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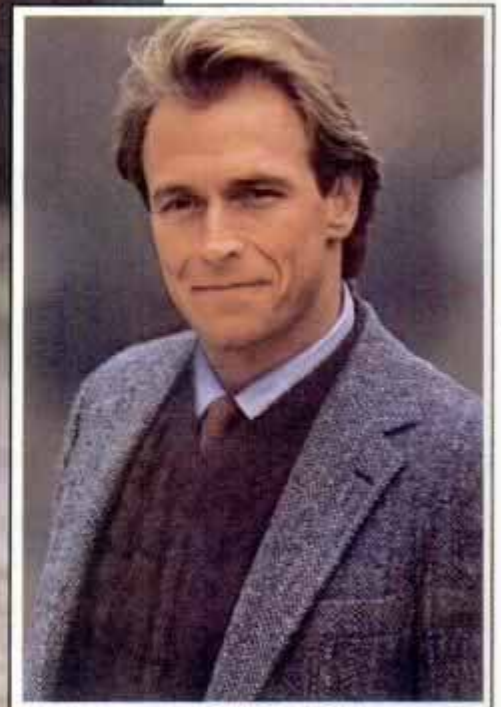


# THE WIDE STICK



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better than ever and  
gives you the edge.*



by **MENNEN**

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### ON THE COVER

The Voljet is a new breed of helicopter that literally runs on hot air. Heated, compressed air is blown out the ends of the rotor, eliminating the chance for ice buildup on the rotor. But the new type of chopper also does away with tail rotor, gearbox and transmission, and in the process is more stable and easier to fly. Read about this exciting new copter in the story on page 82.

—PM illustration by Jeff Mangiat



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Ever since man walked on just his feet, he has been obsessed with speed. There were, no doubt, foot races among the cave men. Horse racing is one of the oldest sports known. And once the wheel was invented, forget about it. In fact, the first auto race is said to have taken place in 1887, just one year after the first car hit the road. So it should be no surprise to learn that we have the bug, too. Not only are we interested in speed for its own sake, we're also interested in the technology of speed, the mechanics of speed, if you will. In other words, what it takes to go fast. With that in mind, we set out several years ago to find out. And what better place to find out than Wendover, Utah, site of the Bonneville Salt



After haulin' down from 267 mph, our record-breaker goes on display.

Flats, where more speed records have been set than anywhere else on Earth. Simply put, we decided to set a land speed record at Bonneville to see what it took. The first year, we took the high-tech approach—front-wheel drive, twin turbochargers on a special V6 engine, waste gates, fuel injection. The car made two runs, and the engine blew up on each one. Last year, we tried again, this time foregoing high tech for the hot-rod route—hot cam, high compression, big carburetor, headers, gears. A windstorm blew the car off the road and totaled it while it was being towed to Bonneville. So when Gale Banks, the speed wizard from Azusa, California, approached me to consider a team effort with him for one more shot at a record, I was hesitant. I had had it with Bonneville, and my obsession with speed had expired. Banks was persistent, though, and I'm glad he was. In our third attempt, and thanks to Gale Banks and his fantastic team, we hit and hit big. The full story starts on page 78, but quickly: The previous record in our class was about 201 mph and our Pontiac Trans Am went 267 mph. Our Firebird is now the fastest stock-bodied car in the world. And it was really a kick several weeks later to see our car displayed in the Specialty Equipment Market Assn. (SEMA) show in Las Vegas. Now Banks is talking to me about 300 mph for next year. . . . **The technology** of speed is just as fascinating on water as it is on land. Just about the time you read this, the America's Cup finals should be taking place in Australia. Our lead story this month (page 67) takes you inside the fabulous 12-Meter yachts that race for the coveted Cup and pointedly demonstrates that today's leading edge sailors are just as much computer operators as they are boatmen. . . . **The most difficult** aspect of piloting a helicopter has always been controlling the torque produced by the reciprocating engine and the main rotor. Now a new design eliminates the torque problem, the tail rotor and half the moving parts of a conventional chopper. As our cover story reports (page 82), this new compressed-air design may revolutionize the whole field of rotary aircraft. . . . **Our automotive** department staff literally traveled the world to bring you our special report on imported cars (page 95). With imports taking about three out of every 10 new car sales, and with Detroit entering into joint ventures with carmakers from London to Seoul, the world is getting smaller. 'Til next time.

Joe Oldham





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*\*But read the ad for an even more astonishing deal!*

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**The SL-0298 Cordless Shaver.**  
One of the finest shavers, at any price.

Because of our large buying power and agents all over the world, we have unlimited access to merchandise. And after scouring all sources, examining hundreds of options, we decided that the SL-0298 Cordless Shaver would be such an irresistible offer, especially if we could "sell" it at a give-away price. At our special-offer list-building price of \$12.95, the SL-0298 must be considered a "steal". That's why we feel justified putting the word "sell" in quotes.

The SL-0298 Cordless Shaver works on two standard AA cells, not included, but available anywhere. It totally frees you from electrical outlets and awkward charging units. If you use alkali cells, they should give you from two to three months' shaves (depending on how tough your beard is), under normal use. The SL-0298 is powered by a completely sealed Japanese precision micro-motor. The rotating cutting head (the preferred system, used exclusively on the most expensive shavers) is constantly self-sharpening, and gives an incredible 70,000 cutting strokes per minute. The shaving foil is so ultra-thin that you can comfortably read a newspaper through it. It is perforated in a scientifically designed spiral pattern, for incredible smoothness and shaving efficiency. All of these features assure you of the closest and smoothest shave you've ever had—as close or closer than with a blade. Compare the SL-0298 to "Brand N" or to "Brand R", both of which cost more than 3-times as much. You will prefer the SL-0298 every time. The SL-0298 Cordless Shaver comes in a velvitized travel case, with Velcro closing, protective cap, and cleaning brush. It's a complete shaving system.



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Because this is a list-building promotion, we must limit this offer to a maximum of three (3) shavers per household. You may, however, request up to six (6) shavers maximum, if you mail your order within 30 days of the publication of this ad. (No exceptions, please!) If you do buy six (6) SL-0298 Cordless Shavers, you only pay for five (5) — the sixth one is with our compliments, absolutely FREE! With this offer, only mail orders, accompanied by check or money order (no chargecards, no phone orders!) can be accepted.

Take advantage of this incredible buy—this totally unprecedented offer—while it is available. Write your name and address on a sheet of paper, and also write clearly "Code B843." Tell us how many shavers you want and include your check or money order. Add \$2.95 postage/insurance for the first shaver and \$5.90 for two to six shavers. Add sales tax for California delivery. Mail to:

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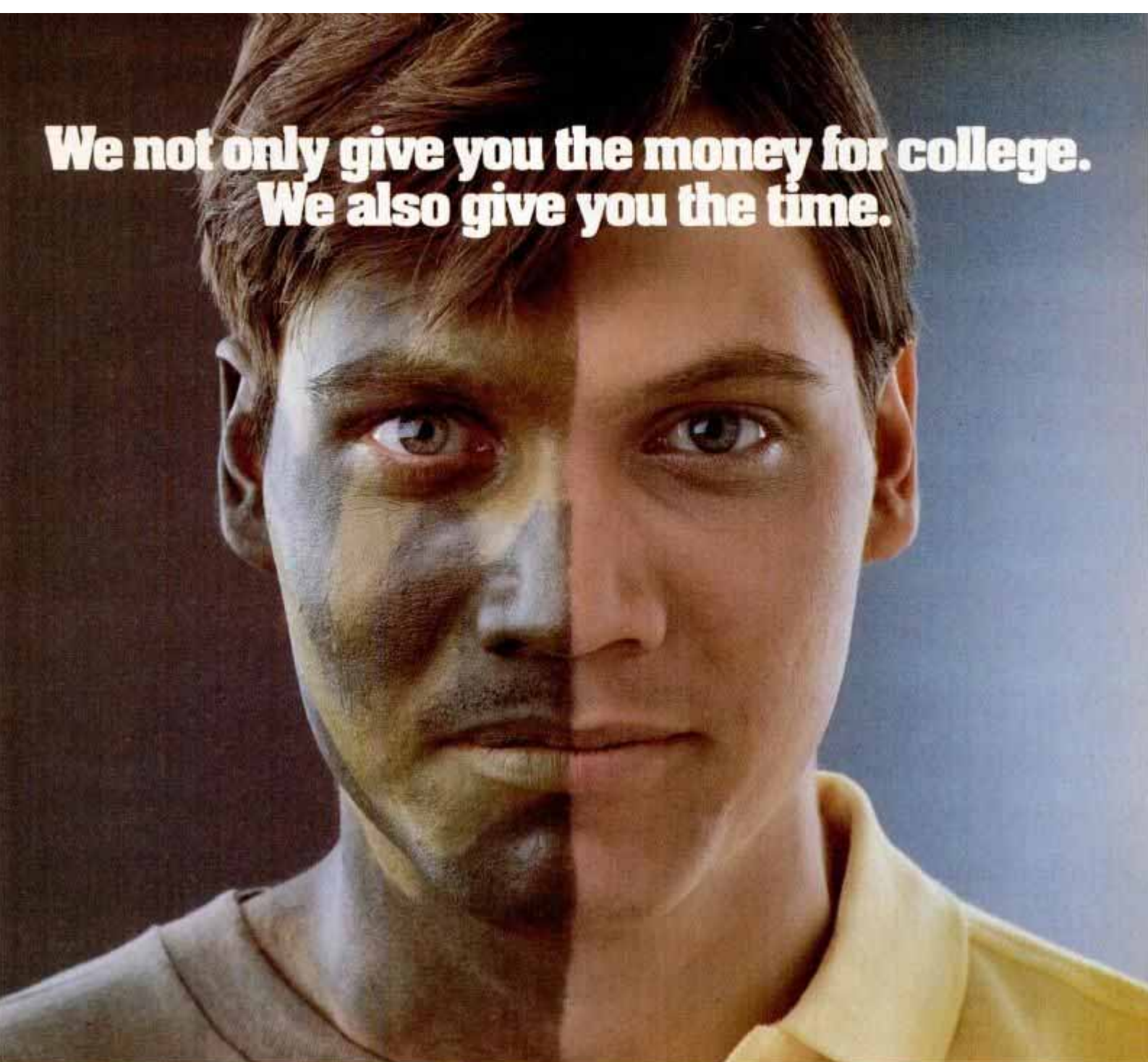
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# Letters



## Two For The Yard

I wanted you to see the gazebo I built last summer from your plans in the June '84 issue (*Cool Summer Shelters*, "Garden Gazebo," page 74). As you can see, it's slightly modified to keep out black flies and mosquitoes and bad weather. The large windows are screened and reinforced with galvanized wire mesh. I also increased the



PM gazebo was enclosed by reader Chesal.

overall dimensions to 10 ft. x 10 ft. and designed 1/2-in. plywood double-hung shutters. They can be opened or closed using nylon cords from the inside. The door I added is made of mortise-and-tenoned 2x4s for strength.

I am a long-time subscriber to *POPULAR MECHANICS*. It's got the best information for the craftsman than any other publication. Rosario Capotosto is my favorite woodworking teacher, and I've built many a jig for my table and radial-arm saws from his plans. Thanks, Rosario, and keep up the good work.

TONY CHESAL  
NEW WATERFORD  
CAPE BRETON N.S.  
CANADA

I thought you—and *PM* readers, too—would enjoy seeing our completed barnlike garden shed built from your excellent plans. My wife and I are very satisfied with the utility of the structure, which should provide many years of pleasure. We're also proud of its appearance and the way it enhances the beauty of our property.

PAUL RIFFEL  
RICHFIELD, MN

*Plans for the barn/garden shed are \$10.50 and available from Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101. Also, the PM brochure "Plans and Ideas" is available for a \$1.50 from the same address.*

Barn/garden shed, this one built from *PM* plans by reader Paul Riffel, can provide utility and be an attractive addition to any yard.



## Radar detectors Pro . . .

I have been waiting for someone to perform a test like yours on radar detectors (*PM Comparison Test: Radar vs. Detectors*, page 76, Nov. '86). Now my mind is made up on which one to buy. I know that when *PM* does a test it's reliable. Thanks for the article.

PATRICK PRICE  
ALEXANDRIA, LA

In your radar detector test, I found the research way beyond that presented in any other publication. Others have approached the subject with a 1-sided view; *PM* has attacked it from all perspectives.

CARSON TANG  
BROOKLYN, NY

As part of a bill to raise the speed limit on Interstates from 55 to 65 mph, Congress has included a provision to outlaw the use of radar detectors. Don't let them sneak this one by.

KATHY SIZEMORE  
BECKLEY, W. VA.

## . . . and con

As a long-time subscriber, I am personally offended that you would take the space in your otherwise great magazine to help promote devices which assist others in breaking the law.

NORM TOTEY  
EVERETT, WA

What next? Instructions for other ways to avoid police arrest? If I speed, I'm breaking the law and deserve arrest.

HARRY HUMMEL  
BRADENTON, FL

The attitude in your radar detector test is that it's perfectly okay to flaunt the law, only the stupid get caught, that everybody drives faster than 55, and you condone it.

WILLARD C. RAND  
ST. JAMES, MO

*Only about half of the people who drive on Interstate Highways exceed the 55-mph national speed limit. We're not encouraging nor discouraging the breaking of this law. Each individual should make up his mind as to whether or not to use a radar detector.*



## Rare chair

Never, in all my years of building furniture did I have any desire to construct a chair—not until the August 1986 issue of *POPULAR MECHANICS* arrived, that is (*Choice Seating*, page 84).

The plans were easy to follow and well done, considering the careful fitting needed for this project. I added relief carving to the front of the chair, too.

W.O. WEST, JR.  
ONEIDA, TN



## Timeless stands

In your January '69 issue, I found the ideal bench for my 6-in. metal-cutting lathe (*Build This Box-Leg Power-Tool Stand*, page 178). I added a lower shelf and covered the outside with plastic laminate. Also shown is a disc sander I saw in the Mexican edition of *PM* (March '72, page 69). Both are useful. In fact, I used the disc sander to build the lathe bench!

CARLOS URBINA PACHECO  
TORREON, COAHUILA  
MEXICO



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BECAUSE SO MUCH IS RIDING  
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**SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.**

16 mg "tar," 1.0 mg nicotine av. per cigarette, FTC Report, Feb. '85



A brown horse is shown in a stable stall, with its head resting against a wooden post. The horse's mouth is open, and it appears to be holding the post. The background is a textured, light-colored wall. In the foreground, two packs of Marlboro cigarettes are prominently displayed. The pack on the left is yellow and labeled 'Marlboro 100's', while the pack on the right is red and labeled 'Marlboro'. Both packs have a white band across the top with the words 'FILTER CIGARETTES'.

**Come to where the flavor is.  
Come to Marlboro Country.**



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



# Imports



BY BILL HARTFORD

## Sports/Utility Stampede

If you've sworn off cars and would rather be out playing king of the mountain than reading this magazine, you might just skip our imported passenger cars special section beginning on page 95. We bet you've discovered the joys of sports/utilities and there's no going back. The ubiquitous "utes" have replaced the getaway car for hundreds of thousands of drivers. The 4x4 scramblers are happy on hills and highways and their numbers keep growing.

### Range Rover

The British are coming! Next month, in fact, with a 4x4 that's fit for a king. The \$30,000 Range Rover isn't new; it's cruised and climbed other parts of the world since 1970. Here, it'll be able to devour distances at more than 100 mph powered by a 150-hp, fuel-injected, 3.5-liter V8. And the comfort, ride and appointments will be matched only by its work-horse specs. A recent offroad excursion reminded us how extraordinary is this vehicle's ability to imitate a Sherman tank, and do it gracefully.

### Suzuki Samurai

It's true. If you're not having fun yet, you haven't discovered the Samurai. Base price is just \$6895, and the noisy, bouncy ride lets you know it fast. But still, you can't help love it—all 135 in., 64 hp and 2127 pounds of it. It resembles a large toy but, as we discovered, can run with the pack on high-

ways. Off road, just lock those hubs and the world is yours.

### Nissan Pathfinder

Between the extremes are a handful of mid-priced 4x4s. For \$10,000 to \$12,000 base price, there are '87s from Toyota, Isuzu and Mitsubishi, and Nissan's first entry in the category—the Pathfinder. Not available at the time

of PM's comparison test (*Off-Road Warriors*, page 74, Sept. '86), the Pathfinder is closest to the Trooper and 4Runner in major specs: wb: 104.3 in.; length: 171.9 in.; payload: 1150 pounds; and cargo volume: 71.3 cu. ft. Its trailer-tow capacity is 2000 pounds, same as the Trooper's but a lot less than the 4Runner's 3500.

### Toyota 4Runner

This impressive 4x4—which came in second in our test, just behind the GMC S-15 Jimmy—will push \$20,000 when decked out. The three SR5 models in the line—one a turbo—haven't changed for '87. Options include power windows, cruise control, sun-roof and air conditioning.

### Isuzu Trooper II

The handsome Trooper looks even smarter for '87 with its new grille and flush headlights. Two- or 4-door models in a wide range of trim levels make it

easy to personalize. The 4-door now comes in the top-of-the-line LS series.

The LS gives you black-out trim, deep-tint rear windows, and 2-tone paint. Sorry, no camouflage option.

### Mitsubishi Montero

The value-packed Montero (\$11,638 as we tested it) has an appealing posture on its 92.5-in. wheelbase. That's just a shade shorter than that of the Bronco II and Jeep Wrangler. There's a new 4-speed automatic in base and Sport versions, and larger tires. And for '87 there's a new version called the Raider—but that's over at Dodge dealers. **PM**



Compact and playful, the Suzuki Samurai (left) is scaled similar to the Pembroke Welsh Corgi riding shotgun. Nissan's Pathfinder (above) joins 4x4 sports utilities for '87; it's got hip edge on competition with 140-hp ohc V6. Range Rover (below) is \$30,000 purebred from England. Montero (below left) is value leader. Trooper II (bottom) gets '87 facelift. Toyota 4Runner (bottom left) is the cargo-volume winner and only turbo in this group of stalwart 4x4s.





# Travel With The Best!



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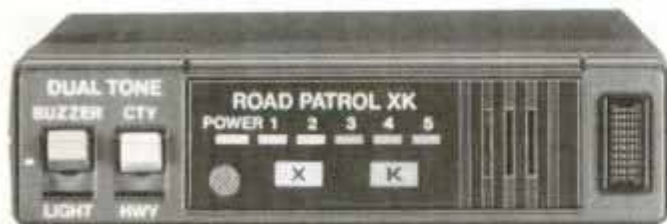
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BY DENNIS ESKOW

## Lab Finds Juicy Promise

History was made recently at the U.S. Department of Agriculture labs in Pasadena, California, when researchers announced they had grown citrus juice vesicles in the lab. The "test-tube baby" sacs produce the flavor in oranges. The actual juice comes from a more complex organ known as the endocarp, which has not yet been produced through genetic engineering methods.

"Our intent is to use the new laboratory-reared vesicles to study how the fruit develops," says plant geneticist Brent Tisserat. The test-tube growth method, called tissue culture, produces the juice sacs in a matter of days. Thus, botanists trying to develop new varieties of fruit can cut their research time by years. In the past, they had to grow trees and wait for the first fruit to appear before knowing if an experiment worked.

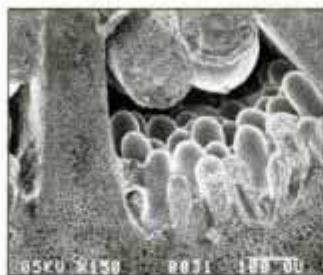
The new discovery has implications for the future flavoring of lemons, oranges and grapefruit. Tisserat told us that laboratory colonies of juice sacs should be ideal for controlled experiments with plant growth hormones, resulting in the creation of species that grow faster than traditional plants without losing the traditional flavor.

Normal citrus fruits are seasonal. But the lab-grown vesicles will be available all year.

The secret to growing the sacs in the lab was to remove amorphous cells called callus from the young plants growing in the test tube. This finding may be applied to test-tube growth of other plants.



Citrus juice sacs grown in a lab will unravel mysteries.



Sacs magnified 1000x show dust-like particles of callus cells.

## Inventive Book

What's the latest poop on bulletproof vests for dogs? Who has the last word on the artificial tongue? These and other questions—along with their well-written, witty answers—are posed in the new *World Almanac Of Inventions* (World Almanac Press, \$12.95).

The entire 352-page volume is written by Valerie-Anne Giscard d'Estaing, daughter of the former French president. And, lest you think

it's just for laughs, there are informative and extensive sections explaining the workings and history of more than 160 inventions from the ordinary household refrigerator to the nuclear-powered submarine.

## Against all odds

I don't play the lottery. I don't believe in luck. And neither will you if you read *Probabilities In Everyday Life* by John D. McGervey (Nelson Hall, \$23.95). The book studies the different ways we come up against statistics in everyday life, and shows you how to figure out what the odds really are. The Case Western Reserve physics professor gives very straightforward explanations of how chance works. In the lottery, for instance, he notes that your odds of winning the typical state game is one in 40 million. That compares to 50-50 chances of winning at blackjack if you use one classical betting strategy.

The science of statistics can be traced back to the card-playing habits of Frederick Gauss in the early 19th century. He and some others, while seeking ways to beat the house, developed some of the classical laws of statistics.

Thus, it is fitting that about half of McGervey's book is devoted to what we know as gambling, from horse racing to contract bridge. But it is also filled with valuable information that will help you select the right life insurance policy, or make a reasonable investment.

## Precise research

In the engineering unit at Lawrence Livermore National Laboratory, tolerances get down to some very low numbers. Two tools the lab is showing off this year are the new Precision Engineering Research Lathe and the X-Ray Beam Splitter.

The lathe uses a diamond-tipped tool to cut materials to within one-tenth of a micron. It also cuts metal two to 10 times smoother than before.

The beam-splitter, about one-tenth the thickness of a human hair, divides an X-ray beam into two beams. Its molybdenum-silicon mirror reflects only part of an X-ray.

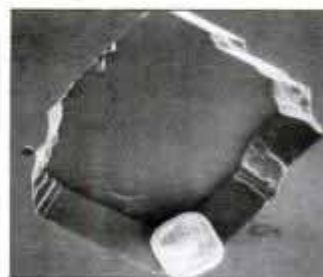
## Accidents happen

The best way to find out what caused an accident is to make it happen again. In the lab. The most popular analysis methods involve interpretation of photographs taken at the scene. Changing the information you get from a photo into a 3-dimensional model is a major undertaking. But scientists at General Motors' Technical Center have come up with a way to do it by computer. In minutes.

The GM FotoGram system, recently tested by the Illinois state police, works with an IBM or compatible computer. The investigators study the accident photos, then feed into the computer actual distances of objects from one another. In the photo, a car may be 3 in. from a victim's body. A lamppost may be a quarter inch from the car. The computer, also having been given three actual coordinates taken at the scene, translates the data from the photo so investigators can deduce speeds, braking distances and other important factors. **PM**



Diamond-tipped tool is inserted into Livermore's precision lathe.



Beam-splitting mirror in micrograph under a salt grain.



# COMING NEXT MONTH



**SPECIAL SECTION BOATING '87**

## Special: Boating '87

- New boat buying made simple
- Guide to special-purpose boats
- Driving the new big outboards
- Fascinating new boat designs

## High-Speed Showdown

We pit the Buick GNX, with its 300-hp turbo V8, against the twin-turbo Callaway Corvette.

## Rock Climbing Secrets

Scale the peaks with America's premier mountaineer. Plus all the new high-tech gear.

## Family Sedan Shootout

New Chevrolet Corsica takes on 11 imports and domestics in a performance extravaganza.

## At Last—The \$17,000 Bicycle

Five future bikes that are on the cutting edge of aerodynamic and exotic materials design.

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Build our solid poplar contemporary wardrobe with pickled finish.



Hard rock show



Stow those clothes

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# Electronics

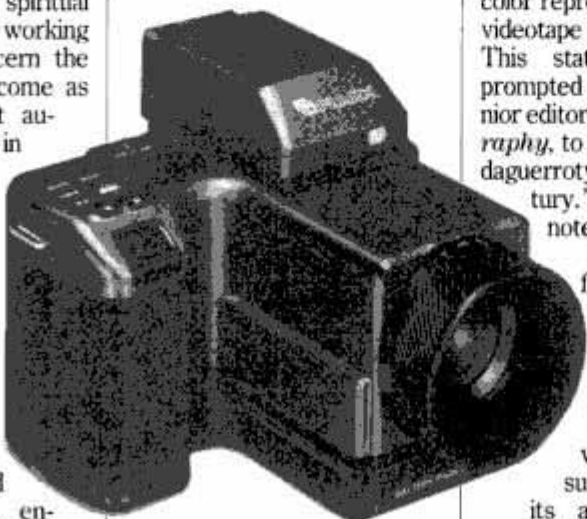


BY STEPHEN A. BOOTH

## ESP: Image Of The Future

You didn't need a spiritual medium, just a working pair of eyes, to discern the shapes of things to come as displayed during last autumn's Photokina Fair in Germany and Electronics Fair in Tokyo. ESP—which means Electronic Still Photography—made its strongest showing ever at these two product exhibitions. In all, nine camera and electronics companies demonstrated prototype cameras, encouraged no doubt by Canon's successful introduction of the first still video camera last summer (*Electronics*, page 56, Sept. '86).


This contrasts strongly with the last Photokina, held in Dusseldorf just two years ago, when the only ESP cameras to be seen were hidden in the back rooms of two manufacturers' exhibits. Among the electronics companies, only Hitachi has consistently demonstrated ESP since 1984—though it was Sony that got the ball rolling six years



Fuji's ES-2P electronic still camera for the '88 Olympics.

ago with the demonstration of its Mavica system. Ironically, Sony hasn't been heard from since. Like photo giant Kodak, the Japanese innovator has confined its ESP demonstrations to picture-display and print-processing equipment. But we've yet to see an ESP camera equivalent of the Walkman or Instamatic.

As described in past columns here, Electronic Still Photography differs from the kind we know in that it uses no film, and its pictures require no processing. Instead, images are recorded on a 2-in.-dia. magnetic disc that's housed in a hard plastic shell. The disc holds 25 to 50 images, and you view them on a TV screen




Nikon ESP camera was used at the '86 Pan-Asian Games.

when the disc is removed from the camera and inserted in a VCR-like playback deck. To get prints, you just connect the deck to an ink-jet or thermal printer similar to those used with computers—though in the future it's likely your local photoprocessor will produce prints for you using a laser device and conventional photosensitive paper.

At this writing, ESP prints appear crude compared to conventional film photos, and color reproduction is closer to videotape than Kodachrome. This state of affairs has prompted George Schaub, senior editor of *Popular Photography*, to dub ESP prints "the daguerrotypes of the 20th century." (Collectors take note!)

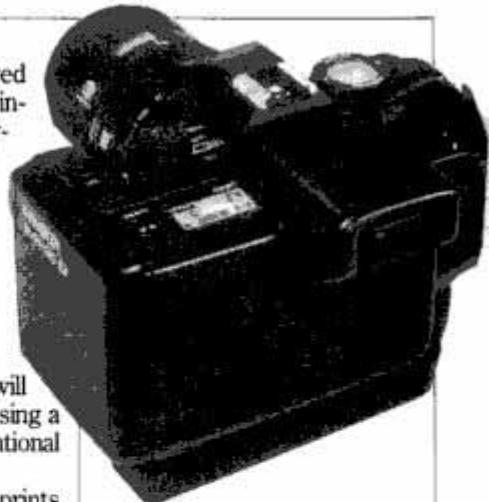
What's responsible for the current quality level of ESP photos is the electronic image pickup (usually a CCD or charge-coupled device) that scans the subject and conveys its appearance to the magnetic disc. The best of today's pickups can resolve no more than 400,000 pixels (picture elements, or pieces of detail)—though the magnetic disc is capable of storing far more. By way of comparison, a frame of 35mm color print film rated at ISO-100 speed



Panasonic uses mag-disc (right), looks like snapshot camera.

can resolve and record about 18 million pixels (the film is both the image pickup and storage medium).

Despite this limitation, ESP images are adequate for viewing on a TV screen or as prints

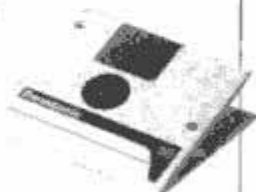


Minolta Maxxum film camera has SVB-90 for electronic pix.

in news publications. Meanwhile, the power of imaging pickups is picking up. Kodak recently announced a chip capable of seeing 1.4 million pixels. You can bet the imaging chips will continue to improve—some of the leading manufacturers do.

For example, Minolta's ESP prototype at the recent Photokina was none other than its now-famous Maxxum autofocus film camera—fitted with a special ESP back designed to hold a mag-disc instead of film. The SVB-90 back also contains the disc motor, other electronics and the CCD pickup that receives visual information from the film plane.

Thinking perhaps even further ahead was electronics giant Panasonic, which displayed a snapshot-style ESP designed to be usable and affordable to amateurs. It's called the Photovision 3100 and could hit the streets in two years. Standard issue includes a playback unit and tiny printer



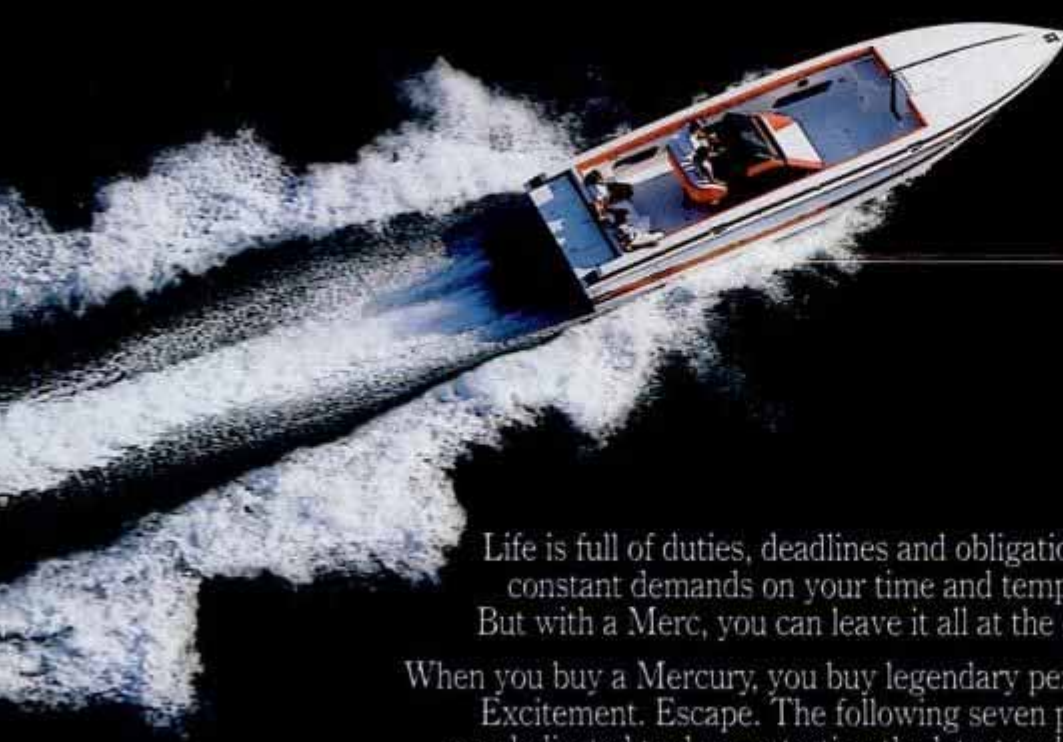
—all for a tentative price of \$1200. That's a fraction of the \$14,000 you'd need for the most basic Canon rig today.

(Please turn to page 25)



**THE LATEST TECHNOLOGY  
IN GETTING AWAY FROM IT ALL.**

**MERCURY**



Life is full of duties, deadlines and obligations—  
constant demands on your time and temper.  
But with a Merc, you can leave it all at the dock.

When you buy a Mercury, you buy legendary performance.  
Excitement. Escape. The following seven pages  
are dedicated to demonstrating the latest technology  
in escapism, as the Mercury legend lives on  
in the remarkable engines for 1987.



# WITH THESE OUTBOARDS, YOU CAN ESCAPE THE CARES OF YOUR WORK WEEK IN A HURRY.



## THE FIRST AND ONLY FUEL-INJECTED OUTBOARD.

You can choose from dozens of fuel-injected cars on the market. But there's only one fuel-injected outboard. Mercury's tradition of research and racing has produced a new engine for 1987 that is so technologically superior the competition may take years to catch up. In fact, the new Laser 220 XRi embodies a number of patented features that may prevent them

from *ever* catching up. The Laser is 2.4 liters of fuel-injected V-6 performance with response so quick that, in a flash, the standards for outboard performance must be re-evaluated.

## THE LASER THINKS FOR ITSELF SO YOU CAN KEEP YOUR MIND ON THE FUN.

Under the cowl is an Electronic Control Unit that precisely delivers fuel to each cylinder based on: engine speed, load,

manifold pressure, air temperature and engine temperature. It even compensates for weather, altitude and low grade fuel.

## FIVE MORE V-6's THAT HAVE EARNED THEIR STRIPES.

When you look at the Mercury 135 to 200, the first thing you notice is that they appear fast even when they're standing still. That's because all the Mercury V-6s have a 60° block instead of a 90°, as most competitors do.

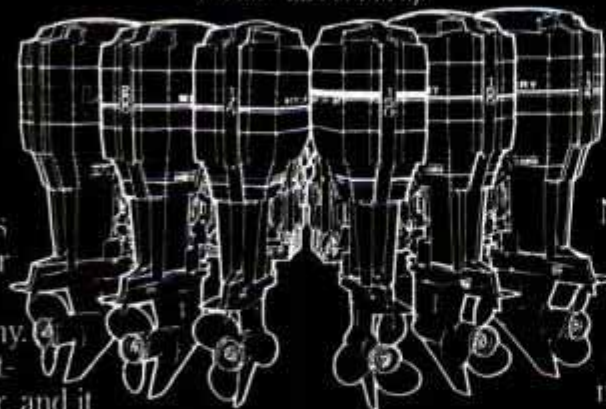


# ER

# XR2

# 21210

V-6 line 220 to 135 hp



That makes them lighter for better fuel economy. Dual mounting is easier, and it also makes for better visibility aft. And, when was the last time you saw a fast runner who was fat?

The Mercury 150XR2 has become almost part of the uniform for top professional bass fishermen...and still the one used most often by the pros.

Nobody beats you to the hot spots with one of these new Meres.

### THE MOST SEAWORTHY OUTBOARDS EVER MADE.

No other engines are made with Mercury's exclusive XK360 corrosion resistant aluminum alloy. No other uses as many high grade stainless steel components.

Or, the Merc 14 step coating process that includes on-line electrodeposition painting.

That's why no other outboard shrugs off salt like these Meres. Chances are, you didn't get where you are by moving slow, so why buy an outboard that moves that way? In the V-6 category, nobody even comes close.

**MERCURY**  
**OUTBOARDS**



# MAYBE YOU CAN'T RECAPTURE YOUR YOUTH, BUT YOU CAN GIVE IT A HELLUVA CHASE.



At Mercury, we feel dependability is a minimum design requirement. But, to the design engineers who have dedicated years to better performance, an engine that is only dependable is simply dull.

**THREE NEW ENGINES FOR PEOPLE WHO BELIEVE PERFORMANCE SHOULD BE SEEN AND NOT HEARD.**

There's been a quiet design revolution going on in Fond du Lac,

Wisconsin, the past 7 years. It has produced three remarkable three-cylinder outboards, a 70, 80, and 90 horsepower. Nothing with this kind of power ever delivered it so quietly.

As you might expect, engineers can think things through pretty carefully in 7 years, so everything about these new engines has been thoroughly researched and tested.

There's a variable ratio oil injection system which makes

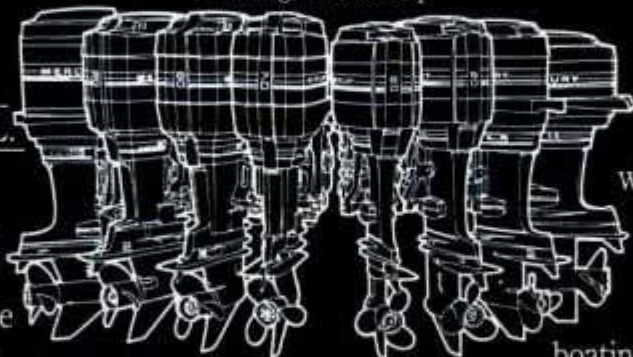
the mix richer at top speed than at idle to protect your engine. There's a large cavitation plate set deeper on the lower unit for better holding in tight turns—a special advantage for water skiers.

And the strongest, most expensive bearings we've ever put into engines this size. While these new engines speak softly, they carry a big torque curve, so they deliver power from start-up to top speed. They're quieter, stronger, faster and new for 1987.



# MERCURY

*Midrange 115 to 35 hp*



## OIL INJECTION FOR ALL.

Every electric start outboard from 35 hp on up comes with Mercury oil injection as standard equipment, so you never have to mix gas and oil. There are no extra hoses or fittings. Fill the tank with oil and that's it.

## MERC POWER TRIM AND TILT—16 YEARS LATER AND STILL NO EQUAL.

Since its introduction in 1971, Mercury has had the best trim

and tilt system on the water. In fact, measurably better, with 5° more trim and 10° more tilt than any other outboard on the market today. Extra trim helps top end performance. Extra tilt gets your engine all

the way out of the water when you dock. A Merc also "tucks under" 3° more to get bigger boats on plane and water skiers up quicker. If you're just getting into boating, we can't think of a more exciting place to start than with one of these mid-range engines from Merc.

**MERCURY  
OUTBOARDS**



# NO HASSLES, NO PRESSURES, NO DEMANDS. BROUGHT TO YOU BY MERC.



When you shop for a small outboard, Mercury knows you are looking for more than a machine. You want confidence, the security of an engine that will take you away from it all without the slightest concern about getting back again.

## ONLY MERC OFFERS ONE-HANDED OPERATION.

On the 9.9, 8, and 6 hp models, you can handle all major functions with one hand. (See detail.) Start. Shift. Throttle. Stop.

And just by pushing down on the tiller you can also adjust the motor to 6 trim and shallow water positions, or lock it up in full tilt position. Don't bother to look for this feature on other outboards, Mercury has it patented.

## LIGHTER TO LIFT, EASIER TO START, SLOWER TO TROLL.

You'll find the Merc 9.9, for instance, to be about 10 pounds lighter than other outboards of comparable horsepower.

That can make quite a difference on the trip from your trunk to your boat transom.

When you're ready to start, a fuel primer system (not a choke) automatically injects just the right amount of fuel for quick starts with one flick of the wrist.

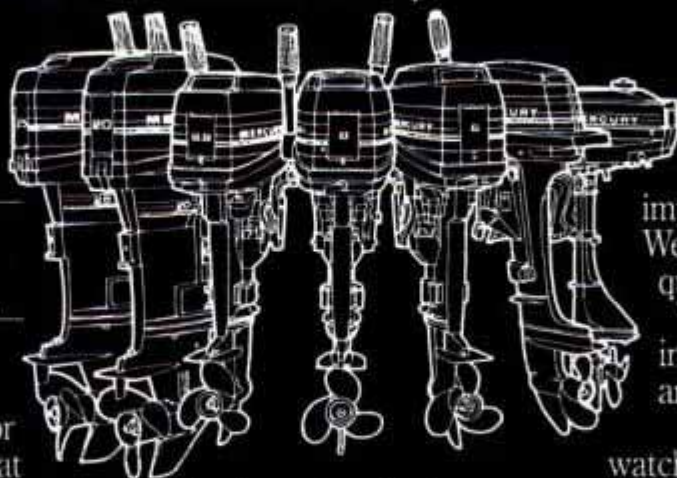
Now, a small irony. These outboards with a reputation for being fastest are, in this case, also slowest. They're designed to idle down to a quiet 650 rpm, about 200 slower than most of our competitors can troll.



# MERCURY

# 9.9

*Small outboards - 25 to 2 hp*



**A TIME-HONORED 20  
AND 25 WITH A  
COUPLE NEW TWISTS.**

We have actually run these outboards at full throttle for 2000 hours without any major mechanical failure. To put that into perspective, that's 83 days around the clock. Wide open. That's twice around the world at the equator if you didn't run out of water.

We've tested them for wear on the Colorado River which, in

spring, has been described as "Too thick to drink and too thin to plow." We've slammed them into a concrete block at 25mph, and redesigned the lower unit until it survived time after time.

Now, we've tested them and

improved them again. We made them run even quieter and idle better.

We made them even more immune to the weather and low grade fuel.

So if you've been watching, waiting, studying and comparing small outboards, it's time to invest in a legend... one of the new Mercs for '87.

**MERCURY  
OUTBOARDS**



# WHEN YOU GET MORE OUT OF YOUR TROLLING MOTOR, YOU GET MORE OUT OF YOUR DAY.

Merc Thrusters for 1987 are designed to get better performance from a single 12 volt battery than most of our competitors get from a 24 volt system. In fact, they give you more quiet operating hours per charge than any other electric outboard.

The reason is our planetary gear reduction system that allows the electric motor to operate at

peak efficiency. The gears drive a big 10½ inch prop at slower speed but higher torque, which gives Merc more pounds of actual thrust per watt of power.

There are 7 Thruster models. Our standard Thruster is available as a deck mount foot control. The Thruster II comes either as a deck mount remote or transom mount manual. And our high

output Thruster Plus and Thruster Plus L line has 4 models, including one with a 6 inch longer shaft for deep bow boats.

When you're out on the lake recharging *your* battery, don't drain the one that runs your troll motor. Use the one that gives you the most fishing time with the least "juice", the Merc Thruster.



## THE SYSTEM BEHIND THE MERC LINE.

Mercury's Satisfied Owner System makes sure that the new engine you buy is the finely engineered machine you expect. When your engine arrives at a dealership, it gets a 43-point inspection, including a series of on-water tests and a post-water-test inspection. Then, together, you and your dealer go through every detail of operation,

maintenance and warranty.

Mercury also offers a Product Protection Plan that's like a two-year extension of the original limited warranty. You pay only a nominal \$25 charge to the servicing dealer for each repair, and Mercury pays the rest directly to the dealer. Unlike some plans, your money is never tied up while you wait for reimbursement.

And now, a word about our dealers. There are 6000 of

them worldwide, so you're never far from good advice and factory-trained service technicians. Whether you need repair, service or the facts on matching the right engine to the right boat, your Merc dealer knows his stuff. For your nearest Mercury dealer, look in the Yellow Pages, under outboard motors.

**MERCURY  
OUTBOARDS**



## ELECTRONICS

(Continued from page 16)

### Screen test

If you own a portable laptop computer, you know how difficult it can be to read its power-stingy liquid-crystal display screen. The problem is particularly troublesome with the larger 16- and 25-column screens that have now become the popular choice in laptops. One reasonably effective solution, offered by Bondwell, Morrow, Quadram, Zenith and others, is to backlight the screen with a light-emitting panel—usually electroluminescent. This improves visibility in dimly illuminated environments.

Fine, you say, but what about all the laptops that don't offer backlighting—like the popular Tandy/Radio Shack, NEC and Hewlett-Packard portables? Not to worry. Axonix Corp., a supplier with a varied line of accessories for midget micros, will retrofit your laptop PC with an electroluminescent backlighting panel.

Installation cost, says Axonix, runs from \$200 for Tandy's Model 100 and 200 or NEC's PC8201 to as high as \$350 for Data General's Data General/One. The company claims the retrofit improves contrast from the LCD's typical 2 to 1 or 3 to 1 to as high as 10 to 1.

The only liability is, of course, increased battery drain. You can expect battery life to be cut by about half, Axonix notes. That's not too bad a trade-off for all-weather legibility. The updated screen doesn't change the physical shape or size of the display, but it does add a slight amount of weight—about 4 ounces.

The company says it can turn around units shipped to it in about a week. Warranty is 90 days parts and labor. For more details, contact Axonix, 417 Wakara Way, Salt Lake City, UT 84103.

### Rx for PCs

Personal computers are amazingly reliable beasts, but they do require tender-loving care to function at their best. Hoyt Hilsman has written *Micro Doctor*, a series of books that offers valuable advice on keeping your machine up and running.

Three books, each published by Little, Brown & Co. and priced at \$13.95, cover the Apple II family, the Commodore 64 and IBM's PC. They address the care, troubleshooting and simple repair of these popular units in down-to-earth language, using easy-to-understand illustrations.

All three books are structured in the same way, giving doctorly advice on basic care, cleaning and routine maintenance. They next take you through each major component of the pc system, discussing symptoms, possible causes and modes of treatment. The chapters describe simple repairs that screwdriver-shy users might take a shot at to save a trip to the repair center. They also explain more involved troubleshooting and repair procedures

likely to inspire only the dedicated-and-fearless computer aficionado.

IBM PC owners might want to check into another valuable and entertaining book aimed at demystifying the micro while offering a satchelful of nuts-and-bolts advice on maintenance and problem prevention. It's Henry F. Beechold's *The Plain English Maintenance & Repair Guide For Personal Computers*, published by Simon & Schuster Computer Books (paperback, \$15).

### Autosound's anniversary

Nineteen twenty-seven was one heckuva year. Just think of it: Sixty years ago, Lucky Lindy flew the Atlantic, Al Jolson played the first "talkie" and Babe Ruth's 60 home runs propelled the Yanks to 110 victories, a pennant and a World Series championship.

In electronics, 1927 was also a benchmark year. Philo Farnsworth took a patent on an electronic TV system, and Bell Labs broadcast pictures over the air. Meanwhile, the first coast-to-coast radio hookup coincided with the introduction of car radios.

I've been thinking about car stereo a lot lately: How lonely the long-haul would be without it, how maddening the rush-hour commute!

Though Emile Berliner introduced the flat, easily reproduceable phonograph record a century ago, only recently has digital compact-disc technology made platters copacetic with the car. Instead, auto-audio has relied on the radio and tape.

We sometimes take FM stereo for granted, but it's really only 25 years old (monaural FM got FCC approval in 1941). And although Germany's BASF developed magnetic tape 55 years ago, the popular cassette is barely 20 years old—as is Dolby Noise Reduction, which makes it listenable.

Of course, we wouldn't have practical car stereo at all if it weren't for Bell Labs' transistor (1947). And few people dreamed how much we'd pack into today's dashboard when the first integrated circuits came to hi-fi two decades ago. Stay tuned to PM this year as we celebrate autosound's 60th birthday with the latest news and tests of highway hi-fi.

### Diskography

Ever wonder how a computer diskette is made? Or how it works? Do you know how to use a diskette? The answer to these questions and hundreds of others are found in the 112-page *Diskette Guide Book* available free from disk-maker BASF Corp. Information Systems, Public Relations Dept., Crosby Dr., Bedford, MA 01730. **PM**



Bill Koch  
8 time Nat'l X-C  
Ski Champion  
Olympic Silver Medalist  
World Cup Winner

## Scientific Study Ranks NordicTrack #1

In tests of exercise efficiency at a major university, NordicTrack burned more calories and provided greater aerobic workouts.

### Rank of Exercise Efficiency

1. NordicTrack X-C Ski Exerciser
2. An Exercise Bike
3. A Rowing Machine
4. A Shuffle-Type Ski Exerciser

NordicTrack's higher oxygen usage test scores show that more muscle mass is involved in the exercise and more calories are being burned.

### It's Only Logical that NordicTrack Would Get the Highest Scores

- because NordicTrack is more complete than an Exercise Bike. Adds important upper body exercise. Provides more uniform leg muscle usage.
- because NordicTrack is more thorough than a Rowing Machine. NordicTrack's resistance is proportioned according to the individual muscle strength—no major muscles are overstressed or under-worked.
- because NordicTrack has inertial resistance not available on a Shuffle-Type Ski Exerciser. Other ski exercisers use less efficient frictional resistance with a resulting callisthenics-like feeling. NordicTrack's unique flywheel resistance for a life-like feeling of smoothness and continuity is matched only by real skiing.

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Kings: 10 mg "tar," 0.8 mg nicotine —  
100's: 12 mg "tar," 0.9 mg nicotine av. per cigarette by FTC method.

**SURGEON GENERAL'S WARNING: Quitting Smoking  
Now Greatly Reduces Serious Risks to Your Health.**



# Homeowners' Clinic



BY NORMAN BECKER, P.E.

## Knocking Baseboards

**W**e have hot-water, baseboard heat. When the system is producing heat, there is a constant knocking at both ends of the baseboard units. This knocking also continues while the heat is subsiding. Our house is a split-foyer style with upper and lower levels. It has a 2-level heating system. We've consulted several heating contractors, but none can solve the problem.

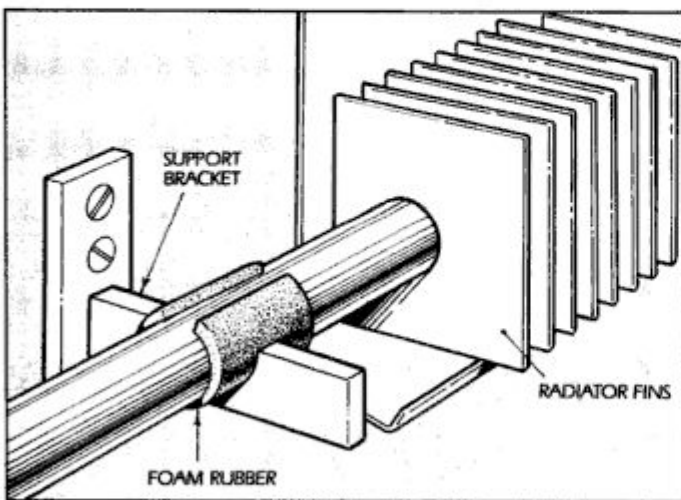
HOWARD L. BONTZ  
ALEXANDRIA, VA

All piping materials expand and contract with temperature changes. A 50-ft. length of copper pipe, any diameter, will expand in length more than  $\frac{1}{2}$  in. when the water inside is raised from 70° F to 170° F (typical for a baseboard radiator). This expansion can strain joints and cause leaks. It can also make elements bind against radiator covers and jam ris-

ers against floor holes, causing noise. Even when provisions are made during installation to absorb this expansion, some noise may still come from the baseboard units.

The noise is probably caused by the heat distribution pipes or connecting fins rubbing on their support brackets as the pipes expand when the heat is coming up and as they contract when the heat is going down.

This noise can usually be eliminated or reduced by inserting foam-rubber pads between the baseboard support brackets and the connector fins or distribution pipe, whichever is being supported. When inserting the pads, gently lift the heating pipes or fins. If you apply too much pressure, you will strain pipe joints and possibly crack them.



Placing foam-rubber pads between a radiator pipe and its support bracket reduces squeaks caused by an expanding pipe.

## Leaking plugs

Last month I had my house treated for termites. There is a concrete floor in the basement. In order to treat the house on the inside, holes were bored in the floor every 12 to 16 in. and about 4 to 6 in. deep. After the exterminators finished pumping the termite insecticide into the holes, they filled them with concrete plugs about half the size of a cherry. Though the top of each hole is sealed, the rest of it is empty.

The problem is that, for the first time, I get water in the basement after a rain. I get a little water when it rains lightly, but a few gallons from a heavy rain. Could the manner in which the holes were closed cause the problem?

STEVE KIOPEKLY  
RALEIGH, NC

When concrete cures, it shrinks. As a result, the concrete plugs have shrunk and do not adequately seal the holes from the hydrostatic pressure on the underside of the floor slab.

Try replacing the plugs with a hydraulic cement such as Waterplug (made by Thoro System Products Inc., 7800 N.W. 38th St., Miami, FL 33166). It provides an impervious nonshrinking seal that expands when it sets. It comes as a powder that's mixed with water to form a putty that's pressed in place. It's sold in pint containers (about \$3.50) at home supply stores.

## Door update

In the Sept. '86 *Homeowners' Clinic* (page 27), one of your readers states his problem with paint peeling from his metal door in cold weather. I, too, have experienced the problem on one of my doors, which is galvanized metal.

When the paint peeled the second time, I found the problem to be a "white rust" forming on the galvanized metal. After some research, I found that I needed Rust-Oleum's Galvanized Metal Primer.

I again stripped off the old paint, sanded the metal, then applied the primer. I followed it with zinc chromate primer and applied two topcoats of

PPG latex semigloss exterior paint. Two years have passed and the door is holding up well.

FRANK CIRINCIONE  
PARKTON, MD

Thanks for your comments, Frank. I checked with Rust-Oleum and they feel the second primer of zinc chromate is optional.

## Heater safety, II

I read your informative article *Water Heater Safety* in the Sept. '86 issue (page 27). I have an electric water heater with a relief valve rated at 100,000 BTU/hour. The data plate on the tank casing contains the following wattage for the heating elements: Upper—4500, Lower—4500, Total—4500. However, there is no BTU input to the water heater listed on the plate.

How can I tell if the relief valve is sized correctly for the water heater?

ELMER ZELLIEN  
KRUMVILLE, NY

Electrical water heaters normally have an upper and a lower heating element. The data plate on the heaters will contain the maximum wattage of each element, as well as the total wattage of the unit. In most residential heaters, the heating elements do not operate simultaneously and, as a result, the maximum wattage of an element is the same as the total wattage.

To convert from electrical energy to heat energy, use this formula: 1 watt=3.413 BTU/hour. The total wattage of your heater is 4500. This is equal to an input rating of 4500 x 3.413 or 15,359 BTU/hour.

Since the relief valve is rated at 100,000 BTU/hour, it's adequately sized for your water heater. **PM**

Do you have a home-maintenance or repair problem? Send it to *Homeowners' Clinic*, *Popular Mechanics*, 224 West 57th St., New York, NY 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get *PM's Home Care Guide*, \$2.45 postpaid. Send your order(s) to *Popular Mechanics*, Box 1014, Radio City Station, New York, NY 10101.











# Freewheeling



BY WADE HOYT

## Way Off-Road Vehicles



Soft-top Mercedes G-Wagen "pickup" has a paramilitary look.

February is PM's big import roundup issue. You'll find a rundown on all the new foreign cars in our *Imports '87* special section. Pictured here are a few off-road imports that you won't find at just any local dealership.

Shown above is the soft-top version of the Mercedes G-Wagen, which is—as one would expect—the Mercedes of 4x4s. Powered by a 154-hp, 2.8-liter, fuel-injected overhead-cam Six, it's got a top

speed of 96 mph and will tow up to 6160 pounds! A rigid ladder frame allows it to survive abuse like the punishing Paris-Dakar Rally, while coil springs give it a Mercedes ride off-road or on.

The most popular version is a 4-door, 9-passenger model that costs \$37,000 and up. You won't find it at a Mercedes dealer, but at "direct" (gray market) importers like Daimler Import Inc. of Matawan, NJ; (201) 583-8555.



Honda 4x4 spotted in parking lot at GM Proving Grounds has Blazer chassis. Swing-away wheel gives access to rear (only) seat.



A.M. Junior can be painted and upholstered to match Dad's car.

## Child on board!

For less than the price of four Yugos (\$15,000) you can give your kids a 1/2-scale model of the \$137,800 Aston Martin Volante. Equipped with an 8-hp, 4-stroke engine and a 5-speed gearbox, the Aston Martin Junior will hit 40 mph.

There's even a radio, working lights, a horn and real Wilton carpeting. Send your check (no cash or stamps, please) to Peter Gaydon, Aston Martin Lagonda of North America Inc., 180 Harvard Ave., Stamford, CT 06902.

## Shelby 16-valve Daytona

The first domestic car to offer a high-revving 16-valve engine will be a special Shelby high-performance version of the Dodge Daytona that is scheduled to go into production in mid-1988.

The new Daytona (code-named H-22) will look a lot like the current Dodge Conquest/Mitsubishi Starion.

Shelby is looking at three options for producing a 16-valve cylinder head for the 2.2-liter Chrysler Four. One is to use a U.S. design by racing engineer Hans Hermann, but this package may be too big for the proposed Daytona.

Option Two is the contract Chrysler has with Lotus in England to develop a 16-valver. But GM's recent purchase of Lotus may put the kibosh on that scheme.

The easiest out would be to use the 16-valve head that

Maserati is developing for the 1988 2-seat Chrysler/Maserati convertible.

Other features of this high-tech Daytona will be 4-wheel Kelsey-Hayes disc brakes equipped with Teves ABS hardware, a German Getrag 5-speed transmission, an electronically controlled adjustable suspension made by Monroe incorporating Nissan technology and, hopefully, 4-wheel drive. Shelby is looking to Steyr-Daimler-Puch of Austria (makers of the Mercedes G-Wagen) for a system similar to the viscous-clutch 4wd of the VW Synchro.

Other Shelby-Dodges in the works include a hotrodded Lancer, available this March for under \$17,000 with inter-cooled turbo power and a standard Pioneer CD player. In June you'll see a lightweight, high-speed Shadow. **PM**





For the  
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At a very reasonable \$5799\*, the Honda Civic Hatchback is still one of the lowest-priced cars in America. Accept no substitutes.

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**HONDA**

The Civic Hatchback



# Inside Detroit



BY JIM DUNNE

## Ford's Allante-fighter?



Thunderbird Gilda convertible is by Italian coachmaker Vignale.

**T**he 2-seat luxury convertible Ford showed at the Paris auto show (above) could one day be built as a special Thunderbird. The Vignale Gilda showcar's body rides on a standard T-Bird chassis, and has rear-drive with room for a V8 engine under the hood.

With the Gilda in production, Ford could challenge Cadillac's Allante, a car that it resembles a lot. Lower price would be a big Ford edge. Estimates are that the Gilda could be produced for about \$25,000, or half of the Cadillac flagship's sticker price. Savings come from the use of the standard T-Bird chassis and powertrain. Headlights on this car are smaller than those currently used anywhere, and contribute to the low hoodline.

### Chrysler's cruiser

This prototype of the 1988 Chrysler C-body (above right) is going through on-road and laboratory testing at Chrysler's proving grounds in Chelsea, Michigan.

The new big car will have front-wheel drive and use a new V6 engine that Chrysler will build itself. Insiders look for this formal 4-door sedan



Next big Chrysler is styled to look like best-selling Oldsmobile.

—which bears a striking resemblance to the Olds 98—to sell alongside the rear-drive Fifth Avenue for a year or so, and then replace that car completely at the top of Chrysler's lineup. Look for Dodge to get a version of the C-body, too.

of the engine at the time when it can do the most damage to the transmission. Here's how it works: At each shift point, a computer tells the electronic ignition to retard the spark slightly for a period of 2 milliseconds. This cuts the power



T-Bird for '89 features low hood and BMW-style greenhouse.

### Hesitation shift

No, it's not a new football lineup, but a nifty way to allow small, front-drive transmissions to carry the high-torque loads of powerful turbo-charged engines. Transmissions take their severest jolts during gearshifts. That's when the resistance of a higher gear ratio fights against the higher speed of a revved-up engine. More frequently of late, something breaks.

The problem is critical because front-drive transmissions that were designed for small engines of moderate power now have to handle the output of engines equipped with turbochargers. An example is the Buick turbo 3.8-liter V6, which cannot be used in GM's front-drive cars because it's too powerful.

One solution, short of building completely new transmissions, which would cost automakers hundreds of millions of dollars, is to temper the power

of the engine just enough to smooth out the shift and take extreme loads off the transmission. "You can't notice any loss of power while driving," says Tom Zimmer, GM's Hydra-Matic chief. "But the shifts are smoother and put less stress on the transmission." Look for this technique to spread to all transmissions eventually, for aesthetics—smooth shifts—as well as to ease the strain on the powertrain.

### Unclog injectors

Been using bad gas? If your fuel-injected engine stumbles, or stalls, the problem could be clogged injector tips. Deposits are made up mainly of carbon but include a half-dozen or so other elements, including metals. Fuel passages in the pintle of the injector no bigger in diameter than a human hair easily clog when you use bad gas. The cure is to change gas stations, or dump an additive in your tank. Additives like Chevron's Techron cost \$7 to \$9 a bottle, but will clear up the problem in one tankful. If you change stations to buy a gas with additives to clean up cloggings, the problem should be gone in two tankfuls.

### Electronic map

Hughes, GM's electronic arm, may have the answer to the go-anywhere electronic map that can be displayed on a TV screen in your car. Hughes claims it can put a map of the entire U.S., "including every street name and alley way," on a 4-in. wafer. If that ever gets translated into an on-board map system, you'll never get lost on a trip. Those fold up paper maps of each state—that once were free and now cost 75 cents each—could soon be memories of a past motoring age.

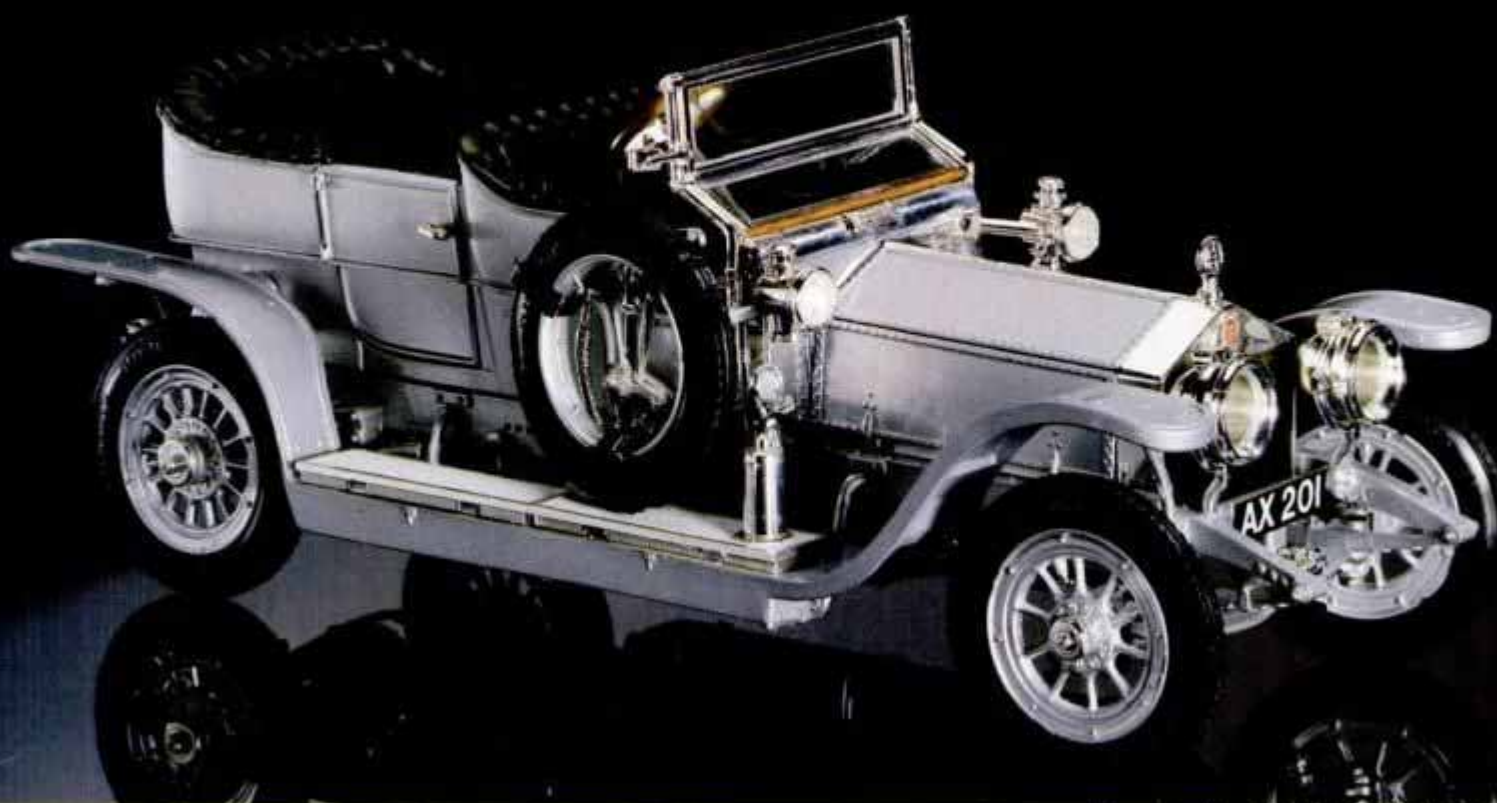
### New Bird

More surprises are in store for T-Bird watchers. Hard on the heels of a major restyling this year, Thunderbird is in store for a completely new look in the 1989 model year. The photo at left tells only part of the story. Yes, the low hoodline and small headlights are part of the package. Also new will be

(Please turn to page 34)



Rolls-Royce Motors  
demands nothing less than perfection.



Shown actual size. Length 7-3/4". Scale 1:24

## THE SILVER GHOST

*The authorized die-cast model of the most famous Rolls-Royce ever. Plated with sterling silver to match the original.*



The 1907 Rolls-Royce Silver Ghost. It advances a revolutionary concept in the fascinating and popular field of model car collecting. Perfection.

A scale re-creation with such convincing standards of detail, quality and precision that Rolls-Royce Motors has recognized it as the *authorized* die-cast model of The Silver Ghost.

And so scrupulously accurate that company officials have verified the model for authenticity.

Named for its silver-plated trim, metallic-silver paintwork and extraordinary silence, The Silver Ghost offered luxury and performance previously unknown. And the prototype for this die-cast model is based directly on first-hand studies of the original.

Steel dies taken from the prototype are used to cast the more than 127 components needed to build a single model.

The elegant *Roi des Belges* coachwork is painted with metallic-silver automotive lacquer. And the exterior trim is

plated with *sterling silver*—protectively coated—matching the original exactly.

There are soft tufted seats, doors that open and close, fully operable steering, complete instrumentation—and engine detailing that shows the *two* sparkplugs on each of six cylinders.

What price perfection? A custom model of this quality would cost hundreds or even thousands of dollars. But

The Silver Ghost is just \$120, and payable in four installments of \$30 each.

Crafted and imported exclusively by Franklin Mint Precision Models, it's available by direct application only. So be sure to order by March 31, 1987.

All trademarks identifying the ROLLS-ROYCE SILVER GHOST are registered and are used by The Franklin Mint under license. The name DUNLOP appears on the tires by permission of SP Tyres UK Limited.

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*Please mail by March 31, 1987.*

I wish to order "The Silver Ghost," precision crafted in die-cast metal, with sterling silver plated trim with protective coating. It is to be sent to me fully assembled and ready for display, together with its Certificate of Authenticity.

I need send no money now. I will be billed in four monthly installments of \$30.\* each, with the first payment due when my model is ready. *\*Plus my state sales tax*

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## INSIDE DETROIT

(Continued from page 32)

the rear side glass. It is similar to the wide-open shape of the BMW 635 CSi, though the prototypes have this feature completely masked off with a fake C pillar. Rear-drive, plus V8 and turbo 4-cylinder engines, will continue as basic designs.

### Oldsmobile cares

And they'd better. Olds' Toronados, Rivas, Eldorados and Seviles are built at the new Hamtramck plant, which under GM's own auditing system has been ranked as building the poorest quality cars

of any in the company. That hurts, especially when each of those models is the flagship of its fleet.

Olds took drastic steps to ensure that its cars, at least, improve. A special quality team inspects each Toronado as it comes off the assembly line and checks the items that dealers say are most frequently wrong. Mickey Mouse items like ashtrays, cassette tape holder and the door trim plate, along with serious problems like parking brake operation and powertrain malfunctions are among the items the Olds team is watching for.

One technique for improving quality at Hamtramck: Each goof is sent back to the

person on the line who made the error. That way the message to get it right the first time goes to the responsible person.

### No wonder

Ford is working on an on-board problem-solver that will tell you exactly what is wrong with your car. No more guessing about the reason for that knock, clunk or chuggle. Self-diagnosis is the next big electronics step for Ford, according to Chairman Don Petersen. And you won't have to plug into an analyzer at the dealer's shop to get to the bottom of a problem. The diagnosis will be spelled out on your instrument panel in plain English.

Petersen says the average 1987 auto has \$650 worth of electronics, but by 1990 that figure should rise to \$1400. Meanwhile, Ford plans an electronically controlled suspension system that rides soft when you want it, firmer when you prefer, for some of its 1988 cars.

### Cadillac leaves home

For over 65 years Cadillacs have been built at the home plant on Clark Street in an old Detroit residential/industrial neighborhood. Quality was never a big problem there and, because of Clark Street, Cadillac became a world famous symbol of luxury and the supremacy of the American way of building motorcars. But after this year, no more. The old plant will be abandoned by GM when Cadillac production is moved to areas like Poletown in Hamtramck. It's all part of an 11-plant closure over the next months.

Clark Street resisted earlier attempts to be shut down. GM had planned to close the plant a couple of years ago, but the strong buyer demand for the rear-drive Broughams made GM officials change their minds. Now rear-drive Caddies will be built in Texas by Chevrolet. As for the abandoned plant, GM's planners say it "might be suitable for a warehouse."

### First 4-wheel steer?

Honda unveiled a 4-wheel-steering system that may show up in its Prelude sporty cars later this year. The Honda system turns the rear wheels both in the same direction as the front wheels and in the opposite direction. The direction of the rear-wheel steer depends on the speed of the car.

When small changes are made in the front-wheel direction, as in highway driving, the rear wheels turn slightly in the same direction. When large changes are made in front-wheel direction, as in parking maneuvers, the rear wheels turn in the opposite direction. Honda claims that the turning diameter of its cars can be shortened by 3 ft. with the rear-steer setup, making U-turns in narrow streets possible, and helping a driver to park in a tight space. A mechanical hookup between the front steering rack and rear wheel tie rods does the trick. **PM**

## NEW Breakthrough Design Adjustable Socket Kit

U.S. AND FOREIGN  
PATENTS PENDING



### This One Tool Replaces Twenty Sockets

No more need for a whole set of individual sockets. No more fishing around in your tool kit for the right size. This new CHANNELLOCK 906 Adjustable Socket does it all. Replaces 20 individual sockets. Fits 20 bolt or nut sizes, both metric and standard. Best of all —

- IT'S SIMPLE TO OPERATE. Just turn the knurled collar and the triple action jaws lock into a can't-slip grip on the bolt or nut as shown in illustrations.
- BUILT TO LAST. PRECISION MADE of high grade forged steel. Tough enough to withstand 1,200 inch lbs. of torque.
- COMPACT, EASY TO CARRY on your boat, car, truck, tractor, motorcycle.

- DOUBLES AS A NUT DRIVER. Just connect a 3/8" spinner handle onto the adjustable head.
- SIZE RANGES - Standard: 11 sizes 5/16 through 5/8 inches  
Metric: 9 sizes 8 through 16 mm.
- LIFETIME GUARANTEE



Place CHANNELLOCK 906 over nut or bolt. Rotate knurled collar to tightest fit. Triple action jaws close and lock into a can't-slip grip.

Send for catalog information.

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# Save Gas, Save Engine with "POLY"

The following introduces one of the most fully tested and proven gas saving, friction-reducing engine treatments ever to reach the market!

## The Secret is "Poly"

"Poly" is short for polytetrafluoroethylene (TFE), the slipperiest substance known to man. (1981 Guinness Book of World Records). Petrolon Corporation, makers of Slick 50, invented a way to permanently bind this slippery chemical to your engine with one treatment. Just one quart of Slick 50 can reduce engine friction, increase gas mileage and horsepower and reduce engine operating temperature, causing your oil and engine to last longer. . . plus it reduces metal wear, defraying costly overhauls.

## Years of Testing and Use Have Proved it True!

Slick 50 has been thoroughly tested in independent laboratories and out on the road: The March/April 1982, p. 35 issue of "Consumer Digest" magazine stated, "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 or 3 miles per gallon."

One of the country's most respected research institutes reported applying a powerful ultrasonic cleaning process to a Slick 50 treated engine and were surprised at its permanence. "We actually expected the Petrolon Slick 50 TFE Resin coating to also be removed, but later found it was still there."

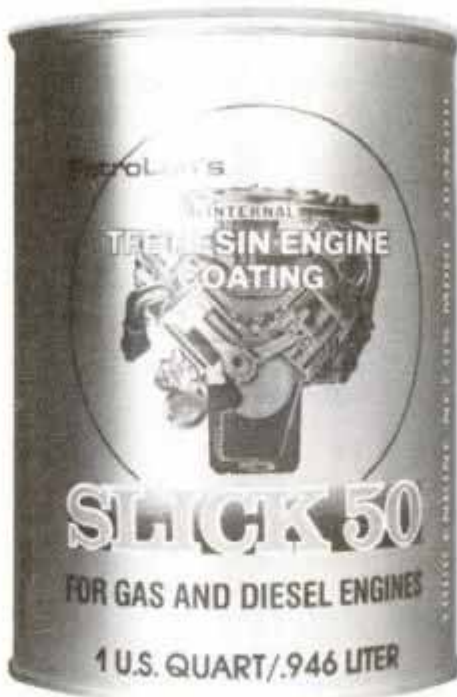
"Dune Buggies & Hot VWs" magazine April 1983 issue records the results of their one year testing of Slick 50. "We can indeed say scientifically that Slick 50 does work, and that it does reduce engine wear! . . . for the price of one treatment when compared to engine rebuild, we feel that you'd be money ahead using Slick 50."

The Federal Aviation Administration has fully accepted a similar product for aircraft—Slick 50 Aircraft Piston Engine Treatment (F.A.R. #33.49). This FAA endurance test simulated 1400 hours of engine use.

The power technology laboratory at a leading southwestern university stated, "Slick 50 does increase horsepower and decreases fuel consumption in tests done at the university."

The Space Shuttle Columbia uses the chemical "poly" in its gears and bearings because it is the only chemical lubricant which can withstand the heat and corrosive elements of space.

Perhaps most dramatic of all is a torture test overseen by the Automotive Services Council for Pennsylvania and shown on WTVE television. Three cars with 75,000 to 129,000 miles on them were treated with Slick 50. Six months later the oil was drained from each vehicle, and the cars driven without the oil plugs for about a half hour. The water temperature never rose and the engines sustained no apparent damage.



There isn't room here to tell you about the dozens of other tests proving that Slick 50 is everything we say. However, if you're still skeptical, send \$2.00 to cover printing and postage costs, and we'll send you detailed test results plus actual letters from users who report how Slick 50 saved their engines and saved them money!

## It's Easy to Treat Your Engine

A few minutes before oil and filter change, add the engine flush you get free with each order to clean out the engine. Let the engine idle for 5 minutes. Then drain the oil, change the filter and add the proper amount of oil, less one quart. Add one quart of Slick 50, drive for 30 minutes, and leave it in the crankcase for at least 3,000 miles. As the engine operates, the oil carries the "poly" between the parts where it is burnished into the pores of the metal.

## Only One Treatment Necessary

It's permanent, so you do it only once, not each time you change oil. One quart of Slick 50 will treat all standard 4, 6 and 8-cylinder gasoline and diesel engines.

## Works with Most Oils

Slick 50 will work with all petroleum-based oils and all synthetics compatible with petroleum-based oils with the exception of graphite oils. However, once an engine is treated, you can go back to a graphite type if desired.

## 4 Ways Slick 50 Saves You Money

Your actual percentages may vary depending on your driving, vehicle condition, weather and geographic location, but no matter what your conditions, Slick 50 can:

1. Increase mileage
2. Increase horsepower (small economy cars and large RV's really need this)

3. Reduce operating temperatures, thus increasing the lubrication and life of the oil and engine
  4. Minimize or eliminate costly overhauls by reducing engine wear
- Up to 90% of the engine wear on a car can be caused by lubrication starvation cars experience when first started before the oil begins to circulate. Slick 50 can eliminate this problem for less than the cost of two tanks of gas.

## Slick 50 Will Not Affect Your Warranty

Slick 50 is suspended in an excellent grade of petroleum oil which meets or exceeds every manufacturer's engine warranty requirements. In addition, this oil carries an American Petroleum Institute service classification SF-CC-CD.

## There's No Risk with Our Money Back Guarantee

Use Slick 50 for 3000 miles. If you don't notice an improvement in engine performance, return your invoice with a short note telling why, for a prompt full refund — no questions asked.

## Profit from Selling Slick 50 Yourself

Here's an opportunity to make handsome profits. Having such solid test results from major institutions make Slick 50 easier to sell than many other products. Free dealership information is sent upon request.

For purchase or further information call toll-free 1-800-525-8624, ext. 2 (in California 1-800-233-9559) or send to: Progressive Energy Corporation, 255 South Bent Avenue, #B-1, Dept. PM027, San Marcos, California 92069.

Yes, I want to improve my car's performance and save my engine — rush me risk free

- One Slick 50 at \$39.95 + \$4.00 shipping and handling. Calif. Residents add 6% Sales Tax.
- Give me free shipping and handling for my order of 2 or more at \$39.95 each.
- Check    C.O.D.    Visa/MasterCard

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# Tool Tests



## Screwdriver With A Twist

**S**kil has introduced the first cordless, battery-powered screwdriver that resembles a conventional screwdriver—not an electric drill. The Skil Twist is designed for easy, 1-hand operation to drive and remove screws and nuts. The tool

accepts any 1/4-in.-dia. hex-shaped bit.

The high-torque, low-speed motor delivers 130 rpm to provide excellent control that reduces cam-out and stripped screwheads. Forward and reverse rotation is controlled by a rocker

switch. The Twist also features a collet lock that allows you to use the tool as a manual screwdriver to loosen stubborn screws.

The Twist also features a collet lock that allows you to use the tool as a manual screwdriver to loosen stubborn screws.

The Twist comes with a 120-volt charging stand that can be bench- or wall-mounted and a double-ended bit for

Phillips and slotted screws. The nickel-cadmium batteries can be recharged up to 1000 times. The Twist sells for about \$25 at home centers and hardware stores. Contact Skil, 4801 West Peterson Ave., Chicago, IL 60646.—Rosario Capotosto



Rocker switch is reached easily by your thumb. Arrows on the switch indicate tool's forward and reverse rotation.



Engage the collet lock by pushing in the steel bar, as shown. Don't use the rocker switch while collet lock is engaged.



With the collet locked, use the Twist as a manual screwdriver to loosen a stubborn screw. Note hand position above switch.



Once screw has loosened slightly, disengage the collet lock and press down the rocker switch to remove the screw.

## Drip-free, semisolid paint

I recently tried a new interior latex paint from Sears that is quite different than any paint that I've seen before. Called Ready-To-Roll, it's a semi-solid paint that has the consistency of thick pudding.

The paint requires no mixing, pouring or thinning, and it's virtually splatter-free.

Ready-To-Roll comes in a resealable plastic tray that contains 1/2 gallon of flat paint. Total coverage per tray is about 265 sq. ft. It can be applied with a roller or brush. To load a roller, simply roll across the paint with light downward pressure. Draw a



Ready-To-Roll paint comes in a resealable plastic tray. Each tray holds 1/2 gallon of paint.

brush across the paint's surface—don't dip the brush. I discovered that the paint rolls on very smoothly and evenly while providing 1-coat coverage. It's sold at larger Sears

stores for \$15.49 per tray in seven colors.

For more information, contact Sears, Sears Tower, Dept. 703-PM, Chicago, IL 60684.—Rosario Capotosto



The tray is designed to accommodate a 9-in. roller. Use a high-quality, short-nap paint roller.



Semisolid paint goes on evenly and smoothly with 1-coat coverage. It's virtually splatter-free.



# The Royal Road To Riches

Dear Friend,

My name is John Wright. Not too long ago I was flat broke. I was \$31,000 in debt. The bank repossessed my car because I couldn't keep up with the payments. And one day the landlord gave me an eviction notice because I hadn't paid the rent for three months. So we had to move out. My family and I stayed at my cousin's place for the rest of that month before I could manage to get another apartment. That was very embarrassing.

Things have changed now. I own four homes in Southern California. The one I'm living in now in Beverly Hills is worth more than one million dollars. I own several cars, among them a brand new Mercedes and a brand new Cadillac. Right now, I have a \$1 million dollar line of credit with the banks and have certificates of deposit at \$100,000 each in my bank in Beverly Hills.

Best of all, I have time to have fun. To be me. To do what I want. I work about 4 hours a day, the rest of the day, I do things that please me. Some days I go swimming and sailing — shopping. Other days, I play racquetball or tennis. Sometimes, frankly, I just lie out under the sun with a good book. I love to take long vacations. I just got back from a two week vacation from — Maui, Hawaii.

I'm not really trying to impress you with my wealth. All I'm trying to do here is to prove to you that if it wasn't because of that money secret I was lucky enough to find that day, I still would have been poor or may be even bankrupt. It was only through this amazing money secret that I could pull myself out of debt and become wealthy. Who knows what would have happened to my family and me.

Knowing about this secret changed my life completely. It brought me wealth, happiness, and most important of all — peace of mind. This secret will change your life, too! It will give you everything you need and will solve all your money problems. Of course you don't have to take my word for it. You can try it for yourself. To see that you try this secret, I'm willing to give you \$20.00 in cash. (I'm giving my address at the bottom of this page.) I figure, if I spend \$20.00, I get your attention. And you will prove it to yourself this amazing money secret will work for you, too!

Why, you may ask, am I willing to share this secret with you? To make money? Hardly. First, I already have all the money and possessions I'll ever need. Second, my secret does not involve any sort of competition whatsoever. Third, nothing is more satisfying to me than sharing my secret only with those who realize a golden opportunity and get on it quickly.

This secret is incredibly simple. Anyone can use it. You can get started with practically no money at all and the risk is almost zero. You don't need special training or even a high school education. It doesn't matter how young or old you are and it will work for you at home or even while you are on vacation.

Let me tell you more about this fascinating money making secret.

With this secret the money can roll in fast. In some cases you may be able to cash in literally overnight. If you can follow simple instructions you can get started in a single afternoon and it is possible to have spendable money in your hands the very next morning. In fact, this just might be the fastest legal way to make money that has ever been invented!

This is a very safe way to get extra cash. It is practically risk free. It is not a dangerous gamble. Everything you do has already been tested and you can get started for less money than most people spend for a night on the town.

One of the nicest things about this whole idea is that you can do it at home in your spare time. You don't need equipment or an office. It doesn't matter where you live either. You can use this secret to make money if you live in a big city or on a farm or anywhere in between. A husband and wife team from New York used my secret, worked at home in their spare time, and made \$45,000 in one year.

This secret is simple. It would be hard to make a mistake if you tried. You don't need a college degree or even a high school education. All you need is a little common sense and the ability to follow simple, easy, step-by-step instructions. I personally know a man from New England who used this secret and made \$2 million in just 3 years.

You can use this secret to make money no matter how old or how young you may be. There is no physical labor involved and everything is so easy it can be done whether you're a teenager or 90 years old. I know one woman who is over 65 and is making all the money she needs with this secret.

## Here's what newspapers and magazines are saying about this incredible secret:

### The Washington Times:

*The Royal Road to Riches* is paved with golden tips.

### Los Angeles Herald Examiner:

We've all got to start somewhere... *The Royal Road to Riches* is the first step in the right direction!

### National Examiner:

John Wright has an excellent guide for achieving wealth in your spare time.

### Income Opportunities:

*The Royal Road to Riches* is an invaluable guide for finding success in your own back yard.

### News Tribune:

Wright's material is a MUST for anyone who contemplates making it as an independent entrepreneur.

### Success!

John Wright believes in success, pure and simple.

### Money Making Opportunities:

John Wright has a rare gift for helping people with no experience make lots of money. He's made many people wealthy.

### Hollywood Trade Press:

We have never heard of an advertiser offering to pay readers \$20 to try its program. Wright's willingness to do this convinces us that his money secret must really work.

### California Political Week:

... The politics of high finance made easy.

### Hollywood Citizen News:

He does more than give general ideas. He gives people a detailed A to Z plan to make big money.

### The Desert Sun:

Wright's *Royal Road to Riches* lives up to its title in offering an uncomplicated path to financial success.

When you use this secret to make money you never have to try to convince anybody of anything. This has nothing to do with door-to-door selling, telephone solicitation, real estate or anything else that involves personal contact.

Everything about this idea is perfectly legal and honest. You will be proud of what you are doing and you will be providing a very valuable service.

It will only take you two hours to learn how to use this secret. After that everything is almost automatic. After you get started you can probably do everything that is necessary in three hours per week.

## PROOF

I know you are skeptical. That simply shows your good business sense. Well, here is proof from people who have put this amazing secret into use and have gotten all the money they ever desired. Their initials have been used in order to protect their privacy, but I have full information and the actual proof of their success in my files.

### 'More Money Than I Ever Dreamed'

"All I can say — your plan is great! In just 8 weeks, I took in over \$100,000. More money than I ever dreamed of making. At this rate, I honestly believe, I can make over a million dollars per year."

A. F., Providence, R.I.

### '\$9,800 In 24 Hours!'

"I didn't believe it when you said the secret could produce money the next morning. Boy, was I wrong, and you were right! I purchased your *Royal Road to Riches*. On the basis of your advice, \$9,800 poured in, in less than 24 hours! John, your secret is incredible!"

J. K., Laguna Hills, CA

### 'Made \$15,000 In 2 Months At 22'

"I was able to earn over \$15,000 with your plan — in just the past two months. As a 22 year old girl, I never thought that I'd ever be able to make as much money, as fast as I've been able to do. I really do wish to thank you, with all of my heart."

Ms. E. L., Los Angeles, CA

### 'Made \$126,000 In 3 Months'

"For years, I passed up all the plans that promised to make me rich. Probably I am lucky I did — but I am even more lucky that I took the time to send for your

material. It changed my whole life. Thanks to you, I made \$126,000 in 3 months."

S. W., Plainfield, IN

### 'Made \$203,000 In 8 Months'

"I never believed those success stories... never believed I would be one of them... using your techniques, in just 8 months, I made over \$203,000... made over \$20,000 more in the last 22 days! Not just well prepared, but simple, easy, fast... John, thank you for your *Royal Road to Riches!*"

C. M., Los Angeles, CA

### '\$500,000 In Six Months'

"I'm amazed at my success! By using your secret I made \$500,000 in six months. That's more than twenty times what I've made in any single year before! I've never made so much money in such short time with minimum effort. My whole life I was waiting for this amazing miracle! Thank you, John Wright."

R. S., Mclean, VI

As you can tell by now I have come across something pretty good. I believe I have discovered the sweetest little money-making secret you could ever imagine. Remember — I guarantee it.

Most of the time, it takes big money to make money. This is an exception. With this secret you can start in your spare time with almost nothing. But of course, you don't have to start small or stay small. You can go as fast and as far as you wish. The size of your profits is totally up to you. I can't guarantee how much you will make with this secret but I can tell you this — so far this amazing money producing secret makes the profits from most other ideas look like peanuts!

Now at last, I've completely explained this remarkable secret in a special money making plan. I call it "The Royal Road to Riches". Some call it a miracle. You'll probably call it "The Secret of Riches". You will learn everything you need to know step-by-step. So you too can put this amazing money making secret to work for you and make all the money you need.

To prove this secret will solve all your money problems, don't send me any money, *instead postdate your check for a month and a half from today*. I guarantee not to deposit it for 45 days. I won't cash your check for 45 days before I know for sure that you are completely satisfied with my material.

## \$20.00 FREE!

There is no way you can lose. You either solve all your money problems with this secret (in just 30 days) or you get your money back *plus \$20.00 in cash FREE!*

Do you realize what this means? You can put my simple secret into use. Be able to solve all your money problems. And if for any reason whatsoever you are not 100% satisfied after using the secret for 30 days, you may return my material. And then I will not only return your original UNCASHED CHECK, but I will also send you an *extra \$20.00 cashiers check* just for giving the secret an honest try according to the simple instructions.

**I GUARANTEE IT! With my unconditional guarantee, there is absolutely NO RISK ON YOUR PART.**

To order, simply write your name and address on a piece of paper. Enclose your postdated check or money order for \$12.95 and send it to:

**JOHN WRIGHT**  
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Suite 3065  
Santa Monica, CA 90405

Since the material I'll be sending you is heavy, please add \$1 to cover portion of shipping costs.

But the supply of my material is limited. So send in your order now while the supply lasts.

If you wish to charge it to your Visa or MasterCard — be sure to include your account number and expiration date. That's all there is to it. I'll send you my material right away by return mail, along with our unconditional guarantee.

## SWORN STATEMENT:

"As Mr. John Wright's accountant, I certify that his assets exceed one million dollars."

Mark Davis

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# Appliance Clinic



BY STEVE TOTH

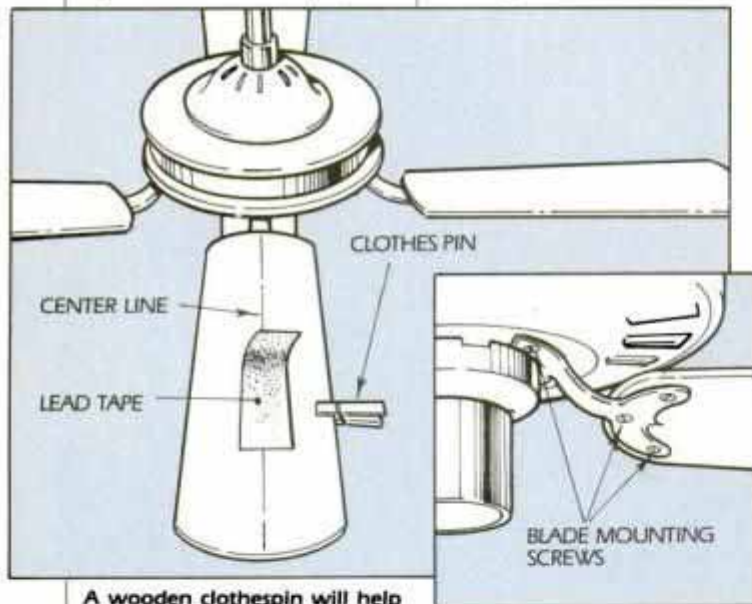
## Oscillating Fan

**A**fter installing one of the ever-popular ceiling fans, we have discovered it oscillates about its vertical axis on medium and high speeds. We have measured the blade tip to ceiling distance and found it to be equal for all four blades and have checked the pitch of each blade and found all blades equal. Is there a simple, old-

*each blade holder to be sure it's not bent. If one is bent, gently try to bend it back, or replace it.*

*Now turn the fan on to medium or high speed and check for wobble.*

*If your adjustments have not helped, turn off the fan. Take a spring-type wooden clothespin and attach it to*



**A wooden clothespin will help you locate the wobble in a ceiling fan. Once found, rebalance the fan with lead tape.**

time method of achieving the proper balance to stop the oscillation? **STAN HELFRICH**  
LAS CRUCES, NM

*There are several things that you can do to keep your fan running smoothly. First, make sure that all blades are firmly screwed to the blade holders, and the holders firmly screwed to the motor's flywheel. Next, look up at the fan from below. Check*

*one of the blades. Position it halfway between the blade holder and the blade tip on the rear edge of the blade. Turn on the fan and watch to see if the wobble improved or worsened. Now turn it off and move the clothespin to another blade and test again.*

*Perform this test to all the blades and note on which blades the wobble was reduced.*

*Now, move the clothespin to the outside or inside tip of the blade. Turn the fan on to*

*high or medium speed and see which adjustments result in the smoothest operation.*

*Remove the clothespin and install plumber's lead tape on the top of the blade along the center line near the point where the clothespin was attached. Test the fan for smooth operation. If you still have a little wobble, add more tape until the wobble stops.*

## Hot freezer

Several weeks ago we bought an Admiral Ultra-freeze no-frost freezer, model No. FNF17E8, serial No. HL 55510. We noticed that it runs almost continuously and is quite hot on the top and sides toward the front. The yellow energy sticker states that a year's energy consumption works out to 4 KWH/day. I borrowed an electrical measuring device from the local utility company and it shows consumption of 10 KWH/day. The freezer is in a cool basement and is opened about once a day. Is this normal?

**RICHARD BRUBAKER**  
DAYTON, OH

*I checked with the people at Admiral Corp. They've found that when the freezer is empty or doesn't have much food in it, air temperatures in it will fluctuate considerably. This lack of mass will cause the freezer to run more. Once the freezer is loaded with food, run time drops considerably.*

*As far as the heat on the top and front is concerned, your freezer has a hot-wall condenser tube, which runs to the front of the cabinet. This is designed to prevent sweating during humid weather.*

*The fact that your freezer is running longer than normal will make this tube hotter. Hence, the front of the cabinet is hotter. As soon as the freezer is loaded sufficiently, and it starts running normally, the top and sides will be warm but not hot to the touch. If you don't have enough food to fill the freezer, try using water-filled plastic milk jugs.*

## Stuck disposer

Our garbage disposal, an ISE Model 77-23, serial No. 7103041, can't drain the dishwasher discharge fast enough, so there's a momentary backup into the sink.

The disposal works fine when used alone, with no backup. The plumbing downstream has been checked and the sink trap replaced. The drain lines are clear. Is it possible to have a partial blockage in the disposal? If so, how do you clean it out?

**LEONARD J. STOHLDRIER**  
SUNSET HILLS, MO

*Sounds as if you have some sort of blockage in the drain system. The blockage may not be enough to cause a backup into the sink under normal use, but it will when you add the extra 4 to 5 gallons of water discharged from the dishwasher.*

*The garbage disposer is designed so that if you pour a gallon of water into it, a gallon of water will exit it. The disposer has no way of holding any water.*

*To check this, disconnect the power to the disposer. Next, disconnect the trap.*

*Look into the disposer's discharge port to make sure it's all clear.*

*Then, with a bucket under the garbage disposer, pour some water through it to make sure it flows freely. Reconnect the drain trap and the electrical power.*

*If the garbage disposer appears to be clear, then have a plumber or sewer-cleaning company auger out your drain system.*

*Be sure they use a motor-driven auger-type clean head tool and not a hand snake. The type of tool they use does make a difference. A snake will puncture a hole in the obstruction but it will not actually clean the insides of the pipe as well as an auger would.*

**PM**

*If you have a problem with any appliance, send your question, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*



# In a world of computers, robotics and electronics, Buick is still very good at golf clubs, suitcases and grown-up bodies.

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B U I C K



# Old House Restoration



BY BOB VILA

## Keeping Dry

**M**oisture damage due to high indoor humidity has emerged as a particularly troublesome problem for many homeowners. Years ago, when houses were built with relatively loose-fitting components and little, if any, insulation, there was rarely a problem with condensation developing in walls, crawl spaces and attics. But since the advent of the energy crisis and the development of energy-efficient construction, all that's changed.

The trouble started when builders began constructing "tighter," more energy-efficient homes—those featuring added insulation, weatherstripping and airtight

windows. While these features are beneficial in themselves, they can lead to problems if they're installed incorrectly or without regard to the damaging effects of trapped moisture.

Excessive amounts of warm, moist air trapped in some homes can cause considerable damage: Wall corners and closets collect mildew, while walls, floors and ceilings are stained and begin to decay. In time, much of the house may take on a damp or musty odor.

Let's take a close look at this whole situation and see how to prevent it from occurring or correct it.

Moisture comes from

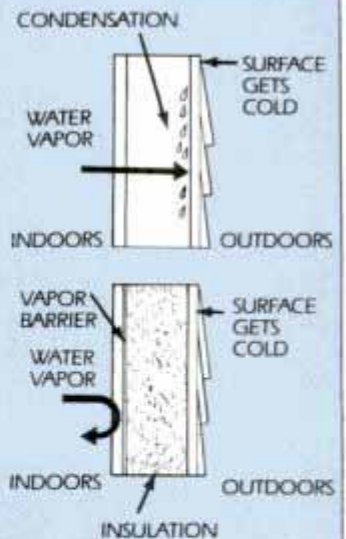
many sources inside the home: cooking, washing, bathing, watering house plants, laundering and the respiration and perspiration of the occupants. When this warm, moist air comes in contact with cool air or a cool surface, it condenses and forms beads or a film of moisture. This condensation has a tendency to show up on a cool window, ceiling, wall or water pipe—a condition known as sweating.

Water also enters from the outside, through pores or cracks in the foundation, a condition known as seepage. Before you can remove dampness from your home, first find its source—inside, outside or both.

To test for seepage, tape a piece of aluminum foil securely to the foundation wall where a damp spot frequently appears. Make sure that all edges are air tight. Leave it in place for a day or two, then remove it. If the foil's face against the wall is damp, the problem is seepage; if the other face is damp, the problem is condensation.

## Coping with moisture

During cold weather, warm, moist air tends to work its way into the colder wall spaces and, eventually, up

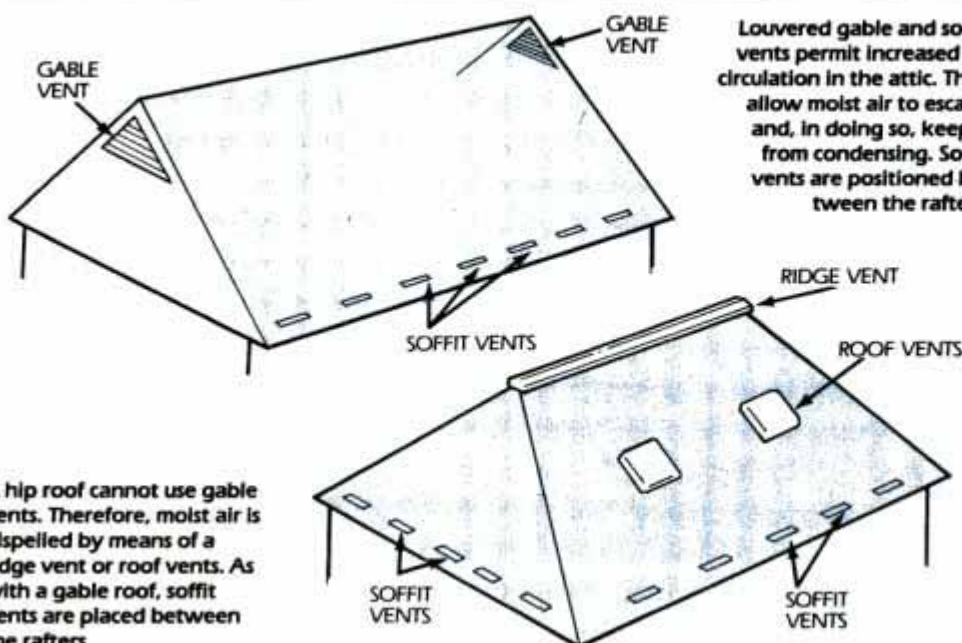


**Top view: Moisture enters and condenses in a wall without a vapor barrier. Bottom view shows a wall with a barrier.**

into the attic. There, it condenses on the colder inner faces of the wall or roof sheathing, ruining insulation, rotting wood framing and rusting nails. In hot humid weather, moisture may simply collect inside the home. This damage can be prevented, however. The keys are: ventilation to remove excess moisture from areas where it will do damage; and, insulation and vapor barriers to keep warm, moist inside air separated from colder (and sometimes drier) outside air. When properly combined, these will make a house warmer in winter, cooler in summer and better ventilated the year round.

A vapor barrier is a non-permeable film (as a paint or coating), foil, plastic sheet or treated paper. Often, it's used on the face of insulation. It forms a barrier to prevent moisture from passing through walls, ceilings or floors. A vapor barrier always faces the warm side of the structure. Though in an attic, insulation without a vapor barrier is installed over existing insulation that already has a vapor barrier.

(Please turn to page 44)



**Louvered gable and soffit vents permit increased air circulation in the attic. They allow moist air to escape and, in doing so, keep it from condensing. Soffit vents are positioned between the rafters.**

**A hip roof cannot use gable vents. Therefore, moist air is dispelled by means of a ridge vent or roof vents. As with a gable roof, soffit vents are placed between the rafters.**

*Contributing Editor Bob Vila is host of public television's "This Old House," funded by Owens-Corning Fiberglas.*



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## OLD HOUSE RESTORATION

(Continued from page 40)

In the case of a crawl space, a polyethylene sheet is placed over the dirt floor and often concrete is poured over that. Combined with venting, this prevents moisture from rising into the structure above it.

No vapor barrier stops moisture completely. Some moisture always seeps through, especially if there are holes or other gaps in it. Therefore, ventilation is needed to rid the attic of moisture rising from the living space.

Attic vents provide openings to allow moisture to escape outdoors before condensing. As a rule of thumb, provide 1 sq. ft. of unobstructed vent opening for each 150 sq. ft. of attic floor space. A key word here regarding the vent opening is "unobstructed." Louvers or screens decrease the area of the vent opening by as much as 50 percent, so allow for this when buying a vent.

If the attic has a vapor barrier, 1 sq. ft. of opening per 300 sq. ft. of attic floor space should be sufficient. The vents should be placed so they provide efficient cross ventilation.

Roof vents, placed on the back of the house so they are not visible from the street, and ridge vents are other options to consider. These are especially useful if you have or want a finished attic which would close off the standard gable vents.

If the vents alone are not enough, install exhaust fans to speed the job along. These fans may be installed on the roof or gable end, above a vent or in place of one. Use one that operates on an energy-saving manual switch, a time-delay switch or a humidistat switch.

Other places to consider installing exhaust fans that vent to the outside of the house are in the bathroom, laundry room and kitchen.

Moisture can be removed from the air by a dehumidifier; there are various types available, but look for one that collects a minimum of a gallon of water from the air in 24 hours.

You may also significantly reduce condensation by covering cold-water pipes with appropriate insulation.

## Waterproofing

In a properly built home, the outer face of the foundation walls should have been waterproofed by the builder. But, too often, this was either poorly done or, in some cases, not done at all. Even if the foundation was waterproofed, the coating may have grown brittle and cracked. As a result, considerable seepage often enters through seams, cracks or porous sections of the wall, especially after a heavy rainfall.

Special hydraulic patching cements are available to repair these leaks. When these substances enter concrete's

pores, they expand and harden to form a firm, waterproof plug. This characteristic, combined with the fact that it hardens in minutes, makes it possible to patch leaks even while water is still flowing through the opening.

For added insurance against seepage, paint or cover the foundation wall with a masonry waterproof coating once all visible cracks are sealed. Both Thoro System Products, Inc., 7800 N.W. 38th St., Miami, FL 33166, and Quikrete Companies, 1790 Century Circle, N.E. Atlanta, GA 30345, offer a variety of waterproofing materials and coatings. Another option is Tuff-N-Dri/Warm-N-Dri by Owens-Corning Fiberglas Corp., Fiberglas Tower, Toledo, OH 43659. It combines a water-shedding elastic polymeric coating with a protective, rigid fiberglass insulation board. These products are sold at building supply dealers and home centers.

If seepage through the foundation wall persists, your basement may be suffering from a high level of groundwater and considerable hydrostatic pressure. This is the pressure a liquid exerts perpendicular to a surface; in this case, the foundation wall or basement floor. It can drive a considerable amount of water through cracks in the foundation.

There are two ways to correct this problem. One is to install a sump pump at the lowest part of the basement. This pump discharges accumulated water to a safe disposal area outside the house. The other option is to dig a trench around the foundation and lay a perforated drain pipe into the trench surrounded by gravel. Known as a curtain drain, this will safely channel ground water away from the foundation.

The foundation may also require a similar arrangement, known as drain tiles, to be installed at the juncture of footings and the foundation wall. And even if you have a curtain drain and drain tiles, they may have silted in or become plugged by tree roots. Your only remedy here is to dig up the drain and make the needed repairs.

And while you're working to waterproof your home, don't forget the basics. First, make sure that roof drainage is channeled away from the foundation. Downspouts can direct runoff to a pipe below ground that takes the water to a dry well or gravel-filled trench (if allowed by local building codes). If this is impractical, a large splash pad installed at the base of each downspout can divert water away from the foundation.

Second, to eliminate or reduce surface runoff that can find its way into your basement, grade the lot so it slopes away from the house. If your house is on a sloping site, you may want to dig a trench on the high ground above the house to catch surface runoff and divert it before it reaches the foundation. **PM**

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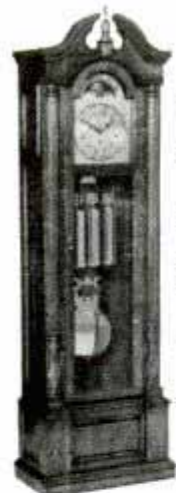
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# Under New Tax Law, Forming Your Own "S" Corporation Gives You America's Ultimate Tax Shelter

"About 50,000 people are incorporating themselves each month and getting tax benefits others only dream about... and it's remarkably easy to do." by Ted Nicholas

Here's how to best cope with the chaos felt by many executives and small business owners over tax reform.

In fact, with the stroke of a pen and a little ingenuity you can really profit. You can now enjoy the lowest individual tax rates in over 30 years. And at the same time, you can gain all the advantages of incorporating yourself without paying any corporate income taxes whatsoever! **Enjoy the best of both worlds.**

You will be in control of the most powerful tax shelter in America, your own corporation. Virtually all other tax shelters have been eliminated by the recent tax reform.

Imagine owning two family cars *tax free*. Imagine turning your hobby into a *tax free* business expense. And would you enjoy first class business trips... boat or plane... or meals at fine restaurants which are 80% tax free?

These are just some of the remarkable tax advantages and fringe benefits which can be yours. Congress has filled the tax laws with provisions which richly reward those who form small corporations. Over 50,000 people start corporations each month. 98% are small businesses, often one man operations.

It's incredibly easy to do. There are just two simple one page forms. One incorporates you and the other gives you "S" Corporation status. I'll show you how to complete and mail them to the proper agency.

My name is Ted Nicholas. Fourteen years ago after launching 18 corporations myself, I wrote a book called "How to Form Your Own Corporation Without a Lawyer for Under \$50." It's become one of the best selling business books of all time, helping more than 825,000 to incorporate easily at minimum expense.

Now I've completely revised and updated the book to show the latest tax advantages and demonstrate how easily you can form your own corporation and partake in the enormous tax benefits.

All you need is right in this handsome oversized, 8½ x 11" book along with a bonus I'll send you *absolutely free*.

My book contains tear out forms. Just fill them in according to my simple step by step instructions and send them in. Right off, you'll save from \$300 to \$2,000 in legal fees, and in a few days, you'll have your own legally recognized corporation. And you can begin to take advantage of a host of benefits like these...

**Avoid Corporation Tax Completely.** By forming an "S" corporation at the corporate level you pay no Federal Income Tax whatsoever. You completely skip a level of taxation. And avoid double taxation. Also avoid State Tax. (In most states "S" corporations are recognized tax-wise.) The only tax you pay is at a personal level. The new top individual tax rate is only 28% except for a 33% limit

on some incomes. This is still lower than the corporate rate.

Corporate Pension and Profit-Sharing Plans offer tax free compounding. Unlike IRA or Keogh plans, you can borrow your funds whenever you want.

**Tax-Free Medical and Dental Plan.** By filing another, one-page form included in the book, as long as your employees are included and certain guidelines are followed, you can legally write off 100% of your family's medical, dental and pharmaceutical expenses, even vitamins and psychiatrist's visits.

**Tax-Favored Dividends.** Your corporation can own shares in other corporations and receive dividends that are 80% tax-free.

**Limited Liability.** In a partnership or proprietorship, your personal liability is unlimited—quite dangerous in an age when people routinely sue for astronomical sums. You're also personally liable for the blunders of a partner. With a corporation, your risk is strictly limited to whatever you leave in the corporation. That can be zero. Your home, furniture, pension plan, car, and savings are never at risk. And there are many other advantages my book can make possible for you, including tax-free financial and legal counsel... tax-free athletic and health club memberships... tax-free day care... no-interest loans... tax-free tuition reimbursement for you or your children... tax-free theater and sports tickets... write-offs for an office in your home... easier transfer of your company's ownership when you sell... estate planning advantages and much more.

My book also reviews the pros and cons of different types of corporations, including Subchapter S, non-profit and professional... How to operate a corporation anonymously... How to turn an existing business into a corporation.

You'll also see how to sell stock in your corporation so that it's tax deductible to investors in case of loss. This makes your stock much more attractive to potential backers.

Plus, you'll get a complete set of tear-out forms, including a Certificate of Incorporation, Minutes, By-Laws... everything you need.

If you've dreamed of having your own business, but don't know where to start... if you have an idea for a sideline, mail order or weekend venture... if you're a professional, consultant, free-lancer, partner or small business proprietor... if you want to start several companies without getting soaked with legal fees... or if you're simply fed up with oppressive taxes even with new lower rates and want a safe, legal way to slash them this is the book you have been waiting for.

## Free Bonus

As a bonus for ordering now, I'll send you, absolutely free, a copy of an exclusive report called "How an 'S' Corporation Can Save You Tax" (normally \$14.95). It shows you how to completely avoid corporate tax.

This report written by Joseph R. Oliver, CPA, describes how to avoid double taxation... keep dividend interest and rental income free of tax... avoid accumulated earnings tax... and get the benefit of full personal tax deductions for any losses you might incur.

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C-1212



# Home Video



BY JAMES B. MEIGS

## Hands-On: Multivision



Multivision 3.1 brings digital special effects to any TV. It also provides remote control and stereo sound to older models.

**W**e've been hearing about the Multivision digital television adapter for almost a year now. The idea sounds great: An add-on adapter that can give any TV set such digital features as being able to show two pictures on the screen at once, plus remote control and stereo TV reception all in one uncomplicated package.

Well, the Multivision 3.1 has finally arrived and, after using it for a few days, I'm pleased to report that it performs as advertised. The gadget isn't cheap, but for a list price of \$500, you can convert any \$200 color set—new or old—into a full-featured digital monitor that would cost \$1200 or more.

The first thing I noticed when I unpacked the unit was its sleek, sophisticated design. When I turned to the owner's manual, I saw something else. The Multivision was conceived, designed and manufactured in the U.S., so the instructions are clear and logical. No translation problems here.

Hooking up the system is very straightforward. A single RF connection mates Multivision to the TV set. Its back panel has inputs to plug in up to two VCRs, plus TV antenna and cable TV.

As soon as it's hooked up, the Multivision gives you complete remote control over selecting channels and switching between VCRs. Add a pair of speakers (it has a small built-in amplifier) and it provides MTS (Multichannel Television Sound) TV stereo. You can also connect it to your existing audio system and speakers. It even lets you control the volume from your chair.

But Multivision's most exciting feature is its digital capability. Unlike virtually every other digital video product so far, the Multivision includes two built-in TV tuners. This means you can easily tune in one channel on the main picture, and watch a second channel in the small picture-in-picture (PIP) window on the screen. You can swap the two images at the touch of a re-

mote button, and you can freeze the action in the PIP. Although several of today's video products allow you to position the PIP in whichever corner of the screen you prefer, Multivision goes one step further: It lets you move the PIP anywhere on the screen, and gives you several choices for its size as well.

Who needs to watch two pictures at once? Sooner or later, almost everyone. Sports fans frequently switch back and forth between two games; Multivision lets them keep an eye on both at once. Kids might want to keep the PIP tuned to MTV while they watch another channel so they can swap pictures whenever their favorite videos appear. And anyone who changes channels during commercials might like to keep an eye on the original channel so they can switch back when the commercial ends.

It's good to see solid American engineering come back to the video field. Multivision is a Silicon Valley company made up of entrepreneurs who bring their computer expertise to the world of video accessories. Judging by their first product, they're off to a great start.

### Hot box

It looks like California's Silicon Valley has become fertile soil for innovative ideas in video. Hot on the heels of Multivision, another pioneering company has introduced a video accessory breakthrough. The new company, called Videonics, is also staffed with computer-whiz engineers hoping

to apply their knowledge of computers to the needs of video fans.

Videonics's first product is so novel in concept, it almost defies description: At its heart, it is a computerized VCR playback controller. It will let you identify dozens of segments on a videotape and then play them back in the order you like simply by touching a button on the handheld remote.

The company offers two versions of the product. One, called CollectEd, functions like a video jukebox, allowing you to keep track of almost countless segments (such as music video clips or scenes in home movies) or dozens of tapes. Punch in the codes for the pieces you want, and CollectEd will automatically find and play them.

The other version, dubbed DirectEd, lets you use the system's control capabilities for home editing. With one playback deck (such as a video camcorder) and one record deck, it will let you log the scenes you want in the finished production. Once DirectEd is programmed, you simply turn on both decks and it puts together the finished program.

The capabilities announced so far are just the beginning for the system. Videonics says it will introduce a series of add-on modules for the system in the future.

Future modules might give owners a low-cost way to obtain stereo television, offer even greater control over home editing, or provide a variety of audio features. **PM**



Computer-aided video: Videonics processor makes editing easy.





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3  HARD ROCK ZZ Top, Van Halen, Bryan Adams, Dire Straits

4  POP/SOFT ROCK Madonna, Lionel Richie, Phil Collins, Prince

5  CLASSICAL James Galway, Itzhak Perlman, Neville Marriner

4 RUSH ME THESE 6 SELECTIONS (indicate by number)

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# Car Clinic



BY MORT SCHULTZ

## Chemical Quirk

**M**y 1984 Audi 5000 owner's manual says that when this car's cooling system is drained, it should be refilled only with phosphate-free antifreeze. I've never heard of this product. Why does Audi recommend it? Are Prestone, Zerex, Peak and Alugard phosphate-free?

RICHARD OLSEN  
RAMSEY, NJ

Many European car manufacturers require under their warranties the use of phosphate-free antifreeze when filling cooling systems because of aluminum parts in the engine. The way I hear it, it has to do with European water which contains a higher concentration of minerals than U.S. water. When minerals mix with phosphate in the presence of aluminum, they form deposits that settle in passages and block the flow of coolant.

None of the products you name are phosphate-free. If you use one of them while your car is under warranty, you may have a tough time proving your case should your engine break down because of a condition related to using antifreeze containing phosphate.

What about when your car is no longer under warranty? What negative effect, if any, will using a popular brand of antifreeze have?

The makers of Prestone, Zerex, Peak and Alugard say none at all. Cooling system experts generally agree. If you want to follow the

manufacturer's recommendations you will have to stick to phosphate-free although it costs \$6 per gallon more than these others. You can get phosphate-free antifreeze from your dealer.

Let me leave you with this final thought: AMC, Chrysler, Ford and GM also produce engines with aluminum cooling system components; yet they approve the four brands of antifreeze you mention.

## Stick up

After taking my 1976 AMC Hornet through the car wash, I found one of the chrome

strips peeling away from the side of the body. How do I make a repair?

MARJORIE MARTIN  
SAN FRANCISCO, CA

One way is to reattach the strip using 3M Auto Attachment Tape (part No. 06377), which you can buy from a dealer who sells auto body supplies. Use turpentine to clean adhesive off the car body and chrome strip. Both body and chrome strip must be whistle-clean.

Measure and cut tape, peel off backing paper from one side of this double-sided material, and stick the tape to the chrome strip; then, peel off the backing from the other side of the tape and stick the chrome strip to the car body.

Another way to make this repair is to discard both chrome strips and replace them with self-adhering plastic trim you can get in stores that sell auto parts. Clean the adhesive off the car body, and lay out guidelines on the body with masking tape. Cut the plastic trim to size, peel off the backing paper, and stick the trim to the body. Do the job on a warm, dry day.

## Sound and fury

My complaint is with noisy valve lifters in a 1986 Plymouth Gran Fury. On a cold start, the engine makes as much noise as a diesel; yet, the dealer and a factory representative tell me it's normal. The car now has just over 10,000 miles. Can I expect the noise to get worse?

WARD E. KELLOGG  
CLEVELAND, AR

This engine is equipped with roller lifters, which offer reduced friction as compared to flat tappets for improved fuel economy. The lifters incorporate a hydraulic mechanism that is virtually the same as that of a conventional lifter, so there's no reason why they should make a lot of noise.

The condition you describe—lots of noise on a cold start—is usually due to bleeding down of the tappet-body cylinder, due either to excessive clearance around the tappet plunger or poor check-valve seating. Either of these conditions would call for replacement of the lifters.

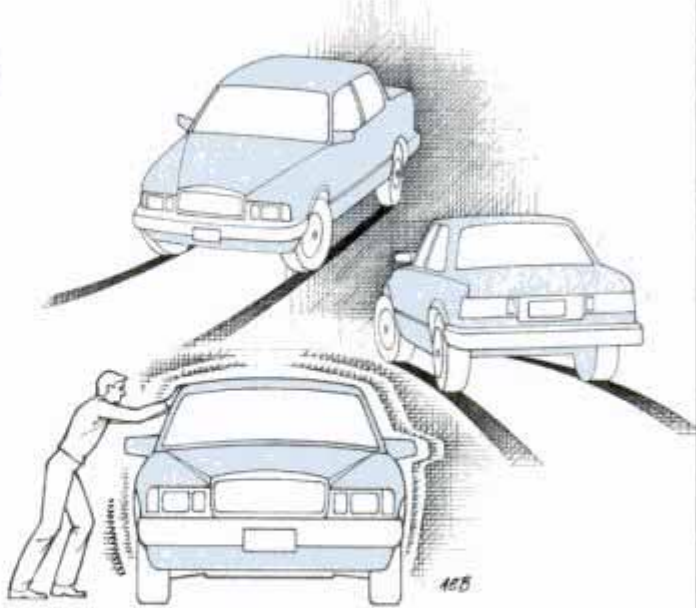
But there are some other less complicated possibilities. (Please turn to page 50)



## Tight topics

If you ever find it tough to remove a wheel, don't use heat or a hammer. The wheel may loosen, but it could also be damaged. There's a chance, too, of damaging the wheel nuts and wheel bearings.

The best way to loosen a tight wheel is to make sure all wheel nuts you took off are reattached and retightened. Then, raise the car and loosen each nut two turns only. Lower the car and



rock it from side to side. Get help. Four or six hands are better than two hands.

If this doesn't work, start the engine, shift to DRIVE, move

ahead a few feet, and make a hard stop. Then shift to REVERSE and do the same thing backing up. This will get that wheel to loosen.



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# TOYOTA

PARTS AND SERVICE



## CAR CLINIC

(Continued from page 48)

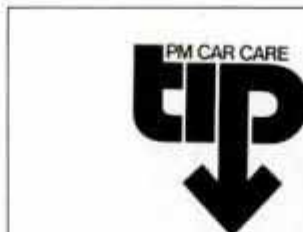
ties you might want to look into first. One is to make sure your engine is equipped with a name-brand or Chrysler oil filter. Some cheap units might allow draining of the oil galleries overnight. Secondly, you should be using 5W-30 oil as the maker recommends to provide fast upper-engine lubrication on cold startups.

### Adrift

I have a problem with the alignment of my 1983 Ford F150 pickup, which I bought new. From the beginning, the truck has pulled to the right. Many attempts have been made to align the front end, and I've gotten as many reasons from Ford dealers as to why pulling is normal. The uneven tire wear I'm looking at tells me it isn't normal.

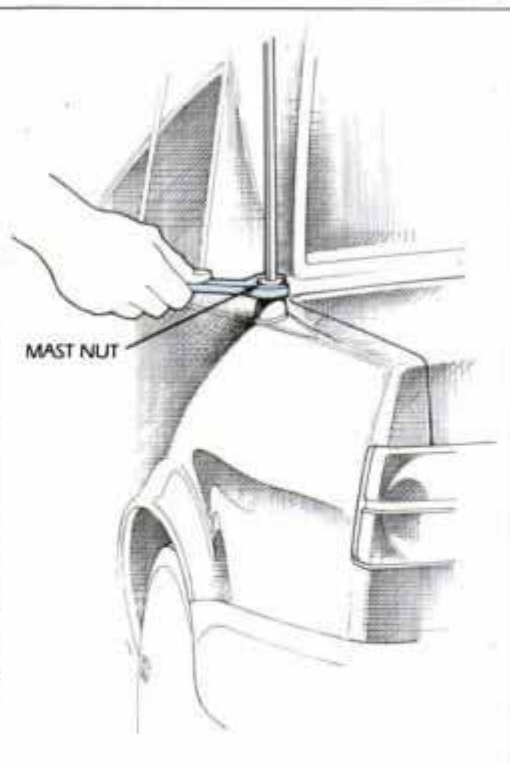
L.D. MALLORY  
GARLAND, TX

*It's not normal. Tell the dealer to forget what his front-end spec chart may say and to set camber less than 1° and toe-in as close to zero as possible, being sure to keep it under 1/32 in. This should solve the uneven tire wear problem. Up to now, camber and toe have been set on the high side by Ford to*



### Masts that last

This is one of those car care tips that will have many of you saying, "I know that." I hope just as many follow through on it. If the antenna mast nut comes loose, the antenna can fall off or be damaged. How widespread is the neglect? Enough for more than one auto manufacturer to advise service department personnel to check nuts on customer's cars. It takes a few seconds to tighten the nut. That's time well spent that may also improve your radio reception. Please, though, be nice to the chrome and use a properly sized wrench or crescent wrench, and a drop of penetrating oil.



*allow for heavy loads. The Ford policy has changed, evidently because most owners of Ford pickups haul light loads or none at all.*

*As for the pull, are you traveling on a lot of roads that are crowned to the*

*right? If so, a slight pull is normal. But if the truck pulls on a level road or pulls to the right on a road that's crowned to the left, then it's a candidate for a caster-cam kit (part No. E4TZ-3K064-A). The side-to-side caster difference*

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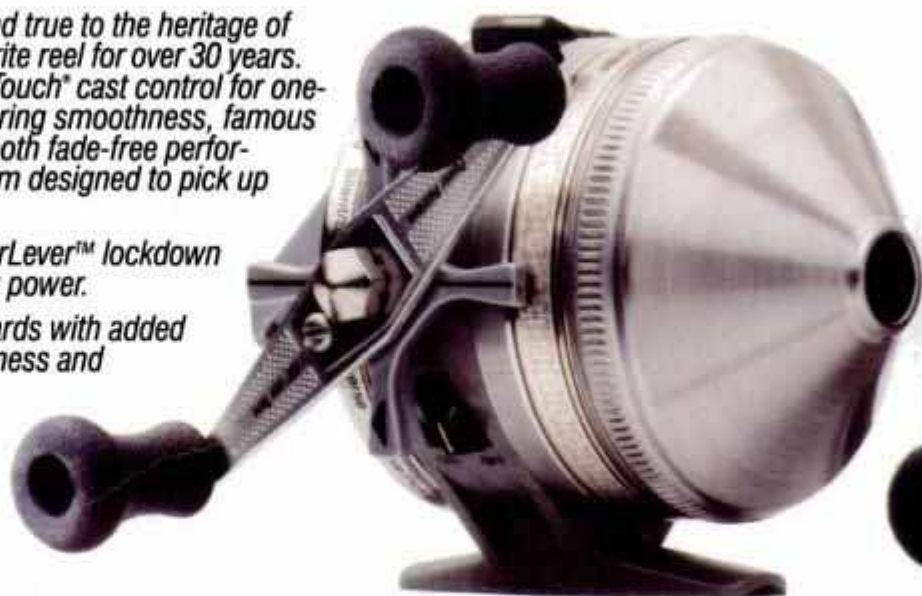
*One Classic — An ideal bassin' reel with PowerLever™ lockdown drag for instant muscle-boosting, hook setting power.*

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in your truck is probably causing a drift toward the side with less caster. The caster-cam kit, which can be installed in Ford trucks with forged axles (1980-86 F100 and F150 pickups and 1983-87 Rangers), balances the caster. The lowdown on this kit is given in Technical Service Bulletin (TSB) 85-13-12. Have the dealer call the Dallas or Houston zone office to request reimbursement for the work. Your warranty should still cover it, because you're on record that the condition has existed since you took delivery.

## Goo, goo

My 1984 Toyota Camry was delivered with just under a quarter tank of gas, so the first thing I did was stop at a gas station. That's when my trouble began. I soon learned that I have to hold the gas pump nozzle at just the right angle and feed gas into the tank gently, as if I'm feeding a baby—else the pump kicks off. There has to be a better way. All I get from two dealers is advice to try another gas station. Help—I'm running out of stations.

ENRIQUE CHANG  
SAN RAMON, CA

*Haven't dealers suggested that the vent line going from the tank up along the filler neck to the nozzle ought to be checked? If air isn't passing freely, gas*

*will bubble in the nozzle and cause the gas pump to kick off. The vent line may be pinched, kinked or clogged.*

## Tir(e)jade

The whitewalls on my 1986 Oldsmobile Cutlass Ciera get a black substance on them that's hard to get off. A mechanic told me it's coming from the disc brakes, and that it's not unusual. Do you agree?

ROY E. PHILIPPI  
HONOLULU, HI

*Yes, the dust is the result of the switch from asbestos brake linings to linings that use finely ground metal powder. These newer linings create more dust than asbestos, but work better.*

*Try various tire cleaners until you find one that works best for you. I've had good results with Westley White-wall and Tire Cleaner, but I don't know if you can find it in Hawaii. Whatever you try, follow accompanying instructions on how to use it. The Westley product, for instance, has to be applied to a dry tire. You let it sit for several minutes, and then wash it off.* **FM**

## DO YOU HAVE A CAR PROBLEM?

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

## SERVICE TIPS

- The days of oil seepage from around the rear camshaft covers of 1982-86 GM J-cars could be at an end if you have a newly designed cover and gasket installed. It's part No. 10054590.
- If your '86 or '87 Chrysler Corp. 2.2-liter carbureted engine is idling roughly and tailpiping black smoke after a cold start, ask your dealer to reset the choke vacuum kick from where it is now (.070 in.) to .085 in. TSB 18-47-86 says that'll get rid of the overly rich condition.
- Some 1986 $\frac{1}{2}$  Nissan 200SX and 1987 Stanza and Sentra models equipped with Mitsubishi distributors are experiencing warm-engine acceleration hesitation between 2000 and 4000 rpm. TSB TS86-184 says to replace the distributor with a new unit—part No. 22100-18F12 if the car is a 200SX; 22100-D3511 if it's a Stanza; and 22100-27M16 if it's a Sentra coupe. The repair applies to the following: 200SX VIN ranges JN1PS24S0-9GW 100001 through 111481; JN1PS26S0-9GW 100001 through 111481; Stanza VIN ranges JN1HT21S0-9HT 001923 through 027132 and JN1HT23S0-9HT 000684 through 005037; Sentra coupe VIN ranges JN1PB24S0-9HU 003763 through 022489.
- If every repair outlined in TSB 86-20-2 fails to improve air-conditioning comfort in a 1986 Escort, Tempo, Lynx or Topaz, have your dealer install a new expansion valve (part No. E6FZ-19849-B).



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# Cycles

BY NORMAN  
MAYERSOHN



## All-Terrain FatCat



FatCat 2-wheeler is an easy-to-master ATV and ideal fun machine for the beach or backwoods.

**E**ven if you're the type (like me) who finds no humor in comic-strip cat capers and wheezes in the presence of living felines, you'll still find Honda's 2-wheeled ATV animal easy to cozy up to.

Engineered specifically for user-friendliness toward beginning off-roaders, the FatCat makes first-time jitters flee with an automatic clutch, electric starting and bicycle-type brake controls. Even the styling, right down to the cartoon logo, is designed to have an appeal far beyond the normal range of today's all-business dirt machines.

In fact, that's what FatCat is all about—expanding the pool of motorcycle buyers beyond the typical profile of a longtime enthusiast. Sales figures for motorcycles are relatively stale these days, so in order to grow Honda has committed itself to making converts out of nonriders. Where to start them off, then? On appealing (and nonthreatening) packages like the swoopy Elite and Helix scooters plus simple-to-master machines like the FatCat.

Too often, building that kind of versatility into a bike means that once you've wound it all the way out there's no more fun to be found. With the FatCat, though, the excitement is provided by the places it will

carry you, often where nothing else could. High-flotation tires, running at low air pressures, are ideal for crossing mushy ground as well as deep sand.

We gave them the ultimate test on the seemingly endless dunes of California's Pismo Beach.

Stalling and restarting on the steep hills of Pismo could make your day tiring, but FatCat's dry centrifugal clutch lets you pull away smoothly by revving the throttle. And if you still manage to botch it, there's a pushbutton electric starter to save the day. The torquey 199cc 4-stroke engine, developed specifically for ATV duties and used exclusively in this bike, is well-suited for low-speed plonking and is easy to maintain.

Low speed, in fact, is the cause of most new-rider problems in the deep sand of the dunes. The steep rise of the hills can cause you to bog down if you approach them slowly. Charge into sand at full bore, though, and the FatCat grunts up and over the top, launching you on a smooth flight. Landings are cushioned by the telescopic front forks and a single hydraulic shock on the bike's rear swingarm.

You won't be tempted to try these antics on public highways, of course, because the FatCat isn't street legal. And because it doesn't carry turn signals or mirrors, there's less to bust when you do take a tumble. A Forest Service-approved muffler is standard equipment, and there's the option of a headlight guard, luggage rack, speedometer and a handlebar tool pouch.

Honda's all-terrain critter is



The Rowcycle offers a healthy workout.

not the only fat-tire 2-wheeler for sale, but at this point, it is the easiest one for new riders to adjust to.

With a very short familiarization period, a beginner is on the way to adventurous leaps over high dunes or quiet dirt-trail exploration, with no prior experience needed.

## Row, row, Rowcycle

With cycles getting ever more specialized these days, it's particularly nice to come across one that offers more choices rather than fewer. The 3-wheeled Rowcycle can be propelled with arm and leg power, or just upper body effort, so it gives all the workout advantages of a rowing machine with the practical advantage of recreational transport.

In normal operation, the Rowcycle seat slides back and forth, using both arm and leg power. A 3-speed transmission, which shifts ratios by changing the travel of a lever arm, gears the cycle down for uphill climbs or allows flat-out running up to 20 mph.

The rider shifts his weight on the rotating seat to steer the single front wheel, making it possible to ride without using legs at all.

Because it is built of lightweight 6061 T6 aluminum tubing, all this gear weighs but 42 pounds—light enough to be hauled on most car bike racks. Fully welded together and finished with a durable powder coat covering, the Rowcycle's long suit is top-notch construction quality.

The sliding seat can be locked into any position, which makes the cycle move by upper body movement entirely. Beyond the total body exercise benefits, this allows the 3-wheeler to be operated by wheelchair riders. For these folks, it's a whole new world of sport, moving along at a good clip while keeping a sporty profile and taking in beneficial exercise. On longer journeys, the physically chal-

(Please turn to 54)



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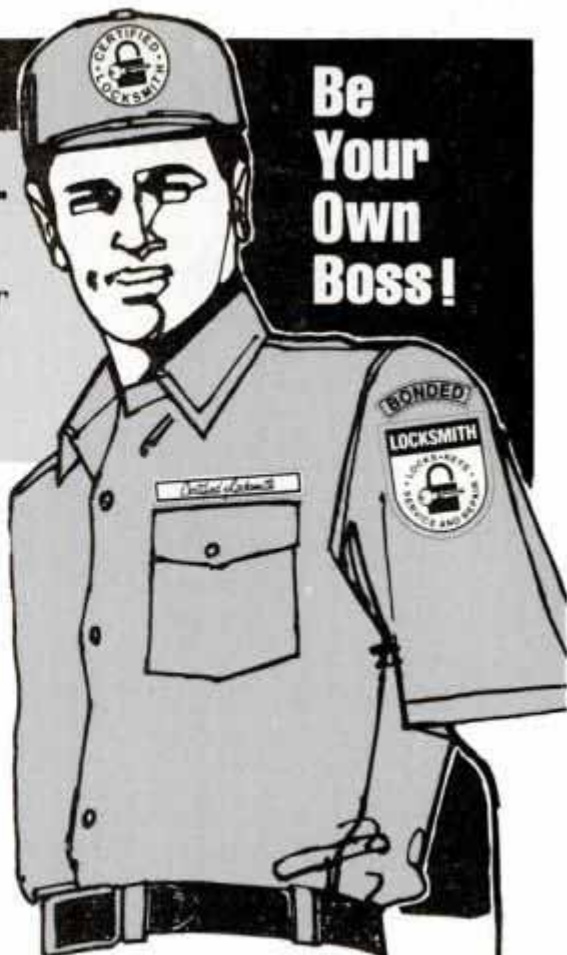
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## CYCLES

(Continued from page 52)

lenged can also tow a wheelchair along behind the Rowcycle and transfer rides between the two as required.

At a retail price of \$1250 (\$850 if ordered factory direct from Rowcycle, 3164 North Marks #120, Fresno, CA 93711) the Rowcycle hardly comes cheap. However, the 3-wheeler is not out of line considering the cost of a quality bicycle today.

With the manufacturer's machines showing up in events like National Triathlon for the Physically Challenged at Stanford University, there's bound to be a healthy and welcome growth in this specialized branch of sports.

## Cooler heads prevail

Only a few months ago we predicted that the well-dressed cyclist would soon be decked out in aerodynamic headgear for street riding, but perhaps you weren't ready for the pointy look in your personal cycling wardrobe.

Well, it's time to get with the program, because now Bell Helmets has unleashed the Stratos. This new helmet is a product of the development program conducted for Velodrome riders in the 1984 Olympic Games.

In terms of aerodynamic efficiency, the Stratos is claimed by Bell to offer a 25 percent reduction in drag compared to an unhelmeted head. For the competition conscious it's also a featherweight because of a 50 percent cut in the weight of the hard outer shell.

Even more useful to the street rider is the full ventilation system. Air enters through louvers in the front of the helmet and is routed to the brow, then, through channels in the liner, up and over the rest of the head.

A rear outlet duct helps to create a venturi effect that pulls more air through the helmet's vent system.

Thoughtful small touches include a new strap anchor setup that places the retention straps flat against the wearer's cheek



The Bell Stratos: Aero helmet hits the street!

and a flip-up, removable eye shield. Not only does the eye shield cut down on glare and wind in the rider's eyes, it also improves the aerodynamic qualities of the helmet.

The Stratos comes in one color, anthracite, with a suggested retail price of \$74.95 at bicycle dealerships.

## Bright idea

At this time of year, afternoon bicycle jaunts tend to run into the dusk and dark hours. Sunset rides are certainly picturesque, but the chances of getting hurt on your bicycle increase as your vision and your visibility to others on the road diminishes.

Just as halogen lighting has upgraded night driving in cars over the past few years, it's now finding its way into flashlights and bicycle headlamps.

Take a look at the Brite Lite system, which offers a choice of 2.4- or 4.5-watt front lighting and a .6-watt taillight for



Halogen Brite Lite system offers sensible safety for those after-dark bicyclists.

your bicycle. What makes this setup so practical is the use of a "gel-cell" lead/acid battery that can be recharged up to a thousand times with the kit's 110-volt charger. It will bring the battery back to ready-to-go status overnight and hold it on standby indefinitely.

Unlike NiCad cells, the lead/acid battery does not lose power abruptly and will last up to 6½ hours at a clip, depending on the combination of battery and lamps being used.

The Brite Lite Standard system includes a 2.4-watt headlamp, a taillight, 4-hour battery pack, AC charger and mounting brackets at \$69.95.

The Performance lighting system moves up to 4.5 watts for the headlamp for \$89.95, and the Super option gives the brighter light plus a longer lasting battery pack for \$109.95.

Excess weight is the bane of efficiency-minded riders, so they'll be glad to know that the whole setup nets out at less than 30 ounces. Brite Lites are sold at bicycle dealerships and by direct mail through Brite Lite, P.O. Box 1386B, Soquel, CA 95073.

PM

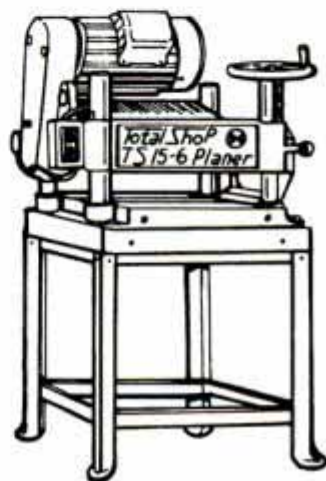


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# Outdoors



BY TIM COLE

## Lake Country RV



One of Lake Powell's ubiquitous houseboats finds quiet seclusion.

It was not the kind of place where you'd expect to confront sensory overload. But after leaving the congested Northeast—where noise and confusion seem to wash over the brain unnoticed—the sheer quiet of Lake Powell felt every bit as tangible as a sock on the chin.

The evening star lay suspended in a field of blue over billion-year-old buttes of terra cotta and vermilion. The crystalline air riffled the canyon water and the striped bass rose to inspect the evening delicacies flying off the surface. Night slowly embraced the barren landscape, and the lights from our houseboat, nestled between sandstone outcroppings smoothed by the desert winds, welcomed us home. It was the silence I remember, a peace so absolute you could almost feel it brush against your skin—and penetrate your heart.

This powerful tranquility straddles the Arizona-Utah

border, forming a 186-mile water playground. Established by the Glen Canyon Dam in 1963, it took almost two decades to fill the great rift formed by the Colorado, San Juan and Escalante rivers, once the homeland of the Anasazi Indians. Narrow, high-walled canyons that probe the desert outback boost the lake's total shoreline to almost 1900 miles. Thirteen species of game fish inhabit Lake Powell's depths of cobalt blue. Best of all, you can tour this great wonder, created by the collaboration of man and nature, with relative ease from the deck of a sturdy, personalized houseboat. Like traveling by RV, houseboating injects a note of simplicity and freedom to your itinerary.

Del Webb Recreational Properties, which is based in Wahweap, Arizona, has the principal houseboat concession on Lake Powell. Their 34-footers will sleep six; the 50-footer twice that. And you get

20th century convenience without suffering the indignity of actually being pampered.

Twin outboards mounted on longitudinal pontoons propel these "boatels" at a sedate 10 knots—just enough to let Lake Powell's truly astonishing scenery inch steadily by the windowpanes.

Contact Del Webb at 2916 N. 35th Ave., Suite 8, Phoenix, AZ 85017-5261.

## Price vs. performance

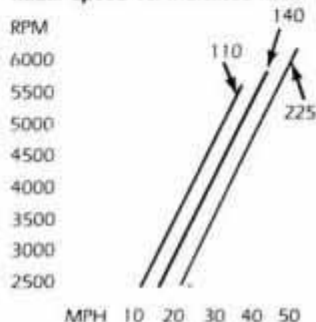
Somewhere out there, amid the swirling uncertainties that define "freedom of choice," is the right boat and motor package for you. But after you have settled on the right hull form, how do you go about powering up? PM decided last summer to give this matter special study and set up a demonstration on the Connecticut River involving three Johnson engines—a 110-hp, 99.6-cu.-in V4 (average retail price \$6096), a 140-hp, 110-cu.-in. V4 (\$7221), and a 225-hp, 165-cu.-in. V6 (\$9949). With the capable assistance of Gaudreau's Marine in South Meriden, Connecticut, we mounted each of them in succession on the back of an 18-ft., 10 $\frac{1}{4}$ -in. Starcraft 190 V and drove the boat through PM's normal top-end and acceleration tests. We wanted to compare each engine's performance across the rpm range, noting differences in speed relative to price.

You'll notice from the accompanying graph that the 110 achieved a rather spritely top end of 38 mph, just 3 mph slower than the 140. Both engines also have a closely matched rpm/mph profile. Not

bad when you consider the 110 costs \$1125 less. However, there's a strong correlation between good acceleration and ultimate performance under full load. Top speed on many engines will fade after a hull is loaded with gear. And a brisk shot out of the hole is a good indicator of how much power a boat will have with gear safely stowed. The 110 achieved a 0- to 30-mph acceleration time, 1.3 seconds slower than the 140, meaning you can expect the 140 to have superior performance over the long haul.

At the other end of the

Radar Speed Vs. Indicated RPM



RPM/MPH follow predictable tracks. Key is acceleration.

spectrum, the big 225 V6 predictably achieved a 0- to 30-mph acceleration rate of 5.72 seconds, enough to pin your lips back, even for a big lake fisherman like the 190 V. While the high-performance 225 would be more appropriate for a performance hull, its acceleration indicated plenty of reserve muscle to fight "top-end fade." But note the 9 mph difference between the 225's top end and the top end

(Please turn to page 64)

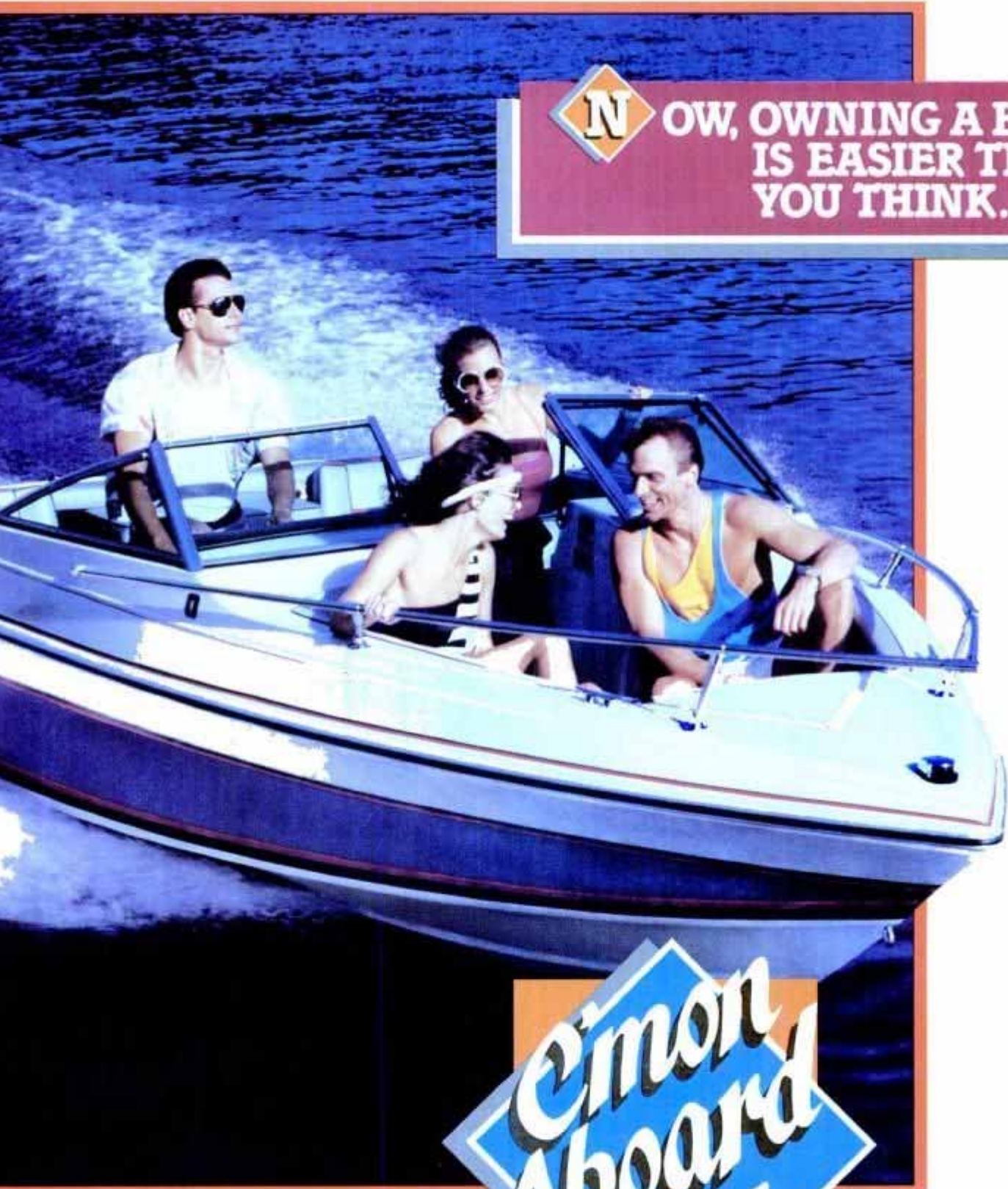


Johnson-equipped Starcraft during test runs on Connecticut River.





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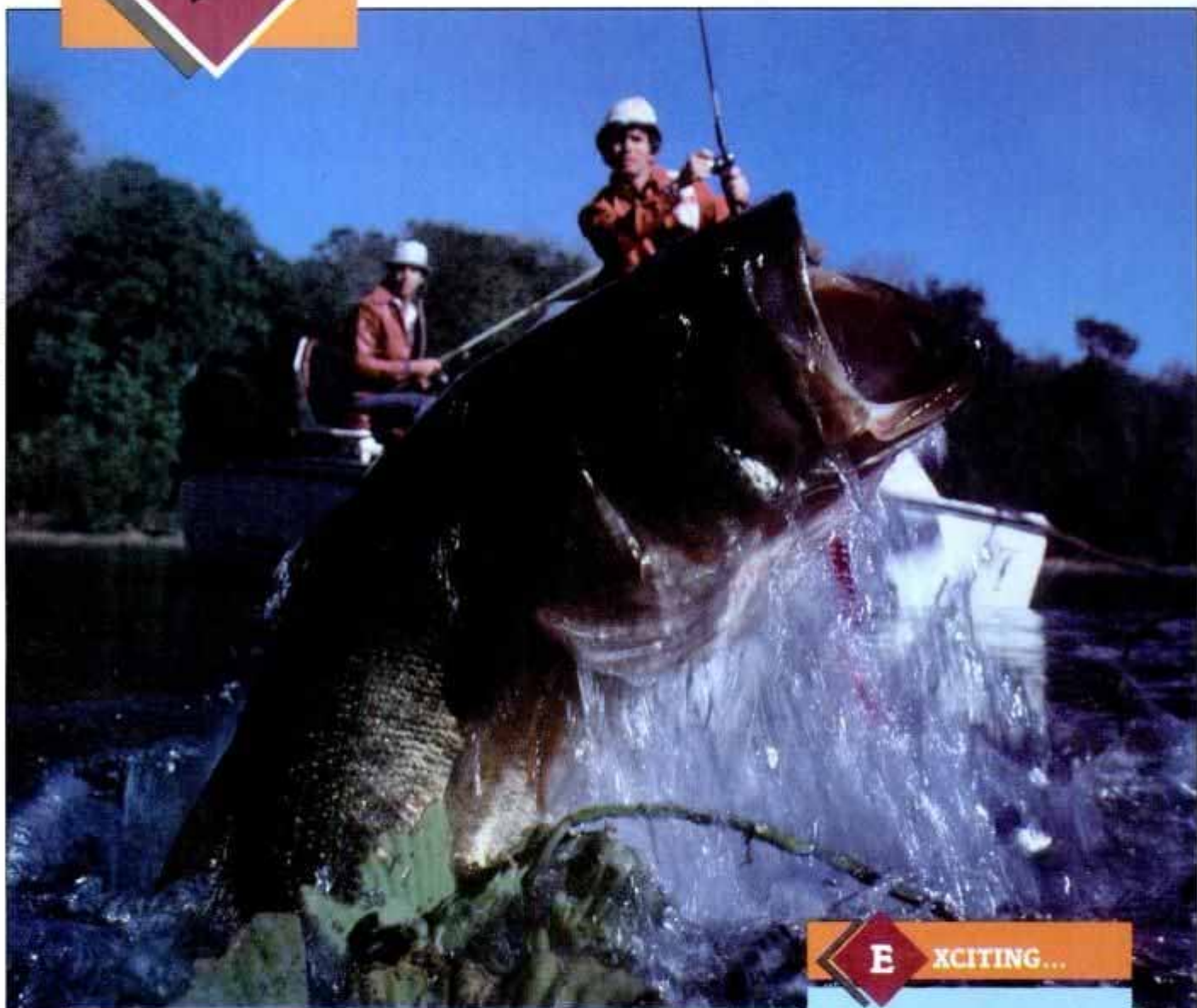


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\*Monthly cost of ownership figures based on 20 percent downpayments and average finance rates and terms from nationwide sample of lending institutions polled Fall 1986.



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### Financing is simple...

Financing a boat is as easy as financing a car. Rates are low and your dealer, bank, or marine

lender can put together the financial package that's right for you.

### Getting started is easy...

Advances in design, technology, and materials make today's boats longer-lasting, easier to operate, and easier to maintain.



### DYNAMIC...

Throw the throttle down and start wave-hopping your way to sun, fun, and free-spirited escape.

**\$113-\$158/month\*** —  
19 ft. runabout  
with 170 HP I/O  
(total cost \$8,250-\$14,350\*\*).

**\$629-\$829/month\*** —  
34 ft. luxury cruiser with  
twin engines (total cost  
\$71,000-\$104,590\*\*).



\*\*Retail prices based on nationwide manufacturer sample and include price of engines where applicable.



Your local C'mon Aboard marine dealer will work with you to help make owning, operating, and storing a boat as easy as possible.

### Boats are good investments...

Boats hold their value much better than cars, plus they have great resale value. Just think of

the hours of fun and adventure your boating dollar can buy.

### Boat shows are the best place to start...

Boat shows are fun for the whole family. They're a great place to explore the boating adventure. You can "window shop,"

without obligation, and see a wide selection of boats, accessories, and even financing options. Best of all, boat shows often feature special price reductions.

**SEE FOR YOURSELF HOW EASY OWNING A BOAT CAN BE, VISIT THE BOAT SHOW NEAREST YOU!**



**C**

**CHALLENGING...**

As you silently glide across the water with the wind in your hair, the feeling of freedom consumes you. You tighten your sail and go for more.

**\$66-\$83/month\***

16 ft. catamaran sailboat (total cost \$3,790-\$4,795\*\*).

**\$295-\$414/month\***—  
32 ft. cruising sailboat with auxiliary engine (total cost \$33,430-\$46,690\*\*).



\*Monthly cost of ownership figures based on 20 percent downpayments and average finance rates and terms from nationwide sample of lending institutions polled Fall 1986.

\*\*Retail prices based on nationwide manufacturer sample and include price of engines where applicable.



This is the 1987 Four Winns 225 Sundowner. Like all of our boats it bristles with innovations designed to expand your enjoyment on the water and extend the value of your investment...



The most innovative standard feature on this and every other Four Winns stern drive model for 1987 is something you'll appreciate for years to come...

and something you won't find on any other boat.

It's the exclusive Four Winns WINNER'S EDGE 3-Year Owner Protection Plan\* ...the best extended protection program in boating. The only factory supported plan that provides a comprehensive limited warranty in the first year followed by two more years of extended protection covering...

Hull & deck...Engine & stern drive...  
Electrical system...Power steering...  
Fuel system...Power trim & tilt...  
and most other major Four Winns boat systems and components, all at *no extra cost!* And should the boat be sold within 3-years, the remainder of



the program can be transferred to the new owner.

We're building boats today as if our future depended on it, constantly adding

value and versatility all along the line. We have to... because the day we say Four Winns boats are good enough is the day you'll look for another boat.

\*Full warranty details are available. See your Four Winns Dealer, or write Four Winns, 925 Frisbie St., Cadillac, Michigan 49601.

There's one standard feature on this boat you'll appreciate for years to come.

WINNERS  
EDGE 3-YEAR OWNER  
PROTECTION PLAN



FOUR WINNS

We're Building Boats Today As If Our Future Depended On It.

925 Frisbie Street, Cadillac, MI 49601  
(616) 775-1351



NO FREEDOM 170 HORIZON 190 HORIZON 210 HORIZON 170 CANDIA 200 CANDIA 195 SUNDOWNER 215 SUNDOWNER 225 SUNDOWNER 235 SUNDOWNER 245 VISTA 267 GUEST 291 LIBERATOR 241 LIBERATOR 261 LIBERATOR



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If you're fishing around for an economical boat with lasting value, catch a look at the sturdy, dependable Cobia Sunskiff 177 outboard. Time has proven the Sunskiff to be a true fisherman. It has a casting platform, tackle box, aerated baitwell, self draining motor well and ice chest, plus teak rod storage. Yamaha's 3-cylinder 70 features Precision Blend Oil Injection and comes standard with Yamaha's two-year factory limited warranty. Participating dealers only. Price does not include transportation, dealer prep nor accessories.

Send \$3.00 for your copy of the 1987 Cobia catalog or pick one up at your Cobia dealer.

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## 1987 BOAT SHOW SCHEDULE

Boat shows provide boat buyers many opportunities throughout the year to shop and compare. Local boat dealers listed in the "Yellow Pages" have additional information on boat shows in their areas.

CITY	1987 DATES	PHONE NUMBER
Annapolis, MD	Apr. 17-19	(301) 268-8828
Boston, MA	Jan. 31-Feb. 8	(617) 536-8152
Boston, MA	Feb. 18-20	(617) 242-6092
Chicago, IL	Jan. 7-11	(312) 836-4740
Cleveland, OH	Jan. 16-25	(216) 621-3618
Detroit, MI	Jan. 31-Feb. 7	(313) 427-5770
Fort Lauderdale, FL	May 7-10	(305) 764-7643
Hartford, CT	Jan 29-Feb. 1	(203) 529-2123
Hartford, CT	March 12-15	(203) 529-2123
Houston, TX	Jan. 10-18	(713) 526-6361
Jacksonville, FL	Jan. 29-Feb. 1	(904) 725-3111
Los Angeles, CA	Jan. 30-Feb. 8	(714) 633-7581
Miami Beach, FL	Feb. 12-18	(305) 531-8410
Nashville, TN	March 4-8	(312) 836-4740
New Orleans, LA	Jan. 31-Feb. 8	(504) 885-9709
New York, NY	Jan. 2-11	(212) 684-6622
Philadelphia, PA	Jan. 31-Feb. 8	(215) 449-9910
Providence, RI	Jan. 21-25	(401) 846-3734
San Mateo, CA	Jan. 23-Feb. 1	(415) 436-4664
Seaside Heights, NJ	Apr. 22-26	(201) 530-0636
Seattle, WA	Jan. 15-25	(206) 634-0911
Syracuse, NY	Feb. 18-22	(315) 472-5433
Tacoma, WA	Apr. 15-19	(206) 634-0911
Worcester, MA	Jan. 7-11	(401) 846-3734

## OUTDOORS (Continued from page 56)

achieved by the 140. You pay almost \$3000 for this extra oomph. Is it worth it?

The jump from the 110 to the 140 is definitely worth the additional expense for this size boat. But going with a large-displacement outboard like the 225 just doesn't seem all that critical.

### Scuba power

Robert Hyde first harnessed the "swash-plate" engine a decade ago in a contemporary automotive steam powerplant, having borrowed the technology from a clothes washer designed in the 1890s.



Underwater power from compressed air.

From these beginnings, Hyde developed an underwater application of the swash-plate engine to power scuba divers.

Made out of a unique ABS/polycarbonate blend from Mobay Corp., Celanese Celcon and a new self-lubricating fibrous Teflon material called Rulon, Hyde's Hydrojet operates off the compressed air in a diver's scuba tank. Five 1 $\frac{3}{8}$ -in. cylinders are grouped in a housing around a main shaft. The propeller-shaped housing turns when the cylinders are fed compressed air, which is transmitted to the device via the low-pressure outlet on a standard first-stage regulator. The throttle is an air hose led to the diver under a common buoyancy compensator strap.

Hyde says the Hydrojet can run at normal swimming speed for 40 minutes at 90 ft. with a 500-pound air reserve. Because a diver uses less swimming energy, Hyde says there's no appreciable loss in bottom time. Contact Hyde Power Systems, 9340 W. Putter Court, Crystal River, FL 32629.

### Propane possibilities

Once upon a time, outdoor propane users were limited to one appliance for each bulk propane cylinder. Well, the folks at Coleman's Heating, Cooking and Lighting Div. have come up with a hot device. Their 30-in. propane distribution post attaches to a 5-, 11- or 20-pound Coleman

bulk propane cylinder. Their new electric-start propane lantern screws onto the top of the post. Light spills into the cooking area from this elevation, and side outlets lead to a standard Coleman propane stove and heater. Safety seals on the post ensure leak-free operation. Contact The Coleman Co. Inc., Heating, Cooking and Lighting Div., 250 N. St. Francis, Wichita, KS 67201. **PM**



Multiple appliances from a single bottle.



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Bayliner's 1987 lineup of Capri family runabouts is exciting proof of Bayliner's industry-leading commitment to making boating more affordable.

Every Capri is loaded with standard equipment: Power-mated engine, AM/FM

cassette stereo, swim platform, canvas and more. Eight models even include a custom Escort trailer, pre-rigged at the factory.

Join the more than 75,000 families who've discovered how affordable top quality can be; visit your Bayliner dealer. Find him in the yellow pages, or write for the name of the dealer nearest you.



I'd like to know more about boating's best values...please rush me more information, and the name of my nearest dealer for:

- Bayliner family boats
- Force outboards
- Blue Fin aluminum boats

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## FORCE OUTBOARDS FOR 1987

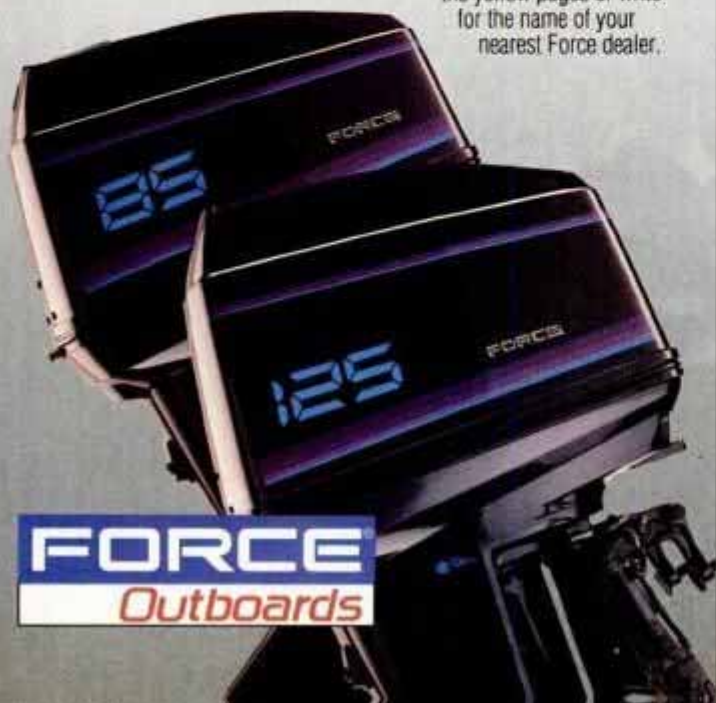
Prices As Much As 30% Below The Others

There's a dramatic new look to Force outboards for 1987. It's our way of calling attention to the more than 200 engineering refinements we've completed during the past year.

What hasn't changed is the kind of spirited performance and reliability that has made Force the fastest-growing outboard line on the water today.

Priced as much as 30% below competitive brands, Force offers unbeatable value.

So if the high cost of outboard power has your boating plans on hold, a visit to your Force dealer could change those plans for the better. Look in the yellow pages or write for the name of your nearest Force dealer.



**FORCE**  
*Outboards*

*Full Value Package*



**\$3,995\*** Complete boat/motor/trailer package as shown

## BLUE FIN ALUMINUM BOATS

America's Most Affordable Boating Packages

If the idea of a complete, top-quality boating package at an affordable price makes sense to you, take a close look at Blue Fin for 1987. Eight value-packed models, each one loaded with standard equipment. Each built to last.

And each one comes to you as a complete outfit—including rugged aluminum boat, power-mated Force outboard and custom Escort trailer, all rigged and ready to go—at prices that start at less than \$2000!

We call it Blue Fin's Full Value Package...you'll call it the most affordable way yet to get your family on the water.

See the complete Blue Fin line-up today; write for the name of your nearest Blue Fin dealer.

**BLUE FIN**

\*Manufacturer's suggested boat show prices in effect at participating dealers. Actual prices set by dealer. Taxes, registration, freight, options and dealer prep charges extra. Prices may change without notice.



# NEW/AUTO

## Blast It Off!



Rust and paint just melt away, leaving a fresh metal surface.

For just \$99 you can put a professional auto body sandblaster in your home garage, but you need a minimum 1-hp compressor that can deliver at least 4 cfm at 100 psi. The machine shown above, made by Borroughs Tool and Equipment, is capable of handling a variety of abrasives, including glass beads for light cutting where minimum surface removal is desired, and aluminum oxide to blast away heavy rust or oxidized paint. And for protection against flying particles, a face shield is included in the package.

The sandblaster has other uses around the house. It can be used, for example, as a paint, scale and rust remover and as a power sprayer for insecticides, solvents, and soap and water. For more details and further information, contact the Borroughs Tool and Equipment Corp., 2429 N. Burdick St., Kalamazoo, MI 49007. Orders using a Visa or MasterCard can be placed by calling 1-800-253-0138.



No more fishing around in hot oil for a slippery drain plug.

## Fast pit stops

The Engine Oil Drain Valve attaches permanently to your oil pan in place of your drain plug. To drain dirty engine oil, you just move a lever. Even when the engine is hot, you can open and shut the valve with the flick of a screwdriver, avoiding hot parts, messy oil and skinned knuckles. A locking detent prevents leaks when the valve's lever is closed. The drain valve, which is pressure-tested, costs \$11.95 and is available at auto parts outlets or from Fumoto Engineering of America, 23228 Hawthorne Blvd., Suite 202, Torrance, CA 90505.

## Wet strength

Some popular high-performance tires can't match their excellent dry-pavement traction when the road turns to slush. But Eagle GT+4 tires offer Eagle GT-level performance, with increased wet and snow traction. List price is between \$125 and \$175 at any Goodyear dealer, or write Goodyear Tire and Rubber Co., 1144 E. Market St., Akron, OH 44316.



Stay in the rain without changing to skinny tires.

## Need a connection? It's a snap



No more chipped fingernails when removing the battery.

Quick Power Connectors snap securely to the battery post and use existing battery cables. The red and blue connectors completely cover the post and make positive and

negative terminal identification easy. To disconnect, just lift up on the clamp. Send \$6.95 to Osswald Jonsson Co., P.O. Box 37338, Phoenix, AZ 85069.

## Supercharger wakes up Chevy V6



The Max 25 Roots-type, belt-driven supercharger gives the Chevrolet 2.8-liter V6 engine a 30 percent horsepower boost in the 2250- to 3750-rpm range. The unit is legal in California

when installed on Chevy and GMC mini pickups and AMC light-duty trucks equipped with this engine. Kits start at \$2000 from KF Industries, 3288 Fair Oaks Lane, Spring Valley, CA 92078. **FM**



# The **GUTS** and **GRIT** to **SURVIVE.**

**THE NEW PRESTOLITE CENTURA BATTERY. TRUST YOUR INSTINCTS AND GET TOUGH.**

*Demand the toughest Prestolite battery ever made—the new, rugged Centura.*

*Centura's got the guts to get you started when the rest of the world stays in bed. Up to 650 cold cranking amps to knock even sub-zero starting problems out cold.*

*Centura's got the instincts to survive when ordinary batteries die. Its high tech design and rugged construction combine to tame heat, cold, vibration, and water loss—all those things that "wimp out" regular batteries.*

*Centura's even got a tough, fold down carrying handle that doesn't go limp when you pick it up. And two pairs of terminals, top and side mount, for vehicle*

*interchangeability and to make jump starting your buddy a breeze.*

*Centura's got grit. A tough, 12-month full replacement warranty with real guts. The "other guys" wimp out after only 90 days.*

*And only Centura's got the toughest name in batteries behind it. Prestolite. For over 50 years our batteries have survived their share of jungles in cars, trucks, even tanks! So whatever you're driving, domestic or import, off-road or stop-and-go, your car deserves better than a "civilian" battery.*

*Go for the guts and grit. Go for Centura.*

**GB** GENERAL BATTERY CORPORATION  
P.O. Box 14205, Reading, PA 19612-4205



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With independent double-wishbone front suspension for stability. A body and frame that's welded, not bolted. Power front disc brakes. And six-stage electroplated paint tough enough to withstand a 36-month limited warranty.

There are 17 P'UPs to choose from, including several rugged 4x4's along with our versatile Spacecab. There are two state-of-the-art engines, gas and diesel.



With gas you can expect mileage figures as high as 25 MPG city and 31 MPG highway. With diesel, expect better.

And with both, expect world-proven toughness, demonstrated over 73 years on some of the worst roads through some of the most treacherous climates in over 100 countries.

That's a lot to put into any truck. Especially when you're only putting in \$6279.

\*Except Hawaii. Manufacturer's suggested retail price P.O.E., excluding tax, license and transportation fee. Prices as of 11/10/86 and may subject to change. \*\*Use estimated EPA figures for comparison. Your mileage may vary. Actual highway mileage will probably be less. CA ests. lower. Buckle up — for life!

*The First Car Builders of Japan.*

# ISUZU

Исuzu — японский автомобильный бренд



# SAILS & SCIENCE

Popular  
Mechanics  
FEBRUARY 1987

In the America's Cup race, space-age design and high-tech engineering are more than half the battle.

BY TIM COLE, Boating/Outdoors Editor

**N**owhere in sport will you find such a divergence between perception and reality. Twelve-Meter yachts competing one on one for the America's Cup summon visions of timeless grace and gentility. But out on the racecourse, these dueling sailboats locked in combat are the nautical equivalent of a big-city street fight.

Aboard each \$1.8 million boat, 11 highly trained amateurs, ranging in size from hulking 250-pound winch grinders to flyweight bowmen, manhandle 60,000 pounds of aluminum and synthetics around a 24.3-mile course. Lines spliced to half-inch cable shriek through blocks, accumulating tons of sail loading in an instant. Flapping shackles, spinning winch handles and swinging spars cleave through the air. Screams from the skipper and tactician somehow manage to drown out the roar of the wind, the waves and

The power and glory of sailing is reflected in *Kookaburra III*, an Australian yacht vying to defend the Cup.

PM PHOTO BY SHARON GREEN







An aerial view of *America II* shows the boat's crew in position to sail this complex piece of aerodynamic and hydrodynamic machinery upwind.

the general tumult. This is no frivolous gambol over the wavetops, no relaxing meander over the foam-flecked briny. It's a rumble.

And while this violent, highly physical environment of wind, spray and muscle may be at odds with our collective image, it characterizes the highly demanding world of America's Cup competition, which reaches a climax this month in Perth, Western Australia.

The America's Cup is sailing's symbol of supremacy and, in fact, the oldest prize in sport. Once described as an oversize "vinegar cru- et," it was first won by the yacht *America* in a race against the British in 1851. The Cup has been fought over and fantasized about for most of its 136-year history, becoming a quadrennial joust that reached a peak in 1983 when *Australia II* narrowly defeated the American yacht *Liberty*.

Now, the Cup may be destined for yet another home when a single

surviving 12-Meter yacht, having eliminated 12 challenges from six nations, faces off against the Cup's Australian defender in a best-of-seven series.

This year, more than ever, the quest for the America's Cup has become a contest between competing national technologies as well as men—a battle of the brain (and the bucks) in computer-aided design and materials science. NASA, Boeing and Cray computers are just a few names in the long list of American organizations that have offered their expertise to bring home the Cup. Similar work has been conducted by high-technology firms from around the world.

And the goal? To engineer a hydrodynamic vehicle so perfect that it captures every particle of energy from the environment and converts it directly into motion.

Twelve-meter designers and builders begin the task by tank-testing scale models—complete with

PM ILLUSTRATION BY STEPHEN DAVIS







## Not Just Winging It: Life On A 12-Meter

It takes 11 physically fit, psychologically motivated sailors to drive a contemporary America's Cup yacht. They're aided by variations on Australia II's famed winged keel, hydraulic tensioning devices, low-friction blocks, cars and tracks and state-of-the-art electronics. Here's a rundown of major 12-Meter components and what they do.

1. Forestay—forward mast support
2. Topping lift—holds spinnaker pole up
3. Spinnaker pole—supports spinnaker
4. Foreguy—holds spinnaker pole down
5. Afterguy—tensions spinnaker pole back
6. Spinnaker—nylon sail used downwind
7. Aircraft-grade aluminum hull
8. Grab rail for bowman
9. Splash rail
10. Deck hatches
11. Hydraulic forestay tensioner
12. Extruded reinforcements for sidestays

13. Hydraulic mast lift
14. Lead ballast concentrated low in keel
15. Winglet—dampens keel vortices
16. Trim tab—helps steering, handling
17. Sidestays—side mast supports
18. Instruments—time, boat/wind speed, etc.
19. Hydraulic gooseneck—tensions boom out
20. Dacron sail panel—low-stress area
21. Kevlar sail panel—high-stress area
22. Mast—supports main, genoas, spinnakers
23. Boom—supports mainsail
24. Hydraulic vang—tensions boom down
25. Spinnaker sheet—tensions spinnaker
26. Mainsail sheet—tensions mainsail
27. Running backstay, slack—supports mast
28. Running backstay, tensioned—supports mast
29. Permanent backstay—supports mast

30. Rudder—primary control surface
31. Computer keyboard—calls up speed data
32. Backstay winches—help tension backstays
33. Outer steering wheel—controls rudder
34. Inner steering wheel—controls trim tab
35. Aft grinder—turns backstay winches
36. Mainsail winch—helps tension mainsail
37. Hydraulics panel—selects trim devices
38. Mainsheet grinder—turns mainsail winch
39. Headsail trimmers' "foxhole"
40. Primary winches—tensions headsails/spinnaker
41. Primary winch grinder handles
42. Mast man cockpit
43. Winches for halyards, lifts, hoists
44. Turning blocks lead lines aft
45. Turning blocks for headsails/spinnakers



## SAILS AND SCIENCE

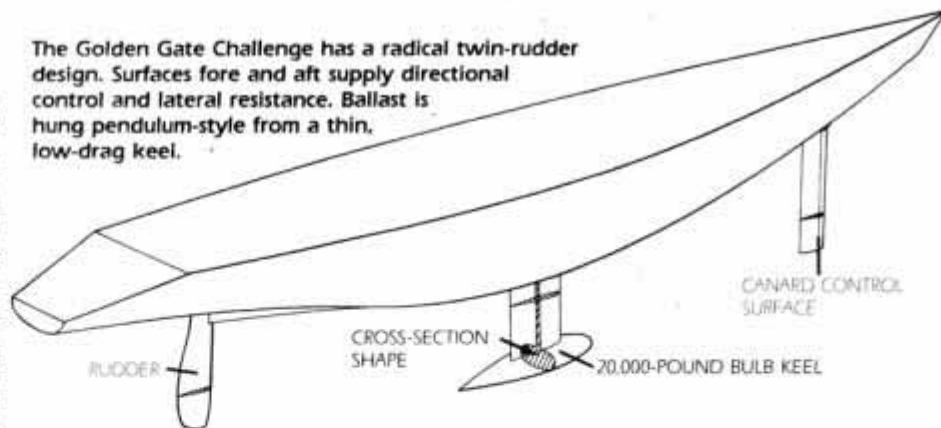
their secrecy-shrouded winged keels, which, in various forms, have become commonplace in 1987. The 65- to 70-ft. hulls are formed of aircraft-grade aluminum over extruded frames (except for this year's highly successful New Zealand challenger, which is made of molded fiberglass over a load-bearing truss system of aluminum tubing). The term 12-Meter refers to the sum of a boat's measurements at predetermined locations. A boat's measurements must add up to 12 meters, but it can arrive at this result by manipulating a multitude of coefficients.

Computers accumulate data on a boat's on-water performance. Beamed by telemetry to a shoreside mainframe, the data help establish performance optimums that a team will try to duplicate in competition. The crews' objective is to fine-tune the relationship between a boat's sails and keel. These foils must provide the same principle of high-lift, low-drag that makes an airplane wing work. When the wind presses against a yacht's sail plan, the keel at the opposite end of the pendulum pushes back, providing lateral resistance that propels the boat forward. The effect is like squeezing a pumpkin seed out from between your fingers.

On the sails side, designers have resorted to high-strength, low-weight materials like Kevlar and Mylar. These synthetics maintain sail shape in gusts, thereby imparting wind energy directly into forward motion, instead of allowing it to dissipate with sail distortion.

Keel shape, like sail shape, is critical, and designers strive to create a clean laminar flow over the keel's surface. Winglets are designed to have neutral

The Golden Gate Challenge has a radical twin-rudder design. Surfaces fore and aft supply directional control and lateral resistance. Ballast is hung pendulum-style from a thin, low-drag keel.



resistance through the water, and serve several useful functions. When applied in concert with a turbulence-reducing "inverted" keel—a keel which has a hull junction, or root, shorter than its bottom—lead-filled winglets can position weight lower in the boat. That keeps the boat more upright in most conditions, which allows sails and keel to work more efficiently.

The winglets also limit drag-inducing vortices. And when the boat does heel, even slightly, the leeward wing angles down into the water, which improves the boat's lateral resistance.

It's likely that some variation of the 1983 *Australia II* keel will win the America's Cup in Perth this month. But speculation continues to focus on several keel mutations. With the help of the Cray XMP-48 supercomputer, San Francisco's Golden Gate Challenge has reportedly developed a revolutionary canard control surface in front of the keel instead of behind it. Winning performance in early rounds indicate that this radical concept just may work, particularly in heavy air. Ring keels and keels with slots and slats have also appeared in concept form.

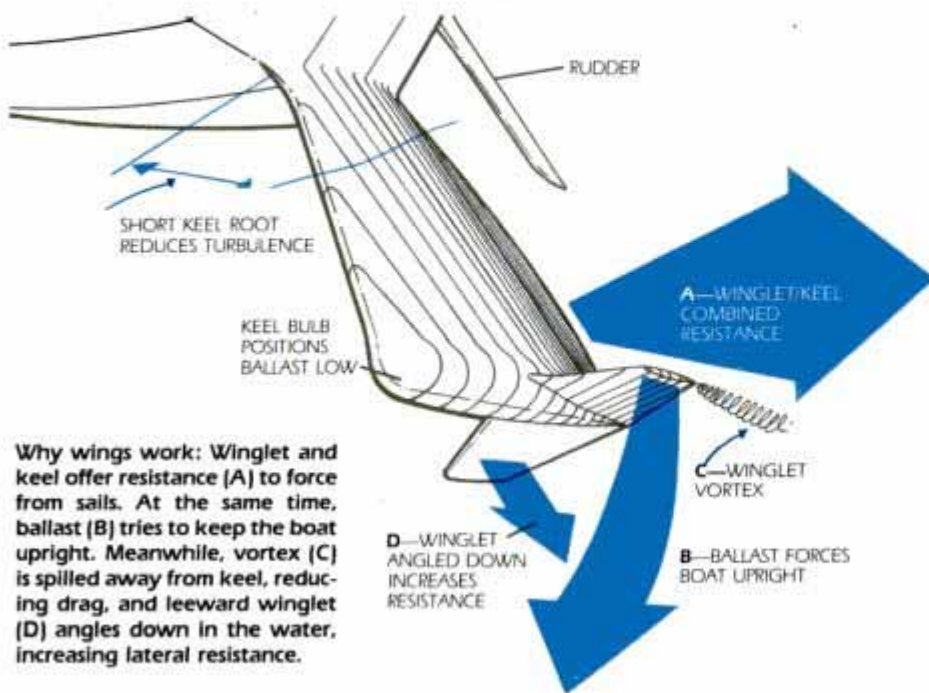
This kind of technology is useless, though, unless teams of sailors aboard each entry can wrestle the boat through the water. Skipper, navigator and tactician are the brain trust in the after part of the cockpit. The navigator determines the yacht's position on the racecourse. The tactician evaluates the yacht's position relative to the competition, making tacking and jibing recommendations to the skipper, who steers. The mainsail trimmer adjusts the sheet, or line, that controls the mainsail. Two genoa trimmers occupy foxholes port and starboard and haul in the sheets that control the genoa, or large triangular foresail. Two grinders operate the two main 3-speed winches port and starboard in front of the foxholes.

The mast man sits in another small cockpit just behind the mast and hoists spinnakers, staysails or the spinnaker pole "uphaul." The bowman, or point man, wears a special rappelling harness and works the foredeck—hauling sails through special deck hatches, snapping lines together for spinnaker sets, performing the intricate "dip-pole" jibe, and at times traveling up the mast on the end of a halyard to clear lines. The "sewerman" works belowdeck getting spinnakers and other sails ready for various legs of the multilap triangular racecourse.

The crew must work in fluid harmony to drive the boat at peak efficiency. Competition compounds the complexity—marked by fast, furious tacking duels and spinnaker sets. The result is an enterprise every bit as mentally taxing and physically arduous as "Monday Night Football." The biggest irony is the fact that all this effort is invested in a machine that sails upwind at a maximum (albeit stately) speed of about 9 knots.

Why so much trouble for an ornate Victorian mug that stands 31 in. high? Maybe it's the pursuit of scientific excellence. Maybe it's the way the Cup helps us focus our skills, our pride and our traditions. Maybe the thing that burns in a man's heart—that compels him to spend millions of dollars and years of his life—is the grand impracticality of it all.


PM



**Why wings work:** Winglet and keel offer resistance (A) to force from sails. At the same time, ballast (B) tries to keep the boat upright. Meanwhile, vortex (C) is spilled away from keel, reducing drag, and leeward winglet (D) angles down in the water, increasing lateral resistance.



# STEEL ON ICE



When lakes and rivers freeze, strap on your icesailer and hang on tight.

BY KAY ROBBERSON; Photos by David Brownell

**I**t's a game of reflex and decision, basic science and, in some cases, high art. It's called icesailing and it begins with the elemental blending of mind and muscle. Consider the sensations. An unseen gust tugs at a single 45-sq.-ft. sail. You grip the wishbone boom more tightly by instinct, letting the wind take you faster. The blades beneath your board hiss over the ice at breath-stealing speeds. You sheet in the sail, capture the gust and shoot away, the burning in your arm muscles countered by the sudden chill in the pit of your stomach.

From New Hampshire to Wisconsin to Europe,

Bundled up and helmeted, an icesailer at speed gets close to the elements on New Hampshire's Lake Winnepesaukee.



# STEEL ON ICE

more and more boardsailors are discovering that they love the wintertime variation of their sport. Using blades for sailing ice and special skis for sailing snow, boardsailors simply change the decks under their feet to enjoy their sport year-round.

Technically, icesailing is the cold-weather application of the now-famous freesail system—the coupling of a universal joint to the base of a mast. The mast is attached to a wishbone boom that the sailor holds. While the rig of a conventional sailboat remains upright and stationary, the freesail system used on a typical sailboard permits the rigging to move in any direction—up, forward, clockwise and counterclockwise. Rig movement controls steering.

Despite its growing popularity, icesailing had a somewhat bumpy beginning. During the 1970s, before most people had a clue to what Windsurfing was, pockets of speed-seeking boardsailors attached their sailboard rigs to skateboards and invaded empty parking lots. Concrete, however, proved much less forgiving than soft water: The same moves that got you wet at the lake got you black and blue, or worse, on concrete.

Then in 1981, a Block Island, Rhode Island, sailboard retailer named Henry duPont sent a newsletter to all the known boardsailors in New England. "We've found that when it freezes on Block Island, the season's not over," he wrote. "It's actually just starting."

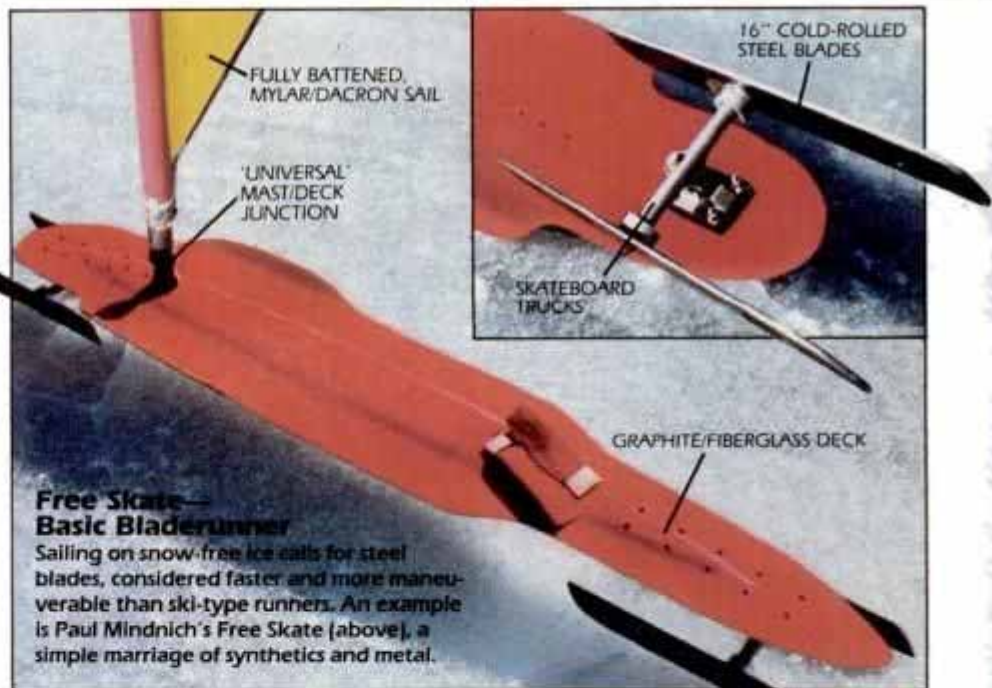
With detailed diagrams and a complete set of instructions, duPont told sailors how to build their own "Windsurfing ice boat." DuPont's iceboard was available as a kit, which included a sheet of 3/4-in. plywood stiff enough to support a sailor's weight. The two main runners, or blades, were attached to the outer sides of the deck after being mounted on angled runner supports. Each main runner was 24 in. long and 3 in. high, cut out of 1/4-in.-thick cold-rolled or spring steel and filed to a 90° edge. The single frontrunner was 8 in. of 2-in. angle-iron that was filed to a smooth, sharp edge. The kit came complete with machine bolts, carriage bolts, washers and woodscrews.

By today's standards, duPont's plywood deck and steel runners were fairly crude. "It was copied from photographs of the European machines," duPont says, "but it was easy to build, easy to sail and offered remarkably high performance. Speeds of 30 mph were attainable in 15-knot winds."

Farther south and not far from Block



A Winterboard takes to the snow (above). Note the hockey helmet and 1-piece winter coveralls: They're standard attire for most icesailing situations. At right, icesailors line up for the start of a race.



**Free Skate—Basic Bladerunner**  
Sailing on snow-free ice calls for steel blades, considered faster and more maneuverable than ski-type runners. An example is Paul Mindnich's Free Skate (above), a simple marriage of synthetics and metal.

Island's frozen ponds, a New Jersey boardsailor had a more sophisticated vision of how to use the freesail system on ice. Windsurfing on water gave sailors control, speed and freedom, and duPont's simple ice platform mainly provided speed. From his years of sailing ice boats, Paul Mindnich understood speed. What he wanted from an iceboard was the precision control he was used to on water.

A custom sailboard and surfboard shaper by trade, Mindnich saw the possibilities of coupling speed and efficient mobility on the ice. He built the

first Free Skate in 1983.

The Free Skate revolves around the idea of using four blades on two standard skateboard trucks, which are bolted to the underside of the deck. Mindnich manufactures and sells complete sets of blades which are made of 1/4-in.-thick by 2-in.-high cold-rolled steel pre-cut to 16-in. lengths.

The Free Skate deck consists of layers of fiberglass chopped strand mat, carbon fiber for enhanced longitudinal rigidity, and five layers of 34-ounce unidirectional fiberglass. Mindnich also uses four layers of 10-ounce surfboard





cloth. The Free Skate ushered in a whole new era, where the same skills required for water Wind-surfing carried perfectly over to ice.

While Mindnich and his sailing buddies tested the Free Skate on New Jersey ice, European boardsailors were also busy adapting their gear for winter. With more snow-covered lakes than clear, sailable lakes, much of European development focused on marrying board decks to skis, particularly in the Scandinavian countries. Europe's big contribution came in the form of Sam Tuurna's Winterboard.

Designed more for recreation than high-speed performance, the Winterboard is a steel-mesh deck with skis. Three of them, to be exact. At first glance, the skis look much like cross-country skis, but their steel edges and camber are designed specifically for sailing. The outer skis are set on an angle for lateral resistance and stability; the center ski is the tracking ski. It has no edges, but it's stiff and wide. A small skeg or fin is mounted on its trailing edge to help steer.

"The Winterboard is really a compromise design," says Bruce Caslowitz, a

Connecticut sailboard retailer. "It's made for sailing on ice or snow, but it's probably better for sailing on snow. The skis were built especially for the steel-mesh deck, and though it doesn't steer all that well, it's extremely stable and great for recreational sailors. Anybody who boardsails can get into it really easily."

Where do these ice machines usually congregate? Anywhere there's ice.

"Here in the Northeast," says Mindnich, "there's an underground network of ice hotlines, with recordings pulsing short blurbs of ice info every winter weekend." Mindnich says the area has long been known to conventional ice yachters as the Melt Belt, thanks to coastal weather patterns that turn snow into rain that refreezes into unobstructed ice.

Competition has intensified during the past three winters. Last season, icesailors converged on Lake Winnepesaukee for the Michelob Light Icesurfing World Championships, organized by Winterboard but open to all types of icesailers. The event marked the first time a major ice and snow sailing extravaganza brought sailors from around the world to one place to showcase their winter toys. Course racing and speed trials had been planned, and more than 10,000 spectators jammed the frozen expanse of Lake Winnepesaukee, waiting for action. The wind, however, left town, so the weekend turned into a winter social.

But the Michelob Light Worlds did highlight another important aspect of icesailing with the freesail system. Free Skates and Winterboards, while perhaps the most popular forms of the sport, are by no means the only way people are taking to the ice. Carl Meinburg of Mammoth, California, has been clocked at 48 mph on his Ski Sailer, which has a universal joint connected to a plate that's bolted directly to his downhill snow skis. Several variations on this theme—some using bars which attach to the sailor's ski boots—have also found their way onto the snow fields. And on the blade side, West Germany's Ingo Merz has created a large-size icesailer that's considered much faster, but far less maneuverable, than the Free Skate.

With two steady classes, and with experimentation under way by people like Meinburg and Merz, it looks like winter boardsailing is here to stay. With the wind in your hands and astonishing speeds under your feet, it's a thrill that seems to last from season to season.

PM





Super Beta  
HIGH QUALITY PICTURE

AF

tamovie

CCD

RCA

AUDIO



# INSTANT REPLAY

There are four varieties of video camcorders. We field-test each format to help you choose what's right for you.

BY JAMES B. MEIGS, Contributing Editor

**T**oday's camcorders are smaller and lighter, yet packed with more features than their predecessors of only two years ago. But that's where the similarities among the current breed end. Once you've made up your mind to buy one of these combination video camera/recorders, the tough decisions are just beginning. Camcorders come in four incompatible formats—VHS, VHS-C, 8mm and Beta—and in a bewildering array of configurations. How do you choose?

To find out, we selected one camcorder from each format and took them into the field for extensive hands-on evaluation. Our test procedure was simple. We shot the same sequence of indoor scenes with each camcorder, making sure to test its limits in various areas: low light, fluorescent and incandescent lighting, autofocus, picture

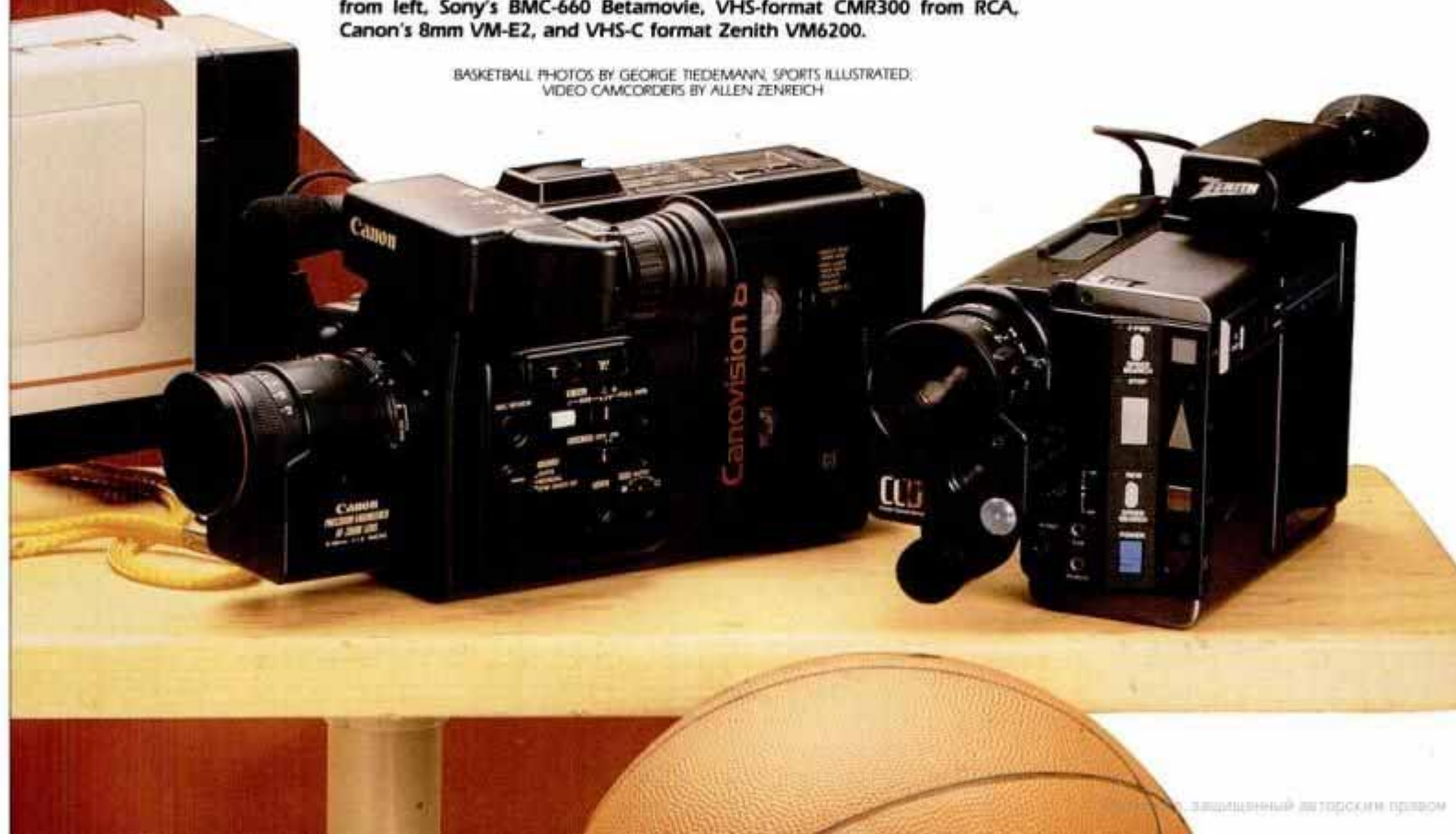
resolution, color quality and audio fidelity. We then took each model outdoors for a series of bright daylight shots. Finally, we evaluated the tapes by playing them back on a high-resolution monitor.

In each case, we used the camcorders' automatic functions—much as you probably will. Manual operation is possible (for example, to control focusing and white balance) and in some cases yields better results. However, we feel that out in the real world, most users will rely on automatic operation more frequently.

The results were encouraging: All the camcorders produced good pictures under most conditions, and were almost equally easy to use. From the conventional VHS camp we chose RCA's CMR300. This Hitachi-made unit, and the nearly identical Hitachi VM5000A, are the first camcorders of

**You won't take foul shots with any of today's camcorders, but each video format racks up points in different ways. Benchwarmers ready to shoot are, from left, Sony's BMC-660 Betamovie, VHS-format CMR300 from RCA, Canon's 8mm VM-E2, and VHS-C format Zenith VM6200.**

BASKETBALL PHOTOS BY GEORGE TIEDEMANN, SPORTS ILLUSTRATED;  
VIDEO CAMCORDERS BY ALLEN ZENREICH





## INSTANT REPLAY

any type to use an MOS (metal-oxide semiconductor) image-pickup chip. Other camcorders use either a vacuum-tube pickup or a CCD (charge-coupled device) imaging chip.

Zenith's VM6200 was our pick from camcorders with the compact VHS-C format. Having used the original Zenith VM6000 nearly two years ago (*Snow Motion*, page 84, Nov. '85), we were eager to check out the CCD pickup, picture-improving HQ circuitry and longer recording time afforded by its smaller, lighter descendant.

Alone among photography companies, Canon makes its own 8mm camcorders. Other photo brands buy theirs from major electronics manufacturers. For this reason, Canon's VM-E2 was our 8mm camcorder of choice. Sony makes 8mm models, too, but it's the only company that offers a Beta format camcorder. Accordingly, the BMC-660 Betamovie rounds out our shooting match. Here's how each camcorder fared in our tests.

### RCA CMR300

The bad things about this model are obvious at first glance. Like all models using full-size VHS cassettes, this is one big, heavy camcorder. The good things don't become apparent until you actually start shooting with it: The CMR300 is nearly foolproof to use and produces beautiful pictures.

RCA's design is as solid and depend-

able as a pickup truck—and about as elegant. For example, instead of producing a variety of smaller batteries to help keep the camcorder's weight down, RCA offers a single large one that should keep the camcorder running for close to two hours. (The longest tape available runs 2 $\frac{2}{3}$  hours.)

The camcorder's boxy profile and substantial weight—5.5 pounds, before you add the battery—both seem almost prodigious compared to the tiny mini camcorders available today. But the convenience of using a standard VHS cassette might well be worth the bulk to many owners of VHS home VCRs.

Despite its size, in fact partly because of it, the CMR300 is easy to hold and use. The rear of the camcorder rests solidly on your shoulder and, with the weight of the battery in back, provides a steady platform for shooting. With your right hand wrapped around the handgrip, the zoom controls and record button fall conveniently under fingers and thumb. The weight of the system is most likely to bother you not while shooting, but while lugging the camcorder around. This is a serious consideration: It could be the difference between deciding to carry your camcorder during a day of sightseeing or just leaving it behind.

The CMR300 has all the features camcorder buyers have come to expect in today's models: autofocus, a sizable electronic viewfinder (with indications

to keep you informed about what the recorder is doing), an instant review button (which plays back the final four seconds of your last shot so you're sure you got it), and more.

It also has a few nice extras: clock and date displays that can be recorded on the tape, and—our favorite—a continuous automatic white-balance function. All camcorders have some method of adjusting to the color tint of whatever light you're shooting in. Some simply have an indoor/outdoor switch, others require that you first shoot several seconds off a sheet of white paper to serve as a color reference. While RCA gives you the option of adjusting the color yourself, its continuous auto white balance handles most situations beautifully. We found it lent indoor scenes a warm, pleasing tone—even shooting under fluorescent lights. Outdoors, it was right on the money.

Perhaps the most impressive thing about the CMR300 is the MOS (metal-oxide semiconductor) chip it uses to pick up the image. Indoors, the MOS image pickup provided the best low-light pictures of any camcorder in the shootout, even in conditions so dim we didn't think we'd get anything. Outdoors, colors were bright and true. Resolution—or picture detail—was above average in all conditions.

### Zenith VM6200

This model is designed for people who

## TALE OF THE TAPE

VITAL STATISTICS				
COMPANY	RCA	Zenith	Canon	Sony
MODEL	CMR300	VM6200	VM-E2	BMC-660
FORMAT	VHS/HQ	VHS-C/HQ	8mm	SuperBeta
PICKUP	MOS	CCD	CCD	CCD
LENS	f/1.2 11.5-69mm 6X zoom	f/1.6 9-54mm 6X zoom	f/1.2 8-48mm 6X zoom	f/1.4 12-72mm 6X zoom
LIGHT SENSITIVITY <sup>1</sup>	7 lux	15 lux	8 lux	25 lux
AUTOFOCUS	Infrared	CCD	Infrared	Infrared
WHITE BALANCE	Continuous & Automatic	Continuous & Automatic	Separate indoor/ outdoor settings	Manual
RECORD TIME	160 min.	20:60 min.	120 min.	200 min.
PLAYBACK	Yes	Yes	Yes	No
VIEWFINDER	Electronic	Electronic	Electronic	Optical
WEIGHT <sup>2</sup>	5.5 lbs.	3.0 lbs.	3.5 lbs.	5.5 lbs.
PRICE <sup>3</sup>	\$1500	\$1500	\$1500	\$1500
PM HANDS-ON SCORECARD				
LOW-LIGHT PERFORMANCE	Best	Average	Above Average	Below Average
WHITE-BALANCE COLOR-TONE RENDITION <sup>4</sup>				
SUNLIGHT	Brilliant	Accurate	Brilliant	Brilliant
INCANDESCENCE	Warm	Accurate	Accurate	Accurate
FLUORESCENCE	Warm	Accurate	Accurate	Accurate
IMAGE RESOLUTION	Above Average	Average	Above Average	Best
AUDIO FIDELITY <sup>5</sup>	Average	Average	Best	Below Average

1. Manufacturer's rating; the lower the better. 2. Not including battery and tape. 3. Approximate retail at press time, before possible discounts. 4. With RCA and Zenith, the continuous white-balance was used. With Canon, the auto white-balance must be adjusted for indoor or outdoor lighting. Sony requires manual adjustments for each light condition. 5. All camcorders record monaural sound only.



want compatibility with their VHS home VCRs but don't want to lug around more than 5 pounds of machinery. It uses VHS-C cassettes—miniature cassettes holding 20 minutes of conventional VHS tape—that can play back in any VHS VCR once plugged into a special adapter tray.

If you don't want to bother with an adapter, the Zenith VM6200 camcorder itself can play back its tapes when connected to a TV set or to another VCR for dubbing. Using the tiny VHS-C cassette gives the Zenith an edge in size (only 9 in. long, compared to 15 for the RCA) and weight (a modest 3 pounds, without battery).

So what do you have to give up in the bargain? Not much. The VM6200 includes auto focus, power zoom, continuous auto white balance—all the standard features. The 20-minute tape length might seem a major limitation to some (although it's really more than enough for most applications). But for the occasions when you really need more, the camcorder includes the option of taping at the EP (Extended

Play) speed, stretching record time to an hour on one cassette. One touch we liked was the Instant Record Button, which powers up all the camcorder's functions and gets you ready to shoot with one touch. Another good idea: The autofocus sensor continues to function even when you are focusing manually. Tiny arrows in the the viewfinder guide you to the best focus in case you want a second opinion. This "focus assist" could be helpful if you wear eyeglasses.

Shooting indoors at the standard speed, the Zenith produced good pictures overall. Although it couldn't handle extreme low-light conditions as well as the RCA, it produced perfectly good pictures in normal room lighting. We did notice slightly higher levels of video noise—the buzzing graininess that particularly affects red areas of video pictures—with this model. Resolution, or picture clarity, was also slightly below the high standard set by RCA. Shooting outdoors, results were generally excellent. When we switched to the EP speed for longer record times, performance dropped visibly—as you might

expect at slow recording speeds. While many viewers might not notice the difference, we'd suggest that you shoot any important recordings at SP.

While the VM6200 is easy to hold and simple to operate, its very light weight can almost become a drawback. We found we had a tendency to swing it around too freely, producing some wildly unsteady shots.

Of course, this is a problem with any lightweight camcorder (including Canon's VM-E2). Overall, the VM6200 is a first-rate camcorder and an impressive piece of engineering.

## Canon VM-E2

What a beautiful piece of technology. Canon's latest 8mm camcorder, due in stores in the next few weeks, admirably reflects the lessons Canon has learned with its film cameras.

For example, Canon has moved the power zoom controls to the left side of the camera body. You operate them with your left hand while aiming the camcorder with your right—a position

*(Please turn to page 136)*

## Point And Shoot: Two For The Road

**N**ot everyone wants a zoom lens, an electronic viewfinder and all the other capabilities of today's full-featured video camcorders. Some people just want to push a button and make movies—the video equivalent of an instamatic film camera.

It was for this reason that Sony introduced its 2¼-pound 8mm Handycam last year. Now JVC has unveiled a similar point-and-shoot camcorder that works with VHS VCRs. Though JVC's new VideoMovie GR-C9 won't be available in the U.S. until later this year, the 1¾-pound camcorder is expected to be priced in the same neighborhood as Sony's Handycam (which is now available for about \$1000).

Judging by a hands-on workout of both products, the two camcorders are remarkably similar—and even look alike. The big difference is the format.

Sony's Handycam records on 8mm cassettes, and since it can't play back itself,

The simplest point-and-shoot video camcorders come in the 8mm and VHS-C formats. Both Sony's 8mm Video-8 Handycam (right) and JVC's VHS-C format VideoMovie GR-C9 (far right) have fixed-focus lens and record only.

Sony sells it with a tiny companion 8mm VCR (Model EV-C8U) to play back the movies. The need for a separate playback deck is, for some people, a major drawback. But once the 8mm tape is in the playback deck, it can be viewed on any TV set or copied to a VHS or Beta tape in another VCR.

JVC's GR-C9 also lacks the playback function. But it uses the tiny VHS-C cassette which, once placed in an adapter the shape of a regular VHS cassette, can play back in any VHS VCR. Although not everybody likes the idea of needing an adapter for playback, this approach makes the GR-C9 compatible with the VHS-format VCR you might already own.

Aside from format, both models embody the same design philosophy: Keep it simple. Both use elementary

optical viewfinders and basic fixed-focus lenses. (Sony's model does have a 3-position switch for focusing on close, medium and distance subjects, but you'll get acceptable results in any position. JVC includes a macro switch for extreme closeups.) Both camcorders have utterly simple operation: They power up as soon as you slide the lens cover open. To start recording, simply touch the single button on the handgrip.

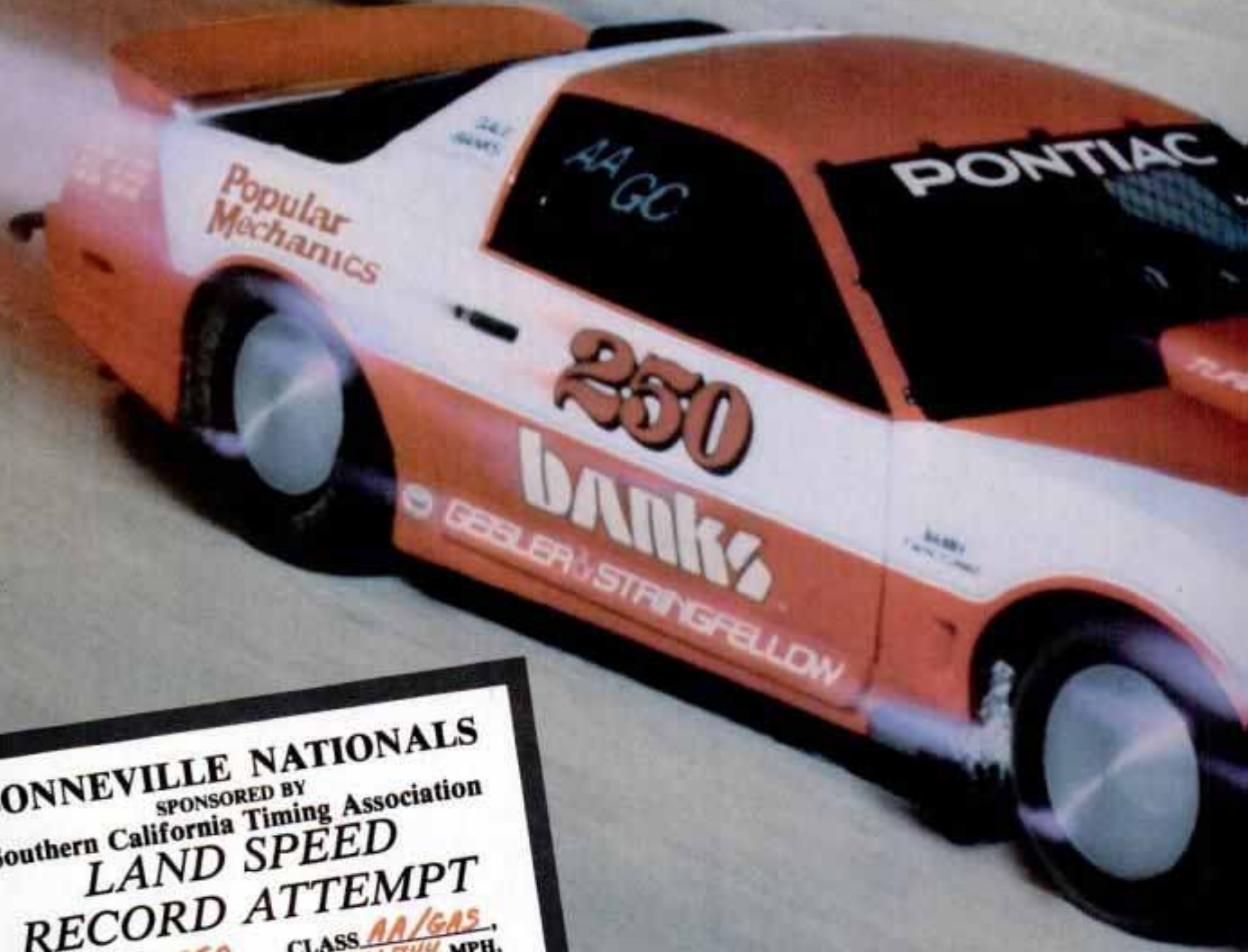
How are the pictures? In both cases, the pictures are quite acceptable, with good color and good low-light reproduction. Although neither model quite reaches the high picture-quality standard set by the best full-size camcorders, their images are more than good enough to satisfy most home moviemakers.—J.B.M.





# PROJECT SALT SHAKER

BY STEVE PARKER, West Coast Editor



## BONNEVILLE NATIONALS

SPONSORED BY  
Southern California Timing Association

## LAND SPEED RECORD ATTEMPT

VEHICLE NO. 250, CLASS AA/GAS,  
WITH AN EXISTING RECORD OF 201.744 MPH,  
QUALIFIED WITH A SPEED OF 211.619 MPH.

RECORDED DOWN RUN SPEEDS OF:  
2 222.072 3 243.463 4 252.805 5.

RECORDED RETURN SPEEDS OF:  
2 244.554 3 260.064 4 267.618 5.

A maximum two-way average speed of 260.211 MPH

RECORDED BY  
ACW

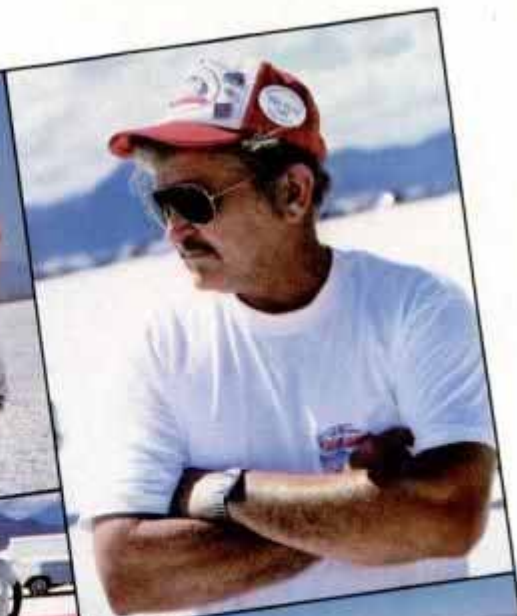
DATE 8-20-86  
MON TUE  WED THU FRI SAT

Timing slip shows qualifying speed plus speeds between mile markers 2 through 5 on the Pontiac's record run. The 260.211 mph average broke the old record by 60 mph.





Sunburned but happy crew poses with car. Driver Don Stringfellow (top right) ponders the task ahead. Front view of Firebird (lower right) shows blunt aero nose. Seventy-five pounds of cracked ice for turbo intercooler (near right) must be replenished at the start of every 3-minute record run.



We join Gale Banks Engineering to see what it takes to push a stock-bodied car to a new national Land Speed Record.

**A** small, dark object hurtles across the glaring white landscape, tracking a long black line painted on the surface, looking much as a toy slot car might against a backdrop of pure snow. From your stationary vantage point, you hear no sound, sense no vibration. But as the object nears, you begin to detect the unmistakable pounding of a high-performance V8. In a single moment the car, a Pontiac Aero Trans Am, is in your field of vision, and in another moment, gone again, following that black line on the salt into seeming infinity, approaching 270 mph and setting a world record.

Capturing a record at Bonneville Speedway, the polite name for the barren Salt Flats in northwestern Utah, is no easy matter. But shattering a record by almost 60 mph in one of the toughest classes of competition is a proud accomplishment. POPULAR MECHANICS, together with one of the best race teams to ever hit the Salt, had the good fortune to be a close part of just such an effort in August 1986.

PM's Trans Am has become the fastest production-bodied car in history, reaching an average speed during two runs of 260.211 mph, with a fastest run of 267.618. Car builder Gale Banks is a 25-year Bonneville veteran whose firm, Gale Banks Engineering of Azusa, California, is a premier turbocharging supplier and consultant. Banks





has had the car in development for three years to challenge the 201.744 mph AA/Gas Coupe record. Bruce Geisler, (with 13 Bonneville records), and driver Don Stringfellow (charter member of the elite 200 Mile Per Hour Club), are also part of the record-breaking team.

The PM entry at Bonneville was a 1986 Pontiac Trans Am with the optional Aero-body package. Running on slick Goodyear NASCAR Charlotte racing tires, with a Lamb Components frame and suspension closely resembling an NHRA Pro Stocker, it weighed in at nearly 5000 pounds!

It was going to take one mean engine to move all that weight. Nothing less than pure cubic inches and horsepower would fit the bill. A 454-cu.-in. V8, equipped with two intercooled turbochargers, computer monitoring of all vital engine functions, and twin Holley 4-barrel racing carbs, would be pumping out close to 1500 hp.

A 45-gallon water tank was mounted in the original gas tank position to supply the bulk of the cooling power. Running through a 4-in.-thick Modine NASCAR radiator, three separate thermostats controlled water flow, adding more and more coolant at 140°, 160° and 180°. An ice chest under the rear hatch was loaded with 75 pounds of chopped ice for the intercoolers. After a 3-minute run, the ice turned into gallons of 80° bath water.

A 5-speed Doug Nash transmission passed the 1500 hp to a 9-in. Ford rear end. Front brakes were removed, but the larger-than-stock rear discs were helped by twin Simpson parachutes. The 5-link rear suspension cut down on the car's side-to-side movement as much as possible.

An impressive array of analog white-on-black instruments on the dash was supplemented by a huge tachometer mounted in a pod to the right of the steering wheel. Two large warning lights were set to give notice of fuel- or oil-pressure problems, and an aircraft boost gauge reported on turbo performance. The driver controls the boost (the engine can handle 30 psi, more than three times that of a

stock passenger car) as well as the fire systems for the cockpit and engine compartments. Computer, engine electrics, instrumentation and all the rest of the electrical gear was motivated by a pair of garden-variety Sears DieHard batteries in waterproof marine cases.

### Day 1

Our caravan of trucks and motorhomes arrives on the Salt Flats on a Sunday, after the 14-hour trek from Los Angeles. We immediately set up a base camp, complete with tent-like enclosure for the car. Even though the tiny twin towns of Wendover and West Wendover (one gambles, the other doesn't), are only 10 miles away, the desolation of the dry lake is awe-inspiring. The ground is always brighter than the sky. The salt has the consistency of hard-packed snow. The reflection off the salt is dangerous: Don't venture out of the motorhome without sunglasses, a hat and plenty of sunscreen on your neck, chin and inside your nostrils!

The car is rolled off its trailer, the warmup plugs installed, and the engine is fired. Something doesn't sound right, and the machine is shut down. A lap-top computer is brought out of a tool chest to access information from the 32 channels available to "Hal," the friendly on-board monitoring system. Sure enough, one cylinder is showing a temperature of 500° while the others are at 1500°. The nonfiring cylinder could have spelled an abrupt end to the effort, but the computer caught it in time. The valvetrain will be replaced tonight.

### Day 2

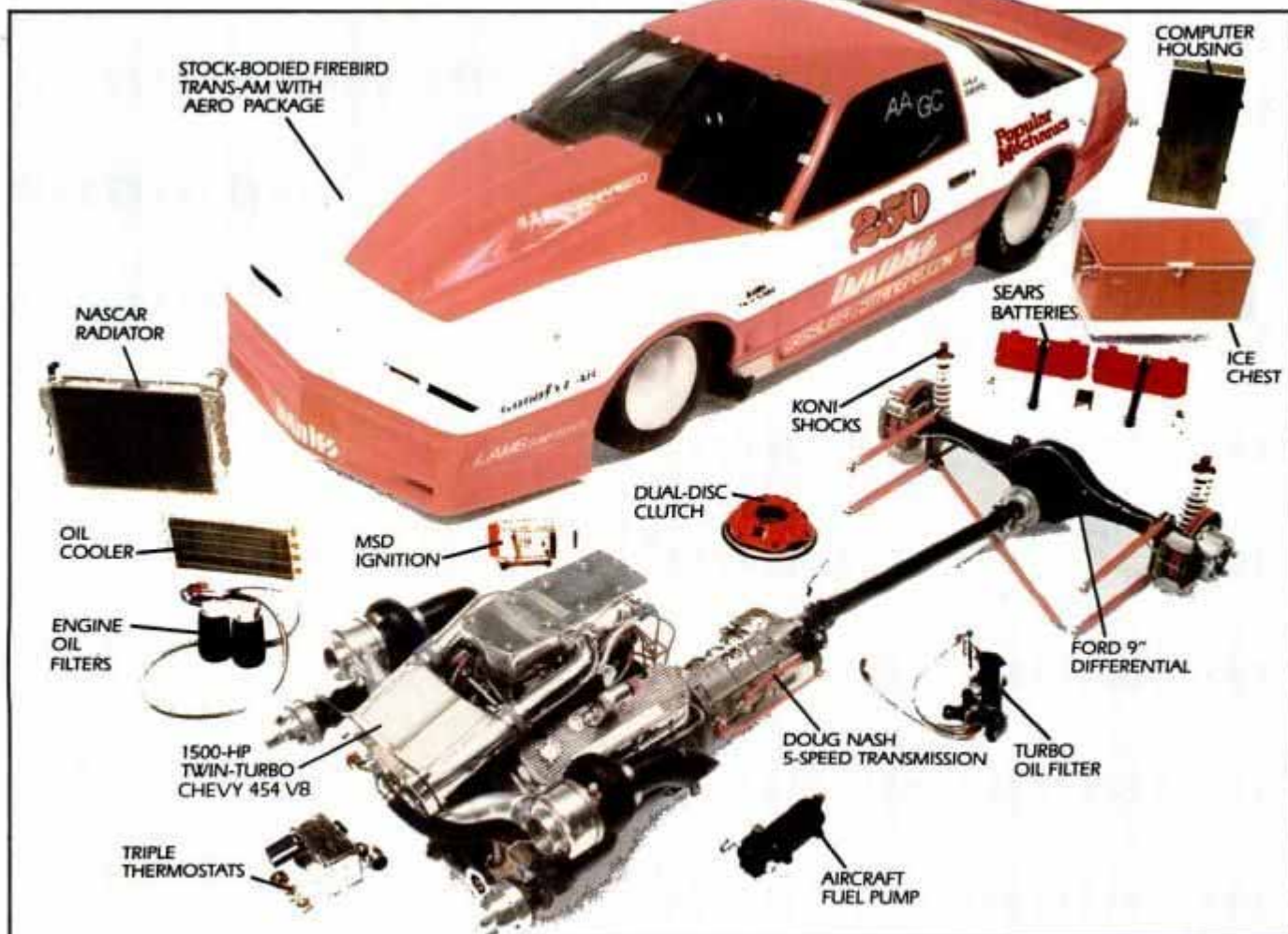
The team spends the entire day adjusting the engine, starting and stopping the powerplant, tuning it and reading out the results. The day gets very hot and the computer glitches badly when the temperature is over 100°. The engine runs, on and off, all day. But the car never moves.

*(Please turn to page 129)*





- 1 On-board computer "Hal" monitors engine and provides valuable tuning data.
- 2 Modine NASCAR radiator has a 4-in.-thick core.
- 3 Triple 140°, 160° and 180° thermostats control engine coolant flow.
- 4 Front springs are from ¾-ton pickup, rear coil-overs by Koni.
- 5 Twin-disc racing clutch and flywheel are by McLeod, bell-housing from Lakewood.
- 6 Autometer tach dominates racing instruments on dash.
- 7 Lamb Components supplied fat disc brakes and suspension.







# HOT-AIR CHOPPER

The next-generation helicopter will fly without a tail rotor, gearbox or transmission. It will literally run on hot air.

BY FRED MACKERODT, Contributing Editor; Illustration by Jeff Mangiat

**A** helicopter lifts off from St. John's, Newfoundland, and heads out over the Labrador Sea. It's target: an oil rig 100 miles offshore. The chopper cruises steadily at 120 knots, but the ceiling is only 800 ft. and a freezing 50-knot wind whips the water. This is not helicopter weather.

About halfway into the flight, ice starts to form on the landing skids. But the pilot knows he and his seven passengers are safe. The main rotor will remain free of deadly ice because it's heated by 300° F compressed air moving through the core of the blades. The air is pushed by a single turbojet powerplant, and the craft is so quiet that the passengers hear only a muffled whine.

After about 45 minutes, the ice-encrusted oil-drilling platform moves into sight. Now over the bright red target on the pad below, the pilot applies

backpressure on the cyclic, or control stick, to arrest forward motion. At the same time, he eases the collective—a lever at his right side—to keep from ballooning higher. The craft goes into hover and the collective is lowered even farther, bringing the chopper down smoothly. The pilot applies right-rudder pressure to align the helicopter into the wind, then the craft touches down.

Such oil-rig flights would be among the most arduous assignments for this new helicopter being developed by Voljet International Corp. of Caldwell, New Jersey. The Voljet does away with the need for a tail rotor and a lot of other power-robbing and trouble-prone mechanical linkages found on conventional helicopters.

On conventional choppers, tail rotors primarily control the torque created by the engine twisting the





HOT AIR FROM COMPRESSOR

HOLLOW ROTOR BLADES

HOT-AIR OUTLET

The Voljet Air Pressure Jet copter would approach an arctic oil-drilling platform without concern about icing. This unconventional chopper has a turbine linked to a single-stage air compressor that blows hot air through the main rotor and out the rear of the chopper.

manqiat



## HOT-AIR CHOPPER

shaft which turns the main rotor. Without the tail rotor to keep things straight, the airframe would spin in the opposite direction of the main rotor.

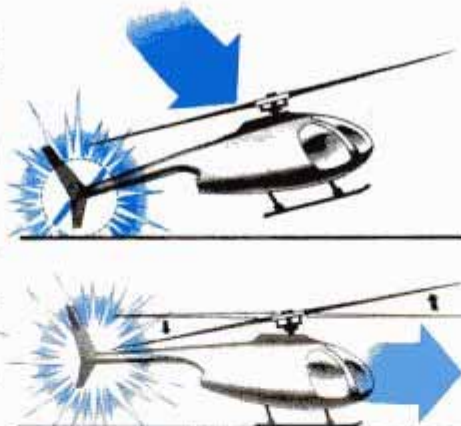
The Voljet 585 has a 1050-shaft-horsepower Pratt & Whitney PT6C-60 turbine—that much is conventional. It's hooked to a single-stage air compressor. Compressed air is ducted via the hollow rotor shaft and through hollow Kevlar-impregnated graphite rotor blades with a stainless-steel mesh in the leading edge. The air blows out the ends of the blades, spinning the rotor without creating torque.

Steering, which is also handled by the tail rotor in a conventional helicopter, is controlled by a simple rudder on the Voljet. During hovering and at speeds under 20 knots, the authority of this rudder is enhanced by directing the engine exhaust over it.

The Voljet, an Air Pressure Jet copter, is also much quieter than conventional choppers, a great advantage in an industry where operational noise considerations limit landing sights. A substantial portion of the noise in a conventional helicopter is created by tail-rotor buzz and transmission howl. Without these two items, the Voljet will be much quieter. In addition, the air exiting the wingtips smooths the airflow, diminishing another source of helicopter noise—blade slap.

The heat of the compressed air, which enters the rotor shaft at 300° and exits the blade tips at 200°, keeps the blades free of ice. This feature will be particularly important to offshore oil-rig operations where pilots are often forced to fly in icing conditions.

The lack of a tail boom adds to the maneuverability of the Voljet and is said to make it safer, especially in engine-out autorotation. Ninety percent of helicopter forced landings result in accidents involving the tail boom. There are two typical accident scenarios. In an effort to arrest the rate of sink without the benefit of power to "brake" for a landing, a pilot will tend to execute an exaggerated flare, making the helicopter rear back and driving the tail rotor into the ground. To avoid this, a pilot often attempts to make a flatter



Most accidents involving conventional helicopters take place on landing. At top, the pilot flares the craft and the tail boom strikes the ground. Above, chopper balloons forward to level off and the main rotor tilts back, cutting into the tail. Neither accident is possible with Voljet (below).



approach, sliding the helicopter in on its skids. This can cause the main rotor blades to tip, setting up a teeter-totter action which builds until it causes the main rotor to slice into the tail boom.

Because of the inertia built up in the freewheeling main rotor of the Voljet, the developers say that during autorotation it will be possible to make a soft landing, then take off, change position and land again—all without power!

Flying the new helicopter is also said to be much simpler, because it is inherently more stable and easier to control than a conventional chopper. According to the developers, "Anyone who can fly a Cessna 152 can fly the Voljet."

How does the general handling of a conventional chopper compare to the projected handling of the Voljet? In a conventional craft, collective (up-down) is raised to lift the helicopter off the

ground. At the same time, the throttle is increased to maintain both engine and rotor speed, and tail-rotor pedal (left-right) is applied to offset the resulting increase in torque to maintain the desired direction.

Cyclic (pitch forward-back, bank left-right) must now be applied to offset the lateral movement caused by the thrust of the tail rotor and the rolling tendency caused by the forces of the main rotor and tail rotor acting in different planes. The resulting tilt of the main rotor disc slightly decreases overall lift, requiring more inputs of collective, throttle and tail-rotor pedal.

Steady in the hover, a turn into the wind is initiated using the appropriate tail-rotor pedal. Throttle must be adjusted to compensate for the tail rotor's modified power demands, and collective must be adjusted to compensate for the resulting change in lift. Both throttle and collective requirements reverse themselves when the necessary tail-rotor pedal is applied to stop the hovering turn, when the craft is pointed into the wind.

To leave the hover and enter a normal climb, cyclic is eased forward, immediately causing reduced lift which must be compensated for by increasing collective. This necessitates increased throttle to maintain engine and rotor rpm. The resultant increase in torque must be offset by the application of the tail-rotor pedal to maintain the desired direction. Additional collective is applied to climb, again requiring throttle and pedal adjustments.

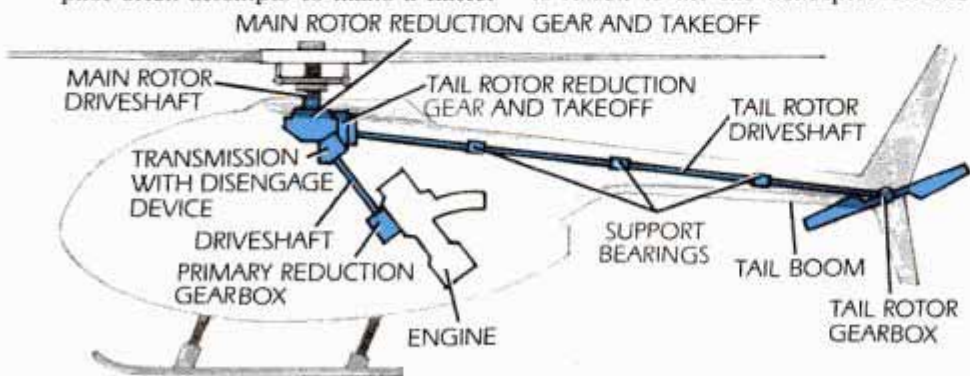
In the Voljet, collective is raised to leave the ground and stop at the desired hover height. The required rudder pedal is applied to position the nose into the wind. The cyclic is then eased forward, and the collective increased, establishing the desired climb.

While the Air Pressure Jet helicopter is a thing of the future, the idea actually goes back to Galileo, whose sketches depicted an air-driven gyro craft. Work on APJ copters began 40 years ago.

What will make the system more viable today are the technological advances that have taken place in the past 30 years. Compressor efficiency, which was 30 percent in the '50s, is 80 percent today, aided by improved materials for tighter tolerances. Better seals allow more thrust to reach the blade tips, and rotor materials also have greatly improved.

Projected cruise of the Voljet is 120 knots with 52-gph fuel consumption. Eight people can be carried. The company, which has flown three proof-of-concept examples, plans to deliver the first \$480,000 Voljet in 1989.

POPULAR MECHANICS will fly a prototype sometime before the end of the year. Watch for our story. **PM**



Color-coded parts in the conventional chopper shown above would not be in the Voljet.



# POWER SAW SECRETS

A look at the portable circular saw and its surprising versatility.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO  
Contributing Editor



**A**sk any house carpenter to surrender his portable circular saw and he might offer you his right arm instead. The saw is without question a carpenter's most valuable power tool. The features that make a circular saw indispensable to the building trade include portability, cutting power, adjustable depth of cut at 90° and 45° and reliable performance at an affordable price. Also, with the appropriate blade, the saw will cut a variety of materials including wood, metal, masonry and plastic. These same professional features make the saw an important tool for the home workshop, too.

A portable circular saw won't replace a table saw or radial-arm saw, but it can complement these shop tools. We'll show how, with the aid of a few simple shopmade jigs and guides, you can use a circular saw to perform a variety of cuts safely and accurately. But first, let's take a look at some saw basics, including safe operating procedures and blade selection.

## Saw mechanics

From a pure design standpoint, a circular saw is a rather simple tool. An electric motor powers a gear-drive mechanism that spins a shaft on which the blade is bolted. An on/off trigger switch is built into the top



## POWER SAW SECRETS

handle. The upper half of the blade is covered by a fixed protective guard. The blade's lower half is shielded by a spring-loaded retractable guard. As the saw advances into the workpiece, the lower guard rotates upward and out of the way. Once the cut is completed, the lower guard closes automatically. As important and effective as the blade guards are, remember that they don't shield the small portion of saw blade that projects through the underside of the workpiece. Always check the retractable guard before using the saw. It should slide up smoothly and close quickly without sticking.

The saw rests on a base plate, or shoe, that is raised or lowered to establish the cutting depth. Generally, the shoe is positioned so that the blade cuts through the workpiece by about  $\frac{1}{8}$  in. Also, the shoe tilts for making bevel cuts up to  $45^\circ$ . For maximum support and stability, choose a saw with a heavy-gauge, wrap-around shoe. It's worth mentioning that there are two different depth-of-cut mechanisms used on saws—pivoting shoe and drop foot. The pivoting-shoe mechanism, usually a locking lever or wingnut, is located behind the saw's motor. A drop-foot mechanism, found on higher-quality saws, is integrated into the saw's front knob. When a pivoting shoe mechanism is adjusted, the angle of the top handle changes. With a drop-foot saw, the handle's relationship to the shoe isn't affected regardless of depth of cut.

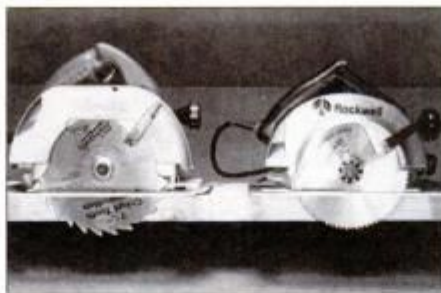
Portable circular saws are classified according to the diameter saw blade they use. Common sizes range from  $4\frac{1}{2}$  to  $10\frac{1}{4}$  in. Carpenters favor the mid-range models:  $7\frac{1}{4}$  and  $8\frac{1}{4}$  in. This includes the heavy-duty worm-drive saw. For do-it-yourself homeowners and woodworkers, the  $5\frac{1}{2}$ -in.,  $6\frac{1}{2}$ -in. and  $7\frac{1}{4}$ -in. saws provide a good combination of power and features.

The principal difference between the various size saws is that larger saws have a greater depth-of-cut capacity. For example, at  $90^\circ$  a typical  $5\frac{1}{2}$ -in. saw has a depth of cut of about  $1\frac{3}{4}$  in.; a  $6\frac{1}{2}$ -in. saw:  $2\frac{1}{2}$  in.;  $7\frac{1}{4}$ -in. saw:  $2\frac{7}{16}$  in.;  $8\frac{1}{4}$ -in. saw:  $2\frac{13}{16}$  in.

### Saw blades

To gain optimum performance from the saw, it's important to match the blade to the job. There are more than 20 different saw blade models available and each is designed for a specific purpose. Generally, the more teeth a blade has the smoother it will cut. Blades with super durable carbide-tipped teeth are unsurpassed for obtaining smooth, clean cuts. And, carbide-tipped teeth can be professionally sharpened and, in some cases, replaced to outlast a standard steel blade many times over.

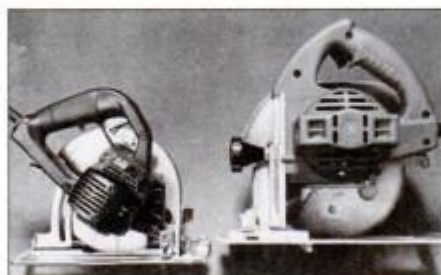
Shown on the facing page are eight



Larger  $7\frac{1}{4}$ -in. circular saw (left) cuts deeper than a  $6\frac{1}{2}$ -in. saw. Note that both saws will cut through 2-by ( $1\frac{1}{2}$ -in.-thick) stock.



Often saw design, not size, dictates depth-of-cut capacity. When set at  $45^\circ$ , this  $7\frac{1}{4}$ -in. saw (left) cuts no deeper than  $6\frac{1}{2}$ -in. saw.



With a pivoting-shoe saw (left), angle of handle changes as blade is raised. Drop-foot model (right) keeps handle in same position.



A worm-drive saw, distinguished by a long motor housing and rear-mounted handle, is the pro's choice for power and durability.



An arbor lock makes blade changing easy. Simply push in lock to keep arbor from spinning when removing arbor nut.



If your saw doesn't have an arbor lock, jam a wood block in the blade to keep the arbor from turning as you loosen arbor nut.



Remove blade and check spring on retractable guard for a buildup of resinous sawdust. Inspect and clean the spring periodically.



Most circular saws come with an accessory rip fence. Attach the T-shaped fence to the saw's shoe for making narrow rip cuts.

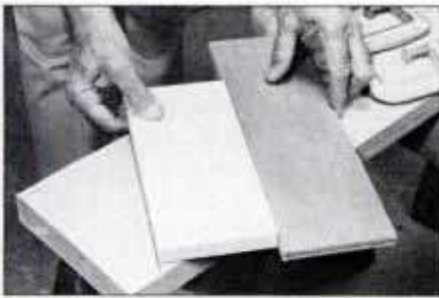


To determine where to clamp a straight-edge guide, first measure from an inward-facing tooth to the edge of the saw's shoe.

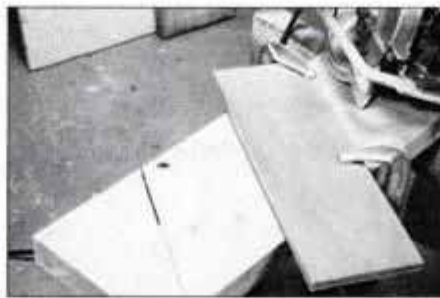


Then, use this dimension—in this case,  $4\frac{3}{4}$  in.—to position the straightedge guide exactly parallel to the cutting line, as shown.

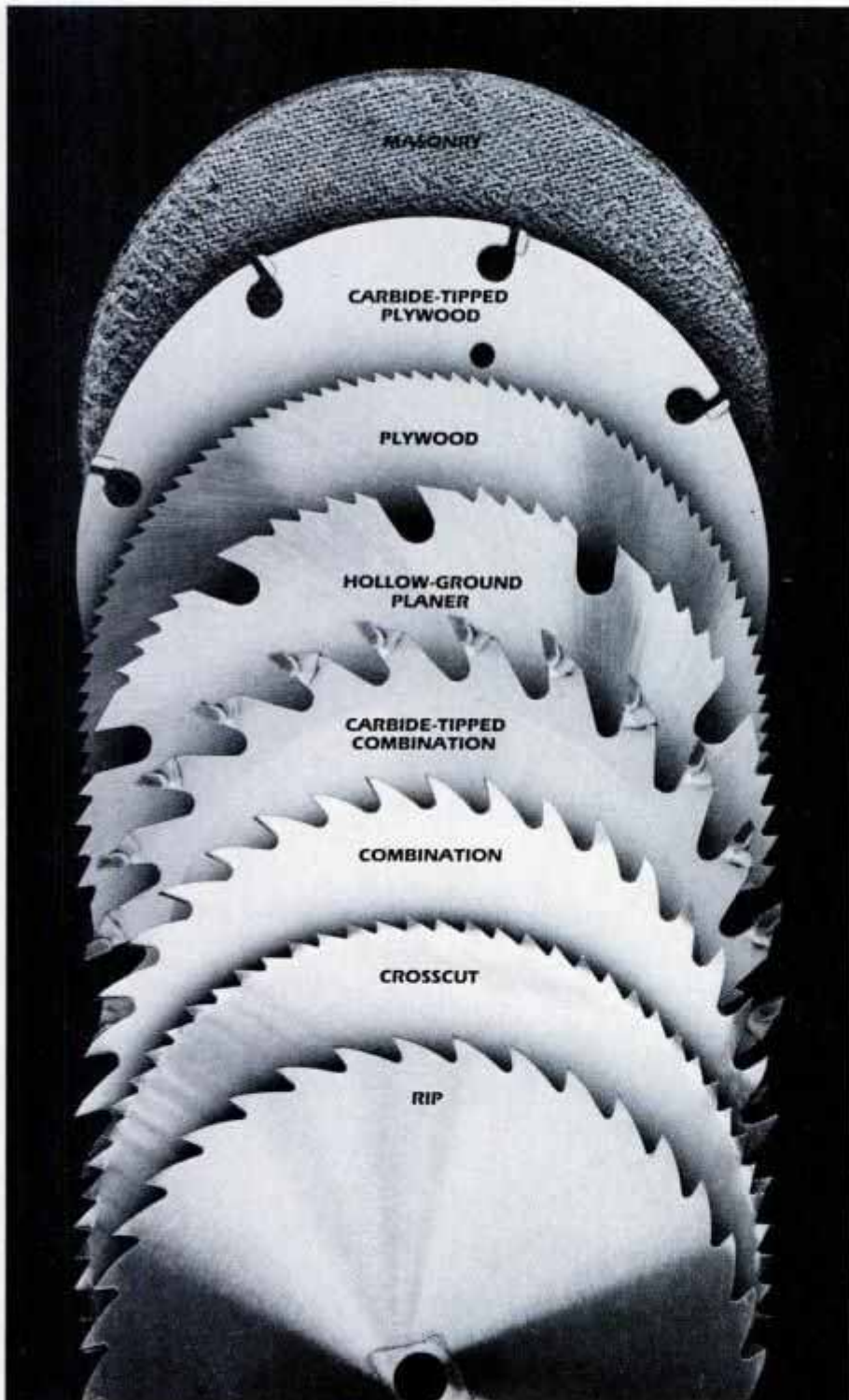




An offset block—a board equal in width to the distance from the blade to the edge of the shoe—helps position the guide quickly.



Clamp the guide to the workpiece, remove offset block and make the cut. Partial cut shows kerf exactly on cutting line.



Shown are eight of the most common circular saw blades. Each blade is designed for a specific type of cut or for use on a particular material. This basic lineup represents a small sampling of the numerous saw blades available for use on a portable circular saw.

common saw blades that together would handle most cutting jobs encountered by a do-it-yourselfer. A rip blade is designed for cutting in the direction of the wood's grain—known as ripping. The large teeth are set, that is, alternately bent left and right, to form a kerf that is wider than the saw blade body to prevent binding. A rip blade produces a quick, but somewhat rough, cut. For cutting *across* the wood's grain, use a crosscut blade. This blade has small teeth that are filed to knife-like points to shear wood fibers cleanly. Use a crosscut blade for cutting miters and moldings, too.

A combination blade is a versatile, general-purpose blade that is used to rip and crosscut. Although this popular blade doesn't rip or crosscut as well as the two blades mentioned above, it does produce fast, somewhat smooth cuts while reducing blade changes. Use it for all types of cuts in plywood, softwoods and hardwoods.

For a smooth, clean cut, nothing beats a carbide-tipped blade. The blade shown has 24 tungsten carbide-tipped teeth for making rip, crosscut and miter cuts. Carbide-tipped blades come in various styles with the number of teeth ranging from eight to 60 for cutting a wide variety of materials including wood, composition boards, plastic and nonferrous metals such as aluminum, brass and copper.

Another blade that produces super-smooth cuts is the hollow-ground planer blade. The teeth of this blade have no set. Blade clearance in the kerf is provided by the hollow-ground feature—the blade is thinner near its center than at the teeth. Use this blade for finish-cuts only, especially when cutting fine hardwoods. For optimum results, advance the blade slowly and steadily. The next blade is a hollow-ground blade, too. However, this 112-tooth blade is designed for smooth-cutting plywood, veneers and plastic laminate. The small, sharp teeth help prevent splintering the plywood's veneer.

Another version of a plywood blade is the Enduro carbide-tipped blade. Eight long-lasting carbide-tipped teeth cut aggressively through plywood, particle-board and oriented-strand board. This is a good rough-cutting blade for sheathing and floor underlayment.

The final blade shown is a masonry cutoff blade. This toothless blade is made of fiberglass-reinforced silicone-carbide abrasive. It comes in two grades: one for cutting hard masonry materials such as concrete, marble, granite and glazed ceramic tile; and one grade for cutting soft to medium-hard materials such as concrete block, common brick, flagstone and limestone. A metal cutoff blade made of aluminum-oxide abrasive is available for cutting



## POWER SAW SECRETS

all types of ferrous and nonferrous metals. The metal blade looks almost exactly like the masonry cutoff blade, but the two are *not* interchangeable.

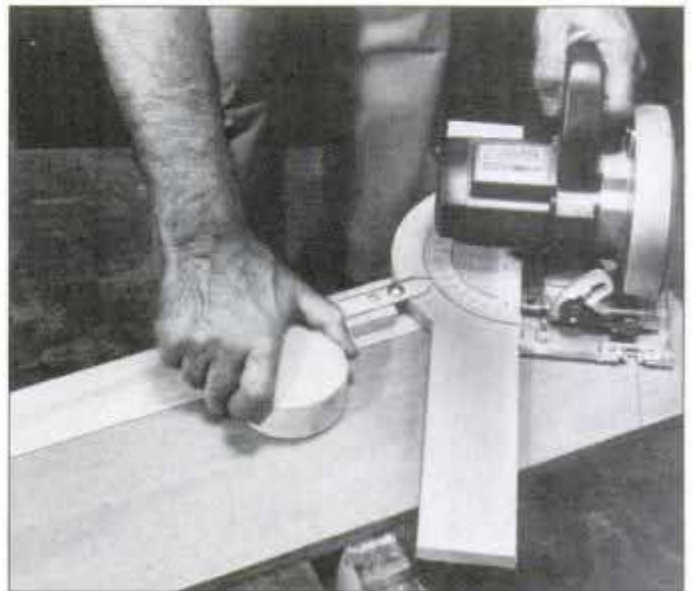
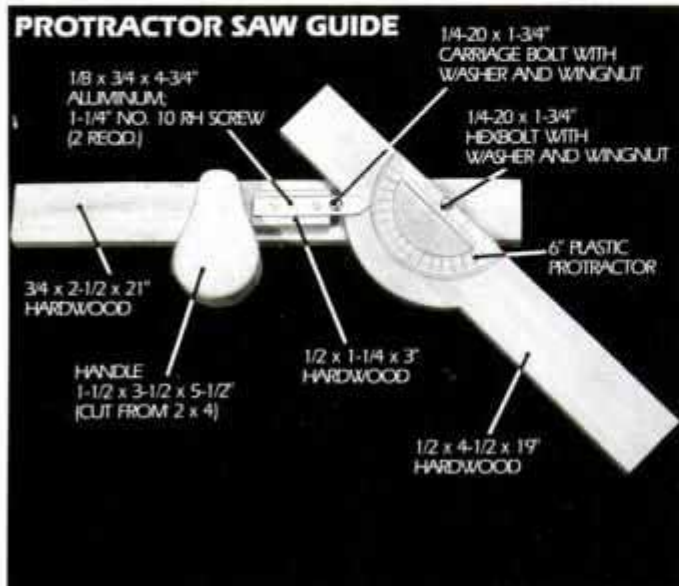
### Sawing techniques

Before we get into operating procedures, here are a few rules to promote safe sawing. Always unplug the saw to adjust the shoe and change blades. Use

a sharp blade that is the proper type for the material being cut. Be sure the arbor nut is tight. Check that the retractable blade guard is operating properly. Support the work on both sides of the cut to prevent pinching the blade in the kerf. Let short cutoffs fall freely to the floor. Protect your eyes with goggles or a face shield. Let the saw reach maximum rpm before starting the cut.

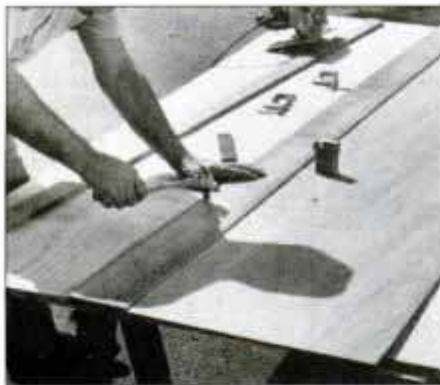
And, finally, always disconnect a power tool when you're finished.

On the job site, a portable circular saw is most often used freehand. A pencil line or snapped chalk line serves as a guide. However, in the workshop, where more precise cuts are required, a straightedge guide, or fence, is needed. The simplest guide is a straight board clamped to the workpiece parallel to the

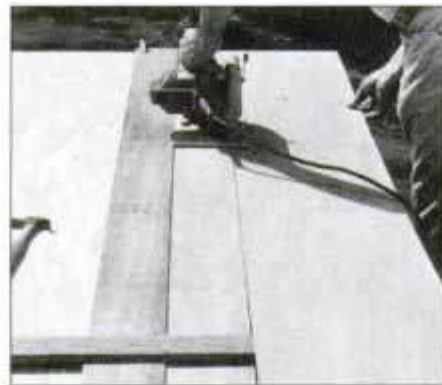


Cut precise miters with a protractor saw guide. This handy shop-made jig utilizes a plastic protractor for cutting miters up to 45° right and left. Jig size can be altered if necessary to fit a specific job.

Adjust the guide to the desired angle and tighten the wingnuts. Use the handle to hold the guide securely against the workpiece edge. The guide can be used to make accurate square (90°) cuts, too.



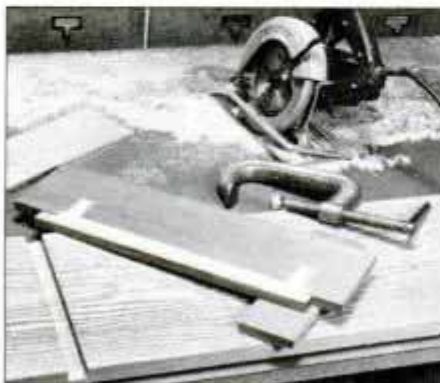
Make a self-aligning saw guide from two pieces of 1/4-in. plywood. Nail a 6-in.-wide strip to a piece that's at least 12 in. wide.



Then, run the saw's shoe along the edge of the narrow strip to trim the wider panel to size. The saw guide is now ready for use.



Position edge of guide on cutting line and clamp it in place. Now, make the cut. Keep the saw securely against guide strip.



Make dado-cutting guide from 1/2-in. plywood. Tape a strip to guide that's equal to dado width minus the blade's thickness.



Use an offset block to position the guide. Flip back the hinged strip and align edge of the offset block with the cutting line.



Make first cut with strip hinged back. Flip strip down and make next cut. Remove waste between kerfs with repeat-cuts.

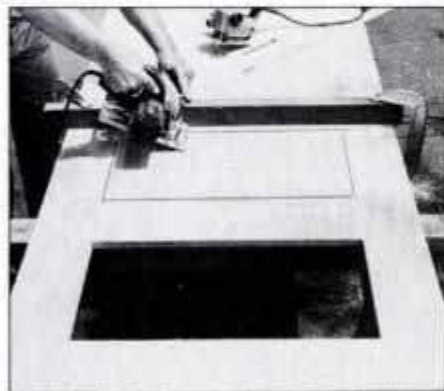




Use a silicone-carbide masonry blade to cut slate. Make the cut progressively; lower the abrasive blade slightly after each pass.



Cut all ferrous and nonferrous metals with an aluminum-oxide metal blade. Avoid side pressure that may shatter blade.



Tall fence aids in making pocket cuts. Retract blade guard by hand, raise rear of saw so blade clears work, and start the motor.



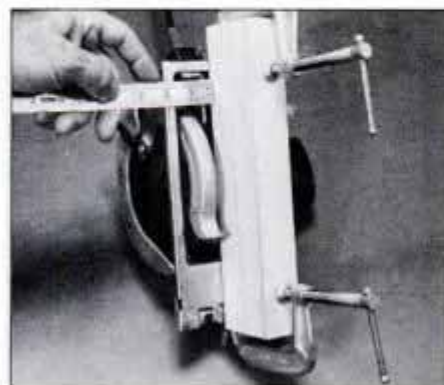
Then, lower saw slowly until it sits flat. Advance saw along the fence to the corner. Reposition fence for the remaining cuts.



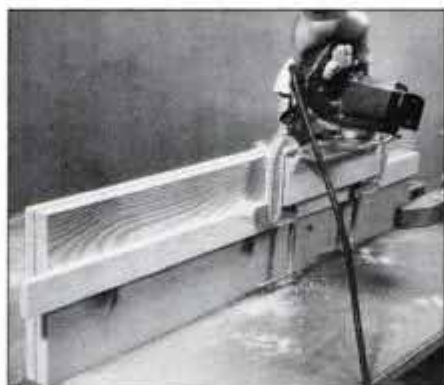
Tabletop jig has tracks for cutting 45° miters, as shown, and 90° square cuts. Make track width to accommodate your saw's shoe.



Track at end of jig makes accurate square cuts. Build jig to accommodate wide stock. This jig accommodates a 16-in.-wide board.



Make rabbet cuts with a wood block clamped to saw shoe. Measure from ends of block to be sure it's parallel with shoe.



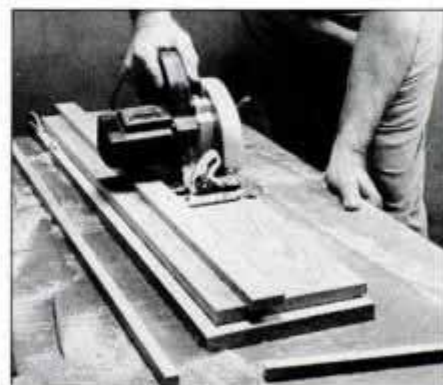
Tacknaill a fence to side of work to support block on saw. Advance the saw slowly while bearing down on fence.

cutting line. The distance between the line and the guide must equal the distance from the saw-blade teeth to the edge of the shoe. A quick, easy way to position the guide is to use an offset block—a 1/2-in. plywood board equal in width to the distance from the blade to the outside edge of the shoe. Simply hold the offset block on the line of cut and butt the guide against the block; no measuring is necessary. Make the cut with the saw's shoe held firmly against the straightedge guide.

Another convenient shopmade jig, especially for making long cuts, is a self-aligning guide. Start by nailing a 6-in.-wide × 8-ft.-long strip of 1/4-in. plywood to another 1/4-in. plywood piece that's about 12 in. wide × 8 ft. long. Then, trim the wider plywood panel while guiding the saw's shoe against the edge of the 6-in.-wide piece. To use the guide, simply clamp it to the workpiece with its edge on the cutting line, and make the cut.

For sawing accurate miter cuts, use a protractor saw guide (see photos on page 88). The easy-to-make guide adjusts for angles up to 45° left and right. It can also be set for making square (90°) crosscuts. Build the guide, as shown, using a 6-in. plastic protractor and a pointed aluminum bar as the angle indicator. Two bolts with wing-nuts keep the adjustable fence at the desired angle. Hold the guide using the handle on the 21-in.-long support fence. Insert two 1/2-in.-long anchoring pins, cut from brads or 2d finishing nails, into the edge of the support fence to keep the guide from shifting during use. Insert the pins with their points protruding about 1/16 in. The sharp points will stick into the workpiece to anchor the guide.

The dimensions of the guides and jigs shown can be altered to suit your specific saw and work. However, never use a jig that prevents the saw's safety system from functioning properly. The shopmade accessories shown are designed to *increase* the safety and accuracy of the saw. **PM**



After making edge cuts, reposition fence and make cuts to form rabbets. This technique works well for large, deep rabbets.







# COUNTRY CUPBOARD

Solid pine linen cabinet for your best blankets and cozy quilts.

BY AUGUST CAPOTOSTO

**B**efore the days of linen closets, special cabinets, known as linen chests, were popular for storing blankets, bedspreads, sheets and tablecloths. Today, linen chests have gained new-found popularity as closet space is squeezed out of new home designs. A linen chest has two seemingly contradictory features: It's both spacious and space-saving.

The easy-to-build Colonial-style linen chest shown, provides more than 13 sq. ft. of shelf space (more than 18 sq. ft. including the cabinet's top surface) while taking up only about 5½ sq. ft. of floor area. The 19¼-in.-deep cabinet will fit into the smallest room, or stand unobtrusively in a hallway. This simple cabinet is versatile, too. Use it as a bedroom clothes closet, dining room china cabinet, or in the kitchen as a pantry for storing canned goods and jars.

In keeping with the style of authentic Colonial-period furniture, we built this linen chest of pine. Pine, a softwood, is easy to work with and relatively inexpensive. If you'd prefer to build the chest of hardwood, use either maple or cherry.

## Cabinet construction

Start by edge-joining two boards together to form each cabinet side, shelf and the top. Be certain to cut the boards slightly oversized to permit trimming the parts to their final dimensions later. Join the boards with glue and ¾-in.-dia. × 2-in. hardwood dowel pins (see drawing detail 7). First, smooth the boards' mating edges on a jointer to ensure straight, tight-fitting joints. Next, use a doweling jig to bore ¾-in.-dia. × 1½-in.-deep dowel pin holes (photo 1). Space the holes about 12 in. apart. Spread glue into the holes and along each board's edge. Then, tap

in the dowel pins and drive the two boards together using a mallet and wood block (photo 2). Use pipe or bar clamps to hold the parts together until the glue dries thoroughly. Position clamps over and under the assemblies to distribute clamping pressure evenly and deter bowing. Once the glue has dried, rip and crosscut the panels on a table saw to their final dimensions (photos 3 and 4).

Next, rout ¼-in.-deep × ¼-in. dadoes in the cabinet sides using a ¼-in.-dia. straight bit (photo 5). The dadoes, three per cabinet side, will house the shelves. Also, rout a ¼-in.-deep × ¼-in. rabbet in the top inside edge of each cabinet side to accept the top frame (parts F and G in the materials list). Then, install a ¼-in. rabbeting bit with a ball-bearing pilot in the router and cut a ¼ × ¼-in. rabbet in the rear inside edge of each cabinet side to accept the plywood back (photo 6). Pencil the outline of the recessed cutout on the

bottom of each cabinet side, as shown in drawing. Cut recesses on a band saw or with a sabre saw. Sand the recesses smooth using a drum sander in a drill press or radial-arm saw (photo 7).

Now construct the top frame from 1×4s (actual dimensions: ¾ × 3½ in.). Join frame members with half-lap joints cut on a radial-arm saw. Assemble frame with glue and ¼-in. brads.

## Cabinet assembly

To begin, glue and nail the shelves and top frame to the cabinet sides with 6d (2-in.) finishing nails. Lay the cabinet on its back on a flat surface. Then, before the glue sets, square-up the cabinet and tacknail a wood strip diagonally across the cabinet face to hold it square until the glue dries (photo 8).

Next, cut the stiles (C) and rails (D and E) that form the cabinet's face frame. Join the upper rail to the stiles with glue and ¾-in.-dia. × 2-in. dowel pins. Clamp the frame together with the lower rail positioned temporarily



Linen chest stores more than just blankets. Use it for china, clothes, even canned goods.

Color photo: J.R. Rost  
Black-and-white photos: August Capotosto  
Technical art: Eugene Thompson  
Photo styling: Gabe Herrick



## COUNTRY CUPBOARD

between the stiles (photo 9). Then, bore  $\frac{3}{8}$ -in.-dia.  $\times$  1 $\frac{1}{2}$ -in. dowel pin holes in the front edge of each cabinet side; bore four holes per side. Insert dowel centers in the holes, position the face frame on the cabinet, and press down to transfer hole locations to the rear of the frame (photo 10).

Now use a drill guide to bore  $\frac{3}{8}$ -in.-dia.  $\times$   $\frac{3}{8}$ -in. holes in the frame where indicated by the dowel centers. Cut down eight  $\frac{3}{8}$ -in.-dia.  $\times$  2-in. dowel pins to about 1 $\frac{1}{2}$  in. long. Apply glue to the holes and cabinet sides, insert shortened dowel pins and attach the frame to the cabinet with bar clamps.

Clamp a straightedge guide to the cabinet stile to rout the decorative V-

shaped groove. Position the fence so that the router's  $\frac{1}{4}$ -in.-dia. V-groove bit is  $\frac{1}{2}$  in. from the stile's edge (see drawing detail 4). Adjust the router's depth of cut to  $\frac{1}{4}$  in. and cut the groove (photo 11). Repeat this procedure for the other stile. Now install a  $\frac{1}{4}$ -in.-rad. rounding-over bit with ball-bearing pilot. Rout the edge of each stile to complete the detail (photo 12).

Next, glue and nail the top to the cabinet with 3d (1 $\frac{1}{4}$ -in.) finishing nails (photo 13). Use bar or pipe clamps and large C-clamps to hold the top until the glue dries (photo 14). Then, attach lower rail (E) to the bottom shelf with glue and 6d finishing nails. Attach  $\frac{3}{4}$   $\times$   $\frac{3}{4}$ -in. cove molding (J and K) to the sides and

front of the cabinet with glue and  $\frac{3}{8}$ -in. brads. Also, cut the cabinet back, but don't install it yet.

### Door construction

The doors feature frame-and-panel construction. The stiles and rails are assembled with tongue-and-groove joints. We planed down  $\frac{3}{4}$ -in.-thick stock to  $\frac{1}{4}$  in. for the door panels (J), but you could use  $\frac{1}{2}$ -in. pine plywood.

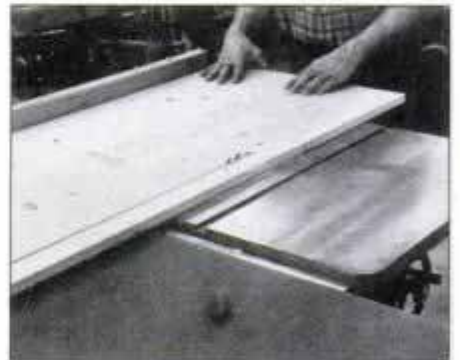
First, cut the stiles and rails to the dimensions given in the materials list. Install a dado blade in the table saw and cut a  $\frac{1}{4}$ -in.-wide  $\times$   $\frac{5}{16}$ -in. groove in the inside edge of each rail and stile to accept the panel. Use a featherboard, as shown in photo 15, to hold the work-



**1** Bore  $\frac{3}{8}$ -in.-dia. dowel pin holes in board edges with the aid of a doweling jig. Masking tape gauge on bit acts as a depth gauge.



**2** Spread glue in holes and on board edge. Insert dowel pins, tap two boards together using rubber mallet and wood block.



**3** After the glue dries, rip panels to size. If necessary, joint one edge straight. Then, cut panel with jointed edge against the fence.



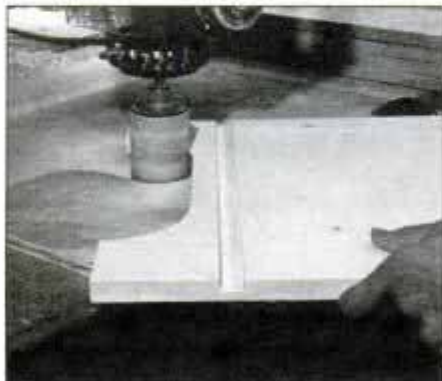
**4** Crosscut panels on table saw. Tacknail a wood strip to bottom of panel. Strip rides in miter gauge slot in saw table to control cut.



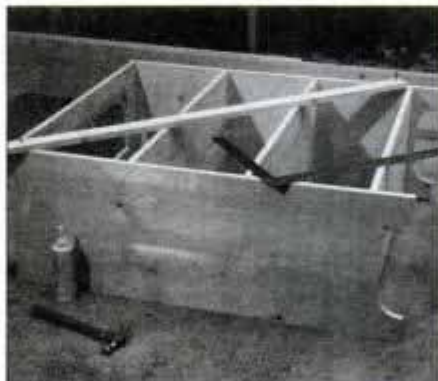
**5** Rout dados for the shelves in the cabinet sides with  $\frac{3}{8}$ -in.-dia. straight bit. Parallel straightedge guides ensure accurate cuts.



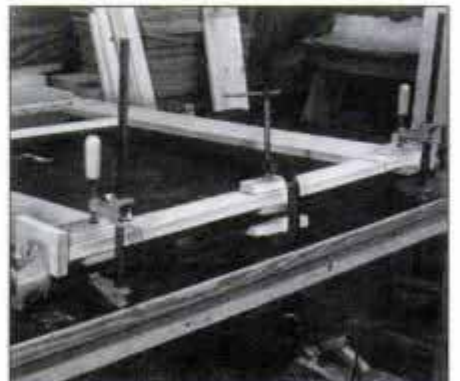
**6** Rabbet rear inside edge of cabinet sides to accept plywood back. Rout rabbets with  $\frac{3}{8}$ -in. rabbeting bit with ball-bearing pilot.



**7** After sawing the recessed cutout in the bottom of the two cabinet sides, use a 3-in.-dia. sanding drum to smooth recesses.



**8** Once the cabinet has been glued and nailed, tacknail a wood strip diagonally across the cabinet front to hold it square.



**9** Assemble face frame with dowel joints. Clamp the frame, as shown, with lower rail in position temporarily until the glue dries.







## COUNTRY CUPBOARD

piece against the saw fence. Be careful when grooving the short rails that they don't drop into the wide slot in the dado blade table insert. To prevent this, groove a long board and then crosscut the rails to size.

Next, readjust the saw fence and dado blade to cut a  $\frac{1}{4} \times \frac{1}{4}$ -in. tongue in both ends of each rail. To ensure safe, accurate cuts, use a tenoning jig as shown in photo 16. (For plans to build the tenoning jig shown, see *Woodworking Jigs*, page 104, Nov. '83.) If you decide to plane down  $1 \times 10$ s to  $\frac{1}{4}$  in. thick for the door panels, as we did, be sure to choose boards that are knot-free or that have small, tight knots. Large knots will loosen and fall out when planed so thin.

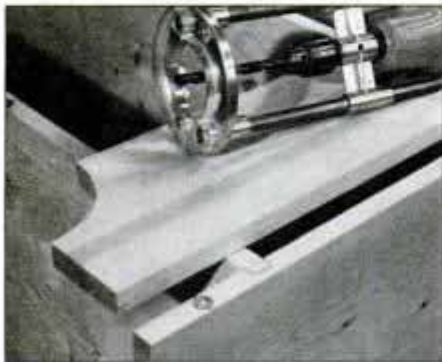
Begin assembly by gluing the lower

rail between the stiles (photo 17). Then, insert the panel and glue the upper rail in place. Don't glue the panel into the grooves. This will allow the panel to expand and contract freely. Clamp each glued-up door assembly together using short bar or pipe clamps and C-clamps (photo 18). Position waxpaper-covered hardwood bars, known as cauls, under the C-clamp jaws to distribute clamping pressure and prevent bowing.

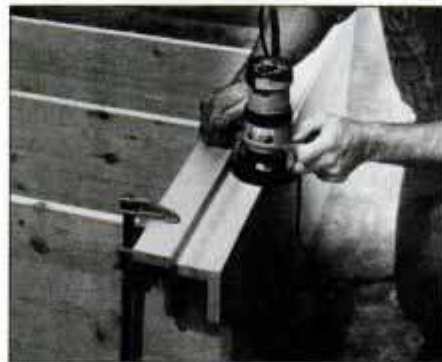
After the glue dries thoroughly, use a dado blade in the table saw to cut a  $\frac{3}{8} \times \frac{3}{8}$ -in. rabbet in the right side stile of the left-hand door, and the left side stile of the right-hand door (see drawing detail 5). The rabbets allow the doors to overlap when closed.

Sand all parts with 120- and 220-grit abrasive paper. Apply one coat of sand-

ing sealer thinned three parts sealer to one part lacquer thinner. After the sealer dries, sand lightly with 220-grit paper, wipe all surfaces with a tack cloth and apply one stain coat. We applied a mixture of three Minwax stains. The mixture consisted of: five parts cherry (No. 235), three parts Colonial maple (No. 223), and one part dark walnut (No. 2716). Let the stain dry overnight. Then, apply four coats of shellac thinned to 3:2 cut with denatured alcohol. Sand lightly between each coat with 220-grit abrasive paper. Rub down the final coat with 4/0 steel wool and apply a protective coat of paste wax. Finally, hang the doors with  $\frac{3}{4} \times 2\frac{1}{2}$ -in. nonmortising hinges, install the knobs and attach the back with  $\frac{3}{8}$ -in. brads. **PM**



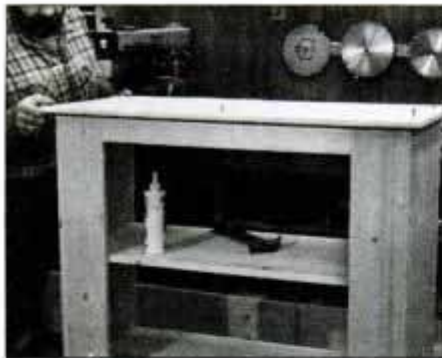
**10** Attach face frame to cabinet with dowel pins. Use dowel centers to transfer hole locations from cabinet to back of frame.



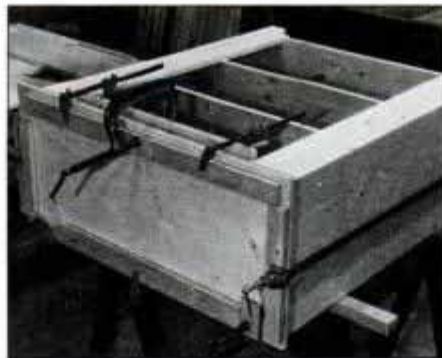
**11** Rout a decorative groove in face frame with a  $\frac{1}{4}$ -in.-dia. V-groove bit. Clamp straightedge in place to guide router.



**12** Then, complete the decorative detail by rounding the outside edges of the face frame with a  $\frac{1}{4}$ -in.-rad. rounding-over bit.



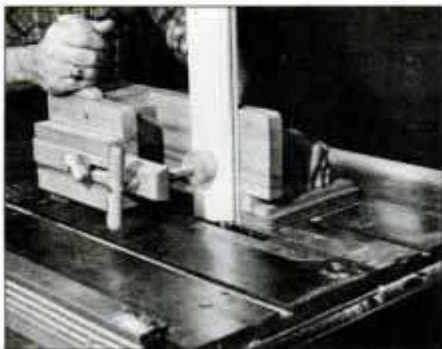
**13** Attach the top with glue and 3d finishing nails. The nails are used to keep the top from shifting when glued and clamped.



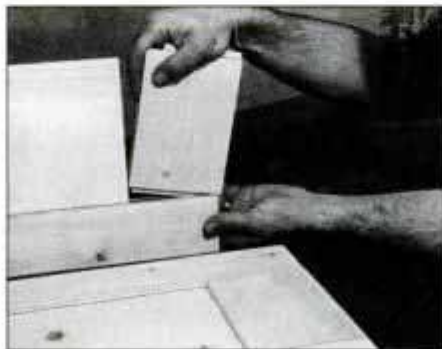
**14** Clamp the top securely to the cabinet until the glue dries. Boards under clamp jaws protect piece and distribute pressure.



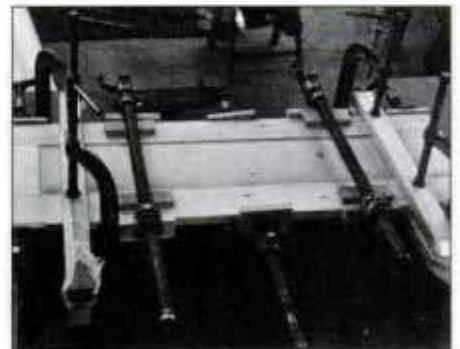
**15** Cut  $\frac{1}{4}$ -in.-wide grooves in door rails and stiles with dado blade in table saw. Featherboard holds workpiece against saw fence.



**16** Cut  $\frac{1}{4} \times \frac{1}{4}$ -in. tongue on ends of door rails safely with a tenoning jig. The tongues could be cut on a radial-arm saw, too.



**17** Apply glue to the groove in door stile and insert rail. Don't glue the door panel in place. It must expand and contract freely.



**18** Use this setup to clamp the doors. Wax paper-covered cauls are protected from glue squeeze-out to distribute pressure.



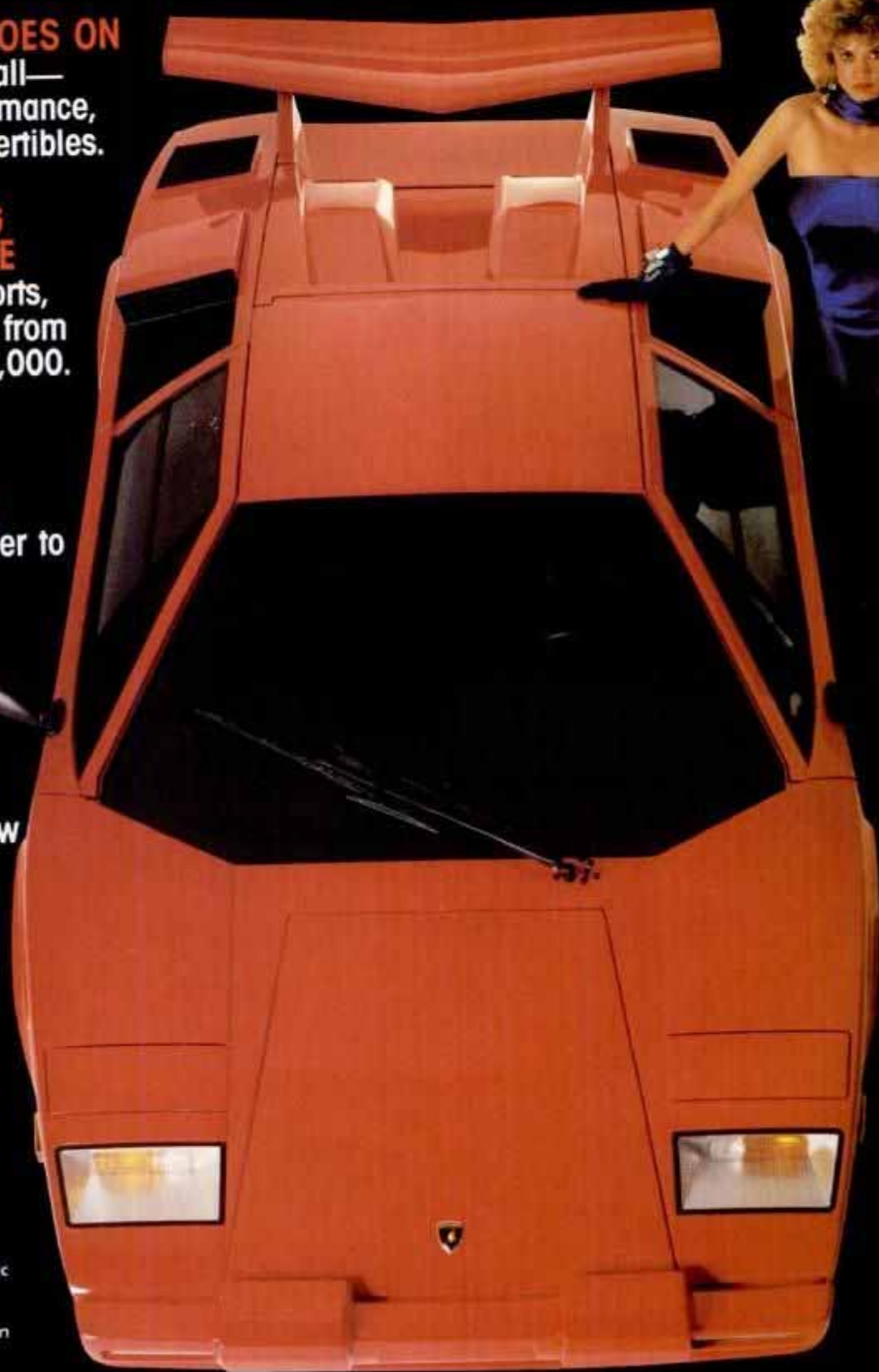
SPECIAL REPORT

# IMPORTS '87

● **THE HEAT GOES ON**  
Imports have it all—  
economy, performance,  
luxury and convertibles.

● **SOMETHING  
FOR EVERYONE**  
All the '87 imports,  
with list prices, from  
\$3990 to \$198,000.

● **DETROIT'S  
JOINT  
ADVENTURES**  
It's getting harder to  
'buy American'  
when Chevys,  
Chryslers,  
and Fords  
are being  
designed and  
built abroad.  
Here's a preview  
of upcoming  
models.



Lamborghini's superexotic  
Countach 5000 Quattro-  
valvole and friend: top  
speed, 180 mph; 0 to 60 in  
five seconds flat.



Seat belts save lives

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**SUBARU XT. THE SPORT MAGAZINE  
SUPER BOWL MVP AWARD.**



**"SON, I THOUGHT YOU WERE GOING TO BUY A SUBARU."**

**"BUT DAD, I DID."**

**SUBARU**  
Inexpensive. And built to stay that way.

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# CONTENTS

## THE HEAT GOES ON

Importers are giving Detroit a run for your money in every market segment, from super economy cars to ultra luxury machines and everything in between—performance cars, convertibles, sports sedans, “personal” cars. You name the market niche, and some importer has an entry.

## SOMETHING FOR EVERYONE

A buyer's guide to all of the 1987 imports including list prices, from the \$3990 Yugo GV to the \$198,000 Rolls-Royce Limousine.

## DETROIT'S JOINT ADVENTURES

It's hard to “buy American” when even Chevys, Chryslers and Fords are being designed and built abroad. Here's a preview of upcoming “captive” imports and multinational car-building ventures—from Fords built in Australia and Mexico to Chryslers built in the U.S. on Mazda chassis!



### ITALY

Alfa Romeo

Bertone

Ferrari

Lamborghini

Maserati



### SWEDEN

Saab

Volvo



### GERMANY

Audi

BMW

Mercedes-Benz

Merkur

Porsche

Volkswagen



### JAPAN

Acura

Chevrolet

Chrysler

Dodge

Honda

Isuzu

Mazda

Mitsubishi

Nissan

Plymouth

Subaru

Toyota



### MEXICO

Mercury



### BRAZIL

Volkswagen



### FRANCE

Peugeot

Renault



### ENGLAND

Aston Martin

Bentley

Jaguar

Lotus

Rolls-Royce

Sterling



### SOUTH KOREA

Hyundai

Pontiac



### YUGOSLAVIA

Yugo

Section cover photo by Bill Ashe. Styled by Palmer Manetti. Lamborghini courtesy of Meadowlands Car Imports, North Bergen, N.J. Dress by Jackie Rogers. Hair by Gail Mangold. Shoes by Albanese, 482 Park Ave., NYC. Stockings by Fogal. Jewelry by Wendy Gell.



# THE HEAT GOES ON

BY WADE HOYT, Automotive Editor

**I**mport cars are hitting our shores in an ever-growing variety, giving the American car buyer a choice of personal transportation unmatched anywhere else in the world, and forcing domestic automakers to be more competitive in what they offer the buyer. At last count there were 34 distinct dealer networks in the U.S. selling products from overseas. More are expect-

ed over the next 12 months. In the old days, Detroit had to compete with the imports only on price: cheap little cars from Europe and Japan versus big American barges. It was a simple contest: You paid less and you got less car. As the quality of foreign cars rose, and in many cases surpassed that of the domestics, Detroit had to battle on that front, too.

Next, it was engineering, as various imports forged ahead with such innovations as diesel engines, front-drive and MacPherson strut suspension, while Detroit played catch-up.

For a long time the imports pretty much confined themselves to opposite poles of the market, building ultra-expensive luxury and sports cars, or cheap econoboxes.



GERMANY  
BMW 735i



SWEDEN  
Saab 900 Turbo  
Convertible



**Imports have every market niche covered, from the cheapest to the most expensive.**

No more. The imports have now expanded across the board, challenging the home team in every market niche from economy cars to luxurious, high-speed sports sedans, with a wide range of family sedans and specialty cars in between.

When Chrysler revived American interest in convertibles a few years ago, the importers were right there. This year, there are even more import drop-tops.

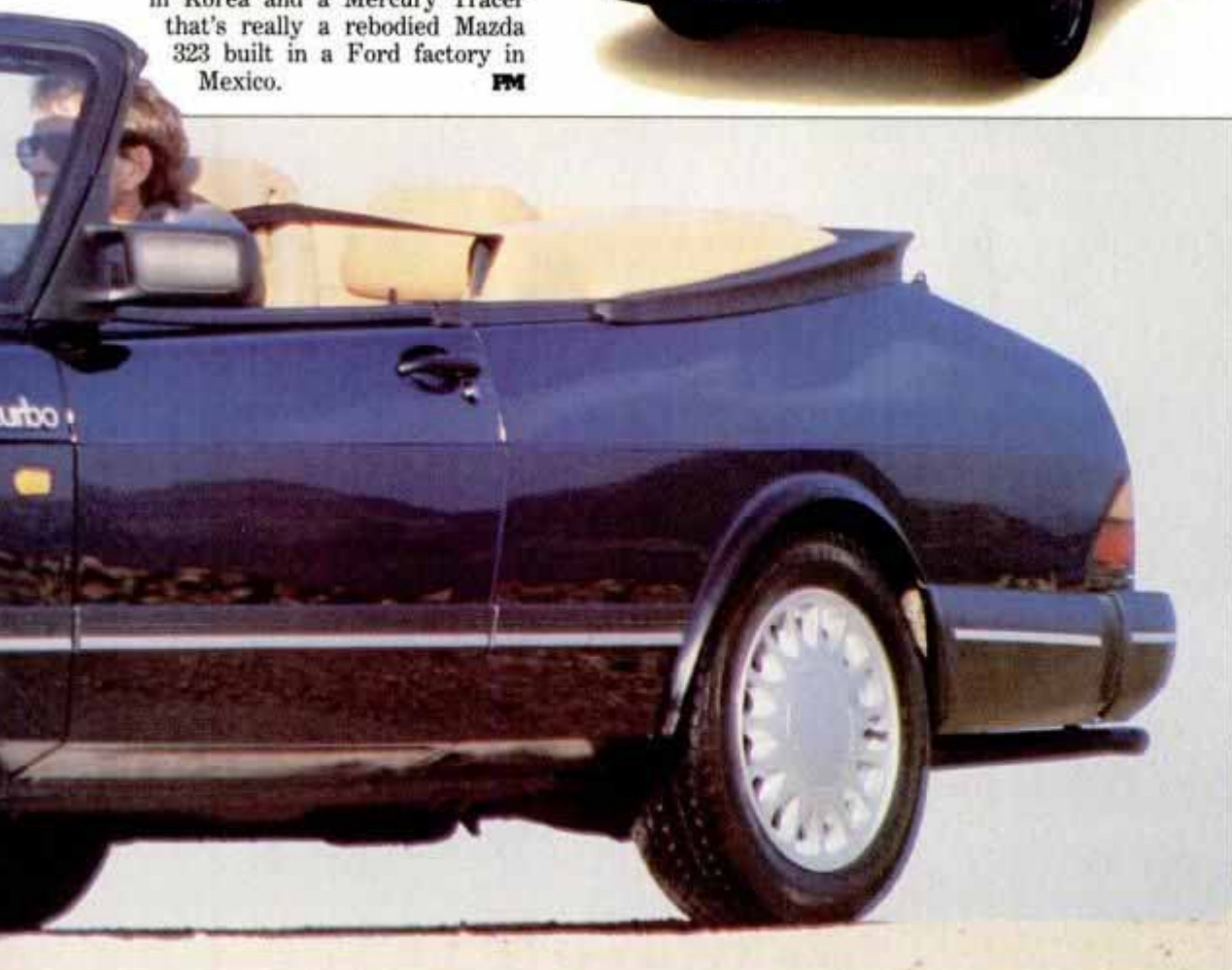
You want speed and luxury? Sample the restyled BMW 735i. Wait a while, and you'll be able to buy it with a 340-hp V12!

Want economy? Try the 3-cylinder Subaru Justy, or the Chevrolet Sprint built by Suzuki. The Sprint is only one of a growing number of "captive" imports that include a Pontiac LeMans built by Daewoo in Korea and a Mercury Tracer that's really a rebodied Mazda 323 built in a Ford factory in Mexico. **FM**

**JAPAN**  
Subaru Justy



**MEXICO**  
Mercury Tracer





# SOMETHING FOR EVERYONE

BY JIM DUNNE, Detroit Editor



JAPAN  
Toyota Camry



SWEDEN  
Volvo 780

**T**oday's import shopper is faced with a dizzying array of cars. New names like Justy, Fox, Sterling and Tracer add more choices at both ends of the price ladder. Many carryover nameplates like BMW 735i, Camry, Audi 4000, Jaguar XJ6, Stanza and Tercel are being re-vamped for '87.

Pontiac's newest LeMans is a good example of the complexity a shopper faces today, and is a harbinger of more to come. LeMans is an old Pontiac nameplate—taken from a French racecourse—that is now used on a German-designed car being built in Korea. GM owns part of Daewoo, the Korean company that produces the LeMans. GM also owns Opel, where the LeMans ancestor was introduced in 1985 as the Opel Kadett. So, with the design already proven in Germany, the cheaper labor available in Korea, and the need for an entry-level car in the Pontiac lineup, GM's planners came up with the LeMans concept. You can look for similar combination cars in the next few years.

How can the average buyer sort through the flood of models and come up with a

reasonable choice? Three important criteria help narrow the choice: price, location of dealers and body style needed.

Price is the easiest of all. A study quoted by Volvo says that the average car buyer spends 28 to 35 percent of a year's disposable income on a new car. That one-third may amount to the monthly payment, but it still serves as a good guide to what most people feel they can afford. The study shows that the one-third fraction has held steady since the 1930s.

Don't buy a car without local dealer support. If you have a choice between a hometown Honda dealer and a 20-mile







**As the dollar sinks slowly in the West, importers stir more luxury, more power and more economy into their stew.**



**SOUTH KOREA**  
Hyundai Excel

distant Toyota outlet, lean toward the Honda.

You'd be surprised how the choice of body style will cut down on the number of cars you have to choose from. Some lines don't offer station wagons. Convertibles are still scarce, even though more of them hit the market each year. Three-door hatchbacks are common among the mini compacts, but you won't see them much in the mid- or full-size lines.

Listed below in alphabetical order are the import offerings for 1987:



**SOUTH KOREA**  
Pontiac LeMans

**Acura**—Acura enters its second year in the U.S. with the luxury 4-door Legend sedan and 2- and 4-door Integra sport hatchbacks virtually unchanged. Prices are up an average of 4.3 percent over 1986 Honda-produced newcomers. Biggest change is a

**GERMANY**  
Porsche 928S 4





**SPECIAL REPORT**  
**IMPORTS '87**



**ENGLAND**  
Sterling 825SL

new option package for the Legend: leather seats, 4-way electric powered seat adjustment, heated outside mirrors and vanity mirrors inside.

**Alfa Romeo**—Newest model in the lineup is the Milano, a 4-door, 5-passenger sports sedan that offers all the driving fun that Italian cars are noted for, including crisp handling and a 130-mph top speed that will keep you up with Mercedes, BMWs and Jaguars. The Milano has a 154-hp, 2.5-liter V6 engine and standard 5-speed manual transmission that will move it from 0 to 60 mph in a quick 8.5 seconds. Introduced in the U.S. last summer, the Milano comes in three models: Silver, Gold



**JAPAN**  
Toyota Tercel

and Platinum. The premium version has leather/suede seats and antilock 4-wheel disc brakes among a long list of standard safety and comfort features.

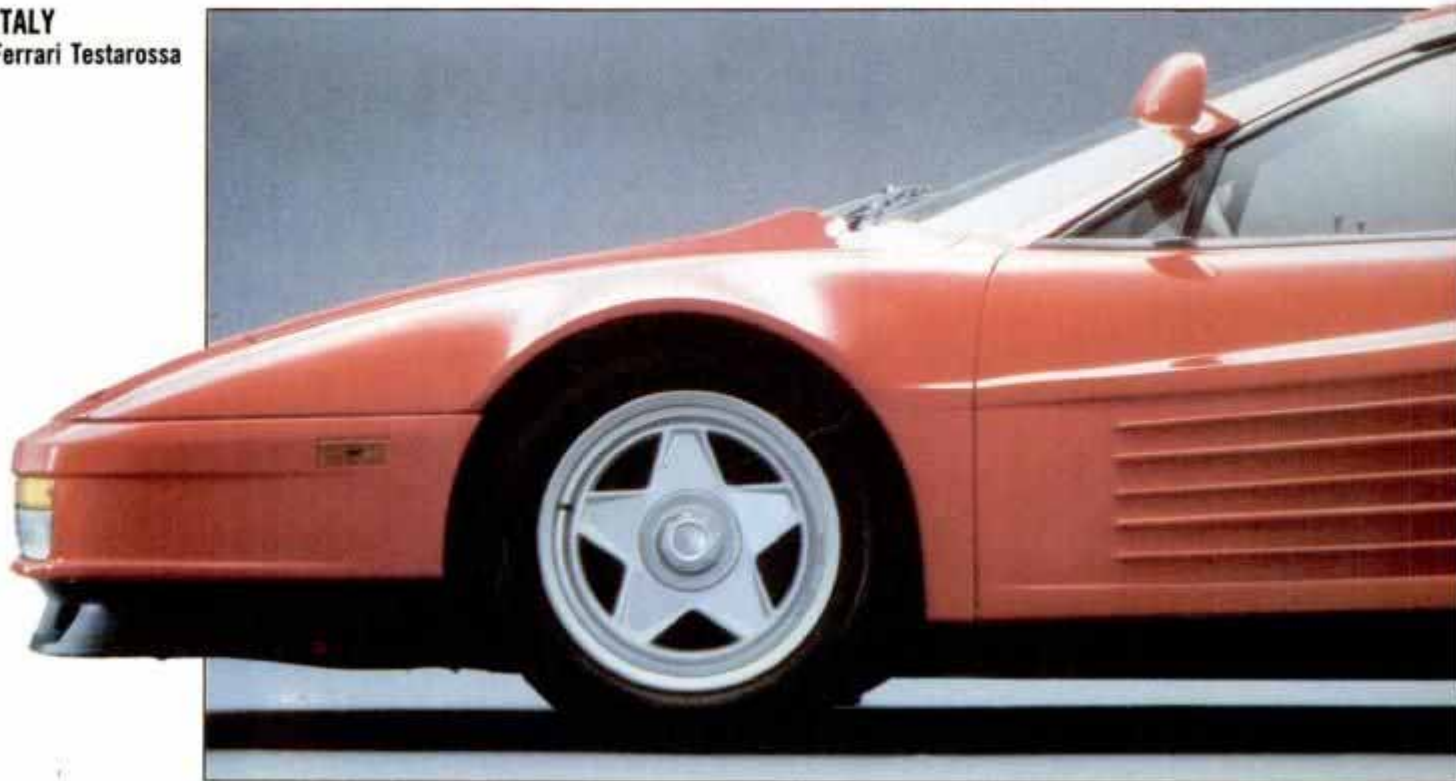
**Aston-Martin**—Generally the same car for 1987 as '86, except that the fuel-injection system introduced in mid-1986 will be in all models. The made-in-England sports cars are powered by a 5.3-liter V8 and rank with the fastest production cars in the world. Buyers of this marque have a choice of 3-speed automatic or 5-speed manual in all but the top-line Lagonda, which only has the automatic. The \$167,000 price keeps the car exclusive. Only 25 are sold in the U.S. each year.

**Audi**—Big changes are in store for the 4000 line of Audis, but not until later this year. By June, the completely restyled 4000 will be in dealerships, but until then there is little new in that line or the 5000 series except for paint colors. The sleek new 4000 made its first appearance at the Paris auto show last year and is on sale in Europe now, but U.S. buyers will have to settle for the older style Audi for a few more months. The new car looks much like the 5000, with heavy emphasis on aerodynamics, more rounded shapes and flush-fitting windows.

**Bertone**—Fiat's X-1/9 still lives, but a replacement is on the drawing boards. Officials expect that 2000 to 2500 will be sold in 1987. The mid-engine sports car has better heating and factory-installed air conditioning for 1987, along with cast-alloy road wheels and some new exterior colors.

**BMW**—The 3-Series convertible has arrived. Next month the 325i Cabrio goes on

**ITALY**  
Ferrari Testarossa





sale. As if it needed it, the 535i model now has a sport version, called the 535is, to challenge the best of the high-priced sport sedans. Firmer springs and shock absorbers, a front air dam with fog lights and a trunk-mounted spoiler do the trick for the high-speed driver, while a 10-way, electric-powered seat will make him feel just right behind the wheel.

March 1987 is the introduction date for the restyled 735i, a car which has "virtually everything different" from the current seven series. To control the 3.5-liter, 6-cylinder, ohc inline engine, the 735i uses the next generation of Bosch electronics plus a catalytic converter. Power is up to 208 from 182. An air bag for the driver and ABS brakes are standard. By mid-year a 340-hp, 5-liter V12 will be available.

**Chevrolet**—Turbos are in style with both Chevy imports. The Sprint turbo boosts power by 40 percent in the fuel-squeezing 1-liter, 3-cylinder engine, raising peak output to 70 hp from 48. The Suzuki-built Sprints are Chevy's best fuel misers. The ER model posts 58 mpg highway/54 city in EPA tests. Chevy claims you can travel from New York City to Los Angeles for less than \$50 in gas. Like most turbocharged small cars, the Sprint has almost too much power for the chassis to handle. Chevy claims world-class 0 to 60 times of under seven seconds for this tiny rocket.

Spectrum is an Isuzu-supplied subcompact that gets 35 more hp (up to 105) from its turbocharger. Spectrum Turbos come in only one color: charcoal metallic. You get an orange accent stripe free.

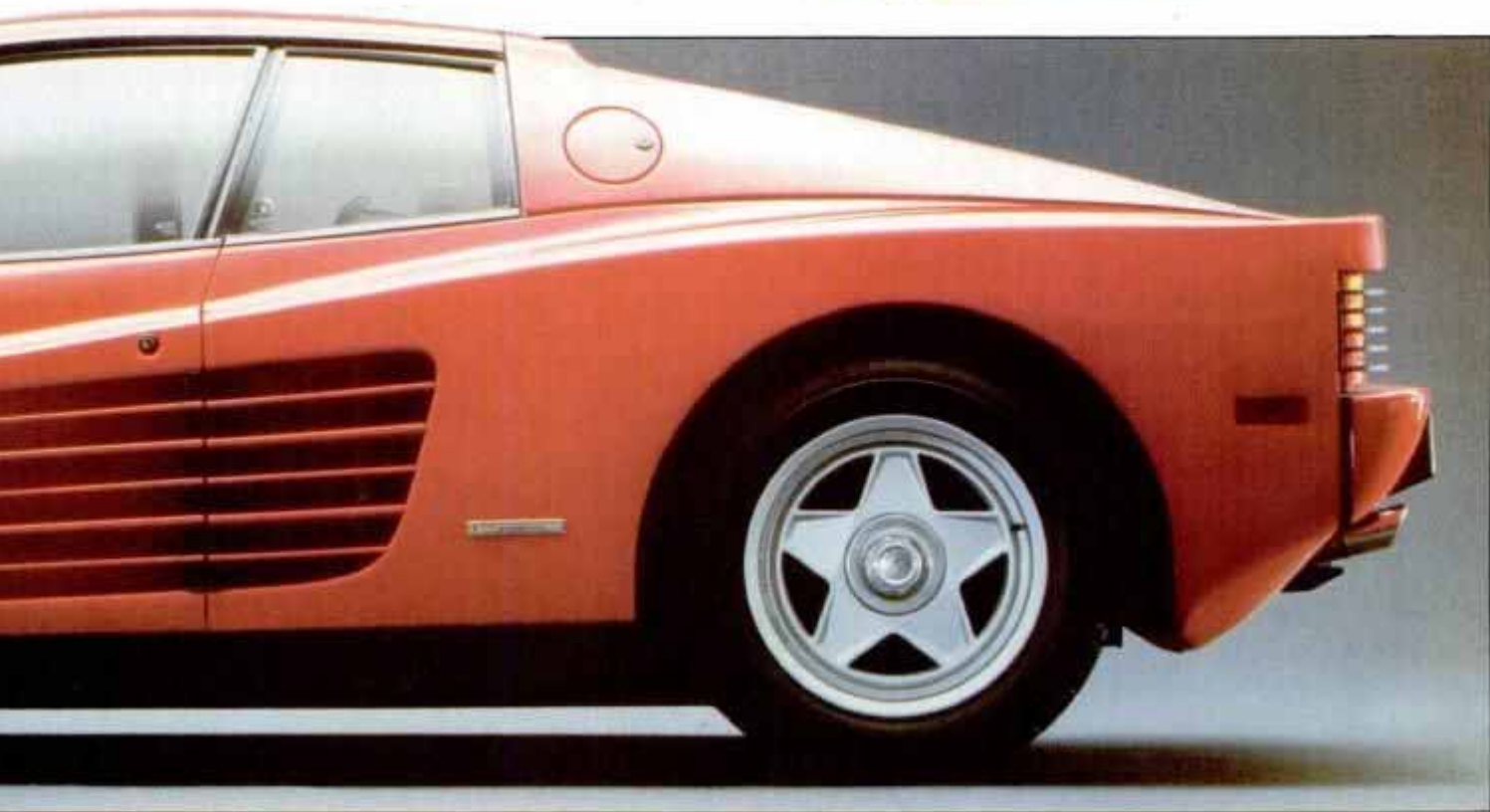
**Chrysler**—Mitsubishi-built Conquests



**GERMANY**  
BMW 325i Cabrio

will be sold only through Chrysler dealers for the first time, while Colt and Vista will continue to be marketed by both Plymouth and Dodge. Conquest now has heated outside mirrors, intermittent wipers and vanity mirrors standard, along with a passive restraint system for front-seat passengers. Colts have a new front-end design and small convenience changes inside, including a larger console. Engine output in the Turbo is up a few horsepower to 122. Vistas are essentially unchanged, but the rear seating arrangement now has a flat-folding rear seat for better loading of cargo through the rear hatch. Chrysler's Maserati 2-seat convertible/hardtop luxu-

**JAPAN**  
Mazda 323







**JAPAN**  
Nissan Pulsar NX



**BRAZIL**  
Volkswagen Fox



ry coupe will appear in late spring for a reported \$30,000-plus.

**Ferrari**—Ferrari's 178-mph Testarossa sports car gets automatic seatbelts for 1987, similar to those sliding ones on Toyotas. They fit in a slot in the top of the door, move forward when the door is opened, rearward when the door is closed. That addition meets the federal government's passive restraint requirement. Almost no other changes show up in the new lines.

The 328GTS V8 will account for half the sales in the U.S. in '87, while the pricey 380-hp V12 Testarossa will take about 28 percent. In a typical year, Ferrari delivers about 1100 new cars to U.S. buyers.

**Honda**—For the Honda line, 1987 is a year for a breather. The Civic wagon now has full-time 4-wheel drive. New exterior paint colors are about all that is different on other models except for the price, which increased an average of 3.5 percent.

**Hyundai**—During the first 11 months of 1986, the Korean car reached an amazing 150,000 sales. For its second year in this country, Hyundai is looking for 250,000 deliveries, even though there are few changes in the new models.

The 2- and 4-door hatchbacks and 4-door sedan have flush headlights and a lockup torque converter for the optional automatic transmission, plus power steering for the first time. Also new as an option is a passive safety belt system, similar to that of the VW Golf. The shoulder belt is attached to the window frame of the door, and wraps around the driver or front-seat

passenger when the door is closed. Price remains one of Hyundai's best selling features at \$4995 for the base Excel 2-door.  
**Isuzu**—A Turbo model is added to the I-Mark line for 1987 with an engine that develops 110 hp, compared with the 70 hp of the standard I-Mark. This is the same car that Chevrolet sells under the Spectrum name but with different trim. In addition to the new engine, the I-Mark will have a facelift that includes a new hood, front fenders and composite headlamp. A new RS version of the Turbo has a stiffer suspension system to improve handling, plus an all-white color scheme.

**Jaguar**—A removable rear roof section on the XJ-S Cabriolet can be replaced with a soft top or left clear for convertible-like driving. A true XJ-S Convertible is available from Hess & Eisenhardt. The long-anticipated new XJ6 will go on sale in the U.S. this April. The all-new Jag has traditional XJ6 styling. Its engine is a new dohc 3.6-liter aluminum straight Six, while the transmission is a ZF 4-speed automatic. New suspension systems and outboard rear disc brakes are highlights of the chassis. Inside, Jaguar keeps the leather and wood theme, but the instruments are a blend of analog—for speedometer and tach—and digital.

**Lamborghini**—Only about 150 of the Italian sports cars will be sold in the U.S. this year. Jalpa, selling for almost \$60,000, and Countach, in the \$127,000 range, are handled through only 10 dealers, most of them in bigger cities. "We're strictly carryover," is the way Lamborghini officials describe the 1987s. That means the 5-liter, 4-valve 420-hp V12 engine remains standard in the radical Countach, while the Jalpa gets along with its more conventional 3.5-liter V8.

**Lotus**—A new fuel-delivery system "to simplify things and eliminate some redundancy" is the only drivetrain change in the 1987 version of this British 2-seat, mid-engine sports car. The 2.2-liter 4-cylinder, 16-valve turbo engine will propel the Lotus from 0 to 60 mph in 5.8 seconds, and to a top speed of 150 mph. About 200 cars were sold in the U.S. last year, but 1987 should see an increase of 50 or so.

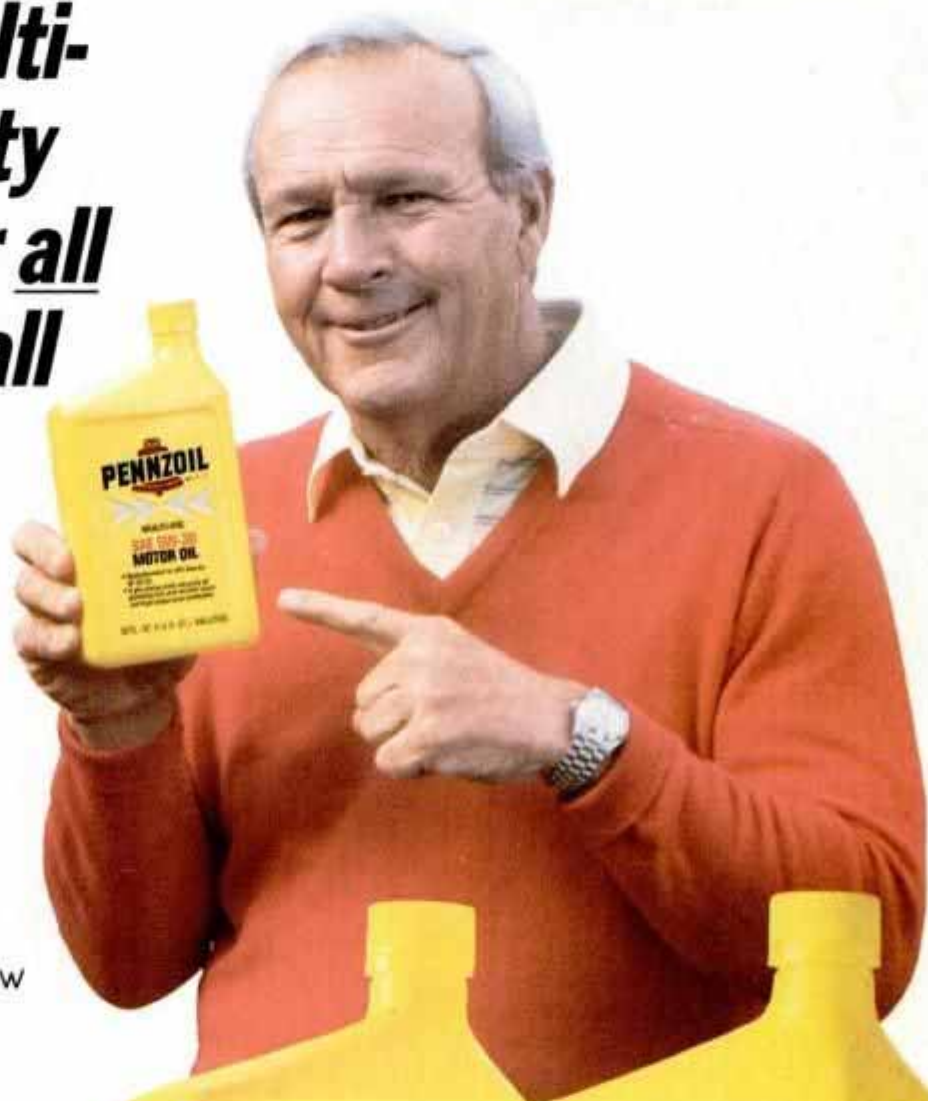
**Maserati**—Three twin-turbo V6 Biturbo models (a 2-door, the 4-door 425 and the Spyder convertible) supplement the big 4-door Quattroporte V8. Prices for 1987 are about the same as last year, even though all models switch from carburetors to fuel injection. A 5-speed gearbox is available for the first time on the 425 and Spyder.

**Mazda**—Mazda made major changes in its 3-car lineup in 1986, so 1987 is mostly a carryover year. From the outside, the difference between the 1986 and 1987 Mazda models is virtually nonexistent. However, a 4-passenger station wagon model was added to the low-price 323 line, while



**“Some information you need to know.”**

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their new small  
engines.***



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# SPECIAL REPORT IMPORTS '87



**YUGOSLAVIA**  
Yugo GVX

top-line models of the RX-7 sports car can now be ordered with antilock braking. In the 626 models, a 4-speed automatic overdrive transmission is now available as an option. Mazda's pickup trucks get 4wd for the first time, plus a 2.6-liter Four.

**Mercedes**—Five new models from Mercedes this year "fill in the holes" in the

model lineup and bring to 14 the number offered by the German builder of luxury cars. New on the American market are the 190D 2.5 Turbo, 190E 2.6, 260E, 300D Turbo and 300 TD, a sleek new station wagon in the mid-size range. Most fun is the 190E 2.6, a 6-cylinder hotrod version of the "baby" Mercedes that's almost as fast as the awesome 16-valve 190E 2.3-16 but \$8600 cheaper. All models will have air bags for crash safety available again this year, though they are optional on lower priced models. Biggest seller: the 300E. Diesels account for only 25 percent of Mercedes sales in the U.S., down from 75 percent three years ago.

**Mercury**—Mercury is unchanged except for some new paint choices, but Scorpio and Tracer will join the 1987 Mercury

## 1987 Import Car Prices\*

<b>Acura</b>		328 GTS	69,700	560SEL	61,500	900S	17,585
Integra RS	\$9859	Mondial Cabriolet 3.2	74,400	560SEC	68,000	900 Turbo	20,405
Legend	19,898	Testarossa	109,700	<b>Mercury</b>		9000S	21,805
<b>Alfa Romeo</b>		<b>Honda</b>		Tracer	\$5500	9000 Turbo	25,515
Milano Silver	\$12,980	Civic Hatchback	\$5799	<b>Merkur</b>		900 Turbo Convertible	27,000
The Graduate	13,995	Civic CRX HF	7639	XR4Ti	\$17,832	<b>Sterling</b>	
Milano Gold	14,700	Civic Wagon	8330			825S	\$19,000*
Spider Veloce	16,995	Civic Sedan	8455	<b>Mitsubishi</b>		825SL	23,000*
Milano Platinum	18,995	Civic CRX Si	9395	Mirage	\$6059	<b>Subaru</b>	
Spider Quadrifoglio	20,500	Accord Hatchback	9795	Mirage Turbo	8479	Standard Hatchback	\$5398
<b>Aston Martin</b>		Accord Sedan	10,625	Tredia L	9369	Justy	5500*
Aston Martin V8 Coupe	\$112,000	Prelude	11,999	Cordia L	9759	BRAT	8338
Vantage Coupe	127,000	<b>Hyundai</b>		Tredia Turbo	10,429	Sedan GL	9838
Volante Convertible	137,800	Excel	\$4995	Cordia Turbo	11,325	Three-door Coupe GL	10,138
Lagonda	167,000	<b>Isuzu</b>		Galant	13,999	Wagon GL	10,238
<b>Audi</b>		I-Mark S	\$7209	Starion LE	15,469	XT GL	11,518
4000S	\$15,875	I-Mark Turbo	10,505	Starion ESI-R	17,789	4WD Turbo Coupe	14,053
Coupe GT	17,580	Impulse	12,421	<b>Nissan</b>		GL 4WD XT Turbo	15,648
4000CS Quattro	19,850	Impulse Turbo	14,872	Sentra	\$6199	<b>Toyota</b>	
5000S	20,060	<b>Jaguar</b>		Sentra Wagon	8699	Tercel	\$5898
5000CS Turbo	26,640	New XJ6	\$40,000**	Stanza	9999	Corolla Sedan	8178
5000CS Turbo Quattro	31,215	XJ-S Coupe	39,700	Pulsar NX	10,700*	Corolla Sport	9548
5000CS Turbo Quattro Wagon	32,555	New Vanden Plas	43,000**	200SX	10,899	Corolla FX-16	9678
<b>Bentley</b>		XJ-S Cabriolet	44,850	Van	12,500**	Tercel Wagon 4X4	9938
Bentley Eight	\$89,900	XJ-S Convertible	46,950	Maxima	15,699	Corolla GT-S	10,368
Continental Convertible	167,500	<b>Lamborghini</b>		Maxima Wagon	16,699	Celica	10,598
<b>Bertone</b>		Jaipa	\$58,000	300ZX	21,500*	Camry	10,798
Bertone X1/9	\$11,730	Countach	126,000	300ZX Turbo	23,800*	Van	11,688
<b>BMW</b>		<b>Lotus</b>		<b>Peugeot</b>		MR2	12,548
325	\$21,475	Esprit Turbo	\$56,991	505 GL	\$13,900	Celica GT-S	13,978
325e	25,150	<b>Maserati</b>		505 GLS	15,950	Cressida	19,350
325es	24,370	Biturbo	\$28,500	505 GLS Turbodiesel	18,100	Celica Supra	19,900
325i Cabrio	30,000**	Biturbo 425	31,000	505 STI	18,400	<b>Volkswagen</b>	
528e	28,330	Biturbo Spyder	35,390	505 Turbo	18,650	Fox	\$5690
535i	33,600	Quattroporte	68,000	505 Turbo S	22,600	Golf GL	8190
535is	35,200	<b>Mazda</b>		505 STX	23,250	Jetta	9290
735i	42,475	323 Hatchback	\$5999	505 STI V6	27,700	Jetta GL	9900
L7	46,675	626 DX Sedan	9849	<b>Pontiac</b>		Golf GTI	10,325
635CSi	46,965	626 DX Coupe	9899	LeMans	\$7200*	Scirocco	10,680
<b>Chevrolet</b>		RX-7	14,199	<b>Porsche</b>		Cabriolet	13,250
Sprint	\$6185	RX-7 Turbo	20,399	924S	\$21,900	Quantum Wagon	13,450
Spectrum Hatchback	7702	<b>Mercedes-Benz</b>		944	25,500	Vanagon GL	14,730
Sprint Turbo	7880	190E 2.3	\$26,400	944 Turbo	33,250	Quantum GL	14,985
Spectrum Sedan	7999	190D 2.5	26,400	911 Targa	40,500	<b>Volvo</b>	
<b>Dodge/Plymouth/Chrysler</b>		190D 2.5 Turbo	29,800	911 Turbo	58,750	240 DL	\$15,400
Colt E	\$5906	190E 2.6	31,000	928S 4	58,900	240 DL Wagon	15,890
Vista Van Wagon	9999	260E	34,500	<b>Renault</b>		240 GL Wagon	18,095
Vista Van 4WD	10,999	300D	39,500	Medallion	\$13,500*	740 GLE	20,155
Conquest	14,417	300E	39,500	Alpine	25,000*	740 Turbo	22,135
Chrysler/Maserati	30,000*	190E 2.3-16	39,600	<b>Rolls-Royce</b>		740 Turbo Wagon	22,735
<b>Ferrari</b>		300TD	42,500	Silver Spirit	\$106,200	760 GLE	27,160
328 GTB	\$64,500	300SDL Turbo	47,000	Silver Spur	117,500	760 GLE Turbo Wagon	27,485
Mondial 3.2	68,300	420SEL	52,000	Corniche II Convertible	168,100	760 GLE Turbo	28,060
		560SL	55,300	Limousine	198,000	780	34,000**
				<b>Saab</b>		<b>Yugo</b>	
				900	\$14,115	Yugo GV	\$3990

\*Base prices in effect Nov. 15, 1986. \*\*Estimate



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lineup later this spring. Merkur Scorpio is a 4-door luxury sports sedan that will be imported from Ford of Germany, while the Tracer is a Mazda-based sub-compact that is being built in Mexico. Scorpio will sell in the \$22,000 range and offer a V6 engine with rear-wheel drive and antilock braking. It competes primarily against the Audi 5000. Tracer will carry a pricetag in the \$7000 range and come in 2- and 4-door sedan and station wagon models. The car will use a Mazda 323 drivetrain.

**Mitsubishi**—Mirage sheetmetal is



**GERMANY: New Audi 4000**

slightly different this year and there's a 4-door for the first time. Each model gets a tweak in horsepower from carb adjustments. It's a carryover year.

**Nissan**—Two model lines, Sentra and Stanza, have major changes for 1987,

while the Maxima gets softer styling forms in fenders and grille. Sentra's five models have changes in the underbody to increase strength and to give passengers a quieter ride with less vibration. Length is 3 in. greater, and that translates into more room in the rear passenger compartment and trunk. An SE sports coupe has fuel injection for added power.

Stanza's new look moves the line closer to the Maxima in appearance. Underneath the sheetmetal the similarity is even closer. This year Stanza uses the Maxima chassis and suspension, and that upgrading means a 4-in. increase in length to 177.8 in. overall.

The top Maxima SE model has a new 4-speed automatic transmission as an option. Sporty, compact 200 SX has a slightly changed hood to accommodate a 3-liter V6 engine—the same as the one used in the base 300 ZX.

A standout among the sporty cars in Nissan's lineup for 1987 is the Pulsar NX. It has a totally new appearance that comes out of Nissan Design studios in San Diego. The car has a unique roof arrangement. To the rear of a new T-bar roof, the entire rear hatch can be removed for open-air driving, or replaced by a wagon-like hatch. As the

optional performance engine, the Pulsar NX has a 1.6-liter dohc, 16-valve, 4-cylinder engine that develops 113 hp.

Significant changes were made in the 300ZX sports car line, most occurring in the suspension. On the outside, bump-



**FRANCE: Renault Alpine**

ers, hood and the front air dam are styled to appear as a single unit. At the rear are new taillights. In an effort to remedy one often-heard complaint about the car's handling, front and rear suspensions now produce a firmer, more controlled ride thanks to recalibrated springs and shock absorbers. In addition, the power-steering pump reacts more quickly, and the front stabilizer bar is larger. The rear suspension has a new 24-mm stabilizer bar that combats body roll. The Turbo model now has a faster-reacting reduced friction turbine for quicker turbo boost.

A new van shows up in the Nissan line. Not as radically styled as the Toyota van, the Nissan body holds

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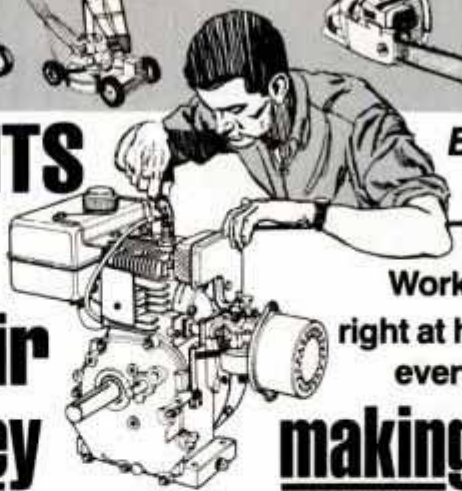
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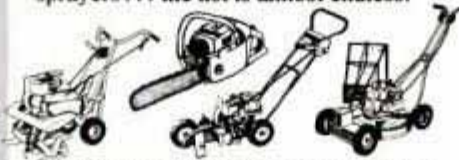
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seven passengers. It's a true van and offered in addition to the Stanza wagon.

**Peugeot**—More power from two new engines should go a long way toward changing the image of the French-made Peugeot from solid but stodgy sedans into something akin to a performance vehicle. The 4-cylinder base engine now displaces 2.2 liters and has an aluminum block. Horsepower is up to 120 from 97.

In the STX and Turbo models, anti-lock braking and a variable power steering system are now standard. The steering assistance lessens as speed increases, thus giving full assist in parking, but providing better road feel at higher speeds. A 2.8-liter V6 has been added to the line as the top-performance engine. This is the 90° V used in Volvos and Renaults—and once used in the DeLorean sports car—but shake and vibration characteristics nearly disappear with the refinements of offset crankshaft pins and a balancing shaft added this year.

**Pontiac**—The famous LeMans name is alive again in German-designed 2- and 4-door sedans that are built by Daewoo in Korea. Priced in the \$7000 range to fit at the lowest end of the Pontiac lineup, the LeMans replaces the Pontiac 1000, which has gone out of produc-

tion. Based on the 1985 Opel Kadett, the LeMans uses a 1.6-liter inline Four in a front-drive chassis. A 5-speed manual transmission is standard, with a 3-speed automatic optional. Pontiac plans to make the LeMans available starting in May or June.

**Porsche**—Porsche's new 944S, a 16-valve, 4-cylinder 2+2 sports car, joins the three other 4-cylinder models in the lower end of the lineup. At the high-



FRANCE: Renault Medallion

priced end, the 928S 4 becomes the German marque's top performer now that its 5-liter, 32-valve V8 is in production. In the 944S, power is up 27 percent to 188, while torque is increased 21 percent "with almost identical fuel consumption," says Porsche.

A major styling change to the front and rear sets the 1987 928S 4 apart from earlier models. Taillights wrap around

the fenders, while an integrated spoiler plus revised running lights alter the front end. Tuned engine breathing that boosts power to a whopping 316 hp, and better aerodynamics, are given as reasons behind a new top speed of 165 mph and a 0 to 60 time of 5.7 seconds. That makes the 928S 4 quicker than Porsche's powerful turbo 911s.

**Renault**—Two models will be sold through American Motors dealers later in the year: the 5-passenger Medallion and the 2+2 Alpine sports car. Medallion is a 4-door hatchback and wagon that has been in production in France for over a year. It uses a 2.2-liter, 4-cylinder engine that drives the front wheels. Medallion's compact size will put it up against the Lancer, Grand Am, Camry, 626 and Accord.

The Alpine is a full-blown rear-engine sports car that will compete with Corvettes and Porsches. It has a 2.6-liter V6 engine for a top speed in excess of 140 mph. The body is plastic, while the chassis includes 4-wheel disc brakes and independent suspension.

**Rolls-Royce**—Biggest difference between the 1986s and the 1987s is a small one, only a 2.6 percent increase in price. Rolls sold 1110 cars in the U.S.

*(Please turn to page 128)*

## \$1000 A Month With Just A Hack Saw!

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fore I finally found the right design and measurements and tricks to the manufacturing of P.V.C. pipe furniture. I only wish that when I started, I could have bought these shop drawings and I would have gladly paid \$100 for just one of them.

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# DETROIT'S JOINT ADVENTURES

BY MICHAEL LAMM, Contributing Editor

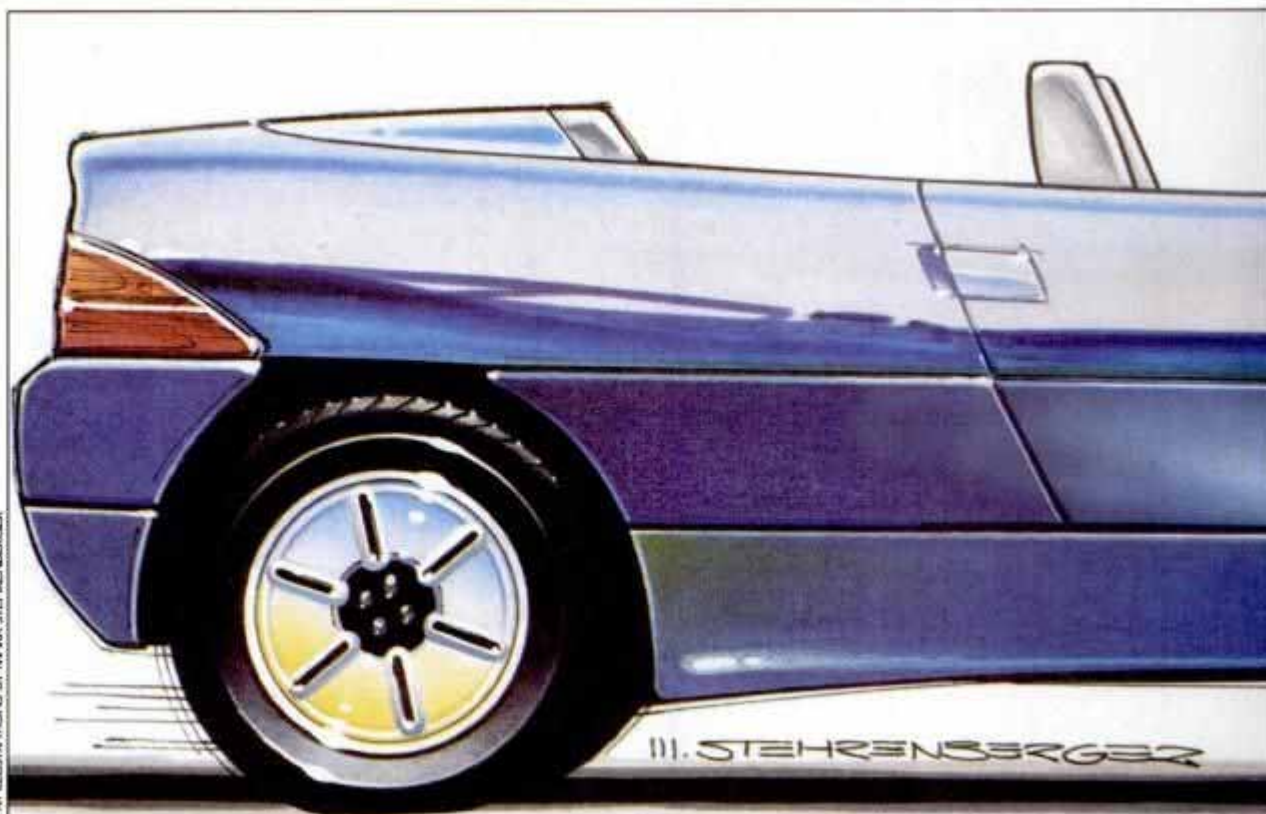


U.S.A.  
1989 Ford-Mazda  
Mustang III

**T**he 1987 models already include a number of joint ventures and "captive" imports like the Japanese Chevrolets (Sprint and Spectrum), Korean Pontiacs (LeMans), the GM-Toyota Novas coming out of Fremont, California, and the Kenosha Renaults. But that's just the tip of the iceberg as far as international cooperation goes. Here's what's next:

### Mustang III

Ford and Mazda have joined forces to produce several new cars, the most promising being the 1989 Mustang III, or ST-16. This vehicle will be spun off the next-generation Mazda 626 platform but will

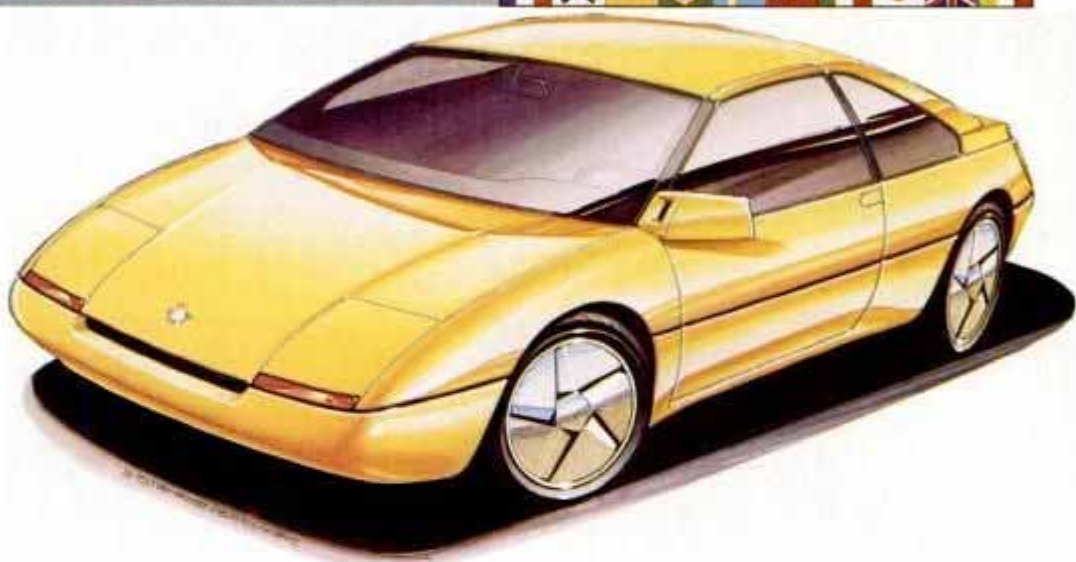


IRA ILLUSTRATIONS BY MARK STEHRENSBERGER





## It's hard to 'buy American' when even Fords, Chevys and Chryslers are being designed and built abroad.



probably use Ford's own 2.5-liter Four and Taurus fwd running gear. I say "probably" because there's some talk that it might use a Mazda-designed 3.0-liter V6 instead of the Ford Four.

In addition to the Mustang III, Ford will keep the Mustang GT, which will remain essentially like today's 5-liter V8 rear-drive muscled. The GT will continue to be built in Dearborn, while the Mustang III will come from Mazda's U.S. plant now going up in Flat Rock, Michigan.

Mazda will sell its own version of the Mustang III, but this car will look quite a bit different and will use a Mazda powertrain. I've heard that Mazda wasn't too happy with the styling

side of the joint venture, because most product clinics judged the Mustang III better looking than Mazda's iteration.

### Ford Super/Sport

Another collaboration between Mazda and Ford will result in a 2+2 coupe and convertible to be built in Australia in 1988. Giorgetto Giugiaro's famous Ital Design studios styled the latest rendition of this car, previously called the Barchetta, which means "small boat" in Italian. The name's been used for over 30 years on small convertibles, including early Ferraris. But because so many Americans mispronounced the name (it's *Barketta*, not with a "ch" sound), Ford changed it to

*(please turn to page 124)*

**U.S.A.**  
1988 Chrysler-Mitsubishi H2X



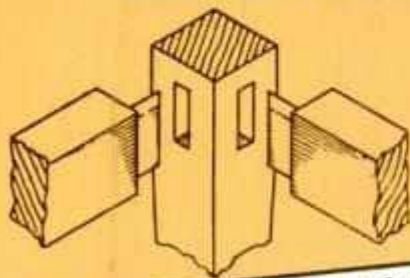
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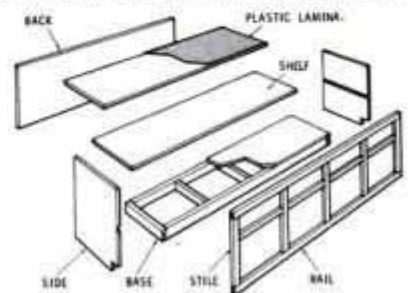
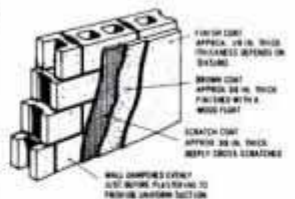
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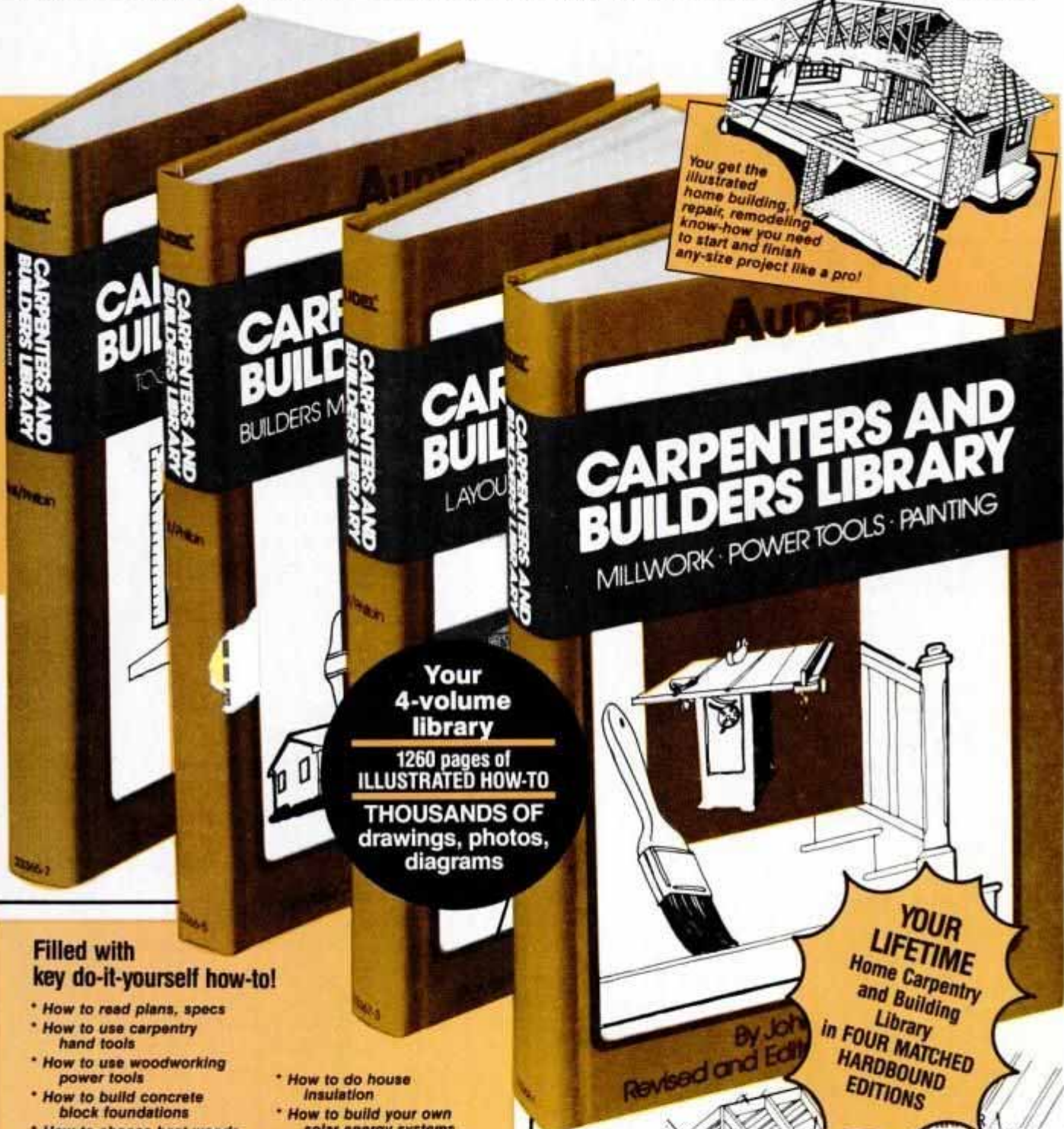
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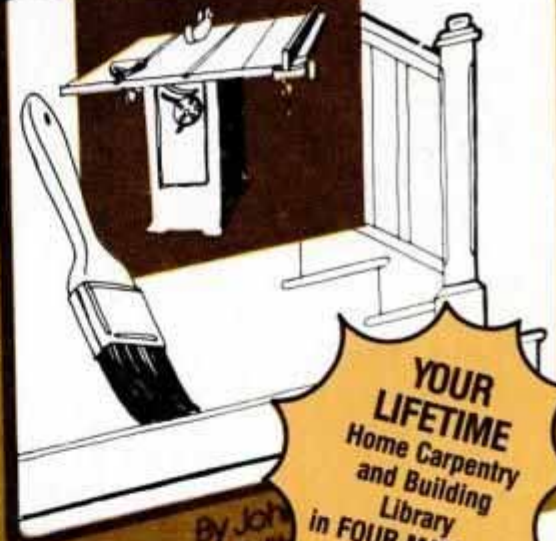
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## Future Battlefield Fashion Will Be A Knockout

Inside the "gas chamber" at the research facility, a soldier closes the clear plastic face guard on what looks like a fighter pilot's helmet. Entering the chamber, he fiddles with a heavy backpack, as a bank of high-intensity Xenon lamps flash on and off. The face mask goes from clear to a bluish tint. The door closes, and a smoke grenade is set off. Suddenly, a light flickers on inside the helmet, and the soldier gazes upward at a computer-generated head-up display of the room he is in. Although the bright lights could have blinded him, and the thick smoke could have darkened the scene, a helmet-mounted infrared camera lets him see the room as if in plain daylight. Scenes like this are being played out daily at a research facility of the Scicon company in England. Scicon is developing an outfit it calls Infantryman 2000. It's a uniform designed to place a soldier in the midst of chemical or any other kind of warfare.

The future soldier will wear a large backpack that includes a twin-missile-firing device, a high-speed computer with programming pad, and connectors to his helmet, gloves and boots. The helmet will be equipped with a laser rangefinder, four wide-angle infrared cameras that give him 360° vision, gas warfare and rebreathing filtration equipment, and a speaker that lets him communicate with other soldiers.

The computer-equipped gloves will be thick enough to keep out toxic agents, but will be able to give him a sense of touch equal to his own skin. The boots will have microwave sensing devices to detect land mines. Scicon expects to be able to equip NATO troops this way within 10 years.

Editor: Dennis Eskow  
Contributors: Frank Lusk, Mike Dillon, Lee Green,  
Steve Eskow, Bob Bran

PM ILLUSTRATION BY ED VALIGURSKY





## AVIATION



### Gulfstream IV revs its engines

The aviation industry has been talking about it for a long time, but the Gulfstream IV jet is expected to

be flying transcontinental later this year for real.

"Our design engineers were charged with the task of creating an aircraft that would carry eight to 10 passengers plus crew from Paris

to New York nonstop," Gulfstream Chief Executive Allen Paulson told a recent aviation business meeting. Shown above, the Gulfstream IV is to be produced in medium-range (back-

ground) and long-range versions (foreground). The differences will be mainly in avionics. The aerodynamic design, with new high-tech winglets, includes Rolls-Royce Tay engines.

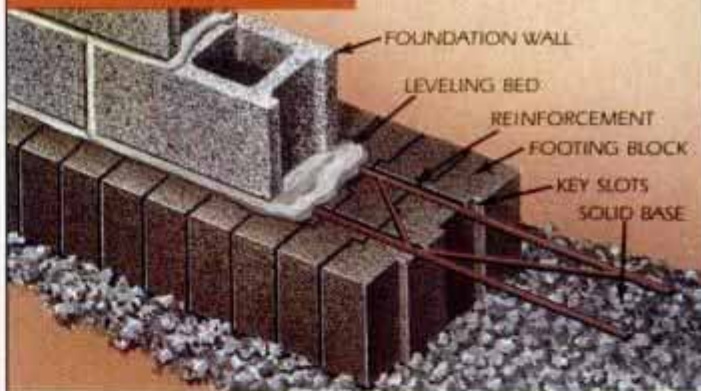
### Voyager's econopower

Voyager, the experimental airplane designed to fly around the world nonstop, is powered by front and rear engines. At the front is a conventional 130-hp, air-cooled engine. But the rear-

mounted Voyager 200 engine is a 110-hp liquid-cooled model designed by Teledyne Continental to keep the plane aloft for 14 days on less than 1500 gallons of fuel. The 4-cylinder, 300-cu.-in. engine incorporates lightweight cylinder design with an upgraded combustion chamber. A significant reduction in cooling drag is expected when the Voyager takes off for its record-setting trip.



### HOUSING



### Instant foundation

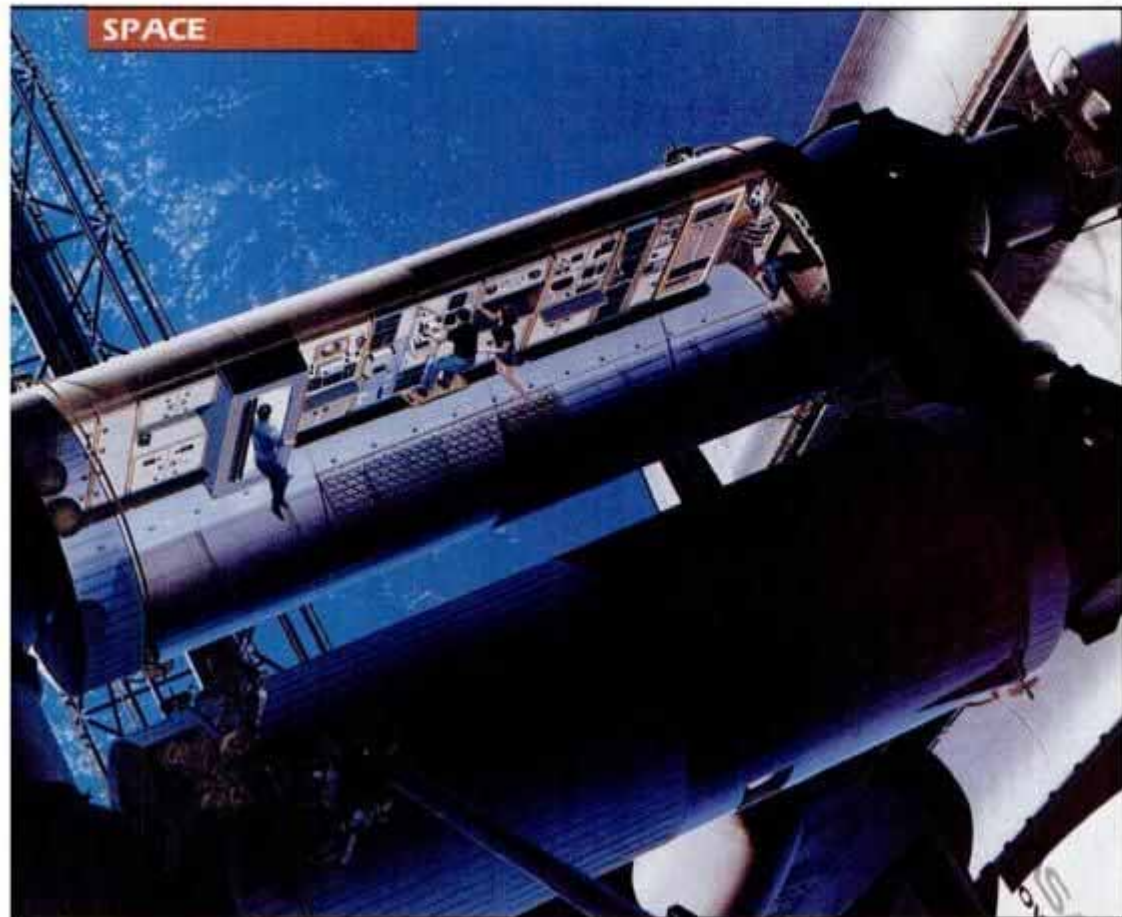
Before laying up the foundation walls for a house, you have to build forms, pour concrete, wait for the foundation footings to cure, then strip away the forms. That's beginning to change with the introduction of Footer Block from Innovative Design Research in Herndon, Virginia. These interlocking blocks can be laid directly on compacted soil or gravel. Once in place, a leveling bed of



mortar is applied to the top of the blocks, letting you start immediately. Construction costs will be cut because it's faster.



## SPACE



### Space program lives

Our grounded space program is still buzzing with work, all of it aimed toward a resumption of spaceflights late this year or early next year. Boeing's design for a space station laboratory module (left) is the first module likely to be developed for the 1992 opening of the station. An astronaut (left end of module) is working at a commercial processing unit. The two astronauts in the center are at the main work station where experiments are run. Astronauts enter the science module from the main station through an airlock at the right side.

The winged orbiting vehicle (bottom left) is a proposed manned facility to be built and launched privately by Space Industries and Westinghouse in the 1990s. It would go into permanent orbit 200 miles above Earth. Supplies and communications to the private vehicle could come from the space station. The private facility would be used for industrial purposes only.

A new space "furnace" (bottom right) alternately superheats and supercools materials being tested for use in the space station, where they will be subjected to direct solar energy and the icy darkness of space. Despite delays in the American space program, plans for the station are running on schedule.



## ELECTRONICS

### A high-tech marriage

The video disc provides the action. The computer supplies the graphics and runs the simulator. It's a marriage made in Malvern, Pennsylvania, where Flight Safety has developed a series of "interactive systems" in a computer program that teaches maintenance of a

Lear Jet or other craft. Images of dials and switches found in the plane appear on the screen and present you with a problem such as low engine power. You touch the switch on the screen and it flips into position. If you operate the system properly, the engine goes back to full power. If not, the screen tells you to go to the teaching program which explains what you did wrong.





# TECHNOLOGY UPDATE 2/87

## ENERGY



### Energy rides a new wave

At the side of an ocean cliff near Oslo, Norway, stands a steel silo that is producing just over 1 kilowatt of electric power day and night. Construction of the tower cost \$600,000. Electricity from the silo, which rises from the seabed, costs 4 cents per kilowatt hour. At the silo's base is an ocean wave resonator that pumps up and down as it is hit by

waves. The pumping action forces air up the steel tower. The air drives a turbine at the top of the tower. And the turbine runs the generator. In the illustration (right), there's a semicircular cement collar. That collar forms a channel into which waves rush to produce the oscillations needed to keep the plant going. At low tide, the equipment stops running for about an hour. But storage batteries keep the power flowing during that hiatus.



## MILITARY



### Carl Gustaf is combat king

NATO forces are experimenting with a new portable missile launcher called the Carl Gustaf M3. The carbon-steel sleeve of the weapon

makes it ultralight for shoulder firing of antitank missiles and rocket-assisted shells. It can also fire an over-size round with a 132-mm warhead capable of destroying main battle tanks. NATO is experimenting with other man-carried missile systems, but this model is currently the favored weapon because it can fire different projectiles, and thus a variety of warheads.



### Sweden's new combat jet

The JAS 39 Gripen (left) flies supersonic day or night and in all kinds of weather. It's the latest weapon in the NATO arsenal. The first Gripens flew late last year in tests over Sweden. About 30 percent of the airframe is carbon fiber, keeping it

lightweight. The JAS 39 is a fly-by-wire aircraft that will undergo test carrier landings later this year. The powerplant is adapted from the same General Electric jets used on the American F-18 Hornet craft. The JAS 39 has a totally computerized cockpit, replacing most dials and switches with computer screens.



### Missile on cruise control

Boeing Aerospace has completed test and delivery of the Air Launched Cruise Missile (ALCM) to be used

aboard the B-1 bomber. The ALCM has a classified range that lets it travel on its own guidance system from a standoff position in friendly skies toward a target deep within enemy territory. **TU**





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**MEXICO**  
1988 Ford-Mazda  
Mercury Tracer



**SOUTH KOREA**  
1988 Ford-Mazda-  
Kia Festiva

Super/Sport. The Ford S/S will be a spin-off of the Mazda 323 and will be built at Ford's Broadmeadows plant in Australia.

The S/S was originally conceived to go on the Fiesta XR2 platform as what Ford calls an LIV—a Low Investment Vehicle. Dearborn made the initial sketches for this car, Ghia then built the first prototypes, and these were shown throughout Europe during '85 and '86. All were open cars, with a 1.6-liter pushrod Four, 4-speed transaxle, manual top, docked tail and steeply sloping, rounded nose.

Dearborn let it be known that such cars would soon be built, their purpose being to fill the market niche vacated by the passing of such entry-level sports cars as the MG Midget and Triumph Spitfire.

Ford of Australia got involved because it's under government pressure to export in order to improve Australia's balance of payments. Ford of Australia has ample stamping and assembly capacity, but it

doesn't build the Fiesta. It does, however, make a version of the Ford Laser—which is based on the Japanese Mazda 323—so that's the platform for the S/S. Ford of Australia hopes to produce about 200,000 Super/Sports a year, most of them headed for the U.S. and Europe. Mechanical details are sketchy, but the final car will probably include the Mazda 1.6-liter Four and front-wheel drive.

### MoPar Mitsu

Mitsubishi and Chrysler have likewise entered a joint-venture agreement to build cars in this country, starting in 1989. Their assembly plant is currently going up in Normal, Illinois, near Bloomington. They've called the new company Diamond Star Motors to reflect Mitsubishi's and Chrysler's corporate logo symbols.

The first car to be built in the Illinois plant is code named H2X. It'll be an Americanized version of the Mitsubishi Cordia, a front-drive 1.8-liter Four.

Diamond Star's first offering will be a sporty 3-door hatchback. Then, by late 1990, it'll add a notchback 4-door sedan. The H2X will use Mitsubishi mechanicals and engineering, but Chrysler and Mitsubishi styling centers in California joined forces to help design the sheetmetal. Hatchback and sedan will both reflect Chrysler's new aero look. Plant capacity will be 240,000 cars a year, to be split 50/50 between Chrysler and Mitsubishi.

### Mercury Tracer

Lincoln-Mercury intends to offer a Mexican-built import called the Tracer (code named CT-18) for 1988. The Tracer will be assembled in Hermosillo, Mexico, as a replacement for the Lynx, Mercury's version of the Ford Escort. The Tracer is currently being assembled in Taiwan and sells in Canada as a 1987 model. The Mexican Tracer will be virtually identical to its Taiwanese cousin and will use the

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1988 Buick-Olds-  
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PM2

## IMPORTS '87

Mazda 323 platform and 71-bhp, 1.6-liter fwd Mazda powertrain.

The Hermosillo Tracer, due here in mid-1987 as an '88 model, will offer 3- and 5-door hatchback body styles in three series: base, L and GL. These share Ford's rounded aero look.

As an aside, Ford's own internal audits have given the Taiwanese Tracer the company's highest marks for quality. This worldwide honor came when Ford surveyed and evaluated its cars from all countries where Ford products are built.

### Ford Festiva Mini

Ford will also bring over the Kia-built Korean minicar called the Festiva. This will be sold as an early 1988 model in the U.S. The 3-door Festiva is already being produced for Ford in Japan by Mazda. It's a Mazda design—a 1.3-liter fwd Four. It's roughly the same size as the Chevrolet Sprint (Isuzu Cultus) and will sell in that entry-level market.

### GM-Opel

As recently as May 1986, GM was thinking about bringing over the Opel Ascona (J-car) to be badged as the 1989 Cadillac Cimarron. Latest reports now say Caddy is working on a new Cimarron of its own and that no Opel will be brought over to replace the J-car.

However, Oldsmobile and Buick have both been talking about bringing in the new rear-drive Opel Omega in some capacity. Opel just launched the Omega as a 1987 replacement for the bread-and-butter Rekord and the rwd Opel Monza. Opel is General Motors' German subsidiary, owned and largely controlled by GM in the U.S.

The Omega is interesting because it stays with rear-drive at a time when most rivals have switched to fwd. In Germany, the Omega offers four trim levels and nine different engines ranging in size from 1.8 to 3 liters and including two 2.3-liter diesels plus the 3-liter in-line Six from the Senator. All are overhead-cam, and Opel has factored in closed-loop catalytic converters that comply with U.S. emissions requirements. Most Omega engines are Fours, delivering 82 to 122 bhp. The Six, available only in the sporty Omega 3000, puts out 177 hp (or 156 smogged for the U.S.). All Omegas share two basic body types: sedan and wagon. Careful aero design gives the sedan a Cd of 0.28; the wagon 0.32. Equipment includes a 5-speed manual or 4-speed overdrive automatic transmission, 4-wheel disc brakes with ABS, and all-independent suspension. It should be an interesting addition to the B-O-C product lineup.

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## IMPORTS '87

two years ago, and expects to maintain that pace this year. The new Bentley Eight is the Rolls-Royce version of an entry-level car, one that newcomers can afford. It sells at a more affordable \$89,000, thousands less than the regular Rolls models or the Bentley Continental Convertible. The big Limousine holds last year's price line at an attention-getting 198 grand.

**Saab**—The 900 gets a face-freshening with wraparound bumpers front and rear, flush headlights and chrome grille bars. And more convertibles are planned—almost 2000 will be imported in 1987. The new 9000S has a naturally aspirated engine instead of a turbo. Otherwise it has the same appointments as the 9000 Turbo.

**Sterling**—Sterling is a fwd 4-door luxury sedan based on the Honda Legend, but it's built by Austin Rover in Cowley, England. Sterlings are distributed in the U.S. through 150 or so dealers, mostly located in large metro areas. The engine is Honda's premium 2.5-liter, 24-valve V6 that drives through a 5-speed manual or 4-speed automatic transmission. Two models will be available, the 825S and the 825SL. They range between \$19,000 and \$23,000. The higher priced SL has antilock brakes and leather seats standard.

**Subaru**—Justy is the name of the newest model in the Subaru line. It is a front-drive minicar available in a 2-door hatchback body style. Justy's engine is revolutionary for Subaru—an inline 3-cylinder with 3 valves per cylinder. The 1.2-liter engine and 5-speed manual transmission give Justy an EPA rating of 38 mpg city, 41 highway.

The low-priced sedan/wagon and hatchback coupe get more power out of a freer-breathing version of Subaru's "normal" pancake Four engine that has changes in its camshaft, intake porting and combustion chambers. Fuel injection is standard in all front-drive models, and the majority of 4wd types as well. Bumpers on all cars are upgraded to meet the 5-mph standard.

**Toyota**—Redesigned are the Camry and Tercel. A Corolla FX16 shows up for the first time in the U.S. Supra now has 230 hp, a new high for that car. Celica adds a convertible. And the MR2 sports car gets a T-top roof option.

Camry, in addition to its styling redo, has a 16-valve, twin-cam 4-cylinder engine and a station wagon model added to the line. The low-price Tercel also has a new look outside, and under its hood is a 3-valve 1.5-liter engine that develops 78 hp.

Corolla FX16 is the first built-in-America Toyota car. It combines the power of the MR2 1.6-liter, 16-valve engine with the roominess of a standard

Corolla 2-door. Horsepower is up 15 percent in the Supra Turbo, while anti-lock braking makes its first appearance on this car to update stopping power.

**Volkswagen**—The Fox joins the line as an entry-level subcompact that VW builds in Brazil, and will sell in the U.S. in the \$6000 range. Two body styles will be available when the car is introduced in the first quarter of '87: a base 2-door and a better appointed \$6490 4-door GL. Later in the year, a station wagon will be added. The 4-passenger front-drive sedans are powered by a fuel-injected 1.8-liter 4-cylinder engine through a 4-speed manual transmission. While Fox is VW's lowest priced model, its standard equipment is a notch above what you'd expect: Electric rear defogger, full carpeting, clock, tinted glass, intermittent wipers, reclining seats and lockable glove box.

To make room at the low end of the VW lineup for the Fox, Golf models now start with the GL. Above the GL are two new names, a Golf GT and GTI 16-valve. The new GT is essentially the 1986 GTI, and comes in 2- and 4-door body styles. The GTI 16-valve is VW's newest road superiority model. It uses a dohc 16-valve 4-cylinder engine that develops 125 hp, 4-wheel disc brakes, stiffer front springs and quick-ratio power-steering system to establish its claim as one of the best performing and handling cars in the subcompact sedan market. Twin tailpipes, spoked alloy wheels and a unique front spoiler with air scoops for brake cooling set the 16-valve apart from the standard Golfs.

**Volvo**—At the top of the Volvo line for 1987 is the new 780, a Bertone-styled 2-door that uses the 760 chassis and will compete in the \$30,000-plus luxury sedan market. While the 780 is closely related to the older 760, it has its own personality, including individual styling, Bertone assembly, unique instrument panels and a 170-hp V6 engine that is more powerful and smoother than Volvo's Fours and inline diesel Sixes. Antilock brakes and air-bag safety systems are standard on the 760 and 780, optional on the 740s.

**Yugo**—GVX, a sporty version of the low-price champion Yugo GV, will make its appearance as a late-entry 1987 model. The GVX offers extra features like large-diameter front sway bar, aluminum alloy wheels with 70 aspect ratio tires, integrated front and rear bumpers, fog lights and more support in the seats. Yugo describes the GVX as "a more aggressive and stylized" car than the GV that sells in the "high-quality, low-price, high-volume market." Meanwhile the Yugo GV, at \$3990, continues as the lowest priced car on the U.S. market. **PM**



## SALT SHAKER

(Continued from page 80)

### Day 3

To qualify to set a Bonneville record, you first must break the old record with a run on the short (2¼-mile) course. The Trans Am is rolled out around noon to the fuel truck, the fuel system is sealed by officials, and our wait in line begins. Almost three hours later, we reach the start line. The weather is getting cold and windy. This will be the first time the car has ever been run beyond THIRD gear, and tension is thick.

The qualifying run is flawless. Stringfellow manages to coax 211.619 mph out of the Pontiac, beating the old record by just a hundredth of a second less than 10 mph. We've qualified, but there's no real celebration. We have the rest of the week to actually set a new record. Or so we think.

### Day 4

We're up at 4 a.m. to be first in line for the record runs. Just a small amount of maintenance is necessary on the car, even after the qualifying run, save for turning up the boost.

About 10 vehicles are running for various records this morning. All the racers will streak to the other end of the course, 5 miles distant, where they get one hour to refuel, retune and prepare for a return run. The average speed of the two runs counts toward the record.

If there is a spiritual home to American hotrodding, Bonneville is it. When Stringfellow dropped the hammer on the Trans Am that morning, he was performing the most time-honored of rights in the Head Temple of speed. And the offering brought results.

The car hits 252.805 on that first 5-mile run, and there is nothing but joy at the other end of the course. And serious work. The car has to be refueled and cool water and 75 pounds of ice loaded as the car is prepped for the backup run necessary for an official record.

With the boost turned up slightly, the Pontiac exceeds the speed of the first run, and turns a 267.618, making for a 2-way average of 260.211, almost 60 mph faster than the standing record!

Even with a 6-hour tech inspection required after record runs, the crew's spirits are not dimmed. Banks says the car still has about 400 hp left, and 300 mph will be his next target.

The caravan leaves the Salt Flats happy: We don't need more time to set a record. A good thing, too. It rains Wednesday night, turning the dry lake into a wet one and eliminating high-speed runs for the rest of the week. Those who didn't get a run in early will have to wait 'til next year, when Banks will be back gunning for 300 mph! **PM**

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**There is a difference  
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Only NRI gives you such complete training, so much real bench experience, and the confidence and all the tools you will need to earn cash money fast.

A well-trained locksmith earns money in many different ways—installing locks in apartments, homes, businesses, and automobiles, fixing broken locks, cutting new keys, and more. And this huge market is just begging for new qualified locksmiths. Today there is only one locksmith for every 18,000 people!

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Thorough step-by-step lessons and professional locksmithing equipment such as the Taylor KD5 Key Machine give you hands-on experience in this exciting growth field. You'll start earning huge cash profits of 800% to 900% duplicating keys. And only NRI offers you an Electronic Security Alarm training system.

Compare! NRI offers the only course that is nationally approved by the accrediting commission of the National Home Study Council.

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training at an easy-to-follow pace.

All the lessons, hands-on training, and experiments have been developed to ensure that you begin practicing from the very first day... and can begin making cash as soon as you like. All the money-making secrets of a locksmithing trade will become yours with your NRI training.

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Add to your income with part-time work with established locksmiths... start your own part-time or retirement business in your own home... make locksmithing and security a full-time career as a skilled technician in your own growing business. There is opportunity everywhere!

NRI's free 4-color booklet will show you how quickly you can train to be your own boss in a profitable locksmithing business and gain the respect you deserve as a trained technician like other professionals in your community.

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1701-027



# NEW/WORKSHOP

## Mini Turning Tools



Turn small, highly detailed projects easily with this 8-piece miniature turning tools set. The tools are 7- and 7½-in long.

This set of eight tiny lathe tools (\$39.50 postpaid) is designed for highly detailed projects. Standard turning tools are often too large for fine work. The set includes a ⅛-in. gouge, ⅜-in. gouge, ⅜-in. skew, ⅜-in. parting tool, ⅜-in. round nose, ⅜-in. square nose, diamond point and a ⅜-in. beading tool.

Each tool has a 5-in.-long hardwood handle attached to a 2- or 2½-in.-long tool-steel



Narrow tool-steel cutting edge permits turning intricately shaped workpieces.

cutter. The tools are especially helpful for turning chess pieces and miniatures. It's sold by Woodcraft Supply, 41 Atlantic Ave., Box 4000, Woburn, MA 01888.

## Savvy sander



Automatic belt-tracking keeps the sanding belt aligned and reduces constant adjustments.

Sears introduces sanders with an automatic belt alignment system called Memory Trak that helps keep the sanding belt centered on the tool's pulleys.

Shown is the 1½-hp sander (model No. 11791; \$120). This 16-pound tool accepts a 4 x 21-in. sanding belt and has a speed of 1300 feet per minute (fpm). It sands flush to vertical surfaces, has a locking trigger switch, a dust collection system and ball and roller bearing construction. The sanders are sold at larger Sears stores and through the Sears tool catalog. For information, write to Sears, Roebuck and Co., Dept. 703-PM, Sears Tower, Chicago IL 60684.

## Sign maker

Produce beautiful wood signs and plaques quickly with Dremel's sign layout kit (\$13). The kit has stencils in three styles—Old English, script and block. Each letter comes in three sizes—2, 3 and 4 in. high. Transfer the stencil character to the workpiece using carbon paper and cut out the letter or number. Depending on the cutting procedure used, you can produce cutout, sculptured, engraved and relief-carved letters. The stencils are reusable.

It's sold at hardware stores and hobby centers. Write Dremel, 4915 21st St., Racine, WI 53406.



Wood sign and plaque kit includes three styles of letter and number stencils in three sizes.

## Sander/grinder



Use the sander/grinder to shape, smooth and polish wood, metal, fiberglass and concrete.

Tackle sanding, grinding and wire-brushing jobs with Makita's 4-in. sander/grinder. The tool weighs 3½ pounds, has a 3½-amp motor and delivers 10,000 rpm. It features ball and needle bearing construction, lock-on trigger switch and a removable side handle. The sander/grinder comes with a plastic carrying case, 80-grit sanding disc, grinding wheel and spanner wrenches for about \$98. For details, contact Makita, 12950 East Alondra Blvd., Cerritos, CA 90701.

## Wrap-around clamp

Here's a new clamp, called Snug, that stretches and sticks to itself to handle lightweight clamping chores. Wrap the ½-in.-wide x 20-ft.-long, vinyl-based clamp around the work and tuck in the end. They're effective when assembling irregular-shaped pieces. A 20-ft. clamp costs about \$4 at hardware stores. Contact Carrollton Corp., 70 Carrollton Ave., Elmira, NY 14905-2006. **PM**



Try reusable stretch clamps to hold chairs (top) and other hard-to-clamp objects. Stretch and wrap for maximum pressure (above) then tuck underneath to hold.



# \$25,000,000,000

## The Government Holds For You

Would you like to stake a share of the \$25,000,000,000 the government holds for just making a few phone calls and looking in some phone books? That is all you have to do to enjoy thousands of dollars. If you can read English and can speak on the phone, you can make thousands of dollars overnight—and you don't have to do any selling at all.

This ad will explain every detail of an exciting new business that has never been advertised or attempted before—what's more, you can enter with absolutely no money.

Life was not always rosy for me. I got involved in a bad business investment a few years ago and lost about \$11,000. Everything I owned was taken away from me. I needed money desperately to feed my family, so I was forced to toil as a waiter at the Sheraton Harbor Island Hotel in San Diego by night, and I was a filing clerk during the day. It was so exhausting, that as soon as I got home, I would sleep for just a few hours, wake up in a stupor, drink four cups of coffee, and then scramble to my next job. I had no choice. It was the only thing I could do to stop disappointing my loved ones. I remember coming home on Mother's Day really eager to call my mother, only to find that my phone had been disconnected. I went through the mail praying for some good news, only to find an envelope with no return address—it contained an eviction notice. At this point I thought we would have to live in our beat-up Fiat. We were fortunate to have relatives that were kind enough to let us stay with them. I never knew life could be so miserable. I sat down on the sidewalk just realizing how much being in debt could hurt. With tears in my eyes, I prayed for a way out.

My friend Gary, who was in the same financial boat as I was told me a story that changed my life forever. He told me very excitedly, "I received a funny-looking letter. When I first saw it, I thought it was another creditor making a claim on me. The letter told me about money that was rightfully mine—it said that if I signed the enclosed form, I would receive \$2,592.59. Things were so bad that I had nothing to lose, so I signed the form neatly and returned it to the company.

"Ten days later I received a check for \$2,592.59 with an explanation. A distant aunt had died and left \$4,320.98 in her savings account. The company that found me collected \$1,728.39. The firm had no trouble finding out that I was related to her. Just for matching up people with the same last names, that agency was making millions every year."

It was just then that an amazing idea popped into my mind. I was overcome with excitement; this revolutionary system was so simple, yet I knew it would take me out of my rut. I was compelled to find out more about it. I had lost everything I owned; what else could

### Testimonials

*I have been able to locate and notify 421 claimants (worth \$20,197,323.97 in claims). I was even contacted by a Texas ranger that thought I was running a scam. Later when the ranger understood what I was doing he told me I could use him for a reference. I have made over \$300,000 since I last wrote you Dave.*

**Herb H., TX**

*Due to the methods in your book I was able to secure \$16,212 with the help of my brother. I had to get my 16 year old brother to help me because I am under age. I am 15 years old and have been traveling to Miami, Jamaica, St. Croix, New York. I'll be going to England very soon and L.A. Thank you for helping me make money with your system.*

**Andre I., CT**

*I've spent at least \$7,000 on money-making books and seminars. The difference between them and your method is that yours works! In less than three weeks (part time) I was able to secure \$52,614.21. Thanks for a business that will easily make me \$100,000 this year. If I can ever be of service just call.*

**Steve S., CO**

*Having read your book, I have recently launched into the fascinating endeavor of locating people. As a result, I have succeeded in finding an individual with a fairly large sum of money.*

**Ben S., CA**

*Thank you so much for the methods outlined in your book. I was able to secure \$24,685 in just six hours of work. I have read just about all the other "get rich" books but yours has to be the best.*

**Terrie T., MI**

*I lose? I found out everything I could and began to work on a plan. I put it into effect. My prayers were heard. To my relief I started to make more money than I have ever seen in my life for doing practically nothing. In fact, my income for just last month was \$50,076.78.*

*I had a C-minus average in high school—one year, I received an F in English. By no means was I ever considered to have the smarts. But I did it. All you have to do to make large amounts of money is thumb through phone books and make a few phone calls.*

*Last summer we moved into a gorgeous home. My wife told me it was her life long dream to own a brand new car. You should have seen her tears of joy when I surprised her with her own new \$20,000 car. Later I bought a 1986 Mercedes 560SL that cost me \$56,000.*

*The amount of money I was making was incredible. Just as a hedge against taxes, I bought two three bedroom houses valued at \$200,000.*

**Twenty-five billion is just sitting there waiting for someone to recover it.** One out of ten Americans have forgotten or lost money in bank accounts, stocks, insurance premiums, etc. I will disclose a plan to you that will show you how to get your hands on this money.

Only 10 percent of the rightful owners claim their share of the \$25 billion. The states make no strong effort to contact the rightful owners. Why should they, when unclaimed property is their biggest source of revenue, second only to taxes? The states are required by law to make a list of unclaimed owners. These lists are hard to find but I will show you how to get every one that the states publish. And in some cases, they're free.

Let me give you a random sample list from the state of Wisconsin. (Addresses are included in lists.)

Owner's Name	Property	Amount
Drinks, Teresa, A	Savings	\$10,891.47
Lavelle, Samuel	Stock Proceeds	\$21,529.61
McDonnell, Martha	Savings	\$12,843.78
Meyer, Thunaida	Savings	\$18,489.18
Patterson, Arthur	Savings	\$14,629.24
Stien, George	Savings	\$57,525.83

This listing is only a minor portion of the \$25 billion in unclaimed property that is waiting for you.

To make thousands of dollars, all you need are telephone books and a phone. The proven system in this book can be learned in a half hour. After that, you are all set. **If you can read English and can speak on the phone, you're in business. It's as easy as that.**

### Sample Proof

Bonnie Goldstein, a well-known syndicated newspaper writer who doesn't know anything about finding people, located the owners of \$4,100 in two and a half hours with two telephone directories—she said so in the *San Francisco Sunday Examiner & Chronicle*.

### My Guarantee

Send for my complete guide to recovering unclaimed money. Read the simple formula that has been tailored for each individual state. Sit down and make the required few phone calls and directory searches. **After following the simple formula, you must be able to recover \$10,000 in one day or your complete payment will be returned to you.**

This opportunity can give you a new home, car and all of the luxuries money has to offer. **Think of what \$10,000 today could do for you.** Could you use this kind of money? There is a definite flaw in our revenue system, and you can profit from it.

David Bendah (619) 265-8777  
6602 El Cajon Blvd., Suite B, Dept 513B  
San Diego, CA 92115

Dear Dave:

Send me your complete guide to recovering \$25,000,000,000 in unclaimed money on the condition that I must be able to locate \$10,000 easily in one day with your book or you will return my entire payment.

On that basis, here is my \$10.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip \_\_\_\_\_

Please add \$1 dollar to cover part of the shipping costs. All checks must be accepted by TeleCheck; payments not accepted will be returned in full.

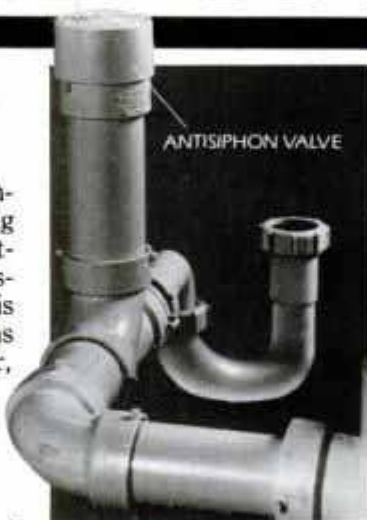


# NEW/HOME

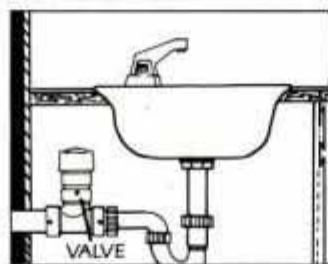
## Ventless Valve

Installing a sink, tub or other fixture—where running a new vent line through existing walls is difficult or impossible—is simplified with this antisiphoning valve. It opens automatically to admit air, which prevents water from being siphoned from the trap, then closes to block the escape of sewer gas.

The valve installs behind the trap and solvent-welds to 1½-in.-dia. plastic pipe. It can be joined to the same diameter metal pipe if its solvent-weld adapter is discarded. Although the valve meets national plumbing code requirements, it may not meet local standards. Check before you install. It costs about \$5 at hardware stores and home centers. For further details, write to Genova, 7034 East Court St., Box 309, Davison, MI 48423-4500.



Genova's PVC antisiphon valve is designed to eliminate the need for a vent stack.



The valve installs behind the trap and can be joined to existing plastic or metal pipe.

## Invisible glove

Rub in this hand cream (\$3) before beginning a dirty job to form a layer against dirt, paint and grease. Cleanup afterward is easy. Invisible Glove is sold in 3-ounce tubes at home centers. Write to Borden, Home and Professional Products, Box 16700, Columbus, OH 43215.



Apply cream to both hands before beginning a dirty job to make cleanup fast and easy.

## Propane power



This liquid propane-powered refrigerator burns about 7 pounds of fuel a week.

Powered by liquid propane, this refrigerator uses no electricity and has no moving parts. It has a 10-cu.-ft. storage capacity and measures 27<sup>3</sup>/<sub>16</sub> in. wide × 28½ in. deep × 62<sup>3</sup>/<sub>8</sub> in. high. It costs about \$899 (shipping extra) from Lehman's Hardware, 4788 Kidron Rd., Kidron, OH 44636.



The window control system allows homeowners to open awning and roof windows easily.

## Open sesame

Open awning and roof windows electronically with this remote-controlled operating system. Designed to be used with Andersen windows, the system allows the homeowner to open and close hard-to-reach windows with a handheld command module.

The system includes a power pack that plugs into a

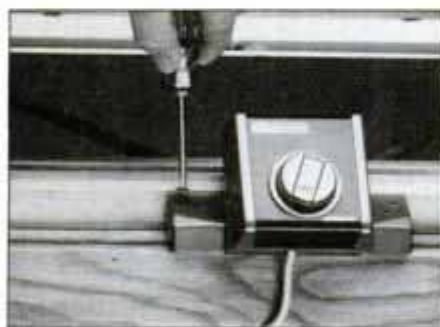
wall outlet, the command module that plugs into the power pack and the window operator, which is connected to the power pack with a line cord.

Also included is a sensor that detects rain falling on the sill outside the window screen, triggering the operator and closing the window. A concealed hand crank in the

operating unit allows the window to be closed during power failure.

Additional operators (\$96) are available so that four windows can be controlled from one module.

The kit costs about \$230 at home centers. For more information, you should write to Andersen Corp., Bayport, MN 55003. **PM**



The window's hand crank is removed and the electric operator is then installed on top of the crank mechanism with two screws.



The command module allows windows to be opened or closed from anywhere in the room. It operates up to four windows.



The rain sensor strip screws to the window-sill on the outside of the screen. It shuts a window if damped by rain.



# Make your home into something special!

That's exactly what your home will be when you fill it with Heathkit electronic products - products that make your life easier and more enjoyable. Within our diverse line are kit and assembled products sure to enhance each room in your home.



**1. Make your entryway more secure and easy to use with the Keyless Doorlock.** You'll never again be locked out because of lost or forgotten keys. All it takes is a simple fingertip entry of a four-digit code, and the Keyless Doorlock unlocks your door.

**2. Add a new dimension to your living room with your own Computerized Weather Station.** This Digital Weather Station displays up-to-the-minute temperature, wind, and barometric pressure readings, along with time and date.



**3. Give your kitchen a unique blend of style and efficiency with our Digital Wall Clock.** This easy-to-build kit keeps time with quartz-crystal accuracy. And with its simulated oak wood-grain finish cabinet, you'll have a timepiece that fits into almost any decor.



**4. Put your den to greater use with this IBM PC AT Compatible Computer.** Do word processing, personal accounting and more when you run exciting IBM-compatible software on your fast and powerful HS-241. And you can build it yourself in just a few hours.

**5. Bring the latest in digital technology to your bathroom.** This Digital Scale lets you closely monitor your weight with electronic precision. And, it's battery operated so it's safe to use right out of the shower.



**6. Add a video entertainment center to your bedroom.** Our 19"-diagonal stereo TV kit gives you an extra-sharp color-corrected picture with full stereo sound, and convenient viewing that you can control from your bed. Comes in a simulated walnut cabinet that complements your room.



**7. Transform your rec room into a haven for hobby fun.** Put our Deluxe QRP CW Transceiver in this room and enjoy superb HAM radio operation that excels in performance and features. It offers expandable transmission and reception capabilities.



**8. Give your workbench a touch of professionalism with this oscilloscope.** Whether you're a service technician or a hobbyist, you'll love the wide range of measurement capability our laboratory-grade Dual Trace 10 MHz Oscilloscope gives you.

**9. Add practicality to the utility room and save money, too.** Avoid expensive food spoilage with our Freezer Alarm that



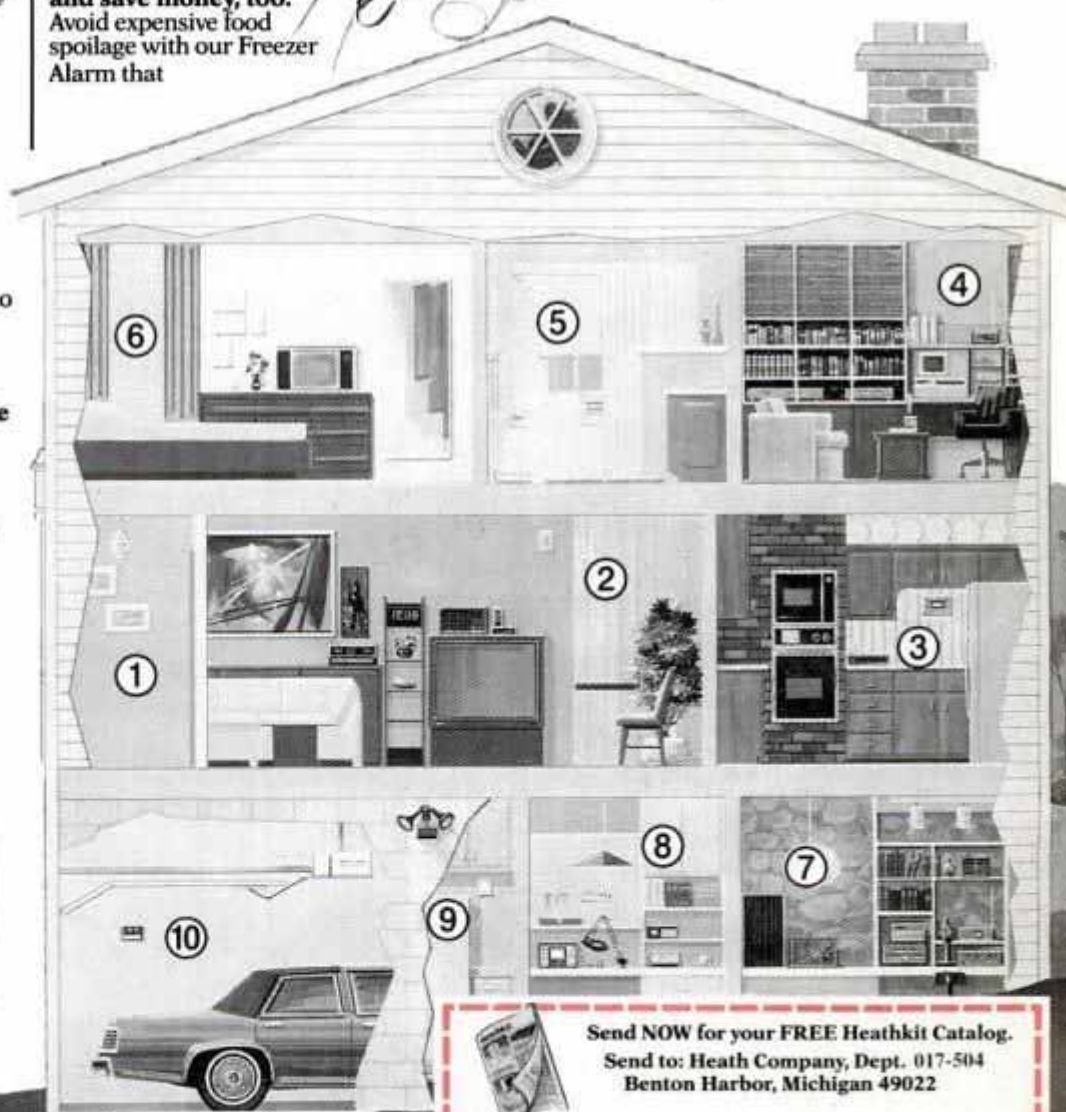
warns you when the inside temperature of your freezer rises too high. Prevent water damage with our Food Alarm that warns you of water that's where it shouldn't be.



**10. Make your coming and going easier than ever.** Your garage door will open with incredible

ease and dependability with our Deluxe Garage Door Opener. Easy to install, this opener is durable and includes a handy security light.

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Company



## INSTANT REPLAY

(Continued from page 77)

that will feel familiar to anyone who uses a 35mm film camera.

The VM-E2 shares most of the automatic features found on the RCA and Zenith camcorders, except for one. It lacks continuous auto white-balance operation. White-balance setting is automatic, but you must set a switch for either indoor or outdoor operation. While this isn't as convenient as the hands-off continuous operation offered by RCA and Zenith, Canon's white-balance settings do reproduce colors accurately indoors and out.

Meanwhile, the VM-E2 has a feature the other camcorders don't—and one we enjoyed. It's a "gain up" switch that boosts the camcorder's sensitivity—noticeably—in low-light conditions. Though boosting the gain adds noise to the picture, it does grab images that are otherwise unobtainable.

Remarkably, images captured with the VM-E2 in its regular mode show very little video noise. This was a problem with earlier 8mm camcorders. In terms of resolution, the VM-E2 yields sharp, clear images on a par with the other camcorders we tested.

One of the nicest things about the 8mm video format is its audio quality.

This camcorder uses an AFM (audio frequency modulation) recording system for excellent monaural audio fidelity. The VM-E2 was the only camcorder in the shootout without a noticeable amount of background noise in its soundtracks. You can record for up to two hours on the longest 8mm tape.

### Sony BMC-660

Lo, how the mighty have fallen. Sony's Betamovie was the first video camcorder for home moviemakers—even now, it's an impressive technical achievement. Although Sony has continued to update it, adding SuperBeta, a picture-boosting process, and a CCD image pickup, the camcorder hasn't changed dramatically over the years.

Meanwhile, the other camcorder formats have caught up to and surpassed Betamovie in sophistication. Super Betamovie has a few of the features most buyers expect today. In particular, it doesn't have playback. To view a tape, you have to remove the cassette and play it in a Beta VCR. It also lacks an electronic viewfinder and continuous auto-white balance.

Despite its bare-bones feature package, Super Betamovie can still shoot

impressive home movies—up to 3½ hours' worth. In fact, it had the best resolution of any camcorder in the shootout. Color performance was excellent both indoors and out, once the white balance had been set. But in other areas, Super Betamovie can't compete. In low-light conditions, the camcorder could barely register an image. The camcorder also made the most mechanical noise of all four models—quite obvious in the soundtracks.

### Conclusion

Tallying up our final results, we ranked the RCA CMR300 first in all-around picture quality, but felt that the system's size and weight are a big handicap for anyone who wants to take it on the road. The Zenith VM6200 and Canon VM-E2 are beautifully engineered compact movie machines. We would lean toward the Zenith if we wanted to keep compatibility with VHS VCRs, but would favor the Canon if picture quality and recording time were top priorities. Sony's Super Betamovie, while still a very capable camcorder, unfortunately is just not in the same league. We would consider it only if we wanted to stick with Beta at all costs. **FM**

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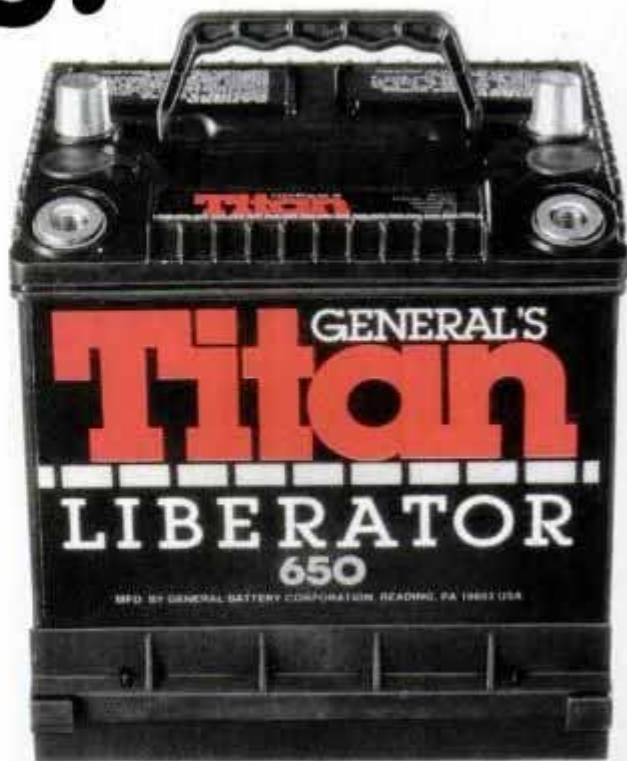
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Buyers were keen on the sleek aerodynamic styling of both the wagon and sedan. Sable (foreground) has full-width parking light and glass C-pillars.

# FORD TAURUS/ MERCURY SABLE

**N**ot since Chrysler rolled out the 1934 Airflow has a family sedan commanded quite so much attention. And for many of the same reasons. This time, though, most people like the aero look. Ford's Taurus and the Mercury Sable—unlike the Airflow—leave the majority of Americans oohing and ahing instead of oh-oh-ing.

The owners we surveyed didn't have to stop and think about what they like best about their Taurus/Sables. "Our Sable is the most beautiful car I've ever seen," wrote a Michigan homemaker. "I really like the aerodynamic styling. It's so unusual for a 4-door family sedan!"

A North Carolina insurance agent: "Very stylish. Favorably priced versus the Audi 5000. Lots of sex appeal for a sporty sedan, with excellent interior roominess, including the trunk."

"The Sable's European styling looks sporty," said a Texas secretary. "I had wanted to buy an American car for a long time, but until the Sable came along I couldn't find one I really liked."

After 1.4 million miles, owners praise looks and performance.

BY MICHAEL LAMM, Contributing Editor

Even so, styling didn't tell the entire story. A California paralegal noted that, "The Taurus LX fills my needs and wants because it's basically user-oriented—for example, the bifold sun visors, cargo net in trunk, both front

seats fully adjustable, the generous interior space. It's a great pleasure to drive this car."

A Louisiana product assurance specialist: "Great roominess! I'm 6-foot-6 and have no problem with headroom or legroom. Plenty of space for the rear passengers, too. It's a sharp, stylish car, with great pep from the 3.0-liter V6. We love it!"

Both the Taurus and Sable make Ford's 2.5-liter Four available; fewer

*(Please turn to page 138)*



Interior got high marks, except for poor illumination of some switches at night.



Performance and economy of the new 3-liter V6 engine impressed most owners.



## TAURUS/SABLE

(Continued from page 137)

than 1 percent of our respondents, though, had ordered it. The Taurus also offers a 5-speed manual transaxle, but this MT5 series, as Ford calls it, ar-

rived relatively late, so none of our owners had purchased it.

About the V6/automatic combination, a New York advertising designer told us, "We just completed a 3-week, 3000-mile trip and averaged 30 mpg overall. I did all the driving and experi-

enced no fatigue or backaches. The Taurus had as much response and power on the hills as on level highways. Very enjoyable!"

An Ohio salesman: "Ergonomically, the Sable is the best American car I've (Please turn to page 140)

### SUMMARY OF 1986 TAURUS/SABLE OWNERS REPORTS\*

<b>Total miles driven</b> 1,389,920	Reputation.....15.6	<b>Workmanship opinion:</b>	<b>Dealer repairs satisfactory?</b>
<b>Average miles per gallon:</b>	Size.....8.6	Excellent.....54.5%	Yes.....66.9%
<b>In town:</b>	Roominess.....7.9	Good.....39.7	No.....33.1
3-speed automatic.....21.0	<b>Specific likes:</b>	Average.....4.2	<b>Dealer service opinion:</b>
4-speed automatic.....21.6	Styling.....63.8%	Poor.....1.5	Excellent.....31.6%
<b>On the highway:</b>	Handling.....56.5	<b>Comfort opinion, front seats:</b>	Good.....45.4
3-speed automatic.....27.8	Comfort.....36.8	Excellent.....71.4%	Average.....16.0
4-speed automatic.....28.1	Ride.....30.5	Good.....25.4	Poor.....7.1
<b>Engine choices:</b>	Fuel economy.....29.2	Average.....1.7	<b>Number of vehicles owned:</b>
3.0-liter V6.....99.1%	<b>Specific dislikes:</b>	Poor.....1.5	This car only.....29.4%
2.5-liter Four.....0.9	No complaints.....13.1%	<b>Comfort opinion, rear seats:</b>	Two cars.....41.6
<b>Transmission choices:</b>	Noises and rattles.....8.5	Excellent.....55.6%	Three cars.....19.5
4-speed automatic.....82.4%	Exhaust odor.....8.1	Good.....41.0	Four or more cars.....5.0
3-speed automatic.....17.6	Too few interior lights.....6.2	Average.....3.0	<b>Makes of other cars owned:</b>
5-speed manual.....0.0	Instrument panel layout 5.8	Poor.....0.3	Ford.....46.5%
<b>Series choices:</b>	<b>What changes would you like?</b>	<b>Had any mechanical trouble?</b>	Chevrolet.....16.6
Sable GS (std.).....27.9%	No changes.....26.8%	No.....58.8%	Mercury.....13.3
Sable LS.....26.7	More interior lights.....8.9	Yes.....41.2	Oldsmobile.....7.5
Taurus GL.....23.3	Quieter car.....6.3	<b>What type of trouble?</b>	Pontiac.....7.5
Taurus LX.....16.7	Lower rear headrests.....5.2	Electrical.....16.4%	<b>Would you buy a Taurus or Sable again?</b>
Taurus L (std.).....5.2	Relocate window regulators.....4.5	Spongy brake pedal.....12.9	Yes.....74.6%
Taurus MT5.....0.3	<b>How much did you pay?</b>	Fuel induction system.....9.3	No.....6.5
<b>Why did you choose this car?</b>	Average.....\$14,222	Transmission.....7.9	Maybe.....18.9
Styling.....73.7%	Range.....\$11,000-18,000	Air conditioning system 7.1	<b>Age distribution of owners:</b>
Handling.....16.8			Under 29 years.....5.6%
			30-49 years.....41.5
			50-plus.....53.0

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

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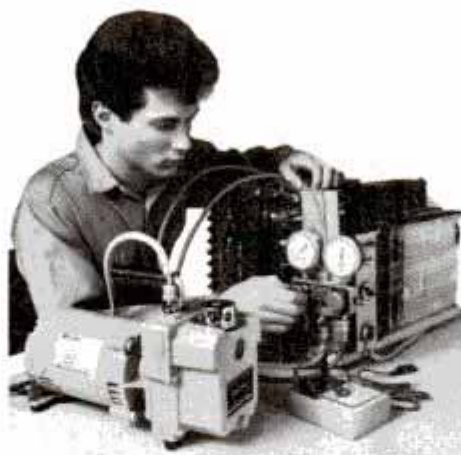
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(Continued from page 138)

ever sat in. All controls are placed for driving ease. Seats and ride integrity are excellent."

There were, however, a few minor grumblings. These came from owners of both nameplates, with no preponderance either way. Nearly 9 percent of our respondents mentioned that headlight, ignition, power window and wiper switches all need to be better illuminated for nighttime use. Shorter drivers also contend that they have trouble seeing past the rear headrests and speaker boxes.

A Missouri test engineer: "Now that Ford Motor Co. has put the horn button back in the steering wheel (a good move), I'd like to see them return the dimmer switch back to the floor."

Nor was a Florida naval officer alone in telling us, "The rear doors are hard to open. I've had the car back to the shop three times to fix the rear door handles."

Some children of a PM staff member managed to close the rear door latches on our long-term Taurus station wagon while the doors were open, then found that they could not be unlatched. The doors had to literally be tied closed for the trip back to the dealer for a quick repair.

A Maryland product specialist: "This Sable gives off the odor of rotten eggs." A Kentucky miner echoed, "My Sable's catalytic converter emits a bad sulfur smell at times, especially after hard acceleration. I've seen people holding their noses beside the car. I'm very dissatisfied owning a car that stinks! Honestly, the car sometimes smells worse than a septic tank." (Ford dealers will install a new converter of different design on early cars with this problem, free of charge.)

### Transaxle troubles

And the automatic transaxles, both 3- and 4-speed, suffered from rough shifting, leaks and, in a few cases, total failure. "Due to a leak," pointed out a New York carton designer, "the transmission went dry at 400 miles. The dealer and factory reacted correctly when they replaced the defective unit extra fast. They flew in a new one and installed it as promised." Dealer service was generally judged good.

Nearly everyone liked Taurus/Sable workmanship, with 94.3 percent rating it good to excellent.

"Workmanship is as good as or better than any European make," said a Massachusetts vice president.

Ride and handling also came in for good marks. They were, in fact, these cars' second-best-liked attributes. "Superior handling," observed a Michigan

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executive, "sure-footed stability and a more solid feel than any other domestic passenger car I've ever driven. Compares favorably with much more expensive European makes."

An Arizona engineer: "The Taurus's ride/handling balance is hard to beat. It's superior to our previous Cadillac and about equal to our Mercedes 190E."

"We have the standard Sable GS," wrote a Missouri meatcutter, "and I find the ride firm but comfortable, with good control on the road. This is my first fwd car, and I really love it."

"Taut and controlled but not harsh," is how a Texas electrical engineer put it. A Nevada educator added, "Best driving machine I've ever had—quick, sure handling, a good ride and corners very well."

"The Taurus GL is the nicest handling car I've ever driven," wrote a self-employed Michigander.

A Texas insurer added, "Best combination of ride and handling in any car short of a BMW touring sedan. Ford did its homework."

"I like the engine design," said a Texas teacher, "because it's easy for home maintenance and servicing, like oil and filter changes. Everything's highlighted in yellow."

### Back on track

Taurus/Sable owners summed up their feelings in compliments as handsome as the cars themselves. "Ford is back on track," said a Minnesota plant manager. "Look out, Lee!"

"Look out GM," added a Maryland realtor, "Here comes Sable! Ford Motor Co. has a winner." A Maine production controller backed up that sentiment with the observation: "Overall ride and comfort was a surprising, pleasant improvement over my '84 Ciera wagon. Gas mileage 1½ mpg better than equal-size Ciera."

"It's the style of the future," predicted a Michigan technician.

And an Ohio chemistry professor observed, "It's so easy to wash! The smooth design does it."

A New Hampshire software quality engineer: "Ford has beat all others with one great family car—for looks, performance, roominess and fuel economy."

A Wisconsin retiree: "When strangers come up and tell me what a pretty car I'm driving, it's a great feeling!"

A Texas real estate agent: "Wonderful combination of looks, driving fun and practicality."

And finally, a Maryland social worker: "We think our Taurus LX is the best car on the road and are very pleased that an American company is shooting for quality and will be able to compete on the world market again. It's about time an American automaker is building a car to be proud of." **PM**

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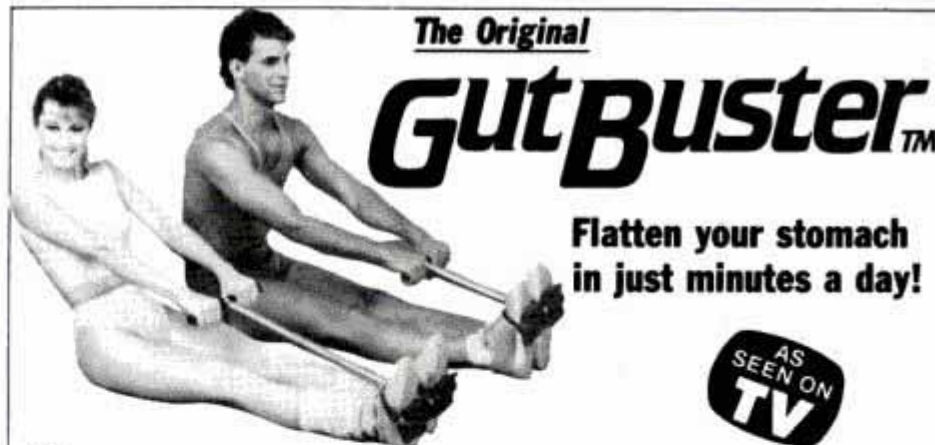
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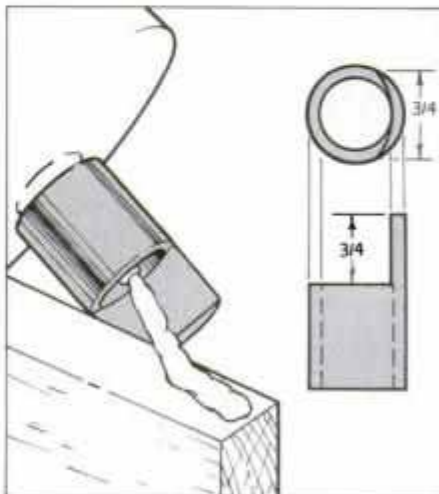
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# HINTS FROM READERS

## Glue guide



Those of us with a not-so-steady hand know how frustrating it is to waver while edge-gluing boards, dripping a large glob of glue down the face of the lumber. You can avoid this troublesome problem by making a simple guide that fits around the glue bottle's spout.

Using a coping saw, cut a  $\frac{3}{4}$ -in. PVC coupling to shape as shown in the illustration above. Dab a small amount of PVC cement on the lower inside portion of the fitting and slide it in place. Its  $\frac{3}{4}$ -in.-high tip acts as a fence to steady the bottle. The glue guide works well enough so that it can be reused after the bottle has been emptied.

—Bruce Northey

## Faucet flush

Occasionally, an indoor faucet's strainer becomes clogged by mineral deposits, rust or debris. This causes an irregular flow of water. To fix this annoying problem, remove the strainer, invert it and run water through it from the opposite direction to flush it out.

—Helen LeMunyon

## Short-piece shelving

Use wall-mounted shelving standards and brackets to store short lumber pieces. This prevents workshop clutter and saves floor space. Brackets in 10- to 14-in. widths are best, and for shelving use  $\frac{1}{2}$ - or  $\frac{3}{4}$ -in.-thick plywood. Stack short pieces end to end, grouped according to size.—Ralph S. Wilkes



# New Stitch Welder Tames Sheetmetal Distortion



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*J. Wright, Penna.*



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Welding with the Stitch Welder is faster and easier than conventional stick welding. The arc's self-starting, so there's less chance of rod sticking. Once you strike an arc lay the rod on the metal and let the machine do the work. After some practice you'll produce welds requiring little grinding or filling. Remember, as with any welding tool the Stitch Welder requires practice to produce good results. We've included complete detailed instructions.

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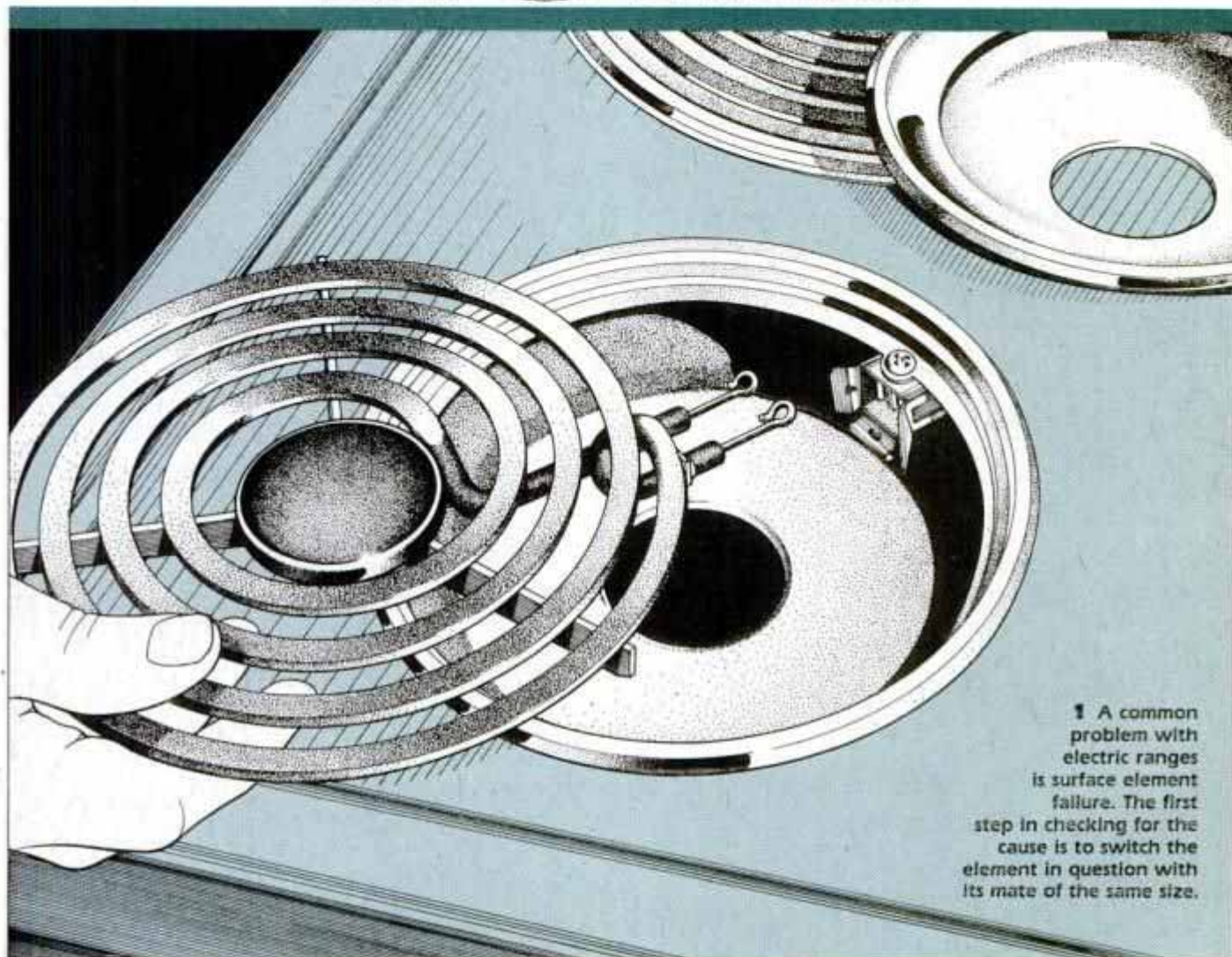
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1 A common problem with electric ranges is surface element failure. The first step in checking for the cause is to switch the element in question with its mate of the same size.

## How To Troubleshoot GAS AND ELECTRIC RANGES

**W**hen your electric or gas range breaks down, don't complicate the problem by chasing phantoms. The reason why an electric element or gas burner doesn't work usually lies with a key part that can be easily tested.

Let's talk about electric ranges first. Seldom will all elements (surface and oven) fail at once. But if they do, the problem is a major electrical failure in the house or in the range.

Check the circuit breaker or fuse. Maybe an overload tripped the circuit breaker and resetting it or replacing a

BY MORT SCHULTZ  
Illustrations by George Retseck

fuse will set things right. If not, seek professional help.

When there's surface element failure, usually only one element won't work. Under these circumstances, you know that you're getting current to the range and the problem is confined to the element or to a part that controls the element.

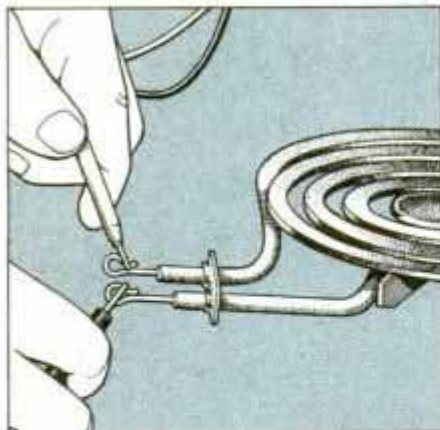
Troubleshooting single-element failure is a simple procedure. Take the

element from its original position, remove the other element of the corresponding size and put the nonworking unit in its place.

Turn the control to high. If the problem element works, it's obviously okay. If it doesn't, get another.

Some ranges have only one element (and two or three hot plates). Since there is not another element to switch with the suspect element, you have to test it with an ohmmeter. The meter will either show resistance or it won't. If it doesn't (the needle stays on zero), replace the element.





**2** To test an element with an ohmmeter, hold the probes to its terminals. You should get a zero resistance reading.

## Tracing element failure

If you have a bad element on your electric range, it's to your advantage to try and find out why it failed. About 85 percent of the electric ranges currently in use have surface elements that are pushed into and pulled out of the terminal blocks.

Elements of the remaining 15 percent have terminals that are screwed to power wires.

If your range has push-on/pull-out elements, examine terminals of the bad element to see if they're bent. Bent terminals indicate the element has not been reinserted properly—that it's been cocked when reconnected to the terminal block.

Bent terminals don't make good contact, causing arcing, and this could lead to element or terminal-block failure. Evidence of this is a black coating on terminals.

Terminals might have a blue tinge to them. This is caused by grease—which has spattered on the terminals—being heated to high temperature. Eventually, this heated grease can cause the terminals to burn and lead to element and terminal-block failure. This condition can also affect elements with screw-on terminals.

If terminals of push-on/pull-out elements are coated, shine a light inside the terminal block. If you see contacts that are burned or eaten away, replace the block and use fine sandpaper or steel wool to clean the ends of element terminals.

Electric range elements use nichrome resistance wires, made of a nickel and chromium alloy. The wire is held inside an insulator and covered by a metal sheathing with a black oxide coating.

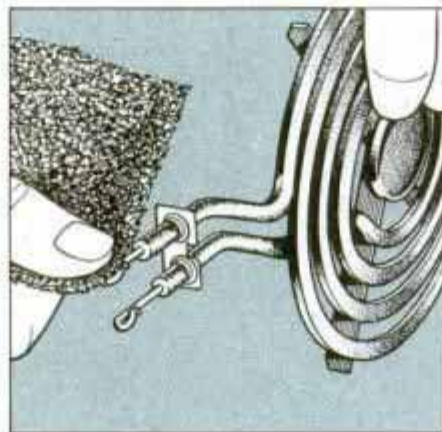
In time, the insulator can break

down. This allows the nichrome wire to touch the sheathing. The result is that the wire burns out, but before it does it may burn a hole through the surface of the element, causing it to fail.

## 'Bad' turns out good

Suppose that after swapping elements you find that the new element now glows brightly. The reason for your problem is either an element control switch that's shot or a damaged control-to-element wire.

A damaged control-to-element wire is more likely if your range has a lift-up rather than a stationary top. As the top of the range is lifted and closed, the wires that carry current to the elements can be pulled apart or caught



**3** If you find burned contacts inside the terminal block, replace it. Next, clean the element's terminals with steel wool.

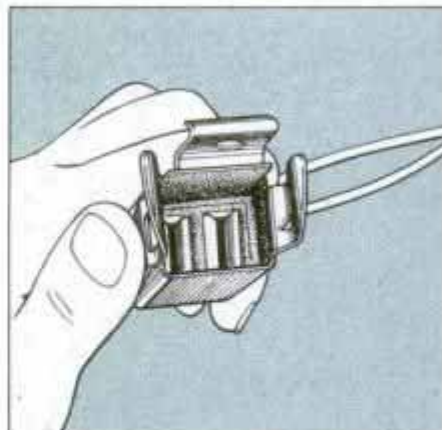
under the lift-up top and crimped.

If you spot a broken or crimped wire, turn off power to the range, strip insulation from the ends of the broken wire and twist loose ends together. Then, solder the wire and cover the splice with a ceramic wire nut. *Caution:* Don't use a plastic nut, which will melt at high range temperatures.

If you don't see a broken or crimped wire, it doesn't mean that one doesn't exist—only that you haven't found it. At this point, troubleshooting the element control switch will determine if the control is bad or if you have to look harder for a damaged wire.

Before starting, be sure power is turned off.

The first step in testing an element control switch is to get behind the control panel. With most ranges, this is done by removing screws holding the panel (console) in position and leaning the panel forward. With other ranges you have to remove screws from a cover at the rear of the console.



**4** If a heating element's terminals have a black or blue coating, check if the terminal block contacts have been burned.

Examine the control switch that operates the element which isn't working and the one controlling the corresponding size element. Transfer "power" wires between the two elements. These power wires are normally colored red, black and/or white.

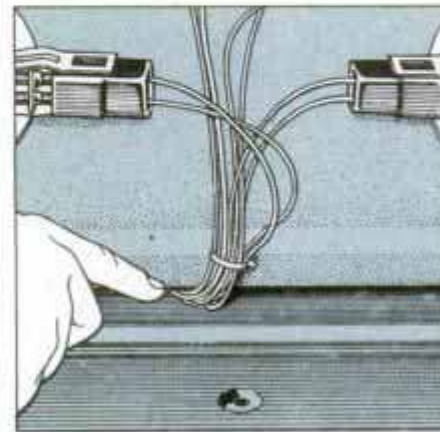
They are the ones that don't bridge controls, but emanate from inside the console.

(To be on the safe side, use adhesive-backed labels to mark which wires connect to which terminals before disconnecting them).

Now, turn on power and turn both control switches to HIGH. If the element that did not work now glows, and the element that had been working doesn't, the control switch is bad. Again, turn off the power, replace the switch and reconnect the wires to their original positions.

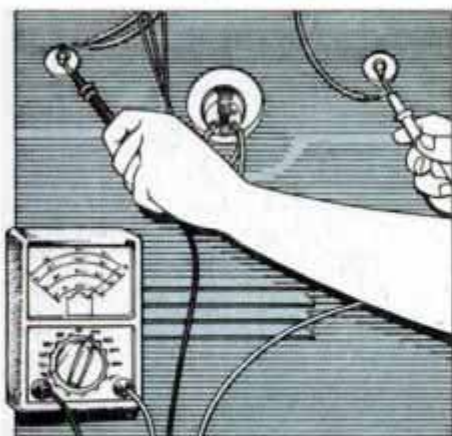
*Caution:* When the power is turned on, be certain that you do not touch any wire or terminal.

If things are status quo—that is, the



**5** The lift-up top on some ranges can easily pinch and damage wires. Check for this and replace any damaged wires.





**6** Oven elements that can't be removed from the inside can be tested with an ohmmeter from behind the range.

bad element still isn't glowing, and the good element is still glowing and you've inspected the terminal block—a broken wire exists. Check again.

## Oven problems

When either the bake or broil element won't work, the cause is much the same as when a surface element won't work—either the element is bad, a control switch is shot, or there's a bad wire.

Testing oven elements is a little more difficult than testing a surface element. You have to use an ohmmeter. Turn off power. From inside the oven, remove screws holding the nonworking element in place.

Then, carefully pull the element toward you, detach the terminals—they'll be held to power wires by spade connectors or screws—and remove the element. Place the ohmmeter leads on the element terminals. The ohmmeter should show resistance. If it shows zero, replace the element.

If the element cannot be removed from inside the oven, take off the rear panel. Test the element by holding ohmmeter probes against the element terminals.

Suppose the ohmmeter shows the element is okay.

So why doesn't it glow?

The cause probably is a defective oven selector control switch, which is used to select the BAKE and BROIL functions on your range.

## Testing the selector control

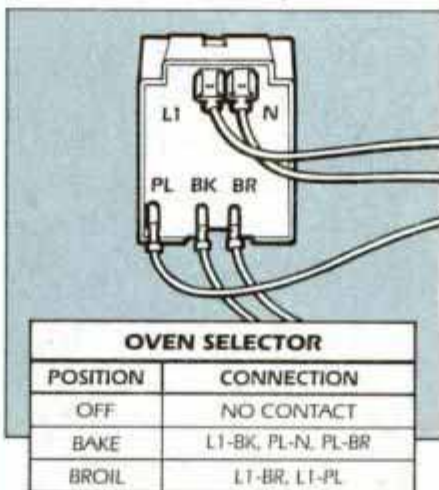
As part of the wiring diagram for the range, which is probably pasted to the outer or inner side of the back panel, you will see an oven selector chart, similar to the one illustrated in Fig. 6. Using this oven selector chart and an

ohmmeter, you can test the oven selector control switch.

To demonstrate this, let's use the chart to test the bake and broil sides of a control. The chart points out that in the BAKE setting there should be continuity between contacts L1 and BK, PL and N, and PL and BR.

Turn off the power and open the control panel to reach the contacts of the oven selector control switch. Disconnect the wires from the contacts. Make sure that you note which wire goes where.

Turn the oven selector control switch to BAKE. Then, hold ohmmeter leads first to L1 and BK contacts; then, to PL and N contacts; and finally, to PL and BR contacts. If you fail to get zero



**7** The oven selector switch chart tells which terminals control bake and broil functions. Check them for continuity.

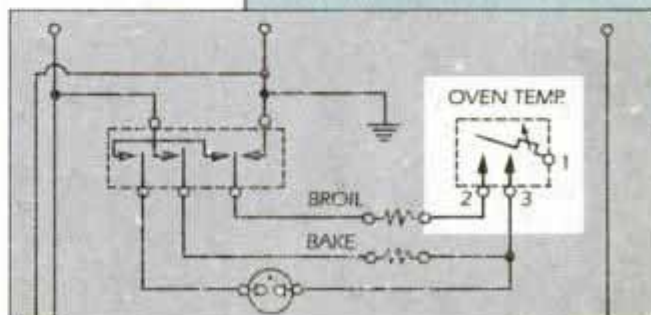
resistance in any of the three positions, replace the switch.

The broil side of the control is tested the same way.

Turn the switch to BROIL and hold the ohmmeter leads first across contacts L1 and BR, and then contacts L1 and PL.

If the ohmmeter shows other than zero resistance in either position, replace the switch selector control.

**8** If an oven's bake and broil elements aren't working, the cause may be the oven temperature control switch; its wiring diagram is at right. Note contacts 1 and 3 control bake; contacts 1 and 2 control broil.



## Testing the oven temperature control

Another likely trouble area is the oven temperature control switch. When the control switch goes bad, one or both elements won't work.

In the event that both the broil and bake elements aren't working, however, there's one thing to do before testing the oven temperature control—check the clock-timer. It should be in the manual position. If someone accidentally moved the clock-timer to the AUTOMATIC position, the element won't glow until the clock reaches the time set on the timer. Move the clock switch to MANUAL. Now, check to see if broil and bake elements work.

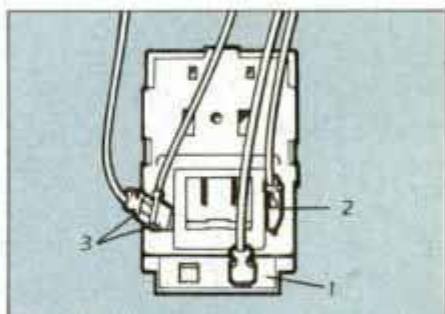
If you have to test the oven temperature control switch, check the wiring diagram to determine which contacts are involved (Fig. 7). It points out that the oven temperature in bake is controlled by contacts 1 and 3, and the oven temperature in broil is controlled by contacts 1 and 2.

Using this information, here's how to check the switch:

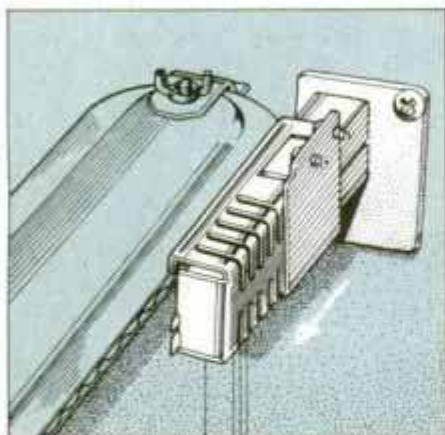
Turn off power and open the control panel. Disconnect wires from the oven temperature control switch. Turn the control to at least 300°. Place ohmmeter leads across contacts 1 and 2 and turn the oven selector switch to BROIL. Then, turn the oven selector switch to BAKE and hold ohmmeter leads across contacts 1 and 3. If you don't get zero resistance in either or both positions, replace the switch.

## Gas pains

Let's move on to gas ranges. The most







**9** Replace a carborundum glow coil that has burned out by unscrewing it, drawing it toward you, and then disconnecting it.

frequent problem is failure of burners to light because igniters (often called pilot lights) don't work.

There are three types of igniters: gas-fed, electric-spark and carborundum (glow-coil). Gas-fed and electric-spark igniters are used to ignite surface and oven burners. Carborundum igniters are used in ovens only.

If a carborundum igniter doesn't glow when activated, the coil is probably shot and has to be replaced. To replace a glow coil, just unscrew it and install a new one.

*Important:* When installing the new coil, make sure you don't touch the igniter. If oil from your fingers gets on the element, it will fail.

The only other part that might be at fault with a carborundum oven igniter is a gas valve that doesn't open, but servicing a component that handles gas is something to leave to a professional.

An exception to this "hands-off gas parts" advice is with a gas-fed pilot light igniter.

When a spillover clogs the orifice, you can unscrew the jet to clean it. First, however, be sure to turn off the gas going to the pilot light.

When the jet is clean and back in place, open the gas line. Then, spread a water-detergent solution around the jet. If suds bubble, there's a leak. Turn off gas, tighten the jet a little more, and do the leak-test again.

If you can't stop the leak by tightening the jet, turn off the gas valve, remove the jet and spread a thin layer of pipe-joint compound around the threads. If this doesn't work, then turn off the gas valve and call a service technician.

## Repairing spark igniters

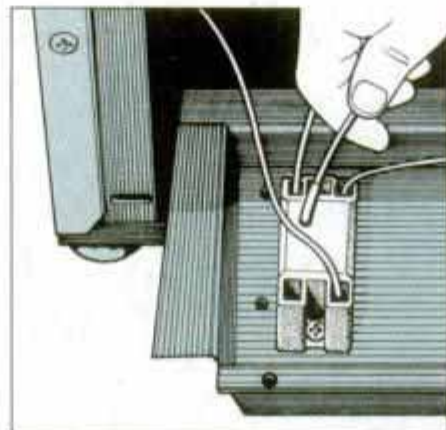
Spark igniters (electrodes) are safer to

handle than gas-fed igniters because they are electric and you don't have to worry about gas leaks or about shutting off gas to test one.

But be sure to first disconnect the range's power cord. Spark igniters for surface and oven burners consist of control switches, electrode/wire assemblies and a module.

For those who aren't familiar with spark-igniter setup for surface gas burners, two burners are ignited by a common igniter.

If a spark igniter fails to ignite one burner but ignites the other, the control switch of the nonworking burner is probably shot. A main cause for this is water dripping onto the switch and causing a short.



**10** If a spark igniter fails to light a burner, a bad module may be to blame. Check this by reversing left and right wires.

Generally speaking, if you see a blackened area on the control switch, this means it's been burned by a short. In such a case, you should replace the control switch.

Suppose a spark igniter doesn't ig-



**12** If an electrode wire assembly is faulty, and not the module, replace it. Begin by unscrewing the part and lifting it up.



**11** The black spot on this burner control switch (arrow) indicates the switch has been shorted and needs to be replaced.

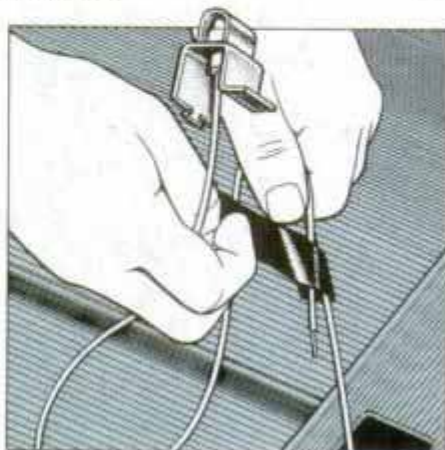
nite either burner. This tells you the trouble is a bad electrode/wire assembly or a defective module.

To find out which problem is causing the trouble, turn off electricity. At the module, disconnect and reverse wires that go to the right- and left-side electrodes. Restore electricity and turn on the controls.

If the problem has been failure by the right-side electrode to ignite right-side burners and the right-side igniter now works but the left-side igniter doesn't, this means the module is bad. You should replace the module.

If the right-side burners still don't work, then either the right-side electrode or the electrode wire is shot. It doesn't matter which, they are replaced as a unit.

Before pulling the electrode/wire assembly out of the range, cut off the old electrode, tape the end of the new wire to the old one, and fish the old wire out of the range while feeding the new wire into place. **PM**



**13** Cut off the old electrode, tape the new wire to the old one and pull both through the passage until the new wire emerges.



**"When Pace showed us  
it's just as  
easy to sell  
a big order  
as a little one  
we started making the  
biggest earnings of our lifetime!"**



**A true story by  
John & Christine  
Shelley (of Virginia)**

"For 19½ years, we ran a franchise of a national auto accessory and appliance store", said Christine, "and we had the privilege of working 7 days a week. We wanted shorter hours, better pay and more time with our family. And with Pace Products—we got all three!"

"I started with PACE part-time when I was 58", added John. "It worked out so exceptionally well that in just a year we sold the store and went full-time with Pace Products, Inc. Now we have so much more freedom".

"My first PACE sale brought me earnings of just \$100. But the next week, my earnings were much bigger. I stepped into selling Pace's SEAMLESS SPRAY, which has earned me commission checks as big as \$4,200! And to tell the truth, those jobs didn't take any longer to sell than the one that earned me my first \$100!"

"That's the one thing about Pace Products," John continued. "The average order brings earnings of \$500 and more—so they add up fast! Pace Products are one coat maintenance items that are really needed by schools, plants, motels, warehouses, apartment complexes . . . you name it. You can go up and down the main street in any town and nearly every building is a perfect prospect! Big increases in labor costs over the last ten years have made replacing roofs and blacktops so expensive, that your customers are easy to sell. And Pace Products are important energy savers, too!"

"Once you get an order, you know you're going to get it again and again. 70% of my orders are repeats! And the greatest thing about Pace is that you get commissions on repeat sales, automatically. That comes in handy when you have to miss a few days of work for some reason or another."

"One of my most popular Pace Products is WET-JET roof coating. It's an all-weather gilsonite asphalt roof coating which is reinforced with fiberglass. It saves the cost of a new roof and that's a small fortune these days. The average WET-JET sale earns me well over \$500."

"And then there's SILVERLEAF, which is

made with Reynolds Aluminum Pigment. I can quickly show any prospect how he can save thousands of dollars putting Pace Products on the roof himself, using his own people. And SILVERLEAF insulates to save on winter fuel and summer air conditioning."

"Both WET-JET and SILVERLEAF can be applied by the customer's own crew using the labor-saving SEAMLESS SPRAY equipment that Pace provides my customers on FREE LOAN. That's a great way to close an order, as this equipment lets three unskilled men do a professional job of reinforcing and renewing the roof. And that's where some super savings come in that let you close big orders!"

"There are so many great PACE products—like PARK-KING, a one-coat siliconized black-top sealer and HYLO-ZYME drain conditioner which clears all plumbing drain lines in the building . . . and it's easily applied through vents in the roof!"

Christine was just as enthusiastic about PACE as John. "I do phone answering and even take some of the orders myself", she said. "What I like best is that when we sell a certain amount, not only does John get a bonus . . . but I get a check of my own!"

"Every three or four months, John and I take a trip together. And we spend whole weekends now with our sons and grandchildren, even take

an extra day if we feel like it. What a difference!"

"Working with all the people at Pace is such a pleasure", added John. "They've done everything I've ever asked them to do right away. They just bend over backwards to help. And they are the most efficient company I've ever worked with".

"Pace has been leading the building maintenance field for over 25 years. We serve companies like Ford, Proctor and Gamble, and the average businesses up and down the street in every town. That's why Pace is the fastest-growing company of its kind in America!"

"I'm sure glad I saw the Pace ad in the paper that day back in 1971. I sent in the coupon and started with about 8 hours a week. That's when all these good things started happening for us. If you want to find the same kind of success and independence we did, why not send in the coupon? I can guarantee that Mike McIntosh and the whole Pace team will do everything they can to start you off right!"

John E. Shelley

**Memo from Mike McIntosh . . .  
Vice President/Sales**

Our thanks to John & Christine for letting us print their own Pace Story. They've told it better than we ever could. If you'd like a taste of the independence and great earnings that John and Christine are enjoying with PACE without investing one cent of your money, drop me a line or mail the coupon. I'll send you all the exciting facts about how you can immediately begin a new career with PACE!



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# SHOOTING FOR SAFETY

**A**ctive shooters have a new weapon in the fight against hearing damage on the firing range. It's an electronic external hearing protector that automatically reduces loud gun reports to 85 decibels—about as loud as a normal conversation—while automatically boosting whispers or range commands to the same level.

The ear-muff-style device was developed by Gentex Corp., makers of sophisticated military helmets and face shields, with considerable input from the David Clark Corp., a long established shooting safety accessories manufacturer. The device, called the Gentex 1030 Active Hearing Protector, has its roots in the military DH 140 helmet issued to artillery crews and range instructors. The civilian version is shown here. Its immediate progenitor is still used by police SWAT teams and other special forces. The system is particularly effective during police work in enclosed spaces, when whispering must be amplified and loud, sudden reports blocked out.

But the new Gentex binaural system—meaning amplifiers and microphones are positioned in both ear cups—has a difference. The Gentex civilian model is cheaper, less bulky and a simple on/off switch is virtually the only moving part. The 1020 system—with microphone and amplifier in only one earcup—sells for \$145; the 1030 illustrated here is priced at \$250.



Now, an electronic hearing protector that 'blocks the bang' is ready on the firing line.

BY DON GEARY

The electronic hearing protector is based on careful research in the field of sound suppression. Normal conversation, it is estimated, takes place in the 50 to 70 decibel sound range. For comparison, a hair dryer produces around 80 decibels, a passing subway train about 100 decibels, a .30-06 rifle 125 decibels and a 12-gauge shotgun about 127 decibels.

Experts agree that prolonged exposure to sounds of around 80 to 90 decibels (on a factory assembly line, for instance) can contribute to hearing loss. Sounds become painful around 120 decibels and serious injury can result at 180

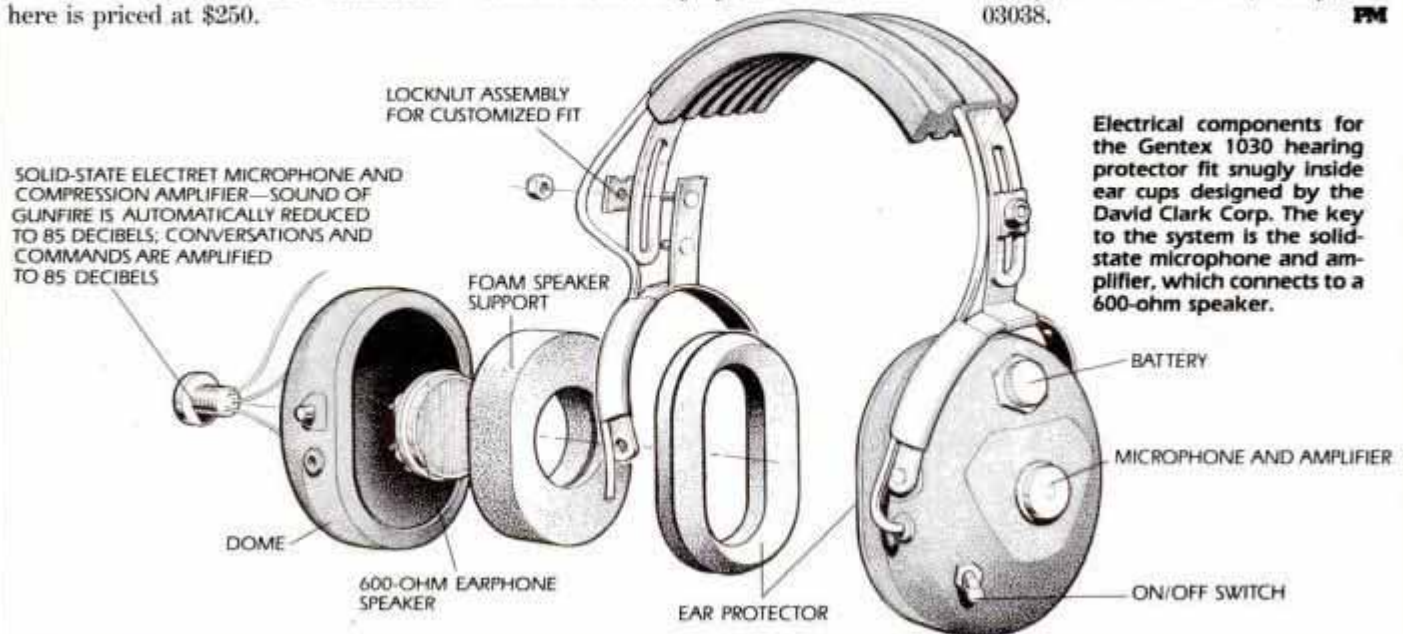
decibels and over. The Gentex 1030 combines the David Clark-designed half-round cups and its own special microphone amplification system. Powered by a 1.4-volt DC hearing aid battery (diagram), an electret microphone positioned in the center of each protector cup picks up sounds less than 85 decibels. The sound is then amplified through a solid-state series of pre-amplifier, compression amplifier and output amplifier and sent to tiny 600-ohm speakers inside both cups.

Sounds above 85 decibels—from a gun report, for instance—trigger an automatic reduction in gain, which effectively blocks the bang.

This sound-suppression system also features a cushioned headpad and a lock nut slide assembly for maximum comfort during a long day on the range. Rubberized protectors form a solid seal where the 1030 meets the ear. Some higher quality ear-muff-type ear protectors have liquid-filled ear cushions, which are more comfortable and form an even tighter seal. Gentex spokesmen say its foam-filled ear seals offer just as much protection without the maintenance problems inherent in liquid-filled cushions. Trifling aside, shooters can now enjoy truly high-tech solid-state electronics in a traditionally designed hearing protector.

For more information, contact Gentex Corp., 5 Tinkham Ave., Derry, NH 03038.

FM





# Vision Break-through

*When I put on the pair of glasses what I saw I could not believe. Nor will you.*

By Joseph Sugarman

I am about to tell you a true story. If you believe me, you will be well rewarded. If you don't believe me, I will make it worth your while to change your mind. Let me explain.

Len is a friend of mine who has an eye for good products. One day he called excited about a pair of sunglasses he owned. "It's so incredible," he said, "when you first look through a pair, you won't believe it."

"What will I see?" I asked. "What could be so incredible?"

Len continued, "When you put on these glasses, your vision improves. Objects appear sharper, more defined. Everything takes on an enhanced 3-D effect. And it's not my imagination. I just want you to see for yourself."

When I received the sunglasses and put them on I couldn't believe my eyes. I kept taking them off and putting them on to see if indeed what I was seeing through the glasses was indeed actually sharper or if my imagination was playing tricks on me. But my vision improved. It was obvious. I kept putting on my cherished \$100 pair of high-tech sunglasses and comparing them. They didn't compare. I was very impressed. Everything appeared sharper, more defined and indeed had a greater three dimensional look to it. But what did this product do that made my vision so much better? I found out.

## DEPRESSING COLOR

The Perception sunglasses (called BluBlockers) filter out the ultraviolet and blue spectrum light waves from the sun. You've often heard the color blue used for expressions of bad moods such as "blue Monday" or "I have the blues." Apparently, the color blue, for centuries, has been considered a rather depressing color.

For eyesight, blue is not a good color too. There are several reasons. First, the blue rays have one of the shortest wavelength in the visible spectrum (red

is the longest). As a result, the color blue will focus slightly in front of the retina which is the "focussing screen" onto which light waves fall in your eye. By eliminating the blue from the sunglasses through a special filtration process, and only letting those rays through that indeed focus clearly on the retina, objects appear to be sharper and clearer.

The second reason is even more impressive. It is not good to have ultraviolet rays fall on our eyes. Recognized as bad for skin, uv light is worse for eyes and is believed to play a role in many of today's eye diseases. In addition, people with contact lenses are at greater risk because contacts tend to magnify the light at their edges thus increasing the sun's harmful effects.

Finally, by eliminating the blue and uv light during the day, your night vision improves. The purple pigment in your eye called Rhodopsin is affected by blue light and the eyes take hours to recover from the effects.

## SUNGLASS DANGER

But what really surprised me was the danger in conventional sunglasses. Our pupils close in bright light to limit the light entering the eye and open wider at night—just like the aperture in an automatic camera. So when we put on sunglasses, although we reduce the amount of light that enters our eyes, our pupils open wider and we are actually allowing more of the blue and ultraviolet portions of the light spectrum into our eyes.

BluBlockers sunglasses are darker at the top to shield out overhead light. The lens used is the CR-39 which most eye doctors will tell you is one of the finest materials you can use for glasses and is manufactured under license.

The frames are some of the most comfortable I have ever worn. The moulded nose rest will fit any nose. The hinge causes the frames to rest comfortably on your face and can be adjusted for almost

any size face.

We also have a clip-on pair that weighs less than one ounce. Both come with a padded carrying case and an anti-scratch coating.

I urge you to order a pair and experience the improved vision. Then take your old sunglasses and compare them to the BluBlockers. See how much clearer and sharper objects appear with BluBlockers. And see if your night vision doesn't improve as a direct result. If you don't see a dramatic difference in your vision—one so noticeable that you can tell immediately, then send them back anytime within 30 days and I will send you a prompt and courteous refund.

## DRAMATIC DIFFERENCE

But from what I've personally witnessed, once you use a pair, there will be no way you'll want to return it.

Astronomers from many famous universities wear BluBlockers to improve their night vision. Pilots, golfers, skiers, athletes—anyone who spends a great deal of time in the sun have found the BluBlockers indispensable.

Our eyes are very important to us. Protect them and at the same time improve your vision with the most incredible breakthrough in sun glasses since they were first introduced. Order a pair or two at no obligation, today.

To order, credit card holders call toll free and ask for product by number shown below or send a check plus \$4 for delivery.

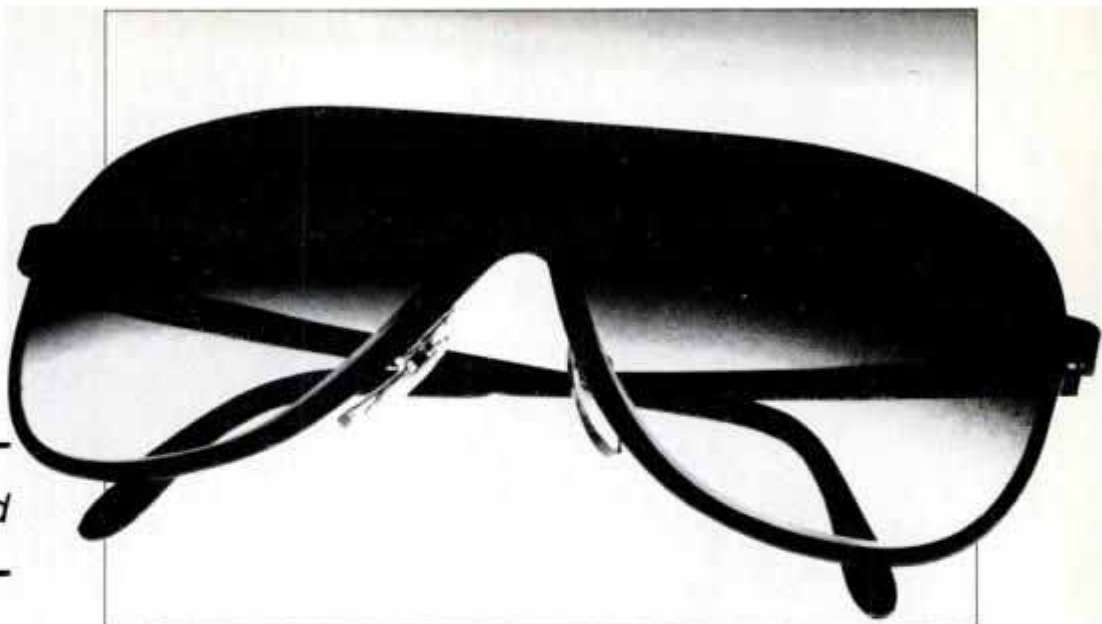
BluBlockers (0020ROK) . . . . . \$59.95

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VISA/MC# \_\_\_\_\_ Exp. Date \_\_\_\_\_

Car #1: Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

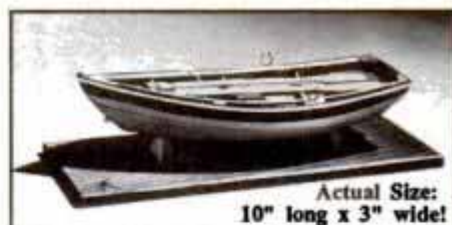
Car #2: Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

Car #3: Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

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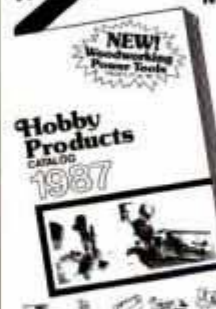
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## CHECK YOUR BELTS NOW

# TIMING IS EVERYTHING

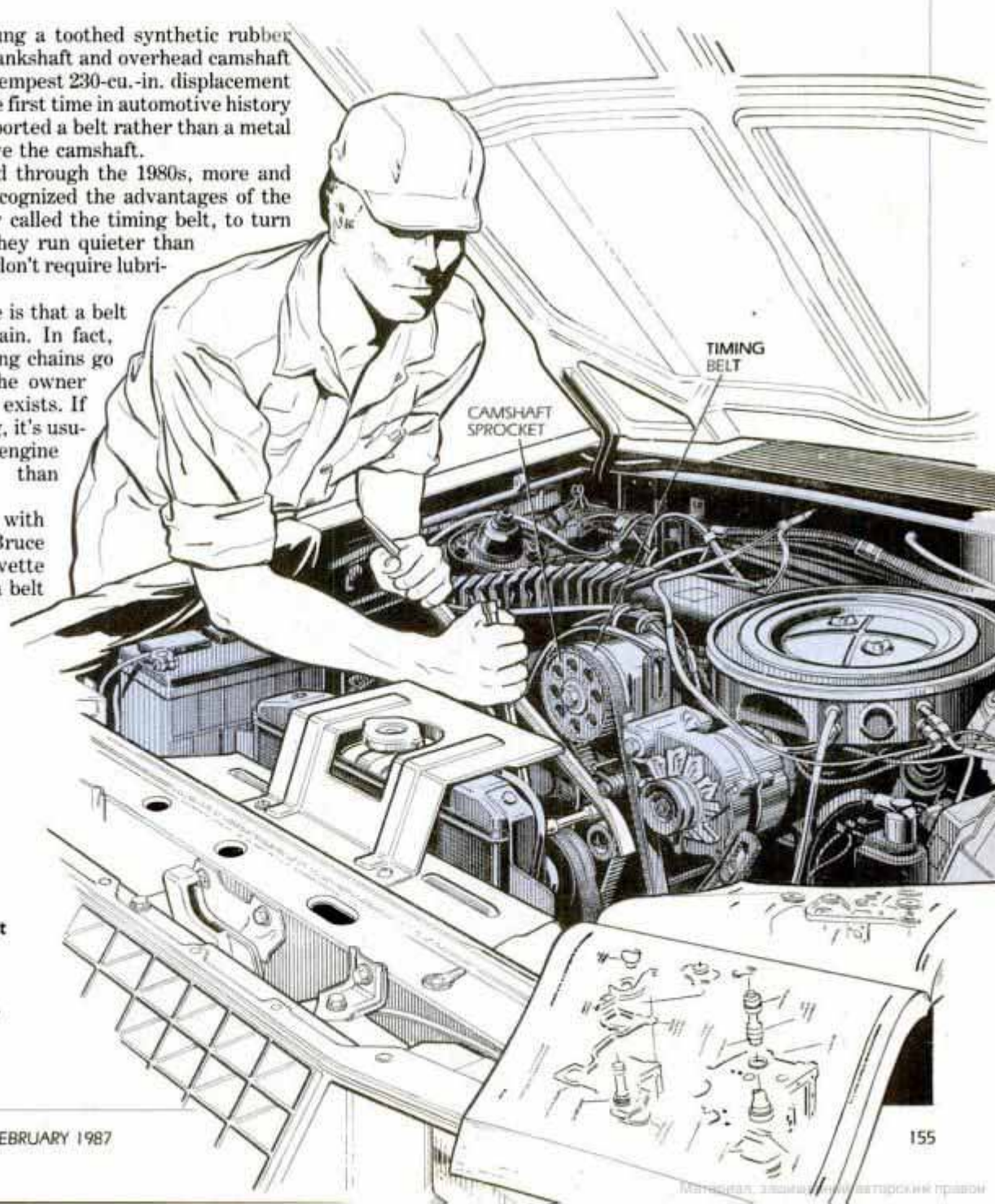
BY MORT SCHULTZ, Contributing Editor

**I**n 1966 Pontiac strung a toothed synthetic rubber belt between the crankshaft and overhead camshaft in its LeMans and Tempest 230-cu.-in. displacement (CID) engine. It was the first time in automotive history that a popular engine sported a belt rather than a metal chain or gearset to drive the camshaft.

During the 1970s and through the 1980s, more and more manufacturers recognized the advantages of the toothed belt, commonly called the timing belt, to turn overhead camshafts. They run quieter than metal chains, cost less, don't require lubrication and weigh less.

The big disadvantage is that a belt isn't as strong as a chain. In fact, most engines with timing chains go through life without the owner ever knowing the chain exists. If one does need replacing, it's usually never before the engine has rolled up more than 100,000 miles.

It's a lot different with timing belts. Ask Bruce Clark, whose 1980 Chevette 1.6-liter engine broke a belt



Setting the engine at TDC and replacing a timing belt require you to follow the specific instructions issued by the manufacturer. You will need the service manual. If you're just going to inspect the belt, a manual may not be necessary.



at 55,000 miles, or George May and George Keller, whose belts in their 1981 and 1982 Escorts, respectively, sheared at 45,000 miles.

Clark was lucky. His engine suffered no damage. "It just quit instantly," he said. But May had to replace four bent exhaust valves, and Keller had a host of trouble, including damaged valves, pistons and head.

Then there are Bob Hackman and Bob Lendy—two others who wrote to PM's *Car Clinic* about belts breaking. Hackman's 1983 Pontiac 2000 had a double whammy. The original belt broke at 35,000 miles—the replacement at 59,000 miles.

In 25 years of *Car Clinic*, we haven't received a single letter complaining of a timing chain breaking. In the past couple of years, however, we've received dozens about timing belts. Since that belt was first put on that Pontiac engine in 1966, they've been put on approximately 200 other models. That number will increase in the future.

In all fairness to belts, ohc engines have a route about three times as long and as serpentine as a cam-in-block motor, and belt failure doesn't necessarily mean major damage—some engines have sufficient valve-to-piston clearance to prevent catastrophe.

## Belt or chain?

Do you have a belt or chain on your car? To find out, check with the dealer or a mechanic. Look under the hood.

If the cover on the end of the engine is plastic, there's almost certainly a belt there, because the chain requires a steel or alloy cover with a gasket to hold in the oil.

One of the first things to do is check the maintenance schedule for your car. Over the years, several manufacturers have recommended replacing belts at intervals ranging from 20,000 to 60,000 miles. These recommendations apply primarily to engines that would, in all likelihood, incur damage if belts broke as the engines were running.

If there is no recommendation, you're not off the hook. Neither are you out of the woods even if a dealer of your particular model tells you not to worry—that he's never seen a belt in any of his cars break. Even if the engine is designed to avoid being damaged if the belt fails, the considerable inconvenience of an on-the-road breakdown is still very much in the picture.

"Timing belts require special attention. They should be checked periodically for signs of wear or damage."

That's what engineers at Gates Rub-



1 Turn the crank in the direction of normal rotation to align the timing marks.

ber Co. say. Gates supplies most of the timing belts to the automotive industry. Be smart! Take their word for it.

## Inspect often

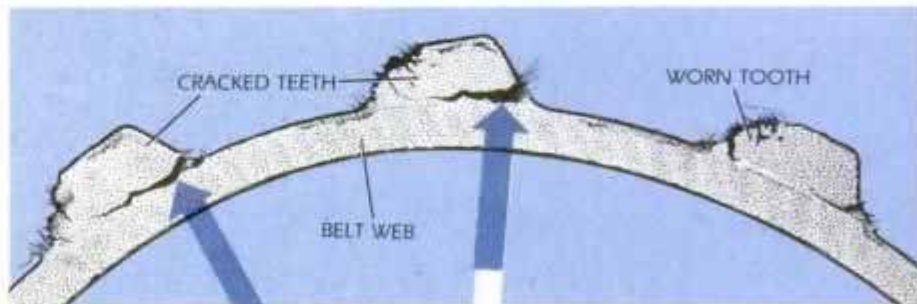
How often should you inspect a timing belt? It seems that in the cases mentioned, every 60,000 miles wouldn't have been soon enough. That's why inspections should be done between 30,000 and 40,000 miles.

The task should pose no problem, but if you are undecided whether to tackle the job yourself, give some thought to the following description to reach the belt in a Ford 2.3-liter engine. If the procedure sounds like one you could handle, you can probably do the work on your engine. You'll need a service manual with exact procedures.

In any engine, to get at the belt and give it a close, thorough inspection, the timing belt cover has to come off. The covers of many engines have inspection holes that allow you to view only a small portion of the belt.

That's not good enough.

Disconnect the battery ground cable for safety reasons. With the 2.3-liter Ford engine, you then have to take off the fan blade, V-belts and upper radiator hose to get at the cover. You might



2 Don't hesitate if you see bad teeth. Replace the belt before it's too late!

want to drain the radiator coolant into a clean vessel for reuse or perhaps combine this procedure with a fall tune-up and winterization.

At this point, the engine should be turned so the timing pointer on the crankshaft pulley is aligned with the top dead center (TDC) mark on the engine's ignition timing scale, which is usually attached to the timing cover or front of the engine. On some engines the scale may be on the pulley and the pointer on the timing cover. On others, the timing pointer and scale are on the flywheel and bell housing.

Attaining and maintaining the proper crank, countershaft and cam positioning is required for proper timing of the engine when a new timing belt is installed. However, if you're not planning to replace a bad belt yourself (see below for what's involved), but will button up the engine and let a mechanic do the job instead, go ahead and take off the cover without moving the engine to top dead center.

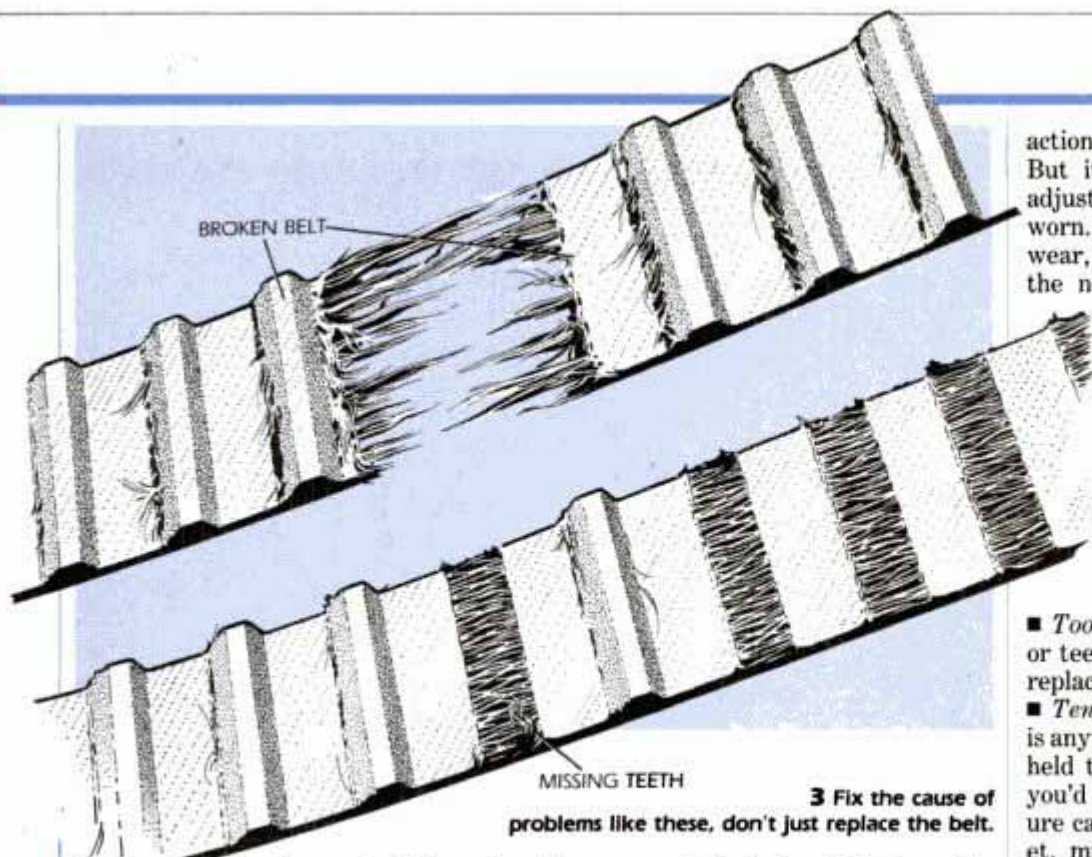
## Top dead center

Setting the engine at TDC and replacing the timing belt require that you refer to a service manual for your engine, since what you have to do differs from one engine to another.

To set the Ford 2.3-liter engine at top dead center, align the timing pointer of the timing belt cover with the 0° or TDC mark on the crankshaft damper. Do this by engaging the crankshaft center bolt with a wrench and turning the crankshaft in the direction of engine rotation, which is clockwise with this engine, until the two marks line up (Fig. 1). Be very careful now—if you turn the engine in a direction that's opposite the way the engine normally rotates, you could cause the timing belt to jump a tooth.

As many other engines do, the 2.3-liter engine provides a way to verify if the engine is truly at top dead center. There's a rubber plug in the top of the timing belt cover. By removing the plug or taking off the cover, you can see





**3** Fix the cause of problems like these. don't just replace the belt.

if the timing mark punched into the camshaft drive sprocket is in line with a timing pointer. When the two are in line, it confirms that the engine is at No. 1 top dead center.

Be aware that the crank rotates twice for every complete engine firing cycle, so it's necessary to be sure that the engine is at No. 1 TDC on the compression stroke, not exhaust.

If the two marks aren't in line, rotate the crankshaft one complete revolution. The marks may now fall in line. If not, the timing belt has jumped a tooth, and engine timing will have to be reset. This involves replacing the belt, turning the crankshaft to get the timing mark on the sprockets aligned with the timing pointer and setting the distributor rotor to No. 1 firing position by rotating the counter.

### Inspection

Suppose things proceed normally—timing is in order and you remove the timing belt cover to expose the belt underneath.

How do you conduct an inspection?

First, let me emphasize what you should *not* do: Never twist the belt to get a better view. Doing so can weaken the tensile cords inside the fabric of an otherwise sound belt.

Weakened cords can snap, causing the belt to fail prematurely.

You will probably have to bend and stretch to get a good look at the entire belt. I find a flashlight comes in handy—also patience to get each inch of the belt brought into view. To get a look at

that part of the belt which is on the camshaft sprocket, for example, turn the crankshaft until the belt teeth come off the camshaft sprocket and are visible. To get a good look at the lower half of the belt, turn the crankshaft until that half comes to the top of the engine.

Here's what to look for:

■ **Fabric wear**—Thready strands that stick out are an initial sign that the belt is weakening. Fabric wear is a natural occurrence that's caused by the sliding

action between belt and sprocket teeth. But it's accelerated if the belt isn't adjusted properly or if a sprocket is worn. Depending upon the degree of wear, the belt may or may not last until the next inspection. The decision to replace it now or to take a chance is yours.

■ **Tooth cracking** (Fig. 2)—If you spot a tooth or teeth that are cracked, don't wait to replace the belt. Within the next 30,000 miles, there's a chance the cracked tooth will separate from the belt web, causing the engine to go out-of-time or the belt to snap.

■ **Tooth separation** (Fig. 3)—If a tooth or teeth are pulling apart, or missing, replace the belt now.

■ **Tensile failure** (Fig. 3)—If your belt is anywhere near this point and is being held together by a couple of strands, you'd better find out why. Tensile failure can result from a damaged sprocket, misalignment between a sprocket and the belt, or some object becoming embedded between sprocket teeth.

A main contributor to belt failure is a worn sprocket, so when you inspect a timing belt, also inspect sprocket teeth. Look for nicks or abrasions and uneven tooth wear. A way to check for wear is to lay a straightedge along the edge of each tooth. If a horizontal gap appears between the card and the tooth, there's wear, so replace the sprocket (Fig. 4).

### Replacing a belt

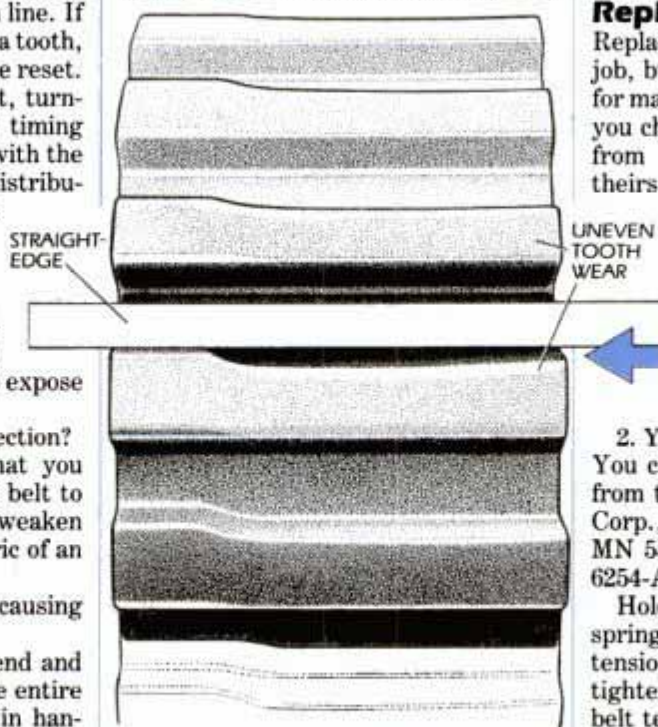
Replacing a timing belt isn't an easy job, but neither is it an impossible one for many Saturday mechanics. The way you change the belt in your car differs from the way other people will do theirs. To give you an idea of what's involved, here are the steps you'd have to follow to replace the belt in a Ford 2.3-liter engine (Fig. 5). Engine back to No. 1 TDC? Okay:

1. To relieve tension on the old belt, loosen the pivot bolt and tension adjusting bolt.

2. You now need a belt adjusting tool. You can get it for the 2.3-liter engine from the OTC Division, Sealed Power Corp., 2013 Fourth St. NW, Owatonna, MN 55060. The part number is T74P-6254-A; cost is \$29.

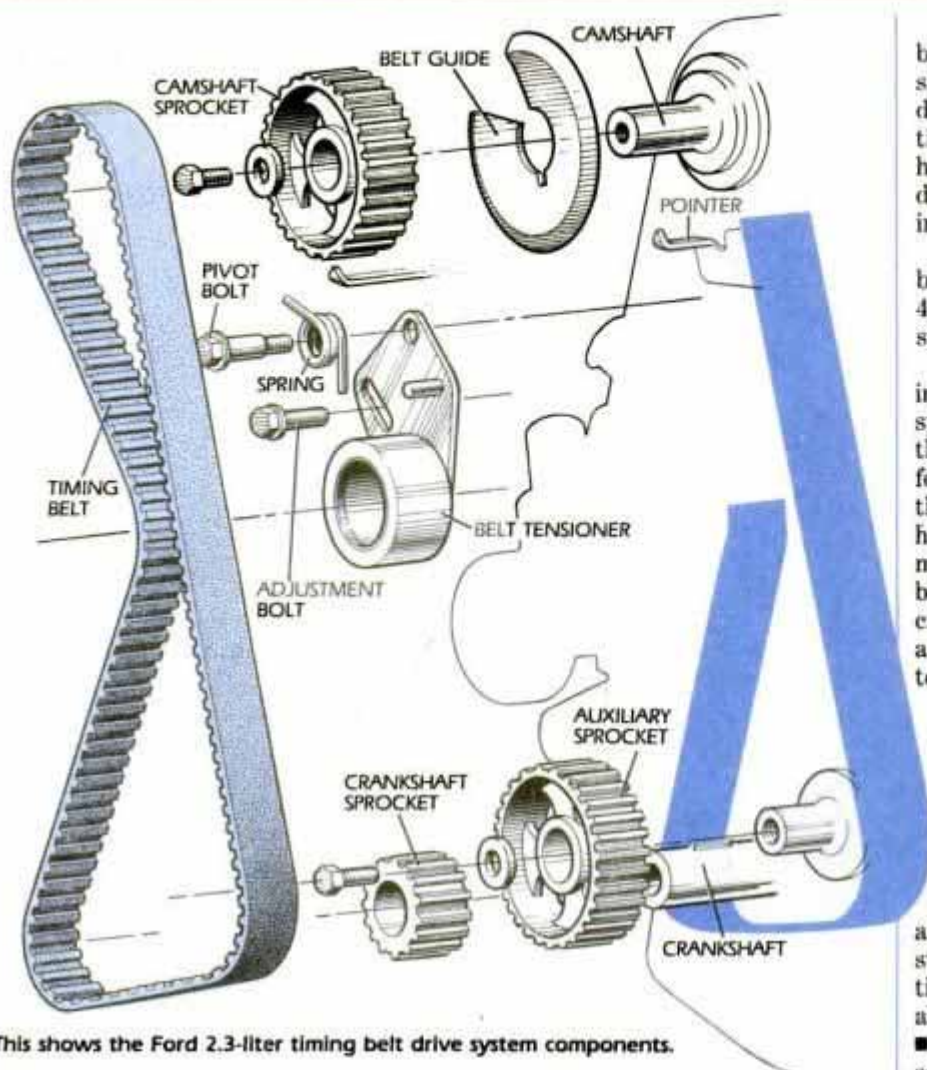
Hold the tool under the tension spring roll pin and push back on the belt tensioner until the belt is loose. Retighten the adjusting bolt to hold the belt tensioner in this position.

3. To take off the old belt, remove the crankshaft damper, belt guide and out-



**4** Sprocket wear will damage new belt prematurely. Replace all worn sprockets.





5 This shows the Ford 2.3-liter timing belt drive system components.

6. Remove the crankshaft damper bolt and reassemble the outer crankshaft sprocket flange, crankshaft damper and belt guide. Then, check the timing marks. If they've moved, you have to go back and reset timing. If you did everything carefully, though, timing marks should be on the nose.

7. Torque the tensioner adjustment bolt to 14-21 ft.-lb., the pivot bolt to 28-40 ft.-lb., and reinstall the belt cover, sparkplugs, V-belts and fan blade.

In spite of your best efforts, you may inadvertently displace one of the sprockets. Don't panic! Just be sure that you've got all the marks lined up. If for some strange reason you replaced the cylinder head and you have no idea how to start setting timing, just remember that all three sprockets must be at No. 1 TDC compression. The crankshaft doesn't matter, but the cam and countershaft sprockets could be tougher. If you have to, check the distributor arm to be sure it's pointing at the lead for No. 1 plug; the distributor is usually driven off the countershaft.

## Guiding lights

Although the procedures for replacing a belt differ from one car to another, there are a number of cast-in-stone rules—some of which we've mentioned but will repeat—that apply for all cars. They are the following:

- Remember that few engines use the same belt. It's imperative that you get the correct belt for your engine. Even a minor difference can allow the new belt to ratchet, which will cause timing to change and damage the engine.
- Never use a pry bar, screwdriver or other common workshop tool to pry the belt onto the sprockets. It can break the tensile cords and lead to premature belt failure.
- Never twist or bend a belt; keep it away from oil, grease and dirt.
- See if the old belt has oil on it. If it does, find and repair the source of the leak. Oil on the belt and oil smeared around the inside of the timing cover usually indicate the camshaft and/or crankshaft seals are leaking. Oil will cause excessive wear on the new belt.
- Remember: Never turn the crankshaft backward, but always in the same direction as its normal rotation. Turning it against normal rotation can cause the engine to jump-time or the belt to break when the engine is started.
- Finally, never turn any of the sprockets when the timing belt is not installed. You could upset valve timing or cause valve damage.

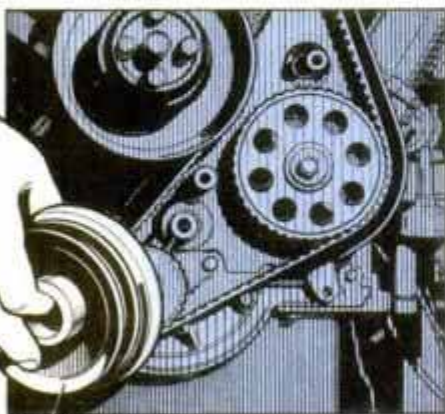
PM

er crankshaft sprocket flange (Fig. 6). It might take the big cheater to break this one loose. Leave the trans in PARK or FOURTH gear—if necessary, apply the parking brake and block the wheels. You'll probably change the timing you so carefully set while doing this, so break the nut loose, and then reset the timing to TDC. Don't even touch the

sprockets as you slide the belt off. If you move them, you'll throw timing off base and will have to reset it.

4. To install the new timing belt, place the belt over the teeth of the crankshaft sprocket, then over the auxiliary sprocket, and finally over the camshaft sprocket. But be careful—if you move any one of the three sprockets you'll throw out the timing. Make sure the belt is inside (to the right of) the belt tensioner, and center the belt on each of the sprockets. Using the tension adjusting tool, release the belt tensioner and slowly guide it back onto the belt. If you alter the timing of any of the sprockets even one tooth, the engine simply will not run properly, if at all. It's possible that valve timing is critical enough to bend something, too. Some cars, like water-cooled VWs, have ample piston-to-valve clearance, so there's no danger of damage.

5. The next step is to equalize tension between the sprockets. Remove the sparkplugs, take the engine out of gear, and reinsert the crankshaft damper bolt to rotate the engine twice.



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6 Remove any components that block the belt as it slides onto the sprockets.



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# CHEVROLET CORSICA/ BERETTA

Chevrolet's replacement for the Citation is positioned between the Cavalier and Celebrity in size and, we hope, will be in price.



Beretta (top) and Corsica (above) share mechanicals, styling.

BY MIKE ALLEN, Assistant Auto Editor

If you're wondering what a Corsica/Beretta is, here's how it sorts out: The Corsica is a 4-door Beretta. Or the Beretta is a 2-door Corsica. At any rate, these are two identical vehicles in different bodywork, sharing no external panels while retaining a substantial styling identity.

Chevrolet claims an industry record for the most market research ever done on a new product in planning this replacement for the Citation. Corsica's four doors are supposed to appeal to families young and old, while Beretta is aimed at a "sportier" crowd. The styling is pleasantly contemporary, inoffensive and similar enough that the best way to tell them apart is to count the doors. The instruments are nicely readable, with round analog gauges instead of the video-game variety. The two cars have different interiors, but both are spacious, typically Chevrolet, and well

thought out, if not memorable. Engines available include the 2.8-liter V6 and a re-engineered version of the 2.0-liter Four. The much-ballyhooed and years-overdue Muncie-Getrag 5-speed finally puts in an appearance, and the wait was worth it. This compact transaxle is the only one in the GM domain capable of dealing with the V6's 160 lb.-ft. of torque. The German-designed, U.S.-built Getrag has nicely spaced ratios, and a silky smooth shift feel. Unfortunately, the cable linkage is so vague and rubbery that little of that comes through to the driver's hand. And the reverse lockout spring can't be trusted to prevent you from grinding REVERSE instead of FOURTH when downshifting from FIFTH.

Perhaps more important is the use of symmetrical, equal-length halfshafts, eliminating almost all of the torque steer inherent in sidewinder fwd de-

signs. That's been a problem for any manufacturer building a high-performance front-drive car, but the V6 Corsica seems largely unafflicted.

I had no chance to drive a 4-cylinder, but that engine is available in several other cars of about the Beretta's weight and makes a good combination with the Isuzu-built 5-speed.

The V6 performance, even with the automatic, is in keeping with Chevrolet's intention of peddling the Beretta as a specialty car. While not likely to steal many buyers from Corvette and Camaro, it should find a home in many garages where a Cavalier Z-24 with the same powerteam might make a different impression on the neighbors. The Beretta (or Corsica) could even be mistaken for a foreign car, while the Cavalier and Celebrity are unmistakably from the heart of America.

Having learned that Camaros with 4-



cylinder engines still can be sold as "sporty" cars, Chevrolet should have no trouble selling 4-cylinder Beretta GTs. There are three levels of suspension tune available, with the base level standard on the Corsica. Berettas start out with the second-level F-41 parts optional on Corsica.

But even the Chevrolet suspension engineers agree that road isolation—the thump you feel in your backside over tar strips and manhole covers—is better in the F-41 versions. In spite of the softer springs, there is more harshness at almost any speed in the base suspension, as well as a subtle but annoying Dutch roll at freeway speeds. Perhaps the difference is in the upgraded (from 185/80x13 to 195/70x14) tires as part of the F-41 package.

If you really want to corner flat, there's the true Z-51 package, sporting a pair of solid stabilizer bars, 32 and 21mm front and back, and 205/60-15 rubber on very attractive alloy wheels. This package (for Beretta only) still manages an acceptable ride.

All three versions of the suspension are very driveable, both in traffic and on the freeway. Of course the limits of adhesion are a lot higher with the uprated suspensions, but still show an acceptable amount of understeer at the limit, and few bad habits.

These cars are being assembled at Chevy's Linden, New Jersey, plant, one of the cleanest factories this side of Silicon Valley. With a high degree of automation, Chevy management and the UAW members who assemble the cars were very keen on telling me how high the quality is. Indeed, with much new equipment—from Remote Piloted Vehicles trundling bodies about, to what is claimed to be the first production use of laser welding in a vehicle assembly plant—the contrast to the older structure and final assembly areas is striking.

Unfortunately, the quality wasn't obvious when I toured the plant during initial production. Body panels showed evidence of handling damage in the form of minor dents, and almost every vehicle I looked over showed surface distortion near one of several spot-

welded seams. Chevy will need to tune its manufacturing process to make the car live up to quality claims.

The paint shop purportedly is state of the art, automated and so clean that even management isn't allowed to enter unless they need to. "State of the art" seems to mean pronounced orange peel. That glossy smooth finish is apparently a thing of the past.

Other than these two areas, fit and finish are excellent. Tolerances between body panels are as close as any other car in this class, and interiors are well-fitting and free of rattles.

All in all, the Corsica and Beretta (not priced as of this writing) are modern and welcome replacements for the middle of the Chevrolet mid-size lineup. The Citation, hurried into production in record time to meet the need for a fwd car, had outlived its niche. **PM**

### THE PM REPORT CARD

CORSICA/ BERETTA	GRADE	COMMENTS
Acceleration	B+	At least with the V6
Handling	A	Mild final understeer, predictable
Braking	C	No bad habits
Steering	B-	Too little road feel for so little power boost
Transmission	B-	Excellent Getrag 5-speed betrayed by cheap, rubbery-feeling cable shifter
Ride	A-	Fine balance of road feel and isolation
Fuel economy	--	Not available
Seating	B	Mediocre but easily adjustable seats
Vision	A	Excellent
Gauges/ controls	A	No video-game stuff, just big, readable black-and-white analog gauges; radio knobs, not buttons
Ventilation	A-	Nice vacuum-operated controls
Noise @ 55 mph	A	Quiet; no need to turn down stereo at toll booths
Cargo capacity	B+	Pack lightly if you're really traveling with four aboard
Engine serviceability	B-	V6 compartment cramped but not impossible; Four is not bad
Fit and finish	C	Despite boasting, bodywork still full of dents and ripples, orange-peel paint



Engine compartment appearance received much attention: no more bundle of snakes.



Derived from Cavalier drivetrain and suspension, car is noticeably wider inside.

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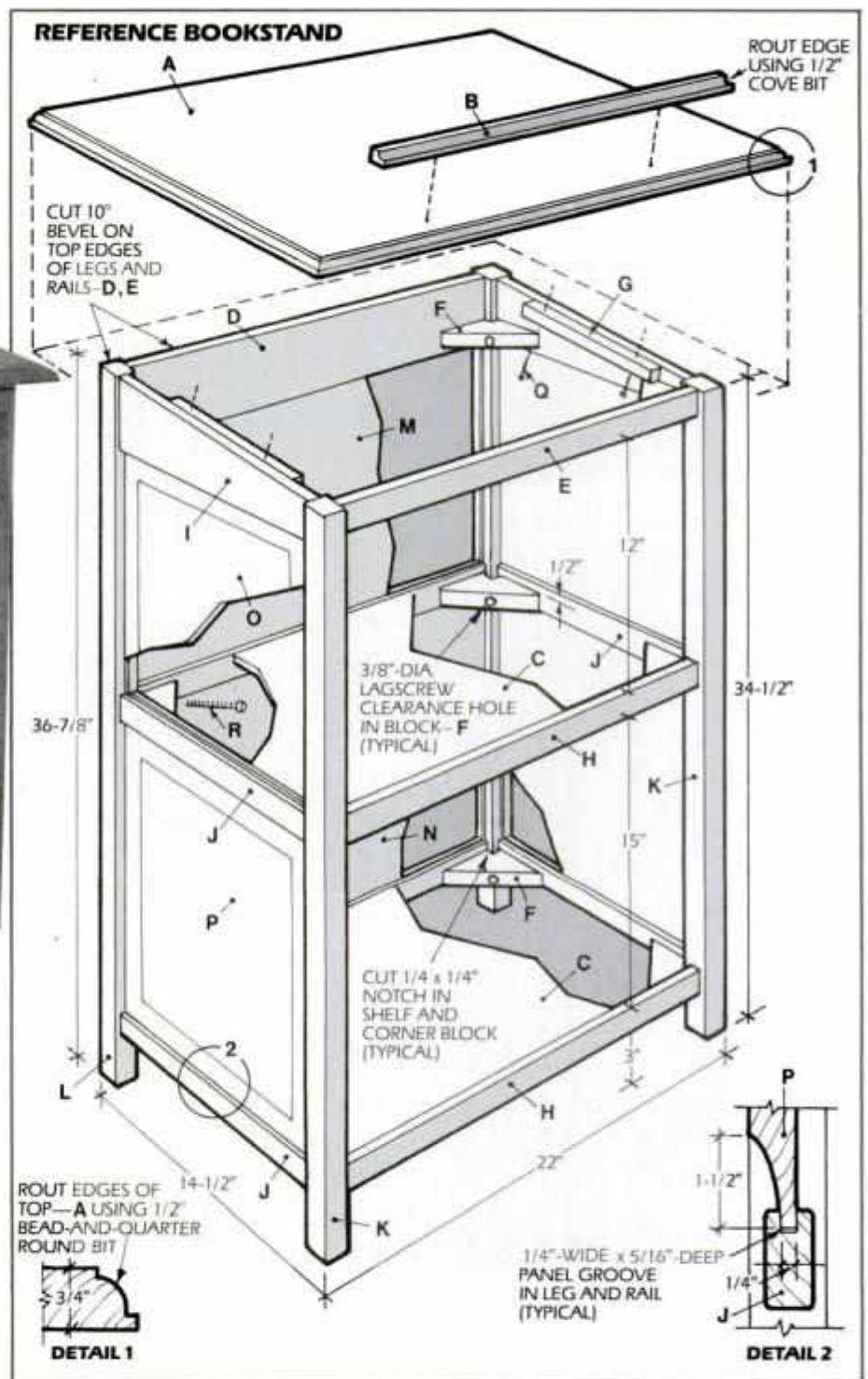
Build a solid oak dictionary stand that also holds a full encyclopedia set.



Stand keeps reference books ready to use.

**T**his reference bookstand was built to hold a large, unabridged dictionary. Because of the book's unwieldy size and weight, I knew it would seldom be used if it were stored away on a bookshelf. But with a stand, the dictionary is readily available whenever it's needed. The two shelves located below the top are used to hold other reference books such as encyclopedias and a world almanac. Note that the stand shown will accommodate 12-in.-tall books on the upper shelf and 15-in.-tall books on the lower shelf. If necessary, alter the stand's dimensions for your reference books.

Build the stand entirely of solid red oak except for the shelves, which are 1/2-in. oak veneer plywood. Install  
(Please turn to page 164)



## MATERIALS LIST—BOOKSTAND

Key	No.	Size and description (use)	Q	12	1/16"-dia. x 3" lagscrew
A	1	3/4 x 18 x 26" oak (top)	K	2	1 1/4 x 1 1/4 x 34 1/2" oak (front leg)
B	1	1 1/2 x 3/4 x 22" oak (stop)	L	2	1 1/4 x 1 1/4 x 36 1/2" oak (back leg)
C	2	1/2 x 12 1/2 x 20" oak plywood (shelf)	M	1	3/4 x 12 1/2 x 20" oak (top, back panel)
D	1	3/4 x 3 3/4 x 19 1/2" oak (top, back rail)	N	1	3/4 x 15 1/2 x 20" oak (lower, back panel)
E	1	3/4 x 1 1/4 x 19 1/2" oak (top, front rail)	O	2	3/4 x 12 1/2 x 12 1/2" oak (top, side panel)
F	12	1 x 3 x 3" oak (corner block)	P	2	3/4 x 12 1/2 x 15 1/2" oak (lower, side panel)
G	2	3/4 x 3/4 x 8" oak (cleat)	Q	4	1 1/2" No. 8 fh screw (used to fasten top)
H	4	3/4 x 1 1/2 x 19 1/2" oak (front and back shelf rail)	R	12	3/16"-dia. x 3" lagscrew
I	2	3/4 x 12" oak; angled from 1 11/16" to 3 1/4"-wide (top, side rail)	Misc.:		Carpenter's glue, stain, polyurethane varnish.
J	4	3/4 x 1 1/2 x 12" oak (side shelf rail)			



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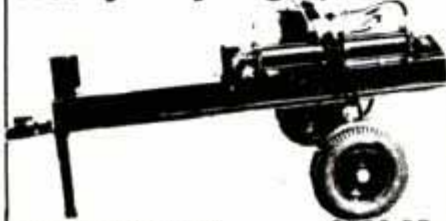
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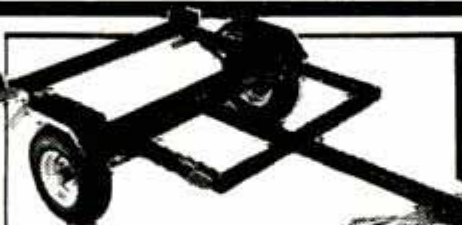


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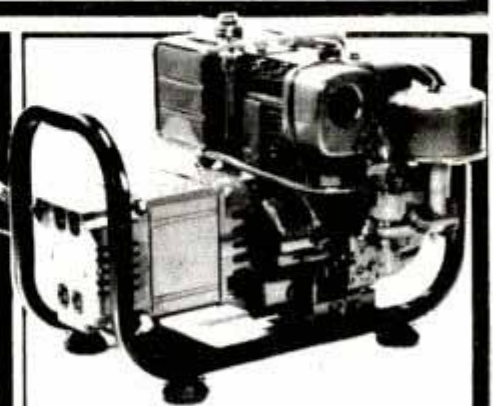


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## LOOK IT UP

(Continued from page 162)

raised oak panels on the sides and back of the stand. This way, the bookstand can also be used as a lectern. If you can't find oak boards wide enough for the top and raised panels, then edge-glue two boards together.

Start by cutting the parts to size as given in the materials list. Be certain to cut 1/4 x 1/4-in. notches in the corners of both shelves and in all the corner blocks. The notches provide clearance for the stand's four legs. Also, bore a 3/8-in.-dia. lagscrew clearance hole through each corner block. Cut 1/4-in.-wide x 5/16-in.-deep grooves in the rails that hold the raised panels in place. Be certain to groove both edges of the three rails that separate the upper panels from the lower panels. Then, cut two grooves in each back leg (part L in the materials list) and one groove in the front legs (K) to accept the panels. Stop the grooves 4 in. from the legs' bottom end. Also, note that the top edge of the legs and of the uppermost rails (D,E) are beveled 10°.

## Cutting the raised panels

Next, cut the raised panels using a shaper or router fitted with the appropriate cutter. If you prefer the flat-panel look, simply install panels cut from 1/4-in. oak-veneer plywood. Then, rout the decorative detail in the top's edge with a 1/2-in. bead-and-quarter-round bit (see Detail 1). Use a 1/2-in. cove bit to rout the edge of the book stop (B).

Using a diagonal (45°) clamping fixture or doweling jig to hold the legs, bore three 3/16-in.-dia. lagscrew pilot holes in each leg. Now, before assembly, sand all parts with 120-grit abrasive paper. Begin assembly by gluing the shelves to their matching rails and corner blocks. Clamp assemblies square and set them aside until the glue dries. Next, glue together the top rails, corner blocks and cleats (G). Attach the stand's top by screwing through cleats and into the top's underside.

Slide the panels into the grooves cut in the rails and legs. Don't glue the panels in place. This will permit the panels to expand and contract freely. Next, position the horizontal stand members so that the corner blocks' holes align with the pilot holes bored in the legs. Attach each leg with three 3/16-in.-dia. x 3-in. lagscrews.

Sand the entire piece lightly with 220-grit abrasive paper. Wipe away the sanding dust with a tack cloth and apply a coat of stain, if desired. Once the stain has dried, apply two coats of polyurethane varnish. Sand lightly between coats with 4/0 steel wool.

—Leonard Heiferling







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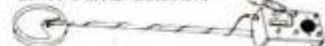


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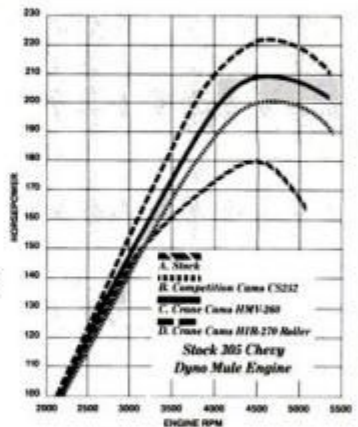
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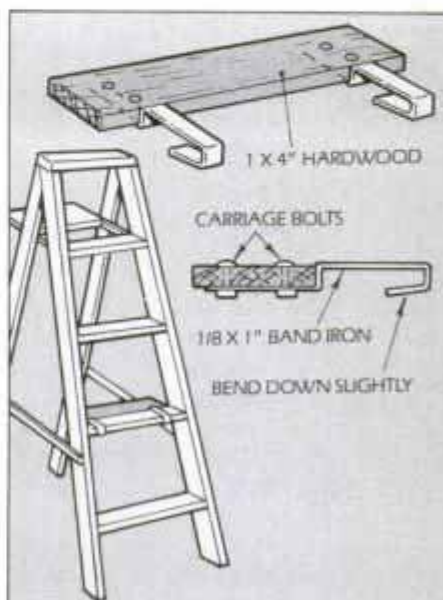
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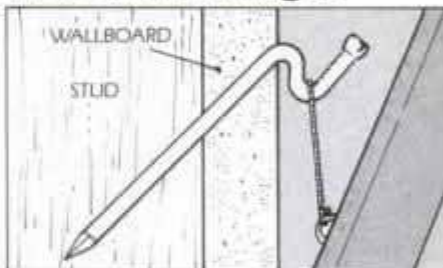
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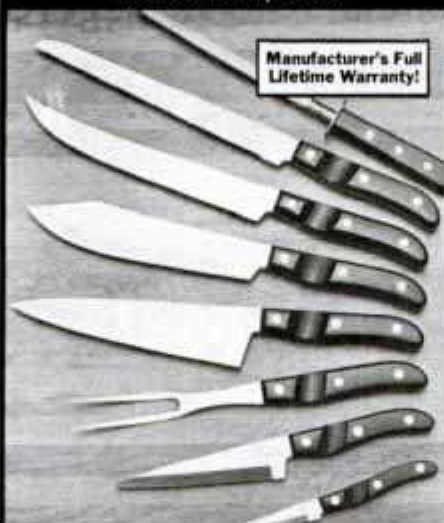
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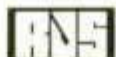
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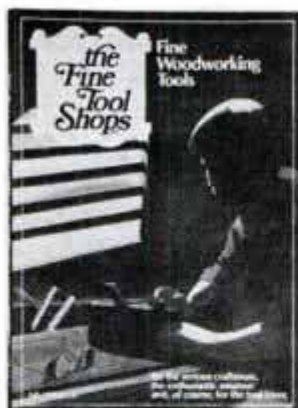
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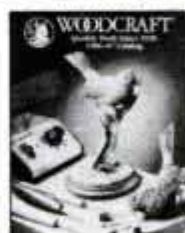
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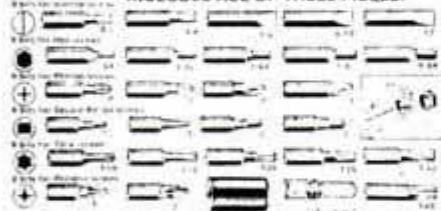
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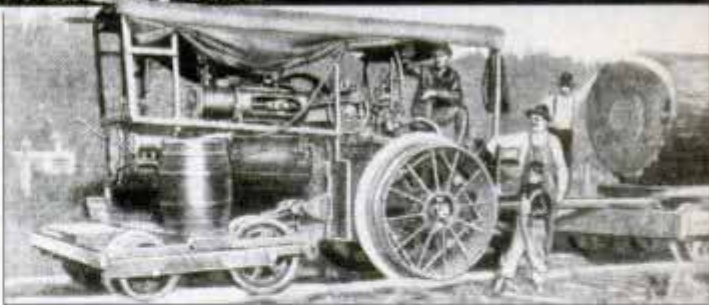
75 YEARS AGO: February 1912



Locomotives replace canal mules.

## Electric mules

America's image of powering vessels down canals was transformed in 1912. The Panama Canal Co. announced it was going to use specially designed locomotives to tow ships through various parts of the waterway. Mechanized towing already had been installed in the form of motorized winches. But the locomotive was a replacement for the traditional barge-toting mule that took vessels over long distances. The types of vessels plying the Panama Canal were too big for mule power.



## Do-it-yourself railway starts rolling

Lumber companies in Orting, Washington, needed rolling stock to haul felled trees. So they built their own railroad. The track was composed of fir timbers. The locomotive was an old trac-

tion engine of the type used for threshing. The track was laid over very uneven ground, and a log bridge was built to cross a river. The makeshift railway system worked for 10 years.

50 YEARS AGO: February 1937



America gears up for war.

## War readiness

America was not yet at war in 1937, but the mood was building in Europe as Hitler flexed his muscles. The U.S. Army began developing high-speed combat tanks designed to fight in a European conflict. In one maneuver, the newest tanks proved they could run at speeds of more than 40 mph over an obstacle, leap off the crushed obstacle, and fly several feet, landing squarely on their treads. The tanks carried twin machine guns in their turrets and were also designed for artillery use.



## Newly furnished van hauls furniture

A New Jersey furniture company designed the first stretch van, a 30-ft. 6-wheeler with a steel interior. It was built to carry all the furniture for a 12-room house. The 8-ton van was streamlined, but the move was for esthetic rather than engineering reasons.

To accentuate the good looks of the art-deco truck, the furniture company added a band of gold leaf along the side, a gold-bronze top and gold leaf trim on the radiator. The successful project cost the company just under \$12,000, a fortune in those days.

25 YEARS AGO: February 1962



Building inside out.

## Growing a home

POPULAR MECHANICS readers in 1962 were treated to plans for a home built mostly from the inside out. The home started out as a basic 4-room ranch with a large bathroom. During the first year, by constructing parts of the next stage indoors, the homeowner could add two bedrooms and a half bath. In the third year, a large screened porch that could serve as a recreation area was constructed. The completed house was a cozy 60 ft. x 20-ft. wood structure, the perfect vacation home.



## Vietnam trouble

America's biggest problem in Vietnam was arming the South Vietnamese troops. They were generally too small to carry the weapons designed for American troops. A Vietnamese soldier is shown trying out a modified flame thrower, designed to be lighter than the standard issue weapon.

## Space shuttle

The Air Force came up with the first concept for a Space Shuttle in 1962. It would send an X-15 rocket plane to high altitude atop a B-52

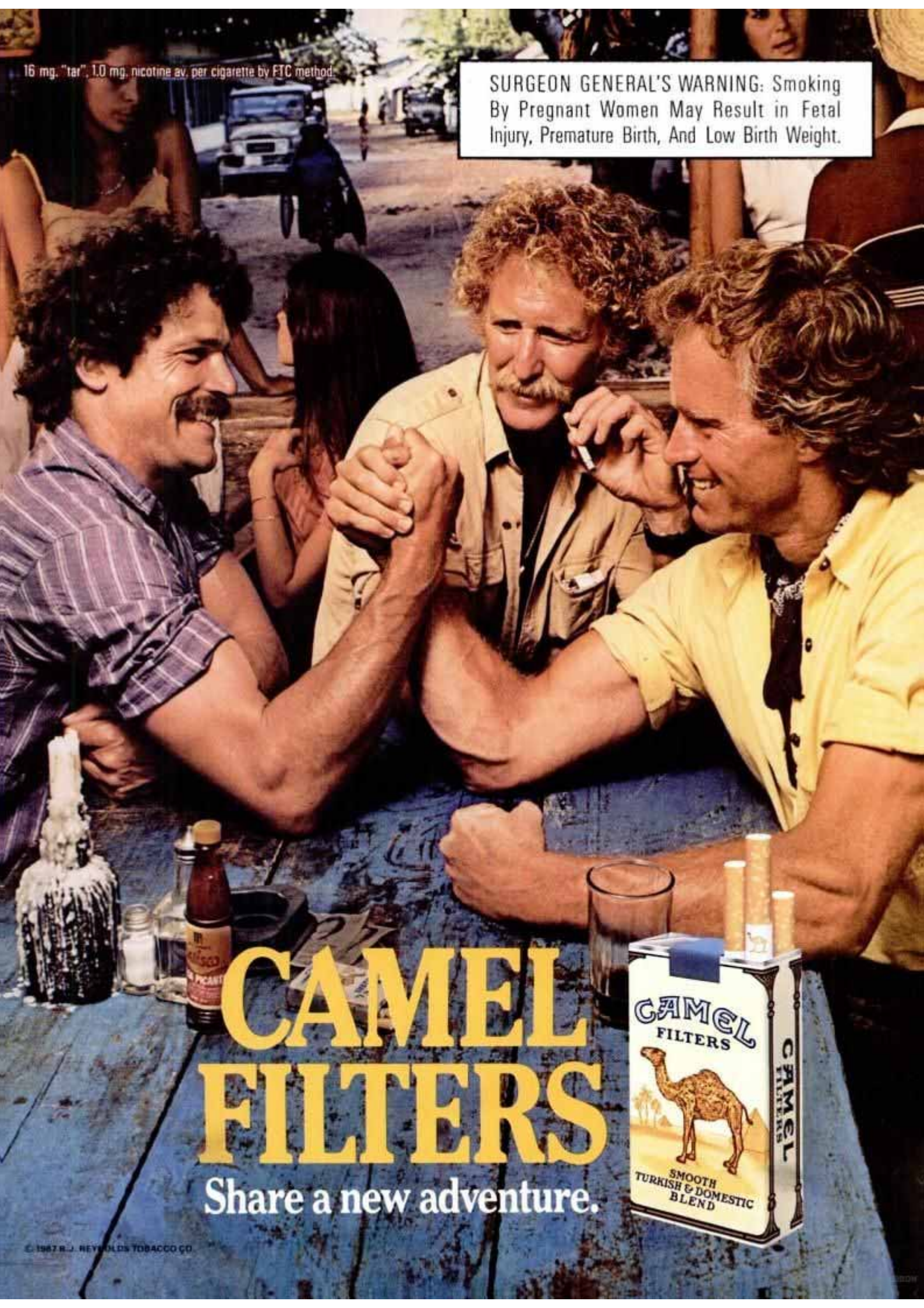
bomber. The X-15 would then be launched into space. The unmanned rocket plane would deposit a satellite in low earth orbit. The idea was scrapped in 1965. **PM**

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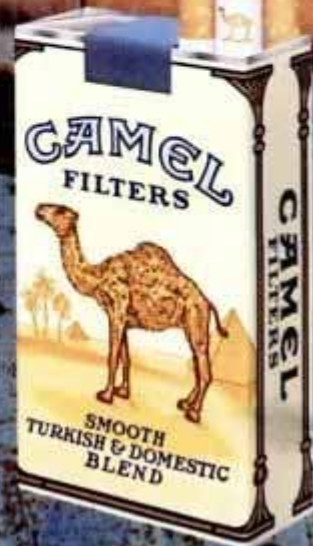
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