

Popular Mechanics

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HOME IMPROVEMENT:
44-PAGE SPECIAL

How To Install Windows, Spruce Up Your Bathroom ...And Much More!

PM TESTS AMERICA'S 6 BEST SPORTS SEDANS
Matching The Imports For \$6,000 Less

WOODWORKING
PM's Craftsman Shows How To Use A Lathe

SPORTS: Best New Tennis Rackets And Fishing Tackle

'I Flew The World's Hottest Jet'



Test Pilot Chuck Sewell Describes The First Flight Ever In The Radical Supersonic X-29



Cars Of The Future'



Marlboro



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17 mg "tar," 1.1 mg nicotine av. per cigarette, FTC Report Mar.'84

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Rick Mears, 1984 Indy 500 Champion

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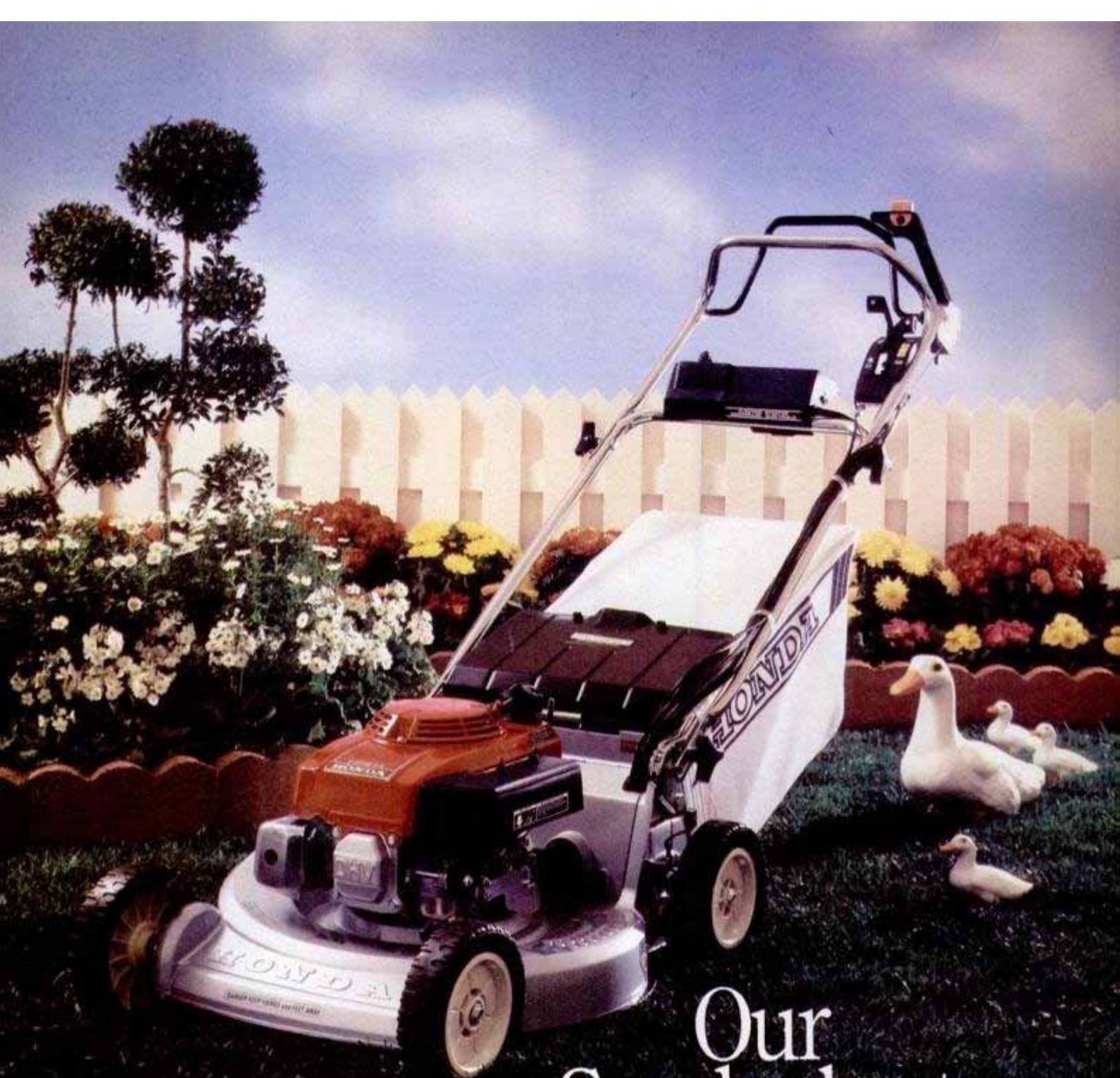
Monroe Auto Equipment 
Division of Tenneco Automotive

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HONDA

Power

Equipment

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For optimum safety and performance, we recommend you read the owner's manual before operating your Honda Power Equipment.

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ON THE COVER

Grumman test pilot Chuck Sewell prepares to take the radical new forward-swept wing X-29 on its first flight. Read his exciting account of what it's like to fly the world's hottest jet, plus the daring feats of other famous test pilots. Story begins on page 75.

—PM photo by Rich Breunig/Grumman

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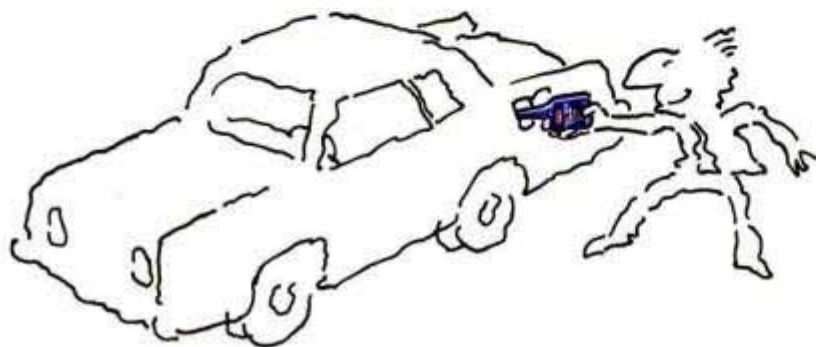
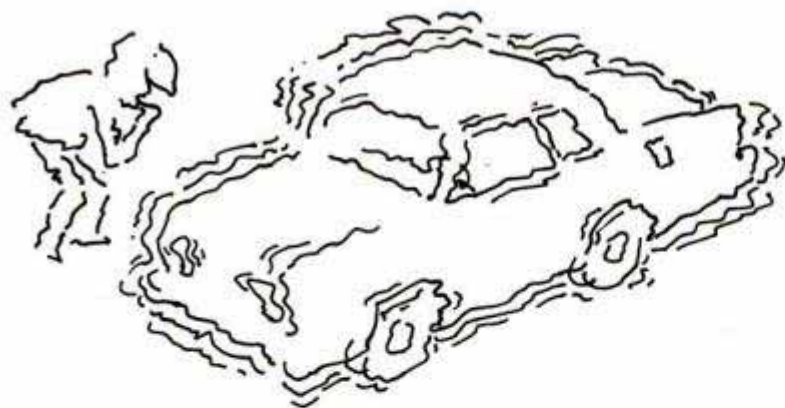
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The Dieseling Dilemma:



End It All with Fuel Mix.

Fuel Mix is specifically made to help stop dieseling (that aggravating noise some engines make after they're switched off). Pour Fuel Mix in the gas tank, and as you drive, Fuel Mix goes to work fast in combustion chambers where dieseling is caused. And Fuel Mix's advanced formula works better than ever. Fact is, nothing else you can buy stops dieseling more effectively. Fuel Mix smooths out engines and saves gas, too. So before you see a mechanic or switch to costly premium gasoline, try Fuel Mix from Gumout.

There's more fix in Fuel Mix.



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EDITOR'S NOTES

Grumman chief test pilot Chuck Sewell is used to flying supersonic jets not knowing whether the wings are still on or not. In most jets the wings are so swept back you couldn't see them if you wanted to. But on the maiden flight of the forward-swept wing X-29, he was just too busy to look. Shortly before the flight, Sewell showed Vice President George Bush why he'd be so busy in



Vice President George Bush in the cockpit of the experimental X-29 gets a briefing from test pilot Chuck Sewell.

the cockpit of the X-29. Bush, a WWII pilot himself, was delighted to try out the "driver's seat" and was most interested in the vast array of switches, indicators and controls that an X-29 pilot has to handle. But Bush didn't catch a glimpse of half the instruments for this flight: They were located on the ground at Edwards Air Force Base and at Grumman's facility in Calverton, Long Island. There were two dozen back-seat drivers monitoring this flight, which Sewell describes in *'I Flew The World's Hottest Fighter'* beginning on page 75. Science Editor Dennis Eskow spent a day with Sewell talking about the X-29 flight and the great effort it takes to put a new jet into the air. After exhaustive engineering calculations done at a desk come hours of wind-tunnel testing. After the interview, Dennis compared notes with Managing Editor Bill Hartford, who's no stranger to aerodynamics, having worked in one of Grumman's wind tunnels years ago as an engineering student. . . . **For this month's issue**, Hartford volunteered the roof of his house to the Home and Shop Dept. Home and Shop Editor

Steve Willson promptly cut a hole in it—to an exact $53\frac{3}{4} \times 56$ inches—for the installation of the roof window you'll read about on page 109. It's only one of the window stories in our *Home Ideas Guide*. The technique of cutting in and replacing casement and double-hung windows—on pages 114 and 117—was handled by Shop and Tools Editor Joe Truini, who teamed up with his mentor and father, Joe Sr. . . . **Home improvement and maintenance** may give you all the exercise you need, but if you're ready for more, look at the latest tools for tennis in *Light 'N Lively: The New Tennis Racket*, starting on page 88.



Truini and dad do a window installation.



Willson at work while Hartford watches.

John A. Salletter

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HARDWARE STORES®

TOOL VALUE OF THE MONTH



GREEN THUMB

5⁹⁹

Pruning Shears

Exclusive design offers extra cutting power! With cushion-grip handles, safety blade lock. Hurry! Offer good from March 10 only while supplies last, at participating True Value Hardware Stores. 205971

HARDWARE VALUE OF THE MONTH



Master PLUMBER

4⁴⁸

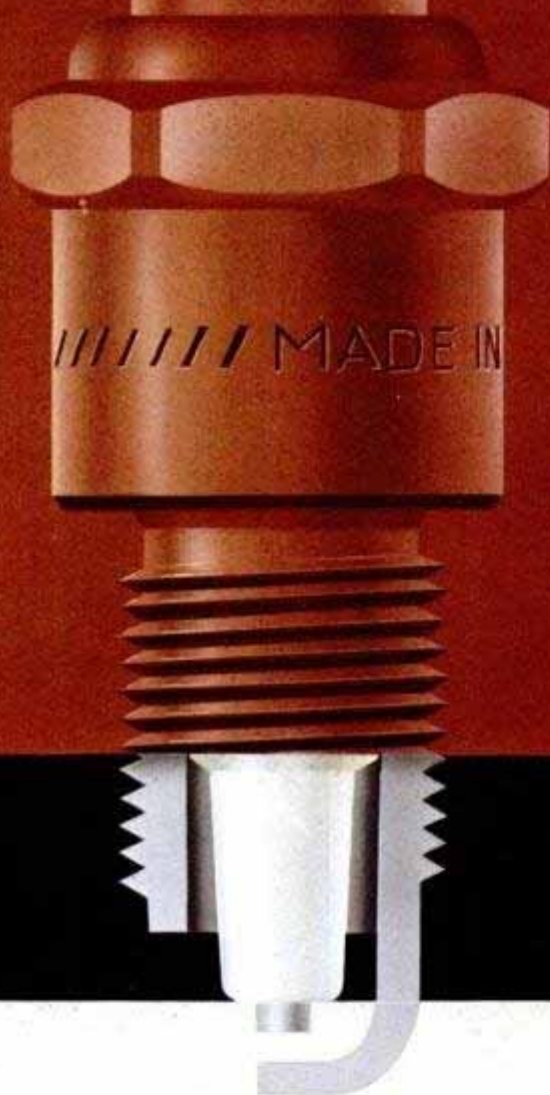
Canister Auger

15' x 1/4" spring steel frees clogged drains in minutes, winds up to store in handy drum! Hurry! Offer good from March 20 only while supplies last, at participating True Value Hardware Stores. 504365

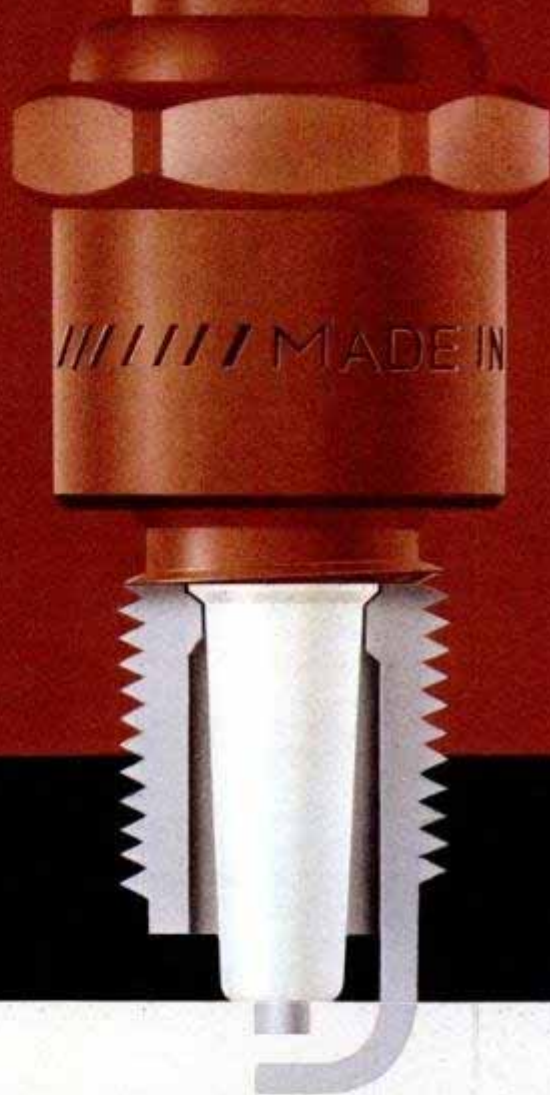
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adds to our plug.**



**What the Plus
adds to our plug.**



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The key to premium performance lies in the spark plug's insulator nose. Quite simply, the longer the nose, the better the fouling protection.

Had we added only copper to Copper Plus,[®] we could have lengthened our insulator nose by only 25%.

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*Offer ends December 31, 1985. Aviation and industrial plugs excepted.



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LETTERS TO THE EDITOR



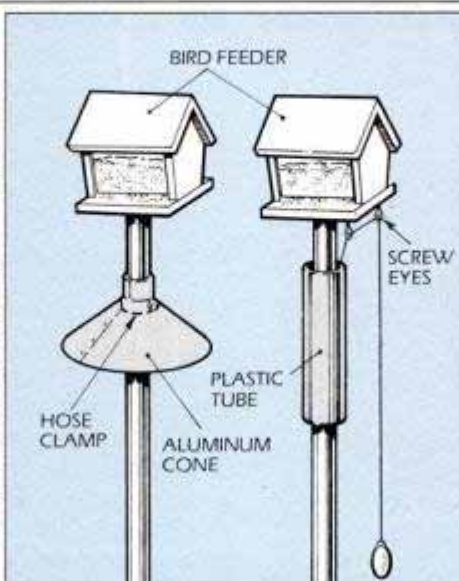
For the birds

I was amused by the letter from a reader who was having problems with your supposedly squirrel-proof bird feeder (*Letters*, page 6, Dec. '84). I can sympathize because I've had my own run-ins with these smart critters.

Most people hang their feeders from a tree or part of the house, making them easy for squirrels to get at. If you put your feeder on a pole, it's simple to keep squirrels away. Here are two ideas (right) that have worked well for me. Cut a 16-inch-diameter circle of sheet aluminum, slit it to the middle so it can be formed into a cone and Pop-rivet the ends together. The cone is held on the pole with a hose clamp. It works just like the rat guards on ships' mooring lines.

The other trick consists of a collar of plastic tubing large enough to slide easily up and down the pole. It's counterweighted as shown so it's held in the up position. When a squirrel reaches the collar, his weight causes it to slide down to the ground.

The startled animal jumps off and the



Two ways to foil thieving squirrels from reader J. Cates. They're fun to watch, too.

collar is pulled back up. It's fun to watch the squirrels' reactions as they try to figure out what's happening.

J. W. CATES
ROANOKE, VA.

Flying in flak

I greatly enjoyed your article on the legendary B-17 (*Our Still-Flying Fortress Turns 50*, page 79, Jan. '85). However, the German fighters depicted in the Keith Ferris painting are Messerschmitt Bf-109s, not Focke Wulfs as stated in the caption. You can tell by the two bulges in the cowling just ahead of the cockpit. These were made necessary when the G-model 109s were refitted with heavier-caliber machine guns whose larger breech-blocks protruded above the fuselage.

DWAN CLOW
ALBUQUERQUE, N.M.

Our thanks to the many readers who took the trouble to point out this discrepancy. Although Focke Wulf 190s were also used against our bombers, the planes shown in the painting are indeed Messerschmitt Bf-109s.

A beautiful story, but as a former B-17 engine mechanic I must point out that the Forts were powered by Wright Cyclone engines, not Pratt & Whitney Hornets as you stated in your article.

HERMAN STOCK
COLORADO SPRINGS, COLO.

Our reference was to the Boeing 299, the original B-17 prototype, which did have Pratt & Whitney engines. You're right that most production B-17s used Wright Cyclones, although some later models, especially the B-17G, went back to Pratt & Whitney Hornets.

You said that the bomb decals on a B-17's nose indicated the number of kills it had made. This is incorrect. The bombs stood for the number of missions flown. Kills were represented by miniature enemy flags.

BENJAMIN B. PRESTON
PALM SPRINGS, FLA.

You scored a direct hit on that one.

Owning up

I found it very refreshing that you took the blame for an error that appeared in the story about former President Carter's furniture-making hobby (*Letters*, page 6, Dec. '84).

It was probably the first time Jimmy Carter wasn't blamed for something!

R. M. FRAZA
PORT BYRON, ILL.

Tires defy physics

As a physics teacher, I was shocked to see you discuss tire traction in terms of tread area (*How To Pick The Right Winter Tires*, page 72, Jan. '85). As any physics student knows, friction (traction) is independent of area.

THOLA TEPICHE
IRVINGTON, IND.

Auto Editor Wade Hoyt replies: You're right in theory, but the laws of simple sliding friction do not apply to the complex interaction that takes place between rubber and pavement. In practice, wide tires do develop more traction than skinny ones. If they didn't, no racing drivers would use them because a fat tire without other benefits simply produces unwanted aerodynamic drag.

The British beat us to it

Allow me to correct a correction. In your January '85 *Letters* column (page 8), a reader pointed out that it was Chrysler, not Ford, that was first to develop antilock brakes in the early '70s. Actually, an excellent antilocking device, called the Dunlop Maxaret system, was used on the British-made

Jensen in the early 60s—a decade sooner. Too many people seem to feel that everything worthwhile in life has to be invented here in America.

K. D. GROVE
ELK GROVE, ILL.

Where to complain to

In your December '84 *Car Clinic* column (page 20), Mort Schultz advised a reader to consult the Chrysler zone office in Natick, Mass. This has led to our receiving requests for reimbursement from all over the country.

We would like to point out that Chrysler has 23 zone offices throughout the United States to assist customers. The Natick office is authorized to handle requests from people residing in the six New England states only.

J. V. SILVIA
CHRYSLER CORP.
NATICK, MASS.

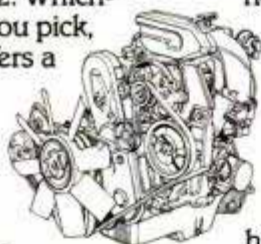
We regret the misunderstanding. Readers wishing to know the correct zone office for their particular areas can find out by consulting any local Chrysler, Dodge or Plymouth dealer.

Team Ranger: Tough 4x4 and 4x2.

Ford's tough Ranger comes in rugged 4x4's and street-smart 4x2's. They go where you want to go!

It's a tough team to beat—Ranger and you.

Bash around the boonies in a Ranger 4x4 with a couple of dirt bikes in the back—or zip around town in an easy to park 4x2. Whichever one you pick, Ranger offers a hefty V-6 engine that the imports don't. And Ford's 2.3L Four now gives you the



extra response and performance of electronic fuel injection. And this high-tech engine is standard.

Go on all 4 wheels.

For 4-wheeling, nobody's topped Ford's exclusive Twin-I-Traction-Beam front suspension and its proven four wheel drive system (choice of manual or optional automatic locking hubs). Also, there's a 5-speed transmission that

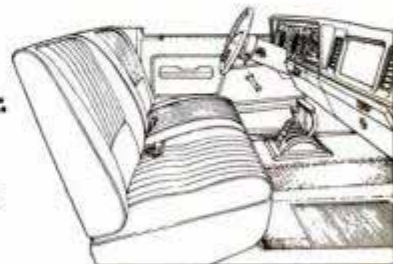
comes standard in all Rangers.

Or just two wheel power.

Ford's 4x2 Ranger is one tough American-built small pickup! It has the widest cab in its class. Up front, there's Ford's exclusive Twin-I-Beam suspension. In back, strong double-wall box construction—plus payload options up to 1,765 lbs.

If you have a boat or trailer to tow, tough Ford Ranger adds to your fun. When properly equipped with the trailer towing package, gutsy little Ranger can tow up to 5100 lbs. For working hard and playing hard, it's Ranger!

On top of every-



thing else Ford Ranger is a great value. It's a small price to pay for a lot of fun.

Best-Built American Trucks.

At Ford, Quality is Job 1. A 1984 survey established that Ford makes the best-built American trucks. This is based on an average of problems reported by owners in the prior six months on 1981-1983 models designed and built in the U.S.

Lifetime Service Guarantee.

As part of Ford Motor Company's commitment to your total satisfaction, participating Ford Dealers stand behind their work, in writing, with a Lifetime Service Guarantee. No other car companies' dealers, foreign or domestic, offer this kind of security. Nobody. See your participating Ford Dealer for details.

Dealer installed light bar not for occupant safety.



"My Ford Ranger and Me."

"My Ford Ranger 4x4 and Me."

FORD RANGER
AMERICA'S TRUCK BUILT FORD TOUGH



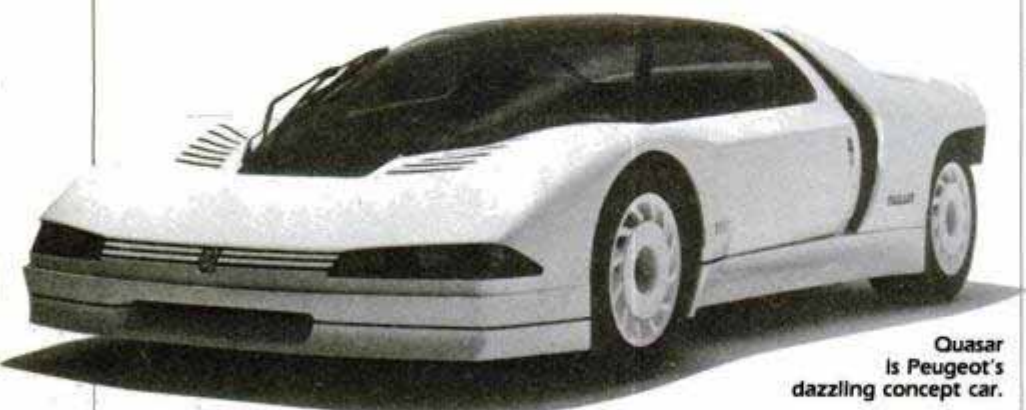
Get it together - Buckle up!

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IMPORTS & MOTORSPORTS



Peugeot's one for the show



Quasar is Peugeot's dazzling concept car.

It's a showstopper—and an auto show is the only place you'll see Peugeot's concept car. The Quasar, which is even more striking when you see it in its



Quasar dash is cantilevered off of the center tunnel; electronics system is from Clarion.

Kevlar and carbon-fiber skin, was designed at Peugeot's own styling center—not done in a studio across the Italian border. The two-seater Quasar's gull-wing-like doors lift and pivot forward. Under the dome-like canopy is a one-piece dash that cantilevers off the center tunnel and includes a center screen for displaying navigation and system checks. The rear engine—a twin-turbo, dohc, 16-valve Four—drives all four wheels with 600 hp on tap. The Quasar is Peugeot's first show car ever and the slickest on the circuit this year.

Slippery Subaru

It has a drag coefficient of 0.29, making it the world's most aerodynamic production car. The styling is so smooth from nose to tail that you'd expect a low Cd figure, but what you don't expect is four-wheel drive. The new XT Coupe is in showrooms now in four variations, all of which use Subaru's 1.8-liter ohc Four. At its hottest, this Fuji flyer is 111 hp, turbocharged, with on-demand

4wd. This is the 4wd Turbo model which also features adjustable air suspension. The base model is the DL, a front-wheel-drive two-seater. It's fuel injected and is \$8,000. The GL is a 2+2 with lots of good options and jumps to \$10,000. The Turbo 2+2 is between \$13,000 and 14,000. There's only a slight premium for 4wd, so the top-of-the-line 4wd Turbo also comes in under \$14,000. Your move.



The Subaru XT Coupe at its hottest is turbocharged and equipped with four-wheel drive.

Step up, van fans

It looks like there's no stopping high-stepping sales of minivans. GM has just joined the parade (see page 48) and



Mitsubishi minivan might have four-wheel drive and a sliding door on each side.

Mitsubishi's been spotted testing a four-wheel-drive hauler that's got two sliding doors—one on each side. No word when this one might become available to the American van buyer. That means Renault will be next up with its Espace, which we'll be driving soon. After we get a feel for that van, you'll be the first to know.

Where do you put the golf clubs?



Sinclair C5 electric is steered by the front wheel; handlebars are under your knees.

The Sinclair C5 is a 15-mph, three-wheel electric vehicle with pedals that's legal to drive on highways along with tandem trailer trucks—in England. It's an appealing trike to be sure, but would be more toy than transportation for most people here. Still, the C5 has caused quite a stir in its home country where designer Clive Sinclair (of computer fame) feels its 20-mile range and low price make it perfectly practical for daily running around. Just don't run too far, and don't get run over. **PM**

How to pick the right oil for every car from A to Z.

For starters, pick Valvoline.

Then select the right type of Valvoline motor oil for your car and the way you drive. Because we don't just make *one* kind of oil and tell everybody to use it. We make different oils to meet the special needs of different cars.

Like Valvoline Turbo™ V –the motor oil specially formulated to with-

stand the intense heat of turbos. And our multi-viscosity All-Climate® and single-grade Super HPO® motor oils, with special detergent properties for tough stop-and-go driving.


Or Valvoline Racing Oil, engineered to take the stress of high-performance engines.

So no matter what kind of car you drive, Valvoline has the oil that suits it to a T.



Valvoline. Because your car is special.™

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THE PM WORKBENCH



Mini-precision power tools



Lightweight, high-speed precision tools (left to right)—jigsaw, disc sander and orbital sander—operate off a variable-speed power adapter. Model 9805 kit (far right) includes rotary tool, power adapter and 37 bits.



Black & Decker has a complete line of scaled-down precision power tools for the home woodworker and hobbyist. The Model 9805 Rotary Tool Kit (\$95; upper right) contains a Model 9811 150-watt rotary tool, a Model 9821 power adapter and 37 assorted accessory bits. Black & Decker also offers power tools which operate off the Model 9821 power

adapter. The tools are (upper left to right): a jigsaw (\$38), 3-in.-dia. disc sander (\$44) and a 2 x 2 3/4-in. orbital sander (\$38). All tools and accessories are available separately.

For details regarding the entire line of precision power tools, contact Black & Decker, 3012 Highwoods Blvd., Raleigh, N.C. 27625.—J.T.

Comfortable quality



Durable, high-impact handles, designed for comfort and power, come in four sizes (top to bottom): 4 1/4-, 3 1/4-, 3 1/8- and 2-in. Blades are made of chrome vanadium.

Finally, there's a screwdriver handle designed for the human hand. ProDriver screwdrivers—claimed to have the world's most comfortable handles—feature an indented thumb area for sure grip, curvature design for the hand and a rounded top for in-palm comfort. ProDriver handles come in four sizes; 2-, 3 1/4-, 3 3/4- and 4 3/4-in.; and five shank/bit styles; Phillips No. 1, 2

and 3 and two slotted bits. They're available at hardware stores and home centers. Prices range from \$2 to \$6. For details, contact PlastiCrafters, 1202 20th Ave., Rockford, Ill. 61108.—J.T.

A keyless chuck

If you're tired of struggling with a chuck key each time you change drill bits, then try Sears' new 3/8-in. drill featuring a power-driven keyless chuck. To tighten a bit, simply run the drill while holding the plastic chuck collar. To remove a bit, pull back on the collar and run the drill in reverse. The Model 10419 (\$90) drill has a variable-speed (0 to 1,200 rpm), reversing 2/5-hp motor with permanently lubricated ball, roller and sleeve bearings. Contact Sears, Roebuck and Co., Sears Tower, Dept. 703-PM, Chicago, Ill. 60684.—J.T.



Sears' new variable-speed reversing drill features a power-driven automatic chuck for quick, easy bit changes without a key.

Superstrong cement patch



Anchoring and patching cement can be mixed for pouring, as shown, or to a pliable consistency for knife or trowel application.

Mending cracks and holes in concrete has been simplified thanks to Rockite anchoring and patching cement. Simply mix the powder-like substance with water and apply. According to the manufacturer, Rockite also is excellent for anchoring bolts, railings and fence posts in concrete. It's available at hardware stores and home centers in packages ranging in size from 1 pound (\$1.70) to 125 pounds (\$87.50). Contact Hartline Products, 2186 Noble Rd., Cleveland, Ohio 44112.—J.T.

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

THE BADGE OF THE PROFESSIONAL.

On the job, there's one sure way to spot the master carpenter or building tradesman. It's the Badge of the Professional, the 25-foot Stanley POWERLOCK® Tape Rule clipped to his belt.

Wherever you see the Badge of the Professional, you're sure to see other Stanley top-of-the-line tools... levels, squares, hammers, saws, planes, and chisels. It makes good sense. Stanley tools deliver quality that won't quit. That's why you'll see Stanley tools that have been on the job for two or more generations.

See for yourself. The next time you see someone whose work you respect, look for the Badge of the Professional. It's a good rule to follow.

STANLEY

helps you do things right.



BADGE OF THE PROFESSIONAL

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**DOES YOUR CAR LOOK
AS GOOD THROUGH
THE CORNERS AS IT SHOULD?**



14 L156
5 R175

BF GOODRICH T/A[®] RADIALS

THE BFGOODRICH RADIAL T/A

- A. Good response result from raised white sidewall construction. Good cornering and handling result from strong, proven tread compound and dual construction.
 - B. Excellent dry traction and handling are achieved by special belt construction and dual compound.
 - C. Excellent hydroplaning and excellent cornering are achieved by high void ratio.
- High Radial T/A was not only to make your car look nice, but also to make it look nice when cornering. As the car undergoes cornering, the sidewall of the tire acts together with suspension to maximize tire footprint. This makes driver inputs and handling more sensitive and reliable.



A tire may be designed for good looks, but it must be engineered for good performance. A well-engineered tire can actually work with almost any car's suspension to improve its cornering. Of course, no tire can promise you the ultimate in cornering power because all tires have limits of adhesion. Yet it is a fact that the match between sidewall and belt stiffness of the BFGoodrich Radial T/A makes it highly predictable when approaching those limits. The result is cornering that responds reliably to driver inputs.

The same computer-aided technology used in building the Radial T/A (in 50, 60, and 70 aspect ratios) was applied to the entire family of BFGoodrich T/A Radials. The result is a complete line of high-performance car and truck tires in many sizes, designed for a wide variety of performance needs and driving styles.

WE MAKE CARS PERFORM

STEPHEN A. BOOTH

PM ELECTRONICS MONITOR

Audio and video lead chorus line at Consumer Electronics Show

LAS VEGAS—Gambling and showgirls share the limelight here with hi-fi, video, computers, telephones, car stereo and satellite gear when January's Consumer Electronics Show comes to town. Because audio and video generated the most excitement, this month we'll focus on those categories.

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The buzzword "digital" now applies to TV sets and music synthesizers as well as audio Compact Disc players.

There were plenty of the latter in Las Vegas: Marantz' CD-64 and Technics' SL-P1 bring the cost of home CD players down to \$400. Alpine, Mitsubishi, Sanyo and Yamaha joined Pioneer and Sony with in-dash CD units.

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From top: Quantec's wireless VideoCaster sends VCR signals to several TVs. The AudioSource AV-One and Pioneer SX-V300 combine and control hi-fi and video. Play canned or live music with Casio's CK-500 portable music center. Printer gives pictures instantly for Hitachi's electronic camera.

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That's Casio's portable (\$499)—a four-octave key, 12 voices and rhythms, but AM/FM dual cassette boom!

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A new home video product, the VCP—a videocassette player priced lower than VCRs with recording ability. They'll be available from several brands for about \$200. In accessories, the VideoCaster (Quantec Int'l, \$120) lets your VCR broadcast—wirelessly—to several TVs at once.

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Olds Cruisers. They handle cargo like a wagon. And people like an Oldsmobile.

When it comes to muscling cargo, the Olds Cruisers can handle the job with the best of them. But what makes these wagons so special is the way they handle people. Take the Cutlass Cruiser—this year offering an available 3.8L multiport fuel injected V6. With over 74 cubic feet of cargo space with the second seat down, it offers the kind of room you expect from a wagon. But even better, it offers the special kind of luxury you expect from an Oldsmobile.

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Custom Cruiser

Firenza Cruiser

cutlass

Let's get it together
It's a special feel
in an
Oldsmobile

POPULAR

DETROIT LISTENING POST

GM adds Saturn Corp.



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Chevy or Pontiac showrooms. GM sources admit privately that the Mazda 626 was an inspiration for the Saturn prototype that was shown to the press, but stress that production cars are at least three to four years away, and they could be quite different from the prototype (a more aerodynamic Ford shape, not the prototype's J-car look, was predicted).

The prototype is powered by a 1.9-liter all-aluminum Four built by the lost-foam casting process. This is GM's first ill-fated Vega. Mercedes and Porsche now use such designs with annual sales of a million. The first Saturns will be two-door and four-door sedans, with annual sales volume pegged at 500,000. A sporty hatchback, a station wagon and maybe a minivan will join the lineup very quickly. Saturn is less of a car story than a financial thriller. It will soon have total

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The power-assisted rack-and-pinion steering and power front-disc/rear-drum brakes are standard equipment at all four corners, supporting a 2,100-pound car. Overall length is 166.3 in., all atop an abbreviated overall width of 64.4 in. and height of 95.7 in. wheelbase. Price at this point is undecided, but best guesses put the \$7,000 Corolla range.

The inset picture is a spy shot (Please turn to page 14)

Chevy Nova unwrapped

After much controversy and significant preparation—and while a Chrysler lawsuit hangs fire in the antitrust courts—GM/Toyota's joint venture, New United Motor Manufacturing Inc. (NUMMI), took the wraps off its Nova four-door notchback Sedan. (NUMMI), Nova won't see showroom floors

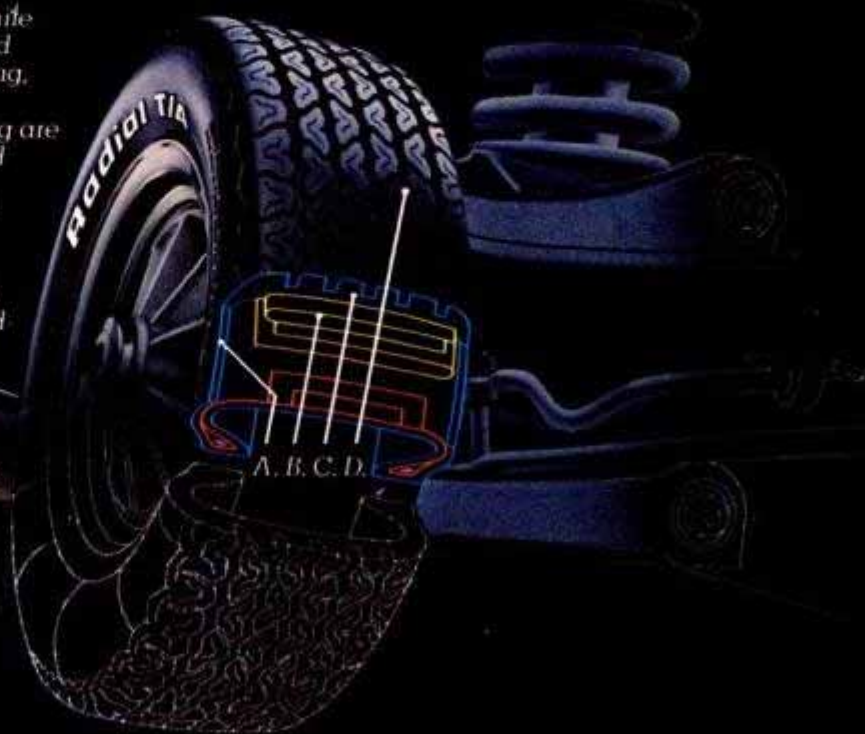


The Chevy-Toyota Nova shown to the press is a four-door sedan with trunk (above). Spy shot (right) shows hatchback due this fall.

THE BFGOODRICH RADIAL T/A

- A. Good looks result from raised white letter styling. Good cornering and steering response result from strong, stable sidewall construction.
- B. Excellent dry traction and handling are due to race-proven tread compound and radial construction.
- C. Long tread life is due to special belt configuration and dual compound tread.
- D. Reduced hydroplaning and excellent wet traction are achieved by high void to rubber ratio.

The BFGoodrich Radial T/A[®] was designed not only to make your car look more attractive, but also to make it look better in the corners. As the car undergoes body roll during cornering, the sidewall of the Radial T/A acts together with suspension changes to maximize tire footprint. Even with highly sensitive suspensions, the effect is to make driver inputs and corrections easy and reliable.



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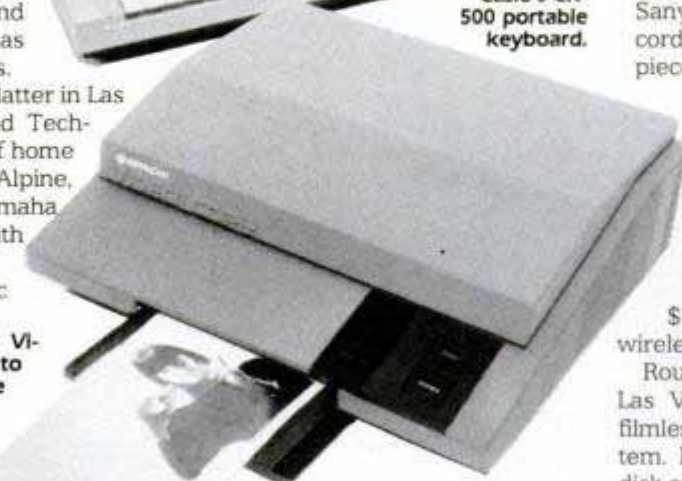
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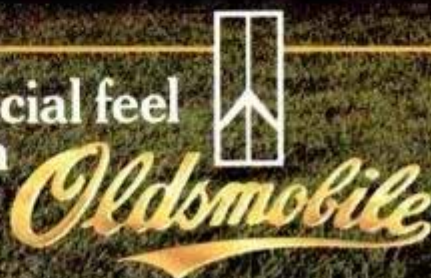
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Firenze Cruiser



Cutlass Cruiser

There is a special feel
in an



Let's get it together...buckle up.

DETROIT LISTENING POST



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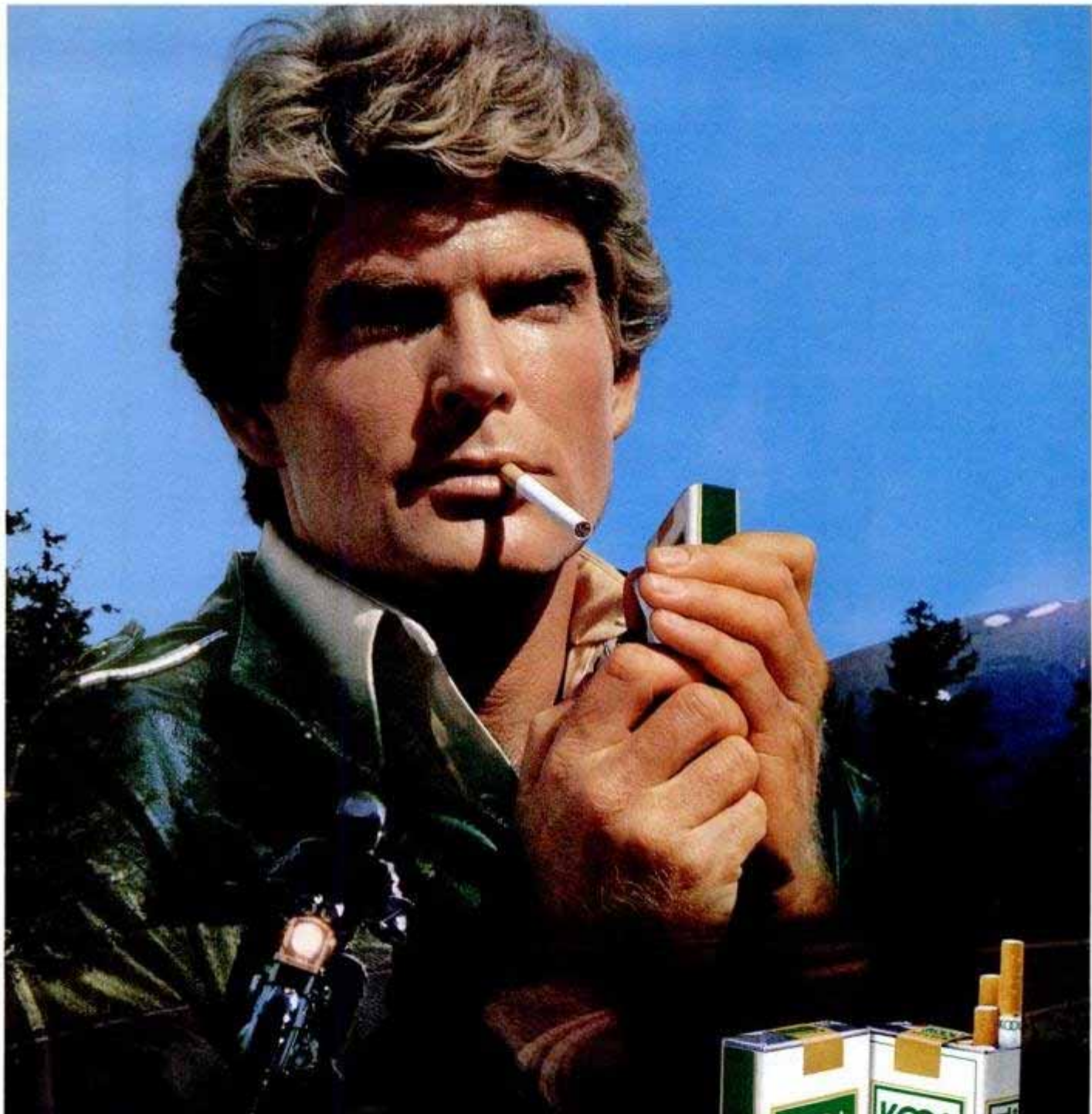
The inset picture is a spy snap of a [\(Please turn to page 20\)](#)



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PHOTO BY GREG COVETZ



Come up to Kool.

Kool gives you extra coolness
for the most refreshing sensation in smoking.

A sensation beyond the ordinary.



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

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Milds Kings, 11 mg. "tar", 0.8 mg. nicotine,
Filter Kings, 17 mg. "tar", 1.1 mg. nicotine
av. per cigarette, FTC Report Mar. '84.

DETROIT LISTENING POST

(Continued from page 18)

stock Toyota Sprinter hatchback at a Detroit gas station, complete with an embarrassed GM test engineer hunched at the wheel. Except for the bow-tie grille and U.S. headlights, this is pretty close to the five-door Nova due here in the Fall.

Chrysler/Maser out

We hear rumblings that Chrysler Chairman Lee Iacocca was *outvoted* regarding his personal desire for a two-seat sports car project with Maserati (see

Detroit's European Connection, page 83, Jan. '85). Rumors are that Highland Park will now develop its own sports platform, possibly to debut as a convertible, maybe with the superperformance twin-cam engine Chrysler's said to be working up.

Cadillac Allanté

Cadillac's two-seat convertible project, code-named Callisto, is the subject of official birth announcement cards, which were mailed out after our *European Connection* story hit the newsstands. The car's official moniker: the 1987 Cadillac Allanté.

Ear to the ground

Class action 1, GM 0: General Motors has discontinued all passenger-car diesels. The General's oil-burners henceforth will go only in light trucks.

Inflation defeated: According to the American Automobile Assn., driving and car ownership costs for operating an '84 car 15,000 miles went up only *three-tenths of a penny*, to 23.2 cents per mile in 1984. The average ranged from a low of 22.7 cents in the Great Lakes area to a high of 23.6 cents in New England.

Bacteria cafeteria: Researchers at the Bowling Green, Ky., Corvette plant are testing *Pseudomonas Paucimobilis* on paint solvents in a tank of sand called the "Bacteria Cafeteria." The test is to determine whether the bugs can be used to one day break down the plant's hydrocarbon emissions.

R-25 killed: Too bad, too. You may have seen our item on the *Renault R-25* (DLP, page 32 Nov. '84) and the car



What cleans a dirty carburetor instantly? You just put your finger on it.

Gumout® Jet Spray is America's best-selling carb cleaner, number one with do-it-yourselfers and professionals alike.

Cleans instantly, on contact—carburetor throats, barrels, ports, jets, linkages and more.

Nothing cleans faster, better or more professionally than Gumout Jet Spray. Available in 5 oz., 13 oz., and new 19 oz. sizes.

GET YOUR HANDS ON SOME.

A Quality Product of the Permatex Company. 



AMC President Jose Dedeurwaerder shows '86 Jeep Comanche minipickup (DLP, page 42, Oct. '84). Intro date: Fall '85.

itself in auto shows this year, but for now, AMC says it has decided not to import the potent competitor to BMW and Mercedes-Benz.

Short drives: The *Plymouth Duster 2.2* is pegged at Chrysler as an economy car with spunk, and darned if it isn't! Good driveability and peppy performance offset a total absence of headroom for six-footers.

At the same time PM's Auto Dept. in New York was starting a long-term test on the new *Corvette* (see page 58), I had a chance to drive one on the street and wished I lived in California. It's *real* bad in the snow, ideally a car garaged in winter. Otherwise, it's the best 'Vette since the 1966 427-cu.-in. monster. Very tight, and very fast. The unique "4+3" manual, with overdrive electrically engaged in the top three gears, is an innovation that we hope spreads to the Z28 and Trans Am.

We get letters dept: Sharp-eyed reader William M. Hannon of Lookout Mountain, Tenn., wrote about the adhesive we mentioned in our July '84 issue (*How To Customize The New Minivans*, page 88). The correct name of the substance is Sikaflex. It's available from the Sika Corp., Industrial Products Div., Lyndhurst, N.J. 07071. **FM**

Introducing The Ultimate Weapon Against Athlete's Foot

New

FootWork™

TOLNAFTATE 1%

ATHLETE'S FOOT REMEDY

There's nothing like new FootWork. It's a great new way to get fast, effective relief from the agony of athlete's foot.

Nothing stronger or faster

FOOTWORK kills athlete's foot fungus *on contact* and brings rapid relief from itching and burning.

Prevents and cures

Regular use of FOOTWORK means you may never be bothered by athlete's foot again!

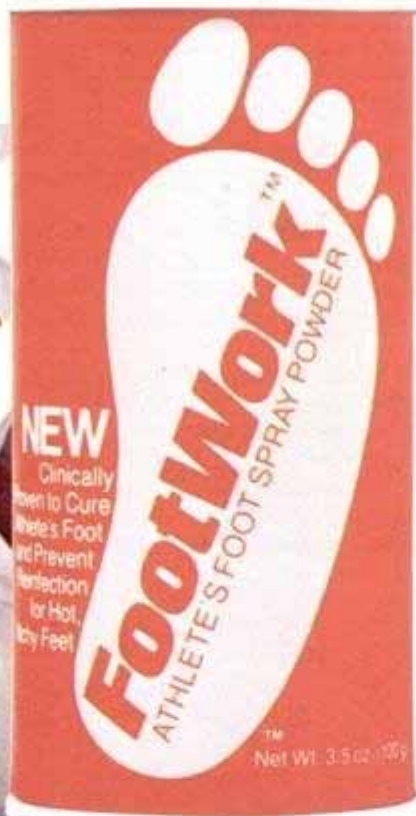
Doctor recommended

FOOTWORK is made with the highest concentration of the antifungal ingredient doctors recommend most.

4 convenient ways to get relief

FOOTWORK is available in powder, aerosol powder, cream and liquid.

New FOOTWORK... there's no stronger, more effective way to prevent and cure athlete's foot without a prescription.



Save **25¢** on
New **FootWork™**

CONSUMER: Please be sure the coupons you redeem have not expired and are accompanied by the required purchase.
RETAILER: For payment of face value plus 8¢ handling, send to Lederle Refund Offer, P.O. Box 1177, Clinton, Iowa 52734. Coupon is void where taxed, prohibited or restricted by law. Cash value 1/100 of a cent. Valid only in USA. This coupon is nontransferable, nonassignable and nonreproducible. Offer limited to one coupon per purchase. **Coupon expires December 31, 1985.**

25¢ 41294 203827 **25¢**
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APPLIANCE CLINIC



Squeaking belts

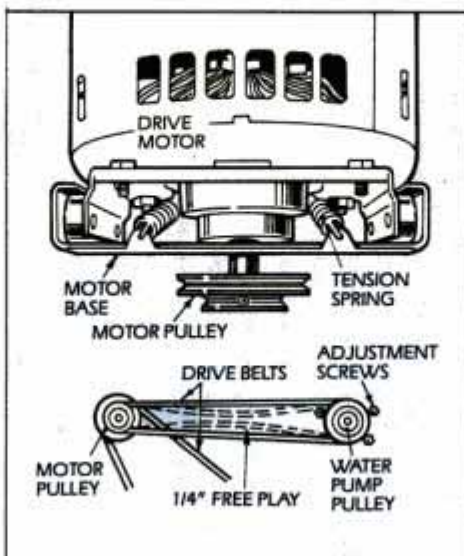
We have a 3-year-old Maytag washer, model No. A2085, serial No. 408257EG, with a suds saver. Since we've had the machine, there is a loud squeaking noise when the water empties from the machine into the sink. The noise doesn't occur when the suds saver pumps the water from the sink into the machine. We changed the belts, which took care of the noise for a few months. The noise doesn't affect the washing operation, but it keeps my son awake, since the laundry room is just below his bedroom. Can you help?—Jo Behm, Roseville, Minn.

The squeaking noise may be due to an improperly adjusted belt, a glazed motor pulley or possibly a motor mount base that needs lubrication. To check the motor base, unplug the machine and take off the front panel. Remove the two Phillips-head screws at the base of the panel and swing the panel out from the bottom to disengage the retaining clips at the top.

The motor and motor base are on your left. You will notice that the motor slides along the base on four plastic wheels and is held in position by two tension springs. The wheels must roll freely in the base. To check this, push the motor toward the rear of the washer then let it go. It should slide back by itself. If it sticks in the rear position or doesn't return smoothly, clean and lubricate the base and wheels.

Maytag recommends either Poly-Lube, part No. 2-4314, which is a liquid silicone oil, or Poly-Grease, part No. 2-3959. Both are available at any Maytag parts distributor. As a simpler fix, try a silicone spray to lubricate the wheels and track.

If the motor moves freely in its base,



Washer motor rolls in its base on wheels and is held in position by tension springs. To adjust water-pump belt, loosen adjustment screws and move water pump.

the next thing to check is the water-pump belt tension. To do this, pull the motor forward so both belts are tight. Then, reach underneath the machine, grasp the water-pump belt in the middle and squeeze the two sides together. There should be approximately 1/4-in. free play between the inner surfaces of the belt before the motor begins to move in its base. If you can squeeze the belt together and get no movement of the motor, the belt is out of adjustment.

To adjust the belt tension, tilt the washer to its back. Loosen the three screws that hold the pump to the base of the washer, then move the pump to get the 1/4-in. free play in the belt.

The last item to check is the motor drive pulley. It may have become glazed due to belt slipping. Try sanding off the black accumulation from the pulley using fine emery paper.

Nonstop refrigerator

I own a CIV-143P Frigidaire refrigerator, serial No. 11A30876. This model has the freezer compartment at the bottom. My problem is the unit never shuts off. I replaced the thermostat, located in the top half, but to no avail. Temperatures in the bottom half drop to about -30°, but temperatures in the top half remain in the +40° range. The evaporator coil does not get cold. Considering its age—29 years—do you think the refrigerator is worth fixing? If

so, what's the solution?—Willard Nevinger, Williamsville, N.Y.

It sounds like you have a refrigeration sealed-system problem. Either you have a shortage of refrigerant or an obstruction blocking the proper flow of refrigerant from circulating through the system.

Repairing the sealed system is a major operation, involving a big expenditure for labor. Considering your refrigerator's age, it might be wise to invest in a new one.

Lamps cause radio static

I have a pair of Sears table lamps with touch-on switches; touch any metal part of the fixture and it will turn on. The problem is that they are raising havoc with my AM radios, both battery and electric, causing static that makes them unusable.

Sears told me to check with a TV repairman for a filter. I talked to several and they said the noise is being pulled through the antenna and there is no filter to correct this. Do you know of any solution to this problem?—Keith M. Troyer, Continental, Ohio

Sears has recently marketed a filter for these touch-on lamps that is designed to eliminate the static your AM radios are picking up. The filter is stock No. 74006.

This piece of equipment can be obtained free of charge by mail-order or from any large Sears retail store. Stop by the table-lighting section and tell a salesperson you are having a problem with your touch-on lamp and that you want the static filter.

You can also receive the static filter by telephoning toll free 1-800-858-4280 outside California, or 1-714-549-0959 in California. **PM**

SERVICE TIP

How many times have you gone to use your dishwasher and found the detergent lumpy? Dishwasher detergent readily absorbs moisture from the air and this causes lumps. If the lumps are soft and small enough to dissolve, the detergent can be used but you may notice a decrease in cleaning effectiveness. The best thing to do is throw it out and buy a new box.

Store detergent in a cool dry place. Keeping it under the sink is not advisable because it's usually too warm and moist there. After each use, be sure the pouring spout is closed.

If the detergent box has no spout, be careful tearing the moisture-protective covering when opening the box so you can reseal it. Most detergents have a relatively short shelf-life, so it's best not to stock up; you should buy just one box at a time.

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, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.



A MARINER WON'T TAKE THE DAY OFF WHEN YOU DO.

There's nothing like a day on the water to help you forget your troubles. But an unreliable outboard can quickly give you new problems to worry about.

That's why you should be running a Mariner.

Mariner Outboards from 4 to 200 horsepower have CD ignition for quick, reliable starting. And to make sure they keep running, we build them with rugged lower units

and internal components that undergo the industry's toughest testing. So you can spend your free time on the water, not in the repair shop.

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This year, we even made it easier to buy a Mariner-powered

boat with our exclusive



MMAC financing option. See your dealer for a catalog showing our complete line, or write Mariner, 1939 Pioneer Road, Fond du Lac, Wisconsin 54935. And find out more about the outboards that take pleasure seriously.



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1. Full-size interior with enough room to seat six full-size adults.
2. Reclining front seats with finely woven cloth seating surfaces.
3. Luxurious, deep cut-pile carpeting.
4. AM/FM stereo radio with 4 speakers for full, rich sound reproduction (may be deleted for credit).
5. An electric clock with the precise accuracy of quartz movement.
6. Sound insulation that's so effective, it's called Super Luxury.
7. Careful attention to detail like carpeted lower door sections and conveniently located courtesy lights.
8. Carpeted, deep-well trunk, with low lift-over access. It's so roomy that no car sold in America has one larger.
9. Standard padded rear half vinyl roof with brushed aluminum wrapover molding for an elegant appearance. Optional Brougham roof treatment shown.
10. 5.0 liter V-8 engine with electronic fuel injection. Because, after all, it takes more than comfort and good looks to make a luxury car luxurious.
11. Automatic Overdrive transmission that reduces engine wear by lowering engine RPMs at highway speeds.
12. Solid body-on-frame construction for a secure, stable ride.
13. Full coil suspension system that soaks up minor imperfections in the road's surface.
14. New gas-filled shock absorbers for the smoothest riding LTD Crown Victoria to date.



Ford LTD Crown Victoria.

contents.

15. Standard, steel-belted radial, white-wall tires, for sure-footed traction and low rolling resistance.
16. An optional automatic load leveling suspension that with the trailer towing package keeps LTD Crown Victoria riding smooth and level whether you're towing 5,000 pounds, or just carrying luggage.
17. The option of speed control for reduced fatigue on long trips.
18. The comfort and convenience of optional pivoting front vent windows.
19. Optional power windows with a lock-out switch for added convenience.
20. Available automatic climate control to keep your environment as you like it.
21. Optional 6-way power seat adjustments for the most comfortable seating position possible.
22. Available tilt steering wheel for great comfort and easy ingress and egress.
23. The security of your participating Ford Dealers Free Lifetime Service Guarantee. See your dealer for details.
24. The dedication to quality and craftsmanship. At Ford, "Quality is Job 1."
25. The comfort of knowing you're driving one of the most luxurious Fords ever built.

Have you driven a Ford... lately?



The luxury Ford.

Get it together—Buckle up.

Electronic whole-house air cleaner

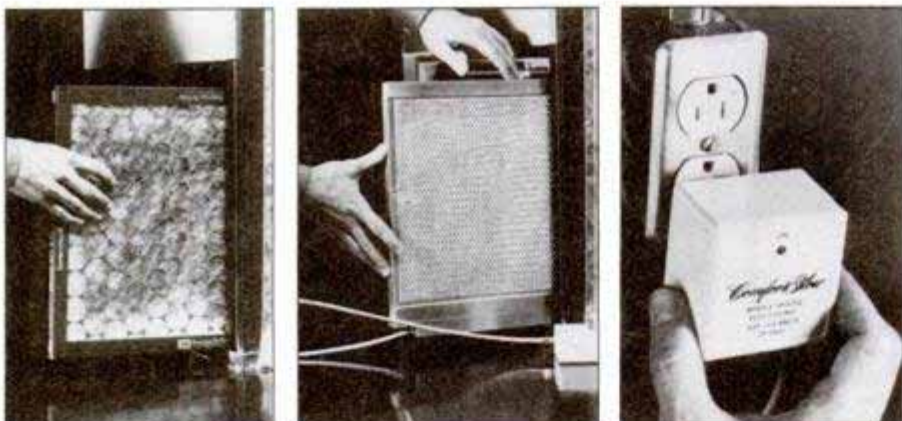
The Comfort Glow electronic whole-house air cleaner is a highly efficient, maintenance-free air filtering unit for forced-air furnaces and central air-conditioning systems.

All you have to do is remove the 1-in. disposable filter, install the collector cell and plug the solid-state power module into a standard 110-volt electrical outlet. The collector traps up to 99 percent of lint, pollen and other airborne particles, according to the manufacturer. Disposable filters trap about five percent of these particles. The air cleaner operates 24 hours a day and uses less electricity than a 15-watt light bulb.

The Comfort Glow whole-house air cleaner is available at hardware stores and home centers for under \$200. For further information, you should contact Marketing Dept., AMCA International, 2701 Industrial Dr., Bowling Green, Ken. 42101.



Electronic whole-house air cleaner consists of an aluminum collector cell and a plug-in power module.



Remove the existing disposable filter (left) and install the collector cell (center). Then, plug the solid-state power module into a standard 110-volt electrical outlet (right).

Fine-finish sprayer



Do-it-yourself staining and finishing has been given a boost by the Wagner Fine Finish Series 50 airless sprayer. This sprayer is designed specifically for applying thin-bodied paints and finishes such as varnish, shellac, lacquer, stains and polyurethane varnish. It also sprays auto body primers and paints.

The Series 50 sprayer is available at hardware stores and home centers for about \$45. For a free furniture-spraying manual (Form No. 0501088) or auto-painting manual (No. 0501099), write directly to the Wagner Corp., Literature-PM, 1770 Fernbrook La., Minneapolis, Minn. 55441.

A thinking tape

Calcutape combines a 16-ft. tape measure and a calculator in a single compact unit. Besides performing all the functions of a standard calculator, the Calcutape can convert English measurements to metric, diameter to circumference, Fahrenheit to Celsius, gallons to liters, and much more. It also has a pythagorean program for determining a triangle's hypotenuse.

The battery operated Calcutape can be purchased at most Sears stores for about \$60. For more information, contact Keson Industries, Box 394, 5 South 475 Frontenace Rd., Naperville, Ill. 60540.



No-hands faucet

The Optima electronic faucet turns on water flow automatically when hands are placed under nozzle. This bit of magic occurs when an infrared light beam, emitted by a sensor on the nozzle, is broken. Remove your hands and the water stops. A mixer lets you regulate water temperature. It comes with a 24-volt transformer that is wired to a 110/120-v. power supply. The kitchen faucet costs about \$325. A lavatory model is about \$350. Contact Sloan Valve Co., 10500 Seymour Ave., Franklin Park, Ill. 60131. **PM**





“MY OTHER CAR IS A KUBOTA.”

Bob Sollima's appreciation of great engineering doesn't stop with the car he drives. That's why a Kubota diesel tractor is parked in his garage, right next to the Rolls.

Together, Bob and his Kubota maintain a sprawling five-acre equestrian estate in California. Much of the terrain is laced with riding trails. In Bob's own words, the Kubota's compact size and 4-wheel drive are “indispensable for navigating the narrow trails with ease.”

The hydrostatic transmission on his B-Series model is another “very useful” feature for loader-scraper jobs. Clearing brush. Cutting new trails. Repairing storm-damaged trails. Working around the corrals and horse stalls.

Just as important is “muscle power.” Bob says his Kubota's “a real back-saver for hauling everything from bales of hay and bags of fertilizer to flats of flowers.”

And with 10,000 square feet of new lawn, Bob can also add mowing to his chores. Thinking about it, it's surprising he finds time to enjoy his other car.

 **KUBOTA**

Nothing like it on earth.



Any which way but loose

Before I take my 1982 Oldsmobile Firenza to the shop, I'd like to know what to expect. The problem is a knock coming from the front of the 1.8-liter engine. The car is no longer covered by warranty.—Jim Lacey, Rochester, Minn.

Although an engine knock could mean big trouble, in your case I'm pretty sure it's small potatoes. You see, a number of 1.8-liter engines in 1982 GM J-body cars have had a tendency to knock, because the timing belt was installed too loosely and slaps against the timing belt front cover. Belt tension specs were revised later in the production run, but there are still many 1.8-liter engines like yours.

What you have to do is take off the front cover and remove the belt. Inspect the roots of the cogs for cracks, because in running loosely the belt may have been damaged. If so, replace it. If you install a new belt, adjust belt tension to 40 ft.-lb.

Make adjustments with the engine cold using a belt tension gauge, such as Kent-Moore tool J-26486, for accuracy. Don't knock the cam out of time!

Escort service

A friend of mine has a 1981 Ford Escort that has been driven about 30,000 miles. Tires have never been rotated. Both rear tires are practically bald. Both front tires look brand new. The Ford dealer says the front end probably is out of alignment and is causing the condition. Can this be true?—George Helm, Manteno, Ill.

No. Front-end misalignment doesn't seriously affect the rear, or vice versa. What may be throwing the dealer off base is the fact that the shop manual says the rear end is adjusted at the factory. However, this doesn't mean it couldn't have been *misadjusted* at the factory and should not be readjusted before new tires are installed.

Bring the car to a shop that has modern electronic four-wheel alignment equipment. If a mechanic makes the adjustment using old-style two-wheel equipment and isn't absolutely precise, settings won't be accurate.

To adjust rear toe, scribe a vertical mark on the tie rod front bracket at the bolt-head centerline to provide a reference point. Loosen the tie rod-to-body bolt and slide the tie rod in the slot—toward the front of the car to increase toe-in or toward the rear to increase toe-out. Torque the tie rod-to-body bolt 90-100 ft.-lb.

Chrysler TSBs, ad nauseum

Chrysler's done it to us again, folks. It all started last July (*Car Clinic*, page 18), when I reported what I was told by someone at Chrysler that technical service bulletins (TSBs) were available in book form. Wrong!

Then, in December (*Car Clinic*, page 20), I was told by someone else at

Chrysler that you could write to the company and ask if there was a TSB dealing with your problem. Wrong!

Now it seems the only way to take advantage of Chrysler's "generous" TSB-to-consumers program is to request a specific TSB, assuming you know which TSB number to ask for. But if you know that, why bother? You can tell your dealer the number and have him fix your trouble. Catch 22!

So, GM remains the only company with a workable TSB program. Call their toll-free number (1-800-551-4123) and you'll get ordering info.

Hail of a problem

Hail dented the hood, roof and trunk lid of my car, and I'd like to know if what I was told is true—that applying dry ice to dented areas after the car sits in the sun will cause them to pop out.—R.W. Broadstone, Grand Island, Neb.

I don't know, and I haven't found a body and fender guy who can vouch for that remedy. But, you have nothing to lose by trying.

If the trick doesn't work and dents can be reached from behind, they can usually be hammered out. If this doesn't work, the area will have to be sanded to bare metal, leveled with body filler and glaze, then sanded, primed and repainted. A dent deeper than 1/16 inch or so usually has to be drilled and pulled before the repair can be made.

Head pressure headache

The 2.5-liter fuel-injected engine in my 1982 Buick Skylark drops dead in hot weather when the air conditioner is on, and not one GM dealer has been able to tell me why. It happens after the car's been driven about 25 miles. I can be waiting for a light to change or on the

(Please turn to page 30)

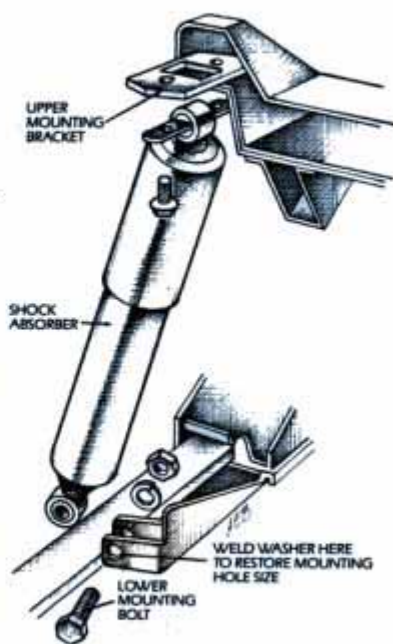


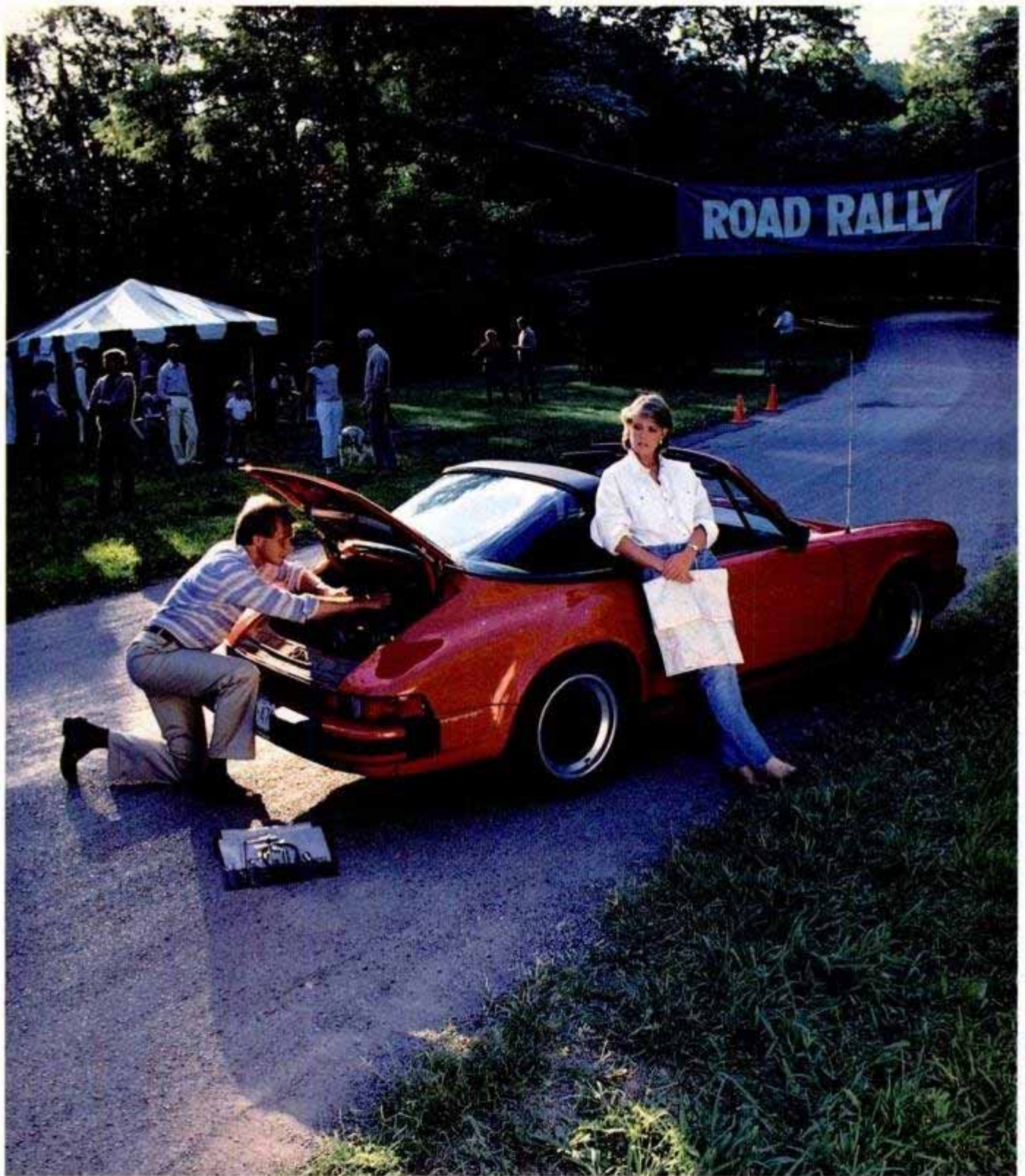
Ted's message: Find—then fix

"Some years ago, my Chevy developed a bad vibration between 50 and 55 mph. Balancing wheels, aligning the front end, replacing tires, checking drive shaft angularity, inspecting U-joints and ball joints—nothing helped," writes Ted Johnson of Lemont, Ill. "I was really lost until I decided to try and localize the condition."

To do this, Ted drove his car and had a friend follow in another car. When the vibration started, Ted signaled his friend to give the car a once-over. He saw the rear end bouncing up and down.

"An investigation showed that lower ends of the rear shock absorbers were loose," Ted says. "Mounting holes in the brackets had enlarged so much that bolts which were supposed to hold the shocks firmly were slipping (see illustration). The problem was fixed and vibration eliminated by welding flat washers on brackets over the holes and installing new shocks."





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MAKE IT NAPA BRAND NEW!

Check your Yellow Pages

CAR CLINIC

(Continued from page 28)

move—it doesn't matter. Poof, off goes the engine.

It restarts soon after, but the trouble repeats itself for the rest of the day. When the weather is cool, the car runs like a dream. Can you explain why this is happening?—John Karakitses, New Port Richey, Fla.

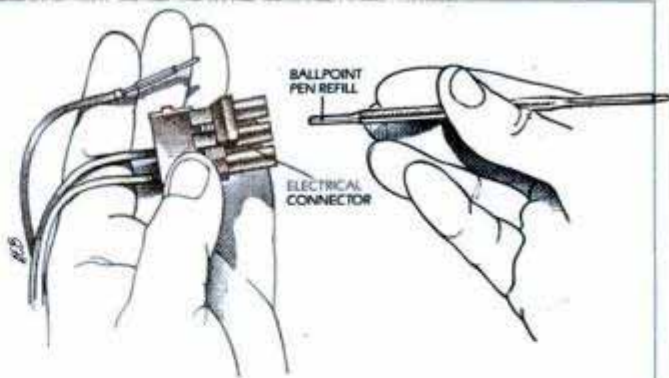
If the car dies only when your foot is off the throttle, it's possible that the idle air control system is malfunctioning. Have your mechanic check to make sure that it kicks up engine idle speed when the a/c cycles on.

However, if the engine dies with the throttle open, it's probably due to excessive a/c head pressure. Head pressure is the pressure of refrigerant as it's being discharged from the compressor. The engine cooling fan is supposed to cool the air-conditioning condenser, so pressure won't get too high.

If the fan isn't working, head pressure will exceed normal limits. This causes the compressor to overwork and

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, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be discussed in the column.



Cheap shot

There are tools you can buy to disconnect wire terminals from locks in plastic connectors. However, Ernie Spencer of Butte, Mont., suggests that you try an old metal

ball-point refill instead. It's just the right thickness and shape to insert into a connector so you can depress the tab that locks the wire in place.

need more power to run—power it gets from the engine. Since there isn't ample power for both the air conditioner and engine to operate, the engine stalls.

I suggest you have the engine cooling fan circuit and fan motor tested. Look especially for a bad ground, a short or a faulty relay.

If this doesn't pan out, the condenser should be checked for fin blockage and the compressor should be checked for internal problems.

Rest period

Can I address readers who own Dodge Ramcharger pickups?

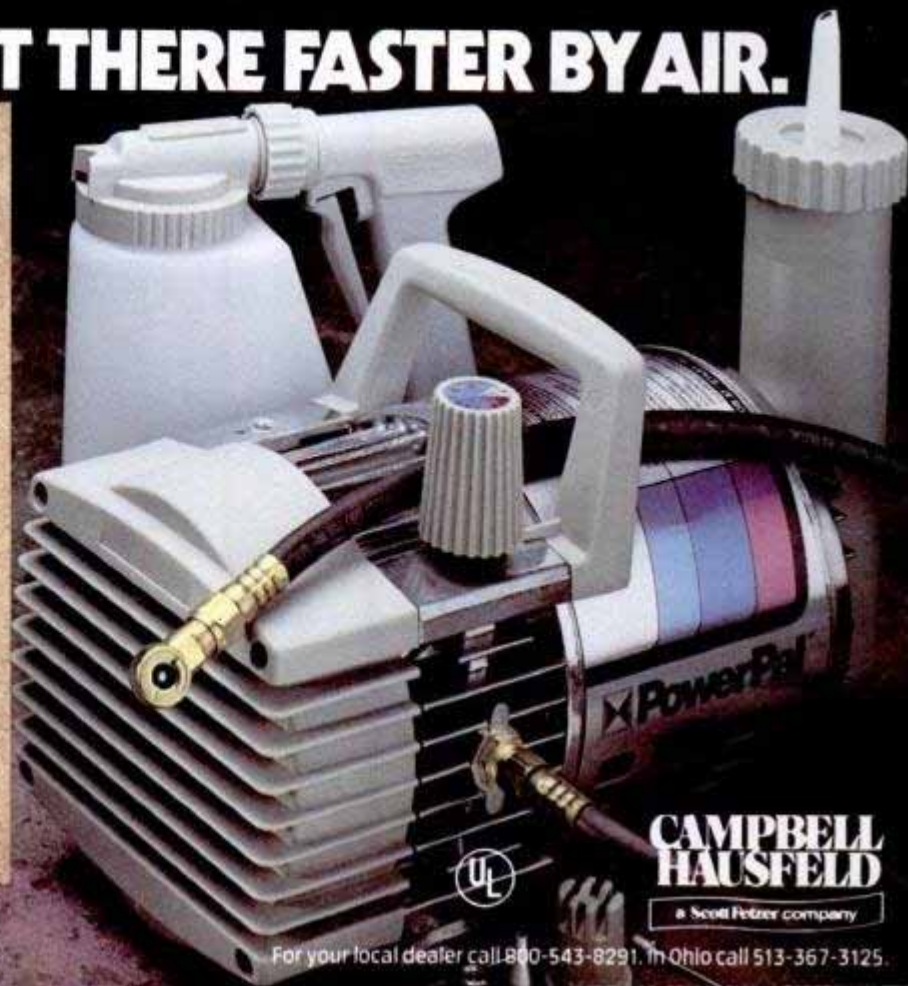
I spent a small fortune trying to repair a hesitation problem with the 360-cu.-in. engine in my 1978 model. The solution is to remove the intake manifold, clean the crossover ports, which build up carbon, replace the gaskets and reinstall the manifold. The truck now runs like a charm.—Jim Fesso, Shaumburg, Ill.

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- ✓ 2. INFLATE SPARE
- ✓ 3. UNCLOG KITCHEN SINK
- ✓ 4. CAULK BEDROOM WINDOWS
- ✓ 5. CLEAN FURNACE FILTER
- ✓ 6. SPRAY SHRUBS
- ✓ 7. FLUSH RV LINES

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Clamp Light™ Task Light. When you can't get a grip on what you have to do, let Black & Decker's Clamp Light™ Rechargeable Task Light help out. It's clip-on and cordless, so it's always ready to lend a hand. **BLACK & DECKER**

'Wail' of a problem

I have a 1983 Ford Ranger with a 2.8-liter V6 engine and five-speed transmission. After only 8,000 miles, the transmission developed a whine. The dealer installed a new transmission. This one, too, started whining after 7,500 miles. What's going on?—Kit Birmingham, Big Pine, Calif.

The dealer is looking in the wrong place. The noise probably is coming from the clutch—not the transmission. It could be caused by the clutch release bearing, if it has cocked and is rubbing.

When the first transmission was replaced, the bearing was probably set straight, but unless it's aligned using a special alignment tool (Ford part No. T75L-6392A), it goes off kilter again.

The dealer must check the clutch and pilot bushing bore to make sure they fall within specifications. Face runout of the clutch housing must not exceed .010 in.; bore runout must not exceed .015 in. If runout dimensions are within these tolerances, the bearing should be aligned using the special tool. If not, a new clutch housing will have to be installed, or the old housing will have to be aligned using shims and/or offset dowel pins.

Chokes in the clutch

My 1984 Toyota Tercel four-wheel-drive wagon vibrates, shudders, chatters—call it what you will—as I clutch and declutch at slow speeds (stop-and-go driving, parking, backing up or downshifting at 25 mph or less). It happens in both 4wd and front-wheel-drive modes. The Toyota service department swears the clutch is within specs. Four attempts to fix the trouble have failed. The vehicle has been driven 6,000 miles, and the problem's been with me since day one.—John Bowden, Carson City, Nev.

There's no reason to doubt the service department.

because there is no known mechanical repair that will get rid of this condition, which is common to your model vehicle. Bucking occurs because the engine loads up too much when clutching and declutching are done at reduced engine speeds. You can verify what I'm saying by increasing engine speed to around 1,200 rpm as you work the clutch. I bet you'll get no chatter. Incidentally, the condition won't cause damage. If it's annoying, get into the habit of increasing engine speed as you shift. **PM**

SERVICE TIPS

- An engine surge under light acceleration when the 2.2-liter engine of a 1984 Voyager is warmed up can be eliminated with a different purge orifice (part No. 4275586) in the purge hose connecting the canister to the base of the carburetor.
- A new valve stem oil seal (part No. 90180294) is available to stem oil loss on 1982-84 GM 1.8-liter engines. Regarding this engine, there is confusion about the correct oil fill level. The 1982 and 1983 engines take three quarts, with or without a change of filter. The 1984 engine takes four quarts, with or without a change of filter.
- A tapping noise from the engine compartment of a 1984 Ford Bronco II or Ranger, especially noticeable in cold weather, may be made by the EGR solenoid. Try a new solenoid (part No. E3TZ-9D474-G).
- A vibration or rumble from the transmission of a 1984 Accord or Prelude while driving in fourth gear between 32 and 42 mph with the torque converter lockup clutch engaged is reason to bring your car to a Honda dealer. Have him replace the torque converter with one carrying Honda part No. 26000-PC9-305. TSB 84-064 gives the details.
- Buzzing from the air-conditioning outlets of a 1985 Buick Electra or Park Avenue when the system is on high blower speed can be eliminated by removing the vane running across the center outlet area, behind the louvers. The procedure is outlined in TSB 85-1-1.

THE LIGHT YOU PUT OUT WHEN IT'S DARK.

AreaLiter™ Portable Light. The bright way to improve your nightlife is with Black & Decker's AreaLiter™ Fluorescent Portable Light. The rechargeable light that's always ready to light up the great outdoors.

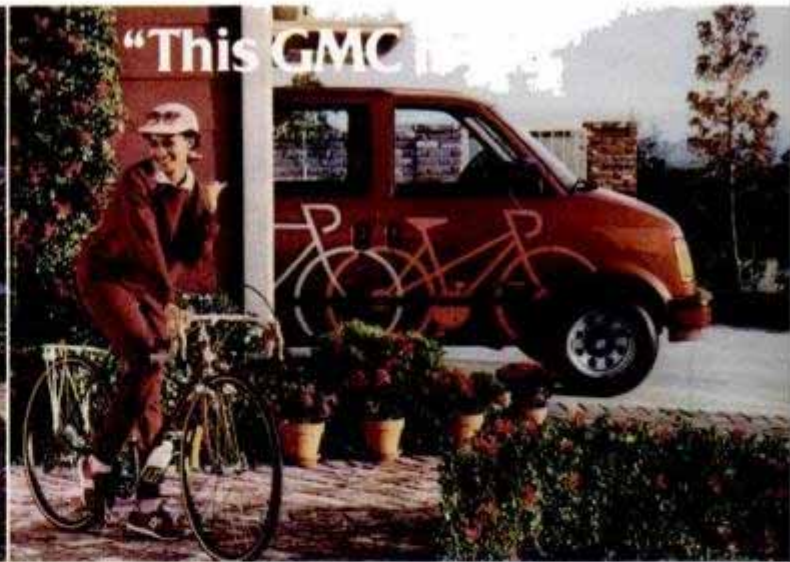
BLACK & DECKER™



"This GMC is me."



"This GMC is me."



"This GMC is we."



"This GMC is me."



Express yourself.

Introducing Safari from GMC. It's the van that's new-size outside, you-size inside. Its personality is your personality!

Safari's roomy interior lets you carry eight passengers (with optional seating) or up to 151.8 cu ft of cargo. Even tow up to 5,000 lbs, properly equipped. So Safari's always ready to go fish with you. Antique with you. Whatever you want to do, our new van will eagerly do, too. And Safari's sleek new size lets you slip easily through traffic or slide into a parking space, garage or car wash.

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trucks you can live with. So you can dress up your Safari with plush interiors. Power windows and door locks. Air conditioning units for front and rear passengers. Add the powerful Vortec engine, the biggest V-6 available in a van.

Express yourself in a Safari from GMC. It's new. It's you. With more uses, more comfort, more fun than any new-size van yet. Look up your nearest GMC dealer in the Yellow Pages, under "Trucks." Then buckle up and head for a

look at Safari. See how fast you'll say, "This GMC is me!"

Vans shown with customized paint and wheels not available from GMC.



GMC

A truck you can live with.

THE PM GARAGE

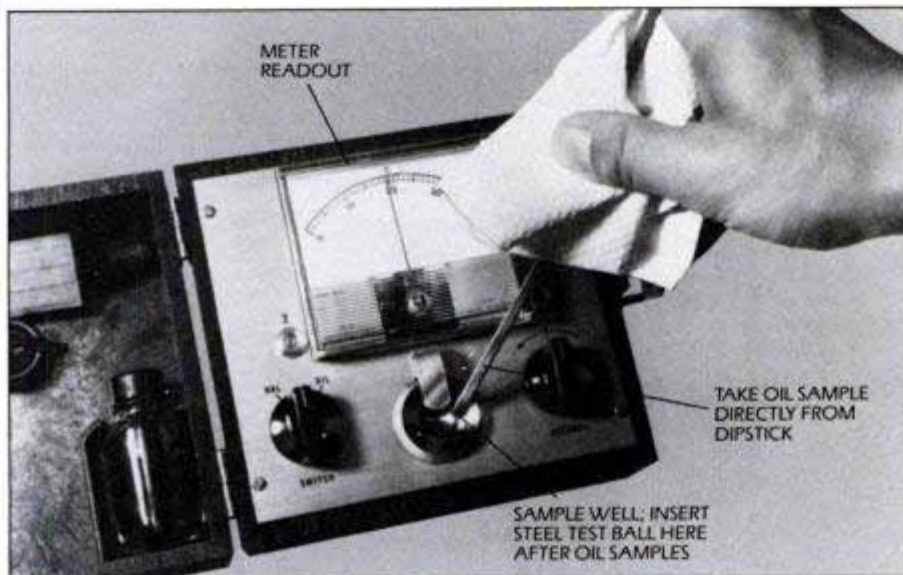


Oil analyzer stretches changes

If you're the type to spend a little more for a premium-grade motor oil, you can recover some of the outlay by safely squeezing additional miles between changes. Kent-Moore's Oil Condition Monitor runs a pricey \$434, but your fleet of family haulers or business vehicles may justify the investment.

This instrument keeps you informed about the lubricating quality of engine or transmission oil by measuring the

lubricant's electrical insulating properties. First, measure a fresh sample when you change it and note the meter reading. Recheck the oil occasionally by dripping a small sample from the dipstick into the sample well. When the meter readings reflect a change, the oil has become contaminated. The Oil Condition Monitor comes from Kent-Moore Automotive, 29784 Little Mack, Roseville, Mich. 48066.—N.S.M.



Monitor evaluates the oil's lubricating ability by reading change in electrical resistance.

Computer decoder

Until I found out about this trouble-code reader, I thought that computerized cars required expensive diagnostic equipment for trouble shooting. This \$17.99 trouble-code reader does the



LED indicator blinks to read trouble codes.

job handily with a blinking LED that is mounted on a three-way terminal box. You simply plug it in and the LED will flash to give you the trouble-code number.

A double flash, pause, then a triple

flash tells you the code is number 23, for example. By referring to the shop manual "trouble trees," the code will tell you exactly what is wrong with either the control boxes or their connecting wires.

The trouble-code reader can be purchased at automobile supply stores and is available directly from Thexton Manufacturing Co., 7685 Parklawn Ave., Box 35008, Minneapolis, Minn. 55435.—Angus Laidlaw

Tester with options

A new electrical checker that looks like a test lamp will also perform the functions of jumper wires.

In order to see if there's power at a terminal, connect the checker's leads to the battery and click the switch to its center position. If the lamp lights, there's juice. If you want to apply

Stud service

Every time I have to snug up an exhaust system connection, I cross my fingers and hope that the manifold studs will hold.



Clamp will replace broken manifold studs.

Corrosion caused by all the heat makes them snap easily, and they're a bear to reach, so drilling out and replacing them is almost impossible, as I found on a Honda.

Clamp-A-Stud makes a solid, permanent repair in minutes and is available in several sizes so that they will work in most applications. At approximately \$15 each, the clamps are much cheaper than replacing an entire manifold. Order Clamp-A-Stud directly from the manufacturer by writing to In-Mech Industries, Box 5098, Tahoe City, Calif. 95730.—W.H.

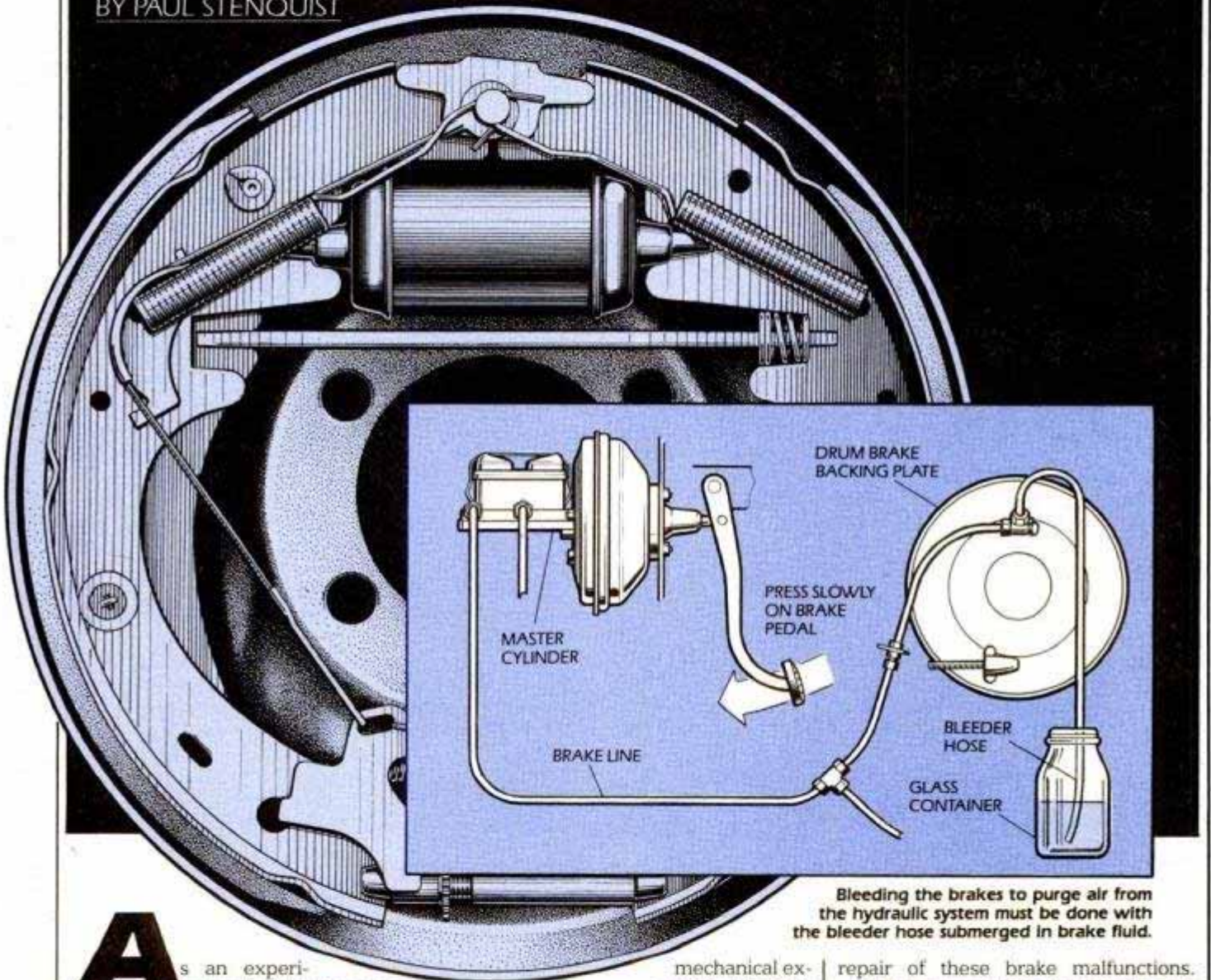


Versatile tester can also apply 12-v. power.

power to see if an accessory works, flip the switch to the power position. Listing for \$28, the electrical checker is made by Thexton Manufacturing Co., Box 35008, Minneapolis, Minn. 55435.—Pete Warren

How To Solve Five Tough Brake Problems

BY PAUL STENOQUIST



Bleeding the brakes to purge air from the hydraulic system must be done with the bleeder hose submerged in brake fluid.

As an experienced Saturday mechanic, you've probably become proficient at normal brake system maintenance chores. Regular readers know that we recommend a complete inspection and overhaul at 30,000-mile intervals. This includes replacement of linings and pads, resurfacing of drums and rotors if needed, and inspection of all hydraulic components.

Mastery of these regular maintenance procedures is the first level of

mechanical expertise. Problem solving is the next level, and it's more difficult than maintenance service because it requires a broad background in theory along with years of experience.

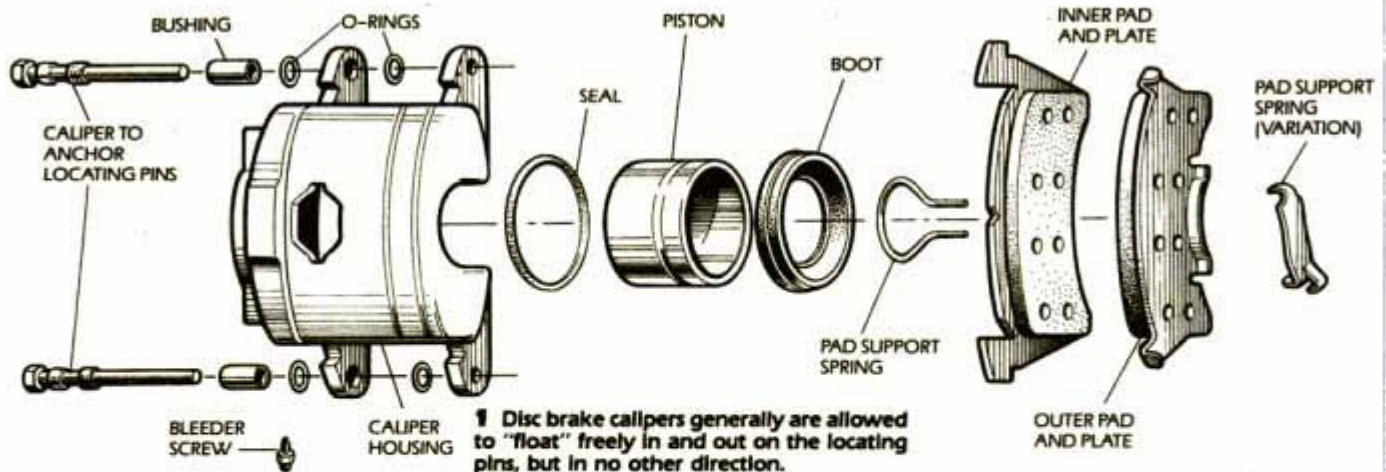
The skilled Saturday mechanic, however, can learn to recognize and solve certain common problems. This month we'll discuss the potential causes of five tough brake problems—problems that occur with some frequency. We'll also provide some general guidelines for the

repair of these brake malfunctions.

Before attempting any repair, you should be equipped with the factory service manual for your car. At the very least, you should have a general auto repair manual that includes a section for your car.

Car pulls to one side

A violent tug of the steering wheel to one side or the other that occurs when the brakes are applied could be the result of a brake-system malfunction.



1 Disc brake callipers generally are allowed to "float" freely in and out on the locating pins, but in no other direction.

Most often this is caused by the brake on one side of the car becoming less effective than the one on the other side.

It's sometimes tough to determine whether a pulling problem is caused by the front or rear brakes. Of course, unequal effectiveness of the front brakes causes a more violent pull than the same problem in the rear. As a general guideline, we can say that a pull which moves the car violently and yanks against the steering wheel is probably due to a front brake problem. A pull that is more of a drift, and does not tug on the steering wheel, is probably the result of a rear brake problem.

If you suspect that a pull is being caused by a disc brake, chock the rear wheels, jack up the car and support it on sturdy stands. Remove both front wheels and examine the calipers and discs for obvious signs of trouble. Look for a brake fluid leak or a loose caliper or caliper mounting bracket. Most disc brake calipers are designed to slide in and out on pins or machined guides. However a caliper should not be free to wobble in any other direction.

If everything appears to be in order, you'll have to remove the caliper to check the pads and caliper itself. Many calipers are retained by threaded pins on which they slide (Fig. 1). Others are retained on machined guides by a key and setscrew. Refer to your repair manual for specific removal directions if you're not already familiar with your vehicle's brakes.

Examine the pads. If they're contaminated with grease or brake fluid, their effectiveness is reduced and you've found the immediate cause. It will also be necessary to repair the grease seal or caliper leak that caused the contamination before you replace the pads on both sides of the car.

Replace a leaking caliper with a new or rebuilt unit, or rebuild the old caliper yourself. If the caliper piston and bore

are not scored or otherwise damaged, the caliper can be restored to working order by replacing its seal and dust boot. Check your manual for specific step-by-step instructions.

If you find that the caliper piston is stuck in its bore, the caliper should be replaced, as the contaminants that caused it to stick have most likely damaged the piston and caliper bore.

If you have to replace the pads on one side of the vehicle, do the same on the other side so braking will be equal.

If a drum brake problem seems to be the cause of the problem, back off the adjusting screw star wheel. Use a brake adjusting tool inserted in the adjuster access slot, which is located either in

the drum itself or in the backing plate (Fig. 2). On vehicles with the adjuster slot in the backing plate, you may have to hold the adjuster lever away from the star wheel with a screwdriver while you turn the wheel with the adjusting tool. If the access hole is in the drum, use a small hook to pull the adjuster away from the wheel. For cars equipped with other types of adjusting mechanisms, check your manual.

Once the adjusters have been backed off, remove the drums and check for incorrect or distorted shoes, damaged lining, grease or brake fluid on the lining, or a loose or damaged brake backing plate.

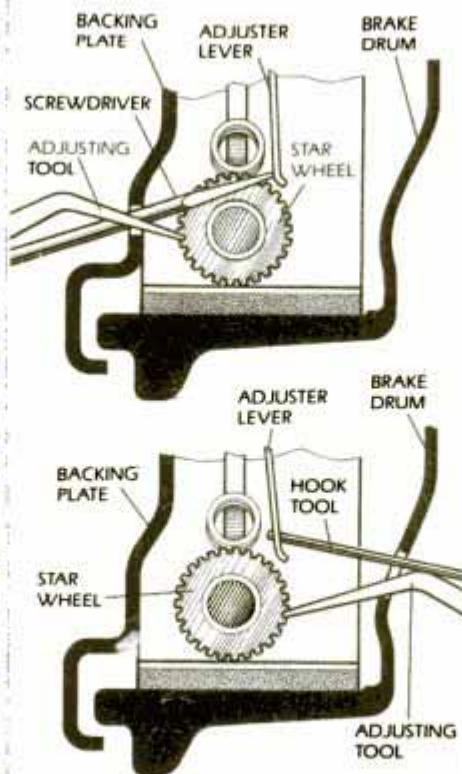
If shoes, lining and backing plates look okay, check the wheel cylinders for leaks (Fig. 3). Then, examine the drums. Look for hard spots or an out-of-round condition that prevents full shoe contact. Hard spots will show up as spotty wear. An out-of-round condition may cause wear on one side of the drum only. But in less serious cases, remachining of the drum may be the only way to confirm whether an out-of-round condition exists.

If the drums have hard spots, they must be replaced. Drums that are slightly out of round can sometimes be remachined, but you might wind up with an imbalanced condition. Replacement is your best bet.

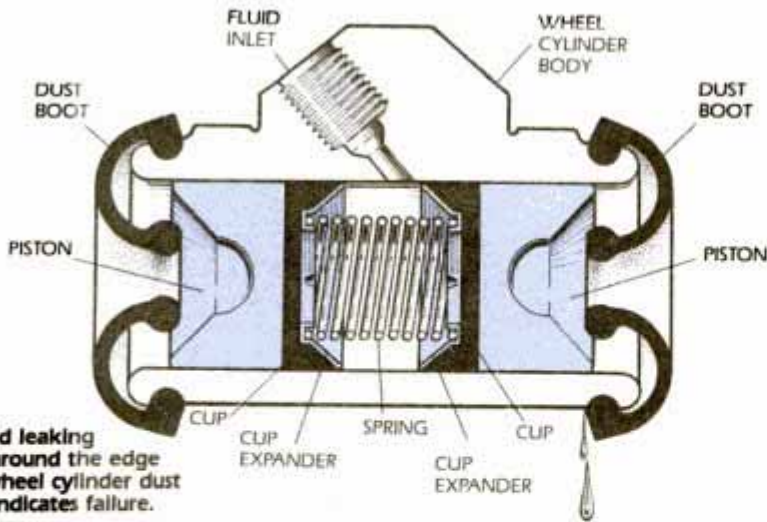
Again, if you replace the lining on one side of the car, you must do the same on the other side, or you may end up with a more severe pull than you had in the first place.

If a brake pull problem defies solution, try replacing the brake hoses. A brake hose that is damaged internally can delay hydraulic pressure buildup at one wheel cylinder or caliper (Fig. 4).

Once you've replaced the hose it will be necessary to bleed air from the brake hydraulic system. See the *Pedal Pump Up* section of this article.



2 To back off star wheel, move adjuster lever with screwdriver (top) or hook.



3 Fluid leaking from around the edge of a wheel cylinder dust boot indicates failure.

Pulsating brake pedal

A brake pedal that pulsates when applied indicates a brake rotor, brake drum or wheel bearing problem. Steering-wheel vibration at highway speeds may also be a symptom of this type of problem.

On cars with drum brakes, the problem can be due to a bent rear axle, a distorted drum or a bad wheel bearing.

To eliminate the possibility of a bent axle on rear-drum, rear-drive cars, have someone observe the wheels while you drive the car. If a rear wheel wobbles, the axle is probably bent.

A rear wheel bearing that is bad enough to cause pulsation of the pedal would also be abnormally noisy.

If both bearings and axles appear to be okay, back off the adjusters as described above and remove the drums. Have the drums resurfaced at an auto parts store or machine shop that is equipped with a brake lathe. If one drum or the other is distorted seriously, the machinist won't be able to resurface it and it will have to be replaced.

Check front wheel bearings by tugging on the top and bottom of the freely hanging wheel before you remove it. Noticeable looseness indicates either a wheel-bearing problem or ball-joint trouble. Loose ball joints will not cause a pedal pulsation. If the bearings are okay, have the drums resurfaced or, if necessary, replace them.

Pedal pulsations are even more common on cars with disc brakes. Remove the wheels and check the discs for lateral runout by mounting a dial indicator perpendicular to the disc. A magnetic base offers the easiest method of mounting. Measure runout 1 in. from the edge of the disc (Fig. 5).

Specs vary somewhat, but for most discs, runout should not exceed 0.005 in. when the disc is rotated one full revolution. If it does exceed manufacturer's specs, mark the position of the disc, remove it and check hub runout (on cars where the hub and disc are separate units). Generally, hub runout should be less than 0.002 in. If hub runout is in excess of the manufacturer's tolerance, replace the hub.

If hub runout is within spec, but disc runout is not, try installing the disc with your index mark positioned 180° from its previous location. Check disc runout again. If it's not within specs, replace or refinish the disc as necessary.

If lateral runout is okay, check the disc for thickness variation by taking micrometer readings at 12 equidistant points, 1 in. from the edge (Fig. 6). Compare your figures to the manufacturer's specs. In most cases, thickness

variation must be less than 0.0005 in. (one-half thousandth of an inch.) If a disc is not within specs, it must be refinished or replaced.

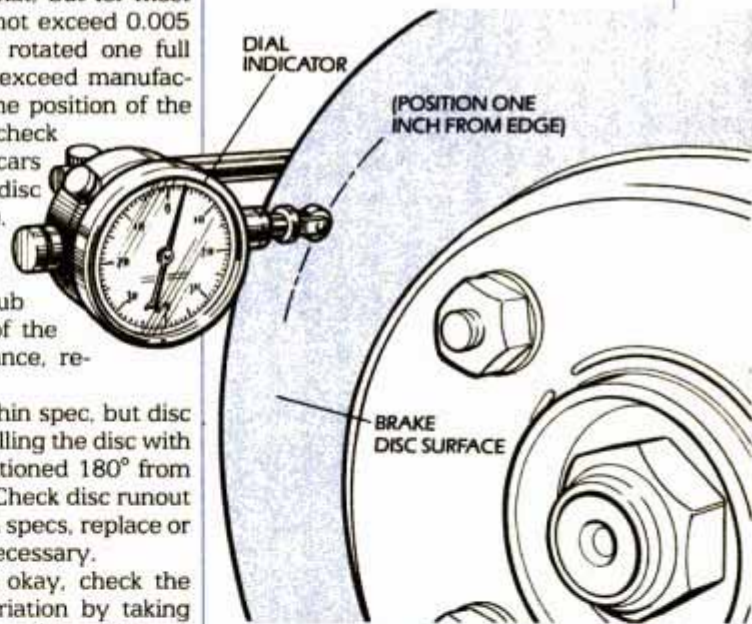
Some manufacturers, most notably Honda, insist that rotors must be refinished on the car, using special equipment designed for the job. If this procedure is recommended for your car, you'll have to get professional help from a shop equipped with the proper on-car rotor refinishing tool.

Brake squeal

Disc brake pad vibration is the most common cause of brake squeal—a shrieking noise that occurs when the brakes are applied.

The noise can also be due to excessive pad wear if your brakes haven't been overhauled in a while.

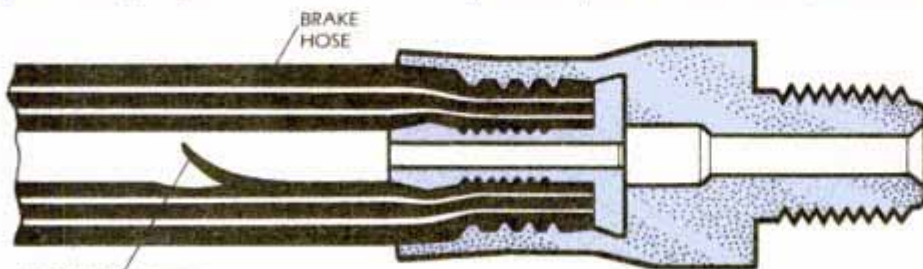
An application of antisqueal compound is the simplest and most effective remedy for problems on cars with new or relatively low-mileage pads. The compound, a paste-like substance, is available through auto parts stores.



5 Check for disc runout with a dial indicator mounted 1 in. from rotor edge.

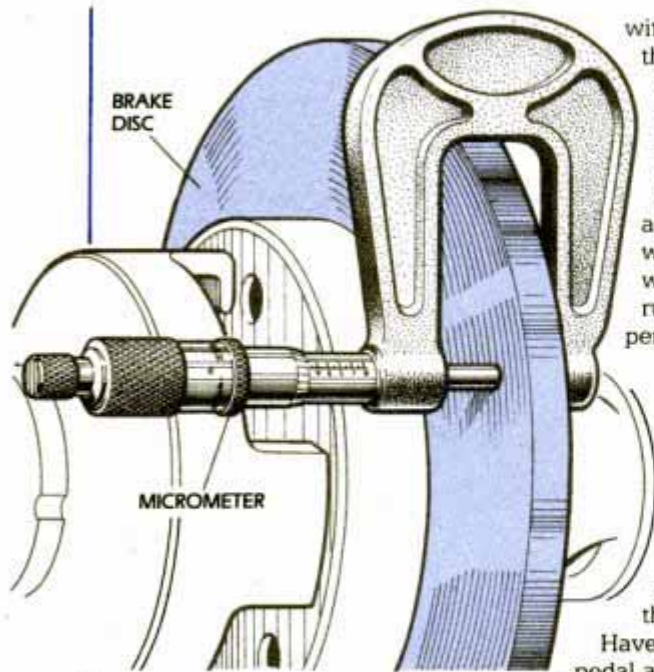
To apply the compound, disengage the calipers from their mounts as you would when replacing pads. Then apply a thin strip of the product across the center of the inboard pad backing plate and a round patch on each end of the outboard pad backing plate. Do not apply the material to the front of the pads. Clean the rotors with brake cleaner and reassemble the caliper mount, taking care to attach any antirattle clips or springs properly (Fig. 7).

If squeal is a problem on drum brakes, back off the self adjusters and



DAMAGED BRAKE HOSE INNER LINING

4 Internally damaged brake hose can restrict pressure to one brake, cause pulling.



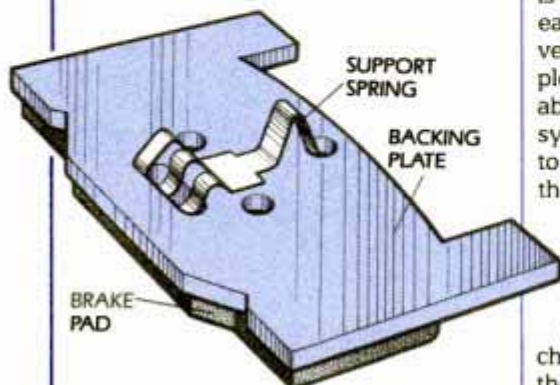
6 Check disc thickness variation by measuring at 12 points around circumference.

remove the drums. Then sand each lining with medium-grit sandpaper until any glazing has been removed. Clean the drums with brake cleaner and reinstall. If this does not solve the problem, replace the lining with a premium-grade, name-brand shoe and lining and have the drums refinished.

Pedal pump up

If your brake pedal goes to the floor or almost to the floor the first time you hit it, but then "pumps up" to a normal height and firmness after repeated applications, there are air bubbles in the hydraulic system. These bubbles must be bled out to restore the system to proper working order. Brake bleeding must also follow the replacement of a caliper or any other job that allows air to enter the hydraulic system.

Begin by filling the master cylinder to within 1/2 in. of the top. Then, starting



7 Disc brake pads will make noise if pad support spring is installed improperly.

with the wheel cylinder or caliper that is most distant from the master cylinder (or the one recommended in your service manual), loosen the bleeder screw with a 6-point socket or box wrench. Don't try to loosen a bleeder screw with an open end wrench or crescent wrench. The wrench will probably slip and ruin the screw, necessitating caliper or wheel cylinder replacement.

Once you've loosened the bleeder screw, close it and attach a neoprene hose to its nipple (see lead illustration). The hose must fit snugly over the screw's nipple. Insert the other end of the hose in a glass bottle that is half full of clean brake fluid. Make sure the hose is submerged in fluid.

Have a helper pump up the brake pedal and continue to apply firm pressure. Then open the bleeder screw and let the fluid run through the hose and into the jar until the brake pedal hits the floor. Fluid flow will stop at this point. Tighten the bleeder screw and have your helper release the pedal slowly. Check the master cylinder, top it off if necessary and repeat the procedure. Continue until the expelled fluid is free of air bubbles. Do not return expelled fluid to the master cylinder.

Bleeding all the air from the hydraulic system is a time-consuming process, but be patient because it's the only way to end up with a firm brake pedal when the job is finished. It may take several pump-up-and-release cycles to get a flow of pure brake fluid. When the line still has air in it, there will be a gurgling, spitting sound as you crack open the bleeder valve. When there's a smooth flow of brake fluid, with no air bubbling into the catch bottle, you'll know that the air is out of the system.

Once the wheel cylinder or caliper that is farthest from the master cylinder is free of air, repeat the procedure at each of the other wheels. On some vehicles, particularly those with multiple-piston disc brakes, you may not be able to bleed all of the air from the system using this method. If this proves to be the case, have a professional do the job using a pressure bleeder.

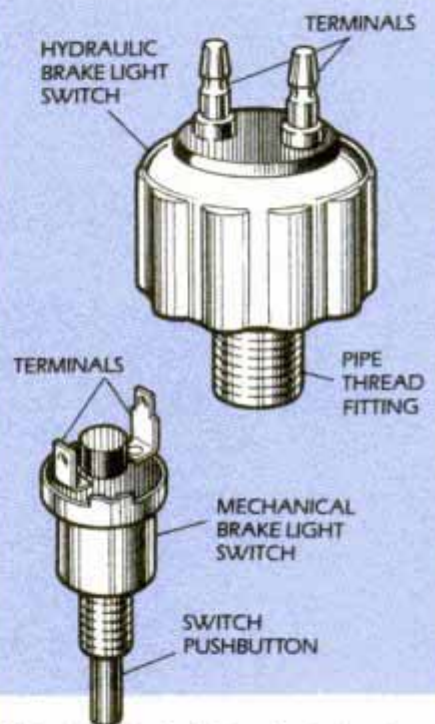
No brake lights

A car without brake lights is an accident waiting to happen. Some motorists make it a habit to check their brake lights by depressing the brake pedal when the car is parked directly in front of another car or a wall. If the brake lights are working,

you'll see the reflected red glow.

If only one light fails, it's usually just a bad bulb. But if both lights fail, the culprit is probably a fuse or brake light switch. Check for a bad fuse first.

Two basic types of brake light switches have been used by automakers (Fig. 8). Hydraulically operated switches, most often found on older cars, are closed by hydraulic pressure when the brake pedal is depressed. Mechanical brake light switches are conventional pushbutton-type switches that are operated by the brake pedal or by a bracket on the pedal. If your car has a hydraulic switch, it's probably right on the end of the master cylinder, or nearby. If it has a mechanical switch, look for it under the dash and behind the brake pedal assembly.



8 Hydraulic brake light switches (top) usually are mounted on master cylinder; push-button types (bottom) on pedal linkage.

To test either type of switch, remove the wiring connector from the switch terminals. Then, with the engine running, connect the two contacts in the connector using a jumper lead. If the switch is the cause of the problem, this should cause the brake lights to turn on.

If the lights still don't work, you'll have to look for an electrical circuit problem. Check for voltage into the switch with a test light or voltmeter. If voltage is available, check for an open circuit between the switch and brake lights using an ohmmeter.

When doing any kind of brake work, seek professional help if you run into problems. Don't take any chances. **PM**

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SCIENCE WORLDWIDE



Lasers knock again

Laser technology has been applied to a wide range of automotive technologies, from design to actual manufacture to the computer equipment installed in some futuristic cars. Now, Ford Motor Co. researchers are studying combustion characteristics with laser rigs. By pointing a high-intensity laser beam at a model of an engine, researchers can precisely measure heat loss at various locations. Light scattered by the hotter gases in a model cylinder create a weaker reflected beam. Judging by the wavelength of the reflected beam, the researchers can determine temperature losses to within a fraction of a degree over an area less than a micrometer across. A Ford spokesman says the laser technique will reduce emissions and lead to more muscular and more efficient powerplants.

Ford researchers aim laser at experimental cylinder to measure engine heat loss.



Halley watch

The excitement is building as Halley's Comet comes closer. Scientists already have photographed Halley using charged-couple devices (CCDs) mounted to a telescope. The first camera photographs will be taken by astronomers this summer. But most of us won't get a firsthand glimpse of Halley until December 1985. Watch out for optics advertised as being especially designed for viewing the comet. They'll soon be flooding the market. The best views, however, will be with plain ol' field glasses and ordinary amateur telescopes. We'll keep you apprised of developments in future reports. An excellent rundown on Halley, *Mr. Halley's Comet*, can be ordered for \$2 from Sky Publishing, 49 Bay State Rd., Cambridge, Mass. 02238. The 30-page book includes viewing dates.

Star 'engine room' discovered

Several galaxies across the universe emit tremendous amounts of radio waves. In the past, scientists supposed that the waves, which could not be connected with any visible objects, were created by unseen star-like masses or some other unknown phenomena. Canadian astronomer Philipp P. Kronberg and American Richard Stramek, relying on radio-telescope studies of the galaxy M82, say they have discovered that a series of stellar explosions—supernovae—may account for the excess energy. To test their theory further, they currently are searching M82 for a new supernova. If they find it, they write in the journal *Science*, they will have identified the "engine room" of all high-energy galaxies.

How deep was my valley

Until recently, scientists have believed that plant life can't grow beneath 600 feet in the ocean because sunlight can't penetrate beyond that depth. But Smithsonian Institution researchers Mark and Diane Littler have located a previously unknown species of algae at just over 880 feet off San Salvadore Island in the Bahamas.

The Littlers found the purple algae growing abundantly on the steep side of a seamount. The algae were taken to a lab and exposed to simulated conditions found in their natural habitat. Tests showed that they were conducting photosynthesis. Sunlight is the catalyst. To investigate how the process works, the Littlers are diving again this summer.

Dramatic 'weapon' fights bacteria



Rod-like bacteria at 2000x magnification survive a penicillin attack and grow.

As quickly as science comes up with a new antibiotic, bacteria mutate and are able to fight it off. Beecham Labs has introduced a new drug that may change all that. By adding potassium clavulanate to the penicillin derivative called amoxicillin, Beecham scientists have managed to destroy resistant rod-like bacteria. The result, a drug called Augmentin, will be on the market this year. It is expected to be used against pneumonia and other serious cases where penicillin fails.



With the drug Augmentin, the bacteria react by expanding and exploding harmlessly.

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ALL OUTDOORS



Yamaha V-Max is quick off the line with its 145-hp V4. The 1,200-cc liquid-cooled engine uses four valves per cylinder.

Two-wheeled roadburner

At a rating of 145 hp, Yamaha's new V-Max has more power than most modern cars. But, rather than being a flashy display of racetrack styling, the V-Max takes on an All-American neo-chopper stance. The 15-inch rear tire would look right at home on your Chevette, the shorty fenders take a page from the Harley-Davidson styling book and an abundance of polished brightwork lets no one ignore the bike's passing.

Dominating the cyclescape is the

1,200-cc V4 powerplant. Developed for the Venture luxury touring model, and pumped up with steroids for the V-Max application, the liquid-cooled, 16-valve engine has Yamaha's new V-boost intake layout. Instead of the standard one-carb-per-cylinder setup, this design has butterfly valves that open at high rpm to allow each piston to inhale through two carbs.

In both styling and specifications, Yamaha's V-Max is king of the brute-

bike set, bound to spawn imitators.

Yamaha's engineers didn't call it a day after drawing up the V-Max, though. Their super sport FZ750 bike sets a new record in the production engine valves-per-cylinder race—five! The 20-valve Four uses a three-intake, two-exhaust-valve combustion chamber design, and its featherweight components allow an astronomical 11,000 rpm redline. Yamaha experimented with six- and seven-valve designs, too. The five-valve layout will also find a home in a new 2.0-liter V6 engine for Japanese Formula 2 road race cars.

Boot pads

To your list of assorted skiing gremlins—fractured limbs, twisted joints, cuts and bruises—add one more: boot bang. Those painful bites on the shins, irritations of tendons, and bruises to ankle and heel bones are caused by ski boots—even the best fitted, highest quality ones. A new type of boot padding called Ski Spats gives boot bang the boot. Ski Spats rely on a polymer gel cushioning material that closely resembles human fat—an excellent natural pad against pressure injuries.

The cushion is sewn into stretchable, polypropylene spats that fit over your socks. As your foot moves, the material flows between your foot and the boot, providing a fatlike pad. Ski Spats cost \$29.95. Write Spenco Medical Corp., Box 2501, Waco, Tex. 86702.



Ski Spats put an end to ski boot bruises.

Speed log



Mini-size Digi-Log gives readouts of speed and distance to make navigation a breeze.

Just because you brave the briny in a tiny dinghy, that's no reason not to have sophisticated navigation equipment. The Digi-Log will tell you your speed to 1/10 knot, from 0 to 30 knots—and your distance up to 199.9 miles, accurate to 1/10 mile—on a large liquid-crystal digital display screen. The unit uses a trailing electronic impeller or paddle wheel on a 30-foot nonrotating cable positioned along the hull. Through-hull installations are possible. It's \$169 from Seafarer, 6316 S.W. Capitol Highway, Portland, Ore. 97201.

Row your bod

Now, you can get all the exercise benefits of rowing and racing scull without ever getting wet. The Rowcycle land rowing vehicle provides a workout while you row through the neighborhood at speeds up to 30 mph in the five-speed tricycle mode. Carry the Rowcycle indoors and shift into the stationary mode. The 50-pound unit comes with a nickel-chrome tubular steel frame and hand brakes operated at the oar handles. It's \$795 from Ellefson Engineering Inc., Dept. P, 1545 Bluff Creek Dr., Chaska, Minn. 55318. **PM**



Rowcycle zips you down the road or can be used stationary.

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Voyager seats 5 and carries a big load. Or seats 2 and carries an enormous load. It even has an option for 8.* Plus a new convert-a-bed option that sleeps 2 comfortably.**

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*Requires opt. 2.6 engine and auto. trans. **Some options not available on all models. †27 hwy. est. mpg [21] city est. mpg with 2.2 engine and 5-speed manual. Use these EPA ests. to compare. Actual mpg. will vary with options, driving conditions and habits, and vehicle condition. ††Whichever comes first. Limited warranties on powertrain and outer body rust-through. Deductible applies. Excludes fleet/leases. Dealer has details. °Lowest percent of NHTSA safety recalls for '82 and '83 models designed and built in North America. Best backed based on warranty comparison of competitive vehicles.

Popular Mechanics



Plans



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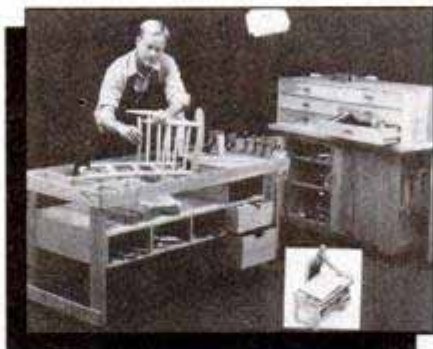
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Portable Tool Center and Workbench — This unique, superbly designed tool center and workbench is actually two plans for the price of one. Special features include a removable top with a grid surface underneath — permits easy vertical placement of clamps and drawers that open on both sides. The bench is built lower to make heavy lifting easier. *Portable Tool Center* — keeps your tools and accessories at your fingertips. PL-1769 \$5.95



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Model Plane — A free flight or radio controlled model that flies on CO₂. 13 page instruction manual, 1 page lay-out and a materials list are included. B-1276 \$3.49

Stereo Cabinet — Special features — such as spring-loaded drawers to release cassettes, a vibration-free design to provide superior sound, and a wiring diagram — put this cabinet in a class of its own. Our design allows you to alter the dimensions to fit anywhere in your home. Six-page instruction manual comes with five layout and design sheets that help keep the job simple. PL-1/85 \$10.00

Decorative Cabinet Showcase — This beautiful oak cabinet with a sliding glass door will complement your recreation room or dining room. It can be used as a showcase for family memorabilia, trophies, china; even as a gun cabinet. A compartment below provides extra storage for personal items or gun accessories. PL-1720 \$4.95

Picture Tools — Organize your workshop tool panels. Pictures of over forty different hand and power tools with adhesive backs are both functional and attractive. Put each tool in its place and find it when you need it. PLB-1282 \$5.45



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HOMEOWNERS' CLINIC



Eliminating ceiling fan wobble

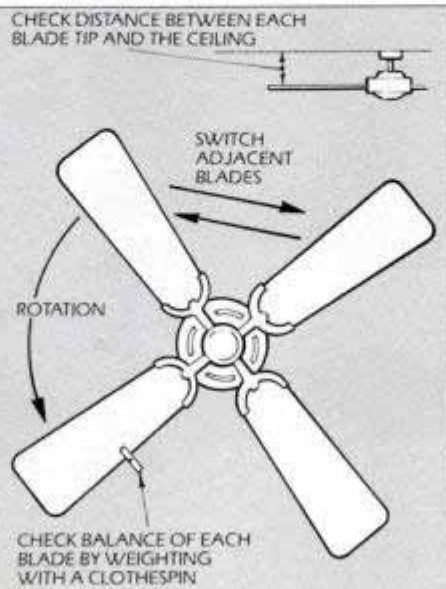
I have a 52-in., four-blade ceiling fan that wobbles badly. The ceiling box that supports the fan is very solid. It is a ball-type mounting.

My guess is that the blades are not balanced. Can you give me a methodical way of balancing the blades? The manufacturer did not number the blades in sequence for mounting.—Bill McClellan, Johnson City, Tenn.

A wobble in a ceiling fan usually is caused by blades being out of balance or out of track. However, it can also be caused by the blades being closer than 6 in. from one side of a sloped cathedral ceiling or a ceiling beam.

If this isn't the case, check to see if one or more of the blades is out of track. Using a yardstick, measure the distance from the ceiling to the tip of each blade. It should be the same. If it isn't, call or contact the nearest manufacturer's service center about correction or warranty replacement. If the blades are not out of track, try swapping blades. Switch the position of two adjacent blades while leaving the other two in their original position. While the blades are off the fan, lay them on a flat surface to see if they are warped. If so, they will have to be replaced.

If you still have a wobble after swapping all the blades, try clipping a spring-type clothespin halfway between the tip and the blade iron on the leading edge of one blade. Turn the fan



Three steps to cure ceiling fan wobble: First, check blade track; second, switch pairs of adjacent blades; third, test blade balance by adding the weight of a clothespin.

on low and see if the weight stops the wobble. Try each blade to determine if it needs more weight. If the clothespin stops the wobble, it should be replaced with thin adhesive backed lead-weighted tape, which is available through the manufacturer's service center.

If none of these attempts solves your problem, you can call Fan Doctors at 1-901-745-9222. Fan Doctors is a troubleshooting answering service of Hunter Fans, Robbins and Meyers Inc., Memphis, Tenn. 38114.

Aluminum roof shingles

There's a house in our town that has had an aluminum shingle roof on it for at least 25 years. From the looks of the shingles, they will last 25 more years. However, I can't locate any manufacturers or distributors of aluminum shingle roofing. If you have some addresses of companies or information about the shingles, I would appreciate hearing from you.—E.G. Sauls, Ariton, Ala.

Alcoa, Reynolds and Classic Products Inc. manufacture aluminum shake roof shingles for use on residential structures. These shingles are used more in the Sunbelt than in other regions.

The aluminum shingles are light, weighing less than 50 pounds per roofing square (100 sq. ft.) as compared to

asphalt shingles, which weigh a minimum of 235 pounds per square. They are also longlasting. Alcoa will issue a warranty on the painted surface for 25 years, Reynolds for 20 years and Classic Products for 40 years. The shingles are quite costly—about three to four times the cost of asphalt shingles. I also suspect they are somewhat noisy during a rain.

You can get more information about these shingles from the manufacturers: Alcoa Building Products, Box 716, Sidney, Ohio, 45365; Reynolds Metal Co., Box 27003, Richmond, Va. 23261; and Classic Products Inc., Box 208, Piqua, Ohio, 45356. They should also be able to supply names of roofers in your area who install aluminum shingles.

Septic system woes

I have a septic system problem. Once a year, I have to dig up my tank cover and clean out the tank. We have a water softener which uses about 20 pounds of salt weekly. We switched soaps, softeners, etc., but nothing helps. Waste foods and grease are kept to a very minimum. I would appreciate any suggestions that you could give me on this matter.

—Gerald R. Flatz, Westville, Ind.

Cleaning or pumping out a septic tank once a year really is not that bad. Most health departments recommend that the tank should be cleaned every two to four years, depending on use. Even when a septic system is functioning properly, the tank should be cleaned periodically, or at least inspected for sludge buildup.

Otherwise, the sludge can accumulate to a level where solid wastes will be carried out into the leaching field and eventually clog the voids in the soil and the perforations or open joints in the drain tiles. When this happens the leaching field requires replacement, usually at a cost of at least 10 times the price of a cleaning.

Apparently, the waste water from your water softener regeneration process discharges into your septic system. This is a potential problem, especially if the leaching field is installed in a finely textured clay-type soil. The salt brine in the waste water is not broken down by bacterial action as it passes through the septic tank on its way to the leaching field.

As the salt accumulates in the field it can, and often does, clog the voids in the soil, thereby damaging and shortening the life of the disposal field. The waste water from the water softener should not discharge into your septic system. It should run to a separate dry well, or onto the ground surface away from the leaching field, plants and shrubs. Be sure, too, that this discharge area slopes away from your water well if you have one.

PM

Do you have a home-maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.

FIRSTHAND REPORT



Except for its grille, the GMC Safari is identical to the Chevrolet Astro.

PM DRIVES GM's New Minivan

The rear-drive Chevy Astro and GMC Safari are more midi-vans than minis. Towing capacity is 5,000 pounds.

BY MICHAEL LAMM, West Coast Editor

It's interesting how minivan makers don't copy one another. They're all different. Of the three minivans currently on the market, one puts the engine out back with rear-wheel drive (VW), another uses a front engine and fwd (Chrysler) and the third places the engine amidship with rwd (Toyota). Now here comes GM with its new garageable vans, the GMC Safari and Chevrolet Astro, and these twins have what we used to call "conventional" engineering: that means front engines and rear drive.

The Safari and Astro use a front subframe bolted to a unitized main body box. The subframe carries the engine and front suspension, and the subframe "handlebars" bolt through big rubber donuts to the passenger compartment. The idea is to keep engine noise, vibration and suspension harshness from reaching the cabin. Another GM minivan innovation is the single-leaf rear spring. Mono-leaf

springs are light, space-saving, inexpensive and have no internal friction.

The question is, can you cram as much space into a front-engine, rear-drive van as into one whose engine and driving wheels are at the same end? As you walk up to GM's new minivans and open the door, you notice that the floor is totally flat. No driveshaft hump. But, you also notice that the loading sill stands fairly high: 22.3 inches—about 6 inches higher than Chrysler's Caravan and Voyager.

Then, if you get down on your hands and knees and peek up under the floor, you see that there's quite a bit of unused space outboard of the driveshaft. Even so, cargo versions of the



Carlike interior has a big center console over engine cover.

Safari and Astro have roughly 25 cubic feet more usable room than the fwd Caravan and Voyager and 1.3 cubic feet more than the mid-engined Toyota Van. That's because the Safari/Astro stands 10 inches taller than the Caravan/Voyager and 3.5 inches higher overall than the Toyota Van.

The Safari comes in two basic ver-
[\(Please turn to page 168\)](#)

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FIRSTHAND REPORT



Bodywork shares some panels with previous Cressida. Wide rectangular headlights are new.

PM DRIVES THE TOYOTA CRESSIDA

Revamped flagship for Japan's No. 1 importer is part sports sedan, part luxury limousine.

BY MICHAEL LAMM, West Coast Editor

Sleepers have a habit of waking up. The Cressida used to be a sports sedan sleeper back when it cost a mere \$9,200 five years ago. Even for 1984, the Cressida stickered out at a moderate \$13,795.

Toyota recently woke up to the fact that every Cressida they load on the boat can fetch the dealer \$15,690. It's presently within a jingle of the Volvo GL, Audi 5000S and 4000S Quattro, BMW 318i, Saab 900 Turbo, Fila Thunderbird, Riviera T Type, Electra Park Avenue and Olds 98 Regency Brougham.

What gave the Cressida the courage to jump up suddenly into that higher price category?

First of all, it's got all those pedigreed parts that drove you nuts about European sport sedans: a twin-cam Six that looks like a little Jaguar, fully independent suspension, gas-filled shocks with automatic damping control, vented

discs all around, variable-assist rack-and-pinion steering, five-speed stick or overdrive automatic, plus enough electronic gadgets to discharge an eel.

The Cressida isn't just another over-equipped, over-educated Japanese automobile, though. It's also comfortable, roomy, reasonably thrifty and built to last like the pyramids.

Two things in the Cressida are reasonably new for 1985: its styling and the suspension system.

The Cressida sedan uses MacPherson struts up front and a coil-spring, semi-trailing-arm suspension around back. Both ends have hollow stabilizer bars and self-regulating shocks. Sensors "feel" throttle position, car speed, steering angle and brake actuation. All this information feeds into a computer, which activates four solenoids that restrict or open up orifices inside the front struts and rear shocks. It sets them

(Please turn to page 53)



Twin-cam, 2.8-liter Six from Supra gives the 3,100-pound sedan decent performance.



Handsome interior has enough electronic gadgets to distract an engineering class.

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For even more mobility, there's Canon's new, amazingly small VC-200A color video camera. It weighs only 3 lbs. 5 ozs., yet incorporates an outstanding list of features including a Canon f/1.2



6X power zoom lens and a new 1/2" high-band Saticon® pickup tube for superb picture resolution.

At a mere 7 lbs., Canon's new VR-30A portable recorder has four heads for crystal clear special effects, Dolby® stereo, high speed search capability and can tape up to eight hours.

The new Canon VT-50A tuner/timer can record as many as eight programs two weeks in advance. Plus it has 139 cable-ready channels and a built-in battery recharger. Together the VR-30A recorder and slim VT-50A tuner/timer form the new Canon DeckMate™, a unique docking system that allows convenient stacking to create a compact console VCR.

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TOYOTA CRESSIDA

(Continued from page 50)

firmer or softer, depending on what the black box thinks is right.

There are five levels of firmness, from "soft" to "extra firm." Extra firm is where the Cressida feels best. Like the Nissan Maxima, which has a similar select-a-shock system, "normal" is too soft and gives a ride like the swan boats in Boston Public Gardens.

As for hard cornering, the Cressida is no Porsche. It can take being tossed around, but the front tires nibble some, and they also have a tendency to break loose in a small way. Nothing serious. These are big, hefty 205/60R15s on 6-in.-wide alloy wheels.

The Cressida also has computer-controlled, variable-ratio, rack-and-pinion hydraulic power steering for 1985 instead of the recirculating-ball type it's had up to now. I found the new system crisp and positive, with all the feedback advantages of manual steering.

The Cressida's 2.8-liter dohc Six is also shared with the Supra. Power is up this year from 143 to 156 hp at 5,200 rpm, due mainly to higher compression.

The entire car feels like a very tight, solid, silent piece of machinery. Basically, it's a comfortable car for five with plenty of room for luggage for two.

If there's one teensy-weensy flaw in the Cressida sedan, it's the car's split personality. It seems that the Cressida can't quite decide whether to be sporty or luxurious. The one I drove had the analog instruments, which I'd take any

day over the digitals (also available). While the Cressida's round dials are easy to read, where's the oil-pressure gauge? Where's the voltmeter? What respectable sport sedan leaves off such basic instruments?

The Cressida's interior—along with those of a half dozen other "high-tech" Japanese automobiles—is well on its way to electronic overkill. Toyota expects average folk to be computer literate. To get everything you paid for out of the Cressida, you have to spend a couple of evenings curled up with the owner's manual.

The optional trip computer gives

such information as average gas mileage, which might be moderately useful on rare occasions, but the computer also has a memory for three people's birthdays. Now, really!

Yet, the Cressida redeems itself in many ways. Its front seats are engineered, tailored and positioned for comfort. The cloth version feels superior to the optional leather, but both are highly adjustable and supportive. They do credit to the car. The rear bench has good legroom.

There's no doubt that the Cressida is a good car, but no longer is it the sleeper it used to be. **PM**

THE PM REPORT CARD

1985 TOYOTA CRESSIDA	GRADE	COMMENTS
Acceleration	B	Adequate
Handling	B	Front tires nibble, some understeer
Braking	A	Four vented discs
Steering	A	Crisp, good feel
Transmission	A-	Long throws, 3rd sometimes hard to find
Ride	A	SPORT setting just right
Fuel economy	B	Good considering car's size and power
Seating	A	Superb support, 7 adjustments
Vision	B	Tall headrests
Gauges/controls	B	Incomplete—no oil pressure, voltmeter; otherwise good
Ventilation	B	Needs intermediate fan speed
Noise @ 55 mph	A	Nicely quiet with windows up
Cargo capacity	B	Fairly shallow trunk; have seen bigger on smaller cars
Engine serviceability	A-	Oil filter looks like a bear
Fit and finish	A+	Flawless

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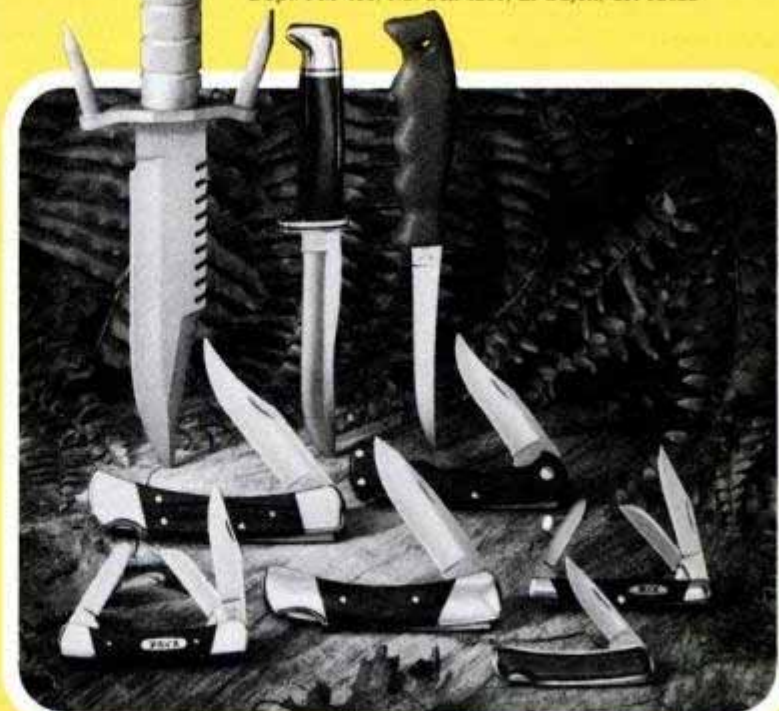
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PM OWNERS REPORT: PORSCHE 944



Owners love the performance and charisma, but gripe about prices and tiny jump seats.

BY MICHAEL LAMM
West Coast Editor

A lot of emotion goes into buying a car like the Porsche 944. The whole purchase process becomes very much an affair of the heart. So does driving and living with the car.

A California medical secretary confessed, "I've always dreamed of owning a Porsche, and I finally decided to get one. I did it on my own, too. I bought this car as a 35th birthday gift to myself. I feel like a different person in it!"

A Missouri writer said, "You can't compare the 944 with ordinary cars. For example, my Mercedes is purely functional: four doors, big trunk, good economy, no trouble. The 944 is to enjoy."

A Georgia research chemist wrote,

"The dealership and service department are very courteous when they deal with you."
—ILLINOIS ENGINEER

"It's fun every time I hop in!"
—MASSACHUSETTS MECHANICAL ENGINEER

"The 944 has surpassed my expectations."
—MISSISSIPPI ARMY OFFICER

"Porsche deserves better dealers in this country."
—WASHINGTON D.C. ATTORNEY

"The paint chips easily on gravel roads."
—NORTH DAKOTA PROFESSOR

"The cost of labor at the dealer is outrageous."
—TEXAS VICE PRESIDENT

"This car should be illegal. It refuses to be driven at legal speeds!" A Colorado chiropractor: "Runs 100 mph easily." A few dealers tended to abuse the



PHOTOS BY BILL ASHE

Aggressive styling (top) and strong, smooth slant-Four powerplant were highly praised.

944's early selling frenzy. A Maryland airline pilot told us, "I've heard about Porsche dealers jacking up the price by as much as \$2,000."

An Illinois attorney pointed out that "service and parts seem overpriced, and my nearest dealer is 50 miles away." And an Illinois businessman echoed that: "Seventy dollars just for

A NATIONWIDE SURVEY BASED ON 1,331,724 OWNER-DRIVEN MILES

an oil change is highway robbery!" Yet most owners (82.4 percent) rated [\(Please turn to page 57\)](#)



STREET WISE.

WRANGLER

ENGINEERED FOR SURVIVAL

Goodyear understands that the streets can be just as much a survival course as any off-road stretch. Which is why we engineered the Wrangler All-Season Radial with a unique,

aggressive block-tread. To not only tackle the worst any street has to offer, but to do so mile after grueling mile. The all-terrain Wrangler. It handles just as well on the road as off.

GOODYEAR

**Now, Quaker State comes
in clean, easy to pour plastic bottles.**

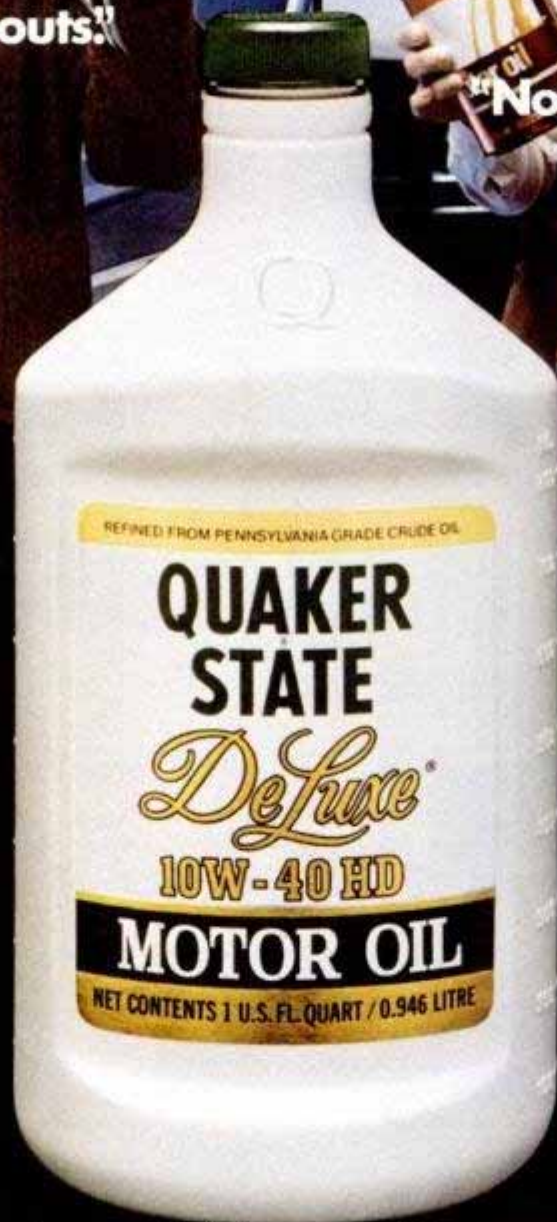
Exclusively.



"So long spouts!"



"No more leaky cans."



That Quaker State quality America has trusted for over 70 years now comes in the most convenient containers you can buy. They're a cinch to open, pour and reseal. That means if your oil is less than a quart low you can top it off and save the rest for later.

Quaker State's leading motor oils are refined from 100% Pennsylvania Grade Crude. So now you get 100% Penn-Grade protection. And 0% mess.

And if the new bottle isn't in your store now, it'll be there soon.

Today you need an oil this good in a package this good.

PORSCHE 944

(Continued from page 54)

their dealers' sales policies good to excellent, and 81.2 percent scored dealer service likewise.

Handling and performance ranked second and third, right behind styling.

as the Porsche's best liked features.

A self-employed North Carolinian observed, "This is the car for a person who loves performance. It's as close to a race car as you can buy for the street. It doesn't have all those gimmicks, like the 300ZX and the Supra. This is an honest car that gives performance and

more driving pleasure than any other vehicle I've ever owned."

A few owners noticed a certain jiggleness in the suspension. "Has a tendency toward ride harshness when traveling over frequent gaps in the pavement," said a California manager.

(Please turn to page 190)

SUMMARY OF 1984 PORSCHE 944 OWNERS REPORTS*

Total miles driven 1,331,724	Specific dislikes:	Average 3.4	Number of vehicles owned:
Average miles per gallon	No complaints 10.7%	Poor 1.1	This car only 18.4%
Five-speed manual	Poor dealer service 10.7	Rear seats 5.8%	Two cars 39.7
In town 21.1	Weak air conditioner 10.2	Excellent 5.8%	Three cars 23.2
On the highway 27.5	Useless rear seats 9.3	Good 7.0	Four or more cars 18.6
Three-speed automatic	Price too high 8.9	Average 24.4	
In town 19.9		Poor 62.8	Makes of other cars owned:
On the highway 24.1	What changes would you like?		Ford 20.2%
	No changes 16.4%	Had any mechanical trouble?	Chevrolet 17.9
Transmission choices:	More horsepower 16.4	No 58.8%	Oldsmobile 13.8
Five-speed manual 92.2%	Turbocharger option 12.2	Yes 41.2	Toyota 13.3
Three-speed automatic 7.8	Tilt steering wheel 8.0		Mercedes-Benz 10.1
	Power seats 6.3	What type of trouble?	
Why did you choose this car?	Better air conditioner 6.3	Power antenna 14.5%	Would you buy a Porsche 944 again?
Styling 71.6%	How much did you pay?	Electrical 14.5	Yes 72.9%
Performance 31.2	Average \$24,748	Sunroof motor 13.6	No 8.3
Handling 27.2	Range \$20,975-29,000	Air conditioner 12.7	Maybe 18.8
Reputation 23.2		Oil gauge 7.3	
Quality 14.4	Workmanship opinion	Dealer repairs satisfactory?	Would you buy another Porsche?
Resale value 13.6	Excellent 78.2%	Yes 78.0%	Yes 76.0%
	Good 19.8	No 22.0	No 4.3
Specific likes:	Average 1.9		Maybe 19.8
Styling 80.7%	Poor 0.0	Dealer service opinion:	
Handling 68.9	Comfort opinion	Excellent 30.9%	Age distribution of owners:
Performance 42.1	Front seats	Good 49.3	Under 29 years 25.2%
Comfort 20.5	Excellent 67.2%	Average 11.2	30-49 years 65.7
Power 17.7	Good 28.4	Poor 8.5	50-plus 9.2

*Percentages might not equal 100% due to rounding or insufficient data.

Popular Mechanics PLANS



Master Craftsman Toolbox: This TOOL-BOX will organize, protect your tools and add a touch of class to any workshop. (Dimensions 20 1/8" x 9 1/4" x 12 3/8") Built with cherry or walnut wood, styled with brass corners caps and lock. This solid wood toolbox will last for generations and become a family heirloom. Plans include step-by-step instructions and materials list. (PL-1826 \$4.95)

Send your name and address with check or money order payable to POPULAR MECHANICS. Mail to: Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101



Craftsman Work Center: Build the MASTER CRAFTSMAN WORK CENTER. A portable tool center, two cabinets and deluxe assembly bench allow you to keep all your tools close at hand. A grid top makes clamping easier; covers with a sheet of plywood for other tasks. Swivel casters with brakes; drawers that open on either side and your choice of finish gives you a personalized work center. Plans and materials list. (PL-1760 \$5.95)

Classic Workbench: Here's the classic European workbench every wood-worker dreams of owning. Using these plans, you can build this workbench for less than half the cost of a factory-made version. Dovetail joints give the drawer super resistance to racking. Detailed plans, instructions and materials list. (PL-1748 \$5.95)



Doll Cradle: Build your daughter or granddaughter a beautiful DOLL CRADLE. A reproduction of an 18th century cradle made from pine with a varnish finish. Hand-crafted with your own personal touch it will be cherished for generations. (PL-1820 \$3.95)

Calliope: Create the exciting sounds of circus music. Build a mini-CALLIOPE crafted from pine and easy-to-find materials. This nostalgic music maker is a great gift for the budding musician. Recreates the sound of an orchestra of flutes and whistles. Plans and materials lists included. (PL-1830 \$3.95)



PM LONG-TERM CAR TESTS

**SUBARU GL
4WD TURBO**
Four-wheeling on
demand

**CHEVROLET
CORVETTE**
A most-improved
sports car

**RENAULT
ALLIANCE**
'Big-block' 1.7 power

This month we bid a fond farewell to our Ford Tempo, keep humming along in the rotary-engined Mazda RX-7, and add three new cars to the test fleet: a Subaru Turbo, Chevy Corvette and a Renault Alliance with the new 1.7-liter engine.

Subaru 4WD Turbo

Now that we've lived with this Subaru for 4,800 miles, we're bombarded with questions from friends: How's the turbo? How's the 4wd? How's the air suspension?

The turbo gives this car the power not only to keep up with traffic, but to step out ahead of it when necessary.

A lever behind the shifter lets you choose 2wd or 4wd manually. Our particular test car has the optional two-speed 4wd, with a low range of 1.20:1. On a Sierra Mountain's ski trip last



Sleek new Subaru sedan features a 111-hp turbo Four and "on-demand" four-wheel drive.

winter, the 4wd kept us going where other cars bogged down.

Subaru's optional air suspension raises the car 1.2 inches in front and 1.4 inches in the rear whenever you're in 4wd. But, when you reach 55 mph, the air suspension microprocessor drops the car down to its normal running height. You can actually feel and hear the air suspension lowering the car when it's parked. It's like a camel: First the front drops down, then the rear, and finally the car lets out a plaintive sigh.

As of today, at 4,812 miles, the car has not given us one moment's trouble. We did silence a squeak in the front suspension by squirting rubber lubricant onto the stabilizer bar grommets, and we had to tighten two screws at the rear bulkhead. But that's been it!

We also changed the oil at 3,750 miles, even though the book says to wait until 7,500 miles. The filter's easy to reach, as is the drain plug, but oil dribbles down onto the skidplate.

We're averaging 25.1 mpg in nearly all-2wd driving. One stretch of freeway gave us a high of 30.2 mpg, and a couple of long in-town tours bottomed out at 20 mpg.—M.L.

Chevrolet Corvette

On the cover of our March 1983 issue, we called the then-new Corvette



All-black '85 Corvette looks like an '84 on the outside but is much refined underneath.

"The Best American Car Ever." Our call was based on test drives at the GM Proving Grounds of prototype and pre-production Corvettes. Other magazines also raved about the Corvette.

Soon after our report, readers began contacting us to relate problems with their new Corvettes: Small things breaking. A ride that would make a truck driver wince. Recalls.

When we got the results from several hundred Corvette buyers in our *Owners Report* (page 132, Nov. '83), we knew the '84 Corvette had problems. Now, Chevrolet tells us they have all the problems solved. We decided to find out for ourselves.

We chose an automatic transmission, standard suspension, Delco/Bose stereo
(Please turn to page 196)



The Renault Alliance is much more car now with its optional (\$103) 1.7-liter Four.

CAMEL LIGHTS

It's a whole new world.



Today's
Camel Lights,
unexpectedly
mild.

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

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

Build Our Multipurpose Utility Shed

This attractive and versatile back-yard building is ideal for storing lawn and garden tools and sports gear.



This compact outbuilding can be expanded easily to hold a small car. Build it from plans you buy.

If you find that your interests have outstripped your space to pursue them, building a back-yard structure like this can give you the added storage and work room you've been wanting. The basic structure measures 12 x 16 ft. and it can house bulky lawn and garden equipment like tractors, carts and mowers as well as recreational

vehicles like bicycles, motorcycles and snowmobiles. And there will still be room for sports gear, woodworking equipment and general storage.

Designed and built by William I. Winans, this do-it-yourself project has a contemporary look and is loaded with the well thought-out features shown in the photos below. These include a 7-ft.-

wide overhead garage door to provide easy access for large equipment and a bay window.

The interior features a built-in workbench for gardening chores and routine maintenance, a fold-down stairway for access to the loft above, a side wall covered with perforated hardboard to

(Please turn to page 197)

SOURCE LIST

Guardian siding: Simpson Timber Co., Third and Franklin, Shelton, Wash. 98584.
John Deere garden tractor: Mentor Elevator and Supply Co., 5782 Heisley Rd., Mentor, Ohio 44060.
Peg-Board paneling: Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606.
Perma-Shield casement windows: Andersen Corp.,

Bayport, Minn. 55003.
Sierra roof shingles: Genstar Roofing Products Co., 580 Decker Dr., Irving, Tex. 75062.
True Temper garden tools: Allegheny International, Box 3500, Shiremanstown, Pa. 17011.
Waterwood sheathing and decking: Louisiana-Pacific Corp., 111 S.W. Fifth Ave., Portland, Ore. 97204.



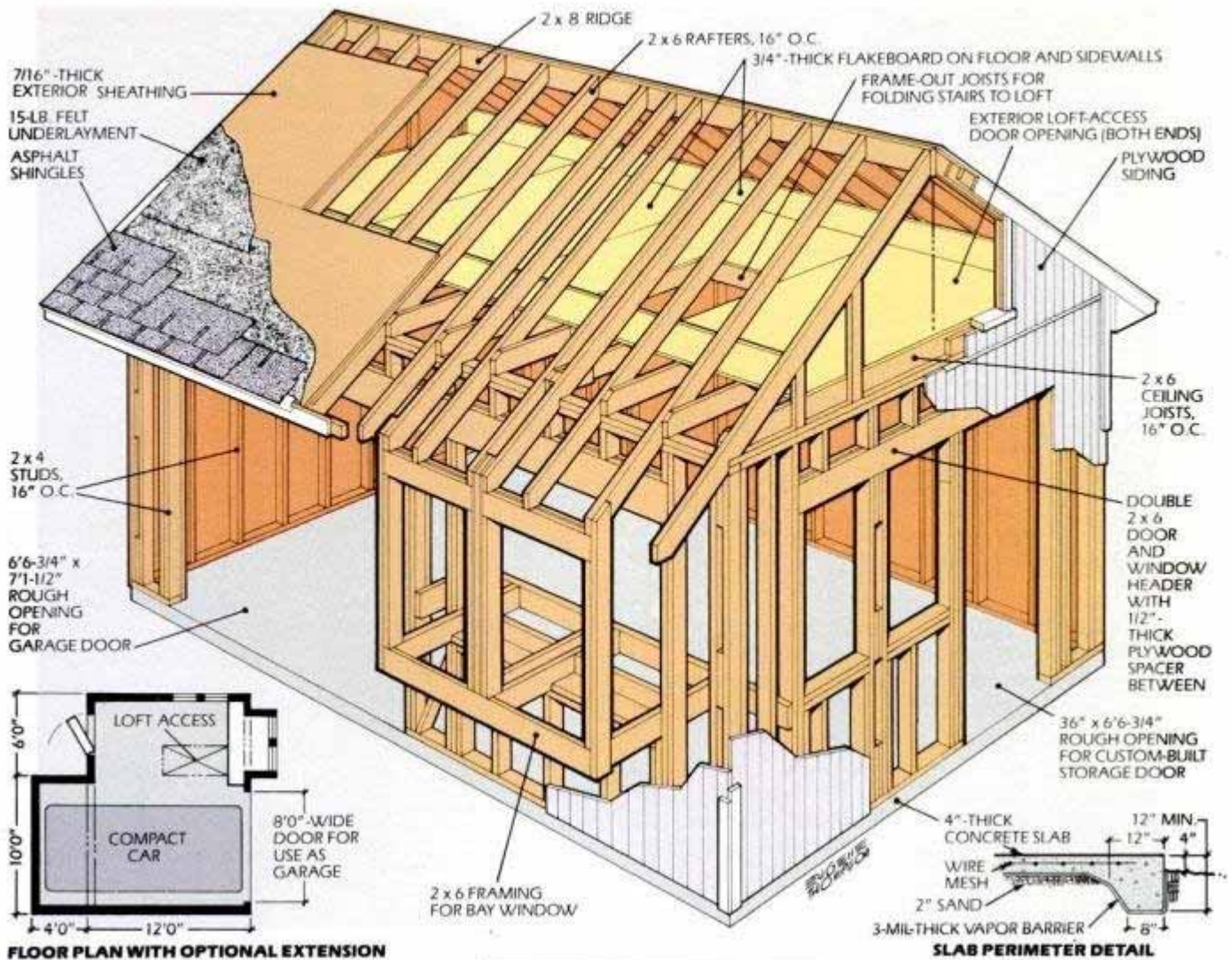
The front of this shed features a bump-out bay window made of two casement units and a 7-ft.-wide overhead garage door to provide easy access for garden tractors.



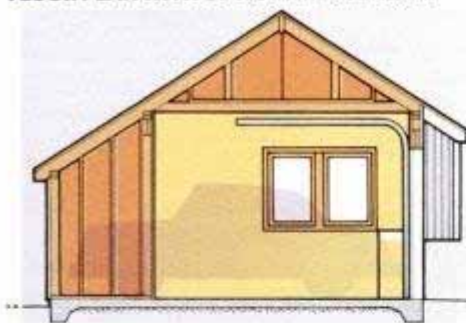
Interior of one side wall is covered with perforated hardboard to gain maximum storage room. With heavy-duty fasteners, even a lawn mower can be stored flat.



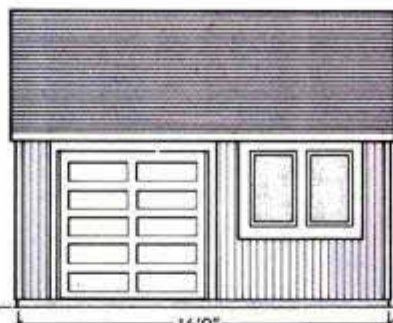
A potting bench/workbench is built into the bay window to create a pleasant place to work. It is surrounded with wall cabinets above and two roll-out storage bins below.



FLOOR PLAN WITH OPTIONAL EXTENSION



CROSS SECTION WITH OPTIONAL EXTENSION



FRONT ELEVATION



RIGHT SIDE ELEVATION

Building design: William I. Winans; Technical art: Eugene Thompson; Photos: Bob Bender



Interior access to the storage loft is accomplished with a standard fold-down attic stairway. It's framed into the floor above and is pulled down with rope handle.



The unique side entry door doubles as a folding tool rack. It can open from both the inside and outside, but when closed, it occupies practically no interior space.



The storage loft has exterior doors on both ends to provide easy access for large and/or heavy objects. Both are sized to accept standard 4-ft.-wide building materials.

Built to take it. All.

Ford Club Wagons out-power, out-tow, out-room any other wagons. And for '85, they give you peak performance in your choice of high-output engines—both gas and diesel.

Here's where you find all the room and power that's missing in today's small minivan wagons.

Ford Club Wagons give you the true luxury of spacious design. No other wagons, big or small, provide so much usable space—for people and/or cargo. You can seat up to 12 in roomy comfort (15 in Super Wagon).

More power to you.

What a power choice you get! Five engines, from biggest standard Six to the biggest V-8 in any

wagon. Included: husky 6.9L diesel, the most powerful in its class. Plus Ford's 5.8L High Output V-8 with 4-barrel carb... and 27% more horsepower than Chevy can offer you.*

Tops for towing.

Only Ford Clubs have strong body-on-frame construction. That's why they can be equipped to tow up to 10,000 lb.—much more

than Dodge or Chevy. They're built to take it.

"Out-front" comfort.

Ford's out-front design gives you extra room plus easy walk-through to the rear. Power steering is standard. Options include speed control/tilt wheel...and new power door locks/windows.

You can choose buckets or Captain's Chairs up front. Plus rear bench seats with quick-remove feature for increased cargo space and flexibility of use.

For a wagon that's great for everything from family use to recreation to van pooling—join the Club!



Best-Built American Trucks.

At Ford, Quality is Job 1. A 1984 survey established that Ford makes the best-built American trucks. This is based on an average of problems reported by owners in the prior six months on 1981-1983 models designed and built in the U.S.

Lifetime Service Guarantee.

As part of Ford Motor Company's commitment to your total satisfaction, participating Ford Dealers stand behind their work, in writing, with a Lifetime Service Guarantee. No other car companies' dealers, foreign or domestic, offer this kind of security. Nobody. See your participating Ford Dealer for details.

*Optional; not available in California or with manual transmission. Horsepower based on SAE Standard J1349.



"My Ford Club Wagon & Me."



FORD CLUB WAGON

AMERICA'S TRUCK

BUILT FORD TOUGH



Get it together. Buckle up!

PM PEOPLE

Smaller 'Kitt car' for Knight Rider

David Hasselhof, who plays Michael Knight on NBC's popular *Knight Rider* show, showed off a new version of the high-tech talking car. We were on location when Hasselhof stepped out of his dressing trailer and climbed into the 4-foot-long mini Knight Rider.

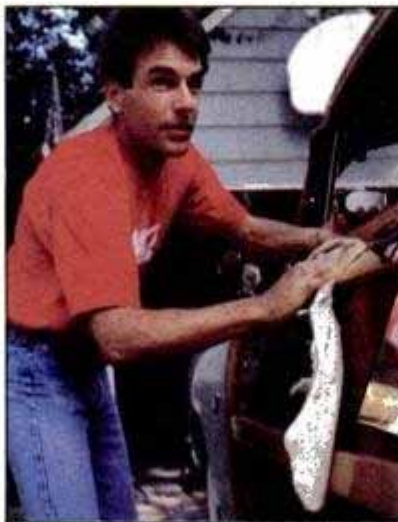
The fiberglass body sits on a lightweight metal frame designed and built by members of Hasselhof's production team. It runs on a Briggs and Stratton lawnmower engine at over 25 mph. "Feels like a real TransAm once you get moving," Hasselhof said. David helped with the design of the mini vehicle and with bolting on the body. "This TV series has given me a personal affection for the car—big or little," he said. David is showing off the car at race tracks around California.



PHOTO BY LEE GREEN
David Hasselhof shows off his mini "Knight Rider."

Paint laureate

Soviet physicist Uri Kamarov says bubbles forming in the latex paint on a window-frame in his Leningrad home have led him to new studies in phase physics. "The bubbles formed in low sunlight were very smooth, and I am now doing microscopic studies to find out why," he told a London physics seminar.



PHOTOS BY JACK HAMILTON
St. Elsewhere's Mark Harmon polishes Woody he's restoring. The brittle wood needed someone with a light touch (inset) for refinishing.

Mark Harmon operates on Woody

Mark Harmon plays a resident doctor on the TV series *St. Elsewhere*. But off-camera he does his surgery on old cars. His latest project is restoring a 1951 wood-paneled Ford station wagon. Harmon, son of sportscaster Tom Harmon, spent 10 years looking for the car. He found it sitting on four flat tires behind a dusty barn in Santa Rosa, Calif., last year. He paid \$2,200. "I put air back in the tires, charged the

battery, squirted gasoline in the carburetor and it turned right over," he notes.

In the past few months he finished exterior work, restoring rotted "bird's eye maple." The wood is so hard, Harmon taped over a drill hole to avoid splitting it. With an acetylene torch, he removed stubborn veneer. "That takes a soft touch," he says. "If you hold the flame in one place too long the wood surface burns."

Van Allen belts

Quick: What are the Van Allen Belts? If you said bands of radiation surrounding the Earth, you'd be part right. Physicist James Van Allen, for whom the belts are named, says his favorite belt is a sander.

"I like to see a good piece of wood improved by a fine finish," he told us in a recent interview.

Van Allen says he doesn't do nearly as much shopwork now as he did 10 years ago when he was still building furniture in his Iowa home. But he likes to get away to the shop now and then. "It's a natural place to do some deep thinking," he says.

Fuller's models

Shortly before his death in 1983, architect Buckminster Fuller showed a model rocket-launching pad he designed at a meeting of the Pennsylvania model Rocketeers Society.

"He had little interest in rockets themselves," says rocketeer George Moulton of College Park, Pa. "But he was fascinated with model building. He told us he would rather build a scale model than watch one of his designs get constructed full scale." Fuller's launching system was housed in a Teflon Geodesic Dome on tracks. It would slide open for a launch.

Steiger: painter

Oscar-winning actor Rod Steiger paints canvases in his spare time. He shuns the high-tech lighting now popular with artists. Low-voltage and other lighting systems focused on the canvas help the artist work in color differences and shadows.

"I don't care what the light is," Steiger told us. "I would just as soon paint by an ordinary lamp as use any special kind of lighting." Steiger, who uses photographs to paint impressionistic scenes with bright, strong colors, has never shown his paintings publicly.

Hail Caesar

"You want a high-tech exercise machine?" comedian Sid Caesar asked. "Set two chairs next to each other, kneel between them and push up like this." He grunted and pushed his kneeling body off the floor. "Furniture is perfect exercise equipment. And walls. They're great, too." Caesar, who spends half his life on the road, says that exercise with whatever's available is the only way to go. **PM**

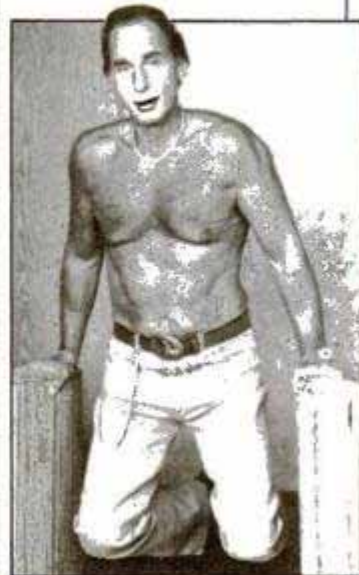


PHOTO BY CATHERINE CARLSON
Sid Caesar shows us his two-chair method of muscle building.

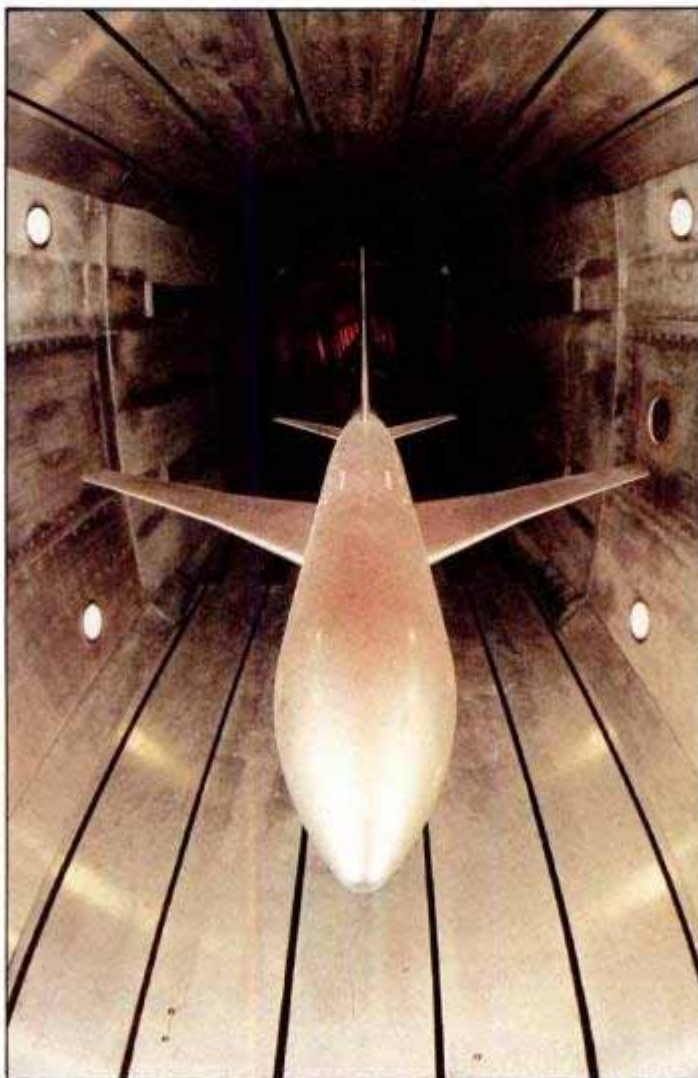
AVIATION Mighty wind roars

Despite the fact that military aircraft today routinely kick in and out of Mach 1, engineers have had no way to study what happens to an aircraft body as it enters, leaves and re-enters the sound barrier. Now, NASA has developed a breakthrough wind tunnel that has been used to test itself during its first year of operation. The National Transonic Facility at NASA's Langley Research Center in Hampton, Va., houses a 200-foot-long, 49-foot diameter wind tunnel that dramatically duplicates conditions from Mach 0.8 to Mach 1.21.

The NTF tunnel combines traditional wind-tunnel technology with "cryogenic atmosphere" controls. By evaporating liquid nitrogen at -300° F. inside the tunnel, the NTF produces cold, heavy air.

The "older" part of the tunnel, taken from designs tested in the 1970s, includes the 24-foot (from tip to tip) propeller that generates the wind. Three motors drive the propeller. Two variable-speed induction motors working through a two-speed gearbox can vary the force of the air passing through the tunnel. These can be cut off and power switched to a single 60,000-hp motor that produces constant wind speeds. Top wind speed with either system is 600 mph, about Mach 0.8. But the big chill produced by the nitrogen simulates forces created by going in and out of Mach 1.

During the first year of operations, NASA scientists have been running the tunnel through its entire speed range and recording pressure, temperature and wind velocity conditions. Their computer



PHOTOS BY BRIAN WOLFE

studies are compared with sensor readings on operational aircraft to generate "Reynolds Numbers."

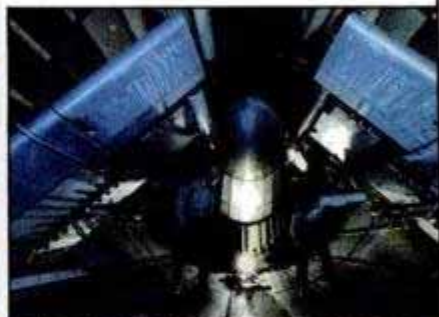
The Reynolds Number is the ratio of the test model's mass multiplied by the speed and density of air flowing over, then divided by the viscosity of the air. By developing a Reynolds Number index, NASA scientists think they've precisely reproduced transonic conditions.

Later this year, NASA expects to take delivery of the Grumman X-29 forward-swept-wing jet (see *I Flew The World's Hottest Fighter*, page 75). While the super jet will

have gone in and out of the sound barrier several times by then, it will not have performed every maneuver it is capable of doing.

A year of wind-tunnel testing, coupled with continued flight tests from NASA pilots, will create a data base from which to design the next generation of the X-29.

Military officials hope it will develop into a fighter plane that will be able to dogfight at any altitude at speeds well over Mach 1. NASA officials are looking for the first hints of an aircraft that can go in and out of space at high speeds.



Scale model of supersonic craft body (left) sits inside NASA's 200-ft.-long transonic wind tunnel. The tunnel simulates speeds between Mach 0.8 and Mach 1.2. Technicians examine propeller section (top) where winds up to 600 mph are generated. Super-cool air working with propeller-driven wind creates transonic conditions. Engineers working in control room (above) compare data produced by tunnel with that of actual supersonic aircraft.

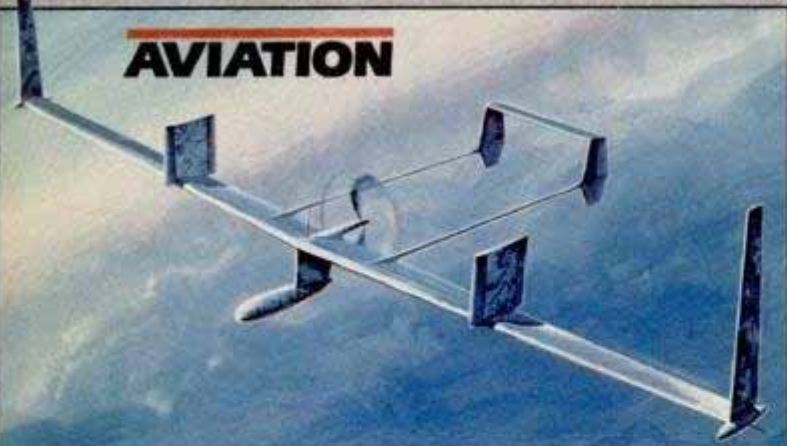
A blast from the past

In April 1935, *Popular Mechanics* reported on the Army's new wind tunnel at



Fort Belvoir. The tunnel had 18-foot blades and could house quarter-scale plane models. It produced winds of a then-astounding 300 mph to allow engineers to test stall, dive and other characteristics. It is no longer in service.

AVIATION



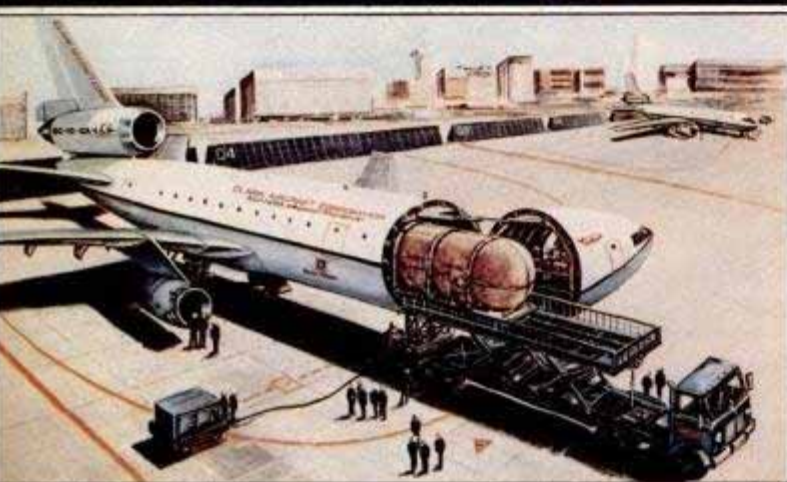
Soaring under the sun

It started as a NASA project 10 years ago when solar energy was looked at as the hope for the future. NASA had to drop the idea of a solar-powered aircraft with budget cuts of the early 1980s. But now the Agriculture Department has indicated an interest in a high-altitude unmanned solar-powered aircraft. The Solar High Altitude Powered Platform (Solar HAPP), built by Lockheed, would fly about 12.4 miles above the Earth at just over 100 mph. It would be powered by a propeller engine system running directly off the sun for about half the day, and off a bank of batteries in darkness. Clouds would be no problem at that altitude. The aircraft could carry sensing equipment to help forecast weather for farmers.



Tale of two airliners

When you have a successful airliner, you like to make the most of it. The recently introduced MD-80, a 155-seat twin-jet, has proved so popular (nearly 500 sold already) that its maker, McDonnell Douglas, is considering two new spinoffs that would make it even more appealing to prospective airline customers, while saving the vast investment required to develop a brand-new design from scratch. One version, designated the MD-89 (left), would have its fuselage stretched 12.7 feet to accommodate 173 passengers. The other, the MD-87, would be shortened 17.4 feet to produce a short-haul 130-seater. That's really getting your money's worth, especially when you consider that the MD-80 is itself a derivative of the venerable DC-9.



Open wide and take a big bite

Some Space Shuttle payloads are so large they can't be transported to the launch site by even the biggest existing cargo planes. One possible solution is a McDonnell Douglas DC-10 civilian jetliner fitted with a hinged nose that swings open to provide a huge entryway for outsized cargo.

The clever transformation, proposed by Clark Aircraft Corp. of Santa Barbara, Calif., would permit the handling of shipments up to 45 feet long and nearly 18 feet in diameter. Also under study by NASA and the Air Force are modified versions of the Boeing 747 and Lockheed C-5A.

AGITECH



A harvest of new machines

The Grizzly (top left) is a new 1,200-pound vehicle that can haul a half-ton load up a 45° incline.

Designed by Syracuse University Professor Lawrence P. Feer and Thomas Faul Designs of Ontario, Canada, the Grizzly is equipped with 16 soft rubber tires designed to roll lightly over land without destroying it.

Another hot new farming machine, the mechanical apple picker (bottom left) uses a mechanical arm to strike trees, shaking loose the apples into a hopper. It was designed by a team at West Virginia University.



ELECTRONICS

A salesman with a chip on his ...

Electronstore has developed a new computerized kiosk that you probably will see in hotels, airports and shopping centers later this year.

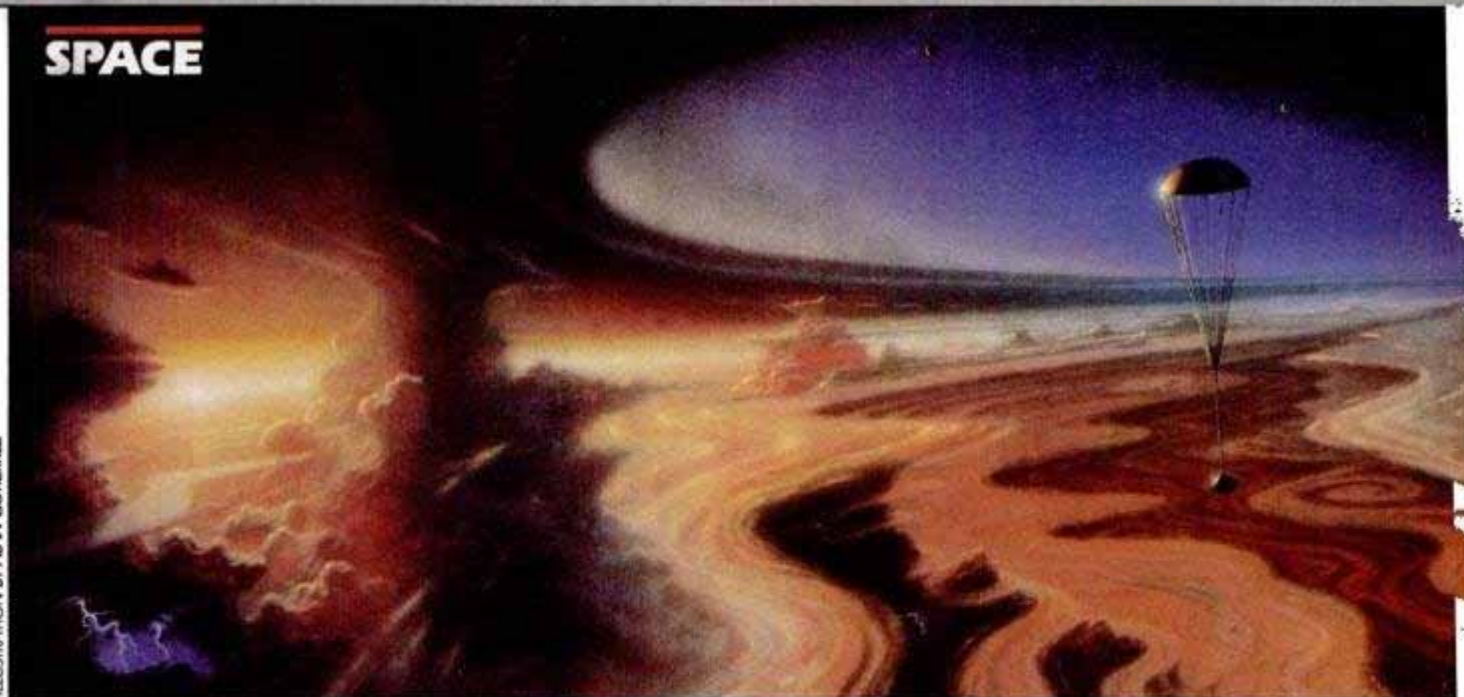
Sit inside the kiosk and slip your credit card into a slot in the machine and on comes the video screen. Videotaped salespeople tell you how to use the computer in the kiosk to order anywhere from 300 to 500 products as you would in a catalog. The computer lists all the brands available for any one product. Want more information? Punch up the brand name of a product, say an electric drill, and on comes a videotape of someone using the drill. A voiceover gives specifications, price and warranty information. Then, simply punch in an order for the product you want. The machine even produces a bill.

PHOTO BY STEVE ESKOW



SPACE

ILLUSTRATION BY ALAN GUTIERREZ



Jupiter probe enters final test phase

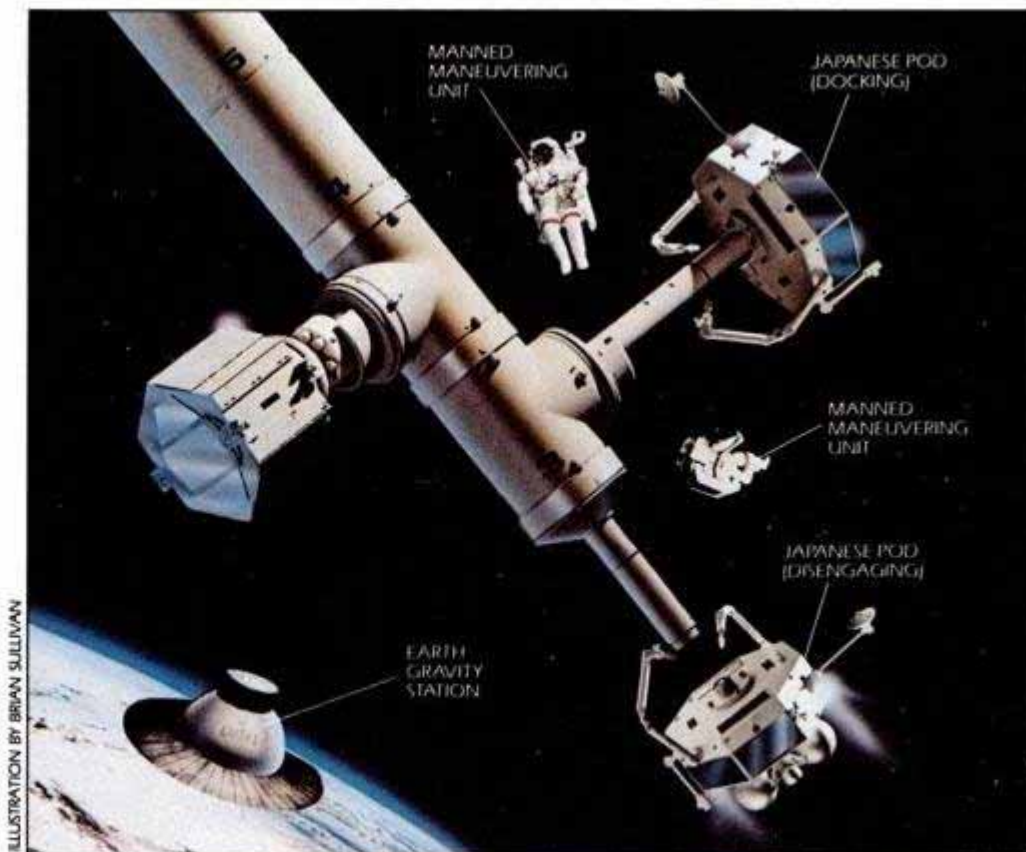
Jupiter is one of the most widely photographed and observed bodies in the heavens. But scientists know little about what goes on inside its gaseous and dense atmosphere. Late next year, the veil is expected to be pierced when America launches the Galileo project.

The Galileo package will take two years to fly to Jupiter on a Titan rocket. When it arrives, an orbiter will begin to circle the planet. Then, a sensor package will be parachuted in through

the large "eye" of Jupiter, a red cloud that is a permanent fixture on the planet's surface. Because Jupiter's gravity is almost $2\frac{1}{2}$ times that of Earth, and its atmospheric pressure is dozens of times greater, the package is expected to self-destruct before it can reach the surface. But, on the way down, it will sense the chemical makeup of the Jovian atmosphere. It will broadcast video images and computer data to the orbiter, which will relay them to Earth.

Station adjuncts

As American aerospace companies work on their designs of the space station, space agencies from other countries and from smaller American firms are coming up with proposed add-ons. Japan's Ministry of Trade and Information is proposing to add a small manufacturing and research pod to the station. The 8-foot-wide circular pod would be Shuttle-launched and could be rocketed back to a Shuttle. Its arms would work with men in Manned Maneuvering Units to perform experiments outside the station. Inside, the pods would be used to manufacture silicon chips automatically. Meanwhile, Natural Energy Systems of Florida has proposed construction of a lightweight flying saucer that would spin in orbit alongside the station. Astronauts could enter the mini station to stand in simulated Earth gravity.



Astronauts maneuver to Japanese space pod as Earth gravity station follows space station in orbit.

TECHNOLOGY UPDATE

MILITARY



How to hide an aircraft carrier under water

Ever since World War I, military schemers have been intrigued by the prospect of launching fighter planes from submarines. Most attempts met with little practical success. But now the British have come up with an idea so audacious that it just might work. It's a submersible aircraft carrier fitted with a watertight hangar and a pair of long-armed double-jointed deck

cranes designed to launch and retrieve V/STOL jump jets like the famed Harrier.

The plan is based on the SkyHook launch system already under consideration for handling Harriers aboard small patrol vessels that lack sufficient deck space for conventional take-offs and landings (see *Skyhooks For Harriers*, page 181, Oct. '83). In a SkyHook launch, a crane

plucks a Harrier off the sub's deck, holds it in midair until it develops sufficient vertical thrust to hover under its own power, then it releases the plane and off it flies.

To land a Harrier, the procedure is simply reversed. The plane hovers under the crane's claw until a hookup is made, then cuts its power and the crane swings it back down on deck.

The SkyHook concept offers several advantages over vertical takeoffs and landings. It saves fuel by reducing hover time and enables planes to operate in seas too rough for safe deck landings and take-offs. It also speeds the deployment of aircraft, since one can be launched while another is being recovered. According to estimates, a returning Harrier could be refueled, rearmed and back in the air in about three minutes.

ROBOTICS

Walk this way...

Teaching robots to walk is one of the most difficult challenges facing science and engineering. But the challenge is being met in a variety of interesting ways. Engineer Ivan E. Sutherland and his associates have demonstrated a 1,600-pound, six-legged machine that carries a man who gives "joystick" commands for speed and direction. Hydraulic actuators in each leg determine precisely how high and in what direction the leg must move. It may be the prototype of a future vehicle for handicapped people. University of Tokyo researchers have developed the Biper robot, a two-legged model that can walk forward, backward and sideways. Controlled from a computer console, it is the first stage in development of a household "servant" robot. At Carnegie Mellon University, Marc Raibert is studying a one-legged hopping machine. Results are expected to include a four-legged running machine. Odetics of California is the first company to make a commercial walker. The Odex is being tested by the Army for minefield duty.



Ivan Sutherland rides six-legged hydraulic walker.

Within minutes of surfacing, this submersible aircraft carrier proposed by the British could launch V/STOL fighter/bombers at an unsuspecting enemy.



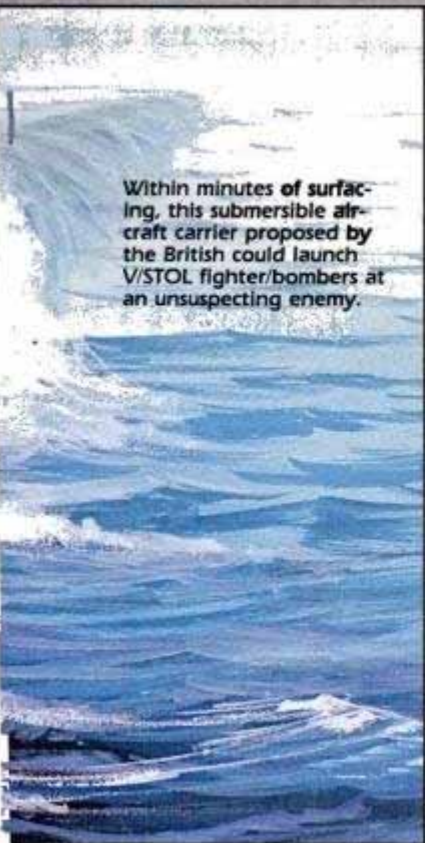
Potent new assault ship with a one-two punch

If future Marines ever have to hit an enemy-held beach, they'll mount their attack from a new dual-role amphibious assault ship that combines the aerial striking power of an aircraft carrier with the ability to launch and recover the Navy's fast, new air-cushion

landing craft. As the landing craft fly out of a huge bay in the vessel's stern, Harrier jump jets and attack helicopters will take off from a mini flight deck to provide protective air cover as troops fight to establish a beachhead.

The 844-foot, 40,500-ton

ship carries 2,000 troops, has a 600-bed hospital with six fully equipped operating rooms and can still do better than 20 knots. The first of the new assault ship class, the USS Wasp, will be constructed by Litton for delivery to the Navy in 1989.



Champion choppers

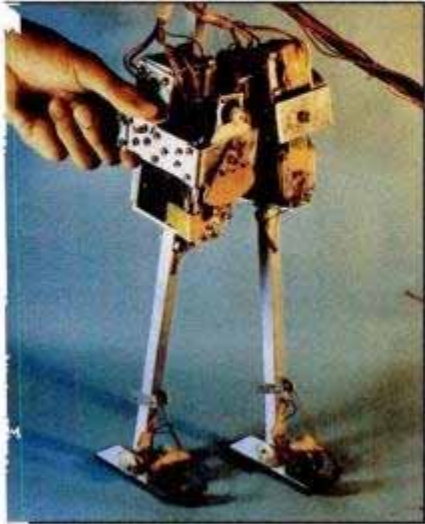
During submerged operation, the cranes retract into streamlined, watertight compartments that are built along the top of the sub's hull. The SkyHook program is being jointly developed by British Aerospace and Dowty Boulton Paul of England.

Russia's Mi-26 (near right) is undisputed champion as the world's most powerful heavy-lift helicopter with a payload capacity of 20 tons. But now we're about to top it. The Boeing Vertol XCH-62, currently under construction (far right), will lift a whopping 35 tons—75 percent more than the Mi-26. Looking like a praying mantis clutching its prey, the tall-legged, tandem-rotor monster will have a special cab slung under its belly to give the lift operator a clear view of the load. Abandoned 10 years ago for lack of government funding, the XCH-62 has now been revived and is expected to be operational by 1988.



Editor: Dennis Eskow
Contributors: Sheldon M. Gallager, Terry C. Treadwell, Fran Wenograd Golden, Ted Francis, William Blizzard, Steve Eskow

Biper robots walk forward, backward and sideways too.



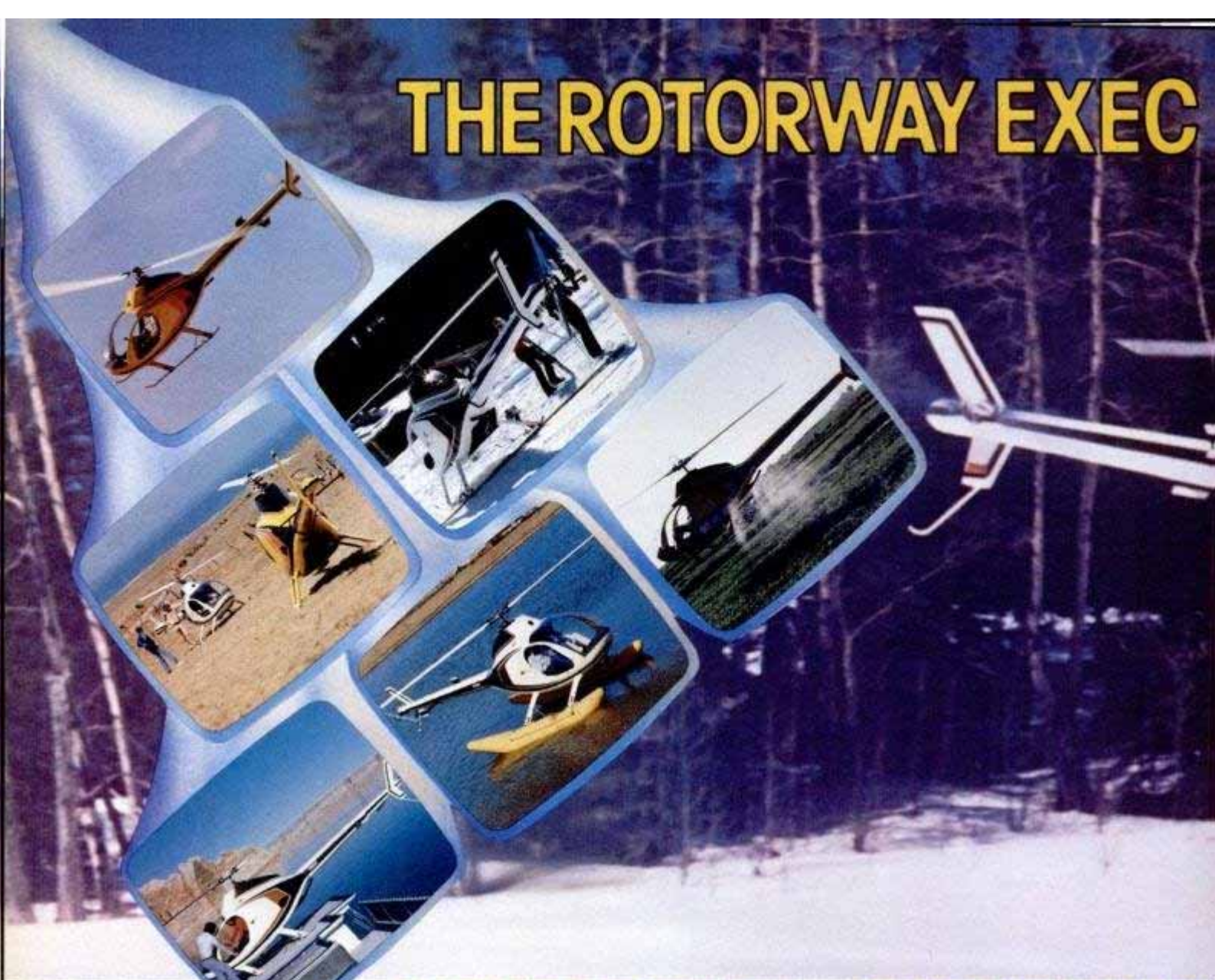
Marc Ralbert's one-legged hopping machine carries a balance rig that moves up and down by compressed air on spring leg.



The Odex from Odetics is the first commercial walking robot.



THE ROTORWAY EXEC



SEE IT AT HOME... AND BELIEVE

AFFORDABLE

The RotorWay Exec is an unbelievable innovation in personal transportation! After all, who would believe this helicopter costs less than a luxury sports car? That its main rotor hub utilizes state-of-the-art elastomeric bearing technology found in helicopters costing \$150,000 and up, or that when it comes to performance, safety and styling it meets or beats anything in its class, or that its four cylinder water cooled 152 H.P. power plant runs on auto fuel, not expensive AV gas??

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As the old saying goes, seeing is believing and not only will you see first hand the evolution of helicopters in general and the evolution of the Exec in particular, but you'll also take a heart pounding

ride with our pilot through picture post-card deserts and majestic snow covered mountain peaks. Then it's on to breathtaking Lake Powell where sculptured red rock towers rise hundreds of feet from the waters edge providing awesome views of the pristine blue water beaches below. Then, with tranquility behind us it's time for more action packed high speed flying. You won't believe what this ship can do... until you see it!

UTILITY WITH EXCITEMENT

You'll see that fun isn't the only thing the Exec has to offer. Agricultural spray equipment and water floats add utility to the long list of uses this personal helicopter has to offer.

If you've ordered one of our information packets in the past you'll definitely want this video, and our updated information package. You won't believe what the Scorpion and Exec have evolved into... until you see it!

COST EFFECTIVE OPERATION

Something you CAN believe however, is the fact that the low end of general aviation is dying, if not already dead. FACT! Sales of 2 and 4 place fixed wing aircraft are currently 20% of what they were 10 years ago! Why? Most industry experts say skyrocketing costs are to blame. That's hogwash! When you allow for inflation over the past 10 years, the cost really hasn't increased all that much. So, what's the reason? Lack of new designs is one thing, but even more so, is the fact that entry level fixed wing aircraft don't offer much excitement or utility. Think about it. Is it cost effective to fly the company airplane 200 miles? Not very, and distances longer than that are best traveled on commercial flights. This is especially true now with airline deregulation. Plus the fact that you still need ground transportation going to and from the airport.

In case you haven't realized it...it's time

... ON VIDEO!



IT... THE THRILL IS BACK!!

for a change. It's time for the helicopter. You're ready for excitement and we've got it...THE THRILL IS BACK!!! Point to point NOT airport to airport is the most efficient way to fly within a 200 mile radius. The Exec totally fulfills the urgent demand for this type of essential transportation.

HELICOPTER VS. SMALL AIRPLANE

Some people will tell you general aviation hasn't changed in forty years. The truth is they just haven't been looking in the right direction. Helicopters WILL replace the small airplane! We've made this tape to prove it to you, so prepare yourself for some shocking reality! On top of all this, it isn't necessary to be IFR rated to fly a helicopter. If weather moves in and you're halfway to your destination just land where you run out of sky and safely wait it out. With as little as 2 or 3 acres of land you can park it at your home or office. (Depending on local housing density.)

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the latest in Digital Video Effects and state-of-the-art Ampex Digital Optics combined with an incredibly dynamic soundtrack!

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See it...then believe it! THE THRILL IS BACK!!!

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WORKSHOP MINICOURSE



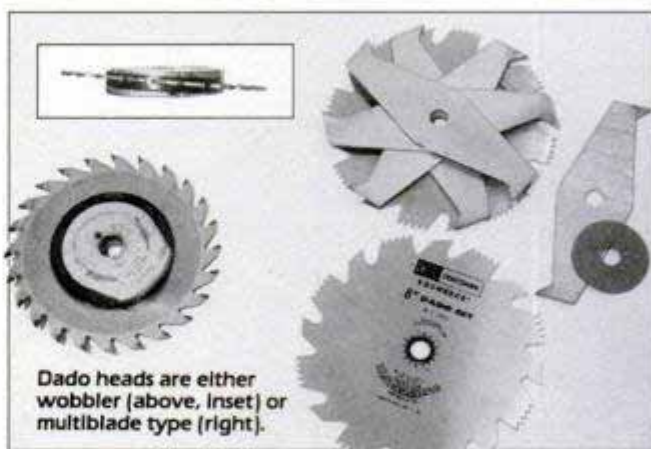
Using dado blades: Part 1

After stock has been cut to size, often it must be machined again to create common joints like rabbets, dados and grooves. A regular saw blade can be used by making repeated cuts. But, to increase working speed, accuracy and efficiency, a dado blade is indispensable because it can be adjusted to make many different-width cuts.

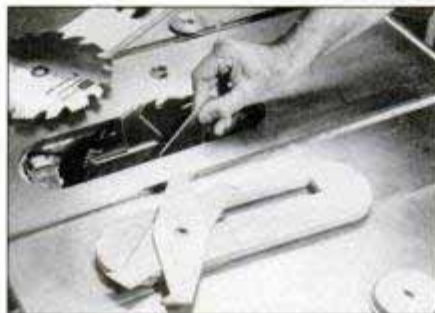
There are two kinds of dado heads commonly available for home workshop use: the adjustable "wobbler" blade and the more conventional multiple-blade set. The wobbler consists of a single blade mounted on a wedged hub. By turning the hub dial, you can tilt the blade slightly away from the hub's true vertical plane. Then, when mounted on the saw arbor, the blade will rotate with a side-to-side motion, or wobble, and will produce a wider cut—from $\frac{3}{16}$ in. to $\frac{13}{16}$ in.

The multiple-blade set consists of two outside cutting blades and several inside chipper blades. Depending on the combination used, the kerf width can vary from $\frac{3}{16}$ in. to $\frac{13}{16}$ in. Paper or cardboard washers also can be inserted to make finer adjustments.

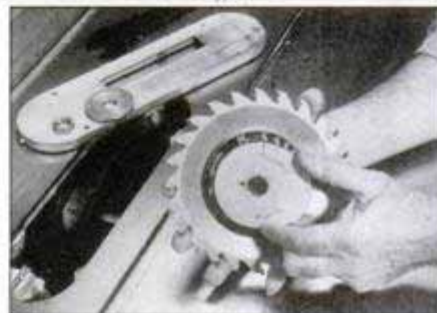
Shown here are several ways to use these blades. We'll have much more in the next two months. Also, if you like the adjustable hold-down jig shown, you can find plans for building it in *Great Woodworking Jigs*, page 104, Nov. '83.—Rosario Capotosto



Dado heads are either wobbler (above, inset) or multiblade type (right).



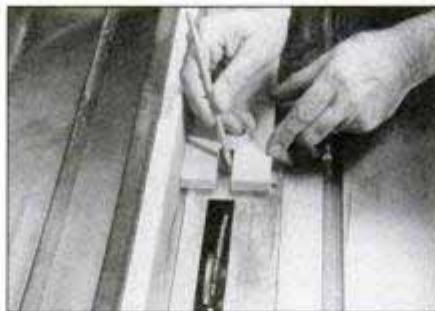
Multiple-blade dado set is installed on saw arbor one piece at a time. For fine adjustment, use paper washers between blades.



Wobbler head has single blade that can be tilted to varying degrees—relative to saw arbor—by turning adjustable wedged hub.



To make cuts against fence with wobbler blade, attach board to fence, then slide over rotating blade to cut recess in wood.



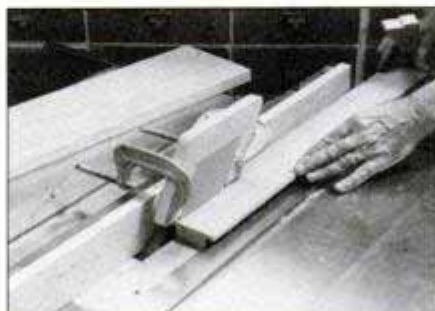
To determine exact distance from blade to fence, make test cut in scrap. Then, move board back and mark cut edges on table.



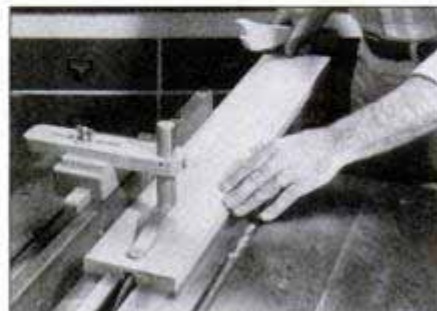
Adjust fence for rabbet by measuring from pencil lines. If table won't take marks, apply a piece of masking tape and mark it.



Cut duplicate rabbets against fence because one fence adjustment yields same cut even if boards vary slightly in width.



Use a feather board hold-down when rabbeting bowed stock. This keeps board flat against table for consistent cut depth.



When cut is made away from fence, use adjustable hold-down jig with steel finger over area being cut so board stays flat.



There's a lot to appreciate behind the wheel of a new Grand Prix. While its finely detailed interior harbors you in private luxury, its brightly accented exterior invites longing glances.

But it's out on the open road that Grand Prix really shines! Feel the power of its responsive 3.8 liter V-6 engine or the available 5.0 liter V-8. Either way, Grand Prix comes standard with an automatic transmission.

**Aren't you
glad we use dials?
Don't you wish
everyone did?***

PONTIAC GRAND PRIX

WE BUILD EXCITEMENT

Enjoy the control of its power steering and power brakes, and ride on the sure-footed comfort of its full coil suspension.

But there's one more thing we're sure you'll appreciate: the available Rally gage instrument panel with tachometer that keeps you dialed in to many of Grand Prix's most vital systems. Grand Prix... undeniably Pontiac!



*Courtesy of Armour Dial, Inc.

LET'S GET IT TOGETHER & BUCKLE UP

How Motorcraft Extended Tip Spark Plugs handle idle threats.



Motorcraft

Stop and go traffic can be murder with fouled plugs.

That's when sooty carbon buildup, caused by repeated cold starts, can lead to rough idle and misfire. A threat we never took lightly at Motorcraft.

Hence, our extended tip design. An engineering masterpiece that can handle power surges up to 38,000 volts without missing a beat.

A design that burns away sooty carbon as you drive.

The result: a sure, clean burn for better engine performance and better gas mileage (provided your engine is properly tuned and normally driven).

The extended tip spark plug from Motorcraft. Quality parts for all makes of cars and trucks.

Get it together — buckle up.

Motorcraft
EXCEEDS THE NEED





'I Flew The World's HOTTEST FIGHTER'

'If all three computers
go down, we go from fly-
by-wire to fly-by-prayer.'

BY CHARLES A. "CHUCK" SEWELL
Chief Test Pilot
Grumman Aerospace Corp.

The sun loomed just over the eastern horizon of the California desert as I slipped into the cockpit of the jet no man had flown before. The world watched as I strapped myself in. Cameras flashed and technicians ran around the odd-looking jet with the backward wings. We started checkout procedures on the Grumman X-29, a plane designed to cruise at Mach 1.72. (Editor's note: The top speed of the X-29 is a secret, but it is believed capable of flying faster than any winged aircraft.) As the canopy came down over my head, there was a momentary thrill, that "high" quarterbacks are supposed to get with the first snap of a football game.

But quickly the charged air in the cockpit cooled and I was busy with the preflight madness that takes more than an hour to finish. The X-29, prototype of what

could become the hottest fighter in the world, consumed every bit of attention I could muster. So complex is the instrumentation, so detailed and extensive, that it takes more like 25 men to fly it. I was the only man sitting in the cockpit, but there were dozens of others ready to

"fly" the forward-swept wing craft in what you might call the back seat.

Most of them sat in a blockhouse off the runway at Edwards Air Force Base. Some were in a control room 3,000 miles away at the Grumman test facilities in Calverton, Long Island. Sitting before me were 100 caution, advisory and warning lights. I could count 121 circuit breakers and five red-guarded emergency switches. My flight control system panel was a mass of 15 switches and 36 lights. But add it all up and it still didn't give me all the information that would be

necessary to take the X-29 aloft for the first time.

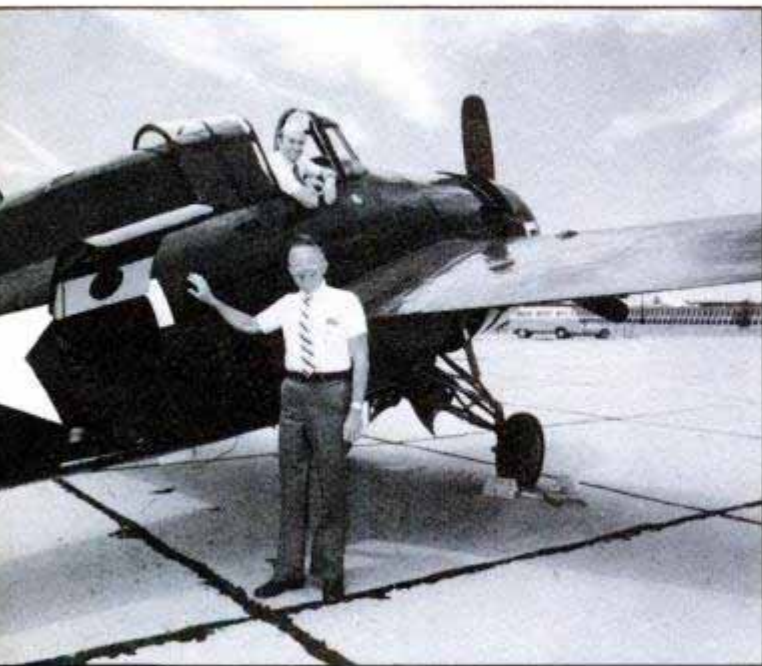
A warning light flashing before me signaled trouble in one system of the airplane. But inside that blockhouse another, more extensive set of instruments would give the specifics. The men inside, each an expert in his own field, could talk me through any trouble. And the group at Calverton, 2.5 seconds away by special satellite transmission, could look over the shoulders of the men looking over mine.

For an hour we went through the whole routine, switch by switch, light by light, circuit breaker by circuit breaker. Then, I shut down the big GE 404 engine. For the next few minutes, I went over my flight test cards—the script for the maiden flight—and the ground crew topped up the tank that holds 3,967 pounds of jet fuel.

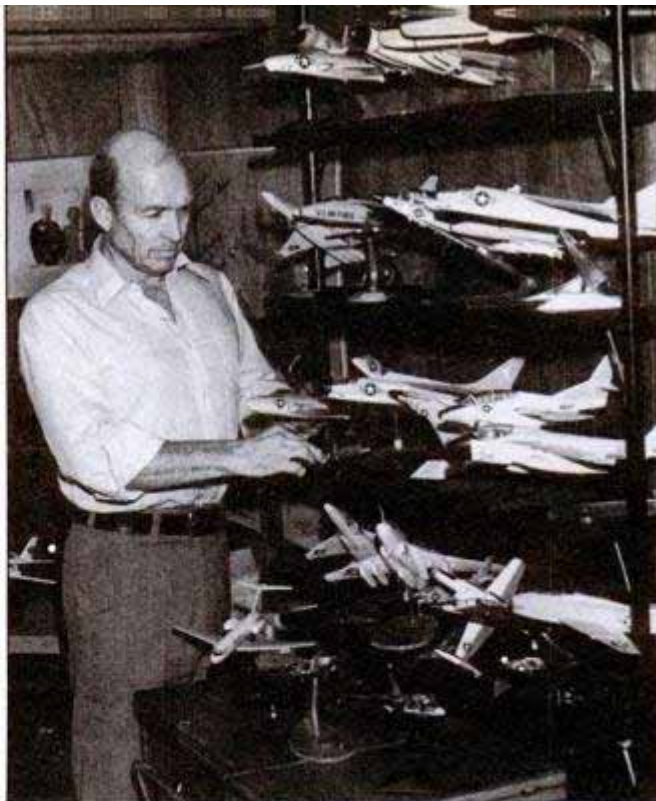
By now, the chatter over the radio was steady and confident. Why not? The X-29 had withstood all manner of wind-tunnel testing. And I had flown over 400 hours of simulated flights in a computerized fixed base simulator and in a bubble cockpit built into the nose of a C-131 cargo plane we call TIFS (Total In Flight Simulation). Sitting in the bubble when TIFS was airborne, I had been subjected to real crosswinds and real landing conditions I would face in the moments ahead.

We had been at Edwards exactly three months, plotting weather conditions, going over the routines that would be programmed into the flight, and running taxi and fast taxi tests down the ample runway where the X-1 had once taken off to become the first aircraft to break the sound barrier.

With the fuel tank full and the batteries charged, I got the go-ahead to start up the powerful engine again. And now we were 10 minutes from takeoff. During fast taxi tests the week before, I had put the plane in the takeoff mode. Even earlier, I had taxied the X-29 at Calverton up to 119 knots just so I could get the feel of the craft and to see how it moved as it



Sewell posed in the cockpit of a Grumman Wildcat fighter from World War II along with Grumman engineer Dick Mazurek in 1969, the year Chuck joined the aircraft company as a test pilot.



In the basement of his home, author Chuck Sewell examines the models he has collected of each of the planes he has test flown.

shifted from the taxi mode to the airborne mode.

In the taxi mode, the airplane is firmly on the ground, just a high-performance car with wings. But in the flight mode, the wheels are barely touching the ground. Just a slight pull and you're off. In the week before takeoff, I had brought the X-29 to 140 knots. For all intents and purposes, I had already flown it.

The final fast taxi tests were the most difficult, and the most rewarding. I took it all the way to the threshold of the airborne mode, then stopped and turned the X-29 around, all in less than 11,000 feet of runway. I had been in the airborne mode for as long as 7½ seconds. You'd eat up a lot of ground on most any runway at that speed over that time period. But at Edwards, the airplane and I had 15,000 feet of hard surface runway and another 4½ miles of lake bed.

Now, we were just a couple of minutes from shooting off the tarp and I gathered up my flight test cards and set them before me. In a moment, a set of three Honeywell computers would begin talking with one another, starting my instruments on the carefully calculated "fly-by-wire" routine for the first test. Thinking about those computers heightened my confidence. The three work together to create a digital flight control program, one that senses much of what I sense—but seconds before me. We knew the X-29 would be unstable under some conditions, and the computers were there to make sure my back-seat pilots and I could keep control of the airplane under just about every conceivable circumstance.

Each of the three computers thinks it's in the middle and talks back and forth with the other two. If one computer goes down, the remaining two will go to "digital reversion" programming, just about as fast and as smart as the original digital. If two computers go down, the third goes to "analog reversion," slower than digital, but still fast enough to get me back down on the runway the soft way.



Sewell pilots the X-29 on its maiden flight out of Edwards Air Force Base, Calif. He flew slower than supersonic, but still beat the chase plane.

If all three computers go down, we go from fly-by-wire to fly-by-prayer. The X-29 pitches up and down faster than any man can react. If your speed is over 200 knots, that airplane will self-destruct in two-tenths of a second once it starts to pitch. No pilot in the world could get control of a tumbling X-29 without help from a computer.

But the advantages of the X-29 are almost endless. Forward-swept wings (FSW) let the air around the plane stream in toward the fuselage instead of



Sewell (left) poses with other members of the Royal Air Force aerobatics team. He served with the team for two years in the '50s.

streaming out toward the tips. That provides so much extra lift that when I throttle up over 155 knots, the plane will literally leap off the runway.

An FSW plane built of metal would need wings so heavy that the advantage of extra lift would be lost. By the 1970s, however, when Grumman started designing the X-29, new aviation materials allowed us to build extra-strength, but lightweight, wings. Now, we can go supersonic and keep our wings.

The maiden flight was hardly supersonic. As the seconds ticked away and I got clearance for takeoff, I



After a mission over North Korea, a young Chuck Sewell examines damage to his plane's wing. He was nicknamed "magnet tail."

knew the speed would be kept to under 235 knots. I wouldn't get to use the afterburner on this flight. But X-29 is like a high-performance sports car. It lets you know it has muscle even when it isn't running at top speed. That GE 404 powerhouse is so strong you can kick the throttle all over creation and in and out of afterburner phase and never come close to a stall. A few F-18 pilots, who also enjoy that engine, have said they thought it might have stalled momentarily in flight. But it seemed to kick right back on line even

(Please turn to page 169)

AVIATION MILESTONES

HISTORY'S BEST TEST PILOTS

Wearing silk scarves at first, then g-suits, a separate breed of pilot has taken us higher and faster in new planes.



Jules Vedrines, first to fly faster than 100 mph, was killed testing a racing plane.

Lt. Jimmy Doolittle (top) tested instrument flying in an open cockpit craft before flying on instruments only in a Consolidated trainer with blacked-out canopy (above) in 1929.

BY WILLIAM HOFFER

Why break your Aeroplane yourself . . . when we can do it for you?" The advertisement appeared in the May 1911 issue of *Flight* magazine. The ad space had been purchased by Wilfred Parke, a 22-year-old Englishman, father to a whole new breed of men: professional test pilots. Hired by aircraft designer Alliott Ver-

don Roe to test the Avro Type F monoplane, Parke's meticulous studies concluded that the plane was too frail and underpowered. He had become the first pilot to perform a spin intentionally and recover from it, and his carefully reasoned resumé of how it was performed became the first handbook for test pilots. Parke was killed in 1912 when the engine failed on his Handley Page biplane during an attempted stall test.

That same year, French test pilot Jules Vedrines became the first to fly faster than 100 mph. He did it in a Deperdussin Monocoque Racer. Vedrines died in a 1919 crash.

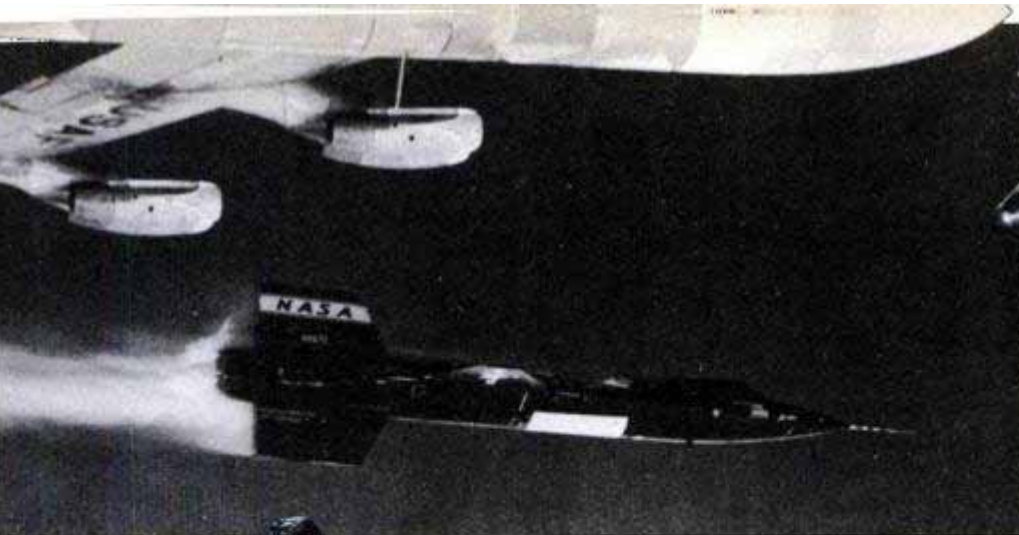
Jimmy Doolittle, whose name was immor-

talized in World War II, already had a claim to fame as an Army Air Corps test pilot in September 1929. The 33-year-old Lt. Doolittle flew a Consolidated trainer over Mitchell Field on Long Island, N.Y., to become the first to fly solely on instruments. Doolittle's cockpit was covered by a tinted hood that blocked all outside visibility. He had performed open-cockpit tests prior to this daring finish.

The coming of the rocket plane in World War II called for tiny cockpits and pilots with smaller frames. Germany started training women, and in 1937, Hanna Reitsch became the first woman test pilot. Five years later, she was chosen to fly the ME 163B rocket plane. She also made 10 successful flights in a



Crew readies a Handley Page biplane for tests. Wilfred Parke, world's first pro test pilot, was killed in a Handley Page in a 1912 test.



The X-15 (top) was flown a record 4,104 mph by Joe Walker (top right). Chuck Yeager (above) flew *Glamorous Glennis* rocket plane (right) over Mach 1 in 1947.

steerable version of the V-1 rocket.

Germany also placed the first test pilot inside a jet plane. On August 27, 1939, Erich Warsitz flew the experimental Heinkel HE-178 over Marienke, Germany, for six minutes. Then, he cut the power for a planned glide in. Warsitz misjudged his approach, but expertly sideslipped the plane to land safe and sound.

The first woman test pilot for nonmilitary craft was an American, Alma Heflin, who took a single-wing two-seater on its first flight for the Piper Aircraft Corp. on Nov. 12, 1941.

American test pilots were busy trying out over a dozen new aircraft in 1947, but all eyes were on North American Aviation pilot George Welch. He had been known as the first American pilot to engage the Japanese at Pearl Harbor. With the war behind him, Welch now flew the XP-86, the first swept-wing jet and a prototype of the F-86 Sabre. Welch was killed in 1954 during tests of the F-100 Super Sabre.

Perhaps the best known test pilot in American history is Chuck Yeager. On Oct. 14, 1947, the 24-year-old pilot carried a Bell X-1 rocket plane dubbed *Glamorous Glennis* (named for Yeager's wife) to an altitude of 42,000 feet and a speed of 670 mph, or Mach 1.015. Man had broken the sound barrier with the noisy salute of a sonic boom.

The year George Welch was killed, Convair test pilot Skeets Coleman changed aviation history by making the

first transition from vertical to horizontal flight in a Convair XFY-1 VTOL. The plane was affectionately known as *Pogo*, after the Walter Kelly cartoon hero. Coleman took off vertically, flew horizontally and landed vertically.

On Feb. 26, 1955, North American Aviation test pilot George Franklin Smith became the first flyer to survive an ejection at supersonic speed. Smith flew his F-100 Super Sabre at 6,000 feet and more than 700 mph, ejecting five seconds before it crashed into the Pacific Ocean off Laguna Beach, Calif. The 64g force he encountered ripped off his helmet and knocked him unconscious. But his chute opened and he flew again.

NASA test pilot Joseph Walker flew the Bell X-15 a record 4,104 mph, almost Mach 6, in June 1962. Walker was killed in 1966 while he was piloting a chase plane during a test of the B-70 bomber.

NASA officially designates the threshold of space as 50 miles high. The first pilot to take a winged aircraft over the threshold of space was Air Force Major Frank R. White. He flew the Bell X-15 out of Edwards Air Force Base on July 17, 1962.

An estimated 800 men and women have worn the wings of test pilots over the past 75 years. At least 112 of this elite group are known to have died. All of them challenged the sky to give us the gift of flight.



Skeets Coleman piloted *Pogo* on the first vertical and horizontal flight in 1954.



George Smith stands next to the F-100, from which he made the first supersonic ejection.

PM TESTS THE NEW AMERICAN SPORTS SEDANS



Last month we tested eight imported sports sedans, prestigious driver's machines bearing names like Mercedes, BMW, Audi and Volvo. The average price of the eight was \$20,202, average weight 2,882 pounds, average fuel economy 18.6 mpg, average quarter-mile time 16.87 seconds and average cornering force on the skidpad was .77g.

This month we have six domestic sports sedans with names like Ford, Chevrolet and Buick—hardly names to impress your friends. But hold on a minute. Our six Americans weigh an average of 2,933 pounds,

average 17.3 mpg, 17.17 seconds in the quarter-mile and .79g on the skidpad. In other words, they're in the same ballpark with the fancy imports. The difference is that the American sports sedans cost an average of \$14,247, or a fat \$6,000 less than the average import.

What this signifies is a virtual revolution in Detroit. Today's mid-size American sports sedans are truly world-class in handling and performance. But perhaps even more important is the way they *feel*. Who'd ever imagine a Ford LTD derived from a Fairmont could be as much fun to drive as a BMW?

Our six test cars consist of the new Chrysler H-car—

In performance and handling, these family cars from Detroit rank among the best sedans in the world.



Olds Ciera GT (far left) posted the best skidpad performance of any car PM has ever tested, including Porsches and Ferraris! Ford LTD LX (left) may look old-fashioned, but it can out-drag and out-brake any sports sedan in this group.



After a hot day at the track, a sudden shower cools off our test fleet. Including front row (left to right): Chrysler LeBaron GTS and Chevrolet Celebrity Eurosport; back row (left to right) Oldsmobile Ciera GT, Ford LTD LX, Buick Century T Type and Pontiac 6000 STE.

specifically a LeBaron GTS—Ford's hot LTD LX and all four "Europeanized" General Motors A-body intermediates.

Surprisingly, the individual GM divisions are given enough latitude that—even though all four use exactly the same front-wheel-drive notchback body—the appearance, performance and overall feel of the individual cars is very different.

Once again we went to Raceway Park in English-town, N.J., where we ran all six cars through our normal track testing drill—quarter-mile acceleration, slalom, braking, skidpad—and took basic measure-

ments of interior volume and trunk capacity.

We also spent a day with a group of drivers doing back-to-back loops over the same set of roads in each car. Then, we filled out extensive evaluation sheets, rating each car in 22 categories. Fuel economy is the average returned by the group in street driving only.

In general, we liked these cars a lot. Oh sure, they're not perfect. But even the inexpensive Chevy Eurosport has an honest, solid feel about it. Head out to drive coast-to-coast and you know that: 1) You'll get there; 2) You'll have fun doing it; 3) If you do encounter problems, the Chevy will be a lot easier and

cheaper to repair than a high-priced European exotic. Of course, the people you pass may think you're in a rent-a-car, but that can be an advantage, too.

Buick Century T Type

Each General Motors division is allowed to equip its cars the way it wishes, using a mix of corporate parts and "specific" parts unique to that particular car. For example, Buick and Oldsmobile use a 125-hp, 3.8-liter V6 and four-speed automatic, while Chevrolet and Pontiac achieve nearly identical results with a High Output 130-hp, 2.8-liter V6 and three-speed automatic. The Buick and Olds are fitted with optional 215/60R14 Goodyear Eagle GT tires, the Chevy and Pontiac use 195/70R14 Eagle GTs.

In the slalom, the Buick and Oldsmobile used their bigger tires to advantage, and outthanked the Chevy and Pontiac to post some of the highest figures we've ever seen for a sedan.

Any time you get over .80g on the skidpad, you're in pretty fancy country for a street-legal car, let alone a four-door sedan.

If the A-bodies are so similar, how come the Buick won and the others finished as far back as fifth? Trim and options. The Century T Type is a really nice piece of machinery compared to the rent-a-car bland Chevrolet Eurosport.

We particularly liked the exterior body detailing—the way the radio antenna is recessed, the way the grille and taillights are handled and the very European treatment of trim. Our road testers also praised the very comfortable leather seats and Teutonic functional interior styling.

The most impressive facet of the T Type is still the performance. It's not

fast in a straight line, but it sure can go around a corner. The T Type has a marvelous combination of smooth ride, flat cornering, great brakes and excellent feel. It's downright fun to drive.

Ford LTD LX

When the Fairmont first came out in 1978, you could order it with an optional 302-cu. in. V8 and four-speed. Over the years, Ford's Fairmont was restyled into the LTD, and the V8 was dropped. Now, the five-liter V8 is back as part of the LX package. There's no more four-speed, only an automatic. But, no mat-



In the slalom, Chevy's Celebrity Eurosport lagged behind Buick and Olds A-cars due to smaller 195/70 tires.

ter. Ford's SVO engineers have gone through the LTD chassis and given it all the good suspension parts. They've added Goodyear Eagle GT 205/70HR14 tires, and come up with a four-door Mustang GT.

The 165-hp LTD V8 will handily outperform any of the sedans we had in our police car comparison test (*Why Police Can't Get The Cars They Need*, page 75, July '84).

Produced by the PM Auto Dept.
Text by Rich Taylor
Photos by Peter Tenzer

Put your foot down, and it goes. In the quarter-mile, it was by far the fastest car in this group, and faster than all the imports except the Merkur. It also has phenomenal brakes.

Where the LTD LX shows its age is in cornering. Oh, it will go around a turn okay. The handling is very neutral, and very good. Unfortunately, the cornering limits are low. The LTD LX was last of all 14 imported and domestics in the slalom and skidpad tests.

The LTD LX has a lot of traditional American virtues—there's more fun-per-dollar in this automobile than you'll find anywhere else in a four-door family sedan.

Oldsmobile Ciera GT

Unbelievable as it may seem, the Oldsmobile's 62.41-mph slalom speed exactly matches the performance of the Mustang SVO in last year's sport car test (*Corvette Takes On The World*, page 88, Jan. '84). It racked up the fastest slalom speed we've ever recorded, and is significantly faster than the Corvette, Ferrari 308 and Porsche 928.

Its .84g skidpad performance is also better than any street car we've tested. But it also takes

some compromises. Every one of our testers complained about the Ciera's loose steering, the fact that it doesn't instill confidence, its poor driveability, sloppy handling and too much torque steer. It's obvious that the Olds engineers have designed a car that will post impressive test figures, rather than one that is impressive to drive.

Then, there's the traditional glitzy Olds interior. While every other car in this group has gone after a soft, muted, tasteful look Olds has stayed with plastic chrome, tacky velour and fake wood.

DOMESTIC SPORTS SEDANS—PM's ROAD TEST RESULTS

CAR	GAS MILEAGE (EPA city/PM test)	¼-MILE (sec. @ mph)	SLALOM ¹ (mph)	SKIDPAD ² (cw/ccw)	BRAKING (ft.) (60-0 mph)	TRUNK CAP. ³ INDEX	INTERIOR ⁴ SPACE INDEX	ROAD TEST ⁵ RANKING
Buick Century T Type	18.0/16.0	17.20 @ 78.00	61.53	.83/.81	141	20	120.2	1
Chevrolet Celebrity Eurosport	19.0/18.6	17.33 @ 79.26	60.90	.78/.80	165	20	121.6	5
Chrysler LeBaron GTS	19.0/18.5	17.08 @ 79.54	62.20	.78/.80	155	12*	123.4	6
Ford LTD LX	21.0/16.0	16.88 @ 83.95	56.10	.73/.73	121	13	122.1	2
Oldsmobile Ciera GT	18.0/16.2	17.11 @ 78.60	62.41	.82/.84	138	20	115.5	3
Pontiac 6000 STE	19.0/19.5	17.46 @ 78.26	60.36	.77/.81	144	20	119.8	4

- Best speed achieved while weaving through seven cones placed 100 feet apart; the higher the speed, the better the transient handling.
- G-forces generated during steady-state cornering around a 200-foot-diameter circle; cw = clockwise, ccw = counterclockwise.
- The number of standard-size grocery bags that will stand upright (1-inch crush space permitted) in the trunk.
- Front-seat width × headroom × legroom + rear-seat width × headroom × legroom + 1,000.
- Subjective ranking on the road by a team of testers; cars are graded by "feel," independent of test track results. *Hatchback with folding rear seatbacks upright. Bold numbers indicate best performance.

The seats in this car are truly awful. There were two bright spots: We especially liked the Delco sound system and the instrumentation. This was the only car in the whole group with a full set of round, easy-to-read, analog gauges. That's rarer than you might think, even these days.

Pontiac 6000 STE

Two years ago, we tested the STE and liked it a lot (see *Does Twice The Price Mean Twice As Good?* page 82, Feb. '83). We still do, but the sports sedan market has gone racing past, while the STE is still pretty much unchanged. It's not a bad car. It just wasn't as good as the T Type and Ciera.

The worst part of the STE interior is the LED digital dashboard. The layout is confusing, and the matching gray pushbuttons are difficult to use. The video game graphics are so hard to follow that we had to ask: "What's a Japanese dashboard doing in a nice American car?"

The STE chassis is very different from that under the Buick and Olds. It has the smaller 2.8-liter V6, three-speed automatic and significantly smaller tires. Obviously, it's not going to perform as well at the track. The added room around the smaller engine will make it easier to service, though.

"Good directional stability, but too much body lean and tire squeal," said one of our testers. "There's good road feel, but the tires nibble at the surface and pull the wheel. It's neither as much fun to drive as the T Type, nor as capable on the track as the Ciera GT.

Chevrolet Celebrity Eurosport

The Eurosport performed almost

identically to the Pontiac STE at the track, except for braking. Stopping distances were disappointingly long compared to the other three A-cars. Maybe the STE's four-wheel disc brakes really are more than a marketing come-on.

Our testers complained about "vague steering and wobbly handling," "unwanted torque steer," and "lots of pitch and roll, does not inspire confidence."

But it was the interior that pushed the Eurosport to the bottom of the A-car heap. The dash is "lousy, not enough instruments and I can't read the ones that are there," while the seats are



Four-wheel disc-equipped Pontiac 6000 STE outbraked the disc/drum Eurosport, but was bested by Ciera and Century A-bodies with heavier 3.8-liter engines up front.

"terrible, no lumbar support, no lateral support, a bench seat cut in half." Of course, the Chevy was \$2,000 to \$3,000 less than its A-car siblings, but all the cuts had been made where you could see them.

Chrysler LeBaron GTS

We had a hard time understanding the LeBaron GTS. This is Chrysler's new five-door hatchback, built like nearly all Chrysler's cars off the ubiquitous K-car chassis. This means the 2.2-

liter four-cylinder, front-wheel drive and optional turbocharger. We had driven preproduction engineering prototypes and loved them, but two early production cars were disappointing.

On the track, the 146-hp LeBaron GTS Turbo was on a par with the other cars in this group. Even though it's smaller on the outside than the other Americans, the GTS measured the largest for interior space.

On the other hand, our testers wrote comments like: "Out of its depth in this group; this is a car to compete with the Honda Accord and Mazda 626, not with world-class sports sedans." We thought the optional video game dashboard contained "silly cartoon instruments," but the analog gauges are excellent. We also found it noisy and rough. The cable-operated shifter is balky and the handling abrupt, almost like a go-kart.

Summed up one tester, "The Chrysler LeBaron feels like a small economy car."

Conclusion

There is such a thing as a world-class sports sedan built in America. If you want a sedan to drive, not to impress valet parking attendants, Buick will sell you a Century T Type that honestly

is as good any sedan in the world, judged on any basis except status. For a price that's under \$15,000, you really can't go wrong.

If you just want to have fun, Ford's unpretentious LTD LX provides more driving enjoyment than anything else with four doors. If you don't go wild with options, you can pick up one for under \$12,000. That's a bargain, especially when measured on a smiles-per-mile basis. It may look like an old cop car, but that's all part of the fun. **PM**

DOMESTIC SPORTS SEDANS—SPECIFICATIONS AND DIMENSIONS

CAR	VEHICLE* TYPE	BASE PRICE	PRICE AS TESTED	ENGINE	TRANS- MISSION	WHEELBASE (in.)	LENGTH (in.)	WEIGHT (lbs.)
Buick Century T Type	5-passenger, 4-door sedan	\$11,418	\$15,367	ohv 3.8V6	4-speed automatic	104.9	189.1	3,000
Chevrolet Celebrity Eurosport	5-passenger, 4-door sedan	\$8,288	\$12,615	ohv 2.8V6	3-speed automatic	104.9	188.3	3,000
Chrysler LeBaron GTS	5-passenger, 5-door hatchback	\$9,995	\$14,805	sohc 2.2 inline-4 turbo	5-speed manual	103.3	180.4	2,600
Ford LTD LX	5-passenger, 4-door sedan	\$11,847	\$13,489	ohv 5.0V8	4-speed automatic	105.5	196.5	3,000
Oldsmobile Ciera GT	5-passenger, 2-door sedan	\$9,721	\$14,500	ohv 3.8V6	4-speed automatic	104.9	188.4	3,000
Pontiac 6000 STE	5-passenger, 4-door sedan	\$15,200	\$15,200	ohv 2.8V6	3-speed automatic	104.9	189.2	3,000

*All cars are front engine, front-drive except Ford LTD LX, which is front engine, rear-drive.

SHORTWAVE

Today's downsized receivers put the world in

Remember the 1941 Zenith Trans-Oceanic? That first "portable" shortwave receiver had vacuum tubes and huge batteries that made it as big as a cinderblock and nearly as heavy.

Portable shortwave radios have trimmed down and smartened up over the last 44 years. Today's smallest receivers let you hold the world in the palm of your hand and tune into foreign broadcasts as easily as you find a local station. The latest generation begins with 8-ounce pocket models in the \$75 range and tops out near \$400 with full-featured receivers about the size of a hardcover desk dictionary, but lighter.

Price is kept down, and so is size, because these handhelds are designed for listeners who are interested primarily in international broadcasts. This programming is found within the seven "meter bands" (49, 41, 31, 25, 19, 16 and 13 meters) that occupy the 5.95 to 21.75 MHz frequencies. For the most part, the rest of the shortwave spectrum—

down to 1.6 MHz and up to 30 MHz—is for specialized, nonbroadcast services like ham radio and military and commercial communications.

Because of their specific focus, the smallest new portables are often called limited-band receivers. For example, they exclude the 40, 20 and 15 meter bands, also found within the 5.95 to 21.75 MHz range but used for amateur radio.

Though you won't be able to monitor conversations between ham operators, you will hear the news as it breaks. But news and commentary aren't the only attractions of international shortwave reception. There's also a wealth of cultural programming—music, sports, drama, short stories, even gardening—in English. Large stations such as BBC, American Forces Radio, Radio Moscow, Radio Australia, NHK Japan and Radio South Africa transmit in English nearly all the time. Even obscure stations such as Radio Tirana (Albania) air at least one English program a day.



SONY ICF-2002

PANASONIC R-799

G.E. WORLD MONITOR

PANASONIC R-9

LIGHTWEIGHTS

your hands for global listening that's easy and affordable.

By KEN WICKLIFFE

If you've studied a foreign language, shortwave provides a fine opportunity to improve your skills. A few stations broadcast courses to teach foreigners the native tongue. Voice of Free China (Taiwan) runs a daily half-hour of Chinese lessons. Radio Japan, too, is known for its language lessons.

Zenith doesn't make shortwave radios anymore, but dozens of portable models are available from companies such as Bearcat, General Electric, Kenwood, Panasonic, Radio Shack, Sharp, Sony, Toshiba and Uniden. These shortwave lightweights use either mechanical-dial tuning or electronic, direct-entry station selection.

Direct-entry radios represent the height of current receiver technology, and are higher priced than mechanical models. Locking in the desired signal is as easy as making a call on a pushbutton phone: You simply punch in the desired frequency on a numeric keypad and the station you've chosen is projected on a liquid-crystal display window.

Meanwhile, the broadcast is projected through your loudspeaker or headset with drift-free clarity, thanks to the rock-steady quartz-synthesized circuitry found in electronically tuned receivers. Non-quartz, mechanical radios often drift—you tune the station perfectly one second, and the signal gradually fades to static the next. Quartz circuitry will track the station through any transmission fluctuations. In fact, many direct-entry radios don't even have a fine-tuning adjustment.

Instant frequency access isn't the only benefit of direct-entry electronic tuning. Most models also store often-used frequencies for one-button recall, automatically scan the dial for strong signals and let you scan manually at will.

While manual scanning is possible on the direct-entry receivers, it can involve a lot of button pushing. Scanning on a dial-operated electronic model is simplicity itself—you just turn the tuning

(Please turn to page 173)



SHARP FV-310

Panasonic's R-9, being used here, has AM, FM and seven shortwave meter bands. The 8-oz. radio is the world's smallest nine-band receiver.



Shimano Deep Sea Triton
Trolling Series 50 reel

Rod: Shakespeare
Omni X SP1305
Reel: Shimano
Quickfire
GT-X1200

Hand-L-Warmer 12-volt
rod handle heater

Rod: Orvis Graphite
Reel: Fritz Von
Schlegell Marryat

Rod: Quantum Q-Stick 8215
Reel: Ryobi Graphite Touch
'N Trip VM 36

Rod: Daiwa Kevlar/
Graphite KG593
Reel: Daiwa
Procaster
Tournament
Series PT 10E

WHAT'S NEW IN FISHING TACKLE

The latest fishing tackle is lighter, livelier, more sensitive and longer lasting. It's like getting '80s tech at '50s prices.

BY CLIFF GROMER

In case you haven't noticed, fishing tackle has quietly entered the space age. A direct benefactor of NASA developments in lightweight, highly stressed components and spin-off technology, fishing rods now are being made with high-tech materials and exotic bonding techniques.

And some reels feature sophisticated electronics with programmable computers that do everything short of dropping the fish into the frying pan. The latest gear is as far removed from Huck Finn's cane pole as Luke Skywalker's light saber is from King Arthur's broad sword. While you still can catch fish with either high-tech or no-tech tackle, the latest gear will help you bag more

(Please turn to page 176)



Daiwa KGX Series rods (left) use graphite fibers wrapped in a net of crisscross Kevlar fibers. Whisker Rods (right) use graphite fibers bonded with silicon carbide microwhiskers in an epoxy resin.

LIGHT 'N LIVELY:

THE NEW TENNIS RACKET

The heads are getting larger,
the handles are getting smaller,
and high-tech tennis rackets
have more spring.

BY ROBERT J. LAMARCHE
Photos by Paul Barton

Tennis players face an almost bewildering assortment of high-performance rackets. But all frames do have one common denominator—graphite. The lightweight fiber is almost 20 times stiffer than wood, bringing us racket frames that are sturdy, maneuverable and very resistant to flexing on impact with the ball. The last factor is critical in providing control.

By varying the way they use graphite in frame construction, racket designers can vary playing properties. In the popular unidirectional construction, graphite fibers are laid parallel in a flexible epoxy resin mat. Depending on the amount of stiffness required, one or more of these mats are aligned at angles to each other and rolled into a tubular shape. Then they're placed in a racket mold where heat and either an expandable foam core or internal air pressure work to form the shape of the frame.

Wilson has advanced the graphite revolution with braided fiber technology. Bundles of fine graphite fibers are machine-woven into a braided tubular structure. Braiding, says Wilson's Dan Ross, "enables all of the fibers to work together."

Both unidirectional and braided graphite technology have led to the creation of midsized and oversized rackets such as the Wilson Pro Staff. The strength and stiffness help support the enlarged head, especially when the ball is hit away from the center of the string surface. The combination produces rackets that are light and lively.

Graphite's weakness is its brittleness. When a player tries returning a low shot on a hard court surface, the racket gets scraped. Eventually, the graphite

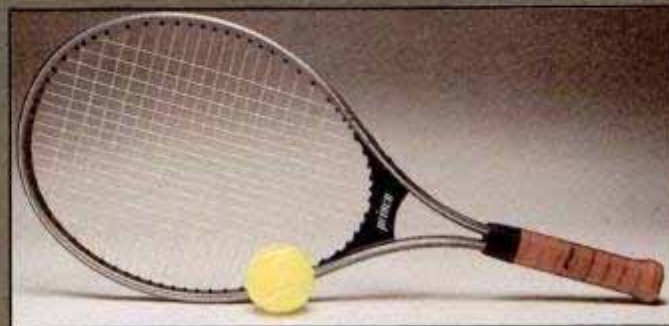
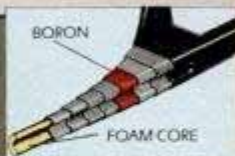




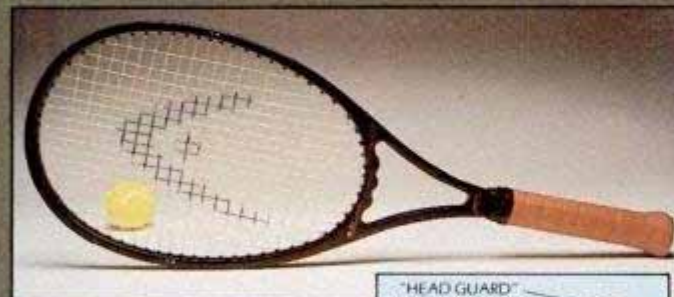
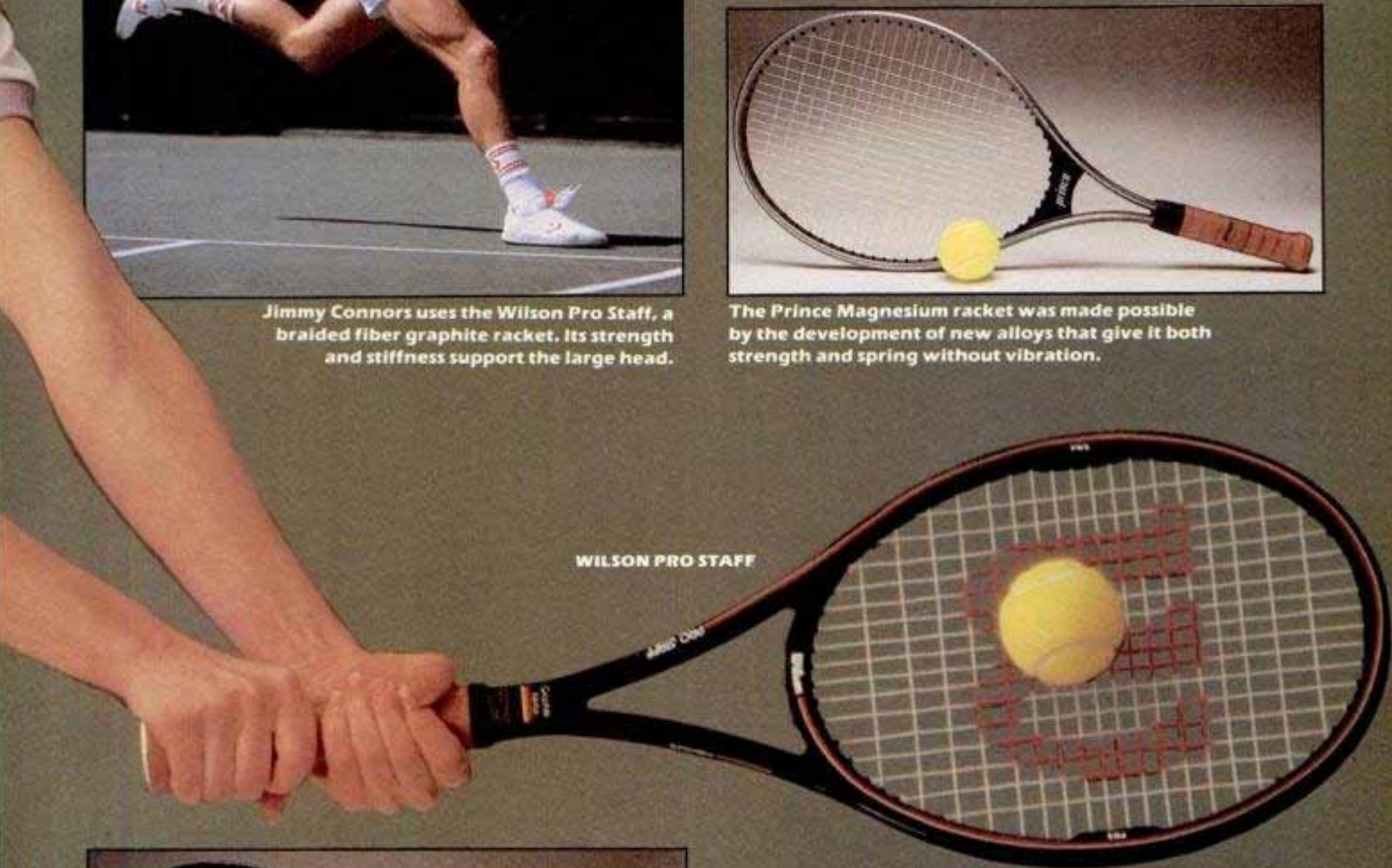
Jimmy Connors uses the Wilson Pro Staff, a braided fiber graphite racket. Its strength and stiffness support the large head.



Technology used in the Pro-Kennex Boron Ace (above) is now being incorporated into metal rackets. The foam core used to dampen vibration in the Boron Ace (inset, right) is performing that role in metal, too.



The Prince Magnesium racket was made possible by the development of new alloys that give it both strength and spring without vibration.



The AMF Head racket is a graphite model with hollow core and bumper guards that damp vibration. The frame's cross-section was trimmed.



fibers in the head begin to fracture and the racket's structural integrity weakens. With racket prices at \$75 to \$500, the average club player is concerned.

Last year, AMF Head responded by adding a re-

placeable bumper guard. It's held in place by the racket's strings, avoiding vibration problems. To keep the racket head's aerodynamic shape, AMF engineers trimmed the thickness of the frame's cross-section, then beefed it up with more graphite.

Manufacturers who use expanded soft cores for their graphite frames say the inner construction helps absorb shock. The claim could be the answer to the industry's sagging metal frame market.

The rap against metal frames has been the annoying vibrations. Pro-Kennex, whose Ace Superior racket is in the forefront of the new metal racket technology, incorporates a dense core of foam to damp vibration. "It's not magic and it's not a cure-all, but it's certainly a generation better than the conventional metal racket," says Scott Rogers of Pro-Kennex. AMF

Head has taken another tack, installing plastic "gaskets" between the throat piece and metal frame of the racket to dissipate vibration.

Aviation materials such as magnesium have also begun to revolutionize the metal racket market. "Although magnesium has been around a long time in its cast form, the recent addition of key alloys has made it possible to use it in racket construction," notes Craig Robinson, Prince's engineering director. "It's a lighter, stronger metal than aluminum."

Fibers such as boron produce thin filaments of exceptional stiffness. Kevlar, a synthetic used in bulletproof vests, also is proving its value. Both usually are used in overlays on racket faces.

Racket frames that you tend to notice more are the ones with unique angles of bends designed into the hoop area that surrounds the string surface. Such angling dates back to the 1800s, when the game was in its infancy. Strange angles helped prevent warping of wooden heads.

In the last decade, the introduction of space-age materials has eliminated the warping problem. But some makers continue experimenting with angles to optimize string response.

Yonex, for example, has developed a popular

square-shaped head (Martina Navratilova has used it) that produces a fairly uniform length in the frame's main and cross-strings.

"By making the strings roughly equal, you get the same response on impact over a bigger area of the racket face," says Ben Yoneyama of Yonex. "This gives club players a better chance of hitting a good shot, even if the ball is struck slightly off-center."

In recent years, numerous tools have been redesigned with human anatomy in mind. A few rackets have appeared with handles that have angles of between 13° and 19°. Makers claim the bend allows for a more efficient and anatomically correct hitting position than conventional frames.

One racket—Snauwaert's Ergonom—has a frame fixed to an open-throat shaft at an angle of about 40°. This aligns the effective hitting area of the strings in a more vertical direction for ground strokes. That translates to more power.

Few industries have had to run so hard a race as the tennis racket business to keep up with technology. But the results on the court have been impressive, and tennis players are watching developments in the aerospace industry in hopes that an "ultimate" racket will soon make a landing. **PM**

It's Not Just A Racket In The Tennis Market

Browsing through a tennis pro shop is becoming a sport in its own right. Something new hits the marketplace on the average of once a week in the burgeoning world of tennis tech.

Take shoes, for instance. Whatever



Le Coq Sportiff shoes feature outside ankle and arch supports for extra firmness.

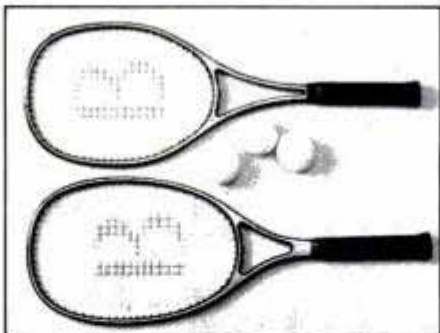


Adidas offers stitched and cemented rubber shell soles and foot-cooling mesh uppers.

you wore last year, it's sure to be obsolete this year. The current hot number is the Le Coq Sportiff, a shoe within a tough plastic support system. The Sportiff has an outside heel stabilizer and exterior arch support system. The

stabilizers are contoured to fit comfortably and securely at the ankle point—in the past the weakest point in a tennis shoe. The exterior arch, because it is placed outside, is firmer and higher than traditional interior shoe arches.

Adidas has come out with the Player and Pro Court series for 1985. Both feature stitched and cemented rubber shell soles for higher shock absorption. Mesh uppers on some of the new Adidas shoes keep the feet from getting



Bard rackets feature boron-graphite construction and hollow-core foam damping.

uncomfortably hot during competition.

Among the newer lightweight rackets are two by Bard International. The Jade is a \$140 boron-graphite model with fiberglass reinforcement. The \$200 King is the first 100 percent boron-graphite racket. It weighs less than 12 ounces. Its hollow-tube foam core makes it vibration-free.

One new product that may make life

much easier for occasional players this year is the Wilson tennis ball. It has a 7 percent bigger diameter than the regulation ball. But the inside wall is thinner, thus the weight is the same but the area you can hit is larger.



CompuTennis CT120 Scorer is an objective critic that will diagnose your game.

For the player who has everything, Sports Software Inc. offers the CompuTennis service. The player either has to fly to Palo Alto, Calif., or make a videotape of his game and send it to CompuTennis. Using a specialized CT120 Scorer, a competent tennis pro reviews your game and provides a computer printout that highlights your strong and weak points. CompuTennis customers range from ABC sports to individuals like Chris Evert-Lloyd and Tracy Austin. Costs vary with the individual needs of the player.—D.E.



A Racket For The Weekend Warrior

BY BOBBY RIGGS
Two-time U.S. Open Champion

ILLUSTRATION BY RICHARD ANDERSON

'My favorite nightmare: They challenge me to the first Intergalactic Open.'

The first tennis racket I ever owned came to me by a feat of sheer hustle. I was 12 years old, playing marbles with a kid from down the street and I had just cleaned him out. But this pre-adolescent refugee from the pool hall wasn't about to walk away a loser. "Hey! My sister has a tennis racket she never uses, I'll put it up against all your marbles," he said.

Going for all the marbles

I had taken a few lessons with a borrowed racket, and I was fascinated with my first challenge to go for all the marbles, so I accepted. And beat him.

It was a wooden racket, the old Spalding Top Flite with the bare handle and small head. A piece of the handle had been cut off from the bottom and some of the strings were pretty frayed. I fastened them down with adhesive tape and took it off to play.

In the 40-plus years since I took home that racket, I guess I've tried just about everything new in tennis. So it is with great sympathy that I answer a casual weekend player when he or she asks me about the hottest equipment available.

The hottest equipment available, my honest answer would be, is any racket that feels comfortable in your hand when you swing it. Add to that a well-kept tennis court and any instructor who can play basic tennis and you've got the hottest equipment. But not everybody wants an honest answer.

There's the tennis buff who takes to the courts a dozen or so times a year. Most of his tennis is experienced from a stuffed chair in the living room. With a cold drink in one hand and the Sunday funnies in the other, his tennis training involves watching network TV coverage for a couple of hours. During the match, he'll hear the color commentator mention that John McEnroe has gone from wood to metal. His new racket has a bigger head. He's playing better. He's more consistent. Or he hears them talking

about Jimmy Connors, how he started using a composite racket with a large-sized head in 1984. It made Connors' game better, too. By Monday, our armchair Pancho Gonzalez is off to the pro shop to get a lightweight racket with an oversized head.

It doesn't do much for the casual player's game, but it looks great in the clubhouse.

Tennis rackets are heading in one direction these days. The new rackets are almost all head with a feathery handle. And there's a weird-looking model with an L-shaped ergonomic handle and a head so big it covers the entire behind of any woman player holding the racket behind her back.

This leads me to my favorite nightmare: an invasion by 7-foot-tall alien tennis players. They carry rackets with 2-foot-diameter heads and, upon landing on Laguna Beach in California, they tell a surfer, "Take us to your clay court."

Upon arrival, they challenge me to the first Intergalactic Open. I, of course, accept. With their immense height and oversized rackets they are able to serve like cannons and I never even get to return a shot. I call it Invasion of the Headmen. It's a thriller.

Advice worth \$2 million

You want some advice about equipment? Do what Martina Navratilova did a couple of years ago. Get yourself a sensible scientific diet plan, purchase some weight-training equipment, find that comfortable racket and work on your game every chance you get. Following advice like that, Martina makes \$2 million a year. Surely any weekend warrior who comes close to that kind of training regimen and equipment procurement will be able to win at least a couple of bets around the clubhouse.

Just remember, it doesn't matter how high-tech the equipment gets. Tennis is a tough racket. And only the tough get good at it.

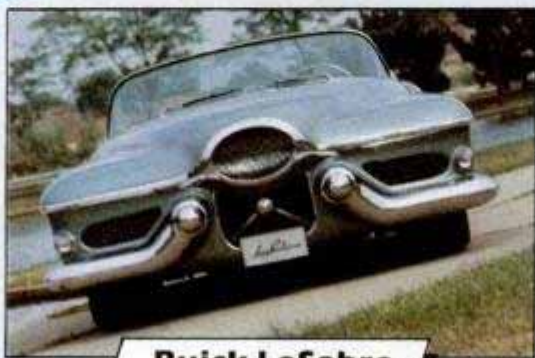
PM

Yesterday's Dream Cars

Some of them escaped the crusher. Where are they now?

BY MICHAEL LAMM
West Coast Editor

The 1950 Buick LeSabre may have looked heavy-handed in front (right), but the rear view (below) is almost European in its gracefulness—if you can overlook the huge tailfins and fake jet exhaust. Corvette-like bodywork was mostly cast magnesium. Its supercharged V8 could run on gasoline or alcohol.



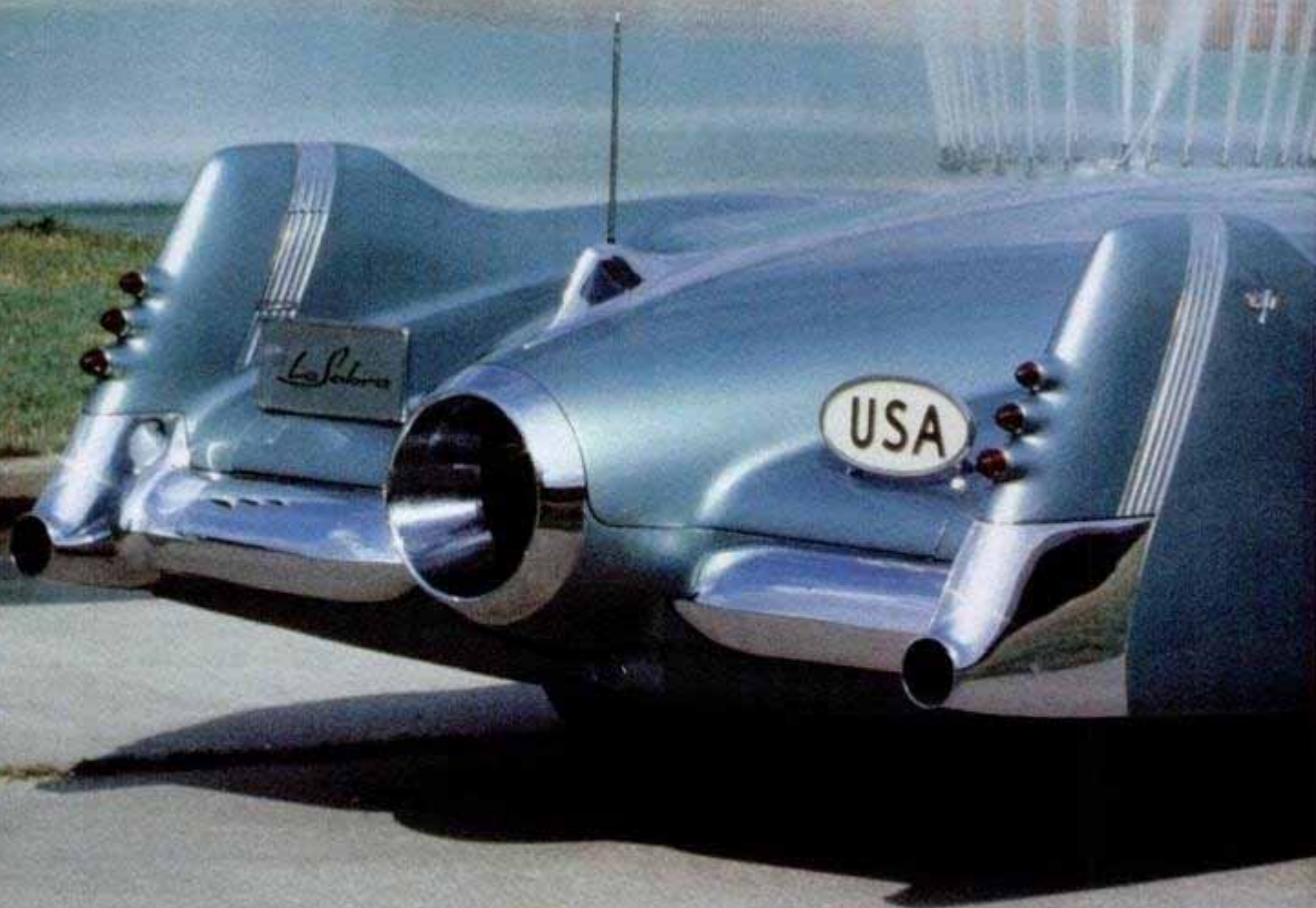
Buick LeSabre

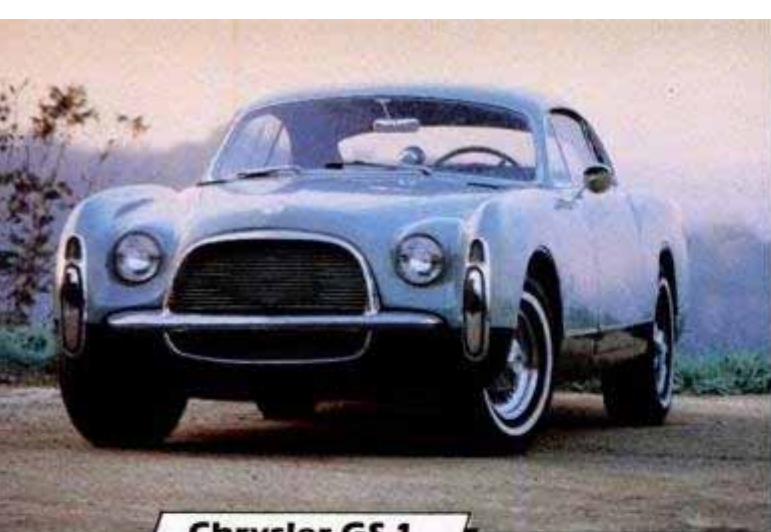
PHOTOS BY ROY QUERRY

Have you noticed how auto show dream cars are staging a comeback after all these years? Cars like the aerodynamic Ford Probe IV, the mango-shaped Chevrolet Citation IV, the Mazda MX-02 with its four-wheel steering? Automakers want to play a lot more peekaboo nowadays than they did in the sterile Seventies, but their lifting of corporate skirts seems a tad timid compared to the way dream cars used to be shown back in the fabulous Fifties.

The concept of dream cars stems from the days of the great custom coachbuilders, starting right after World War I. The more prominent and fashionable bodymakers like Locke, Brunn, Judkins, Fleetwood, LeBaron, Murphy and so on would print up elaborate picture catalogs to give wealthy customers ideas of what they could choose. The coachbuilders also used national auto salons to show off their most graceful creations.

Then, in 1927, General Motors invited Harley Earl, who'd been a West Coast coachbuilder, to come to Detroit and establish GM's Art and Colour

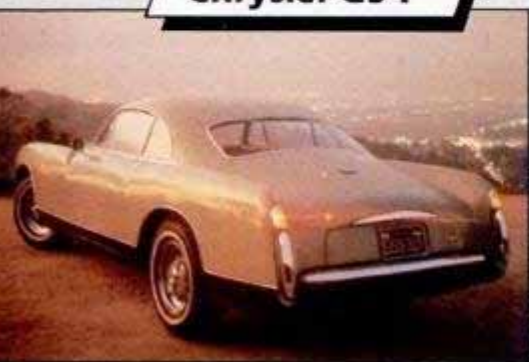




Chrysler GS-1



Buick Y-Job



PHOTOS BY VIC HUBER

This 1952 Chrysler GS-1 prototype (left) was put into limited production in Europe by Ghia in 1953-'54. As sold in Paris for \$10,000, it used the New Yorker's 125.5-in. wheelbase and a 250-hp, 331-cu.-in. hemi V8. The Chrysler's pivoting bucket seats were later copied by Chevrolet in the '70s.

Sedate by later standards, the Buick Y-Job, built in the late '30s, had many innovative mechanical features, from an automatic transmission to power windows and top. Fender lines, "harp" grille (right) and the overall low stance had an influence on many of the postwar Detroit designs.



Yesterday's Dream Cars

section. Art and Colour became not only Earl's personal fiefdom but, in many ways, soon served as the industry's idea mill and the incubator for autodom's best car designers. Everyone who ever became anyone in this field passed, at one time or another, through Art and Colour (renamed GM Styling in 1937 and Design Staff in 1972).

In 1930, John Tjaarda, working at Art and Colour, conceived a radical mid-engine design called the Sterkenburg V8, which was shown at the influential 1933-'34 Century of Progress exhibition in Chicago. Although GM never followed up on the Sterkenburg, it had a direct influence on the trend-setting 1936 Lincoln Zephyr and, in a smaller scale, on Dr. Porsche's Volkswagen prototypes.

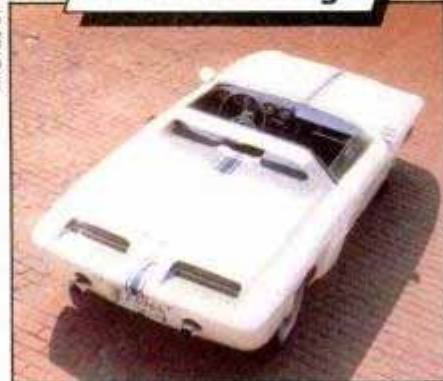
Late in the Depression, some of Detroit's top executives ran an informal competition to see who could build the most radical personal car. Edsel Ford commissioned a series of sport roadsters that led to the original '39 Lincoln Continental.

PHOTOS BY ROY OLJEVY



Ford Mustang I

The Henry Ford Museum in Dearborn owns one of the two Mustang I roadsters built in 1962. With steel tube frames, aluminum bodies, two seats, tiny Plexiglas windshields, no tops and midship-mounted European Ford V4 engines, they were never seriously considered for production.



The Pontiac X-400, as it looked on the show circuit in 1963 (below) and as it was found in Tucson (opposite page). The car is now being restored to its original condition and specs, which included a 389-cu.-in. V8 with a GMC 4-71 supercharger along with four Carter 4H sidedraft carburetors.

Pontiac X-400



PHOTO BY BILL SCHOENING



Concept AM/Van

American Motors minivan was ahead of its time in 1977, and still looks good today.

Five mid-engined AMX/3 sports cars were built for AMC in 1970 by Bizzarini. Two are owned by Dick Teague, the car's designer.

PHOTO BY DICK TEAGUE



AMX/3

GM's Harley Earl treated himself to the granddaddy of modern dream cars, the legendary Y-Job.

Because Earl was friendlier with Buick's boss, Harlow Curtice, than with Cadillac management, the Y-Job ended up on a Buick chassis and actually furthered both Buick's image and Curtice's career. The Y-Job used a modified Buick straight Eight, and it included such pioneering accessories as power steering, an archetypal Dynaflo auto-

matic transmission, electric window lifts, a totally disappearing electric power top, fender-cap tail lights and the "harp" grille, inspired by a Mercedes grand prix racer.

The most radical aspect of the Y-Job, though, was how low it was to the ground. Earl drove this car as personal transportation through much of WWII, and he had it repainted in black lacquer almost as often as most people wax their cars. During and after the war,

Earl and his staff worked on the Y-Job's successor, the Motorama LeSabre. And that highly important car was the one that ushered in the golden age of dream cars.

The golden age spanned the years 1949-'61 and coincided with General Motors' fabled and fabulous Motorama show. GM led all other U.S. automakers in the creation and presentation of dream cars, not only in sheer numbers, but also in the way GM conceived,



Chevy Aerovette

Mid-engined Aerovette is still in the hands of the GM Design Staff. Originally powered by a transverse V8, it was later converted to 2-rotor and 4-rotor Wankel power. In 1977, a 400-cu.-in. V8 was reinstated. Car has unique bifold gullwing doors.



Pontiac XP-833

Corvette-like Pontiac XP-833 previewed lines later seen on the first Firebird in 1967. Two show cars (one with an overhead-cam Six, the other with a V8) were sold to Pontiac employees with the proviso that they never be driven on the street.



PHOTO BY MIKE GRIPPO

cles like the famous 1952 Chrysler K-310 coupe, the 1953 Dodge Fire Arrow and '53 Fire Bomb.

Chrysler's showcars were pleasant to look at but, unlike GM's Motorama cars, the Exner/Ghia partnership produced what I always felt were dead ends: They didn't lead anywhere. Chrysler's early dream cars always looked too European for mainstream American tastes. More important, they had none of GM's mechanical magic—no gee-whiz engineering. Very few of their ideas ever turned up in production. However, by way of contrast, Chrysler's later dream cars—those of the '60s—were very pure and sensibly futuristic.

Ford, under George Walker and Gene Bordinat, built most of that company's dream cars in-house. Ford's cars, like the 1955 Futura (which George Barris later converted into TV's Batmobile), were often so futuristic and radical that they seemed almost ludicrous.

Hudson asked Carrozzeria Touring of Milan to build 25 semi-production 1953-'54 Hudson Italia coupes and one X-161 Italia sedan, while Pinin Farina (two words then, but now Pininfarina) created a few concept cars for Nash, among them the two-place 1956 Rambler Palm Beach coupe and a '56 Nash sedan prototype. Packard commissioned Creative Industries, Mitchell-Bentley and Henney (its supplier of hearses) to craft a number of dreamboats, among them four fiberglass 1953-'55 Panther roadsters and the Packard Request, all designed by Dick Teague and all still running and accounted for.

Queen of all dream cars, though, was Harley Earl's fabulous and highly influ-

ential 1950 LeSabre. This one roadster had more imitators, set more trends and turned more heads than any other car on any show circuit anywhere because, among other distinctions, the LeSabre ultimately led to such less elaborate variations as the first Corvette. Not only was the LeSabre strikingly beautiful without being radically unpalatable, but it oozed with mechanical wonderments. The LeSabre's doors, hood, decklid, cowl, lock pillars and fender valances were all cast magnesium! The car also had an aluminum-alloy honeycomb floor and a supercharged 335-hp aluminum ohv V8 with twin carbs, one for gasoline and the other for methanol. It sported four-wheel independent suspension, twin fuel cells inside the finned rear fenders, a wraparound windshield and bucket seats.

The LeSabre had various now-common power accessories, but beyond that it carried retractable hydraulic jacks at all four corners and a moisture-sensitive mechanism that raised the top when it started to rain.

Harley Earl originally hoped to drive the LeSabre as his personal car. But he soon found that impossible because of the attention the car drew, and also because of its general unreliability. Earl assigned his personal mechanic, Leonard McLay, to keep all the gadgets working, and he did drive the LeSabre at shows and in parade laps at auto races. Earl also liked to give rides in the LeSabre to VIPs who visited the GM Tech Center.

Crushing rumors

When I was growing up in Texas in the early '50s, my buddies and I would pore over magazine pictures of that era's factory dream cars. Imagine, then, how shocked I felt when I first heard that, after these dream cars had fulfilled their various duties, the automakers simply demolished them. I couldn't accept it at first, but word leaked out that, sure enough, *all* dream cars were routinely broken up for scrap.

A second rumor followed hot on the heels of the first, this one saying in effect that, well, maybe not *all* of Detroit's dream cars got crushed. Just most of them. The intriguing part of this last rumor—and I later found out it was true—mentioned a certain wrecking yard with the strange name of Warhoops, north of the GM Technical Center in Warren, Mich.

Although Warhoops had standing orders to demolish every such car that came its way, those orders weren't always carried out, at least not immediately. I'd heard that somewhere in Warhoops' yard, in a separate area, lay half a dozen GM dream cars of the past. People from rival car companies had

(Please turn to page 179)

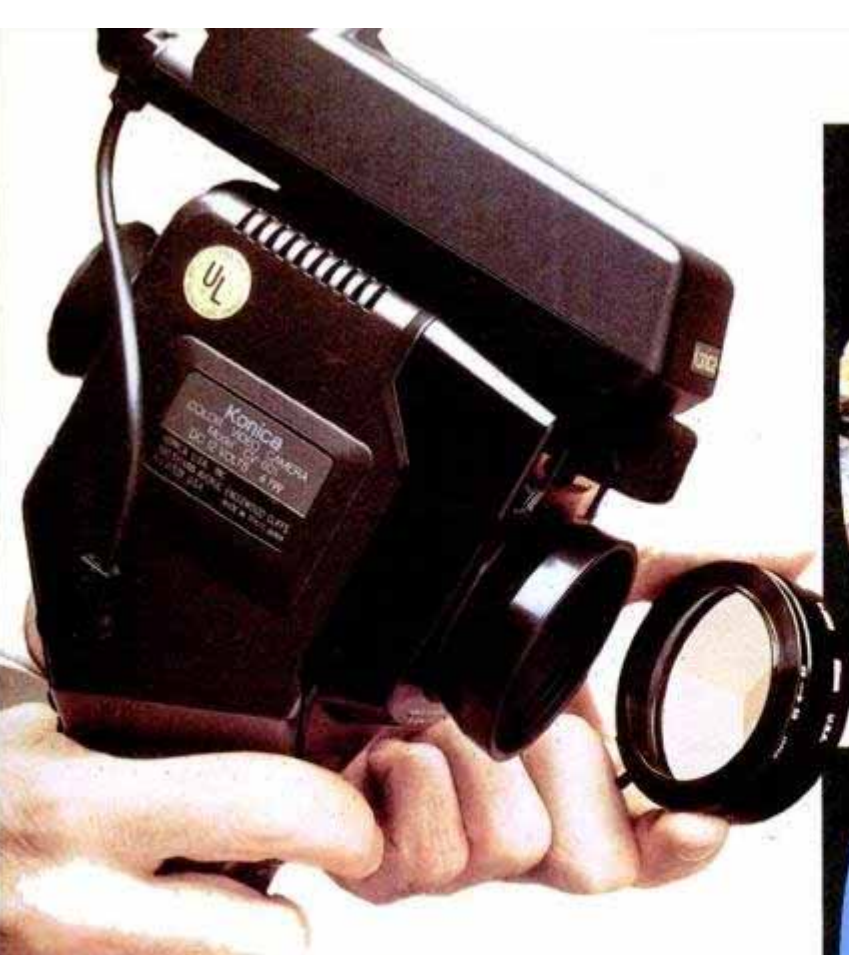
displayed and promoted them.

Motoramas were a blend of futuristic autos wrapped in musical stage revues with singers, dancers, glitzy props, live orchestras and a very soft sell. GM said their purpose was "to put the General Motors story before the American public." GM Styling, whose design staff conceived the dream cars, claimed to be "testing public reaction to new ideas and automotive innovations."

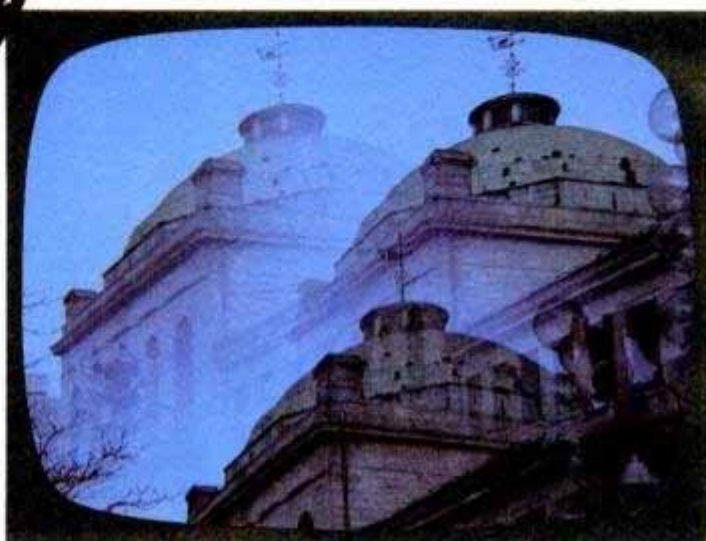
The first Motorama (actually called "Transportation Unlimited") took place in New York and Boston in early 1949. Motoramas continued intermittently through 1961. After 1953, they went from city to city in huge convoys.

Ford and Chrysler, along with the declining independents like Packard, Hudson, Nash and Studebaker, followed GM's lead and brought out dream studies of their own, usually introduced at major auto shows.

Chrysler Styling, guided by Virgil Exner, worked with Mario Boano and Luigi Segre at Ghia, in Turin, to produce a steady and impressive flow of idea cars and show cars. Those from the early '50s were very Italianate—vehi-



Inset shows flowers before taping with multi-image filter.



A multi-image filter, as used here, can create hallucinatory effects.

CREATE SPECIAL EFFECTS FOR YOUR VIDEO MOVIES

Simple filters can add visual sophistication to your taping.

BY CARL CAIATI

Home movies don't have to be boring. Your videocamera production can display some highly creative touches with the application of a few trick effects—the same ones the pros use.

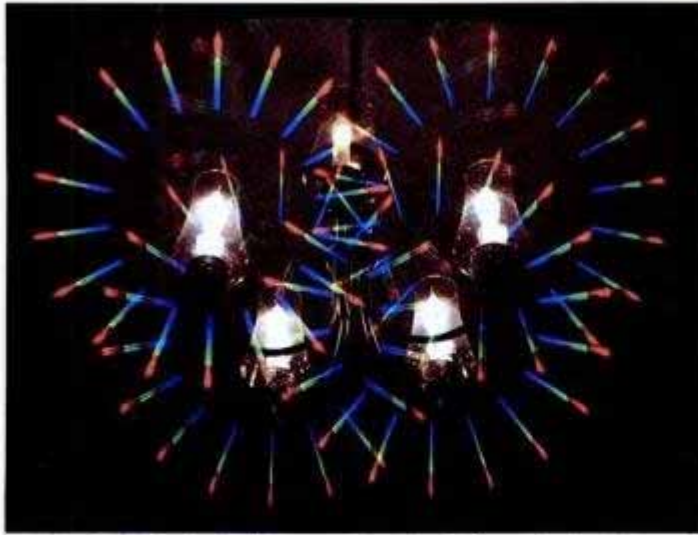
Special effects in video can be electronic or optical. Optical effects are the easier to master, and affordable, too. You can achieve them with readily available filters and lens attachments that fit every videocamera. Most filters cost less than \$15 at photo and video stores; the most sophisticated don't exceed the \$20 mark by much. Often, they're sold as multifilter kits by manufacturers such as Ambico, Cokin, Kodak, Marumi and Tiffen.

There's a wide assortment of special effects available to the videographer. Some of these are already

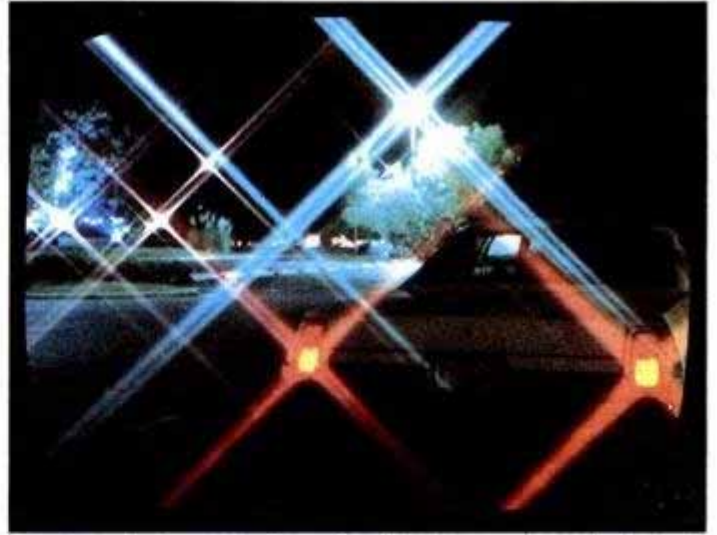
included in your videocamera. Wide-angle, zoom, macro and telephoto lenses are virtually standard features that can be mastered by studying your owner's manual.

Corrective color-balancing also is incorporated in most cameras—so you needn't invest in corrective filters. The special-effects filters you will want to acquire fall into two categories: mild and wild.

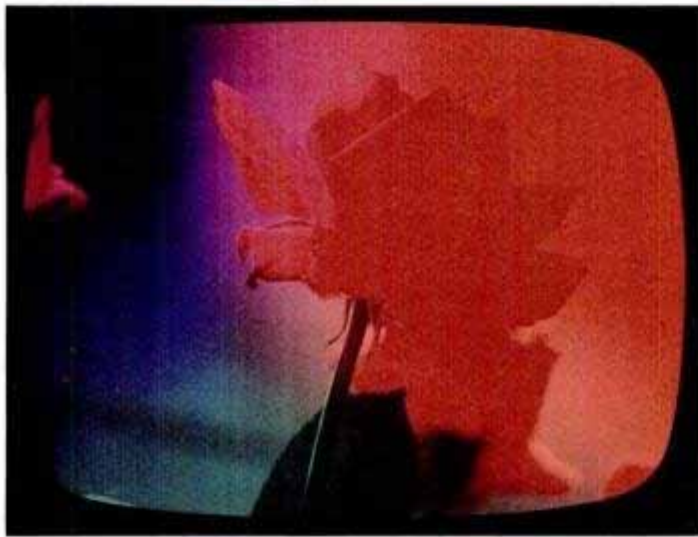
Mild enhancement effects are obtained with polarizers, diffusers and graduated color filters. "Trick" or distortion effects are created with multicolor filters, multi-image lenses, starburst and rainbow filters. Try them all and practice, practice, practice until you get the technique down pat. That's the best feature of videocamera work: Tape is inexpensive and can be



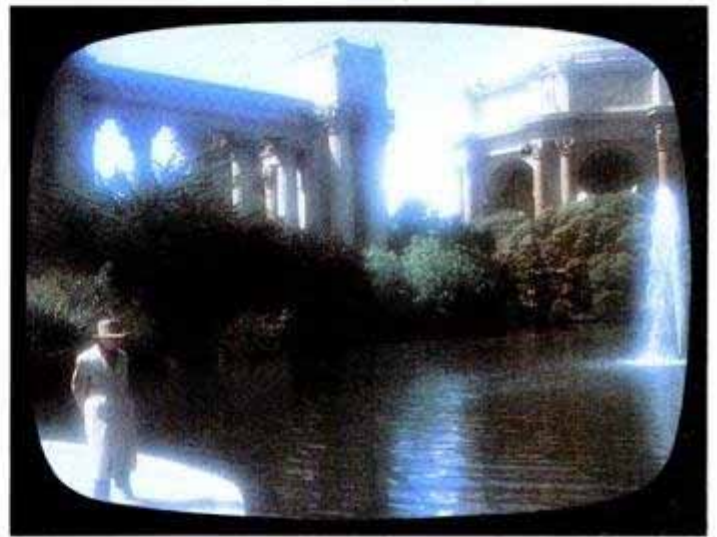
Radial-diffraction filters generate rainbow colors from light sources.



A starburst filter imparts a sense of motion—more so if rotated.



A flower's natural hues become intensified when using a tricolor filter.



A heavy-diffusion filter imparts a soft, dreamy atmosphere to a scene.

used over and over again. You're spared the expense of having film developed to learn from your mistakes.

Polarizing filters

One of the oldest enhancement filters is the polarizer, useful for controlling and eliminating unwanted reflections from shiny surfaces. It also cuts down glare on sunny days, as well as atmospheric haze.

Polarizing filters are mounted in holders so that, when rotated, they maximize or minimize the reflections. The effect of the polarizer can be seen either through the filter itself, or through your videocamera's viewfinder. Polarizing filters are also highly effective in manipulating sky color without affecting other color tones in a videotaped scene. For example, they'll darken the sky in the background, for dramatic contrast. Using two polarizers mounted in a common revolving-base holder will give more pronounced effects.

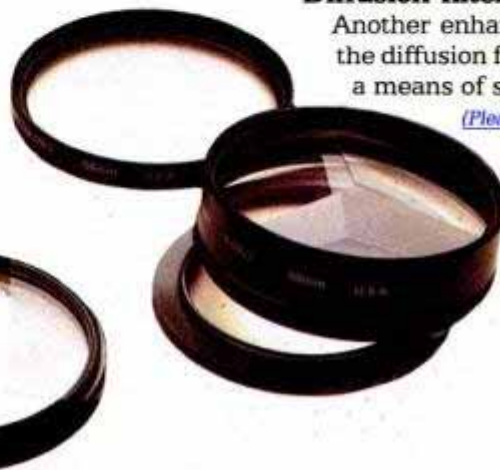
For best results, remember that polarizers achieve their maximum blocking effect when the camera is positioned at the same angle to the

reflecting surface as the source of light illuminating the surface. To calculate exposure with polarizers, first set the polarizing element in the proper position, then activate the automatic white balance on your video camera. Because polarizers only admit partial planes of light to the camera, exposure increases most likely will be required.

Diffusion filters

Another enhancement filter is the diffusion filter. Diffusion is a means of softening the im-

(Please turn to page 181)



This three-filter kit from Ambico includes multi-image, rainbow and starburst elements. An adaptor ring might be needed. Cokin, Kodak, Marumi, Tiffen sell kits, too.

TECHNOLOGY COMES TO TIRE DESIGN

The 'black art' of tire design has given way to modern technology—computers and all.

BY WAYNE W. WILLIAMS
Illustrations by George Retseck



Armstrong's Tredloc belt is braided Kevlar, which will eliminate the cut edges of conventional belts that can lead to belt-edge separation.

Most people marvel at the great advances made during the past decade in the design and production of automobiles. What many forget, however, are the great advances in what comes between the car and road: tires.

Ever since Ford put Michelin radials on its cars in the late '60s, car companies and tire manufacturers have thought of tires as a part of a total ride-control system, not as a separate entity.

And since the '60s tiremakers have been leap-frogging each other trying to design the ultimate tire. Today, tire designers, chemists, and engineers using the latest technology—thermography, finite element analysis, laser photography—have all but eliminated common tire problems of the past such as flats, belt edge separation and poor tire uniformity.

Here's a company-by-company rundown on the latest high-tech tire developments. Some have already been incorporated into tires you can buy now. Other developments will be on the tires you'll see in the next few years.

Armstrong

A radical departure from the use of normal twin steel belts has been introduced by The Armstrong Rubber Co. Instead of utilizing steel belts for stabilization, Armstrong uses a woven Kevlar Aramid fiber called Tredloc. Tredloc is available in Armstrong's Assurance premium all-season radial.

Here's how Tredloc works: Strips of rubber-insulated Aramid cord are wrapped around the tire to produce an interlocking structure that gives the belt a physical integrity and unity. The finished belt looks like a school-girl's braided hair. The belt is extremely thin, and provides great strength in a circumferential direction.

Armstrong engineers claim the Tredloc belt, due to its very rigid interlocking structure, slows down the wear in a tire's shoulder area, and thus reduces the possibility of belt-edge separation. Aramid was chosen because it is stronger than steel, and constant flexing of the overlapping layers doesn't hurt the material.

Armstrong is experimenting with steel, fiberglass and new cord materials to see if they will prove suitable for use in tires designed for different applications. A steel Tredloc belt may offer advantages in radial truck tires, where penetration resistance in the tread area is very critical, and extra stiffness not objectionable to truckers.

Bridgestone

The all-season S402 tire uses cap/

base construction, which means the tread area has a wear-resistant tread rubber compound layered on top of a base rubber formulated to stay cool at high speeds. In addition, the tread compound is formulated to remain flexible at low temperatures to improve its winter performance.

The S402 has a computer-designed, rectangular block pattern tread that Bridgestone engineers claim will run to 40,000 miles.

Another new development, the S407 is a 70-series, speed-rated, all-season tire with twin steel belts and a polyester carcass, but it also has a nylon belt-edge cap that reinforces the belt-edge area, and reduces shoulder growth at high speeds. The nylon cap maintains its shape as the tire heats up during high-speed operation. The cap actually holds the steel belts in place, thus allowing the tire to obtain an H-speed rating by the European Economic Commission, certifying that the tire is capable of withstanding speeds up to 130 mph for a sustained time period. (V-rated tires can operate at speeds above 130 mph.)

Bridgestone's big news for the future is a new tire construction theory called Rolling Contour Optimization (RCOT). By reshaping a static tire's cross section slightly to more closely resemble the contour of a rolling tire, Bridgestone claims to minimize the movement of the tire's internal parts. This reduces the tension in sidewalls and belts, improving steering precision, fuel economy, ride comfort and brake performance.

Continental

Most run-flat tire designs are merely adaptations of standard wheel/tire configurations. A completely new run-flat system on the horizon throws all of the ground rules out the window. It's called the ContiTyreSystem. Designed by the German tiremaker Continental, this new system has an internal rather than external bead-seating system. A good way to envision it is to imagine a present day tire-wheel combo turned inside out.

The wheel is much shallower than a conventional design, allowing room to fit larger brakes on an automobile. If the tire loses air, the flat portion of the wheel rubs against the deflated carcass, thus reducing damage. Test tires have run hundreds of miles flat with no damage, eliminating the need for a spare. Look for the ContiTyreSystem as original equipment on at least one German car in a couple of years.





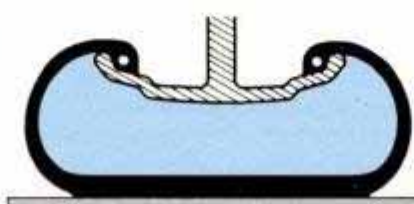

Firestone

The all-season Supreme is the successor to the WR-12. Firestone engi-
(Please turn to page 184)

Bridgestone Potenza rally-street tire (below) has Pac-Man-like tread for maximum performance on pavement or dirt. In radical ContiTyreSystem (right), tire wraps around special wheel, so bead is on the inner circumference of the rim. This will give the tire excellent run-flat characteristics.



RUN-FLAT PERFORMANCE

<p>INFLATED</p> 	<p>FLAT</p> <p>Conventional</p> 
<p>When the air goes out of a standard tire, two things happen: the rim rubs the sidewall and tread together, causing internal damage, and the bead often slides off the rim.</p>	
	<p>Dunlop-Michelin</p> 
<p>In the Dunlop-Michelin system, a ridge on top of the bead stays locked into a groove in the special rim, even when flat. The sidewall and tread can still rub, though.</p>	
	<p>Continental</p> 
<p>In the ContiTyreSystem, the rim drops straight onto the tread. The bead stays in place and the sidewall and tread can't rub. Tire can safely be driven flat at 50 mph.</p>	



Carved legs and edge molding join with ceramic tile to create a rich look in this easy-to-build table.

Build A TILE-TOP Country Coffee Table

Using ready-made cabriole legs, you can build this attractive coffee table in just a few days.

BY WILLIAM BEYER

Building this elegant-looking table is a lot less complicated than you might think. We used ready-made legs, and a patterned, tan ceramic tile top that's both attractive and durable.

The size of the tiles determines the overall size of the table. We used nine No. AK-21 sheeted tiles from Colortile that measure 12 $\frac{1}{4}$ in. square. Each sheet contains four 6-in. tiles separated by a $\frac{1}{4}$ -in. grout space. If you use a different size tile, you will have to alter the overall dimensions of the table or use different size edge moldings.

We obtained the cabriole cherry legs from Windsor Classics Ltd., which is located at 15937 Washington St., Gurnee, Ill. 60031. You can use any leg that has a square upper shank measuring 1 $\frac{11}{16}$ × 1 $\frac{11}{16}$ in.

Building the table

Begin by cutting mortises in the two inside faces of each leg shank according to dimensions given in the leg detail drawing. Use a drill press with a $\frac{1}{2}$ -in. bit to bore overlapping holes the length of the mortise. Or, use a router with guide and stops clamped to the leg

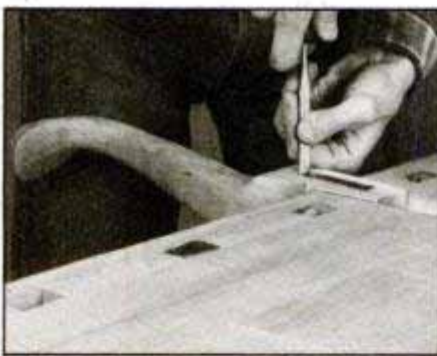
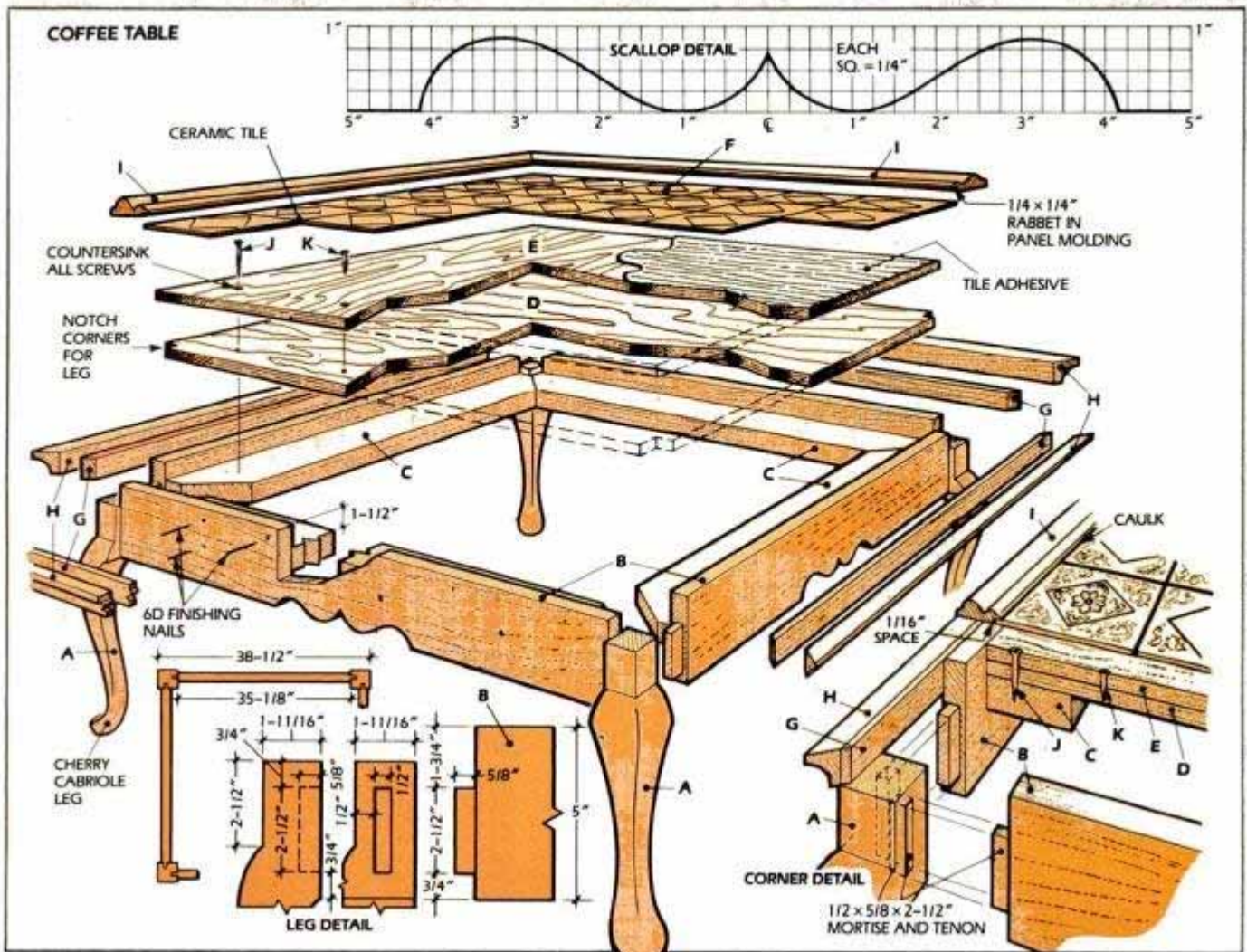
shank. You should square the mortise cuts with a sharp chisel.

Cut the four side pieces to width and length, then cut tenons to the size indicated. You can use a radial-arm or table saw, or cut them by hand with a backsaw as shown.

Mark the scallops on each side piece, using the grid pattern on the drawing for reference. Now you should cut the scallops with a jigsaw or band saw and sand the curves smooth.

Clamp the legs and sides together without glue and check all joints for a tight fit. Place the assembly on a flat

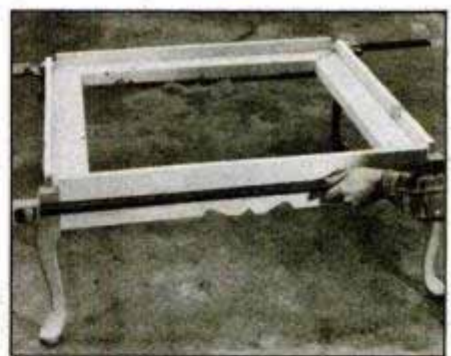




Cut mortise in ready-made cabriole legs using either a drill press or router. Then clamp leg in the bench vise and square the mortise cut with a sharp chisel.



Clamp a blade guide block to sides and cut tenons with backsaw. Or make cuts using radial-arm or table saw, with blade set to remove 1/8 in. of waste from each surface.



After test-fitting legs, sides and 2x4 base supports, disassemble and mount base supports to the sides. Then glue and clamp the assembly together on a flat surface.

surface and make sure each leg bottom touches the surface.

Miter the 2x4 base supports (part C), then trim 9/16 in. off the point of each miter to form notches around the inside corners of the legs. Test-fit these support pieces in the leg and side assembly, and when you are satisfied unclamp the assembly. Mount the base supports on the table sides 1 1/2 in. below the top edge with glue and three

6d finishing nails. Then, glue and clamp the sides to the legs and let dry.

Cut both plywood bases and notch the corners of the lower piece. Glue the lower base to the base supports and then glue the upper base to the lower base. Secure with 1 1/4-in. No. 10 fh screws in the middle of the panels, 2 1/2 in. No. 10 fh screws around the perimeter, and 6d finishing nails driven through the sides.

Mark the position of the outer tile edges, then using a notched trowel, spread the tile adhesive on the plywood

(Please turn to page 187)

MATERIALS LIST—COFFEE TABLE

Key	No.	Size and description (use)
A	4	1 1/8 x 1 1/8 x 14 3/8" cherry (leg)
B	4	3/4 x 5 x 36 3/8" pine (side)
C	4	1 1/2 x 3 1/2 x 36 1/4" fir (base support)
D	1	3/4 x 3/4 x 36 1/4" exterior plywood (lower base)
E	1	3/4 x 3/4 x 36 1/4" exterior plywood (upper base)
F	36	1/4 x 6 x 6" ceramic tile (table surface)
G	4	3/8 x 1 x 38 1/2" pine (filler strip)
H	4	1 1/8 x 1 1/4 x 39 7/8" pine cove molding (side edge)
I	4	3/8 x 1 1/2 x 39 7/8" pine panel molding (top edge)
J	16	2 1/4" No. 10 fh screw
K	5	1 1/4" No. 10 fh screw
Misc.		6d finishing nails, tile adhesive, grout, grout sealer, 120- and 220-grit sandpaper, stain, polyurethane.

Photos: William Laskey and David J. Warren
Room stylist: Virginia Howley
Construction: David J. Warren
Technical art: Hank Iken

PART ONE:

Become A Woodturning Expert

This month learn the fundamentals of safe, fun woodturning. Look for our advanced wood lathe techniques story in June.

TEXT AND PHOTOS BY
ROSARIO CAPOTOSTO



The practice of woodturning dates back at least to 300 B.C. when the Egyptians designed a two-man lathe for turning columns. One man supplied the power while another did the cutting. Needless to say, lathes have come a long way since then, but the basic mechanical principle—rotating stock between two points to permit carving—remains the same nearly 2,300 years later.

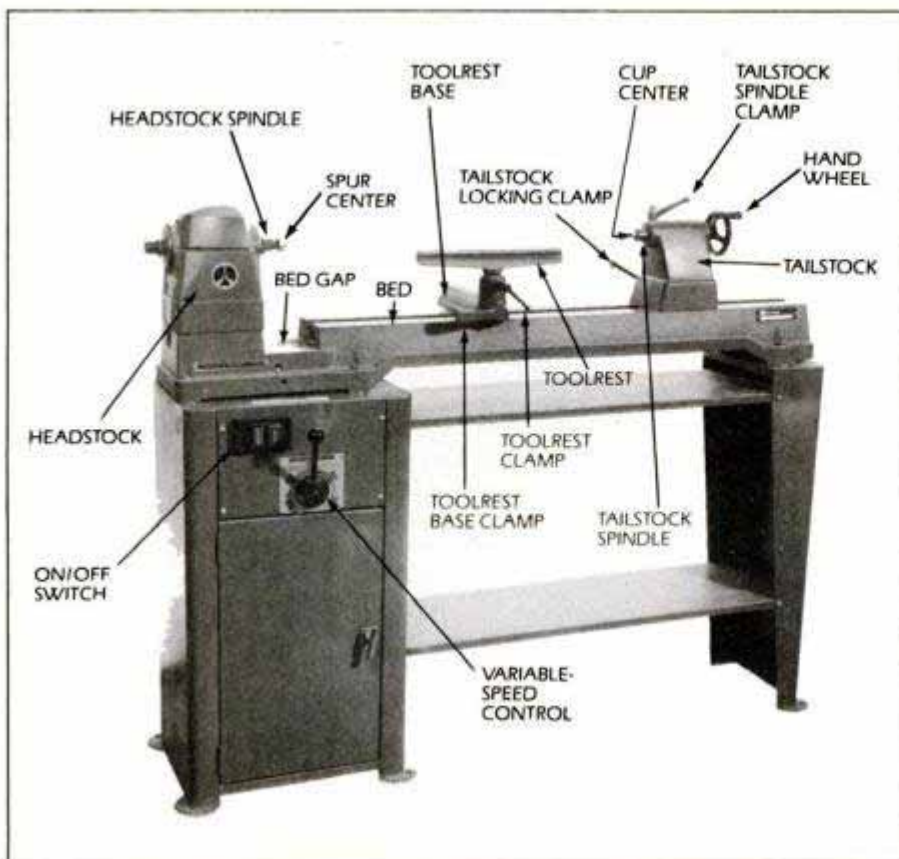
Today, the lathe is a popular item in many home workshops and the reason is simple: Woodturning is fun, easy to learn and it offers instant satisfaction. Even a novice woodturner can produce a finished project in less than an hour—and all on a *single* machine. But, practice is essential to acquire the “feel” of using the turning tools safely and properly. *Caution:* The lathe, though easy to operate, is potentially a dangerous tool. Observe the safety guidelines listed on page 106.

Lathes are available in a wide variety of sizes to fit nearly everyone’s budget and workspace. The 12-in. wood lathe shown is a good multipurpose model for the home work-

The chips fly as the author uses a gouge to turn a spindle. In this photo, he’s shown holding the tool with the palm-down grip.

shop. Lathes are sized according to the maximum diameter work they can turn. This dimension, known as the swing of the lathe, is determined by doubling the distance from the spindle center to the bed. For example, a lathe measuring 6 in. between the spindle and bed has a 12-in. swing.

The longest workpiece turned by a lathe is determined by the spindle length capacity. This dimension varies according to the lathe, but most 12-in. lathes, for example, measure about 39 in. between centers. Extension bed sections and longer accessory beds are available for many models. Lathe rotation speeds vary depending on the model, too, but they generally range from 200 to 4,000 rpm. Use lower speeds for preliminary roughing cuts and for turning large diameter pieces. Choose higher speeds for small diameter turnings and finishing operations (see the lathe speed chart on page 106).



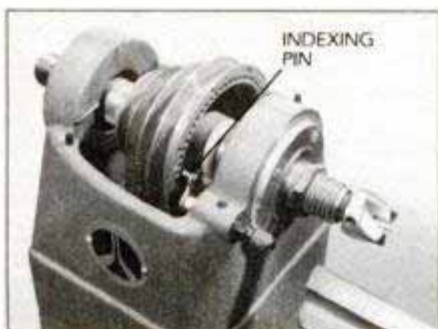
Here's a typical 12-in. wood lathe shown with its major parts identified.



Determine the swing of a lathe by doubling the distance from the spindle center to the bed. This lathe has a 12-in. swing.



The variable-speed drive mechanism, shown on a Delta lathe, allows quick selection of any speed between 340 and 3,600 rpm.



Index pin permits exact layout of reeds and flutes on lathe. It slides into evenly spaced drive pulley holes, locking stock in place.



Complete set of basic turning tools includes (left to right): three gouges, two skews, a spear-point, round-nose and parting tool.



Essential measuring tools include (left to right): two sizes of outside calipers, an inside caliper, dividers, compass and rule.

Lathe components

The lathe is a simple machine in both design and operation. The stock, or turning blank, is held between the headstock and tailstock by the centers. The headstock spindle, which is connected to the motor, houses a spur center, which rotates the blank. A cup or cone center, called a dead center because it doesn't turn with the blank, is held in the tailstock spindle. Position the tailstock and toolrest anywhere along the bed to accommodate the blank. Woodturning between centers is known as spindle turning and is the most common lathe work. Both ends of the headstock spindle are externally threaded to accept a face plate. Face plate turning is used to make bowls and dishes. Note that the bed gap at the headstock end permits turning larger diameter blanks than



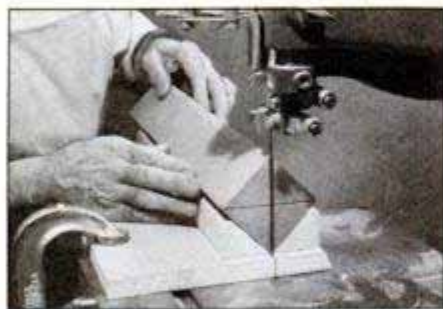
Lathe accessories (left to right): screw on arbor for mounting grinding and buffing wheels; face plate; spur center; screw center for small, delicate work; geared chuck for boring operations; adapter; ball-bearing center; and cup (dead) center.

is possible directly over the bed. For extra-large turnings, mount the face plate on the left end of the headstock spindle. This procedure is called outboard face plate turning. We'll take a closer look at face plate turning in part two of this story in our June issue.

Turning methods

There are two basic methods used to turn a blank: scraping and cutting. When scraping, the turning tool is held horizontally on the toolrest and fed directly into the blank to scrape away particles of wood. This is a safe, easy-to-learn technique. But when cutting, the tool is held at an angle toward the top of the spinning stock so that the cutting edge pierces the work and peels off shavings. The cutting method is faster and produces a smoother finish.

TURNING A CYLINDER



Band-saw cradle jig makes it easy to locate the center on hardwood blanks. Shallow kerfs allow spur center to seat firmly.



Drive in the spur center with a mallet. Reference mark on blank end corresponds to mark on spur center to permit recentering.



With the tailstock clamped in position, turn the hand wheel to advance the tailstock ram which drives the cup center into blank.



Adjust the toolrest so it's no more than 1/8 in. away from the blank and approximately 1/8 in. above the spindle centerline.



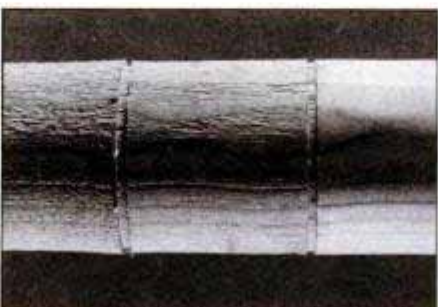
Using a gouge, start cutting a few inches from the end. Cut toward and off the end. Repeat this procedure on opposite side.



Use a skew to finish-cut the cylinder to size. Cut with the blade's center section only. Toe (arrow) must not make contact.



Cylinder can also be finish-cut to size using a block plane. Set plane for a very shallow cut and slide it along the toolrest.



Turning method determines surface smoothness (left to right): scraping with gouge, scraping with skew and cutting with skew.

However, it also requires greater skill and more practice to master. *Caution:* Don't jam the cutting tool into the work; it could be thrown from your grasp.

Turning tools

The six most common woodturning tools you should know about are: gouge, skew, parting tool, spear-point, round-nose and flat-nose.

The gouge is a hollow, round-nose chisel used to rough-cut blanks into cylinders and for making cove cuts. Gouges can be used for cutting or scraping. The skew has a slanted cutting edge with a double bevel. Skews are most commonly used to finish-cut cylinders, form long sweeping curves and to cut square shoulders, rounded beads and long tapers. In addition, skews can be used as scraping tools.

A parting tool is a scraping chisel that comes in two shapes: ground on two edges to form a V-point, or ground on a single edge to resemble a skew without beveled edges. Parting tools are used primarily for cutting diameter sizing grooves in a cylinder. The grooves serve as depth-of-cut guides, as shown, when turning a spindle.

The spear-point, also known as a diamond-point, has a pointed tip with two beveled edges. Use this scraping tool to round off grooves and to finish the inside of corners and recesses.

A round-nose tool is a scraping chisel used for making concave shapes. Note that it's beveled on one side only. The flat-nose tool is used almost exclusively for scraping flat surfaces during face plate turning.

Spindle turning

To prepare a blank for turning between centers, first mill the stock square and cut the ends square. Next, locate and mark the center on each end with an awl. On hardwood stock, make two diagonal saw cuts on headstock end and centerbore a small hole to help seat the spur center firmly. Make the shallow cuts with a handsaw or on a band saw using a centering jig, as shown.

Then, drive the spur center into the blank end using a mallet. Now make a mark on the stock end next to a clear reference point on the spur center such as a manufacturer's logo or other distinguishing mark. This way if the blank is removed from the lathe before completion, you can reposition the spur center in its original spot.

Next, mount the blank between centers with the spur center in the headstock spindle. Then, clamp the tailstock into position. Turn the hand wheel to advance the tailstock spindle until the cup center seats firmly in blank end. Apply oil, graphite or beeswax to tail end of work to minimize heat buildup.

Now, position the toolrest no more than 1/8 in. from the blank and about 1/8 in. above the spindle centerline.

Turning a cylinder

If the blank is more than 3 in. square, it'll be easier and quicker to rough-cut the cylinder if the corners are chamfered to form an octagon. Cut the chamfers on the table saw, jointer or band saw.

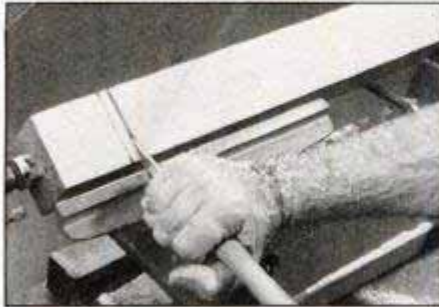
Mount the blank and adjust the toolrest. While at low speed, make the first roughing cuts with a large gouge using the cutting technique.

Start cutting a few inches from the end of the blank to

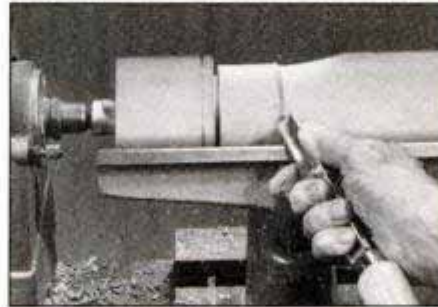
prevent splintering. Then, move the gouge toward and off the end. Keep your index finger against the toolrest to maintain a constant depth-of-cut.

You should begin the second cut a few inches from the starting point of the first cut. Advance the gouge toward the end until merging with the first cut. Repeat this procedure until you reach the middle of the blank. Then, you should start near the other end and work toward the center until the blank is round.

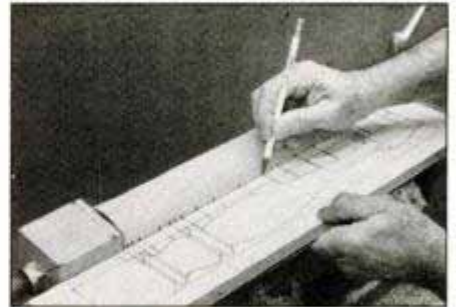
TURNING A SQUARE-SHOULDERED SPINDLE



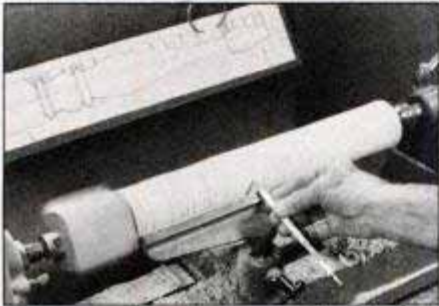
Make small cuts on each corner to prevent splintering. Then, use a parting tool to establish spindle diameter at the shoulder.



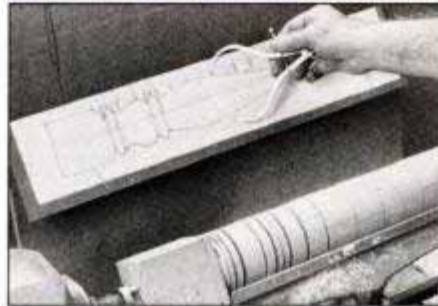
Turn the remainder of the blank, up to the shoulder, into a cylinder. Note how gouge is rolled over to the left, into the work.



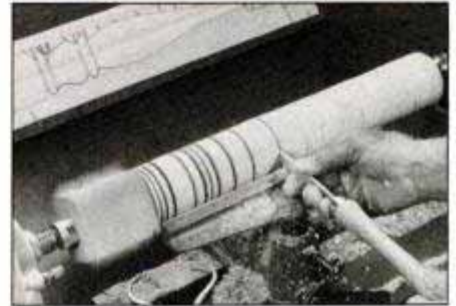
Transfer diameter-sizing grooves from a full-scale pattern to the blank. Mark grooves at distinct changes in profile.



Hold a pencil against the revolving blank to define clearly the location of each of the diameter-sizing groove marks.



Adjust the outside callipers directly from the pattern. Set the callipers about 1/16 in. over-size to permit finishing to size.



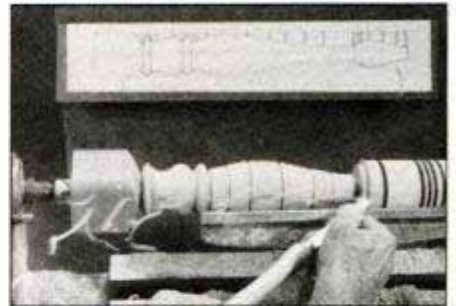
Continue cutting diameter-sizing grooves with a parting tool. Check groove repeatedly with callipers to match pattern.



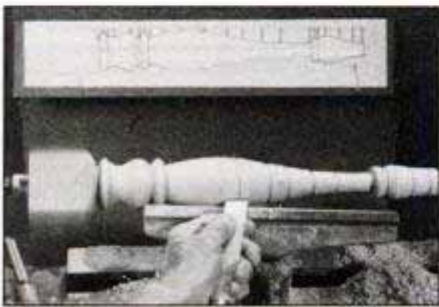
When repositioning the toolrest opposite the square shoulder, rotate the blank by hand to make certain there's clearance.



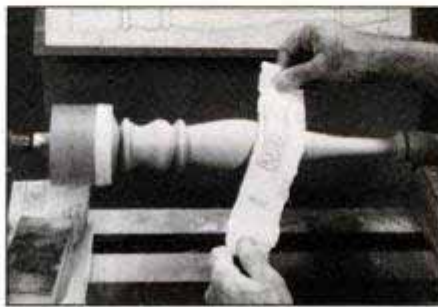
Round the top of the shoulder with a skew. Hold the blade flat on the toolrest and swing the handle slowly to the right.



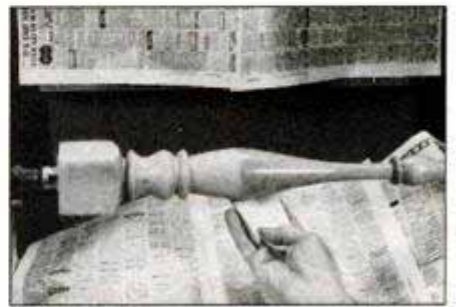
Use the spear-point tool to remove waste quickly. Note how the sharp cutting edge peels off long, thin ribbons of wood.



Final leveling cut using a skew brings the spindle close to its finished size. Move the toolrest closer before continuing.



Remove toolrest to finish-sand spindle. Note masking tape band on square shoulder. This is a safety reminder to keep hands clear.



Applying the finish is easy with the spindle still on the lathe. Newspapers catch spin-off. Again, stay clear of square shoulder.

Use a skew to finish-cut the cylinder to the desired diameter, checking the cylinder size frequently with outside calipers. Cutting with a skew is a little tricky and takes some practice. Only the center section of the skew's cutting edge makes contact with the blank, not the blade's upper point or toe.

Place the skew flat on its side against the cylinder with the cutting edge pointing above and over the work. Keep the blade firmly against the toolrest, then draw the skew back slowly until the midpoint of the cutting edge is over the cylinder. Be careful not to catch the toe of the skew in the work. Raise the tool handle so that the cutting edge makes contact with the wood. Now push the skew along the cylinder to make a shearing cut.

Shearing cuts are made with tool's beveled edge flat against the work, therefore, it's essential that the bevel be ground perfectly flat.

Next, with the lathe running at high speed, finish-sand the cylinder using fine-grit abrasive paper. Be certain to remove the toolrest from the lathe bed during sanding operations to eliminate the chance of getting your fingers caught between the toolrest and the blank. Remember, practice is the key to safe, fun woodturning. We'll have more lathe techniques in June. **FM**

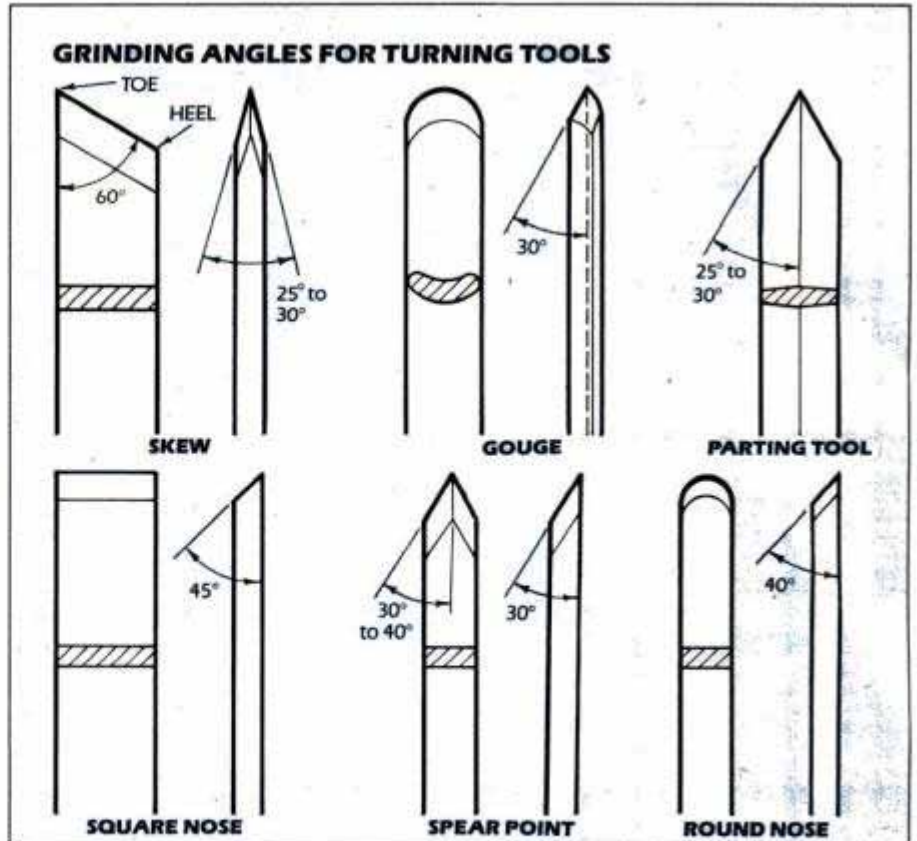
SAFETY GUIDELINES

The lathe is a relatively safe power tool to operate provided you obey the following precautions:

- Never wear loose clothing or jewelry.
- Always wear a face shield or safety glasses.
- Keep your turning chisels sharp and grip them firmly in both hands.
- Check the stock carefully. Avoid using wood with splits or knots. Allow laminated (glued-up) blanks to dry thoroughly before turning.
- Choose the correct lathe speed for the diameter work being turned (see chart).
- Position the toolrest no more than 1/8 in. from the stock. Rotate the stock by hand to be certain that it clears the toolrest.
- Never adjust the toolrest while the lathe is in motion.
- Always remove the toolrest from the lathe bed when sanding or finishing.



Shaping convex curves with a skew is similar to cutting long tapers. Always work downhill from the high point of the curve.



These drawings show the grinding angles for six common turning tools. Maintaining a consistent angle across the cutting edge is more important than the actual angle.



Make a long taper by first cutting diameter-sizing grooves with a parting tool. Then, remove the waste, as shown, with a gouge.



Finish-cut the taper with a skew. Use the center of the cutting edge only. Always move downhill; left to right in this case.

LATHE SPEEDS FOR WOODTURNING

Diameter Of Work	Rough Cutting (rpm)	General Cutting (rpm)	Finishing (rpm)
Less than 2 in.	900 to 1,300	2,400 to 2,800	3,000 to 4,000
2 to 4 in.	600 to 1,000	1,800 to 2,400	2,400 to 3,000
4 to 6 in.	600 to 800	1,200 to 1,800	1,800 to 2,400
6 to 8 in.	400 to 600	800 to 1,200	1,200 to 1,800
8 to 10 in.	300 to 400	600 to 800	900 to 1,200
Over 10 in.	200 to 300	300 to 600	600 to 900

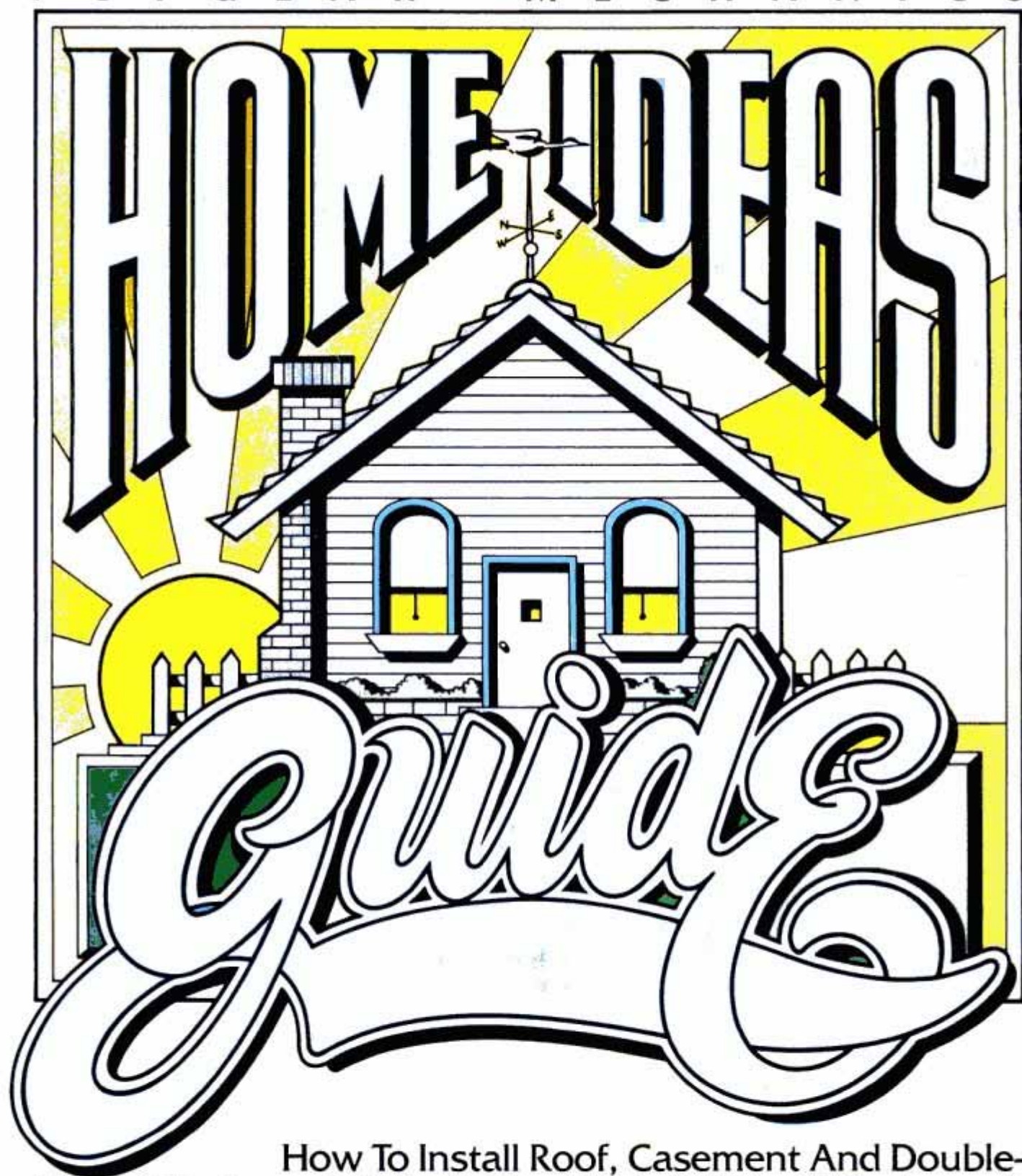
Adjust wood turning speeds according to the workpiece diameter; use slower speeds for larger turnings.



To form concave curves, move the skew into the blank and swing the handle in an arc. Cut downhill toward the curve center.

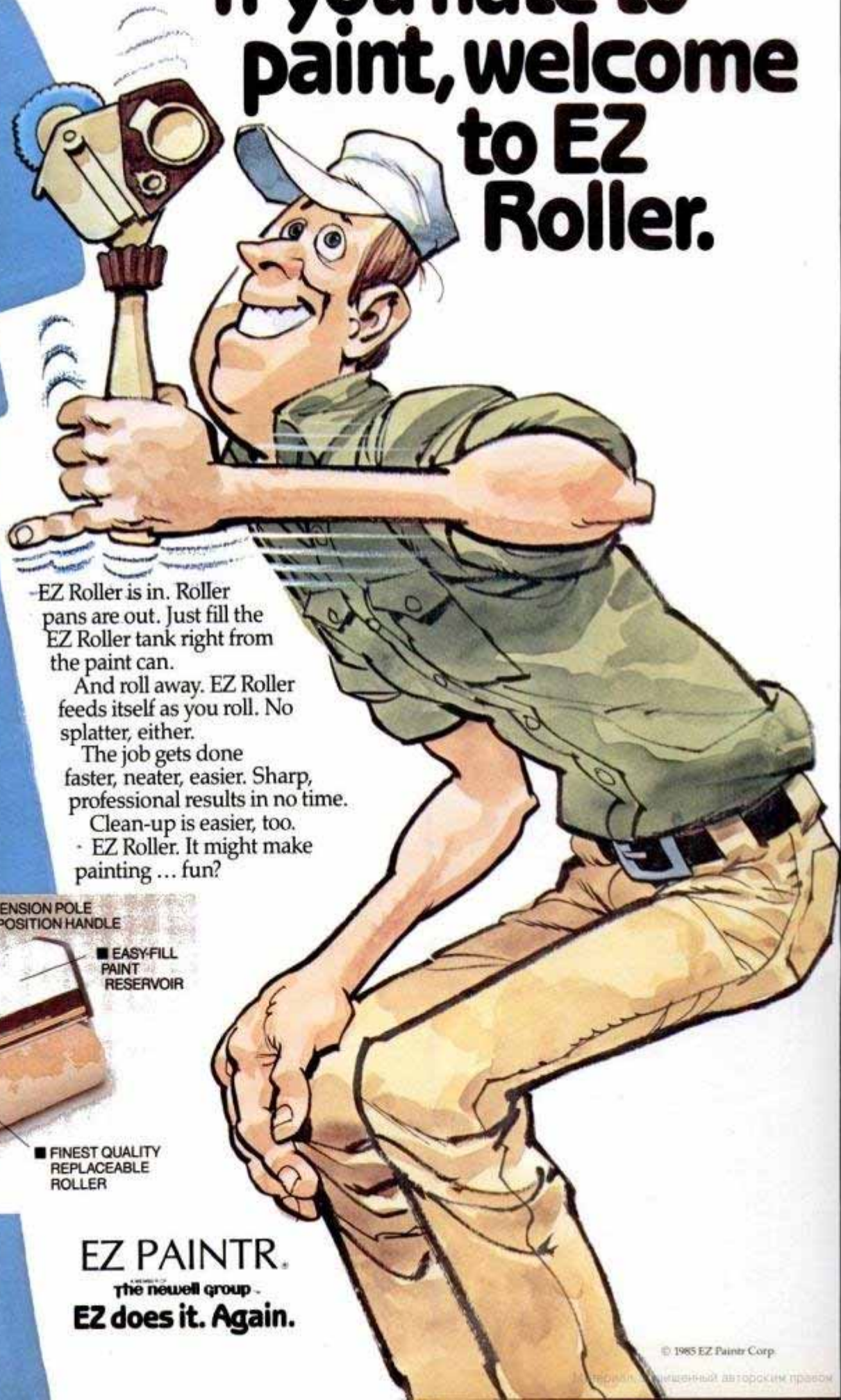


Use the toe of the skew to square-up a shoulder. To produce a smooth surface, take very light shavings of about 1/32 in.



How To Install Roof, Casement And Double-Hung Windows 🏠 What's New With All-Vinyl Windows 🏠 Update Your Bathroom With A New Shower, An Easy-To-Build Vanity And Other Interesting Products 🏠 How To Relocate A Toilet 🏠 PM's Homeowners Insurance Review 🏠 How To Install High-Quality Carpeting Yourself

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HOW TO INSTALL NEW WINDOWS

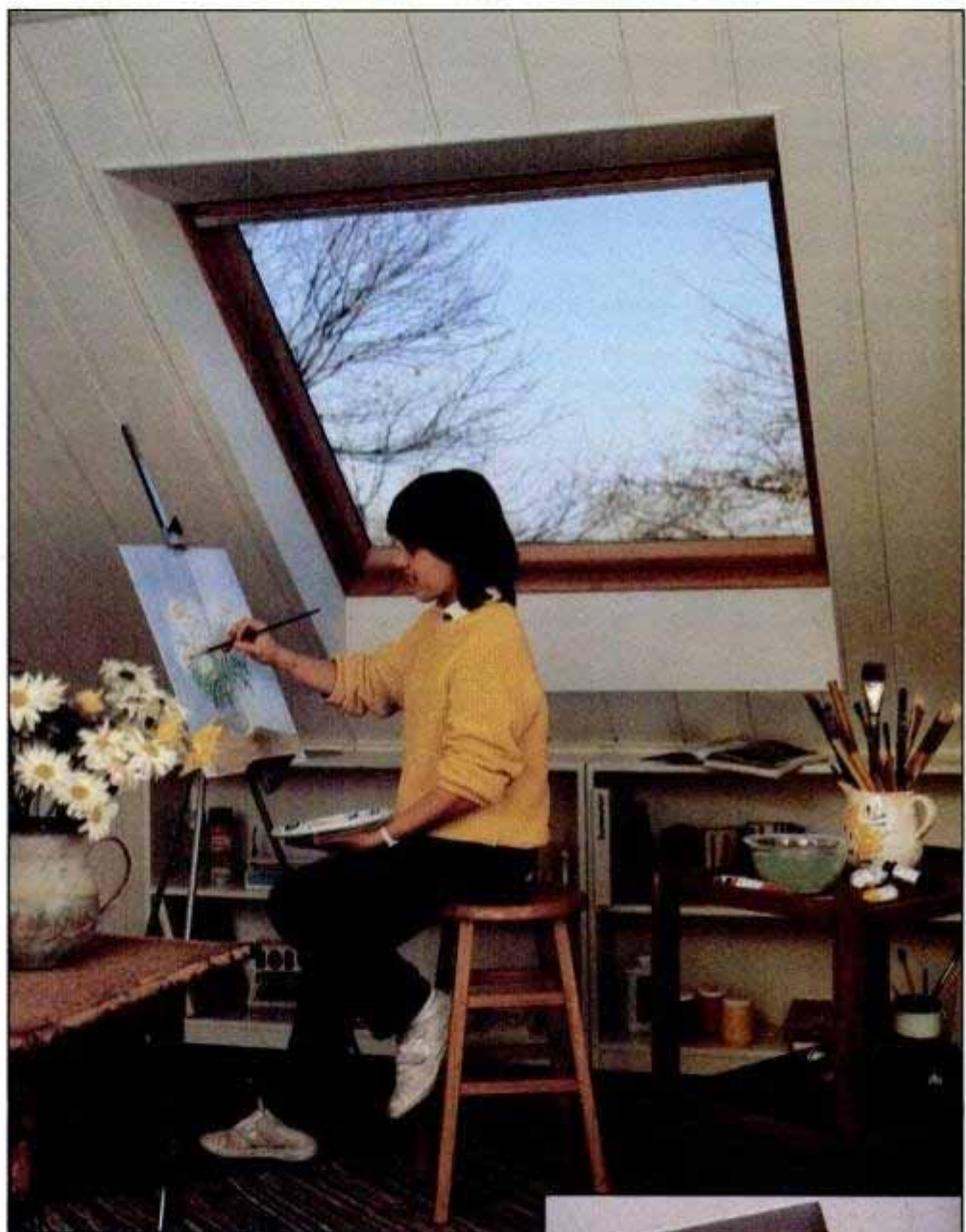
Here's a step-by-step guide to installing roof, casement and double-hung windows.

BY STEVEN WILLSON,
 Home And Shop Editor,
 AND JOSEPH TRUINI,
 Shop And Tools Editor

Replacing an old window with a new one or adding a new window where there wasn't one before are two of the most popular home remodeling jobs. In the first case, you can often boost your home's energy efficiency—and in the process lower your heating bills. In the second case, you can transform a poorly lit room into one much more pleasant for living and working.

In most cases, window installation is the kind of job that a homeowner will "contract out" because the task seems too imposing. Actually, it's very straightforward and well within the abilities of those who are willing to install new roof shingles and siding, fix-up a front porch or even build an exterior deck on the back of their house.

Following are step-by-step instructions for installing an operable roof window, a standard two-pane casement window and the ever-popular double-hung window. The roof window and double-hung units shown here were new installations; the casement was a replacement job. But all three can be installed either way, depending on your requirements.



Made of wood and completely flashed with aluminum, the Velux Model GGL-8 roof window (above) can transform a poorly lit attic room into a desirable work area. Sash operates by pulling handle latch (right).

Roof window model No. GGL-8 from Velux-America Inc., Box 3268, Greenwood, S.C. 29648; photos by George Ancona. Perma-Shield casement window and Narroline double-hung window from Andersen Corp., Bayport, Minn. 55003; photos by Carl Weese.



NEW WINDOWS

Roof window

To start with, remember that a roof window is not what is commonly called a "skylight." Although both are installed in similar places and both do let in a great deal of extra light, the roof window has an operable sash instead of fixed glazing like a skylight. This permits the roof window to act as a ventilator in the summer, especially when installed in attic rooms. The model shown here is Velux's GGL-8. It's 52 $\frac{3}{4}$ x 55 in. and costs about \$510, with flashing. Optional features include screens, blinds, awnings and an electric opener.

Begin by determining where you want the window to be. The manufacturer recommends that this window be placed low enough to afford a good view when seated. But other positions are just as viable depending on the structure of your house and privacy considerations. The best way to choose the position is to cut out a section of cardboard to match the window you want to buy and hold it against the ceiling in various places until you are satisfied. Then, trace the cardboard shape on the ceiling and remove the ceiling to expose the rafter cavities. The ceiling here was covered with painted knotty pine boards that we carefully removed to use later.

Once a few rafters are exposed, you

may want to alter the position of the window slightly to save cutting a rafter or two, depending on the width of your window.

Next, determine how you want to trim the window after it's installed, because this will dictate where you must place the window header and rough sill. We chose what the manufacturer called a "horizontal soffit lining with a vertical sill lining." The results are shown clearly in the photos on page 109. This arrangement does yield the greatest light penetration, but the window can also be trimmed so the jambs are perpendicular to the sash on all sides.

Next, locate the centerpoint of the rough opening and bore a hole through the roof at this point. Push a wood dowel or piece of scrap wood into this hole to act as a reference point for measuring the opening outside.

Move to the outside and install the roof brackets and plank as shown. These brackets—and the reciprocating saw used for cutting the rafters—are common rental items; for two days the cost for both brackets and saw was less than \$30. Nail the top of these brackets directly to the roof underneath a shingle tab to avoid damaging the roof. When the brackets are removed, it's a good idea to fill the holes with a few dabs of plastic roof cement

and press the tabs back down into it.

Once the brackets and plank are installed, lay out the rough window opening on the roof. Measure from the dowel centerpoint and draw the rectangle using a framing square and chalkline so the outline shows up well on the roofing. Also, measure from the eaves and ridge to the corners of the rectangle to make sure the top and bottom of the opening will be parallel to the ridge and the eaves. It is extremely important that the opening be square and to the exact size given in the manufacturer's instructions.

Next, remove the shingles from the interior of the outline and put them aside for filling in later. Then, make the cuts as shown using a circular saw with a carbide blade set to a depth that just cuts through the sheathing. Remove the boards or plywood from the cut and immediately remove all nails in both the sheathing and the rafters as a safety precaution.

Now, go inside and frame a wall section to use as a temporary brace when cutting out the rafters. Use 2 x 4 stock, with studs on 16-in. centers, and drive the wall into place underneath the ceiling just above the opening you plan to cut. If this wall fits snugly, you don't have to nail it into the floor or ceiling.

Begin marking the rafters to be cut



Choose window location inside room, then remove ceiling—in this case, pine boards—to expose rafter cavities. Measure across rafters to relocate window position.



Bore hole through roof at centerpoint of desired window position. Then, slide dowel or piece of scrap wood into hole to act as measuring reference point on top of roof.



Position roof brackets below area to be cut using dowel as reference. Attach by lifting up shingle tabs and nailing directly to roof. Then, lay sturdy plank across brackets.



Hook tape on dowel to locate window, then draw rectangle on roof. Use a framing square for accuracy and check measurements from corners to eaves and ridge.



Remove shingles from interior of rectangle, then cut through roof sheathing using carbide blade in circular saw. Set blade depth so cut is just below bottom of sheathing.



Pry off sheathing boards—or plywood sections, depending on roof—using flat bar or wrecking bar. Be sure to remove all nails from boards and rafters before proceeding.

When you
consider what it
comes with,
you'll be surprised
at what it
goes for.



Consider front-wheel drive, rack and pinion steering, full carpeting, door glass defrosters, steel-belted radial tires, overtaking headlight flasher, power-assisted self-adjusting front disc brakes, trip odometer, torsion bar front suspension, trailing link rear suspension with nitrogen gas-filled shock absorbers, front air dam, remote-control outside mirror, a peppy 1342cc

engine, a coin box, day/night rearview mirror, reclining front bucket seats with adjustable headrests and opening rear quarter windows.

One final consideration: \$5,399.*

HONDA

The Civic Hatchback

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NEW WINDOWS

by establishing a plumb line on the surface of the rafters that form the corners of the opening. Then establish the sill and header positions, relative to these lines, following the maker's instructions. Make the cuts, starting at the sill end followed by the header end. Install the double 2x6 header and



Build a temporary bracing wall using 2 x 4 stock, then drive it under ceiling above rafters that will be cut. If fit is tight, wall does not have to be nailed in place.

sill using 16d common nails.

Complete the rough opening by installing the short rafter—or rafters—between the header and sill so they align with the edge of the cut sheathing above. Check for precise square before nailing these in place.

Next, remove the sash from the window frame following the manufacturer's instructions. Pay particular attention to how the sash is removed because reinstalling it later—at least on this window—can be tricky. Then, mount the frame into the opening. On this unit, L-shaped steel brackets are mounted on the frame sides first, and then the frame is screwed directly to the roof as shown. Because this roof



Place level against edge of sheathing and draw plumb line across surface of rafter. Do the same on rafter at other side of opening, then snap chalkline between both points.

had two layers of shingles in place, we removed the new ones about 18 in. around the opening and installed the brackets on top of the old shingles. This maintained the proper projection of the frame above the roof so the flashing would fit right.

Next, cover the sides of the frame with roofing felt as shown, then flash the unit according to the instructions. This unit came with aluminum step flashing that was alternated with every shingle as we moved up the roof. This unit also has an aluminum cap piece that covers all the jambs and the step flashing below. After the frame is in place, install the sash from below, then trim the interior.



Locate inside surface of window header, then measure up 3 in. along rafter and make parallel mark, perpendicular to rafter edge. Cut this line using reciprocating saw.



Window header is made of two 2 x 6s nailed into ends of cut rafters and toe nailed into sides of uncut rafters. Nail first 2 x 6 in place, then nail second one into first.



Rough window sill is framed like header above with doubled-up 2 x 6s. Nail first 2 x 6 into ends of cut rafters and sides of uncut rafters. Then, nail second into first.



Toe nail a short rafter between the header and sill, so its bottom edge aligns flush with both. The rafter's inside surface should fall just below edge of cut sheathing.



Remove sash from frame, then attach L-shaped hanging brackets to frame sides. Lift frame onto roof, center in opening, then screw brackets into roof sheathing.



Surround frame with overlapping pieces of roofing felt. Start at bottom, followed by sides and top. Curl up felt against frame and keep nails 8 in. from opening.



Use old shingles to fill in roofing around frame. Start at bottom and work up, alternating shingles with L-shaped step-flashing to make window weatherproof.

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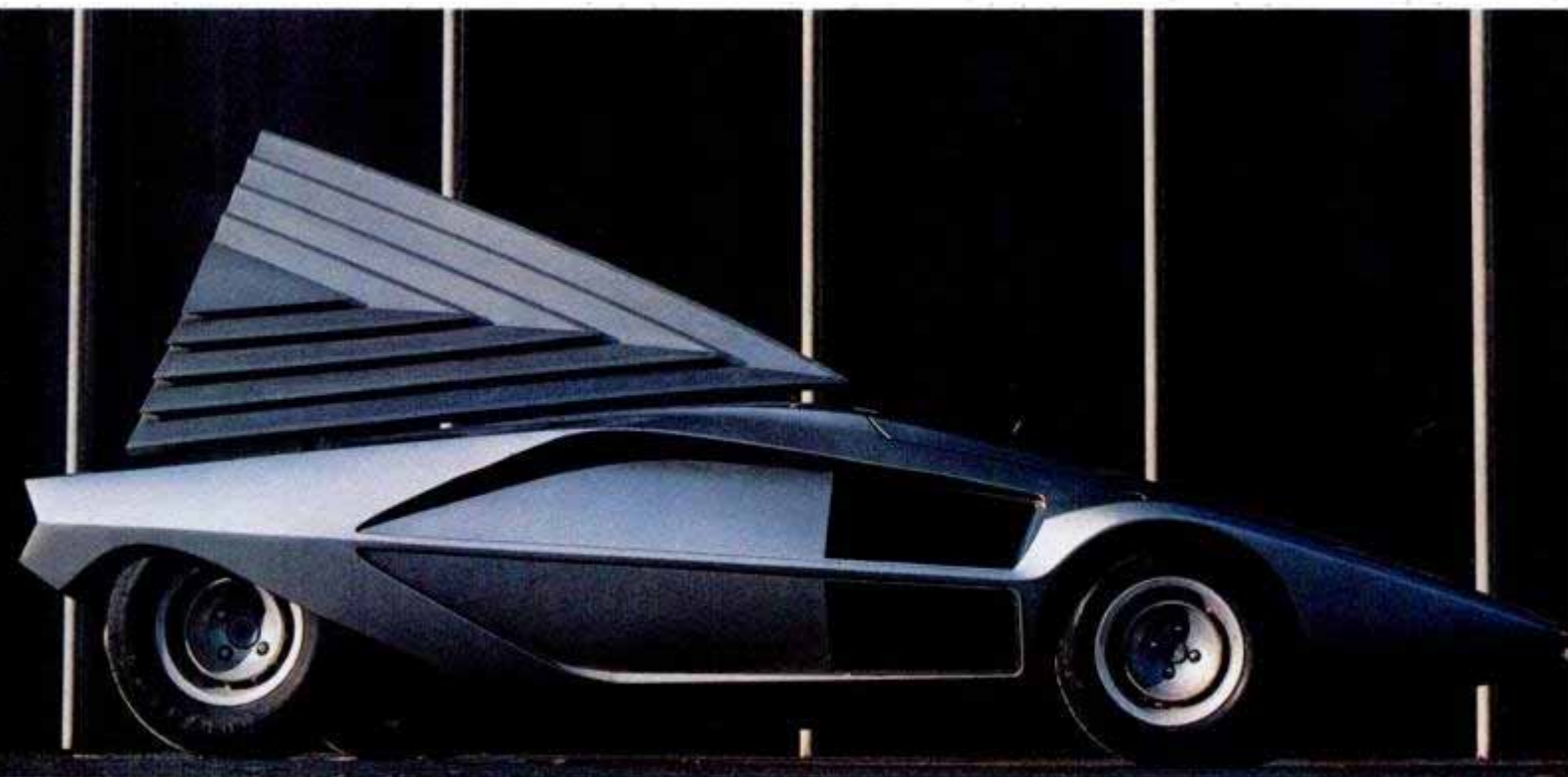
A plug that will perform equally well in your car.

The Autolite *copper* spark plug.

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IF AUTOLITE'S ON IT, THERE'S COPPER IN IT.



 **ALLIED** Automotive

NEW WINDOWS

Casement window

The most effective way to deal with old, drafty windows is to simply replace them. There's no better long-term solution and windows are available in a wide variety of styles and sizes which make replacement straightforward.

The basic steps in replacing a window are: First, determine the rough opening of the old window. If necessary, remove the window's interior trim molding to measure the opening. Next, order a replacement window that is equal to or slightly smaller than the old

window. Making the opening slightly smaller is much easier than enlarging it to accommodate an oversized window. Then, remove the old window, modify the opening, if necessary, and install the new window. And remember, there's no substitute for quality, so purchase the best window you can afford. Any money saved with low-quality windows will probably be lost to higher heating bills. Always be sure that you check the local building code before starting any construction.

To illustrate the procedures involved,



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After loosening the old window from the inside, move outside and pull the unit from the house using a pry bar. This casement window was nailed through the exterior casing.



Pry out the window top first. Grip window frame and pull the unit from house. Keep window closed to make the unit more rigid.



If necessary, frame-in the rough opening to accept the new window. Nail stock to the header first, then to sides, as shown.

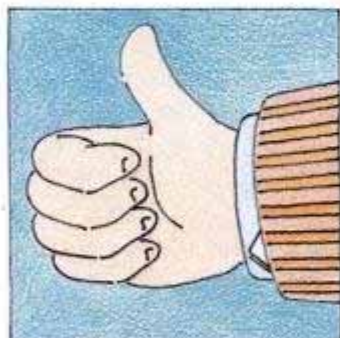


Nail stock to the house to bring the sheathing flush with the opening. Use material that is the same thickness as the sheathing.



Staple 15-pound roofing felt around the rough opening before installation to deter air and water penetration.

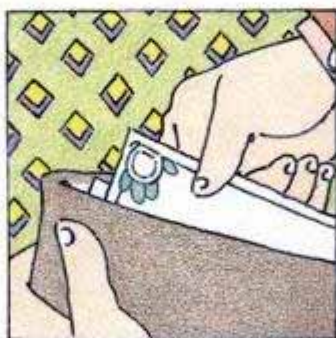
6 reasons why an Armstrong floor is the perfect choice for the do-it-yourselfer.



1

Armstrong Quality

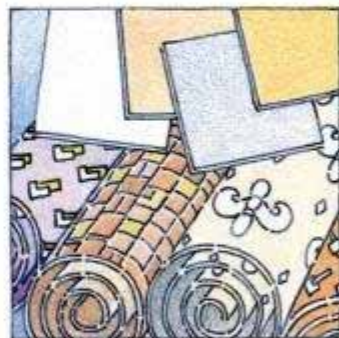
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2

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Even our best do-it-yourself floors are surprisingly affordable. And, of course, installing them yourself can save as much as \$4 per square yard compared to professional installation.



3

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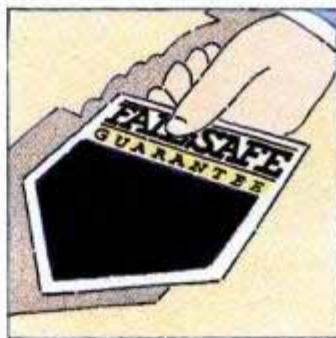
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NEW WINDOWS

we replaced a 28-year-old single-pane metal casement window with a new vinyl-clad wood casement window equipped with double-pane insulating glass. The left side, as viewed from the outside, opens for ventilation and cleaning. Casement windows also come with righthand vents and both left- and righthand vents in one unit.

The first step in taking out the old window is to remove the exterior house siding or shingles from around the window. Take off only as much material as is necessary to uncover the window trim. Using a hammer and a wood block carefully pound along the *inside* window jamb to loosen the unit from the house. Now move outside and use a pry bar to pull the window free.

Next, modify the rough opening dimensions, if necessary, to accept the new window. For the installation shown, the opening width and height had to be decreased slightly to yield the rough opening that was recommended by the manufacturer.

Now, nail wood strips of the same thickness as the sheathing around the face of the opening. Cut the strips flush with the inside edge of the rough opening. Next, staple wide strips of 15-pound roofing felt around the exterior of the opening. The felt helps prevent air and water infiltration.

Now place the new window in the



Place the new window into the rough opening, bottom first. Keep pressure against the sill while positioning the top.



Plumb the window, then nail through the holes in the vinyl anchoring flange. Use large-head galvanized or aluminum nails.

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opening from the outside. While you hold the window, have a helper check the window for plumb. Add wood shims where they are necessary. Then, nail through the prebored holes in the window's vinyl anchoring flange using large-head galvanized or aluminum nails. Be careful not to strike the vinyl flange or it may crack, especially during very cold weather.

Next, replace the house siding so that it overlaps the vinyl anchoring flange and then caulk around the window. Now you should move inside to finish the window interior.

Since wall thicknesses vary, most windows come with extension jambs that allow you to build out the window flush to the finished interior wall. Extension jambs are available in a variety of widths to accommodate most walls. If it is necessary, rip the extension jambs to fit flush to the wall. Then, nail the extension jambs in place and fill the spaces around the window with fiberglass insulation. Be sure you don't pack the insulation in too tightly or its insulating value will be greatly reduced. Now, install casing molding and finish the interior woodwork as desired.



Fit the extension jambs into the window's prerouted grooves to build out the window jambs flush to the interior wall.

Double-hung window

This installation shows how to cut a new vinyl-clad wood double-hung window into a typical wood-frame house. The installation techniques shown will differ slightly for other types of construction.

For this installation, we made our rough opening cuts from outside because the wood shingles were easy to remove and replace. If you'd rather cut from the inside—and repair the interior wall later—follow the approach that is shown with our roof window installation beginning on page 109.

Begin by marking the window's rough opening on the interior wall. Maintain a uniform header height with existing windows and doors. Next, transfer the rough opening position to the outside wall. Use a long drill bit, known as an electrician's bit, to bore through the wall at each corner of the opening outline.

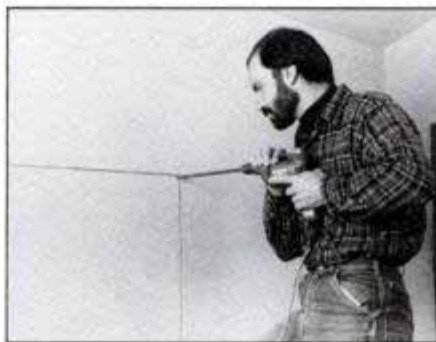
Be certain to keep the drill bit perpendicular as it passes through the outside wall. Now, move outside to cut the window's rough opening.

First, remove all the siding or shingles located in the area bordered by the four holes. Next, snap chalklines from hole to hole to outline the rough opening. Then, using the chalklines as guides, cut out the sheathing with a portable circular saw. Set the saw blade just deep enough to cut through the sheathing. Since the starting point of the cut is contained within the panel, carefully execute a plunge cut. Now pull the nails from the sheathing using a cat's paw and remove the panel to reveal the wall studs. Take down all the insulation that is within the rough opening cutout.

The next step is to cut out the studs in the opening. In order to saw all the way through the 3½-in.-wide studs, two cuts must be made: first, a plunge cut with a circular saw, then a follow-up cut with a reciprocating saw to cut the last ½ to ¾ in. of wood that a standard size circular saw is unable to reach. The

follow-up cut could also be made with a handsaw. Be careful that you do not saw through the interior wall during the follow-up cuts.

Make the first cuts into the studs 1½ in. below the sill of the rough opening. This will permit installing a 2×4 sill plate (actual dimension: 1½ × 3½ in.). Then, make the second set of cuts 5½ in. above the top of the rough opening. This will provide space for installing a double header made with 2×6s (actual dimension: 1½ × 5½ in.). Now move inside to cut out the interior wall.



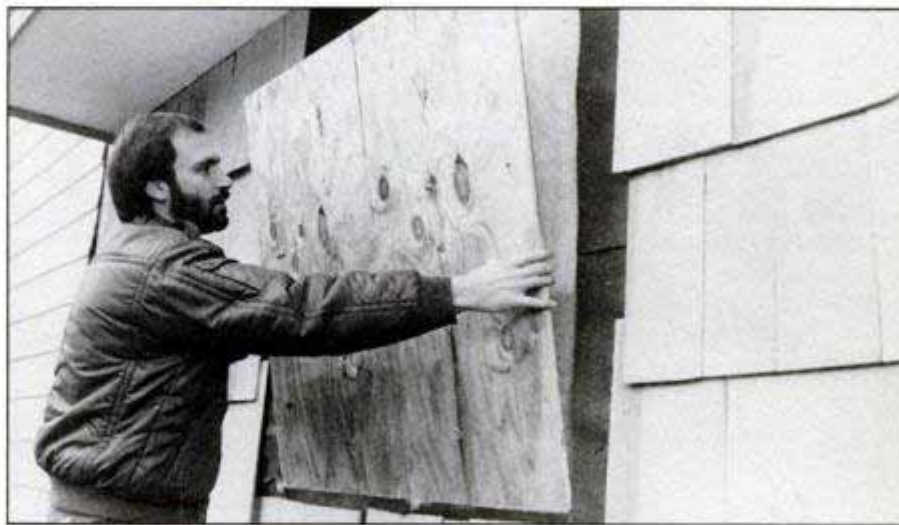
Transfer the rough opening location to the outside wall by boring through the wall with a long electrician's drill bit.

Use the rough opening lines drawn on the wall as cutting lines. Saw through the plasterboard with a drywall saw or compass saw, as shown. If the wall is paneled, use a sabre or circular saw. Next, break away all the plasterboard from within the rough opening. Then, use a hammer to tap the cutoff studs free from the wall. At this point, the rough opening will be ready for framing in.

Cut a 2×4 sill plate to fit in the bottom of the rough opening. The sill plate is nailed to the studs remaining in



Snap chalklines from hole to hole to outline the window's rough opening. Then, use a circular saw to cut out the sheathing.



After making the saw cuts that will form the rough opening, pull out the nails and remove the sheathing. Then, remove all the insulation that is found between the wall studs.

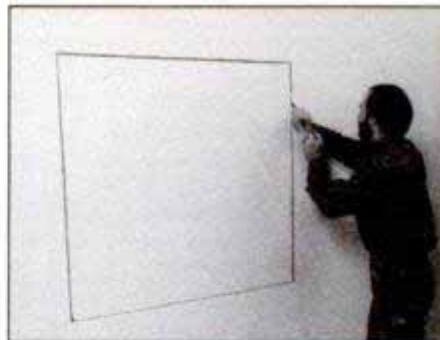
NEW WINDOWS



Measure 1 1/2 in. below the opening and make a deep plunge cut at each stud to establish the position of the sill plate.



Since a circular saw can't cut through the stud entirely, use a reciprocating saw to cut the remaining 1/2 to 3/4 in. of wood.



After sawing through the studs at the sill and header locations, move inside and cut out the plasterboard using a compass saw.

What's the only thing that cuts better than a Husqvarna saw? A Husqvarna dealer. Because through May 31, 1985, your participating Husqvarna dealer's cutting up to \$30* off the price of selected new semi-pro saws. And to put an even better edge on the deal, he's offering three free saw chain sharpenings. Just clip out and bring in the coupon below.

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the wall. These short studs, located below and above the window, are called cripple studs. The cripple studs remaining in the wall will support the middle of the sill plate, but two more cripple studs must be added to support the sill at each end.

Slip the two additional cripple studs inside the wall, one to the right of the opening, the other to the left, and nail them to the nearest full-length wall stud. If the stud is too far back to nail with a hammer, screw the sill directly to the wall stud using an automatic-return ratchet screwdriver or an electric drill fitted with an extension bit holding a screwdriver tip.

If the above techniques fail, then you'll have to cut away the plasterboard to expose the wall interior. *Note:* When the window location is not critical, it's best to position the rough opening where the wall studs are located to best serve the installation. Finally, nail the sill plate to the cripple studs.

Now assemble the double header for installation above the window. We made the header with two 2x6s nailed with a 1/2 in. plywood spacer between them. The spacer is needed to build up the header thickness to equal the 2x4 wall stud width of 3 1/2 in.

When installing a large window, in a wall supporting a floor above it, build the header using 2x8s or 2x10s. Also, it'll be necessary to install a temporary bracing wall as shown in the roof window installation, to support the ceiling until the opening is framed in. If you're unsure of the structural requirements, check with a local building inspector. Slip the header inside the wall above the rough opening and toe nail it into the full studs on either end. Then, cut jack studs to fit between the header and sill plate. Nail the jack studs to the nearest wall stud. Toe nail two more jack studs—into the sill and header—flush to the side of the rough opening to provide solid support for nailing the window and interior casing molding. These two additional studs are needed only if the first two jack studs are set back away from the rough opening

edge. Now nail the sheathing and plasterboard to the framing around the opening.

Next, install the window from the outside. Check the window for plumb and then secure the unit by nailing through the vinyl anchoring flange with large-head galvanized or aluminum nails.

After that, you should replace the house siding or shingles and caulk around the window.

The next step is to move inside and fill the spaces around the window jambs with fiberglass insulation. Again, be sure you don't pack the insulation in too tightly or its insulating value will be greatly reduced.

Now, trim the window interior with casing molding and finish the woodwork as desired. **PM**



Break away the plasterboard and hammer the studs free. If you remove more than two studs, be sure that you brace the ceiling.



Drive the window header into the wall above the rough opening. Build the header from two 2x6s with a 1/2-in. spacer between.



Install the window from the outside and secure it by nailing through the vinyl anchoring flange. Then, you can replace the shingles.

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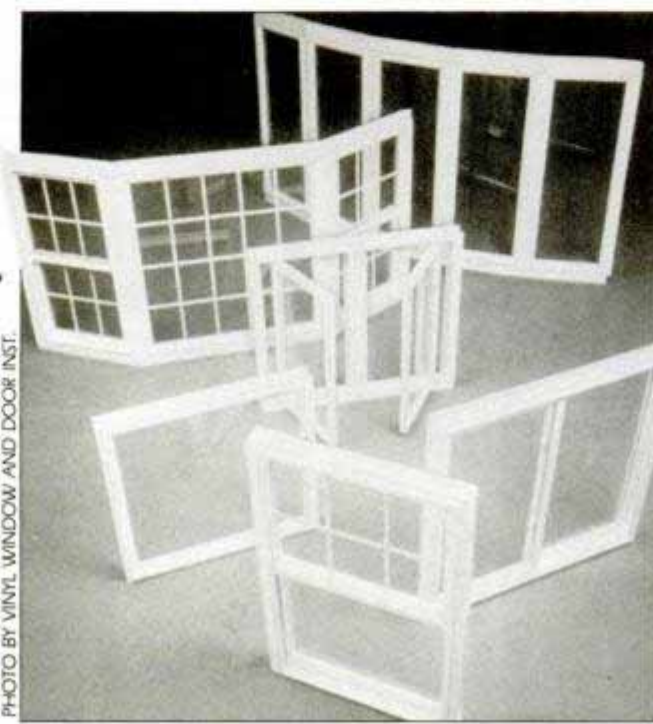
WHAT'S NEW ABOUT ALL-VINYL WINDOWS

These windows are durable, they work well and they'll never have to be painted.

BY JOHN H. INGERSOLL

Think of vinyl windows as one step closer to the maintenance-free house. You won't ever have to paint the frame or sash, or worry about broken weight cords. You'll have no worries about pitting, rusting or rotting, even if your house is close to ocean surf. You'll have to replace a broken pane of glass every now and then, but that job goes a lot faster in a vinyl sash than in a wood sash.

How long do they last? "A lifetime," say industry executives modestly. Well, it's true the rate of deterioration for rigid polyvinyl chloride (PVC), the plastic used, is so slow you would be hard put to spy damage to a window left out in all kinds of weather for 20 years. Even manufacturers of aluminum win-



All-vinyl windows now are available in all the configurations offered by wood windows. Including bay, angled bay, casement, awning, slider and double-hung models shown.

dows concede that a vinyl window might last as long as the house it serves. In fact, many aluminum window manufacturers have been producing vinyl windows as alternates for

their traditional window lines.

Everything darkens or fades eventually under the brutal ultraviolet rays of the sun. I asked vinyl window makers, "Doesn't white vinyl drift to off-white or yellow after years in the sun?" Bert Sayer of Thermal Profiles admitted that the color will change. He said, "After 50 years outside, a vinyl frame might show some change if compared to the original color." But none have been around that long. The vinyl window wasn't invented until 1954—in West Germany—and didn't appear in the United States as a prime window until 1968. I could not find a single manufacturer who had a serious complaint about color change. "The change is acceptable," says Sayer.

Vinyl window salespeople tend to promote energy saving as a big plus, but you should take this with a grain of salt.

This new industry likes to match the U-values of raw vinyl (1.3) with those of wood (1.2) and raw aluminum (1416.0). The figures for wood and aluminum are

How To Pick Quality Vinyl Windows

Some toy planes, tractors, tennis rackets or any other manufactured items are good, and some are better. The same is true of vinyl windows. Here are six ways to tell the difference:

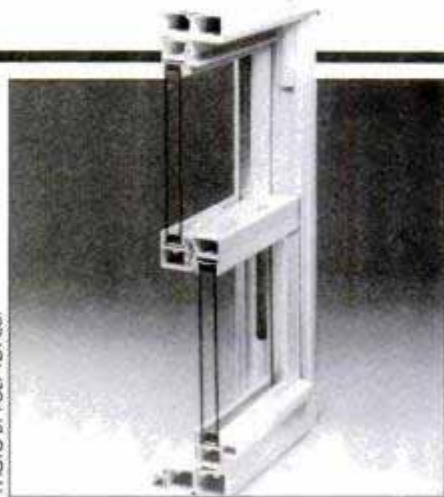
- 1 Frames with double-wall, hollow-core profiles are stronger by the very nature of the shape than single-wall frames. Get a salesperson to show you a cutaway of the frame, as shown (far right).
- 2 Buy the window that operates the way you want. Some contain sashes that tilt out for easy cleaning. Others feature side-loading sashes that must be removed. A few provide neither convenience.
- 3 Look for welded mainframe corners. A plastic weld melts a seam into a solid con-

nection, which is easy to distinguish from a visible seam.

4 Sash frames should not be welded. If they were, replacing broken glass would prove difficult. Also keep in mind that butt corners on sash frames tend to stand up better than mitered corners.

5 A mechanical interlock on both sashes of a double-hung window—formed by two L-shaped flanges on the meeting rails—provides a better seal for your home than weatherstripping alone.

6 Ask to see literature on air and water infiltration test results as directed by ASTM D-4099-82 specifications. Any quality windows will either meet or surpass these specifications.



The best vinyl double-hung windows have sashes that meet with a mechanical joint, and double-wall, hollow-core frames.

The important part of your car isn't how fast it goes.

It's how well it stops.

Brakes need power. Horsepower. As Mr. Goodwrench explains, "If a car is going 55 miles per hour, it takes a capacity of over 400 horsepower to hold back all that kinetic energy and stop the car in about three seconds.

"That means your brakes have to be more powerful than your engine. Because even a 'hot' car takes about seven seconds to get to 55 mph.

"But to stay powerful, brakes need your attention. You see, brakes wear.

"That's because brakes work by causing friction against the brake drum or disc on the wheel. And that rubbing causes a natural process of wearing away."



So it's a good idea to see Mr. Goodwrench and have the brakes of your GM car inspected at the intervals recommended in your owner's

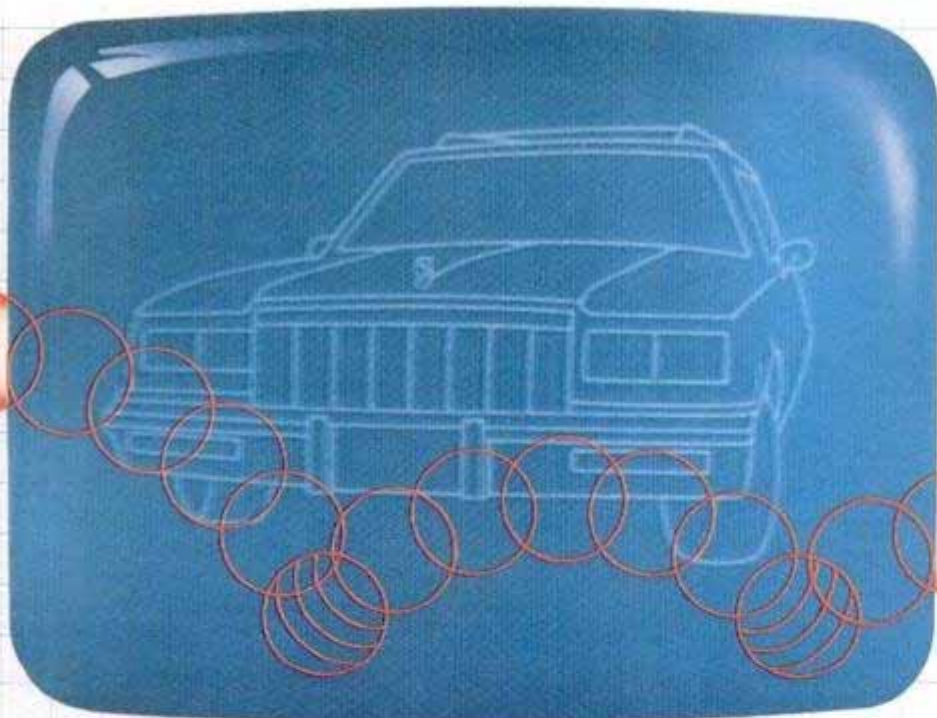
manual. And if your brakes need maintenance, Mr. Goodwrench has the right training—GM training. And the right parts—his GM Goodwrench replacement brakes.

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(You can get the same one for considerably less)

Even we were a little surprised. All we did was build the best radar detector we knew how. We shipped our first ESCORT in 1978, and since then we've shipped over 600,000. Along the way the ESCORT has earned quite a reputation—among its owners, and also in several automotive magazines.

Credentials

Over the past five years, *Car and Driver* magazine has performed four radar detector comparison tests. Escort has been rated number one in each. Their most recent test concluded "The Escort radar detector is clearly the leader in the field in value, customer service, and performance..." We think that's quite an endorsement.

Our Responsibility

One of the reasons for our reputation is our attention to detail. If we don't feel we can do something very well, we simply won't do it. That's why we sell Escorts direct from the factory to you. Not only can we assure the quality of the ESCORT, but we can also make sure that the salesperson you speak to is knowledgeable. And if an ESCORT ever needs service, it will be done quickly. And it will be done right.

50 States Only

And that's the reason we don't presently sell ESCORTs outside of the United States. Even in the countries that use identical radar (Japan and Australia, to name two) we know that we couldn't provide the kind of customer service that ESCORT owners expect. So we pass up the additional sales rather than risk our reputation.

"Dear Sir..."

So we'll admit we were surprised when a letter from one of our customers included an advertisement from a Japanese automotive magazine. The ad pictured an ESCORT, and the price was 158,000 yen. Our customer was kind enough to convert that to U.S. dollars. Using that day's rate of exchange, an American-made ESCORT was worth \$714.93 in Japan. Further translation revealed the phrase "The real thing is here!" and warned against imitations.



This 1/2 page ad was a total surprise.

Econ 101

Needless to say, we were flattered. We knew that ESCORT had an impressive reputation, but we never expected to see it "bootlegged" into other countries and sold at such a premium. But the laws of supply and demand are not so easy to ignore. When there is a strong need for a product, there is an equally strong incentive for an enterprising capitalist to fill that need. And apparently, that's just what happened.

Easy Access

Of course, it's easy for you to get an ESCORT—just call us toll-free or write us at the address below. The price is the same as it's been for the last five years: \$245. Quite a deal for what the Japanese must think is the best radar detector in the world.

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Take the first 30 days with ESCORT as a test. If you're not completely satisfied return it for a full refund. You can't lose.

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ALL-VINYL WINDOWS

no surprise to anyone who has heated water in an aluminum pan, or picked up a hot skillet by its wooden handle. To be fair, you must pit installed windows against one another. For data on total window performance, I called Scott Werner, director of testing at Architectural Testing Laboratories in York, Pa. Here are his figures for aluminum and wood windows:

WINDOW DATA

Type	C-Value
Single-glazed aluminum window without a thermal break	1.14
Double-glazed aluminum window without a thermal break	0.77
Double-glazed aluminum window with thermal break	0.64
Single-glazed wood window	0.92
Double glazed wood window	0.55

Note: C-value refers to the rate of thermal conductance through a material, concerning itself only with the material. U-values are numbers for thermal transmission, a subtle difference that includes the values of air layers on either side of the material sample. R-values, most commonly mentioned on insulation packaging, are the result of $1/U$, or the thermal resistance of a material and its air layers.

Not enough testing has been completed on vinyl windows, as yet, according to Werner.

However, he said the values typically are close to those exhibited by wood windows. You'll notice the differences are not extraordinary. As Werner points out, the glass, which accounts for most of any window, is more energy critical than sash and frame.

In extremely cold weather, thin panels of vinyl siding have been known to crack when hit by a branch or football. What about vinyl window frames? "There are three reasons why that won't happen," says Ralph Vasami of Fiberlux, the first company to intro-

duce a vinyl prime window in the United States. Vasami is also chairman of the newly formed Vinyl Window and Door Institute in New York. "First, the wall thickness of a vinyl window frame is greater than that for siding. Second, a window frame is less exposed to weather than siding. The temperature of the outside frame face is influenced to some extent by the room temperature impinging on the inside face. And third, most of the material going into vinyl windows today is high-impact-modified PVC—in short, tougher."

Standard specifications

As a sidelight, in 1982, the American Society for Testing and Materials (ASTM) published standard specifications for PVC prime windows, labeled D 4099-82. In some ways, the ASTM specs grace the vinyl window industry with recognition, in addition to establishing performance standards.

Yet, there are people who knock vinyl—in any form. One of their rallying cries is "Fumes from burning vinyl will kill you!" Here are the facts:

First, PVC does not burn unless exposed to a continuous flame (a blowtorch or total house fire). When exposed, vinyl will char not burn. Take away the flame and the charring stops.

Second, fumes from charring vinyl include hydrogen chloride (HCl), but not at toxic levels, carbon dioxide (CO₂) and carbon monoxide (CO). Odorless CO can indeed kill. It's the same CO that comes from burning wool, cotton, wallpaper, wood flooring, wood framing, paint, and hundreds of other ordinary household materials. Just to set the record straight, wood also throws off toxic, corrosive and carcinogenic chemicals, such as formaldehyde, benzene and acrolein.

As Juliette Lang Cahn, the director of the Vinyl Window and Door Insti-

tute, sums it up, "A massive house fire producing a toxic atmosphere beyond the tolerance of human life is necessary to char enough vinyl to constitute life-threatening conditions. Vinyl is a secondary, not a primary, hazard in a house fire." All in all, vinyl windows are worth your attention. Now, what about the bottom line, cost?

Where vinyl windows are sold at retail the prices are attractive. From a big lumberyard outside Hartford, Conn., prices for a 3 x 5-ft. double-hung, double-glazed prime window with screen stacked up like this:

Window	Cost
PVC (vinyl) window	\$105.30
Aluminum window	115.43
All-wood window	124.42
Vinyl-clad wood window	174.77

The trouble is, although vinyl windows in some styles are sold through Sears and many of the big building material supply outlets, this relatively new product is by no means available everywhere. For example, when I called eight yards in the Connecticut area only two offered vinyl windows for sale, and three drew a blank when asked about the units.

Most likely, you will get an ad from—or hear about—window dealers in your area who want to sell and install vinyl replacement windows. If you don't want to do the job yourself, it's worth talking to one of these contractors. Be sure to check out references and reputation. Then, expect to pay from \$185 to \$300 per window for the job. Some owners have paid over \$400 per unit. "It's whatever the traffic will bear," admitted one industry exec.

Replacement windows are big business today, and worth considering if

(Please turn to page 130)

Pioneer Vinyl-Clad Wood Window

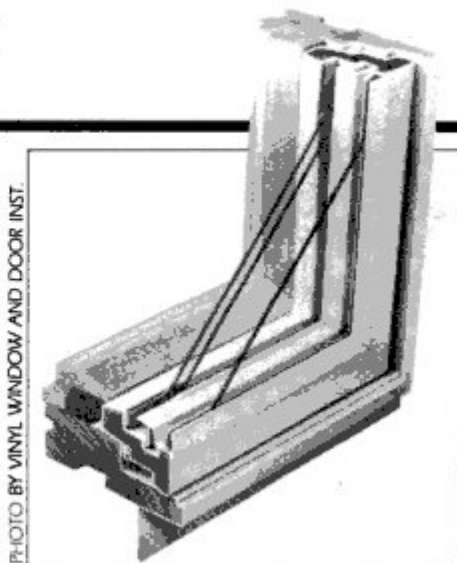
Introduction of Andersen Corp.'s Permashield vinyl-clad wood window in 1966 preceded the first all-vinyl frame window by two years. Andersen's product, produced in white and Terratone (a bronzy brown), remains unique in the field. Its window is the only one with wood members encapsulated in vinyl.

The U-value (see text) of a standard, double-glazed Permashield window is 0.52, and when fitted with new high-performance glass, its U-value is 0.30. The glass, double glazed, has a microscopic metallic coating on the third glass surface, counting from the outside—a coating that's nearly invisible.

Andersen is by no means the only

wood window company employing PVC. John Jambois, a research specialist for Profile Extrusions, Hasting, Minn., a vinyl component maker, estimates that 75 percent of all wood windows employ PVC in some capacity. "Some companies," says Jambois, "are cladding the exterior wood members with vinyl, but not encapsulating the wood, as Andersen does. Others use PVC for jamb liners, sills, built-in weatherstripping or glazing beads. Some are laminating roll-formed aluminum to the outside of wood window frames and sash."

The aim in all cases is to lower maintenance and smooth out the operation of wood windows.



Vinyl-clad windows, like the Andersen model above, are made of wood. Surfaces exposed to weather are encased in vinyl.



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WHY PM READERS NEED MORE HOMEOWNERS' INSURANCE

Those with varied interests and tools often need more insurance coverage.

BY WALTER L. UPDEGRAVE
 Drawings: Howard Lewis

The average homeowner, who limits himself to cutting the grass or raking leaves in the back yard, can probably get by with a standard homeowners insurance policy. But, as a PM reader, you're probably far more active than most people. You may well have a workshop or garage fully equipped with professional quality tools that allow you to take on more jobs around the house—everything from routine home and car maintenance to ambitious home renovation or engine rebuilding projects. More likely than not, you also own high-tech audio or video equipment or a personal computer.

As a result, you need above average insurance protection, particularly in a few key areas. The following checklist, designed for PM readers, can help you review your present coverage, decide if it's adequate and, if not, suggest ways to improve it.

Personal possessions:

Most insurance policies put a limit on how much you can collect for stolen, destroyed or damaged personal property. This limit is a percentage, usually 50 percent, of the coverage on the home itself. So, if your home is insured for \$80,000, the standard policy would cover personal property losses up to \$40,000. That may sound like a lot, but it's not.

"Most people tend to underestimate



Your workshop is only one of the reasons you may need more insurance coverage.

the value of their personal property," says David Hurst of the State Farm Mutual Insurance Co., "especially when you look at what it costs to replace it." For example, a workshop that cost \$5,000 to stock over the past 10 years could cost more than double that to replace today. Add to that the cost of replacing furniture, rugs, clothing, televisions, stereo equipment and major appliances and the 50

percent limit isn't difficult to reach.

Besides this overall limit, most policies also set much smaller limits for specific items. Here are some typical examples: a \$2,000 limit for firearms; \$1,000 for boats and outboard motors, including trailers; \$1,000 for other trailers; \$3,000 for a home computer, if also used for business purposes; \$2,500 for silverware; \$200 for loss of money, gold or silver; and \$1,000 for

HOMEOWNERS' INSURANCE

jewelry, furs, and precious stones. These limits are the *maximum* you collect for each loss. So even if the rifle collection a thief stole cost \$6,000, the most you'd collect is \$2,000.

Better protection: But there are several ways to improve your coverage. One is to increase the overall limit for personal possessions by opting for a higher quality policy. For example, by going from State Farm's basic to its more comprehensive "Homeowners Extra" policy, the personal property limit climbs to 75 percent of total coverage. On an \$80,000 policy that means an overall limit of \$60,000 for personal possessions—a hefty increase from the \$40,000, or 50 percent, limit. You'll pay a higher premium, but the cost is moderate relative to the extra protection.

The limits for specific items can also be raised via an endorsement or floater. An endorsement is an addition to your policy that protects specific property. You could raise the limit for jewelry, say, to \$5,000 or more by adding an endorsement. A floater, so named because it "floats" with the property it insures, provides broad, all-risk protection. A floater on power tools covers them wherever they're used—no matter how far from home—and would also provide protection against such mishaps as dropping or otherwise damaging them. The cost of floaters and endorsements varies directly with the property value.

Some items are better protected under their own separate policies. If you restore antique autos, for instance, an endorsement or floater isn't the answer—a special antique/classic auto policy is. Personal computers may be covered under a homeowners policy or

Know the difference between replacement value and actual cash value coverage for your personal possessions.



a special computer policy, depending on the protection you need.

And certain one-of-a-kind items, such as fine art and collectibles, are often insured for their "stated" or "agreed" value—a figure you and the insurer reach by appraisal or documentation such as a sales receipt. In such cases, an occasional reappraisal makes sense to keep the coverage current with the value of the asset.

Replacement cost coverage: Choosing the amount of coverage isn't enough. You've also got to know the difference between the two methods of reimbursement: actual cash value and replacement value. A quick example shows why. Suppose your stereo system is destroyed in a fire. You bought the system five years ago and it costs \$1,200 to replace today. With replacement value coverage, your in-

urance company would reimburse the cost of replacing that system now—\$1,200 (minus your deductible).

But actual cash value coverage—though still based on what it would cost to replace the system—pays only the depreciated value. If the insurer assumed a stereo has a useful life of 10 years, they'd pay you only half its replacement cost, since your system, now five years old, has theoretically depreciated to half its value. Instead of a \$1,200 settlement, you'd only get \$600. Replacement value coverage costs a bit more, but usually the extra protection makes it worthwhile.

A quick note on deductibles. Most insurance companies offer deductibles ranging from \$100 to \$1,000. In event of a loss, you're responsible up to the amount of the deductible and the insurer covers the rest. You can lower your annual premium by raising your deductible—going from a \$100 to \$500 deductible, for instance. But, in the event of a loss, the insurer will only pay for damages in excess of \$500 instead of \$100. In short, you're taking a \$400 gamble. Before changing, make sure the potential premium savings warrants the extra risk.

Home workshop: Your homeowners policy should cover the tools and supplies you keep in your workshop. Also, the liability coverage in your policy will protect you from problems that could arise if someone working in your shop were injured. But there are two areas concerning workshops that deserve special scrutiny.

If you've set up your shop in the basement, take special care to guard against flood damage. "Homeowner policies do not cover flooding," says State Farm's Hurst. The same usually goes for earthquake and hurricane



Homeowners' insurance is designed for personal, not business, use of your home.

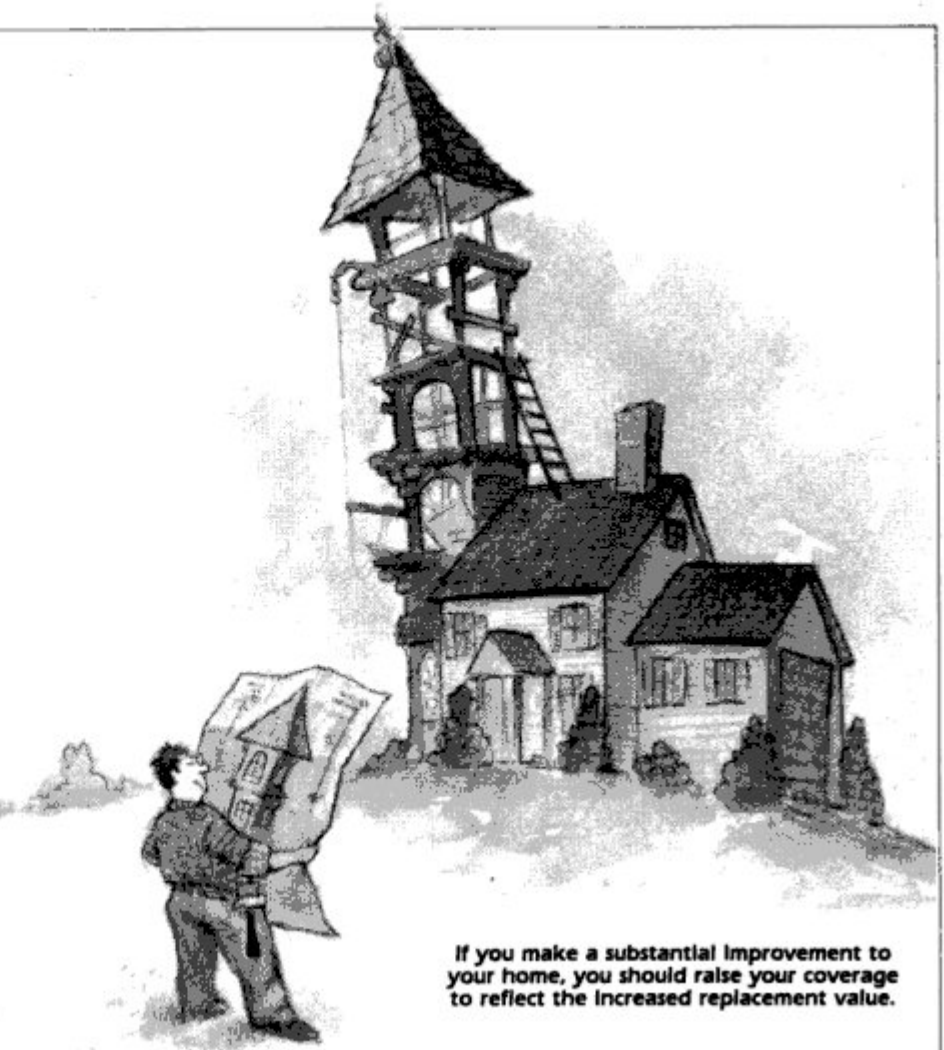
damage. If you live in an area prone to such disasters, check with your agent about special coverage. Private insurers shy away from flood insurance, so you may have to turn to a federal flood insurance policy.

A workshop in a garage or other building that is *not* attached to your home also may need special attention. Standard policies limit the protection for unattached structures to 10 percent of the coverage on the home. So an \$80,000 policy on your home would provide only \$8,000 in coverage for your garage workshop. This \$8,000 limit applies only to the structure; the contents would be insured under the higher limits of the personal possessions portion of your policy. Still, if it would cost you more than this 10 percent restriction—\$8,000 in this case—to rebuild your workshop, you should get coverage consistent with replacement costs.

Business or personal use?: Homeowners insurance is designed to cover the personal, *not* business, use of your home. The difference may be critical since your insurer can refuse to honor a claim that arises out of business activity conducted at home. Sometimes, the line is clearly drawn. Selling on a one-time basis a piece of furniture you made in your workshop wouldn't amount to running a business. Building custom-made furniture for a long list of clients would. But the distinction can get fuzzy. Would writing one or two computer game programs a month constitute a business? How about repairing autos on weekends in your garage?

A general rule, says Mary Zavada of the Insurance Information Institute, a nonprofit agency that offers information on home and auto insurance, would go something like this: If it's done regularly full- or part-time for a profit, then it's most likely a business.

There are two ways to cover business activities at home. One is to add office coverage to your policy for such activities as arts and crafts shops, photo studios and other small business ventures run out of the home. But for a larger business, you'll probably need a commercial policy. There's also the problem of proper insurance for people doing work around your home. Is the liability coverage in your homeowners insurance enough, or is a separate workers' compensation policy required? Again, this is a gray area. Hiring a neighbor's son to mow the lawn occasionally is at one end of the spectrum; keeping a live-in maid is at the other. Somewhere in the middle is the babysitter who comes to your home four times a month.



If you make a substantial improvement to your home, you should raise your coverage to reflect the increased replacement value.

"There are wide variations among states in this area as far as cost and who has to be covered," says Hurst. In California, New Jersey and New Hampshire, he says, homeowners policies include coverage for most domestic help. Other states may require a workers' compensation policy depending on the number of hours worked a week and the length of employment. Many policies, says Hurst, make allowances for a "casual" employee—one who is not hired on a regular basis. But there are borderline cases and, to be on the safe side, you should consult your insurance agent.

Home improvements: If you make a substantial improvement to your home—such as adding or renovating a room, or converting an unfinished basement to a family room—chances are your coverage should be raised to reflect the increased replacement value of your home. According to Hurst, the agent would account for the improvement either by reappraising the home—particularly in cases where extra rooms or more square footage have been added—or, possibly, by increasing your coverage to reflect the cost of materials and labor used.

While many of today's policies have

an automatic inflation index to keep their coverage in pace with inflation, you shouldn't rely on this feature to cover home improvements. Sums up Zavada, "Whenever you are doing anything that's major—and I consider \$1,000 or more major—you really should check with your agent."

Hard-to-replace homes: A home whose replacement value is well above its market value may require a special policy designed for older and hard-to-replace homes. A good example is a vintage Victorian with original panelling, intricately carved staircases and authentic gingerbread woodwork. To duplicate such workmanship and materials today would cost a small fortune—almost certainly more than the house would fetch on the market. But an older home policy allows you to insure the home at a lower replacement value. In the event of damage, the insurer will pay for returning the home to serviceable condition, but not with materials originally used. The idea, explains Zavada, is that "your prime interest is in having a house, not necessarily replicating every detail."

This type of policy may also be the right choice for a home whose market

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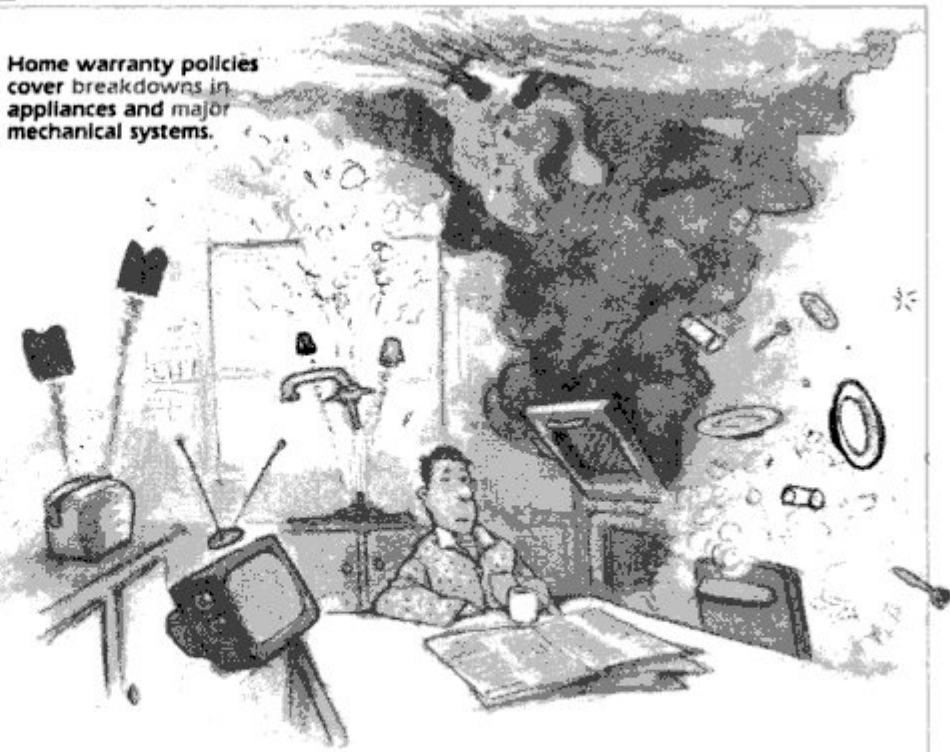
value is much lower than replacement value because the neighborhood has gone downhill. In fact, an older home policy may be the only choice, says Hurst, since insurance companies are wary of insuring homes for more than their market value. "That presents what we call a moral risk," says Hurst. Loosely translated, they are afraid you'll burn down the house for the insurance settlement.

Home warranties: Besides insurance, there's another type of coverage available for the home: home warranty protection. How do the two coverages differ? "Regular homeowners insurance covers you against fire, theft and other types of damage," says Michelle Kight of Ticor Home Warranty in Los Angeles. "A home warranty plan covers breakdowns due to normal wear and tear." Although such warranty protection is available from companies around the country, Kight claims that "a lot of people don't even know they can get it."

Most warranty programs cover breakdowns in the plumbing, heating, cooling and electrical system and in major built-in appliances such as dishwashers, garbage disposals, microwave ovens, ovens and ranges, and hot water heaters. Depending on how bad the damage is, most companies will either repair the item or replace it with one of comparable quality.

However, most warranty plans now on the market are geared toward protecting people who are buying or selling a home. As a result, most are available only for used homes being sold. Costs of home warranty plans vary, but Ticor's warranty runs about \$300, which can cover the seller of the home during the listing period and the

Home warranty policies cover breakdowns in appliances and major mechanical systems.



buyer for a year after the sale. Often, the warranty can be renewed yearly.

"We think anyone who purchases a home over three years old should consider a home warranty," says Kight, who claims major home systems and appliances start running into problems between the third and seventh year. Kight admits the coverage isn't exactly cheap, but notes that replacing hot water heaters and furnaces or repairing serious electrical or plumbing problems easily can cost several hundred dollars.

The decision to buy such coverage should be based on the age, condition and quality of the appliances and home systems and the likelihood of

their breakdown. Also, check for original warranties that may still be in effect for some appliances. Given the relatively steep premium, home warranty plans don't pay if the home has new equipment of high quality.

Keep good records: If a major fire or other disaster wiped out your home, would you be able to document exactly what possessions were destroyed and attach a value to them? Probably not. That's why it's wise to make an extensive, detailed inventory of all the property in your home, garage and workshop. As you buy new items, add them to the list, and keep as many receipts as you can, especially for larger purchases. All this can help you better document your claim in the event of damage or total loss. "And keep a copy of the inventory away from home, in a safe deposit box or at your insurance agent's office," adds Hurst. "That way if your home is destroyed, your inventory is safe."

Remember, finally, that insurance isn't something you buy once and then forget about. It should be reviewed periodically to make sure it fits your current needs. Also, no policy is written to cover *all* possible situations or problems. If you think your coverage might be inadequate in some areas, talk to your agent about it *before* disaster strikes. For free brochures on home and auto insurance, write the Insurance Information Institute at 110 William St., New York, N.Y. 10038 (include a self-addressed, stamped envelope). The Institute also takes questions on its toll-free consumer hotline: 800-221-4954. **PM**

Keep detailed records to document exactly what possessions you have and what their value is.



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Though not every vinyl window maker produces every style or window, if you look hard you'll find what you want. Every style—double-hung, single-hung, storm, slider, casement, bay, bow, box bay, awning, basement and even greenhouse windows—are produced in vinyl by one or another of the companies listed on this page. Most also make sliding glass doors, storm doors and in some cases, patio doors of vinyl. At present, you can choose white vinyl frames or a few shades of brown. More lively colors are promised for the future. As with any product made of solid, rigid PVC, the color is the same throughout the thickness of the vinyl.

To date, vinyl windows have captured 16 percent of the total U.S. window market, and industry pundits foresee taking more than 30 percent by

1989. Where will they turn up next? Vasami predicts it won't be long before vinyl framing supports residential greenhouses, and sees this window turning up soon in the manufactured housing area. But the real sleeper, he says, is the boat business. Millions of frames for windshields and portholes in pleasure boats may turn to vinyl and away from wood and metal, neither of

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- Benjamin-Robert Inc., 2623 South Stewart Ave., Chicago, Ill. 60616
- Bernard Industries, 4123 Glenwood Rd., Brooklyn, N.Y. 11210
- C & E Enterprises, 1900 Thomas Rd., Memphis, Tenn. 38134
- CertainTeed Corp., Box 860, Valley Forge, Pa. 19482
- Fashionwall Products Co. Inc., 24351 Indoplex, Farmington Hills, Mich. 48018
- Fiberlux Inc., 59 South Terrace Ave., Mount Vernon, N.Y. 10550
- Fox Plastics Corp., 4518 Taylorsville Rd., Dayton, Ohio 45424
- Great Lakes Window, 1811 Monroe St., Toledo, Ohio 43603
- L.E.A. Products Inc., 2642 Rosselle St., Jacksonville, Fla. 32204
- Mercury Excelum Inc., 1178 Silas Deane Hwy., Wethersfield, Conn. 06109
- Poly-Tex Co., 300 North Braddock Ave., Pittsburgh, Pa. 15208

- Remington Building Prod., 100 Andrews Rd., Hicksville, N.Y. 11801
- Rogo Window Mfg. Co. Inc., 100 West 7th St., Bayonne, N.J. 07002
- Season-All Industries Inc., 1480 Wayne Ave., Indiana, Pa. 15701
- Slocumb Industries Inc., Box 9410, Wilmington, Del. 19809
- Styline, Hwy 14N, Walworth, Wis. 53184
- Thermal Mfg. Corp., 321 South Blvd., Oak Park, Ill. 60302
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- Twin City Storm Sash Co., 2641 Louisiana Ave. South, Minneapolis, Minn. 55426
- Ultrafab Inc., 1050 Hook Rd., Victor, N.Y. 14564
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WHY, for heaven's sake suffer any longer with a tines-in-front type of tiller that has no power to the wheels and shakes you to pieces? And why break your back with hoeing, raking and shovelling? The New TROY-BILT "JUNIOR" makes all your gardening chores faster and easier—increasing your gardening JOY! Send for full details TODAY!

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The BIG JOB tiller...for small, high yield gardens!



"Grow more in less space!"



"No more hand weeding!"



"Turns on a dime!"

Mail this coupon today!

TROY-BILT® Roto Tiller-Power Composter
Dept. A2421
102nd St. & 9th Ave., Troy, NY 12180

YES! Please send me complete information on the new JUNIOR and all other TROY-BILT Tiller Models ranging from the 5 HP PONY to the 8 HP "PROFESSIONAL" including details on prices and big "OFF-SEASON" Savings now in effect!

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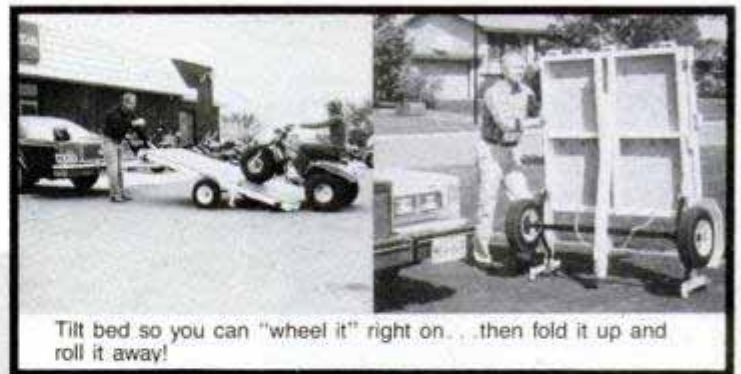
NEVER RENT AGAIN!

NEVER borrow a trailer again either.
NEVER even take up space storing one again!

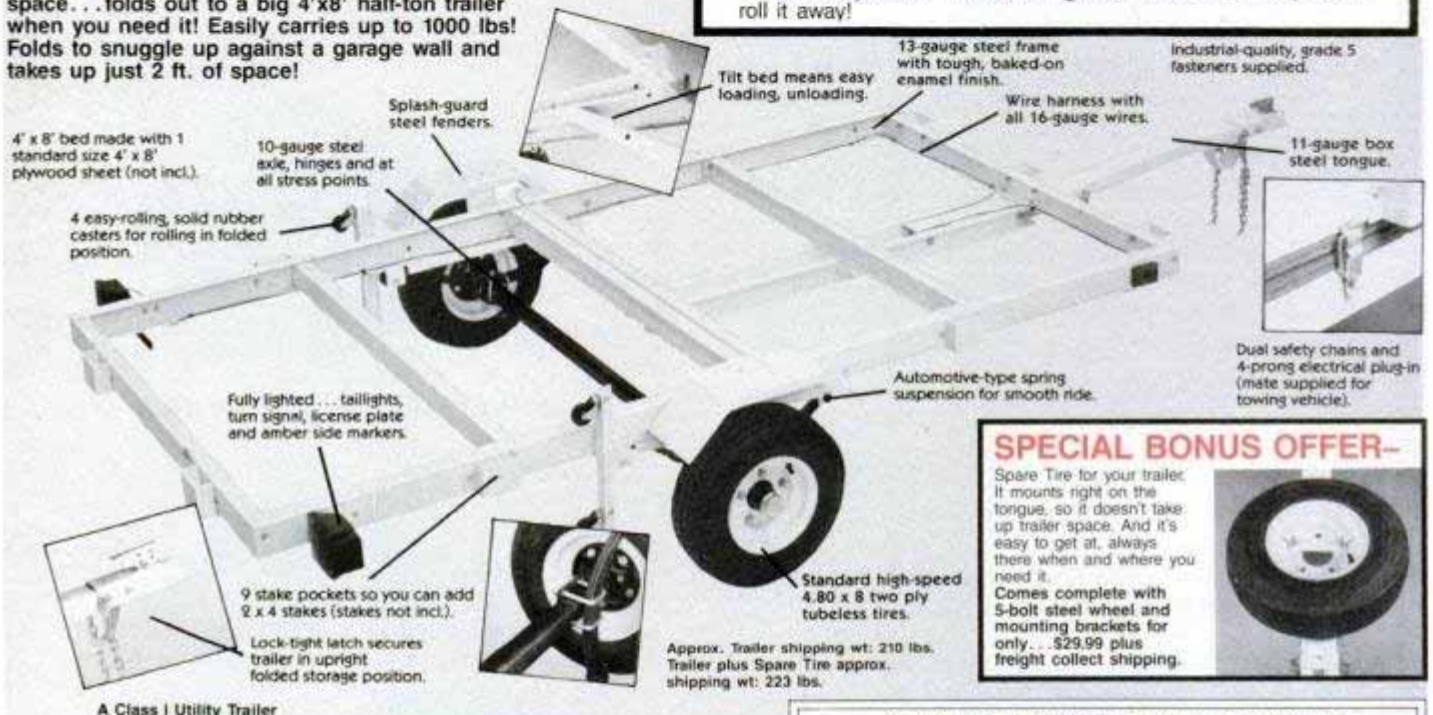
Introducing the



Folding Utility Trailer The heavy-duty tilt-bed trailer that folds up and stores in 2 feet of space. . . folds out to a big 4'x8' half-ton trailer when you need it! Easily carries up to 1000 lbs! Folds to snuggle up against a garage wall and takes up just 2 ft. of space!



Tilt bed so you can "wheel it" right on. . . then fold it up and roll it away!



SPECIAL BONUS OFFER—

Spare Tire for your trailer. It mounts right on the tongue, so it doesn't take up trailer space. And it's easy to get at, always there when and where you need it. Comes complete with 5-bolt steel wheel and mounting brackets for only . . . \$29.99 plus freight collect shipping.



Saves time, space, money and work. . . it even saves wear & tear on your vehicle!

2-wheel travel convenience and 4-wheel foldability. That's the secret. Foldability. The average utility trailer may do the job of hauling. . . the problem is where to store it. The 6-Wheel Wonder eliminates storage problems. Instantly folds down for space-saving storage. A big roomy carry-all for hauling, a compact little roll-away for storing! And because the bed tilts, you cut down on back-straining lifting. Roll anything with wheels right onto the trailer. . . even your ATV.

Judge for yourself. Try the 6-Wheel Wonder FREE of obligation to keep it. Put it to work, load it up and try it out. Then see how quickly and compactly it stores. If you're not 100% satisfied with it, send it back for a full, complete refund. . . including freight charges.

Mail in your order today! Credit card buyers can also call Toll-Free, 24 hours-a-day, 7 days-a-week— 800-228-5000. (In Nebraska — 800-642-8777.)

Save at least 55% over average retail prices for a comparable trailer.

JUST **\$199⁹⁹**

That's \$250 LESS than anything similar!

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FREE. . . Valuable Surprise Free Gift. From our huge inventory of unique products.



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Product of ROC Taiwan

5 YEAR LIMITED WARRANTY

Warranty statement included with product or you can write for free advance copy to: D.R.I. Industries, Inc., Dept. 75545, 11300 Hampshire Ave. S., Bloomington, MN 55438-2498

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Bloomington, MN 55438-2498

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How Many? Utility Trailer(s) @ \$199.99 each. (00017702)

How Many? Spare Tire and Mounting Bracket Set(s) @ \$29.99 each. (00017703)

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Because of the size and weight of the Utility Trailer, it must be shipped by truck. To make delivery arrangements with the carrier, we need a phone number you can be reached at during the day, and if possible, supply street address for truck delivery (fill in below).

I will pay shipping charges to driver upon delivery.

PLEASE PRINT NAME

Mr. _____
Mrs. _____
Ms. _____

AREA CODE () NUMBER

ADDRESS _____ Street & No.

CITY _____ STATE _____ ZIP _____

HOW TO INSTALL A FIBERGLASS SHOWER

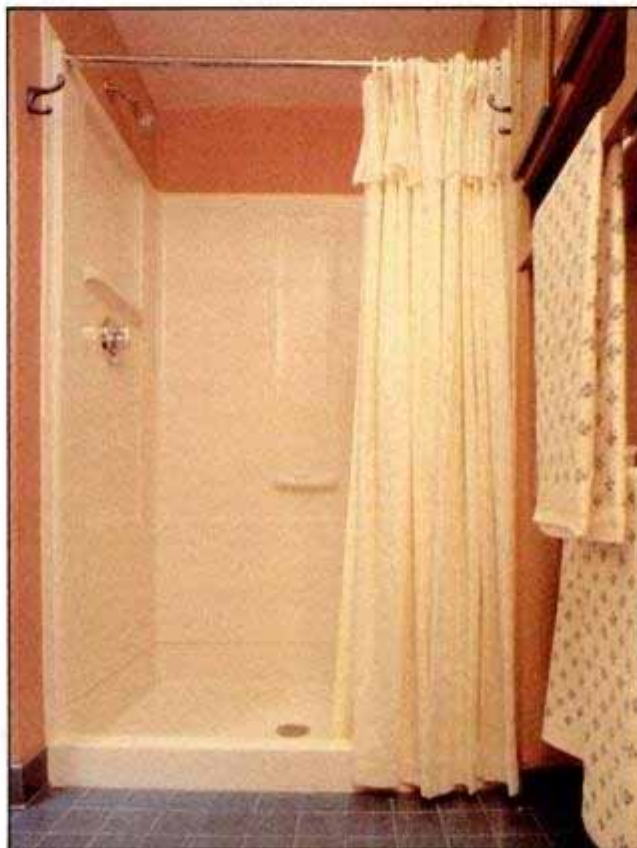
Update your bathroom with an attractive low-maintenance fiberglass shower.

Fiberglass shower stalls have several great advantages over tub and shower walls covered with other materials. When properly installed they are very durable, virtually waterproof and require very little maintenance—mildew and soap stains are cleaned easily from the surface. And these units are available in many different sizes, shapes and colors.

Their installation is a do-it-yourself job, especially if you have confidence in your plumbing skills. If not, you can still save a substantial amount by framing in the "pocket," installing the four components, then having a plumber hook up the waste and supply lines for you.

The unit shown here is Owens-Corning Fiberglas's 48-in. stall shower, which costs about \$185. It comes in four pieces: a base, two end walls and a side wall.

Other companies also manufacture these units and most are installed in the same basic way.



A fiberglass shower stall—like the 48-in., four-piece model above—is attractive, durable and requires little maintenance.

than 1/16 in. on all sides. Then, install the water supply lines, diverter valve and riser up to the shower head. The valve should be positioned about 48 in. above the floor. The riser should extend above the top of the shower wall with enough room so the escutcheon that covers the shower head nipple clears the wall. A 2-in.-dia. chrome escutcheon is a good choice.

Next, locate the top of the end and side walls, then install 2×4 blocking between the studs as shown. Position these blocks so the top wall flanges fall in the middle of their surfaces. The outside face of each block should align with the studs' front edges.

Lower the shower base into the opening and level it in place using wood shingles for shims. Slide them under the front edge and support ribs as needed. Once level, mark the location of the base on the floor and across the studs on the surrounding walls. You should also mark the location of the drain hole on the floor, then remove the base.

Where to begin

Start by framing the rough opening to the manufacturer's specifications. Make sure the opening is absolutely square and plumb. The clearance around this shower was negligible, less

Cut the drain hole and install the drain pipe according to the specific manufacturer's directions. For this type of shower, the drain pipe extends 1/8 in. above the subfloor and is connected to a trap below the floor that



Install plumbing adapter in wall for shower head nipple so nipple falls above side wall.



Draw level line across studs to position solid blocking behind flanges at top of walls.



Nail 2×4 blocking flush to the inside edge of all studs on the rear and side walls.

PHOTOS BY MICHAEL LUTCH

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CASSETTE PLAYER/RECORDER! Employs automatic volume recording level control. Full cassette keyboard. Automatic stop at tape end. Microphone jacks.

AM/FM RADIO has slide rule tuning, volume control, stereo indicator. Slide switches for balance, tone, power on/off.

LED DIGITAL CLOCK! Has pushbutton settings for alarm, time set, sleep, snooze. Wakes you to music from radio, cassette or buzzer alarm.

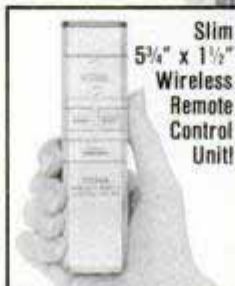
TWIN 4" STEREO SPEAKERS! Full-range speakers have protective grills, 8-ft. plug-in cords, separate 4 1/2" x 5" x 5" cabinets.

**90-Day Limited
Factory Warranty!**

Mfr. List: \$199.95

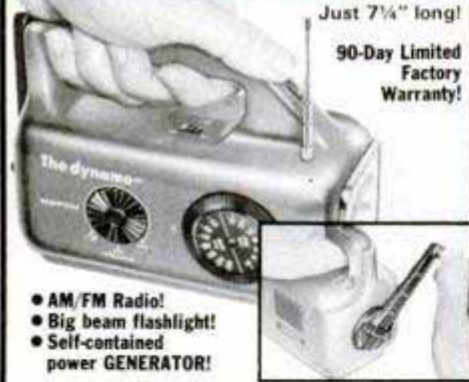
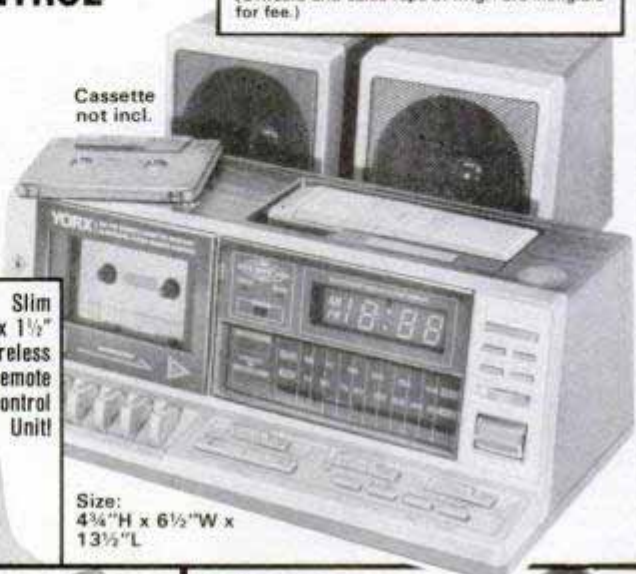
Liquidation Price .. **\$68**

Item X-217-63272-01
Ship, handling: \$5.50



Cassette not incl.

Size:
4 3/4"H x 6 1/2"W x
13 1/2"L



Just 7 1/4" long!

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- AM/FM Radio!
- Big beam flashlight!
- Self-contained power GENERATOR!

3 minutes of rapid cranking runs radio approx. one hour, light approx. 1 1/4 hour.

To obtain quick, nationwide distribution for the unique Dynamo, the Japanese manufacturer gave us **EXCLUSIVE** rights to sell the entire production at an exceptionally **LOW PRICE!**

NO BATTERIES EVER! A self-contained, hand-cranked generator provides the power you need to run the radio or light! Generator crank folds neatly into back of handle. Dynamo has 2 1/2" dia. speaker, 11" telescopic antenna, Headphone jack.

Liquidation Price Now Only **\$39**

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Set of TWO LEATHER Flight Cases

- Three-digit combination locks!
- Suede-like lining!
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Factory
New!
First Quality!

The manufacturer liquidated a portion of their production overruns.

An impressive duo! With more room than conventional briefcases! So you can easily tote **MORE** items and **BULKIER** items! You get **TWO** different sizes! One nests within the other when not in use. Large catalog-type case is 17 1/2"L x 13"H x 8"W. Smaller case is 15 1/2"L x 11"H x 6 1/2"W. Two inside dividers serve as file pockets.

Mfr. Sug. Retail: \$289.00

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Liquidation Price Now Only . . . **\$79**

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- Sturdy, 4-point base with "non-skid" rubber feet!
- 1 1/2" tubular steel frame!



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Here's a sturdily built exercise machine! Has 1 1/2" tubular steel frame, wide stance, 4-point stand for pedaling at high speeds in your home! Features include a tachometer, speedometer and odometer. Caliper tension adjustment regulates degree of pedal resistance. One hour timer is mounted on handlebars. A great way to tone your muscles and improve your strength.

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Send the items indicated at left. (Minnesota residents add 6% sales tax. Please allow 3-4 weeks for delivery. Sorry, no C.O.D.)

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Charge: MasterCard VISA Am. Ex. Diners Club

Acct. No. _____ Exp. _____

PLEASE PRINT CLEARLY

Name _____

Address _____

City _____

State _____ ZIP _____

Phone _____

Sign here _____

FIBERGLASS SHOWER

feeds into the waste system of the house.

Lower the shower base into place again, making sure it rests on any shims the same as before. Then, install the drain seal gasket as shown. (Note: Some communities require the seal between the waste system and the shower drain be made with lead and okum instead of the soft gasket shown here. Be sure to check your local plumbing code before proceeding.) Cover the base with cardboard cut from the shipping box, or an old blanket, to protect it while working.

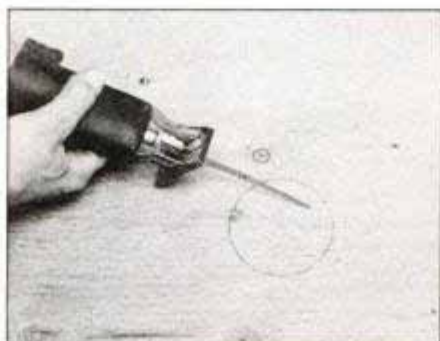
Next, nail the shower base flange to the surrounding studs. Prebore clearance holes and use 1½-in. roofing nails. Be extremely careful to avoid striking the base with the hammer, which might chip or crack it. Then, apply

silicone caulk to the base where the side wall joins. This shower has a U-shaped channel formed in the base to receive the walls. This should be filled with caulk as each wall is installed. Do not fill the entire length of the channel at the beginning.

Lower the side wall into place as shown, and attach to the wall studs with screws. These are driven through another channel formed in the top of the walls, or—on other models—through a flat flange on top of the walls. Next, install the end wall opposite the supply valve using the same techniques. This wall is screwed into the entire length of the front corner stud as well. Depending on your shower model, the joints between the side and end walls may require caulk. The manufac-



Center shower base in framed enclosure, then level all four sides. Install shims where needed, then trace drain hole onto floor.



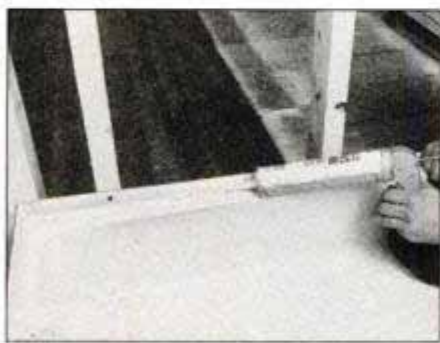
Remove base and cut hole in subfloor with reciprocating or sabre saw. Connect drain pipe to trap in waste line below floor level.



Lower base into former position and center hole around pipe. Press seal into hole and around pipe. Tap in place with hammer.



Prebore clearance holes in base flange, then nail flange to studs using 1½-in. roofing nails. Do not strike base with hammer.



After base is nailed in place, apply bead of silicone caulk to recessed channel in base that receives rear shower wall only.



Lift rear wall into position then carefully lower into base alignment channel. Push from top so wall is seated uniformly.

The Professional Meter for Personal Use.



The standard of the industry is setting a new standard for home use as well.

The Fluke 77 multimeter is ideal to test and repair anything electrical: home wiring, appliances... even your car. It's inexpensive, simple to operate and filled with professional features. Made in the U.S.A. and backed by a 3-year warranty, the new Fluke 77 is the world's first handheld meter to combine analog and digital displays.

For a free brochure or the distributor nearest you, call toll-free 1-800-227-3800, ext. 229. Or write John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, WA 98206.

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Volts, ohms, 10A, diode test	Volts, ohms, 10A, mA, diode test	Volts, ohms, 10A, mA, diode test
Autorange	Audible continuity	Audible continuity
0.7% basic dc accuracy	Autorange/range hold	"touch Hold" function*
2000+ hour battery life	0.5% basic dc accuracy	Autorange/range hold
3-year warranty	2000+ hour battery life	0.3% basic dc accuracy
	3-year warranty	2000+ hour battery life
		3-year warranty
		Multipurpose holder

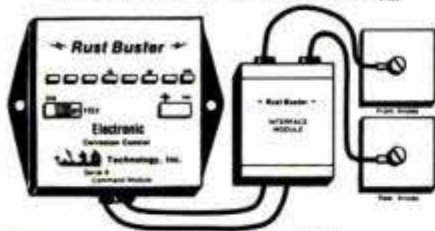
* Patent Pending

† Suggested U.S. list price, effective January 1, 1985

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NEW TACH-O-BRASS

UNIVERSAL CABLE LUBRICATOR

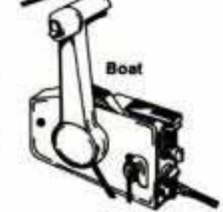
LUBRICATES AUTOS - TRUCKS - EQUIPMENT
MOTORCYCLES - THREE WHEELERS - BOATS
SPEEDOMETER - TACHOMETER - BRAKE - CLUTCH - THROTTLE



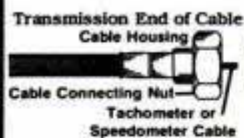
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Lubricates cables without removing them from the cable housing. Aids in eliminating cable noise and needle vibration. Cables may be lubricated in less than 10 minutes. Simple, anyone can use it with the aid of an ordinary grease gun. TACH-O-BRASS is made of solid brass. Instructions included.

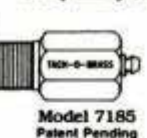
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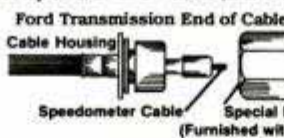
Boat



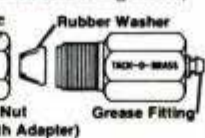
Transmission End of Cable
Cable Housing
Cable Connecting Nut
Tachometer or
Speedometer Cable



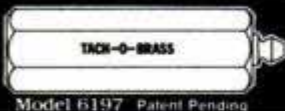
Model 7185
Patent Pending



Ford Transmission End of Cable
Cable Housing
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Special Nut
(Furnished with Adapter)



Rubber Washer
TACH-O-BRASS
Grease Fitting



Model 6197 Patent Pending

TACH-O-BRASS

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CLEANS AS IT LUBRICATES THE ENTIRE LENGTH OF THE CABLE! CABLES LAST LONGER... WILL NOT FREEZE UP IN WINTER MONTHS! SAVE AS MUCH AS \$150 TO \$300 ON NEW CABLE COST!

SPECIAL INTRODUCTORY OFFER \$12.95 (Plus \$2.00 shipping & handling. Grease gun not included.)

Model 7185 or Model 6197

(qty.) TACH-O-BRASS Model 7185 UNIVERSAL LUBRICATOR
(qty.) TACH-O-BRASS Model 6197 STEERING CABLE LUBRICATOR FOR YOUR BOAT

Enclosed is \$_____. Please make check or money order payable to Antonia Products, Inc. Charge my: Mastercard VISA Exp. Date _____

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FIBERGLASS SHOWER

turer's instructions will explain what to do for their particular model.

Now, position the other end wall in its base alignment channel and trace the location of the diverter valve on its back as shown. Remove the panel and cut the hole using a hole saw. Bore from the back and be sure to cover the front surface, in the area of the cut, with masking tape so when the saw breaks through it will not chip the surface.

Apply caulk to the channel, attach the wall, then cover all the screw channels with the vinyl trim strips supplied by the manufacturer. Other shower models do not have these strips; the drywall merely extends over the flange and covers the screw heads. Finally, install the shower head, valve handle and the drain strainer. **PM**



Attach wall by screwing top flange into wall studs and blocking. Prebore pilot holes and use 2-in.-long screws.



Lower side wall into place, then trace position of supply valve opening on back of panel. Remove wall and cut with hole saw.



After walls are all attached, cover screw channels in upper flanges with vinyl trim strips. Drywall butts against top of flanges.

UPDATE YOUR BATHROOM WITH A NEW VANITY CABINET

There is no shortage of ready-made vanity cabinets available at lumberyards, home centers and even mass-market retailers. But these may not always suit your size, taste and budget requirements. The sensible solution is to build your own, like the one shown here. Your only real limitations are the width and depth of the sink you want to use. And you won't need a shop full of expensive woodworking equipment. We designed this cabinet so you could build it with only a circular saw and a simple router table. For instructions on how to build this table, see page 148.

Begin by cutting the front corner posts to size and shape using a circular saw with a rip guide and hollow-ground planer blade. This blade is a bit more expensive than the standard combination blade, but it yields a much smoother cut. Then, cut the grooves to accept the face frame stiles in one edge and the side rails in the other, as shown on the drawing. Use the router table with a $\frac{1}{4}$ -in.-dia. straight carbide bit to make all these cuts and the matching tenons.

Next, cut the $\frac{5}{8}$ -in.-deep \times $1\frac{3}{4}$ -in. groove on the outside surface of both posts. Cut the

Build this pine vanity using only a router and a circular saw.

TEXT AND PHOTOS BY STEVEN WILLSON



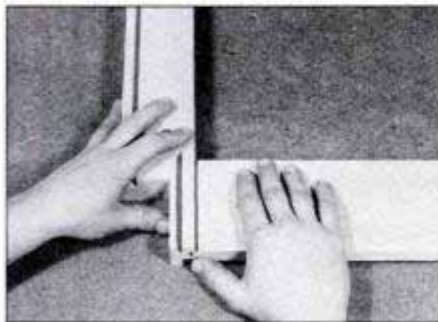
This easy-to-build bathroom vanity cabinet features plastic laminate countertop and flush-mounted, flat panel doors.

front edge first on the router table, then remove the waste by ripping the board with the circular saw. Note that the groove stops $3\frac{1}{4}$ in. from the bottom of the leg to create the uniform $\frac{1}{2}$ -in. reveal that is shown on the drawing.

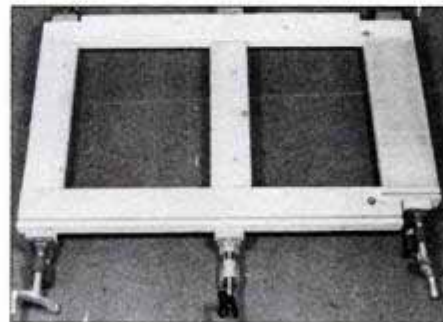
Cut the rear corner posts to size, then cut the notches and grooves shown. Cut the side rails to size and cut the tenons on each end. Assemble by gluing and clamping the side rails to the corner posts. Check for square and let both dry overnight.

Next, cut the front face rails and stiles to size. The stiles need a tenon on the edge where they meet the corner posts, and a stopped groove at the top and bottom where the rails join. For the top rail the groove should be $1\frac{3}{4}$ in. long; for the bottom it should be $2\frac{3}{4}$ in. long. Assemble the face frame with glue and clamps, making sure to use a notched block as a clamp pad to protect the stile tenon from damage.

Cut the toe board to size and shape, then glue and clamp it—along with the face frame assembly—between the two side assemblies. Check for square and tack-nail two temporary braces across the back to maintain alignment until the glue dries.



Assemble sides by gluing rail tenons into corner post grooves. Front post shown also has grooves for toe board and facing stile.



Clamp the side parts together and check for square. Be sure to use clamping blocks to protect the front corner post from damage.



Glue small hardboard block into front and rear corner post grooves—just below middle side rail—to provide additional support.

A NEW-SIZE BREAKTHROUGH IN VANS. CHEVY ASTRO.

IT STANDS

It was inevitable. Chevy's new-size van stands out in cargo room, comfort, power and more. The new-size Chevy Astro* is a striking new idea in high-tech transportation available as a passenger or a cargo van model.

The only available V6 in its class:

Vortec V6. This new V6 is a tornado of power. Its swirl-port induction system mixes fuel and air for more complete combustion and a mighty 145 SAE net horses.

Highest towing capacity available in a new-size van. Properly equipped, Chevy Astro can tow up to 5,000 lbs., including cargo and trailer.

More cargo room than any front-wheel-drive van. Up to 151.1 cu. ft. of deep space. Payload capacity, when properly equipped, goes up to 1,700 lbs., including passengers and cargo.

Engineered for a quiet life. Run a hand over Astro's precisely crafted body and you'll feel how metal-to-metal gaps are minimized to help shut out wind and weather.

Test drive the one that stands alone. See your Chevy dealer now and explore Chevy Astro's advanced world.

*All comparisons exclude other GM products.



More available seating than any front-wheel-drive van. Chevy Astro offers available seating for up to four in the cargo van and up to eight in the passenger van.



Cockpit instrumentation puts you in command with an uncluttered design, nonglare instrument cluster and a multi-function switch mounted on the steering column.



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Garageable. Even with all its room, Astro is designed to fit a standard car wash and your garage.



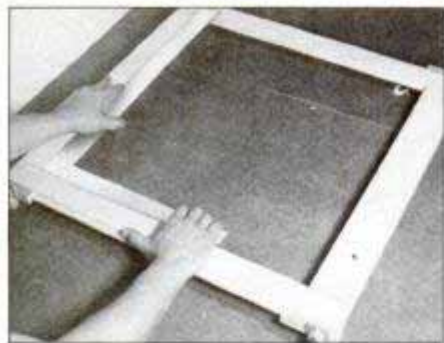
Biggest side- and rear-door openings in its class. Plus the only swing-out rear doors.



ASTRO

NOTHING WORKS LIKE A CHEVY VAN

NEW VANITY CABINET



Glue and clamp face frame parts together; check for square. Be sure to use U-shaped clamping blocks to protect stile tenons.



Glue and clamp toe board and face frame to both side assemblies, then tack-nail brace across back of sides to keep square.

Next, glue and nail the upper and lower rear rails into their notches, followed by the cabinet back. Cut and install the cabinet bottom and shelf. Then add the corner blocks to provide a means of attaching the countertop to the cabinet. These should be glued and clamped or glued and screwed in place. Now attach the cabinet to the wall by driving screws through the upper rear rail into wall studs.

Finish the case work by nailing wainscoting boards across both sides, starting at the corners where the sides meet the room wall. To do this, plumb the first board in place. Hold it stationary and scribe its back edge to the wall. Trim to scribe line using a block plane. When satisfied with fit, nail the board



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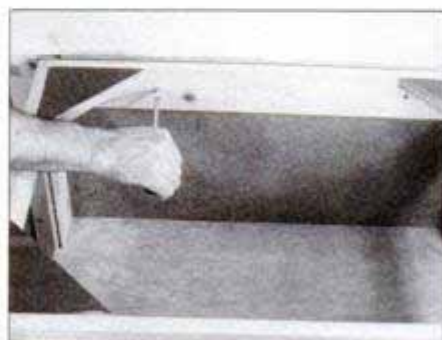
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Glue and nail rear rails into respective corner post notches. Glue and nail hardboard back in place using 2d common nails.




When cabinet frame is complete, install bottom by nailing into lower rear and side rails, and front of lower face rail.



Place vanity in desired position and locate two wall studs behind it. Attach by driving 2½-in. No. 10 fh screws into studs.

Rustproof Your Own Car

And Save \$200.00 In 30 Minutes

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THE PROBLEM - RUST

Next year it'll cost the public an estimated \$13 billion dollars while it destroys one of your family's largest investments. It's rust. And every year it gets worse. Because every year its prime causes get worse. Like air pollution, acid rain and road salt.

WHAT CAUSES RUST

Rusting is a natural process - the chemical change of the element iron to its more "stable" form, iron oxide or rust. Rust begins as soon as steel is forged. Moisture and salt are the two most common causes of rust.

Fact 1 (Road Salt): Nationwide over 10 million tons of road salt will be spread in the winter of 1985.

The use of road salt has increased 500% over the last decade.

Fact 2 (Sheet Metal): Due to Detroit's quest to manufacture more fuel efficient cars, the thickness of the sheet metal used on current autos is about 40% thinner than it was 10 years ago. This trend of more road salt and thinner sheet metal is continuing, and it's getting worse all the time.

Fact 3 (Air Pollution): Air pollution is causing acid rain throughout the country. Acid rain is a prime cause of rust.

Fact 4 (Salt Air): If you live near the Atlantic or Pacific Oceans or the Gulf of Mexico, you know that salt air is stealing your hard-earned dollars by causing your car to rust.

While the environment is doing its best to destroy the average family's second and third largest investments, namely the family automobiles, we at **AUTO SAVE INC.** are pleased to present you with a new chemical solution.

THE SOLUTION - SEAL COAT™

We are excited to present a revolutionary **new** do-it-yourself kit which will allow even a **novice** do-it-yourselfer to rustproof his or her own automobile (new or **used**) in approximately 30 minutes and save up to \$200.00. Our research shows the vast majority of the motoring public will be able to use this easy-to-apply kit.

CHEMICAL COMPOSITION

The chemical formulation has been specifically designed to be effective in rustproofing **used cars** as well as new cars. The formulation contains an exclusive penetrant which neutralizes rust that has already developed as well as completely protecting all unaffected metal surfaces. **SEAL COAT™** has been tested and found to be **700% more effective than undercoating.**



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360° Spray Tip

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Cars
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Trucks

SEAL COAT™ is also Thixotropic (Self Healing) and has maximum creep tendencies so it will seek to cover seams and cracks where ordinary products won't reach.

SEAL COAT™ was developed under the guidance of a company which has been manufacturing rust proofing compounds for the last 67 years. This chemical contains special properties that never dry completely; therefore, it won't chip, crack, peel or flake off.

INVENTOR

The kit has been developed by a former top executive with the largest auto dealer rustproofing company in the country.

He has been involved in the automotive chemical industry for over 15 years and has been responsible for the development of several other famous do it yourself products.

EASY APPLICATION

Detailed instructions guide you to all areas to be sprayed. In many cars, no holes need to be drilled because of access holes left by the manufacturer. Otherwise all that needs to be done is drill hole, insert specially designed wand, spray material and seal hole with plugs. The whole process can be finished in 30 minutes.

We hesitate to add this because the kit is so easy to use, but if you feel unsure about your ability to use the kit, we suggest you buy it and have your local gas station mechanic apply it. Their charge should only be around \$20.00 and you will still save a considerable amount of money.

KIT CONTENTS

1. SEAL COAT™ chemical formula in convenient pressurized cans.
2. Five ft. rigid spray wand with 360° spray tip.
3. Three ft. flexible spray wand.
4. Plastic rustproofing plugs.
5. Detailed illustrated instructions.

6. Decal to prove car has been rustproofed.

COST - \$49.95

SEAL COAT™ protects your automobile investment now and pays for itself when you sell it or trade it in. The entire cost is only \$49.95 and 30 minutes of your time. **You might be interested to know that \$49.95 is just about what it costs a car dealer to apply rustproofing to your car, but they charge \$249.00.**

Now who needs that \$200.00 more, you or the car dealer?

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If you are not 100% satisfied with THE SEAL COAT™ RUSTPROOFING SYSTEM return it in its original unused condition within 30 days. We will mail your refund immediately.

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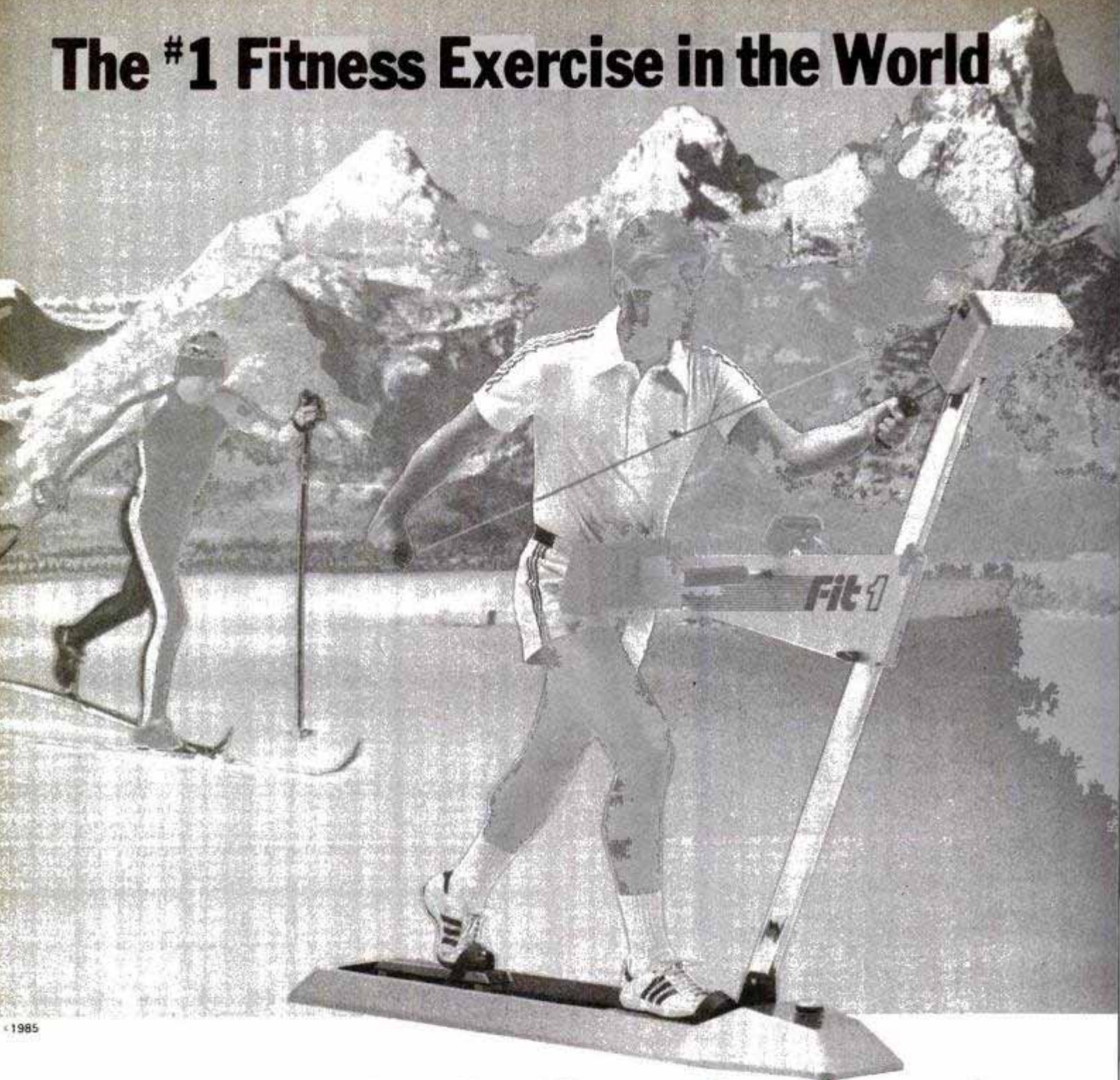
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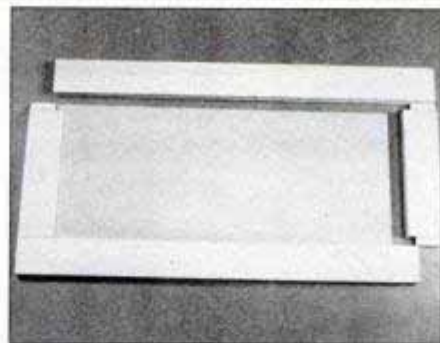
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NEW VANITY CABINET

in place using 3d finishing nails. Drive these nails—at a 45° angle—through the rear of the tongue into the cabinet rails behind. Set the nail heads so they will be covered by the groove in the board that follows. Nail the remaining boards in place.

Next, check the size of your door opening and cut the door parts to match, even if the dimensions differ slightly from those given in the materials list. You should plan about 1/16-in. clearance around the entire perimeter of both doors. Glue and clamp the rails and stiles together with the panels floating in their grooves; do not glue them in place. Hang the doors with the hinges, and trim the rail and stile edges to fit—if required—with a block plane.

Ease the outside corners of the front



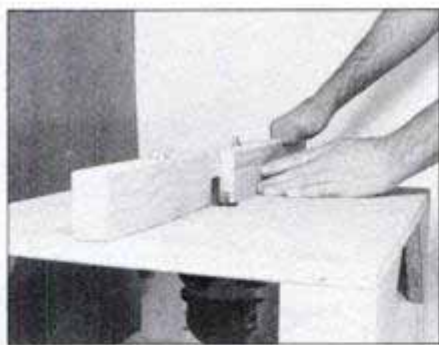
Finished door parts ready for assembly show simplicity of joinery. Glue only rails to stiles; allow panel to float in groove.



Apply laminate to countertop edges then top, using contact cement. Cut off waste with router and laminate trimming bit.



Plumb first wainscoting board in place, then scribe rear board edge to match room wall. Trim to scribe line using block plane.



Cut door rails to size, then cut door panel groove in edge using router table with a 1/4-in.-dia. straight carbide cutting bit.



Cut tenons on rail ends with same cutter used for door panel groove. Tenons require at least two cuts per side to remove waste.

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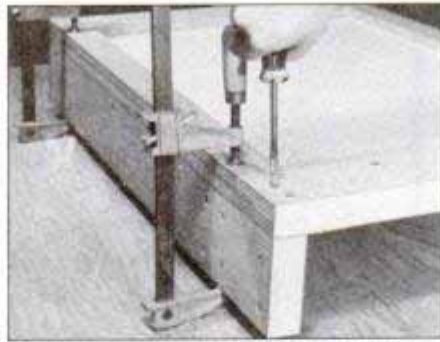
Gabriel®

SHOCKS & STRUTS

NEW VANITY CABINET

posts using a block plane. Sand the whole case with 150-grit, then 220-grit, sandpaper. Remove dust and stain the cabinet—or leave it natural. Finish with at least three coats of polyurethane. Rub with 4/0 steel wool and wipe with a tack cloth between coats.

Next, cut the countertop and back splash parts to size. Glue and screw the perimeter supports to the underside of the countertop and double-up the entire length of the back splash. Then, cover both pieces with plastic laminate. When using contact cement, start on the edges first. Trim the waste using a



Run bead of silicone caulk between finished countertop and back splash; clamp together. Drive long screws from below top.

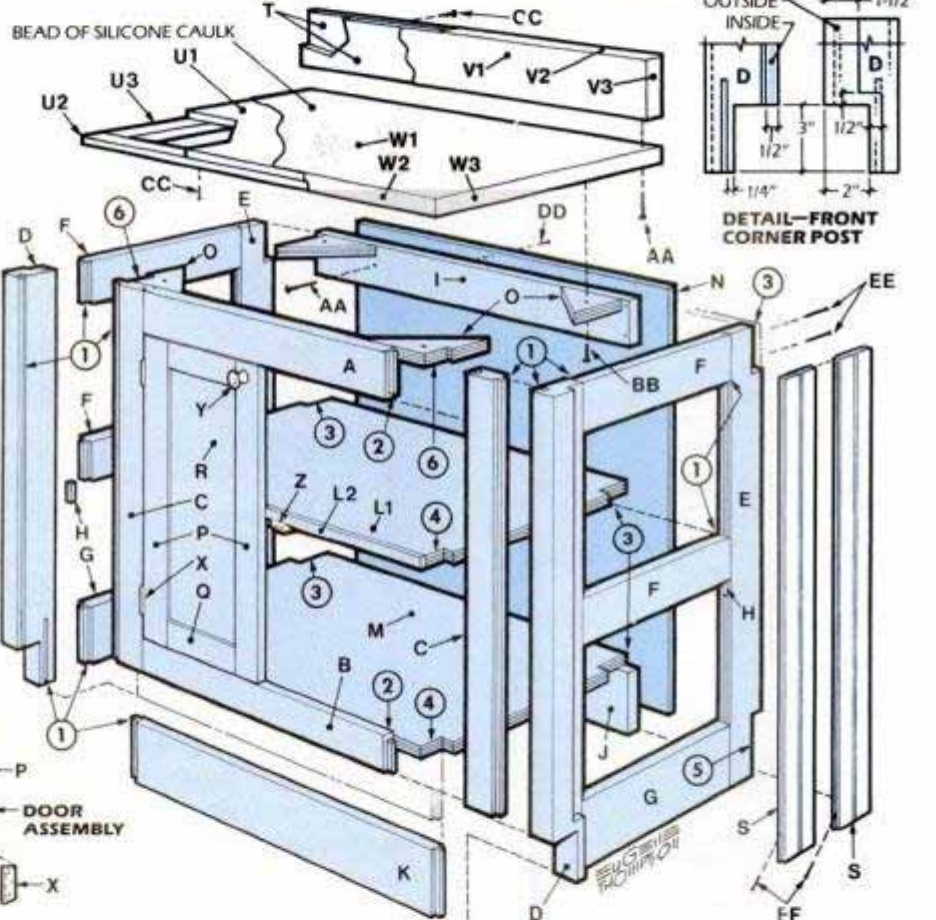
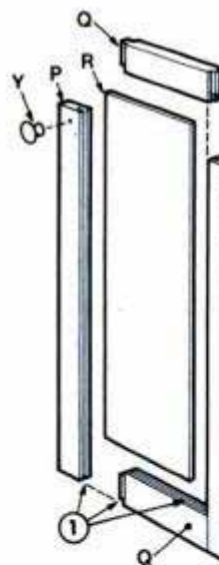
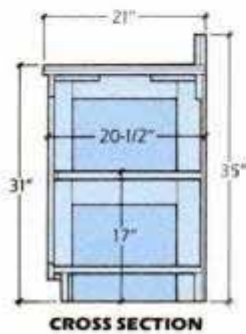


Trace sink perimeter on countertop and cut out with sabre saw. Apply masking tape to saw shoe to avoid marking laminate.

BATHROOM VANITY

21" DEEP x 31-1/2" WIDE x 35" HIGH

NOTES: 1. ALL TENONS AND GROOVES 1/4" WIDE x 3/8" DEEP
2. 1/4" WIDE SHOULDER
3. 3/4 x 3-1/4" NOTCH
4. 7/8 x 2-1/4" NOTCH
5. 3/4 x 4" NOTCH
6. 1/4 x 2-1/4" NOTCH



MATERIALS LIST—BATHROOM VANITY

Key	No.	Size and description (use)	S	24	3/4 x 3/4 x 29 3/4" wainscoting board (side)
A	1	3/4 x 3 x 24 1/4" pine (upper front rail)	T	2	3/8 x 4 x 31 1/2" particle board (back splash)
B	1	3/4 x 2 x 24 1/4" pine (lower front rail)	U1	1	3/8 x 21 x 31 1/2" particle board (countertop)
C	2	3/4 x 2 3/8 x 26 3/4" pine (front stile)	U2	2	3/8 x 2 x 31 1/2" particle board (support)
D	2	1 1/2 x 3 1/4 x 29 3/4" pine (front corner post)	U3	2	3/8 x 2 x 17" particle board (support)
E	2	3/4 x 3 1/4 x 29 3/4" pine (rear corner post)	V1	1	1/8 x 4 x 31 1/2" plastic laminate (back splash)
F	4	3/4 x 3 1/4 x 13 3/4" pine (middle, upper side rail)	V2	1	1/8 x 1 1/4 x 31 1/2" plastic laminate (edging)
G	2	3/4 x 4 x 13 3/4" pine (lower side rail)	V3	2	1/8 x 1 1/4 x 4" plastic laminate (edging)
H	4	1/4 x 3/8 x 1 1/2" hardboard (support block)	W1	1	1/8 x 21 x 31 1/2" plastic laminate (countertop)
I	1	3/4 x 3 1/4 x 29 3/4" pine (rear top rail)	W2	1	1/8 x 1 1/4 x 31 1/2" plastic laminate (edging)
J	1	3/4 x 4 x 29 3/4" pine (rear bottom rail)	W3	2	1/8 x 1 1/4 x 21" plastic laminate (edging)
K	1	3/4 x 4 x 28 1/4" pine (toe board)	X	4	1 1/2 x 2" Stanley No. 284 butt hinge
L1	1	3/4 x 19 x 29 3/4" plywood (shelf)	Y	2	door pull
L2	1	1/2 x 3/4 x 29 3/4" pine (edging)	Z	2	magnetic catch
M	1	3/4 x 19 1/2 x 29 3/4" plywood (bottom)	AA	7	2 1/2" No. 10 fh screw
N	1	1/4 x 29 1/4 x 29 3/4" hardboard (back)	BB	4	1 1/2" No. 10 fh screw
O	4	3/4 x 6 x 6" plywood (corner block)	CC	28	1" No. 10 fh screw
P	4	3/4 x 2 x 21 3/8" pine (door stile)	DD	*	2d common nail
Q	4	3/4 x 2 3/8 x 12" pine (door rail)	EE	*	6d finishing nail
R	2	1/4 x 12 x 18 3/8" plywood (door panel)	FF	*	3d finishing nail

*As required



PROMART
HOME CENTER

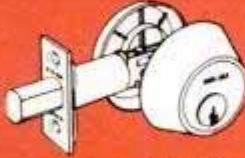
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Hardware



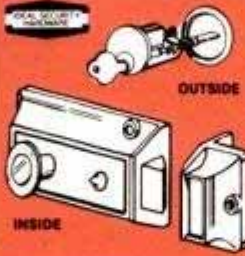
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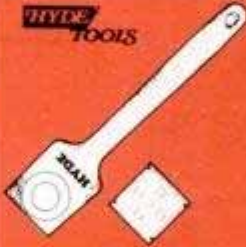
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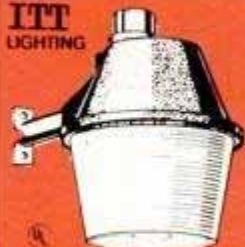
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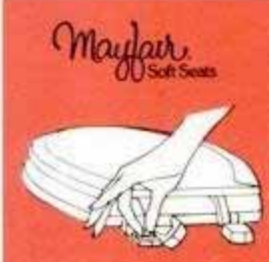
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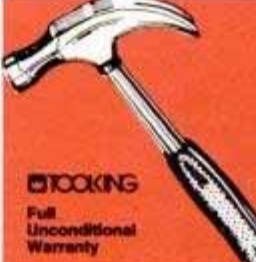
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NEW VANITY CABINET

router and a laminate trimming bit. Before joining the splash to the top, run a bead of silicone caulk between the two. Attach the assembly to the cabinet by driving screws up through the corner blocks. Trace the outline of your sink on the countertop, cut the hole and apply more silicone caulk to its perimeter. Lower the sink into place and make the connections.



When sink cutout is complete, run wide bead of silicone caulk around hole and lower sink into place. Remove excess caulk.

Easy-To-Build Router Table

This simple router table was built in a couple of hours using mostly scrap material. It measures 12 x 18 x 22 in. and it was used to cut all the tenons and grooves required for building our bathroom vanity.

The legs are cut from 2 x 4 stock, as is the fence, though the latter was ripped to 2 1/2 in. The table top was made from a kitchen

countertop sink cutout that was already covered with laminate. The laminate provides a hard, durable surface that lets the fence carriage bolts slide easily.

The tough laminate also prevents the square ridges underneath the bolt heads from turning when the wing nuts on the fence are tightened.



This router table can be built in just a few hours from scrap material. The fence is adjustable; the router is installed from below.



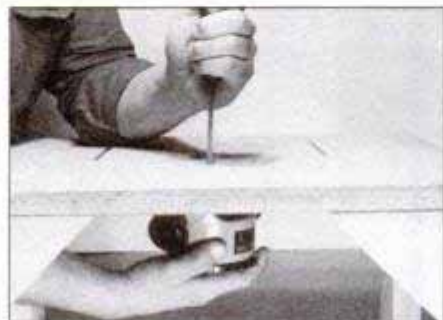
Assemble table then bore 1 1/4-in. cutter hole in middle. Mark fence slots as shown, and bore cutter access hole at end of line.



Clamp guide board onto table top, then lower cutter into access hole. Turn on router and cut slot with base against guide.



Remove base plate from router and use as template for marking screw mounting holes. Center base over cutter hole.



Countersink screw holes slightly below table surface. Attach router housing to underside of top by driving screws from above.



Use 1/4-in.-dia. carriage bolts to attach fence. Square ridge on bolt head bears against laminate so nuts will tighten.

HOW TO RELOCATE A TOILET

Although most new homes have been sensibly laid out for the way people live today, many older homes have shortcomings like limited closet space, inefficient kitchens and outmoded bathrooms. In some very old homes, bathrooms were excluded entirely and when added, they often suffered from extremely poor fixture layout.

There is, however, nothing carved in stone about the placement of these fixtures, although there are some limitations. Because a bathtub is so large, your options are necessarily reduced. And the location of your vanity mostly depends on the size of the cabinet. But the toilet—or water closet as it's sometimes called—is a relatively small, self-contained unit that could fit in several places. So, if you decide to remodel your old bath and think the toilet will work out better elsewhere, then move it as we did here. And, if you're adding a new bath or powder room to your house, keep in mind that the same basic approach works for new toilet installations as well.

Most toilets are one of two basic types: a low-profile one-piece unit and a higher two-piece unit that has a wall-

A step-by-step guide to moving the fixture, the waste pipe and the water supply line.

TEXT AND PHOTOS BY STEVEN WILLSON



If you want to move an existing toilet, or install a new one, here are the plumbing basics that are involved in the job.

When the toilet is flushed, the water goes into the bowl, carries out the waste and leaves behind enough water in the bottom of the bowl to create an air-tight seal between the waste line and the room. This prevents sewer gases from escaping into your house. To move the toilet, you must move the fixture, the water supply line and the waste line.

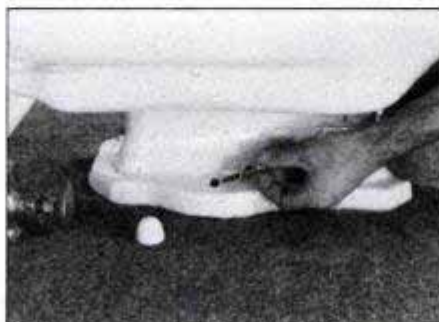
Start by shutting off the water below the external shutoff valve that is beneath your storage tank. In some cases, there will be a valve in the basement located in the toilet supply line. But often this is omitted because of the shutoff valve directly below the water tank. This was the case in our installation, so we had to begin by shutting off the water to the entire house at the water meter as shown. We then installed a temporary shutoff valve below the bathroom, and turned on the water again so the rest of the house would be supplied while we were working.

mounted water tank connected to the bowl by an elbow. Both work on the same basic principle: Water enters the storage tank—from the house cold water supply line—through a valve that is activated by a ball float inside the tank.

Next, flush the toilet to remove the water in the tank, then sponge out the tank and the bowl to remove the standing water left behind. Remove the covering caps of the sides of the toilet base then remove the hanger bolts—or the



Begin by turning off the house water supply at the water meter. A valve should be on either the main side (above) or house side.



Lift off cover caps, then remove hanger bolts (above, on older toilets) or nuts on hold-down bolts (on newer units).



Make sure that all water is sponged from the interior of the storage tank, then remove the supply line and shutoff valve.

RELOCATE A TOILET

nuts on the hold-down bolts—that attach the bowl to the floor.

Using adjustable wrenches or small pipe wrenches, remove the shutoff valve and supply line directly below the water tank. Then, lift the bowl off the floor flange and set it to one side. With a two-piece toilet, first you'll have to loosen the elbow that connects the tank to the bowl and then lift the tank from the wall before moving the bowl.

In some cases, the bowl may be stuck to the floor because of hardened caulk or other sealers. If the bowl does not lift freely, cut away the material around the base with a putty knife.

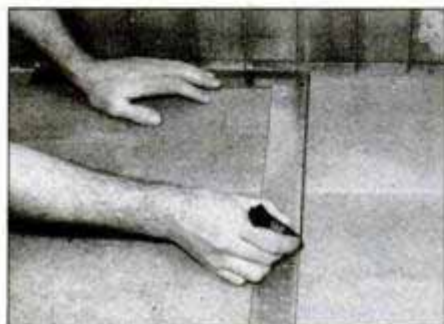
Once the bowl is free, the floor flange will be exposed as shown. In this installation, old cast-iron waste lines were already replaced with newer plastic lines, which made the job much easier.

If you still have the cast lines, it's a good idea to replace them with plastic, at least for the section that's being moved. This material is much easier to work with and requires no special tools. To make the conversion, use the adapter specifically designed for the job. Install it in the nearest cast fitting by using okum and synthetic lead. The pipe fittings and supplies are available at well-stocked hardware stores.

Next, cut the pipe below the flange using a hacksaw and remove the flange from the floor. Now, prepare your new floor. In this case, we cut out a square of subflooring back to the two adjacent floor joists and filled in the old waste hole with plywood. Then we covered the subflooring with hardboard underlayment to provide a smooth surface for our vinyl flooring.

Locate the new position for the toilet by marking a centerline on the floor using a framing square as shown. Then slide the bowl against the wall so its base is centered over this line, and mark the entire perimeter of the base. On this job, we were adding a new layer of wainscoting to the walls, so we held a piece of this material between the toilet and wall before we made our marks. Do the same if you plan to cover walls with boards, drywall or plaster.

Measure from the back—or front—of the bowl base to the waste hole in the bottom of the fixture, and mark the center of this hole on the floor. Then draw a circle over this crosshatch mark that corresponds to the diameter of the flange, just below the lip that will rest on the floor. Cut the hole after you've made sure there are no water pipes or



Establish a centerline for the toilet's new position and draw it on the floor using a framing square against the room wall.



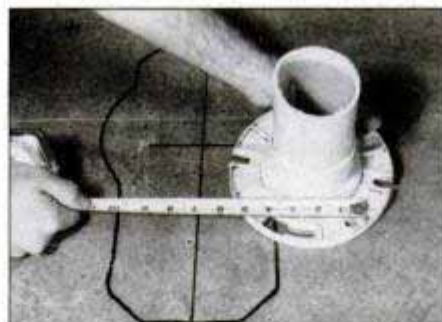
Stand the bowl on end and measure the distance from the back of the bowl's base to the edge of its outlet horn (center hole).



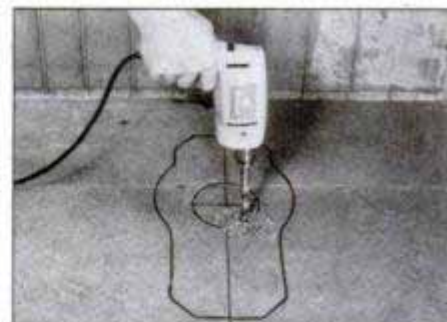
Center the bowl over the floor line, then push it against the wall with a piece of wall finish material held between the two.



Make sure the bowl is square to the wall and centered over the floor line. Outline the entire base perimeter on the floor.



Move the bowl away and mark the center-point of the outlet horn on the floor. Then measure the diameter of the waste flange.



Draw a circle for the waste flange on the floor, centered over the crosshatch marks. Bore a blade entry hole on its perimeter.



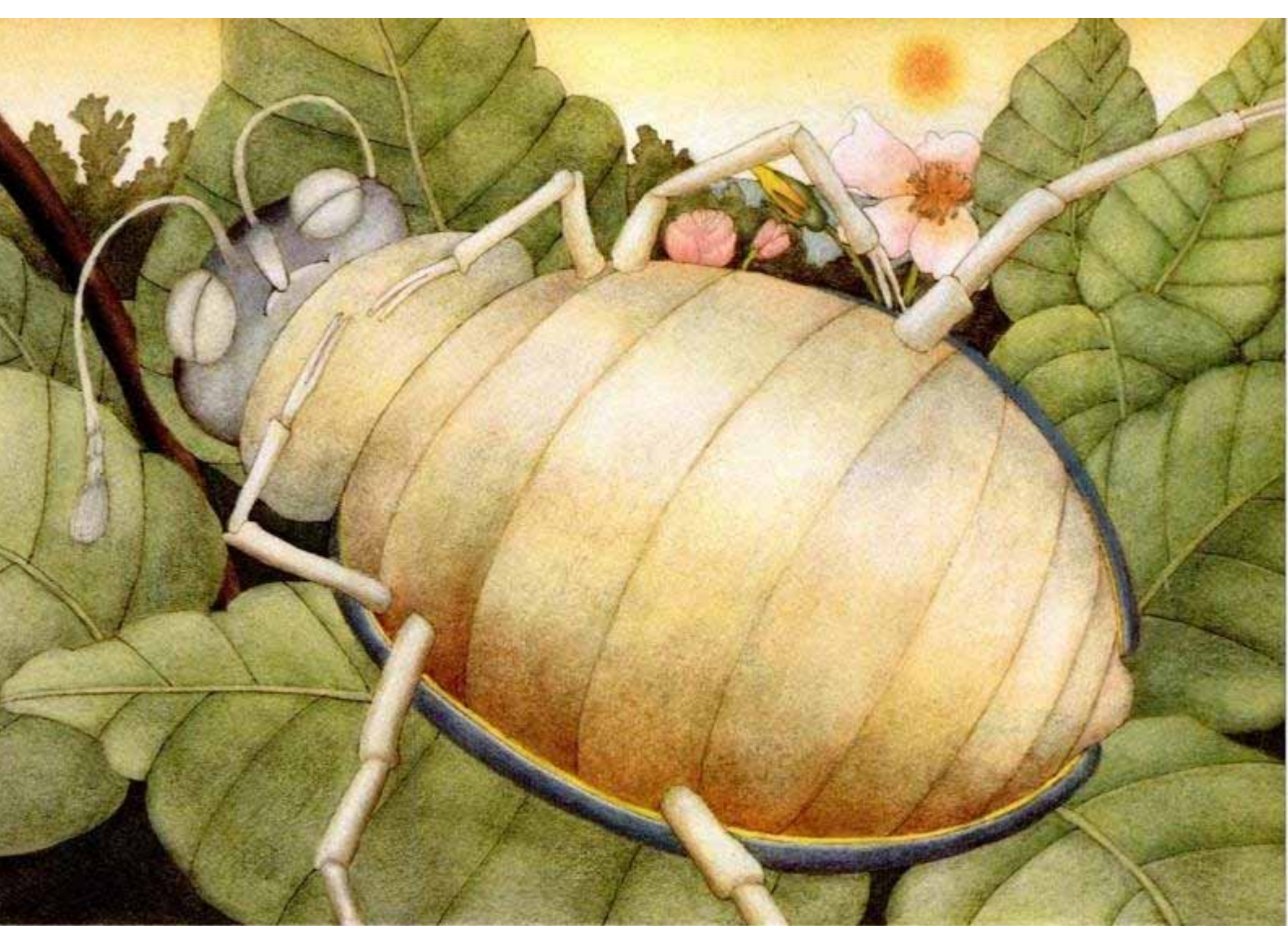
Cut the waste flange hole using a key hole, sabre or reciprocating saw. Make sure there are no wires or water pipes below the cut.



Place the waste flange in the hole and make sure it seats flat on the floor. Note how the joist side was cut slightly for fit.



Align the flange on your new flooring so the hold-down bolt slots face to the sides. Attach with screws driven into the floor.



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RELOCATE A TOILET

electrical wires beneath the floor. If there are obstructions, move them.

Once the hole is cut, finish off the room floor by installing the new flooring of your choice. Then attach the flange over the finish material by screwing it in place. Make sure the slots in the flange that receive the hold-down bolts are positioned on the sides of the flange. There is some adjustment for the bolts in these slots to achieve precise alignment later.

Now, attach the flange to the house waste system from below the floor. Depending on your local plumbing code, and where you place the toilet, this job can be very simple, or much more complicated. In this installation, the toilet was less than 6 ft. away from the main house stack—the large diam-

eter vent you see on the top of house roofs. Therefore, we just ran a length of 3-in.-dia. plastic pipe from an old tee in the stack and to the flange. If, however, the flange is much farther from the main house vent, you will have to run another stack up through the roof so the system is vented properly. Consult your local building department before proceeding. Also keep in mind that horizontal runs of waste line should be pitched $\frac{1}{4}$ in. for every foot of run toward the sewer outlet.

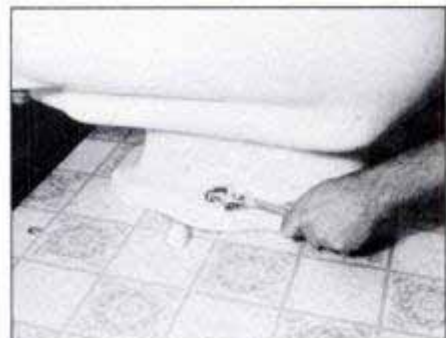
There are many fittings available for making the connections you need. These are joined to the pipe using a two-step system of solvent cleaner and welding cement as shown in the photos. These products are standard hardware store items. Keep in mind that the



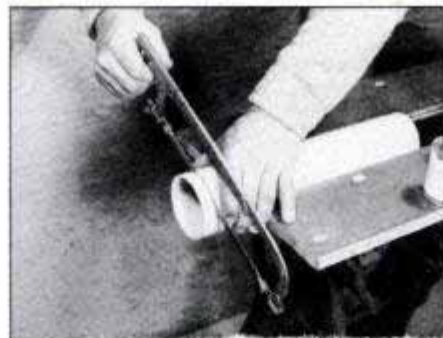
Slide the hold-down bolts into the flange slots so both are parallel to the room wall. The slots have room for precise adjustment.



Press a new wax seal, smooth side up, onto the flange. It should fit just between the bolts and be centered over the waste hole.



Lower the bowl into place so the side holes slide over the bolts. Push down to flatten the seal, then install washers and nuts.



Begin fabricating the new waste line by cutting lengths of 3-in.-dia. plastic pipe to size. Use a hacksaw and make square cuts.



To join any fitting to the pipe, first wipe the pipe end and fitting seat with solvent and a soft cloth until both are clean.



Next, apply plastic welding cement to the mating surfaces of the pipe and fitting using the applicator that comes with the can.



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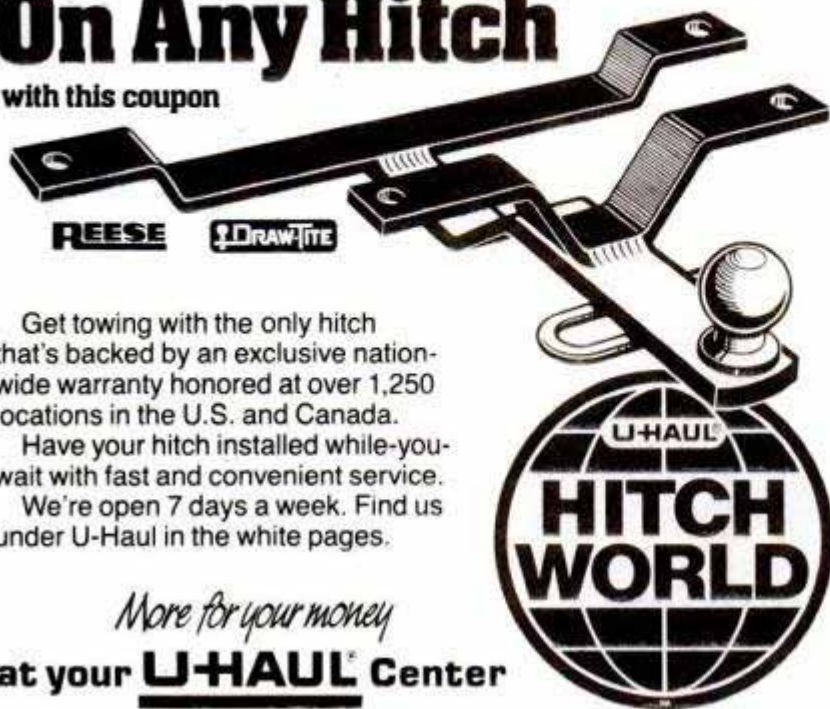
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RELOCATE A TOILET

cement bonds almost instantly. Within two minutes the joint will be impossible to move. Because of intense fumes, be sure to follow the instructions printed on the containers.

Once the waste line is hooked up, install the new cold water supply line to the toilet's water tank. In this installation the existing supply lines were iron pipe, which is inferior to copper tubing in just about every way. It is much harder to work with, and it corrodes over time. Whenever you are installing new plumbing, replace as much of the iron pipe and fittings as you can.

The conversion to copper is more straightforward than the conversion from cast to plastic waste lines. All that's required is a standard copper adapter that has a sweat fitting on one



Slide the fitting over pipe and push until the pipe is seated. Then turn fitting 1/4 turn to make sure cement spreads evenly.



Test-fit preassembled section between the flange and the waste line. Then clean and cement both end joints at the same time.



Tap into your existing cold water line by removing a section of iron pipe, as shown, or by cutting through a copper line.

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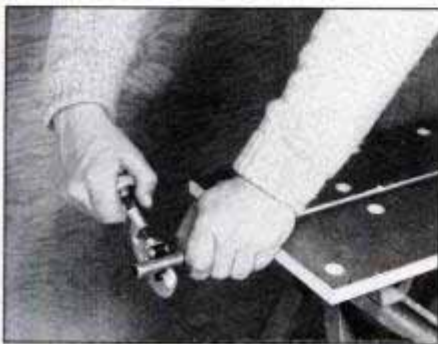
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#MMC 1985

end and pipe threads on the other.

To install it, locate a convenient place to join into the old system, such as a tee, coupling or elbow, and remove a section of old pipe. Then sweat-solder the adapter onto the end of the copper tubing as shown. When sweat-soldering, the most important task is to clean thoroughly both the fitting and pipe where they join. Rub with steel wool until both shine brightly, then use liberal amounts of flux.

Slide the fitting over the pipe, then heat with a propane torch. Adjust the torch so the interior blue flame is about 1 in. long, then hold the tip of this flame next to the joint. When it's hot enough, touch the joint with solder and the solder will melt instantly. The joint is complete when the solder drips out the



Use copper tubing instead of iron pipe for the new supply line. For best results, cut it to length using a tubing cutter.



Once the tubing is cut, and the burrs removed from the inside of the pipe, clean the end with steel wool until it shines brightly.



Using your finger, apply a generous amount of soldering flux to the end of the tubing. When heated, the flux helps clean the pipe.

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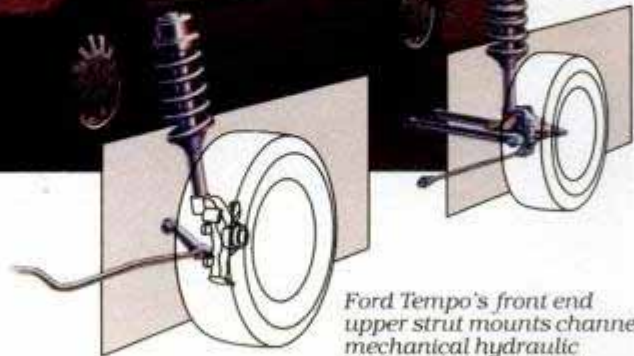


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RELOCATE A TOILET

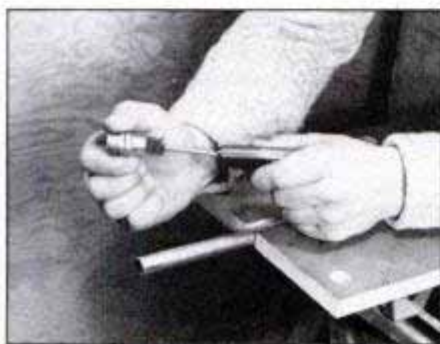
other side. Let the assembly cool, then apply pipe joint compound to the threads and turn the adapter into the old iron pipe fitting. If you already have copper supply lines in your house, choose a convenient spot, cut the tubing with a tubing cutter, install a tee between the cut sections and run your new supply line from the top of the tee.

As with the waste lines, the supply line should be pitched slightly down from the fixture it supplies—about 1/4 in. for every 4 ft. of horizontal run. This is required so the system can be drained completely from a single low point.

Extend the new supply line to the toilet using a variety of copper fittings. Then bore a hole through the bathroom floor at just below the supply hole in the water tank. In most new construction

the supply line comes out of the wall behind the tank. This allows the bathroom floor to be cleaned without obstruction. But in our case, there was a 12-in.-wide beam directly below the wall, so we came through the floor.

Next, place a new wax seal over the waste flange as shown and lower the toilet onto the seal. Make sure the hold-down bolts protrude through the base holes. Then rock the bowl back and forth slightly to flatten the seal. Install washers over the bolts, tighten the nuts and cover with the porcelain or plastic covering caps. Reinstall the shutoff valve and supply line above it, then turn on the water and immediately check for any leaks in the supply line. Finally, flush the toilet and check for leaks in the waste line. **PM**



The inside of each fitting must be as clean as the tubing end. Use steel wool, emory cloth or the inexpensive wire brush shown.



Also apply soldering flux to the inside of each fitting—in this case a male pipe thread adapter—and slide it over the tubing end.



Using a propane torch, heat the joint with the tip of the inner blue flame. When hot enough, the solder will melt into the joint.



Allow the pipe to cool for several minutes—or dip it in water—then cover threads on the adapter with joint compound.



Thread the copper pipe and adapter assembly into the iron pipe supply line and tighten it securely with an adjustable wrench.



Reinstall the shutoff valve and join it to the toilet tank with its extension nipple and compression fitting. Turn on the water.

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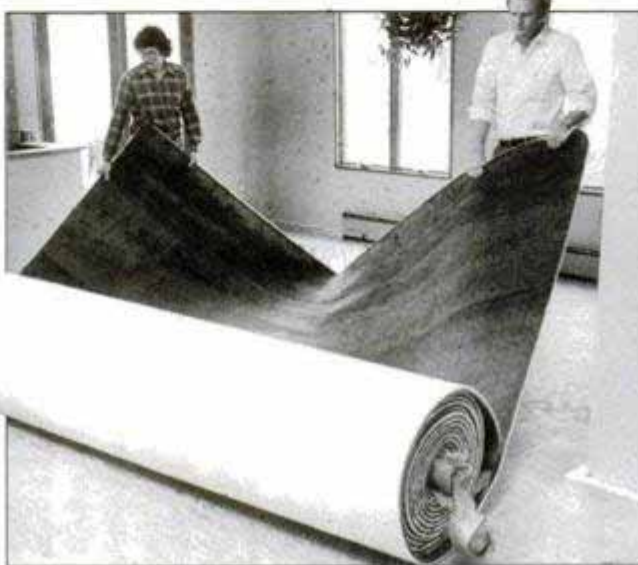
Attached padding offers quality, a soft step and easy installation.

BY ARTHUR ROOZE
 Associate
 Home And
 Shop Editor

Cushion-backed carpeting is increasingly popular with homeowners looking to save installation cost without having to settle for a second-best floor covering. Attached, high-density urethane or latex foam backing eliminates the need for separate padding and simplifies many of the fitting, stretching and tacking procedures required with unbacked carpeting.

Foam-backed carpeting is dimensionally stable. It won't expand and contract with temperature and humidity changes, so it doesn't have to be stretched uniformly into place. In a small room, in fact, it can be laid loose, without attachment to the floor. The backing is mildew-proof, so it's usable below grade level, and applicable directly over concrete.

Seaming also is easier with backed



Backed carpeting is available in 9-, 12-, and sometimes even 15-ft. widths, with either 1/4- or 3/8-in.-thick foam padding.

carpeting; it has straight, square-cut edges that butt together evenly, and are joined readily with seam sealer. The backing also keeps the carpet edges from unraveling, so there's no need to bind a cut edge.

Foam-backed carpeting comes in 9-, 12-, and sometimes 15-ft. widths. To determine the amount you'll need, measure both dimensions of the room including any projections. If possible, lay out the carpet so the major traffic

Technical consultant: Mike Tarvin, Textile Rubber and Chemical Co.

Photos: George Ancona

flow is along its length. Allow for the carpeting to extend at least 3 in. into each doorway.

A room larger in both directions than the width of your carpeting will require a seam, placed preferably in a low-traffic area and away from doorways. As you plan the layout, keep in mind that the pile of two adjoining pieces of carpeting must run in the same direction. If you are extending the carpeting into a closet, plan your seam to fall under the closet door.

The room we carpeted required a seam near its center, and at four closet doors. We used carpeting with a 3/8-in.-thick urethane foam called Kangaback, manufactured by Textile Rubber and Chemical Co., Tiarco Drive, Dalton, Ga. 30720. This, and similar backing, is available on a wide variety of carpet brands, and also comes in 1/4-in. thickness. We secured the carpeting with 2-in.-wide double-face tape.

The only installation tools you'll need are a tape measure, a long straightedge, a utility knife with extra blades and a wide, blunt cold chisel to work the carpet tightly into corners. Since we had a long center seam, we rented a knee kicker to help draw the joint snug, and a tractor—a small wheel device for pulling up nap



Remove baseboard, then run 2-in.-wide double-face tape around the room perimeter. Leave the protective top paper in place.



Tape down 6-in. x 6-in. Ts over the entire floor, spaced about 18 in. apart. Again, leave the protective paper in place.



Position the largest piece of uncut carpet, folding as necessary. If possible, place finished factory edge at seam location.



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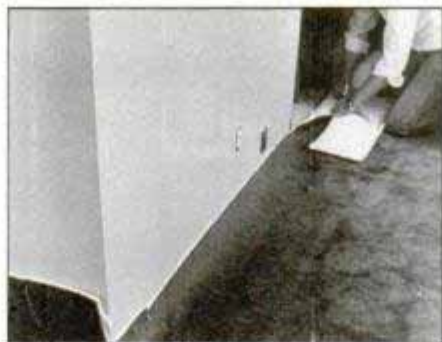
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FOAM-BACKED CARPETING

at the seam. Rent both for about \$10 a day at most carpet stores. We also bought liquid seam sealer and a squeeze bottle with applicator cap.

Before you begin installation, move all furniture out of the room, and remove the baseboard and shoe molding. If you plan to reuse these pieces, take them off carefully, and number them. Remove all doors that open into the room. Vacuum the floor to pick up dust, which could prevent the tape from sticking. Then, proceed with each step as shown in the photos.

Note that any seam located near the center of a room is joined and taped in



Unfold carpeting and rough-cut to fit the room, using a utility knife. Allow at least 2-in. excess along the walls, and 3 in. extending into doorways.



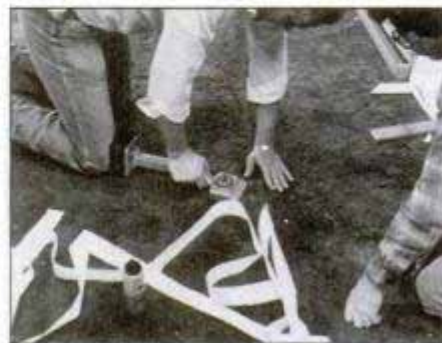
Butt the seam joint. If cutting is required, cut from the back side using a long straightedge and sharp blade. When fitted, scribe the floor below with a pencil.



Roll back carpeting far enough to put down three side-by-side lengths of tape, the center length directly over the pencil line. Then, reposition the carpeting.



Apply seam sealer to one foam edge, then join the two pieces, peeling back the protective paper from the tape below as you go. Work in 18-in. segments.



Apply pressure from both sides of the seam to snug the joint. Use a knee kicker, or kick with the heel of your shoe. Press firmly to anchor the carpet to the tape.

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Barn/Garden Shed Our well-designed yard building provides handsome storage for yard tools, hand tools, power equipment, gardening supplies and a gardening center for the whole family. It also has an upstairs loft! Dim.: 12 x 16 ft. Plans, instruction manual & material list. (1 plan: PL-1278—\$10.50) (2 plans: PL-1278A—\$17.50)



PM's Computer Home Workstation—This three-piece desk keeps everything neat and gives you plenty of room to work. This is for a state-of-the-art home computer system. An efficient work station you cannot buy, it can blend with your home decor and, it is more advanced than any office workstation you've seen. Plans and material list. (PL-1828—\$6.95)



Desk—For Home/Office Electronics—Here are plans for building the desk and matching bookcase storage cabinets for your electronically equipped up-to-date home office. Both pieces are carefully designed to meet your needs. Plans and material list. (PL-1818—\$5.95)



Glass-Doored Display Cabinet of solid oak in Mediterranean style. Can serve many purposes. SHOW OFF YOUR GUNS; has locking storage for ammo. Or, fitted with shelves, it makes a fine trophy, knicknack or china cupboard. (PL-1720—\$4.95)

Send your name and address with check or money order payable to **POPULAR MECHANICS**. Mail to: **Popular Mechanics, Box 1014 Radio City Station, New York, N.Y. 10101**

NRI shows you how: Make money repairing small engines!

There are 50 million small engines out there, and many are waiting for qualified servicemen to fix them. NRI can give you the training you need to cash in on this opportunity, and you learn at home in your spare time, at your convenience.

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You learn by doing with NRI "hands-on" training. As part of the NRI Master Course, you get a brand-new 5 HP Tecumseh engine plus a power generator to work on. You learn to diagnose problems, tuneup and adjust, even tear down for valve and ring jobs. And your training includes professional tools like an inductive tachometer, volt-ohm meter, torque wrench, valve spring and ring compressors, complete wrench set, and more... all to equip you for learning and earning.



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NRI's Basic Course puts special emphasis on lawn and garden equipment, teaches you the theory and practice of ignition, lubrications, cooling, and starting systems. Its 30 "bite-size" lessons concentrate on one subject at a time to let you move at your own pace, give you greater clarity and faster learning.

The same teaching techniques give you advanced training on the 45-lesson master course... training in the repair and servicing of a wide range of other motors including generators, industrial equipment, even motorcycles. You learn to service electrical systems, transmissions, clutches, power take-offs, and more.

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Although not required for graduation, your Master

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1102-045

place first. Then, once the seam is made, roll the carpet pieces on both sides toward the seam, remove the protective covering from the tape underneath and roll the carpeting back into place. Smaller sections of carpeting like narrow strips along a wall can be seamed after the main carpet piece is taped in place completely.

After carpeting has been cut to fit walls, corners and doorways, put down metal binder strips or saddles at the doorways. Replace baseboard or shoe molding, and remount the doors. You may need to cut off the door bottoms slightly for a free swing. **PM**



Roll seam with a tractor, which pulls up the pile evenly along its length. Or, use your fingernails, making sure no sealer has squeezed up and adhered to the pile.



Roll up carpeting toward the seam, remove protective paper from Ts, then roll out carpeting again, so it's perfectly flat. Remove paper from perimeter tape at edges.



Using a wide, blunt cold chisel, push carpet tightly against the wall and down on the tape at the same time. Cut along the crease line with a utility knife.



To seam a closet piece, cut carpet edge directly under the door using a straightedge and utility knife. Rough-cut carpet with scissors to fit around the jamb.



Join the seam as shown on the previous page, then make final trim cuts around door jamb. Put down a metal binder strip over any seam in a heavy-traffic doorway.



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PAW ENGINE KITS ARE COMPILED FROM THE COUNTRY'S TOP AUTOMOTIVE PRODUCTS. TOP BRAND NAMES AT WHOLESALE PRICES.

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YOUR LOW PRICE \$34.95

1942 Early S.B. 35 78 1942 Late S.B. 78 84

SPECIAL

UNASSEMBLED 350 CHEVROLET 4 BOLT MAINS

9 or 10-1 COMPRESSION RATIO

SHORT BLOCK KIT

350 4 bolt main block bored oversized honed for Moly Rings. Decked one honed garter valve Rocker arm outside factory orange Tinted heavy duty connecting rods with A.B.R. chrome Moly rod bolts. Chrome Moly rings, crankshaft custom ground on rod & main journals. Moly polished with Clevis 77 rod & main bearings for perfect fit. Double roller timing (that set your choice hydraulic or solid camshaft). Assembly balanced for maximum performance.

LONG BLOCK KIT

As above with cylinder heads performance valve job. New valves 1.94 intake & 1.50 exhaust. Hi performance springs. HD rocks. Chrome Moly push rods, lifters, in your oil pump. Complete gasket set & long slot rocker arms.

SHORT BLOCK KIT - YOUR LOW PRICE \$995.00

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OPTIONS AVAILABLE
For 11 Compression Ratio ADD \$100.00
For Steel Crankshaft ADD \$75.00
For Cylinder Heads with 2.32 & 1.90 valves ADD \$75.00
For Crankshaft with screws in 1000's & 2000's states ADD \$40.00
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RPM RANGE 650 to 9000

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These Manifolds are Non E.G.R. We have E.G.R. Manifolds please phone for price

ON SALE

S.B. CHEVY WEIAND MANIFOLD SPECIAL

OPEN PLENUM
RPM RANGE 2000 - 6000

1946 Your Low Price \$69.95
S.B. Chevy

ON SALE

PREMIUM QUALITY PISTON RINGS

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Iron Compression 24.95
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9810 800 CFM Chevy \$197.95
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YOUR LOW PRICE

MECHANICAL STREET & OFF ROAD Produces 6 gpm 80 GHP \$24.95

ELECTRIC STREET & OFF ROAD Produces 5 gpm 72 GHP \$36.95

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SMOOTH IDLE - STRONG LOW END AND MID RANGE POWER.

Kit Includes Camshafts-Lifters-Springs **\$139.95**

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Available Std. 030 040 060

Chevrolet 305 350 99.00
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For Moly Rings ADD \$15.00

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Available for most V8 & 6 Cyl Domestic engines Ford-Chevrolet-Mopar Your Low Price **\$115.00**

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Kit Includes
CL77 Rod Bearings
STD-010-20-030 Piston Rings
STD-030-040-360 Gasket Set

Available for most V8 and 6 Cyl. Engines

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TRW FORGED FLAT TOP PISTON & RING SPECIAL

Available Std. 030 040 060 CALL

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351C 194.00
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Kit Includes Arms, Balls, Nuts

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12 Engine cleaning brushes, covering sizes 1/4 inch up to 5 1/8". A must for all engine people.
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Available for most popular Domestic Engines

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• ROD & MAIN BEARINGS
• PERFORMANCE GRINDING
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• CAMSHAFT - LIFTERS - SPRINGS
• FINGER CHAIN SET
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COMPLETE UNASSEMBLED HOME REBUILD SPECIAL

• BLOCK
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• CONNECTING RODS
• CAMSHAFT
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STD BORE 030 OVER 060 OVER

CUBIC INCHES FROM YOUR 350 CHEVY

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SPECIAL

UNASSEMBLED 289-302 FORD

Your Choice 9 or 10:1 COMPRESSION RATIO

SHORT BLOCK
Semi-ported block, bored, overlaid, competition honed, forged pistons, chrome moly piston rings, connecting rods, fitted chrome moly rod bolts, custom ground for precision fit with matching bearings. Your choice of solid or hydraulic camshaft. Double main timing chain. Bearings for maximum performance.

LONG BLOCK
As above with cylinder heads, competition valve job, hi-performance valve springs, chrome moly push rods, MD lock, 4-volume oil pump, lifters, garnet set.

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• 42100 Series Black
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• 1/2" Dia. Diameter 0-8000 RPM
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• 42101 Chrome
• 1/2" Dia. Diameter 0-8000 RPM
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As Low As \$19.95

WE SHIP COD, NO DEPOSIT ON MOST ITEMS IN STOCK ORDER BY PHONE

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MANLEY O.E.M. REPLACEMENT VALVES



• Intake
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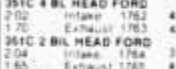
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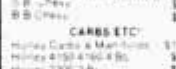
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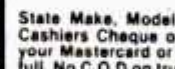
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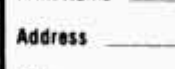
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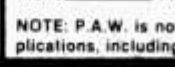
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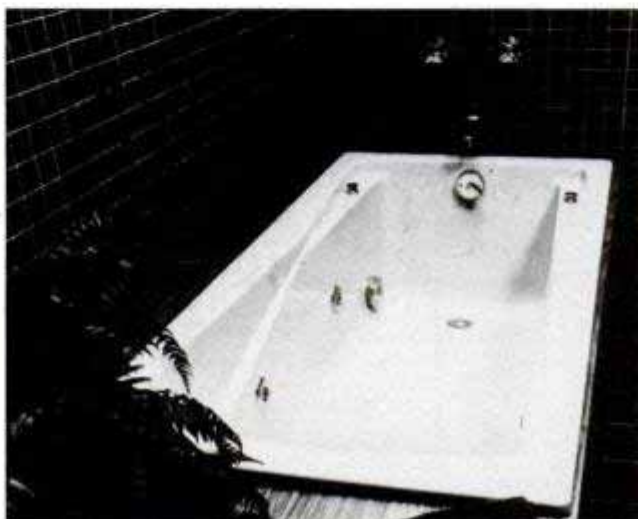
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Acrylic whirlpool

Fiberglass-reinforced acrylic whirlpool bath from Kohler Co., dimensioned to fit a standard 5-ft. space, can readily replace an existing tub. The unit mounts either in a raised platform, as shown, or directly on the floor, utilizing an optional side panel. Four whirlpool jets are independently adjustable. Weighing 60 pounds, the bath is available in eight colors from plumbing supply houses and home centers; cost is about \$1,200. For more information, write Kohler Co., Kohler, Wis. 53044.



Ultrathin scale

Wafer-thin electronic bathroom scale measures just 1 in. high, has no springs or moving parts. Large digital readout displays weight—from 15 to 350 pounds. Scale has automatic on/off switch and a low-battery indicator. Available at department and houseware stores, the Accutech Electronic Scale sells for about \$50 and is made by Fyrnetics Inc., 1021 Davis Rd., Elgin, Ill. 60120.



Multipurpose bathroom storage cabinets



Solid pine cabinets from Sears, with open lower shelves for folded towels, can be installed on the wall over the toilet. "Open Home" style, left (\$170), has a wide crown molding and raised-panel doors. "Pinewood," right (\$130), has brass-plated strap hardware. Each contains three interior shelves. Matching vanities are available. Sold at larger Sears stores and through their general catalog.



Even-temp shower valve

You may eliminate your shower going hot or cold when someone flushes a toilet or turns on the dishwasher by installing this pressure-balanced shower valve. According to the manufacturer, an internal diaphragm makes instantaneous adjustment to pressure changes, maintaining water temperature to within 1°. The single-lever faucet is smaller (7½-in. dia.) than most conventional shower-control units, so it may require replacing several ceramic tiles in the shower wall. The Tempress II faucet, by Danfoss, Box 606, Mahwah, N.J. 07430, sells at plumbing supply outlets for about \$75.

Water-saver toilet

Designed for use where water supply or septic disposal capacity is limited, the Seiche One toilet uses only one quart of water per flush because a flapper valve takes the place of a trap for blocking sewer gas. According to the manufacturer, installation takes about one hour. Toilet and hook-up parts cost about \$250. Patrick Creek Corp., Box 135-A, Hinesburg, Vt. 05461.

(Please turn to page 172)





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DRIVING GM'S MINIVAN

(Continued from page 48)

sions: Cargo Mover for commercial use and People Mover. The venerable Iron Duke ohv 2.5-liter Four is standard, with the 4.3-liter V6 optional. Base gearbox is the four-speed manual, with a five-speed stick or four-speed over-drive automatic optional. The five-speed goes on sale in May and will be available only with the 2.5 Four.

In the fun-to-drive Safari People Mover, I found myself sitting high in excellent front bucket seats, with the stick shift lever set slightly back from normal. Seating can range from two to eight passengers. The rear benches or buckets have fold-flat backrests and quick-release floor mounts. With only the two front, the People Mover boasts a 7.4-foot cargo deck.

The seven/eight-person setup comes with cup racks and storage bins on either side of the rear bench, and you can order slide-out storage compartments under the front seats.

Fit and finish impressed me as being absolutely first-rate, and I have only three trifling qualms about the Safari. First, it looks like internal rain gutters will drip water on your head as you enter and exit. Second, the rear window divider and high seatbacks make backing up chancy. And third, I judged the brakes a little spongy. The van stopped fine, but the pedal lacked definition. Other than that, the Safari is another great minivan, and I'm sure the identical Astro from Chevrolet is, too. **PM**

THE PM REPORT CARD

GMC Safari	GRADE	COMMENTS
Acceleration	B	Good with the V6
Handling	B	Fine for normal driving
Braking	C	Short stops but soft pedal
Steering	B	Okay for normal maneuvers
Transmission	A-	You have to get used to lever position
Ride	B	A tad jouncy over front axle
Fuel economy	B	Four okay (21-28 mpg); V6 thirsty (16-20 mpg)
Seating	A	Great seats, high position
Vision	B	Tall rear headrests and backlight divider obstruct vision
Gauges controls	B	Tricky, yet legible. Try to be digital but aren't
Ventilation	A	Infinitely adjustable system
Noise @ 55 mph	B	Noisy engine fan
Cargo capacity	A	Rear seats come out easily
Engine serviceability	C	Engine cover easy to remove
Fit and finish	A	Very nicely done

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WORLD'S HOTTEST FIGHTER

(Continued from page 77)

at the moment it seemed to stall out.

When we started to roll down the runway, a T-38 chase plane was taking off alongside. For this flight, I would keep both my flaps and my landing gear down just in case I had to make a quick landing. I would go into the airborne mode with my wheels still on the ground, as in the taxi tests. You can't feel the wheels leave the ground when you fast taxi this way, so I watched for my up-and-away light to go on, and suddenly I was off. Even as I started clearing the runway, I lost sight of the chase plane. As I headed up toward my 15,000-foot level-off spot, I checked the air-conditioning and defogger controls in the cockpit just as I set myself up over Edwards for the first of three "integrated test blocks." These are the basic pitch, roll and yaw moves. I had gone through the entire set of maneuvers on

a simulator three or four times. I knew these routines by heart.

The computers hummed along nicely and the plane responded to my every command. Now the test pilot in me went to work. How would I rate this plane for flying? Could I trust my life to it? A second thrill hit me as I realized the X-29 was easier to fly than the simulator. I could see the real world around me, not cathode ray images.

But the real advantage this had over the simulated flight was feeling. I could feel that powerhouse pushing me along. I could feel the airplane responding as I twisted and turned it in our set flight pattern. What a great airplane!

Now, taking the X-29 down to 10,000 feet, I reduced the throttle to landing speed and tried a few course corrections, turning first away from Edwards and then back toward the base. I made a bank angle correction and the airplane moved swiftly to my command. I

(Please turn to page 170)

A Life In The Sky

A test pilot's reward is the flight itself. But his work just gets started after the first takeoff and landing. In the weeks following the first X-29 flight, there was a short Christmas break and then a series of meetings to go over the test results.

A pilot's opinion is valued highly, as I learned during a tour of duty in Vietnam. I was flying with an F-4 squadron under the leadership of my good friend Roy Gray. On a mission, one of our planes took a 50-mm shell and started to dive. Roy dropped lower, observing as the pilot ejected.

The plane had been hit where six hydraulic lines come together and the pilot's controls no longer responded. Another pilot, Eddie Page, had a master's degree in aeronautical engineering. We got together with Eddie and our executive officer, Bud Baker, and put out a report on how to make the F-4 less vulnerable to ground fire by separating the hydraulic lines. We sent the report to Washington and soon the jet was undergoing modification.

Today's F-14 reflects that modification begun with the F-4s. By separating the engines, room has been made between them for the hydraulic lines. The engines, therefore, act as a shield. A pilot can fly a plane with one engine. But he can't fly it without the hydraulics.

It was combat experience that gave me some of my best test pilot preparation. But the experience I received at Navy test pilot school and as an exchange pilot with the Royal Air Force gave lots of polish to skills that were won in actual combat.

I went to test pilot school in Pautuxent River, Md., in 1961. I had received orders earlier for the school, but I was sent to Japan and had to beg off the first time. I was a captain then. When I finally went to school, I was a major. I was given far better assignments than the lower-ranking pilots. In one year, I was able to fly 20 different aircraft over 500 hours of testing. Today, 500 flying hours in one year is unheard of.

An active pilot might log 200 hours.

The other big break came when I was assigned to the 74th squadron of the Royal Air Force from 1955 until 1957. Under the leadership of the late and great pilot Keith Hazelwood, the squadron became the RAF Formation Aerobatic Team. I flew left wing for the team and we did very well in competition and demonstrations.

There is a lot of romance in the work of a test pilot, but there is also a lot of work and a lot of detail. For the military test pilot, the work is very exciting, but it is even more so for the contractor test pilot. I fly the airplane first.

The romance part bit me when I was about 5 years old, growing up on my grandfather's farm in Valley View, Tex. I had been fascinated with airplanes, as any little boy, but one afternoon a light plane got into trouble and had to put down on a field near our farm. There were people running and screaming all over the field. The excitement got me going.

I learned about the negatives of being a professional pilot on the job. With the territory has come a certain danger. You lose a lot of friends in this business. Last year was a terrible year for losing friends. Doug Benefield, one of my very good friends, was killed in the crash of a B-1 bomber. Less than a month later, Darrell Cornell was killed in an F-20 crash in Korea. That same day, Bill Laughton was killed in a special version Air Commander he was testing.

During the Christmas break, after I had flown the X-29 for the first time, my mother congratulated me and said she was looking forward to my retirement. Despite all the bad news of 1984, I told her not to count on my retirement any time soon.

By next year, I hope to be flying an upgraded version of the F-14. Beyond that, I can't say what I'll be doing. But as long as I can follow a flight plan, you can bet I'll be in the air.—C.S.

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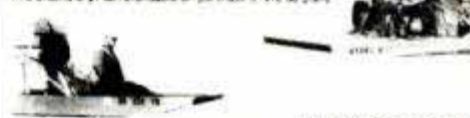
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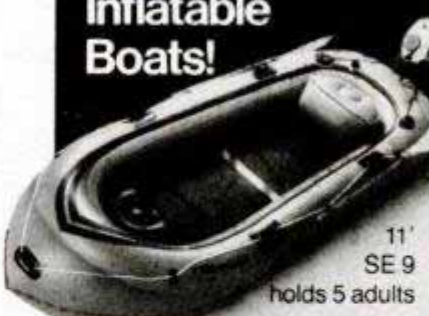
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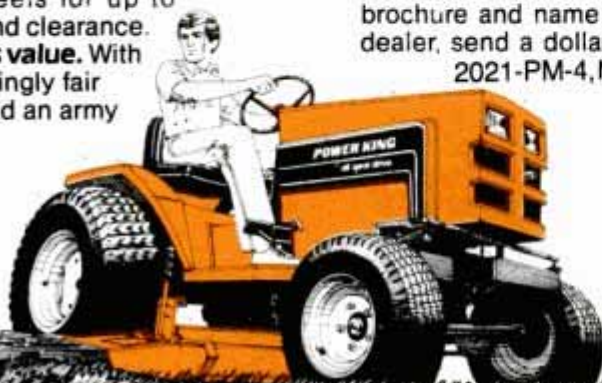
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WORLD'S HOTTEST FIGHTER

(Continued from page 169)

powered up and down and the engine hummed beautifully. I wished I had had a plane that moved something like this in Korea or Vietnam.

When I flew with the Marines out of Pohang in 1952, it was in an F9F-2 Grumman Panther. In its day, it was a hot single-seat fighter-bomber. The other pilots in my group nicknamed me "magnet tail," to put it politely, because I always managed to pick up enemy fire.

I took 13 straight hits as a fighter-bomber pilot in Korea and even got shot down behind North Korean lines once. For three days I evaded enemy troops, hoping to paddle out to a U.S. held island in my raft. On the third day, I saw a man descending overhead in a red parachute. I hadn't seen his plane go down, but I figured a red chute belonged to a MIG pilot. Little did I know that some U.S. Air Force pilots had been issued red chutes to help rescuers spot them if they went down in snow.

In what seemed like minutes later, an Air Force Albatross was skimming the water near that pilot and picking him up. I waved to the American rescue craft, but the enemy was shelling the area and they had to run out of there very quickly. Imagine, I thought, Americans picking up a MIG pilot and stranding a Marine. But, a short time later a Dragonfly helicopter picked me up and took me to an American ship.

Loved the plane

Had I flown an airplane as fast and as easy to move about as the X-29, maybe none of it would have happened. The fighter pilot in me loved the experimental plane even more as we got ready for the next to the last test on the X-29's first flight. This would be a real landing attempt with a wave-off.

I started descent in an actual landing approach. When the X-29's wheels were dangling about 15 feet off the runway, I took the wave-off. There was a crosswind of about 5 knots and a head wind of about 15 knots as I moved the plane away from the runway and back up to 1,500 feet. The X-29 cleared the deck crisply and we were going into our 360° turn for the final test within seconds. The final test was the real landing. The X-29 glided in like a bird and came to a stop a few hundred feet up the runway. We had done it!

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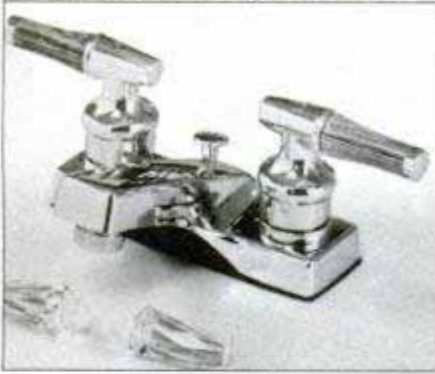
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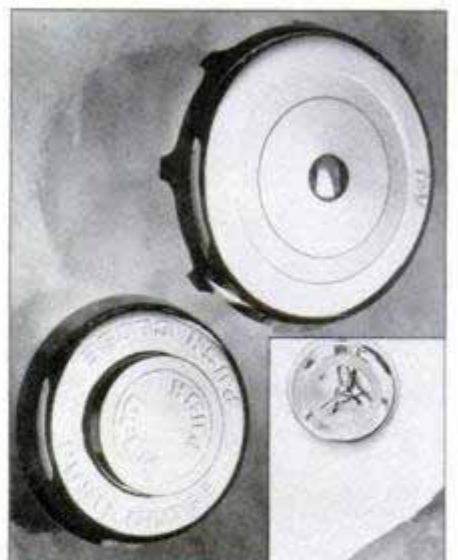


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Water heater timers

Programmable timers for both electric and gas hot water heaters save energy by lowering water temperatures automatically during periods of low hot water use. The 24-hour timing clock can be set to allow a maximum of three high-temperature settings per day. Made by AMF Paragon, Box 28, Two Rivers, Wis. 54241, the Qwaterback II (gas) and Model TC-604 (electric) come with complete installation instructions. They are at hardware and home supply centers for about \$69. **PM**

SHORTWAVE LIGHTWEIGHTS

(Continued from page 85)

dial, raising or lowering the displayed frequency. They're as accurate as direct-entry models and some have push-button station-memory presets.

Memory presets, more commonplace on direct-entry receivers, let you store your most-used frequencies for one-button recall. This is more helpful than you may realize, since shortwave frequencies are often five digits long.

Automatic scanning is another innovation of electronic tuning and it's nice for quickly seeing what's available on the dial. Auto-scan will move up and down the shortwave band, stopping momentarily at each signal. But it tends



Zenith's 1941 Trans-Oceanic measured 20 1/2 inches high by 16 1/2 wide by 7 1/2 deep, and weighed nearly 20 pounds with batteries.

to miss weak and moderate signals.

Compared to electronic direct-entry, mechanical tuning's advantage is simplicity. Because it's easy to use and relatively inexpensive, it's usually found in the smallest portables. On the negative side, shortwave frequencies are packed on the ruler-like tuning scale more tightly than AM or FM stations, so finding the right frequency can be frustrating with the mechanical system.

Both the ruler-like scale on mechanically tuned radios and the digital LCD readout on electronic ones will show you meter band and station frequency. For example, the relatively high frequency of 21.75 MHz (21,750,000 cycles per second) is found on the 13-meter band, while the low frequency of 6.2 MHz is located on the 49-meter band. The meter band describes wavelength: Literally, the physical distance (in meters) the radio wave travels to complete one cycle. The lower the frequency (or fewer cycles per second), the longer each wavelength.

Tuning systems aside, the difference between one of today's shortwave portables and another model is likely to be the convenience features that make shortwave listening more pleasant.

For example, the sensitivity adjust-

(Please turn to page 174)

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SHORTWAVE LIGHTWEIGHTS

(Continued from page 173)

ments found on many portables enhance a radio's performance. With this adjustment, you can keep high-powered stations from muscling-out weaker ones located nearby on the dial.

Some radios with a sensitivity control have a high-low switch, while others have a continuously variable knob. The knob gives greater flexibility, but even a switch is better than no control at all. Keep in mind that the smaller, mechanically tuned portables tend to be less sensitive than their larger, electronically tuned cousins. If extreme portability is your desire, you might find your shortwave reception dominated by international heavies.

In general, though, today's portables have excellent sensitivity and selectivity: They can often turn a weak signal into an intelligible one, and can home-in on just the station you want.

Accordingly, the pull-up whip antenna built into all portables should prove sufficient for most listening. Experiment with different radio positions, antenna angles and heights.

External antenna

If you plan to try for the distant signals, select a radio that has jacks for an external antenna. You might not want to string cables across your backyard, but an antenna jack lets you connect a longer wire to the radio which will serve to increase the amount of signal received.

You can even improve reception by wrapping a wire around your radio's whip antenna and running it along the floor at the base of a wall, or around the side and top of a window frame.

While the usefulness of sensitivity controls is readily apparent, a feature such as tone control might seem a frivolity for shortwave. But it can improve the audibility of weak signals. Turning the tone control toward bass, or switching it to low, can make a static-ridden signal more intelligible.

A clock or timer may seem like a silly complication on a radio, but it's helpful because shortwave program times are stated in world-standardized Greenwich Mean Time (GMT). GMT is five hours ahead of U.S. Eastern Standard Time. A timer is nice if you like to doze off to the sound of a radio.

Lighted dials and battery-check meters are handy additions to a radio, for obvious reasons. Audio output jacks let you use headphones, for better fidelity than the radio's built-in speaker may afford. An audio-out also lets you connect your radio to a tape recorder.

Finally, AM and FM bands are included on most receivers, so you can catch a weather report or a ball game

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without switching to a different radio. Advanced features and improved technology might make shortwave listening easier than before. Nonetheless, listening with even an advanced radio can be bewildering for someone who is accustomed only to tuning in AM and FM stations.

Changing frequencies

Shortwave's first peculiarity is that stations change frequencies at various points in the day, mostly for atmospheric reasons. At night, low frequency signals, like those of AM radio, travel great distances because of ionospheric reflection. Accordingly, shortwave stations move to the low end of the dial when the path between transmitter and listeners is dark.

During the day, higher frequencies are used to make the lower ones available for dark parts of the world, and also to avoid the interference common on low frequencies.

For example, when it's 7 p.m. on the U.S. East Coast, BBC can be found at the low frequencies of 6.005 and 7.325 MHz, respectively, on the 49- and 41-meter bands. But come 7 a.m. in New York, London's calling on 11.750 and 15.215 MHz in the higher-frequency 21- and 19-meter bands.

Shortwave stations also change frequency or meter bands from year to year, according to the 11-year sunspot cycle. During years of peak sunspot activity (midway through the cycle), reception improves on the higher frequency 13-, 16- and 19-meter bands. The rest of the time, reception here is spotty, so broadcasters crowd the lower-frequency bands.

Right now, we're at a low level of sunspot activity; the next peak is expected to arrive in 1990. This means that for the time being, stations will be more closely spaced in the low-frequency bands—one reason to invest in a radio with good sensitivity and selectivity, and possibly, electronic tuning.

How can you keep up with your favorite stations as they jump about the dial? There are two ways.

The first, and easiest, is by reading a shortwave program guide like the *World Radio TV Handbook*, (c/o Billboard, 1515 Broadway, New York, N.Y. 10036).

The second is by writing to stations and requesting program guides. Schedules often are given during programs, and frequency changes are announced in advance.

Here's another rewarding aspect of shortwave listening. Many international broadcasters will verify your reception of their station with a letter or a colorful QSL card. Many shortwavers take pride in their collection of written verifications.



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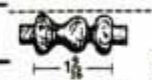
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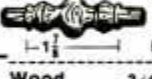
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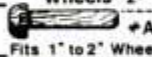
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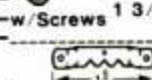
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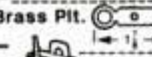
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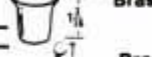
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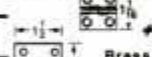
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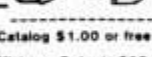
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FISHING TACKLE

(Continued from page 87)

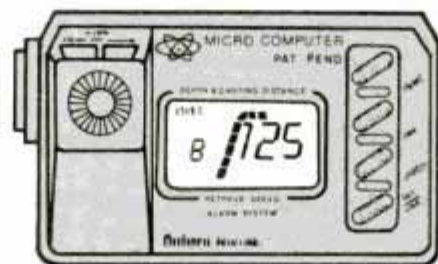
fish with less effort, more comfort and less skill.

The lighter the gear, the less the fatigue factor. Not on the tackle, on you. A long day of casting shouldn't remind your muscles of your first day in Army boot camp. The new rods are super lightweight, so you gain this advantage immediately. They also tell you more of what's happening with your gear.

New rod designs allow more of the signal to be transmitted from the lure to the rod blank. You can tell a lot more easily whether your lure is being held back by weeds or a fish.

Rod innovations begin with construction, and the materials that go into the new gear read like an update on The Periodic Table of Elements—graphite (carbon), boron, silicon, Kevlar. This last material isn't mined, it's made. Kevlar is as strong as graphite but is 20 percent lighter.

The Kevlar/graphite composite, as used in Daiwa's KGX Series rods, represents some of the current evolution in



Daiwa's computerized reel uses graphic and digital readouts to transmit information.

rodmaking where graphite is combined with other materials in order to enhance its properties.

Graphite by itself is an excellent rod material because of its high stiffness-to-weight ratio—about four to eight times that of fiberglass. Also, the price of graphite rods has dropped since their introduction in the early '70s to what you would have had to pay for a good fiberglass rod back in the '50s.

Graphite offers excellent sensitivity—about 200 times that of fiberglass. Energy transfer is smooth and efficient in both directions, making for good casting qualities and exceptional signal transmission from lure and line back through the rod blank with minimum loss, when graphite fibers run uninterrupted from rod tip to butt. Shimano capitalizes on graphite's sensitivity in the handleless construction of its Magnumlite GT Fighting Rod, which lets you grip the blank itself.

Daiwa adds Kevlar fiber in a cross-wrapped net interlace pattern on the wall of its graphite rod shaft. The Kevlar doesn't hurt the rod's sensitivity, adds a greater resistance to stress-

induced twisting, and also helps damp the rod action.

One problem with graphite is its resistance to bonding. The fibers sometimes pull loose inside the bonding matrix, resulting in internal friction and fiber breakage.

Daiwa's solution to this problem is its whisker rods. They start by growing giant-size silicon carbide crystals, which then are stretched to resemble a cat's whiskers. Added to the epoxy resin and the rod's graphite fibers, the whiskers provide a super strong bond and are more flexible than boron/graphite composite rods, and more resistant to shocks and rod fatigue.

Hot rod fibers

Boron/graphite composites are considered the leading edge in rod materials. Boron is about 20 times as sensitive as graphite and is stiffer, with greater natural damping. Boron fibers are produced by reducing boron trichloride gas over heated tungsten alloy filaments. The boron coats the tungsten.

While these fibers have a higher strength-to-weight ratio over graphite, a pure boron rod, due to the weight of the tungsten, would be relatively heavy. High-content boron rods generally contain only 15 percent boron fibers.

While some rod designs mix boron and graphite fibers running the length of the rod, Shimano uses boron's extra strength and excellent signal transmission properties as transition or patch reinforcing panels where graphite cloth panels overlap in the rod.

A quick glance may not reveal the high-tech nature of some rods, but one look at Daiwa's microcomputerized baitcasting reels will tell you you're in high-tech city. The Procaster Tournament PT 10E and PT 15E electronic reels use real-time signal processing to give you continuously updated visual information and audible feedback.

The reel's built-in computer monitors the length of line you have out, and gives you an instantaneous readout of your retrieval speed on a miniature LCD screen. This information, displayed in bar graph form, allows you to duplicate the specific through-the-water speed of your lure that proves attractive to fish.

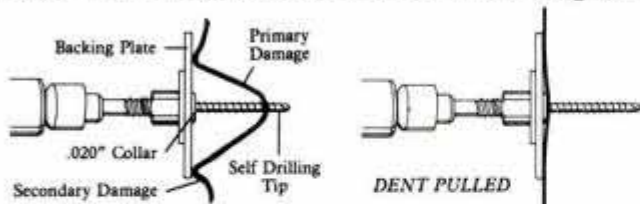
The computer also tells you how far you've cast and, when vertical jigging, the distance readout gives you the depth, in feet, of your lure. Used in conjunction with a fishfinder graph recorder, you can coax your lure right under the fish's nose.

Featuring what someone is sure to call the beep from the deep, the reel signals once every 10 feet during retrieve. The beep also tells you relatively how deep your lure has sunk after a cast by beeping once every second.

(Please turn to page 178)

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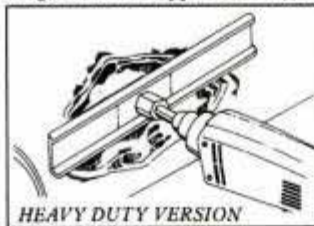
The Eastwood **BODY-MAN** tool replaces expensive, hard-to-use body tools. It lifts out dents and saves hundreds of dollars in repair bills. The unique all-metal design uses a self-drilling tip combined with a backing plate; automatically pulling damaged metal (with a vise-like pressure) back to original shape.

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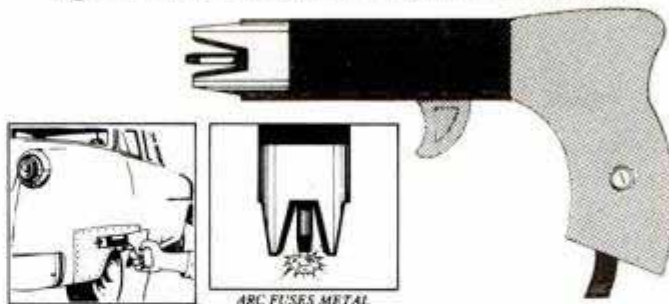
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FISHING TACKLE

(Continued from page 176)

How does the reel do all this? The microprocessor, designed by Seiko watch engineers, simply counts the number of revolutions the reel makes in feeding out and retrieving line. It compares the line footage to a clock in order to judge speeds, and it makes allowance for the increased diameter of the spool as line wraps around it. In order for the reel to judge how quickly the diameter increases, you have to program in the thickness of the line you're using. In return, the computer also will tell you how much line was out when a fish was hooked and how much line you have left after an unexpected breakoff.

Reel materials

Other reel news concerns new materials applications. Add graphite or composite (graphite/titanium has the highest strength-to-weight ratio) fibers to plastic, and you drastically reduce reel structure complexity and weight and still have a stronger, non-corrodible product. And, because they are injection molded, the cost of graphite reels has dropped to the level of older conventional reels that were more time-consuming to produce.

Another new space-age materials application for rods is Shimano's use of titanium in the drag system of its Triton Series big-game reels. The drag washers are made from a composite cloth containing titanium microparticles suspended in a nonresinous matrix. These washers allow the drag system to cope with tremendous drag heat. The titanium, in addition to being noncorrosive in salt water, can shrug off sizzling temperatures of up to 2,000° F.

Another neat design feature is the built-in cooling fins on the water shield covering the drag, which radiates heat to matching fins in the one-piece frame.

Browning Mitchell has added a new wrinkle with its Turbo Mag system, which gives you magnetic braking without sacrificing casting distance. The reel uses a small air turbine with multiblades. During the cast, the fast spinning spool and turbine pulls a circular rotor disc away from the braking magnets, allowing the spool to spin freely. But, as the spool slows down, the blades shift the circular disc sideways, closer to the magnets, braking the spool where backlash most often occurs.

And, if all this doesn't get you warmed up to the new tackle technology, how about the Hand-L-Warmer 12-volt battery-operated rod handle warmer? The unit takes about 30 seconds for initial warmup and has a low power drain. So, if you don't get that big one to warm your spirits, at least all of you won't be cold. **PM**

YESTERDAY'S DREAM CARS

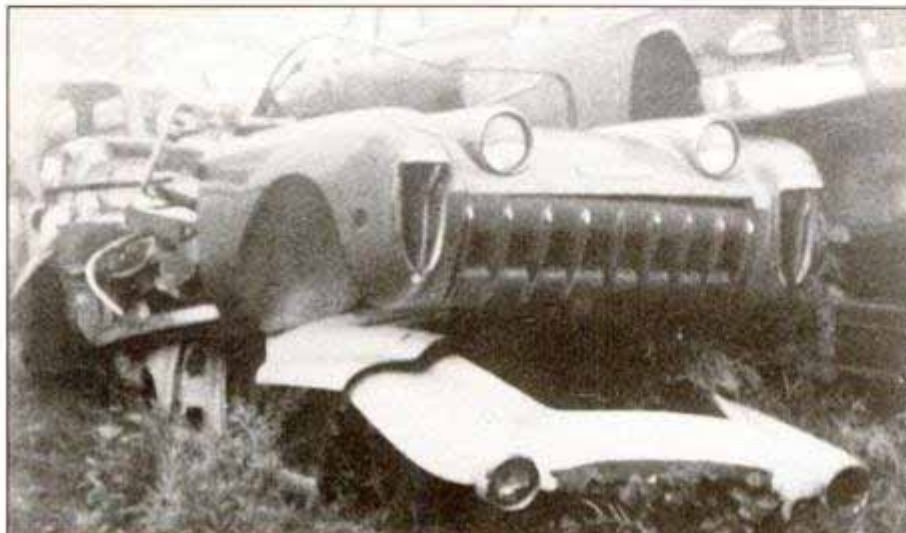
(Continued from page 95)

spotted them from helicopters! The uncrushed cars supposedly included some experimental two-seater Cadillacs, the original 1953 Motorama Corvette, 1954 Waldorf Nomad, the 1955 Motorama Chevrolet Biscayne, plus a handful of other show and idea cars that somehow managed to escape their intended fate. It's certainly true that once in a while a dream car that's long been assumed destroyed does turn up.

In the mid-'70s, for example, I heard from a friend at Ford that the original

served as design studies leading up to the first production 1967 Firebird. Both had fiberglass bodies. One XP-833 was fitted with Pontiac's sohc Six, the other with a 350-cu. in. V8. These cars were originally destined to be scrapped, but Pontiac's then-assistant chief engineer, William T. Collins Jr., felt such an emotional attachment to them that he managed to rescue the pair.

When they were later threatened again, Collins offered to buy the V8 roadster, and another Pontiac employee purchased its six-cylinder cousin. Both men still own the cars today, but only with the restriction that they never



Two GM Motorama show cars stacked up in the Warhoops wrecking yard in Michigan. Contrary to standing orders they were not destroyed, and there's enough left to restore.

Mercury XM Turnpike Cruiser from the '50s had been discovered rusting quietly in an Ohio bodyshop. That car was later purchased by an enthusiast in Southern California and is now undergoing restoration.

One of the original Waldorf Nomads, which looked like a cross between a production 1954 Corvette and the '55 Chevy Nomad station wagon, has long been rumored to be hidden in a warehouse somewhere along the coast of Southern California. Many people have searched for it, but no one's found it.

The 1953-'54 Pontiac Parisienne Motorama coupe de ville, though, turned up in 1982 and is presently being restored in a New Jersey shop. Two Pontiac X-400s, a 1960 and 1963-'64 model, came to light recently, one in the Chicago area and the second in Tucson. These are supercharged, drag-race-oriented convertibles. They were originally modified at the behest of the Latham Supercharger Company and former GM Design Staff Vice President William L. Mitchell. Mitchell, I hear, still drives another such car, the Pegasus, a lowered and highly customized 1971 Firebird powered by a 4.5 liter Ferrari V12.

Before we leave Pontiacs, I'd like to mention the two XP-833 roadsters that

drive the roadsters on public streets.

Why? "It's really a legal policy," Collins told me recently. "These aren't fully developed cars, so the company's exposure to a liability suit would be pretty high." Many dream cars had no engines or running gear, so the crush-'em edict was used merely to save the automakers the expense of storing them. Others that did have engines and did run were considered to be potential lawsuit hazards, and that is why so many dream cars went to the crusher.

But some didn't. Two large repositories now exist: the Alfred P. Sloan Jr. Museum in Flint, Mich., where GM donated ex-Motorama cars, and the garage of the GM Design Staff. Among the surviving cars in Flint are Harley Earl's 1939 Y-Job, his LeSabre, Charles Chayne's Motorama Buick XP-300, the Buick Wildcat II, two Bill Mitchell custom Rivieras, the 1956 Centurion, the bubble-roofed 1959 Cadillac Cyclone and the Corvair Super Spyder.

Those at GM Design Staff include the Corvair Monza GT, the Monza SS, Sebring Spyder II, the Corvette Manta Ray, Mako Shark I, the XP-87 Stingray racer and the mid-engined 1977 Aerovette.

Other GM dream cars with known

(Please turn to page 180)



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YESTERDAY'S DREAM CARS

(Continued from page 179)

whereabouts include the 1953 Cadillac LeMans, currently owned by a Los Angeles auto dealer, the rear-engined 1964 Corvette XP-819 experimental that went up for sale in Illinois recently (asking price: \$75,000); and the SR-2 Duntov Corvette race car, purchased by an enthusiast in Florida.

Dream car mishaps

Ford dream cars are a little harder to find nowadays, partly because they were plagued with terrible luck. One Ford show car sank with the *Andrea Doria* in 1956. Another rolled down a ramp and totaled itself. A third—a stainless-steel Lincoln convertible—got crushed by a falling tree. However, among the surviving Fords is the 1962-'63 Mustang I. Troutman-Barnes in Los Angeles built two versions of the Mustang I sport two-seater, both with a midship V4 engine, steel-tube frame, alloy body and movable pedals. These cars weighed a mere 1,500 pounds.

One Mustang I is in the Henry Ford Museum in Dearborn. This museum also owns one other FoMoCo dream car, the 1953 Lincoln X-100, whose design led to the 1961 Thunderbird. I hear the X-100 is in pretty rough shape, though, so it's not on display.

Of Chrysler dream jobs, relatively few survive. The K-310 has been a holy grail for years. Its successor, the 1953 Chrysler d'Elegance, lent its lines in downsized form to the first VW Karmann-Ghia, so it's been cloned.

A very similar show car, the Chrysler Ghia GS-1 was reproduced for a total run of 400 cars, all of them distributed from Paris. Some still survive in Europe and the Arab states. MoPar's 1955 Falcon lives, as does the 1957 Dart/Diablo, but the Norseman plus four other Chrysler show cars went down with the Ford on the *Andrea Doria*.

I was fortunate enough to have had the privilege of actually driving two of Detroit's dream cars. I vividly remember tooling around Los Angeles in a Chrysler gas-turbine experimental car in 1964. This was one of 50 built before they crushed all but four of them. And then, around 1970, I got a chance to drive one of American Motor's mid-engined AMX/3s. This took place at Michigan International Speedway. Dick Teague, who recently retired as AMC's design vice president, owns two of the five AMX/3s built (body by Bizzarini). There are, in fact, several surviving AMC dream cars, including a 1977 minivan (way ahead of its time) and the 1966 Project IV AMX with rumbleseat.

You might know the whereabouts of some dream cars that I haven't yet heard of. If you have, drop us a line. **PM**

SPECIAL EFFECTS

(Continued from page 97)

age, or image sharpness, and can produce some pleasing effects.

The basic (or No. 1) diffusion filter gives a slight soft-focus effect, particularly good in portraits where softness enhances the image while reducing skin blemishes. A No. 2 diffusion filter provides heavier diffusion for an overall dreamlike or fantasy effect. The heaviest of the diffusion filters, called fogglizers, create fog-like effects that can enhance portraits and scenic shots. In spot diffusers, the center is punched out or perforated to allow a soft-focus background while leaving the central image or subject in sharp focus.

With diffusion filters, larger lens apertures will increase the soft focus ef-



LENS-MOUNTED FILTER HOLDER

Marumi's V-1 motorized filter container can impart smooth rotation for filter elements.

fect, while smaller apertures serve to minimize or counteract it.

Graduated color filters

Graduated color filters, another enhancement accessory, help compensate for exposure variations in a single picture—for example, a bright sky and dark foreground, or vice versa. They can also create color-enhancement effects: A normal daylight scene can be converted to a sunrise or sunset scene by using pink or violet graduated filters. Always place the color segment of the filter in the area of the image where it will be most effective.

Multicolor filters

Multicolor (bicolor and tricolor) filters are solely for "trick" or exaggerated color effects. When properly applied, they can be visually stimulating. Bicolor filters are half one color, half another. Tricolor filters are composed of three thirds, each a different hue. Multicolor filters are most effective with lighter or brightly lit scenes. The larger the lens aperture used, the more gradual the transition between the color segments.

Multi-image lenses

These "trick" lenses are capable of

(Please turn to page 186)

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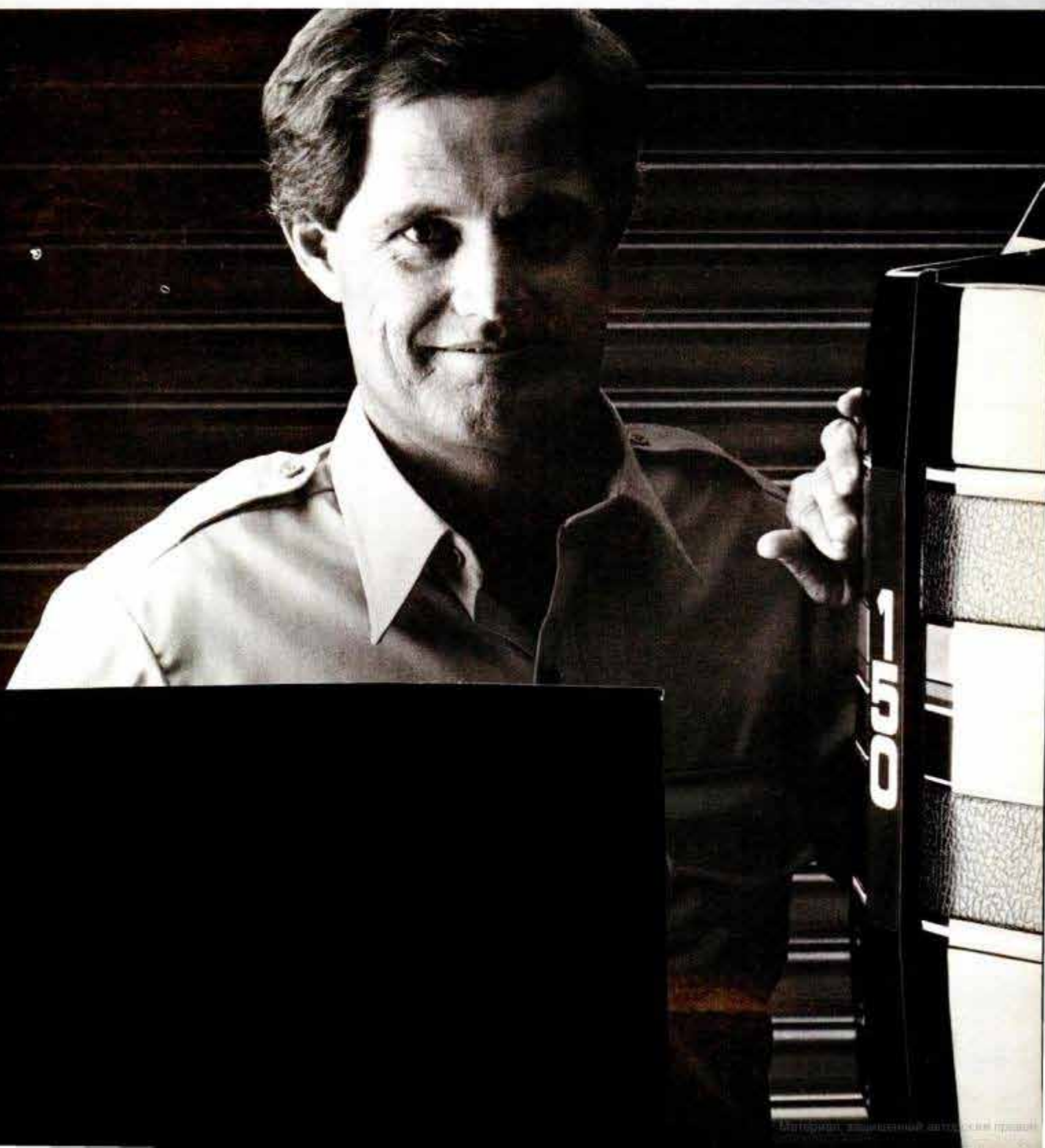
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TIRE DESIGN

(Continued from page 99)

neers say that new compounds help extend wear and still allow for better rolling resistance than the WR-12.

Firestone used a computer noise treatment simulator to determine the noise levels of the tire before bringing it to market. It will be the company's mainline all-season passenger tire for the next few years.

BFGoodrich

Goodrich's Comp T/A tire is the first V-rated tire built in America. The Comp T/A has a rayon carcass. BFG engineers say it's more forgiving of heat than polyester. The tire also uses a folded fiberglass belt with two nylon overlays. There is no steel in the Comp T/A except in the bead area. The fiberglass belt is laid in at a 20° angle for extra stiffness. An average highway radial has belts laid in at about 25° for a soft ride, with adequate handling.

The Comp T/A uses a high void-to-rubber ratio (big gaps to let the water escape) in its tread area for wet-weather traction, but maintains a wide-based, stiff block tread pattern for excellent handling characteristics.

Goodyear

It's the largest rubber company in the world, and it pioneered the all-season tire with the Tiempo in 1977, followed by the Arriva in 1980. Goodyear's latest, the Vector, is certainly the benchmark by which other all-season radials will be judged in the future.

Goodyear engineers, well aware of the rapid shoulder wear in early all-season designs, came up with a dual steel belt in the Vector with a reduced step-off for reduced shoulder wear. In a radial tire, the bottom belt is always wider than the top belt. The overlap in width between the belts is called the "step-off." The closer both belts can be in width, the less flexing there is, and flexing causes shoulder wear.

In the past, wider step-offs have been used because the tighter tolerances needed to match belt widths could not be met. Goodyear says that its latest plants have the technology to produce tires with low step-offs.

In tackling the challenge of producing an all-season tire with high mileage, low noise vibration and high traction, Goodyear engineers used a computer to design an aggressive open shoulder area for reduced hydroplaning in wet weather and increased snow traction and high-speed stability. The elements of the tread also provide high lateral stiffness but low circumferential stiffness for increased treadwear, plus ride comfort and snow and ice traction. The Vector could be the first 100,000-mile



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tire—with proper maintenance.

As with all-season tires, Goodyear is very serious about performance tires, and has a whole line of Eagles that are designed for different high-performance applications. The Eagle VR50 features a unidirectional tread pattern. This means the tire must be mounted so the tread always travels in the same direction. The tire was designed in close cooperation with General Motors for use on the 1984 Corvette. That tire, a P225/50VR16, when mounted on 9.5-in. wheels, pulled over 1g on the GM skidpad. By comparison, when you go around a street corner in your family car, your tires are developing about .2 to .3g. One full g is simply tremendous grip in a corner.

The Eagle VR50 is constructed of a polyester carcass and two steel belts with two nylon overlay belts. The nylon tends to contract and hold its shape when it gets warm, and serves as an excellent shell to keep the internal steel belts and polyester carcass from moving during high-speed operations. This cuts down friction and, therefore, heat buildup. Most HR- and VR-rated tires have nylon overlays or wraparounds.

The Goodyear VR50 is V-rated, which is the highest speed rating a tire can earn. It's an extreme high-performance tire for extreme high-performance cars. It's very wide and low and probably won't even fit on your car. Still, the VR50 has features that probably will be on normal passenger car tires in the near future.

Goodyear and Pirelli have been working jointly on run-flat tire designs. They've come up with a wheel that helps lock on a tire when it is suddenly deflated, allowing the car owner to safely drive to a repair facility even on a flat. The asymmetric rim has a modified safety hump on an otherwise standard wheel. The hump forces the bead to stay in place, and not slide out of position. This system can use standard tires and doesn't require any modifications in mounting equipment.

Michelin

About the same time Goodyear was introducing its Vector tire to the U.S. replacement market, Michelin Tire Corp. debuted its new all-season tire for domestic cars—the XA4. Michelin boasts that the tire will provide exceptional traction with tread life expectancy up to 60,000 miles.

To build the XA4, Michelin used segmented molds that ensure a high degree of tire uniformity and roundness. The tire comes out of the mold in virtually the same shape it will have when it is mounted on a wheel and inflated to the recommended air pressure. The tire boasts 25 percent less rolling

(Please turn to page 186)



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TIRE DESIGN

(Continued from page 185)

resistance than other Michelin tires.

Michelin entered the high-performance segment of the domestic marketplace with its Sport XGT radial tire. Looking very much like the familiar TRX tire, the XGT has proven exceptional in wet-weather handling. To gain this type of higher performance in the wet, Michelin engineers used longitudinal grooves and an open-block tread coupled with open shoulder areas that allow rapid water displacement to combat hydroplaning.

Michelin and Dunlop have been jointly working on yet another kind of run-flat design that requires a different type of tire and wheel to get the job done. The wheel has a low-flanged rim with extra grooves in the bead area. The matching tire has extended ridges that lock into the groove. A deflated tire stays seated in the groove, and cannot be dislodged.

Other companies

As a way to get the best possible performance from a tire, dual-tread designs have worked quite well. Yokohama's A008 performance tire and the Pirelli P77 all-season are two tires that perform exactly as designed.

The Pirelli P77 almost looks like two

separate tires joined together at the middle by a solid center ring. Internally, the tire has a nylon casing with two steel belts. The real difference between this tire and others, though, is its tread design. On the outer half of the tire are solid tread blocks with narrow spaces between them. This type of tread works well in wet and dry handling. However, the inside portion of the tread uses open blocks and wide spacing with a softer compound for ice and snow traction.

With the dual-tread design and dual rubber compounding, each side of the tire can be designed with a single purpose in mind, eliminating the compromises that usually are necessary in the construction of a tire. When combined, the two sides work well in balancing out the total characteristics desired in the tire.

Yokohama's approach was to make the outer portion of the A008 as close to a race-tire configuration as possible, while designing the inner three-fourths of the tire in the same way as other performance tires. In dry conditions the outer tread, which does most of the work in hard cornering, has very little squirm and excellent grip. In the wet, the wide grooves on the inner portion of the tread dissipate water and allow for good drainage and stability.

Another very new performance tire concept has its origins in Europe. Swiss engineer Jerry Juhan has developed a twin-tire concept that Goodyear has built for him. Imagine two motorcycle tires mounted side-by-side and then stuffed into a wheel well of your car.

The large void area in what would normally be the center of a single tire aids wet-weather handling since it serves as the perfect channel to let water escape.

The void does create a numb, non-self-centering feel in steering, though, because a center rib helps a tire center itself. The concept has certainly appealed to Goodyear, as it has produced some of the twin tires with its own Eagle GT tread pattern.

Another advantage of the design is that one of the tires can go flat and the other one will stay inflated, eliminating the need for the spare.

Lifetime tread compound

Lastly, we should mention William Peters and his miracle tread compound which, he claims, will yield nearly indestructible tires. Before dismissing Peters as another crackpot inventor, you should know that the U.S. Army has faith enough to have granted him \$189,000 to further investigate and test the compound. **PM**

SPECIAL EFFECTS

(Continued from page 181)

producing three or more repetitive images on a single video frame. They usually come installed in revolving holders or adapters that allow you to shift or place the multiple images wherever you'd like.

The lenses actually are cut in varying facets. Some lenses that are on the market have prismatic facets that can create up to six multiple-image patterns positioned around a central focal image. Rotating the multi-image lens allows image positioning as desired. Multi-image lenses obtain their best effects with normal focal length lenses.

Starburst filters

Cross-screen filters, better known as "star filters," create an eye-catching star-like effect. By means of an engraved screen surface, the star filter causes the light source to flare out along the grid lines. The stronger and brighter the light source, the more prominent and exaggerated the flaring.

Star filters come in four-point, six-point and eight-point versions. Star filter elements can also be used in combination, for added effect. Starbursts are most dramatic when used against black or dark-colored backgrounds. They create their most novel effects with night

scenes containing point light sources, and with reflecting glassware, jewelry, and incandescent light—especially candlelight. Shooting at large, intense light sources (such as the sun) through star grids is not recommended with tube-pickup cameras because the pickup tube may be damaged seriously. The same recommendation applies to rainbow filters. If your camera uses a solid-state pickup, you're safe.

Rainbow filters

Rainbow filters—or diffraction gratings—break up rays of light to create multicolored flares when aimed at concentrated light sources.

Diffraction filters fall into five general categories. Linear rainbow filters produce repetitive, single-direction light patterns along a straight plane. Radial filters produce flares in spoke-like patterns around a concentrated light source. Circular gratings allow rings of color to surround the light source. Rainbow filters cause a light source to break into surrounding multicolored starbursts; some have a clear center portion for producing softer effects. Nebular gratings create streaked effects, with a splash emanating from the light source and graduating to a circular pattern. More pronounced radical effects may be obtained if the nebula grating is rotated during videotaping.

Diffraction filters produce their predominant effects best when large lens (iris) apertures are used. Overall intensity (thus the "effect") diminishes as the lens is stopped down.

Adding movement

By rotating a rainbow-type filter in its casing, you can impart movement to heighten the imagery of your videocamera production. This is also true of starburst, multi-image and polarizing filters. Although the filters can be rotated by hand, you might find that operation is sporadic and not smoothly controlled when done manually. A solution to this problem is the motorized filter-element container recently introduced by Marumi.

This lens-mounted device, the Marumi V-I, lets you rotate the inserted filter elements independently of the videocamera's lens. You can rotate the filters continuously or at intervals, in either direction and at variable speeds. A separate, battery-powered unit will allow you to control the movement with one hand.

The Marumi V-I costs less than \$100, accepts all Marumi filters and can be adapted to handle other brands. It will attach to most videocameras as is, or can be secured with adapter rings readily available at photo and video stores. **PM**

BUILD A TILE-TOP COFFEE TABLE (Continued from page 101)

and the top edges of the sides. Set the tiles in place, maintaining equal spacing between each tile. When the adhesive has set, grout the tile joints, and when they are dry apply a silicone sealer to keep the grout from absorbing dirt and stains.

Miter the corners of the $\frac{3}{8}$ -in.-thick filler strips, then glue and nail them to the sides, flush with the top edge, using 4d finishing nails. Then, miter the cove molding pieces and glue and nail these pieces to the filler strip using 4d finishing nails.

Finally, cut $\frac{1}{4} \times \frac{1}{4}$ -in. rabbets along the bottom inside edges of all the top panel molding pieces, and miter the corners. Glue and clamp in place, flush with the outside edge of the cove mold-

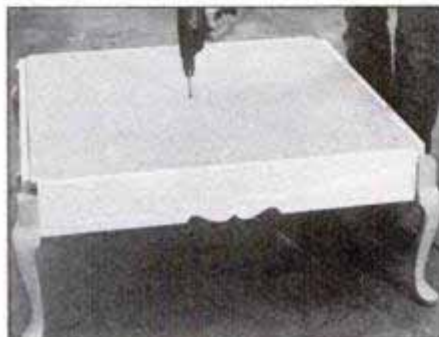
ing. When the glue has dried, sand the entire table, first with 120- then 220-grit sandpaper.

We finished our table with one coat of Minwax cherry oil stain and a second coat of dark walnut.

Antique look

Next, we applied Minwax platinum stain to give the whole piece an antique look, followed by two coats of satin-finish polyurethane, sanding lightly between coats.

Fill all the exposed nail holes with a color-matched wax stick, and after allowing the finish to cure for a few days, apply a very fine bead of transparent caulk to the joint between the panel molding and the tile. **PM**



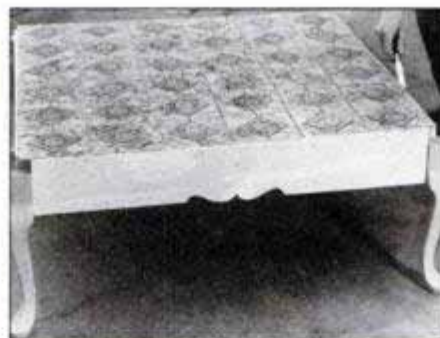
Cut base pieces from $\frac{1}{8}$ -in. exterior plywood. Notch corners of lower piece for legs, and secure both with glue and screws.



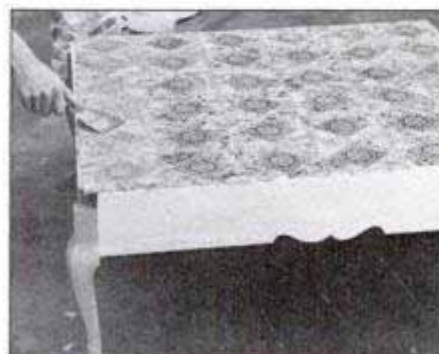
Lay tiles on top with even spacing, mark along outer edges and remove. Then apply adhesive evenly with a V-notched trowel.



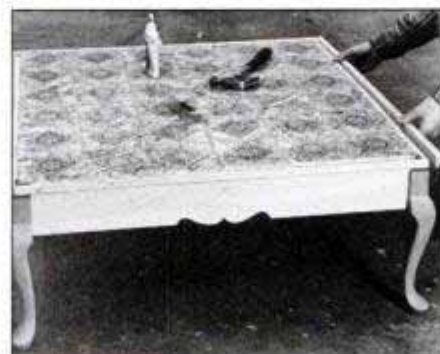
Set tiles in adhesive beginning at one corner, and following edge marks. Tap with mallet to achieve a uniformly flat surface.



Clear away excess adhesive from outside edges with a chisel or putty knife so that rabbeted top molding will lay flat on tiles.



After adhesive sets apply grout, working it into each joint. Wipe away excess and smooth joints with a flat, almost dry sponge.



Apply filler strips and side cove molding with glue and 4d finishing nails; glue and clamp the top panel molding in place.

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PORSCHE 944

(Continued from page 57)

However, a California mail carrier countered, "The ride might be called stiff by some, but on a long-distance drive, I've found it less fatiguing than my softly sprung American car."

As for overall comfort and general riding qualities, virtually everyone agreed that the 944's front seats felt great but that the tiny rear seats were for kids and pooches only.

Porsche quality disappointed nearly no one, with 98.1 percent of our respondents giving workmanship a score of good to excellent. A Texas industrial engineering manager observed, "Workmanship is excellent; there are not even minor problems."

The only criticism we heard regarding workmanship had to do with paint quality. A few drivers said the paint chipped too easily and, in some cases, showed a blush of orange peel.

A bit more power

When we asked owners to suggest improvements for the Porsche 944, 16.4 percent asked for a bit more horsepower, and 12.2 percent would have taken a turbocharger had one been available at the time. (The 944 will offer a turbo later in the year.)

Other goodies on their wish list included a tilt steering wheel, power seats and power door locks. And an Ohio ad artist recommended, "Raise the chin spoiler. It's so low it hits parking stops and scrapes on dips in my driveway."

The overwhelming majority, though, praised Porsche for the 944's appeal and its many standard features.

An Indiana financier: "Appreciate the seven-year rust warranty." A Utah physician: "I am amazed at what a 2,479-cc engine can do!" And a Florida food broker pointed out, "Considering that you get air conditioning, a sunroof, automatic radio antenna, power windows, power hatch release, and de-icing electric outside mirrors all as standard equipment, I don't think the price is too high."

'Love letters'

Finally, we couldn't help noticing a much greater than usual number of what we call "love letters." Owners added these as postscripts on their survey questionnaires: spontaneous, unsolicited, heartfelt endorsements of the 944. An Alabama computer technician, for example, said, "It's exactly as advertised—fun, fast, and safe." An Illinois chemical engineer: "I look forward to routine trips to the bank, grocery and other places—this car has definitely spoiled me. I thoroughly enjoy driving now!" **PM**

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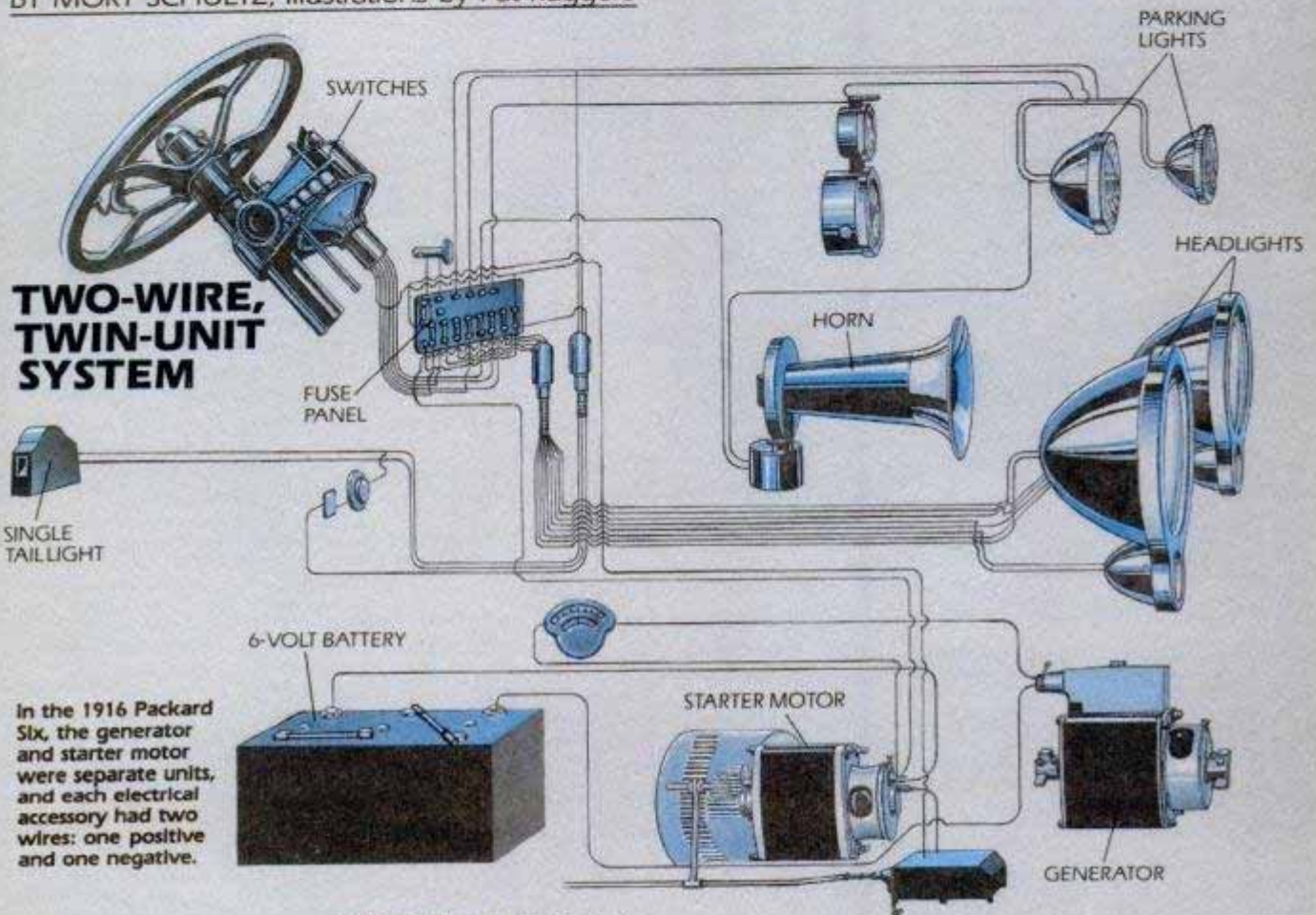
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ELECTRICAL SYSTEMS A CENTURY OF PROGRESS

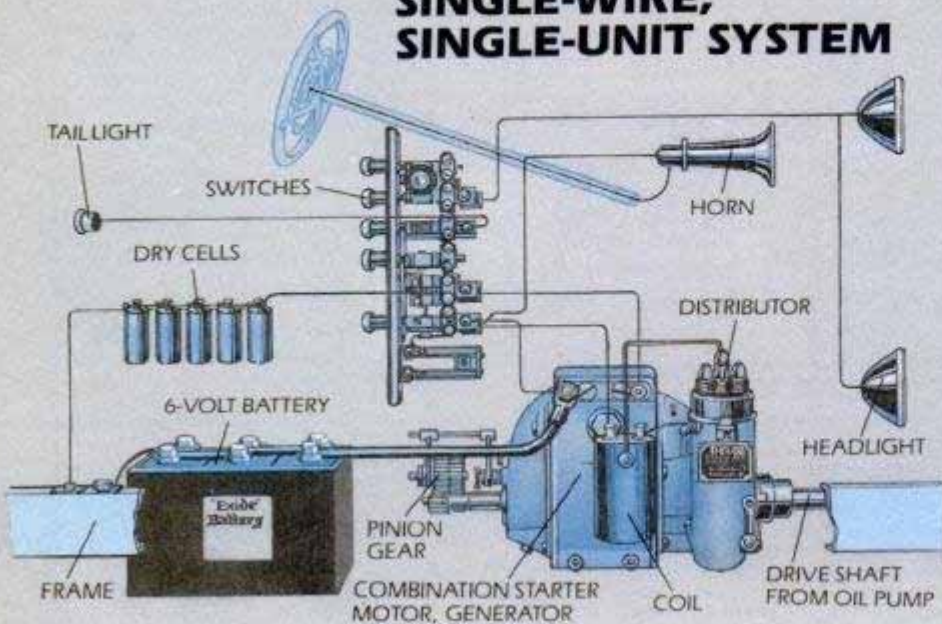
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BY MORT SCHULTZ; Illustrations by Pat Ruggero



SINGLE-WIRE, SINGLE-UNIT SYSTEM



DELCO electrical system of the same era combined the starter, generator and distributor into a single unit and used the car's frame as the ground "wire" for the 6-volt battery.

When Alessandro Volta invented the storage battery in 1796, he had no idea he was inventing the modern automotive electrical system. Volta made his discovery 89 years before the first car was offered for public sale. It was another 25 years before the storage battery got even a passing nod from some automakers.

Between 1885 and 1910, most cars having gas engines didn't need storage batteries because they had no devices that required electricity. Ignition was left to the nonelectrical hot tube; later to the magneto, which was a self-generating mechanism.

Until 1908, motorists warned pedestrians to "move it" by shouting or by pressing a pedal to clang a bell. Neither

PM thanks the research library of the Motor Vehicle Manufacturers Assn. (MVMA) for its help in preparing this series of articles.

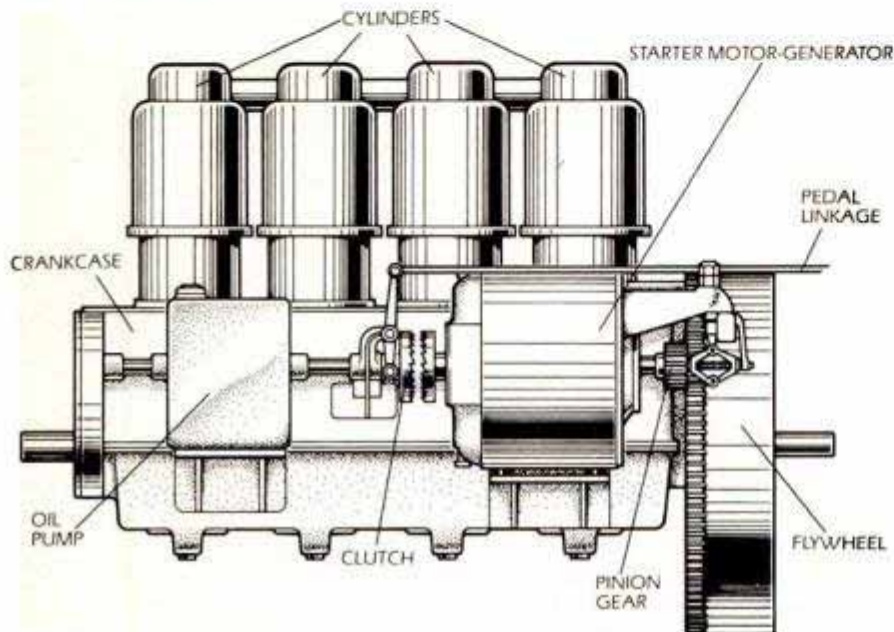
method was as raucous as the electric horn, which got its name, the Klaxon, from the Greek word *klaxo*, meaning "to shriek."

Between 1908 and 1911, the few autos that had Klaxons used dry cells to operate them. However, dry cells wore down quickly and had to be replaced, which was expensive.

By 1911, storage batteries had attained a degree of reliability exceeding that of dry cells; they lasted at least a month. Then, they could be recharged and put back into service, unlike dry cells, which were discarded. This de-

A problem still presented by those first dynamo-equipped cars was battery overcharging. However, this trouble was resolved with the development of a variable speed regulator by DELCO. It was first used in the 1912 Cadillac, which displayed another feature that set the auto industry on its head: the self-starter.

Once they adopted the self-starter, auto manufacturers had to adopt the battery/generator system to work the starter. However, the system put out much more current than the starter, lights and horn needed, and carmakers



Kettering's electrical starting motor was engaged by a foot pedal. When the pedal was released, a clutch allowed the motor to be driven as a generator by the oil pump.

gree of reliability was due in large measure to research and development done by the electric car industry, which needed good batteries so that its vehicles could compete with gas- and steam-engine models.

The few manufacturers who adapted the storage battery to work the Klaxon then looked around to see what else they could do with the excess current the storage battery provided—and found electric lights.

The first electric lights were introduced on the 1898 Columbia. This was an electric car with storage batteries. Manufacturers of cars with gas engines had another way to produce light. This was with the Prest-O-Lite tank, introduced in 1904. It was a steel cylinder containing pressurized acetylene gas that was fed to headlamps and ignited by flame.

Other manufacturers revived the dynamo, which had been around for some time. (Today we call the dynamo the generator, but in those days most called magnetos "generators.") The battery then didn't have to be taken out of the car every month for recharging.

realized they could harness this current and use it for igniting the fuel mixture. The magneto then became obsolete.

Self-starter beginnings

The self-starter came about by accident—literally. In the winter of 1910, on a wooden bridge on Belle Island, Mich., a Cadillac driven by a woman stalled. Not having the strength to hand crank the engine herself, she was forced to wait on the bridge in the cold until help arrived.

In time another motorist, also driving a Cadillac, happened along. His name was Byron T. Carter, and he was a close friend of Henry M. Leland, the head of Cadillac. Carter offered to start the woman's car. As he hand-cranked the engine, it backfired, and the crank flew off and struck Carter in the face, breaking his jaw.

Ironically, moments later another car carrying two Cadillac engineers, Ernest Sweet and William Foltz, came along. They rushed Carter to a physician, but complications set in and a few weeks later Carter died.

(Please turn to page 194)

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AUTO ELECTRICAL SYSTEMS

(Continued from page 193)

Leland was devastated. He called a special conference of his engineers and told them that finding a way to get rid of the hand crank was top priority.

"The Cadillac car will kill no more men if we can help it," he announced.

Self-starters for automobile engines had been tried in the past. Some were mechanical devices, some pneumatic and some electric.

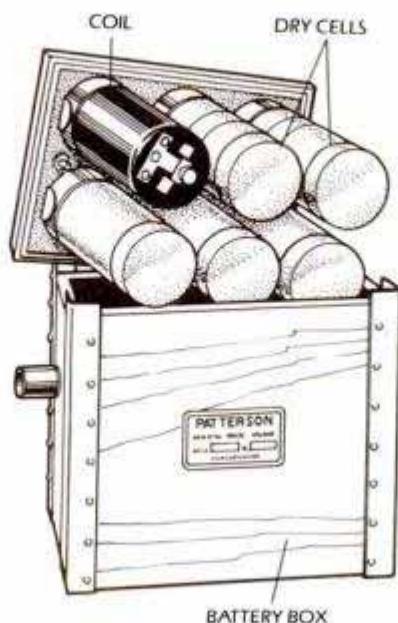
But all attempts at finding a self-starter that was reliable, efficient and relatively small had failed.

When the Cadillac engineers could not come up with a workable system, the company invited Charles F. Kettering and his boys at DELCO (still independent of GM) to take a hand. Kettering presented the device in time for its introduction in the 1912 models.

The Kettering solution

Kettering's unit was a combination starting motor and generator equipped with an overrunning clutch and reduction gear. Gear teeth engaged the flywheel to provide a reduction of about 25 to 1 between the starting motor and crankshaft, allowing sufficient torque to crank the engine successfully. GM brass didn't trust the new system at first and demanded a backup magneto and hand crank.

As public confidence in the reliable battery/generator/self-starter system soared, it soon replaced the magneto in all GM cars. GM enjoyed a sales boom, and the remainder of the auto industry soon adopted the system. Of the 462 models shown at the 1911 New York Auto Show, only 19 had battery/generator systems, and they all had backup



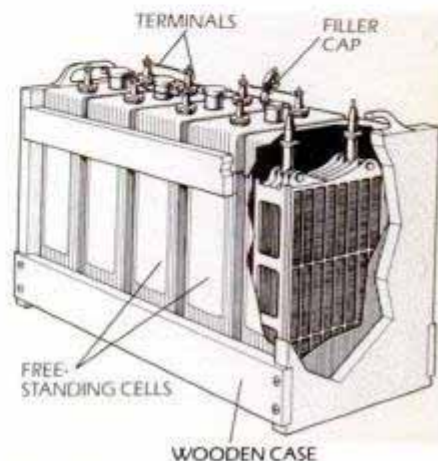
The 1910 battery box contained five non-rechargeable dry cells and a spark coil.

magnetos. Of 119 makes displayed at the 1924 New York Show, 110 had storage battery/generator systems and self-starters.

Other electric milestones

Here are some other electrical system "firsts":

In 1915, the Forrest Co. of New York City thought it had found a better way to keep a storage battery filled with water. Called the 20th Century Automatic Water Filler, the device consisted of a one-pint aluminum water container screwed to the firewall. Water flowed from it through rubber tubes to the



The 1920s Edison wet-cell storage battery had all the features of a modern battery.

battery, which in those days was usually mounted beneath the front seat or floor. Water entered the battery through hard rubber caps that contained float valves to halt the flow when the cells were filled.

In 1939, the first sealed-beam headlamps were introduced.

During World War II, the military needed an electrical generating unit that could provide more current than the d.c. generator. They found it with the a.c. (alternating current) generator, commonly called the alternator.

In 1949, Chrysler Corp. became the first to offer a combination key-operated ignition and starter switch. Previously, the starter was operated by a separate button on the dash.

In 1962, the alternator for civilian vehicles arrived none too soon: The number of electrical devices manufacturers put on cars by then began to strain the limits of the d.c. generator. The first car manufacturer to make the alternator available was GM, followed shortly by Chrysler.

In 1971, Pontiac introduced a completely sealed storage battery that required no water during its lifetime. It had side terminals that the company claimed stayed completely corrosion-free. In time, the battery was to be named the Freedom Battery. **PM**

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PM LONG-TERM CAR TESTS

(Continued from page 58)

sound system and leather interior.

We picked up the car in Detroit and drove it back to New York, averaging 70 mph for 9½ hours. The new Corvette is such a stable road car that we never felt pressured or uncomfortable. Several changes in the '85 model account for its excellent road manners.

The engine has been upgraded with direct port fuel injection, working with tuned runners. The result is an increase from 205 hp to 240 and much sharper throttle response.

Backing up the engine in our test car is the Turbo Hydra-Matic 700 R4 transmission. It's not our favorite automatic. Shifts are sometimes vague and the transmission keeps shifting into overdrive when you don't want it to. Still optional is the four-speed-plus-overdrive manual transmission.

We asked for the 3.07 performance axle ratio, but Chevrolet bolted in the standard 2.73 ratio instead. This ratio allowed the engine to really loaf along, especially when overdrive was engaged. Lest you think the Corvette won't accelerate because of the 2.73 ratio, suffice to say that simply flooring it from a dead stop will produce any amount of wheelspin desired. And our timeslips of 6.2 seconds for 0-to-60 mph and 14.23 seconds at 101 mph for the quarter-mile are testimony to the Corvette's underhood muscle.

We asked for the base suspension because the Z51 performance suspension on last year's cars was just too rough. This year, the larger 16-inch wheels and tires from the Z51 have been made standard. The Delco/Bilstein gas-pressurized heavy-duty shock absorbers are a separate option for '85. Chevy fitted the Bilsteins and threw the base shocks behind the seats so we could install them later to compare ride and handling.

So far, we've only tried the Bilsteins and we can report that the base suspension with the Bilsteins is a vast improvement over the '84 Z51 setup. The car stays on the ground more, the ride is a lot softer and more comfortable, yet we don't feel that any control has been sacrificed. The softer ride should keep the new Corvette from developing rattles the way Z51-equipped cars did last year.

We've put about 2,000 miles on the Vette so far. Except for a sticky door lock, we can't say anything negative about the '85 model, and we're amazed at the 18 to 21 mpg it delivers. —J.O.

Renault Alliance

Now that's more like it! With its optional, 1.7-liter 77 hp Four, our '85 Alliance has been stepping out smartly

for the last 2,100 miles. Our last Alliance test car had the original 1.4-liter Four, which we regarded as the car's only shortcoming. The new engine delivers between 20 and 25 mpg, depending on the temperature and how kind we are to it between tankfuls.

When we picked up the car, it had 4,100 miles on the odometer. We'll keep pushing the Alliance for as many thousand miles as we can—especially to see if we can find any weaknesses in the new powerplant, since AMC/Renault takes great pride in predicting its durability (see *AMC/Renault's Two New Engines*, page 100, Oct. '84).—B.H.

Mazda RX-7 GSL-SE

Considering how much doubt about rotary engine reliability existed around here, our Mazda RX-7 sure has won a lot of converts. Now with 8,500 miles on the clock, we find that the plentiful torque available will let a lazy driver lug down to 30 mph in fifth gear or drive away from a spotlight in second gear. That abundance of low end grunt, in fact, makes us think that a regearing might make the car more relaxed on the open road. Make the final drive ratio numerically lower, space the transmission ratios closer and the gas mileage (15.8 mpg in city commuting) might well improve a notch.

Not that we don't have some small complaints. There's always a puff of blue smoke after morning fire-up, the windows don't quite go all the way down, and the seats can be punishing on your back after a couple of hours of stop-and-go driving. Small stuff.

Despite the years-old body design and the low-key black color scheme, our RX-7 still gets lots of admiring looks on the road, and the few detracting points don't alter the overall assessment—quick and nimble, a blast to press hard. Wind it out 'til the over-rev buzzer shrieks, then shift it up a gear to leave all the less exciting two-seaters behind.—N.S.M.

Ford Tempo GLX

As we said in our last installment (*PM Long-Term Car Tests*, page 57, Jan. '85), Ford's front-drive Tempo is the perfect recipe for a family sedan: stylish, relatively roomy and reliable to the point of boredom.

When we reluctantly gave the car back to Ford, it had 10,935 miles on it and still hadn't developed its first rattle. Fuel economy averaged 23.4 mpg for our last 2,900 miles. We added oil only once (at 4,800 miles) and changed it at 6,000 miles. And we've recommended the car enthusiastically to several friends.—W.H.

MULTIPURPOSE SHED

(Continued from page 60)

store items vertically, and built-in cabinets above the workbench and roll-out storage bins below for heavy items like bags of potting soil and fertilizer. Finally, the building features a unique folding entry door—that opens from both inside and out—to hold frequently used lawn and garden tools.

But the most interesting design feature doesn't even show: Winans' method for expanding the building to hold a compact car. He accomplished this by specifying a built-in header in the rear wall that can support the loft and roof load without the need of studs below. To turn the building into a mini-garage, all you need to do is extend the concrete slab, knock out the studs below the header, build new walls and extend the roof over them. When you are done, you still have enough room for storage and working at the bench. This 4 x 10-ft. garage bump-out is shown in the drawing on page 61.

If you'd like to build a back-yard structure that has a more rustic appearance, you should look at the last building Winans designed for us. It appeared in our March 1983 issue (page 102) and plans are still available.

To receive a copy of PM's 32-page plans catalog, send \$1 to PM Plans Catalog, Box 1014, Radio City Station, New York, N.Y. 10101. **PM**

HOW TO ORDER PLANS



Plans for PM's Utility Shed consist of four 17 x 22-in. drawing sheets, a detailed eight-page instruction manual and a complete materials list (like those shown above). A single set of plans costs \$17.50. If you need another set of plans to file for a building permit or to give to a contractor, each additional set will cost \$15 when it is purchased with the first set. Send your check or money order to Utility Shed, Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.



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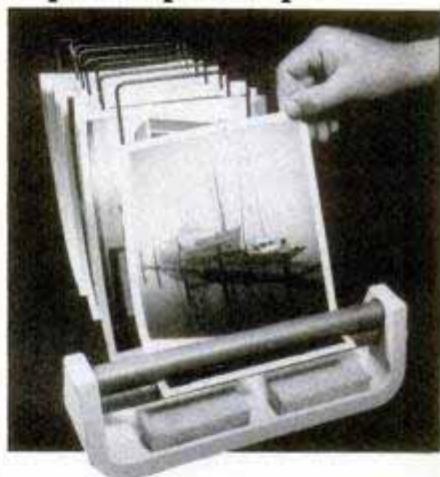
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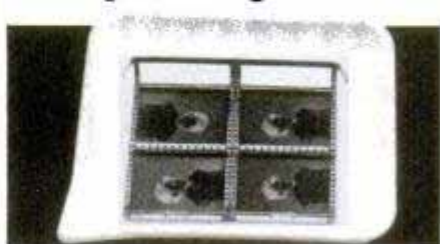
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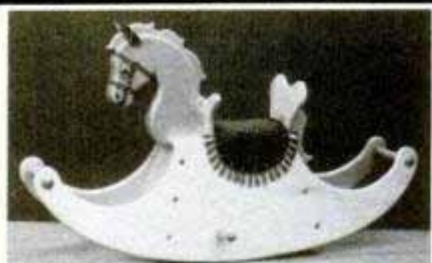
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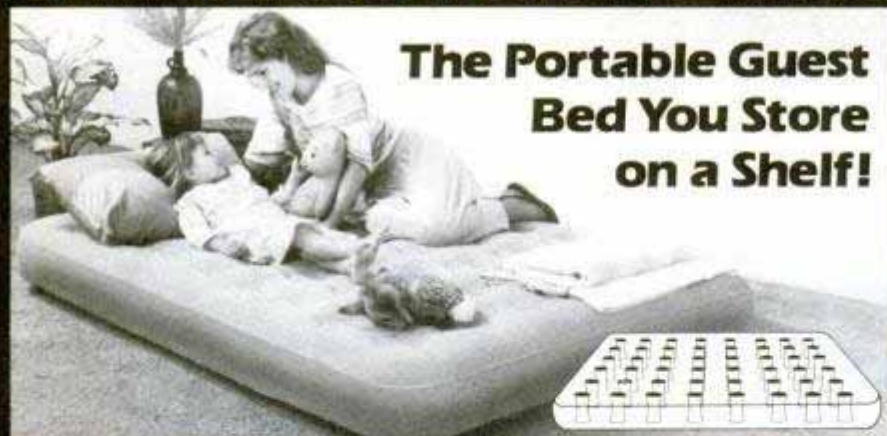
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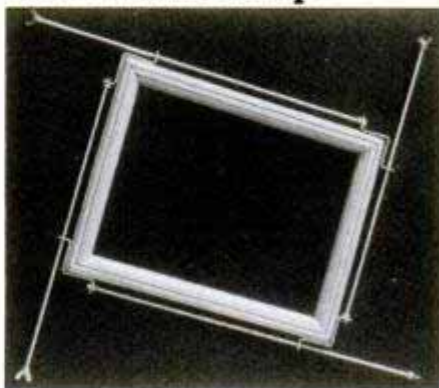
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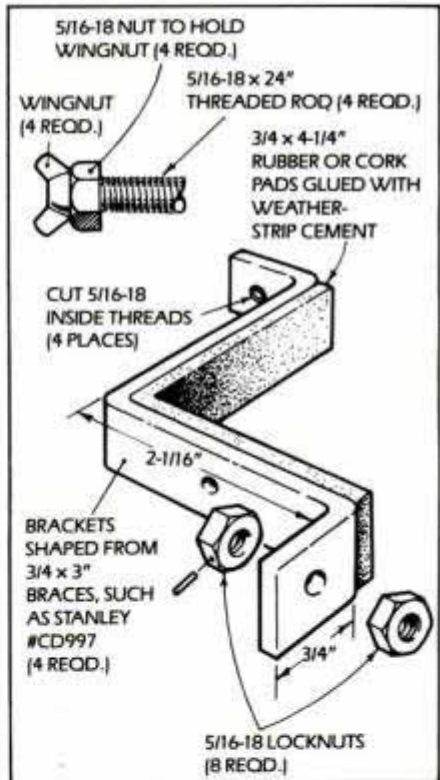
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HINTS FROM READERS

Picture frame clamp



To glue and clamp a picture frame, place frame and clamp assembly on flat surface. Tighten each wingnut with equal pressure.

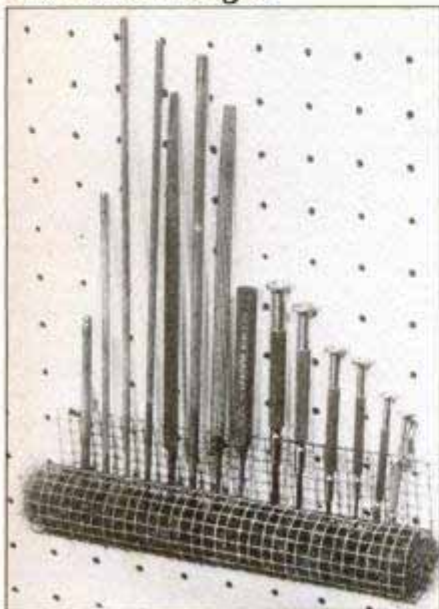


I made this simple picture frame clamp from ordinary metal corner brackets and 5/16-in. threaded rods, and use it often. Enlarge one end-hole of each of the four brackets to a 5/16-18 threaded hole. Drill out the other end-hole to 5/16 in. Bend the brackets as indicated in the drawing, and line the inside surfaces with rubber or cork. Assemble with the rods as shown in the photograph.

—Robert Moser

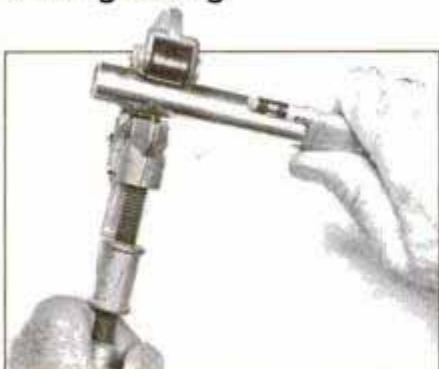
HINTS FROM READERS

Small tool hanger



Storing small tools on Peg-Board makes them easy to find and grab. This hanger solves the problem of attaching straight items like scribers and rat-tail files to the board. To construct this hanger, first roll a piece of hardware cloth around a pipe or dowel. To keep very small pieces from falling through the mesh, you should stuff some steel wool into the tube formed by the hardware cloth.—*David W. Roberts*

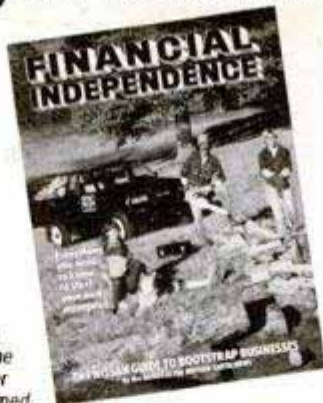
Cutting tubing



Cutting polished aluminum tubing with a tubing cutter can be frustrating when the slick tubing keeps turning in your hand. A pencil or small stick that is taped lengthwise to the section of tubing should ensure a slip-proof grip.

—*Rosario Capotosto*

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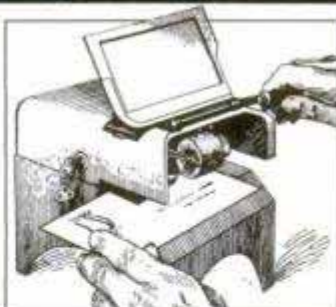
75 YEARS AGO: April 1910

Auto, plane race

It occurred at the second aviation meet held in the United States. Phoenix, Ariz., was the site of a contest between a biplane and an automobile. Although both industries were in their infancies, the Ford-built auto had the clear edge in consumer acceptance. The machines raced 10 times around a one-mile track, the plane traveling 20 feet above the car. The biplane won. But for most of the race the two machines were even. The plane had a 62-mph average ground speed, 2 mph better than the car.

Monorail improved

German inventor August Scherl demonstrated his improved monorail car in the United States. Scherl's monorail car was patterned after England's Brennan car. The Scherl car was 18 feet long and 4 feet wide, much smaller than the 40- by 10-foot Brennan car. There were two gyroscopes at each end of the Scherl car. They revolved at 8,000 rpm. Scherl boasted that should the power to the gyroscopes fail, energy stored within them would maintain the perfect balance of the car for at least an hour.



It was ingenious

The forerunner of the modern mailing machine was described as ingenious. A turn of a handle moistened, affixed and tallied stamps on 4,000 envelopes an hour. Today's machines do 175 to 200 envelopes a minute.



A car and plane had a race.

50 YEARS AGO: April 1935

Flying boat popular

Five nations rushed to manufacture a successful flying boat. Igor Sikorsky prepared to build a 100-passenger transatlantic clipper. A cross section of the French double-decked flying boat graced PM's cover. It was 104 feet long, weighed 37 tons loaded and was 30 feet high. Its average air speed was 180 mph. Perhaps the most well known of the flying boats was Pan American's China Clipper. Flying boats ceased service following World War II. The construction of landing strips for military craft ended the flying boat era.

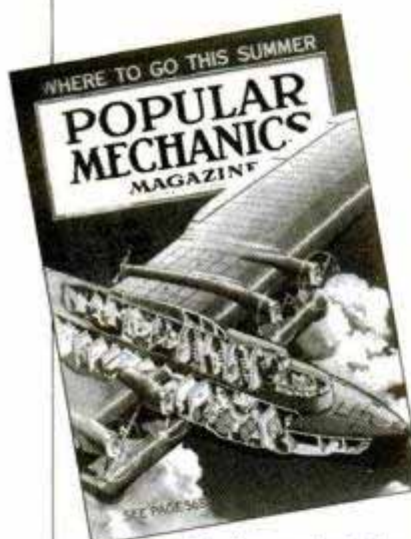


Better traction

A new, heavy-tread tire was developed that was claimed to provide better traction on snow and ice. The tire's scientific tread design provided easy steering, a firm grip and a smooth ride on pavement.

Nose for prediction

Dr. Alfred N. Goldsmith, pointing out that we already hear and eventually will see by radio, predicted that radio would appeal to man's other senses. Goldsmith, an engineer, called his futuristic idea "telegustatory broadcasting." He admitted it would be easier to transmit odors since the "telefactory" receiver would need only spray a duplicate of the transmitted odor. Was Goldsmith close? Recently, a manufacturer began marketing an odor disc player along with long-playing and short-playing fragrance discs.



Flying ships changed aviation.

25 YEARS AGO: April 1960

Back-yard view

It was PM's fifth annual section on outdoor living. The section was devoted to the "millions who soon will be permeating the air with the odor of sizzling steaks cooked over open, charcoal fires." Our cover depicted the outdoor living wall, a tribute to American ingenuity in leisure pursuits. It was described as a "veritable oasis in your back yard." The storage wall consisted of three cabinet units: an entertainment center, a kitchen-sink cabinet and a storage unit. The center housed a TV and hi-fi unit.



Supersonic transport

Aircraft companies took the first steps toward introducing faster-than-sound, passenger-carrying airplanes. While the manufacturers' predictions of speeds up to 2,000 mph would prove to

be a bit too optimistic, their vision of its configuration was accurate: Engineers predicted a delta-wing and a needle-pointed shape fore and aft. In 1962, production of the Concorde (Mach 2.2) began.

PM



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nicotine av. per cigarette by FTC method.