20,000.

## Down, but far from out

Despite its well-publicized money troubles, Chrysler is carrying on with plans to launch at least five new models this fall. First come the "Super Ks," three inches longer and considerably plusher than the standard Aries/Reliant, from their special luxury interiors to their (yuck!) opera windows. Called Chrysler LeBaron and Dodge 400, they will be two-door-only at first, but four-door and wagon LeBaron versions will follow later in the model year.

The new fwd Chrysler LeBaron also will be available as a (drum roll) convertible! (See photo, page 70.) Chrysler plans to test the water to see if a convertible comeback is in the cards for America's automakers. Theft, vandalism, dirty air, stereo and airconditioning combined to sink the open-air American car, but some imports and aftermarket top-choppers have carried on successfully, despite high prices (see page 70). The Ks will be converted in small quantities at first by Cars and Concepts Inc. of Brighton, Mich.

Based on the economical fwd L-car (Omni/Horizon) platform, Plymouth Scamp and Dodge Rampage will be Chrysler's answers to the Japanese pickups and especially VW's fwd, Rabbit-based minihauler. Both 1.7- and 2.2-liter Fours will be available, load rating will be close to a

half-ton, and estimated highway mpg will be in the 40-plus range.

Meanwhile, it will come as no surprise when the company drops all of its full-size cars, as well as the mid-size LeBaron/Diplomat two-door and wagon models for '82. The rear-drive LeBaron with plushed interior, luxury grille and formal roof, takes the New Yorker name, while the Cordoba/Mirada personal coupes and luxury Imperial will be carried over with little change. All rear-drive models will be built in Canada, with U.S. plants going 100 percent with fwd cars.

## Two-seater fever

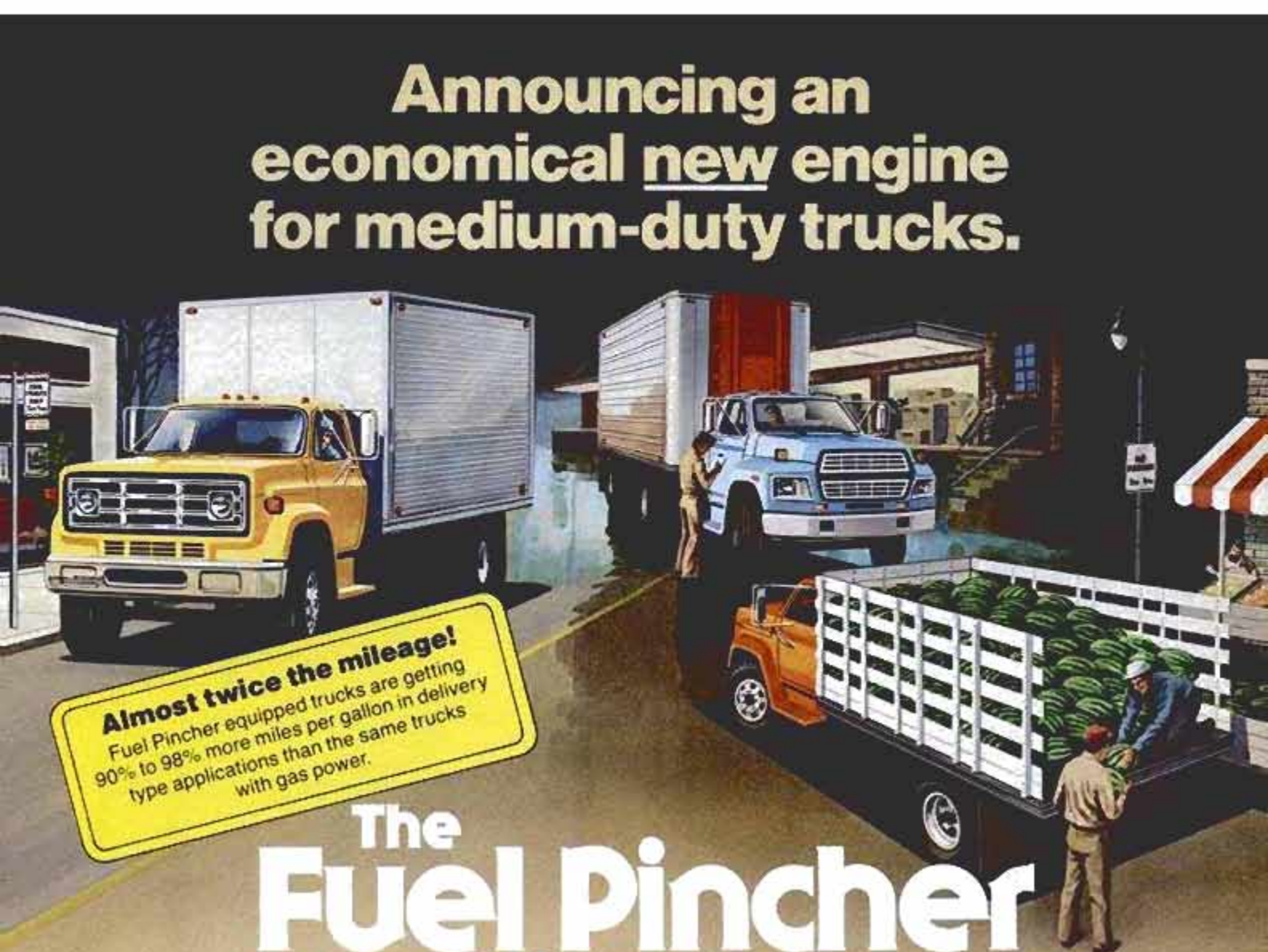
While the convertible may be on the verge of a small-scale comeback, the Detroit-built, two-seat sports and sporty cars are threatening to become a whole new, and very competitive, market segment. Ever since Ford dropped its two-seat T-Bird after just three years of production, Chevrolet's Corvette has had things all its own way. But while the Corvette's unchanging ways have rendered it increasingly too big, heavy, expensive and fuel-inefficient, import interlopers such as Datsun's 280-ZX and Mazda RX-7 have been expanding the market and even stealing some of it away.

Now come the just-introduced Ford EXP and Mercury LN-7, to be followed by Pontiac's plastic-bodied, mid-engine P-car and an all-new and smaller (but no less costly) Corvette for '83, rumored K-based sports cars from Chrysler and even a mini-Riviera-type two-seater that Buick is looking at for a possible '84 or '85 introduction. Seems a lot of Detroit planners see the affordable two-seat "personal" car as the "ponycar" of the 1980s, what with so many single folks and childless couples. **FM**





# Announcing an economical new engine for medium-duty trucks.



**Almost twice the mileage!**  
Fuel Pincher equipped trucks are getting 90% to 98% more miles per gallon in delivery type applications than the same trucks with gas power.

## The Fuel Pincher Diesel

### A brand-new design

The Fuel Pincher is not a converted gasoline engine, or an old diesel that's been modified. It is a completely new V-8 diesel available in 165 or 205 horsepower models. With an exclusive swirl-fire combustion system that provides maximum mixing of fuel and air to "pinch" power from precious fuel.

### Delivers substantially better MPG than a comparable gasoline engine

Depending on your operation, the Fuel Pincher Diesel should give you much higher MPG than a comparable gasoline engine doing the same job. At today's fuel prices, this can mean a substantial reduction in your operating costs. Enough to pay back the moderate extra cost of the Fuel Pincher in a surprisingly short time.



### Offers remarkable performance

The Fuel Pincher Diesel performs much like a gasoline engine. It starts quickly and easily, even in cold weather. Delivers strong acceleration from a standing start or when passing. And provides the torque you need to climb hills under load.

### Keeps downtime low

The Fuel Pincher is built with sturdy diesel construction to be dependable and spend little time in the shop. It has no carburetor or electrical ignition system. No spark plugs. No special emissions equipment. So it should help you cut both downtime and maintenance costs compared to its gasoline counterparts.

Find out more about the economical new Fuel Pincher Diesel—including its 50,000-mile/24-month limited warranty—from your local truck dealer. Or call

1-800-521-0121  
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Tell your dealer you want the Fuel Pincher Diesel.  
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## Find the case of C.C.\* we hid along the Lewis and Clark trail.

We retraced Lewis and Clark's historic expedition up the Missouri River into Montana. And where they found their roughest going, we hid a case of the smoothest whisky, Canadian Club.

Where Lewis and Clark had floated the unspoiled river, Canadian Club's rafts followed. We tested our nerves, as the explorers had, on the wild rapids of the Clark's Fork.

As we explored those historic Montana streams, we buried a case of Canadian Club overlooking the very site of one of the expedition's most important sightings. One clue: neither Lewis nor Clark made it.

## Discover the taste of the world's finest whisky.

As you search along this historic trail, remember Canadian Club has a proud history of its own. For over 120 years it's been enjoyed by those who seek the very best. Canadian Club is lighter than Scotch, smoother than bourbon, and enjoyable on the rocks, in a sour or Manhattan, or with your favorite mixer.

So come search along the Lewis and Clark trail to discover why it's "The Best In The House," or simply venture down to your favorite bar and say, "Canadian Club, please!"



# Canadian Club

"The Best In The House"\* in 87 lands.

6 YEARS OLD. IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC.,  
DETROIT MICH. 86 & PROOF BLENDED CANADIAN WHISKY © 1981

Материал, содержащий информацию о товаре



# PM WORKBENCH

## PM EXAMINES PRODUCTS AND SERVICES

### Crazy blade

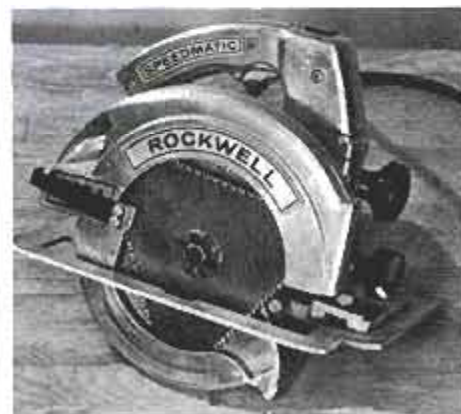
Crazy Saw is a pyramid-shaped saw blade that fits any portable circular saw with a 7¼-in. capacity. It can cut forward, backward, sideways, and even make curved lines (as shown below) in any kind of wood, plywood and particleboard. Its coarse-tooth design and wide set let it make fast cuts. A prototype was used here, but the manufacturer says the blade will be going into production soon and will retail for about \$8. For information, write to Abiqua Sales Inc., 1362 Industrial Way, Woodburn, Ore. 97071.—H.W.



Triangular-shaped Crazy Saw is about the same size as a 7-in.-diameter blade.



Blade versatility is shown in cuts (A) where the blade was pushed straight into wood and moved left, and (B) a curved cut.

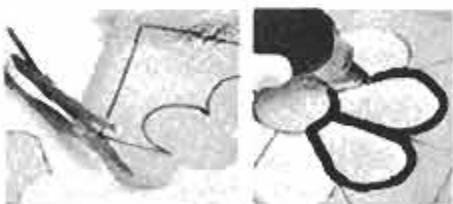


Installation is the same as with any blade.

### Stained-glass look



Saloon sign looks like stained glass, but the material can be cut with scissors.



After tracing the pattern, simply cut (above, left). Join pieces with simulated leading that you squeeze from a bottle.

Although it looks like stained glass, the panel above is made from a polymer-based material called Jolite. It comes in 12 different-colored sheets that can be purchased separately or in kits for specific projects. Each sheet costs \$1.79, and a 4-oz. bottle of simulated lead is \$2.79. Walnut-stained pine frames are available from 9 x 12 in. to 21 x 33 in. The project shown costs about \$35, including a book of patterns (\$2.50). Jolite is found at craft stores or can be ordered from Jolite Inc., 1210 Viceroy Dr., Dallas, Tex. 75247.

—P.S.

### Three new machetes



Machete makes short work of splitting kindling and clearing brush. A leather sheath is available for carrying it safely.

Three machetes have been introduced by Stanley Tools, Dept. PID, Box 1800, New Britain, Conn. 06050. The blades are made of high-carbon, tempered steel and are polished, then lacquered for rust resistance. The plastic handles are contoured for working comfort and attached to the full tang with four brass rivets. Sized at 18, 22 and 24 in., they are priced at \$9.99, \$11.05 and \$12.20, respectively. Leather blade sheaths are also offered at \$13.05, \$15.70 and \$17.70. The machetes are sold in hardware stores.—Steve Willson

### 'Steel' for your wheels



Each 13-oz. can of Steel Wheels covers about 60 sq. ft. (at least 12 wheels). It is priced at \$4.29.

Before spray-painting wheels, remove rust. Mask tires with newspaper and air valve with tape.



Here's an aerosol spray paint for car wheels, hub caps, bumpers, machinery and tools that will make them shine with the look of real stainless steel. Steel Wheels covers well, dries quickly and is reasonably abrasion-resistant. According to the maker, each coat is 47-percent stainless-steel powder. The product, available at paint, hardware and automotive stores, is from New York Bronze Inc., 201 Bay Ave., Elizabeth, N.J. 07201.—Rosario Capotosto

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.



# INTRODUCING THE LIFETIME ENGINE LUBRICATION PROTECTION PROGRAM.

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Quaker State Motor Oil protects so well, we guarantee that, if regular use of Quaker State ever fails to protect your engine, we'll pay for the repair or the replacement of all the affected oil-related parts. And we'll do it quickly.

In fact, in the event of a claim, Quaker State will arrange for a claim representative to contact you within 24 hours. Once you provide your copy of the Lifetime Engine Lubrication Protection

Program, all service records to verify compliance with the terms of the program and a statement of damage and repair costs, all work may be done in the repair shop of your choice at your earliest convenience.

**GET ALL THE DETAILS.** To obtain coverage and for details of limited warranty, see your participating new car dealer. He'll tell you how to qualify and how to keep your lifetime protection in effect. And don't worry...it's easy. Just ask for Quaker State's written Lifetime Engine Lubrication Protection Program.

**QUAKER STATE: QUALITY FOR ALL CARS.** Even if you're not driving a new car, you'll still want to use the motor oil that's refined from high quality Pennsylvania Grade Crude Oil and dares to guarantee its quality as well. So no matter what you're driving, new car or old, you'll be stayin' on the road with Quaker State.



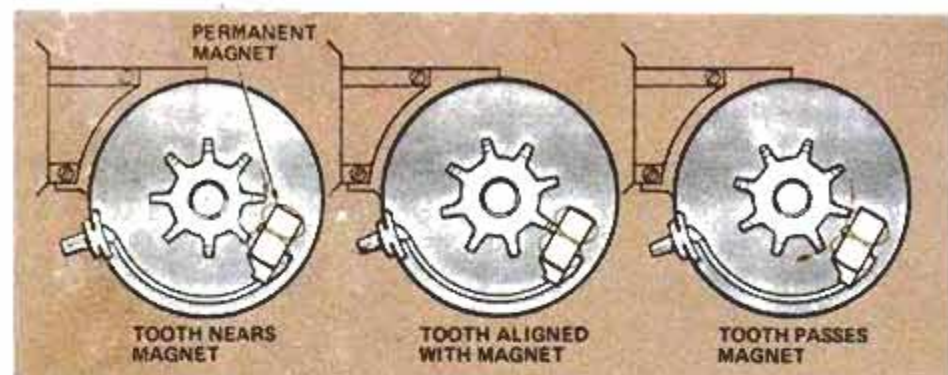
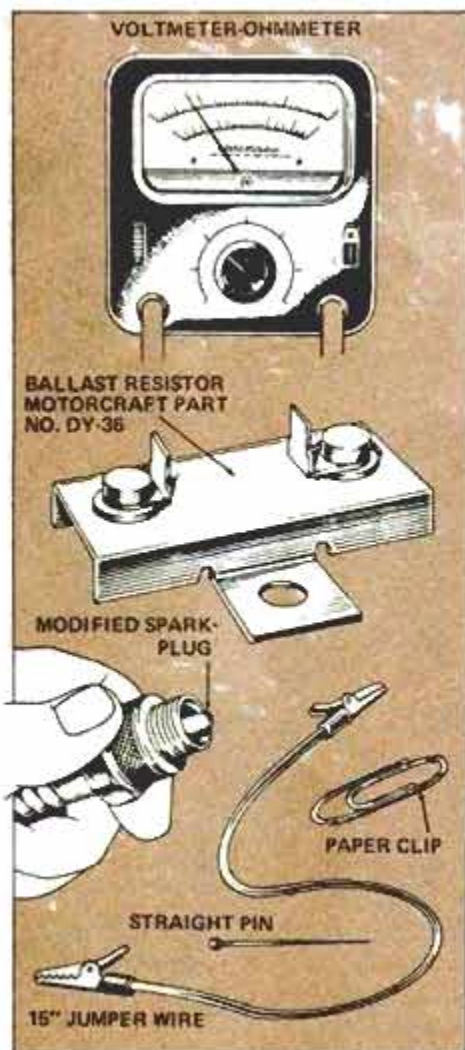
## STAYIN' ON THE ROAD WITH QUAKER STATE











The tools you'll need (left) are a voltmeter, test sparkplug with side electrode removed, ballast resistor, jumper wire, straight pin and paper clip. The magnetic-pickup arrangement (above) is heart of SSI system. There's one tooth for each engine cylinder.

and feedback carburetor; and 1981 Ford and Mercury with 351W-cu.-in. engine with feedback carburetor built for use in California. The MCU is found in some 1981 and '82 cars.

### Testing the secondary ignition circuit

When there is a problem which you think may be caused by ignition failure, test the battery (cranking voltage should be at least 9½ volts). Then, test the following components that make up the ignition system secondary circuit:

■ **High-tension cables**—Wipe cables with a rag that has been moistened in a warm-water, household-detergent solution. Then, inspect cables and boots covering sparkplugs. Replace damaged cables.

Now, disconnect each cable, in turn, at the distributor cap and sparkplug. Examine its metal contacts inside both boots. Look for corrosion. If corrosion is excessive or metal is eaten away, replace the cable.

Before reconnecting the cable, coat the inside of both boots with a layer (about ½ in. thick) of silicone grease. Ford recommends Motorcraft WA-10.

■ **Distributor cap and rotor**—Unhook

the distributor cap and examine it for cracks, carbon tracks that indicate a crack and corroded terminals. Replace a damaged cap.

Pull the rotor off the distributor shaft. Replace it if it is cracked, chipped or broken. Before installing the old or a new rotor, coat the tip of the metal electrode with silicone grease (Motorcraft WA-10).

Now, test each sparkplug cable for excessive resistance. Disconnect each cable at the sparkplug, but leave the cable connected to the distributor cap.

Insert one ohmmeter lead firmly into the boot at the sparkplug end. Hold the other ohmmeter lead to the contact inside the distributor cap to which the other end of the cable is connected. Read the meter. Resistance should be 300 to 1,500 ohms for each inch of cable length. If it's more, replace the cable.

If the problem hasn't been resolved by this point, test the SSI primary circuit. First, though, an understanding of how the circuit works will prove valuable.

### SSI primary circuit: how it works

The SSI system primary circuit contains a solid-state ignition module, ignition coil and a magnetic-pickup assembly which is located in the distributor.

The magnetic-pickup assembly is a stationary unit with an armature which is rotated by the distributor shaft. The armature has one tooth for each engine cylinder (four teeth for a four-cylinder engine, and so on).

The magnetic-pickup assembly generates a voltage pulse each time a tooth of the armature passes the permanent magnet in the center of the assembly. Pulses are transmitted to the ignition module. Meanwhile, the ignition coil is transforming the energy it's getting into thousands of volts.

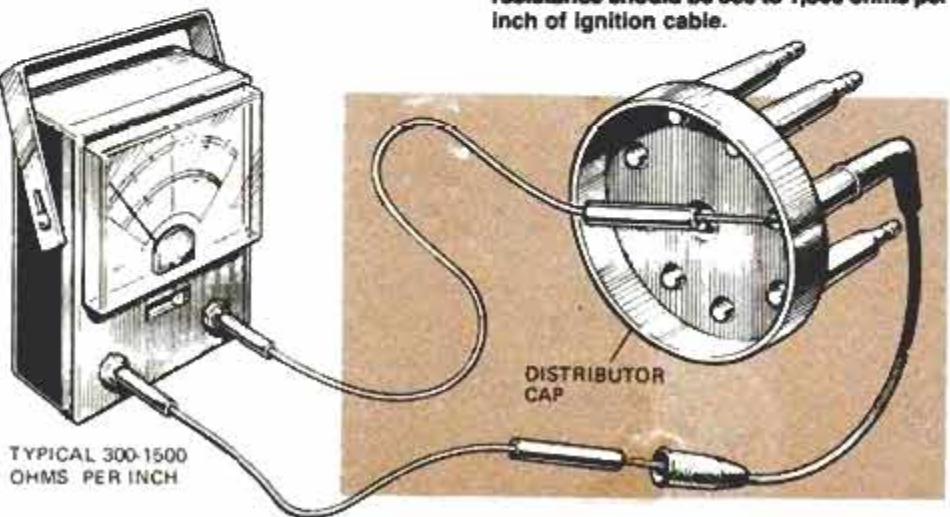
Each time the ignition module receives a pulse, it turns off the primary circuit. At this point, the ignition coil discharges its energy to the sparkplugs by way of the distributor cap, rotor and high-tension cables.

The first test of the primary circuit is an overall test. Results will help isolate a problem.

### Overall testing of the primary circuit

1. Take off the distributor cap and rotor.
2. Crank the engine until one tooth of the armature is aligned with the magnet of the magnetic-pickup assembly.

Check resistance in sparkplug cables through the distributor-cap contact. The resistance should be 300 to 1,500 ohms per inch of ignition cable.





3. Identify the system on your car or truck, because if it is the Duraspark I system, an additional step is needed to make this test. The Duraspark I system, introduced in some models in 1977, uses a special ignition coil that is identified by its blue top. It produces higher secondary voltage to the sparkplugs than the coil used in other versions of the SSI system. The Duraspark I system is used on the following models:

■ 1977 Ford, Mercury and Lincoln cars with V8 engines built for use in California.

■ 1978 Ford, Mercury and Lincoln cars with V8 engines, except for the Versailles with 302-cu.-in. engine, built for use in California.

■ 1979 Ford, Mercury and Lincoln cars with 302-cu.-in. V8 engines built for use in California.

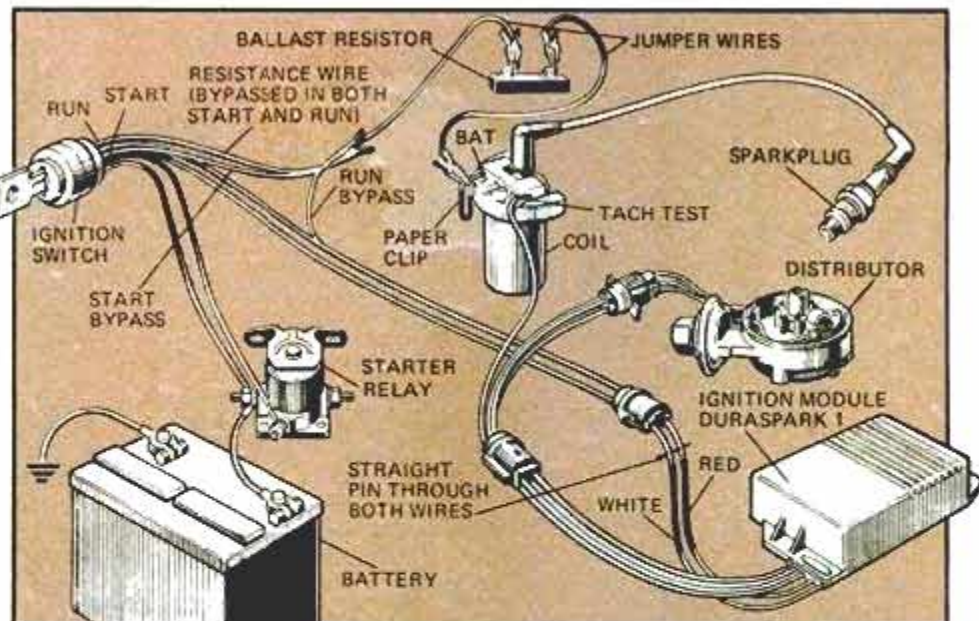
4. If you're working on a Duraspark I system, get a ballast resistor (Motorcraft part No. DY-36) from a dealer. Place it in series with the primary circuit at the BAT terminal of the ignition coil.

You should do this by first disconnecting the wire from the BAT terminal of the ignition coil. This wire (the start-bypass wire) goes to the ignition switch. The other wire connected to the ignition coil—the tach test wire—runs to a connector, where it joins other wires coming from the distributor and continues on to the ignition module.

Attach one alligator clip of a 15-inch jumper wire to the connector of the start-bypass wire. Attach the other alligator clip of the jumper wire to one side of the ballast resistor.

Now, straighten out one end of a paper clip and insert it under the coil connector so it contacts the terminal to which the start-bypass wire was connected. Connect a second 15-inch jumper wire to the paper clip and ballast resistor.

To complete preparation of the Duraspark I system for this test, find the red and white wires leading out of the ignition module. (Incidentally, another way to verify if you have a Duraspark I system is to



The Duraspark I system requires careful preparation before the test can be performed. Make sure all jumper wires, paper clip and straight pin are firmly in place. A bad connection can overload the system and cause damage to components.

check the color of the ignition module sealing block. This is the point through which wires enter the module. If the sealing block is red, you have a Duraspark I system.)

Take a straight pin and push it through the white wire and then the red wire, so the pin makes contact with conductors inside the insulation. Place the pin through the wire at a spot between the ignition module and connector.

**Caution:** If you attempt to test a Duraspark I system without setting up for the test properly, as described above, excessive current will damage the ignition module and/or ignition coil.

5. No matter which system you are testing, disconnect the ignition coil-to-distributor cap cable from the distributor cap. Insert a test sparkplug in the cable boot.

For a test sparkplug, use a plug having the same designation as the rest of the plugs in your engine. However, break off the side electrode.

Hold the test plug with insulated sparkplug pliers and press its shell

against the engine block or cylinder head.

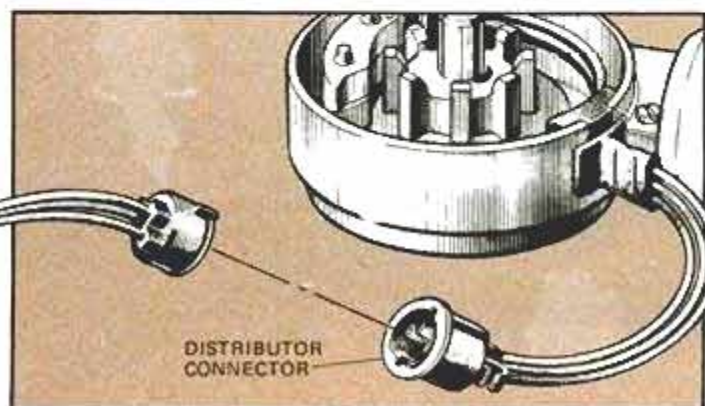
6. Turn the ignition switch to on. Then, tap the side of the distributor housing with a screwdriver. A spark should jump from the center electrode of the test sparkplug. If it doesn't, test the voltage drop of the circuit covered by the red module wire (outlined below). If a spark does occur, test the voltage drop of the circuit covered by the white module wire.

#### Voltage-drop test—white module wire

With a Duraspark I system, withdraw the straight pin from the red wire, but leave it in place in the white wire. If you're working on a different system, insert a straight pin through the white wire that leads from the module. Place the pin through the wire at a spot between the ignition module and the connector.

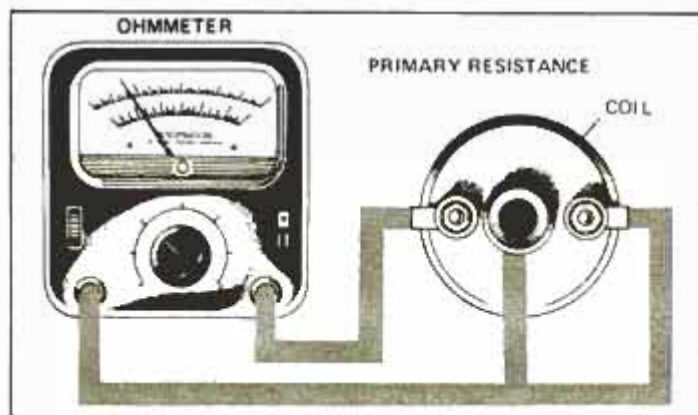
Connect the positive lead of a voltmeter to the battery positive post and connect the negative lead of the voltmeter to the straight pin sticking into the white wire. Crank the engine. The voltmeter reading should be 1 volt or less. If it's more, there is a malfunction in the white-wire circuit. This circuit consists of the neutral safety switch of a car with automatic transmission, START side of the ignition switch, starter circuit, battery, and all wires and cables connecting these parts.

If the voltmeter reading is 1 volt or less, perform the test with the sparkplug described above. However, this time have someone in the car turn the ignition switch to START, so

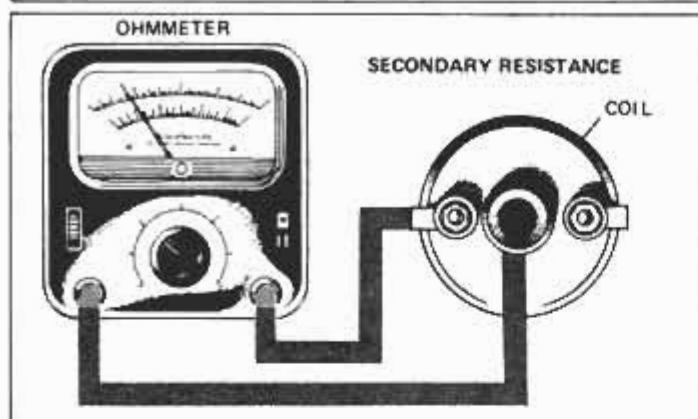


Distributor connector should be used in conjunction with the test sparkplug. While the engine is cranking, connect and disconnect this distributor connector and check for any sparks coming from the test sparkplug.





To test internal condition of the coil, connect an ohmmeter across the two terminals. With Duraspark I it should read .7 to .8 ohms. Other SSI systems should read between 1.15 and 1.25 ohms.



To test tower-terminal resistance of coil, connect ohmmeter as shown (left). A Duraspark I system should yield a 7,300- to 8,200-ohm reading. Other SSI systems should yield a 7,700- to 9,300-ohm reading.

the engine cranks. Check for sparks coming from the test sparkplug.

If there is spark, the cause of the engine starting problem is not ignition—the cause is probably in the fuel system. But if there is no spark, test the ignition coil. Before discussing how to do this, let's double back and describe how to test the voltage drop of the circuit covered by the red module wire.

#### Voltage-drop test: red module wire

With a Duraspark I system, withdraw the straight pin from the white wire, but leave it in place in the red wire.

If you are working on a different system, insert a straight pin through the red wire leading from the module. Place the pin through the wire at a spot located between the ignition module and the connector.

Connect a voltmeter so the positive lead is attached to the battery positive post and the negative lead is attached to the straight pin. Turn the ignition key on.

The voltmeter reading should be 1 volt or less. If it's more than 1 volt, there is a malfunction in the red wire circuit. This circuit consists of the ON side of the ignition switch, battery-to-ignition-switch circuit and all wires and cables connecting these parts.

If the voltmeter reading is 1 volt or less, remove the straight pin from the red module wire unless you're working on the Duraspark I system.

With the Duraspark I, keep the pin in the red wire and reinsert it through the white wire. Keep the ballast resistor hooked up for further testing.

Hold the test sparkplug in position as someone in the car turns the ignition from ON to OFF several times. Disconnect and reconnect the distributor connector. Sparks should appear at the sparkplug. If they do, test the distributor (this test will be described next month). If sparks don't appear, check the ignition coil.

#### Voltage-drop test: Ignition coil

The purpose of this test is to check the BAT circuit between the ignition switch and ignition coil.

Notice that the coil has two terminals. The BAT terminal is connected to the ignition switch, and the TACH TEST terminal is connected to the ignition module. (In the first cars having SSI, the TACH TEST terminal was designated as the DEC terminal, an acronym for Distributor Electronic Control.)

To prepare for this test, connect a jumper wire from the TACH TEST terminal to ground. Then, connect a voltmeter negative lead to the coil BAT terminal and the voltmeter positive lead to the positive post of the car battery. Have someone in the car turn the ignition switch first to START and then to ON. If the BAT circuit is okay, you will get the following results:

■ As the engine is being cranked,

the voltmeter will record 1 volt or less.

■ With the ignition switch in on position, the voltmeter will record less than 6½ volts if you are working on a system other than a Duraspark I.

■ With the ignition switch in on position, the voltmeter will record less than 1 volt if you are working on a Duraspark I system.

If you don't get these results, see that wire connections at the coil and ignition switch are clean and tight. Test again. If necessary, replace the wiring.

If the engine problem you've encountered hasn't been resolved by this point, test the internal condition of the ignition coil.

#### Ignition-coil internal tests

Proceed as follows:

1. If the coil has a connector over it, remove it by grabbing both sides and pulling. If wires are screwed to the terminals (no connector), detach them.

2. Disconnect the Ignition coil-to-distributor cable from the coil tower.

3. Connect one lead of an ohmmeter to the coil BAT terminal and the other lead to the coil TACH TEST terminal. Read the meter:

■ With a Duraspark I system, the ohmmeter should read from 0.7 to 0.8 ohms.

■ With other SSI systems, the ohmmeter should read from 1.15 to 1.25 ohms.

If the ohmmeter reads more than this, the coil has developed excessive resistance in its primary circuit. Replace it.

4. Leave the ohmmeter connected to the coil BAT terminal, but move the other ohmmeter lead from the coil TACH TEST terminal to the coil tower. Make sure ohmmeter leads make firm contact with coil terminals. Read the meter:

■ With a Duraspark I system, the ohmmeter should read from 7,300 to 8,200 ohms.

■ With other SSI systems, the ohmmeter should read from 7,700 to 9,300 ohms.

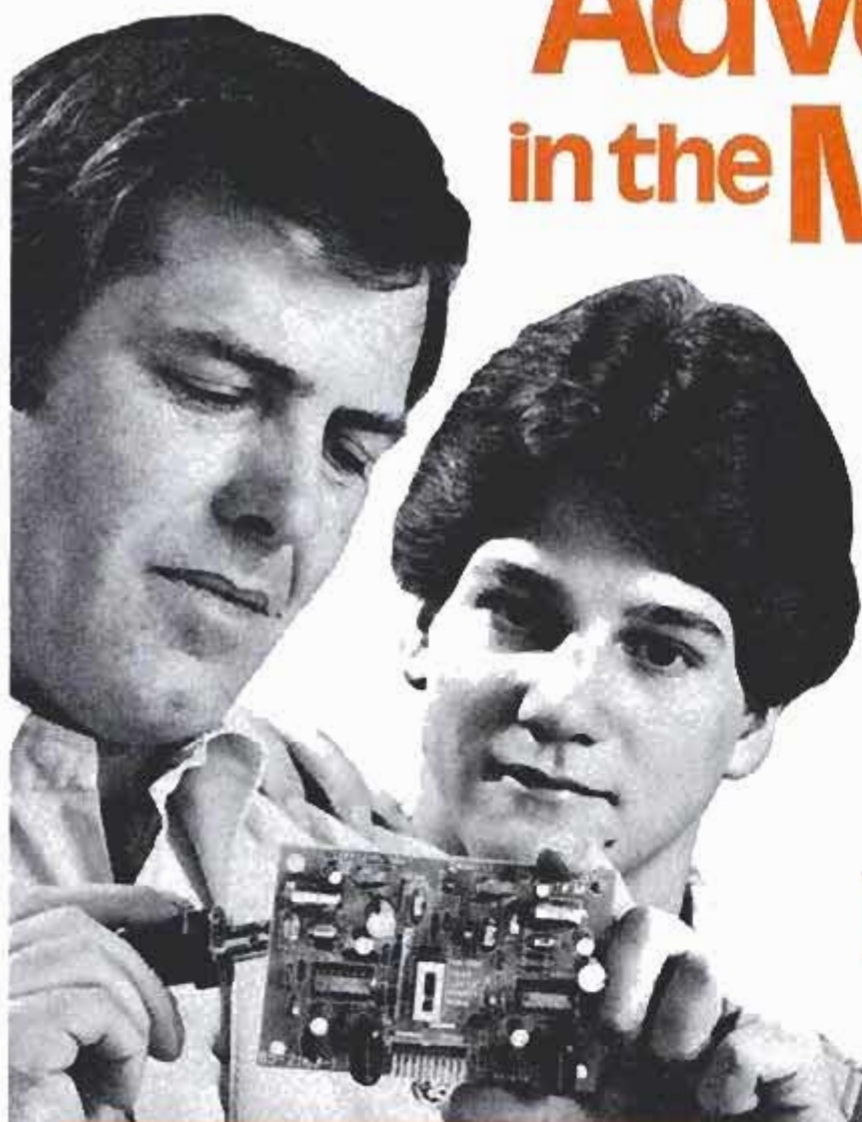
If the applicable reading is not attained, there is probably excessive resistance in the coil secondary circuit. Replace the coil.

**Caution:** Coils used in the Duraspark I and other SSI systems are not interchangeable. In addition to its blue top, the Duraspark I coil has a special alignment lug on the coil tower that prevents its use on other engines.

If the coil is not the cause of your problem, continue testing other parts of the SSI system. We'll talk about them next month.



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# SCIENCE WORLDWIDE

## Targeting language

Victims of gunshot wounds to the head sometimes make miraculous recoveries, retaining most of their ability to think and speak, despite destruction of millions of irreplaceable neurons.

One reason may be that specific brain functions go on in particular areas: If these areas survive, behavior patterns survive. The 19th-century French surgeon Paul Broca was one of the first to supply evidence for this theory. While performing an autopsy on a man who had been unable to speak well for years, Broca discovered brain damage to a small portion of tissue under the left temple. He proposed that the area was a kind of "speech center." Later researchers agreed. And like scientists naming craters on the moon, they identified the site as "Broca's area."

The latest in this line of research is a series of experiments at the University of Washington in Seattle where Dr. Itzhak Fried and his colleagues surveyed live brain tissue near Broca's Area. As reported in a recent issue of *Science*, the tissue was exposed during brain operations performed on unconscious subjects under local anesthesia. Researchers were able to pick up distinct patterns of change in electrical activity as subjects silently named objects shown to them in pictures. Other visual tasks, not related to naming, caused no such change.

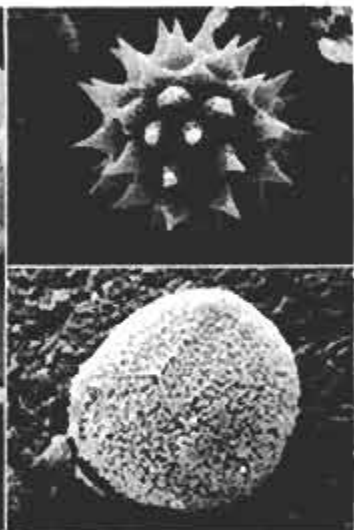
In other words, the doctors were able to chart electrical signals in a small part of the brain as it struggled to come up with the right name.

## Ancient pollen

Botanists are discovering that pollen, the scourge of allergy sufferers, was evolving in interesting ways hundreds of millions of years before people were around to sneeze at it.

Thomas Taylor, an Ohio State University professor, has been slicing into clumps of fossilized plants, looking at cross sections through microscopes. He has found sometimes plain, sometimes ornate and spiky grains of the powder-like substance that acts as the male element in fertilizing flowering plants.

Earliest grains, Taylor says, were large and comparatively inefficient travelers between plants. But in time, the plants began to package pollen better. As its size shrank, it



Thomas Taylor displays a fossil containing 400-million-year-old pollen such as specimen shown at right, above. At top right is a view of a modern sunflower pollen grain.

was able to move farther afield, a long-range emissary for its species. It's possible, Taylor says, that spikes evolved to enable pollen to catch a ride on a passing animal, or to provide a kind of defense mechanism.

Taylor's far-flying specimens are 400 million years old. For comparison, Lucy—the oldest partial skeleton of an erect-walking human—trode Earth a mere 3.5 million years ago.

## Oil spills: Beach fights back

Scientists at SRI International in California have discovered that sandy beaches can dispose of contamination without human help.

But the cleanup process adds to the amount of carbon dioxide in the atmosphere, according to SRI scientists Henry Wise and Kenneth M. Sancier. According to the greenhouse-effect theory, carbon dioxide—from fossil-fuel combustion and other sources—could trap solar heat like the roof of a greenhouse, causing atmospheric temperature increases and climatic change.

Investigators from the research institute have discovered that beach and desert sand acts as a catalyst, promoting a chemical reaction in which organic compounds, like oil, slowly burn, releasing the colorless gas. Overall, the natural disposal of wastes on beaches and deserts might account for as much as a tenth of the total carbon dioxide produced by fuel combustion.

## Buddy system for better bodies

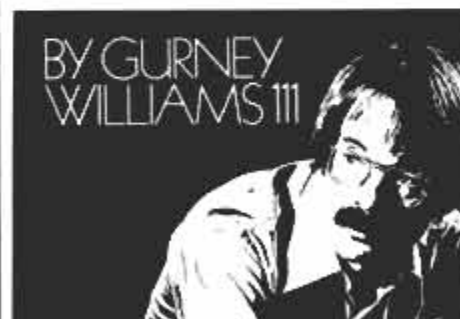
People trying to shed extra pounds can do it better with help from a

mate, according to an investigation recently completed by Stanford University psychologists.

In a year-long study of 23 couples, overweight participants—one member of each pair—lost an average of 23½ pounds. That's a more substantial loss than results from many conventional weight-loss programs, according to William Threlfall, a doctoral student in psychology.

The home reducing program required couples to work together in keeping records of calories consumed and using problem-solving strategies to consume less. Counselors helped actively for only about 10 weeks out of the year. For the rest of the time, couples worked on their own with minimal supervision from professionals.

Two of the results were surprising. Partners of overweight participants also lost weight, an average of almost 10 pounds. And couples with the least successful relationships lost more weight than happy couples. Why? Perhaps, researchers suggest, they had a higher motivation to look good for their partners—or for someone new. **PM**





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State Farm agent Chuck Thulin, Boulder, Colorado. "If you've been thinking of taking extra measures to protect your home and family against fire, burglary and vandalism, State Farm agents are offering some encouragement.

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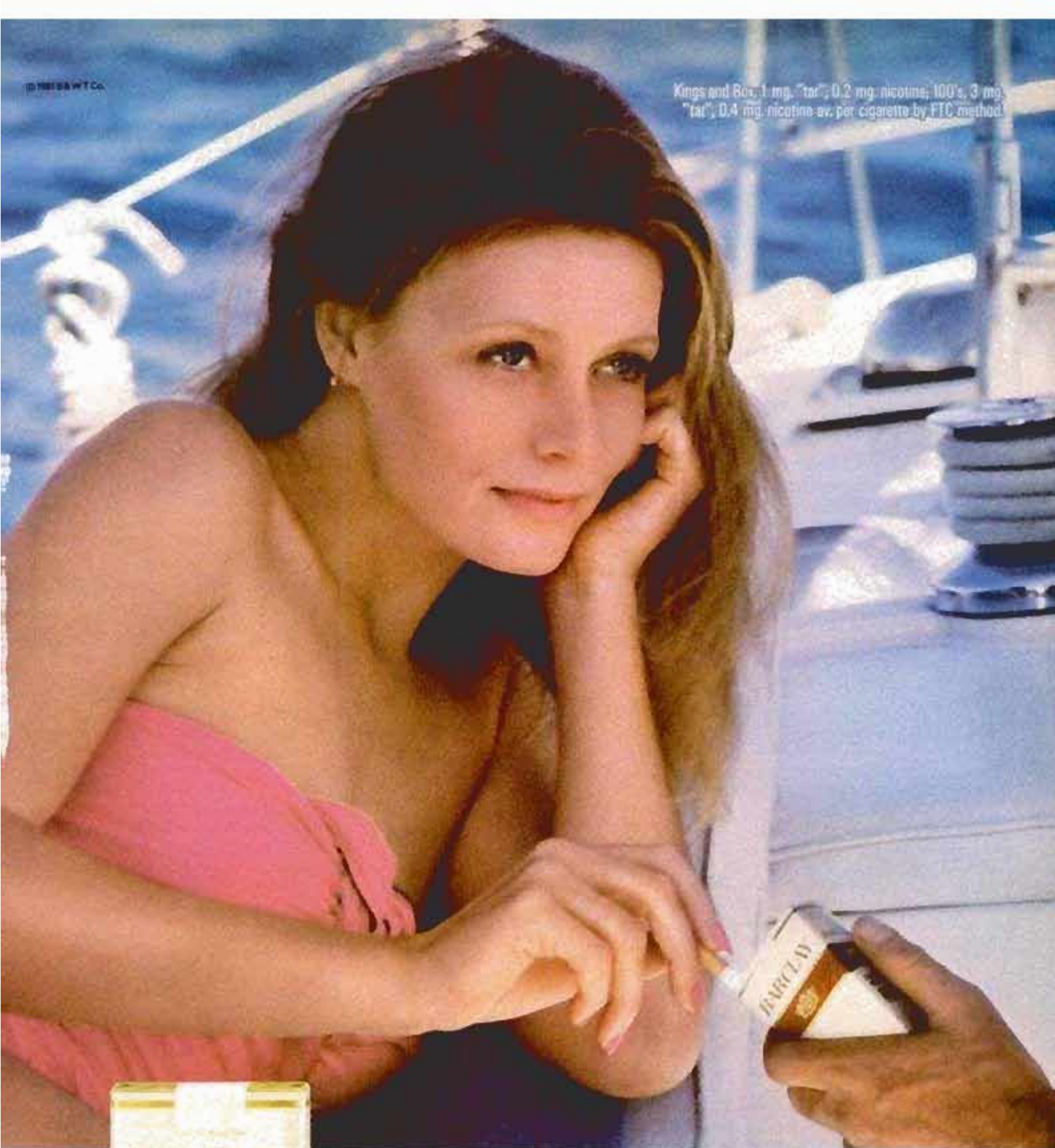






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# THE PM GARAGE

## CAPSULE REPORTS ON NEW AUTO PRODUCTS

### U-joint ratchet wrench

A ratchet with a universal joint and curved handle isn't really new. But in this new wrench, the universal joint isn't at the top of the shank. It's in the ratchet head, so the straight part of the shank can be held absolutely vertical and in line with the head.

Furthermore, although the curve at the shank end will help clear obstructions, its real purpose is to permit use of the tool as a speed han-



Ratchet with universal joint has a curved handle that acts like speed wrench.

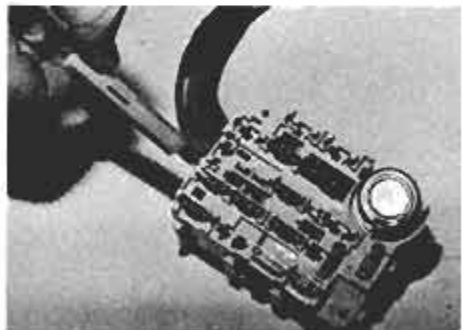
dle. In fact, the knurled end of the handle is actually a bearing that spins as you crank the ratchet.

The tool, called Sidewinder, lists for \$25. To locate a dealer, write to Davenport Tool Co., 102 North Washington St., Rochelle, Ill. 61068.

—Paul Weissler

### Tester for spade fuses

You can use almost any kind of test lamp to check a fuse and its circuit if you have the older tube-type glass fuses. But if you want to check a spade-type fuse, you've got a problem. There's a hair-thin probe slot in the outer end of the fuse, and the



Special needle-thin probe on the fuse test lamp can check the new spade-type fuses.

only thing you might do with a conventional test lamp is insert a sewing needle and hold it with alligator clips.

This probably won't work, since the alligator clips wouldn't grip the needle securely. The maker of Buss fuses has introduced a fuse test lamp with a thin probe end that can get into the spade-fuse slot. It's \$6.27 from Bussman Div., McGraw-Edison Co., Box 14460, St. Louis, Mo. 63178.—Paul Weissler

### Oil saver

Hollywood Accessories can help you save oil with its new Pierce and Pour pouring spout. It features a compact plastic design with a sharp metal tip to puncture oil cans with ease. You push the filler in and twist to lock. A screw-on cap prevents spillage and keeps dust and dirt out of the can.

It sells for under \$1 at most auto



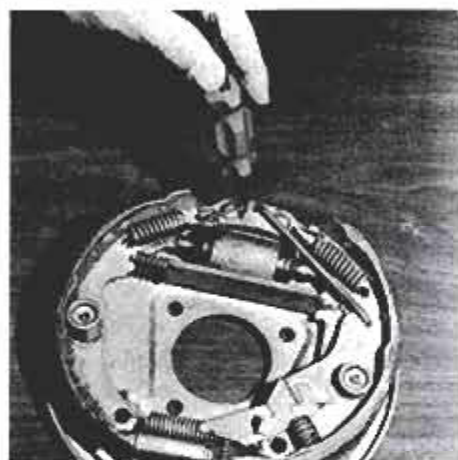
Pouring spout locks in place on an oil can and prevents oil contamination, spillage.

departments. The firm's address is 19914 South Via Baron, Compton, Calif. 90220.—Joel Breault

### Brake-spring tool

If you try to do a rear drum-brake job on GM X-body cars, you'll have a real problem removing the brake-shoe return springs. Reason: The anchor at the top isn't a pin, so there's nothing against which the conventional tool can bear.

The answer is a special tool with a hook that engages the spring and a shank with a cuplike recess in the tip. The tool fits around and bears against the rivet head of the X-car anchor. When you're refitting the spring, use the other end of the



New spring-seating and removing tool is made specifically for all X-car drum brakes.

shank; it has a shoehorn shape to make it easy to slip the spring over the anchor tab.

This tool lists for \$6. The maker is Lisle Corp., Clarinda, Iowa 51632.

—Paul Weissler

### Magnetic body molding

You can avoid annoying parking-lot nicks and dents on your car by using Bodyguard Magnetic Side Molding.

The molding is 1 in. wide by 1 in. thick and is made of a soft plastic called Hypalon. A magnetic strip runs along the base of each length.



Magnetic body side molding is 1 in. thick.

Put the Bodyguard on the car body when you park. When you drive, lift the molding off, coil it up and stash it in the trunk. Or leave it on the car—provided you don't plan on doing over 100 mph.

Prices start at \$26.80 for the 16-ft. kit and run to \$44.80 for the 32-ft. kit. Contact Bodyguard Side Molding, Box 1016, Yuba City, Calif. 95991.

—Joel Breault



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**FACT:** Chevy V8 Special Economy Truck combines the power of a V8 with the economy of a Six!

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**20** EPA EST. MPG (CITY)

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. Not available in California where com-

parisons do not apply.

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\*Results may vary according to car's condition, filter change interval and where and how you drive.



# THE ECONOMY CARS AMERICA NEVER BOUGHT

HAS THE TIME COME FOR CARS THAT WERE AHEAD OF THEIR TIME?

by Michael Lamm WEST COAST EDITOR



AMERICAN AUSTIN

BANTAM

A 1930 American Austin leads a 1938 Bantam through Phoenix outback. British Austin begat U.S. version, which begat the Bantam, which eventually evolved into the first Jeep.

**P**eople who wring their hands and cry, "Oh, why did it take America so long to introduce small cars?"—those folks just haven't looked back into automotive history. If they had, they'd have seen that American motorists had more than enough opportunities to switch to small cars any time from 1912, when so-called cyclecars enjoyed a brief vogue, until the very moment the Arabs pulled the plug in December 1973. Small cars were here. The de-





SUBARU 360

Subaru offered 360 (left) in 1969, but a lack of power and weak brakes actually prompted the state of New Jersey to outlaw the car. Messerschmitt three-wheeler (below) seats two in tandem and is capable of getting 60 mpg at highway speed.

sire to buy and drive them, though, was not.

I've always liked small cars. During college in the mid-1950s, I drove Volkswagens which, at that time, were still rare enough so filling-station attendants had to ask where to find the gas filler. I later graduated to an MG-TD, then to an Austin-Healey four-banger and I have owned and driven all sizes of hobby cars, from a 1932 American Austin coupe to a 16-cylinder Cadillac.



MESSERSCHMITT



CROSLY

Earliest prewar Crosley (above) used 580-cc Waukesha Twin, with bodies built by the Murray Corp. Macy's sold some of these minis in their department stores.



HEINKEL



## TOYOTA SPORTS 800: 15 years ahead of its time

**W**ay back in 1966, Toyota introduced a car into the American market that couldn't have been more wrong for the times. Right in the middle of Detroit's horsepower wars they brought out a two-seater powered by an opposed Twin displacing a meager 800 cc.

As right as this car might have been for the narrow streets and expensive fuel of its homeland, it was a sheer case of over-optimism in the United States of 1966. After all, who needed 69 mpg, a top speed of 97 mph or an engine that churned out only 50 hp, all for \$2,000 out the door? Not many did, apparently, because Toyota couldn't even give them away.

A pity. Because 15 years later, half the car-buying public would give anything for that kind of bargain. We recently drove an

800 that was beautifully restored by its owner, Spencer Young of Tempe, Ariz., and discovered that not only was this car fuel-efficient, but really fun to drive. And even more interesting is the styling. It

looks as contemporary as anything rolling off any assembly line.

We only hope that when Detroit gears up for its commuter micros, they'll make something as nice as this "failure."—T.A.



TOYOTA 800

Yet I'm a little perturbed when I hear critics put Detroit down for "forcing America into gas-guzzlers for all those years." The auto industry never gets credit for having tried to interest motorists in smaller cars long before 1973.

Nowhere is that fact better illustrated than in the Lindvig Car Col-

lection in Phoenix, Ariz. (10651 North Cave Creek Rd.) It's the nation's only museum devoted exclusively to small cars. The exhibits stand out beautifully, and yet—charming as they are—there's not one example that you'd call an American sales success.

Les Lindvig, retired CBS-TV vice-

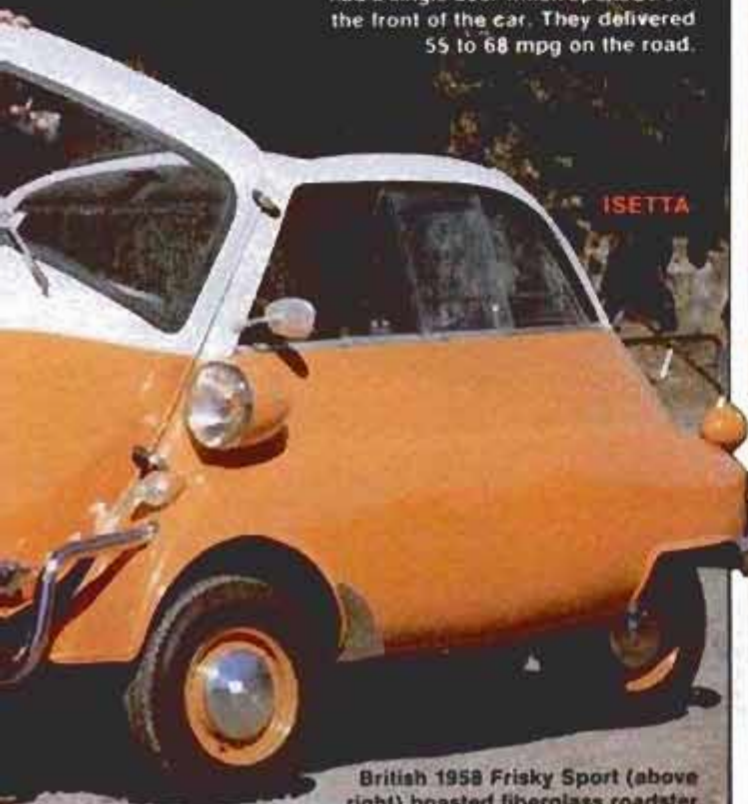
president, had owned a used 1930 American Austin roadster as a teenager back in the Depression. Later, after he got married, Les bought a couple more Austins as hobby cars, then a 1939 Bantam.

A dozen years ago, he decided to collect small cars in earnest and, as

*(Please turn to page 103)*

PM photos: David Goolley Autos courtesy Lindvig Car Collection, Phoenix, Ariz.

Bubblecars proved popular in Europe during the 1950s. A few were imported into United States for commuters. The Heinkel (left) and BMW Isetta (right) looked similar, but weren't related. Both had a single door which opened from the front of the car. They delivered 55 to 68 mpg on the road.



ISETTA

British 1958 Frisky Sport (above right) boasted fiberglass roadster body, Villiers 16.5-hp Twin, 65-mph top speed. Open Jolly (right) and Bianchina coupe used Fiat 500 mechanicals.



FRISKY SPORT



BIANCHINA

JOLLY



by Murray Rubenstein

In September 1939, Germany threw 27 infantry divisions spearheaded by six Panzer divisions—about 1,600 tanks—against Poland and crushed that nation in about five weeks. Eight months later, 10 German armored divisions overran France, Belgium and the Netherlands in less than six weeks. Almost three decades later, Israel's 800 tanks smashed Egyptian resistance in Sinai, and captured the West Bank territories and the Golan Heights in only six days.

Today, the Soviet Union and the Warsaw Pact countries have over 50,000 modern main battle tanks (MBTs) facing the NATO countries who, among them, have about 11,000 tanks. Could history repeat itself or is the day of the tank gone? Can antitank missiles overcome an overwhelming Soviet tank superiority? Upon these answers may eventually rest the fate of Europe.

To the layman, one tank is pretty much like another. At first sight, they appear to be large, lumbering, tracked vehicles sheathed in armor and toting a big cannon and one or more machine guns. That's fine for starters, but to leave it there would be much like saying that a computer is a big black box with tubes or transistors.

It would be more accurate to describe a tank as an armored vehicle moving on tracks, with a carefully thought-out balance of armor, mobility and firepower. No two tanks have exactly the same tradeoffs. England's latest MBT, the Chieftain, is heavily armored and mounts a huge 120-mm rifled cannon, but is deficient in mobility. By modern standards, the Chieftain's 750-hp engine is woefully inadequate for its nearly 61 tons. Well, why don't the British place a more

# CAN T STILL WI

The best machine can still give its builder

## FIREPOWER VS. AGILITY: THE

TANK	GUN (Mm)	LENGTH
 M-1 (U.S.A.)	105*	25' 3"
 T-72 (U.S.S.R.)	125	22' 8"
 T-64 (U.S.S.R.)	125	21'
 CHIEFTAIN (U.K.)	120	24' 8"
 LEOPARD II (W. Germany)	120	24' 5"
 AMX-30 (France)	105	21' 8"

\*120 mm, beginning in 1984

T-72 TANK, U.S.S.R.

Warsaw Pact tank used in "maneuvers" in Poland; upgraded to still-secret T-80.





# TANKS IN WARS?

an edge in a non-nuclear encounter.

powerful engine in the Chieftain? They could, but a larger engine requires more space, weighs more and drinks more fuel, reducing range. A heavier transmission would be needed to handle the extra muscle and, with that increase in weight, the suspension would probably have to be changed, as well.

French tanks, such as the AMX-30, are far more agile, and have a smaller, though still adequate, 105-mm main gun. But they gain their mobility by cutting down on armor, thus increasing their vulnerability. According to specialists at the U.S. Army Armor Center at Fort Knox, Ky., Soviet and American tanks tend to have a well-balanced compromise between armor, armament and mobility.

German tanks, according to the Army tank men, once tended to be very agile at the expense of armor, but they point out that this weakness was eliminated in the Leopard II, West Germany's latest MBT. The AMX-32—France's latest—differs from the earlier AMX-30 mainly in having heavier armor, with a resulting loss in mobility. You don't get something for nothing.

If all tanks are a tradeoff of armor, armament and mobility, why should modern tanks be significantly better than tanks of, say, World War II vintage? There are some armchair experts who rave about some of the best tanks of that war, and stoutly maintain that their favorites could still hold their own with most of today's best. While no tank, given equal crews, can be expected to win every engagement, a good modern tank will generally blow away the best of the armored oldsters. However, if an old tank happens to ambush a modern tank from the rear or side (where the armor is thinner), it could conceivably kill a contemporary MBT. In the 1967

## MAJOR POWERS' SUPERTANKS

HEIGHT	WEIGHT (Tons)	HP	HP/Ton	SPEED (Mph)	CREW	RANGE (Miles)
7'9"	58	1,500	25.9	45	4	300
7'6½"	45.1	780	17.3	31	3	280
7'6½"	41.8	750	17.9	31	3	280
9'6"	60.6	750	12.4	27	4	250
8'	44.1	1,500	34.0	42	4	—
7'10"	39.7	700	17.6	40	4	400



M-1 TANK. U.S.A.

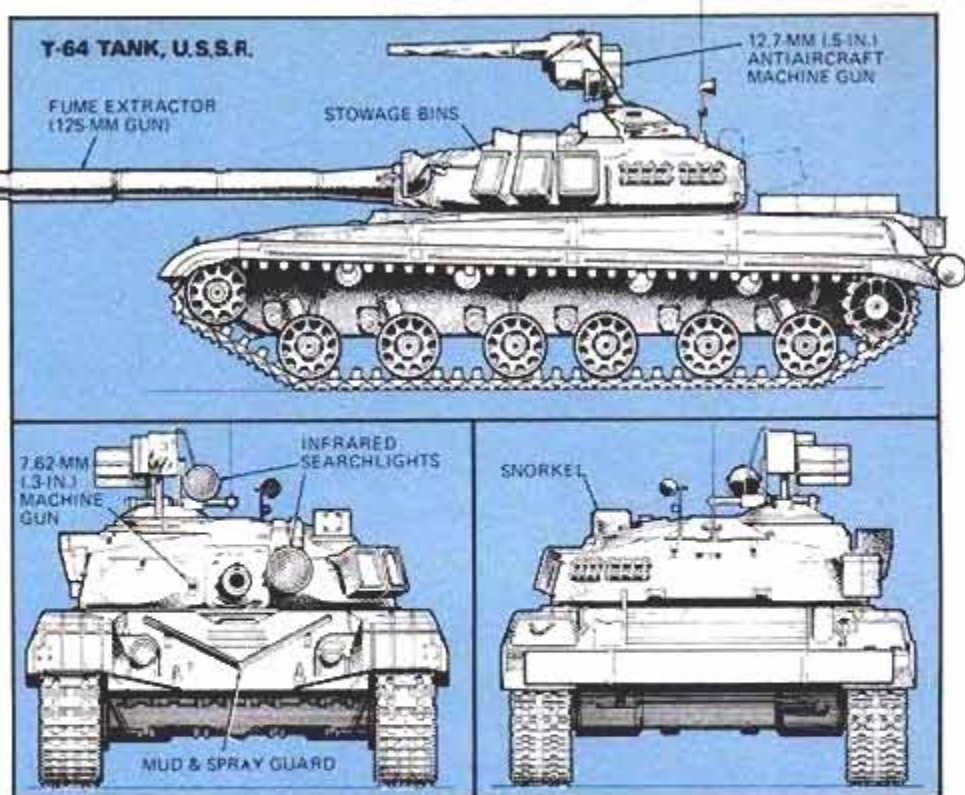
Probably the best all-round tank right now, but expensive compared to opposition.



Six-Day War, an occasional Israeli Centurion (1950 vintage) was destroyed by a WWII vintage Russian T-34 armed with a high-velocity 85-mm cannon. Most of the time, however, it was the Centurion, with its modern 105-mm gun, that took the honors. In the 1973 October War, American Shermans dating back to World War II did destroy some T-62 tanks, then the Soviet Union's newest operational MBT. But the Shermans had been upgraded to carry 105s, had revamped suspensions and more powerful engines. Shells from their original 75-mm guns would have bounced off the hide of the T-62.

Even a super tank of the World War II era, such as the German Tiger II with its high-velocity 88-mm, would be easy pickings for a modern MBT. Its projectile has about one-third the kinetic energy, at muzzle velocity, of a modern 120-mm shell. Also, the old German tank didn't possess night-fighting equipment or on-board computers; it was slower, less agile and sat higher (and was, therefore, a better target). Mechanically, it was much less reliable. Its armor was less likely to stop a shell and, with all of that, it *outweighed* any modern MBT. What's more, its shell would have been unable to penetrate the frontal plate of such heavily armored monsters as the West German Leopard II, the American M-1 or the Soviet MBTs.

Modern tanks have laser range-finders, better communications equipment, improved suspensions



Soviets' T-64 is being produced concurrently with the T-72 (now being upgraded to the T-80). The low profile is at the cost of crew comfort; only those under 5-6 can fit in.

and more reliable engines and transmissions. None of these improvements came easily.

#### Practice makes perfect

Pre-WWII tanks were made of armor plates riveted together. Experience showed that when a tank made this way was hit by a shell, rivet heads popped off and flew around the interior, damaging people and

equipment. Enter tanks with welded construction. Most tanks in use in Europe and the United States were so-called light tanks. Although lightly armored, with small guns, they were cheap and agile. They also were very easy to destroy and were unable to stop medium and heavy tanks. Exit the light tank, until a revival in the mid-'50s when France built the AMX-13, a lightly armored

*(Please turn to page 104)*

All 50-plus tons of it airborne, the MBT-70 pops a "trackie"—thanks to its special hydropneumatic suspension.

When projected costs of models soared to over \$1 million each, joint U.S.-West German project stopped.





## TANK-BUSTERS KEEP PACE WITH THE NEW MACHINES

**W**orld War II's shaped charges, which used a high-speed, super-hot gas stream to punch a small hole through armor, began a series of offensive/defensive escalations in tank warfare. Layered armor, allowing the shaped charge to dissipate in the spacing, solved that one. For the High Explosive Antitank (HEAT) projectile of the '60s, the answer came in the form of thicker armor.

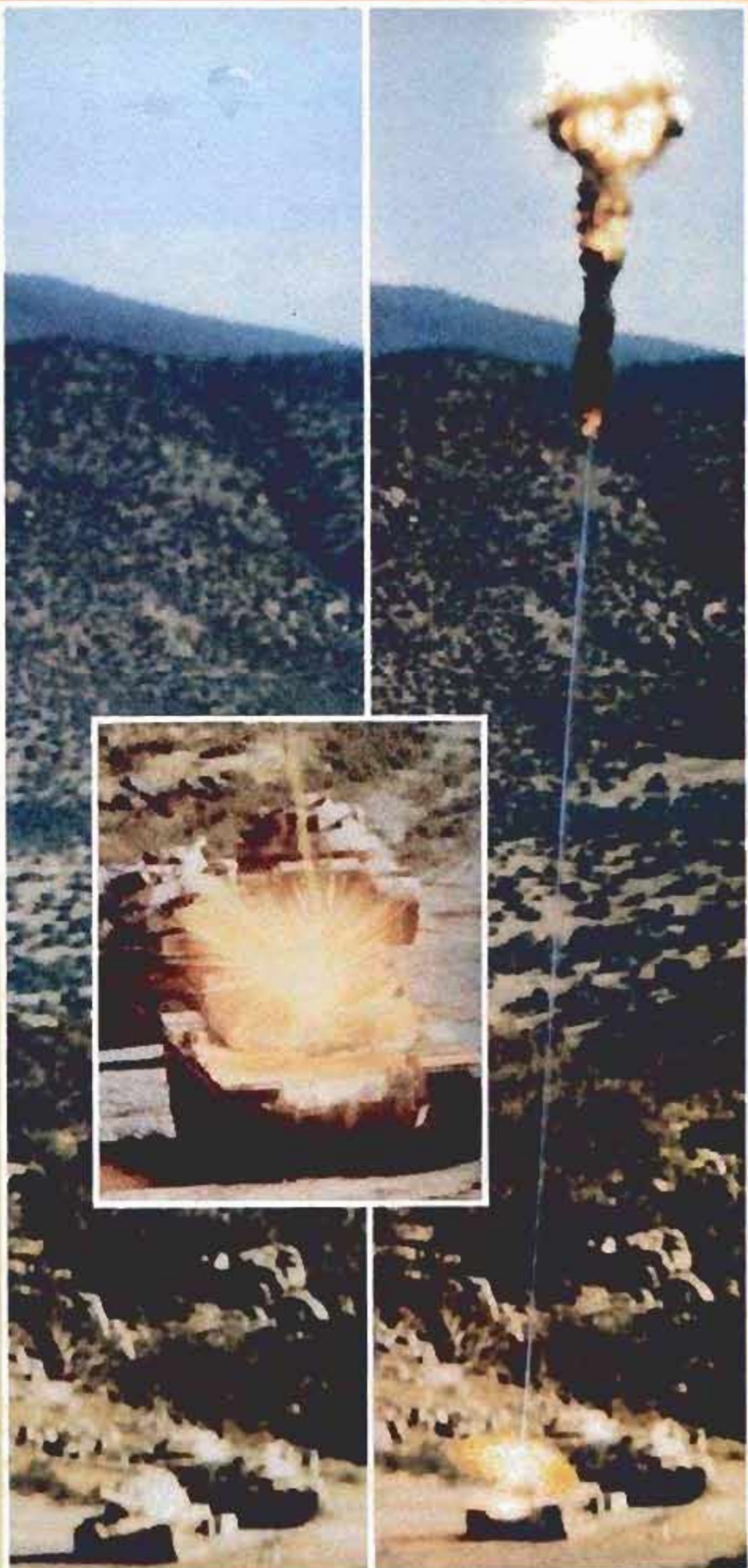
High-velocity steel darts, encased in a special envelope (sabot), came next. Spin stabilization, after which the sabot fell away outside the muzzle, was the initial mode of dart delivery, but that required a fairly large-diameter dart, limiting the velocity. The latest dart is known as the Armor-Piercing Fin-Stabilized Discard-Sabot Tracer. Its sabot is fitted with slip rings for firing in a rifled gun so that pop-out fins, rather than spin, stabilize it at speeds of one mile per second.

The other antitank ammo in widespread use currently is known as a High Explosive Squash Head, a relatively slow projectile meant to literally squash against armor, then explode. Shock waves are transmitted inside to cause spalling—metal chunks that become projectiles themselves.

Laminated (nonhomogeneous) armor, however, is now believed to be reaching the point where it is nearly impervious to ground-fired projectiles. British Chobham armor, still classified, is reported to be the most effective, and is said to include aluminum and ceramics in its laminations.

Until the ballistics people catch up, therefore, the best way to go at a tank today is from the top, where it has a thin skin. The U.S. Army's SADARM (Seek and Destroy Armor) system, shown in photos at right, may be the ultimate antitank weapon. Now in the development stage, the SADARM round is an 8-inch-diameter by 45-inch-long projectile fired by a conventional artillery piece. In a high trajectory, it ejects three submunitions canisters, each in turn deploying a parachute. Sensors (probably magnetic) in each then pick up nearby tanks, fire the rocket-propelled charge and guide it down to the target.

**U.S. Army is developing SADARM antitank weapon system that deploys from artillery shell by parachute (near right), uses sensor to locate enemy tanks, then fires a rocket (far right) carrying armor-piercing warhead. Overhead strike connects (inset).**





# HARDTOPS TO RAGTOPS

## THE REBIRTH OF THE CONVERTIBLE!

Detroit is looking at the ragtop again—because it's alive and well in the hands of specialty coachbuilders.

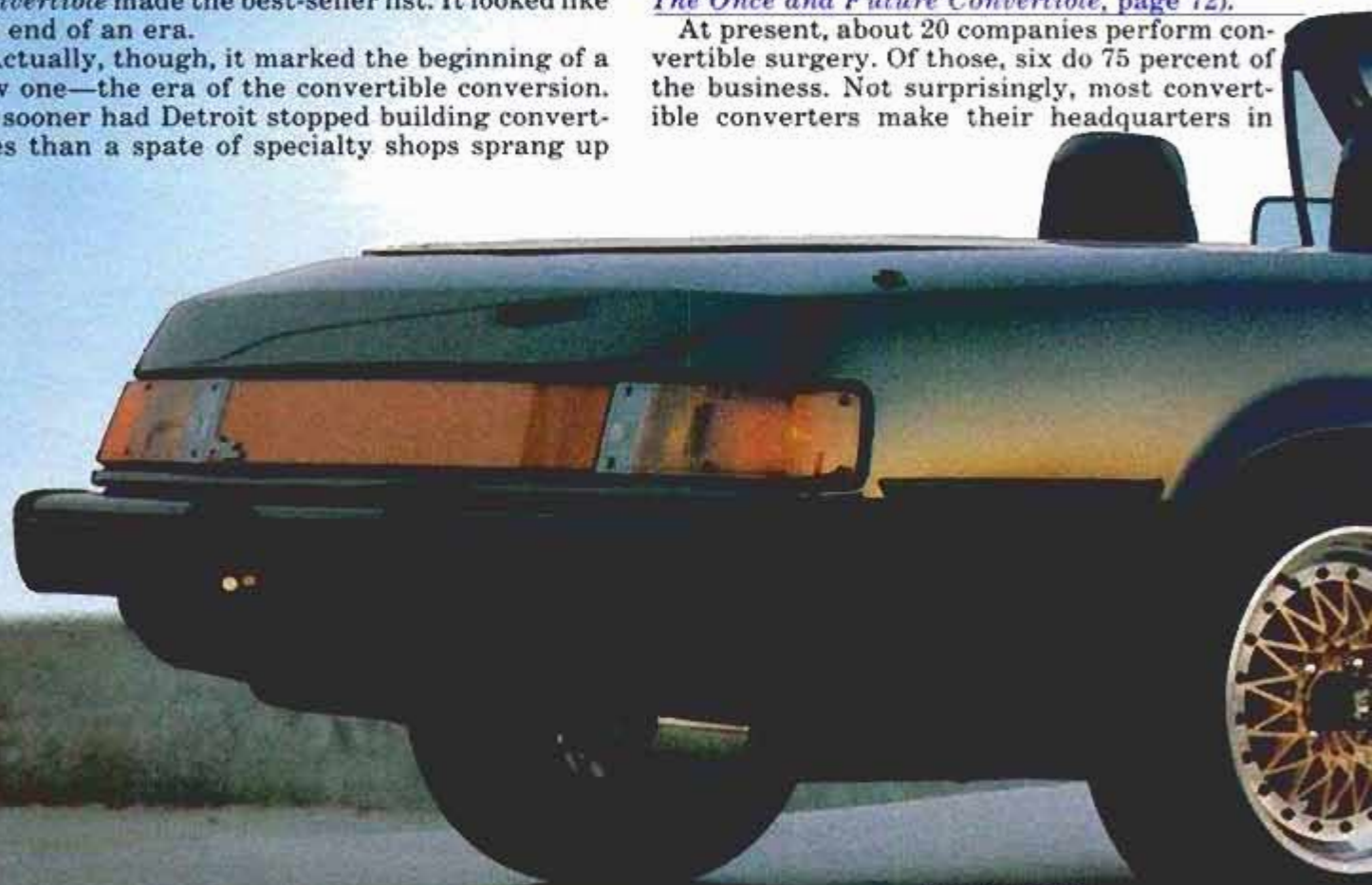
by Michael Lamm WEST COAST EDITOR

**W**hen the last Cadillac convertible rolled off the lines on April 21, 1976, motorists figured that was it—the last convertible. Americans shed a tear, obituaries appeared in various car magazines, and before too long a novel entitled *The Last Convertible* made the best-seller list. It looked like the end of an era.

Actually, though, it marked the beginning of a new one—the era of the convertible conversion. No sooner had Detroit stopped building convertibles than a spate of specialty shops sprang up

around the country to take up where Detroit had left off. It's now estimated that 10,000 American convertibles will be built in 1981—a figure that promises to rise even if Chrysler and Ford don't bring out series-custom ragtops next year (see *The Once and Future Convertible*, page 72).

At present, about 20 companies perform convertible surgery. Of those, six do 75 percent of the business. Not surprisingly, most convertible converters make their headquarters in



Mazda RX-7



Cadillac Eldorado







**Chevrolet Corvette**



Depending on your budget, you can have the top chopped off anything on wheels. The RX-7 is an immaculate one-off by Pacific Avatar. It has a convertible top, a turbocharged motor, modular wheels, leather interior and a high-zoot sound system. The Corvette (above) from Flint Corvette of Los Angeles, will cost \$6,500 above the cost of

the car. The Hess & Eisenhardt Eldorado, which features a power top like the original GM product, is \$39,995 complete. Auto Graphics Design will charge you \$50,000 to \$60,000 for a Mercedes conversion that includes a power top with full headliner. The Mercedes 300 SD, before conversion, is \$43,000. Toyota conversion is about \$4,000.



**Mercedes 300 SD**



**Toyota Corolla**





Sunchaser from the Griffith Company of Fort Lauderdale, Fla. has a Targa top with removable roof panels. The rear basket handle is a roll bar and body brace. Mustang convertible (below) is from Contec of Lake Geneva, Wis. that also converts Firebirds.



southern California and southern Florida.

And most of them convert for dealers. As one top chopper told us, "It would be too expensive for us to floorplan cars (buy new cars), so we have the dealers ship us cars from their stock. Then we ship them back as soon as we finish the conversion."

One of the larger converters, American Custom Coachworks Ltd. (ACC), of Beverly Hills, Calif., operates 11 plants nationwide. "That puts us nearer our customers," says ACC Vice President Duane Mower. But Mower also stresses that, unlike its rivals, ACC *does* buy most of the cars it converts.

Another major converter is the Griffith Co., based in Fort Lauderdale, Fla., with plants in Jacksonville, Fla., Detroit, and Los Angeles. Griffith specializes in Targas; that is, not full convertibles, but cars with integral roll bars or Targa "basket handles." Griffith's conversions include the very popular Sunchaser, based on the Toyota Celica, and the Sundancer, which converts the AMC Concord/Eagle coupe. The Sundancer conversion costs an AMC dealer approximately \$3,000. Its list price is \$3,750 above the cost of the car.

Other major conversion companies include National Coach Engineering Ltd. of Port Sanilac, Mich.:

*(Please turn to page 118)*

## The once and future convertible

**M**y very first new car was a convertible—a '76 MGB, red with black interior. I had owned an assortment of used cars—a VW, a Triumph, two Malibus, an Olds and an Impala—but this B came right off the floor, complete with sacred octagons and sophisticated as a stone ax. At least, I reasoned, it hadn't been saddled with the abuses of a previous owner.

Unfortunately, I crashed the car beyond repair right around the time the last American factory convertible rolled off the line. For some reason, it seemed that America's love affair with the ragtop was over. There was still a demand, but it was too small to justify the expense of separate production lines for convertibles. With an enterprise as large as auto-making, it isn't profitable to build less than 50,000 units per year.

Due, in part, to the success of aftermarket converters and the new ethos of fun and fuel-efficient motoring which has swept Detroit, the factory convertible seems to be on the verge of a comeback. Oddly enough, the company that has the fewest resources with which to gamble will be the first one out with a convertible. For 1982, Chrysler will introduce the LeBaron with a convertible top as an option.

This is a factory-approved, but not factory-



The all-new LeBaron convertible from Chrysler will make its debut in the 1982 model year.

built, convertible, because the soft top will be installed by an outside manufacturer after the car is built. It seems to be a waste of time and energy to build a car and then take half of it apart to put a soft top on it, but those are the facts of life in the car business.

While a convertible TC/3 in '82 might have been more exciting than the sedate LeBaron, it's a step in the right direction. It may herald a whole line of convertible options from other manufacturers.

Ford and GM are also looking seriously at soft tops for the future, but no firm commitments have been made. The 1983 P-car, Pontiac's two-seater sports car, will have a Targa roof, which is related to the ragtop. The

hard, removable roof lets the sun shine in, but storing it in the trunk eats up all the luggage space.

Similarly, Ford offered a T-roof in the '81 Mustang. And the success of aftermarket sunroofs and moonroofs seems to indicate that the buying public is willing to breathe something other than processed, refrigerated air.

These market indicators aren't lost on product planners. And the premium prices drivers are willing to pay for the ragtop option aren't lost on the bean-counters, either. So, if the profit margin is there—as it seems to be—can the factory-built convertible be far behind?—Tony Assenza





Isuzu I-Mark coupe offers diesel Four of 1.8-liter displacement. New Isuzus are almost identical to the old Opels sold by Buick.

## FIRSTHAND REPORT: *Driving the Isuzu I-Mark and P'up*

by Michael Lamm  
WEST COAST EDITOR

**D**éjà vu! If they look like Opels and Luvs, it's because they were. Isuzu used to supply Buick with Japanese Opel coupes and sedans from 1976 through '79 and Chevy Luv pickups through this year.

Isuzu is now importing cars and pickups under its own name. For 1981, Isuzu lists some 200 dealers, mostly in sunbelt states, and expects to sign another 280 dealers by 1984. Service is no problem because Buick and Chevrolet mechanics know how to work on Isuzu products, and many stock parts.

The key to Isuzu's American success will be its diesel offerings in all lines. At \$6,699, the Isuzu I-Mark base coupe becomes the lowest priced diesel in the United States (but only \$36 cheaper than the VW Rabbit diesel). A four-door Isuzu diesel sedan sells for \$7,194, and you can also get diesel power for the Isuzu P'up pickups.

I drove all these Isuzu diesels on the streets and freeways of California's Orange County and was favorably impressed with their power and silence. Coupes and sedans use a diesel that's identical in displacement and dimensions to Isuzu's gasoline engine, although totally different in terms of engineering and materials.

Isuzu P'up (short for pickup) is similar to Chevy Luv, but has been restyled. It provides a better ride and has a roomier cab.



I-Mark four-door sedan with the diesel engine option is EPA-rated at 51 mpg on the highway. It cranks out 51 hp and it is one of the quietest diesels around. Coupes and four-doors are both on 94.3-in. wheelbase and are 170.7 inches.



Virtually no parts interchange, yet this diesel engine weighs only 100 pounds more than its gasoline counterpart. The cars weigh 2,236 pounds.

With either the four- or five-speed manual transmission, the diesel passenger cars give respectable acceleration at low noise levels. Isuzu calls this a high-speed diesel, saying it'll rev to 5,000 rpm easily.

The three-speed automatic, however, leaves the 51-hp diesel sluggish in terms of keeping up with nor-

mal traffic. So, if you plan to buy the diesel, go for one of the sticks. By the way, in fifth gear at 55 mph, the Deluxe sedan's tach registers a paltry 2,500 rpm. Loafing along at that pace on the freeway nets *better* than the EPA's claimed 49-51 mpg, and the government's city figures of 41 mpg for the four-speed coupe and 37 mpg for the Deluxe five-speed sedan seem attainable, too.

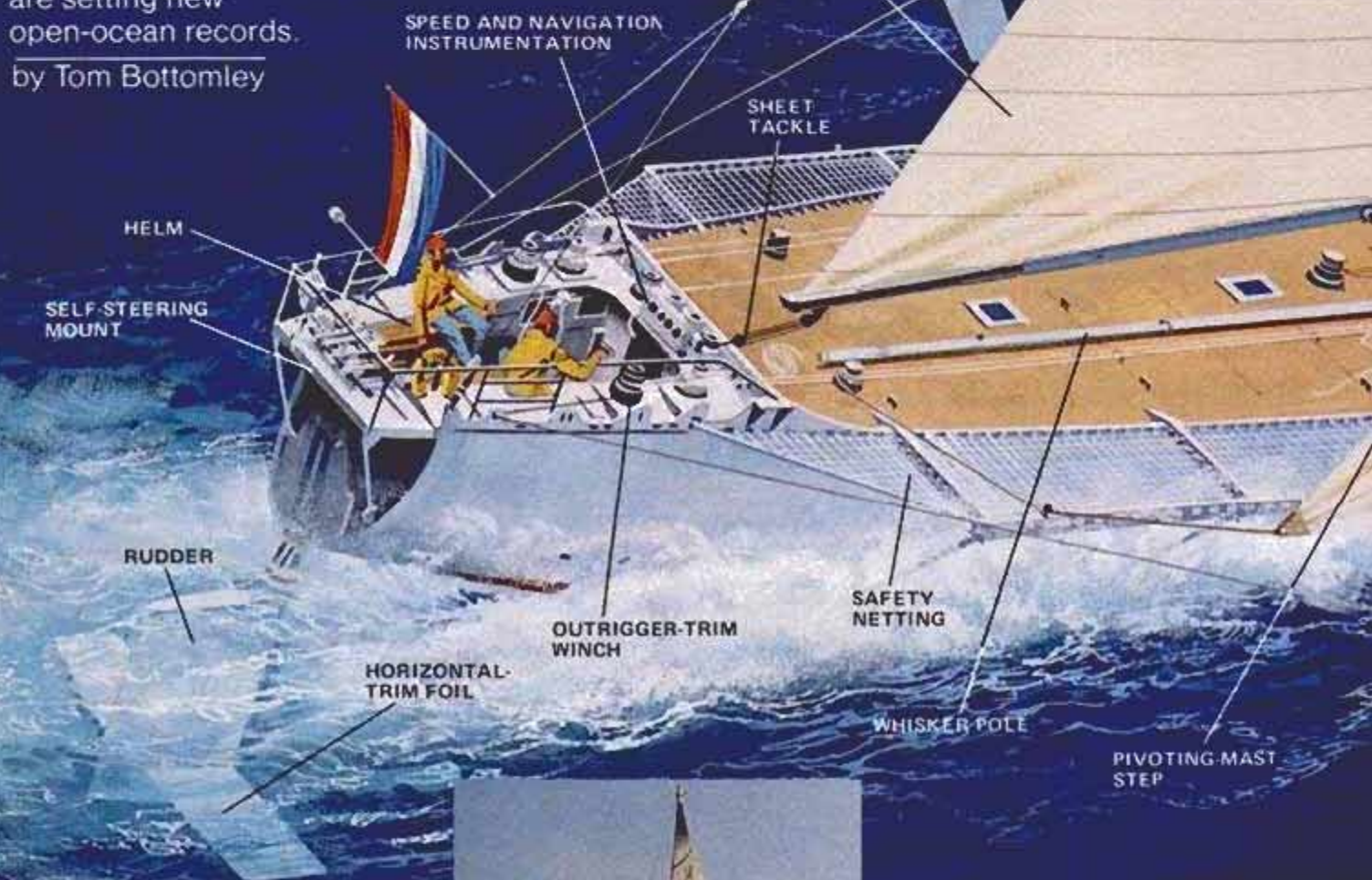
The other happy surprise from  
*(Please turn to page 108)*



# Breaking the sailing speed barriers

High-tech super sailboats are setting new open-ocean records.

by Tom Bottomley



**D**rifting slowly into the sunrise off the coast of England last summer, a French sailboat passed Lizard Point and set a new world's record for crossing the Atlantic. In spite of light winds at the start off Sandy Hook and almost a flat calm at the finish, Eric Tabarly and his 55-foot trimaran, *Paul Ricard*, had cut two days off the fastest west-to-east passage. For 75 years, the American 185-foot, three-masted schooner *Atlantic* had held the official record. Tabarly's time of 10 days, 5 hours and 14 minutes 19 seconds may also mark the dawn of a new era in sailing technology—and new problems.

Sailors have always tried to go faster, but in the last couple of years wind-powered craft have reached speeds that rival the gasoline-burners. Sprint catamarans have reported bursts of speed up to 40 knots, but the distance

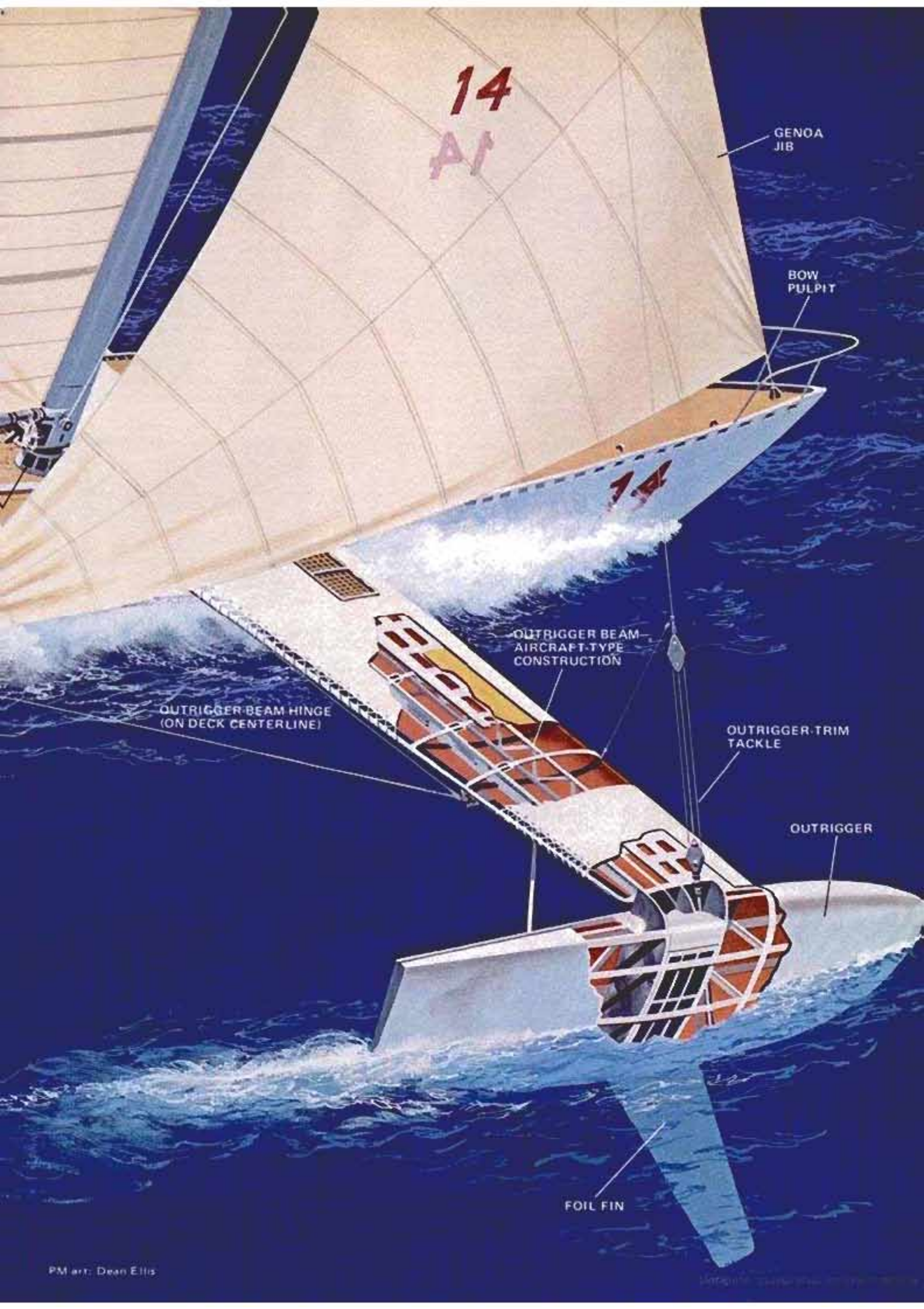


Boiling along the surface of the sea, Eric Tabarly's *Paul Ricard* rides high on hydrofoils. Artist's rendering (above) shows aircraft-type construction, hinged outriggers, adjustable trim foil on rudder, and intricate rigging that made possible sustained speeds to 17 mph for the trimaran.

runners crossing open oceans are particularly impressive. The 1980 OSTAR single-handed race, east to west across the Atlantic, saw eight boats beat the previous race record of 20 days. The dean of American solo sailors, 65-year-old Phil Weld in his trimaran *Moxie*, was the overall winner, chopping nearly three days off the previous time to finish in 17 days, 23 hours.

Where is this extra speed coming from? Basic naval architecture theory says that the longer a boat is, the faster it can go, but that every displacement hull has a top speed (about 1.35 times the square root of the waterline length). Above that speed, massive increases in power produce only a fractional increase in knots as the conventional hull pushes its own weight in water out of the way. The





14

A1

GENOA JIB

BOW PULPIT

OUTRIGGER BEAM  
AIRCRAFT-TYPE  
CONSTRUCTION

OUTRIGGER BEAM HINGE  
(ON DECK CENTERLINE)

OUTRIGGER TRIM  
TACKLE

OUTRIGGER

FOIL FIN



**O**ur Owners Report shows once again that GLC buyers really have to nit-pick to find things wrong with their cars. The most severe criticism we recorded was "dipstick location."

And since that's the worst that owners could come up with, it stands almost as a compliment. It's surely a far cry from the rotary-engine problems Mazda experienced several years ago. In fact, judging by the number of times we saw "It really is a Great Little Car" written on our questionnaires, the initials GLC seem very well applied.

A Wisconsin clergyman told us, "This GLC notchback sedan replaces my 1975 Mercedes 240D, a car I dearly loved. But the Mazda's so great, I hardly miss the Mercedes."



GLC's "neat, uncluttered look" got praise from its owners. "It doesn't say econobox."



A North Carolina hardware store owner: "Comfort was our most important consideration, and the GLC is excellent in that respect. Even the rear seat feels spacious. We looked at absolutely everything up to \$10,000. Price wasn't the object. The GLC has the most room, the best gas mileage, handling and performance."

A teacher from New York said she chose the GLC station wagon "because it's the only wagon in this category that my 6-foot-6 husband can drive. The GLC is comfortable on long trips, gets good mileage, steers easily, maneuvers, has good visibility and my husband can service it without being a contortionist."

A Texas insurance vice-president commented: "We felt the GLC hatchback's

spaciousness and mileage put it ahead of the competition."

A mechanic from West Virginia confided, "I run a small auto-repair shop here, and 75 percent of my customers own foreign cars. I soon noticed that I never get Mazdas in for major repairs, so I figured I couldn't go too far wrong—I traded in our old gas hog and got top trade-in allowance. And as expected, I've had no mechanical problems."

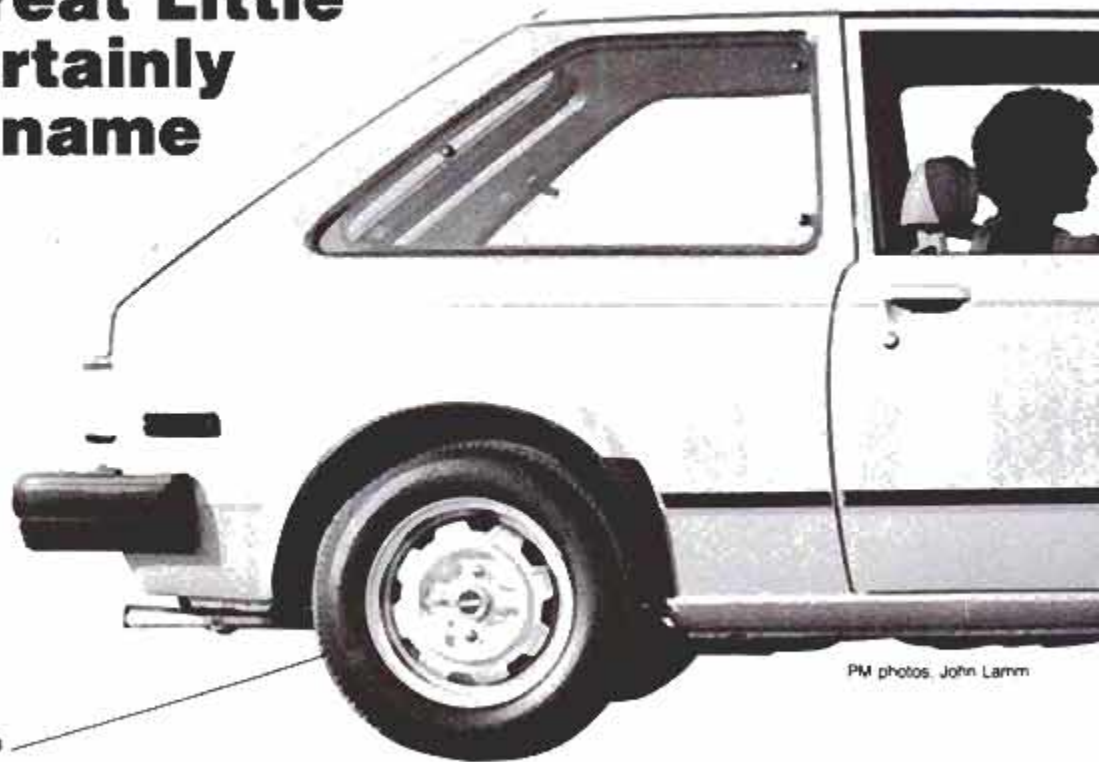
Price also played a major part in every buyer's choice, but since GLCs go out the showroom door almost as quickly as they enter, it's currently a seller's market. A California truck driver noted that "Mazda dealers in this area customarily charge about \$500 over list for the GLC. Even so, I think it's one of the best values for the money."



The GLC features a unique rear suspension in which rear tires toe-in under cornering.

BY MICHAEL LAMM WEST COAST EDITOR

## Pleased owners say that Mazda's Great Little Car has certainly earned its name



PM photos, John Lamm

All-independent suspension was praised for excellent handling.



Some dealers take advantage of the demand for GLCs in other ways. According to an Ohio cashier: "The initial price the salesman quoted clinched the deal, but then I found out he had forgotten to mention rustproofing, finish sealer and puncture sealer—all 'options' that I had to accept if I wanted the car. I feel the first price quote was misleading and, given a choice, I would not have accepted the 'options.'"

Front-wheel drive came in for much praise, particularly from owners living in the snowbelt. A Wisconsin librarian cooed, "It's great in the snow and really hugs tight around the corners." And a Minnesota business rep: "I got transferred to Minneapolis and have to drive 180 miles round trip daily. Fwd needs no explanation hereabouts—it's the only way to go!"

Quality and workmanship received an Oscar, too, with 91.9 percent of our respondents giving it a *good to excellent* rating.

"This is the first new car I've ever bought that has no flaws and no mechanical problems," said a California bookseller, who added, "I once owned a much more expensive British car that always had 15 to 20 items to be repaired. I sold it in less than two months."

Fuel-mileage figures missed the EPA mark by five to six mpg. But even so, the



Engine box is generally easy to work in, but owners want the oil dipstick relocated.

GLC acquitted itself well in the economy department.

A Georgia management analyst wrote, "For the first two months, I commuted 230 miles a day in my GLC. I still drive great distances and now have 10,800 miles on the odometer. I've kept careful track of gas and I've averaged 36.71 mpg. As far as I can tell, weather affects mileage drastically. Cold weather is worst, but on mild days I can get 40 mpg."

As often happens, the EPA misled some owners, 11.1 percent of whom echoed a Texas truck driver who complained, "Gas

*(Please turn to page 110)*

## Greater Little Car

Mazda's Great Little Car (GLC) received extensive restyling and went to front-wheel drive for 1981. Crisper body lines and three inches more in length make the new GLC roomier inside, yet Toyo Kogyo engineers managed to pare its total weight by nearly 100 pounds.

The sohc Four has also been expanded from 1,415 to 1,490 cc (65 to 68 hp), so the GLC's overall performance has improved noticeably. So has its fuel economy, which the EPA estimates at 35/45 mpg for the five-speed transmission. The engine is an all-new powerplant, which Mazda designates as an E-series. This supersedes its previous engine and incorporates a variety of basic technical innovations.

GLCs come in four body styles and four trim levels: three- and five-door hatchbacks, four-door trunk sedan, and four-door wagon. The trim levels are Sport, Custom L, Custom and base. You also get a choice of four- or five-speed manual gearboxes or the three-speed automatic. All of these models, with the exception of the wagon, use front-wheel drive and fully independent suspension. As in the past, one of the GLC's major attractions is price, which seems even more of a value when you consider the car's quality and standard equipment. The current base price for the Custom GLC three-door (at this writing) is \$5,295 p.o.e. This includes reclining front buckets, split rear bench, steel-belted radials, four-speed trans-axle, power front disc brakes, rack-and-pinion steering, cut-pile carpets, electric rear-window defroster, remote driver's mirror and protective body side molding.

## A NATIONWIDE SURVEY BASED ON 1,429,381 OWNER-DRIVEN MILES

**Hard-to-reach oil dipstick was the main complaint.**

**Interior room and front-seat comfort received high marks, especially from tall owners. Assembly of the dash was also cited for being rattle-free.**

**Front-seat comfort was rated good to excellent by 92 percent of owners.**

**The ample cargo hatch has split rear seats. Owners say they carry skis or lumber easily.**



# Water filters... should you install one?

While a water filter can't guarantee health benefits, it can improve taste and remove odors and sediment.

by John H. Ingersoll

If tap water from a community supply were filtered by one family, and another family consumed it straight from the faucet, which family would expose itself to a health risk?

That's the question I asked Dr. Joseph Cotruvo, director, Drinking Water Standards, Environmental Protection Agency (EPA). He said, "There would be no way you could prove any differences in their health were traceable to the water."

Neither Dr. Cotruvo, water-supply engineers, nor environmentalists would fault U.S. water companies. The opinion was unanimous: We still have the safest processed water in the world.

That doesn't mean officials are closing their eyes to potential dangers. It's true that toxic chemicals have seeped into some surface water that's been processed for home consumption. Several chemicals react with chlorine, the purifying agent that's used almost universally to produce trihalomethanes (THMs). Lab tests show that, in some cases, high concentrations of THMs are carcinogenic in small animals. While that doesn't translate into an immediate threat for humans, the EPA has already set standards for the presence of THMs in treated water (100 parts per billion).

"What about well water?" I asked.

"Quantitatively, 99 percent of U.S. ground water is pure," according to Dr. Jay Lehr, executive director, National Well Water Assn. "It's true, however, that in isolated areas, toxic industrial wastes have leached into aquifers serving a number of private wells. But the nationwide risk has been overblown and has needlessly alarmed people who draw pure water from wells."

Then why, one would ask logically,

are home water filters among the fastest selling appliances on the market today? According to makers, most people buy them for the advertised advantages: "... removes disagreeable taste and odor, sediment, rust and dirt. . . ."

Yet a growing number of families are opting for filters because they've become anxious over what they can't see in their tap water—microscopic fragments of asbestos, petroleum derivatives and other chemicals.

If you buy a filtering device for advertised reasons, you won't be disappointed—as long as you install and maintain it as recommended. If your purchase is intended to protect the health of your family, you'll cover some of the bases partially and miss others entirely.

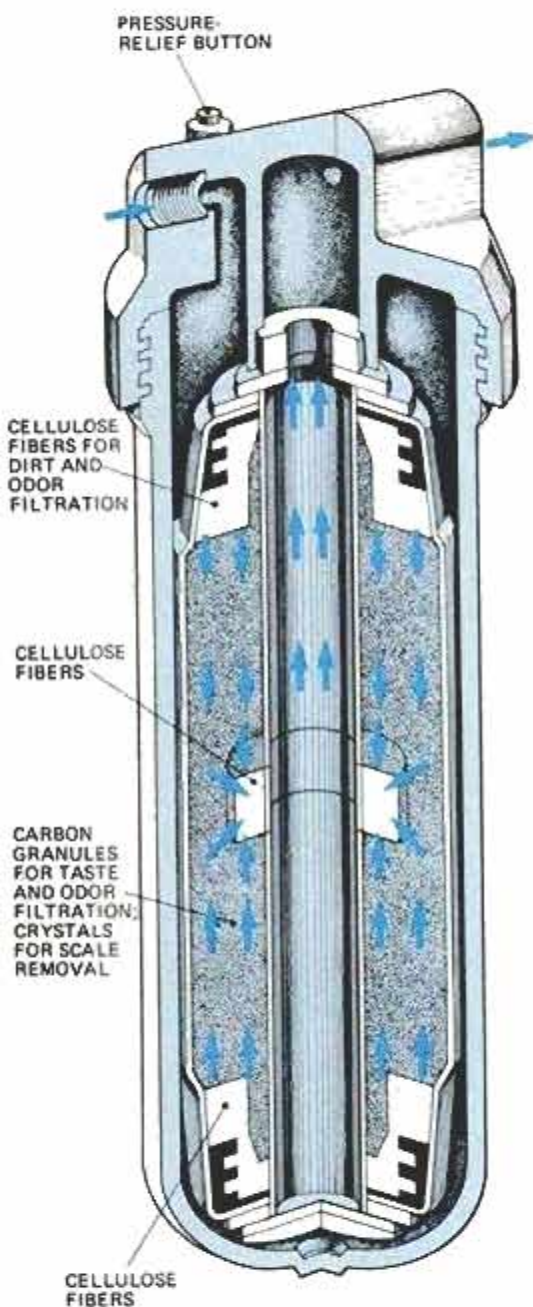
Filters containing activated charcoal do block many frightening compounds, such as THMs. But even the best filters don't remove *all* of these substances. Those packed with a large volume of charcoal generally weed out more organic material at the start of cartridge life; performance falls off less rapidly in time than does that of containers with only a small amount of charcoal.

With few exceptions, performance specifications of each filter are printed on the shipping carton, the canister or both. You'll learn what the filter sifts from the water and, generally, the estimated life of the cartridge under normal conditions. The flow rate in gallons per minute is also noted.

## Fiber filters block sediment

Not all filters contain charcoal. Another group, aimed at taking out turbidity (suspended sediment), contains fibers of spun cellulose or rayon. The tightly wrapped fibers form a cylinder around a tubular opening. Tap water surrounds the cylinder and line pressure forces the water through the wrappings. These fibers trap the silt and pass along clean water to the inner opening that leads to the faucet.

Fiber filters are marked according to the size of particles that they trap. A tightly wrapped fiber could sift out everything over about 5



Combination water filter works this way: Carbon granules improve taste and odor, spun cellulose fibers remove sediment, and salt crystals cut back lime scale. Tap water flows between the outer cylinder and inner filter cartridge. Line pressure forces the water through the filter agents to the inner core and to the faucet.



microns. (The diameter of a human hair is about 100 microns. The smallest particle visible to the human eye is 40 microns.) More loosely wound and less expensive filters catch everything over about 60 microns.

All the wrapped cylinders fill up with particles eventually and then

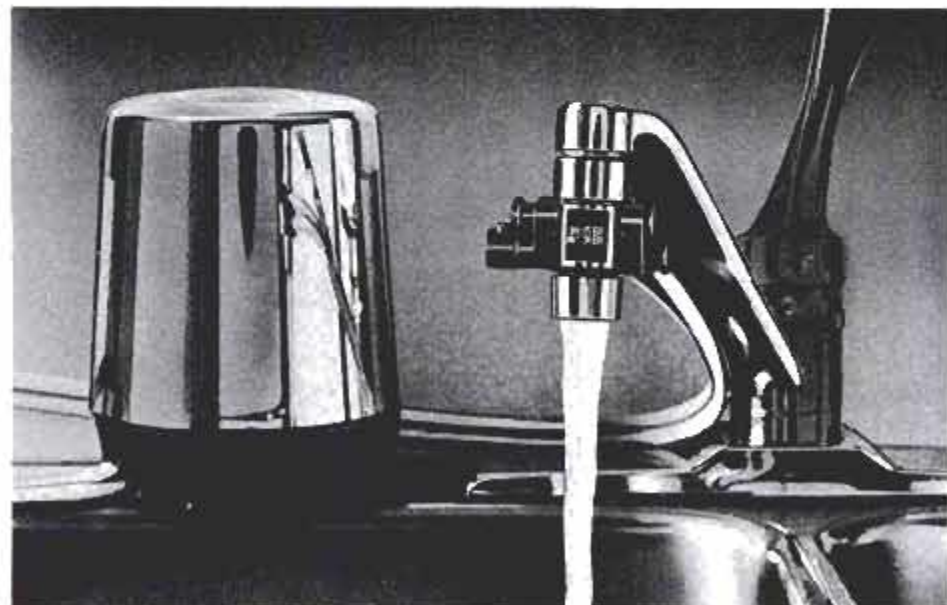
it is necessary to replace them.

A ceramic filter, intended for the same duty, is permanent. Designed to weed out larger particles—in the 250- to 350-micron range, or about the size of the tiniest visible grain of sand—it is cleaned by backwashing for a recommended period. Then you

remove, soak and wash it thoroughly, and it's ready for use again.

Cold-water dirt filters are plentiful and operate at temperatures between 40 and 100° F. But if you want to catch rust before it stains clothes in the washer, buy a hot-water sediment filter. Some with-

## Six ways to cleaner water



When you want filtered water for cooking or drinking, push the side button on this faucet-attached carbon filter made by West Bend. Otherwise, the water bypasses the filter.



The AP600 model filters out bad tastes, odors, rust and grime, and inhibits scale. An indicator pops up when cartridge change is necessary.



Ice-maker water filter (\$12) from Filterite attaches to copper or plastic tubing at the rear of the refrigerator to make ice cubes odorless and tasteless.



This portable electric water filter forces water up into activated charcoal and out the spout at the top into a container. Watermate by Dynek costs under \$50.



A typical under-sink filter kit includes (left to right, rear): hanging bracket, tubing, replaceable filter cartridge, tubing adapters, outer cylinder. Front (left to right): mounting screws, filtered water spout and self-tapping needle valve.



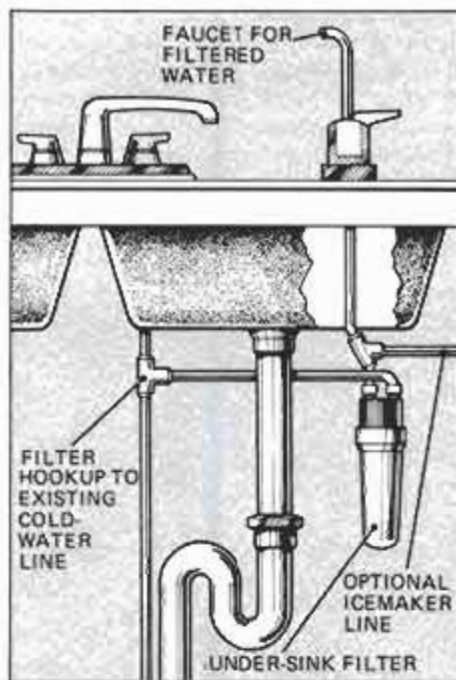
Water Master by American Purification delivers one cup of water at a time. The hourglass filter fits over the cup; water takes under a minute to seep through.



## Installation under a kitchen sink



The under-sink taste-and-odor filter by Culligan mounts on a bracket and delivers fresh water to its own water spout. The handy unit is packed heavily with carbon.



The filter canister installs on an L-shaped bracket on the cold-water line. The line maintains pressure through the filter to its spout and to the optional ice-maker line.

stand temperatures as high as 275° F., but those withstanding 200° are more than sufficient.

Activated charcoal (carbon) filters remove bad taste, odor and many of the chemical compounds with the tongue-twisting names. For most people, the primary taste that they are trying to remove is that of chlorine; where it prevails, hydrogen sulfide (the "rotten egg" compound) runs a close second. Carbon doesn't remove fluorine or any natural minerals.

Recently, some makers have infused their activated carbon with a silver compound aimed at squelching minute bacteria growth on the surface of the carbon. However, according to extensive EPA tests, there is no significant difference in bacteria count between filters with silver and those without.

While the bacteria is virtually benign in such small quantities, it is still a source of concern for some. To cleanse the carbon surface of the filter, simply run water through the filter for five or six seconds.

Finally, there are filters packed with salts to impede lime buildup or scale on the piping and inner walls of hot-water heaters. These small filters are not intended to supplant water softeners. They are designed only to remove the worst of the calcium in hard water.

A number of companies offer cartridges containing filter combinations. One, in fact, is said to block

taste and odor (carbon), sediment (spun cellulose) and lime (salts). Such filters, however, don't perform as well in each category as canisters of the same size that are packed with a single filtering material.

The best cure for hard, rusty, chlorine water is to install three separate filters—one each to solve a specific problem.

Of course, the catch is cost. One combo unit might run around \$50. Three single-purpose devices could exceed \$140, not considering your time required to install the system (or the cost of paying someone to do it).

### Six types of water filters

Costs for filtering devices run the gamut, from as low as \$12 to nearly \$400. Here are the highlights of six types of filters and what they'll do for you:

**1. Faucet-attached filters** are at the base of the price ladder—from about \$12 to \$40. You just remove the faucet aerator and attach the filter fitting. Older faucets may not take the fitting directly. But you can buy adapter rings from a plumbing supply or hardware store. Choose a filter that provides a bypass for unfiltered water. Otherwise, you'll needlessly shorten the life of the cartridge by filtering water to wash, say, the kitchen floor.

**2. Under-sink models** fasten to supply piping. Generally, these in-line models fall into two categories: (1)

units that hook up to cold-water supply piping and feed an existing faucet, and (2) systems that divert water from the cold-water line to the filter and send clean water to a separate spout.

Spout models deliver filtered water when you need it, allowing water for general purposes to flow through the faucet. Some in-line devices have a bypass feature, a valve built into the canister head.

If you buy in-line cylinders without a bypass, install the valve on the supply side. This way, you won't have to trudge to the cellar to turn off the house water before changing filters. A valve on the delivery side prevents water in the line from draining back during a change.

Prices for under-sink models span the widest range—from around \$35 to nearly \$400. Replacement cartridges run from about \$6 to \$75. Variations that account for the wide range of prices include: different amounts of carbon; plastic versus stainless-steel cylinders; canister alone versus canister plus spout and piping accessories; activated carbon inside the cylinder versus activated carbon plus additional mechanical filters.

Before mounting an in-line canister, make sure the supply pipe is strong enough to support the added weight. If you decide it isn't, support the unit with a wall bracket.

**3. In-line sediment filters** are identical in appearance to under-sink models (and can be installed there). Generally, families want sediment removed from all their water. For that purpose, the filter is installed in-line at the service entry, just beyond the shutoff valve.

Prices for these start at about \$35 and run to \$150. Replacement cartridges cost from \$5 to \$22. Essentially, price differences relate to size. Bigger models take out sediment over a longer period of time.

**4. Ice-maker filters** attach to the flexible copper or plastic tubing that delivers water to a cold-water/ice-maker refrigerator or a standard ice maker. You attach it to the line just before it enters the appliance. It costs from \$12 to \$40 for the original and \$12 to \$16 for replacements.

**5. Portable filters** freshen water on a recreational vehicle, boat or at a campsite, assuming you start with potable water. Most of these units are simple pour-through systems. They cost between \$5 and \$25.

Electric models by Dynek are intended for both in-house or out-of-house use. One model, under \$50, operates on 115-v. house current. Another, under \$55, works off a 12-v. line. You pour water into the con-



tainer, and a small electric pump forces water up through a bed of activated carbon, then out a spout at the top. A standard filter replacement for \$8 removes taste and odor; a special filter (\$10) also removes fluoride and some minerals.

**6. Scale filters** connect to the hot-water heater supply line. A smaller model prevents scale buildup in humidifiers. Prices range from about \$35 to \$90.

### Maintaining the filters

Maintenance is vital for all of these filtering devices; you can't install and forget them. As time passes, the filtering agent becomes less efficient. Eventually, it needs to be replaced.

How long the filter lasts depends on the filter size, the condition of your water and how often you use the filter.

The easiest way to determine when the filter needs a change is to check the water flow. When water from the filter slows to a dribble, a change is overdue: The filtering agent is clogged.

You can also tell that your filter is due for replacement when the water begins to taste bad again, or when it shows a slight turbidity. Manufacturers usually give you a ballpark figure for filter life, as well.

More than anything else, water filters improve your meal-time enjoyment. As one Florida homeowner said, "I'd forgotten that a simple cup of coffee could taste so good." **PM**

### WATER FILTER SOURCES

Several manufacturers of home water filters are listed below. You'll find many of their products displayed at home centers and hardware stores. If you can't locate a brand or you want more information, write directly to the maker. Types of filters that each company offers are keyed as follows: faucet-attached filter (f); under-sink or in-line filter (i); ice-maker filter (i); scale filter (s); portable filter (p).

American Water Purification, 1990 Olivera Blvd., Concord, Calif. 94520 (f,u,p).

AMF Cuno Div., 400 Research Pkwy., Meriden, Conn. 06450 (u,s).

Aqualux Water Processing Co., 1919 North State Rd. 7, Margate, Fla. 33063 (u).

Aquatron International, 119 Enterprise Dr., Gretna, La. 70053 (u).

Crystalab, 612 Capitol Ave., Hartford, Conn. 06106 (f,p).

Culligan USA, 1 Culligan Pkwy., Northbrook, Ill. 60062 (u,s).

Dyneck Corp., 160 Irving Ave., Port Chester, N.Y. 10573 (p).

Everpure Inc., 660 North Blackhawk Dr., Westmont, Ill. 60559 (u).

Facet Enterprises, Box 1637, Henderson, N.C. 27536 (u).

Filterite, 2033 Greenspring Dr., Timonium, Md. 21093 (u,i).

General Ecology, 151 Philips Rd., Lionville, Pa. 19353 (u, i, p).

Mini Aqua Filter, 826 Broadway, New York, N.Y. 10003 (f).

Peerless Faucet Co., 931 East 86th St., Box 40980, Indianapolis, Ind. 46240 (f).

West Bend, Box 278, West Bend, Wis. 53095 (f).

## Installation on house supply line



This sediment filter is installed on the main cold-water line. The pipe openings in the filter head line up with bracket holes.



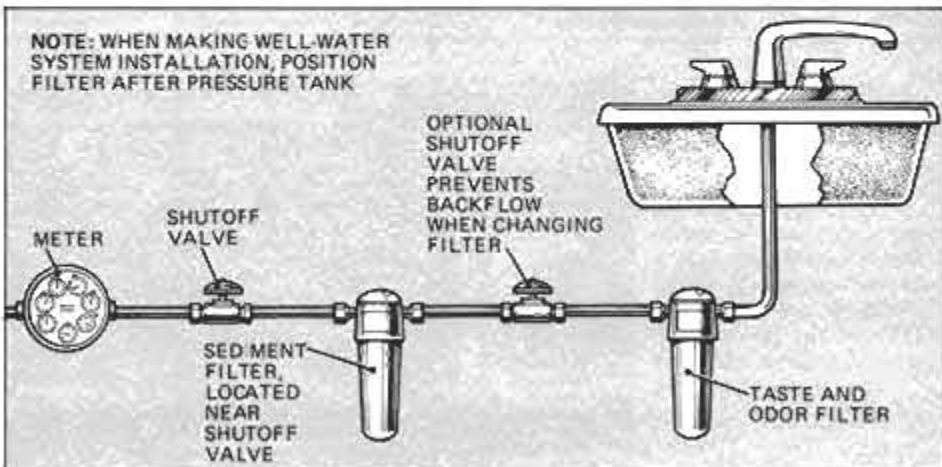
A male-threaded pipe fitting holds the filter securely in its bracket. The adapter allows you to hook up the filter to the existing piping in the cold-water line.



Slip a nut over the pipe and put pipe in the joint opening. This system eliminates need to thread the pipe after cutting it.



Tighten the nut firmly, but not excessively. This in-line filter has a water bypass valve to facilitate any cartridge changes.



Suggested locations for the sediment and taste-odor filters are shown in the diagram above. The optional shutoff valve prevents backflow from occurring when changing filter.





In a dugout on the Amazon, PM's McKeown watches as the author lands a battling peacock bass on a sturdy rod rigged with light line.

Typical lures (right) are being reduced in weight to match the new minitackle. Zebco's Omega 144 trigger spin-cast and the Garcia Mitchell 308 (far right) are just a few examples of the latest and lightest.





# Lighter tackle for heavier catches

Limber rods, smaller reels and mini-monofilament are towing tiny lures to fool more and bigger fish.

by Homer Circle

**T**here now seem to be three essential types of anglers: 1, those who use heavy tackle to prevent fish from escaping; 2, those who use average tackle and expect to lose occasional fish; and 3, those who have switched to ultralight tackle, lose some fish, but catch more than the other two together.

Not that I'm putting down the guy who uses heavy tackle when fishing for larger fish. But, if you're interested in hooking the

greatest possible total of fish in a day's outing, take along a new ultralight rig. Many days it will be the difference between fish and no fish.

Most of the millions of sport fishermen belong to the "average tackle" segment. They use lines testing from 10 to 20 pounds, rods of light to medium-light action and reels to suit their needs. Their lures will be in the 1/4- to 3/4-ounce range. The majority of them fish for bass, America's most popular

*(Please turn to page 116)*

Superflexible fiberglass, graphite and boron compounds are used in new rods that make lines invisible. Daiwa's Minicast 2 combo (far right) can handle 2-pound line.



PM photo: George Harrison





# 4 better ways in your shop

Shop people are always looking for new jigs and techniques. Here are four we think you'll enjoy.

## Wheel tools

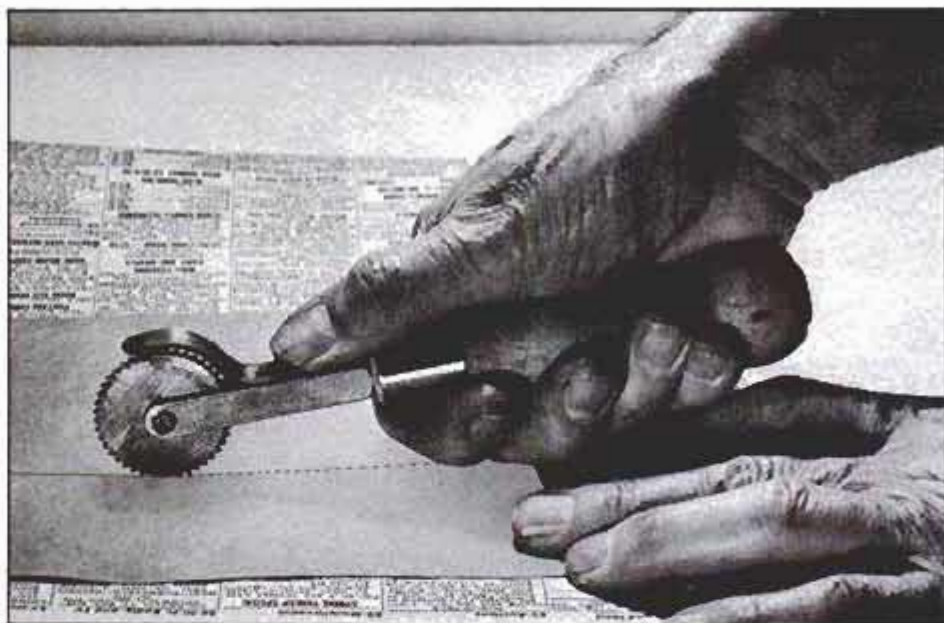
**W**heel tools are common in many industrial operations such as rubber fabrication, leather work, and sewing. However, it's safe to say that many home craftsmen have never seen one, let alone considered making one. Although simple in design, the tool has a number of useful functions.

Nine wheel varieties are shown in the drawing on the next page; you should make only those you need. Select the ones that you want to make before determining the dimensions for the fork and handle.

### Wheel uses

Wheel No. 1 (see drawing on facing page) is used to crease corrugated cardboard, and similar materials. This makes folding easier. This wheel is also helpful in working self-adhering foil and paper into inside corners, though wheel No. 4 is more specifically designed for that purpose.

Wheel No. 2 can be used to cut sheet material, usually with the help of a straightedge guide. No. 3 presses together leather or other materials that are being bonded before stitching. No. 5 is also useful in working with leather or any mate-



A wheel tool has many uses and each wheel shape may have several. A serrated wheel cuts a perforated line that makes material easy to tear. Use the same wheel for decorations.

rial being cemented into concave areas or grooves. No. 6 applies pressure to rounded corners where seams occur in materials that are being matched and bonded to a surface.

Wheel No. 7 consists of two thin wheels placed face to face. Such combinations can be used to produce a variety of surface designs in leather.

If you couple a pair of No. 2 wheels, you can even cut strips from many materials. No. 8 is a typical design to produce an interesting embossed pattern in leather.

Wheel No. 9 is the suggested shape for the serrated wheel shown above. Such a toothed wheel is probably the most versatile type. It can produce evenly spaced decorative holes, or



Wheel slot is cut in fork with a milling cutter. Axle hole, not shown in photograph, should be bored before you mill the slot.

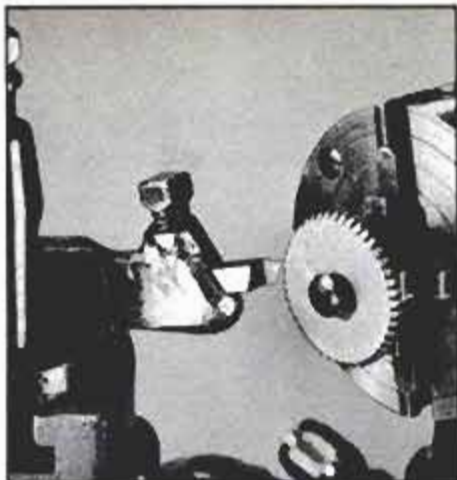


After the slot is milled, reverse the fork in the chuck and machine a 3/4-in.-dia. shank. Then insert fork in the handle.





A disassembled wheel tool and its parts. Guard and its screws aren't shown, but one should be used in all cutting operations.



To machine teeth for wheel that cuts perforated lines, mount it in four-jaw chuck and machine points to a 30 to 35° pitch.



To form a creasing wheel, like No. 1 in the drawing, cut gear teeth completely off and machine the wheel to the desired shape.

the holes may be used as guides for stitching. Also, scoring a line with this wheel will make most materials easier to tear.

### Making the tool

You can turn the handle or find a handle similar to the one shown (such as a file handle) at hardware stores. Bore a  $\frac{1}{2}$ -in. hole in the end to receive the fork. If you do not turn your own handle, trim the stub very carefully to get a good, snug fit in the ferrule.

Make the ferrule from a 1-in.-long piece of iron pipe. Drill and tap holes for the setscrews after the ferrule is in place on the handle.

To make the fork, drill the axle hole in a  $\frac{1}{2}$ -in.-square steel bar. The axle assembly shown in the drawing includes a brass nut of the type used on bicycle-wheel spokes. A No. 2 machine screw and washer hold the wheel and axle assembly together between the fork prongs. Drill the hole to the outside diameter of the axle that you plan to use.

Next, mill a slot in the bar at the axle end to a depth of  $1\frac{1}{2}$  in. The slot could be cut with a handsaw and then filed, but it is important to allow adequate, but minimal, clearance for the wheel in the fork. If you expect to use the tool mostly for cutting, you may wish to use thinner wheels. In that case, mill a  $\frac{3}{8}$ -in.-square bar with a narrower slot.

Next, turn the other end of the bar to a  $\frac{3}{8}$ -in. dia. for a length of  $1\frac{1}{2}$  in.

The guard is made by bending a  $\frac{1}{2} \times \frac{1}{2} \times 2\frac{1}{4}$ -in. metal strip to the shape shown in the drawing. You may want to make the rounded part of the bend before you cut the strip to the required length. Drill and countersink holes in the guard and use these holes to position, drill and tap holes in the fork for two 6-32 flat-head bolts. Attach the guard to the

fork and fasten the fork in the handle with the setscrews.

### Making wheels

The toothed wheel shown in the photograph on page 84 was made from a  $\frac{1}{8}$ -in.-thick steel gear with a  $1\frac{1}{2}$ -in. diameter. Clamp the gear in an independent-jaw chuck with a bolt inserted through the hole. Machine the bevels that convert the gear teeth into individual cutters. You may want to experiment with the angle, but the cutting edge works best at a 30 to 35° angle.

All of the wheels in the drawing may be made in this way from ordinary steel stock or gears. Gears with a slightly larger diameter than  $1\frac{1}{2}$  in. are useful, since you may be able to find a large number of the same thickness. By cutting the teeth off, you can produce blanks from which

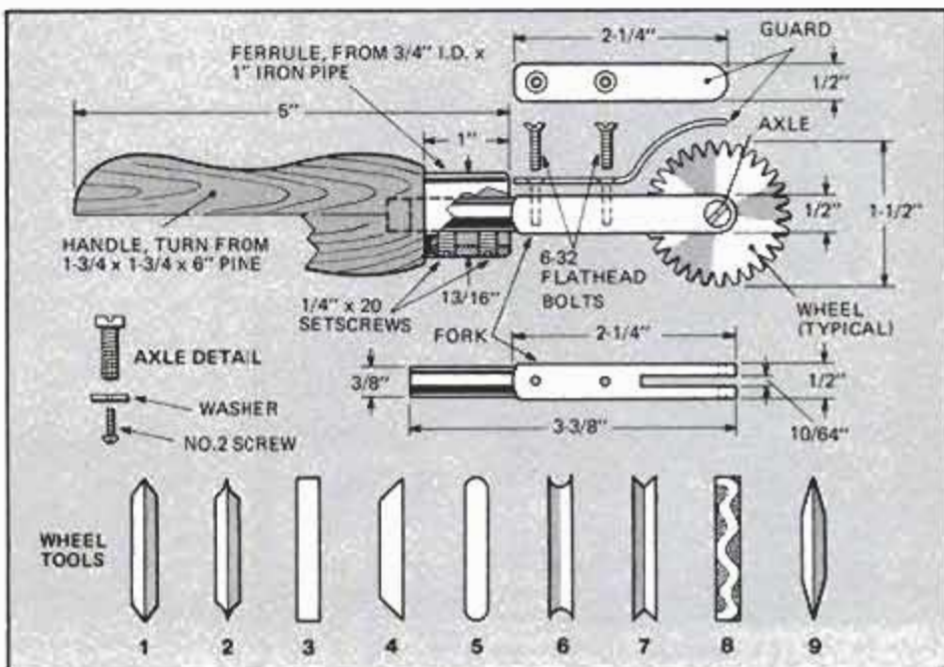
you can make the other wheels with a minimum of milling.

Using gears may be a problem if the center hole is large. Some gears may have holes as large as  $\frac{1}{4}$  in. To reduce the hole to the size of your axle, insert bushings into the gear holes as needed. You can avoid this problem by making the entire wheel yourself from case-hardened tool steel.

Maintenance of your wheel tool is important, as it is with any other tool. Keep the axle lubricated and the wheels clean. If you find the axle wearing out, replace it. Make a few extra axles when you're constructing the original tool and you'll always have ready replacements.

To finish the wheel-tool handle, rub in a few coats of linseed oil. Allow 24 hours between coats.

—Walter E. Burton



The wheel tool and nine wheel designs that are most useful in your shop and home.



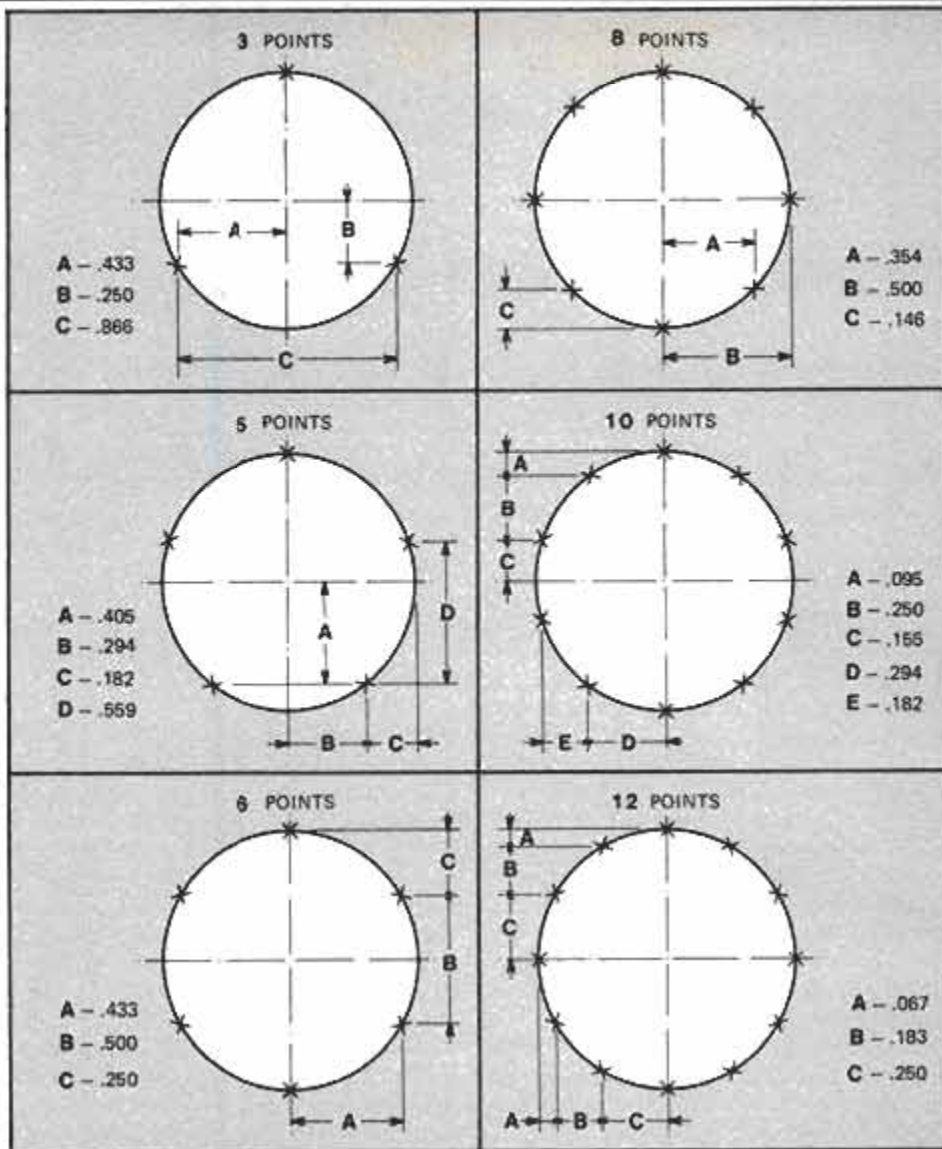
## Circle points

**D**rawing geometric shapes, such as stars or octagons within a circle, usually requires some mathematics and plane geometry. That's fine, until you try to produce one of these shapes in your shop for a project. If your plane geometry is a little rusty, you'll appreciate the handy tables of constants shown.

The tables are easy to use. Here's an example: Suppose you want to cut a pentagon or a five-pointed star from a  $\frac{1}{4}$ -in. by 24-in.-dia. plywood disc. Locate one point where the vertical axis intersects the circumference. Then, consult the table under the listing "5 points" and multiply .405 by 24 in. to get the product measurement A of 9.72 in. ( $A = .405 \times 24 = 9.72$ .) Use an engineer's rule to measure the vertical axis from the center point and draw a perpendicular line at this point intersecting the circle circumference on both sides. The two lower points are determined in this way. From this line, measurement D is made for the two upper points. Join opposing points across the circle with a straight line to form a five-pointed star. Join points around circle to form a pentagon.

In this example, constants B and C may be used to check your points, because one point is on one of the perpendicular axes. Otherwise, all constants must be used.

—Edward G. Hoffman



## Metal shims



Three shims of different thicknesses produce combination needed to hold one or more workpieces square and in position.

**A**n assortment of "shim bars"—short pieces of square and rectangular steel bars—can be among the most useful tools in your workshop. They are valuable mainly as spacers and supports to maintain alignment in various milling and grinding operations.

Each bar should be straight and uniform in thickness and width. Length is not critical, but 3 to 6 in. seems to be most useful.



Shims of varying thicknesses: Shim on the far right is a high-speed steel lathe bit.

Make your shims from foot-long pieces of square key stock, available in many hardware stores. Buy key-stock bars that range from  $\frac{1}{8}$ - to  $\frac{1}{2}$ -in. square. Either use all of the key stock to make several shims of the same thickness or mill shims to finer grades.

For example, you can easily cut three 4-in. shims from 1 ft. of  $\frac{1}{2}$ -in.-thick key stock. Then grind one of the shims to a thickness of  $\frac{1}{32}$  in. and one to  $\frac{1}{16}$  in.

Once you have accumulated a set of shims, mark them to show the thickness of each and store them in a way that will prevent damage.

Another type of bar that can be used for shims is a square or rectangular 3-in.-long lathe bit. These bits are made of high-speed steel which is finish-ground on all sides. The thickness of a bit is precisely calibrated. These bits are more expensive than key stock, but they could be handy if you don't have the time to make your own.

—Walter E. Burton



## Handsaw depth stop, guide and gauge



Saw with depth stop cutting a dado. In the left end of the board is a dado that was cut with this tool. Keep saw teeth sharp to make clean cuts. When using the saw guide, clamp board between the T-square head and guide jaw with a moderate grip.

If you have ever wanted to cut a dado in a piece of furniture or a partially assembled project, you know there are times that the cut must be made by hand, rather than with a power tool. You can prevent possible damage to the project or yourself by using this clever depth-stop jig for a handsaw.

If this tool will be used constantly in your shop, you may want to buy a quality 15-in. saw just for the setup. But if you already have a spare saw, check it to make sure its teeth are in good condition (to avoid cutting ragged dados).

Start by marking positions on the blade for  $\frac{1}{16}$ -in.-dia. holes, as shown. The holes should be  $7\frac{1}{2}$  in. apart and  $1\frac{1}{2}$  in. from the teeth points. With a framing square, align the square's body with the points and then measure  $1\frac{1}{2}$  in. up the tongue. Do this at two points, then locate holes with

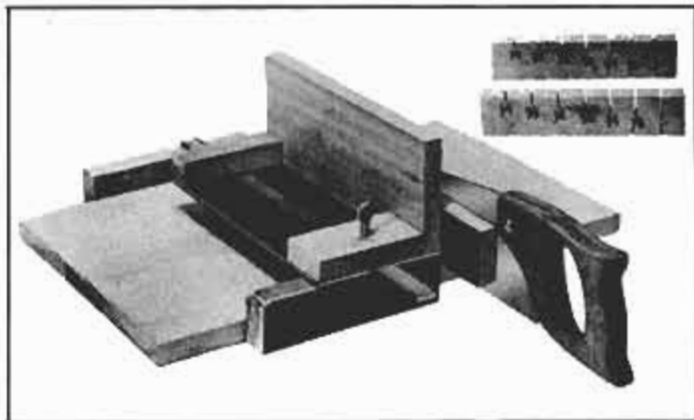
punch and hammer. Next, anneal the areas to be bored so you won't burn the bit on the hardened saw blade. This can be done using a  $\frac{1}{4}$ -in.-dia. metal rod with a shallow point ground on one end. Chuck the rod in your drill and apply it to the area with moderate to heavy pressure. Continue pressure until a red-hot

spot on the blade expands to a  $\frac{1}{2}$ -in. diameter. Take care to clamp the blade against a nonflammable surface, and wear safety goggles to protect your eyes.

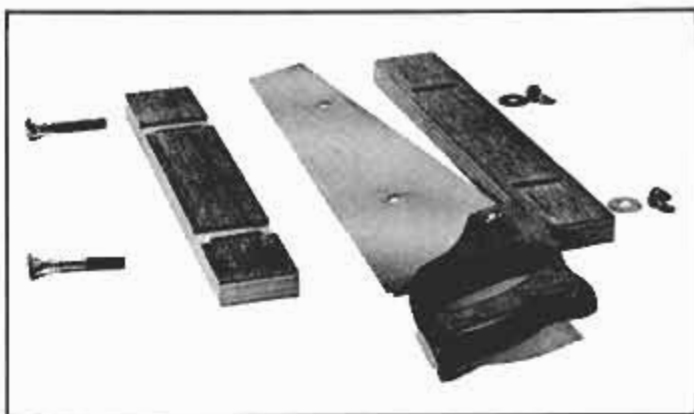
After the blade has cooled, you can drill the holes without damaging your bit.

The depth stop shown is constructed of  $\frac{1}{2} \times 3 \times 14$ -in. oak-veneer, lumber-core plywood, but any hardwood stock may be substituted. Using a square, mark perpendicular lines across one board  $3\frac{1}{4}$  in. from both ends. Align and clamp the

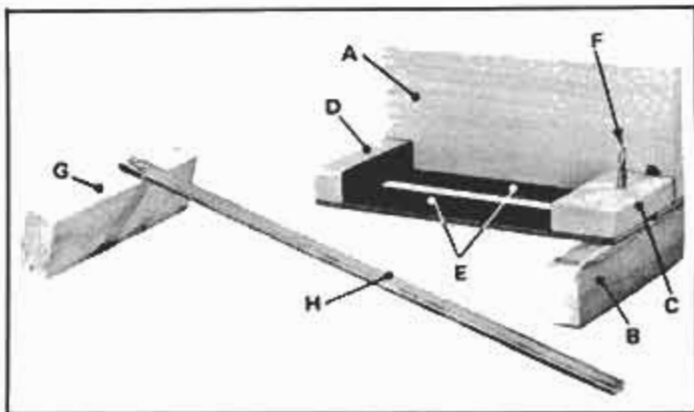
(Please turn to page 114)



Saw stops and guide are shown in use position on a workpiece. A depth gauge (upper right) is also a handy accessory to set depth stops. Make the gauge from two pieces of hardwood.



The saw with depth stops is a simple tool. Dados are cut in one of the stops (at left) to allow bolt heads to be recessed. This side of stop rides against the fence of the saw guide.



### MATERIALS LIST SAW DEPTH-STOP GUIDE

Key	No.	Size and description (use)
A	1	$\frac{3}{4} \times 4 \times 10'$ hardwood (guide fence)
B	1	$1 \times 2 \times 7'$ hardwood (fixed jaw)
C	1	$\frac{3}{4} \times 2 \times 4'$ hardwood (thumbscrew plate)
D	1	$1 \times 1 \times 4'$ hardwood (blade-guide stretcher)
E	2	$\frac{3}{8} \times 2 \times 10'$ hardboard (T-square blade guides)
F	1	$\frac{1}{4} \times 20 \times 2'$ thumbscrew
G	1	$1 \times 2 \times 7'$ hardwood (T-square head)
H	1	$\frac{3}{8} \times \frac{3}{4} \times 16'$ steel bar (T-square tongue)

Misc.: Flathead wood screws, carpenter's glue.



# 10 ways to cool your home

Passive and low-energy tricks help you keep summer energy bills down.

by Richard L. Dempewolff

**W**hat can you do about cooling your home on hot summer days—besides turning on an energy-hungry air conditioner? Plenty, according to experts who gathered recently for the fifth National Passive Solar Conference at the University of Massachusetts.

Using calculated shading, ventilating and other tricks, engineers and builders demonstrated that summertime temperatures in almost any home can be maintained 10° to 30° lower than outdoors. Furthermore, for most passive cooling systems the initial cost is negligible; operating cost is either nonexistent or only a matter of pennies.

Before discussing 10 possible systems or methods, it should be emphasized that all of them start with a tight, well-caulked building with

insulation no less than the following: attic, R-30; north wall, R-18; south, east and west walls, R-11. Heating-cooling specialists recommend triple glazing for north-wall windows, and at least double glass on openings in the other walls.

**1 Shading devices above windows** that open (so warm air near the ceiling can vent) are important cooling assists for homes without protective roof overhang, such as contemporary, ranch, split-level or colonial homes.

The louvered sunshade shown in the drawing below has the further advantage of permitting hot air from the house to escape upward through the spaces between the louvers. Awning types tend to trap hot air.

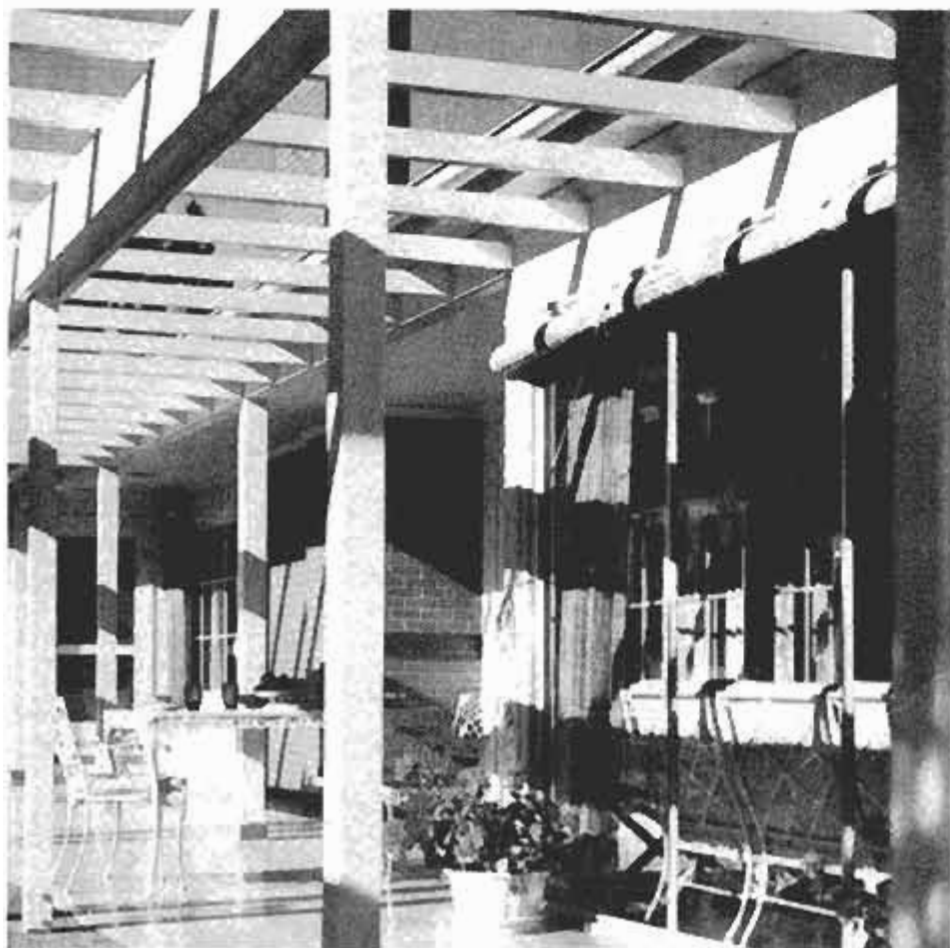
The unit shown is simple to construct and install. You can make the louvers of 1/2 x 6-in. exterior plywood, extending 1 ft. beyond the width of the window on each side. They are notched to fit grooves routed in the support bars at about a 45° angle. The grooves should be spaced apart 1 in. less than the width of the

louvers. Supporting arms are secured as shown, by removing just enough exterior siding above the window to gain access to the cripple studs above the window headers.

The supports should be securely bolted or lagscrewed to the inside faces of the cripple studs (as shown), so they will withstand buffeting in heavy weather. A difference of up to 5° in inside temperature can be achieved if all windows on the south wall are louver-shaded as described.

**2 Wind-generated ventilative cooling** is a fancy term for cooling by opening the windows. However, there's more to it than just flinging windows open willy-nilly. The aerodynamics of most dwellings are such that the windward wall is subjected to considerable pressure. It splits the airstream around the sides and over the roof in a wide arc, creating "wind shadow" areas of relatively low-pressure turbulence.

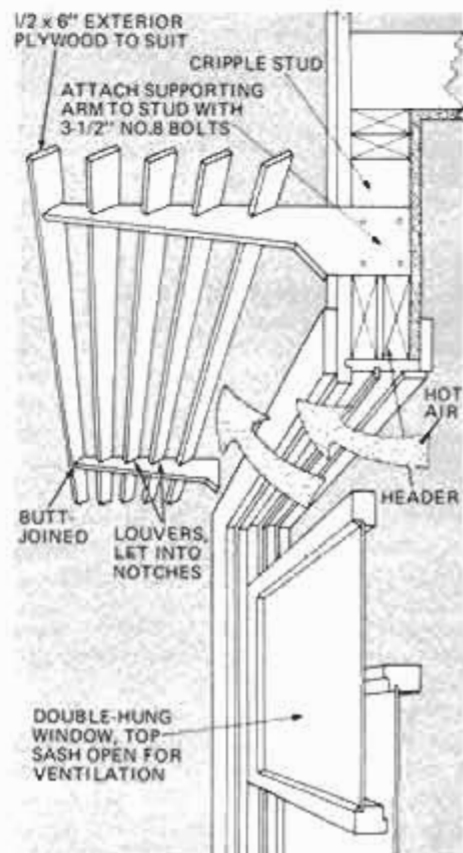
Photos by William Aplin, reprinted with permission from the Ortho book, *Garden Construction Know-How*, © 1976, Chevron Chemical Co.



The shading device in the photo is a unifying design element that extends over all the windows on one wall of this house. You can

also shade individual windows as shown in the drawing. Being louvered, structure lets hot air from the house escape upward.

## Above-window shading





# without an air conditioner

## Vertical window shading



Another way to shade a window—yet allow air to enter and leave the house—is with a sun grille. It's made of 2x3s that are notched and added to an existing roof overhang.

If the prevailing winds in summer are southerly, and you hope to bring in breezes by opening windows in the east, west or north walls, you'll get about as much air movement inside the house as you would in the windless Sargasso Sea.

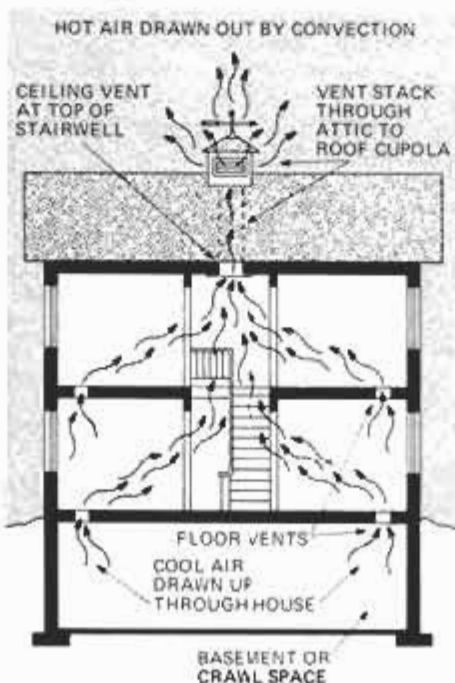
If, however, you open a window or two in the south wall a few inches, and widely open those on the other three walls, you may have to anchor everything lying loose on tabletops. Positive pressure on the windward side, and negative pressure on the downwind sides, will suck air through the building.

If your house is not properly oriented to direct breezes in the above manner, there is still a way to scoop in moving air with a baffle or window wing, made of 2x4 framing and exterior plywood, as shown in the drawing at far right. Install it on downwind side of windows that are farthest downwind on each sidewall. When sidewall windows are opened, such wings will direct turbulent air currents into the house in a variety of patterns. You can experiment directing breezes by opening and closing other windows.

**3 The cooling tower or thermal chimney** is among the most interesting of passive cooling devices. Used in desert countries for millennia, masonry towers opening to the sky exhaust warmed and polluted air from below by convection.

The same principle can be applied to any home through the use of a vent stack or chimney, along with floor vents to draw cooler air up from below. *Caution: Don't cut openings into any chimney that is used*

## Cooling tower



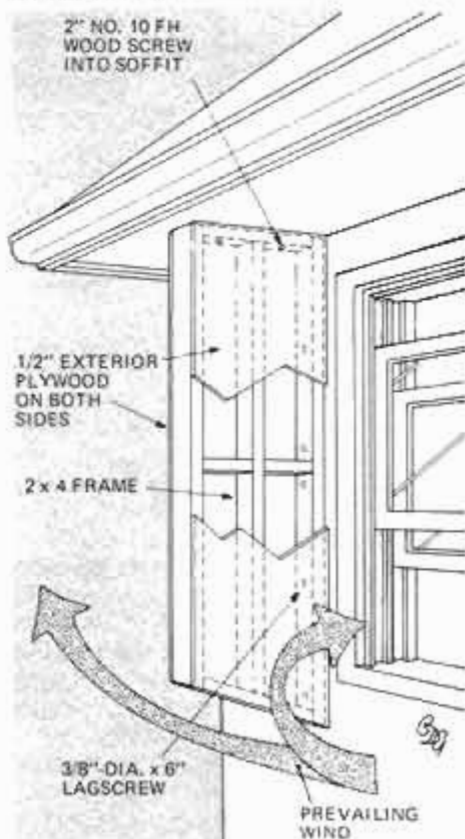
A stairwell serves as a cooling tower when cool air from basement is drawn through floor vents, up the stairs and through a ceiling vent ducted to an attic vent.

for either a fireplace or a furnace.

If your home has a center hall stairwell, you can install a 10-in.-dia. flue pipe from the stairwell ceiling up through the attic to a cupola or turbine vent on the roof. With floor vents (see cooling-tower drawing), cooler air from the basement (or through open windows on the ground floor) will be drawn through living quarters, as the warm air is convected upward through the stairwell and out the stack.

If you have no stairwell, or if your home is a single-story ranch style, one or two flue pipes will do equally well. They must be rigged through the walls from openings high on the wall near the ceiling (similar to a

## Wind-generated ventilation

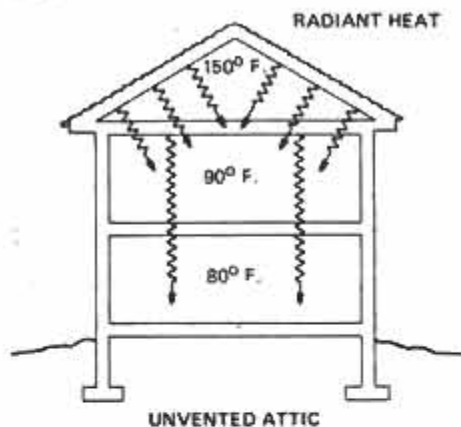


A window wing is designed to redirect breezes into the house. Install it on the downwind side of windows that are farthest downwind on each sidewall of the house.

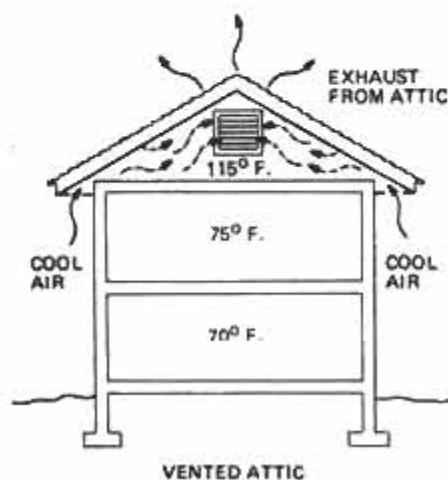
flue that you'd run for a wood stove).

**4 Proper attic ventilation** is one of the easiest, cheapest and most effective ways to cool any house. While most homes have some venting, few have enough. The rule of thumb for the minimum venting required is 1 sq. ft. of ventilation for





UNVENTED ATTIC



VENTED ATTIC

Attic ventilation can cool your attic by as much as 35°F. It can make a 10° to 15°F. difference in the rest of your house.

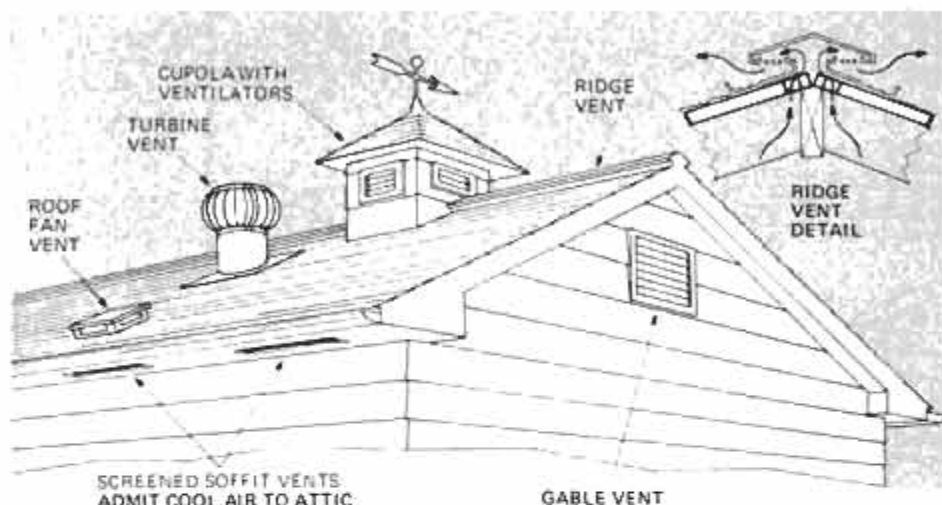
every 150 sq. ft. of attic roof area.

Vents of all kinds (see the drawing above right) are available from most building materials outlets. Gable vents located at each end of the roof peak may be square or triangular (so they fit under the gable-end rafter plate).

Colonial architecture, in particular, lends itself to cupola-type vents that sit astride the ridge with louvers on all four sides. Ridge-cap vents that straddle the entire length of the ridge are usually used on new construction. However, they can be retrofitted by removing the existing ridge cap and cutting a slot about 1 in. wide through shingles and roofing panels (between rafters), along each side of the ridge board.

Soffit vents located in the underside of the overhang combine with the vents mentioned above to circulate air. A house without a roof overhang calls for slightly different treatment to ensure through venting. Here, wall vents are installed high up on the wall (just below the top plate) and holes must be bored through the top plate.

Another attic ventilation alternative is a turbine vent with a bladed dome that spins, even in light



Proper attic ventilation, using a combination of the units shown above, is one of the easiest and the most effective methods for you to cool your home.

breezes; this creates negative pressure in the attic space and draws outside air through all the crevices. A roof vent with a powered fan works on the same principle.

**5 Diurnal heat exchange** is a system that can be totally passive, or enhanced by low-powered blowers (such as small, nearly silent computer fans available in most radio and electronic outlets). It actually makes a heat exchanger of the house itself. You simply open the basement or crawl-space windows at night and allow cool night air to drift through (or be drawn through by the fans) to cool the masonry floor and walls. In the morning, you close the windows.

Using the thermal-chimney concept, cooled basement air may be drawn up through floor vents into the living spaces by convection. For a more efficient transfer, you can install fans in the floor vents to draw cool air from the basement.

Better yet, if your heating system is forced hot air, you can remove the cover of the blower compartment. With a manual switch installed to bypass thermostat controls in summer, and removable seals placed over the return-duct vents upstairs, you can simply flip the switch and activate a central cooling system.

This method can lower the heat level inside your home by 8°F. through the noon hour. After that, the stored coolth (the term cooling specialists use when referring to coolness) exhausts itself.

**6 Earth-coupled cooling** is another method used by ancients who built entire villages underground, and by our own pioneers with their sod huts. The concepts are fine for new construction, but retrofitting calls for more sophistication—*cooling tubes*. These can be made using

15-in.-dia. PVC plastic sewer pipe and easily fabricated PVC fittings. The pipe is buried well below the frost line (about 3 to 5 ft. deep in north temperate states), and extending 50 ft. or more straight out if there's enough property, or circling the building if there isn't. The outer end is brought to the surface and covered with a protective hood and screening to keep out rain and vermin. The inner end is brought through a basement wall just above the floor slab.

In temperate zones, earth at a 5-ft. depth maintains a fairly constant 55°F. Outside air drawn through the pipe with a low-powered fan will be cooled to 60° to 65°F. by the time it gets to the basement. This air is circulated through living spaces via floor vents and a thermal chimney.

Or, again, if your heating system is forced hot air, you can couple the basement end of the pipe to the blower compartment of the furnace. Using the switch and return system already described, you can distribute earth-cooled air (several degrees cooler than the regular basement air) through the house as shown in the drawing of the cooling tube (page 91).

Ground cooling systems are most effective in temperate and arid regions. In warm, humid areas, air from the tubes may be more humid than desired in damp weather.

**7 Thermal mass** concepts in cooling work the same way that they do in solar heating. When used in conjunction with things like earth cooling tubes, they provide a coolth bank in which deposits can be made at night and drawn upon during the heat of the day.

The basement walls and floor in the diurnal system previously mentioned comprise the thermal mass. A



rock bin would be more efficient, if you can find a corner in your basement to enclose about 8 cu. yds. of brook boulders (4- to 5-in.-dia. stones) in a covered, insulated concrete-block cubicle. By connecting one end of that rock bin to a cooling tube and the other to a duct system with blower, you can have a system that comes as close to central air conditioning as any that can be achieved by passive cooling.

Ductwork leading from the rock bin requires a shunt valve to an exhaust stack that, at night, would permit warmed air being purged from the rocks to be passed outdoors. By morning, the rock bin will have been cooled close to the temperature of the night air. You close the shunt valve and direct the incoming air through the house ductwork.

An Austin, Tex., house designed by Michael Garrison of the University of Texas School of Architecture, uses this system in combination with reflective exterior roof coolers, adobe walls and shading devices on windows—along with super insulation. When ambient temperatures hover around 100° F., the house interior ranges from 75° F. in the morning to 80° F. in the afternoon.

**8 Evaporative cooling** is a hybrid system calling for a blower, minor ducting and a little plumbing. Various types of these devices are available commercially. One of the largest makers is the McGraw-Edison Co., Box 20188, Phoenix, Ariz. 85036. The simplest unit is a box with a built-in fan that draws ambient air through wet fiber pads and cools it by evaporation as it passes on to living spaces. In some units, a pipe conducts water to a drip outlet above the pad, which sits in a shallow pan with an overflow drain tapped into a bathroom drain below.

Because of moisture in this type of cooling, it is best adapted to hot, arid regions. It has been used successfully in temperate areas, by passing the moist air over a desiccant bed of calcium chloride that wrings out the moisture before the air is introduced to the living space.

Used in conjunction with a cooling tube, cooling tower, rock bin or other devices, the system can be highly effective. Hot-air ductwork should not be used, since it generally is too small. Furthermore, long circuitous passages that slow the speed at which moist air travels cause scaling and clogging. Best results are obtained by blowing air from an evaporative cooler directly into a large, frequently occupied area, and directing it with small fans to other areas.

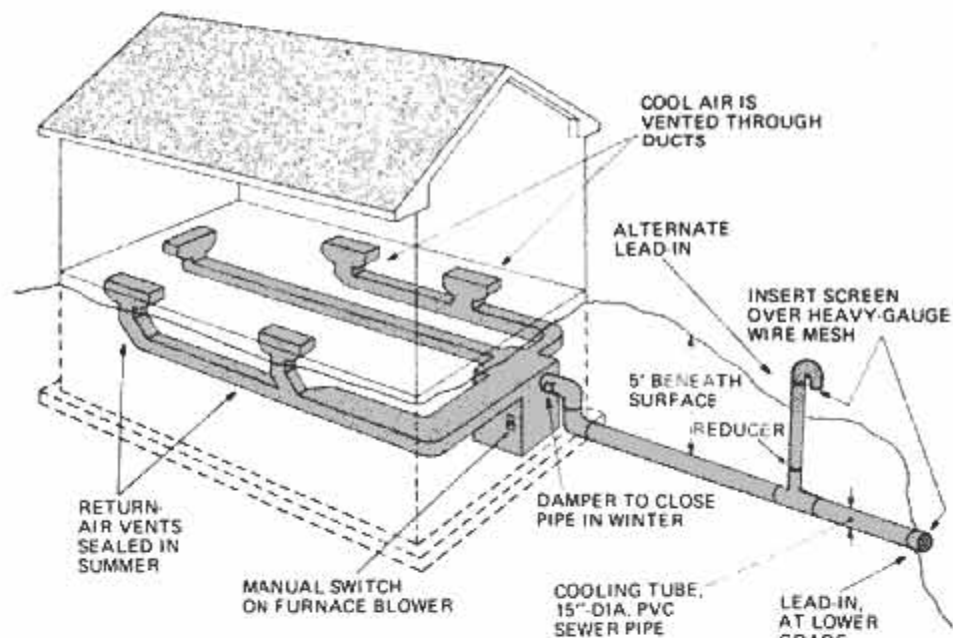
**9 Sky-vault cooling** involves a

method of recycling air (by convection) through a rooftop "radiator" that cools it and sends it back into the dwelling through a manifold for distribution to living spaces. An experimental model at the University of Texas is a flat aluminum air duct similar to a passive solar collector, with baffles inside to increase the air-path distance.

The unit sits on the roof. The sides and bottom are insulated. The top aluminum surface is painted a bright reflective white. The unit cools the air going through it by about 10° F., up until 11:00 a.m. on hot, damp Texas mornings.

Presently, such radiators are still experimental, but production models are on the way, and promise to do a good job in many circumstances. In humid areas, for instance, the night sky often is the coldest available heat sink, getting as low as 20°

## Earth-cooling tube



A cooling tube that is buried 5 feet below ground level, connects to a home furnace. The blower then is capable of drawing cool air indoors from the tube.

less than the ambient air near the ground.

This means that sky-vaulting radiators might do a wonderful job of recycling air at night through thermal storage facilities (like rock bins), so they can be used the next day to provide coolth all day long by methods already described.

**10 Landscaping**, while a long-range means of providing passive cooling, shouldn't be overlooked. Books have been devoted to the subject, so no attempt will be made here to provide more than a hint of what proper planting can do for you. And still valid are the tips given in PM's

article *Sun, Shade and Wind Where You Want Them* (page 185, Oct. '60).

Trees and shrubs can provide large amounts of moisture that cools air passing through and under them, and they retain precipitation, thus providing natural evaporative cooling in their vicinity for some time after a shower.

In planning plantings for functional purposes, a number of basic observations are worth mentioning:

■ A semicircular planting of evergreen trees and shrubs on the northern perimeter of a site will protect a house from cold winter winds and will force southern summer breezes to circle the building.

■ Deciduous trees on the southern and western sides, trimmed high so breezes can pass beneath to ventilate the house, will provide shade

and transpiration to cool the air passing under them in summer. (In winter, their leaves drop off and permit the warming sun to reach the house.)

■ Thick, pruned hedges of privet, azalea and evergreens can be planted to direct passing air currents to windows—just the way a window wing does its job.

While none of the passive cooling methods covered here can, by itself, do the same total job a central air-conditioning plant would achieve in very hot weather, neither will any of them be as costly to install—or to operate. **PM**



# 5 great ideas from the PM vacation home

From bedroom to breakfast nook, this collection includes a project for nearly every room in your house.

by Harry Wicks HOME AND SHOP EDITOR

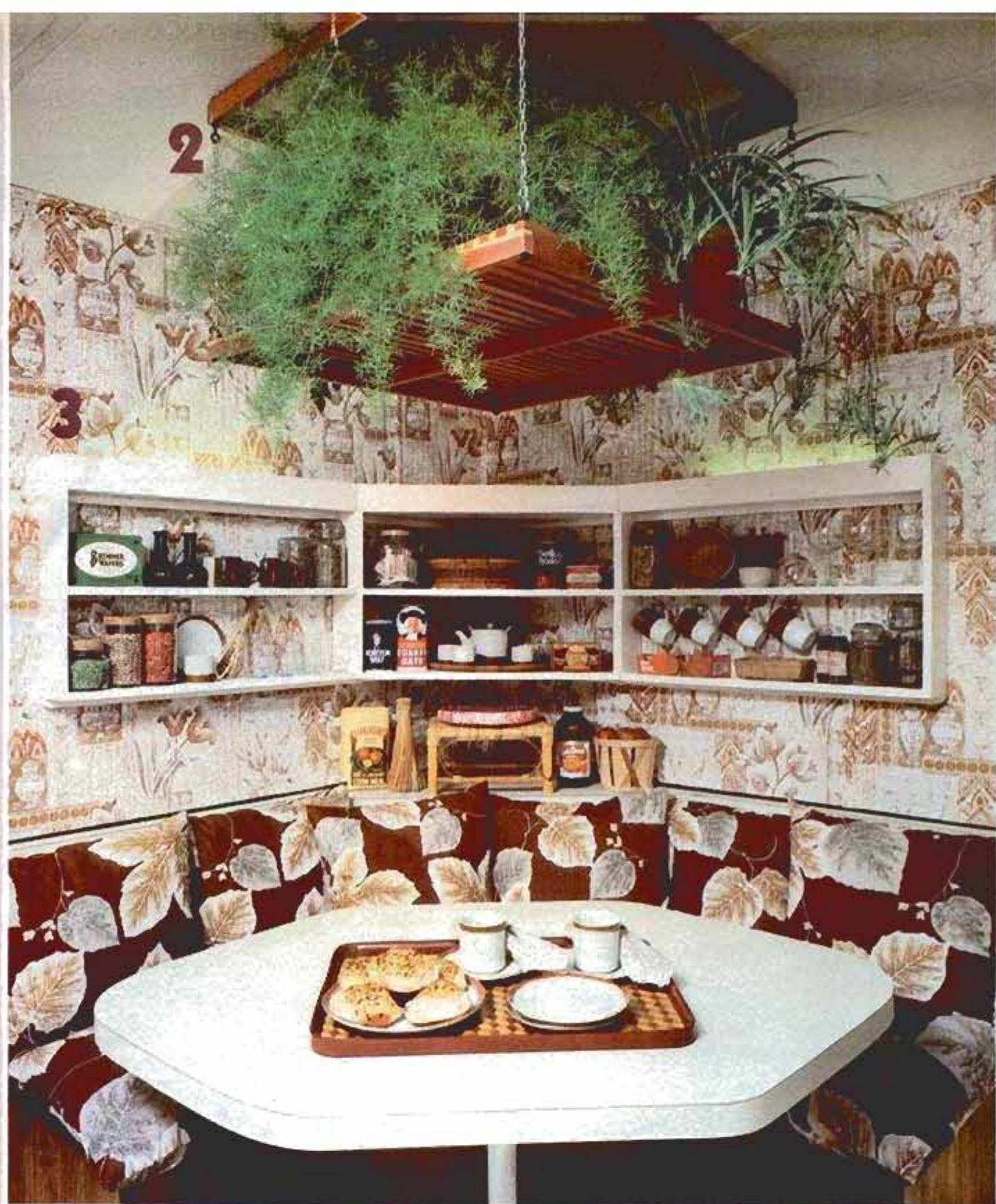
**T**he five super projects on these pages first appeared in our story on the PM vacation home (page 106, Apr. '81). Now we're taking a closer look, with how-to information so you can duplicate them. The projects are extra-functional as household furniture and are handsome, as well. On

these pages, you'll find complete plans for the home entertainment center, hanging redwood planter, open kitchen shelf and three tables with a Parsons-like look.

**Our elegant entertainment center features fabric-covered doors that match the room decor. The hinged doors roll on sturdy casters to prevent any chance of door sag.**







An open kitchen shelf lets you display your favorite cooking paraphernalia; the hanging redwood planter is suspended from chains.

### Working with plywood

Since plywood is used on all projects except the planter, here's a quick rundown on the basics of working with the material. The plywood in these projects is covered with fabric, paint or high-pressure plastic laminate, so you can buy A-D grade.

Experiment on scrap plywood

until you've mastered the art of cutting it to produce smooth, unsplintered edges. If hand-sawing, use a sharp crosscut saw having at least 10 points. Support the panel firmly with its good face up. First score the surface at the edge with the saw almost parallel to the face. *Use forward strokes only.* Once the cut is started, you can use normal strokes, holding the

saw at a 30° angle to the surface.

If you're cutting with power, sabre or circular saw, place the panel's good face down; power saws cut on the up movement of the blade. In a circular saw, use a plywood blade; lacking this, use a combination blade with little or no tooth set.

To prevent excessive splintering on the saw exit surface, you can





Bed table (above) helps to make breakfast in bed something special. When not used for dining or reading, table rolls on casters over the dresser at the foot of the bed.

His-and-her home-office setup (below) is highly functional; the Parsons-like tables are built with the same construction techniques that are used for the bed table.

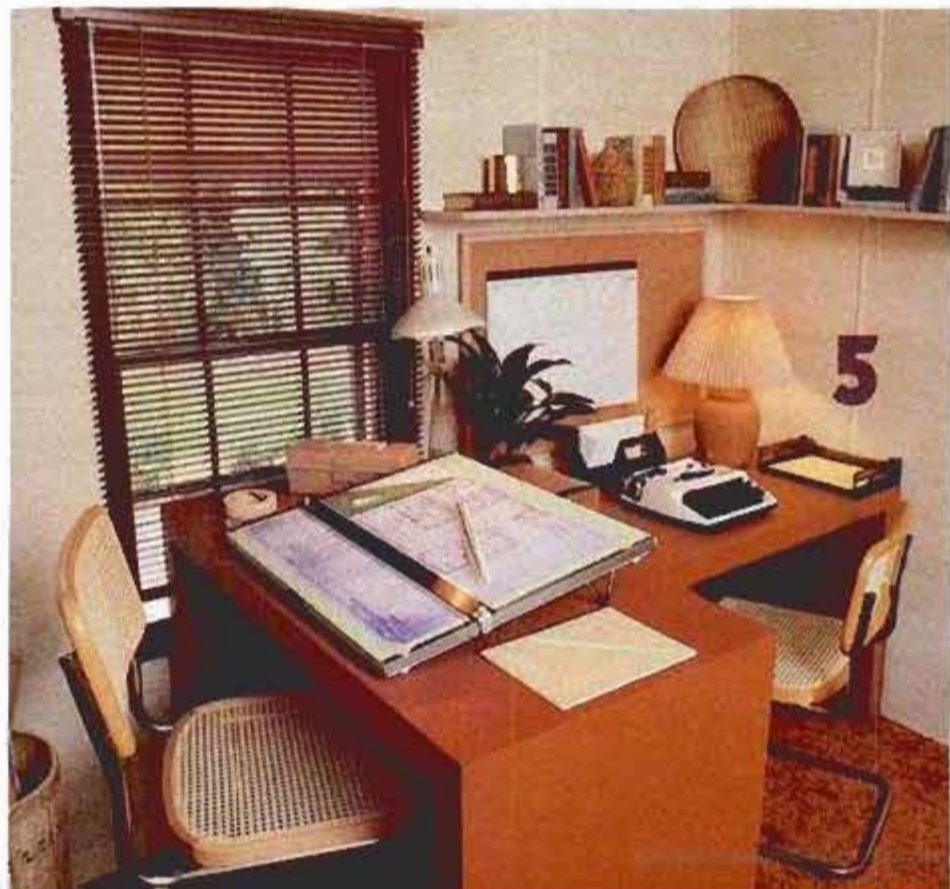
clamp scrap material over the cutting line on that surface.

It's easier to sand all surfaces while the project is disassembled. Start sanding with 100- or 120-grit abrasive paper. Just prior to sanding, fill all exposed edges with a wood filler; sand them, as well.

Assembling these plywood projects is particularly easy, as all surfaces are ultimately covered. Thus you can use nails instead of clamps to hold the work while the glue dries. Permanently countersink nails or temporarily drive them partway into the wood. Later, remove any partially driven nails, use wood filler in all holes and sand the surface.

If you plan to paint your project, first prime the plywood with sealer such as Bin or Enamelac. Let dry overnight before painting. Whether you use an alkyd or a latex paint, I recommend a semigloss finish.

Project designs: John Gaynor; Debbie Seaburg, ASID, Armstrong World Industries Inc.; Eugene Thompson, Harry Wicks. PM photos: Gary Bradt









save money on materials by using 1/2-in. plywood on the door fronts and the cabinet back. (We have sized the unit for this.)

Dado and rabbet joints are used as shown in the drawing. All joints are made using glue and either 6d finishing nails or 1 1/2-in., No. 10 flat-head screws. If you use the latter, bury the heads in countersunk holes that can be filled and sanded.

After cutting all pieces to size, test-assemble the unit without glue to make sure everything fits. Then, take the fitted unit apart and reassemble it with glue and fasteners. Add the trim as shown. Paint the unit, following the general directions noted earlier.

Study the door construction to install the fabric-covered panels. Wrap the fabric around the plywood and staple it on the back. Then align the finished panel with the door front, hold it there with clamps and secure it permanently, using 3/4-in., No. 8 flathead screws from the rear. *Caution: Don't drive the screws too deeply into the door backs or their tips may exit through the wood in front and penetrate the fabric.* Use at least a dozen screws per panel, but don't use glue. This way, you will be able to change the fabric if desired.

If you prefer a center with a natural wood finish rather than paint, build the unit of veneer-grade plywood, in the wood of your choice. Such plywood costs more, of course, but the wood is handsome. If you choose this route, use oil stain and varnish on the piece.

#### MATERIALS LIST—ENTERTAINMENT CENTER

Key	No.	Size and description (use)
CENTER CABINET		
A	2	3/4 x 12 x 80" plywood (side)
B	1	3/4 x 12 x 47 1/4" plywood (top)
C	3	3/4 x 11 1/2 x 47 1/4" plywood (shelf)
D	2	3/4 x 11 1/2 x 44 1/4" plywood (divider)
E	4	3/4 x 11 1/2 x 23 1/4" plywood (shelf)
F	1	3/4 x 8 x 21 1/2" plywood (leaf; leaves 1/2-in. clearance on each side for cabinet to close without rubbing)
END CABINETS (2)		
G1	2	3/4 x 3 1/4 x 46 1/2" plywood (base)
G2	2	3/4 x 3 1/4 x 9" plywood (base)
H	1	3/4 x 2 1/2 x 46 1/2" plywood (bottom trim)
I	1	1/2 x 47 1/4 x 79 5/8" plywood (back)
J	4	3/4 x 6 3/4 x 80" plywood (side)
K	2	3/4 x 6 3/4 x 23 1/4" plywood (top)
L	6	3/4 x 7 1/2 x 23 1/4" plywood (shelves)
M	2	3/4 x 5 1/2 x 22 1/2" plywood (bottom trim)
N	6	3/4 x 3 x 22 1/2" plywood (shelf trim)
O	2	1/2 x 23 1/4 x 79 5/8" plywood (back)
P	2	1/4 x 21 1/8 x 74 3/8" plywood (panel; leaves 1/8-in. clearance on all sides for fabric)
Q	2	1/4 x 3/4 x 80" pine (trim)
R	2	1/4 x 3/4 x 76" pine (trim)
S	4	1/4 x 3/4 x 24" pine (trim)
T	4	1/4 x 3/4 x 22" pine (trim)
U	2	26 x 80" fabric panels, plus extra required to match pattern at center
V	2	3"-dia. plate-type caster (Shepherd Satellite)
W	2	1 1/2 x 80" piano-type hinge with screws
X	1	1 1/2 x 21 1/2" piano-type hinge with screws
Y	2	Drop-leaf table support (for table without apron)
Z	-	3/4" No. 8 fh screws
AA	-	5/8" brads
BB	2	3/4 x 4" quarter round (door pulls)

Misc.: Staples, 6d finishing nails, glue, primer, paint.  
\*Aa required.

## 2 Hanging planter

Unlike the other projects here, this one is made of solid wood. Redwood was selected because of its inherent good looks.

The planter is easy to build. The ceiling-mounted frame and the plant-holding frame have the same outside dimensions; both are built using notched joints for rigidity.

Because the unit shown is used in the kitchen, where there is greater exposure to humidity than in other rooms of the house, the plant-holding frame is assembled with waterproof resorcinol glue. Corner joints in the frames are strengthened by eyebolts, as well as by notches.

The ceiling frame should be mounted with six 3/16 x 6-in. lag-screws set into ceiling joists. If the frame location will put your lag-screw locations over a hollow area

between joists, cut a temporary hole in the ceiling and install a pair of 2x6 cats between joists to anchor the units securely.

Hollow-wall fasteners in the plasterboard ceiling will not provide adequate anchoring.

Study the drawing to secure the hanging planter to the chain. Here, too, screws alone won't be sufficient. Secure the frames to the chain using bolts with nuts and washers. If you install the planter with anything less, it won't be secured adequately.

## 3 Kitchen shelf

This unique project lets you create a shelf that "turns the corner," yet remains open throughout its run. To do this, we have run a corner section at a 45° angle.

Measure the walls carefully where you plan to install the corner shelf. In all likelihood, the dimensions will have to be varied—the shelf's construction, however, will remain the same.

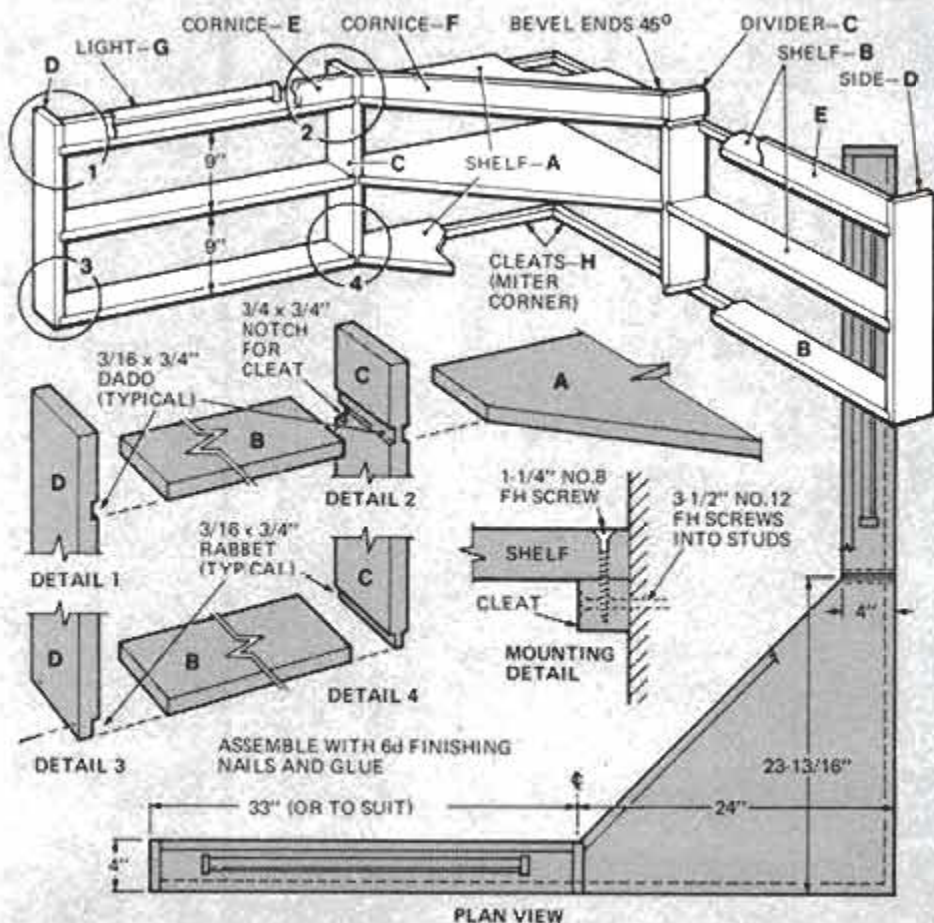
Check the dimension of each wall leg of the unit. To achieve the same look as the shelf shown, both legs should be the same length. Make sure your location permits this.

While you're measuring, check

#### MATERIALS LIST—HANGING PLANTER

Key	No.	Size and description (use)
A	9	3/4 x 1 1/2 x 30 3/4" redwood (frame members)
B	19	1/2 x 3/4 x 30 3/4" redwood (slats)
C	8	3" No. 6-32 eyebolts, 16 washers and 16 nuts
D	8	S-hooks
E	4	18" lengths of chain
F	2	1 1/2" No. 8 fh woodscrews
G	57	1" brads
H	6	3/16 x 6" lag-screws with washers

Misc.: Resorcinol glue.





headroom clearance, too. You don't want persons getting up from the seat below to bump their heads.

Start by cutting all parts to size. To avoid confusion later, label each member as it is cut. Sand the pieces, especially the edges.

Next, cut the vertical members and temporarily tack the shelf together with partially driven 6d finishing nails. Don't use glue yet.

When satisfied with the fit, disassemble the shelf and reassemble it, using white glue and 1½-in., No. 8 flathead screws. Install the unit on the wall with 3½-in., No. 12 flathead screws through countersunk holes in the cleats and into studs. Use screws spaced 16 in. apart (into studs) in top and bottom cleats.

If, for some reason, a screw misses a stud, use a hefty hollow-wall fastener (a toggle bolt, for example) in its place.

Finish with paint as suggested in the general plywood instructions.

#### MATERIALS LIST—KITCHEN SHELF

Key	No.	Size and description (use)
A	3	¾ × 23½ × 23½ plywood (shelves)
B	6	¾ × 4 × 32½ plywood (shelves)
C	2	¾ × 4 × 21" plywood (dividers)
D	2	¾ × 4 × 21" plywood (sides)
E	2	¾ × 2¼ × 31½ plywood (cornice)
F	1	¾ × 2¼ × 30" plywood (cornice; cut to suit)
G	2	General Electric Brite-Stick lights
H	4	¾ × ¾ × 56½ fir (cleats)

Misc.: 1¼" No. 8 fh woodscrews, 3½" No. 12 fh woodscrews, 6d finishing nails, carpenter's glue, primer and paint.

## 4 & 5 Bed table, his-and-her home office center

Construction for the bed table and his-and-her desk/tables is basically the same. All three are styled with the famous Parsons-table look and finished with durable high-pressure laminate. WilsonArt laminate was used on the original pieces.

On the bed table, which is prone to racking because it is set on casters, make certain the narrow L-shaped plywood side panels (I-facing) attach as shown in the drawing. Place the 2½ × 31 11⁄16-in. arm in the horizontal position. This adds strength at the joints (where the top and legs join).

For space reasons, dimensions are also critical on the legs where the casters are mounted. The casters specified (see materials list) were selected because they will spin freely in the small space available.

Since the dimensions at the bottom of the legs where the casters are mounted are so critical, it is suggested that you first make a mock-up from scrap. The mock-up should be absolutely accurate.

Then cut the parts and assemble the real legs, using the mock-up as a

guide. Assemble the entire table before applying the plastic laminate. Sand the surfaces smooth and brush off all sawdust.

Make certain you work in a well-ventilated room, even if you are using a water-base contact cement. Toluol-based contact cement is highly flammable; there must be no sparking motors, open flames or cigarettes in the room.

To start, measure the parts to be covered with laminate and cut the laminate at least ¼ in. wider and longer overall than the area to be covered. Apply the slightly oversize laminate to its mating surface, then trim it flush.

Mark each piece and its mating surface with match marks; set aside until all pieces are cut.

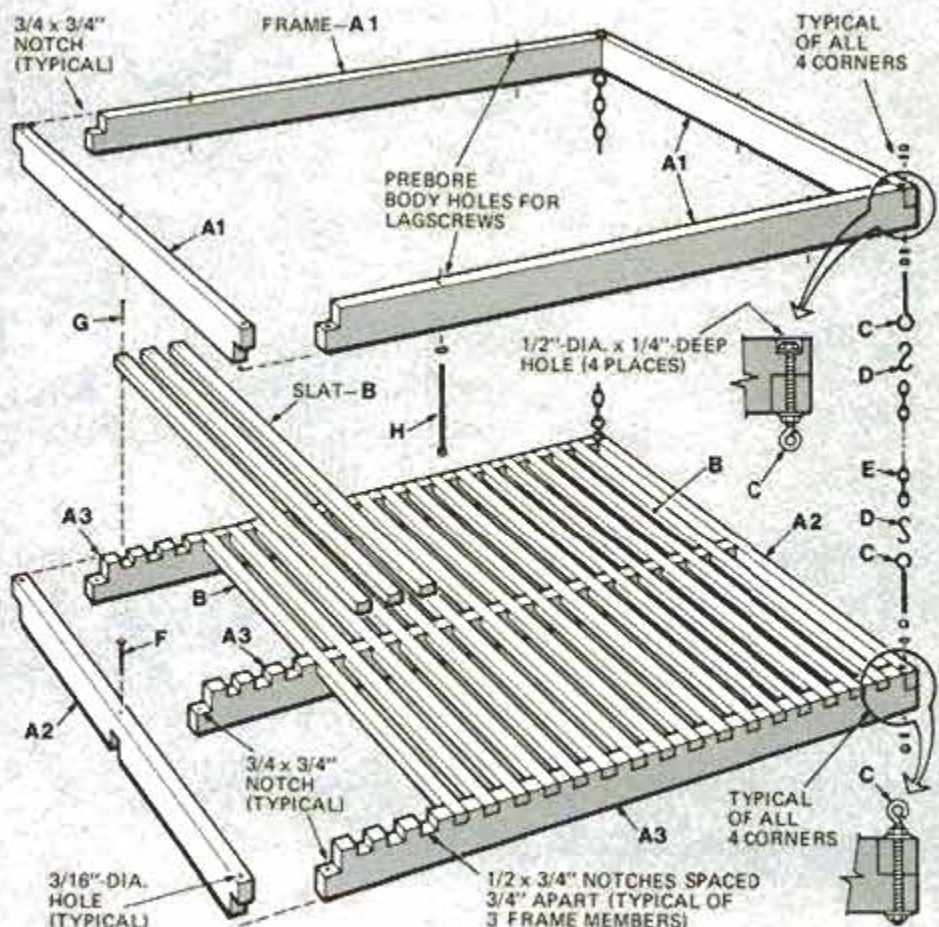
The order for laminating the tables is: inside of legs, outside of legs, side pieces (L-shape over legs and skirt, both sides), and top piece.

Laminate one surface at a time. Apply the cement to one wood surface, then coat its mating laminate surface. The adhesive is ready for bonding when it can be touched with a clean piece of brown paper without sticking to the paper.

Place clean sticks or dowels over the cemented plywood and lower the laminate carefully. Don't allow the glued surfaces to make contact or they will bond. When the pieces are aligned perfectly, slide out the first dowel and make contact at a corner by pressing the piece in place. Continue removing dowels and pressing the laminate in place. When all dowels are removed, roll the entire surface with a wooden rolling pin to ensure perfect bonding. Then use your router and a straight carbide cutter to trim off the overhanging waste plastic.

Before routing, make certain that there are no holes in the edge which the router guide will follow—or the cutter will cut into the laminate, where it shouldn't. Fill any indents and sand them smooth before routing.

Next, bevel the edge on all corners with a 22½° carbide cutter in a rout-



#### MATERIALS LIST—BED TABLE

Key	No.	Size and description (use)
A	2	1½ × 1½ × 65½ fir (framing)
B	4	1½ × 1½ × 30½ fir (framing)
C	4	1½ × 1½ × 16½ fir (framing)
D	1	1½ × 1½ × 13½ fir (framing)
E	1	½ × 17½ × 67½ plywood (top)
F	1	½ × 16½ × 66½ plywood (bottom)
G	2	½ × 16½ × 31½ plywood (side)
H	2	½ × 16½ × 29½ plywood (inner side)
I	4	½ × 31½ × 33½ plywood (facing)
J	2	½ × 1½ × 13½ pine (naifer)
K	2	4 × 8" sheet laminate, WilsonArt No. D65
L	4	1"-dia. ball-bearing, countersunk, round-plate, furniture caster
M	2	¼ × ¾ × 18" sheet acrylic (protective bumper)

Misc.: 4d finishing nails, carpenter's glue, contact cement. Casters available by mail from: Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461.



er; or use a sharp block plane set for *scant* removal. Then, with a smooth file, file only on the downstroke—pushing upward might chip or weaken the laminate edge.

To avoid hitting the dresser accidentally while rolling the bed table in place, add protective "bumpers" of clear sheet acrylic on either side of the table, as shown in the drawing.

### MATERIALS LIST—HIS DESK

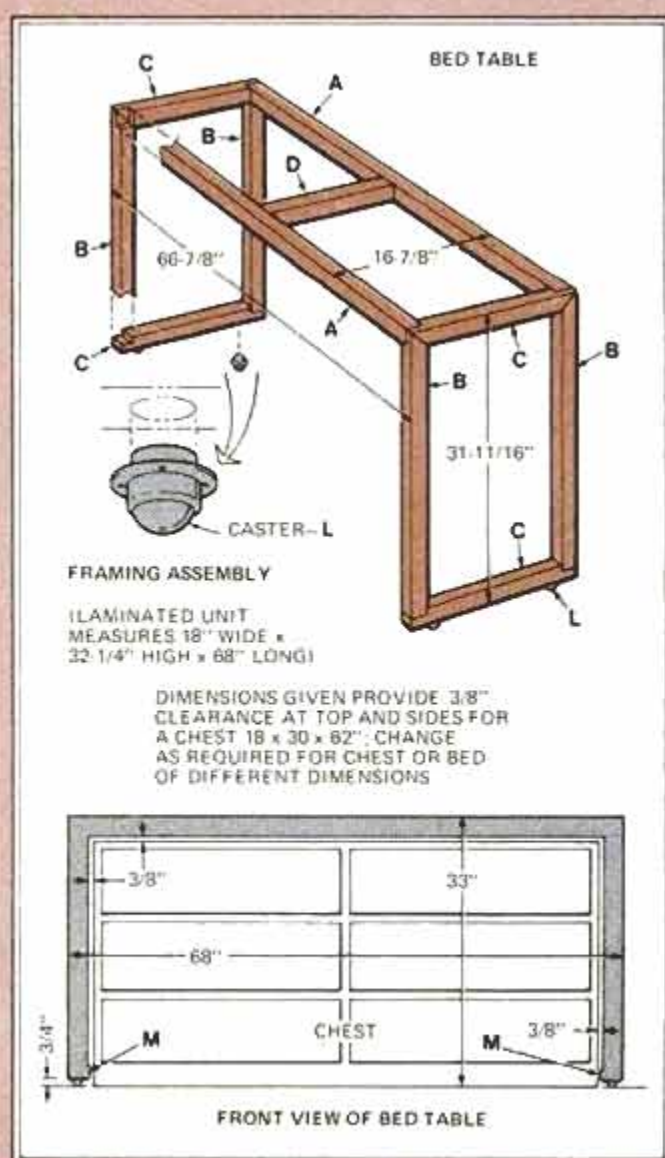
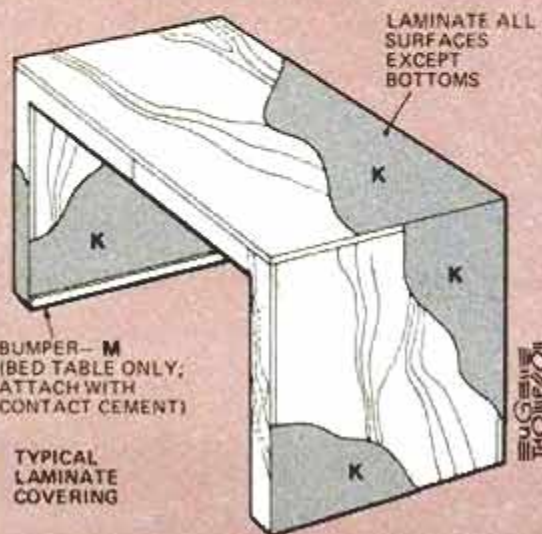
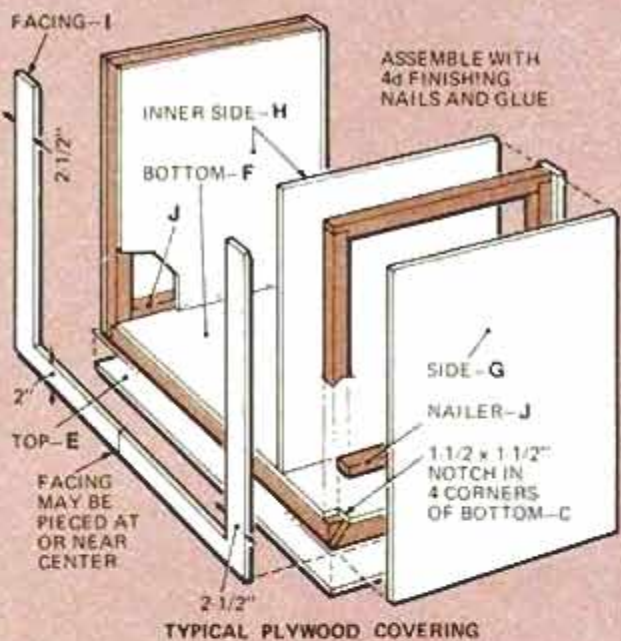
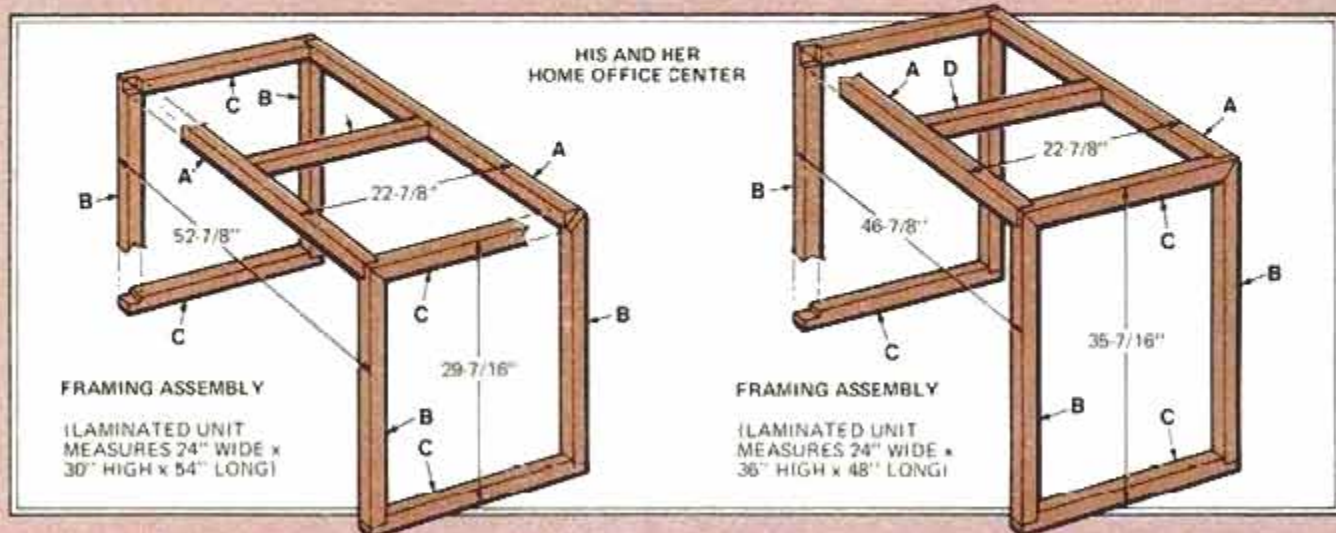
Key	No.	Size and description (use)
A	2	1½ × 1½ × 45½" fir (framing)
B	4	1½ × 1½ × 34½" fir (framing)
C	4	1½ × 1½ × 22½" fir (framing)
D	1	1½ × 1½ × 19½" fir (framing)
E	1	½ × 23½ × 47½" plywood (top)
F	1	½ × 22½ × 46½" plywood (bottom)
G	2	½ × 22½ × 35½" plywood (side)
H	2	½ × 22½ × 33½" plywood (inner side)
I	4	½ × 23½ × 35½" plywood (facing)
J	2	¾ × 1½ × 19½" pine (nailer)
K	2	4 × 8" sheet laminate, Wilsonart No. D65

Terra Cotta  
Misc.: 4d finishing nails, carpenter's glue, contact cement.

### MATERIALS LIST—HER DESK

Key	No.	Size and description (use)
A	2	1½ × 1½ × 51½" fir (framing)
B	4	1½ × 1½ × 28½" fir (framing)
C	4	1½ × 1½ × 22½" fir (framing)
D	1	1½ × 1½ × 19½" fir (framing)
E	1	½ × 23½ × 53½" plywood (top)
F	1	½ × 22½ × 52½" plywood (bottom)
G	2	½ × 22½ × 29½" plywood (side)
H	2	½ × 22½ × 27½" plywood (inner side)
I	4	½ × 26½ × 29½" plywood (facing)
J	2	¾ × 1½ × 19½" pine (nailer)
K	2	4 × 8" sheet laminate, Wilsonart No. D65

Terra Cotta  
Misc.: 4d finishing nails, carpenter's glue, contact cement.





A comparison of projections from manufacturers' treadwear ratings under the new government Uniform Tire Quality Grading System indicates that on a government-specified course:

# To say the Uniroyal Steeler beat major competition is a 15,000 mile understatement.

The U.S. Department of Transportation recently gave the public a standard yardstick to compare tires by.

Now, each tire company is required by law to grade its tires in three areas. Traction. Temperature resistance. And treadwear.

And then to emboss the resulting grades on the side of the tires.

When compared, most of the similarly priced steel-belted radials in the chart fared equally well in the traction test. Same for temperature resistance.

But one tire pulls ahead of the pack when it comes to the important grade that indicates the relative wear rate of your tire.

That tire: the Uniroyal Steeler.

In fact, when you translate its 220 rating into projected miles on the government-specified course, you see it was no photo finish.

On that course, the mileage projection for the Uniroyal Steeler is 66,000 miles.

That's 15,000 miles longer than the ratings the comparable Goodyear, Goodrich, Firestone or General tires would project.

And 24,000 miles longer than Michelin's rating would project.

These mileage projections (including those in the chart) should be used for comparison only. You will probably not achieve these results. Actual treadlife will vary substantially due to your driving habits, condition of vehicle and, in many sections of the country, road conditions and climate.

Nevertheless, what do these ratings say about the Steeler? They say when you compare the ratings, the Steeler should

outlast its major competition under comparable conditions of consumer use.

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GOODYEAR Custom Polysteel	B/C	170	51,000
FIRESTONE 721	B/C	170	51,000
GENERAL Dual Steel II	B/C	170	51,000
B. F. GOODRICH Life Saver XLM	B/C	170	51,000
MICHELIN XWW	A/B	140	42,000

For a free booklet on grade-labeling, please send your name and address to: Uniroyal, Inc., Tire Advertising Department, Middlebury, Connecticut 06749.

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\*Source: U.S. D.O.T. Report dated 9/10/80.



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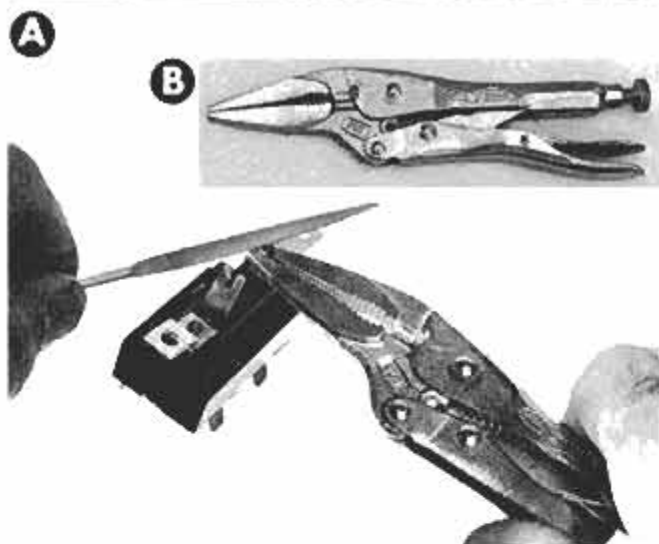


**A** Antique Pecan Wall Plank from Memphis Hardwood Flooring Co., 1551 North Thomas St., Memphis, Tenn. 37107, is 3/4-in.-thick, solid pecan that comes in assorted widths from 3 to 6 in. It's sold in lengths from 1 to 8 1/2 ft. Though it's factory-sanded and finished, rustic lumber characteristics, such as knots, burls and occasional rough saw marks, are retained to provide an authentic antique look. The tongue-and-groove boards are matched with beveled edges and ends to create V-joints. The product is sold at lumberyards, in boxes packaged to cover 24 sq. ft., for \$85.

**B** Something new has been added to the Vise-Grip line of locking pliers—the long-nose Model 6LN. Small enough for delicate work, the tool retains the ruggedness found in the larger models. The jaws are designed to become parallel at a 1/16-in. opening. The result: more gripping surface when holding thin objects and minimal pivoting, typical of conventional long-nose pliers. The tool is 6 1/4 in. long and has a heavy-duty wire cutter built in at the back of the jaws. Available for \$7.95 at hardware and automotive dealers, it's made by Petersen Manufacturing Co., 357 Fillmore, Dewitt, Neb. 68341.

**C** Do-it-yourself decks will be easier to build with this kit, its maker claims. Each kit contains the necessary joist hangers, framing hangers and nails to suit the deck you select, as well as a detailed instruction sheet explaining how to build the deck. On the box, you'll find a materials list that lets you accurately estimate how much the project will cost. Two kits are available, covering deck sizes from 6 x 6 ft. to 12 x 14 ft. The first uses four posts and sells for \$22.75; the larger deck uses six posts and the hardware kit costs \$27.50. Neither includes the cost of the lumber. The kits are made by Teco, 5530 Wisconsin Ave., Washington, D.C. 20015, and are available at home centers and lumberyards.

**D** Norton has introduced a new line of abrasive nylon-mesh blocks, each for a specific task. Called Block Busters, they have individual names that spell out what each is for: Rust Remover, Handy Sander, Grease Cutter, Multipurpose Scrubber and Stripper's Mate. The Rust Remover is shown in action below. Each nylon mesh contains the appropriate combination of industrial abrasives for the suggested job. The maker says that all pads are flexible, washable and chemical-resistant. They're \$1.79 each at hardware stores and home centers, and are made by Norton Co., 1 New Bond St., Worcester, Mass. 01606.







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## CARS AMERICA NEVER BOUGHT

(Continued from page 65)



Mazda R-360 had a V-twin, air-cooled engine, which propelled it to 65 mph. This two-seater averaged over 60 mpg.

it happened, one of the first he came across was another 1930 Austin roadster in nearly perfect condition—the 16th such roadster built in this country. One thing led to another and the Lindvig museum now houses 42 carefully restored cars, plus another five currently undergoing restoration. Les does much of the mechanical work himself.

The American Austin is a good example of a "rejected" car. The first American Austin, based on British designs but considerably Americanized, was launched in 1930. You'd think the petite Austin's timing couldn't have been better, with the Depression and all. No such thing. Despite the Austin's thriftiness and \$395 price tag, Americans continued to prefer bigger cars, so in April 1932, the Butler, Pa., factory closed down.

Florida auto dealer Roy Evans bid \$200,000 on 1,500 half-finished cars, sold them for as little as \$275 each and, in 1935, reorganized American Austin as the American Bantam Car Co.

He had Count Alexis de Sakhnoffsky restyle the Bantam (Sakhnoffsky had originally designed the American Austin), and in that form the company survived into 1941. Again, though, too few Americans bought Bantams. To its everlasting credit, however, Bantam will be remembered as the firm under whose auspices the first Jeep prototype was built.

Going back even further in domestic automotive history, cyclecars became a minor fad before WWI. Most used motorcycle V-twin engines, belt drive, and motorcycle wheels. Some had tandem seating, and several boasted wicker or wooden bod-

ies. They were relatively fast for the day and got great gas mileage, but their brakes were terrible and most suffered from poor engineering and quality. The fad waned in this country with the rise of the Model T, but cyclecars remained a part of the European scene into the late 1920s.

Henry Ford experimented with a miniature version of the Model T in 1919, but he decided not to manufacture it. During the '20s, Nash produced a compact car, the Jeffery, and Studebaker released the compact Erskine in 1927. Neither caught on.

Studebaker tried again with the low-priced Rockne in 1932. Willys came out with the \$445 Model 77 for 1933. Chrysler toyed with a small, front-wheel-drive, five-cylinder, radial-engined car in 1934-37. General Motors built three prototypes of two-stroke, diesel, radial, four-cylinder cars between 1934 and '38. GM kept a light-car project alive until the Corvair bowed in 1960. So did Chrysler and Ford. As a matter of fact, all major domestic carmakers were eyeing and even producing for the small-car market, but the customers just weren't prepared to buy the product.

### The Crosley

One man, though, with great faith in minis was Powel Crosley, who stood 6-foot-4, and who firmly believed in the small-car concept. He'd already made fortunes in refrigerators and home radios, and on April 28, 1939, at Indianapolis Motor Speedway, Crosley sprung his baby on the world. His grandson, Lewis, launched the venture by smashing a bottle of gasoline on the nose of the first car while 200 dealers applauded.

That prewar Crosley used a two-cylinder Waukesha of 12 hp and conventional drive. Fuel consumption was a respectable 44 to 50 mpg, with the top speed figure about the same. But Americans, spoiled by excesses of horsepower and roominess, bought only 5,757 prewar Crosleys between 1939 and '41.

After the war, Powel was at it again, this time with four-cylinder, 722-cc sedans, convertibles, wagons and the Hot Shot sports roadster. Early engine blocks were formed from 120 thin, punched-steel sheets brazed together with copper. Post-1949 Crosleys used overhead cams. During those six years—1946-52—the company sold 82,854 vehicles, but even so, Crosley's postwar production equalled less than three weeks' output of 1955 Chevrolets.

Directly after the war, a veritable

flood of domestic small cars welled up and then receded almost as quickly, among them the three-wheeled Davis, the Airway, Del Mar, Playboy, Scootmobile, Adette, Bobbi-Kar, Hoppenstand, Keller, Gregory, and even a 1948 entry built in Seattle called the Mustang.

The reason most small cars never caught on with the American public: They simply weren't very good. Volkswagen succeeded partly on the fact that, for \$1,495 in 1955, you could buy Cadillac quality for less than the price of a stripped-down Ford.

### The Nash 'Met'

The next moderately successful "American" small car after Crosley was the Nash Metropolitan. The Met lasted from 1954 through part of 1962, and AMC, which Nash became, sold a total of 94,984 Met coupes and convertibles.

Metropolitans were actually built in England; bodies by Fisher & Ludlow Ltd., and power train by Austin. These were strictly two-seaters, but they did offer reasonable performance plus a respectable 30- to 40-mpg economy.

During the 1950s and '60s, quite a few importers began dipping toes into the American small-car market, VW being the most successful. Renault ran a poor second. The rest of the field included Borgward, Lloyd, Gogomobil, Citroen 2CV, DKW, Triumph, Panhard, and even some odd little bubblecars like the BMW-Isetta, Heinkel and Messerschmitt.

In the 1960s, Detroit began bringing in captive imports: Pontiac, the Vauxhall; Buick, the Opel; Ford, the Anglia and Cortina.

At any rate, the pattern seems clear. Every time Americans got a chance to buy small, thrifty, inexpensive transportation, they refused. And it's not that Detroit didn't try. Some nameplates suffered terribly for trying.

The compact Jet of 1953-54 just killed Hudson. The Henry J dealt a crippling blow to Kaiser, as did the Aero to Willys. The Lark couldn't save Studebaker, and the Metropolitan ended up costing AMC millions. None of these cars—nor the compacts of the '60s: Corvair, Falcon, Valiant, Comet, Lancer, F-85, Special—started a stampede toward smaller autos among American car buyers.

It took sky-high fuel prices to do that, and the Japanese and Europeans just happened to already have a full range of cars in the right sizes and shapes. Detroit, in my opinion, has been catching up at an amazing rate.

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## CAN TANKS STILL WIN WARS? (Continued from page 68)

tank with a relatively large gun. After they proved easy to blow away in the various Mideast wars, they pretty much faded from the scene, a dead-end design.

In 1940, the Russians had fielded the revolutionary T-34 medium tank. It was the first tank powered by a powerful diesel with fuel that was difficult to ignite, even in the event of a direct hit. Later versions of this tank are still found in the inventories of many Third World countries.

The suspension of the T-34 tank is known as the Christie suspension, named after an American automotive engineer who sold the Soviet Union some tanks in the late '20s.

The German answer to the T-34 took the form of excellent Panther medium and Tiger heavy tanks, mounting 75-mm and 88-mm guns, respectively. While able to take on the formidable T-34, neither tank was ever available in large enough numbers to affect the outcome of the war.

The West received a jolt in November 1945 when the Soviet Union, in a victory parade in Berlin, unveiled the Josef Stalin III heavy tank. Low, with thick, sloping armor, the 50-ton Stalin III mounted a 122-mm cannon.

The price paid in the case of the Stalin III design was a negligible range and an ammo capacity of only 28 shells (there was no room in the streamlined carcass for fuel or ammunition). With the advent of later MBTs with larger guns, the Soviet Union has retired all of its heavy tanks.

### Roots of tank philosophy

Back in the '30s, British planners had dreamed up two categories of tanks: One, known as the "cruiser tank," was lightly armored, though fast, and was supposed to go roving around behind enemy lines. The war in the North African desert showed that the lightly armored cruisers were easily blown apart by enemy tanks and antitank guns. They were soon replaced in Africa by American M-3 and M-4 tanks with thicker armor, larger cannon and a degree of mechanical reliability that the fragile cruisers were unable to duplicate.

The other British tank classification was the "infantry tank." Heavily armored, but with a tiny "two pounder" cannon, these cumbersome tanks were supposed to move along at a snail's pace, supporting infantry.

The German forces received the

shock of their lives when they first met "Matilda" infantry tanks in France. To their dismay, shells from their tanks and from antitank guns just bounced off the thick armor of the Matildas. By pressing 88-mm anti-aircraft cannon into service, the Germans were eventually able to stop the Matildas. There were only 100 Matildas in France at the time, so they weren't able to change the course of the war. The lesson wasn't lost on the Germans, who placed larger guns on their tanks and designed more potent antitank guns. By 1942, the Matilda had been pretty much retired as a frontline tank.

The British increased the armor on their cruiser, mounted a larger cannon, made it larger and . . . we arrive at the Centurion, which was the best tank of the Korean War. Another shake of the dice and we have the next generation, the excellent Chieftain tank—an "up-gunned," better armored and more powerful extension of the Centurion.

### Battlefield mismatches

If early British thinking regarding tanks was somewhat muddled, the United States wasn't much better off. American tanks, so the thinking went, were not designed to take on enemy tanks directly. That was to be left to tank destroyers mounting larger guns. Instead, U.S. tanks were meant to roam about the enemy rear, taking out thin-skinned vehicles and troops, disrupting communications and harassing enemy. It sounded good, but in practice, our tanks very often ran right into their tanks when there were no tank destroyers around.

There are numerous WWII reports of American Shermans encountering Panthers or Tigers. A monotonous tone runs through the battle reports: "We fired at the enemy and the shell bounced off." A single shell from a Tiger would disembowel the unfortunate Sherman. It was documented more than once that shells from the Panther high-velocity 75-mm guns went through one or two layers of sandbags slung for protection over the prow of the American tank, on through the frontal armor, then exploded inside the tank. Then the Pershings came along, with high-powered 90-mm guns, and the United States was on its way.

In the early '50s, the Soviet Union introduced its T-54 (a streamlined T-34 upgraded to a 100-mm cannon), so the United States went back to the drawing board.

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In 1959, we put into production the M-60, with a British 105-mm gun. The M-60 is still in production, and now has a diesel engine and sophisticated target-acquisition equipment (for instance, a laser range-finder) and computers. But it still sits over 10 feet high, making it one of the tallest targets on the battlefield.

### No tall Russians

The Soviet Union and the U.S. have different philosophies, shown in contrasting tank designs. Soviet tanks, as a rule, are lower, smaller, more agile and tend to pack larger guns. They are also much cheaper and easier to build, so there are more of them.

On paper, the Russian tanks look awfully good. In service, however, they get some complaints. While reliable, Russian tanks are heavy on the controls, with no power assists to make things easier for the driver. They are hot and noisy and, after a few hours, the crew begins to suffer from fatigue and loses its combat efficiency. The Russians also pay a price for the low silhouette: There is headroom enough only for crew members who aren't over 5 feet 6 inches tall.

Soviet tanks up to the T-62 (which was introduced in 1960), required a full stop to fire. The Christie suspension, which had been virtually unchanged since the T-34, made cross-country travel uncomfortable and accurate shooting on the move impossible. Recognizing that they had taken the Christie suspension to its design limits, Soviet designers have changed the suspension on current tanks.

In the late '60s, the Soviets tested two competing tanks, the T-64 and the T-72. Both mounted a new 125-mm gun. They liked both MBTs and put both into production, a military luxury that defense-budget watchers would never stand for in the United States. In response to the new antitank missiles and shells now in service (see page 66), the T-72 has been fitted with a new type of armor and a far more powerful turbine engine which evolve it into the T-80, shortly to be in widespread use.

Aware of the developing Soviet tank designs and realizing that the M-60 couldn't be expected to soldier on forever, U.S. tank designers began to search for a replacement. One result was the MBT-70, an abortive joint venture with West Germany. The MBT-70 had an advanced hy-

(Please turn to page 106)

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## CAN TANKS STILL WIN WARS?

(Continued from page 105)

dropneumatic suspension and all sorts of other technical gimmickry, which raised its cost to well over a million dollars per unit. At this point, the Germans bowed out and began to manufacture their own Leopard MBT. We went back to the drawing board and the result was the M-1 Abrams, which is now entering production.

### Enter the M-1

The M-1 is the first American tank to be fitted with a gas-turbine engine. This lightweight powerplant churns out 1,500 hp—twice that of the diesel engine of the M-60—and makes the M-1 extremely agile for all its 60 tons. In addition, this newest American tank is fitted with what our tank people call "special armor," a laminated armor related to the British Chobham armor that can stop just about any known anti-tank projectile.

An improved torsion-bar suspension allows the M-1 to charge cross-country at speeds which would take apart the undersides of most other tanks. It is fitted with the same 105-mm gun to be found in the M-60 and the Centurion, though there are provisions for a German smooth-bore 120-mm to be fitted from 1984 onward. In addition to laser range-finder and other goodies now in the M-60, the M-1 has a thermal sensing device which can spot vehicles or people from heat emanations.

The Soviets' T-64 and T-72 have been fitted with new armor which our armor experts consider almost the equal of that of the M-1. As for the new T-80, returns aren't in yet.

One thing is certain. Soviet tanks have made steady, if unspectacular, gains through the years. Both the T-64 and the T-72 have electro-optical target-acquisition equipment not available on earlier Soviet tanks. Both are equipped with 125-mm guns capable of outranging the 105 on American tanks. Their automatic loaders (in addition to eliminating one crew member) allow the gun to be fired up to five times per minute. Both Russian tanks are a mere 2.30 meters high. Only our M-1, at 2.36 meters (7 ft. 9 in.) is in the same class. By comparison, the M-60 stands 3.25 meters (10 ft. 8 in.) off the ground. One tank officer told me: "I wouldn't want to be in the biggest, highest, most conspicuous tank on the battlefield." The only criticism by tank officers of the very expensive (at \$2.6 million per unit) M-1, on the other hand, is that there won't be enough of them. **PM**

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Trevaskis has developed what amounts to a 20 cents per gallon "rebate" potential on gasoline, by designing a low-cost injector for automobiles, light trucks, vans and recreational vehicles.

The Vapor-Jet® system has test results showing miles per gallon improvement of 17.3 per cent on Trevaskis' 1971 Ford Galaxy and 13.3 per cent on his 1973 Olds Starfire.

Water injectors were developed to a highly refined state during World War II, to give combat planes increased speed and extended range. However, up to now, the low price of gas and the high cost and extremely difficult installation required for earlier injectors combined to make them unattractive.

The Vapor-Jet® has an unconditional 60 day guarantee.

*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 a mist to form in the upper part of the reservoir. This mist is then drawn by vacuum through a hose which is connected to any intake manifold suction hose. This connection is made very simply by our exclusive hypodermic-like injector nozzle which contains a regulator to allow just the right amount of mist to pass into the combustion chamber.

The introduction of this mist into the fuel air mixture has a cooling effect that increases the mixture density, extends the burning rate, and improves combustion efficiency. This eliminates ping (predetonation) and dieseling (after running of motor). Since steam is a good cleaner it also helps dissolve carbon deposits on the spark plugs and cylinder walls of older vehicles and helps prevent carbon buildup in new ones.

*How much mileage increase can be expected?*

This varies from car to car. Independent testing on Trevaskis' car obtained improvements from 13.3% to 17.3%.

*Will Vapor-Jet® fit all cars and is it*



*easy to install?*

Yes. Vapor-Jet® is easily installed on all domestic and foreign cars, vans, light trucks, R.V.s, campers, motor homes, and small boats. It will work on fuel injection, lean burn cars and cars with turbo chargers and super chargers and rotary engines. It will also work with unleaded gas, gasohol, or propane burning cars. The same kit fits all cars and contains everything needed. Simple installation instructions with a diagram are included and even a novice should be able to install it in less than 15 minutes. Simply take an ice pick or drill and make a small hole through any intake manifold suction hose (i.e.; PCV hose, brake assist hose, vacuum advance hose, etc.). Screw the injector nozzle into the hole, mount the reservoir by means of the bracket and screw supplied and connect the reservoir to the injector nozzle by means of the hose supplied. If you don't want to install it yourself most service stations will for a few bucks.

*Can Vapor-Jet® damage my engine or cause rust?*

Absolutely not! Vapor-Jet® cools down the fuel air mixture giving a better burn and suppresses ping thus aiding your engine. The mist that enters into

the engine turns immediately into vapor and exits out the exhaust.

*What is the purpose of the methanol V.I.M. (Vapor Injector Mix) and how long does it last?*

The reservoir measures 3½" x 5½" x 7½" and holds just under ½ gallon. A full reservoir should last about 1,000 miles. Methanol (wood alcohol) is mixed with water mainly to prevent freezing and to keep the injector nozzle clean in non-freezing weather. The cost of methanol is minimal (about \$5 a gallon). One gallon will last 8,000 miles. Sources of methanol are chemical supply houses, paint stores and drug stores. Substitutes are gas line antifreezes that contain methanol such as "Heet".

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## DRIVING THE ISUZU

(Continued from page 73)

Isuzu involves the P'up pickups. They are available with a diesel engine also, but it's a totally different powerplant: 2,238 cc instead of the coupe/sedans' 1,817 cc and pushrods instead of sohc. The pickup diesel produces 58 instead of 51 hp.

Again, thanks to good engineering and generous insulation, Isuzu pickup diesels comport themselves in relative silence. P'ups come in two wheelbase lengths: 104.3 and 117.9 inches. The latter has the longest chassis and largest cargo bed in its



Isuzu interiors are a bit spartan by current standards, but are quite comfortable.



Standard gasoline engine also displaces 1.8 liters but produces 80 hp at 4,800 rpm.

class (45.7-cu.-ft. capacity).

Four-wheel drive can be ordered only in the short-wheelbase P'ups. They use a unique independent front suspension system that gives a decent ride, and also keeps the body at normal height. The P'up 4x4 comes with a four-speed gearbox and three-position transfer case.

You can, of course, get gasoline engines in all Isuzu vehicles. Coupes and sedans are identical to 1976-79 Opels except for cosmetics. I found them roomy, comfortable, extremely well-appointed automobiles.

The base I-Mark comes with aluminum wheels, electric clock, steel-belted radials, reclining bucket seats, tinted glass, cut-pile carpeting, and power disc brakes. **PM**

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mileage is not as good as advertised."

The most persistent complaint, though, centered on the dipstick. A Florida Air Force officer summed it up this way: "The dipstick is up at the front of the engine, with the tube quite far down and near the exhaust manifold. Since the hood hinges at the front, the tube is hard to see and the stick is hard to replace. If the engine is hot, the manifold is like a branding iron."

Other complaints were less severe and more scattered. Here's a cross section: "The split rear seats don't accommodate baby carriers well," noted a young Texas industrial hygienist. A Utah air traffic controller remarked, "The engine's a tad noisy and could do with a little more power." And a New York draftsman: "It takes the dealer too long to get parts. I was hit in the rear and am still waiting—after five months—for a replacement bumper."

We asked owners to outline or suggest changes to improve their cars. GLC drivers' first recommendation was to revamp the dipstick location. After that, here's a random sampling:

A New Mexico shop owner: "Front seats should have a more defined bucket shape for greater comfort." A California mechanical engineer: "Sheet metal



Rear seats provide lots of headroom and comfortable legroom, according to owners.

should be thicker. The body dents if you lean on it too hard." An Illinois police officer: "I only wish they'd make Mazdas in America!" A retired Florida naval officer: "The split rear seats are a good idea, but they ought to fold perfectly flat, not just half flat as they do in my hatchback."

The minor complaints and fine-tuning suggestions, though, were overshadowed by the raves we heard from most owners. A California computer programmer's comment was typical: "It's fun to drive."

The GLC has good acceleration with good fuel economy. I can carry three people and their skis without crowding. I like the whole concept of the GLC: front-wheel drive, fully independent suspension, large glass area, the versatile hatchback with split rear seats, the five-speed transmission—all of it at a reasonable price."

An Ohio farmer added, "I thought I'd never buy a foreign car, but Detroit offers nothing that can compare with the GLC. The VW Rabbit comes close, but costs a lot more. The Ford Escort, which might match the GLC in price, still has a way to go in terms of construction."


"It has a neat and uncluttered look, yet the GLC doesn't say 'econobox,'" observed an Illinois animal officer.

A Rhode Island systems analyst: "I'm particularly impressed with the GLC's ride and handling. The car is delightfully maneuverable, very good in snow and on ice, and has fine directional stability in crosswinds. Besides that, my three-door hatchback without any options is one of the lowest priced cars available in this country, yet its fuel mileage stands among the highest."

And finally, a New York library director and book publisher told us, "My husband

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and I made a study of small cars and selected what we believed to be the five best.

"Of those five, the GLC best suited our needs in terms of size, price and performance. After 9,000 miles of rough driving, everything is performing as well as new—

no squeaks, no rattles, no mechanical problems. The GLC represents a functional design assembled with high quality—combined with thrifty operation and comfortable accommodations. We'll certainly consider buying another GLC next time."

Fully 92.2 percent of the owners we queried agreed that they would buy a GLC next time around, but a significant number felt they'd move up the Mazda price and size ladder. As one particularly enthusiastic respondent put it, "Mazda 626, here I come!" **FME**

## SUMMARY OF 1981 MAZDA GLC OWNERS REPORTS\*

<b>Total miles driven</b> 1,429,381	Styling . . . . . 22.4 Reputation . . . . . 16.8 Handling . . . . . 11.8	Average . . . . . 6.2 Poor . . . . . 1.9	<b>Dealer service opinion:</b> Excellent . . . . . 31.0% Good . . . . . 38.8 Average . . . . . 16.8 Poor . . . . . 13.4
<b>Average miles per gallon</b> Five-speed manual transmission In town . . . . . 30.1 Long trips . . . . . 37.4 Four-speed manual transmission In town . . . . . 29.7 Long trips . . . . . 36.0 Automatic transmission In town . . . . . 25.5 Long trips . . . . . 31.0	<b>Specific likes:</b> Economy . . . . . 69.9% Handling . . . . . 51.6 Styling . . . . . 26.3 Comfort . . . . . 26.3 Roominess . . . . . 18.0	<b>Comfort opinion (front seats):</b> Excellent . . . . . 53.9% Good . . . . . 39.5 Average . . . . . 6.0 Poor . . . . . 0.6	<b>Number of vehicles owned:</b> GLC only . . . . . 31.2% Two cars . . . . . 46.7 Three cars . . . . . 15.0 Four or more cars . . . . . 6.1
<b>Transmission choices:</b> Five-speed manual . . . . . 65.9% Four-speed manual . . . . . 21.8 Three-speed automatic . . . . . 12.3	<b>Specific dislikes:</b> No complaints . . . . . 22.1% Oil dipstick location . . . . . 17.8 Rattles and noises . . . . . 15.8 Mpg lower than expected . . . . . 11.1 Oil leaks . . . . . 5.0	<b>Comfort opinion (rear seats):</b> Excellent . . . . . 34.6% Good . . . . . 44.1 Average . . . . . 17.3 Poor . . . . . 3.9	<b>Makes of other cars owned:</b> Chevrolet . . . . . 18.9% Oldsmobile . . . . . 13.6 Volkswagen . . . . . 11.8 Mazda . . . . . 11.3 Ford . . . . . 10.9
<b>Body-style choices:</b> Three- and five-door hatchbacks . . . . . 78.2% Four-door wagon . . . . . 13.6 Four-door sedan . . . . . 8.2	<b>What changes would you like?</b> Relocate dipstick . . . . . 21.8% No changes . . . . . 15.1 Revamp front seats . . . . . 9.1 Make rear wiper standard . . . . . 5.0 Fewer rattles . . . . . 4.7	<b>Had any mechanical trouble?</b> No . . . . . 67.7% Yes . . . . . 32.3	<b>Age distribution of owners:</b> 15-29 years . . . . . 31.4% 30-49 years . . . . . 49.3 50-plus . . . . . 19.2
<b>Why did you choose the GLC?</b> Economy . . . . . 61.7% Price . . . . . 30.2	<b>Workmanship opinion:</b> Excellent . . . . . 50.5% Good . . . . . 41.3	<b>What type of trouble?</b> Oil leaks . . . . . 26.5% Carburetor . . . . . 17.6 Transmission . . . . . 15.7 Electrical . . . . . 6.9	<b>Would you buy another Mazda GLC?</b> Yes . . . . . 92.2% No . . . . . 7.8
*Percentages might not equal 100% due to rounding or insufficient data.			

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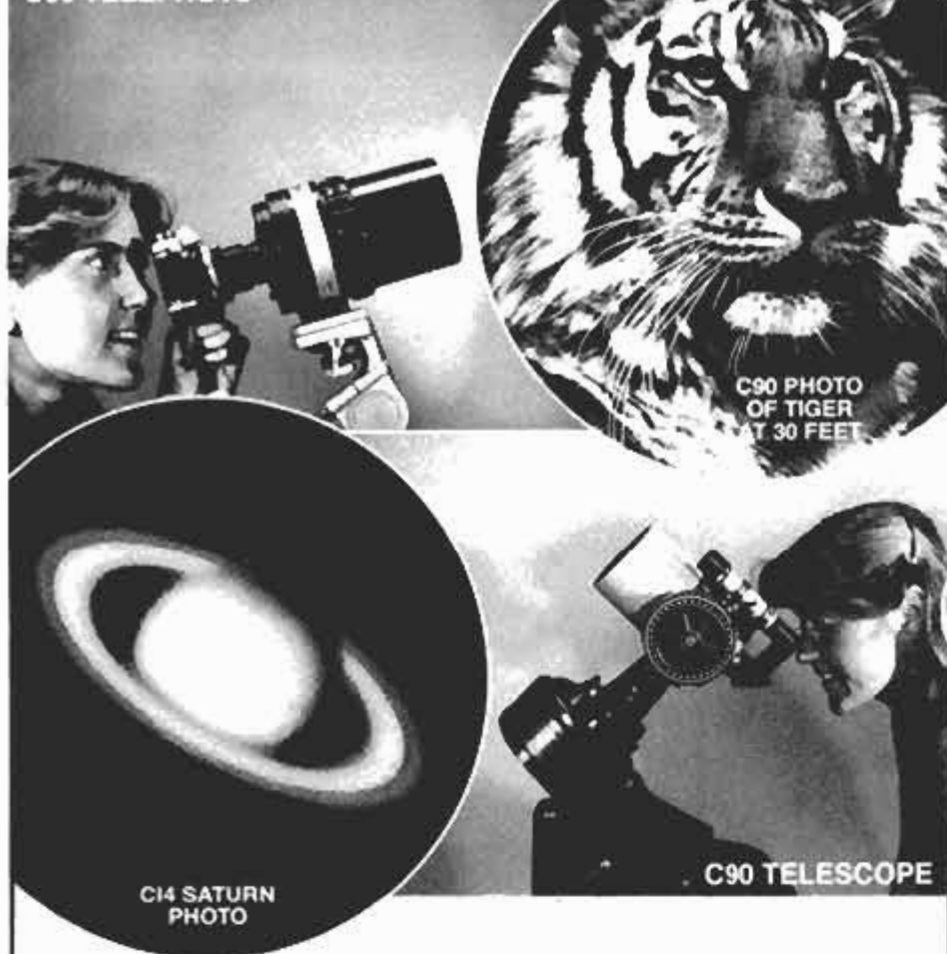
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C8 Telescope

## 4 BETTER WAYS IN YOUR SHOP

(Continued from page 87)

two boards together and bore four  $\frac{1}{16}$ -in.-dia. holes through the stops  $\frac{1}{4}$  in. from the edges on the lines. Drill or chisel out a connecting slot in each stop.

Now cut  $\frac{3}{4}$ -in.-wide dadoes centered over the holes, about  $\frac{3}{16}$  in. deep. The dadoes will allow clearance for the carriage-bolt heads if you plan to use the saw with a guide. Assemble saw with depth stops.

### Make a saw guide

If you don't want to cut dadoes freehand, you can make a guide like the one shown in the photograph on page 87. Assemble the guide, using countersunk flathead wood screws and carpenter's glue (the glue is optional). Before gluing, test-assemble guide and check for square.

First attach one of the blade guides to the edge of the fence using  $1\frac{1}{2}$ -in. No. 8 screws. Then, with the end of the blade-guide stretcher butting the fence, fasten it to the guide from underneath with two  $\frac{3}{4}$ -in. No. 8 screws. Attach the jaw in the same way from the top side of the guide.

Place the T-square blade alongside the assembled blade guide and use it to align the other blade guide. Attach this guide to both the stretcher and jaw. Now, with the thumbscrew plate butting the fence, attach it to the assembly with  $2\frac{3}{4}$ -in. No. 8 flathead wood screws from under the blade guides.

Square and attach the T-square blade to the head and insert the T-square in the guide, as shown in the photo at upper right on page 87.

To use the guide, clamp the workpiece between the guide jaw and T-square head. Pull the head firmly in against the workpiece and tighten the T-square blade in place with the thumbscrew. It is not necessary to clamp the workpiece in a viselike grip. The photograph on page 87 shows the guide in place on a workpiece and the saw with depth stop positioned alongside the fence. Grasp the guide as shown to cut a dado. Cut with strokes of even length with steady, light pressure.

Another handy accessory for your saw and stop is a depth gauge like the one shown in the photograph. Make the gauge out of two pieces of hardwood each about  $1 \times 2 \times 10$  in. Make cuts in the pieces about 1 in. apart and to the corresponding depths you think will be most useful. When setting the depth stops, place the blade in the desired cut with the gauge pieces on a flat surface about 9 in. apart.—Robert Bessmer

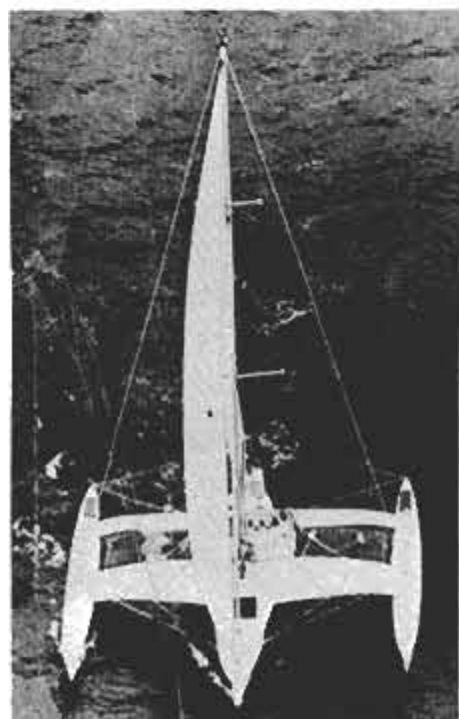


## SAILING SPEED

(Continued from page 74)

answer, as motorboatmen know, is to plane along the top of the water, rather than push through it—a maneuver that is much easier under power than sail.

These new record-breakers are not conventional boats, however. Both *Paul Ricard* and *Moxie* are trimarans, with a central hull flanked by two outriggers. Light multihulls are almost always faster than single-hull craft of the same length; the tip-resistance provided by the outriggers eliminates need for a heavy, deep or beamy hull plus a keel or centerboard. The multihull has less wetted surface to



With a length of 50 feet and a beam of 33, single-hander *Moxie* weighs only five tons.

create drag and less weight to push through the water.

As Richard Newick, highly successful designer of multihulls such as *Moxie*, explains: "If you asked an engineer with no knowledge of wind-powered boats to design one, the last thing he would come up with would be a heavy keel or ballast arrangement that requires a lot of extra power to move."

When Tabarly, with the aid of French naval and aeronautical engineers, designed the *Paul Ricard*, the result was a machine with speed tricks that are unusual for even a trimaran. As a tri leans in the wind, the heeling pressure tends to push the downwind outrigger under water, creating more drag. Tabarly added a foil under each outrigger hull, angled to keep the hull's wetted surface and drag to a minimum. The foil action is the same as that of hydrofoil powerboats that lift and fly along with the hull out of the water.

Since wind velocity is seldom constant, however, it's necessary to plan for what

will happen if a gust raises a foil too high so that air "ventilates" the foil and robs its lift, and the outrigger drops back into the sea and acts almost like a brake. Sudden shock loads on sails and rigging could be disastrous. Tabarly's solution was to pivot on the deck of the main hull the huge cross beam that mounts the outriggers so that the foil in the water could be controlled.

But as the foils started to lift the bow of the main hull onto plane, the stern tended to continue dragging deep in the water. This was counteracted by mounting an adjustable horizontal foil below the rudder which worked like an airplane elevator to keep the boat in proper fore-and-aft trim.

*Paul Ricard's* rig is highly sophisticated but Tabarly made it work. Yet even without hydrofoils, Dick Newick's trimarans have also shown breakthrough speed. In addition to 1980's single-hander winner *Moxie*, Newick's 31-foot *Third Turtle* finished right behind Tabarly's 73-foot trimaran *Pen Duick VI* and the spectacular 237-foot monohull *Club Mediterranee* in the previous 1976 single-hander. *Pen Duick* cost about one million dollars, *Club Med* about two million, and *Third Turtle*, a stock Val-class, about \$24,000, plus \$2,000 more for modifications for the race.

### The no-frills approach

Designer Newick doesn't give away his trimaran speed secrets, but one answer may be in what his boats *do not* have. "There are no modern inconveniences on board," he says. "These are fast, safe boats that will get their owners and crews to the finish line with a reasonable amount of comfort." This no-frills approach means less weight; less weight also means more speed. Stresses on outriggers and hull can be severe, so Newick has used the West System wood-epoxy bonding construction developed by the Gougeon Brothers yard in Bay City, Mich.

High-performance sailing, however, can create some special problems. The first six single-handers to complete last summer's transatlantic were trimarans, but four multihulls also capsized during the race and were abandoned. Single-hull craft have been known to turn completely over and still right themselves in a storm, but a catamaran or tri that tips over usually becomes very stable upside down. In the continual argument between mono- and multihull sailors about which is "best," conventional-hull skippers usually mention the notable cat and trimaran sailors who have been lost at sea, though multihulls certainly do not have a monopoly on casualties.

No ocean passage is devoid of danger, but it is becoming apparent that the new faster sailing speeds require superior seamanship from the crew, new excellence in design and construction, and

sometimes high costs for the engineering and hull strength necessary.

The average sailor isn't likely to try adding exotic hydrofoils beneath his hull right away, but a number of other new speed developments should be filtering down shortly for amateur use.

Last year's America's Cup races tested notable innovations. Lighter and stronger sail fabrics made of Mylar plastic sheeting laminated to Kevlar and Dacron stretch-resistant fibers cut some sail weights as much as 25 percent.

Computers are currently finding a place aboard as they monitor boat and wind speed, compass course, angle of heel, plus the time and distance to the end of each leg of a race course. Tied into a tape recorder, they also store all this data for later analysis of trim and tactics after the race.

### Adding speed by fractions

Lightweight marine aluminum is also used extensively for the A-Cup hulls and spars. Experiments were even made with an aluminum mast, topped with a foam-cored fiberglass and carbon-fiber section that could be bent to increase effective sail area. Hydraulic controls made it possible to change mast position and rigging tensions, as well, to give exact airfoil shape to the computer-designed sails.

Even the underwater keel shape was adjustable on the French entry. Two trim tabs, one attached to and trailing behind the other, were hinged along the aft edge of the keel. With them, the keel could be shaped for added lift to counteract heeling of the hull. The result: a smaller keel size, with less wetted surface, less drag and more speed. Aboard the Swedish challenger, it was noted that leg muscles are stronger than arms, so pedals were installed to power the massive sheet winches. Anything to add a fraction of a nautical mile an hour.

### Blending new and old

For match racing such as the America's Cup classic, boats are built and rigged to infinitely detailed formulas, with the intent being to equalize the boats. As a result, refinements such as bottom waxing, adjustable sail shapes, ease of handling lines when tacking, and endless crew training are experimented with to add tiny increments of speed.

Yet offshore in the latest transoceanic races, new technology is being blended with age-old concepts like the multihulled proas.

As designer Dick Newick comments about the recent "breakthroughs" in boating: "We're finally relearning the things that Polynesians knew 2,500 years ago."

So, while the laws of physics may say that sailboat speeds are limited by length of hull and strength of the wind, clever sailors are out to break through this barrier, too.

PH



# HS TARM

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## LIGHTER TACKLE FOR HEAVIER CATCHES (Continued from page 83)

fish, found in all states except Alaska. They are the veterans, the fish catchers, but they all have days when they get zilched, too.

For most of my fishing years, I belonged to group two. I thought 10-pound line bordered on the foolish side because a big fish could pop it and, man, how I hated to lose a big fish. But I changed as fishing waters became more crowded and catching got tougher.

Today, I still fish most of the time with 10- and 14-pound lines because these will allow casting the widest range of lure types and weights for the greatest variety of sport fish. But there are days when it just isn't jelling. The fish either have lockjaw or are not having any of what I'm offering.

You get little clues if you're observant. A fish will swirl at your lure, but not hit it, or follow it in and then turn away at the last second. You may feel fish bump your lure, maybe splat it with their tails, but not bite. It adds up to a need to try something drastically different.

### What to use

Now reach for that ultralight outfit, your new ace in the hole. These come in a variety of types today, with minireels available in level-wind casting, spin casting or spinning. Doesn't matter which you prefer—each does the job. The essential is the ultralight line they handle so nicely.

Depending on the lures you plan to use, ultralight line can test 2, 4, 6 or 8 pounds. A good rule of thumb says you can use 6- and 8-pound test with lures weighing  $\frac{1}{4}$  and  $\frac{1}{8}$  ounce; 4-pound balances well with  $\frac{1}{16}$ - and  $\frac{1}{32}$ -ounce lures; and 2-pound test handles lures weighing  $\frac{1}{32}$  to  $\frac{1}{64}$  ounce.

It's important that you use a rod in proportion to line, lure and reel. If the action is too gutsy, you'll lose larger fish that snap your extra-light lines. Use an ultralight-action rod, or one that has a supple bend from tip to butt.

### Let the fish help you

Set the drag on the reel so that it offers minimal resistance and keeps the line barely taut when you have someone pull it through your rod guides as a big fish would. Then, when a lunker takes the lure, your supple rod bends to cushion the shock of the strike, and the drag keeps the line taut as the fish tries to shake the lure. The trick is to let the fish tire itself against the tension of the rod and the resistance of the drag.

Obviously, a rig this light calls for smaller lures, and these are just what it takes when fish are being picky and refusing larger lures. We anglers rationalize by saying: 1, maybe the fish are feeding on a new hatch of tiny minnow; 2, maybe the water is so clear they can spot larger lures; or 3, in heavily fished waters, there's a chance the smarter fish that are left see popular lures so often they get lure-shy.

### The best lures

Which lures work best in an ultralight rig? From a computer recently fed with three years of data from fishermen across the nation, here are the lures that caught the most bass, in order of effectiveness: 1, plastic worm; 2, spinner lure; 3, floating-diving lure; 4, surface lure; 5, jig and eel; 6, deep-diving lure; 7, weedless spoon; 8, floating-deep-diving lure; 9, overhead spinner lure; and 10, crank lure.

These 10 types tip the odds in your favor, just by the record. If you are not familiar with them as described, check with your nearest tackle shop and ask to see each. Stay at about  $\frac{1}{4}$ -ounce weight for each one you buy.

### What they catch

With ultralight tackle, you can land most of our popular sport fish—trout, bluegills, perch, bass, walleyes, catfish, and many members of the panfish clan. But ultralight does not mean weak tackle. Except when angling in weedy or snag-filled water, light line can hold and subdue heavy fish.

For example, PM outdoors editor Bill McKeown and I watched a world-record peacock bass, a bullish 11½-pounder, fought to the finish and boated by naturalist George Harrison using 4-pound line. This brawling, but beautiful fish was caught while we were making a trip up the remote Vaupes River, a tributary of the Amazon in Colombia.

While fishing ultralight gear and 6-pound line from a belly boat with its innertube, I've had big bass actually tow me slowly through the water. I weigh 170 pounds, so in open water light lines are quite adequate when used with patience.

So if you want to harvest more fish, and a greater number of species, try the switch to ultralight, especially when your usual gear just isn't bringing home the fillets. I predict you, too, will become not only a light-tackle enthusiast, but also a better angler. **PM**



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## HARDTOPS TO RAGTOPS

(Continued from page 72)

Coachbuilders Ltd. Inc., Fort Lauderdale; Hess & Eisenhardt Co., Cincinnati (better known for hearses and armored cars); and Steas Industries of Brooklyn, N.Y.

### The Intermeccanica method

Making a convertible from a coupe isn't as easy as just sawing the top off. Tony Baumgartner, the man who brought you the Automobili Intermeccanica Porsche Speedster replica, is currently producing Mustang Cabrio and Datsun Viva SX (200-SX) convertibles. In Intermeccanica's typically thorough way, the workman welds a subframe to these cars before he cuts off the top.

On the Intermeccanica Mustang, the subframe is constructed of 2x3-inch steel tubing with 1/4-inch wall thickness welded inside each rocker panel. Then two 1/4-inch steel plates are welded between the door pillar and inner rear fender, tied together behind the rear seat with another structural member. Two uprights are fitted on either side of the cowl in the toeboard area, again welded to the rocker subframes. Then two 1-inch steel rods are inserted into the hollow windshield pillars. These rods are welded to the cowl reinforcements below, and are tied together by a curved piece of steel that runs across the top of what becomes the new windshield header.

In the past, converters hadn't yet mastered the tricks of reinforcing topless bodies. The results were weak, flexy convertibles and dissatisfied customers.

In fairness, though, no car is totally rigid, even with a metal top. Detroit engineers used to talk about the "compliance" of factory convertibles. Generally speaking, all convertibles tend to be less rigid than their coupe counterparts.

Today's more successful convertible designers pay great attention to detail. Formerly, any converted convertible had to be repainted, because workmen would scratch or mar the original finish. Now, though, many conversions are so slick that repainting isn't necessary.

What do you pay for a brand-new, handbuilt ragtop? The less expensive, more popular conversions run from \$3,000 to \$5,000 (all figures exclude the prices of the cars).

Mustangs, Celicas, the GM X-cars (Camaro and Firebird), the Flint Corvette, Preludes, and so on range from \$5,000 to \$8,500. And then you start to get into the heavies, which can run up to \$20,000 for, say, a Hess

## Make these tests when shopping for a converted convertible

1. Check painted body surfaces near top's lower edge. Look for scratches and mismatched colors.
2. Raise and lower the top to make sure it fits. Also, snap top boot in place.
3. Drive car through a car wash or hose it thoroughly to test for leaks in passenger compartment and trunk.
4. If possible, lift car at center of wheelbase with a floor jack, one side at a time. See whether doors open and shut easily.
5. An easier, but less effective, test of body integrity is to park the car with one tire up on a curb. Use a driveway as your ramp. Then see if doors bind.
6. With the top up, drive at least 65 mph on a smooth highway to test for fabric drumming, suspension tramp and sympathetic vibrations.
7. As you're driving, rest two fingers on the exterior gap between door and front fender. You can sometimes feel movement in that area, especially on rough roads or while making sharp turns.
8. Listen closely for squeaks, rattles and odd noises. These show up with top raised.
9. Choose a conversion with as much rear three-quarter visibility as possible.
10. Never buy a convertible with cloth or velour upholstery. These soil easily and fade in sunlight.

& Eisenhardt Eldorado or \$25,000 to \$30,000 for a converted Mercedes 280-CE or Jaguar XJ-S.

If these prices sound high, remember that all convertibles have become collectors' cars. You're more likely to get your investment back on a ragtop than from just another used coupe.

### CONVERTIBLE CONVERTERS

- AHA Inc., 510 Savage Rd., Belleville, Mich. 48111 (Mustang).
- American Convertible Corp., 5000 Southwest 36th St., Fort Lauderdale, Fla. 33310 (Camaro, Firebird).
- American Custom Coachworks Ltd., Box 1220 BVHL, Beverly Hills, Calif. 90213 (Toyota Celica, Datsun 200-SX, GM X-cars, Cadillac, Lincoln Mark IV, Mercedes-Benz 280/300).
- Auto Graphics Design, 1835 Whittier Ave., Costa Mesa, Calif. 92626 (Mercedes-Benz 280/300).
- Automobili Intermeccanica, 18475 Bandler Circle, Fountain Valley, Calif. 92708 (Mustang, Datsun 200-SX).
- California Custom Coach, 1285 East Colorado Blvd., Pasadena, Calif. 91106 (Mazda RX-7 Targa).
- Capital Coachworks Inc., No. 4 Bel Air Village, 1640 Peace Portal Dr., Blaine, Wash. 98230 (Oldsmobile, Mustang).
- Coachbuilders Ltd. Inc., 3130 Northwest 17th St., Fort Lauderdale, Fla. 33311 (GM X-cars & A Special, GM H-cars, Mustang, Lincoln Mark VI, Mercedes-Benz 280/300).
- Coach Design Group Inc., 31344 Via Colinas, Westlake Village, Calif. 91361 (Cadillac Eldorado).
- ConTec, Box 88, Lake Geneva, Wis. 53147 (Mustang, Camaro, Firebird, GM A-Special, Chrysler K-cars, Honda Prelude, Cadillac Eldorado).
- Creative Coach Builders Inc., 4254 122nd Ave. S.E., Bellevue, Wash. 98007 (Jaguar XJ-S).
- Elan Convertibles Ltd., 325 West Burtonwood St., Reading, Pa. 19601 (Mustang, Camaro, Firebird, Escort, Lynx).
- Flint Corvette, 5111 Maywood Ave., Los Angeles, Calif. 90041 (Corvette).
- Grandeur Motor Car Corp., 1405 Southwest 8th St., Pompano Beach, Fla. 33060 (Toyota Celica, Cadillac Eldorado).
- The Griffith Co., 3213 North Ocean Blvd., Fort Lauderdale, Fla. 33311 (AMC Concord & Eagle, Toyota Celica).
- Hess & Eisenhardt Co., Blue Ash Ave., Cincinnati, Ohio 45242 (Cadillac Eldorado & Coupe de Ville, Oldsmobile 98).
- Munich Motor Works, Box 515, Cupertino, Calif. 95015 (Mustang, Camaro, Firebird, LUV & Isuzu pickups).
- National Coach Engineering Ltd., 2525 Lakeshore, Point Stille, Mich. 48469 (Mustang, Camaro, Firebird, Datsun 280-ZX, GM A-Special, Escort, Lynx, Chrysler X-cars, Honda Prelude).
- Pacific Avatar, 12797 Newhope, Garden Grove, Calif. 92640 (Mazda RX-7).
- Silco Inc., 8600 Northwest 53rd Terrace #124, Miami, Fla. 33161 (Mustang, Datsun 280-ZX, 200-SX, Honda Prelude, Volvo Bertone coupe, Subaru).
- Solaire Corp., 2909 Croddy Way, Santa Ana, Calif. 92704 (Volvo Bertone coupe, Honda Prelude).
- Sparlingco, 110 East Garry Ave., Santa Ana, Calif. 92707 (Sapporo, Challenger, Celica, Datsun 200-SX).
- Steas Industries, 701 Chester St., Brooklyn, N.Y. 11236 (Mustang, Camaro, Firebird, Datsun 200-SX, Escort, Lynx, GM-A Special).



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### Quality Begets Quality

Stringfellow's has been in business since 1936. We are a family owned company that has established an enviable reputation for distributing quality products in the state of Florida. We aren't about to put our name on a product that isn't first rate.

When we discovered the **Condenser Cooler** we (Stringfellow's) believe it would work as well as the manufacturer claimed. So we tried it. The unit installed easily on the three central air conditioners at our office. Immediately we could feel the difference in our air conditioning—the air from the vents was markedly cooler, and the cooling units that used to run constantly, are now off much of the time.

### Prove It Yourself

Even so, we suggest you try a test for your self. On a warm day, check the temperature of the cooled air coming from your air conditioning vents. Now, while the unit is running, have a friend outside spray the condenser with water so that water moves across the evaporator coils. You'll notice that the air coming from the vents inside suddenly becomes distinctly cooler.

### How It Works

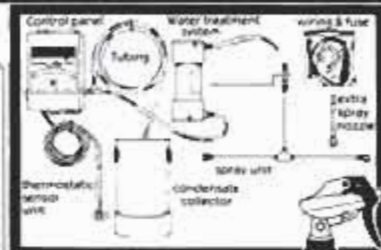
The **Condenser Cooler** isn't a gimmick. It was developed and patented by an air conditioning engineer and has been thoroughly tested by the University of Alabama. The system works on the same principles used for industrial and other large scale cooling. Water is the secret. Water is vastly more efficient than air as a heat remover. Under normal conditions, the condenser of an air conditioner or heat pump expels heat through the air. The **Condenser Cooler** sprays an intermittent mist of filtered water on the condenser coils cooling the freon and allowing heat to be dispelled much more rapidly. Obviously, the faster you can get rid of the heat, the more efficiently your unit will operate. The **Condenser Cooler** works equally well on rectangular or round condensers.

### Why You Save Money

1. With **Condenser Cooler** your air conditioner doesn't have to work as hard or as long. The less the A/C runs, the more you save.
2. The air produced by a unit equipped with a **Condenser Cooler** is lower in temperature and drier than that put out by an unequipped unit. This cooler, drier air coming into your home or office allows you to run the thermostat up at least 3 degrees and retain the same level of comfort. According to the National Bureau of Standards, each degree you raise the thermostat can save

10% in cooling costs.

3. Since the water on the coils lowers the temperature of the freon, the head pressure in the compressor is reduced, significantly extending the life of the compressor. That's important considering the cost of a new compressor.
4. Finally, if your air conditioner is only marginal for the job—say it's old or too small for the living space—the **Condenser Cooler** can give it the boost it needs to perform adequately, saving you the expense of a new unit.



### FREE BONUS TO YOU!

The manufacturers of the **Condenser Cooler** have developed a product that, by itself, can significantly increase the efficiency of your air conditioner. **Formula 412** is a newly developed spray that removes the build up of scale and corrosion that stifles the operation of many air conditioners. The corrosion limits the ability of the evaporator coil to dissipate heat. One application of **Formula 412** reduces the power needs of a compressed air conditioner by three ampere-hours. Order your **Condenser Cooler** now and receive, with our compliments, a free quart of **Formula 412**. Even if you should decide to return the system the quart of **Formula 412** is yours to keep.



### Protect As You Save

The **Condenser Cooler** IS UNIQUE in its use of filtered water as a coolant. The water used is a mixture of ordinary tap water and mineral free condensation water, (that used to be washed from the evaporator coil itself). This mixture is filtered through special crystals to prevent any corrosion of the coil.

### Technology

Here are the mechanics of the **Condenser Cooler** (officially called a hydro-condensate converter). The sensing unit, which uses only 0.5 watts of power, is attached to the inlet line of the compressor and thermostatically activated to produce a spray of water only when it is needed. At the same time, condensed water from the condenser collector is mixed with filtered tap water by the control panel. This assures that only purified, demineralized water is used in the spray which avoids the possibility of clogging the condenser coils.

### Install It Yourself

The **Condenser Cooler** is simple to install and can be accomplished by any handyman in thirty minutes. No lines whatsoever are cut, no external wiring is required, and no modification of the A/C is needed. Just connect the **Condenser Cooler** to the input terminal of the compressor side of the condenser to insure that it operates only when the com-

pressor runs. The spray is automatically controlled by a sensor attached to the refrigerant line. The water connector is attached to the nearest available tap.

### Worry Free Operation

The **Condenser Cooler** HAS NO MOVING parts to wear out and, under normal conditions, should last the lifetime of your air conditioning unit. The **Condenser Cooler** comes with a full two year warranty. The system includes the sensor unit, control panel, water treatment system, spray assembly, and all necessary tubing and connectors.

### Unconditional 60 Day Money Back Guarantee

The **Condenser Cooler** will save you money on air conditioning. We say you'll save up to 35%, but that may be conservative. The efficiency of the system depends on local conditions, but we have had reports of savings as high as 50%.

### It's Not Too Good To Be True

The **Condenser Cooler** is rethunkable and sounds almost too good to be true. But testing by the University of Alabama and an independent engineering firm has shown unmistakably that the system is for real. The University of Alabama study concluded that the **Condenser Cooler** significantly improves the total energy efficiency ratio. Specifically,

1. Extends compressor life
2. Increases cooling
3. Saves electricity

We're so confident of the capabilities of the **Condenser Cooler** we invite you to try it for sixty days so you can have a chance to watch those electric bills drop. If you're not completely satisfied, return the undamaged system to us for a total refund.

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### Guarantee

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If you're not, for any reason, completely happy with your **Condenser Cooler** return it to us for a full and immediate refund - no questions asked.



complaints. Many owners expressed sentiments like the following into our section on complaints:

"No complaints—only praise."—Texas national parks technician. A Michigan salesman moaned, "My only complaint is that I can't get my wife to drive her own car." And a Michigan auditor: "Fuel gauge suffers from inflation, though this isn't a severe complaint. I consider it humorous, but there's always about 100 miles of 'free' driving before the gauge comes down to 'full.'"

Along with complaints, we requested suggestions for improvements. The following recommendations were typical.

A New York housewife: "Put the ash-tray in a more convenient location. It's too near the carpet and it's hard to open. It could also use a light."

A Tennessee bookkeeper: "I wish the Granada offered a divided front seat the way the Cougar does."

A self-employed gentleman in Illinois: "The valve stems are too long. I've had them sheared off going through car washes."

An Iowa terminal supervisor: "The hump in the middle of the front floor is much too large. If the hump could be made smaller, a young person could sit in

the center of the front seat. As it is now, no one can."

A retired Michigander: "Position the oil filler at the front of the engine instead of at the back. It's hard to get to."

And a financial planner from Indiana: "With airconditioning, the six-cylinder engine really doesn't have good pickup. It's slow on hills; no pull. I feel this engine should be made more powerful."



Granada's trunk is very wide, but it's not high enough to fit an upright grocery bag.

The vast majority of Granada owners—nearly 90 percent—opted for the venerable pushrod Six. We've mentioned some dissatisfaction with the Six's fuel mileage and we noted murmurs about power as well, especially with the automatic. By way of contrast, no one in our very small sampling of four-cylinder owners (5.9 percent) said anything bad about that engine.

Ride and handling received solid praise. Forty-two percent of our respondents listed handling as a "specific like." "Handles better than any of my larger cars," testified an Ohio retiree. "It's easy to handle in traffic, steers responsively, parks without a fight."—North Carolina carpenter.

On the other hand, an Alabama industrial engineer opined that, "... the rear tires have a tendency to bounce and squirm to the side on rough surfaces."

However, as we stated at the beginning, most owners are thoroughly fond of their Granadas—there's no end of praise.

"I've had people stop alongside me," mentioned an Ohio steel specification writer, "and ask if the car is a new Mercedes. When I tell them it's a Granada, they're very impressed."

An Illinois executive: "I'm convinced

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that this Granada is the most car for the money. I looked at the GM X-Car, Chrysler's K-Cars, plus the Granada. The deal offered me on the X and the Ks ran \$1,000 to \$1,500 more than the Granada with the same options."

A disabled North Carolinian: "I've owned several Ford products, and I believe my Granada is the nicest one of

all. It's a pretty car which drives great and has enough room to meet all my needs. Gas mileage is really an extra plus. Honestly, I like my Granada very much."

And finally, this paean from a retiree in Georgia: "It's a car with completely new styling—just the size and weight car I've wanted. It's very roomy inside, with a large trunk and a proven six-cylinder

engine. Besides all that, it handles beautifully, has snappy performance, real good legroom and headroom inside and good craftsmanship. The whole car impresses me as being durable and well built. I have no complaints and intend to keep this car for a long time." And no doubt he will.—*Michael Lamm, West Coast Editor*

## SUMMARY OF 1981 FORD GRANADA OWNERS REPORTS\*

<b>Total miles driven</b> 928,954	Styling 53.5%	Excellent 40.1%	Good 39.5
<b>Average miles per gallon:</b>	Handling 42.0	Very good 35.1	Average 13.6
2.3-liter Four 20.3	Comfort 30.0	Good 18.3	Fair 5.0
In town 25.7	Economy 21.0	Fair 5.0	Poor 7.7
Long trips 25.7	Ride 19.3	Poor 1.5	
3.3-liter Six 16.9	<b>Specific dislikes:</b>	<b>Comfort opinion (rear seats):</b>	<b>Number of vehicles owned:</b>
In town 21.0	No complaints 34.0%	Excellent 27.3%	Granada only 55.1%
Long trips 21.0	Gas mileage below expectations 19.7	Very good 35.7	Two cars 35.2
4.2-liter V8 16.2	Rattles and noises 5.9	Good 23.8	Three cars 7.9
In town 23.1	Harsh ride 5.5	Fair 11.0	Four or more cars 1.8
Long trips 23.1	Poor workmanship 4.6	Poor 2.2	
<b>Engine choices:</b>	<b>What changes would you like?</b>	<b>Had any mechanical trouble?</b>	<b>Makes of other cars owned:</b>
2.3-liter Four 5.9%	No changes 23.0%	No 78.6%	Ford 70.8%
3.3-liter Six 88.7	Better fuel mileage 12.6	Yes 23.4	Chevrolet 9.2
4.2-liter V8 5.5	More trunk depth (upright) 6.3		Mercury 7.5
<b>Transmissions (four-cylinder only):</b>	Relocate ashtray 5.4	<b>What type of trouble?</b>	Volkswagen 6.7
Automatic 57.1%	Enlarge glove compartment 4.5	Carburetor adjustment 16.1%	Pontiac 5.0
Manual 42.9	Improve quality of materials 4.5	Oil leaks 9.7	
<b>Why did you choose the Granada?</b>	<b>Workmanship opinion:</b>	Cold starting 6.5	<b>Age distribution of owners:</b>
Styling 47.9%	Excellent 33.1%	Power steering 6.5	15-29 years 9.6%
Size 25.1	Good 44.7	Electrical 6.5	30-49 years 27.8
Economy 25.1	Average 13.9		50-plus 62.6
Price 7.2	Fair 6.8	<b>Dealer repairs satisfactory?</b>	<b>Would you buy another Ford Granada?</b>
Comfort 6.1	Poor 1.5	Yes 78.2%	Yes 86.2%
		No 21.8	No 13.6
<b>Specific likes:</b>	<b>Comfort opinion (front seats):</b>	<b>Dealer service opinion:</b>	<b>Would you buy another Ford product?</b>
	Excellent 34.1%	Excellent 34.1%	Yes 91.9%
			No 8.1

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



## This VET Did It — and YOU Can Do It Too!

"War injuries left me badly handicapped, but now I'm a financial success as a Locksmith, thanks to your training. Besides, the work is fascinating. If I can do it anybody can." — Glen Johnson, Larned, Kan.

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N. Hunt, Wilmington, Del.—"I make \$50 a week extra."

R. Davis, St. Louis, Mo.—"I cleared \$110 last Saturday."

Ed Boyle, Pittsburgh, Pa.—"My business going at top speed. I'm moving to bigger quarters."

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Thanks to the boom in heating with wood, the demand for regular chimney cleaning has never been greater. With the August West System you can clean the average chimney in one hour; the typical fee is \$45. Earnings of up to \$300 part-time, up to \$700 or more full-time are typical.

Our proven System is fast, efficient, cleaner and easier than old-fashioned ways. You often clean from below, working indoors. You get started quickly—on a surprisingly small investment.



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## THIS DO-ALL PRO KEY MACHINE YOURS TO KEEP!



Can add \$25 to \$40 a week to your income... and doesn't cost you a penny extra!



# Thousands across nation using Ohio man's sure-fire way to get rich.

Are you an 8-hour-a-day working person? Do you have little or no savings in the bank? Are you in debt with mortgage, car payments and charge accounts? Do you have little experience at anything except the small specialty of your job?

If you've answered "yes" to all these questions, you are a prime candidate for a foolproof get rich system developed by a working man from Canton, Ohio. His name is Benjamin Swarez and he was in your exact same position not long ago. But, he changed all that by inventing a get rich system designed especially for the working man.

**How did this system come about?** You probably already know about Mr. Swarez and his system. Ads on his system and stories about Mr. Swarez have appeared in nearly every major newspaper and magazine in the country. Thousands of people across the nation have purchased the system and the stacks of letters from satisfied customers received by Mr. Swarez are overwhelming.

Mr. Swarez did not develop his system overnight. But his final, perfected version certainly does generate income overnight.

**Mr. Swarez's first successful system netted him \$80,000 clear.** What's it like to get \$80,000 almost overnight in one lump sum?

It's almost impossible to verbalize. My wife and I just stared at the check for a long time. We had a two-day celebration with a dinner and party. Then I went into work and told my smug boss, who thought he had me under his thumb, what he could do with his low paying lousy job. Next we paid off all our bills including our house mortgage and had a burn-the-mortgage party.

The following day we went to an auto dealer's showroom and laid down cash for a new luxury car. I never had the experience of a new car even as a child.

Then my wife and I went on a shopping spree for clothes. We had been making do with old clothes for so long they had become worn out. She always had to shop for clothes with very little money. I always joked with her that "If I gave you \$5,000 to spend on clothes could you do it in one day?" She used to say, "I could do it in a couple hours." So that's what I did. I gave her \$5,000 to go out and buy clothes. It ended up taking all day and she said she relished every minute.

Finally, we took a long trip. In New York I bought her a large diamond at Tiffany's--another thing we always dreamed about.

But I can tell you that the money was not the most important benefit in this. What money really does is give you precious time. Time to be with your wife and children before they grow up before you know it--and time to do things you really want to do. Another priceless thing you gain is your self respect. No more crawling and kneeling because you're dependent. The words of Frank Sinatra's song "My Way" say it all."



Benjamin Swarez

**How much money can you make and how fast can you make it?**

Mr. Swarez averages around \$200,000 for each system he produces. He says doing a system to make \$10,000 or \$20,000 is literally duck soup. "I have these available to me all the time and don't even use them," he says.

**How fast can you make money?** Mr. Swarez stated, "You can actually make money within hours in some cases. You can compile a system in one afternoon one day and start having spendable money in your hands produced by the system the very next morning."

**Who can do it and how sure fire is it?** Mr. Swarez says, "I've done it 14 times in a row now. I taught my younger brother and brother-in-law the system and they've already made over \$500,000 each. All you need is the ability to follow simple directions, common sense, and the ability to see a job through to completion."

This system is also perfect for people who are confined to homes, such as housewives. Mr. Swarez named his system **SuperBiz**. He has been selling his system to others for a year now. The reason? "Why not?" he says. "First I thought I'd have to keep it secret. But then I found out the system can't be saturated, so why not sell it and make money by selling the system on top of the other money I am making using it."

**People from every state in the union have purchased Mr. Swarez's system.** What do these people have to say? Here are just a few comments:

"...It is such an excellent product that anyone who can read and follow instructions can be a millionaire..."—W.J.B., Peoria, IL.

"...This is the first time I have purchased a 'get rich' product that I sincerely feel will work..."—E.J.D., Chicago, IL.

"...Adjectives alone cannot describe its hidden wealth. After many years, much money and a bellyfull of frustration, I believe I have found an honest man, and yes, I truly mean it..."—J.T.V., Norridge-wock, ME.

"...I have just received your system and have taken it to college. It has really lifted some eyebrows especially the first and last parts..."—M.K., Rockhill, SC.

**A word to the doubting Thomases.** Of course there will be those who will doubt that the system is for real. Mr. Swarez has featured this system in nearly every newspaper in the country and he has sold his system to thousands of people across the nation and in every state of the union. The story has been checked repeatedly by newspaper reporters and government authorities at literally every level. The story checks out. Every word he has stated about his system is true or he would've been out of business long ago.

You can make \$100,000 in a matter of weeks or days. In some cases money starts in hours. Here's how it works...

**1** You will receive Mr. Swarez's system in the mail which contains everything you need to complete one of your own systems. From anywhere, such as your kitchen table, you complete the preliminary steps. This involves filling out provided forms and following provided outlines.

**2** The preliminary steps of the system are done only one time. After these preliminary steps, you can do the steps for each individual system anywhere, from your home, while you are traveling. (Mr. Swarez does his individual systems in his motorhome) or from a favorite vacation spot. Again, by following outlines and filling out forms, you complete your individual system (each of which is in two parts, Part A and Part B).

**3** After completing Part A and Part B of the System, depending on the type of system you do, you may either phone in Parts A and B of your individual system, or you drop it in the mail. In the type of systems where you phone in Parts A and B, you can virtually complete a system one afternoon and have spendable money in your hands the very next morning.

**4** In a matter of days or weeks, depending upon which system you do, you can receive \$100,000 for each system you do. In some cases, over 80% of the money will be in your possession in less than a week. Your money will either be deposited in your bank account or brought to you by mail to your home or your vacation spot.

For those who wish to purchase the N.P.G.S. System called **SuperBiz**, it is being distributed by mail only for the present. Mr. Swarez has kept the price of the system low so those who most need it can afford it.

To order (1) Get a blank piece of paper; (2) At the top print the word **SuperBiz**; (3) Print your name and address; (4) Mail this along with \$20.00 in cash, check or money order to Quality Consumer; Dept. G-221, 706 Twelfth St. N.W.; Canton, Ohio 44703.

Or, if you want us to start processing your order immediately, phone in your order as follows: (1) Dial this TOLL FREE number, 1-800-321-0888 (Ohio residents dial 1-800-362-0636) and ask for Operator G-221; (2) Say the word **SuperBiz**; (3) Give your name and address; (4) Give the operator one of your following credit card numbers; Master Charge or Visa (also include your Interbank number). Or, if you don't want to use a credit card, tell the operator you want it mailed C.O.D. Operators are on duty right now and around the clock.

Direct any inquiries to (216) 452-0868. Please do not dial the toll free number for information. The operators are not permitted or qualified to answer questions.



# TECH LINES

## Oil in that thar hill of beans

The little beans you see at right contain a waxy substance that some say could save a tenth of the gas used in the United States.

The bean comes from the jojoba (pronounced ho-ho-ba) plant, a hardy desert shrub. Jojoba oil has been touted as a base for cosmetics, soap, and even a tonic to restore hair.

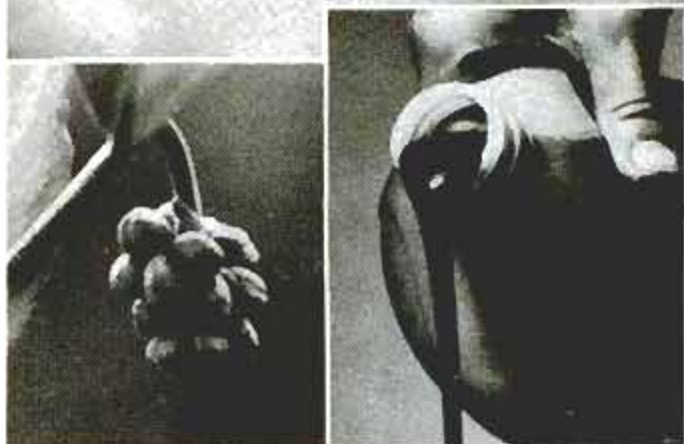
### Automotive

If this begins to sound like a spiel for snake oil, consider also that the stuff squeezed out of the bean is an almost exact copy of sperm whale oil. Until its use was banned, oil from the head of the whale was added to lubricants to increase their efficiency. Replacements haven't worked particularly well. But jojoba, its backers say, actual-

ly beats sperm oil for high-pressure applications in cars, decreasing friction, cutting heat and saving gas.

Only one company, Key Oil of Santa Fe Springs, Calif., is currently marketing jojoba lubricants. Key's Clive Hollinshead thinks jojoba is much too valuable to squander on cosmetics. "We have a product which can save about 10 percent of the gas used in this country," he says. "I don't think that stuff should be used on someone's face."

Jojoba plant survives by thrusting roots as far as 20 feet under desert surface to tap moisture. Oil is pressed from beans (right) at thousands of pounds of pressure, then mixed with petroleum; its proponents say that it can prolong a car engine's life while it saves gasoline.



### Architecture

#### Air roof

No need to stop the game in the stadium below while waiting for a rain-

storm to subside: The stadium itself blows the rain away, according to its Toronto designer.

Architect Peter Goering says the roof of this arena, modeled after the Montreal Olympic Stadium, is a curtain of air blasted upward by 17 turbine engines. With a total horsepower

equal to an engine on a 747 (about 20,000 hp), the turbines would be able to counter "a hell of a thunderstorm," Goering says. And the system would save money. Installation would cost less than half the price of a hard, movable dome, he says. And the roof could be activated in seconds.

The idea has drawn interest in England, Goering says ("The air roof could defeat the British weather," one British newspaper hoped). And the concept has worked in small-scale experiments, in which blasts of air were used to shield sections of sidewalk.

There are a few hitches: The patter of rain hitting the roof would be replaced by the roar of the roof hitting the rain, and some might object to the din. And a parachutist trying for one of those spectacular halftime landings "could get hung up there awhile," Goering says.



Air velocity in proposed dome system would vary depending on rain intensity, with a maximum speed of about 60 mph. Louvers restrict entry of moisture into the blowers.





The standard, government-approved crash-dummy is being criticized for not being human enough. Crash results leave doubt whether the dummies died.

## Transportation

### In search of better dummy

Test dummies have been the silent, unsung heroes behind the government's vehicle crash-testing program. For years, dummies have mutely borne the brunt of head-on collisions, T-boning and sideswipes, while offering their heads to test dashboard safety.

Now, however, it appears that their sacrifice may no longer be able to contribute significantly to vehicle safety.

### Not quite human

The National Highway Traffic Safety Administration (NHTSA), the agency responsible for crash testing, has been using a standard dummy for these tests. They used an index of 1,000 to determine whether the test vehicle was crashworthy. This figure of 1,000 was based on readings taken from sensors installed in the dummies as they were crashed. If the

index exceeded 1,000, it was a fair bet that the dummy died and the car was not crashworthy. An index under 1,000 meant the dummy survived and the car received a passing grade on its crash test.

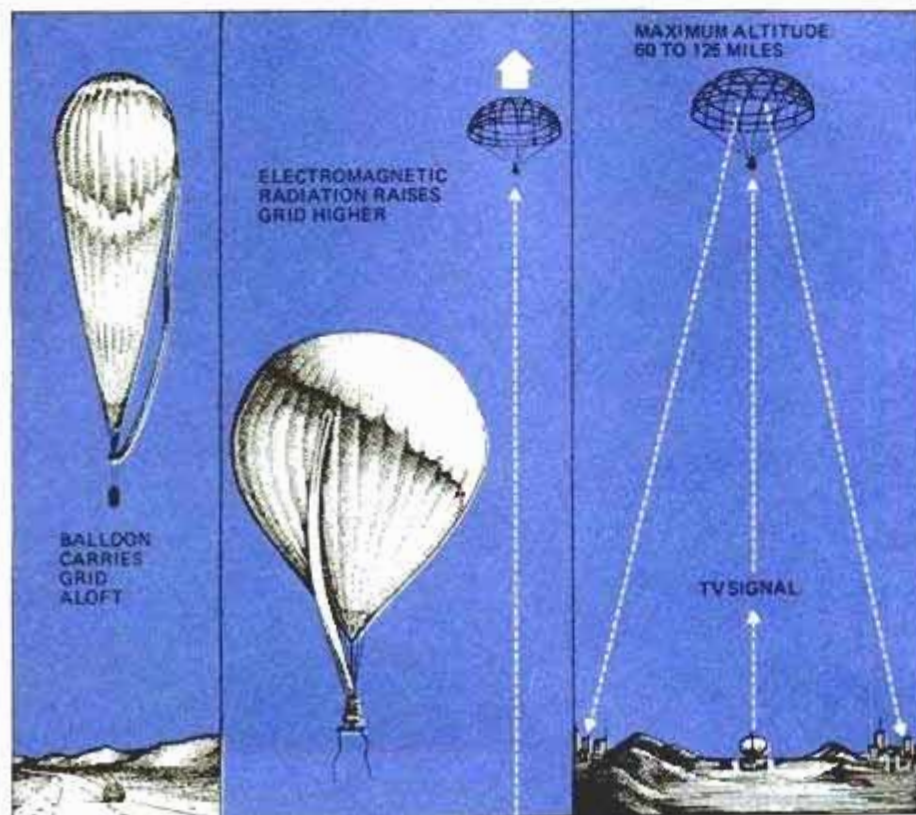
According to John Stulz, supervisor of the certification lab which performs the crash tests, "It is impossible to duplicate the human body perfectly in all situations."

The not-quite-human nature of the dummies casts some doubt on the test scores: There is some question as to when a dummy dies.

For instance, an index of 1,100 indicates a dead dummy. But a 990 index, while passing the test, could mean that the dummy died, but was pronounced living due to inherent inaccuracies in the dummies.

With results that inexact, even the NHTSA admits that it's too close to call.

So far, no one has come up with a suitable substitute for the dummy. For the present, research continues to refine human-like responses from the dummies.



Balloon would carry the fragile web of thin wire to proper launch height. Then electromagnetic signals from Earth would lift it up to 125 miles to relay TV, radio, radar.

## Aerospace

### Shoestring satellite

A University of Oregon physicist has won a patent for what may turn out to be the \$1.98 special of communications satellites.

The actual cost for launching physicist Paul Csonka's web-like telecommunications mirror would be about \$100,000, he says. That's a fraction of the \$40 million it costs to put up a typical communications satellite.

Csonka's plan: Launch the mirror from a balloon, then lift it to an altitude of 60 to 125 miles using electromagnetic radiation from earth stations.

The mirror itself is a simple 10-foot-diameter grid of aluminum or carbon wires. The entire grid weighs just a tenth of a gram—about as heavy as a raindrop.

Csonka says a mirror 60 miles above earth could reflect TV and radio waves to receivers within an area covering half the width of the United States.



## Two-seat Weedhopper

A new, two-seat, ultralight sports plane permits dual instruction for people who have never flown the feathery and poky planes before.

The two-seat Weedhopper (\$4,495 for the kit) cruises at 30 mph, lands at 20 and has a top speed of 40—typical low-speed ultralight statistics. The difference is that this 190-pound ver-

## Aviation

sion, designed by John Chotia, can carry two passengers with a combined heft of 400 pounds.

The big brother to the 3-year-old, single-seater Weedhopper incorporates a new airfoil, a new tail group, a stronger and longer trailing edge on the wing and larger wing struts. The controls are somewhat slower than those on the single-seater.

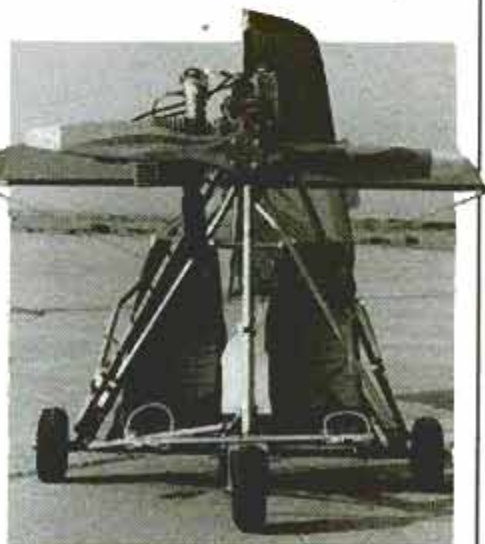
Currently, the Federal Aviation



The two-seat Weedhopper can carry more than twice its weight at speeds up to 40 mph. The new aircraft allows dual instruction for novice pilots.

Administration does not regulate hang gliders and most ultralight planes. But as we went to press, an FAA spokesman said the administration was about to publish a "Notice of Proposed Rule-Making" for ultralights. Essentially, this notice is a draft of rules that might apply to operation and certification of ultralights in the future.

Key question facing federal rule-makers: What is an ultralight? In the past, to be exempt from FAA regulation, an ultralight had to be foot-launchable. (The new Weedhopper qualifies.) New rules are likely to specify a weight beyond which ultralights become full-fledged power planes.



## Inventions

### IBM's plastic key

Unauthorized persons can be kept out of many industrial plants, offices and hotels by an IBM cryptographic system. Visitors insert a plastic card that carries a pattern of magnetized spots. A computer deciphers numbers encoded in the spots, and the visitor is allowed to enter if the total equals a number stored in the computer. (Patent 4,255,811.)

### Warm welcome

At last: a doormat that doesn't just lie there. When a visitor steps on the grilled cover of a newly patented mat, a switch turns on a heater and a blower. The hot draft, moving upward, melts snow and ice from visitors' footwear. (Patent 4,258,248.)

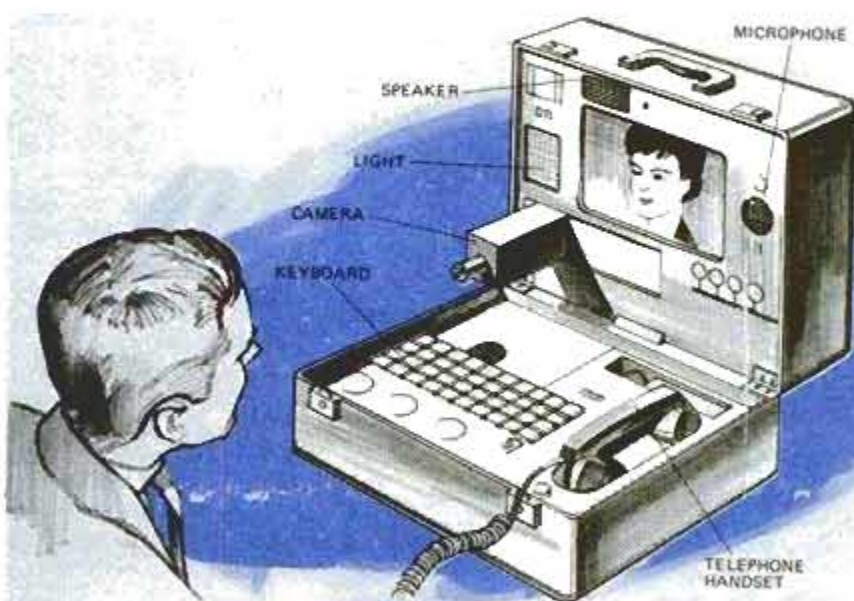
### Home videophone

New, portable videophone equipment permits communication by ear

and eye. Talkers at both ends of a telephone line will be able to watch each other on small television screens.

A speaker and a microphone, car-

ried in an attaché case with the TV camera and display screen, are coupled to a telephone handset. No permanent installation is required. (Patent 4,258,387.)



Portable picture-telephone connects to any telephone to permit two-way speech and TV transmissions with another unit. No modification of phone circuitry is necessary.



## Energy

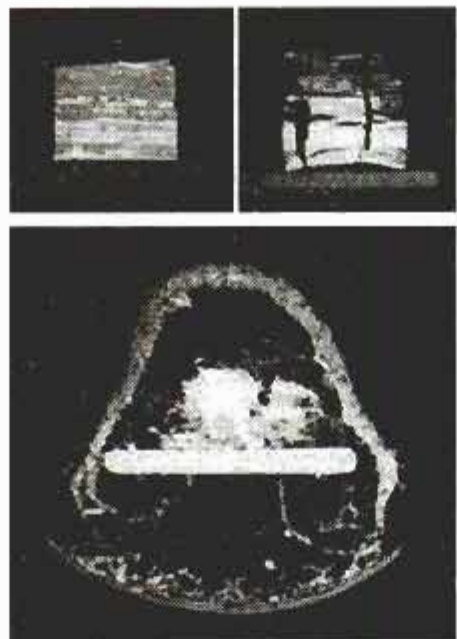
### Inside look at coal

The photos at right provide a novel look at a lump of coal as it breaks down in heat, and releases gas that can be used for fuel.

There's nothing new about coal gasification; before the electric power industry existed, engineers heated coal to drive out gas used for heating and lighting. But until now, no one knew what happened inside the lump as temperatures rose.

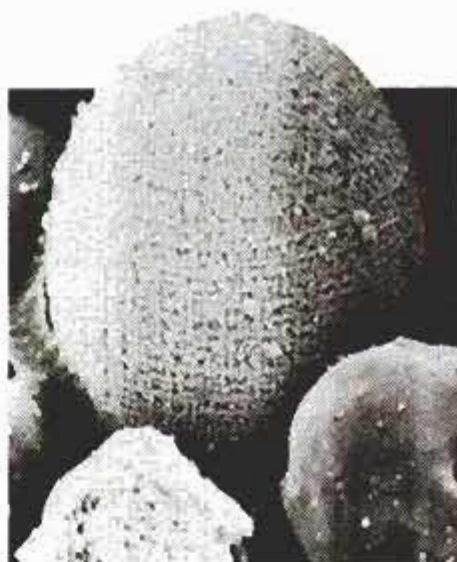
To find out, General Electric scientists built a furnace the size of a small wastepaper basket, compact enough to fit inside a computed tomography (CT) X-ray scanner. Then the GE researchers heated a lump of coal through hundreds of degrees Fahrenheit, making X-ray scans every 30 seconds. They found that the coal developed cracks at first, then began to foam and melt.

Among other applications, the X-ray technique should help scientists



understand how minerals, lodged in coal, speed up or slow down gas production.

Another offbeat perspective on coal technology comes from Westinghouse, whose researchers ob-



Microscopic view of coal ash (above) provides clues on how burning occurred. X-ray pictures (left) give inside look at coal as it turns to foam in a furnace, releasing hydrogen and other usable gases.

tained the picture of coal ash (above) using a scanning electron microscope. Experts can tell by looking at the ash, magnified 1,250 times, what happened in the furnace. One major goal: a cleaner burn.

## Electronics

### Fidelity afloat

Most of the portable radios and tape players that sailors take aboard their boats haven't got the power to stand up to the sea. Particularly when these 2- to 5-watt rigs come topside, they're likely to sound sea-

sick, and corrode in the salty air.

The latest seagoing stereos, though, are hardier. One outstanding example is manufactured by IMI (International Marine Instruments, Stamford, Conn.). Its audio components are specially treated to withstand the rigors of life at sea. The chassis of all components are zinc-plated to make them resistant to cor-

rosion, and all circuit boards are made of materials that won't absorb water from the moist air. (Standard circuit boards undergo changes in electrical characteristics in high humidity.)

In addition, IMI's Combi Cassette Stereo System (\$595) is housed in a protective enclosure. The system comprises a 20-watt-per-channel amplifier, a cassette deck and a pair of small, but capable, speakers.

A radio tuner is available as an optional extra, as is a special control unit that connects the sound system with marine VHF radio. This gear also allows the amplifier to power a loud-hailer that can yell at other ships across the

water. (These extras are standard on the deluxe version, which goes for \$1,995.)

Another boon for on-board music is the first seaworthy turntable. Until now, playing records on a boat was almost impossible, because the roll, pitch and yaw made the tone arm slither across the disc.

### Turntable's 'sea legs'

Earlier attempts to lick this problem by mounting the turntable in gimbals worked only in calm waters.

Now, the cartridge in Panasonic's model SL-10 (\$600) rides straight toward the center of the record on a radial guide rail that holds the unit steady, even during a gale.

A special version of this turntable runs on 12 volts d.c., making it ideal for use at sea.



IMI's 20-watt-per-channel system is protected against corrosion and humidity. Deluxe version (above) includes radio and circuitry permitting a hookup with marine VHF equipment.

Editor: Gurney Williams III  
Contributors: Tony Assenza, Hans Fantel, Stacy V. Jones, Steve Parker, Neil L. Shapiro





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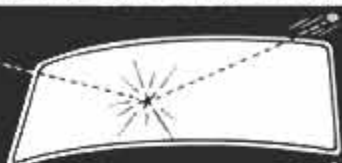
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1PM7



# PM LOOKS AT TABLE-SAW CIRCLE CUTTER

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You can also use the accessory on a bandsaw and radial-arm saw. Circ-L-Cut is available for \$11.20 postpaid from Hepp Industries Inc., Box A 154, Wantagh, N.Y. 11793.—H.W.



The base clamp is secured in the miter-gauge groove with a wrench. A plastic grip knob is supplied for rotating small workpieces with hands away from blade.



The partially cut disc is lifted here to show the seemingly impossible cut. The kerf is straight on the inside edge; all of the cupping is on the waste side.



Small work like this is safely rotated with the knob. After each pass, the blade is raised 1/8 in. until cut is done.



The finished disc requires only a small amount of sanding. Large work takes proportionately longer cutting time, but the results you obtain are equally good.

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# PM LOOKS AT DO-IT-YOURSELF TERMITE TREATMENT

**H**omeowners have an option when it comes to termite control: Hire an exterminator for \$400 to well over \$1,000, or do it yourself. The tool that makes it possible to do it yourself is the Ross Soil Injector, which is pressurized by a conventional garden hose. In its mixing chamber, cartridges of insecticide are dissolved in water. The pointed injection tube is pushed into the ground to distribute the



Space soil injections 12 in. apart and 6 in. from foundation around house perimeter.

solution through holes along the tube.

Injections of the insecticide solution are recommended at 1-ft. intervals, 6 in. outside foundation walls and 6 in. both inside and outside crawl spaces with earth floors. Each injection takes 3 to 6 minutes, making it a 6½- to 13-hour job for the average-size house of 130 linear ft. around the perimeter.

Cost of cartridges for a typical house is about \$150—which means you will save hundreds of dollars over a professional job. The treatment kills termites on contact and it lasts five years or more. It is effective against ants, as well as termites, the maker claims. **Warning:** Do not use on or near food crops. The cartridges contain 20 percent chlordane.

The injector tool can also be used to feed roots and to water trees and shrubs. Fertilizing cartridges for roses, evergreens, fruit and nut

trees and tomatoes are available.

The tool retails for about \$30; the termite-control cartridges are \$30 for a box of 72. They are at hardware stores and garden centers. Write to Ross Daniels Inc., 1720 Fuller Rd., West Des Moines, Iowa 50265, for a catalog and to find the nearest dealer.—*Joseph R. Provey*



For thoroughness, apply insecticide to surface after injections are completed.

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## PM LOOKS AT VERSATILE POWER SOURCE

The tiller on this machine can be removed quickly and easily, leaving a separate power unit which can operate a variety of add-on equipment. Some of the many attachments available for the Mainline convertible tiller are: sickle bar, shredder-grinder, snow thrower, dozer blade, log splitter, transport cart, sprayer, gear pump, plow, cultivator and tiller-furrower.

The newest Model 725 (\$1,386 with 20-in. tiller) has an 8-hp engine with a five-speed transmission. Other models are available with four-cycle gasoline or diesel engines of 8 or 10 hp. The



Remove the tiller and the independent power unit operates other equipment.



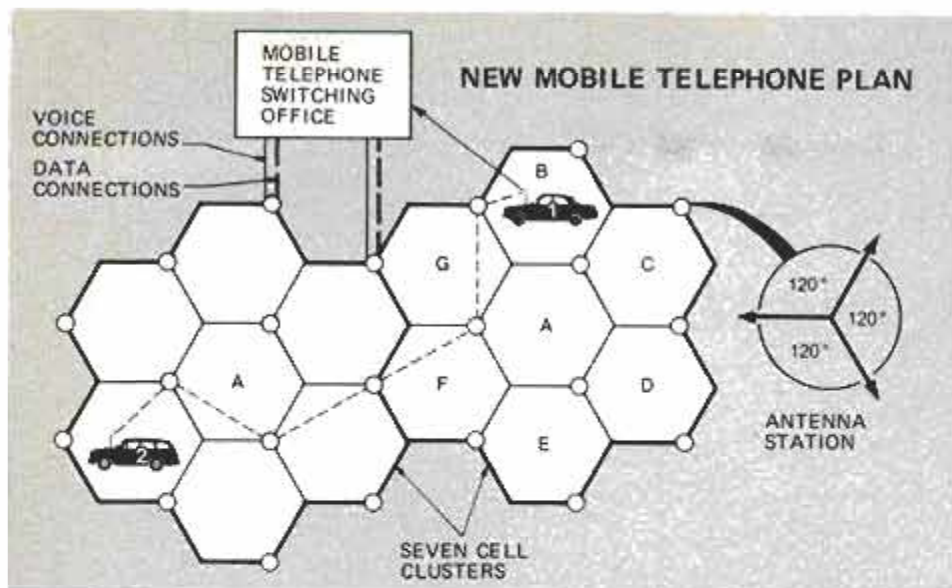
The snow thrower and dozer blade are two of many attachments the Mainline powers. The handle swings to the back for front-mounting attachments.

gasoline units come with electric, rope or rewind start. The units are entirely gear-driven.

The machines are also self-propelled. A separate engagement lever for the rotary tiller lets you transport the Mainline on its wheels up to 9 mph without the tines rotating.

The tillers and attachments have a one-year warranty and are available from Central States Mainline, Box 348, London, Ohio 43140.—P.S.





Hexagonal cells result from the radiation pattern (120°) of the AMPS antenna towers. Once a call is placed, computers in the switching office decide on best route, hex-

agonal cell by cell, to the station being called. Channels, rather than being shared by the whole system, are assigned in clusters, so few calls are "blocked."

### GRIDS FOR GAB

(Continued from page 32H)

the mobile phone moves along. But switching is done so fast that users won't notice any lag, Bell says.

### Windy City test

In the test city of Chicago, the cells were 7 to 8 miles wide—but in a finished system, the cell size would diminish. In a complete system such as Bell envisions, a mobile line would cost \$25 a month and a transceiver would rent for \$45 a month. For that fee, you'd also get 120 minutes of conversation time. Additional phone time would cost 25 cents a minute. That may seem expensive, but time saved in making on-the-road calls could be translated into big benefits for salesmen or other traveling businessmen.

Uses of the system, as shown in Chicago, varied. A tow-truck operator used the cellular system to dispatch trucks—and his competition couldn't hear the call as they might have if he had transmitted over open radio channels.

Then there was the cement-truck operator whose truck stalled with a rapidly setting load of cement. He called the fire department, which came and hosed down the cargo.

### Then—there's Synapz

Synapz is an even newer system that may bring portable phones to everybody, if all claims are true. It was designed by Broadcom in Cos Cob, Conn. Anthony Wynn, Broadcom's executive vice president, expects Synapz to be "six times more efficient" than the AMPS system.

The system is based on the work of

L.C. Van Atta who showed that radar antennas could route their own signals—bouncing signals Ping-Pong ball fashion from one antenna to the next.

The Synapz system assumes that there is a certain amount of "noise" in any antenna system. This noise can be used to set up a series of bounce-back paths between various antennas.

Broadcom maintains this system is self-directing and doesn't need the computer switching of the Bell AMPS system. It is reported to be a closed-loop circuit—that is, it's self-directing as far as finding the best signal routes between antennas.

Details have not been made public, but we suspect that each cell contains a receiver/transmitter similar to a ham radio or business radio repeater.

This system could lead to a worldwide, portable phone system as widespread as CB radio used to be.

With a handheld, portable phone, you would dial the number of the person you wished to reach. The Synapz system would take over, bouncing signals from antenna to antenna until it found the recipient—even if he were thousands of miles away.

While Broadcom doesn't want to manufacture this system, it's looking toward licensing agreements with established companies, or even countries. It is also considering the possibility of data and entertainment transmission.

Today, the AMPS system promises to make mobile phoning better for businessmen; tomorrow, systems like Synapz may bring mobile phoning right into the home. **FM**

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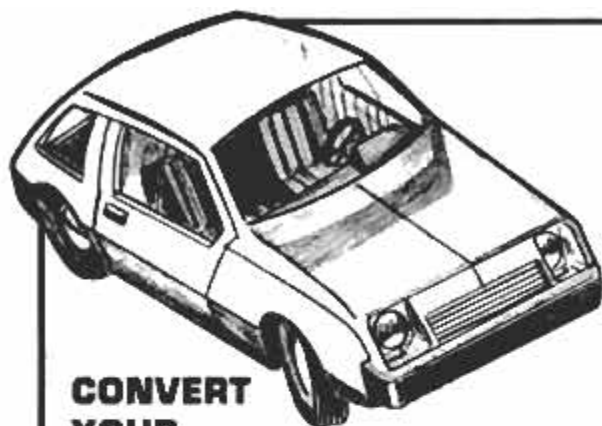
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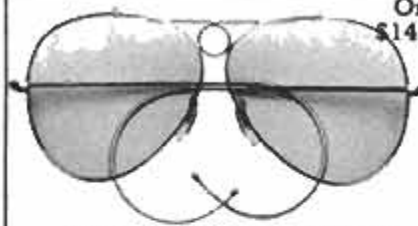
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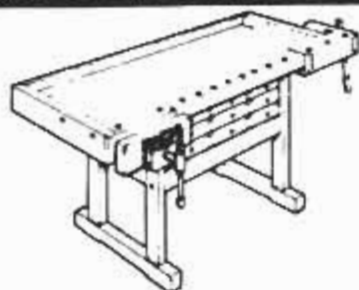
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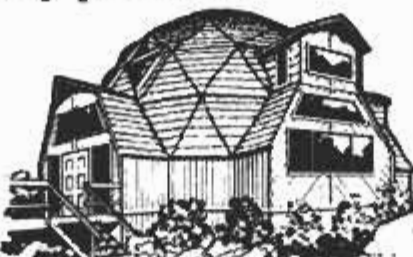
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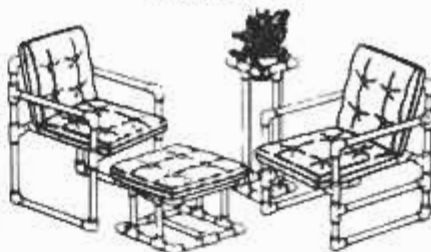
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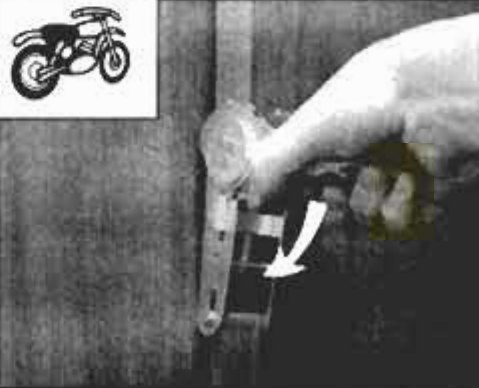
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